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

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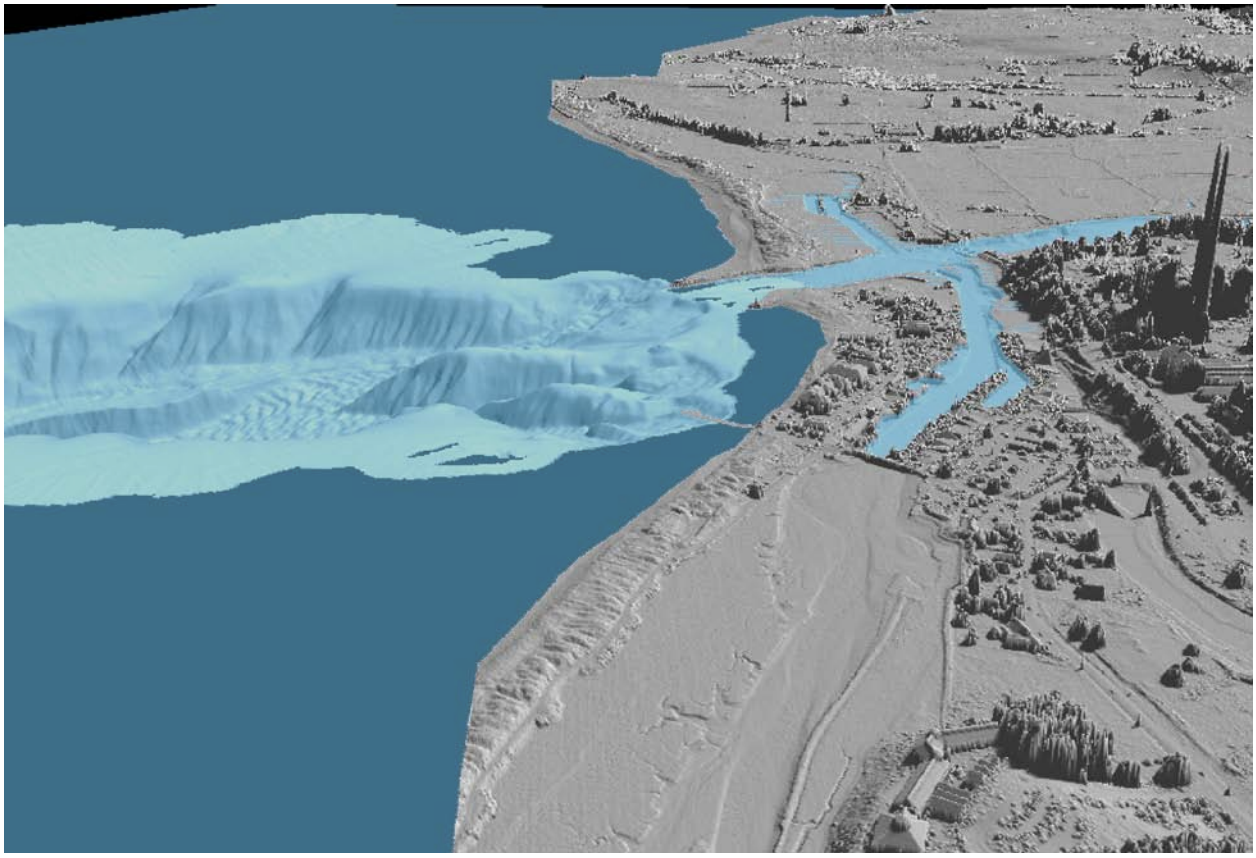
Submarine canyons: sediment highways to the deep



In this shaded relief map, the head of Monterey Submarine Canyon can be send extending into the mouth of Moss Landing Harbor. The tall structures on the right side of the image are the stacks of the power plant.

Along most of the California's coastline, littoral drift is carrying the beach sand southward. I asked in an earlier story, where is all of this sand going, and why aren't the beaches growing wider and wider as you move down coast? There are only a few places all of that sand can eventually go: blown inland as dunes, removed by mining, or transported offshore.

The greatest loss of sand from California's beaches is invisible to us and occurs down the many submarine canyons that wind their way across the seafloor just offshore. Where these canyons extend close to shore they intercept the sand moving along the coast and funnel it away from the beach into deep offshore

basins. The canyons of southern California have been recognized for over 75 years and are the ultimate sinks for most of southern California's beach sand. The Mugu Submarine Canyon, south of Ventura, siphons off over a million cubic yards of sand each year, enough to build a beach 100 feet wide, 10 feet deep, and 5 miles long! A number of other offshore canyons remove sand from the shoreline as well; the Zuma, Redondo, and Newport submarine canyons play similar roles.

Monterey Submarine Canyon, which bisects Monterey Bay and extends almost to the beach at Moss Landing, is one of the world's largest - over 6,000 feet deep -- and big enough to swallow the Grand Canyon of the Colorado River, but completely invisible to us standing on the beach! Every year, virtually all of the nearly 300,000 cubic yards of sand that is transported down the coast from Santa Cruz, some from as far north as Half Moon Bay, as well as the sand carried northward along the shoreline from the Salinas River, is carried offshore into deep water by this vast underwater conveyor belt.

Observations by SCUBA divers and submersibles reveal that in the steeper canyon heads this sand flows down slope, grain by grain, the same process that occurs when you start digging into a sand pile or dune. Transport farther offshore, however, where the slopes are less, is achieved by underwater sand and mudflows known as turbidity currents. Turbidity currents are large masses of sediment that are driven by their greater density relative to seawater, and are capable of flowing many miles down submarine canyons.

Millions of cubic yards are lost from California's beaches into submarine canyons each year, and this is why the beaches don't get any wider. Ultimately, these former beach sands are deposited far offshore in deep water. With their final resting places at depths of 10,000 to 15,000 feet below sea level, these sands are in effect, gone. Concerns over the losses of beach sand due to dams on coastal streams have led to proposals to dam these offshore canyons as a way to trap this sand so that it can be pumped back onto the beaches. Dredging sand up from deep water would be a very expensive process and it would be far easier, and would consume much less energy, to halt or trap the flow of sand at the shoreline before it moves offshore into a canyon head.