Introduction and Overview

Annual Review Workshop for SONGS Reef Mitigation

April 8, 2014

SONGS Mitigation Monitoring Project
Marine Science Institute, University of California Santa Barbara

Welcome to the annual public workshop to review the status and findings of the reef mitigation project for the San Onofre Nuclear Generating Station.

Compensating for losses to the San Onofre kelp forest is one component of the mitigation that is being done to offset damages to coastal resources caused by the operations of SONGS units 2 and 3

Other components include:

1. Wetland restoration to compensate for damages caused by the entrainment of fish eggs and larvae by the cooling water system.
2. Modifications of plant operations to reduce the number of adult fish killed in the power plant by the sea water cooling system.

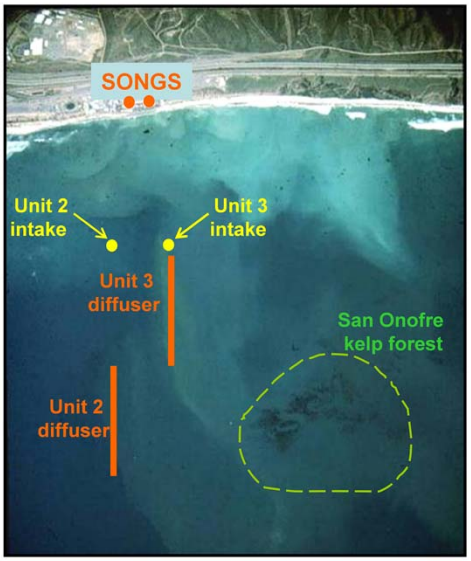
We will not be discussing these other mitigation projects in today's workshop. A separate workshop will be held May 12, 2014 in Del Mar to review the status and findings of the wetland mitigation project, which is being done at San Dieguito Lagoon.

Reef Mitigation Linked to the Adverse Effects of the SONGS Cooling Water System

(San Onofre Nuclear Generating Station = SONGS)

The nuclear reactors of SONGS units 2 and 3 are cooled by seawater that is taken in by large intake pipes and discharged back to the ocean via 2 diffuser lines

A turbidy plume associated with SONGS diffusers has been implicated as the cause of a substantial reduction in size of the San Onofre kelp forest

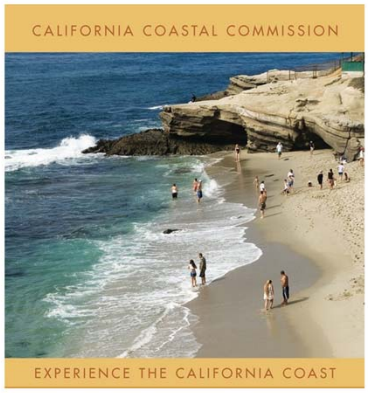


The SONGS artificial reef mitigation project is linked to the adverse effects of the SONGS single pass seawater cooling system on the San Onofre kelp forest, which is located directly offshore of the power plant.

- The nuclear reactors of Units 2 and 3 are cooled by sea water that is taken in through large intake pipes located in about 30 feet of water offshore of the power plant.
- When operational the water was elevated 19^{o} F above ambient as it's circulated through the plant and then discharged through an extensive diffuser system designed to dissipate the heat.
- Mixing of the discharged cooling water with the surrounding seawater was found to result in the formation of a turbid plume in the vicinity of the San Onofre kelp forest which is located adjacent to the two diffuser lines.
- The turbid plume has been implicated for causing a substantial reduction in area of the San Onofre kelp forest.

The California Coastal Act Requires Mitigation of SONGS Marine Impacts

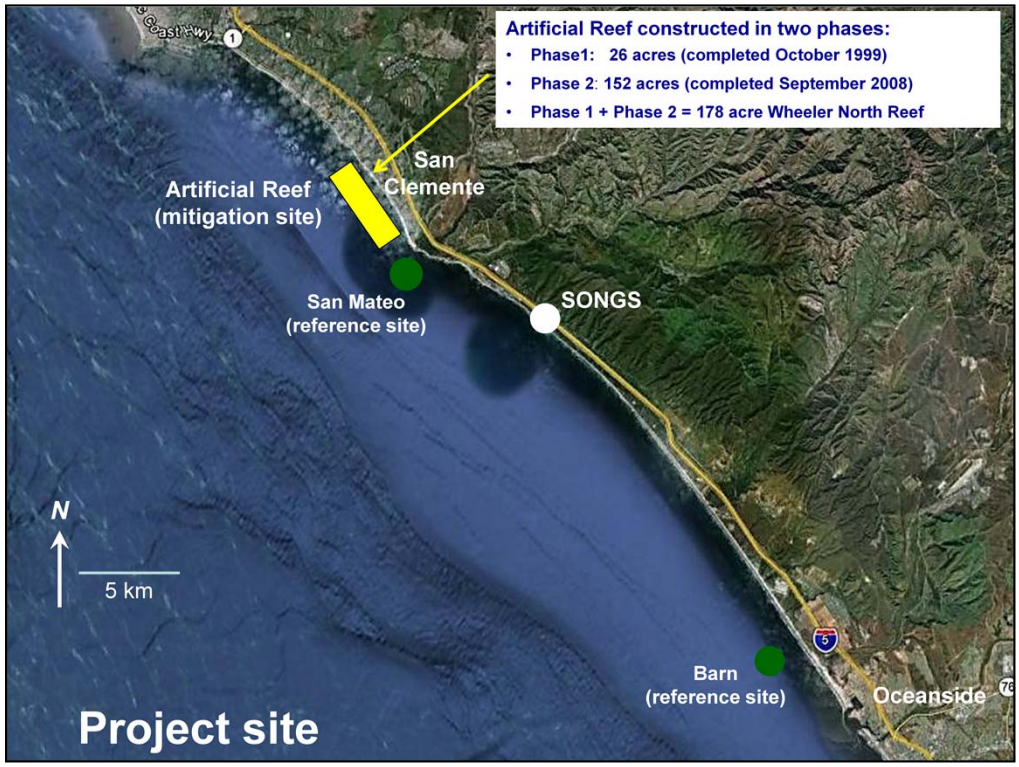
The California Coastal Commission (CCC) is responsible for implementing the Coastal Act



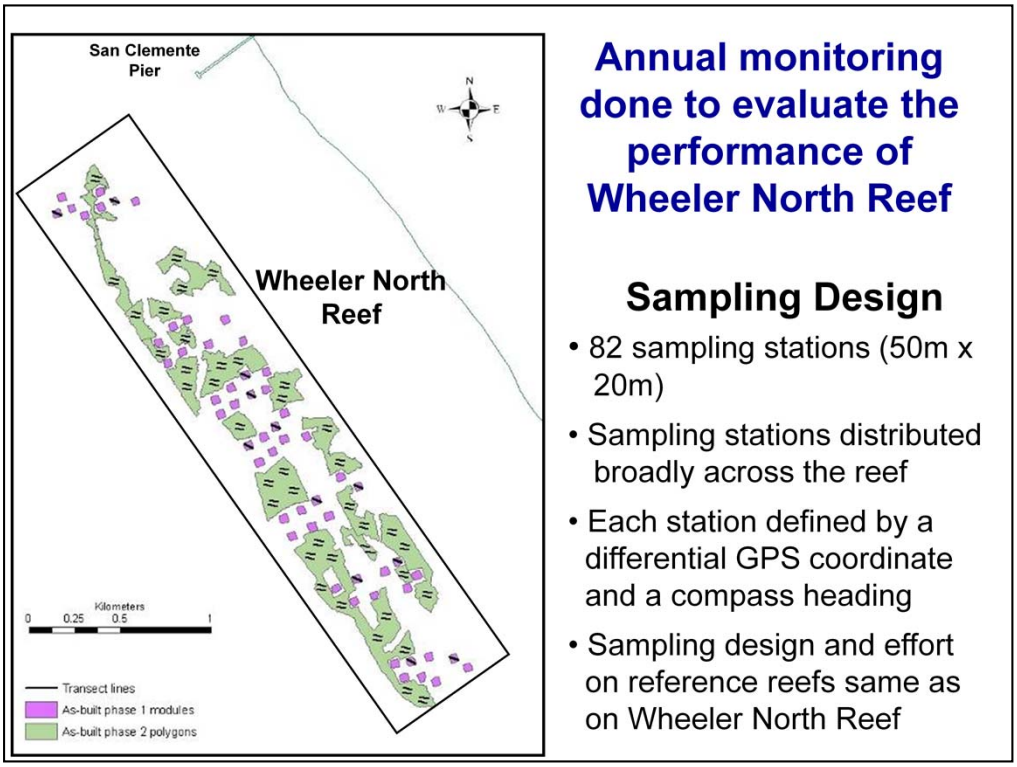
As mitigation for the impacts to the San Onofre kelp forest caused by SONGS the CCC required SCE to:

1. **Construct an artificial reef that creates a minimum of 150 acres of kelp forest habitat to compensate for losses of kelp and kelp bed fish and invertebrates.**
2. **Provide funding for scientific oversight and monitoring of the mitigation project that is *independent* of SCE.**

- The California Coastal Act Requires Mitigation of SONGS Marine Impacts
- Implementation of the Coastal Act resides with the California Coastal Commission (CCC).
- The CCC is responsible for ensuring that the adverse impacts to the marine environment caused by SONGS are adequately mitigated.
- As mitigation for the impacts to the San Onofre kelp forest caused by SONGS the CCC required SCE to: (1) Construct of an artificial reef that creates a minimum of 150 acres of kelp forest habitat to compensate for losses of kelp and kelp bed fish and invertebrates, and (2) Provide funding for scientific oversight and monitoring of mitigation projects that is *independent* of SCE.
- Independent monitoring is done by marine scientists at UCSB who report directly to the CCC.



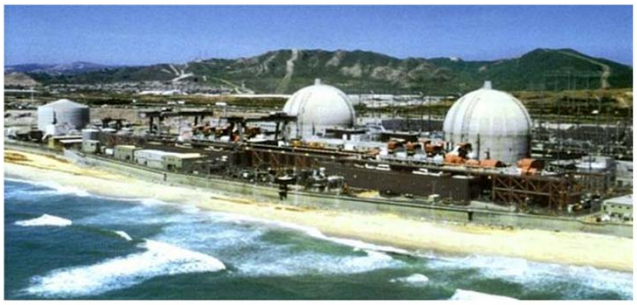
- This map provides a general overview of the project site and shows the locations of the artificial reef and the nearby natural kelp forests at San Mateo and Barn.
- Wheeler North Reef was constructed in 2 phases.
- Construction of Phase 1 was completed in October 1999 and consisted of 56 modules that tested different bottom coverages of quarry rock and rubble concrete.
- Information obtained from the 5 year Phase 1 period was used to guide the design of the Phase 2.
- Phase 2 was completed in September 2008 and consisted of 18 polygons of low relief quarry rock which totaled 152 acres.
- The Phase 1 and Phase 2 reefs combined constitute the 178 acre Wheeler North Reef
- Data were collected during annual monitoring surveys to judge the performance of the Wheeler North Reef in meeting its objective, which is to compensate for kelp forest resources lost due to the operation of SONGS.



- This diagram summarizes the sampling design for the monitoring that is being done to evaluate the performance of the Wheeler North Reef.
- The experimental Phase 1 modules constructed in 1999 are shown in purple; the new Phase 2 polygons constructed in 2008 are shown in green.
- The 82 sampling stations shown as black lines. The sampling stations are arranged in 35 pairs spaced 50 m apart on the Phase 2 polygons and as single stations on 12 of the Phase 1 modules.
- A similar sampling design of 82 stations spaced 50 m apart is used for the two reference reefs.

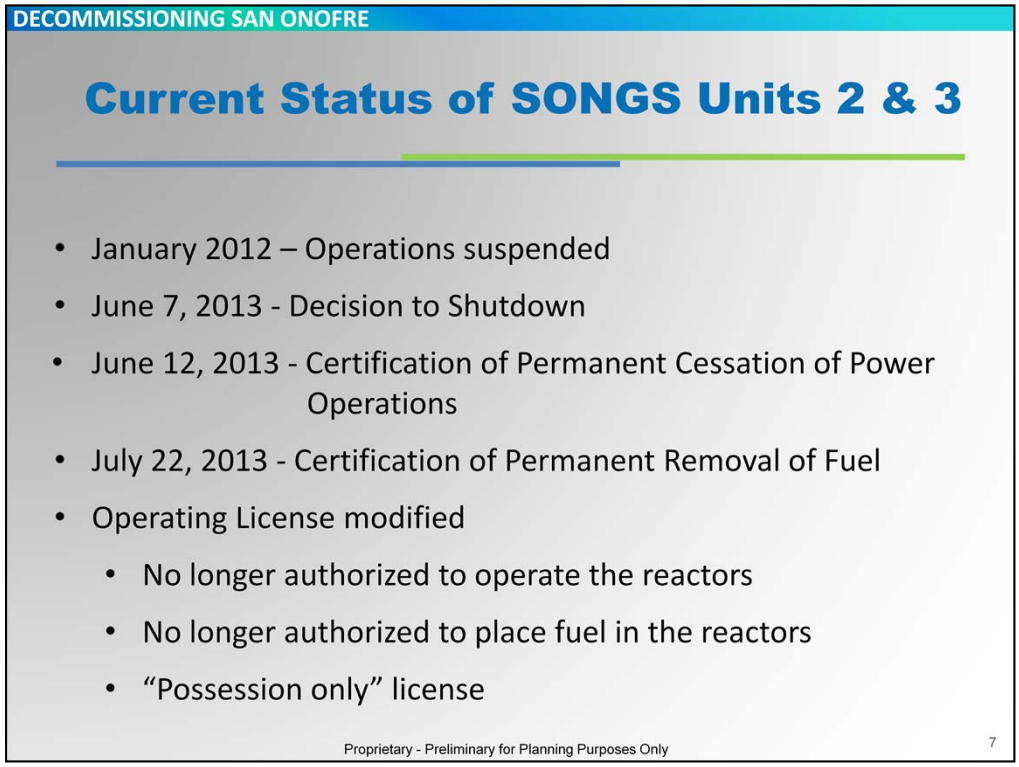
SONGS Reef Mitigation

Goal: ***Replace kelp forest resources lost by SONGS' operations***

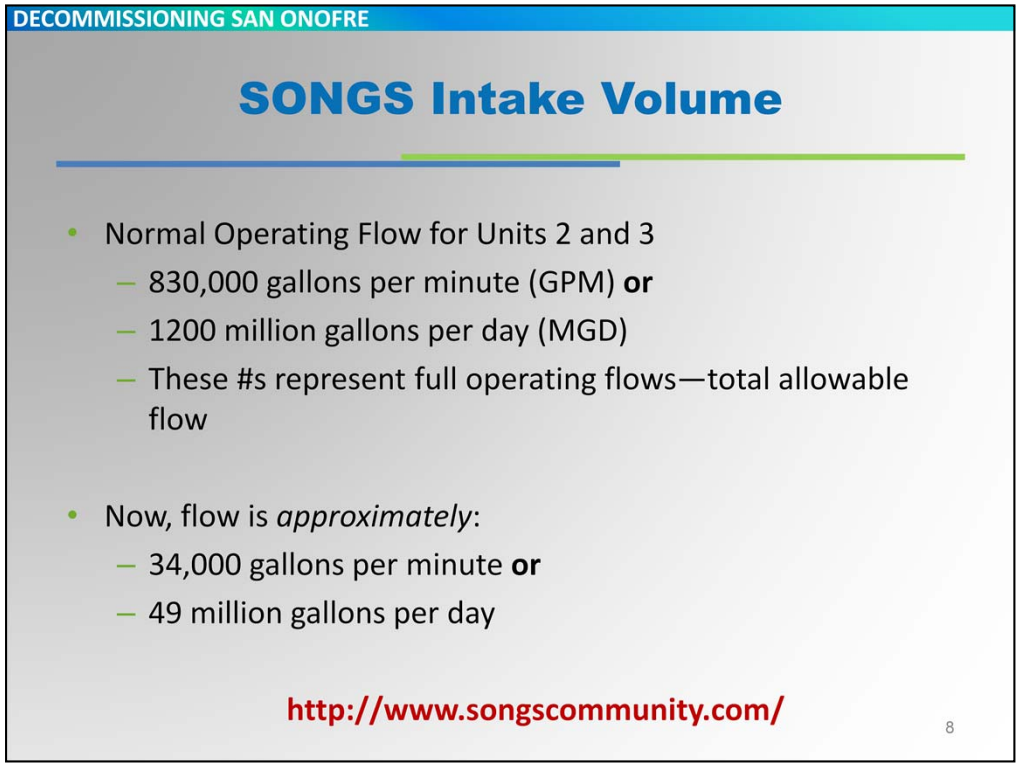


- **Physical and biological performance standards are used as a measuring stick to evaluate whether the lost resources are replaced.**
- **One year of mitigation credit is given for each year that Wheeler North Reef meets the performance standards.**
- **Fulfillment of the SONGS reef mitigation requirement occurs when the number of years of mitigation credit accrued by the Wheeler North Reef equals the total years of operation of SONGS Units 2 & 3, including the decommissioning period to the extent that there is continuing discharge of cooling water.**

- The goal of the SONGS reef mitigation project is to replace the kelp forest resources that were lost due to the operations of SONGS Units 2 & 3.
- Performance standards are used as a measuring stick to evaluate whether the Wheeler North Reef is replacing those resources.
- One year of mitigation credit is given for each year that Wheeler North Reef meets the performance standards.
- Wheeler North Reef is required to provide compensation for damages to kelp forest resources for a period of time equal to the lifetime operation of SONGS Units 2 & 3.
- Thus, fulfillment of the SONGS reef mitigation requirement occurs when the number of years of mitigation credit accrued by the Wheeler North Reef equals the total years of operation of SONGS Units 2 & 3, including the decommissioning period to the extent that there is continuing discharge of cooling water.



- Operations of SONGS Units 2 and 3 were suspended in January 2012 due to premature wear of replacement steam generators.
- SCE decided to permanently shut down the plant in June 2013
- SCE's operating license has been modified to "possession only" and they are no longer authorized to operate the reactors



- Under normal operation conditions the flow rate of the cooling water systems of each Unit is about 1200 million gallons per day,
- This amounts to 2.4 billion gallons a day for both units which is equivalent to a volume of water that is a 1 square mile 12 feet deep.
- Since the shutdown, the flow in each unit has been reduced to about 49 million gallons a day or roughly 4% of the normal operating flow.
- Marine impacts caused by SONGS cooling water system are thus expectedly much less under the current flow conditions.