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

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Beaches–here today, gone tomorrow

Its Beach north of Lighthouse Point in October 1997, before a major El Niño, and in February 1998, when waves had removed the beach.

Our beaches look stable and permanent for most of the year but the sand rarely sits still for long. Waves are constantly at work, pushing the sand back and forth across the beach face. Wind may also blow the sand inland from the back beach and form dune fields like we have in central and southern Monterey Bay and at Pismo Beach.

The seasonal changes are probably the most evident to those of you who walk along the beach regularly. Around November or so each year, the first serious storm waves begin to hit the shoreline, and it is these larger, more energetic waves that stir up the sand and begin to carry it off the beach and move it offshore. The wide summer berm, or the area where you parked your towel or played volleyball in July and August, is gradually removed. With narrow beaches like Its Beach, or those along East Cliff, the dry sand may be completely gone from December to March during most winters. The wider beaches, Cowell's, Main Beach and Seabright, will usually still have some dry beach remaining for the winter die-hards. In the big El Niño winters such as 1978, 1983 and 1998, however, even these beaches will narrow and erode, typically replaced with logs, trees and other debris from the flood-swollen rivers.

The sand moved offshore each winter tends to align itself into a set of sand bars and troughs that are parallel to the beach. This is the shoreline's way of readjusting

itself to the more energetic winter waves. Because the depth where the waves break is determined by the height of the waves, the presence of these sand bars causes the larger waves to break farther offshore. This dissipates more of the breaking wave's energy offshore, which reduces the wave energy expended on the beach, a natural shock absorber for the shoreline. Even with these buffers, however, winter waves are still the ones that do the most damage to the coastline, and anything we've built within reach of the waves, whether houses, restaurants, streets, water or sewer lines, parking lots or bike paths. And as sea level continues to rise in the decades ahead, the waves will gradually reach farther inland and claim more of our coastline.

By late spring, the wave climate has usually changed and the waves are now lower and less energetic. They begin to gradually transport the sand landward, grain-by-grain, from the offshore sand bars and rebuild the narrow winter beach. By July or August the beach is usually at its maximum width again, just in time for all of the summer tourists.

The balance between a winter and a summer beach, or the wave conditions that cause sand to move offshore or onshore, is somewhat delicate, and conditions can change quickly and reverse the transport of sand. Years of observations have shown that wave steepness, which is the ratio between the wave height and the wave length (or the horizontal distance between wave crests), exerts the strongest influence on whether the sand moves onshore to form a wide berm, or offshore to form a sand bar.