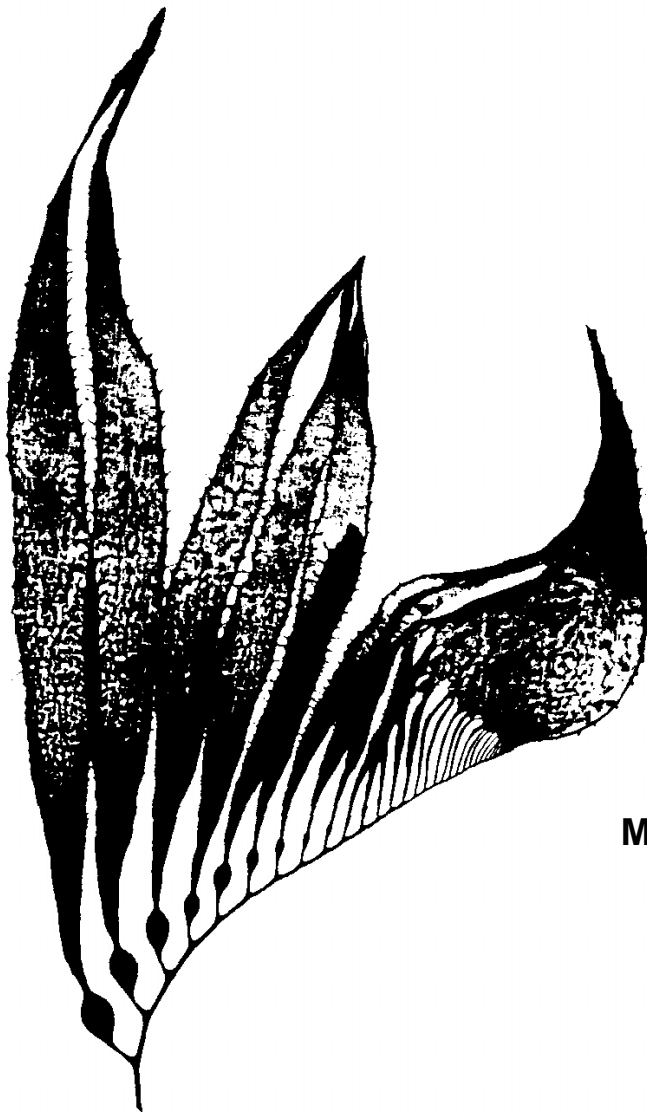


**COASTAL MARINE INSTITUTE  
PROGRAM YEAR 10  
QUARTERLY REPORT 2**

*for the period*

*October 1, 2003 – December 31, 2003*



*A Cooperative Program  
between the*  
**University of California**  
*and the*  
**Minerals Management Service**

*January 29, 2004*

**COASTAL MARINE INSTITUTE**  
**PROGRAM YEAR 10**  
**and**  
**SOUTHERN CALIFORNIA EDUCATIONAL INITIATIVE**  
**PROGRAM YEAR 15**

**QUARTERLY REPORT 2**

*for the period*

*October 1, 2003 – December 31, 2003*

A Cooperative Program

between the

**University of California**

and the

**Minerals Management Service**

**Russell J. Schmitt**  
Program Manager

Coastal Research Center  
Marine Science Institute  
University of California  
Santa Barbara, California, 93106-6150

*January 29, 2004*

# TABLE OF CONTENTS

## Coast Marine Institute

<b>Program Manager's Report</b> .....	1
---------------------------------------	---

### Summary of Research Progress:

Population Trends and Trophic Dynamics in Pacific OCS Ecosystems: What Can Monitoring Data Tell Us?.....	3
Effects of Temporal and Spatial Separation of Samples on Estimation of Impacts .....	5
Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic Species.....	6
Population Dynamics and Biology of the California Sea Otter at the Southern End of its Range .....	7
Population Genetics of Surfgrass ( <i>Phyllospadix torreyi</i> ) for Use in Restoration.....	9
Public Perceptions of Risk Associated with Offshore Oil Development ....	10
Advancing Marine Biotechnology: Use of OCS Oil Platforms as Sustainable Sources of Marine Natural Products.....	12
Joint UCSB-MMS Pacific OCS Student Internship and Trainee Program.....	16
Simulation of a Subsurface Oil Spill by a Hydrocarbon Seep (SSYS- HYS) & Oil Slicks in the Ocean: Predicting their Release Points Using the Natural Laboratory of the Santa Barbara Channel .....	17
Transport over the Inner-Shelf of the Santa Barbara Channel.....	19
Use of Biological Endpoints in Flatfish to Establish Sediment Quality Criteria for Polyaromatic Hydrocarbon Residue and Assess Remediation Strategies .....	21
Spatial and Temporal Variation in Recruitment to Rocky Shores: Relationship to Recovery Rates of Intertidal Communities.....	22
Weathering of Oil and Gas in the Coastal Marine Environment: Quantifying Rates of Microbial Metabolism .....	24
Observations of the Surface Circulation in the Eastern Santa Barbara Channel Using High Frequency Radar and Lagrangian Drifters ....	26
Ecological Performance and Tropic Links: Comparisons Among Platforms and Natural Reefs for Selected Fishes and Their Prey .....	28
Relative Importance of POCS oil platforms on the Population Dynamics Of Two Reef Fishes in the Eastern Santa Barbara Channel .....	30

## Southern California Education Initiative

<b>Program Manager's Report</b> .....	35
---------------------------------------	----

### Summary of Research Progress:

Early Development of Fouling Communities on Offshore Oil Platforms ...	36
--	----

## Program Manager's Report

*for the period October 1, 2003 – December 31, 2003*

This constitutes the quarterly report for the second quarter for Program Year 10 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 17601, Contract No. 1435-01-00-31063, PIs Page, Dugan, Childress, *Habitat Value of Shell Mounds to Ecologically and Commercially Important Benthic Species*, through March 31, 2004;
- ◆ Please note that PI Washburn, require MMS assistance in securing access to a new HF radar site Task 85386, Contract No. 14-35-01-00-CA-31063, *Observing the Surface Circulation in the Eastern Santa Barbara Channel using high frequency radar and Lagrangian drifters*;

### Major Programmatic Progress and Actions during the Quarter:

- ◆ We have updated the web site for the Coastal Marine Institute at <http://www.coastalresearchcenter.ucsb.edu> – copies of quarterly, annual and final reports may be downloaded from this site;
- ◆ Task 12387: *Ecological Consequences of Alternative Abandonment Strategies for POCS Offshore Facilities and Implications for Policy Development*, has been completed and the Final Report, OCS 2003-053, was submitted to MMS;
- ◆ Task 13093: *A Methodology for Investigation of Natural Hydrocarbon Gas Seepage in the Northern Santa Barbara Channel*, has been completed and the Final Report, OCS 2003-054, was submitted to MMS;
- ◆ Task 13096: *Utilization of Sandy Beaches by Shorebirds: Relationships to Population Characteristics of Macrofauna Prey Species and Beach Morphodynamics*, has been completed. The Final Study Report will be submitted to MMS during the next quarter;
- ◆ Task 15115: *Effects of Temporal and Spatial Separation of Samples on Estimation of Impacts*; the Draft Final Report will be submitted during the next quarter;
- ◆ Task 17604: *Shoreline Inventory of Intertidal Resources of San Luis Obispo and Northern Santa Barbara Counties*; the Draft Final Report will be submitted during the next quarter;
- ◆ Task 17605: *Population Dynamics and Biology of the California Sea Otter at the Southern End of its Range*, field work has been completed; a Draft Final Report is being prepared and will be submitted to the Coastal Marine Institute during the next quarter;
- ◆ Task 17608: *Observing the Surface Circulation along the South-Central California Coast Using High Frequency Radar: Consequences for Larval and Pollutant Dispersal*, a Draft Final Report has been submitted to the Coastal Marine Institute, which will be formatted and submitted to MMS during the next quarter;

- ◆ Task 18211: *Oil Slicks in the Ocean: Predicting their Release Points Using the Natural Laboratory of the Santa Barbara Channel*; the Draft Final Report will be submitted during the next quarter;
- ◆ Task 18213: *Use of Biological Endpoints in Flatfish to Establish Sediment Quality Criteria for Polyaromatic Hydrocarbon Residues and Assess Remediation Strategies*, field work has been completed; a Draft Final Report is being prepared and will be submitted to the Coastal Marine Institute during the next quarter.

**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, October 1, 2003 – December 31, 2003**

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.*

We are in the final stages of obtaining a 30 year dataset on larval fish abundance and a 20 year survey of juvenile fish abundance sampled in King Harbor, Redondo Beach, CA. These data combined with updated datasets from the National Park Service and Southern California Edison Company should allow us to map long-term trends in the population dynamics of subtidal fishes over the past 30 years and determine if the declines we have observed are due to declines in larval production/survivorship or declines in adults. Through the use of certain techniques in time series analysis we hope to be able to solve this “which came first, the chicken or the egg?” question and determine if our initial hypothesis involving declining levels of bight wide productivity is plausible.

*(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 2003 surveys. We continue to 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:**

We are currently preparing two papers for publication.

**List of all personal associated with the project:**

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

Graduate students: Sarah Lester

Post-graduate researchers: Keith Seydel

Staff research technician: Corrine Kane

**Future Plans:**

Work will proceed as proposed.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	100%
Project Year 4:	100%
Project Year 5:	91%

**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, October 1, 2003 – December 31, 2003**

Progress has been made towards the final report, which will be submitted to the Coastal Marine Institute next quarter.

**Future plans:**

Complete and submit the final report.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1	100%
Project Year 2	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, October 1, 2003 – December 31, 2003:**

During this reporting period, a manuscript on the results of the study was revised submitted for publication to a scientific journal. A draft final report on this study is in preparation.

**Future plans:**

A draft final report will be completed.

**Problems Encountered:**

None

**MMS Action Required:**

A no cost extension was requested for this project.

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	93%

**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, October 1, 2003 – December 31, 2003:**

Monitoring of radio-tagged study animals by fieldworkers based at Piedras Blancas field station, San Simeon CA, progresses as before: although the MMS-funded portion of the fieldwork is now complete, field monitoring of study animals will continue so long as there are active VHF radios. Our total sample for both the central (San Simeon) and southern (Pt. Conception) study areas consists of 72 study animals, 45 of which were also equipped with Time-Depth Recorder (TDR) instruments. On October 1-15 we conducted the final set of re-capture operations at San Simeon, successfully re-capturing all 11 of the TDR-deployed study animals in the area at that time. An additional TDR was recovered from a study animal killed by a shark at Pescadero beach (this animal was from the 2001 Pt. Conception study group, and thus had traveled 300 km from his initial capture location). This brings the total number of TDR instruments retrieved and downloaded at this time to 27.

In the central study area, 12 of 47 study animals are confirmed dead with carcasses recovered, and an additional 3 are missing and assumed to be dead. The remaining animals fall into two categories: 27 are alive and re-sighted regularly, and another 5 animals survived through the expected lifetime of their transmitter batteries (~2 yrs) but now are rarely seen due to suspected transmitter failure. In the southern study area, 2 of 25 animals are confirmed dead, and an additional 6 are missing and assumed to be dead. The remaining animals fall into two categories: 11 are alive and re-sighted regularly, and another 6 animals survived through the expected lifetime of their transmitter batteries but now are rarely seen due to suspected transmitter failure. The estimated net annual survival rate of animals in the central study group is approximately 0.83 (N = 47), as compared to approximately 0.87 in the southern study group (N = 25). More than 15,000 re-sights have been collected on study animals to date, providing data on both fine-scale patterns of habitat use as well as long-distance movement patterns. Data collection on sea otter foraging has resulted in 36,000 recorded feeding dives.

**Future plans:**

Fieldwork is now complete: data analysis and report write-up is now underway.

**Problems Encountered:**

No problems have been encountered.

**MMS Action Required:**

No MMS action required.

**Estimated Percentage of Budget Expended:**

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

**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, October 1, 2003 – December 31, 2003:**

We continue to focus our efforts on writing the Draft Final report and associated publications this past quarter.

**Future plans:**

We will finalize and submit our Draft Final Report in the next quarter.

**Problems Encountered:**

We have not encountered any problems during this quarter.

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	96%

**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, October 1, 2003 – December 31, 2003:**

Because of the recent interest in the issue of increasing oil and gas development in the national forests in California, we are preparing a short report on public attitudes on the question. The paper, tentatively titled “Public Support for Oil and Gas Drilling in California’s Forests and Parks,” will be completed shortly and sent to MMS. In general, we find that attitudes toward drilling in parks and public forests are quite similar to attitudes toward drilling for oil along California’s coast.

We are also working on a paper investigating the dimensionality of the egalitarianism and individualism measures that we have used in previous publications and reports. We have completed a first draft of the paper, but we need to use more sophisticated missing data imputation methods before sending a copy to MMS. The central finding in this project is that the egalitarianism and individualism measures seem to be independent for people with low levels of political knowledge, but seem to nearly identical for people with high levels of knowledge.

We previously submitted the paper, “Postmaterialism vs. Cultural Theory as an Explanation of Environmental Opinion,” to *Public Opinion Quarterly*, and received a “revise and resubmit” response. We have resubmitted the paper, and we are still waiting for their decision.

We also wrote an article for the forthcoming *Encyclopedia of Energy*. This paper does not include any original research, however, it reports results from previous papers stemming from this project and other MMS-funded projects. A copy was sent to MMS. The citation is:

Eric R. A. N. Smith, “Public Response to Energy: Overview.” In Cutler J. Cleveland, ed., *The Encyclopedia of Energy*. San Diego: Academic Press/Elsevier Science, forthcoming.

**Future Plans:**

We plan to deliver “Trust during an Energy Crisis” to a journal, and “Public Support for Oil and Gas Drilling in California’s Forests and Parks” to MMS in the next quarter.

We have also joined a group that has submitted a joint proposal for a panel at the upcoming American Association for Public Opinion Research meetings in May, 2004. Our paper, “Public Opinion about Energy Development: Nimbyism vs. Environmentalism” will compare Californians’ support for oil drilling off the Santa Barbara coast, off a remote portion of the California coast, and in Alaska’s ANWR.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	92%

**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, October 1, 2003 – December 31, 2003:**

**ECOLOGY**

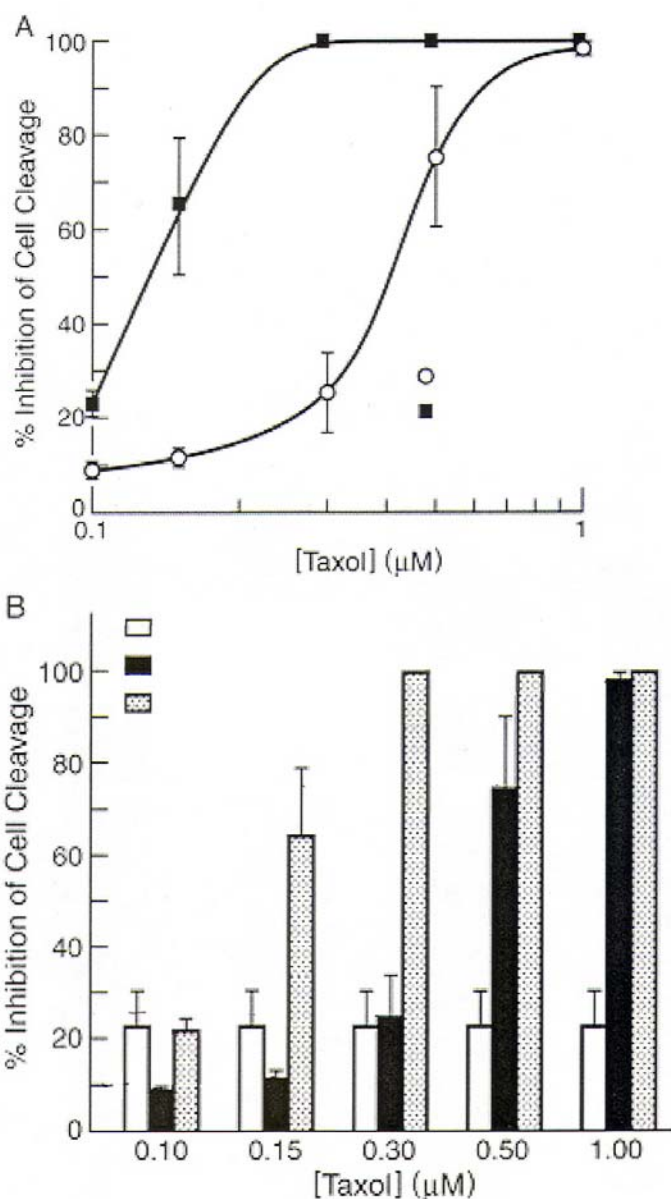
During this quarter we continued the analysis and interpretation of data from photoquadrat sampling. We are preparing a manuscript concerning patterns of distribution and abundance of invertebrates on seven platforms in the Santa Barbara Channel, and the relationship between the structure of platform communities and geographic and environmental factors. In addition, we continued the analysis and interpretation of data from the settlement plate study, which will form the basis for a second manuscript.

**Future Plans:**

Two manuscripts are being prepared for publication, one on the results from photoquadrat sampling and one from recruitment studies at the platforms. If travel funding becomes available, a talk will be prepared for Aquaculture 2004. In addition, we will continue to collect specimens of selected invertebrates for genetic and pharmaceutical analyses, in coordination with the other research groups collaborating on this project.

**PHARMACOLOGY**

In this report our results of isolation of dicoumarol from *D. batophora* and the discovery of this extract to potentiate taxol in dividing cells (Fig A & B) and the identification of the active principle by mass spectroscopy (FIG C).



Figures A and B. Results of isolation of dicoumarol from *D. batophora* and the discovery of this extract to potentiate taxol in dividing cells.

We have found the mass spectroscopy to be identical to a commercial standard. In this spectrum the mass was 359.26 minus the weight of one sodium ion which calculates out to be MW 336.3. The observed molecular mass peak was 359.26 the expected mass was 359.28. We propose to isolate this compound in large amounts during the spring and summer quarters for studies in cancer cells. The source of *D. batophora* is form the Gulf of Mexico and has been reported on several oil rigs in the region.



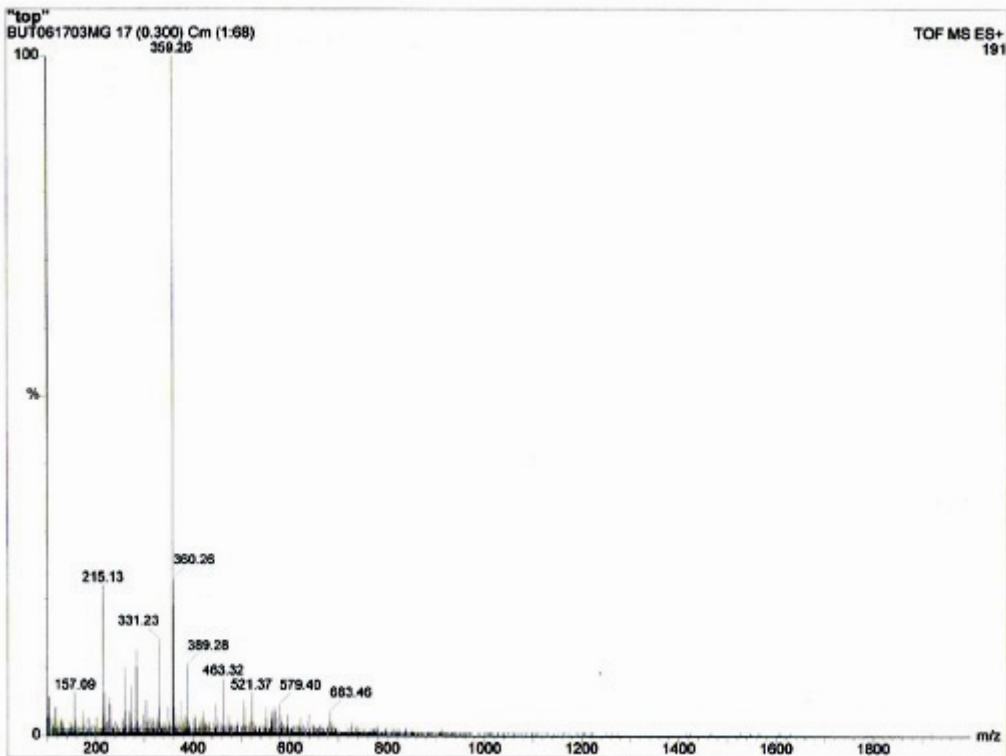


Figure C. The identification of the active principle by mass spectroscopy.

A second project was to isolate the active fractions from the bryozoan *Watersipora cucullata* collected from Platform Gilda in the Santa Barbara Channel. As far as we are able to determine this bryozoan population only exists on this rig in the Santa Barbara Channel however it is common in the Gulf of Mexico. The location of the platform Gilda is proximal to the shipping lanes and also to a high current region suggesting the possibility that it is exotic to this area. We have tested extracts from this organism extensively and found bioactivity in two fractions, a non polar fraction and a relatively polar fraction. Thin layer chromatography indicated the presence of a yellow pigment and a bright red pigment respectively. Bioassay of the ongoing fractions continues and in coming weeks bioactive fractions will be investigated in Dr. Wilson's tumor cell lines.

There are three additional bioactive extracts from other marine invertebrates and algae collected from several different platforms last year. Our plan is to continue the careful preparation, isolation, and bioevaluation of these extracts in coming months.

## GENETICS

We have continued to make progress on determining the genetic variation among samples of *Bugula neritina* during this last quarter. Primarily, we have worked to analyze DNA sequence variation for the mtDNA segment we have PCR amplified. As reported earlier, we have identified one new variant thus far but await the complete analysis of all of our samples. We have also designed a new pair of primers for amplification from the bacterial symbiont in order

to assess whether the new *B. neritina* clade also harbors a unique lineage of symbionts (one that may produce a unique Bryostatin compound). Our progress was slowed somewhat by our technician leaving the laboratory.

**Future Plans:**

During the next quarter we plan to fill the open position in the laboratory, re-amplify and sequence the few mtDNA sequences that were difficult to interpret and to begin amplifying and sequencing DNA from the bacterial symbiont from members of each major *B. neritina* mtDNA clade.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	88%

**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, October 1, 2003 – December 31, 2003:**

A total of four interns worked on MMS and MMS/CMI projects during Summer '03. Jennifer Klaib continued to assist Ms. Dunaway of MMS with the development of marine education curriculum (Tidepool Math), an outreach poster on oil platforms and the MARINE website through early October. Funding from the UCSB Shoreline Preservation Fund was used to support three undergraduate student interns during this period including Shannon Herrar who assisted with fieldwork in the CMI fish demographics project mentored by Dr. Lenihan of UCSB, and Sabrina Beyer and Rachelle Fisher who were mentored by Drs. Page and Dugan of UCSB in analyzing samples of potential fish prey from platforms and natural reefs. We are working with Fred Piltz and other MMS personnel to arrange additional internship opportunities for MMS and MMS/CMI projects during Winter 2004.

No Information Transfer Seminars were requested by MMS during this period

**Future Plans:**

Work will proceed as proposed.

**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 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, October 1, 2003 – December 31, 2003:**

During the most recent quarter (Winter), efforts have focused on data analysis, modeling, and publications.

#### *Bubble measurements*

Analysis of the surface bubble video collected at major seeps in the Santa Barbara Channel continues. Bubble measurements from the previous year were re-analyzed and the time variation in the bubble flux on a sub-second basis calculated. The bubble size was related to bubble oiliness. These results were then submitted in a manuscript to AAPG (American Association of Petroleum Geologist) for a memoir (Leifer and Boles, 2003). Observations showed that very oily bubble droplets occasionally were produced from both minor and major vents.

#### *Seabed morphology*

To estimate the total bubble emissions for the seep area studied, Shane Seep, where there are literally thousands of vents, vent types were classified and example vent bubble distributions estimated. As part of this effort, seabed features have been irregularly mapped over the last three years. During fall, 2003, these mappings were compiled and the changes interpreted in terms of a conceptual model of oil, gas, and tar flow.

#### *Numerical modeling*

The bubble model was improved to include the effects of pressure on methane solubility, compressibility, and hydrate skin.

#### *Dissemination*

Leifer and MacDonald (2003) was published. The paper on the effect of off-axis rays on measured bubble size was published (Leifer et al., 2003a). The paper on designing a bubble measurement system was published (Leifer et al., 2003b). A manuscript looking at inferring bubble oiliness based on bubble hydrodynamics and temporal change of bubble flux and size, from both minor and major vents was submitted to AAPG (Leifer and Boles). A manuscript was submitted to Environmental Geology on the seabed morphology and the inference on the dynamic nature of hydrocarbon seepage, showing that large catastrophic and transient seepage emissions occur frequently and may not be negligible (Leifer et al., 2003c).

**References:**

Leifer, I. and I. MacDonald. 2003. Dynamics of the gas flux from shallow gas hydrate deposits: Interaction between oily hydrate bubbles and the oceanic environment. *Earth Plan. Sci. Lett.* **210** (3/4): 411-424.

Leifer, I., G. De Leeuw and L.H. Cohen. 2003a. Calibrating optical bubble size by the displaced mass method. *Chem. Eng. Sci.* **58** (23/24): 5211-5216.

Leifer, I., G. De Leeuw and L.H. Cohen. 2003b. Optical measurement of bubbles: System, design and application. *J. Atm. Ocean. Tech.* **20** (9): 1317-1332.

Leifer, I. and J. Boles. 2003. Measurement of hydrocarbon flow through fractured rock and unconsolidated sediment of a marine seep. AAPG Memoir, (submitted).

Leifer, I., J. Boles, J.F. Clark and B. Luyendyk. 2003c. The dynamic nature of marine hydrocarbon seepage. *Env. Geol.* (submitted).

**Future Plans:**

Work will proceed as proposed.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	86%

**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, October 1, 2003 – December 31, 2003:**

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.

The primary achievements for the quarter relate to data collection, instrument improvement, and data analysis. Specifically,

- Routine cruises continued to provide data.
- Sampling is being performed with improved instruments.
- Data analysis programs were coded to analyze flow statistics.

Sampling was suspended for part of the period so the drifters could be returned to Pacific Gyre Corp. for modification. Voltage regulators were installed in the drifters and an improved "smarter" battery charger was provided. This remedies the problem of drifters failing at extreme voltages. Discussions with Mr. Andy Sybrandy (Pacific Gyre Corp, Carlsbad, CA) relating to the instrument problem have led to an improved float design for the next generation of Microstar drifters. Despite instrument problems sampling was successfully carried out on 14 and 28 October; 25 November; and 2 December. Sampling was suspended in December to prepare for the (SCCWRP) Bight-03 program. As part of Bight-03 the drifters will be deployed at the mouth of the Santa Clara River during storm events to monitor the movement of stormwater plumes. Understanding the fate of stormwater is useful to the MMS Rigs-to-Reefs program. Data analysis codes continue to be written to compute drifter counts, the mean flow field and its associated variance ellipses, and Lagrangian scales. Decorrelation scales computed with unprecedented resolution are surprisingly small. Two scientific papers on coastal circulation should result from the observational study. The first of the two papers has been outlined.

*Budgetary Issues*

Funds have been used for boat costs (and accompanying personnel) associated with the drifter deployments (and recoveries), for coding the drifter monitoring and data processing systems, and for data analysis coding. A mid-level computer programmer has been hired on a part-time basis to help with the complex (Lagrangian) computer coding required for proper data analysis.

**Future Plans:**

Work will proceed as proposed.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Future Plans:**

Work will proceed as proposed.

**Estimated Percentage of Budget Expended:**

Project Year 1:	100%
Project Year 2:	47%

**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, October 1, 2003 – December 31, 2003**

Field work has been completed. Progress has been made towards the final report, which will be submitted to the Coastal Marine Institute next quarter.

**Future Plans:**

Complete and submit the final report.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1	100%
Project Year 2	100%



**Task 18234:** *Spatial and temporal variation in recruitment to rocky shores: Relationship to recovery rates of intertidal communities*

**Principal Investigators:** **Pete Raimondi**, Department of Ecology and Evolution, University of California, Santa Cruz, CA. and **Rich Ambrose**, School of Public Health, Department of Environmental Sciences, University of California, Los Angeles, CA.

**Major Accomplishments, October 1, 2003 – December 31, 2003:**

*Establishment of Southern Site*

Pt. Fermin (Los Angeles County) was selected as the third, Southern site. This is a site that is currently being monitored and all 4 target species (*Chthamalus*, *Endocladia*, *Silvetia* and *Mytilus*) were present there. This site was set up and sampled in the same manner as the other two sites.

*Experimental Clearing*

We cleared the experimental plots at all three sites by removing all biota, scraping the rock with hand tools, and sterilizing the plots with propane torches. All plots were photographed after they were cleared. Mussels, *Silvetia* and mobile invertebrates from Pt. Sierra Nevada and Pt. Fermin were collected and frozen. These can be used to compare with visual counts.

*Recruitment*

Recruitment collectors were deployed at each site. Five safety-walk plates were put amongst the barnacle plots, 5 barnacle mimics in the *Endocladia* plots, 5 *Endocladia* mimics in the *Silvetia* plots, and 4 tuffies in the mussel plots. In the barnacle zone, a rock area (10 cm x 10 cm) adjacent to the collector was cleared, in the *Endocladia* zone, *Endocladia* was removed from barnacles adjacent to the barnacle mimics, and in the *Silvetia* zone, *Silvetia* was removed from the *Endocladia* adjacent to the *Endocladia* mimics. These plots were also 10 cm x 10 cm, the same size as the collectors. At Pt. Fermin, where there was no *Endocladia* in the *Silvetia* zone, the collectors were placed adjacent to patches of *Caulocanthus*, a turfy red alga in which juvenile *Silvetia* plants have been observed.

**Future plans:**

Recruitment collectors will be exchanged and natural recruitment sampled in adjacent plots every month at all three sites. Cleared plots will be sampled every three months.

**List of all personal associated with the project:**

Principal Investigators: Richard Ambrose and Peter Raimondi

Technician/Graduate Student: Tish Conway-Cranos

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:	~ 1%
Project Year 2:	~ 20%

**Task 85338:** *Weathering of oil and gas in the coastal marine environment: quantifying rates of microbial metabolism*

**Principal Investigator:** David Valentine, Department of Geology, University of California, Santa Barbara, California 93106

**Major Accomplishments, July 1, 2003 – September 31, 2003:**

Large quantities of oil and gas are released into the Santa Barbara Channel by way of natural seepage with lesser amounts emitted during petroleum removal and recovery. These emissions greatly affect beach, air and water quality along the Southern California Coast. As a result many studies and a substantial amount of resources have been devoted to developing a better understanding of the weathering processes occurring in hydrocarbon-rich environments. These studies have provided evidence for natural hydrocarbon-consuming communities thriving in heavily contaminated regions. It is assumed that native assemblages of microorganisms having the capability to consume a variety of hydrocarbons emitted from natural oil seeps are present in the Santa Barbara channel. Although microbial oxidation is known to occur, little is known about the distribution of relevant microbial communities, rates of oxidation and the extent to which various hydrocarbons are broken down or consumed.

This MMS-UC CMI funded research focuses on the microbial weathering of aromatic compounds released into marine environments. The objectives of this research include: (1) determining the intermediates and end products arising from microbial decomposition of these most persistent and harmful hydrocarbons and (2) the development of techniques utilized to quantify rates for microbial consumption and decomposition of aromatic and polycyclic aromatic compounds in marine environments.

*(1) The determination of intermediates and end products arising from microbial weathering processes.*

We are using two distinct approaches to study the intermediates and end products of hydrocarbon weathering. The first approach is the use of radio-labeled substrates to assess major products of microbial metabolism. We are still developing this approach and have been hampered by problems with our HP 5890 GC. The second technique involves chromatographic technology designed to completely resolve the undefined complex mixture typical of weathered petroleum, so-called two-dimensional gas chromatography. We have begun collaborating with Chris Reddy at Woods Hole Oceanographic Institution, who has helped develop the GC×GC technology. We have run our first experiments and are awaiting results.

*(2) The development of techniques used to quantify rates of microbial hydrocarbon consumption.*

We have performed our first experiments designed to assess the rates of hydrocarbon weathering. The experiment involved collecting a time series of surface slick samples at Shane Seep, using the slick sampler developed by other MMS-funded scientists (Liefer et al). Samples were collected at the seep and ‘down-slick’ and represent a rough time series. Samples are being run using GC×GC and we hope will provide a rough ‘total weathering’ rate. Depending on the

results of this experiment, future experiments will be designed to key in on just the microbial weathering.

In addition, a second graduate student has begun working peripherally on this project, Frank Kinnaman. Frank recently completed a scientific diving course and is working toward a deeper certification (in order to collect samples at larger seeps).

**Future plans:**

We are in the process of preparing a long-term incubation study designed to broadly assay hydrocarbon weathering patterns, including aromatics. The duration of the experiment is planned for one year, and will be performed with fresh, sulfidic sediments. Samples will be sacrificed on a monthly basis and assayed new GC×GC techniques at Woods Hole Oceanographic Institution. We plan to acquire fresh petroleum and sediment within the next month.

**Problems Encountered:**

We have encountered some technical problems with the HP 5890 used for this project, likely related to the gas jets. We are currently working to resolve this issue before we purchase the RAGA radioactivity detector.

**MMS Action Required:**

None

**List of all personal associated with the project:**

Principal Investigator: David Valentine

Graduate student researcher: George Wardlaw and Frank Kinnaman

**Estimated Percentage of Budget Expended:**

Project Year 1:	12%
Project Year 2:	33%

**Task 85386:** *Observations of the surface circulation in the Eastern Santa Barbara Channel using high frequency radar and Lagrangian drifters*

**Principal Investigator:** Libe Washburn, Institute of Computational Earth System Science, University of California, Santa Barbara, California 93106.

**Major Accomplishments, October 1, 2003 – December 31, 2003:**

During the final quarter of 2003, the investigation of the surface circulation in the Santa Barbara Channel continued using a combination of drifters and high frequency (HF) radar. The following research directions were pursued during the quarter: 1) exploratory visits were made to evaluate a possible new HF radar site; 2) analysis continued on estimating drifter trajectories using HF radar; and 3) further analysis was conducted on the large HF radar already acquired.

On 9 December 2003 Libe Washburn and Brian Emery accompanied personnel from the National Park Service to Anacapa Island to evaluate the island as a possible HF radar site. The visit was encouraging and Brian Emery, Corinne Bassin, and Edwin Beckenbach returned on 22 December to photograph radar antennas for evaluation of visual impacts. The site looks very promising since the combination of coverage from sites at Mandalay, Coal Oil Point, and Anacapa would provide good coverage over the eastern channel. However, additional funding for the installation will be needed since solar power will be required for powering the radar array. Costs for solar power will be mitigated somewhat because the Park Service already has an array in place. Additional solar panels would be added to power the radar system.

Work continued on developing software to predict surface drifter trajectories from HF radar time series. As an application of this development, a collaborative effort with Dr. Milton Love's research group at UCSB continued during the quarter. The goal of this project is to estimate where rockfish larvae that recruit to oil production platform Irene might have gone had the platform not been in place. Preliminary results of this work were presented by Brian Emery at the Eastern Pacific Ocean Conference on Catalina Island in September.

Analysis of the multi-year HF radar data set continued during the quarter with a focus on evaluating relationships between wind forcing and surface circulation in the Santa Barbara Channel. A general conclusion of this research is that characteristic circulation patterns are strongly coupled to variability in the dominant wind modes. This research is being carried out by Edwin Beckenbach as part of his thesis work which is nearing completion.

During the quarter work continued to increase the reliability of the HF radar system located at Reliant Energy's Mandalay Generating Station in Oxnard, CA. Supplying consistent power to the system has been an on-going challenge. This site is critical for obtaining surface current observations in the eastern Santa Barbara Channel.

Experiments continued during the reporting period to determine how well HF radars can predict near-surface velocities obtained from drifters. The experiments were carried out in collaboration with Dr. Carter Ohlmann of ICESS, UCSB. These experiments will continue under a variety of wind and ocean conditions.

The following summarizes the status of articles submitted to refereed journals that are based on MMS-funded research:

Beckenbach, E.H. and L. Washburn. 2004. Low frequency waves in the Santa Barbara Channel observed by high frequency radar. J. Geophys. Res. (in press).

Emery, B.M., L. Washburn and J.A. Harlan. 2004. Evaluating radial current component from CODAR high frequency and moored in situ current meters. J. Atmos. and Oceanic Tech. (submitted).

DiGiacomo, P.M., L. Washburn, B. Holt and B.H. Jones. 2004. Coastal pollution hazards in Southern California observed by SAR imagery: Stormwater plumes, wastewater plumes, and natural hydrocarbon seeps. Marine Pollution Bulletin (submitted).

**Personnel associated with project:**

<u>Principal Investigator:</u>	Libe Washburn
<u>Programmer Analyst:</u>	Brian Emery
<u>Staff Research Associate:</u>	David Salazar
<u>Graduate Students:</u>	Edwin Beckenbach & Corinne Bassin
<u>Undergraduate Students:</u>	Kyle Visin

**Future plans:**

Efforts will continue to establish a HF radar site on Anacapa Island. Initial visits to the site were promising and efforts will be made to secure Park Service approval and additional funding to establish the site.

**Problems Encountered:**

None. Last quarter, the decision on our application to install an HF radar site on Rincon Island was deferred indefinitely by the new lessee, Greka Energy. In the principal investigator's opinion this amounted to a denial so the Anacapa site is being pursued.

**MMS Action Required:**

Any assistance that MMS personnel can provide in gaining access to new HF radar sites would be helpful.

**Estimated Percentage of Budget Expended:**

Project Year 1: 76%

**Task 85339:** *Ecological performance and trophic links: comparisons among platforms and natural reefs for selected fishes and their prey*

**Principal Investigator:** **Mark Page**, Marine Science Institute, University of California, Santa Barbara, California 93106, **Jenifer Dugan**, Marine Science Institute, University of California, Santa Barbara, California 93106, **Milton Love**, Marine Science Institute, University of California, Santa Barbara, California 93106, and **Hunter Lenihan**, Bren School of Environmental Science & Management, University of California, Santa Barbara, California 93106.

### **Major Accomplishments, October 1, 2003 – December 31, 2003:**

During this reporting period, we continued to sample potential food items of painted greenling, primarily small amphipod crustaceans, monthly at Naples and Mohawk reefs and Platforms Holly and Houchin. Samples were collected by scraping and vacuum sampling in randomly placed quadrats and returned to the laboratory for processing. During this period we also continued to process samples taken in the field to characterize the potential prey available to painted greenling and analyzed preliminary data using multivariate statistics. We also obtained preliminary data on the molt rate of caprellid amphipods for eventual use in growth and production estimates of this potentially important prey of painted greenling.

Painted greenling collections were made at the same locations where invertebrate densities were quantified. Using these fish collections, we estimated mean condition factor (K) for each site to test whether there were differences among regions (east or mid Santa Barbara Channel) and habitat types (reefs and platforms), and to determine if there was a relationship between K and invertebrate prey density. We continue to analyze fish gut content data to determine fish selectivity of prey items in the field.

Finally, we continued with preliminary discussions on the modeling component of our research in which we plan to use the ecosystem-trophic interaction software ECOPATH/ECOSIM. The general goal of our modeling is to estimate how much fish biomass can be produced on POCS oil platforms versus natural rocky reefs. Our effort during this quarter was directed toward structuring the model so that it contains the appropriate species composition and trophic groups, as well as realistic ranges of biomass inputs.

### **Future plans:**

We will continue regular sampling of potential prey and estimation of individual growth rates of amphipods at the study reefs and platforms. With the collected fish samples, we are estimating stomach “fullness” and determining the number and identity of prey items consumed. We will use these data to compare painted greenling diet with available prey at the study reefs and platforms. We also anticipate comparing growth rates of the painted greenling among the study locations from microstructure analysis of extracted fish otoliths. We will continue our ECOPATH/ECOSIM modeling effort.

**Problems Encountered:**

None

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1: 37%



**Task 85340:** *Relative importance of POCS oil platforms on the population dynamics of two reef fishes in the Eastern Santa Barbara Channel*

**Principal Investigators:** **Hunter Lenihan**, Bren School of Environmental Science & Management, University of California, Santa Barbara, California 93106, and **Andy Brooks**, Marine Science Institute, University of California, Santa Barbara, California 93106.

**Major Accomplishments, October 1, 2003 – December 31, 2003:**

Accomplishments during the fall period 2003 were to execute fish population surveys and fish tagging/recapture studies at POCS Platform Gina and reference sites at Anacapa and Santa Cruz Islands. Fish population surveys were completed at each site thus providing a time series of population abundance change at each site. Due to high abundance across all sites, and relative efficiency of sampling, we decided to concentrate our tagging/recapturing effort on *Coryphopterus nicholsi*, the black-eyed goby. Coupled with our tagging studies, our population censuses of gobies provide information on immigration, emigration, and mortality rates. We completed three months of fish tagging in which >2300 *Coryphopterus* were tagged and >550 were subsequently recaptured. This nearly 24% recover rate is phenomenal and will allow for an accurate and precise estimate of population source-sink dynamics. We also invented a method for measuring recruitment of gobies. Finally, we developed a fish tethering technique that will generate estimates of predation rates for gobies that will help us identify mechanisms causing observed patterns in mortality rates.

We involved six graduate and three undergraduate students in our research during the fall period. We also had four staff personnel volunteer their time on our project. Our study overlapped with dissertation research being conducted by graduate student Stu Levenbach of the Department of Ecology, Evolution, and Marine Biology at UCSB. He was able to access his sampling sites and was provided a buddy diver to conduct his sampling and experiments in exchange for help with our sampling and tagging studies.

**Personnel associated with project:**

<u>Principal Investigators:</u>	Hunter Lenihan and Andrew Brooks
<u>Staff Research Associates:</u>	Matt Kay and Stephaine Mutz
<u>Post-doctoral researcher:</u>	Richard Wilder
<u>Graduate Students:</u>	Cat Mangairdi, Andrew Rassweiler, and Stu Levenbach
<u>Undergraduate Students:</u>	Corinne Kane, Shannon Herrer, Ashley Greenley, and Thomas Welche

**Future plans:**

Plans for winter/spring 2004 include completing the tagging/recapture study, continuing repeated surveys to estimate changes in population abundance, quantifying per capita birth and death rates, and designing and erecting a predation study. Our first goal is to locate goby nests, record the abundance of eggs, and to quantify hatching success. We plan to do this in the field but will supplement this effort with a laboratory study in which eggs from our different sites are brought

into the lab, placed in aquaria, and hatching success is recorded. We will measure recruitment of gobies by placing replicate recruitment traps at each site. Predation mortality of gobies will be assessed through a manipulative experiment involving the tethering of gobies within various experimental treatments (i.e., different depths, habitat types, and predator accessibility). Finally, we will continue our attempts to tag and recapture pile surfperch.

**Problems Encountered:**

We have not encountered any significant problems except for the occasional lack of access to Platform Gina due to security alerts.

**MMS Action Required:**

None

**Estimated Percentage of Budget Expended:**

Project Year 1:        52 %



**SOUTHERN CALIFORNIA EDUCATIONAL INITIATIVE**  
**PROGRAM YEAR 15**  
**QUARTERLY REPORT 2**

*for the period*

*October 1, 2003 – December 31, 2003*



*A Cooperative Program*  
*between the*  
**University of California**  
*and the*  
**Minerals Management Service**

*January 15, 2004*

**SOUTHERN CALIFORNIA EDUCATIONAL INITIATIVE**  
**PROGRAM YEAR 15**  
**QUARTERLY REPORT 2**

*for the period*

*October 1, 2003 – December 31, 2003*

A Cooperative Program

between the

**University of California**

and the

**Minerals Management Service**

**Russell J. Schmitt**  
Program Manager

Coastal Research Center  
Marine Science Institute  
University of California  
Santa Barbara, California 93106-6150

*January 15, 2004*

## Program Manager's Report

*for the period October 1, 2003 – December 31, 2003*

This constitutes the quarterly report for the second quarter of Program Year 15 of the Southern California Educational Initiative, a cooperative research agreement between the Minerals Management Service, the state of California and the University of California.

As of this quarter, 1 project is currently are being conducted under the aegis of the Southern California Educational Initiative. The SCEI quarterly report has been combined with the Coastal Marine Institute's quarterly report.

Actions Pending MMS Approval:

- Approval of no-cost extension and fund reprogramming request for the project, Contract no. 1435-00-01-30761, *Early Development of Fouling Communities on Offshore Oil Platforms*, Page and Dugan, PIs, through March 31, 2004;

Major programmatic progress and actions during the quarter are summarized below for the period of October 1 – December 31, 2003.

- We have updated the web site for the Southern California Education Initiative at <http://www.coastalresearchcenter.ucsb.edu> – copies of quarterly, annual and final reports may be downloaded from this site;
- The OCS Final Study Report 2003-052, *Public Policy, Oil Production, and Energy Consumption in Twentieth-Century California*, Schurman and Sabin, PIs, was submitted to MMS this quarter in hard copy and PDF formats;
- The OCS Final Study Report 2003-075, *Species-level identification of infaunal samples and the relationship between taxonomic aggregation and the Before-After/Control-Impact Paired Series assessment design*, Holbrook, Carr, and Osenberg, PIs, was submitted to MMS this quarter in hard copy and PDF formats.
- The project, *Early Development of Fouling Communities on Offshore Oil Platforms*, Page and Dugan, PI, was completed and the Draft Final Report will be submitted to MMS during the next quarter.

*Early Development of Fouling Communities on Offshore Oil Platforms*

**Principal Investigators: H. Mark Page, Jenifer Dugan, and Jason Bram,** Marine Science Institute, University of California, Santa Barbara, California 93106

**Major Accomplishments, October 1, 2003 – December 31, 2003**

We experimentally manipulated the abundance of three invertebrate taxa (barnacles, encrusting bryozoans, and colonial tunicates) that are important as early colonizers on ceramic tiles placed on Platform Houchin at three depths (6 m, 12 m, and 18 m) to test whether selected early successional species inhibit, enhance, or have no effect, on the composition and rate of development of the invertebrate assemblage. Each treatment involved the monthly removal of one taxon from the tile. Processing and data collection from the ceramic tiles deployed in the manipulative experiment was completed in December. Statistical analyses of the results of the experiment are in progress. A master's thesis on the project was completed and filed in December 2003. A draft final study report and two manuscripts for publication are in preparation.

**Future plans:**

Hypotheses concerning factors influencing community development will be examined using additional statistical analyses of the experimental results. We will write a draft final study report and two manuscripts for publication.

**Problems Encountered:**

None

**MMS Action Required:**

Approval of a no-cost extension and fund reprogramming request is needed.

**Estimated Percentage of Budget Expended:**

Project Year 1	100%
Project Year 2	100%
Project Year 3	87%