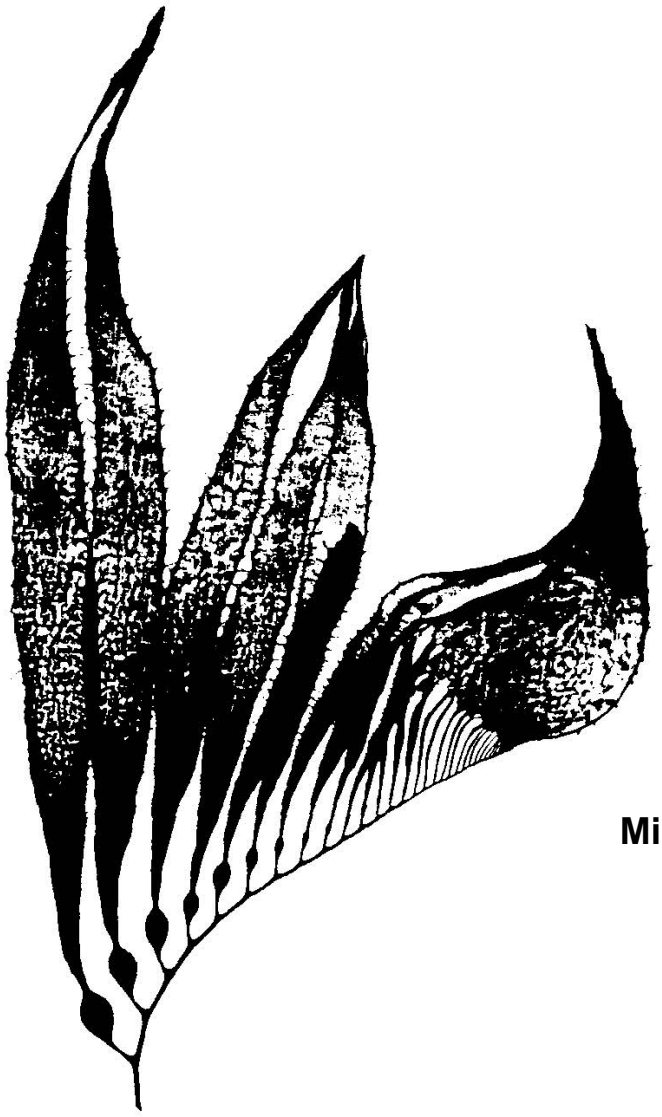
COASTAL MARINE INSTITUTE

PROGRAM YEAR 9

QUARTERLY REPORT 2

for the period

October 1, 2002 – December 31, 2002



A Cooperative Program

between the

University of California

and the

Minerals Management Service

January 17, 2003

COASTAL MARINE INSTITUTE

PROGRAM YEAR 9

QUARTERLY REPORT 2

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Russell J. Schmitt
Program Manager

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

January 17, 2003

Program Manager's Report

for the period October 1, 2002 – December 31, 2002

This constitutes the quarterly report for the second 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 30,2003;
- 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.*
- Approval of no-cost extension for Task 18213, Contract No. 14-35-01-00-CA-31063, PI Schlenk, *Use of Biological Endpoints in Flatfish to Establish Sediment Quality Criteria for Polyaromatic Hydrocarbon Residues and Assess Remediation Strategies,* through June 30, 2003.
- Please note that PIs Washburn & Gaines, may require MMS assistance in securing new radar sites in the Santa Barbara Channel for Task 17608, Contract No. 14-35-01-00-CA-31063, *Observing the Surface Circulation…*

Major Programmatic Progress and Actions during the Quarter:

- 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. Revisions are in progress and a revised version of the draft report will be submitted 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, October 1, 2002 – December 31, 2002

We continued to focus our efforts on writing the final report and associated publications this past quarter.

Future plans:

Finalization and submission of final report.

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, October 1, 2002 – December 31, 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.

We have entered into collaboration with John Stephens Jr. and Dan Pondella of the Vantuna Research Group and Kevin Herbinson of SCE to update all of our databases through 2000 and to include data on fish larval abundances from 1977 through 2000. We plan to use these data to test hypotheses concerning “top down” versus “bottom up” flow of trophic cascades.

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

We have continued 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. Sampling of fish (via visual counts along permanent band transects) and algal cover (via random point contact methods) were accomplished in the manner described in our proposal. Epifaunal invertebrates collected from three of these sites have been rough sorted and preserved for later taxonomic identification. We were able to complete sampling at all of our study sites in 2002. We are beginning the process of identifying epifaunal invertebrate samples collected during our 2002 surveys.

Publications and Presentations:

We had no presentations associated with this work during this period, but have just finished a manuscript for submission to the journal Ecology Letters and beginning work on an additional publication for the journal Ecological Applications.

List of all personal associated with the project

PIs:	Dr. Russell J. Schmitt Dr. Andrew J. Brooks
Post-graduate researchers:	Keith Seydel
Undergraduate researchers:	Andrea DeMent, 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:	70%

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, 2002 – December 31, 2002

The following publication was published during this 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* 242: 143-152.

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

Problems Encountered:

None.

Future plans:

Complete and submit the 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, October 1, 2002 – December 31, 2002

One of our papers has been published and the other is still in review:

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* **59**: S350-S355.

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, October 1, 2002 – December 31, 2002

During this reporting period, individuals of *Asterina miniata* and *Cypraea spadicea* collected from the shell mounds at the former sites of platforms Hazel and Hilda and from the shell mound beneath platform Gina were measured for body size and body dry mass in order to develop an index of nutritional condition. A food subsidy in the form of faunal litterfall from the platform structure is available to benthic consumers on the mound beneath platform Gina, but not at mounds Hazel and Hilda. Our earlier results found that *Asterina miniata* were significantly larger on the mound under platform Gina relative to shell mounds without overlying platform structure, Hilda and Hazel. We hypothesized that the condition of these species, as indicated by the relationship between body size and dry mass, might differ between these habitats.

To investigate this hypothesis, animals were collected by divers from the shell mounds with and without platforms, measured to the nearest mm (shell length for *Cypraea spadicea* and arm radius for *Asterina miniata*), oven dried to a constant weight, and weighed. Ordinary least squares regressions of body size and dry mass were calculated for each habitat sampled and compared statistically. For *C. spadicea*, the slopes of the relationship between length and dry weight were significantly different between habitats ($p<0.01$, test for homogeneity of slopes). For *Asterina miniata*, the slopes of the relationship between arm radius and dry weight also differed significantly between habitats ($p<0.05$, test for homogeneity of slopes). For both species, the difference in body dry weight for a given size between Gina and the Hazel/Hilda shell mounds increased with increasing body size. This pattern suggested that condition might not differ among smaller individuals, but that larger individuals on the shell mound beneath platform Gina may store more lipids and/or develop more gonads.

Work continued on the preparation of the master's thesis and on a manuscript for publication.

Upcoming work:

Work will continue on the Masters thesis.

Problems Encountered: None

MMS Action Required: None

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	73%

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

Lead Technician: Steven F. Lee, M.S. (Dept. of Environmental Health Sciences and Environmental Science and Engineering Program, University of California, Los Angeles, CA 90095-1772)

Major Accomplishments (October 1-December 31, 2002):

During this quarter, most effort revolved around the planning and execution of the Fall 2002 sampling season. In early October, Steven Lee participated in Dr. Jack Engle's Santa Catalina Island CIRP Cruise, during which the two Catalina Island inventory sites, Bird Rock and Little Harbor, were sampled. The data and photographic slides were then taken back to UCLA for analysis. The slides were developed, scored and cataloged this quarter. The data have yet to be entered into the computer, and the graphs need to be updated. Sampling for the rest of the LA/Ventura and Southern Santa Barbara County sites was performed smoothly and without incident throughout November and December (Table 1). Sampling was done primarily by UCLA personnel, but with additional help from UCSB, MMS, USC, and USFWS. About half of the photoplots for the Fall sampling have been scored using the new scoring protocol mentioned below. Data entry into the computer databases has begun and will be completed in the next several weeks. After that the graphs will be updated along with all other data management that is necessary.

Beginning this sampling season, all photoplots were photographed using the new digital photographic methodology adopted by MARINe. In so doing, our Olympus 4040 digital camera was attached to our existing photoframer, and two images of each photoplot were taken. Due to problems associated with the use of the underwater housing, all photographs were taken without the housing and associated strobe assembly. The digital camera was merely attached to the normal Nikonos mount and the photos were taken using the camera's built in strobe. One exception to this was at Coal Oil Point, where the housing was used in order to test proper functioning. The two photos were taken using different flash settings, unlike with the Nikonos where different f-stops were selected. For the first photo the camera was set to automatic so it determined the proper strobe setting, and for the second photo a full flash was manually forced. All 360 degree photographic survey pans were taken using the digital camera as well.

Back at the office, all images were downloaded onto the computer, organized and labeled. Photoplot images were scored electronically for the first time, using the new 19 inch flat panel monitor recently obtained through MMS. Images were opened in Adobe Photoshop, and a grid of 100 evenly spaced points was placed over the photo for point intercept scoring. The point layer can be temporarily removed if necessary, to identify the image on the layer below. Scoring proceeded using the same rules applied to emulsion film slides. Once scored, the image with the dot layer was saved alongside the original image using a standard system of nomenclature.

Table 1. Sampling schedule for Fall 2002

Date	Location	Personnel	Comments
October 18	Bird Rock	J. Engle, S. DeJong, S. Lee, K. Miller, J. Wible	UCSB with UCLA and USC Help
October 19	Little Harbor	J. Engle, S. DeJong, S. Lee, K. Miller, J. Wible	UCSB with UCLA and USC Help
November 3	Old Stairs	S. Lee, S. Bergquist, M. Venkatesan, M. Myers	No Agency Help
November 4	Point Fermin	S. Lee, S. Bergquist, M. Myers, A. Bull, F. Piltz	MMS Help
November 5	Paradise Cove	S. Lee, S. Bergquist, M. Venkatesan, F. Piltz, D. Pancer	MMS Help
November 6	Mussel Shoals	S. Lee, S. Bergquist, M. Venkatesan, M. Myers, Ann Bull, Dave Pancer	MMS Help
November 19	Coal Oil Point	S. Lee, S. DeJong	UCSB Help
November 20	White's Point	S. Lee, S. Bergquist, M. Venkatesan, F. Piltz, M.E. Dunaway	MMS Help
December 2	Arroyo Hondo	S. Lee, S. Bergquist, M. Venkatesan, M. Pierson, M.E. Dunaway	MMS Help
December 3	Alegria	S. Lee, S. Bergquist, M. Venkatesan, A. Bull, M.E. Dunaway	MMS Help
December 4	Carpinteria	S. Lee, S. Bergquist, M. Venkatesan, F. Piltz, A. Bull, M. Hill, Catrina Martin	MMS, USFWS Help

Throughout this quarter, various tasks related to and stemming from the MMS/SCCWRP Data Management System (DBS) contract were performed. Several synopses of our inventory database were completed and submitted to SCCWRP to assist them in their endeavors. These included the creation and completion of several tables outlining definitions of all taxa categories used in our field data sheets and/or our computer data spreadsheets, as well as timelines for when each category was used, modified, or abandoned. Through this data standardization process, which included several DBS meetings, a new set of "Core Taxa" and corresponding field data forms were created which were to be adopted by all MARINe groups. These changes were implemented for the first time in this recent Fall 2002 sampling season, and certain adjustments will have to be made to the Excel computer files before these new data can be entered. Several old categories that were very broad have been abandoned, and several new categories have been created. Clear relationships between these new and old categories will have to be outlined to ensure that past and future data remain comparable. Good communication and correspondence between MARINe groups will be necessary before these changes can be fully implemented. Eventually, this DMS should result in a uniform Access database that will be used by all groups.

Another change implemented for the first time during the Fall 2002 sampling season is the replacement of the grooved barnacle recruitment plates by plates with "Safety Walk" grip tape attached to the top surface. This grip tape has a micro-rugosity that closely resembles that of natural rock surfaces, and thus, represents a substantial improvement over the old grooved plates. Since this new settling surface is uniform, the need to record the orientation of the plate upon attachment has been eliminated.

Recent changes made to the motile invertebrate sampling protocol were also implemented for the first time during the Fall 2002 sampling season. These changes, which were agreed upon by a motile invertebrate subcommittee consisting of Melissa Wilson from UCSC, Dan Richards of NPS, and Steven Lee of UCLA, were tested during this season, with recommendations to be submitted MARINe. While the bulk of the protocol remained intact, the most significant changes were in the way certain taxa, such as limpets and littorines were subsampled. A new 20 x 20 cm sub-quadrat was constructed to be placed in three locations within each 50 x 75 cm photoplot (upper left, center, lower left). This sub-quadrat was further subdivided into four quadrants by monofilament line. Littorines, plus small (<5 mm) and medium (5 mm-15 mm) limpets were counted within these sub-quadrats. Large (>15 mm) limpets and all other motile invertebrates were counted within the entire photoplot. If the density of littorines was extremely high, then counts were made only within the upper left quadrant of each sub-quadrat. This method represents a significant improvement over the old motile invertebrate protocol, eliminating much time and risk of ambiguity and increasing the likelihood that it will be adopted by all members of MARINe.

Future Plans:

Throughout the present quarter, we will continue with data management including data entry, graphing, and analysis of the Fall 2002 data. We will also continue the process of archiving our photoplot images for the LA and Ventura and So. Santa Barbara sites. We recently purchased the supplies necessary to begin compiling a more adequate collection of voucher specimens for our sites. We will be planning separate field collection visits followed by several specimen processing days in the lab. A Hazwoper refresher course will be attended by UCLA personnel during this upcoming quarter. As the quarter progresses, we will begin planning for the upcoming Spring 2003 sampling season. We will also continue to assist the MARINe coordinator and SCCWRP with items related to the DMS project toward the eventual completion of that project.

Problems Encountered:

The new underwater housing for the Olympus 4040 digital camera we received through MMS was defective. A spring attached to the shutter release mechanism pops off and has significantly scratched the interior of the housing. After a long delay, the paperwork from MMS has arrived allowing this housing to be returned to the manufacturer for replacement. This will be done in the next several days.

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, October 1, 2002 – December 31, 2002:

During this quarter the six study sites in San Luis Obispo County (SLO) were sampled for the 15th time, and the five sites in Northern Santa Barbara County (NSB) were sampled for the 22nd time. Sites were sampled November 3rd-7th and 19th-21st.

We have made an effort during the past several months to fully standardize our sampling methods with all groups in MARINE (Multi-Agency Rocky Intertidal Network). We have also switched from photographing our target species photoplots using a 35 mm Nikonos and slide film to using a digital camera. This method worked well in the field for the fall sampling and we anticipate having better quality images overall because we can review them in the field. In addition, scoring of the images on a computer monitor in the lab should ultimately be faster than doing it with slides and a projector.

Future Plans:

Effort in the next quarter will focus on scoring digital photoplot images, entering these percent cover data along with field data into computer files, and preparing for the next set of sampling trips, which will begin in February 2003.

Problems encountered:

None

MMS Action Required:

None

Estimated Percentage of Budget Expended:

SLO, NSB portions	75%

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, 2002 – December 31, 2002:

Monitoring of study animals by fieldworkers based at Piedras Blancas field station, San Simeon CA, continues as before. In October we captured and instrumented another 16 sea otters (15 of which were implanted with Time Depth Recorders). This brings our total capture effort to 47 instrumented 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 re-captures are planned for next quarter (probably March-April), in order to retrieve additional instruments.

Of the northern study group, 7 of 47 (15%) animals are confirmed dead with carcasses recovered, and an additional 2 (4%) are missing but assumed dead; all other animals are re-sighted regularly. Of the southern study group, 1 of 25 (4%) animals have been confirmed dead, and an additional 3 of 25 (12%) are missing and unaccounted for, while the remaining animals are re-sighted regularly. A total of 8,365 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 20,000 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	75%

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, 2002 – December 31, 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 100% of the AFLP fragments for all individuals included in these studies.

Future plans:

The major effort in the next quarter will continue to be computer analysis of our data and the preparation of manuscripts.

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:	86%

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, 2002 – December 31, 2002:

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. Because some additional funding remained at the end of the survey period, a follow-up survey was conducted in October. The sample size is 1,285. These data are now being analyzed.

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 "revise and resubmit" status by the journal. It will be resubmitted shortly.

Data from this project were used as the basis for a poster presentation, "Support for Offshore Oil and Gas Drilling among the California Public," at the "California and the World Ocean '02" Conference in Santa Barbara, California, October, 2002. The paper underlying the poster is on the web at: http://www.polsci.ucsb.edu/faculty/smith/.

A key finding in this paper is that support for offshore oil drilling along the California coast depends on changes in the price of gasoline. Support for drilling has been rising and falling with the price of gasoline since 1977. Contrary to public statements by people on both sides of this issue, we find that support changes substantially over time.

A related finding is that the attitudes of people with the lowest incomes are most likely to be affected by the increase in gasoline prices because the increase represents a larger share of their household's disposable income. Upper-income people may not like paying more for gasoline, but the higher prices are a minor problem to them, and their opinions about offshore oil drilling change less than do the opinions of low-income people.

Future Plans:

The paper submitted to *Public Opinion Quarterly* has been revised and is about to be resubmitted. A second paper proposal has been sent to the American Association for Public Opinion Research (AAPOR), which meets in May.

Problems Encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

Project Year 1: 100%
Project Year 2: 100%
Project Year 3: 61%

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**, Institute for Computational Earth System Science and Department of Geography, and **Stephen Gaines,** Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Major Accomplishments, October 1, 2002 – December 31, 2002:

During the quarter 1 October – 31 December 2002 we made progress in a number of research areas of our project. We continued analysis of the extensive HF radar data set that we have collected during the project. A new finding for the quarter is the occurrence of nearshore eddies which may produce significant onshore transport of buoyant pollutants such as oil and stormwater runoff. This result was reported recently at the California and the World Ocean Meeting in Santa Barbara. The following papers supported by MMS research were presented at the meeting:

> "A Coastal Observing System on the South-Central Coast for Understanding Regional Circulation, Pollutant Transport, and Dispersion", Libe Washburn, Dan Reed, Carter Ohlmann, Cynthia Cudaback, and Ed Dever.
>
> "Pollution Hazards Off the Southern California Coast: Satellite and In Situ Observations of Naturally Occurring Oil Seepage, Storm Water Runoff and Wastewater Plumes" by Paul DiGiacomo, Ben Holt and Libe Washburn.

In preparation for our new MMS-sponsored research project in the eastern Santa Barbara Channel we submitted applications to the California Coastal Commission and the California State Lands Commission to put a high frequency radar site on the Rincon Island. We also located a second possible east channel site near Oxnard California. Currently we are examining radar coverage patterns for the new site. We will apply for permits from the site owner, Reliant Energy, and the City of Oxnard if the site proves feasible.

Due to a helicopter incident at Point Conception we were directed by the United States Coast Guard to remove our radar sites from Pt. Conception and Point Arguello. While this is a setback, we have acquired a valuable multi-year data set for the region around Point Conception and the Santa Maria Basin which we will continue to analyze. The radar equipment removed from these sites will be re-deployed in the eastern Channel and possibly on the Channel Islands.
We are also investigating a new procedure for extending the range of the radars by as much as 50%. We are working with CODAR Ocean Sensors, Ltd. of Los Gatos, California to make the necessary hardware and software changes. If this proves successful our radar coverage will extend over most of the Santa Barbara Channel. Depending on the increase in coverage, which may require fewer radars in the Channel, we will explore the possibility of adding additional sites further south in the Southern California Bight.

Action requested from MMS:

We may require MMS assistance in securing new radar sites in the Santa Barbara Channel.

Estimated Percentage of Budget Expended:

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

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, 2002 – December 31, 2002:

ECOLOGY

During this quarter we completed our comparative analyses of temporal variation of invertebrate recruitment and growth of *Mytilus galloprovincialis* on seven offshore oil production platforms. We used two field methods to evaluate invertebrate recruitment: 1) deployment of hard (tiles) substrates and 2) deployment of small mesh recruitment cages containing fibrous material (Tuffy®). To evaluate growth of our model suspension-feeder, *Mytilus galloprovincialis,* we deployed mussels in mesh cages at our study sites. The mussel cages and hard recruitment substrates were deployed for 90-day intervals, while the recruitment cages containing soft, fibrous substrates were deployed for 45-day intervals. Several invertebrate taxa recruited to the hard substrates, including barnacles, hydroids, tunicates, encrusting bryozoans and tube-dwelling amphipods. Mussels and branching bryozoans were the primary taxa recruiting to the soft, fibrous substrates (Tuffys®).

We found significant temporal variation in recruitment of selected invertebrates recruiting to both the tiles and Tuffys®. For example, recruitment of hydroids was significantly higher in the summer as compared to all other seasons at the majority of platforms. Barnacle recruitment was also highest in the summer, as well as the fall (*Megabalanus californicus*, *Balanus trigonus*). In contrast, recruitment of encrusting bryozoans was significantly higher during the winter and spring. For those species recruiting to the Tuffys® (mussels and branching bryozoans), recruitment also varied temporally, with significantly more branching bryozoans recruiting during the fall. In general, recruitment of branching bryozoans dropped in the winter, and remained at low levels through the spring and summer. Patterns of mussel recruitment were less consistent among platforms, with higher recruitment at the most southeasterly location (Gina) during the winter, as compared to higher recruitment in the summer at two of the northern locations (Houchin & Hogan).

There were also significant effects of season on mussel growth, with the faster growth rates occurring in the summer. In general, the slowest growth rates were observed in the winter, with intermediate rates occurring in the fall and spring.

Analyses of our photo-quadrat surveys of platform legs and conductor pipes using point contact methods continue. These surveys consist of photographic sampling at four depths both up and down current at four randomly chosen conductor pipes and four outside platform legs (64 pictures per platform, 448 pictures total). Data collection from the photographs of the conductor

pipes is completed, with point contact analysis of the photographs of the platform legs nearing completion. Once the data is collected, we will analyze spatial and temporal patterns in the distribution and abundance of invertebrates at the platforms.

We also began multivariate analyses to compare patterns in recruitment of selected invertebrate taxa among platforms. Preliminary analysis of the recruitment data from the summer indicates two platform groups; the northern platforms (Holly, Hogan and Houchin) and the southern platforms (Gilda, Grace, Gail and Gina). We will continue to compare recruitment patterns among platforms and seasons. We will also use additional multivariate approaches to identify potential factors associated with the differences observed among groups.

In the next quarter, we will continue analysis of our data on invertebrate recruitment and distribution using multivariate comparisons of our recruitment and growth data, and of data obtained from our photo-quadrat surveys of the platform legs and conductor pipes. In addition, we will investigate the relationship between the patterns found at the platforms and selected environmental factors (e.g., temperature, chlorophyll). Collection of specimens of selected invertebrates for genetic and pharmaceutical analyses will continue in coordination with the other research groups collaborating on this project. In addition, we are preparing a poster for the upcoming ASLO conference in February 2003 and a manuscript for publication on our results.

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 begun the task of detailed bioassay-guided fractionation using Straight and Reverse Phase High Pressure Liquid Chromatography (HPLC).

Bioassay-Guided fractionation of semi-pure extracts using HPLC

For HPLC application, the organisms are extracted using an optimized method designed for the organism and fractionated using a flash column to obtain a semi-pure extract. After activity of the fraction is confirmed using the sea urchin assay, the semi-crude preparation is analyzed in the UV spectrophotometer then the extract is purified by HPLC. All the active fractions were lipid soluble in chloroform or combinations of methanol-chloroform, based on this polarity, we began using straight-phase silica HPLC columns to begin separation. In the case of the unknown anemone and *Corynactis califonica*, the semi-pure extracts were separated on straight phase using a gradient of hexane in ethyl acetate. Fractions were collected and evaluated for activity using the sea urchin assay. In both cases, an active group of peaks was located.

In the case of *Watersipora cucullata*, straight phase HPLC did not produce any usable results, so we began to separate this extract on reverse phase activated C18 silica columns. Using an isocratic mobile phase of 94 methanol: 4 Acetonitrile: 2 water, an active peak was located. Currently we are in the process of re-purifying the active peaks on HPLC to further separate and identify one pure active substance.

Coumarin work arising from Dasycladales

We have spent the Fall Quarter publishing the work done thus far on dicoumarol, its ability to stabilize microtubule dynamics and its synergistic actions with taxol. The manuscript was accepted for publication by *Cancer Research* in November 2002:

Madari, H; Panda, D.; Wilson, L., and Jacobs, R.S. Dicoumarol: A unique microtubule stabilizing natural product that is synergistic with taxol. *Cancer Research (In press).*

GENETICS

We have made significant progress on determining the genetic variation among samples of *Bugula neritina* during this last quarter. During the previous quarter, we focused our efforts on expanding and completing our collection of 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 and obtain 90 new samples as previously reported and a total of nearly 200 samples. During this quarter we have identified all of these samples to species (this is impossible when collections are done in the field) and cleaned all of the samples of epiphytes. Cleaning of the samples prior to DNA extraction is labor intensive but essential in order to obtain pure *B. neritina* DNA. We have also nearly completed the DNA extractions will soon begin mtDNA typing of each sample. 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. Thus during the next quarter we plan to amplify mtDNA from these samples using our *B. neritina*-specific PCR primers and begin DNA sequencing.

Problems Encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	56%

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, 2002 – December 31, 2002

A total of two interns worked on MMS projects during Fall '02. Tim Wolff and Rusty Roland continued 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. We advertised for two new internship positions to assist Ms. Dunaway with marine education curriculum development. In addition, we applied for and secured funding to support several additional undergraduate interns in the CMI program from the UCSB Shoreline Preservation Fund for Winter and Spring 2003. We are working with Fred Piltz and other MMS personnel to arrange additional internship opportunities for MMS and MMS/CMI projects during Winter 2003.

No MMS seminars were given by CMI investitgators this quarter.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	100%
Project Year 3:	49%

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, 2002 – December 31, 2002:

Summary: During the most recent quarter (Fall), efforts have focused on analysis of field and laboratory data and publication preparation.

Bubble measurements. Surface bubble video collected at major seeps in the Santa Barbara Channel is being analyzed, with video for Shane Seep and Horse Shoe seep done. Different regions of the surface plume have distinct bubble distributions, with edge areas having much larger bubbles and smaller bubbles in the plume center. Also, small bubbles are sometimes observed at the down current edge. The closed bubble measurement system (BMS) was improved through the addition of a second window to prevent bubbles from approaching too close to the illumination screen. A publication is anticipated from this data in the next few months.

Fluid Motions. Further evidence for bubble upwelling is provided in the turbidity of bubble measurements video discussed above. Seabed visibility was 2 m, and as a result upwelling flow lifted sediment decreased turbidity significantly in the bubble plume. Water samples were collected across Shane Seep to identify if there is a nutrient plume. A manuscript on the bubble upwelling flow and its implications is being prepared for submission to Geophysical Research Letters in the next two to three months.

Seabed Morphology. For the last six month, a fourth mud volcano, approximately 2 cm high emitted a few sporadic bubble streams. It is now active and 10 cm deep, 2 m in diameter. Also, actively seeping tar ridges were discovered. The ridges are 3 m long by 1 m wide, and 20 cm high. There are three or four separated by 2 meters.

Dissemination. Leifer and Judd (2002) was published in December 2002. A conference proceedings paper (Leifer et al., 2002) was written for the California World Oceans Conference 2002, in Santa Barbara in October, and will appear in December 2002. A paper investigating the relationship between bacterial community structure in the seep sediment and gas flux is being written. Collaboration with the Marine Science Institute Educational Outreach Program is developing a project with local schools to monitor tar on the beach, and relate it to seep bubble observations at Shane Seep.

References

Leifer, I. and A. Judd, 2002, Oceanic methane layers: A bubble deposition mechanism from marine hydrocarbon seepage. *Terra Nova* 14 (6): 417-424.

Leifer I., B. Luyendyk, and K. Broderick, 2002. Tracking Shane Seep Oil from the Seabed to the Sea Surface, at Coal Oil Point, California. In *Conference Proceedings of the Coastal World Oceans 2002 Conference, Santa Barbara, CA, Oct 24- 27, 2002. In Press*.

Problems Encountered:

None.

MMS Action Required:

None.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	34%

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, 2002 – December 31, 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 (October 1, 2002 – December 31, 2002): The primary achievements for the quarter relate to instrument operation and sampling logistics. Specifically,

- The refurbished Microstar drifters have been tested successfully.
- The near-realtime drifter display system for monitoring and recovery has been further enhanced.
- Development of a data processing software system has begun.
- Results of the work to date were presented at the Lagrangian Analysis and Prediction of Coastal and Ocean Dynamics meeting.

The first full set of drifter deployments served to illustrate shortcomings in the Microstar drifter design. The drifters were reprogrammed to improve the accuracy of GPS position fixes and to enable two-way communications with the host computer. A Mobitex digital pager was obtained and programmed to display near-realtime position data. The pager allows drifter position to be monitored independently from the recovery vessel (skiff). The improved drifters, pager, and display software were tested on 14 November and all worked as expected. Development of a software system to process the drifter data has begun. The software removes erroneous position data (if necessary) and computes velocity as a first difference. Sufficient progress has now been made so that drifter experiments can be performed routinely, as proposed. The set of experiments is expected to begin in January 2003.

The work completed to date was presented at the Lagrangian Analysis and Prediction of Coastal and Ocean Dynamics meeting held in Key Largo, FL, from 12 through 16 December 2002 (LAPCOD 2002). Both the drifter technology and results from preliminary deployments were presented. Colleagues were excited to see drifter data with such fine spatial resolution (10 meters), collected at such a high frequency (10 minutes).

Budgetary Issues: Funds have primarily been used to purchase and update hardware (Microstar drifters). A small amount has been used for boat costs associated with test drifter deployments, for coding the drifter monitoring and data processing systems, and for travel to present this work at the LAPCOD-02 meeting.

Estimated Percentage of Budget Expended:

Project Year 1:	100%
Project Year 2:	6%

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, 2002 – December 31, 2002

Throughout the fall, California Halibut were exposed to dilutions of the Coal Oil Point Sediments for 7 days and 28 days. Speckled Sanddabs were collected from Coal Oil Point by UCSB, transported to our exposure facility in Redondo Beach, and exposed to the sediment dilutions. After 3 attempts, the 28 day halibut exposure was terminated on December 20.

Preliminary DNA damage indicated a dose-dependent increase in both naive halibut and Coal Oil Point sand-dabs. Other indicators will be measured this quarter. These results indicate that fish residing in Coal Oil Point waters are not resistant to DNA damage following sediment exposures.

Problems Encountered:

There was minimal student involvement this quarter and the student supported this past quarter has decided to pursue other areas of research. Consequently, we have been fortunate to recruit Cherlyn Seruto this January and she will complete the biochemical measurements this fall. We encountered 2 fish-kills during exposure periods because of water shut-downs at the SEA laboratory in Redondo Beach where we are carrying out our exposures. We anticipate that funds will be available for an additional summer and fall quarter for the graduate student position.

MMS Action Required:

A no-cost extension for 6 months will be necessary for the graduate student position.

Future Plans:

Work will proceed as proposed. Results will be submitted as an abstract to the 12th International Pollution Responses in Marine Organisms meeting in Tampa Fl. During May 8-13.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	30%