

**SOUTHERN CALIFORNIA EDUCATIONAL INITIATIVE
PROGRAM YEAR 11
QUARTERLY REPORT 2**

for the period

October 1, 1999 – December 31, 1999



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

January 12, 2000

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Russell J. Schmitt
Program Manager

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

January 12, 2000

Program Manager's Report

for the period October 1, 1999 – December 31, 1999

This constitutes the quarterly report for the second quarter of Program Year 11 of the Southern California Educational Initiative, a cooperative research agreement between the Minerals Management Service, the state of California and the University of California.

As of this quarter, 9 projects currently are being conducted under the aegis of the Southern California Educational Initiative.

Actions Pending MMS Approval:

- We require approval of a no-cost extension of the Southern California Educational Initiative until June 2001. Several projects still have funds and are continuing research.
- We are waiting for MMS comments on the Draft Final Report for *Mitigating the Impact of Offshore Oil Development*, Woolley and Lima, Pls.

Major programmatic progress and actions during the quarter are summarized below for the period of October 1, 1999 – December 31, 1999.

- The Final Report for projects *Ecological Effects of Chronic Exposure to Produced Water: A Field Test* and *Environmental Effects of Produced Water: A BACIP Field Assessment*, Osenberg, Holbrook, Schmitt and Carr, Pls, will be submitted to MMS next quarter;
- The Final Report for projects *Effects of Produced Water on Demographic Rates* and *Environmental Recovery Following Cessation of a Produced Water Discharge*, Schmitt and Osenberg, Pls, will be submitted to MMS next quarter.

Effects of Biologically Degraded Oil on Marine Invertebrate and Vertebrate Embryos and Larvae

Principal Investigators: Gary N. Cherr, Bodega Marine Laboratory, University of California, Davis, CA 94923, Rick Higashi, Crocker Nuclear Laboratory, University of California, Davis, CA 95616, Frederick J. Griffin, Bodega Marine Laboratory, University of California, Davis, CA 94923.

Major Accomplishments, October 1, 1999 - December 31, 1999

The last three months have continued the development of a non-destructive screening method for assessing exposure to biologically degraded oil in a marine model system. Batstars (*Patiria*), which are commonly found at or near natural oil seep sites in the Santa Barbara Channel have been used in these studies. We have investigated the use of batstar coelomocytes for the following reasons: 1) coelomic fluid can be withdrawn from individuals repeatedly (several times over a one month period) without compromising their apparent health; 2) coelomocytes are the functional immune system in echinoderms and should be indicators of stressor exposure; 3) since the cells can be cultured *in vitro*, this system can be used for both whole animal exposures as well as small volume *in vitro* exposures. Recent studies over the previous quarter have shown that the coelomocytes possess a transporter which can be competitively inhibited by soluble oil constituents. Since the MXR transporter has been shown to be inducible in organisms from sites exposed to organic pollutants, we hypothesized that the MXR transporter activity in coelomocytes could be used as an indicator of hydrocarbon exposure as well as possible hydrocarbon resistance in at least some echinoderms.

Recent studies have shown that coelomocytes are capable of upregulating MXR transporter based on dye and immunofluorescence studies (using a commercial antibody to MXR protein). We found that some of the inherent variability between individuals is decreased following a 24 hr. exposure of the cells to degraded oil or to verapamil. Some individuals appear to possess cells which do not upregulate the MXR protein for unknown reasons. Still, it appears that we are now ready to attempt some studies with animals collected from seep sites.

Problems Encountered: None

MMS Action Required: None

Future Plans

Work will continue in on baseline MXR activity in animals from clean sites. We will plan to collect animals from seep sites over the next two quarters.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%
Project Year 3	90%

Detecting Ecological Impacts: Effects of Taxonomic Aggregation in the Before-After/Control-Impact Paired Series Design

Principal Investigators: **Sally Holbrook**, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106, **Mark H. Carr**, Department of Biology, University of California, Santa Cruz, CA 95064, **Craig W. Osenberg**, Department of Zoology, University of Florida, Gainesville, FL 32611-8525.

Major Accomplishments, October 1, 1999 - December 31, 1999

- While some files are still being formatted to facilitate data analysis, data analysis continues at Osenberg's lab.
- Processing of bivalve and crustacean samples for size-frequency analysis continues in Carr's lab at UCSC with the image analysis system. At present, bivalve samples from Gaviota have been imaged and processing of Carpinteria samples continues.
- Carr presented an invited symposium paper in the Marine Reserves Symposium at the 80th Annual Western Society of Naturalists meeting that discussed the application of the BACIPS approach to evaluate the effectiveness of marine reserves: "Marine Reserve Effectiveness: Approaches to Evaluation and Need for Adaptive Management". Mark Carr, Pete Raimondi and Craig Syms. Monterey, CA, December, 1999.

Future plans:

- We expect to continue most of the analyses through years 4 and 5. All other samples designated for size frequency analysis are being shipped to UCSC. We are making arrangements to have all samples not designated for size frequency analysis to be archived at the Los Angeles County Museum. Osenberg's lab will continue analysis of the MRC data and begin analysis of the Gaviota and Carpinteria databases. Carr's lab will continue to process size-frequency samples.

Estimated Percentage of Budget Expended:

Project Year 1	100%
Project Year 2	100%
Project Year 3	95%

Effects of an Oil Spill on Multispecies Interactions that Structure Intertidal Communities

Principal Investigator: Peter Raimondi, Department of Biology, University of California, Santa Cruz, California 95460.

Major Accomplishments, October 1, 1999 - December 31, 1999

The plots established at Boathouse, on Vandenberg Airforce Base, were sampled in October 1999. Data was collected on the number and the sizes of barnacles in the cleared plots and the tarred plots. Barnacles were present in the cleared and the tarred plots. Aside from the 100% cleared/tarred treatment, the number of recruits was about equal in the tarred and the cleared plots. There was no distinct pattern in the number of recruits as a function of percent cleared/tarred.

After sampling the plots, 50% of the tar was removed from the tarred plots. Many dead tests were starting to come through the surface of the tar patches due to degradation eroded. Close to all of the barnacles were dead in the tar patch, as indicated by numerous empty tests coated with tar. A few barnacles were alive towards the center of the tar patch and appeared to have grown in a long, narrow form, similar to the form often observed when barnacles hummock. Barnacles on the edges of the tar patch were alive, indicating that barnacles can survive partial tar cover.

In November 1999, Christy Roe performed surveys at Point Sierra Nevada, Shell Beach and Boathouse. These surveys allowed her to calculate the percent cover of tar in two different zones (barnacle and *Endocladia*) and to do site comparisons. Overall, she found more tar at both Pt. Sierra Nevada and Boathouse and less tar at Shell Beach. She found that at both Pt. Sierra Nevada and Shell Beach that tar cover was consistently an order of magnitude higher in the barnacle zone as compared to the *Endocladia* zone. This result was consistent with what we expected, based on the analyzed slides from our data base and previous field observations. In contrast, at Boathouse the percent tar cover was an order of magnitude lower in the barnacle zone as compared to the *Endocladia* zone. This may be a result of the upwards shift in species assemblages at this site. We predict that with time (at Boathouse), the percent tar cover will increase in the barnacle zone and decrease in the *Endocladia* zone. The number, size and relative freshness of tar patches per marked plot were recorded at each of the three sites. Additionally at Pt. Sierra Nevada, four tar patches were found in the mussel zone (in contrast, no tar was found in the mussel zones at Shell Beach or Boathouse). These four tar patches were marked and measured in late October and when we returned to this site in early December all four of the patches had disappeared. This result was also as expected based on slide data and previous field observations that suggest tar does not persist long in the mussel zone.

Variability in tar patch persistence may result from temperature, zonation and wave exposure. These factors not only contribute to the weathering (degradation) of tar, but may also have an effect on where the tar lands. Christy has been utilizing a tide program to make predictions regarding variability in tar patch accumulation and persistence.

Future Plans

Plots in which 50% of the tar was removed will be sampled in March. This will allow us to investigate how the barnacle populations recover from an oil spill once the tar has degraded.

We will continue to monitor both the number and size of tar patches, as well as the percent tar cover in the marked plots on a quarterly basis. We also plan to set up some experiments to measure variability in tar patch persistence as a function of species assemblage.

Personnel

Christy Roe is funded 2/3 time as a laboratory technician on the project. Samantha Forde is funded as a graduate student research assistant.

Estimated Percentage of Budget Expended:

Project Year 1 60%

Inventory of Rocky Intertidal Resources in San Luis Obispo and Northern Santa Barbara Counties

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

Major Accomplishments, October 1, 1999 - December 31, 1999

During this quarter the 5 study sites in San Luis Obispo (SLO) and 4 of the 5 sites in Northern Santa Barbara (NSB) Counties were sampled for the 9th and 16th semi-annual surveys respectively. The 5th NSB site (Government Pt.) will be sampled during the next quarter if access problems can be resolved.

Time was spent during this sampling period developing a new technique for extending our observations at each site beyond our photoplots and transects. In the past we have used video camera overviews to document the distribution and abundance of organisms not found within the photoplots. However, this technique has proved unsatisfactory for providing repeatable observations within a site. In an effort to resolve this problem we have switched to still photo overviews. These overviews will be assessed for repeatability, resolution, and usefulness (both qualitative and quantitative) during the next quarter.

Future Plans:

In addition to sampling Government Pt., 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 early March, 2000.

Problems encountered:

Could not sample Government Pt. due to access problems.

MMS Action Required:

None

Estimated Percentage of Budget Expended:

Project Year 1 80%

Inventory of Rocky Intertidal Resources in Los Angeles, Ventura, and Southern Santa Barbara Counties

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

Major Accomplishments, October 1, 1999 - December 31, 1999

During this quarter, most effort revolved around the planning and execution of the Fall 1999 sampling season. In early October, Steven Lee helped Dr. Jack Engle's group on his CIRP Cruise, during which the two Santa Catalina Island sites, Bird Rock and Little Harbor, were sampled. The data and photographic slides were then taken back to UCLA for analysis. The slides were developed, scored and cataloged this quarter. The data still need to be entered into the computer, and the graphs need to be updated. Sampling for the rest of the LA/Ventura and Southern Santa Barbara was performed smoothly and without incident throughout October and November (see table below). Sampling was done primarily by UCLA personnel, but with additional help from MMS, SB County, SCMI, and Cabrillo Marine Aquarium. The plot photos for all the sites, including the two Santa Catalina Island sites, have been developed and scored and all data sheets have been organized and compiled. Data entry into the computer databases has begun and will be completed in the next several weeks. After that the graphs will be updated along with any other data management that is necessary.

Date	Location	Personnel	Comments
October 24	Carpinteria	S. Lee, M. McCrary, H. Leedy, M. Pierson	MMS Help
October 25	Alegria	S.Lee, M.E. Dunaway, S.Morton	MMS, SB County Help
October 26	Point Fermin	S.Lee, S. Bergquist, S.Lawrenz-Miller, E. Mastro, L. Chilton, S. Vogel	Site Creation with Cabrillo Marine Aquarium Help
November 7	White's Point	S.Lee, S.Luce, R. Sepulveda	SCMI Help
November 8	Coal Oil Point	S.Lee, S. Morton	SB County Help
November 9	Old Stairs	S.Lee, S. Luce, S. Bergquist, J.Smith, K. Johnston	No Agency Help

In addition to the normal eight sites, an additional site was developed this quarter at Point Fermin in San Pedro on the Palos Verdes Peninsula. This set was established in collaboration with the Cabrillo Marine Aquarium, and is located in the Cabrillo Marine Reserve. The rocky intertidal begins just upcoast of the Cabrillo State Beach. There is a steep sandstone cliff that extends toward the intertidal. A footpath skirts this cliff face with access from the beach. This is deemed dangerous and is the justification for a proposed boardwalk to allow visitors, including the disabled, access to the rocky intertidal. Due to the potential increase in foot traffic at the site as a result of this boardwalk,

Aquarium staff were interested in establishing a monitoring program at this site. On October 26, we met onsite with Suzanne Lawrenz-Miller and other Aquarium personnel to survey and set up a monitoring site consistent with our inventory program. We established sets of five *Chthamalus* barnacle plots, *Mytilus* mussel plots, and *Sylvetia*(=*Pelvetia*) plots, and three 10 meter surfgrass (*Phyllospadix*) transects. No barnacle recruitment plates or clearings were established at this site. The site was then revisited for its initial sampling on November 24, during which the Aquarium personnel were trained on sampling procedures and use of equipment so that they may do future sampling independently.

The recent decision to replace the video surveys with still photo surveys was implemented during this Fall 1999 sampling season. Using our new Nikon camera, we experimented with different methods until we came up with what we believe to be a good procedure for gathering photo survey information in a quick and effective way at the sites. We decided to use all of the video reference points that were indicated in the most recent video protocol compiled by Dr Engle for consistency with the previous video footage. Standing at one of those reference points, the photographer uses a handheld field compass to locate magnetic north. That position is used as the center of the first field of view with the camera set at its widest focal distance (35mm on the variable focus lens). The top of the viewfinder (the viewable area, not the viewfinder's indicator marks) is held level even with the horizon. This is best found by looking first out to sea, and then extending that horizon line along the shore. Once the first picture is taken, the photographer takes a mental note of a terrain feature at extreme right edge of the viewfinder and then moves the camera clockwise and level until that feature is at the left edge of the new view. This process is continued until the entire 360-degree pan is complete. Photo surveys of this nature were taken at all of the sites on 35mm-slide film, and these were later developed, organized and labeled.

This quarter, we acquired a new computer to serve as a workstation for the manipulation and storage of photographic images for the inventory project. To this computer we attached the new slide scanner, which includes a bulk loader, and a newly obtained CD-RW drive that can write CDs to hold the digitized photographs from our surveys. After some time was spent becoming familiar with the equipment, we started scanning both the photographic survey images as well as the photoplot images from the Fall 1999 sampling season. Our intention is to have all the photographic images from past, present, and future seasons stored and archived on CD media, copies of which can be distributed to the different groups involved in the project.

Future Plans:

Throughout the present quarter, we will continue with data management including data entry, graphing, and analysis of the Fall 1999 sampling season. We will also continue the process of archiving the photoplot slides for the LA and Ventura sites back to the first sampling season (Fall 1994). As the quarter progresses, we will begin planning for the upcoming Spring 2000 sampling season. There is also some discussion about expanding the recruitment portion of the study with different types of settling substrates, as well as repeating the one time survey protocols again at all the sites, and we will continue to consider these changes.

Problems Encountered:

No major problems were encountered during this quarter. The only major issue continues to be the lack of funding for the LA County sites.

MMS Action Required: We are still awaiting the return of our new video camera, which is in the possession of MMS. It was originally sent to UCLA, but was borrowed by MMS to inspect.

A Design for a Time Series Study of a NIMBY Response

Principal Investigator: Eric Smith, Department of Political Science, University of California, Santa Barbara, California 93106

Major Accomplishments, October 1, 1999 - December 31, 1999

In this period, we further refined the survey questionnaire. We have been discussing the draft questionnaire with stakeholders and others interested in the research. I now have a complete draft.

We continued to develop and test content analysis measures for newspapers. We are developing two sets of measures. The first set is designed to assess the risk information available to the public; the second set is designed to assess the type of information the public receives about the oil and nuclear power industries (nuclear power is being used to provide a set of comparisons with oil).

In addition, we began develop a zip-code based coding scheme to measure the proximity of potential survey respondents in the San Luis Obispo, Santa Barbara, and Ventura counties to oil drilling or refining facilities, and a similar measure of whether oil drilling or refining facilities are in the viewshed of potential respondents. This coding scheme will be designed to work in geographical information systems (GIS) software.

Using March 1998 survey data, I performed a range of preliminary tests on the theory of environmental attitudes and risk perceptions which the project seeks to explain.

Future Plans:

In the next three months, we will finalize the survey questionnaire. We will also complete the article presenting our findings about available comparative risk assessment information in newspapers.

Estimated Percentage of Budget Expended:

Project Year 1	90%
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The Political Economy of the Rigs-to-Reef Option for Decommissioning of Offshore Oil and Gas Structures

Principal Investigators: **Michael McGinnis**, Marine Science Institute, University of California, Santa Barbara, California 93106; **Linda Fernandez**, Donald Bren School of Environmental Science and Management, University of California, Santa Barbara, California 93106; **Caroline Pomeroy**, Institute of Marine Science, University of California, Santa Cruz, California 95064

Major Accomplishments, October 1, 1999 - December 31, 1999

McGinnis and Pomeroy (UC, Santa Cruz) met several times during the quarter to discuss the literature review of the approach that has been adopted to study the relationship between artificial reefs programs in California and Gulf states. An identification of information in California and the Gulf states in relation to both artificial reef programs and the rigs-to-reef programs in the Gulf states has begun. In addition, McGinnis interviewed individuals who have been involved in California State Senators Dede Alpert's Senate Bill No. 241 that would establish the California Endowment for Marine Preservation (related to the rigs-to-reef option for POCS decommissioning).

McGinnis will travel to the Gulf states to interview resource managers who are involved in state rigs-to-reef programs later in March. Pomeroy will interview participants involved in the California Department of Fish and Games artificial reef program, and in Senate Bill No. 241, introduced by Alpert. This Bill was planned to be voted on by the Senate Natural Resources Sub-committee on January 11, 1999.

In addition, McGinnis hired two undergraduate research assistants who will be responsible for gathering information on state artificial reef programs, Gulf state rigs to reef programs, and the National Fisheries Enhancement Act.

Moreover, McGinnis plans to submit a preproposal to CMI-MMS with Milton Love and colleagues that would build on this project's findings.

Fernandez and researcher, Sam Hitz, worked on organizing a meaningful format to present the results of the cost-benefit analysis in order to facilitate a clear comparison of alternatives. Since the costs and benefits are often in different units of measure, it is useful to prepare graphs, tables and accompanying text that explains the estimates we have derived and based on documents and personal communication with representatives from the oil industry, government agencies, and academic researchers. We are still gathering some remaining figures to verify initial estimates which we will probably finalize over the next quarter.

Future plans: Work will proceed as scheduled.

MMS Action Required: A no-cost extension for this study has been requested to June 2000.

Estimated Percentage of Budget Expended:

Project Year 1	35%
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Early Development of Fouling Communities on Offshore Oil Platforms

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

Major Accomplishments, October 1, 1999 - December 31, 1999

During the reporting period, spatial and temporal patterns in fouling community development were measured at depths of 6, 12, and 18 m on Platform Houchin using two types of settlement surfaces attached to frames and by vacuum sampling on conductor pipes. Tuffys were retrieved monthly at all depths. Tiles were retrieved after a two, four, and six month exposure time at all depths. Permanently marked 20 x 20 cm quadrats, representing different disturbance (scraping) regimes on the conductor pipes of Houchin, were photographed in November. Vacuum samples from these quadrats were collected at all depths two and four months following disturbance. A removal experiment using the anemone, *Anthopleura elegantissima*, was monitored at Houchin at a depth of 9 m and a removal experiment using the mussel, *Mytilus californianus*, was initiated at the same depth in November. Circumference measurements and video photoplots were taken at Platform Hogan at depths of 6-18 m. Faunal litterfall traps were deployed on Hogan at a depth of 18 m and the first monthly collection occurred in December. Processing continued of invertebrates on the tuffys and tiles and in the vacuum samples.

On the tiles, the greatest number of mussels, *Mytilus spp.*, (90%) were found at a depth of 6 m after an exposure time of 6 months. Individuals of the barnacle, *Megabalanus californicus*, were significantly larger and occurred in greater numbers at 6 m and after a 6 month exposure time when compared with the deeper sites and the shorter exposure times. On the tiles, across all depths and times of exposure, the major space occupiers were tunicates (30%), bryozoans (30%), and hydroids (12%). Overall, invertebrate cover decreased with depth and increased with length of exposure.

Future plans:

Deployment and retrieval of settlement surfaces, photography of permanent plots, and vacuum sampling of the platform structure will continue as described above. Circumference measurements will continue to be taken and the removal experiments will continue to be monitored. The faunal litterfall from the traps will be sampled monthly.

Estimated Percentage of Budget Expended:

Project Year 1	28%
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Application of Genetic Techniques for use Restoration of Surfgrass (Phyllospadix torreyi)

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

Major Accomplishments, October 1, 1999 - December 31, 1999

We have been focusing our efforts on our analysis of genetic diversity within and among populations of surfgrass. We have completed AFLP fingerprints, using six different primer pairs, on all of these samples. Currently, we are scoring these gels and have begun some preliminary analyses. We have found about 30 variable bands among samples across populations and therefore we expect to have nearly 200 variable bands to determine population differentiation. Thus far we have found genetic evidence for clonality on a limited scale. Clones appear to occur on a spatial scale on the order of 1-2 meters at most. In addition, we have found a great deal of variation within and among populations of surfgrass. Preliminary analyses based on a subset of our data indicate that populations are genetically differentiated from one another on the spatial scale of about 50 km. We have also begun to analyze our samples to determine the mating system of surfgrass. We have analyzed one population to date and found that all seeds were produced through sexual reproduction and not apomixis.

We have also been conducting genetic analyses to identify molecular markers for gender. So far we have screened approximately 70 Randomly Amplified Polymorphic DNA (RAPD) primers for sets of males and females. From these analyses we have identified one possible marker for gender. This marker has only been found in males thus far and never in females. However, not all males possess this marker making it of limited value for our purposes. We plan to determine if these patterns occur in larger samples and if so, we will then try several techniques to convert this marker into a consistent marker for gender.

Problems Encountered:

As reported earlier, we have found that extracting DNA from surfgrass is relatively difficult. We have tried a number of different techniques for DNA isolation and found that Qiagen DNeasy kits, with each sample processed twice, produces the largest quantity and highest quality DNA for AFLP analysis. Using this procedure we are now obtaining highly reproducible AFLP fingerprints.

Future plans:

Work will proceed as proposed.

Estimated Percentage of Budget Expended:

Project Year 1	40%
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