

## Saving kelp

### Work to begin on largest man-made reef, expected to become a nursery for biological diversity

**By Terry Rodgers**  
 UNION-TRIBUNE STAFF WRITER

June 7, 2008

For the first time anywhere, scientists say they've designed an artificial reef north of San Diego County that should be able to sustain itself for decades.

The fruit of their research will start Monday, when crews will begin building the 150-acre Wheeler North Artificial Kelp Reef about half a mile off the coast of San Clemente. The project, meant to compensate for environmental damage caused by the San Onofre Nuclear Generating Station, will feature the largest-ever array of engineered reef structures.

Up to 125,000 tons of quarry rock will be placed across the ocean floor in irregular polygons that, on an engineer's blueprint, look like unjoined puzzle pieces. These shallow rock piles will serve as anchors for giant kelp, the ocean's fastest-growing algae that can reach 120 feet high.

"There's nothing like it in the world. The scale is phenomenal," said Rich Ambrose, who led a group that studied the power station's ecological effects. He is a professor of marine ecology at the University of California Los Angeles.

Until now, most man-made reefs spanned just a few acres and died out after a few years. They were built with a single objective: to attract fish.

Creators of the Wheeler North kelp forest hope it will last for decades, and they expect it to become a nursery for biological diversity. Kelp forests have been called the "rain forests of the sea" because they support about 800 species of marine life.

In addition to its habitat value, the reef likely will produce plenty of seafood for sport anglers and commercial lobster fishers.

Scuba divers also may find the site alluring.

"Diving in giant kelp gives you the same feeling as walking through a redwood forest. It's a special place," said Ed Parnell, a marine ecologist at the University of California San Diego's Scripps Institution of



Southern California Edison  
 Giant kelp is the ocean's fastest-growing algae and can reach 120 feet in height. Kelp forests have been called the "rain forests of the sea."

Oceanography in La Jolla.

## Years of effort

The record-setting project is named in honor of the late Wheeler North, a pioneering kelp researcher who over decades took aerial photos that documented the decline of Southern California's kelp forests.

Its first construction phase took place in 1999, when Southern California Edison – majority owner of the power station – built a 22.4-acre experimental reef. Next week, it will start expanding that kelp bed into the full Wheeler North structure.

The goal is to form the entire rock foundation by late September, then let kelp spores from elsewhere gradually attach themselves to the reef.

Edison will be required to monitor the reef's condition and conduct studies comparing its productivity with that of nearby kelp forests for about four decades. Its total bill for those tasks and construction could approach \$40 million. The cost will be borne by ratepayers for Edison and other owners of the nuclear plant, including San Diego Gas & Electric Co.



Southern California Edison  
A pisaster starfish clings to a San Onofre pilot kelp reef, part of a mitigation project.

Each day, the facility draws in and discharges about 2.4 billion gallons of seawater. This so-called “once-through” cooling system kills an array of marine life – from orange-colored garibaldi, the state fish, to microscopic plankton.

The plant's cloudy discharge also reduces the amount of sunlight in the water column, which in turn shrinks the kelp forests off San Onofre.

Edison officials originally argued that San Onofre's environmental impact was less than what Ambrose and other scientists determined in a report for the California Coastal Commission.

The agency first wanted Edison to pay for a 300-acre reef, but later reduced the project to half that size.

“It was an epic battle,” said Sara Wan of Malibu, a coastal commissioner.

Edison became a cooperative partner once the dispute was resolved in 1997, said Susan Hansch, the commission's chief deputy director. “They have accepted (responsibility) and are doing the best job that they can,” she said.

Besides building the reef, Edison is restoring 150 acres of wetlands at the San Dieguito Lagoon near the Del Mar Fairgrounds. The company has hired Coastal Environments, a marine engineering firm in La Jolla, to oversee both projects.

The \$140 million that Edison expects to pay for all of its San Onofre-related mitigation work, including the reef and lagoon projects, is still cheaper than the \$750 million to \$1 billion it would have cost to retrofit a major part of its plant to prevent marine damage, said David Kay, Edison's senior manager for the environment.

## Lessons learned

Myriad details for Wheeler North have been gleaned from decades of research and experimentation with other reef projects.

Over the past 50 years, the state Department of Fish and Game has participated in the construction of more than 100 reefs at 33 sites in Southern California.

One of the first reefs built specifically to grow giant kelp was constructed in 1980 off Camp Pendleton. It became barren of kelp after less than five years because sea fans and certain forms of algae overwhelmed the spaces where kelp roots clasped to the rocks.

Hoping to avoid similar problems, scientists studied the test reef that Edison built in 1999 off San Clemente to fine-tune their design for the Wheeler North site.

Among their findings: Kelp grows equally well on recycled concrete as it does on hard quarry rock.



Coastal Environments

A front loader pushed rock into the ocean as part of a project to create an artificial reef about half a mile south of the San Clemente pier.

Even more significant was the discovery that an artificial reef will flourish on its own if it's situated close enough to catch spores released from a nearby kelp bed. Initially, divers transplanted tiny kelp plants grown in a laboratory to Edison's experimental reef.

The next challenge was identifying where the sea floor contains bedrock with a thin layer of sand, because such areas are suitable for placing the rock that kelp grow on. Using sediment-penetrating sonar, Hany Elwany – CEO of Coastal Environments – and his engineering team were able to map areas matching those characteristics.

Perhaps the most interesting breakthrough came from marine biologist Jake Patton of Fallbrook. He advanced the theory that giant kelp can sustain itself for generations if it has a “low-relief” reef consisting of a single layer of rocks spaced apart on the ocean floor.

This design allows sand and rocks to move around during storms and major swells. The rock jostling and sand blasting scrape off sea pins, sea urchins and marine plants that compete with kelp for the same space.

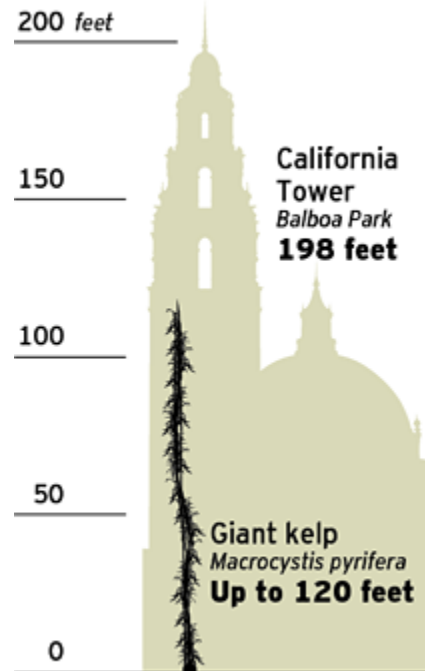
The rock-and-roll theory was controversial. Some officials with the state Department of Fish and Game expressed concern that low-relief reefs would become buried by sand and rendered useless.

But enough scientists were convinced that Patton's design would succeed, and it became incorporated into the final blueprint for Wheeler North.

The Wheeler North reef will be located in 32 to 50 feet of water south of the San Clemente pier. It will have rocks arranged in multisided polygon patterns spread across 2½ miles.

From 100,000 to 125,000 tons of gneiss, a metamorphic rock, will be barged to the site from a quarry on Santa Catalina Island. The smallest rocks are the size of a basketball, and the largest are about the size of a 36-inch TV set.

### GIANT KELP HEIGHT



SOURCES: Birch Aquarium; emporis.com

AARON STECKELBERG / Union-Tribune

Despite all the science behind the project, there is no guarantee that Wheeler North will thrive in the long run.

“Artificial kelp reefs are really a kind of art form,” said Chuck Mitchell, a veteran marine biologist from Orange County. “Even if this one works exactly like a regular kelp bed, it will still be vulnerable to fluctuations in water temperature, nutrient levels, wave action and predators.”

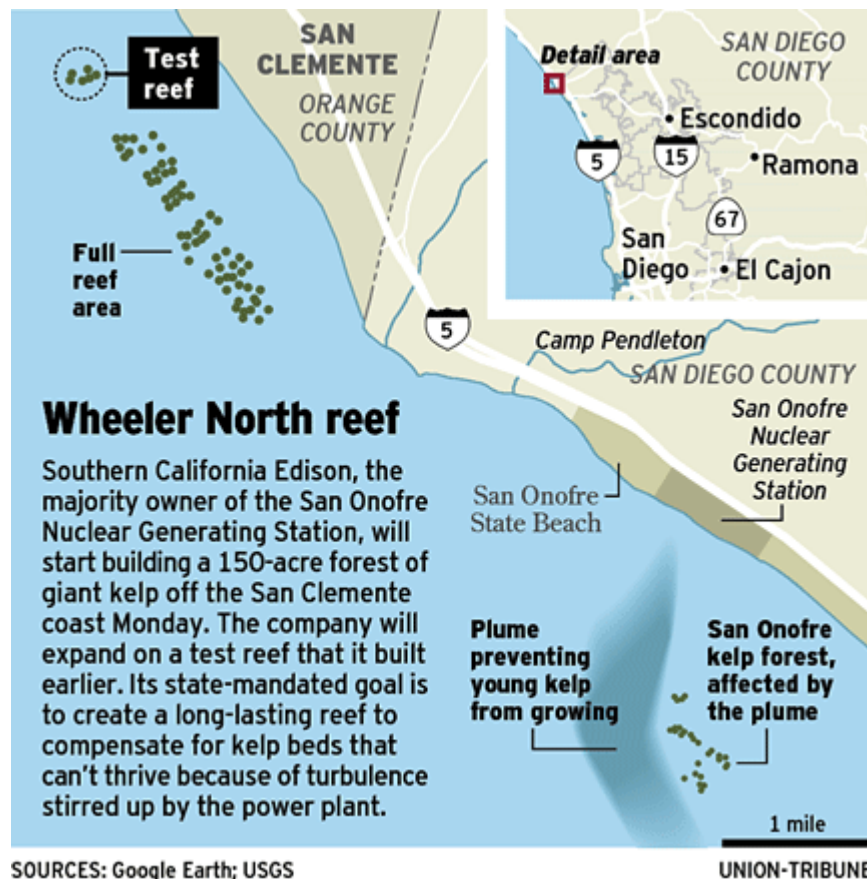
Creating kelp reefs is a noble idea, but “people are simply not as good as God or Mother Nature for creating new ecosystems on this planet,” said Warner Chabot, vice president of the Ocean Conservancy in San Francisco.

“The better option is to simply protect the healthy ocean ecosystem that we've already inherited,” he said.

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