

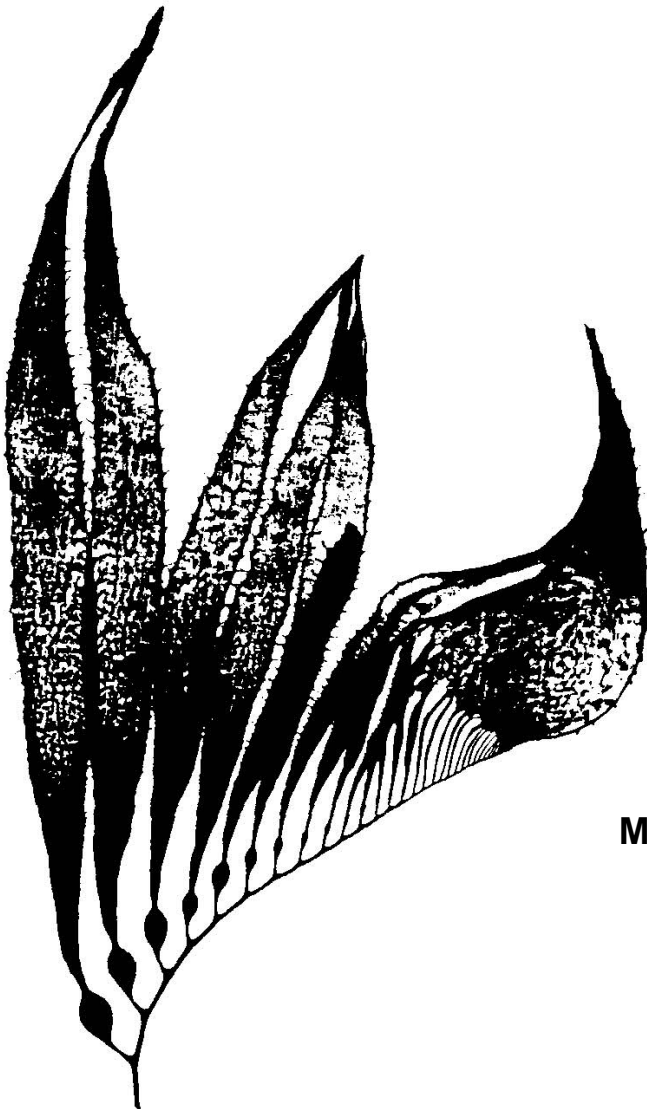
COASTAL MARINE INSTITUTE

PROGRAM YEAR 9

QUARTERLY REPORT 1

for the period

July 1, 2002 – September 30, 2002



A Cooperative Program

between the

University of California

and the

Minerals Management Service

October 9, 2002

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Russell J. Schmitt
Program Manager

Coastal Research Center
Marine Science Institute
University of California
Santa Barbara, California 93106

October 9, 2002

Program Manager's Report

for the period July 1, 2002 – September 30, 2002

This constitutes the quarterly report for the first quarter for Program Year 9 of the Coastal Marine Institute, a cooperative research agreement between the Minerals Management Service, the state of California and the University of California. As of this quarter, 17 projects currently are being conducted under the aegis of the Coastal Marine Institute.

Actions Pending MMS Approval:

- Approval of no cost extension for Task 17603, Contract No. 14-35-01-00-CA-31063, PI Murray, *Shoreline Inventory, Orange County*, through June 30, 2002;
- Approval of no cost extension for Task 14181, Contract No. 14-35-0001-30758, PIs Schmitt & Brooks, *Population Trends and Trophic Dynamics ...*, through June 30, 2004;
- Approval of no-cost extension for Task 17608, Contract No. 14-35-01-00-CA-31063, PIs Washburn & Gaines, *Observing the surface circulation ...*, through September 30, 2003;
- Approval of no-cost extension for Task 17604, Contract No. 14-35-01-00-CA-31063, PI Raimondi, *Shoreline Inventory of Intertidal Resources of SLO & northern SB Counties*, through March 31, 2003;
- Approval of no-cost extension for Task 17601, Contract No. 14-35-01-00-CA-31063, PIs Page *et al.*, *Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic*, through September 30, 2003;
- Approval of no-cost extension for Task 17606, Contract No. 14-35-01-00-CA-31063, PIs Hodges *et al.*, *Population Genetics of Surfgrass (Phyllospadix torreyi) for use in Restoration*, through September 30, 2003;
- Approval of transfer for funds to travel on Task 17605, Contract No. 14-35-01-00-CA-31063, PIs Estes *et al.*, *Population Dynamics and Biology of the California Sea Otter at the Southern End of its Range*.

Major Programmatic Progress and Actions during the Quarter:

- Full proposals were received and we negotiated awards for 4 new projects, and continuation with additional funding for the internship and biotech programs;
- The Final Report for Task 13096: *Utilization of Sandy Beaches by Shorebirds: Relationships to Population Characteristics of Macrofauna Prey Species and Beach Morphodynamics*, has been completed. It will be submitted to MMS as soon as the manuscript containing the data has been submitted for publication;
- Task 13094: *Application of Coastal Ocean Dynamics Radars for Observation of Near-Surface Currents off the South-Central California Coast*, has been completed and the final study report will be submitted to MMS next quarter;
- Task 13095: *Effects of Produced Water on Complex Behavioral Traits of Invertebrate Larvae and Algal Zoospores*, has been completed. The draft final study report has been submitted to MMS and we are awaiting comments;
- The draft final report for Adamson's portion of Task 17610: *Industrial Activity and Its Socioeconomic Impacts: Oil and Three Coastal California Counties* has been submitted to MMS. We are working on revising the copy edits and will submit a revised version of the draft report next quarter.

Task 12387: *Ecological Consequences of Alternative Abandonment Strategies for POCS Offshore Facilities and Implications for Policy Development*

Principal Investigators: **Mark H. Carr**, Department of Biology, University of California, Santa Cruz, CA 95064, **Graham E. Forrester**, Dept. of Biology, University of Rhode Island, Providence, RI, and **Michael V. McGinnis**, Coastal Research Center and Ocean and Coastal Policy Center, Marine Science Institute, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 - September 30, 2002

We continued to focus our efforts on writing the final report and associated publications this past quarter. The primary tasks conducted this past quarter were:

- Preparing text, tables and figures for the final report and publications.

Future plans: Preparation of final report and publications.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%
Project Year 3	100%

Task 14181: *Population Trends and Trophic Dynamics in Pacific OCS Ecosystems: What Can Monitoring Data Tell Us?*

Principal Investigators: **Russell J. Schmitt**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106 and **Andrew J. Brooks**, Coastal Research Center, Marine Science Institute, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002

A number of entities (including MMS) have devoted considerable effort and resources to the long-term monitoring of various components of the coastal marine ecosystems in the Southern California outer-continental shelf (OCS) region. The primary goals of such monitoring are to estimate the current state of the biota and to identify long-term trends in population demographics. Data from such studies are vital to resource and regulatory agencies as they provide critical baseline information needed for accurate assessment of potential effects arising from such particular activities as offshore oil and gas production. The fundamental need for such information is evidenced by the growing number of coastal marine monitoring programs that have been implemented in Southern California.

Our MMS-UC CMI funded research encompasses two separate objectives: (1) the analysis and synthesis of existing long-term monitoring data and (2) the continued annual surveys of subtidal reef communities at Santa Cruz Island.

(1) The analysis and synthesis of existing long-term monitoring data.

To date we have analyzed 8 separate datasets collected in three different ecological systems; subtidal rocky reef, kelp bed, and open ocean pelagic. Trends in population abundances show consistent declines in all three systems over the last 10-15 years. Most interesting, within each system examined, trends for each component trophic level show approximately the same degree of decline. This pattern holds across spatial scales ranging from a single island within the northern Channel Islands group to the entire Southern California Bight. Also interesting is the fact that data collected using extremely different methodologies, e.g. coastal power plant impingement studies versus diver visual surveys, provide similar estimates of the magnitudes of these declines. Most recently, we conducted time-series analyses on these data sets to describe their temporal trends and explore the timing and magnitude of change. The species examined were classified as to trophic level, mode of reproduction, extent of geographic range, association with benthic or pelagic food webs, and habitat. In general, the magnitude of decline was similar for all species, regardless of classification. Trends were similar at all locations examined within the Bight, suggesting regional declines in abundances rather than redistribution of individuals. These patterns are consistent with the explanation that a regional decline in productivity is responsible for regional decline in fish stocks.

(2) The continued annual surveys of subtidal reef communities at Santa Cruz Island.

We are finishing the process of identifying epifaunal invertebrate samples collected during our 2001 surveys. We plan to continue with our monitoring of the abundances of surfperches, their

invertebrate prey, and the algal cover present in benthic microhabitats at 11 permanent study sites on the south coast of Santa Cruz Island.

Publications and Presentations:

Brooks presented results from this work at a symposium on the value of long-term monitoring programs at the Southern Academy of Sciences Meetings in June, 2002. We are currently preparing two additional papers for publication.

List of all personal associated with the project

PIs: Dr. Russell J. Schmitt, Dr. Andrew J. Brooks

Post-graduate researchers: Keith Seydel, Andrea DeMent

Undergraduate researchers: Jada-Simone White, Corrie Kane, Julie Deter

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	100%
Project Year 4:	100%
Project Year 5:	60%

Task 15115: *Effects of Temporal and Spatial Separation of Samples on Estimation of Impacts*
Principal Investigator: Peter Raimondi, Department of Biology, University of California,
Santa Cruz, CA 95064

Major Accomplishments, July 1, 2002 – September 30, 2002

The following publication has been accepted and will be published next quarter:

Raimondi PT, CM Wilson, RF Ambrose, JM Engle and TE Minchinton. 2002. Continued declines of black abalone along the coast of California: are mass mortalities related to El Nino events? *Marine Ecology Progress Series* (in press).

Progress has been made towards the final report, which will be submitted during the third quarter of this, the ninth, year.

Below are the main questions proposed by the project and progress to date.

Question 1: What are the spatial and temporal patterns in the structure of the monitored communities at all 25 monitored sites?

These patterns have now been documented.

Question 2: Should there be any modification to the sampling regime employed at the various sites?

The detailed and complex statistical analyses are completed. Results will be included in final report.

Problems Encountered:

None.

Future plans:

Complete Final Report.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%

Task 15118: *An Experimental Evaluation of Methods of Surfgrass (Phyllospadix torreyi) Restoration Using Early Life History Stages*

Principal Investigators: **Daniel C. Reed**, Marine Science Institute, University of California, Santa Barbara, CA 93106 and **Sally J. Holbrook**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002

Our graduate student, Scott Bull has finished his research and completed his Master's thesis. He received his Master of Science degree in June 2002. Two additional papers have been submitted for publication, one of which has been accepted and should be published next quarter.

Bull, J.S. 2002. An Experimental Evaluation of Different Methods of Restoring Surfgrass, (*Phyllospadix torreyi*). Master of Science Thesis, University of California, Santa Barbara, pp. 77.

Holbrook, S.J., D.C. Reed and J.S. Bull. 2002. Survival experiments with outplanted seedlings of surfgrass (*Phyllospadix torreyi*) to enhance establishment on artificial structures. *ICES Journal of Marine Science* (in press).

Bull, J.S., D.C. Reed, and S.J. Holbrook. 2002. An Experimental Evaluation of Different Methods of Restoring *Phyllospadix torreyi*. Submitted July 2002 to *Restoration Ecology*.

Future Plans:

We will submit a final report on the findings of our project by March 31, 2003.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	100%

Task 17601: *Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic Species*

Principal Investigators: **Mark Page**, Marine Science Institute, **Jenifer Dugan**, Marine Science Institute, and **James Childress**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 - September 30, 2002

During this reporting period, stable isotope ratio analysis was used to estimate relative trophic position of selected species present on the shell mounds at the former sites of platforms Hazel and Hilda and at the mound beneath platform Gina. A food subsidy in the form of faunal litterfall from the platform structure is provided to benthic consumers on the mound beneath platform Gina, but not at mounds Hazel and Hilda. We therefore expected to see a difference in food web structure as indicated by $\delta^{15}\text{N}$ values. The ratio of the “heavy” (^{15}N) to the “light” (^{14}N) nitrogen isotope increases with trophic level because of the selective metabolic loss of the lighter N isotope (^{14}N) during food assimilation and growth.

Sample tissues were analyzed for $\delta^{15}\text{N}$, and the following major results were found: $\delta^{15}\text{N}$ of *Pisaster giganteus* was $11.9 \pm 0.2\text{‰}$ for individuals collected from the mound beneath platform Gina, and 13.0‰ from the mound at the former site of platform Hilda, indicating that they are likely secondary consumers. At platform Gina, divers observed *P. giganteus* individuals feeding on *Mytilus* sp., providing qualitative evidence of trophic position. The slightly higher $\delta^{15}\text{N}$ value for *P. giganteus* from Hilda indicates that they are consuming a greater proportion of higher-level prey there. Values were similar across locations for the sea cucumber, *Parastichopus parvimensis* (Gina: $12.8 \pm 0.2\text{‰}$; Hazel, $11.0 \pm 0.1\text{‰}$ and Hilda, $12.6 \pm 0.2\text{‰}$). As expected, values were higher for the predatory snail, *Cypraea spadicea*, than for cucumbers, but were similar across locations (Gina, $13.1 \pm 0.2\text{‰}$; Hazel, $13.8 \pm 0.3\text{‰}$ and Hilda, $13.7 \pm 0.3\text{‰}$). *Coryphopterus nicholsii*, the blackeye goby, was the highest consumer assayed, with $\delta^{15}\text{N}$ values of $14.5 \pm 0.4\text{‰}$ at Gina and 14.5‰ at Hazel.

Our data has previously established that *Asterina miniata* are significantly larger on the mound under platform Gina relative to shell mounds without overlying platform structure. In order to determine if that difference extends to the nutritional condition of the organisms, we collected bat stars from both mound types, and are in the process of determining whether the relationship between dry weight and arm radius varies by habitat type.

Work continued on preparation of the master’s thesis and on a manuscript for publication in a scientific journal.

Upcoming work

Additional organisms will be assayed for stable isotope ratios, and the results will be compared to data collected from local LTER natural reef sites. Condition of *Asterina miniata* and *Cypraea spadicea* from the shell mounds will be determined. Work will continue on the Masters thesis.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	61%

Task 17602: *Inventory of Rocky Intertidal Resources in Southern Santa Barbara, Ventura and Los Angeles Counties*

Principal Investigator: **Richard F. Ambrose**, Department of Environmental Health Sciences and Environmental Science and Engineering Program, University of California, Los Angeles, CA 90095-1772

Staff Researchers: Steven F. Lee MS. Staff Research Associate III
Sean Bergquist Staff Research Associate I

Major Accomplishments, July 1, 2002 – September 30, 2002

During this quarter, effort was divided between completing tasks relating to the Spring 2002 sampling, miscellaneous tasks relating to the project as a whole, and the planning of the Fall 2002 sampling. In July, all of the relevant sites were visited during low tide events for the

Table 1. Barnacle sampling schedule for Summer 2002

Date	Location	Comments
July 13	Alegria	UCLA Group
July 13	Arroyo Hondo	UCLA
July 13	Carpinteria	UCLA
July 13	Mussel Shoals	UCLA
July 14	Old Stairs	UCLA
July 14	Paradise Cove	UCLA

Summer 2002 barnacle data collection (Table 1). After the sampling, the retrieved plates and the data sheets were sent to the Raimondi group at UC Santa Cruz for further analysis and data management. Beginning in early July, time was spent organizing, labeling and becoming familiar

with a large collection of newly purchased items, including a new vehicle, a mapping grade GPS, office equipment, and other miscellaneous items. These were not purchased off of this project's funds, but their general use will be extended to this project. A large amount of time was dedicated to issues surrounding protocol standardization and the development of a database management system in collaboration with Larry Cooper at SCCWRP; these efforts are part of our involvement with the larger MARINE group. New, more standard data sheets were developed and will be tested in the upcoming sampling season. Steven Lee created a new site reconnaissance form to supplement the existing monitoring program, and this form is currently being considered by other members of the MARINE group. In late September (Sept. 20-21), a taxonomy workshop was held at the UC Santa Barbara campus. This workshop was attended by most of the researchers associated with this project, plus David Lindberg and Paul Scott, who acted as taxonomic experts for limpets and mussels, respectively. The remainder of the quarter was spent working on various project-related tasks, and on preparations for the upcoming Fall 2002 sampling season (see Table 2). We also received our new digital camera, which will eventually replace the older Nikonos emulsion film cameras.

Table 2. Proposed sampling schedule for Fall 2002

Date	Location	Comments
November 3	Old Stairs	UCLA Group
November 4	Point Fermin	UCLA/MMS Help
November 5	Paradise Cove	UCLA/MMS Help
November 6	Mussel Shoals	UCLA/MMS Help
November 19	Coal Oil Point	UCLA/SB County Help
November 20	White's Point	UCLA/MMS Help
December 2	Arroyo Hondo	UCLA, MMS, SB County Help
December 3	Alegria	UCLA, MMS, SB County Help

Future Plans:

Throughout the present quarter, we will continue with the preparation and execution of the Fall 2002 sampling. We will also continue the process of scanning and archiving the current photoplot and photo survey slides for LA, Ventura, and southern Santa Barbara Counties. We are still in the process of refining the way we collect motile invertebrate data in the plots with Steven Lee, Melissa Wilson, and Dan Richards taking the lead in resolving these issues. We will be testing the new datasheet formats as well as the new site reconnaissance datasheet throughout the upcoming quarter. We plan to fully implement these changes by the Spring 2003 sampling season. We will be testing the use of the new digital camera, housing and strobe system during this upcoming sampling. We also plan to help the intertidal swat team with their comprehensive sampling of the MARINE and other sites, time permitting.

Problems Encountered:

None.

MMS Action Required:

None.

Task 17604: *Shoreline Inventory of Intertidal Resources of San Luis Obispo and Northern Santa Barbara Counties*

Principal Investigator: Pete Raimondi, Department of Biology, University of California, Santa Cruz, CA 95064

Major Accomplishments, July 1, 2002 - September 30, 2002:

The majority of the work for the Shoreline Inventory Project in San Luis Obispo (SLO) and Northern Santa Barbara (NSB) Counties during this quarter focused on scoring photographic slides and entering these percent cover data, along with field data collected during the previous quarter into computer files. The Bureau of Land Management installed brass monument markers at all of our sites in order to have permanent locations from which to obtain accurate GPS coordinates for each site.

On July 22nd-26th and 29th, SLO and NSB sites were visited to collect data for an ongoing barnacle recruitment study.

Currently, we are planning and preparing for the upcoming sampling trips, which will take place in November.

Future Plans:

In the next quarter we will sample all sites in both counties.

Problems encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

SLO, NSB portions	60%
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Task 17605: *Population Dynamics and Biology of the California Sea Otter at the Southern End of its Range*

Principal Investigators: **James Estes**, Supervisory Wildlife Biologist, USGS-BRD; **Terrie Williams**, Professor of Biology, University of California, Santa Cruz; **Daniel Costa**, Professor of Biology, University of California, Santa Cruz; **Katherine Ralls**, Research Zoologist, Smithsonian Institution; **Donald Siniff**, Professor of Ecology, Evolution & Behavior, University of Minnesota.

Major Accomplishments, July 1, 2002 - September 30, 2002:

Monitoring of study animals by fieldworkers based at Piedras Blancas field station, San Simeon CA, continues as before. As of Sept 30, we have captured and instrumented 31 study animals at the northern (San Simeon) study site and 25 study animals at the southern (Pt. Conception) study site. We have recovered 10 TDR instruments to-date and downloaded the time-depth data from them for analysis. More captures are planned for October, at which time we intend to add an additional 15, TDR-equipped study animals to the northern study group. This increase in sample size from the initial study plan is intended to compensate for data lost due to the previously reported TDR malfunction (as reported in the previous report, this problem has now been rectified by the manufacturer).

Of the northern study group, 7 of 31 (23%) animals are confirmed dead with carcasses recovered, and an additional 2 (6%) are missing but assumed dead; all other animals are re-sighted regularly. Of the southern study group, none of the animals have been confirmed dead, but 3 of 25 (12%) are missing and unaccounted for, while the remaining animals are re-sighted regularly. It would thus appear that mortality is significantly higher at the northern study sight. A total of 7100 re-sights have been collected on study animals to date, providing data on both fine-scale patterns of habitat use as well as long-distant movement patterns. As reported previously, the male animals captured at the southern study site continue to move throughout the entire sea otter range, with re-sightings as far north as Santa Cruz and Elkhorn Slough. Data collection on sea otter foraging is progressing well, with over 18,000 feeding dives recorded to date.

Problems Encountered:

No problems have been encountered.

MMS Action Required:

No MMS action required

Future plans:

Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	50%

Task 17606: *Population genetics of surfgrass (Phyllospadix torreyi) for use in restoration.*

Principal Investigators: **Scott Hodges**, Department of Ecology, Evolution and Marine Biology, **Douglas Bush**, Marine Science Institute, **Sally J. Holbrook**, Department of Ecology, Evolution and Marine Biology, and **Daniel Reed**, Marine Science Institute, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

The major effort during this quarter was in computer analysis of AFLP fingerprints constructed for Goals 1 and 2 of our proposal. We have now scored 80% of the AFLP fragments for all 605 individuals included in these studies. In addition, we have scored these same individuals for the presence of male markers and have thereby characterized the frequency of males in surfgrass populations. We have found that all of our populations show an extreme female-bias in sex ratio. We are currently preparing a manuscript on sex ratio in surfgrass.

Future plans:

The major effort in the next quarter will involve an analysis of our population data to characterize genetic structure and determine the spatial scale over which genetic differentiation occurs. We plan to request an extension of our current grant to complete the analysis of our data.

Problems Encountered:

No problems were encountered during this quarter

MMS Action Required:

No MMS action required.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	85%

Task 17607: *Public Perceptions of Risk Associated with Offshore Oil Development*

Principal Investigator: Eric R.A.N. Smith, Department of Political Science, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

During this period, data collection for the content analysis of newspaper coverage of oil and energy issues was completed. Those data will be used in conjunction with survey data, which we have already gathered, to explain changes in public opinion toward offshore oil and gas development.

A paper stemming from an earlier part of this project, “Postmaterialism vs. Cultural Theory as an Explanation of Environmental Opinion,” was submitted to *Public Opinion Quarterly* for publication. When it is published, the paper will be co-authored by Eric Smith and his graduate research assistant, Juliet Carlisle. The paper was given a “revise and resubmit” by the journal.

In July, a public opinion survey designed by this research team was conducted by U.C. Santa Barbara’s Survey Research Center in July. This survey was entirely funded by a grant from the University of California’s Energy Institute. These data are now being analyzed.

Future Plans:

The paper submitted to *Public Opinion Quarterly* will be revised and resubmitted. In addition, some of the results of this project will be presented at the “California and the World Oceans ’02” Conference in Santa Barbara, California (October 27-30, 2002). The paper will be titled, “Support for Offshore Oil and Gas Drilling among the California Public.”

Problems Encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	45%

Task 17608: *Observing the Surface Circulation Along the South-Central California Coast Using High Frequency Radar: Consequences for Larval and Pollutant Dispersal*

Principal Investigators: **Libe Washburn**, Department of Geography, and **Stephen Gaines**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

During the quarter July 1 - September 30, 2002 we worked on several aspects of the project including data analysis tasks, synthesis of field observations, manuscript preparation, meeting preparations, and the operation and maintenance of field equipment (mainly high frequency radars, current meters, and moorings). During the quarter we had nearly continuous operation of our 5-site high frequency (HF) radar array. The two radars which were returned to us by NOAA were re-installed in the last quarter and continue to function well.

An important research focus over the last quarter was the analysis of data collected during a 6-month experiment near Ellwood, California. The purpose of the experiment was to explore relationships between invertebrate settlement and near shore transport processes. We hypothesized that settlement would occur in pulses which would correlate with identifiable transport processes such as the internal tide, local upwelling, and along shore advection. Observations from our MMS research provided the physical oceanographic context for interpreting the larval settlement data. Our approach was to obtain frequently-sampled time series of settlement of several invertebrate species while measuring nearshore currents and water mass variability. From June through December 2001 we deployed and retrieved racks with plates and tiles to measure settlement every other day or every third day over weekends. Profiles of currents were measured offshore in 15 m and 30 m water depths using acoustic Doppler current profilers (ADCP's). Additional current data come from a near shore array of ADCP's along the 15 m isobath and our array of high frequency radars which observed surface currents farther offshore. Thermistor moorings extending offshore were deployed to determine the propagation characteristics of internal motions on the inner shelf. Results of the experiment were presented at a national meeting as indicated below.

We also continued our work with the California Coastal Commission and the California State Lands Commission in the application process to place a sixth HF on Rincon Island near Ventura. This radar system will be a key component of our research efforts in the eastern Santa Barbara Channel.

During the quarter, Edwin Beckenbach, a UCSB grad student working on the project, continued his examination of the dynamics of surface current patterns in the western Santa Barbara Channel. He is in the final stages of preparing a manuscript describing an interesting flow phenomenon in the western Channel called topographic Rossby modes. He also continued his analysis of the relationship between local winds and circulation in the western Channel. An interesting hypothesis that he is exploring is that the local wind field controls the vorticity of the regional surface flow. Another important feature of the current field in the western Channel is a region of strong convergence. This convergence may explain patterns of chlorophyll variability observed in the region during other studies.

A new research avenue we began this quarter was the estimation of water particle trajectories based on HF radar data. We conducted a first test of the method by deploying a small number of GPS-tracked drifters in the radar coverage area. Our approach is to predict trajectories based on the radars and then quantify differences by comparison with actual drifter trajectories. Analysis of this preliminary data is continuing. We hope to develop a useful means of tracking floating materials and pollutants from this research.

At present the following papers related to our project have been submitted or are in press:

2002	"Evaluating radial current component from CODAR high frequency and moored in situ current meters", Emery B.M., L. Washburn, and J.A. Harlan	Submitted to J. Atmos. and Oceanic Tech.	Article
2002	Contrasting patterns of eddy circulation and pelagic juvenile fish abundance in the Santa Barbara Channel, California, Nishimoto, M.M., and L. Washburn	In press in Marine Ecological Progress Series	Article
2002	Inner-shelf circulation near Pt. Conception California, Cudaback, C., L. Washburn, and E.P. Dever	Submitted for publication, Continental Shelf Research	Article

During the Eastern Pacific Ocean Conference from 25-28 September 2002 the following presentation related to our project was made:

- 2002 "High frequency sampling of nearshore coastal circulation and invertebrate settlement near Santa Barbara California", C. Cudaback, L. Washburn, J. Caselle, C. Blanchette, B. Gaylord, Eastern Pacific Ocean Conference, Timberline Lodge, OR 25-28 Sept.

Action requested from MMS:

None.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 85%

Task 17609: *Advancing Marine Biotechnology: Use of OCS Oil Platforms as Sustainable Sources of Marine Natural Products*

Principal Investigators: **Russell J. Schmitt**, Department of Ecology, Evolution and Marine Biology, **Jenifer Dugan**, Marine Science Institute, **Scott Hodges**, Department of Ecology, Evolution and Marine Biology, **Robert Jacobs**, Department of Ecology, Evolution and Marine Biology, **Mark Page**, Marine Science Institute, **Leslie Wilson**, Department of Molecular, Cellular and Developmental Biology, and **Stephen Gaines**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

ECOLOGY

During this quarter we completed our studies of invertebrate recruitment and growth of *Mytilus galloprovincialis*, removing the last round of experimental modules and associated gear. The modules consisted of a PVC frame with a mesh cage containing mussels, two settlement surfaces (tiles) and a small mesh recruitment cage containing fibrous material. The caged mussels allowed us to evaluate growth of our model suspension-feeder, *Mytilus galloprovincialis*, among platforms. The settlement tiles and recruitment cages allowed us to investigate invertebrate recruitment across platforms. Preliminary data analysis indicates that mussel growth was significantly different among platforms during the spring. Specifically, mussels grew faster at three of the southern platforms and the most north-westerly platform (Platforms Gina, Gail, Gilda & Holly) ($x = 6.8 - 7.1 \text{ mm mo}^{-1}$) as compared to the other platforms (Grace, Hogan & Houchin) where growth was slower ($x = 6.3 - 6.5 \text{ mm mo}^{-1}$). Temporally, mussel growth rates were higher in the spring than in the winter.

Recruitment of certain invertebrates also varied significantly among platforms during the spring. For example, there was a striking difference in barnacle recruitment, with significantly more barnacles (*Megabalanus californicus*, *Balanus regalis*) recruiting to the most south-easterly site (Gina) as compared to the other sites. This was the first time we observed high recruitment of *B. regalis* at any platform. Recruitment of colonial tunicates and encrusting bryozoans also varied among platforms in the spring, with significantly higher recruitment of both taxa at Platform Hogan, followed by Houchin.

We also continued analyzing our photo-quadrat surveys using point contact methods. These surveys consisted of photographic sampling at four depths both up and down current at four randomly chosen conductor pipes and four outside platform legs. This quarter we completed data collection from the photographs of the conductor pipes at all platforms and depths (32 pictures per platform, 224 pictures total). Point contact analysis of the photographs of the platform legs is in progress. This information will be used to evaluate spatial and temporal patterns in the distribution and abundance of invertebrates at the platforms.

We also collected branching bryozoans, encrusting bryozoans and anemones at various sites for the other research groups collaborating on this project. The branching bryozoans were provided to Scott Hodges' laboratory for genetic analyses and the encrusting bryozoans and anemones went to Robert Jacob's laboratory for natural products research.

In the next quarter, we will continue to collect and analyze data from our various project components. Specifically, we will use point contact methods for analysis of our photo-quadrat surveys of the platform legs and begin data entry and analyses of the data from the conductor pipes. We will also begin analyses of temporal variation of invertebrate recruitment and growth of *Mytilus galloprovincialis* among platforms. In addition, we will obtain chlorophyll data for the period and locations of our study. This data, along with temperature data we collected during the study, will be used to examine the relationship between the patterns found at the platforms and these selected environmental factors. Collection of additional specimens for genetic and pharmaceutical analyses will continue as requested by the other research groups collaborating on this project. We are also preparing a manuscript for publication.

PHARMACOLOGY

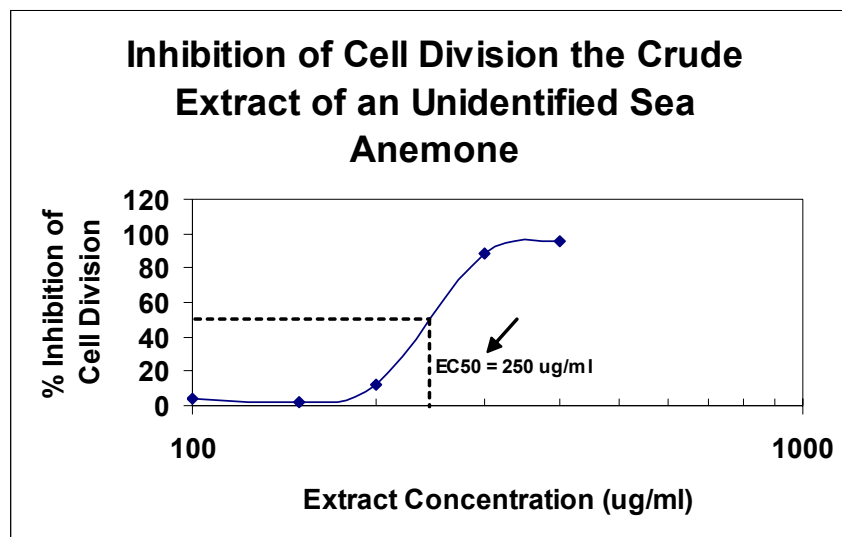
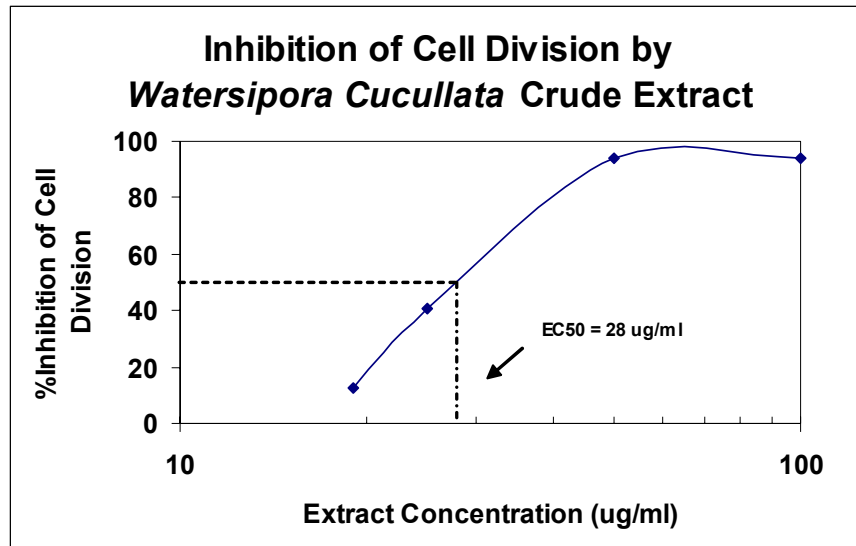
Marine organisms that inhabit the subtidal structures of offshore oil production platforms are a potential source of novel compounds for pharmaceutical use. These organisms provide an unparalleled opportunity to study natural product chemistry from populations of organisms living in ecologically unique habitats. Since the last progress report, we have positively identified the organisms, optimized extraction procedures to obtain the highest biological activity and began purification of the crude extracts on high performance liquid chromatography.

Identification of Organisms

Vouchers of the three platform organisms we are studying were by the scientific staff at Santa Barbara Museum of Natural History. Preserved and live specimens of each were subsequently sent to experts in the field for proper identification. The bryozoan once referred to as *Hippodiplosia insculpta* was discovered to actually be *Watersipora cucullata* and will be now referred to as that. The sea anemone formerly known as *Metridium exiles* is still currently in the process of identification and will be referred to as an unknown anemone. *Corynactis californica* was correctly identified.

Biological Activity of Crude Extracts

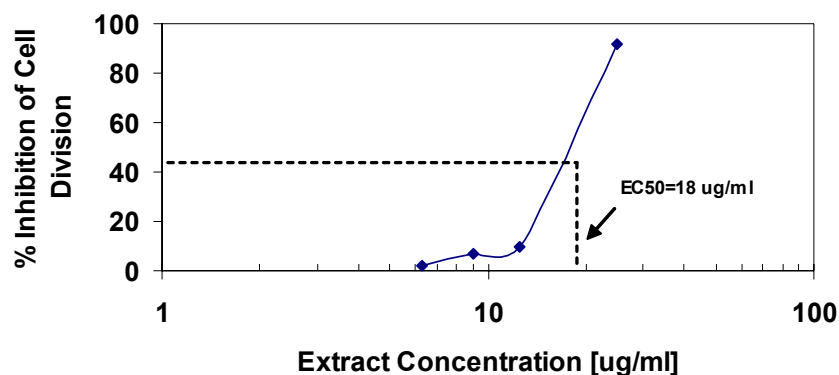
The biological activity of crude extracts of *Watersipora cucullata* and unidentified anemone were confirmed. The dose response curves presented here:



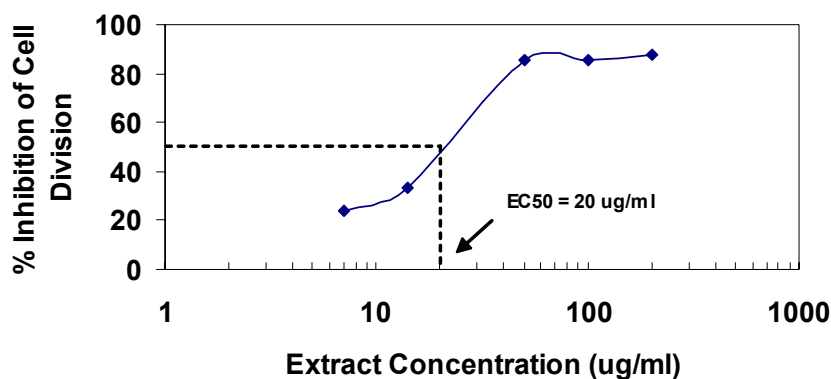
Optimization of extraction procedure

In order to obtain a better yield the extraction procedures for all three organisms was modified. In the case of *Watersipora* and the unknown anemone the extraction was prepared directly from a freeze dried organism. *Corynactis californica* extracts continue to be prepared by homogenizing wet frozen anemones in filtered seawater in a blender and the homogenate was extracted into two phases: a lipid/organic extract and a water/methanol. The crude extracts were partitioned into various solvents, methanol, chloroform and hexane in a solvent-solvent partition and partitioned using a silica gravity column. The gravity column allowed a more detailed

Inhibition of Cell Division by Chloroform:Methanol Fraction of *Watersipora cucullata*



Inhibition of Cell Division by Chloroform Extract of *Corynactus californica*



fractionation of the extract using 10 different solvents comprised of differing percentages of chloroform in methanol. The different fractions were tested in the sea urchin assay and activity localized to at least one fraction. In all cases information obtained by the gravity column has led to the development of a more efficient and direct method of extracting the active material from the organisms in a semi-crude form. The active fractions for the unknown anemone and *Corynactus californica* were from a 100% chloroform extract, the active fraction in *Watersipora* was obtained using a 50/50 chloroform methanol extract. Dose response curves for the chloroform fraction of *Corynactus californica* and the active fraction for *Watersipora cucullata* are presented here.

Coumarin work arising from studies of Dasycladales

Previously we characterized the effects of dicoumarol on the distribution of sea urchin embryos in stages of the cell cycle and on the organization of microtubules and chromosomes in metaphase spindles by indirect immunofluorescence staining of microtubules and 4,6-diamidino-2-phenylindole staining of chromatin. At high concentrations (50 μ M), dicoumarol produced abnormal organization of mitotic spindle microtubules with chromosomes that had not congressed to the metaphase plate. This summer we characterized the effects of low and medium concentrations of dicoumarol (5 μ M, 10 μ M) and found chromosomes that had not aligned properly to the metaphase plate in all instances. In addition, we observed a unique effect of the drug in that it appeared to inhibit nuclear envelope breakdown. We are currently working out the conditions to characterize the effects of the drug on nuclear lamina assembly and disassembly by indirect immunofluorescence. Thus far, our data indicate that the anti-

proliferative mechanism and action of dicoumarol and other coumarin compounds is apparently mediated by tubulin binding and the kinetic stabilization of spindle microtubule dynamics.

GENETICS

We have made significant progress on determining the genetic variation among samples of *Bugula neritina* during this last quarter. During this time, we have focused our efforts on expanding our collections in order to obtain a large, representative sampling of *B. neritina* from OCS oil platforms as well as natural populations along the mainland coast and the California Channel Islands. We have particularly focused our efforts on samples from the Channel Islands because these populations are much more likely to be isolated and to therefore contain unique genetic variants that would be signatures we could use to identify the sources of *B. neritina* on OCS platforms. During this quarter, we obtained nearly 90 new samples from: Platform Gail (5 samples), four sites on Santa Cruz Island (San Pedro Pt. (5), Gull Island (5), Frazer Pt (4), Hazards (26)), Anacapa Island (Goldfish Bowl (1)), Santa Barbara Island (Southeast Sea Lion (2) and Arch Rock (5)), San Nicolas Island (6), and Santa Catalina Island (Isthmus Reef (30)). This wide and varied sampling will be extremely important in our determination of the degree of genetic variation (and thus potential variation in bryostatin compounds) in this species. Currently we are confirming the identification of these collections and cleaning them in preparation for DNA extraction. During the next quarter we plan to amplify mtDNA from these samples using our *B. neritina*-specific PCR primers in preparation for DNA sequencing.

Problems Encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	40%

Task 17610: *Joint UCSB-MMS Pacific OCS Student Internship Program*

Principal Investigators: **Jenifer Dugan**, Coastal Research Center, Marine Science Institute, University California, California. 93106, and **Edward A. Keller**, Environmental Studies Program, University of California, Santa Barbara, California, 93106

Major Accomplishments, July 1, 2002 – September 30, 2002

A total of five interns worked on MMS projects during Summer '02 including two intern in new positions. Tim Wolff continued and Rusty Roland was hired in August to work with Ms. Barminsky and Mr. Brickey of MMS on a regional database for use in site-specific geological and engineering evaluation of producing offshore fields in the Santa Maria Basin, Santa Barbara Channel and offshore Long Beach. Mike Williams and Jason Chau continued to work with Dr. Jim Lima and others at MMS to support the MMS archeology program. We hired a graduate student intern, Catrina Mangiardi, to work on curricula development at the Santa Barbara Maritime Museum for the summer. We are working with Fred Piltz and other MMS personnel to arrange additional internship opportunities for MMS and MMS/CMI projects during Winter 2003.

Future plans:

New interns will be hired as needs are identified.

Estimated Percentage of Budget Expended:

Project Year 1: 100%
Project Year 2: 64%

Task 17611:Simulation of a Subsurface Oil Spill by a Hydrocarbon Seep (SSOS-HYS) and
Task 18211:Oil Slicks in the Ocean: Predicting their Release Points Using the Natural
Laboratory of the Santa Barbara Channel

Principal Investigators: **Jordan Clark**, Department of Geological Sciences, **Bruce Luyendyk**,
Department of Geological Sciences, and **Ira Leifer**, Institute of Crustal Studies,
University of California, Santa Barbara, California 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

Summary: During the most recent quarter, our efforts have focused on data analysis, result presentation, and field/laboratory experiments. New results (described below) were presented at a regional oil company, Venoco Inc. and The California World Oceans Conference.

Bubble measurements. Surface bubble video was collected at all major seeps in the Santa Barbara Channel. The closed bubble measurement system (BMS) was improved through the addition of a window in bubble entry gap that prevented bubbles from approaching the camera (and thus being of uncertain size). A new BMS holding approach was tested and allowed successful bubble video under choppy conditions (6-9 knots, 2 m swell). A publication is anticipated from this data in the next few months.

Catastrophic Seepage. Air pollution records from the West Campus have been analyzed and related to Shane Seep Mar. 8, 2002 catastrophic seepage event. The records allow estimate of annual releases due to catastrophic seepage events, and are being used to develop a model of the subsurface transport of oil, gas and tar.

Oil/Gas Ratio. In conjunction with the University of California Energy Institute (UCEI) supported catamaran drum oil sampler project, the Shane Seep oil slick was successfully sampled. All previous attempts had failed to collect sufficient oil for gas chromatographic analysis. Further data analysis will allow an estimation of the oil-gas ratio. A comparison of slick and tar chromatograms demonstrated that tar residence time is significantly longer (heavily biodegraded) than the oil (no biodegradation).

Fluid Motions. Bubble rise velocities, V_B , for different seep streams (major and minor, seabed and surface) have been analyzed. Bubble velocities were greater than V_B for a stagnant fluid, confirming the presence of an upwelling flow, also shown by the dye tracer studies. This confirms that bubble velocity analysis can be used to estimate fluid motions.

Seabed Morphology. During surveys over the last year, detailed seabed morphological measurements have been made showing the evolution of mud volcanoes over the year. Recently, during a ROV test was used to survey the area around Shane Seep beyond the area easily reachable by divers. It demonstrated that seepage lies along a line ~100 m long. The largest mud volcanoes were found at the areas of greatest seepage, with a few small features outside the currently studied area.

Dissemination. Leifer and Judd (2002) is *in Press*. Leifer and Patro (2002) is published. Leifer and MacDonald (2002) was revised and resubmitted. Leifer and Clark (2002) is published. Results were presented at an August 22 talk, The Shane Seep Blowout and our Understanding of the Role of Marine Hydrocarbon Seeps to the Global Environment, at a regional oil company. Venoco, Incorporated, Carpinteria, CA. Results were also presented at a talk, Predicting the Fate of Oil in the Marine Environment from the Seabed to Surface Oil Slicks and Beyond, at The California World Oceans Conference, Santa Barbara, CA, on Oct 27, 2002. Collaboration with the Marine Science Institute Educational Outreach Program has provided informational aids for explaining hydrocarbon seepage to school children and also developed field experiments for use during field trips. A second video “Catastrophic Seepage” is being edited.

References

- Leifer**, I. and A. Judd, 2002, Oceanic methane layers: A bubble deposition mechanism from marine hydrocarbon seepage. *Terra Nova*, *in Press*.
- Leifer** I., and R. Patro, 2002. The bubble mechanism for transport of methane from the shallow sea bed to the surface : A review and sensitivity study. *Cont. Shelf Res.* **22**, 2409-2428.
- Leifer**, I., and I. MacDonald, 2002. Dynamics of the gas flux from shallow gas hydrate deposits: Interaction between oily hydrate bubbles and the oceanic environment. *Earth Plan. Sci. Lett.*, *Submitted*.
- Leifer**, I., and J. Clark, 2002. Modeling trace gases in hydrocarbon seep bubbles. Application to marine hydrocarbon seeps in the Santa Barbara Channel, *Russian Geology and Geophysics*, **43(7)**, 613-612.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	19%

Task 18212: *Transport over the Inner-Shelf of the Santa Barbara Channel*

Principal Investigator: **Carter Ohlmann**, Institute of Computational Earth System Science,
University of California, Santa Barbara, California 93106

Major Accomplishments, July 1, 2002 – September 30, 2002:

Introduction: The primary goals of this research are to collect surface current data over the inner-shelf of the Santa Barbara Channel with Pacific Gyre's "Microstar" Lagrangian drifters, and use the data to: identify characteristic features of the flow field such as convergences, divergences and cross shelf transports, determine the surface velocity and velocity variance distributions, examine flow patterns on scales that are too small to be resolved in CODAR current measurements, and investigate how well particle paths determined from Eulerian CODAR fields represent measured Lagrangian flows.

Progress (July 1, 2002 – September 30, 2002):

The primary achievements for the quarter are related to drifter design, and sampling logistics. Specifically,

- Microstar drifter electronics have been redesigned to remedy recently identified shortcomings.
- A rough near-realtime drifter display system has been developed to facilitate monitoring and drifter recovery logistics.

The first full set of drifter deployments served to illustrate shortcomings in the Microstar drifter design, and demonstrate the logistical difficulty of monitoring and retrieving 20 drifters with a single skiff and limited personnel. In response, work has been conducted with Andy Sybrandy of Pacific Gyre Corp. to install salt-water switches on the drifters, improve two-way communications, internally record data, and utilize a rechargeable battery system. A set of 20 refurbished and improved Microstar drifters are now ready for the next set of deployments. A rudimentary drifter monitoring software system has been coded in Matlab to aid in the logistics of drifter recovery. The system overlays drifter tracks on a map and, upon selection of a track, displays the last known position to be passed along to the recovery boat.

Software to simulate Lagrangian particle trajectories from Eulerian CODAR data has been completed. All necessary pieces are now in place for comparing CODAR derived trajectories with observed drifter tracks.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	5%

Task 18213: *Use of Biological Endpoints in Flatfish to Establish Sediment Quality Criteria for Polyaromatic Hydrocarbon Residues and Assess Remediation Strategies*

Principal Investigator: Daniel Schlenk, Department of Environmental Sciences, University of California, Riverside, Scott Steinert CSC, Marine Sciences Department

Major Accomplishments, July 1, 2002 – September 30, 2002

Our results of the previous year are to be presented at the National Society of Environmental Toxicology and Chemistry Meeting Nov 16-20, 2002 in Salt Lake City. This has also been submitted for publication in *Aquatic Toxicology*.

Following up on our initial success of hornyhead turbot treatment, we were fortunate to be donated approximately 100 California Halibut, from Hubbs SeaWorld. These fish were cultured and naïve to PAH exposure. A replicated experiment using the recirculating system was undertaken. Fish were exposed to the same gradient of 0, 33, 67 and 100% Coal Oil Point Sediments. Preliminary DNA damage indicated unique saturation at 67%. None of the other indicators have been examined. Tonguefish were also exposed during this period and have not been analyzed.

Serum Estradiol and Testosterone levels were measured in the previously exposed hornyheads and were significantly depressed in the 33% sediment, as well as the 67 and 100% dilutions. Additional dilutions will be necessary to determine a NOEC and contrast this indicator of reproductive dysfunction.

Problems Encountered:

As Luke Roy graduated this summer, additional student support was needed. Undergraduate interns were utilized to provide some help in this capacity, but were limited in their experience. Bjarte Furnes is a new student in the lab and has been providing some assistance, but course-work for first and second year students is limiting his time until January.

MMS Action Required:

No MMS action required.

Future plans:

Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2 :	25%