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## Author's Note

It is important to consider how the influences and impacts of the plants and animals of the past have shaped the present. Landscapes of the past are invoked—salmon-swollen creeks, elk herds on the hills, canyons echoing with the cries of cougars—not because I believe they may possibly reappear, but because conjuring them into our imagination as we wander the hills and the seashore enlivens the present landscape with the shadows of our ancestors.

As you read these articles about Point Reyes and visit its beaches, estuaries, forests, and grasslands, ask yourself “What is the value of this place?”

Some things are not easily counted or quantified, yet are no less significant. It is for these reasons that we carefully look after Point Reyes.

Jules Evens



Daisies by the Sea, by Bobbie Belvel

**T**he Pacific Ocean surrounds the Point Reyes Peninsula—waves washing over beaches, breakers crashing into cliffs, spray drenching the sea stacks scattered along the shore. Even the fog that hangs over the hills is salty from the sea. Seen from the Lighthouse or from Limantour Beach, the ocean seems to have a uniform sameness, a vast monotony. Quite the opposite is true. Like forests and fields on the land, the ocean is a patchwork of habitats that reach from the deepest offshore waters to the highest splash zone. And where the ocean meets the land the greatest array of habitat types occur—bays, lagoons, estuaries, tidepools, tidal sloughs, marshes, tide pans, and beaches.

## Open Ocean

Imagine that you're a brown pelican flying from the Farallon Islands to Point Reyes National Seashore. As you leave the rocky shore at the Farallones you take a wide arc out to the west for a few miles. There you see a pod of blue whales, the earth's largest mammals, travelling south. They are following the

continental shelf, a steep submarine cliff that drops off into onto the abyssal plain, about 35 miles offshore. This change in underwater topography causes a current of cold water from the deep ocean to mix with



warmer surface waters, a process known as upwelling. Cold water has more oxygen and therefore “holds” more nutrients than warmer water. Because of this “super oxygenation,” many small oceanic organisms—tiny shrimplike creatures called krill and schooling fish—occur in this cold “upwelled” water at the edge of the

continental shelf. Pacific gray whales also frequent these waters annually as they travel south to Baja to give birth to their young, then later on their northward journey back to Alaska to feed.

*“Discovery consists of looking at the same thing as everyone else and thinking something different.” — Albert Szent-Gyorgyi*

# From Ocean to Estuary

Being a pelican, you dive into the cold water in the wake of the whales and snack on a few anchovies before taking off again and flying toward shore. It's a long flap in, across miles of boundless ocean. On the way, you occasionally see other creatures—a blue shark cruising just beneath the water's surface, a white shark eating a harbor seal, some common murre diving for sardines. Some large moon jellies float by, and then you even see a huge turtle, a leatherback, munching on one of the jellyfish!

You know you're closer to shore when you notice more birds like surf scoters and cormorants; there seem to be more marine mammals in the water too—especially harbor seals and California sea lions. These animals congregate in these nearshore waters because it is shallow and there are plenty of places for them to get out of the water to rest, breed, and bear young. Even an animal as oceanic as a northern elephant seal must find a safe place on the shore, called a “haul out”, to sleep, breed, and birth its pups. As you circle the rocks just off the Lighthouse, you notice a family pod of harbor porpoises breaking the surface of the water.

Flying along the shore near Limantour Beach you see a school of topsmelt or surfperch just below the breakers. As you dive into the sea to catch some more fish, some other pelicans join you. When you scoop some smelt in your bill, a few manage to wiggle out. An annoying seagull—a dark one with a red bill, called a Heermann's gull—is there to grab your leftovers. These seagulls are called “pirates” because this is the only way they seem to be able to find food, by stealing from clumsy pelicans. Approaching the shore you fly low, catching the updraft of the breakers, bank, and land at the end of Limantour Spit amidst a flock of a hundred other pelicans. All have bellies full with smelt, resting and roosting with the harbor seals and gulls that also gather here, away from the disturbances of humans and dogs.

## Estuaries

The tidal marsh that surrounds the estuary provides a transition from ocean to land. Here, freshwater streams meet the saltwater tides creating one of the most fertile (“productive”) habitats on earth. Fast growing salt marsh vegetation—cordgrass, pickleweed, and salt grass—provides habitat for its own decomposers (bacteria



Pelican in flight, Rich Stallcup

and amphipods). The estuaries act as the doorways for oceanic fish, such as coho salmon and steelhead trout, to travel into freshwater streams to spawn. They also provide prime habitat for ducks—such as the mallard, green-winged teal, and northern shoveler—to feed. Osprey frequent estuaries to hunt fish, as do snowy egrets and great blue herons.

The pelicans can't see beneath the surface, but riding into the estuary on the rising tide are leopard sharks and other fish— Pacific herring, rubberlips, and topsmelt—entering the estuary to take refuge in the meadows of eelgrass that sway beneath the water. You can find the eelgrass washed up on earlier tides and decomposed along the shore of Limantour. The eelgrass beds

harbor other animals too. Animals with strange names— nudibranchs, hydroids, sponges, tunicates, skeleton shrimp, “fixed” jellyfish (they are attached to the grass, not attached to the grass and are not free-swimming like we think of



Coho salmon, NPS Collection

jellies), bubble-shell snails, sea hares, periwinkles, sea slugs, tube worms, limpets, grass shrimp, razor clams, and sea cucumbers— live on the blades. In the roots on the bottom (benthos) are animals that live in the mud and siphon microscopic food from the water—clams, feather-duster worms, fat innkeepers, for example. The eelgrass beds are teeming with creatures that live there always, but the grass also provides food for animals who are passing by, like the sea goose called the black brant. Pacific herring, one of the most abundant fishes, and a favorite food of the pelican, come to lay their eggs here. The arrival of the herring is signaled by the flocks of seabirds that come to eat the herring

roe. Loons, grebes, scaup, and scoters congregate above the eelgrass pastures, stuffing themselves on the buffet.

The tide is rising. A surge of cold water floods into the estuary, bringing in nutrients—particles of decayed marine plants and animals, minerals and molecules—that have been brought to the surface by the upwelling waters.

The life of the estuary is determined by the tides that wash in and out twice daily. The plants and animals that live in the estuary rely on the tide to bring them nutrients, but they also must deal with the problem of being covered with salty water, or exposed to the dry air.

These two contrasting conditions require certain adaptations, and each species of plant or animal has a different ability to withstand the stress of being under water, above water, or both. To deal with the tidal changes, groups of organisms are distributed at different tidal levels, or zones within



Estuary by Bobbie Belvel

# Into the Mud Flats



Mud flats, Bruce Farnsworth

the estuary depending on the amount of time they must stay above or below water. We will consider these communities from the deepest channel, which is almost always covered by the ocean water, to the edge of the land that gets soaked by only the highest tides.

In the deepest water of the estuary, amidst the blades of eelgrass are a myriad of small and camouflaged (cryptically colored) organisms that are difficult to see with the naked eye. Dainty little snails (*Nassarius*) are abundant—grazing on small algae that grow on the grass blades. Some of these snail shells are not occupied by the original snail, but have been taken over by hermit crabs that use the shells for their own.

Eelgrass can grow in channel bottoms and deep basins within the estuary, but much of the bottom is flat and exposed to the dry air for longer periods of time. These “mudflats” or tidal flats support their own unique community of plants and animals. Because the mud flats have few places for animals to attach, the sea stars and urchins of the rocky shore, or the sponges and moss animals of the eelgrass beds are largely absent. Healthy tidal flats are colonized instead by vast cities of worms, clams, and snails. Most of these mud flat dwellers are burrowers and “deposit feeders.” In the “low intertidal” flats

or zone next to the eelgrass beds, the areas that get the most tidal flow, live some of the larger clams, most notably the geoduck, pronounced “goeyduck.”

The geoduck lives in the goey-est muck in a deep burrow that can be up to 5 feet deep. Any

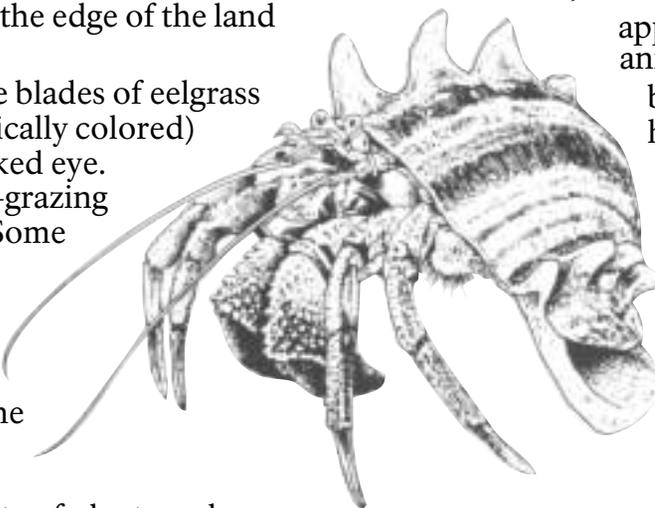
disturbance at the surface signals the clam to retract its enormous siphon that causes a spout of water to shoot up. Geoducks can live at least 15 years and grow as large as 12 pounds. Another big clam in this lowest zone is the gaper clam

it also has a squirt hole in the mud that may surprise you with a spout as you walk across exposed mud flats. Gapers only get to be about 4 pounds in size. When the tide is in, these clams have their siphons extended to suck food from the water. They have to be careful, however; leopard sharks and bat rays ride in on the tide and try to snip off the siphons with their razor-sharp teeth.

Another common low intertidal clam is the Washington clam, also called the “money-shell” clam, since the native Californians used the shell for money. If we could see a cross section of the low intertidal flats, we’d see all the clams burrowed beneath the surface and there would also be a U-shaped hole that housed perhaps the most curious of all the mud flat inhabitants—the fat innkeeper worm. The innkeeper is about the size of a fat cigar, and is called an “innkeeper” because of all the guests that share its big burrow. Because the innkeeper is so good at getting food, three other creatures hang out in the burrow waiting to eat the leftovers, or the morsels he drops—like the scavenger gulls that follow the pelicans around. These three guests include a red scale worm, a goby fish, and a pea crab. Flounders and bat rays

apparently can extract bottom dwelling animals like the innkeeper, by using their broad, flattened bodies like a plumber’s helper and suctioning the prey out!

Higher up, where the mud flat meets the shore and in the tidal sloughs that meander through the tidal marsh, the most obvious animal is the Oregon shore crab, *Hemigrapsus*. Squarish, dull green, and not very large, “Hemi” burrows in myriad holes along the bank. Shore crabs feed mostly at night on diatoms and green algae that grow along the muddy shore, picking at their food with each claw. Mussels live along the upper shore as well, especially in undercut banks.



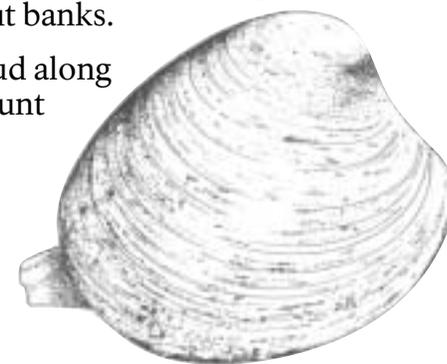
Hermit crab, NPS Collection

Look for raccoon tracks in the mud along the shore; they seem to come to hunt primarily for crabs and mussels.

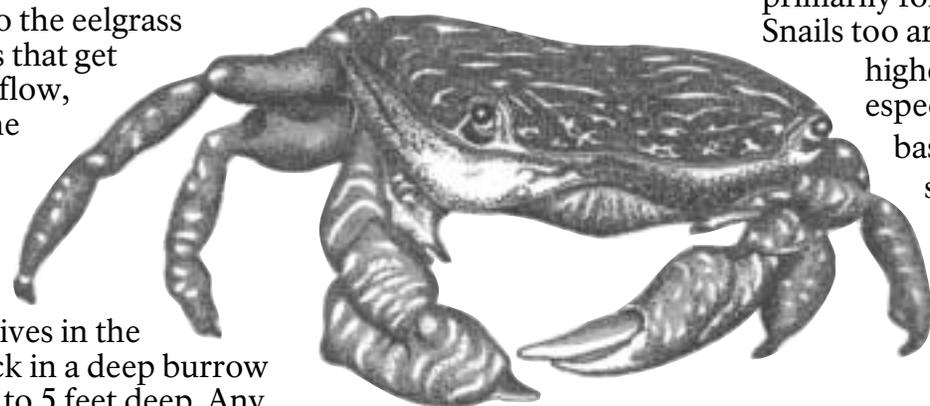
Snails too are common on the higher mud flats, especially the channeled basket whelk and tall-spired horn snail.

The horn snail is most easily found in the marsh pans (small tidepools in the marsh) where it grazes on detritus and diatoms covering the mud.

Basket whelks are carnivores, however, and will eat both dead and live meat. The fact that basket whelks migrate down to the eelgrass beds to deposit their egg capsules is another example of that habitat’s value as a nursery.



Clam, NPS Collection



Shore crab, Lisa Halton



Willetts, by Patricia Kirby

# Along the Sandy Shores

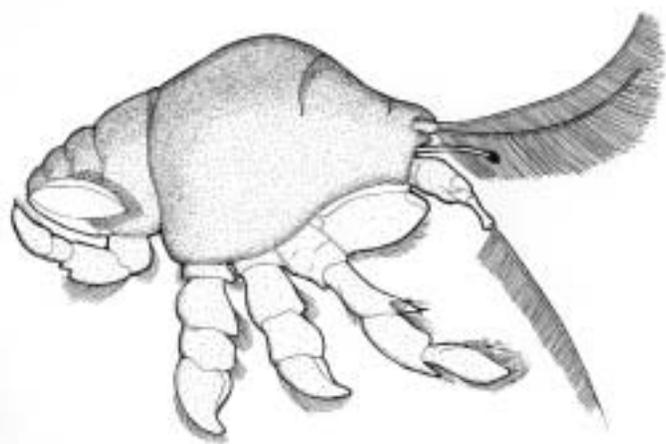


The Great Beach, Sue Van Der Wal

Most of the animals that live on the beach bury themselves in the shifting sands, moving up and down the beach as the waves break and the tide turns. One of the most common animals of the lower beach, the mole crab, has to be able to burrow very quickly to move with each incoming wave and avoid being eaten by the sandpipers that are also following the waves in and out. Seaweed and other flotsam gather on the upper beach, washed by only the highest tides and biggest waves, along what is called the wrack line.

Sometimes, especially after a strong storm, the wrack line is a tangle of bull kelp and feather boa algae, and if you sift through this smelly detritus, you'll find the other most common inhabitant of the outer beach, the beach hopper.

Unlike the estuary that produces its own food sources—sea lettuce, diatoms, microscopic algae, and eelgrass—little sustenance is produced by the sandy beach. The major source of food in this habitat is either plankton washed ashore by the waves, or the dead seaweed and corpses of fishes, birds, and marine mammals cast ashore by the waves. Look for the egg-shaped shells, or carapaces, of the mole crabs scattered along the beach. You should be able to find them since many are left behind by



Mole crab, Christie Anastasia

sanderlings or willets after they've eaten the body of the crab. The shells are ivory colored and about the size of your thumb. The following is a description of their feeding habits:

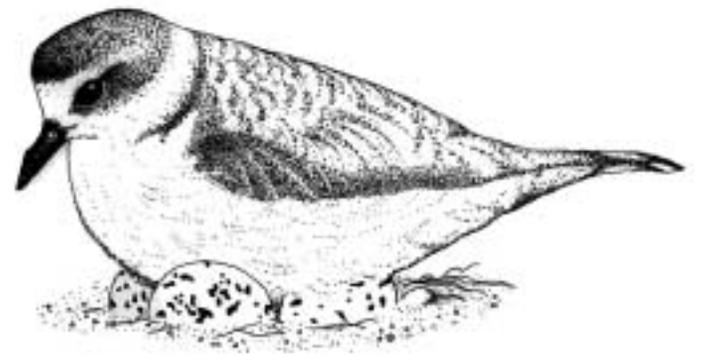
When in the sand, the mole crab always stands on end, head end up and facing down the beach toward the surf. Characteristically, the entire body is buried, while the eyes (tiny knobs on long stalks) and the first pair of antennae (which form a short tube for respiration) project above the sand. When a wave starts to recede down the beach, the sand crab uncoils its large second pair of antennae (like small feathers) and projects them in a V against the flowing water to gather minute organisms . . .

Mole crabs can be in very dense aggregations, concentrated in the wet sand where the waves are breaking. Not only are they constantly being preyed upon by shorebirds, but when a large wave washes in, surfperch try to eat them as well, so they are being hunted on both the inwash and the outwash of the wave.

Another common animal, though rarely seen, is a red worm that burrows in the sand a few feet above the tide. These worms feed by swallowing grains of sand and digesting the detritus that has gathered on the grains, in effect cleaning the beach.

Beach hoppers, or amphipods, are about the size of a pea; you can find them under the wrack on the upper beach, but they are most active at night.

Although amphipods avoid the waves, they like to stay moist in the wet seaweed. The beach hoppers are decomposers—they eat, or break down, the dead things that wash up on the beach.



Snowy plover, Lisa Halton

Other scavengers that occur on the beach include turkey vultures and gulls. Also, judging by the tracks that follow the tide line in the early morning, skunks, foxes, and raccoons visit the beach at night in search of a fresh bird or fish carcass. All these beach janitors are recyclers of the highest order.

Just beyond the grasp of the highest tides, a coastal dune community exists. This dry, sandy habitat is host to many plants such as the American dune grass, sand verbena, saltbush, beach strawberry, dune lupine, and beach morning glory. The dunes provides a safe resting place for many animals, especially during high tide and at night. In the more remote beach areas large flocks of birds—pelicans, gulls, shorebirds—congregate. One bird in particular lives on the beach and relies on it not only for roosting, but also builds its nest in the dunes. The western snowy plover, a small, pot-bellied shorebird, nests here at Point Reyes and raises its chicks along remote stretches of beach. They probably eat the beach hoppers as well as other small invertebrates that venture out onto the sand. Because the snowy plover is endangered, the Seashore has set aside certain beaches for its protection and restricted people from walking dogs there. Also, because plovers are being preyed upon by ravens, the biologists have constructed “exclosures”, large nets and fences around the nests that keep predators away from the adults and chicks.

Occasionally when walking the beach you'll find jellyfish washed up along the shore. One of the most peculiar looking of these doesn't even look like a jelly. The “by-the-wind sailor,” also known as *Vellela*, looks like a ruffled piece of cellophane with blue or purple dye along its edges. Under certain conditions *Vellela* will be strewn in lines for miles down the beach. What are these conditions? As the name “by-the-wind sailor” suggests, *Vellela* is distributed by the wind and appears on our shores usually in spring after the first strong westerly winds of the year, having been blown here from somewhere out in the middle of the Pacific Ocean.

One of the attractions of the beach is the possibility of finding just about anything that has been washed in by the tide. Most common are big “moon jellies,” bull kelp, dead seabirds (especially murrets, grebes, and scoters), sea lion carcasses, and driftwood. In the driftwood look for goose barnacles that have attached themselves at sea, or the European shipworm which bores through wood with the rasplike teeth on its shell. Other common finds include sand dollars, and the shells of razor clams, olive snails, and shore crabs.

# Intertidal Zone

Halfway between land and sea, on the rocky shelf where waves break against rocky outcroppings, is the intertidal zone, a realm inhabited by fabulous creatures that look as if they came from another world. Check a tide table for low tide times, dress to protect yourself from wind, and wear shoes that can get wet and still give good traction. Then tread cautiously. Be careful not to disturb or destroy the creatures that make the intertidal zone their home. Now you can discover the delicate and otherworldly magnificence of the tidepool.

## What is the Intertidal Zone?

In the intertidal zone, the ocean rises and retreats twice each day. Its inhabitants are exposed alternately to immersion in salt water and exposure to air. The animals that survive in this sometimes wet and sometimes dry habitat are mostly invertebrates. Many of the plants are algae.

The high intertidal zone is the area closest to the beach, which is covered with water only once or twice a day during high tides. Here, look for ribbed limpets, acorn barnacles, eroded periwinkle, small-shelled snails, black turban snails, rockweed (a type of brown algae), and lined shore crabs.

In the middle intertidal zone, the area that is exposed at least once a day due to tidal fluctuations, you will find California mussels and the olive green aggregated anemones. These animals cover themselves with sand and bits of shell to prevent loss of water from exposure to wind and sun. Look for ocher stars, mossy chitons, goose barnacles, and sea lettuce.

In the low intertidal zone, the area that is exposed only during a very low tide, look for purple sea urchins thriving amid the strong wave action. One may also find the bat star, a sea star which is webbed between its arms. Giant green anemones, up to 17 cm wide and a vivid olive green with brown tentacles, and coralline algae, an encrusting pinkish lavender/red algae, grow in this zone.

# Exploring the Landscapes



Turkey vulture, NPS Collection

Turkey vultures fly high over the land, continually searching, ranging far and wide, from the shoreline to the ridge top. Everything is connected by the passing shadow of this bird. You can recognize its silhouette—long wings with fingerlike flight feathers outstretched, rarely flapping, often rocking from side to side as it flies. All day long it cruises over the landscape, usually flying alone or in small flocks, along the sandy beach, across the coastal scrub and and prairie, over the forest of Douglas fir, bishop pine, live oak, and bay laurel.

Turkey vultures are scavengers and carrion eaters, which means they devour only dead meat—a seal that has washed up on the beach, a road-killed deer, a cow or elk that has died a natural death out in some pasture. This serves a very important service to the environment. By devouring freshly dead animals, vultures reduce the opportunity for diseases to breed. The digestive juices of the turkey vulture are among the strongest enzymes in nature, capable of breaking down powerful microorganisms. The vulture, therefore, is nature's sterilizer, cleaning up the landscape for the health and safety of all.

Vultures, soaring machines that they are, especially like the hot air currents called thermals, that rise off the ground as the day heats up. Therefore, they tend to be in warmer areas (very rare in northerly places like Canada) and most active during the middle of the day. Thermals do not occur over water, so vultures stay over the land; you'll almost never see a vulture venture out over the ocean! When you see a vulture overhead, think about the habitat they are soaring over and the animals that live there; just about any of them is potential vulture food. Do you think a rabbit, or a squirrel, or a quail is concerned when it sees a vulture fly over? If yes, why? If no, why not? Let's think about the vulture's environment, and the species that live there.



Mountain Lion, NPS Collection

## Coastal Scrub

From a turkey vulture's perspective, the coastal scrub—those large sloping hillsides that reach from the ridge top nearly down to the beach—is an ideal home. The breeze from the ocean provides continual air currents to catch, there are few trees so it's fairly easy to see thing, and the vegetation supports a large variety of animals that are potential food items.

Trees are few in the coastal scrub; only a bishop pine or Douglas fir scattered here and there. The name "scrub" refers to the abundance of bushes that are the dominant plant form in this habitat—coyote bush, poison oak, bush lupine, ceanothus ("blue blossom"), and huckleberry—to name a few. Coyote bush is the most common and is the indicator plant of the coastal scrub habitat. It is an evergreen shrub, three to six feet tall with stiff, bright green foliage and small white flowers.

The coyote bush community provides cover for many mammals and birds, including deer mouse, brush rabbit, gray fox, coyote, spotted skunk, black-tailed deer, tule elk, California

quail, bobcat, and mountain lion. The fox and rabbit are among the most common of these; if you find fox scat, the fur in it is most likely that of the brush rabbit.

One of the most obvious flowers you'll see is bush (or "sticky") monkey flower (*Diplicus aurantiacus*) with sticky green leaves and salmon-colored flowers that bloom almost year-



California poppies, NPS Collection

round. Also long-blooming, but bright scarlet in color, is Indian paintbrush (*Castilleja*). Anna's hummingbird is a year-round resident in the coastal scrub, largely because of these two abundant and often available food plants. Other showy spring flowers include the California poppy and Douglas iris.

One of the world's most beautiful reptiles can also be found here in the warmer months, the red-sided garter snake (*Thamnophis sirtalis*). Its diet includes many of the smaller animals that also live in the coastal scrub—tree frogs, banana slugs, salamanders, spiders, earthworms, and even small mice and birds. Of course, the snake may be eaten by any of a variety of predators, too—coyote, northern harrier, raccoon, and striped skunk.



California quail, NPS Collection

# From Streams...to Forests

## Riparian Corridors

Riparian means “streamside,” and refers to the thickets of large shrubs and trees that grow only along the banks of creeks and streams. The dominant plants of the riparian thickets in Point Reyes National Seashore are yellow willows and red alders, both deciduous tree species that lose their leaves and bud out in early spring. Riparian plants like to have their roots damp all the time and therefore grow only in the lowest portions of the watershed. Blackberries, stinging nettle, horsetails, and miner’s lettuce are common plants found in the riparian understory.

The environmental benefits of riparian plants are many. Beneficial bacteria grow on their roots; these bacteria have the ability to take nitrogenous waste out of the groundwater, “fix” it and release it into the water as nitrogen, a basic food source for microorganisms. For this reason, this process is called nitrogen fixing.

Many of the animals that live in the riparian zone—especially fish and amphibians—require cool water to survive. The overhanging willow and alder foliage shades the water and keeps it cool in the warm summer sun. The root system of the vegetation twines out of the streambed, slowing the water and providing hiding places and attachment sites for many invertebrates, animals like opossum shrimp and caddisfly larvae, which are food for young trout and salmon. The leaves of the trees fall into the stream and break down, giving nutrients to the streambed that can be eaten by the small decomposers.

Why do we call the riparian habitats corridors? Watercourses flow from high ground to lower ground, through a variety of habitats. Because they are long and narrow, like hallways, they provide corridors, or runways of movement for animals from the

highlands to the lowlands. These corridors are of special importance to migrating birds, but are also critical to amphibians such as California red-legged frogs, tree frogs, banana slugs, newts, and salamanders. Mule deer take shelter from the midday sun in their shade. Great-horned owls and northern spotted owls sleep in the shade of the willow tree or nest in a hollow stump of an alder tree.



California red-legged frog, USGS

## Douglas Fir Forest

If you walk through the fir forest—at Sky Trail, or Bear Valley—on

a foggy day, on a day when it’s too damp and cold for turkey vultures to fly, you’ll notice how moist the ground is; you’ll feel the fog drip from the boughs of the trees overhead. Douglas fir trees are very adept at capturing moisture out of the air, and even when it’s not raining, it may feel like rain within the forest.

Scientists have found that the precipitation beneath fir trees is twice the annual rainfall. At Point Reyes, where the annual rainfall averages about 40 inches

a year, the total precipitation in the fir forest may be more than 80 inches! (How tall are you? Compare your height with the annual rainfall and the total precipitation in a fir forest). This ability to capture moisture in the air insures that the ground will be recharged (or rehydrated) by the trees and ultimately provides the foundation for a diverse forest. The Douglas fir forests of Point Reyes may be shared by the California bay and a varied understory of California coffeeberry, California hazel, red elderberry, ceanothus, poison oak, huckleberry, and thimbleberry. The mixed woodland forests surrounding the Douglas firs contain coast live oaks and tan oaks that provide



Banana slug, NPS Collection

habitat and food for many species including the acorn woodpecker. Two types of deer are commonly seen in these forests although the black-tailed deer is the only native species.

The Douglas fir is a grand tree; some individuals within the Seashore rival redwoods in girth and height. Like bishop pines, Douglas fir forests thrive following a fire. The seeds germinate readily, but only those seedlings survive that receive direct sunlight and whose roots come in contact with mineral soil. Therefore, before a new forest can become established, some event must clear the mother forest, provide a bed of mineral soil, and reduce competition from other trees. Fire is the only natural event that provides these conditions.

## Bishop Pine Forest

Overhead, the turkey vulture soars, silently watching the world below. On a pale granite outcrop, silhouetted against the gray skies of summer, a bishop pine (*Pinus muricata*)—trunk awry, limbs askew—stands sentry over the rolling grasslands that stretch toward the dunes of Limantour Beach and the swollen

surf beyond. Hidden in the tufted clusters of long needles that splay from the ends of the smaller branches, a Steller’s jay sounds a scolding “caw”. Molded by the contrary forces of wind, substrate, and available moisture, these contorted conifers lend a twisted grace to the landscape and more than any other species, symbolize the unique and natural beauty that encompasses Point Reyes.

Although once widespread, bishop pines now occur in relict stands, scattered along the humid coastal region of California. Point Reyes hosts one of the most extensive and picturesque groves. Heavily influenced

by soil, slope, and microclimate, bishop pines vary in shape and size. While some trees grow lanky, straight, and tall, many are

short and ragged in appearance. One of the most unusual characteristics of this tree is the large, heavy cones located on the main branches and trunk of the tree. The cones are arranged in tight whorls, their scales sealed closed with pitch. On a hot day, one can hear the cones crackle as the dried resins release the scales, freeing the seeds to fall or be eaten by finches or sparrows. Western gray squirrels also feast on the cones, but they will attempt to gnaw out the seeds before the scales have released their protective grip. Birds, rodents, and wind disperse the seeds. However, this method of regeneration does not compare to the abundance of saplings that sprout shortly following a forest fire.

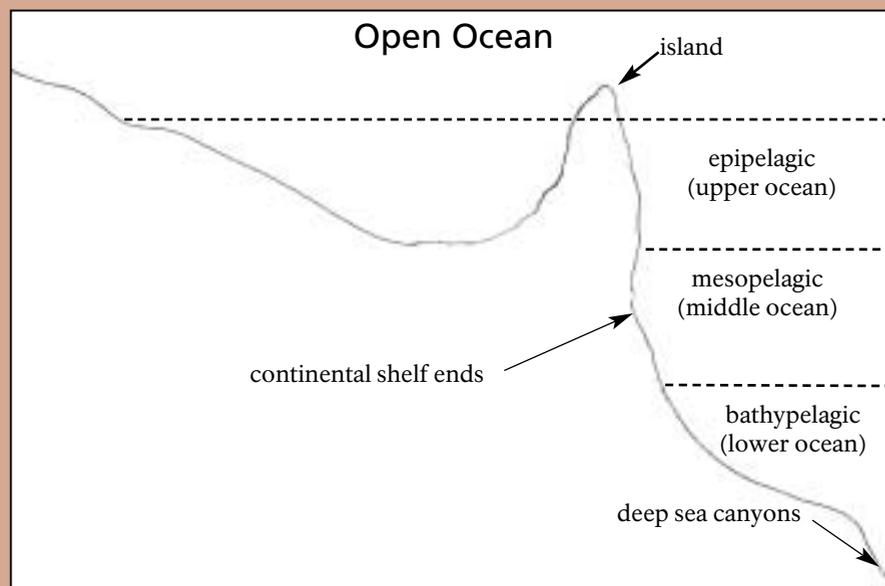
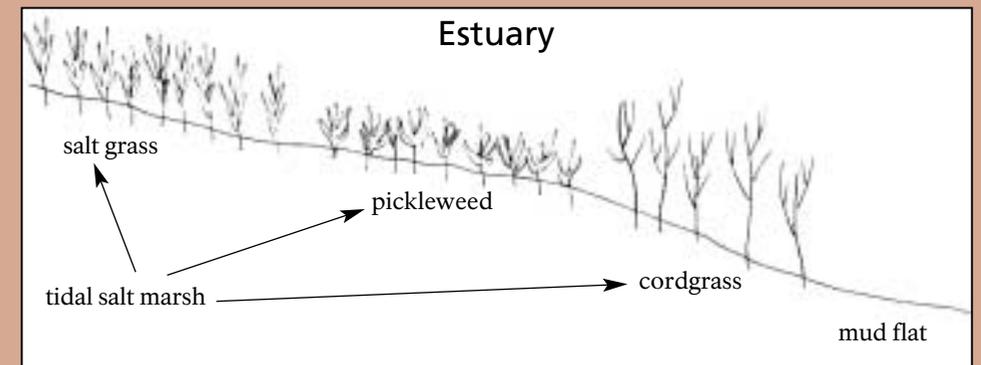
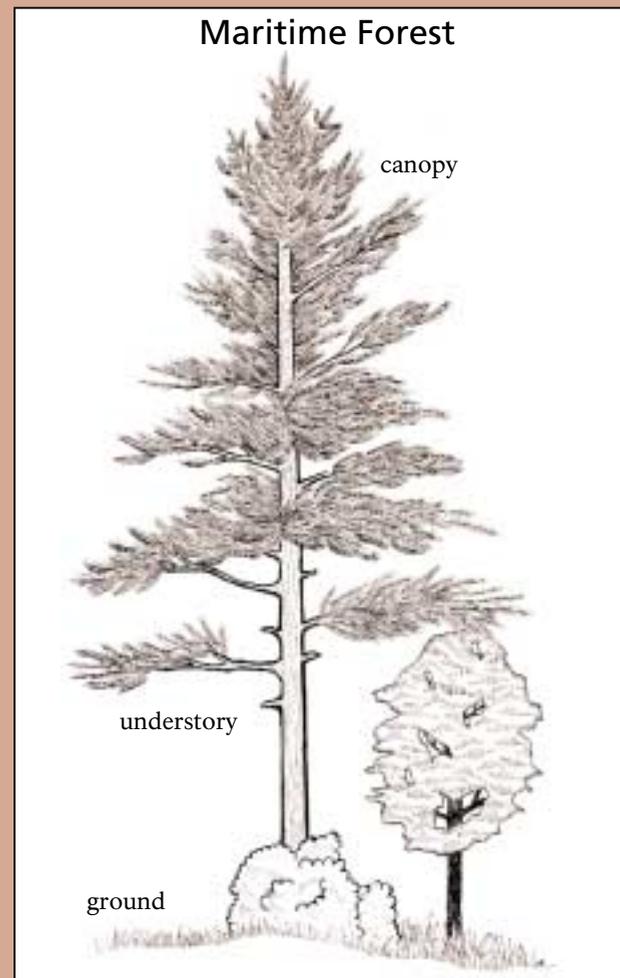
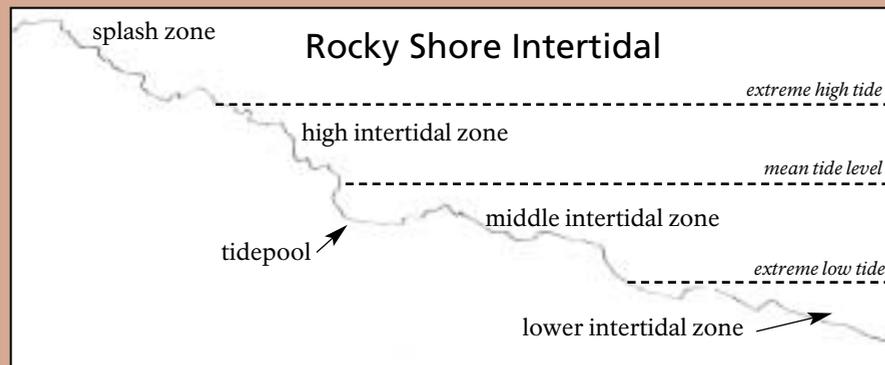
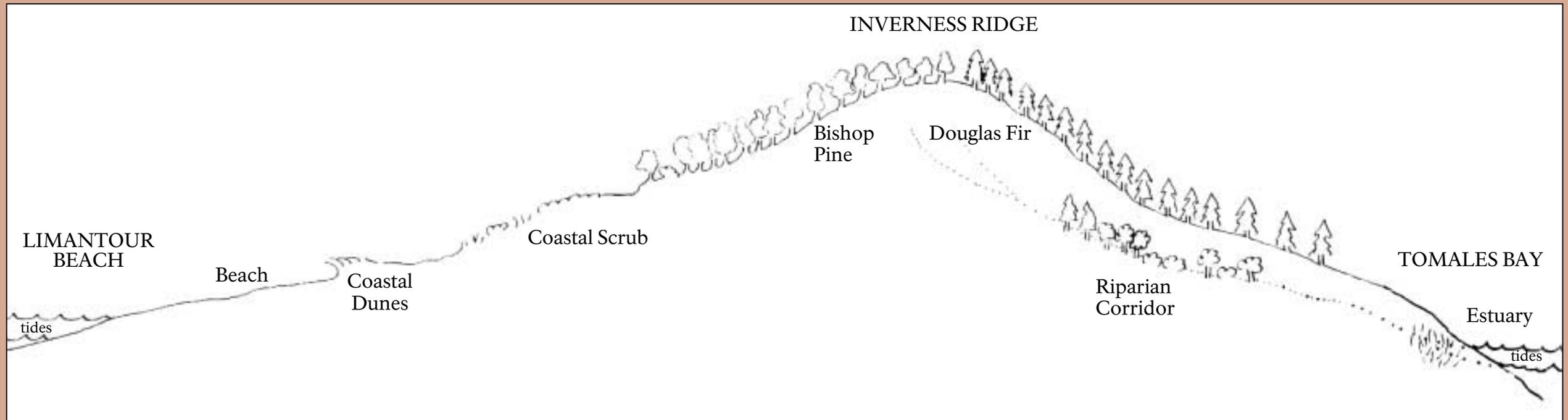
One of the best places to view the regrowth of the bishop pine forests following a large fire is at the Bay View Trail head on Limantour Road.

Other trees share the forest with the bishop pines, but usually as secondary members of the community. These include bay laurel, madrone, California buckeye, California wax myrtle, and, occasionally, coast live oak. Several rare and endangered species are associated with this habitat. Three species of manzanita and two varieties of ceanothus are found only in bishop pine forests.



Douglas fir cones, Bruce Farnsworth

# Habitats of Point Reyes National Seashore



## Douglas Fir Alliance

The Douglas Fir habitats (and all other plant habitats) are actually a mosaic of plant associations based on soils, sun, water, and historical disturbances. Five associations have been identified at Point Reyes National Seashore for the Douglas Fir:

- Douglas Fir - California Bay - Western Sword Fern
- Douglas Fir - Coyote Bush
- Douglas Fir - Coast Live Oak
- Douglas Fir - California Bay - Coffeeberry
- Douglas Fir - Tanbark Oak - Coffeeberry

# Monitoring Habitat Health

“A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.” — Aldo Leopold

When taking a walk or a drive in Point Reyes National Seashore, it's easy to see why the Seashore was authorized in 1962. Its beauty and wild nature are breathtaking. But is Point Reyes National Seashore ecologically healthy? Are species populations on the rise or in decline? Until a few years ago, very few questions could be answered about ecosystem health. This is changing at the Seashore with the implementation of an Inventory and Monitoring program. With the help of volunteers and partners, this program provides scientists and managers with baseline information and long-term trends within Seashore ecosystems.

Volunteers are a critical component to many of the inventory and monitoring projects at

Point Reyes. Some volunteers come from as far as an hour and half away to spend the day outside and to give something back to a place they love. Others leave a nearby classroom in Inverness or Bolinas and gain a practical, hands-on science lesson while gathering data for resource managers. Through their effort and dedication, Point Reyes receives valuable information about harbor seal and elephant seal populations, rare plants, and other species. Interns work with the northern spotted owl monitoring their numbers, their nesting productivity and behavior. Others monitor intertidal zones counting diversity and distribution of species found clinging to the rocks in areas exposed only in extremely low tides.

Park partners are also integral to the inventory and monitoring studies at Point Reyes. In situations where specialized experience is required or there is an overlap with other studies already being conducted, Point Reyes relies on its partners. The Seashore has developed strong partnerships with the Point Reyes Bird Observatory, the Audubon Society, the California Native Plant Society, colleges and universities, the

U.S. Fish and Wildlife Service, and the Gulf of the Farallones National Marine Sanctuary. Through these partnerships, Point Reyes has gained incredible amounts of scientific information regarding mammal, amphibian, and bird populations.



Elephant seal, Point Reyes, Sean Case

spotted owls. These species are closely monitored and actively studied to protect the Point Reyes population from disturbance and decline. We also pay close attention to keystone

species, such as Bishop pines and wood rats, on which total ecosystem health is hinged. Because a disruption in a keystone species can often be felt throughout an entire ecosystem, it is crucial that we understand their population dynamics.



Intertidal monitoring by staff and volunteers, NPS Collection

Through a partnership with the USGS Biological Resources Division we have documented mountain lions, long-tailed weasels, bobcats, raptors, and other notable wildlife using trail cameras at monitoring arrays.

Even with volunteers and partners, there is no way to monitor all of the 900 plus species of plants, the 480 species of birds, and over 100 different



Common murre, NPS Collection

Sensitive species, like the common murre, are the third type of species that is monitored carefully. They are often the most vulnerable to changes in an ecosystem and therefore are good indicators of larger problems in the environment. Lastly, heroic species, such as the tule elk and elephant seals, are monitored. Tule elk and elephant seals capture our hearts and our minds and focus our attention on their survival for the freedom and wildness that they embody.

By focusing our efforts and working with volunteers and partners, there is more scientific work being done today at Point Reyes than ever before. We are gaining a strong base of scientific knowledge to guide management decisions within the Seashore. But there is still more to do than there are staff, volunteers, and partners. So what's the solution? It could very well be you, and some of your time. Your commitment to Point Reyes National Seashore can ensure that Point Reyes will not only remain beautiful, but healthy and full of diversity for years to come.



Northern spotted owl, NPS Collection



Bishop pine, NPS Collection

species of land vertebrates. So the big question is where to focus our limited resources? The answer is where the most can be gained, where the most can be lost, and where the most attention is focused. At Point Reyes, inventory and monitoring efforts are concentrated in four main areas. We monitor federally threatened and endangered species like the northern

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Writers: **Jules Evens, Dawn Adams, Steve Anastasia**

Editor, Design/layout: **Lynne Dominy and Christie Denzel Anastasia**



Artwork: **Bobbie Belvel, Lisa Halton, Patricia Kirby, Christie Denzel Anastasia**

Photography: **Bruce Farnsworth, Sean Case, Richard Stallcup**