

UC SANTA BARBARA

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Researchers Receive Federal Funds to Study Marine Organisms and Potential Products on Oil Platforms

A treasure trove of biological material, in the array of marine organisms -- from starfish to mussels to sponges -- attached to oil platforms or living around them, will be studied intensively in a search for potential medicines and products, as a result of a cooperative agreement and grant from the U. S. Department of Interior, to be signed here September 27, as part of President Clinton's oceans initiative. The potential medicines include anti-cancer and anti-inflammation agents.

Only two universities are receiving these awards, the University of California, Santa Barbara and Louisiana State University, since these institutions are national leaders in this type of research. Each school will receive \$500,000, to be matched by non-federal funds.

According to the researchers, many platform-dwelling species have compounds that could be used in medicine, industry and food, by applying biotechnology.

In waters off the coast of California, platforms provide artificial habitat for over 50 species of algae and invertebrates, and some of these grow at very fast rates. For example, mussels and goose barnacles on oil platforms in the region grow at rates equal to or higher than the highest reported anywhere else in the world.

Of the 27 oil platforms off the coast of California, all are producing oil. This study will analyze marine life around eight platforms in the Santa Barbara channel, located offshore from Carpinteria to Point Conception.

An added plus to this research is that the harvesting of these organisms would not disturb naturally-occurring reef systems; in fact, organisms could be taken as the platforms are cleaned. Some species are already harvested for food. "For example, in the Southern California Bight, mussels for human consumption are harvested on a sustained basis from offshore platforms, suggesting that platform species with desired natural products also could be 'cultured' with minimum impacts on natural reefs," said Russell Schmitt, project coordinator and professor at UCSB.

At UCSB the research is divided into three components: community and population ecology; population genetics and natal sources; and natural products pharmacology. Careful research along these lines is especially important, given the diversity of species in the marine environment.

Community and population ecology (a team headed by Jenifer Dugan and Mark Page, both assistant research biologists with UCSB's Marine Science Institute) is the effort to quantify the distribution and abundance of organisms with potential products of interest for biotechnology. They will study the factors that affect those species and will look at the factors influencing population dynamics and community structure. They will gather the organisms to be used in the other two areas of study.

The population genetics and natal sources team (headed by Scott Hodges, professor of biology and Steve Gaines, director of UCSB's Marine Science Institute and professor of biology) will study the degree of population differentiation of species with desired products between platforms and natural reefs and among platforms.

They will estimate the spatial extent over which platform populations are connected to other local populations via gene flow or dispersal. It is important to establish that organisms on platforms are genetically similar to their counterparts on natural reefs (and therefore have similar natural product properties) and could be harvested in a sustainable way.

DNA sequencing will be done for a suite of species that differ in their potential for long-distance dispersal. A second promising approach, called 'elemental fingerprinting' (see below)* will also be used to trace the source populations of the organisms that live on platforms. Using this technique, scientists can determine

whether larvae that 'settle' at platforms are the offspring of local adults there, or were produced elsewhere. "By sampling potential source populations directly, we hope to be able to specify the actual points of origin for organisms living on platforms," said Schmitt. "This has never been achieved before, and has tremendous implications for marine ecology in general and the sustainable harvest of desired species in particular," said France Cordova, vice chancellor for research at UCSB.

Natural products pharmacology (a team headed by Robert S. Jacobs, professor of pharmacology, and Leslie Wilson, professor of biochemistry and pharmacology) has three components. First, they will search existing data bases to determine whether species known to occur on Pacific offshore platforms are already known to contain desired natural products. Any matches will prompt further research. Then up to 50 extracts from species growing on oil platforms in the Santa Barbara Channel and the Santa Maria Basin will be investigated for specific compounds with potential wound-healing, anti-inflammation and anti-cancer activity (for example, prostaglandins, and compounds with taxol-like effects.) Finally, the mechanism of action with specific classes of natural products found in species from the platforms will be studied. The grant money comes through the U.S. Department of Interior's Minerals Management Service, the federal agency that manages the nation's natural gas, oil, and other mineral resources on the off-shore continental shelf (OCS). It collects, accounts for and disburses about \$4 billion yearly in revenues from offshore federal mineral leases and from onshore mineral leases on federal and Indian lands.

Editors: underwater b-roll of platform-dwelling organisms is available. Slides are available before Sept. 27 by e-mail, and after that they will be on the UCSB website.

The MMS's website address is: <http://www.mms.gov>*(SEE BELOW ON ENVIRONMENTAL SIGNATURE)

*Environmental Signature or Elemental Fingerprinting:

To answer many questions, it is important to find out where a fish was spawned and where it 'settled.' Using a new technology to analyze a sort of natural flight recorder inside the fish, scientists are able to pin down its history. Did it wander in from afar or is it from the next platform over? Many areas of research including where to locate marine reserves can be aided by the new research.

Elemental fingerprinting of organisms is an exciting new approach adapted at UCSB to trace the organism's history. Platform organisms will be collected and their

'elemental fingerprints' will be read and compared with those from several coastal environments spread throughout the region.

As a fish larva grows it deposits a new layer of calcium carbonate on the otolith (ear bone) for each day of life. The thickness of any particular layer corresponds to daily growth. These layers can be counted and measured under a microscope, giving an accurate picture of past age and growth. More importantly, trace elements present in the surrounding seawater on any particular day are incorporated into the calcium carbonate layer, leaving an environmental signature or elemental fingerprint. Otoliths are quite small, about the size of a grain of sand, but they can be accurately analyzed for trace metals using highly sensitive mass spectrometers that can detect elements in the parts per trillion range or better. Further resolution is obtained by subsampling the otolith with a small but powerful laser.

In invertebrate species, it is the statolith that is analyzed.

The technique will be applied in a highly cost-effective manner by working with Robert Warner, UCSB professor of biology, and UCSB's PISCO project (a multi-institution endeavor), which is funded by the private David and Lucile Packard Foundation. With the mass spectrometer that has just been purchased using funds from the Packard Foundation, UCSB scientists will be able to sample with a resolution between 2 and 4 days.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.