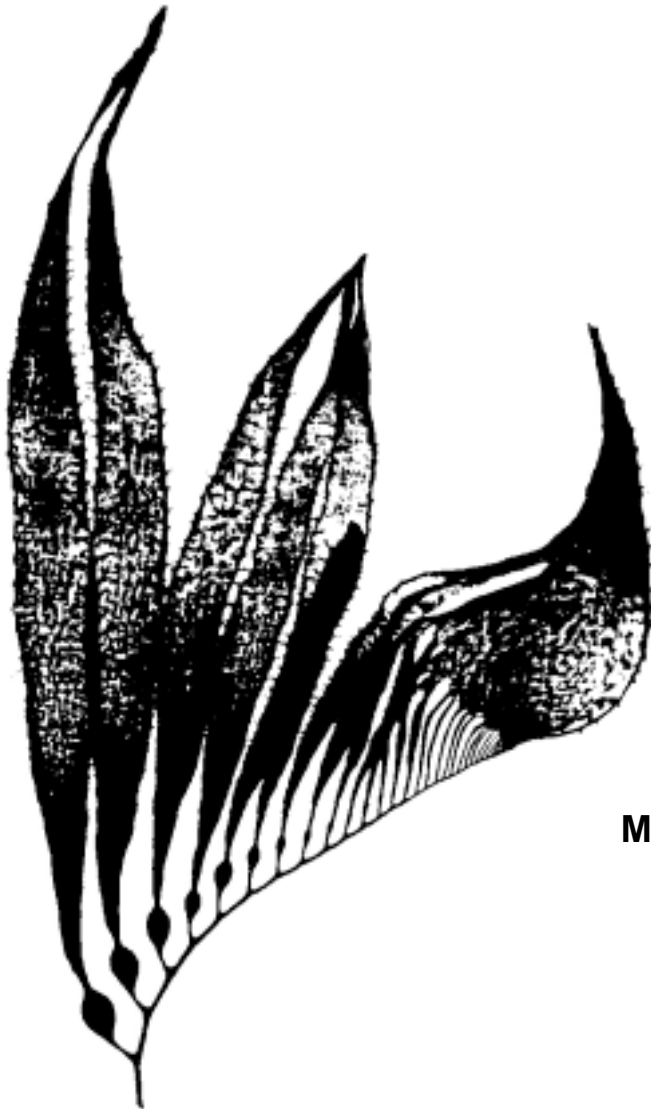


**COASTAL MARINE INSTITUTE
PROGRAM YEAR 8
QUARTERLY REPORT 1**

for the period

July 1, 2001 – September 30, 2001



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

October 22, 2001

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Russell J. Schmitt
Program Manager

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

October 22, 2001

Program Manager's Report

for the period July 1, 2001 – September 30, 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, 15 projects currently are being conducted under the aegis of the Coastal Marine Institute.

Actions Pending MMS Approval:

- Task 17603: *Following Changes in the Abundances of Rocky Intertidal Populations in Orange County, California: Contributions to a Regional Monitoring Network*, requires approval of a no-cost extension;
- Task 17611: *Simulation of a Subsurface Oil Spill by a Hydrocarbon Seep (SSOS-HYS)*, requires approval for the transfer of funds from supplies and indirect costs into equipment. Equipment budgeted cost more than anticipated. Agency approval is required because of the change in indirect costs.

Major Programmatic Progress and Actions during the Quarter:

- The Request for Preproposals was sent out in early October, preproposals are due in November;
- 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 15116: *Wave Prediction in the Santa Barbara Channel*, has been completed and the final study report will be submitted to MMS next 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 12387: *Ecological Consequences of Alternative Abandonment Strategies for POCS Offshore Facilities and Implications for Policy Development*

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

Major Accomplishments, July 1, 2001 - September 30, 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.
- Further analyses of fish abundance and size distributions among depths and habitats (platforms vs. natural reefs).

Future plans: Preparation of final report and publications.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%
Project Year 3	80%

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 are finishing 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 2000.

Publications and Presentations:

Brooks and Schmitt presented work resulting from this project at the 6th Indo-Pacific Fish Conference in May, 2001. Brooks is scheduled to participate 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 submitted one paper to the Journal of Marine and Freshwater research in May, 2001 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

Undergraduate researchers: Andrea DeMent, Jada-Simone White

Estimated Percentage of Budget Expended:

Project Year 1 100%

Project Year 2 100%

Project Year 3 72%

Task 15115: *Effects of Temporal and Spatial Separation of Samples on Estimation of Impacts*

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

Major Accomplishments, July 1, 2001 - September 30, 2001

Summary:

The project is continuing as planned and, although progress has been slow, there have been no major barriers to its success. There is nothing new to report since last time, so the details below remain the same as the previous report.

Below are the three 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.

Question 3: Can the collected data be used to predict the structure of communities at previously unsampled sites?

We are planning to address this question with preliminary sampling this spring.

Future plans:

1. Continue statistical analyses.
2. Preparation of final report

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

During this quarter of research we completed sampling our experiments that are testing the efficacy of various methods of surfgrass restoration. These experiments were conducted in both intertidal and subtidal habitats and involved monitoring the survivorship and growth of naturally recruited seedlings, laboratory-reared seedlings outplanted to the field, and apical meristems and rhizome clumps that were collected from natural populations and transplanted to experimental sites. Factors that are being explicitly tested in these experiments include: (1) the effects of seedling density (three levels), algal cover (two levels) and outplant technique (three levels) on seedling survivorship and growth in both intertidal and subtidal habitats (2) the effect of transplant size on survivorship and expansion rate of transplanted surfgrass and (3) the effect of clump size on the recovery rate of the bare patches created by collecting clumps of surfgrass for transplanting..

In addition to completing our field work we have been busy analyzing data and writing up the results of our experiments for publication.

Future Plans: Work will proceed as scheduled.

MMS Action Required: Approval of no-cost extension.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%
Project Year 3	69%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

Progress to Date

During the reporting period, crab traps were deployed once in September 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 (6-7 crabs/trap) than on soft bottom (< 1 crab/trap). In contrast, *C. anthonyi* were most abundant on soft bottom (6 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); no crabs 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. To estimate short-term growth rate, muscle tissue from selected captured organisms was frozen for the determination of RNA/DNA ratios.

During this quarter, sampling of mobile benthic invertebrates on shallow shell mounds with (Gina, 28 m) and without (Hilda, Hazel, 30-32 m) existing platforms also continued. All individuals sampled within replicate 1 x 20 m band transects were measured, and size frequency distributions were constructed for abundant species. The most abundant species, *Asterina miniata*, was significantly larger and more abundant on the mound beneath Platform Gina (2.5 m^{-2}) than on shallow shell mounds (0.5 m^{-2}). *Parastichopus parvimensis* were found at similar densities on the mound under Gina and on Hilda mound (0.56 m^{-2}), but were less abundant on Hazel mound (0.34 m^{-2}). The mean size of *P. parvimensis* was larger on Hazel mound (123 mm) than on Hilda mound (93 mm) or on the mound under platform Gina (110 mm). Muscle tissue samples from selected captured organisms were also frozen for determination of RNA/DNA ratios.

Upcoming work

Frozen tissue samples of invertebrates and fishes will be assayed for RNA/DNA ratios. Crab trap deployment will continue through November. Results to date will be presented at the 2001 annual meeting of the Western Society of Naturalists.

Estimated Percentage of Budget Expended:

Project Year 1 85%

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

During this quarter, effort was divided between completing tasks relating to the Spring 2001 sampling, miscellaneous tasks relating to the project as a whole, and the planning of the Fall 2001 sampling. As usual, summer vacations limited the number of working days this quarter. In July, all of the relevant sites were visited during low tide events for the Summer 2001 barnacle data collection (Table 1). After the sampling, the retrieved plates and the data sheets were sent to the Raimondi group at UC Santa Cruz for further analysis and data management. The remainder of the quarter was spent working on various project-related tasks, and on preparations for the upcoming Fall 2001 sampling season (see Table 2). Much correspondence preceded the MMS taxonomy workshop that took place in early October in Santa Cruz.

Table 1. Barnacle sampling schedule for Summer 2001

Date	Location	Comments
July 23	Alegria	UCLA Group
July 23	Arroyo Hondo	UCLA
July 23	Carpinteria	UCLA
July 24	Mussel Shoals	UCLA
July 24	Old Stairs	UCLA
July 24	Paradise Cove	UCLA
July 25	White's Point	UCLA

Table 2. Proposed sampling schedule for Fall 2001

Date	Location	Comments
November 2	Coal Oil Point	UCLA/SB County Help
November 13	Old Stairs	UCLA/MMS Help
November 14	Mussel Shoals	UCLA/MMS Help
November 15	Carpinteria	UCLA/SB County/MMS Help
November 16	Paradise Cove	UCLA/MMS Help
December 1	Alegria	UCLA/SB County Help
December 2	Arroyo Hondo	UCLA/SB County Help
December 11	White's Point	UCLA Group
December 12	Point Fermin	UCLA/Cabrillo Marine Help

Future Plans:

Throughout the present quarter, we will continue with the preparation and execution of the Fall, 2001 sampling. We will also continue the process of scanning and archiving the current photoplot and photo survey slides for LA, Ventura, and So. Santa Barbara Counties. We are in the process rethinking the way we collect qualitative and anecdotal data at the sites. We hope to come up with a physical habitat datasheet with more useful presence data for the target and non-target species at the sites. After coordinating with the other Inventory groups, we plan to implement these changes during the Spring 2002 sampling season. We also plan to help the intertidal SWAT team with their comprehensive sampling of the Channel Islands sites, time permitting.

Problems Encountered: None.

MMS Action Required: None

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, July 1, 2001 – September 30, 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 one year of field sampling and associated analytical and reporting work.

To date we performed field sampling during spring 2001 and have analyzed all field data collected during that period. We are now involved in an effort to digitize our field photographs and are preparing for our fall 2001 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.

Problems Encountered: No problems were encountered during this quarter except for tardiness in establishing accounts on campus and obtaining spending authority against this allocation.

MMS Action Required: Approval of no-cost extension.

Future plans: Work will proceed as proposed.

Estimated Percentage of Budget Expended: 25%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

The majority of the work for the Shoreline Inventory Project in San Luis Obispo (SLO) and Northern Santa Barbara (NSB) Counties during this quarter focused on scoring photographic slides and entering these percent cover data, along with field data collected during the previous quarter into computer files. Comprehensive statistical analyses will be done in Spring 2002 and results will be incorporated into a formal 10-year report to the Minerals Management Service.

On July 6th-8th, and 21st-23rd, SLO and NSB sites were visited in order to collect data for an ongoing barnacle recruitment study. Also, on July 24th black abalone were sampled at our Rancho Marino site because withering syndrome was seen there during the Spring 2001 sampling and we want to more closely monitor this site for a decline in the population. No significant decline was seen between the Spring 2001 and July 2001 samples.

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

Future Plans:

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

Problems encountered:

None

MMS Action Required:

None

Estimated Percentage of Budget Expended:

Project Year 1: 50%

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, January 1 - March 31, 2001:

Monitoring of study animals by radio telemetry is ongoing 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 12 of the original 15 study animals from the northern group, at Piedras Blancas, are still regularly monitored. Of the 3 remaining animals, one is a confirmed mortality (cause of death was boat strike) and the other two are suspected mortalities. A total of 13 of the original 14 study animals from the southern group, at Pt. Conception, are still regularly monitored: the 14th is missing and presumed dead. Of the 13 animals still monitored, one remains at Cojo Cove (near Pt. Conception), and the remaining 12 have now moved to locations between Pismo Beach and Monterey Peninsula. These northern migrations represent some of the most impressive movements documented for sea otters, and are providing the first information about where the animals south of Pt. Conception move during the off-season. Such movement data will be invaluable for predicting future patterns of range expansion and population growth.

The autumn range-wide sea otter survey is scheduled for 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	7%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

During This Quarter we made important progress in two of the four major areas of our study. We addressed the question of the spatial scale of clones within surfgrass populations and also the question of whether there are genetic correlates with subtidal and intertidal habitats. Work in these areas involved both field collections and laboratory analysis.

To address clone size, we collected 100 surfgrass samples from 50-m transects at two sites. To address the genetic correlates with habitat, we collected an additional 86 samples from the subtidal region at 9 sites from which we had previously (summer 2000) collected from the intertidal. In the laboratory, we isolated the DNA from all of these new collections and made the first AFLP fingerprints using 2 different primer pairs. During this quarter we have also made AFLP fingerprints for the same 2 primer pairs from DNA of all of the previously collected samples (a total of 605 samples).

Problems Encountered:

No problems were encountered during this quarter

Future plans:

During the next Quarter, we will continue to make AFLP fingerprints for all of the samples collected to date. Our goal is to get fingerprints using 6-8 primer pairs. We will begin the analysis of these data by scoring the fingerprints generated from 6 primer pairs. We will conduct an Analysis of Molecular Variance on these data to determine if additional AFLP fingerprints need to be made.

Estimated Percentage of Budget Expended:

Project Year 1 84%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

People misperceive the risks they face from potential environmental hazards. They exaggerate the statistical odds of some potential causes of injury or death, while they underestimate others. The goal of this project is to use public opinion survey data and news media content analysis to test and refine a new theory to explain people's perceptions of the risks associated with offshore oil development. The specific product of this project will be an analysis of a two-wave, public opinion panel-survey. A content analysis of how newspapers report news about oil development will provide some of the explanatory variables. The two-wave, panel design will allow us to see how individuals change their attitudes over time, and should give us a far better understanding of opinion dynamics than would surveys conducted at a single point of time.

In the beginning months of this research project, we developed a draft public opinion questionnaire. This work was informed by the findings from a previous MMS-funded research project, "A Design for a Time Series Study of a NIMBY Response." The draft survey must be approved by the Office of Management and Budget (OMB) before the survey is conducted.

We also designed and began to implement a newspaper content analysis. We are currently gathering data from the *Santa Barbara News Press*. The goal of this analysis is to discover how newspapers cover the oil and gas industry, how that coverage has changed over time, and how that coverage affects perceptions of risk and public opinion about oil development. The results of the analysis will be merged with the public opinion survey data to help model changes in the public's attitudes over time.

Problems Encountered: None

MMS Action Required: None

Future Plans: Finalizing the survey with OMB approval, and conducting the survey.

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, July 1, 2001 - September 30, 2001

During the quarter 1 July – 30 September 2001 we made progress in a number of research areas of our project. We previously reported that we had submitted a proposal to the Marine Council of the University of California to fund the purchase of a fourth high frequency (HF) radar system. A second proposal was submitted to provide a research assistantship for Mr. Edwin Beckenbach, a graduate student working on our project. Both of these proposals were successful and much of our activity this quarter has involved preparations for a new HF radar installation in the eastern Santa Barbara Channel. The eastern Channel is an important because it has several oil production platforms and it receives extensive amounts of freshwater discharge during winter storms. We have identified two sites near in the eastern Channel for the new radar system, one at the Venoco's Carpinteria facility, the other at the Rincon Oil Island. We are currently working with Venoco and the State Lands Commission to gain access to these sites. We anticipate this will be a time consuming process due to the extensive permits, regulations, and environmental considerations involved. While we await approval for a site in the eastern Channel, we have installed the new HF radar at Pt. Arguello to obtain additional current observations in the Santa Maria Basin. We have also applied to the US Coast Guard to install a HF radar at the Santa Barbara light. If approved, we will move our radar system, now at Coal Oil Point, to the Santa Barbara light. We anticipate better coverage in the eastern Santa Barbara Channel from this new location.

Edwin Beckenbach has been investigating a 3-year time series of current patterns in the western Santa Barbara Channel. An interesting pattern observed there are propagating eddy features on time scales of 10 – 20 days. We initially thought these were simply eddies moving westward down the Channel at about 7 kilometers per day. Based on recent analysis we are exploring the hypothesis that these may be waves (called topographic Rossby waves) resulting from the interaction of coastal circulation with topography. This work will be an important part of Mr. Beckenbach's Ph.D. dissertation.

We also began a collaborative project with Dr. Benjamin Holt and Dr. Paul DiGiacomo of JPL in Pasadena to use current patterns from HF radar to interpret imagery from synthetic aperture radar (SAR). SAR imagery may be a valuable tool for understanding circulation features in the ocean on scales of order 1 – 100 km. Interpretation of SAR imagery over the oceans has been problematic because important data such as 2-dimensional surface current information has been lacking. This new NASA-funded project was made possible due to our successful collection of an extensive data set of HF radar with MMS funding.

Since our last report we have submitted two publications to refereed journals:

Emery, B.M., L. Washburn, and J. Harlan (2001). Evaluating CODAR high frequency radars for measuring surface currents: observations in the Santa Barbara Channel, *Journal of Atmospheric and Oceanic Technology* (submitted).

Nishimoto, M.M., and L. Washburn (2001). Contrasting patterns of coastal eddy circulation and pelagic juvenile fish abundance in the Santa Barbara Channel, California, *Marine Ecological Progress Series* (submitted).

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 Venoco to gain access to HF radar sites at Carpinteria and the Rincon Oil Island would be extremely helpful.

Estimated Percentage of Budget Expended:

Project Year 1 40%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

COMMUNITY AND POPULATION ECOLOGY:

Progress to Date

During this quarter we continued to examine temporal and spatial variation in the growth of *Mytilus galloprovincialis*, a model suspension-feeding species, and recruitment of invertebrates across platforms. These studies required deployment of another round of experimental modules; PVC frames with a mesh cage containing mussels, two settlement surfaces (tiles) and a small mesh recruitment cage containing fibrous material (Tuffys®). Growth rates of *Mytilus galloprovincialis* varied among platforms during the summer, with faster growth rates at the southeastern platforms. Recruitment also varied among platforms. For example, barnacle recruitment was highest at the southeastern platforms, while recruitment of hydroids and tube dwelling amphipods was highest at the northwestern platforms. Bivalve recruitment was low at all platforms.

We also completed photographic surveys at 5 of 7 of the study platforms. Photo-quadrats from four randomly chosen conductor pipes and two vertical support members were taken at four depths (6 m, 12 m, 18 m, 24 m), both up and down current. Species composition and abundance will be analyzed from these photographs.

We completed our preliminary sponge (*Hymeniacidon* sp.) growth experiment. The results were encouraging, especially given the substantial amount of fouling (primarily barnacles) occurring on the experimental plates. Identification of previously collected sponges using spicule type is ongoing. A subset of the spicules were photographed and sent to Dr. Shirley Pomponi, Harbor Branch Oceanographic Institution, for species identification.

During this quarter we also collected samples of *Bugula neritina* from three of our study platforms for genetic analysis by Dr. Scott Hodges. Preliminary observations indicate that the abundance of *B. neritina* varies among platforms. For example, samples of *B. neritina* were readily obtained from Platform Hogan at several depths, whereas it was difficult to collect samples at any depth at Platform Holly. Sea anemones (*Metridium exilis*) and sea urchins (*Strongylocentrotus purpuratus*) were also collected for Dr. Bob Jacobs.

In addition, we collaborated with Dr. Steve Gaines on a preliminary study of fish recruitment at Platforms Hogan and Houchin. Three fish recruitment modules were deployed at 10m at each of the two platforms. Blocks of absorbent resin were also deployed at these sites to investigate variation in chemical signatures among platform.

Future plans: We will 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 fall and winter. In addition, we will complete our photographic surveys of the platforms and begin analysis of the photographs. Species composition and percent cover will be determined using point contact methods. Samples of *Bugula neritina* will also be collected over the next several months for genetic analysis. In addition, we will continue collaborating to test the fish recruitment modules and resins. A presentation on our results to date is being prepared for presentation at the Western Society of Naturalists meeting in November.

PHARMACOLOGY:

A large collection of one species of sea anemone (*Metridium exilis*) has been flash frozen and stored at -80C. An 800 mg sample was subjected to our primary extraction procedure. From this crude material we have prepared a polar and non-polar organic extract and submitted 1.0 mg of each to the Wilson lab for screening in their cancer cell culture panel (described below).

In the Jacobs lab, Laura Mydlarz is overseeing the chemistry activity. She is preparing fractions by gravity column chromatography of the samples of the crude extract. These will typically yield about 10 to 30 fractions of varying quantities of mixtures of compounds. These will also be subjected to screening. Active fractions will then be purified by HPLC. In addition any active fractions will be re-tested to confirm activity and scale up procedures developed to assure adequate supplies. Hamta Madari will test the extracts for effects on dividing sea urchin embryos and Claudia Moya will conduct anti inflammatory tests in tetrahymena.

A number of additional assays, already ongoing in the Wilson laboratory, will be used to assess the possible anticancer potential of the extracts.

- 1) Analysis of extracts on cancer cell proliferation. A minimum of two human tumor cell lines will be used; HeLa (human cervical carcinoma cells) and A549 (human lung cells). Indications of growth inhibitory activities will be followed with further analysis in tumor cells from other tissues (e.g., prostate, breast).
- 2) Identification of possible antimutagenic activities using the Ames test.
- 3) Identification of possible immune stimulating activities using a mixed human lymphocyte assay.

Mechanistic studies on the active principles in the extracts will be carried out in extracts and ultimately with purified substances, both at the biochemical and cellular levels.

As we predicted all of the procedures needed for the preliminary pharmacology testing and the isolation chromatography are now in place and proceeding in a coordinated fashion between the Jacobs and Wilson labs.

Problems Encountered: We had hoped to be able to collaborate with LSU and visit some Gulf platforms. There have been difficulties scheduling this work.

POPULATION GENETICS AND NATAL SOURCES:

During this quarter we made important progress in our identification and localization of the cryptic species of *Bugula neritina* that produces the potential anticancer drug, Bryostatin 1. We have now sampled *B. neritina* on three different OCS platforms (Houchen, Hogan and Holly).

Using the PCR-RFLP technique, we have shown that on these platforms, at depths between 20 and 60 feet, all *Bugula neritina* are of the type that produce Bryostatin 1. Furthermore, we have also confirmed (using PCR-RFLP) that the strain of symbiotic bacterium harbored by these samples is the same as that was previously described by Davidson & Haygood (1999). We have also pursued determining whether populations of *Bugula neritina* on OCS platforms have similar population structures as natural populations. The mtDNA region we use for the PCR-RFLP identification has relatively low variation within the species. Therefore we have attempted to PCR amplify other regions of mtDNA that usually harbor greater levels of variation. We have tried four different primer combinations to PCR amplify the cytochrome b region as well as primers for the COI-COII intergenic region and the COIII region. We have had to rely on using 'universal' primers designed from organisms phylogenetically distant to byozoans. Unfortunately, none of these amplifications have been successful, likely because of sequence differences between *Bugula neritina* and these primers.

Future plans: During the next quarter, we plan to PCR amplify the entire mtDNA region of *Bugula neritina* using long PCR. If we are successful, we will then shotgun sequence the entire mtDNA region. This sequence information will then allow us to design specific primers to PCR amplify regions with high variation within *Bugula neritina* and to determine population structure.

Estimated Percentage of Budget Expended:

Project Year 1 85%

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

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

Major Accomplishments, July 1, 2001 - September 30, 2001

Three student interns hired at the end of the preceding quarter (June 2001) Kerry Sawyer, Joe Moulton and Benjamin Russell, worked through this quarter with their MMS mentors. Ms. Sawyer replaced Kevin Buchanan 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. Mr. Moulton worked with Mr. Scott Drewry of MMS on rebagging, organizing and archiving geologic samples from well sites for long term storage. Mr. Russell worked with Mr. Mayerson and Mr. Brickey of MMS on a regional database for use in site-specific geological and engineering evaluation of producing offshore fields in the Santa Maria Basin, Santa Barbara Channel and offshore Long Beach. Mike Williams and Jason Chau continued to work with Dr. Jim Lima of MMS to support the MMS archeology program. Luke Hamlin continued to assist Ms. Joan Barminski of MMS with the collection and organization of geologic data and samples from offshore sites. He completed his internship at the end of the quarter. We are working with Jim Lima and others to arrange additional internship opportunities for MMS/CMI projects during Fall 2001.

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 future.

Future plans:

New interns will be hired as needs are identified.

Estimated Percentage of Budget Expended:

Project Year 1: 73%

Task 17610: *The Socio-Economic Impact of the Petroleum Industry on the California Coastal Region: A Synthesis of Prior Research* [supplement to Task 17610: Internship]

Collaborating Scientist: Michael Adamson, Coastal Research Center, Marine Science Institute, University California, California. 93106

Major Accomplishments, July 1, 2001 - September 30, 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. A number of areas have been identified in which additional research would accommodate a more in-depth and robust reinterpretation of the findings of prior research, particularly regarding the activities of the oil industry prior to 1950. However, neither the scope of the project nor the resources allocated to it in terms of both time and expense permit additional research to be carried out at this time. The collaborating scientist is now in the process of producing 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. It is estimated that an initial draft of the study may be completed by the end of October. No major delays or problems are foreseen that may affect the timely completion of the study.

Future plans:

Work will proceed as scheduled. Draft report will be completed in the next quarter.

Estimated Percentage of Budget Expended:

Project Year 1: 90%

Task 17611: *Simulation of a Subsurface Oil Spill by a Hydrocarbon Seep (SSOS-HYS)*

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

Major Accomplishments, July 1, 2001 - September 30, 2001

During the most recent quarter, our efforts have focused on improving the quality of our measurement technique, obtaining additional gas and liquid measurements at Shane Seep (34°24.37' N, 119° 53.41' W), improving the bubble measurement system, and developing a protocol for dye release to trace fluid motions in the water column. The bubble measurement system (BMS) was also modified for deployment in the Gulf of Mexico at GC185 () for observations at a hydrocarbon seep from a gas hydrate mound at a depth of 540 m. Finally, the bubble model has been applied and used to simulate bubble dissolution for seeps in the Gulf of Mexico and North Sea, leading to submission of two publications. Each of these areas is addressed below.

Gas and Liquid measurements. Previous gas and aqueous measurements obtained evidenced some problems of repeatability. These problems appear to have been related to preparation of the vacutainers, used to extract gas from collected syringes, and potential air leakage during the extraction process. These problems have been solved and during a cruise 8/22/2001 to Shane Seep high repeatability for multiple measurements taken at the same location, and also for multiple samples from the same syringe was produced. Analysis of these geochemical samples is ongoing.

Bubble measurements. Bubble measurements at the surface were reported in the last report, however, difficulties in illumination prevented bubble observations at the sea bed. At the sea surface, sunlight allowed observations to be made; however, the quality was low and analysis was entirely by hand. Further difficulties in the surface images was due to the high currents and the open design of the BMS. These difficulties were noted in the previous report, as was the redesign of the BMS. The BMS is shown in Fig. 1 mounted on the submarine Sea Link in the Gulf of Mexico. Also shown are images of bubbles in the Gulf of Mexico. Back in Santa Barbara, deployment of the new BMS had the advantage of blocking sunlight, and thus allowed high quality images to be gathered both at the surface and seabed. Examples of these bubble images are shown in Fig. 2. The video sequences are currently being analyzed.



Fig. 1. A) Bubble measurement system mounted on submarine. B) Bubbles rising amongst tube worm bush's. C) Bubbles in the BMS. Ticks 1 cm apart.

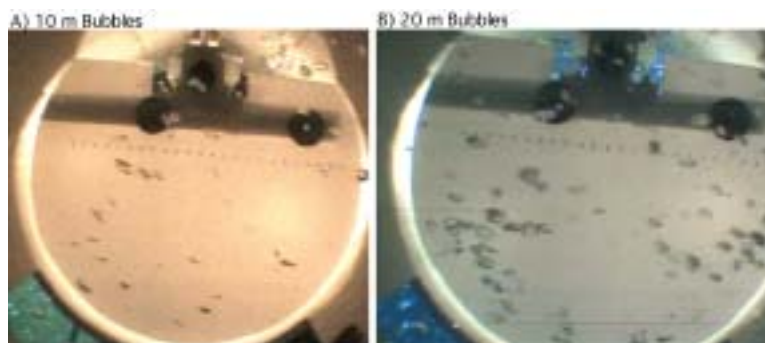


Fig. 2. Bubble images from the Santa Barbara Channel at A) midwater column and B) seabed. Bubbles outside the BMS can be seen through the entry gap. Ticks are 1 cm apart.

Fluid motions. Previous attempts at dye release provided minimal quantitative information. A protocol for the dye release was developed that is highly promising, and visually traced the flow. However at the time, underwater video was unavailable. In the next planned dive, underwater video cameras will image the dye release for analysis of upwelling flow, and turbulence mixing in the vertical and horizontal directions.

Numerical bubble model. The bubble model has been used to investigate bubble dissolution depth from seeps, and the implications of this dissolution to the upwelling flow, dissolved methane in the water column, and slicks at the sea surface. two publications resulted from these simulations (Leifer and Judd, 2001) and MacDonald and Leifer (2001).

MacDonald and Leifer (2001) concluded that based on the rise velocity and dissolution depth of bubbles observed at Bush Hill, the dispersion of oil slicks on the water surface could only be explained if the oil was primarily transported on the surfaces of bubbles.

Leifer and Judd (2001) examined the possibility of a bubble depositional mechanism as an explanation for an observed layer of enhanced methane concentration at a depth of 115 m. The layer was observed during a cruise to UK Block 15/25 in the North Sea ($58^{\circ}17.5'N, 0^{\circ}58'E$) in 1990. For conditions in the North Sea, the model predicted a bubble dissolution depth at the same depth as the observed layer. Model output for a range of upwelling flows based (where the upwelling flow range was based on analysis of upwelling flows in the Gulf of Mexico - where fluxes were consistent with gas flux rates at these sites in the North Sea - Leifer and MacDonald, 2001) are shown in Fig. 3. Thus these two papers addresses one of the key points raised in the proposal, if the bubbles dissolve subsurface, substances transported by the bubbles, such as oil, can be deposited in a subsurface layer.

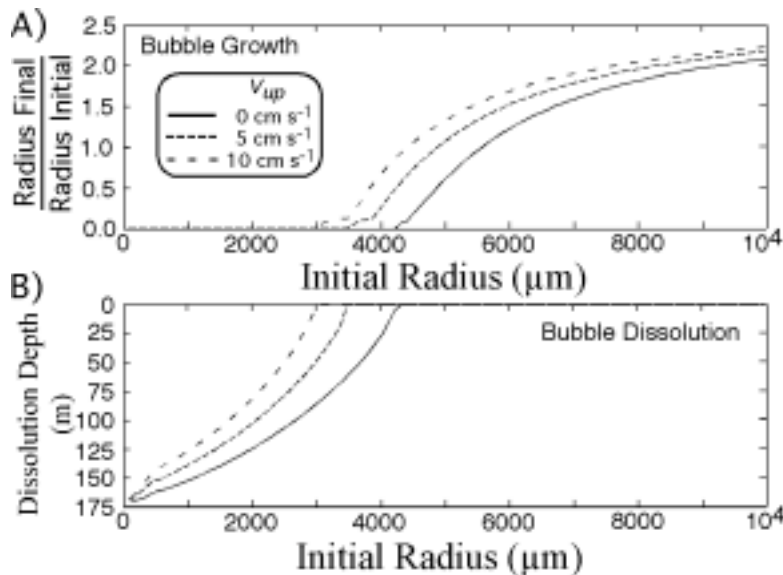


Fig. 3. Calculated final to initial radius A) and dissolution depths B) for different size bubbles for three upwelling flows. Observed bubble size was $\sim 2500 \mu\text{m}$. Data key on figure.

References

- Leifer, I. and A. Judd, 2001, Oceanic methane layers : A bubble deposition mechanism from marine hydrocarbon seepage. *Terra Nova*, submitted.
- MacDonald, I.R., I. Leifer, R. Sassen, P. Stine, R. Mitchell, and N. Guinasso Jr., 2001. Transfer of hydrocarbons from natural seeps to the water column and atmosphere, *Geofluids*, submitted.

Leifer, I. and I.R. MacDonald, 2001. Dynamics of the gas flux from shallow gas hydrate deposits: Interaction between oily hydrate bubbles and the oceanic environment. *Earth Plan. Sci. Lett.*, *submitted*.

Estimated Percentage of Budget Expended:

Project Year 1 58%