STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME

DIABLO CANYON POWER PLANT SITE ECOLOGICAL STUDY QUARTERLY REPORT NO. 6

October 1 - December 31, 1974

by

Daniel W. Gotshall
Laurence L. Laurent
Fred E. Wendell

PACIFIC GAS AND ELECTRIC COMPANY
COOPERATIVE RESEARCH AGREEMENT 6S-1047

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ABSTRACT

During the period October 1 - December 31, 1974, a total of six permanent subtidal stations and ten random intertidal stations were surveyed.

Red tides and rough seas limited both the commercial abalone and sea urchin fishery activities. Most activity was concentrated between Diablo Cove and Pecho Rock. Divers, however, did work urchin beds as far north as Lion Rock.

Sea otter counts have remained relatively stable with almost all individuals being observed north of Lion Rock.

Fourteen random fishing stations were completed. Low catch rates reflected fishing success in areas with a heavy brown algae surface canopy.

1/ Marine Resources, Administrative Report No. 75-4, March 1975.

2/ Operations Research Branch, 2201 Garden Rd., Monterey, CA. 93940.

This is the sixth quarterly report submitted in partial fulfillment of Research Contract No. 6S-1047 between the Department of Fish and Game and the Pacific Gas and Electric Company. Through this contract, the Department of Fish and Game is to conduct ecological monitoring studies to determine what changes have occurred since 1970 and 1971 in the base line inventory of the marine biota, with special reference to fish and abalone.

Quarterly reports will be followed by annual reports. Full tables and species lists will be included in each annual report.

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INTRODUCTION

During the period October 1 through December 31, 1974, Department of Fish and Game biologists surveyed permanent subtidal stations and random intertidal stations. We continued to interview commercial abalone, *Haliotis* spp., and sea urchin, *Strongylocentrotus* spp., fishermen for catch-per-unit-of-effort data and to determine fishing areas. Sea otter, *Enhydra lutris*, abundance, movements and food habits were monitored on a weekly basis. Work continued on the sport fish catch-per-unit-of-effort study begun in September. We continued to make periodic inspection dives in Intake Cove to monitor dredging success and follow changes in the plant and animal communities.

OPERATIONS

Permanent Subtidal Station Surveys

Six of nine permanent subtidal stations were surveyed during October and November (Figure 1). We were unable to survey stations 10, 15 and 16 due to red tide conditions and rough seas.

The bat star, *Patiria miniata*, was still the numerically dominant macroinvertebrate on all stations. The average count at all six stations was 187.2; this compares with an average of 206.3 per station for the same stations surveyed during the summer. Giant red sea urchin, *Strongylocentrotus franciscanus*, showed a decline at all but the deepest station. Average counts declined from 99.3 (calculated from stations 6, 7, 8, 9, 11, 12) for the summer quarter to 50.2 per station for the fall quarter. This change reflects a continued general decline in urchin abundance in all but the most southerly station. This reduction in abundance is probably due to sea otter predation, commercial fishing effort, or both.

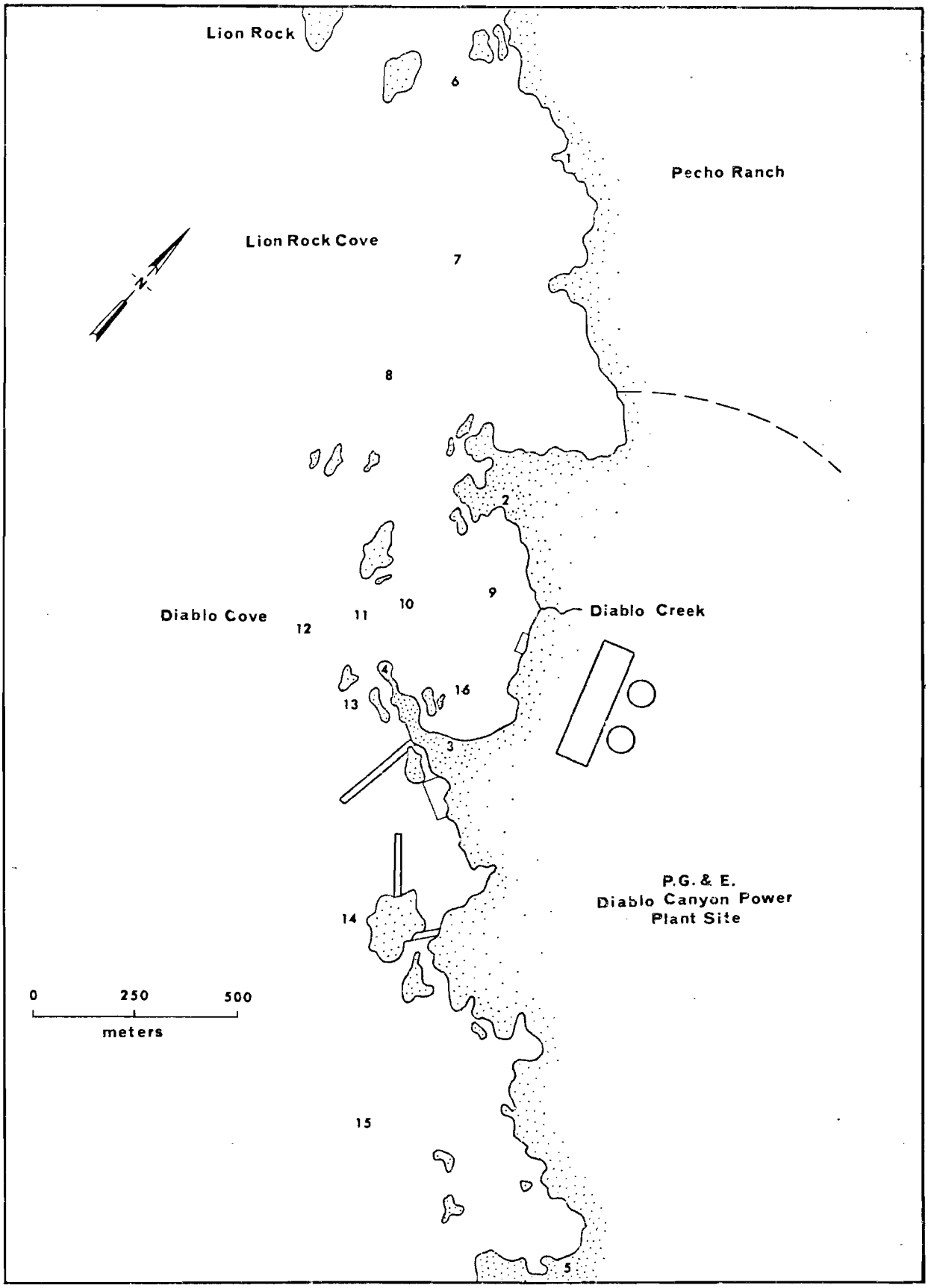

FIGURE 1. Location of permanent subtidal stations - Diablo Canyon power plant site.

The next six numerically dominant invertebrates: *Anthopleura xanthogrammica, Tethya aurantia, Pisaster giganteus, Astraea gibberosa, Pisaster brevispinus,* and *Dendrodoris fulva* showed no significant changes in abundance when compared with figures generated from the summer quarter survey.

Counts of bull kelp, *Nereocystis leutkeana*, at the six permanent subtidal stations surveyed during this quarter decreased from summer quarter counts. Mean counts decreased from 48.6 to 33.9 stipes per station. This decline probably represents the start of the winter break-up of this annual alga. Another brown alga, *Pterygophora californica*, showed a marked change in abundance with average counts increasing from 39.3 to 69.2 stipes per station; many of these were young plants less than 30.5 cm (1 ft) high. A third brown alga, *Laminaria setchellii*, showed no significant changes in abundance.

RANDOM INTERTIDAL SURVEYS

Ten random stations were surveyed during the quarter, five in Diablo Cove and five in the North Control Area (Figure 2). Sampling methods remain consistent with previous surveys. Since our studies began, a total of 54 intertidal stations have been surveyed, 33 in Diablo Cove and 21 in the North Control Area. Our results from these surveys will be cursorily presented in this report.

Algae

Diablo Cove is an algal-dominated area where flora (both algae and *Phylloxpadix*) appear to consistently out-compete fauna for space. Of the more than 60 species of algae encountered in our samples, only a few appear commonly and compose the greater part of overall biomass; *Gastroclonium coulteri, Gigartina canaliculata, Gigartina californica, Iridaea*

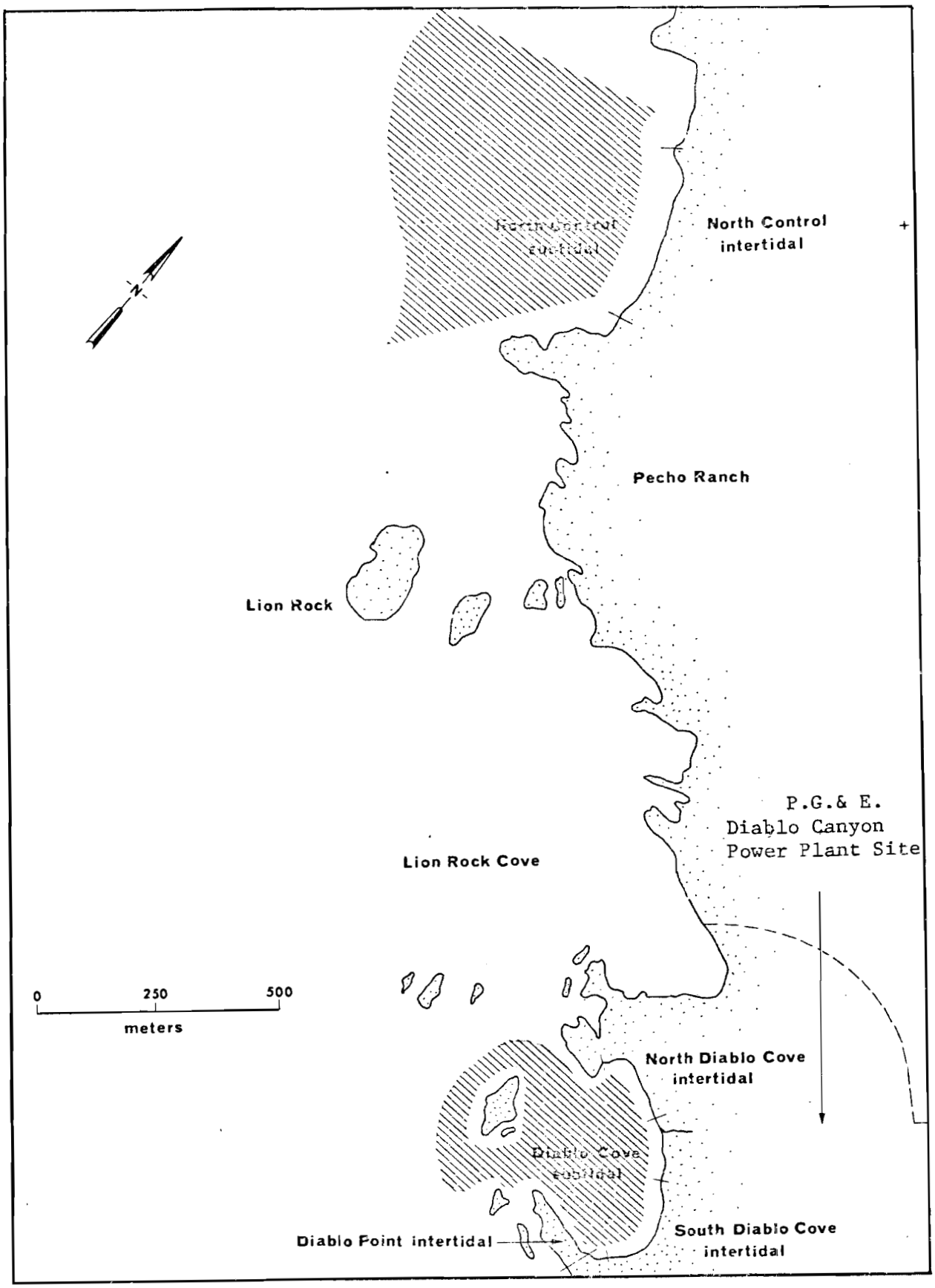

FIGURE 2. Location of random subtidal and intertidal areas - Diablo Canyon power plant site.

cordata var. splendens, and *Prionitis lanceolata*.

The data also show marked seasonality of algal abundance in the study areas. Using the samples taken between November 1973 and February 1974 to delineate the Davidson Period and between May 1974 and August 1974 for the Upwelling Period, average biomass figures (in grams dry-weight) with their 95% confidence intervals have been obtained.

These figures show very plainly lower winter levels of algal abundance followed by a summer "bloom" at each of the study areas. Although the North Control appears less productive during the Upwelling Period than Diablo Cove, this actually may not be true, because: 1) our access to the Control Area and, therefore, sampling effort was ceased for several months in spring and early summer; 2) the Control Area, as originally established, is composed of a large number of stations representing more heterogeneous habitats than exist in any one of the other study areas. This heterogeneity will be resolved in future surveys by reducing the Control Area by half, to include only stations which are similar in make-up to Diablo Cove; this reduction will serve to make the Control more comparable to the stations in the discharge area.

Invertebrates

Of the approximately 40 species of invertebrates quantified from our transects, only five species continue to occur commonly in the quadrats: an anemone, *Epiactis prolifera*; the brown Turban snail, *Tegula brunnea*; juvenile kelp crabs, *Pugettia producta*; and two small predaceous sea stars, *Henricia leviuscula* and *Leptasterias* spp. The major intertidal herbivore, the black abalone, *Haliotis cracherodii*, continued to occur at most stations

in high numbers in the 30 x 2 m (99 x 7 ft) transects occupied to assess their population.

Sea Urchin Fishery

Harvesting of sea urchins during the quarter was erratic at best. Red tide and rough seas limited activity substantially. Divers encountered fewer harvestable urchins in the area around Pecho Rock, where they have been working the last year; consequently, they have been spreading out in search of larger concentrations. Some divers have been working as far north as Lion Rock. Six divers were interviewed during October and November. Their average catch-per-hour was 158.4 kg (349.3 lb). The catch-per-hour during the period July 1 through September 31, 1974, was 361.2 kg (795.5 lb).

Abalone Fishery

Abalone divers were more successful in terms of catch-rate during this quarter. From July through September, divers averaged 7.6 abalone per hour; from October through the end of December, 12 divers interviewed averaged 10.9 abalone per hour. As with the sea urchin fishery, red tide conditions and rough seas hampered operations. Abalone divers were operating from just south of Diablo Cove to Pecho Rock.

Sea Otter Counts

We continued our weekly observations of the sea otter herd south of Point Buchon. Counts in this area remained relatively stable: in October the average daily count was 33.5 animals; November daily counts averaged 41.8 animals; and in December the average count was 36.2 animals. The southward movements observed during the summer declined and by November

sea otters were rarely observed south of Lion Rock. A total of 18 sea otters was observed feeding. We were able to identify food items for only 11 animals; all of them were feeding on either red, *Haliotis rufescens*, or black abalone.

Catch-Per-Unit-of-Effort of Sportfishes Study

We occupied 10 random fishing stations in Diablo Cove and four stations in North Cove (east of Lion Rock). Catch rates in Diablo Cove were hampered by continued high densities of *Nereocystis*, as we averaged only 0.07 fish per hour. The catch was composed of four blue rockfish, *Sebastes mystinus*, one black and yellow rockfish, *S. chrysomelas*, and one gopher rockfish, *S. carnatus*. The four stations in North Cove (east of Lion Rock) produced a catch-per-hour of 0.33 fish. The blue rockfish (4) was the dominant species in the catch, which also included one kelp rockfish, *S. atrovirens*, and one senorita, *Oxyjulis californica*.

MAN-DAYS SPENT AT DIABLO CANYON POWER PLANT SITE

October 1 - December 31, 1974

Subtidal Surveys:	October 20 - 24
Participants:	Gotshall, Laurent and Wendell
Subtidal and Intertidal Surveys:	November 10 - 15
Participants:	Laurent and Wendell
Intertidal Surveys:	December 10 - 14
Participants:	Laurent and Wendell
Commercial Abalone and Sea Urchin Fishery and Sea Otter Surveys:	October 4, 7, 11, 14, 16, 18, 25, 28, 30 November 4, 7, 11, 18, 22, 25, 27, 28, 29 December 6, 12, 17, 18, 28
Participants:	Benech
Total man-days during quarter:	242
Total man-days at site:	45
Boat-days lost to weather:	0
Total Stations surveyed:	30
Travel time man-days	7
Boat time (hr)	20.7
Laboratory time man-days	197

PROJECT PERSONNEL:

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Suzanne V. Benech	Seasonal Aid