



## *Interpretive Trail Guide*

The Sea Ranch seascape is unique not only because of its diverse features over a short distance but also its remarkable and complex geologic history. It has evolved over millions of years and is still changing today. The rock formations on which you stand were originally deposited hundreds of miles south of here and have, over time, moved along the San Andreas fault zone to this location. This northwestward movement produced the folds and tilted rock layers that we see today. The sea and wind interact continually with these rock formations to produce our beaches, dunes, tide pools, coves, caves, arches, blowholes, and sea stacks. These features now foster a wide range of habitats for marine plants, mammals and birds with different adaptations to the constantly changing conditions (e.g., webbed feet, long legs for wading, bills of differing lengths, etc.)

Use this informative brochure while walking the Bluff Trail between Navigators Reach and Galleon's Reach. If walking south read sections 1-4; if walking north read the sections in reverse order 4-1. Fig. 1 (from The Sea Ranch Trails Map) shows the locations of the hedgerows and rest logs ("R") in this area. Seascape features, including marine mammals and birds, are described for each trail segment. We hope the brochure will further your understanding and appreciation of this evolving seascape.

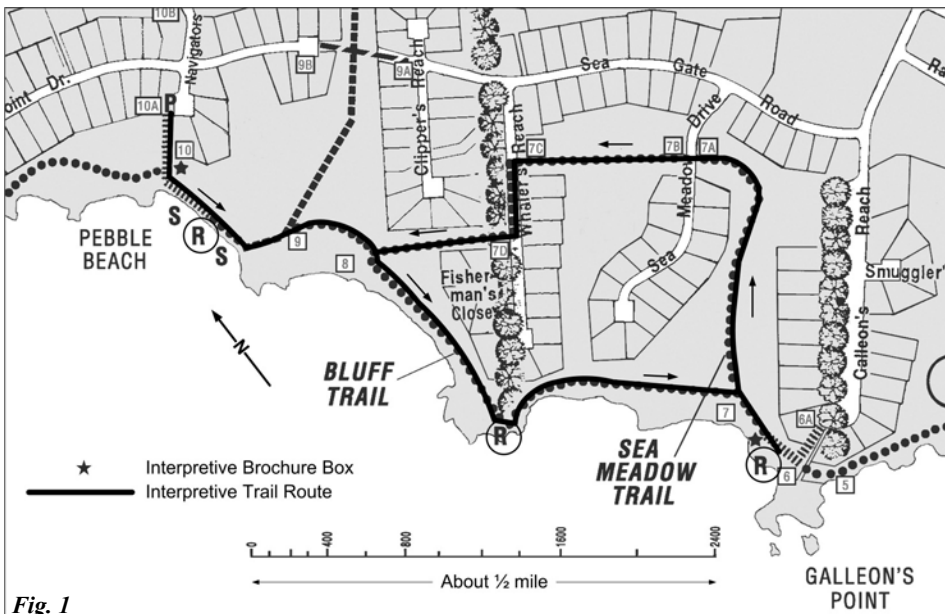


Fig. 1

### *Pebble Beach Rest Log (section 1)*

#### **The Pacific Ocean**

The distance to the horizon is limited by the curvature of the earth and your height above sea level. On a clear day it is possible to see for approximately 9 miles when standing on the Bluff Trail. From a higher terrace near the airport, the horizon is about 20 miles out. The color of the ocean is primarily the reflected color of the sky. Blue color comes from the sunlight's shorter wavelengths being scattered, in sky or ocean; the longer red wavelengths are mostly absorbed. Long lines of contrast between paler water and darker water are caused by wind. Irregular contrast lines nearer shore are from turbidity from streams or rip currents and may have a brownish tinge from sediments.

The California Current that flows along our coastline originates along the coast of British Columbia. Point Arena is the starting point of the most intense upwelling



Fig. 2

in that system (see Fig.2, from NOAA). This is one of only four coastal upwelling systems in the world. As water flows southward along the coast, extensive upwelling of cold (about 55° F), nutrient-rich subsurface water occurs along the shoreline. This upwelling is particularly strong in spring and summer due to the prevailing northwesterly winds during those seasons. Winds, coupled with the earth's rotation, cause the

surface water to flow offshore. Deep water then flows up over the continental shelf to replace it. This upwelling replenishes nutrients in the surface water and stimulates growth of plant plankton which then causes rapid population increases up the food chain of zoo (animal) plankton, krill, fish, marine mammals and seabirds. Kelp forests also grow rapidly in these rich waters. Cold northern waters along our coast interact with the upwelling of cold subsurface water to produce our characteristic fog in spring and summer.

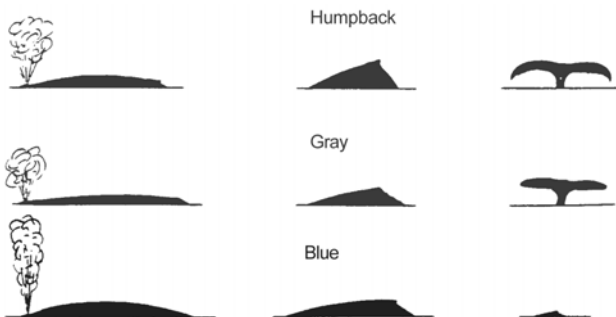
The Pacific Continental Shelf has a complex topography. Its terrain varies from broad banks of sandy and silty sediments to deep submarine canyons, steep escarpments and high peaks. Offshore from The Sea Ranch the shelf slopes moderately for about 20 miles. After that, the ocean depth plunges rapidly to more than 10,000 feet below sea level.

As you smell and taste the fresh salt air, realize that its flavor is from dissolved mineral compounds accumulating in the ocean from land erosion over millions of years.

### Mammals

Look far to your right to the distant point to see the nearest seal haul-out area. Having lungs, mammals must surface to breathe. Two groups of mammals have adapted quite differently to their marine environment. **Pinnipeds** are furred marine mammals whose front and rear limbs have evolved into flippers. They haul out on rocks between dives to hunt for fish. The *Harbor Seal* is up to five feet long and is the most common pinniped here. It has rear flippers that are always extended. *California Sea Lions* are larger at six to eight feet, with visible ears and rear flippers that can be brought under and alongside the body.

**Cetaceans**, such as the baleen whales and the toothed species including dolphins and porpoises, are *hairless* marine mammals with nostrils moved above as blowholes with a muscular flap held open only to breathe. They usually have a dorsal fin and forelimbs modified into two large and powerful pectoral flippers. Rear limbs reduced to vestigial bones as a long strong propulsive tail evolved with two wide horizontal lobes called *flukes*. A very thick blubber layer provides insulation and buoyancy in water which enables the *Blue Whale* to attain the largest size of any animal, *ever*. We see three kinds of baleen whales



©Gordon C. Pike "Guide to the Whales Porpoises and Dolphins of the North-East Pacific and Arctic Waters of Canada and Alaska"

Fig. 3

here (see Fig. 3). *Gray Whales* appear from October through January on their 5,000 mile migration from the Arctic to breed in Baja California. They return, some with calves, to Arctic feeding grounds from February through May. *Humpback Whales* frequent these waters and *Blue Whales* are occasionally seen. *Orcas* are the largest of the dolphins. Several other species of dolphins and porpoises are also seen here.

The truly marine *Sea Otter* does not inhabit our waters, however, *River Otters* will occasionally swim into the ocean from Sea Ranch streams in search of food in the intertidal zone.

### Whaler's Reach Hedgerow Rest Log (section 2)

#### Points, Coves, Caves, Arches, and "Sea Stacks"

From the Whaler's Reach hedgerow, follow the small trail towards the ocean, which takes you to a rocky point. From the point you can look at the bluff leading south to Gal-leon's Cove. Differential erosion has caused a series of points alternating with crescent-shaped coves (Fig. 4). Softer rocks such as shales are more easily eroded than



Fig. 4

harder rocks such as sandstones and conglomerates. The hard rock conglomerates and thick sandstones that resist erosion form the points; the recesses in the bluff form when the softer shale has been eroded to shape sandy coves. Bluff erosion occurs during winter storms when rocks and logs act as battering rams, and throughout the year as each wave compresses the air in cracks within the rocks where, upon re-expansion, the air shatters more rock.

Waves entering a cove slow down in shallow water as the waves direct most of their erosive energy onto the points. A fracture can erode into a cave which eventually may become an arch (tunnel). As surf enlarges the arch, the piece of land may eventually be cut off from the mainland and form a sea stack. The oldest and furthest from shore erode to low rocks while near-shore stacks are newer and taller (Fig. 5).

Walk southward beyond the hedgerow for 80 paces (approx. 200 feet). Look northward at the base of the south

## Galleon's Point Rest Log (section 4)

### Galleon's Cove

Look up the coastline at the beach, tidal zones, folded and tilted rock beds, sea stacks and the large arch of Galleon's Arch Rock where seabirds nest. Sea stacks, once part of the mainland, are the rocks and islands along this coast. They provide roosting and nesting sites for seabirds and other avian species. Depending on the season, many birds nest in depressions between the sandstone ridges, and/or use the rocks for resting, feeding, and overnight roosting. Large flocks of migrating birds fly by our coastline.

### Birds

Birds that are commonly seen in this section of the coast include the *Black Oystercatcher* (Fig. 7). These black shorebirds have red bills and nest in surface cracks and on ledges. Their bills are especially adapted for prying open shellfish. You may hear them call noisily. They have been identified by Audubon California as an indicator species for sea level rise from global warming. The *Pelagic Cormorants* are tall black sea-birds with slender necks. In breeding plumage, they develop red facial skin plus distinctive white flank patches.



Fig. 7 ©Rozanne Rapozo 2009

(Fig. 8) They usually nest on the narrow ledges of cliff faces.

*Brandt's Cormorants* are larger, bulkier and have shorter tails than the Pelagic Cormorants. In breeding plumage, they develop bright blue throat patches. They will rest in the Galleon's area but use the larger islands of our Coast for nesting. Males gather nesting materials of kelp and seagrass, and the females build their large nests in closely-spaced colonies on top of islands.



Fig. 8 ©Cuba, Emily 2009

*Brown Pelicans* (Fig. 9) begin migrating northward in May from their breeding grounds in southern California and Baja California. Some stay here during the summer and on into winter months. They can cover up to 40 miles a day in search of food, gliding low over the waves, then climbing, tucking their wings and plunging head-first into the water for fish, especially anchovies and herring. *Western Gulls* are the only resident gulls nesting along our coastline. Adults have white heads and dark gray backs with black wingtips. Their chicks leave the

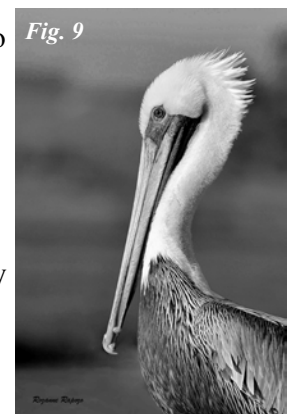


Fig. 9



Fig. 5

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face of the rocky point. At mid tide, as surf hits the point, you can see water cascading from a vertically-elongated triangle, revealing a nascent arch (Fig 6). This fracture probably developed as softer interbedded shale eroded faster than adjacent harder sandstone beds.



Fig. 6

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### Trail Segment From Whaler's Reach Hedgerow to Galleon's Cove (section 3)

#### Beaches

About midway across the meadow, you will cross a bridge and a seasonal stream. Small streams along the coast and the Gualala River deposit fine sands which form white beaches, and pulverized rubble from undercut shale cliffs forms gray, gravelly beaches. Sand, pebbles and gravel provide a three-dimensional substrate for the very abundant life forms that can then burrow to various depths. Small burrowing animals include *Beach Hoppers*, *Sand Fleas* and *Sow Bugs* which, along with detritus, are food for scurrying crabs and shorebirds.

#### Marine Terraces

South of the bridge, look inland to see an emergent coastline that has formed as the land has risen over millions of years. The ocean level has also fluctuated in response to Ice Ages and is presently rising as glaciers and polar ice sheets are melting. The Bluff Trail is on the most recent wave-cut terrace. Six successively older terraces make a giant staircase inland up to the ridgeline. Roads and hillside homes are built on these flatter areas.

In the meadow just to the east are eroded remnants of ancient sea stacks. Walk a side loop inland from Trail Post 7 where, at Trail Post 7C, there is an example of a large basalt stack. Black Point Basalt is the oldest rock exposed at The Sea Ranch and is a piece of ancient oceanic crust.

## *Galleon's Point (cont.)*

nest just 2 days after hatching but are difficult to observe with their gray, darkly speckled feathers providing camouflage among the rocks (Fig. 10).

### **Tidal Zones**

Tides occur in a cycle of 12.5 hours as the ocean surface changes with changing gravitational pull influenced by the positions of the Moon and the Sun relative to the Earth. The time between low tide and high tide is about 6 hours, 10 minutes. Tides are about 50 minutes later each day because the Lunar Day is almost 25 hours long. The Intertidal Zone, between the reaches of high and low tide, presents especially challenging conditions for life. Plants and animals in this region are remarkably adapted for twice daily flooding alternating with exposure to air/heat and drying-out. Competition is keen for the limited rock space on which to anchor as surf pulls strongly at invertebrate animals clinging there. The subtidal zone starts where you see the *Sea Palm* brown seaweeds, as well as beds of kelp. Kelps cling tightly to the substrate with anchoring rootlike holdfasts, form extensive beds and have large air bladders to keep their fronds afloat to bob in the swells. Holdfasts are so strongly cemented that washed up kelps on the beach usually have brought torn substrate with them. It is easy to

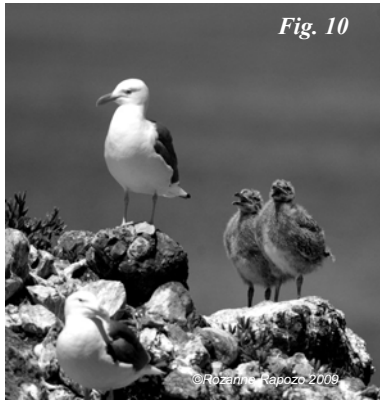


Fig. 10

mistake bobbing air bladders for *Sea Lion* or *Harbor Seal* heads!

These tidal zones teem with life (Fig. 11). The rich diversity of habitats has produced an astounding variety of very differently adapted marine species. Many are microscopic and include bacteria as well as plant and animal plankton. Natural "super glues" cement invertebrates such as barnacles, anemones, and mussels to the rocks. Sea Urchins and Sea Stars have suction devices to prevent surf from pulling them away. There is a great variety of green, red and brown algae. Non-motile barnacles, mussels and anemones *passively* filter food from the flowing water while, in the open ocean, *active* filter feeders, such as the whales, have baleen to sieve krill and other small organisms from the water. In the tidal zones the long-legged beach-combing shorebirds are seen feeding on this abundant life.



Fig. 11

There are piles of organic debris, especially abundant after heavy surf, which tears loose seaweeds from the subtidal zone and leaves them piled up at the high tide berm; this unique ecosystem is known as Beach Wrack.



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## *The California Coastal National Monument (CCNM)*

All of the islands, rocks, reefs and pinnacles along the California coastline acquired status as the California Coastal National Monument in 2000. The President of the United States assigned to the Bureau of Land Management the responsibility of protecting the flora and fauna within the Monument. The Sea Ranch Association is a "Steward" for the CCNM for this ten mile section of the coast off The Sea Ranch. Volunteers regularly monitor the birds, seals and plants to ensure their protection from human activities.

*We hope that you will explore our seascape along the entire length of the Bluff Trail. Please visit as well:*

- *Gualala Point Regional Park (Visitors Center is open Fri-Mon as volunteers are available).*
- *The Sea Ranch Association Office, 975 Annapolis Road for The Sea Ranch Trails Map and other interpretive trail brochures.*
- *The Sea Ranch Association website for additional information on nature and activities: [www.tsra.org](http://www.tsra.org).*

Interpretive guide produced by The Sea Ranch California Coastal National Monument Stewardship Task Force.