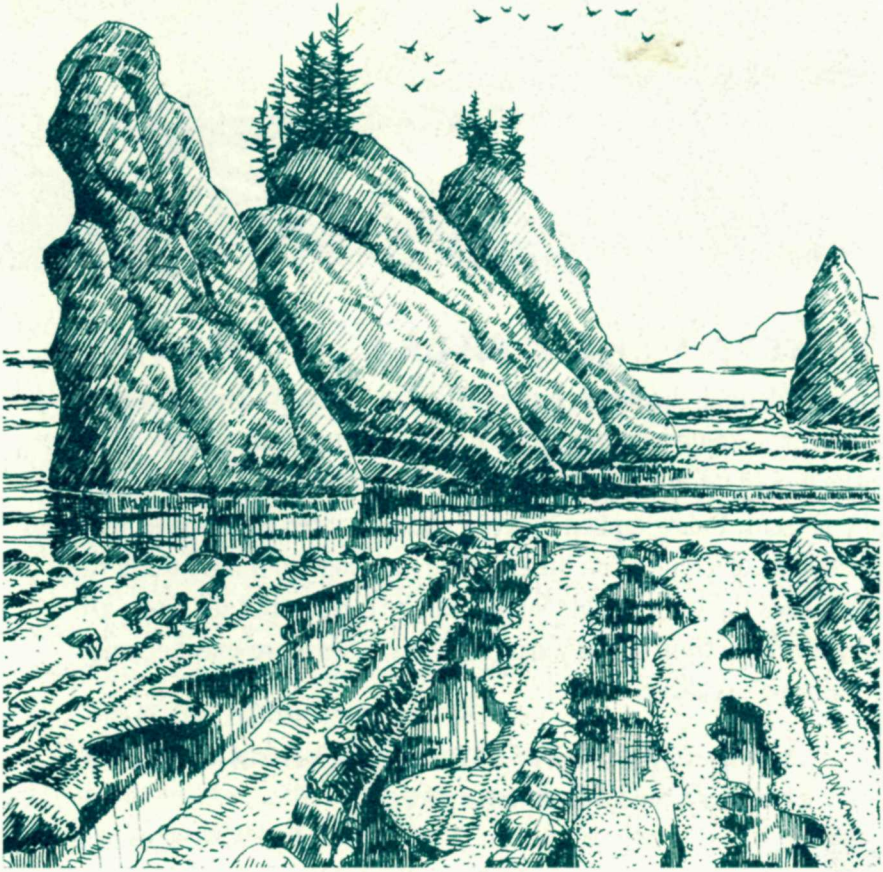
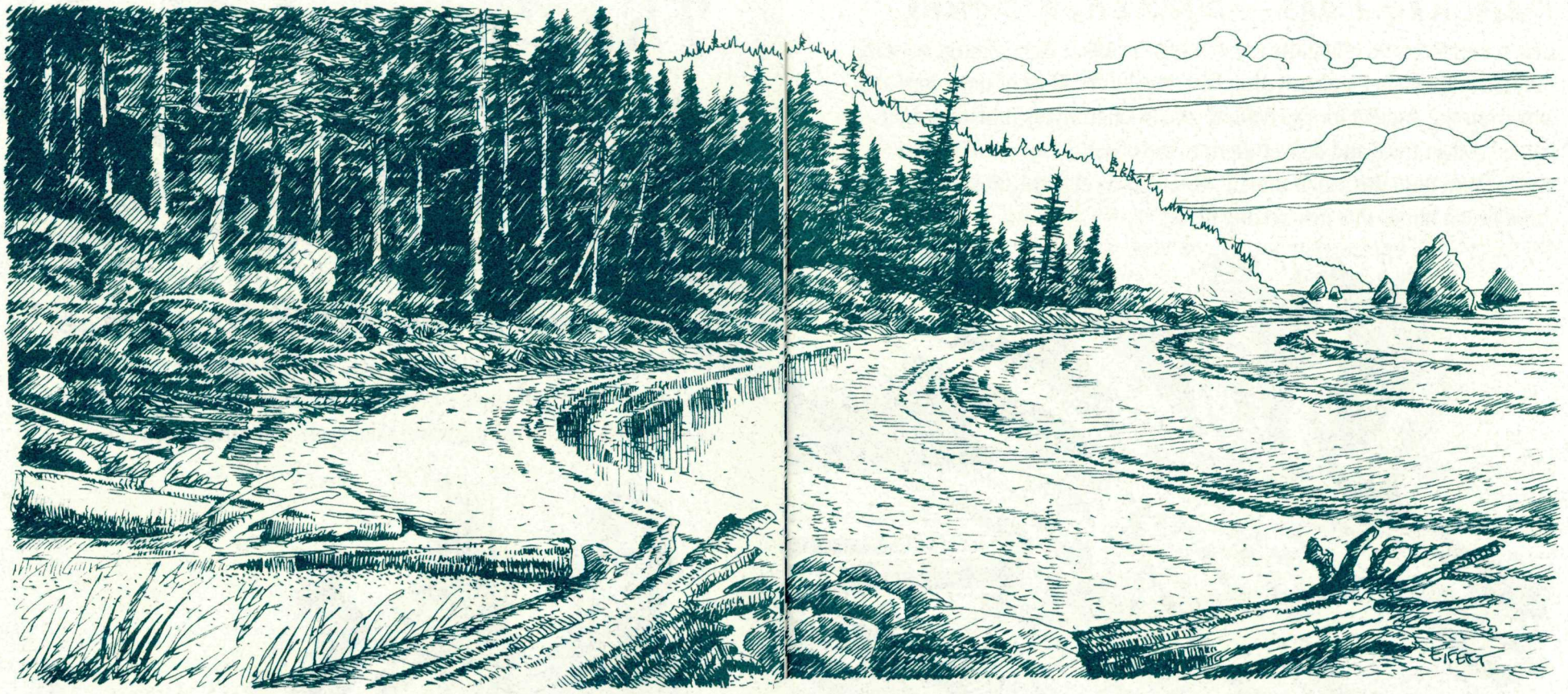
The Coastal Clock

Welcome to Olympic National Park, Olympic Coast National Marine Sanctuary and the offshore National Wildlife Refuges. The park protects about 73 miles of wild coast, while the sanctuary manages 3,300 square miles of marine waters. Coastal trails and overlooks reveal this national treasure of clattering seabird colonies, kelp forests and diverse shorelines.

Time. How do you mark its passage?

Do you mark time with a ticking clock, torn off calendar page, or a passing birthday? Olympic's everchanging coast records the passage of time with each crashing wave, tidal cycle and turning season.





Where's the Beach?

Over millennia, the beach moves as ocean levels rise and fall with changing climates. During past ice ages, enormous quantities of water were locked up in ice, lowering sea level by as much as 400 feet below the present. Today, sunken beaches and sea stacks lie offshore, drowned reminders of a time when the coastline was likely 30 miles further west! What does the future hold? No one can be certain, but sea levels are already rising from global warming. Today's seashore may become tomorrow's seafloor.

"Always the edge of the sea remains an elusive and indefinable boundary..."

Rachel Carson

The Ocean's Edge— A Never-Ending Assault

Relentless surf has been carving away the coastline ever since oceans enveloped this blue planet. Each cresting wave removes seconds from the cliff's life and slowly the bluff disappears into the ocean. But not all rock succumbs so easily. Ocean waves gouge out softer rock around harder headlands. Eventually the sea fully encircles the headland, isolating it from the mainland. These monoliths of resistant rock, called sea stacks, record the passage of time.

Destruction Island, near Beach Four, reminds us of the power of time and erosion. This island, now three miles offshore, was once connected to the land you're standing on.

Beached Logs—Bleached Bones

Beach logs alter the relentless erosion of sea cliffs. Like a natural seawall, they absorb the surf's power, protecting the bluffs. Most of these logs are gifts from the ancient forests behind you. Swollen rivers undercut their banks, collect trees and deliver them to the ocean. The ocean in turn tosses them onto the beach until a winter storm effortlessly carries these beach bones to a new resting place.

Use caution near logs. They can float in the tide and crush anything in their path.

Fluid Beaches

Feel the pounding surf. Let the waves flow over your feet for a few minutes. Sand starts burying your feet! The beach is not stable and secure, but ever-moving, changing with the ocean's whims. Waves carry sand to or from the beach, depending on the wave's energy.

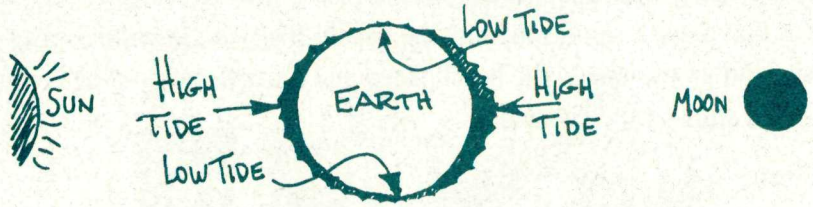
Wave energy changes throughout the year. Summer brings gentle waves that deposit sand, widening the beach. High-energy winter waves wash sand away, making the beach steep and narrow, and leaving behind rounded stones called cobbles.

Upwelling

Look out over the ocean. It looks flat, but the ocean floor is as varied as the land behind you. Cold water rushes through deep submarine canyons and rises when it hits underwater hills. These upwelling currents transport nutrients from the ocean floor to the surface where they feed plankton, the first stage of the oceanic food chain. A rich diversity of fish and birds and 29 species of whales, dolphins and porpoises visit the Olympic coast to feed on these nutrient-rich waters.

Tides—A Cycle of Life

Most of us organize our day by the sun—active with light, resting with darkness. Intertidal creatures live primarily by the tides. At high tide, these creatures can feed, move, or reproduce. At low tide, they hold onto rocks and endure.



Tides are created by the gravity of the sun and the moon pulling a bulge of seawater toward them. This bulge creates high tides and low tides. Since the moon is closer, it has more influence than the sun. When sun and moon line up with Earth, during a full and new moon, their gravitational forces combine to create the highest and lowest tides of each lunar cycle. When sun and moon are at 90 degrees to each other, they pull the ocean in different directions, making less variation between high and low tides.

Along the coast, life depends on tidal rhythms. Watch the ocean. Is the tide rising or falling? When exploring the coast, be aware of the tide. Falling tides may reveal natural treasures. **However, high tides may cover the beach and trap you against a bluff, making it hazardous to return.**

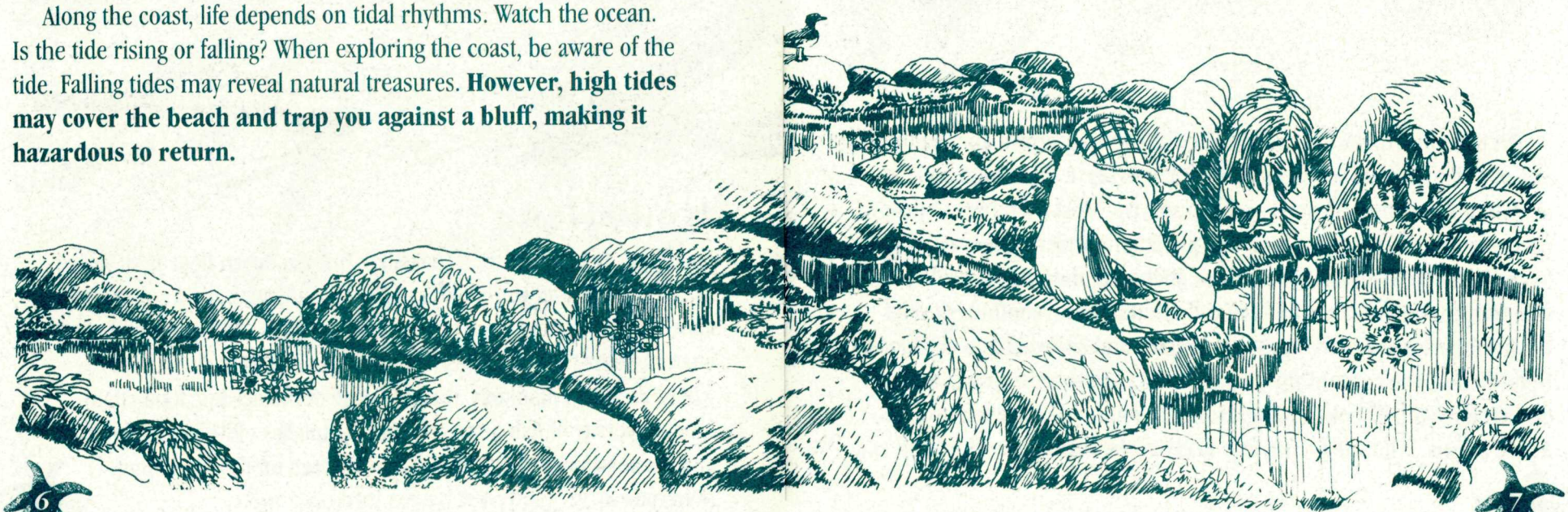
Tidepool Etiquette

Olympic's tidepools support an incredible diversity of life, from marauding sea stars to rainbows of anemones. As caretakers, we must limit our impact while exploring intertidal areas to ensure their protection for the future. Please follow these guidelines while visiting tidepools:

Stay on the trail. In popular areas people have created well-worn trails on the rocks. Please use them to avoid crushing more intertidal creatures.

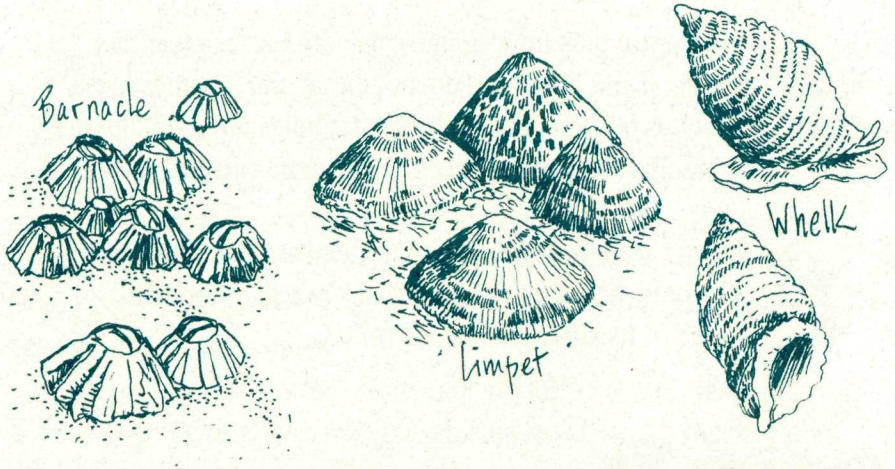
Should you pick up a creature or not? Let the creatures decide. If you lightly tug on an animal and it comes loose, then it is okay to pick it up. But if it holds on tightly, leave it alone. **Pulling up reluctant creatures can kill them.**

If you carefully examine an intertidal animal, don't handle it too much and always put it back exactly where you found it. Its survival depends on you.



A Mosaic of Tidal Life

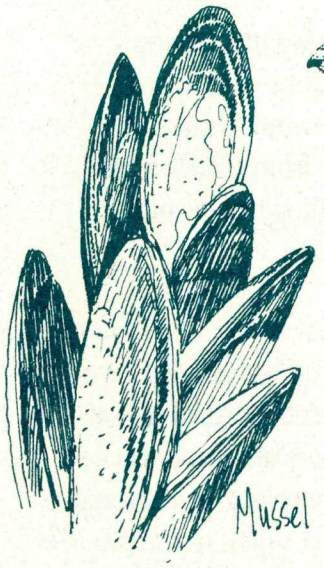
Where is the edge of the sea? Rather than a stationary boundary, it is a broad band called the intertidal zone, delineated by high and low tides. This zone has three distinct communities: high tide, mid tide, and low tide. Each is home to different residents for whom life is a balancing act. If animals move too high in search of space, they may dry out or starve. If they move too low they may be crowded out or become a predator's meal.



On intertidal rocks, thousands of creatures may crowd an area the size of a dinner plate waiting for the ocean to serve them food and oxygen. Like us, they all need space to survive. Most members of this packed community begin life as tiny plankton wandering the sea, waiting to grab a foothold on bare rock. Once anchored, they may provide a substrate for others. This process, called succession, continues until the neighborhood is once again as complex and crowded as a city block. Nevertheless, the community changes over time. A wave-tossed log can destroy a neighborhood, leaving bare rock where life once teemed. A race begins. Who will be the first to claim the vacant space?

Barnacle

Barnacles are tidepool pioneers—the first to settle on freshly exposed rock. Barnacles fasten themselves to the rock with a glue produced on their heads. Once attached, they build a shell to stay moist and protect themselves from predators. Standing on their heads, barnacles sweep feathery feet through the sea to filter out plankton meals. Since they are small and require little food, barnacles can survive high on intertidal rocks.



Limpet

Crawling along on their large muscular foot, limpets live on bare patches amid the barnacles. These snails use rasp-like tongues to graze on algae. Limpets keep their neighborhood barnacle-free by using their shell to dislodge small homesteading barnacles.

Whelk

Whelks are carnivorous snails that eat barnacles. Imperceptibly, whelks crawl toward their prey. Their stalking is slow but effective since their prey can't run away. Once on a barnacle, whelks drill a hole, insert their tube mouth and slurp out a meal.

Mussel

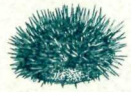
If the bare patch is in the mid tide zone, young mussels follow barnacles into the neighborhood. These plankton-eating mollusks secrete amazingly strong byssal threads to tie themselves to barnacles. They dominate the mid tide zone, crowding out all others. But even mussels have challengers. The lower edge of the mussel zone equals the highest reach of sea stars!

Ochre sea star

By pumping seawater through its vascular system to the tips of its tube feet, a sea star creates suction to grip mussel and barnacle shells. The sea star tries to pull the creature open, the shellfish struggles to remain closed. With enough time, the sea star usually wins. Ochre sea stars–in both orange and purple color phases–are the most abundant sea stars on this coast, but there are many other species, ranging from delicate brittle stars to two-foot wide sunflower stars.

Sea palm

These algae battle mussels to gain space for their young among the pounding waves. Adult sea palms drop spores onto mussels. The young grow, but violent surf may wrench them off, pulling the mussels with them. Other marine algae, from amber forests of giant kelp to iridescent rainbow kelp, add undulating beauty and variety to this coastal wilderness.



Sea urchin

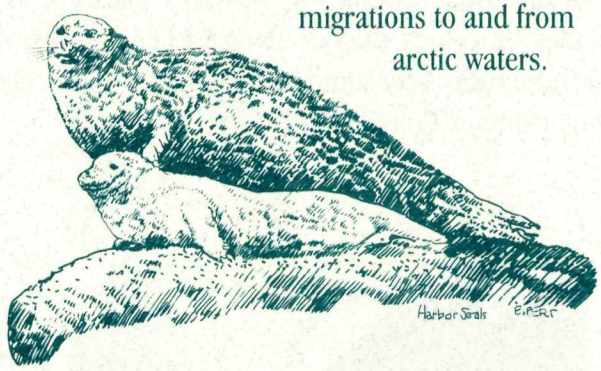
An arsenal of sharp spines protects sea urchins from predators. These walking pincushions are the herbivores of the intertidal zone, grazing on a diet of seaweed. There are three species in the intertidal zone. Each is named for its color–purple, green and red sea urchins.

Sea anemone

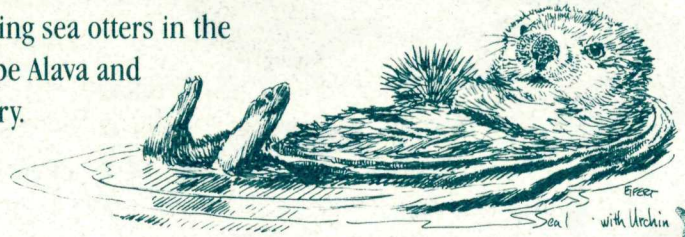
Waiting patiently to capture food, sea anemones wave flower-like tentacles filled with stinging cells. Any organic matter delivered by the ocean will do, dead or alive. Their tentacles stuff captured food into a central mouth. Sea anemones are mostly made of water, so they must live in the lower intertidal zone. Because anemones can reproduce by cloning, over time one anemone can produce an entire colony of itself. The small, pink-tentacled aggregating anemone and the giant green anemone are common here.

Marine Mammals

Have you felt the frigid water off this coast? Mammals must adapt to survive in such cold waters. Whales and dolphins have little hair. They rely on a wetsuit-like layer of blubber to protect them from the cold. Seals and sea lions have fur and blubber. Look for seals and sea lions warming themselves on offshore rocks year-round. Gray whales pass by on their spring and fall migrations to and from arctic waters.

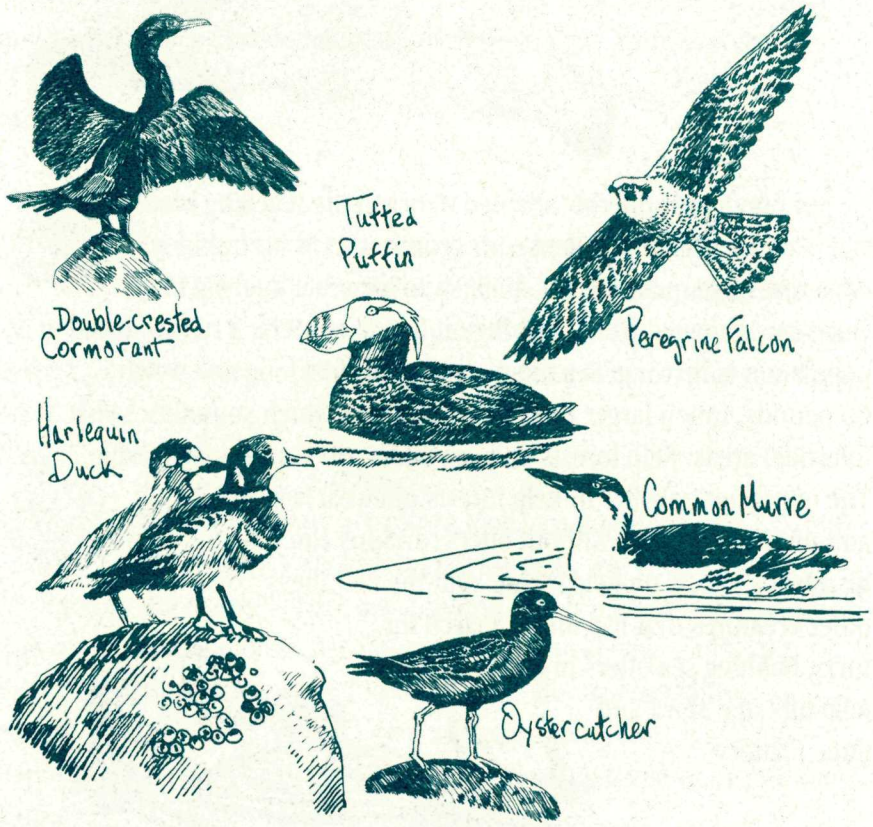


Sea otters are superbly adapted to ocean life. Lacking blubber, they stay warm wrapped in a dense fur coat that traps air bubbles. They also consume huge quantities of shellfish to generate internal heat. Once exterminated from Washington by fur hunters, a reintroduced population is thriving. Sea otters can be five feet long and weigh 60 pounds, much larger than the river otters which sometimes visit intertidal areas. Kelp forests and sea otters are almost inseparable. The otters not only live in kelp forests, they eat sea urchins, and urchins eat kelp. Without otters, urchins can have disastrous effects on kelp forests and the countless other creatures that live there. Search for furry, bobbing sea otters in the kelp off Cape Alava and Cape Flattery.



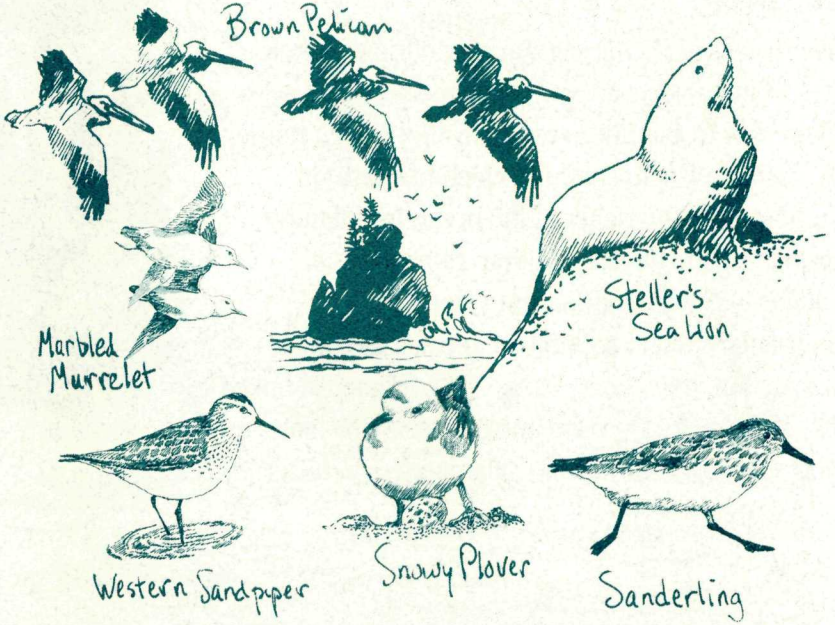
Coastal Birds—A Rich and Diverse Collection

Scan the top branches of wind-blown trees along the coast. From these high vantage points, eagles observe their territories, spot meals and protect their nest from predators. With wings as long as eagles, brown pelicans migrate up the coast in summer. They plummet headfirst into the sea, scooping up fish in their long pouched bills. Look for lines of pelicans flying inches above the waves. Flocks of shorebirds, responding to their own clock, migrate along the coast each spring and fall. Offshore rocks hold some of the largest seabird colonies in the conterminous United States.



Endangered Species

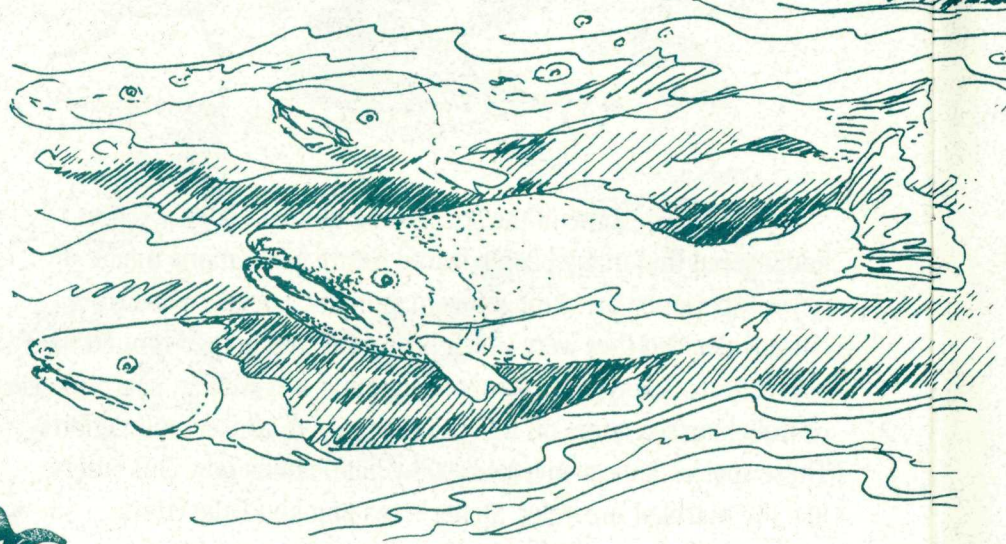
Animal populations fluctuate over time. Given good habitat and lots of food, their numbers increase or remain stable. But shrinking habitat and other environmental changes can lower their populations—possibly to the brink of extinction. Olympic National Park, Olympic Coast National Marine Sanctuary and the offshore National Wildlife Refuges provide important habitat for several rare species.



Not long ago, some of the species mentioned earlier were so endangered that many people feared future generations might never experience these magnificent animals. Luckily, concerned citizens decided they were worth protecting and helped rebuild their populations. Today you may spot migrating gray whales, soaring eagles or frolicking sea otters off this coast, thanks to conservation efforts. These species appear to have healthy populations now. But others, like the marbled murrelet, Steller's sea lion and Lake Ozette sockeye salmon are declining. Their future is in our hands.

Salmon—Bringing the Ocean's Abundance to the Forest

Five species of Pacific salmon spend most of their lives in the northern Pacific Ocean, and some swim all the way to Asia! But eventually they return home, ascending rivers to spawn in clock-like fashion. Salmon bring the riches of the ocean far inland, nourishing the forests and over 130 species of wildlife—as well as humans—along the way. Their fate is tied to both forest and sea as habitat destruction, hatcheries, dams and overharvest take a toll, affecting salmon and anything else that feasts on their seasonal return, from salamanders to bears.

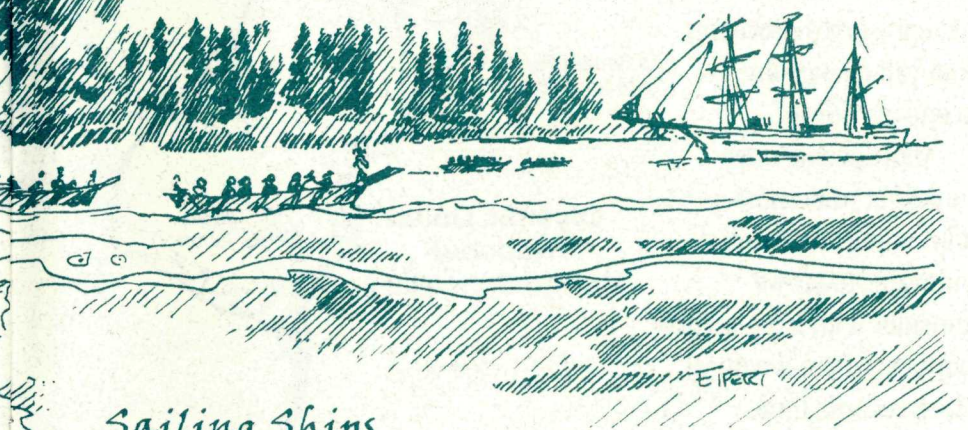


People—Past, Present, Future

Area Tribes

The Pacific coast has shaped human lives for thousands of years. Four American Indian tribes thrive along this boundary between forest and ocean. From the land they fashioned canoes, tools and implements to collect the ocean's bounty. Shellfish, seals, whales and salmon, all fat from the sea's nutrients, provided year round sustenance. The rich resources of their coastal homes allowed complex cultures to evolve.

To learn more about area tribes visit the Quinault, Hoh, Quileute or Makah reservations. At Neah Bay, the Makah Museum offers a glimpse of a tribe whose way of life has always depended on the ocean.



Sailing Ships

Listen to the power of the ocean. Can you imagine spending months at sea to travel here from the East Coast? A hundred years ago many Euro-American visitors to Seattle and the West Coast came by ship. But the distinctive sea stacks off this rugged coastline threatened ships. Since 1891, Tatoosh and Destruction Island lighthouses have served as warning beacons along this watery highway. Despite the lighthouses, many sailors perished when their ships foundered off the wild Washington coast.

Protecting Our Coastal Heritage

Wild and undeveloped coastlines are rare, and development consumes more each year. Olympic National Park, Olympic Coast National Marine Sanctuary and the offshore National Wildlife Refuges (NWR) conserve and protect some of the last and finest wild coast left in the conterminous United States. Preserving the edge of the sea, with its myriad life forms, also preserves processes that will change the scene over time.

Many people once looked at wilderness as something to tame and cultivate. Today we consider it an irreplaceable heritage where a natural clock records time. With your good stewardship the coastal clock will continue ticking and this special place will remain rugged, wild and full of life.

Text by Steve Schaller
Art and Design by Larry Eifert ©