

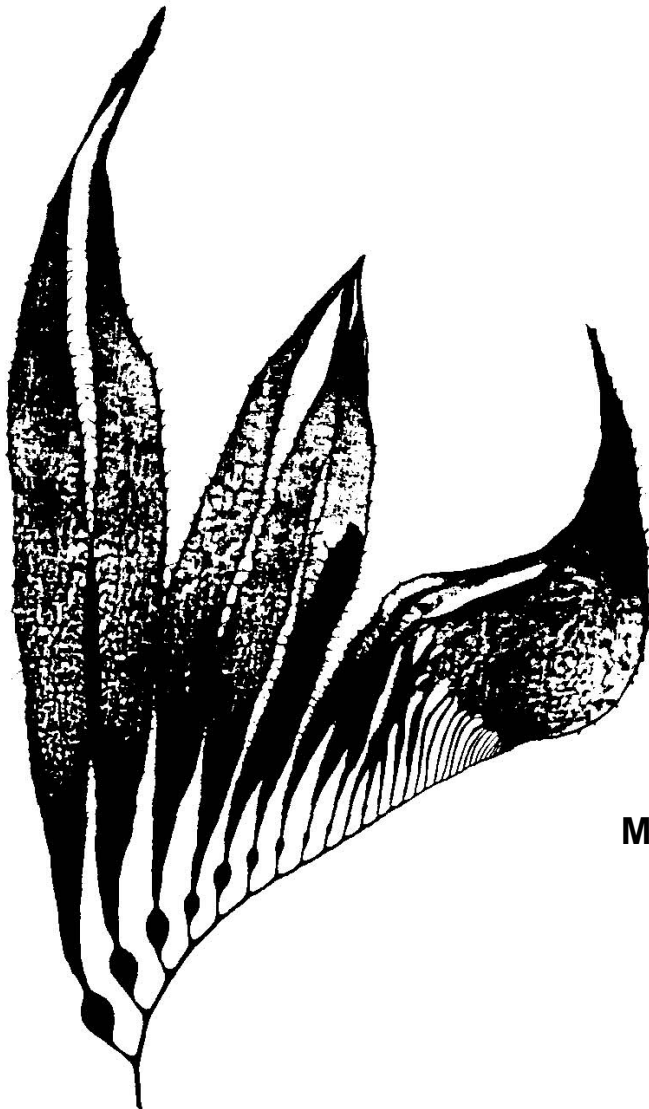
COASTAL MARINE INSTITUTE

PROGRAM YEAR 8

QUARTERLY REPORT 2

for the period

October 1, 2001 – December 31, 2001



A Cooperative Program

between the

University of California

and the

Minerals Management Service

January 22, 2002

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Russell J. Schmitt
Program Manager

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

January 22, 2002

Program Manager's Report

for the period October 1, 2001 – December 31, 2001

This constitutes the quarterly report for the first quarter for Program Year 8 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, 16 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*
- Approval of no cost extension for Task 10596, Contract No. 14-35-0001-30758, PI Schmitt, CMI Management.

Major Programmatic Progress and Actions during the Quarter:

- Pre-proposals have been received for 6 projects. The proposals were reviewed by UCSB and MMS personnel and full proposals have been requested;
- 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 draft 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 and we received the draft final study report on December 27, 2001. The Draft Report will be formatted and submitted to MMS for review next quarter;
- Task 15116: *Wave Prediction in the Santa Barbara Channel*, has been completed and the final study report has been submitted to MMS;
- Task 15117: *Assessing Toxic Effects on Population Dynamics Using Individual-Based Energy Budget Models*, has been completed and the final study report has been submitted to MMS.

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, 2001 - December 31, 2001

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

- Preparing text, tables and figures for the final report and publications.
- Reanalysis of fish densities on platforms, based on exact dimensions of platform structure that we finally obtained.

Future plans: Preparation of final report and publications.

Estimated Percentage of Budget Expended:

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

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

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

Progress to Date:

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

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

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

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

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

We have finished the process of identifying epifaunal invertebrate samples collected during our 2000 surveys. We also 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 2001.

Publications and Presentations:

Brooks participated in a symposium on long-term effects of climate change on the marine environment at the Western Society of Naturalists meetings in November, 2001. We have one paper to the Journal of Marine and Freshwater Research in press and are currently preparing two additional papers for publication.

List of all personal associated with the project this quarter

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

Post-graduate researchers: Keith Seydel, Andrea DeMent

Undergraduate researchers: Pam Porteous, Jada-Simone White, Corine Kane, Amanda Jensen, Paul Myers, Mike Kane, Julie Deter

Estimated Percentage of Budget Expended:

Project Year 1 100%

Project Year 2 77%

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, 2001 - December 31, 2001

No progress has been made on this project during the past six months. This has occurred because the Postdoctoral Scholar doing the bulk of the work left to take a faculty position at another university. Although the project continues as planned, this has slowed its progress. Otherwise, there is nothing new to report since last time, so the details below remain basically the same as the previous report.

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

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

These patterns have now been documented.

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

The detailed and complex statistical analyses continue. Addressing this question awaits the outcome of all analyses, which are still in progress.

The final report is being prepared based on results to date.

Personnel:

No changes, but Postdoctoral Scholar working on the project is doing it from overseas.

Problems Encountered:

The person primarily responsible for the completion of the project has left the University of California, Santa Cruz and taken on a faculty job at another university; this has led to major delays in completion of the project.

Future plans:

1. Finalize statistical analyses.
2. Complete final report.

Estimated Percentage of Budget Expended:

Project Year 1 100%
Project Year 2 100%

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

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

Major Accomplishments, October 1, 2001 - December 31, 2001

This is the last quarter of our project and we spent all of our time analyzing data and preparing a manuscript for publication. Our graduate student, Scott Bull has finished his research and is in the final stages of writing his Master's thesis. We anticipate that he will graduate in winter 2002.

Problems Encountered:

None

MMS Action Required:

None

Future Plans:

We will submit a final report on the findings of our project by March 31, 2002.

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, 2001 - December 31, 2001

During the reporting period, crab traps were deployed twice in October and once in November to sample fish and benthic invertebrates at two sites for each of four habitat types: deep shell mound (former sites of Platforms Heidi and Hope, 39-41 m), shallow shell mound (former sites of Platforms Hilda and Hazel, 30-32 m), shell mound beneath existing oil platform (Houchin, Hogan, 46-49 m), and deep soft bottom (41 m). Three species of crabs, *Cancer antennarius*, *C. anthonyi*, and *Loxorhynchus grandis*, were captured, and sex and carapace width (carapace length for *L. grandis*) were recorded. Specimens of *C. antennarius* were more abundant on deep and shallow shell mounds (8-10 crabs/trap) than on soft bottom (3 crabs/trap). In contrast, *C. anthonyi* were most abundant on soft bottom (10 crabs/trap), followed by deep and shallow shell mounds (1 crab/trap). No *C. anthonyi* were caught on mounds beneath existing oil platforms. Individuals of *L. grandis* were equally abundant on shallow mound and soft bottom habitats (< 1 crab/trap); none were caught at deep shell mounds and shell mounds beneath existing platforms. Of the 5 fish species captured in traps, brown rockfish (*Sebastes auriculatus*) were most abundant on shell mounds at the former sites of oil platforms (2-3 fish/trap). To estimate short-term growth rate, muscle tissue from selected captured organisms was frozen for the determination of RNA/DNA ratios.

Methods for determining RNA/DNA ratios were refined so that we may begin processing frozen tissue samples.

The preliminary results of this study were presented at the 2001 meeting of the Western Society of Naturalists.

Future Plans:

Frozen tissue samples of invertebrates and fishes will be assayed for RNA/DNA ratios. Soft bottom sites adjacent to shallow shell mounds will be sampled by divers. Data from field surveys will continue to be analyzed.

Problems Encountered: None

MMS Action Required: None

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	5%

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

Major Accomplishments (January 1 - March 31, 2000):

During this quarter, the bulk of our efforts revolved around the planning and execution of the Fall 2001 sampling, as well as miscellaneous tasks relating to the project as a whole. Fall sampling occurred throughout the months of November and December (Table 1). Sampling proceeded smoothly at all sites with only a few problems. The seals were back on the rocks at Carpinteria this season, which prevented the mussel plots and seastar transects from being sampled. Rain and wind were problematic during the visit to Arroyo Hondo, but despite the uncomfortable conditions, we managed to complete all of the sampling tasks. A problem was discovered later however, wherein the photoplot slides came back overexposed. It is possible that the heavy rain contributed to this problem, but more likely the camera or strobe settings were incorrect. Although overexposed, the photos were adequate for scoring and a return visit to the site (off-season) is not necessary. The sun was low in the sky during most of the sampling days, which will result in lower quality photo survey slides.

Table 1. Fall 2001 Sampling Schedule

Date	Location	Personnel	Comments
November 02	Coal Oil Point	Steven Lee, Sean Bergquist, Katie Arkema	UCLA personnel only No MMS help
November 13	Old Stairs	S. Lee, S. Bergquist, K. Arkema, Herb Leedy	UCLA personnel with MMS help
November 14	Mussel Shoals	S. Lee, S. Bergquist, K. Arkema, Mary Elaine Dunaway, Ann Bull	UCLA personnel with MMS help
November 15	Carpinteria	S. Lee, S. Bergquist, K. Arkema, M.E. Dunaway	UCLA personnel with MMS help
November 16	Paradise Cove	S. Lee, S. Bergquist, K. Arkema, Karina Schmidt, Maurice Hill	UCLA personnel with MMS help
December 01	Alegria	S. Lee, S. Bergquist, K. Arkema, M.E. Dunaway, A. Bull, William Dunaway	UCLA personnel, with MMS help
December 02	Arroyo Hondo	S. Lee, S. Bergquist, K. Arkema, A. Bull, Dave Pancer	UCLA personnel, with MMS help
December 11	White's Point	S. Lee, S. Bergquist, K. Arkema,	UCLA personnel only
December 12	Point Fermin	S. Lee, S. Bergquist, K. Arkema, M.E. Dunaway, M. Hill	UCLA personnel, with MMS help

New plots were established this season at two of the sites. At Alegria, we established and sampled three new surfgrass transects. These transects were located just offshore of the mussel plots on the edge of the reef flats. Two transects are in a contiguous line and the other is just inshore of that line. There was more extensive surfgrass habitat further offshore, but we wanted to remain within the vicinity of the rest of our plots. At Carpinteria, we established and sampled five circular *Lottia gigantea* plots in the vicinity of the barnacle plots. There was fairly high cover of owl limpets in this area and we had extra time since we couldn't sample the mussel bench. Photographs and limited inter-bolt measurements were taken at each of these sites. A full description of these new plots will be given in the next annual report. Because of a labor surplus, we were able to expand the motile invertebrate sampling to all photoplots except for anemones. At Carpinteria and Alegria, motile invertebrates were sampled within *Pollicipes* plots, and at White's Point *Balanus* plots were sampled. We were also able to sample littorines at all of our sites, but this sampling is limited to the *Chthamalus* barnacle plots. The motile invertebrate sampling continues to be labor intensive and will probably be subject to future data gaps if labor force dwindles.

Beginning this sampling season, MMS personnel again provided sampling assistance after a one-year hiatus. While Steven Lee continues to be the primary technician on this project, the core group of UCLA technicians now includes Sean Bergquist and Katie Arkema. Steven and Sean have both drawn partial salaries off this project in past months, while Katie has not. During the middle of this quarter however, the project's funds were exhausted. An interim source of funding was established through MMS to carry the project through to the next funding cycle, but these funds have not yet become available. An 8-hour HAZWOPER refresher course was attended in November. This season marked the first use of our new 35mm fixed-focal length lens, which is an improvement over the old variable focus lens. This was also the first season where we used the new site description page. This represents a significant improvement over the previous versions, but there are still negative aspects of using this form. At the recent Western Society of Naturalists conference, a decision was made to rethink the way we collect these data. Work has begun on the creation of a new site description sheet that is based on presence/absence and abundance class data for multiple taxa rather than just the ones we currently monitor. A draft of this new form should be ready by the spring 2002 sampling season. Throughout November and December, data and photographic image management was fit in around the sampling schedule. All the photoplot slides were developed, labeled and organized, but the slide scoring was postponed until after the New Year.

Future Plans:

Throughout the present quarter, we will continue with our completion of items relating to the Fall 2001 sampling season, including slide scoring and data management. We will also continue the process of scanning and archiving the current photoplot and photo survey slides for LA, Ventura, and southern Santa Barbara Counties. Planning and execution of the Spring 2001 sampling will also occur in the present quarter. There are some bolt repairs that need to be done next season, and accurate descriptions of the new plots will have to be made at Alegria and Carpinteria. We will continue with the creation of a new site description page as mentioned previously.

Problems Encountered:

As mentioned previously, seals prevented sampling of the mussel bench at Carpinteria, and some the photoplot slides from Arroyo Hondo came back overexposed. We continue to have security problems at our UCLA office. After one of our Visor PDA's was stolen from the office last year (and later, a 35mm camera for a different project), we began storing expensive items in a locked desk drawer. During this quarter, another Visor PDA was stolen from the locked drawer, leaving us with just two remaining PDA's. We now have a large steel cabinet secured with a padlock, which will hopefully prevent further events from happening.

MMS Action Required:

No specific MMS action is required at the present time, except that we are still waiting for the new funding cycle and the interim funding to arrive.

Task 17603: *Following Changes in the Abundances of Rocky Intertidal Populations in Orange County, California: Contributions to a Regional Monitoring Network*

Principal Investigator: Steve Murray, Department of Biological Science, California State University, Fullerton, Fullerton CA 92834-6850

Major Accomplishments, October 1, 2001 – December 31, 2001:

The goals of this project are to perform prescribed shoreline monitoring studies at four rocky intertidal sites along the Orange County coastline during both the spring 2001 and fall 2001 seasons. In addition, data collected from these shoreline studies are to be placed into an on-going data base which is periodically analyzed to determine changes in the abundances of key species population parameters in the light of changes in abiotic conditions or physical or biologically meaningful changes in site characteristics. This grant is to cover field sampling and analytical work through December 31, 2001.

This quarter we completed our field sampling for 2001. We are in the process of analyzing our field data for the fall 2001 sampling period. We are continuing to digitize our field photographs and are preparing for our Spring 2002 field sampling program. We prepared and submitted a report describing trends in the status of rocky intertidal populations at our sites from 1996-97 through 1999-2000. This report also included appended reduced data for our spring 2001 sampling. We plan to add our Fall 2001 data to those appended in this report.

Problems Encountered: No problems were encountered during this quarter. We plan to perform some remapping and to clean field markers at our Crystal Cove site.

MMS Action Required: Approval of no-cost extension.

Future plans: Work will proceed as proposed.

Estimated Percentage of Budget Expended: 98%

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, 2001 - December 31, 2001

During this quarter the six study sites in San Luis Obispo County (SLO) were sampled for the 13th time, and the five sites in Northern Santa Barbara County (NSB) were sampled for the 20th time. NSB sites were sampled November 14th-17th and SLO sites were sampled November 29th-December 2nd. With ten years of data for the NSB sites, this monitoring study is one of the longest-running of its kind. No major changes in species composition or abundance were noted at any of the sites between this and the previous sampling period.

A digital camera was purchased for taking the overview photos that we use to document the distribution and abundance of organisms not found within the photoplots. The digital images will be much faster and easier to access than the slides that were previously used. We have been modifying the overviews over the past two years to maximize their repeatability and usefulness and hope to complete this modification process in the next quarter.

Future Plans:

Effort in the next quarter will focus on scoring photographic slides, 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 March 2002.

Estimated Percentage of Budget Expended: 66%

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, 2001 - December 31, 2001:

Monitoring of study animals by radio telemetry continues by fieldworkers based at Piedras Blancas field station, San Simeon CA. Fieldwork is conducted by shore-based observers in most areas, and by boat-based observers in those areas (such as Point Conception) where shore-based access is limited or where sea otters occur far offshore. In addition, aerial surveys of the entire sea otter range are conducted frequently (every 1-2 weeks) to locate missing animals and document long-range movements. A total of 10 of the original 15 study animals from the northern group, at Piedras Blancas, are still regularly monitored. Of the 5 remaining animals, 3 are confirmed mortalities (causes of death: 1 boat strike, 2 “natural”) and the other two are suspected mortalities. All of the original 14 study animals from the southern group, at Pt. Conception, are still regularly monitored: 3 have now returned to Cojo Cove, and the remaining 11 remain to the north at locations between Pismo Beach and Monterey Peninsula.

The autumn range-wide sea otter survey was conducted in mid November. Beach walks for sea otter carcasses are ongoing: all collected carcasses are subject to detailed necropsies.

Problems Encountered:

No problems were encountered during this quarter.

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	72%

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, 2001 - December 31, 2001

The major effort during this quarter was in laboratory analysis of previously collected surfgrass samples. We constructed AFLP fingerprints using 6 different primer pairs for all 605 samples collected to date. These fingerprints will serve as the raw data for two of our three major objectives. They will permit us to identify genetic boundaries and to identify genetic differentiation with depth and clone size.

During this quarter we have also begun to analyze the AFLP fingerprints that we have made. The major effort here is in scoring individual bands on the AFLP fingerprint. We have scored 34 bands on all of the samples “by hand” and begun a preliminary analysis of these data.

Problems Encountered: No problems were encountered during this quarter

MMS Action Required: No MMS action required.

Future plans:

The major effort in the next quarter will focus on scoring the AFLP fingerprints we have made. We calculate that there are 500-1,000 bands to score for each individual, or a total of 300,000–600,000 bands to score. Because computer programs have recently been developed to do the time consuming process of scoring automatically, we have purchased one such program which we hope to have it up and running in February 2002.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	21%

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, 2001 - December 31, 2001

In this period, we completed drafting the public opinion questionnaire that is the key to this research project. We also began the OMB-approval process by submitting a Federal Register statement to MMS.

In order for any project that gathers data directly from the public to go forward, approval must be obtained from the Office of Management and Budget (OMB). This process includes a number of steps, including publication of a notice in the Federal Register, allowing opportunities for public input. This process is now underway.

Problems Encountered: None

MMS Action Required: None

Future Plans: During the next quarter, work will focus on the news media content-analysis. Data will be gathered in preparation for the first survey. Data will also be gathered to help analyze public opinion survey data from past surveys. These data will be used to help explain opinion change over time.

Estimated Percentage of Budget Expended:

Project Year 1 83%

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

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

Major Accomplishments, October 1, 2001 - December 31, 2001

During the quarter from 1 October to 31 December of 2001 we deployed our new high frequency (HF) radar system at Pt. Arguello, California while we negotiated with Venoco for permission to conduct tests at their Carpinteria pier. Initially the new system worked well, but computer problems arose during the deployment resulting in some data loss from the Pt. Arguello site. A complicating factor was the restricted access to Vandenberg Air Force Base due to the September terrorist attacks. We were unable to check on the site until mid-November due to tight base security. Since then the computer problems have been corrected and the site is operating satisfactorily.

In early December we were given permission by Venoco to test the radar system on their pier at Carpinteria; these tests were successfully completed on 20 December. The testing included measurements of the antenna patterns which are crucial to evaluate this site due to the extensive amount of metal on the pier. We are currently evaluating the results of these tests in collaboration with engineers at CODAR Ocean Sensors, Ltd. Also in December Brian Emery and Libe Washburn met with Mr. William Yates of Rincon Limited Partnerships (RLP) on the Rincon Island to evaluate the facility as a potential HF radar site. Based on our inspection, we feel that this would be an excellent site. Consequently we are be working with RLP and the California State Lands Commission to obtain the necessary permissions and permitting to install our equipment there.

Edwin Beckenbach, a Ph.D. student on this project, continued his investigations of propagating current patterns in the western Santa Barbara Channel. Initially we thought these patterns were trains of eddies, but now we are investigating the hypothesis that they are topographic Rossby waves. We are working on a manuscript describing our results from this research. In another investigation with Cynthia Cudaback, we are examining flow characteristics over the mid and inner shelf using a combination data sets from HF radars, moorings deployed by Scripps (MMS funded), and acoustic Doppler current profilers near shore. Dr. Cudaback is a researcher at the Marine Science Institute at UCSB.

Also this quarter we began working with Dr. Carter Ohlmann of the Institute for Computational Earth System Science (ICESS) at UCSB to develop methods for simulating drifter trajectories using HF radar. Dr. Ohlmann will deploy newly-developed drifters in the western Santa Barbara Channel to investigate flow trajectories there. These drifters use cell phone technology to frequently report their positions.

Action requested from MMS: We request that MMS continue supporting helicopter flights to Pt. Conception to maintain our HF radar site there. This maintenance is essential to our project. Any assistance MMS could give us in working with the State Lands Commission and Rincon Limited Partnership to establish a HF radar sites on the Rincon Island would be extremely helpful.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	32%

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, 2001 - December 31, 2001

We continued our study of spatial and temporal variation in the growth of *Mytilus galloprovincialis* (our model suspension-feeder), and recruitment of invertebrates across platforms. These studies required the retrieval and deployment of another round of experimental modules (i.e., PVC frames with a mesh cage containing mussels, two settlement surfaces (tiles) and a small mesh recruitment cage containing fibrous material) at each platform. We retrieved and deployed the modules at Platform Holly on 11/17, at Platforms Hogan and Houchin on 11/28 and at the Ventura platforms on 12/01. Preliminary data analysis indicates that mussel growth was significantly different among platforms during the fall, with the fastest growth (averaging 7.6 mm per month) at the most northwestern platform (Platform Holly) and the slowest growth (averaging 6.7 mm per month) at one of the southeastern platforms (Platform Grace). Overall, growth rates were lower in the fall than in the summer, particularly at the southern most platforms. Barnacle recruitment also varied significantly among platforms in the fall. Recruitment of *Megabalanus californicus* was significantly higher at Platforms Gina and Hogan than at all other platforms. Recruitment of *Balanus trigonus* and *B. pacificus* was also greatest at these two platforms. Recruitment of all three barnacle species was lowest at Platform Holly. In general, recruitment of *M. californicus* and *B. pacificus* was higher in the fall than in the summer at all platforms. Recruitment of *B. trigonus* was more temporally variable, with higher recruitment in the fall as compared to the summer at two of the northwestern platforms (Platforms Hogan and Houchin) and lower recruitment at most of the southern platforms (Platforms Gina, Gail and Gilda).

During retrieval of our experimental modules, we also dissected adductor muscle tissue from 10 of our experimental mussels from each platform. This tissue will be used for RNA:DNA growth analysis.

One additional photographic survey was completed in November, leaving one remaining. We also began analyzing the photographs using point contact methods. This data will be used to examine species composition and abundance among platforms at four depths, both up and down current.

In addition, we collected the anemone, *Metridium exiles*, for evaluation of potential natural products of pharmaceutical importance. These specimens will be processed by the Jacob's lab, with extracts provided to Les Wilson's group.

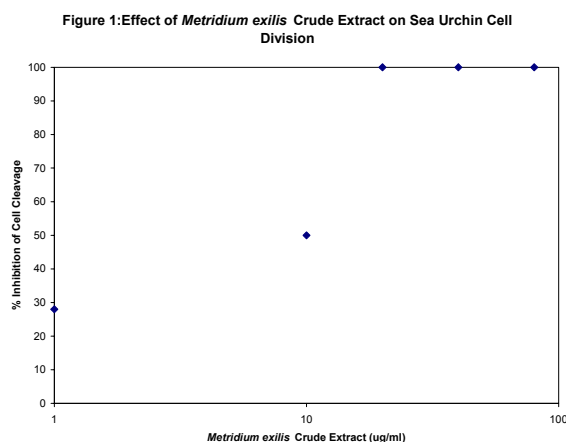
We presented some of our early research results at the Western Society of Naturalists annual meeting in November. The talk, entitled “Spatial patterns of distribution, abundance and dynamics of invertebrates on offshore oil platforms in the Santa Barbara Channel”, highlighted the patterns of spatial variation in growth and recruitment of invertebrates at the platforms.

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 studied the natural product potential of the sea anemone *Metridium exiles*. *Metridium exiles* is found exclusively on platform Gail. Samples were collected using SCUBA. Sea anemones were kept alive in running seawater, removed from their substrate and flask frozen in liquid nitrogen. Frozen anemones were homogenized in filtered seawater in a blender and the homogenate was extracted into two phases: a lipid/organic extract and a water/methanol extract. Extracts were catalogued and weighed and stored at -80°C .

Biological Activity of *Metridium exiles* Extracts:

We tested the crude organic extract in the sea urchin cell division assay. The fertilized sea urchin egg has shown utility as an experimental model for investigating mechanisms of drug action. Eggs fertilized at the same time undergo numerous highly synchronous divisions (generally much better than drug induced mammalian cell cultures), allowing rapid identification drug-induced delay in cell cycle progression. In addition, the first cell cycle the sea urchin culture system exhibits a remarkable degree of pharmacological selectivity to mitotic spindle poisons while being relatively insensitive to agents acting by other common inhibitory mechanisms. We initially tested 160 $\mu\text{g}/\text{ml}$ of the crude organic extract and found 100% inhibition of cell division. We repeated the experiment using concentrations of 1 μg - 80 μg of the crude organic extract and



found that inhibition was concentration dependent with an IC_{50} of approximately 10 $\mu\text{g}/\text{ml}$ (Figure 1).

The crude extracts were also tested in A549 cells (lung cancer cell line). We found after a 24 hour incubation the extracts inhibited cell division with an IC_{50} of 100 $\mu\text{g/ml}$ (Figure 2). However after a 48-hour incubation the IC_{50} was reduced to 23 $\mu\text{g/ml}$ (Figure 3).

Figure 2: Effect of *Metridium exilis* Crude Extract on Lung Cancer Cells (1 Day)

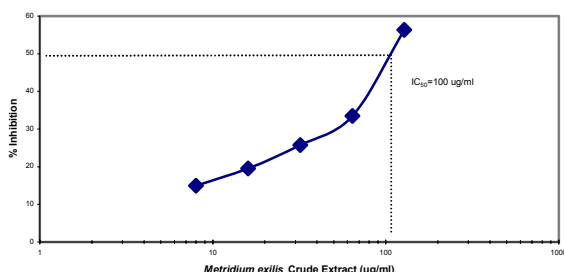
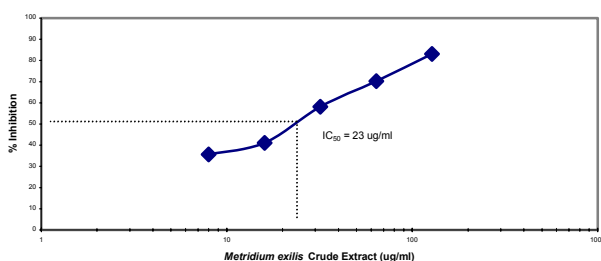


Figure 3: Effect of *Metridium exilis* Crude Extract on Lung Cancer Cells (2 Day)

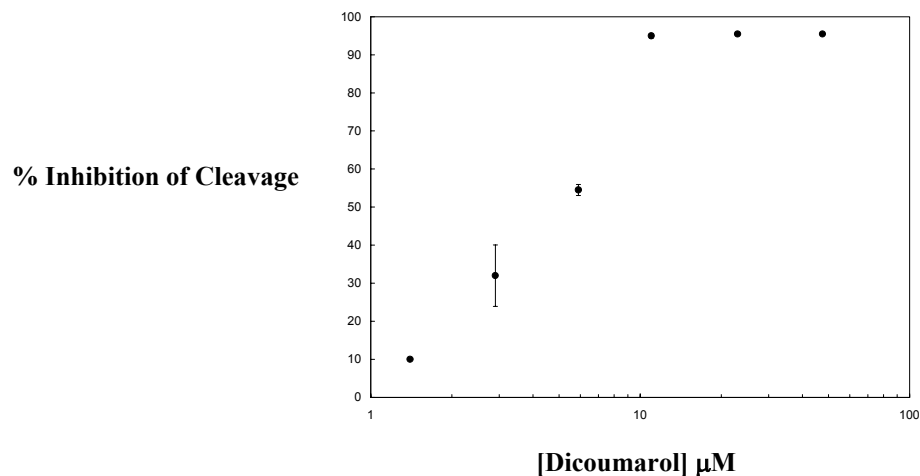


Biological Activity of Coumarin Compounds Related to Metabolites of *Dasycladus* Species (siphonous green algae):

In studies on the anti-mitotic actions of coumarin compounds, we discovered that dicoumarol (a coumarin anticoagulant chemically designated as 3,3'-methylenebis[4-hydroxycoumarin]) inhibits the first cleavage of *S. purpuratus* (sea urchin) embryos in a concentration dependent manner with 50% inhibition occurring at approximately 4 μM drug (Figure 4). Because the sea urchin assay is highly selective for microtubule-targeted agents, we believed the active compounds might inhibit cell division by interacting with tubulin and microtubules. By video microscopy we find that dicoumarol (1 μM) stabilizes growing and shortening dynamics at plus ends of bovine brain microtubules *in vitro* at concentrations substantially below those required to induce polymerization of tubulin into microtubules. Dicoumarol reduced the rate and extent of shortening, increased the percentage of time the microtubules spent in an attenuated (paused) state, and reduced the overall dynamicity of the microtubules. Using fluorescent spectroscopy, we obtained evidence that dicoumarol binds directly to tubulin dimers *in vitro* with high affinity (K_d , 8.72 μM). Indirect immunofluorescence staining of microtubules and 4,6-diamidino-2-phenylindole staining of chromatin were used to characterize the effects of the drugs on the distribution of sea urchin embryos in stages of the cell cycle and on the organization of

microtubules and chromosomes in metaphase spindles. At high concentrations (50 μM), dicoumarol produced abnormal organization of mitotic spindle microtubules with chromosomes that had not congressed to the metaphase plate. These data indicate that the anti-proliferative mechanism of action of dicoumarol and other coumarin compounds is apparently mediated by tubulin binding and the kinetic stabilization of spindle microtubule dynamics. In view of the relative simplicity of the molecule, we feel this new mechanism of action data represents a strong potential for these compounds to stimulate the development of more effective cancer chemotherapeutics.

Figure 4. Log dose response curve for inhibition of *S. purpuratus* embryo cleavage. The error bars represent standard error.



Future plans

We will retrieve and deploy another group of experimental modules (i.e., mussel cages, settlement plates, recruitment cages) to measure growth and recruitment of invertebrates across platforms during the winter and spring. Field maintenance will be conducted on the recently deployed modules (i.e., winter modules). We will also continue processing our experimental mussels from each platform for RNA:DNA analysis. We will complete our final photographic survey and continue analyzing the photos. The completed survey will include approximately 450 photographs (64 photos per platform) and will provide information on species composition and abundance among platforms at four depths (6 m, 12 m, 18 m, 24 m), up and down current on both conductor pipes and the outside vertical support members. We will also continue to analyze spatial and temporal patterns of invertebrate dynamics among platforms, including mussel growth and recruitment of various invertebrate taxa.

Estimated Percentage of Budget Expended:

Project Year 1 73%

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, 2001 - December 31, 2001

Joe Moulton and Benjamin Russell completed their internships at the end of September and Kerry Sawyer reduced her hours greatly. We advertised for 3 new interns for fill those positions and advertised a new internship for a graduate student to work on curricula development at the Santa Barbara Maritime Museum. We hired Ms. Regina Butali to replace Kerry Sawyer in working with Michael McCrary at MMS, USGS-BRD personnel and NPS personnel entering data from aerial surveys and monitoring of seabirds in the Santa Barbara Channel. A new intern 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 will start in January 2002. We will readvertise for the second position in January 2002 also. Mike Williams and Jason Chau continued to work with Dr. Jim Lima of MMS to support the MMS archeology program. We will work with Jim Lima and other MMS personnel to arrange additional internship opportunities for MMS/CMI projects during Winter 2002.

A number of students and PI's presented papers on results of CMI/SCEI studies at the Western Society of Naturalists meetings in November in Ventura. No Information Transfer Seminars were presented by CMI/SCEI PI's this past quarter at the request of MMS. We will work with Fred Piltz and others to develop a seminar schedule in the coming months.

Future plans:

New interns will be hired as needs are identified.

Estimated Percentage of Budget Expended:

Project Year 1: 100%

Project Year 2: 25%

Task 17610: *Industrial Activity and Its Socioeconomic Impacts: Oil and Three Coastal California Counties*

Collaborating Scientist: Michael R. Adamson, Research Assistant, Marine Science Institute, University of California, Santa Barbara, CA, 93106

Major Accomplishments, October 1, 2001 - December 31, 2001

The collaborating scientist has completed all of the research that will be used to write the report. This has included a review of prior work, substantial reading in relevant secondary sources, research into trade journals and company publications, limited archival research, and an in-depth review of oil and gas publications produced by the state regulatory agency.

The collaborating scientist has nearly completed a report that reviews, summarizes, reevaluates, and reinterprets prior findings, and discusses present and future scenarios relevant to policymaking in the context of recent technological developments and changes in local industry structure. This initial draft of the study will be completed and distributed in January 2002.

An extension of the project has been requested to accommodate the review and revision process.

The title of the project has been modified to reflect more accurately the content of the report (see above).

Estimated Percentage of Budget Expended:

Project Year 1: 90%

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, 2001 - December 31, 2001

Progress was made in several areas during this period. Further improvements were made to the Bubble Measurement System (BMS) which improved the image quality such that bubble distributions can be partially computer analyzed. Among other modifications, the inside of the BMS tube was painted black to reduce non-backlighting illumination. As a result, high quality bubble video for the three calderas has been recorded, and analyzed for caldera 1.

Detailed surveys were carried out during this period using a measuring tape with a diver swimming circles at 1m, 2 m, etc., to 7 m from the seep center point while shooting with a video camera. Upon analysis, this survey will quantify the seepage types throughout the seep region, which in combination with the bubble distributions measured will allow total flux estimates. Moreover, this survey, allows a precise baseline for observing changes in seepage over time.

Fluorometric and CTD surveys were conducted which clearly showed the thermal plume due to upwelling from the seep. Water samples were collected and are being analyzed for dissolved oil.

A paper was submitted to Terra Nova on the effect of "sharp" bubble dissolution in which if bubbles are all of the same size, they will dissolve at the same depth causing deposition of methane, oil, and other particles in a layer. This was an extension of modeling work performed for an EGU conference in Strasbourg and used, in part, data collected in the SB Channel under this research.

Thanks to collaboration with Peter Brewer and Gregor Rehder at MBARI, an invaluable data set was made available for comparison with model predictions. The model simulated bubble evolution within 15% of observations over a distance of several hundred meters rise. Most of the 15% could be accounted for by compressibility which is not incorporated into the current model, and which is negligible for the SB Channel seeps. However, for accurate simulation of deeper seeps, compressibility is being incorporated into the model.

Estimated Percentage of Budget Expended:

Project Year 1: 95%

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, 2001 - December 31, 2001

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, 2001 – December 31, 2001): Two significant tasks have been achieved during the first quarter of research.

- A prototype Microstar drifter was tested successfully within the study region.
- Schemes for calculating particle trajectories from CODAR fields have been identified.

The Microstar drifter, is being developed by Mr. Andy Sybrandy (Pacific Gyre Corp), Dr. Carter Ohlmann (UCSB), and Dr. Peter Niiler (SIO). The first ocean test of the Microstar occurred off the Santa Barbara coast (out to the shelf break; ~10 km offshore) on November 6, 2001. The goal of the test was to assess the drifter's communications system. The RIM cellular messaging system performed flawlessly. An occasional missed GPS position was the only problem encountered. A reworking of the "handshaking" protocol between the drifter and host computer (in progress) will remedy the missed position problem. The next set of drifter tests are planned for late January.

Comparison of Lagrangian drifter data with Eulerian CODAR data requires that Eulerian fields be created from the drifter data, and that Lagrangian trajectories be determined from the CODAR data. A simple first order Euler integration and a more complex fourth order Runge Kutta scheme will be used to compute trajectories from the CODAR fields. The coding of these algorithms is set to begin in January.

Estimated Percentage of Budget Expended:

Project Year 1: 10%

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, 2001 - December 31, 2001

Our first task is to generate concentration-response curves in laboratory studies with various PAH-contaminated sediments from Southern California and biochemical indicators of PAH exposure in flatfish. Sediments were collected from a oil seep near Santa Barbara (Coal Oil Point) and a location near oil drilling platforms which have not been historically impacted by urban contaminants. As the funding only arrived December, we were unable to begin any experimentation. Now that I can support the work and travel, we hope to collect animals in the next few months for exposure.

Problems Encountered:

Funding was not received until mid-December

MMS Action Required:

No MMS action required.

Future plans:

Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1	0%
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