OS22F HC: 314 Tuesday 1330h

Reforming Education in the Ocean Sciences for All Citizens III

Presiding: **D A McManus,** University of Washington**; G Matsumoto,** Monterey Bay Aquarium Research Institute

OS22F-01 1330h INVITED

How to inspire the interest of students and teachers in the ocean sciences

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After almost 30 years working in the education field as a teacher, department head, district coordinator, I am currently heading up the South Carolina Governor's School for Science and Mathematics (www.gssm.k12.sc.us) student research program and its middle school initiative. I have also been honored by the National Science Teachers Association (www.nsta.org) where I am the President-Elect. I will provide some general and specific information on how I have been able to inspire the interest of both students and teachers (and administrators) in ocean sciences. I will provide some suggestions about different methods and techniques for reaching out to an ever growing and diverse audience.

OS22F-02 1400h

Project Oceanography - A National Program for Ocean Scientist Participation in the Education of All Citizens

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Meeting the challenge to widen the impact of ocean research requires both encouraging greater participation by ocean scientists and hugely expanding the potential audience. Project Oceanography, a weekly educational television program for middle school students, was conceived in 1996 as an attempt to expose a wider audience to the wealth of ocean science content and activities developed for our summer program, the Oceanography Camp for Girls. Since 1996, more than 70 ocean scientists from 30 institutions have presented their current research results to students in 42 states and 14 foreign countries via Project Oceanography broadcasts. Distribution of programs via satellite and rebroadcast by the 78 registered cable television stations further expands potential viewership to the general public.

The Project Oceanography format has evolved to meet the needs of the three participant groups - students, teachers, and science hosts. Foremost with students is attracting and maintaining their interest. Teachers need programs which align with their curriculum and are easy to implement in the classroom. For the science hosts, the issue is minimizing time and effort required of them for program development. A well-trained support staff, plug-and-play program elements, and effective guidelines for participating scientists have contributed to the survival and proliferation of Project Oceanography.

We have recently demonstrated that the program format is ready for distribution to the community by successful replication of Project Oceanography programs by UCLA and USM. The first live broadcasts from a site other than USF are anticipated in January 2002. This paper will focus on evaluating several performance indicators for Project Oceanography, including products, partnerships, and participants.

URL: http://www.marine.usf.edu/pjocean

OS22F-03 1415h

KidScience, Science Distance Learning Style

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KidScience is a live interactive distance learning television program that takes scientists into the classroom and students out in the field. Scientists dont have time to visit classrooms and schools are very limited to where they can take field trips. KidScience offers students the opportunity to interact with scientists and visit places that most of us will never have the opportunity to go. Programming focuses on science content, features guest scientists, pre-taped video segments, and students to demonstrate activities and experiments and to interact with the scientists. Programs are delivered by satellite across the mainland and throughout Hawaii and Micronesia. Students can interact with scientists via an interactive web site.

Technology has enabled students to study the ocean in creative ways. Oceanographers can broadcast live from underwater, and students can control ROVs via the internet. Live internet cameras are used to observe research projects. Submersibles are used to explore and share the vents and life forms found at Loihii, Hawaiis newest growing Island, and live broadcast from boats allow us all to go whale watching. Scientists on research ships at sea can talk to the students by phone and send images over the internet. Pole cameras and finger cams can give an up close and personal view of underwater environments. All of these things can be included in distance learning programs. If you cant be there in person, visiting via technology is the next best way. Students need to experience things to understand them.

URL: http://www.kidscience.net

OS22F-04 1430h

A Community Education Program in Marine Science for Prince William Sound, Alaska: Youth Area Watch

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The Youth Area Watch is a multi-district, grades 9-12, marine science education program in the Prince William Sound area of Alaska. This area was affected by the 1989 Exxon Valdez oil spill . As a result, this program links professional marine scientists studying the effects of the catastrophe with local educators and students who receive training in sampling or taking observations for the investigators. Year-long monitoring leads to data analysis and reports mentored by the professionals and posted by the students on a website, www.micronet.net/users/ȳaw/. Current projects include restoration, water sampling, harbor seal biosampling, mussel sampling, killer whale identification and surf scoter counts. YAW has proven helpful in increasing community awareness about what marine scientists do and why. It is proposed that it link with the Sea-Air-Land-Modeling-and Observing Network , SALMON , Project at the University of Alaska/Fairbanks which will provide weather and marine forecasts for this area and continue research into local ocean dynamics. This connection should lead to development of curriculum materials on ocean physics at this level which are rare. Audio programs about the sciences involved will be an important, hitherto neglected, component of this outreach effort

URL: http://www.micronet.net/users/˜yaw/

OS22F-05 1445h

Enhancing Undergraduate Education in Oceanography Through Partnership With a Seawater Aquarium

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A multi-year collaboration between the Richard Stockton College of New Jersey and the New Jersey State Aquarium (NJSA) has resulted in the development of an undergraduate marine science course where seawater aquaria are used as microcosms of oceanic environments. Student learning in the course takes place through demonstrations, use and development of computer models in an electronic classroom. Some of the topics covered include maintenance of pH and alkalinity, nitrate build-up and denitrification, and disinfection byproducts. Data from NJSA and other seawater facilities are used to develop and test the students' models. As a result, students in the course gain a first-hand experience with important concepts in oceanography, such as the mass and charge balance of elements in solution, residence times, the difference between the thermodynamic and the kinetic approach, and analytical vs. numerical solutions to computational problems. In the last part of the course, fluxes of carbon and nitrogen in aquarium facilities are compared to biogeochemical cycles of these elements in the ocean.

OS22F-06 1520h INVITED

Innovative Approaches for Non-Traditional Students: Increasing the Recruitment and retention of Under-Represented Undergraduate and Graduate Students in the Aquatic Sciences.

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The latest census results reveal a major shift in the ethnic composition of the U.S. population. The nation's population is becoming increasingly diverse. However this trend is not so evident among the community of scientists in general and, aquatic scientists in particular. Minority students account for a third fewer of the BS or BA degrees in the sciences then predicted by their enrollment in college. While African Americans, Hispanic Americans, and Native Americans still constitute only a tiny fraction of the aquatic science community, there are several programs with successful track records of producing minority undergraduate aquatic scientists. I will examine common and unique features of these programs that have led to their successes. Lessons learned from these and allied efforts will be used to explore a model for a Ph.D. program designed to attract and graduate minority students.

OS22F-07 1550h

Increasing minority participation in the marine sciences through the Minorities in Marine Science Undergraduate Program

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The Minorities in Marine Science Undergraduate Program (MIMSUP) was developed to increase the participation of minority students in the marine sciences. Selected students spend two quarters intensively studying marine science at the Shannon Point Marine Center (Western Washington University). The program of study includes formal coursework, a math tutorial program, instrument workshops, literature discussion groups, and visits to a wide variety of potential employers. Students engage in research and present their results at regional and national meetings of scientific societies. Program participants also do marine outreach teaching in local K-12 classrooms. Now in its eleventh year, MIMSUP has been very successful in educating undergraduate students about the marine sciences. Eighty-four of 87 program alumni have completed, or are currently pursuing baccalaureate degrees. Thirty-one students who have completed undergraduate degrees have continued in advanced degree programs (5 in Ph.D. programs, 21 in M.S. programs, 6 in professional degree programs). Many of the graduates have entered marine or related environmental professions. The program is reaching students who may not have otherwise pursued advanced education or considered a marine science career.

URL: http://www.wwu.edu/∼mimsup

OS22F-08 1605h

Minority Recruitment and Retention in a Coastal State: The UNO Example

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The result of the Y2K census demonstrates that significant proportions of persons under-represented in oceanography live in coastal states, especially those of the Gulf of Mexico. The failure of marine science programs in these states to recruit and retain students of color results from many factors. We believe that the largest of these factors is student access and information about these fields of study as professions.

In this talk, we use our program in recruitment and retention of minority students, especially African American students, in the Department of Geology and Geophysics. Our twenty-eight year program is recognized as among the most successful in recruiting, retaining, and graduating minority students in geosciences in the United States. Our success comes form our holistic approach to improving diversity which includes a) recognition of the demographics of the local population we wish to attract into our program, b) working with local school boards to improve earth science education in the schools, c) keeping active with state and local programs and clubs for teachers of earth science, and d) a summer field experience for high school students to the Rocky Mountains. Finally, a key aspect of our modern program is the support of local industry which provides scholarships and other forms of support for our students.

OS22F-09 1620h

Oceans to Classrooms: Infusing the Standards with Ocean Science Research

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The Marine Science Institute (MSI) at the University of California, Santa Barbara has developed a new educational outreach program entitled, Oceans to Classrooms (OtC). The primary mission of UC outreach programs is to increase the number of underrepresented and low-income students attending the UC. MSI aims to achieve this goal by stimulating student interest in science, specifically the ocean sciences, so that students are motivated to improve their academic performance, become UC eligible, and pursue the study of ocean sciences. OtC capitalizes on the resources available through MSIs scientifically diverse research group to infuse science taught in grades 68 with a broad range of ocean science concepts and cutting-edge research. OtC facilitates interactions between ocean science researchers, teachers and students through organizing professional development workshops for teachers, developing new ocean science research-based curriculum, and coordinating student field trips to MSI ocean science labs and field sites. All of these efforts focus on using recent ocean science research to create hands-on activities based on the scientific method, and to teach the required state standards. Here, we report the feedback from teachers participating in OtC. We also discuss why simply offering ocean science-based curriculum and student visits to labs, etc. is not an entirely adequate approach. To effectively infuse the ocean sciences into K12 curriculum, the teachers must be first transformed. Commonly, particularly in the low-income serving schools, pre 9th-grade teachers lack the resources, the confidence, and the motivation to develop or use new curriculum in their classrooms. We will discuss mechanisms to overcome these psychological and logistical impediments.

OS22F-10 1635h

"Young Women in Science:" Summer Science Programs for Middle and High School Girls

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Encouraging young womens interest in science has been the motivation for developing summer science programs for both middle and high school girls at the University of Southern California Sea Grant Program in conjunction with the USC Wrigley Institute of Environmental Studies and the Office of the Provost. While it is generally acknowledged that middle school is a key time to engage students in science, especially girls, it is also important to maintain and encourage that interest during the students high school years. Based on that idea and the demand by the young women who had completed the middle school programs, we piloted a summer science program for high school girls in 2001. These programs held at the Wrigley Marine Science Center on Catalina Island, offer hands-on lab and field activities that allow the girls to pursue a wide range of topics. The theme of "fun and learning in science" is housed in a larger context of "Women in Science." Female research scientists, graduate students, and teachers, as well as Sea Grant staff interact with the girls, who are given the opportunity to see women in a variety of marine related careers in marine policy, research science, education, and diving safety. Program development, challenges, and results of these programs will be addressed.

URL: http://www.usc.edu/go/seagrant/education

OS22G HC: 317 A Tuesday 1330h

Hyperspectral Remote Sensing of Nearshore and Open Ocean Environments II

Presiding: **C L Leonard,** Science and Technology Intl.**; J Campbell,** University of New Hampshire

OS22G-01 1330h

Hyperspectral Imaging of the Coastal Ocean

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Compared to the open ocean the coastal ocean is a far more complex optical environment. There is a much wider range of water column optical properties due to runoff from land, high levels of phytoplankton growth, sediment resuspension and other processes. An additional level of complexity is added when the bottom is visible through the variable water column. Resolving the bottom features as viewed through the complex and varying optical properties of the water column is the central problem in coastal remote sensing which requires hyperspectral imaging. The Naval Research Laboratory has a focussed program to develop hyperspectral imagers and the algorithms for processing that data for the coastal ocean. Here I report recent improvements in the Ocean Portable Hyperspectral Imager for Low Light Spectroscopy (Ocean PHILLS) aircraft hyperspectral sensor and present data collected during the July 2001 Hyperspectral Coastal Ocean Dynamics Experiment (HyCODE) at Tuckerton, NJ.

OS22G-02 1345h

Hyperspectral Remote Sensing of Nearshore Kelp Beds

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Hyperspectral remote sensing technology has proven to be a powerful tool in a broad array of applications including ocean sciences. Passive hyperspectral remote sensing of surface and/or subsurface objects or phenomena yields a wealth of high resolution spectral and spatial information useful for detection, identification and classification on multiple levels. One specific application for this technology is the detection of kelp beds in coastal waters. The distinct absorption and reflection features exhibited by kelp can be sensed by the narrow contiguous bands of the Advanced Airborne Hyperspectral Imaging System (AAHIS) 3, developed by Science and Technology International (STI). Analyzing the hyperspectral data cubes using algorithms such as principal component analysis and spectral angle mapping allow for kelp detection and mapping. An STI data set collected over the coastal regions in Oceanside, California in March 2001 will be used to demonstrate these methods.

OS22G-03 1400h

A new method for the determination of phytoplankton pigments from spectral in vivo light absorption.

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Multivariate regression models have made it possible to estimate pigment concentrations and phytoplankton abundance from spectral in vivo light absorption. Models were derived for both phytoplankton monocultures and natural samples differing significantly with respect to pigment composition, concentration and cell size. Model performance was evaluated against the conventionally used Gaussian decomposition method. The new method proved to be more accurate and sensitive at deriving pigment content than the Gaussian method. With the multivariate technique it was also possible to determine the concentration of many accessory pigments and the dominant phytoplankton classes. The new method presented here is more sensitive and suitable for analysing the spectral fingerprints of phytoplankton pigments than the Gaussian method.

URL: http://www.dmu.dk/1_om_dmu/2_afdelinger/3_hav/4_projects/5_bio_optics/

OS22G-04 1415h

Subpixel Linear Mixing Within a Coral Reef Environment Based on in situ Hyperspectral Measurements

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It is often necessary to assume a relatively homogeneous benthic cover within a remotely sensed pixel when attempting to identify bottom type in a coral reef environment. In reality, however, with the benthic complexity common on a coral reef, there will always be mixing within a pixel given the spatial resolution of contemporary satellite imagery. It therefore becomes important to determine how spectral components of a pixel combine to result in one integrated pixel value. To address this issue, pure endmember high spectral resolution measurements were taken in Buck Island Marine Park, off St. Croix, U.S. Virgin Islands. Linear spectral mixing was used with these endmember spectra (coral, sand, grass, bleached coral, and benthic algae) to examine the integrated pixel signals. Results indicate that when sand is a component of the mixed spectra, there is a notable increase in magnitude of reflectance, even at only 25% sand cover. Cluster analyses of end member spectra and mixed spectra indicate that a relatively small sand component within a mixed pixel will effectively dominate the pixels spectral signal. The pixel spectral signal lacks similarity to other endmembers present, retaining spectral characteristics specific to sand.

OS22G-05 1430h

Shape Analysis of Hyperspectral Bottom Reflectance Data: Application to Remote Sensing Classification of Benthic Habitats

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