

NORTH COUNTY

It took 30 years, but world's largest artificial reef built near San Diego nuclear power plant is finally thriving



A diver studies the production of the Wheeler North Reef, a mitigation project for the San Onofre Nuclear Generation Station. (Photo by Debbie Karimoto for Southern California Edison)

Fish and kelp production meet targets initially ordered by Coastal Commission in 1991 to offset damage from San Onofre

By Phil Diehl

An artificial reef built to offset marine life killed by the seawater cooling system at the San Onofre Nuclear Generating Station is finally doing its job, now that the power plant has been shut down for more than a decade.

The reef is essentially an anchor for giant kelp, which grows tall and thick to create the forests of the sea. A form of brown algae, the kelp reaches from the sea floor to the surface, creating a shady tower of shelter for all kinds of fish, spiny lobsters, sea otters, sea lions, sometimes whales and even birds.

Kelp forests provide a habitat for important commercial species of fish such as black rockfish and kelp bass. The slightly slimy ocean vegetable also is used to make a number of human products including shampoo, toothpaste, pharmaceuticals and food.

Scientists knew early on that the nuclear power plant's cooling system would stir up the ocean and degrade nearby kelp beds. They also knew it would vacuum up small fish. However, it took them years of study and collaboration to determine the full effects, design a plan to compensate for that loss, and tailor the plan for the desired results.

The Wheeler North Reef project met its required performance standards for things such as kelp growth and fish production for the first time during the past three years, according to the California Coastal Commission. Now the reef just needs to keep up the good work for an additional 27 years.

The nuclear power plant, often called SONGS, shut down in 2013 after defects were found in its replacement steam generators. The commission requires the plant's operator, Southern California Edison, to assure that the reef continues its contributions to sea life for as long as the plant operated, a total of 32 years.

“It’s great to see this work moving forward ... to meet these restoration goals within these habitats,” said Commissioner Justin Cummings at this month’s Coastal Commission meeting.

The reef is named for Wheeler J. North, a marine biologist at the Scripps Institution of Oceanography and the California Institute of Technology. North, who died in 2002, was noted for his studies of California’s coastal kelp forests.

His namesake reef is north of the power plant, a half-mile offshore and from 38 feet to 50 feet deep, extending 2.5 miles from San Mateo Point to the San Clemente Pier. It’s built entirely of rock mined from a quarry and pushed off a barge into the ocean.

As a result of the reef’s recent success, this month the commission unanimously approved a program to reduce monitoring, which will save the utility time and money. Instead of monitoring a total of 233 locations across the reef, the utility will be required to check only 166 locations beginning this year.

“A lot of time and effort went into determining what the reduction would look like,” said Commission Executive Director Kate Huckelbridge. “Time and cost were factors ... but also that we would still have confidence in the results.”

A representative of the Surfrider Foundation said that perhaps it is too soon to scale back oversight.

“This reef failed to meet performance standards for over 10 years,” said Mandy Sackett, senior California policy manager for the nonprofit Surfrider Foundation.

“As of 2018, it had never met the standing fish stock requirement, despite the plant being in operation for decades,” she said.

“We are grateful to see that the recent reef expansion has significantly increased the amount of times that the reef has met performance requirements, yet we feel strongly that the decades of insufficient performance would indicate a need for continued monitoring at the original frequency, at least in regard to fish stock assessments,” Sackett said.

Commission officials said they are confident that the reduced monitoring will be adequate and that it will be returned to former levels if any problems are found.

“There is a lot of confidence that the reduced monitoring is going to be adequate to meet the permit conditions,” said Dan Reed, a research biologist at the University of California Santa Barbara’s Marine Research Institute.

UC Santa Barbara’s Marine Research Institute is employed as the reef’s independent observer by the Coastal Commission with funding from Edison. Reed has been working on the project since 1993.

Construction of the reef was required by the California Coastal Commission in 1991 to offset the power plant’s effects on the marine environment. The commission also mandated the installation of additional barriers on the plant’s cooling system to reduce the amount of fish killed by the plant’s cooling system and the restoration of 150 acres of Southern California wetlands.

Scientists found that as much as 65 tons of small fish and other sea life were killed every year when they were pulled into the cooling system’s 18-foot-wide underwater intakes. The plant used 2.4 billion gallons of seawater daily to cool its steam generators.

Also, when the warm water was returned to the ocean, even though it exited through many holes in a long outlet pipe, the resulting current stirred up sediment and clouded the water. The silt covered and killed marine plants and bottom-dwelling creatures.

In its heyday, San Onofre produced electricity consumed across Southern California, including 20 percent of the juice used by San Diego Gas & Electric Co. customers.

SDG&E ratepayers also took on a 20 percent share of the costs of building the power plant, its mitigation projects including the reef and the restoration of the San Dieguito Lagoon in Del Mar, and now the ongoing demolition of the defunct power plant.

Another ongoing cost to ratepayers and taxpayers is the expense of storing spent nuclear fuel at San Onofre. All of the fuel used since the 1980s remains on the site, packed into dry casks and parked at the edge of the ocean.



The San Onofre Nuclear Generating Station viewed from San Onofre State Beach, California on Thursday, October 17, 2019. (Hayne Palmour IV/The San Diego Union-Tribune)

Initially, the Coastal Commission required a 150-acre reef to be built of low-lying boulders in the ocean north of the power plant near San Clemente.

First, plant operator Southern California Edison built a 23-acre experimental reef and monitored it for five years. Then, based on the results obtained from the experimental reef, Edison completed an additional 152 acres of reef in 2008.

However, the larger reef failed to produce the expected amount of fish, based on estimates of fish populations before the plant was built and compared to two similar natural reefs nearby. As a result, the commission required Edison to build an additional 193 acres, creating what Edison and the State Lands Commission say at a total of 373 acres in all is the largest artificial reef in the world.

Completion of the reef expansion in 2021 finally brought the thriving seaweed beds and fish families that the commission had been seeking for 30 years.

Divers collect data from specific locations, known as transects, to monitor the reef's production. That data is compared to data for two natural reefs nearby in the region, but outside the influence of the power plant.

Each transect measures 3 meters wide, 15 meters long, and 1.5 meters up from the bottom. Initially, the transects were marked with cables anchored into the rock, but today divers use GPS coordinates to find them.

“We dive a lot,” said Reed, of the Marine Research Institute, in a recent telephone interview.

Two boats with six to eight divers visit the reef for about four days a week from the end of May through the end of October every year, he said.

“We basically just count fish and kelp, for the most part,” he said. However, some of the information needed requires the divers to collect the fish, mainly samples of five key species, and take them to a lab to be autopsied.

Studies of the samples' guts, gonads and eggs help determine how much the fish eat and reproduce. A close look at their ears determines age.

"The growth rate can be seen in ear rings, which add a layer of bone each year, much like tree rings," Reed said.

With the information collected the past three years, along with the previous cumulative results, the reef has met its production standards for a total of five years, according to the commission. Now it needs 27 additional years of continued satisfactory marine life production to meet the commission's requirement.

After the results are achieved, the reef probably will remain in place, Reed said. No further monitoring will be required under Edison's permit from the commission.

"To me, it's a success," he said. "We get giant seabass through there ... weighing 400 to 500 pounds, white sharks. It's a functioning reef."

The area is completely open to the public, he said. During lobster season, it's one of the most popular spots for lobster fishing along the Southern California coast.

Well beneath the waves, the reef is only affected by the underwater tidal surge and currents. The rocks were placed in an area of relatively shallow sand supported by a hard substrate, so the reef is unlikely to sink into the ocean bottom. Sometimes ocean currents cover small areas with sand, but they also uncover other areas.

Edison does a sonar survey every five years to measure the actual coverage of the reef, Reed said.

"It's really about what it was when we put it in," he said. "It hasn't changed much at all."

The revised monitoring program should significantly reduce the time needed for diving and lab work, he said. The team will continue to report the reef's status annually to the commission.



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