



# Marine-Themed Interpretative Signage at the Sea Center

2017 CREF Proposal



Spanish Shawl nudibranch on a kelp frond. Photo by Sam Staudling.



Close-up of gas-filled bladders and kelp blades. Photo by John N. Hejna.



Root-like holdfasts make up the kelp holdfast. Photo by Shane Anderson.



## GIANT KELP FORESTS

Some of the most extensive submarine forest in the world lie off the Santa Barbara coast in 30 to 60 feet of water. One forest lies just beyond the Santa Barbara breakwater, others can be found around the northern Channel Islands.

Giant Kelp, a species of brown algae, is the dominant plant in these submarine forests. One of the fastest growing plants in the world, Giant Kelp can grow up to two feet a day and reach 200 feet in length. Kelp plants have no true roots, stems, leaves, or flowers. Each plant is anchored to rocks or debris on the ocean floor by a mat-like network of strands called a holdfast. Growing upward from the holdfast are slender stalks, or stipes, that sprout leafy blades at regular intervals. Small gas-filled bladders are located at the base of each blade to buoy up the long kelp fronds. At the ocean surface, the fronds of several plants may intertwine to form a dense kelp canopy.

Kelp forests provide habitats for a variety of plant and animal life. Marine invertebrates such as sponges, hydroids and bryozoans attach themselves to holdfasts and rocky outcroppings on the sandy floor. Worms, seastars, crabs, lobsters, shrimp, sea urchins, snails, and abalone crawl in and around the holdfasts, and octopuses and bottom-dwelling fish glide along the ocean floor. Farther up the kelp plant, the kelp blades are covered with a myriad of encrusting plants and animals. Small fish graze on these organisms and hide in the blades to escape from bigger fish, sea lions, and sharks.

Compared with forests on land, kelp forests have a short lifespan, sometimes lasting only a few years. Storms and grazing marine animals eventually weaken holdfasts, and ocean waves wash the plants ashore. During severe storms, older kelp forests may be almost destroyed. Dozens of younger plants, their fronds entangled in the kelp canopy, are



Kelp canopy. Photo by Sam Staudling.

also swept away. But as the sunlight reaches the ocean floor again, new plants sprout from kelp spores that have drifted to the bottom.

Kelp is a rich source of vitamins, minerals, and nutrients and has long been used by humans as a food supplement and for fertilizer. Kelp was first commercially harvested in Santa Barbara during World War I, when German potash fertilizer was unobtainable. During the later 1920s, scientists discovered that algin, an emulsifying and stabilizing agent, could be commercially manufactured from kelp, and a kelp-harvesting industry rapidly developed. Today, algin is used in many familiar products such as ice cream, cosmetics, medicine, paint, plaster and paper. In the future, kelp may provide a new source of fuel; decomposition of kelp produces methane, a useful and renewable substitute for natural petroleum gas.



Kelp harvester. Photo courtesy of KILCO.



See a rocky reef habitat at  
**The Sea Center**  
on Stearns Wharf.



A lifesize recreation of a submarine kelp forest is in  
The Marine Hall at  
**The Santa Barbara Museum of Natural History**  
located just beyond the Old Mission.

## COMMON BIRDS OF THE HARBOR



Photo by Gary Robinson

The Santa Barbara Harbor provides feeding grounds and resting areas for more than 20 species of birds. On the beach, Sanderlings, and various species of sandpipers and plovers use their stubby bills to pick tiny sand crabs, beach hoppers, worms, insects, and other bits of food from the sand. Long-billed Curlews, Willets, Whimbrels, and Marbled Godwits have longer bills and probe farther into the sand.

Surf Scoters, Common Loons and Western Grebes dive deep to the harbor bottom in search of fish, clams, and scallops or explore the pier pilings for mussels. Farther off shore, "high diving" Brown Pelicans cruise above the ocean surface watching for fish. When they spot their prey, they fold their wings and plunge headlong into the water, using their pouch as a scoop. Western Gulls feed mostly on dead fish, but will steal live food from pelicans and other gulls if they can, or will scavenge garbage left by humans.

Occasionally a Great Blue Heron or Snowy Egret will perch on a boat or platform in the harbor, waiting for the ebbing tide to expose small fish, crabs, and shrimp in the tidepools and shallow channels.



Top: Brown Pelican  
Middle: Western Gull  
Bottom: Surf Scoter



Illustrations by Bradford Johnson



Whimbrel, Black-bellied Plover, Willet



Snowy Egret  
Great Blue Heron



Clockwise from top left: Western Grebes, Eared Grebes, Common Loon, Surf Scoters

To see more of Santa Barbara's birdlife up close, visit



**The Sea Center**  
on Stearns Wharf  
and



The Bird Habitat and Bird Taxonomy Halls at  
**The Santa Barbara Museum of Natural History**  
located just beyond the Old Mission.



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**Channel**  
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Way, Santa Bar

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or visit

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Our proposal also included the addition of one more sign just outside the Sea Center (it would be located along the railing, below).



# What Causes Tides?

At times observers have noticed that ocean tides are in phase with the moon. Today we know that tides are caused primarily by the moon's gravitational attraction.

At any given time the earth has two tidal bulges caused by differences in gravitational force. However, it is not just the moon. At our latitude these differences force water in a clockwise (for twice-daily) tidal cycle, with two high tides alternating with two low tides each day along our coast.

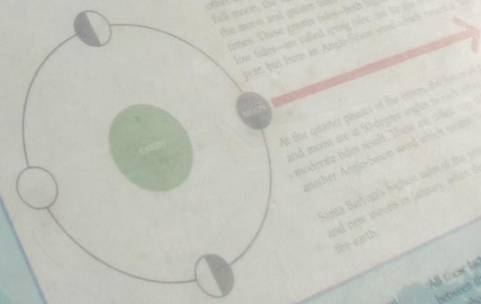


**How much time is there between tides?**  
In the illustration, Santa Barbara is shown with a high tide at the H<sub>1</sub> bulge. Twelve hours later the earth's rotation will have carried Santa Barbara to another high-tide position at H<sub>2</sub>. At this rate, Santa Barbara will rotate back to the H<sub>1</sub> point in exactly 24 hours. However, during the 24 hour period the moon has advanced about 1/30 of the way around the earth. The earth takes about 50 minutes to catch up with the moon once again. Thus each high or low tide is about 25 minutes later than the one before, and the interval between successive high or low tides is about 12 hours and 25 minutes.



## What effect does the sun have upon the tides?

When the sun and the moon are both in line with each other and with the earth, as they are at the time of a full moon, the sun's gravitational force is added to that of the moon and greater tides—both higher high tides and lower low tides—are called spring tides. At the time of a new moon, the sun and moon are in opposite phases and their gravitational forces are in opposition. At these times the tides are called neap tides and are of intermediate height.



At the opposite phase of the moon, the gravitational force of the sun and moon are at right angles and their forces are in opposition. At these times the tides are called neap tides and are of intermediate height. These are also the times of another Anglo-Saxon word which means "neap": the earth.

All these factors add to the complexity of the tidal behavior between the earth and the sun. Santa Barbara is located on the coast of Santa Barbara, New Zealand. To get some more information on the high and low tides in our area, visit the Santa Barbara Museum of Natural History located at 200 Pines at the end of the pier just beyond the old lighthouse in Santa Barbara.

It is difficult to predict tides at specific locations without years of record-keeping. Tidal behavior can be affected by such geographical and weather conditions as:

- the contour of continents or local shorelines
- the depth of offshore water
- the size and contour of ocean basins
- wind and storms

**Tides at the same time?**  
The force of the moon is stronger than its force on the earth is on the water is a

*Nobody wants 2 million or more people to be exposed to these damaged and shabby signs before we can apply for support again.*

# Scalable Solution

- Eliminate the signage and supplies for inside the Sea Center
- Eliminate the additional sign (#8 on list)
- Pare the project down to replacing the 7 signs installed in 1989
- Total budget is reduced to \$38,345.22
- Museum match is \$12,156.71
- **Total requested from CREF funding:  
\$26,188.51**
- This is a reduction of \$17,529.25