

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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Perils of paradise—living at the edge



This rock and concrete seawall built to protect the sewage pumping station in Capitola was built over 80 years ago.

Human civilization developed over the past 5000 years during a time when sea level was nearly stable, or rising very slowly. There are some historians who believe that the nearly stable sea level, in contrast to the previous 15,000 years of rapid rise, may have played an important role in allowing the early agricultural civilizations of the coastal plains and deltas of the Middle East to develop and flourish. There was some stability to the shoreline. It wasn't until several thousand years later, however, that ancient cities and harbors began to emerge along the eastern Mediterranean coastline.

There are lots of reasons why people then, as well as today, chose to live along the coastline: a more moderate climate, fertile soils for agriculture, and easy access to the sea for boats and trade among others.

As sea level rise slowed from 3 to 4 feet a century to a less than a foot, it made a big difference along a flat, low-lying coastline. The coastal plain of the south

Atlantic coast of the U.S. typically slopes at about 1:500, which means that the land only rises a foot in elevation for every 500 feet you move inland. With a rise in sea level of 3 or 4 feet/century, the shoreline will move 1500 or 2000 feet farther inland. While only 8 inches of sea level rise occurred over the past century, it still took its toll on the sandy shoreline of North Carolina. I mentioned the relocation of the Cape Hatteras lighthouse in the last column. The lighthouse was originally built 1500 feet from the shoreline in 1870, in what was considered a safe spot at the time. A century later, the waves were breaking only 120 feet from the base of the lighthouse. Almost 1400 feet of shoreline retreat had taken place in 100 years, or 14 feet per year on average.

Relocation of buildings hasn't been the most popular historic approach for dealing with a retreating coastline, however, and has been seen more as a last ditch effort. Armor or protecting the coast with some hard structure, a seawall or rock, has been the typical response for most of the past century. What is amazing is that some of California's oldest seawalls are still standing. The concrete seawall protecting the old sewage pumping station just below the Grand Avenue Apartments on Depot Hill was built over 80 years ago. The O'Shaughnessy seawall along Ocean Beach in San Francisco was originally constructed in 1929 and has protected this stretch of the Great Highway ever since. O'Shaughnessy was a brilliant and careful engineer who thought of every possible way in which a seawall might fail and then designed the structure to survive all of those possibilities.

We have seawalls in California that have survived 80 years and others that didn't make it through their first 80 days. For perhaps 75 of the first 100 years of seawall construction along the California coast our primary concern was with how to design and build structures that would survive the exposure to severe wave attack. We knew the coastline itself wasn't doing so well, so what could humans build that would do better? And we have tried just about everything to hold off the Pacific Ocean with varying degrees of success.