Annual Report for Period: 10/2008 - 09/2009
Submitted on: 06/29/2009
Principal Investigator: Duguay, Linda E.
Award ID: 0753224
Organization: U of Southern California
Submitted By:
Duguay, Linda - Principal Investigator
Title:
COSEE-West, Community-based Ocean Sciences Education

Project Participants

Senior Personnel

Name: Duguay, Linda

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Duguay is the PI for the entire COSEE-West project and the PI at USC for the USC COSEE-West program. She is responsible for overall coordination for the program and administrative oversight for award. She serves as the COSEE-West representative to the COSEE council. She was elected Chair elect of the COSEE-Council in May 2009 and has agreed to serve as Chair of the Decadal Review Committee. She attended the May 2009 COSEE Council Meeting and will attend the COSEE Council meeting at NMEA in Monterey in late June/early July. She hosted and coordinated the spring COSEE network meeting in late April 2008 on Santa Catalina Island. She participates in COSEE-West advisory meetings and workshops. She also recruits scientists to participate in COSEE-West lectures and workshop activities.

Name: Michaels, Anthony

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Michaels is Co-PI for the USC COSEE-West grant. He provides advice and science content for COSEE, through participation in meetings and lectures. He is currently on leave from the USC to pursue an environmental business venture. Dr. Duguay COSEE-West PI continues to consult with him on various COSEE-West issues and programs.

Name: Lemus, Judith

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Lemus is a Co-PI for the USC COSEE-West grant. She was the original PI for the award at USC but has since moved to the University of Hawaii in January 2008. In 2008-2009, she participated in the COSEE network meeting in May 2009. She represented COSEE-West at the PACON meeting in Hawaii in May 2008 and presented a paper on the concept and results of COSEE-West's online workshop activities. She will be writing up her presentation for submission to an educational Journal.

Name: Hamner, William

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Hamner retired from UCLA in Fall of 2008 and moved to Alabama. He remains involved in COSEE-West is a consultant and metnor. He was the PI for the UCLA COSEE-West grant and co-PI for the joint UCLA/USC COSEE-West program. He provides ocean science content for COSEE, through lectures, both in person and for online courses, and oversight of workshop and marine science curriculum development. He ensures that ocean sciences activities presented through COSEE accurately reflect the science content presented in lectures and that participants understand the concepts behind those activities.

Name: Fong, Peggy

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Fong is a Co-PI of the COSEE-West program, funded by the UCLA COSEE-West grant. She is directly involved with COSEE-West partners and participants through her engagement as a lecturer, workshop leader, and mentor. She contributes to the ocean science content of the COSEE-West program. Dr. Fong presented a lecture on her research in Fall 2008 and participated in the workshop discussion followoing her lecture. She attended the COSEE Network meeting in May 2009. Dr. Fong helped design and direct the COSEE-West online course, spring 2008, in which Dr. Fong, other UCLA teaching faculty, undergraduate and graduate students participating in a UCLA Marine Biology Quarter in French Polynesia interacted with K-12 teachers online via

the College of Exploration host site.

Name: Tuddenham, Peter

Worked for more than 160 Hours: Yes

Contribution to Project:

Mr. Tuddenham is the PI for the College of Exploration COSEE-West grant and co-PI for the COSEE West program. He provides management of all online learning programs for the ocean science content in lectures, workshops, and collaborative research programs. He provides technical leadership and guidance and its application to specific pedagogies for ocean science education excellence. He is overall manager of the COSEE West Online Lecture Hall containing streaming media copies of all presentations. Along with others he ensures face to face workshops and lectures are captured on video in order to make them available on the web.

Name: O'Kane Bishop, Tina

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Bishop is the Academic Director for the College of Exploration and she played a key role in designing and managing COSEE-West's spring 2008 online workshop. She helped establish the workshop format, goals and requirements, striving to ensure that sound pedagogical principles were addressed. She worked with the evaluator to incorporate and investigate research questions to assess this workshop as a new model for collaboration between undergraduate students and K-12 teachers. She coordinated online workshop activities and served as a liaison with COSEE-West staff, UCLA faculty, undergraduate students, graduate students, teacher mentors, and teacher mentees.

Post-doc

Graduate Student

Name: Greene, Lauri

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Greene is a doctoral candidate in the Dept. of Ecology and Evolutionary Biology at UCLA. In the winter 2008 quarter Ms. Greene provided secretarial assistance, helped with the logistis of COSEE-West events and assisted in selecting and presenting marine science activities to K-12 teachers. Ms. Green was employed on the UCLA COSEE-West at 50% time.

Name: Kane, Tonya

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Kane is a doctoral candidate in the Dept. of Ecology and Evolutionary Biology at UCLA. In the spring quarter and summer 2008 Ms. Kane provided secretarial assistance, helped with the logistics of COSEE-West events and assisted in selecting and presenting marine science activities to K-12 teachers. Ms. Kane was employed on the UCLA COSEE-West at 50% time.

Name: Clausing, Rachel

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Clausing is a doctoral candidate in the Dept. of Ecology and Evolutionary Biology at UCLA. She participated as COSEE-West liaison for the UCLA Marine Biology Quarter in French Polynesia, coordinating and overseeing contributions of the undergraduate students to the COSEE-West online course, as well as contributing herself. COSEE-West UCLA covered Ms. Clausing's travel costs.

Undergraduate Student

Technician, Programmer

Other Participant

Name: Hamner, Peggy

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Hamner is the UCLA co-Director of the USC/UCLA COSEE-West program. She provides information to participant teachers that relates to topics presented by invited speakers. With USC co-Director L. Witley, Ms. Hamner oversees program logistics, e.g. arrangements for lecturers, scheduling and publicizing COSEE-West events, coordinating professional development with Master Teachers and school district administrators, handling all UCLA budget matters. She manages the listserv OceanList, through which COSEE-West and other ocean sciences information is disseminated electronically to almost 600 educators in and beyond the Los Angeles area. She works with other staff, presenters, and participants in preparing thematic and articulated lesson plans both for teacher-participants and for broader dissemination. She is the alternate COSEE-West representative to the National COSEE Council. In 2008 and 2009, she retired from UCLA and moved to Alabama. She remains active as the oversight for the Oceanlist serve and as a consultant to the COSEE-West team.

Name: Whitley, Lyndell

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Whitley, is the USC co-Director of the USC/UCLA COSEE-West programs. UCLA co-Director of the USC/UCLA COSEE-West program. She provides information to participant teachers that relates to topics presented by invited speakers. With UCLA co-Director P. Hamner, Ms. Whitley oversees program logistics, e.g. arrangements for lecturers, scheduling and publicizing COSEE-West events, coordinating professional development with Master Teachers and school district administrators, handling all UCLA budget matters. She works with other staff, presenters, and participants in preparing thematic and articulated lesson plans both for teacher-participants and for broader dissemination.

Name: Sitkoff, Seymour

Worked for more than 160 Hours: Yes

Contribution to Project:

Dr. Sitkoff, a retired Science Specialist for LAUSD, coordinated COSEE-West implementation with administrators of Los Angeles County school districts, worked with Master Teachers as they prepared COSEE-related materials for classroom use, and developed and oversaw in-service courses provided by school districts. He ensured that appropriate National Science Standards and California Science, Math, English/Language Arts, and History/Social Studies Standards were incorporated into all materials provided to teachers in the program. Dr. Sitkoff retired from COSEE-West in January 2008.

Name: Kwon, Patricia

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Kwon evaluates all components of COSEE-West, e.g. presentations and workshops, interactions of COSEE-staff with partners and advisory members, effectiveness of workshops presented by Master Teachers to their colleagues, impact of the program within schools. She uses instruments that indicate how well the activities prescribed in the proposal are implemented and how effective these activities are in achieving the goals of the program. Ms. Kwon also participates in evaluation of the national COSEE Network.

Name: Noda, Gwen

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Noda, Program Manager, COSEE-West, UCLA, maintains the participant database, tracking contact information and event participation. She disseminates COSEE-West event publicity and performs clerical and secretarial tasks. She identifies marine science content and exercises, creates reference and support materials provided to participants in lectures and workshops, and presents marine science activities at K-12 educators' workshops. Ms. Noda completed her Master's thesis under the direction of William Hamner in the summer of 2007 and is assuming increasing leadership responsibilities for COSEE-West.

Name: Lee, Jane

Worked for more than 160 Hours: Yes

Contribution to Project:

Ms. Lee, Program Manager, COSEE-West, USC, works closely with Gwen Noda at UCLA on all COSSEE activities including the participant database, tracking contact information and event participation. She disseminates COSEE-West event publicity and performs clerical and secretarial tasks. She identifies marine science content and exercises, creates reference and support materials provided to participants in lectures and workshops, and presents marine science activities at K-12 educators' workshops. Ms. Lee

completed her Master's thesis under the direction of William Hamner in the summer of 2007. She assumes considerable responsibility for USC coordination with UCLA and for teacher workshop activities. She wrote an outstanding newsletter article on COSEE-West for the COSEE program newsletter and helped Dr. Duguay with support and coordination of the COSEE network meeting on Catalina.

Name: Chilton, Linda

Worked for more than 160 Hours: Yes

Contribution to Project:

Linda Chilton, was hired in the spring of 2009 by the USC Sea Grant program to replace Lynne Whitley who has become education coordinator for the Wrigley Institute for Environmental Studies. Ms. Chilton serves as a science education specialist for the COSEE-West program. She participates in lecture/workshop activities both in person and online. She works with the Education Advisory Board on various activities aimed at improving COSEE-West programs and activities.

Research Experience for Undergraduates

Organizational Partners

Los Angeles Unified School District

In Year 1 and 2 LAUSD provided venues for organizational meetings and advertised COSEE-West events; worked with COSEE-West to identify local school district partners; provided equipment (laptop computers, dissecting microscopes) for professional development training sessions. In Year 2 Marine del Rey Middle School in LAUSD Local District 3 hosted another 5 day workshop for teachers advancing content knowledge in ocean sciences for 7th grade California Science standards. This workshop built on the 'Introduction to Marine Science Seminar' offered in Year 1 in which Dr. Bill Hamner provided content lectures and COSEE-West Master Teachers presented activities. LAUSD teachers and administrators are members of the COSEE-West Education Advisory Committee. LAUSD teachers comprise the majority of COSEE-West's teacher-participants and Master Teachers.

Aquarium of the Pacific Corporation

The President of the Aquarium of the Pacific (AOP) in Long Beach is strongly supportive of COSEE-West efforts. The AOP involves COSEE-West staff in marine science policy and ocean literacy meetings held at its facility. The AOP admits COSEE-West participants to its own public marine science events at a discounted rate. Educational staff attend COSEE-West lectures and workshops, and are members of the COSEE-West Education Advisory Committee. USC graduate students have helped AOP develop a special exhibit on marine plankton as a result of a exhibitry workshop that was held the previous year ? year 5 of the first COSEE-West Program. USC and AOP also partner on an award from NSF EHR on Communicating Ocean Sciences to Informal Audiences (COSIA). The project involved a USC senior undergraduate/graduate level course which is co-taught by USC faculty and AOP staff and involved active engagement of the students at AOP with docents and visitors. The course was offered in Spring 2007, Fall 2008 and is scheduled to be offered again in the 2009-2010 academic year.

Cabrillo Marine Aquarium, City of Los Angeles Dept Rec & Parks

COSEE-West continues its strong relationship with Cabrillo Marine Aquarium co-hosting lectures and workshops together. In May 2009 CMA presented its Suzanne Lawrenz-Miller Education Award to COSEE-West at its annual Grant Grunion Gala in recognition of COSEE-West's service to the education community in the greater Los Angeles area. In year 1 the Cabrillo Marine Aquarium (CMA) in San Pedro CA and COSEE-West co-hosted 1 public event at the Aquarium, a marine documentary film presentation with an educators' component. CMA co-hosted a workshop in June 2008 that included an ocean sciences research lecture open to the public and activities for K-12 educators. A 3rd partner organization, the Channel Islands Marine Sanctuary, also co-hosted this workshop. Both CMA & Sanctuary education staff presented the activities. CMA provided both a venue and professional development activities for the COSEE-West Ocean Observatory Institute in August '08 and will do so again in August 2009. CMA advertises its events on OceanList. CMA educators attend COSEE-West lectures and workshops and they are members of the COSEE-West Education Advisory Committee.

Edison International

Edison International supports the Edison Challenge through a grant to USC ? Wrigley Institute. This was the third year of the Challenge. The program is modeled after the QuikSCience program but with an additional professional development component for teachers based on the COSEE-West teacher workshop model. The Edison Challenge is advertised through the COSEE-West list server, Oceanlist, and many COSEE-West associated teachers participate. A total of 61 teams from southern California participated. Wining 2009 teams traveled to the Sierra Nevada Mountains and to the Wrigley Marine Science Center on Catalina Island.

QuikSilver

The QuikSilver corporation/foundation supports the QuikSCience Challenge through a grant to USC. The Challenge is a competition for middle and high school students who work with their teachers to develop innovative ocean science curricula for use in the classroom. In 2008, the QuikSCience Challenge established a program in the New York-New Jersey-Connecticut tri-state regions in cooperation with COSEE-NOW led by Lisl Hotaling of the Beacon Institute. In 2009, Quiksilver Foundation renewed its commitment with a new 2 year, $400,000 award to USC Wrigley Institute for Environmental Studies.

Santa Monica Pier Aquarium

The Santa Monica Pier Aquarium (SMPA) is managed by Heal the Bay, a nonprofit agency that promotes environmental action to improve the health of coastal ecosystems, particularly Santa Monica Bay. In Year 2, COSEE-West and SMPA co-hosted a servies of ocean science lectures. In Year 1 COSEE-West and SMPA co-hosted a series of 4 ocean sciences lectures for the public and began planning a 2nd series for 2008-'09. SMPA advertises its events on OceanList. SMPA educators are members of the COSEE-West Education Advisory Committee. UCLA and USC COSEE-West staff are on the Education Advisory Board of the SMPA.

Other Collaborators or Contacts

COLLABORATING ORGANIZATIONS

Channel Islands Marine Sanctuary
The Sanctuary advertises its 'From shore to Sea' lecture series on OceanList, the COSEE-West listerv for marine sciences educators. Sanctuary educators collaborated in the June '08 workshop at CMA, training middle and high school teachers in protocols for collecting rocky intertidal and beach data developed by the National Marine Sanctuarys program LiMPETS ('Long-term Monitoring Program and Experiential Training for Students').

Jet Propulsion Laboratory
The Jet Propulsion Laboratory (JPL) in Pasadena, CA provided the venue for 1 COSEE-west K-12 educators workshop in Year 1. A JPL scientist presented his research and JPL educators provided related activities and tour of the grounds. JPL brought in COSEE-West as a partner in a Climate Day event for the East San Gabriel Unified school District. JPL provided a venue, a lecture by a JPL scientist, and professional development activities for the COSEE-West Ocean Observatory Institute in August '08 and will do so again in August 09.

Los Angeles Co. Natural History Museum
Ties to the Natural History Museum have been increased in Year 2 through contact with Dr. Carl Selkin, the Vice-President for Education. The Museum has agreed to make it SEA Mobile available to COSEE-West workshops and programs. In Year 1 the LACNHM included COSEE-West participants as special guests at a lecture by Jean Michel Couteau. The museum also provided a room, A/V support, and refreshments for our Education Advisory Committee meetings. In addition, LACNHM publicized COSEE-West lectures in its newsletter, 'The Naturalist', which is distributed to over 20,000 people and on its website. Educational staff attend COSEE-West lectures and workshops, and they are members of the COSEE-West Education Advisory Committee.

NOAA Office of Exploration
In Year 1 staff of the NOAA Office of Exploration worked with COSEE-West co-PI W. Hamner, P. Hamner and G. Noda to develop a web site and lesson plans for a Signature Expedition to the Celebes Sea in Oct. 2007. Results of this collaboration have been shared with COSEE-west participants in workshops and with other educators, students, and the public through the Office of Exploration's Celebes Sea Expedition web site and Ocean Explorer workshops.

Ocean Institute
The Ocean Institute is an informal science center in Dana Point, California. In Year 1 the OI provided the venue for COSEE-West's Informal Science Center retreat and its education staff assisted with activities at this event. OI provided both a venue and professional development activities for the COSEE-West Ocean Observatory Institute in August '08 and will do so again in August 09. OI advertises its events on OceanList.

Southwest Marine Educators Association (SWMEA)
In 2007 SWMEA and COSEE-West collaborated to create a marine science strand of short courses, field courses and workshops at the California Teachers Association Conference, October 2007. SWMEA helped recruit presenters in Year 5 and shared in supporting presentations at the Conference.

Guest lecturers in Year 2. see Appendix 1 of Activities for a detailed listing.

Dr. Satie Airame, University of California Santa Barbara*
Dr. Chris Lowe, California State University Long Beach*
Dr. Yi Chao, Jet Propulsion Laboratory*
Dr. Eric Rignot, Jet Propulsion Laboratory*
Dr. Peggy Fong, University of California Los Angeles
Dr. William Hamner, University of California Los Angeles
Susan Zaleski, University of Southern California Sea Grant
Dr. Josh Willis, Jet Propulsion Laboratory
Dr. Sabrina Drill, University of California Cooperative Extension
Dr. Carolynn Culver, University of California Cooperative Extension
Dr. Steven Murray, California State University Fullerton
Dr. Nina Karnovsky, Pomona College
Heather Nevill, DVM, International Bird Rescue Research Center
Dr. James Fawcett, University of Southern California***
Dr. John Dorsey, Loyola Marymount University***
Dr. Karen Martin, Pepperdine University***
Dr. Patrick Krug, California State University Los Angeles***
Lauri Green, University of California Los Angeles***
Julie Bursek, Channel Islands National Marine Sanctuary***
Kathy Omura, Natural History Museum***
Dr. Doug Capone, University of Southern California***
Dr. Burt Jones, University of Southern California**
Dr. Rebecca Shipe, University of California Los Angeles**

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* online workshop
** OOS workshop
*** lecture seminar at Marina del Rey

Guest lecturers in Year 1.

Dr. Peter Adam- Lecturer, UCLA
Dr. Douglas Capone - Professor, USC
Ms. Ivona Cetinic ? Doctoral Student at USC**
Ms. Dreux Chapelle ? Doctoral Student at WHOI, visiting student at USC
Dr. Peggy Fong - Associate Professor, UCLA *
Dr. Mark Gold - President,Heal the Bay
Dr. William Hamner - Professor Emeritus, UCLA
Dr. David Jacobs - Professor, UCLA *
Mr. Steve Lee - Aquatic Biologist, UCLA & Research Coordinator, Multi-Agency Rocky Intertidal Network (MARINe)
Dr. Anita Leinweber - Assistant Researcher, UCLA
Dr. Sue Magdziarz, - Senior Educator, Ocean Institute **
Dr. George Matsumoto - Senior Education & Research Specialist, Monterey Bay Aquarium Research Institute
Dr. Charles Miller - Deputy Principal Investigator, Climate, Oceans and Solid Earth Science, Jet Propulsion Laboratory
Dr. Laura Murray - Director, University of Maryland Center for Environmental Science, Horn Point Laboratory **
Dr. Jill Sohm ? Post-doctoral Fellow at USC
Dr. Hannah Stewart - Visiting Professor, UCLA *
Mr. Drew Wharton - President Wharton Media
Mr. Eric Enno Tamm - author
Mr. Robert van de Hoek - Co-director, Ballona Institute***
Dr. Edith Widder - President and Chief Scientist, Ocean Research and Conservation Association

* lectures for online workshop
** OOS workshop
*** lecture and tour of Ballona Wetlands for June seminar at Marina del Rey

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

Findings: (See PDF version submitted by PI at the end of the report)

Training and Development:
This is an education project and has provided staff and participants multiple teaching activities and skills

Outreach Activities:
This is an education and outreach project. Outreach activities are multiple. See activities and findings section.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

URL(s):
http://www.usc.edu/org/cosee-west/
Description:
COSEE-West website. Contains all relevant information on the program.
Provides list of lectures, workshops and other activities for formal and informal educators.

Other Specific Products

Product Type:
maintain a list server called Oceanlist
Product Description:
We maintain an OceanList server called (OCEANLIST@lists.ucla.edu) which provides information to over 500 subscribers on ocean education opportunities primarily for educators and students.
Sharing Information:
The product is a list server which serves over 500 subscribers and is open to anyone to join.

Contributions

Contributions within Discipline:
1) Provide opportunities for scientists and educators to interact.
2) Create long-term relationships among diverse communities of ocean science education professionals.
3) Transfer content knowledge from scientist to educators and the public through innovative programming.
4) Enhance appreciation among ocean science professionals of the value of different perspectives for delivering science knowledge to diverse audiences.
5) Increase awareness among ocean scientists of the importance of inquiry-based and hands-on interactive learning in science education.
6) Help informal science centers to appreciate and enlist the expertise of classroom teachers in the development of exhibits.

Contributions to Other Disciplines:
COSEE-West programs and curricula promote the integration of Science into Math and English/Language Arts disciplines.

Contributions to Human Resource Development:

1) Help K-12 teaches become more knowledgeable in marine science and general science and to become more confident in teaching science
2) Help informal science centers in developing their ocean science exhibits and professional development programs for teachers.
3) Create a network of ocean sciences education professionals that integrates all levels of the education continuum: university, formal K-12 and informal.
4) Facilitate scientists (faculty and graduate students) broader impact activities by providing venues and opportunities for them to interact with K-12 teachers, students as well as informal educators.

Contributions to Resources for Research and Education:

1) Create opportunities for involvement of university scientists that enhances university participation in outreach education.
2) Generate and enhance relationships with other NSF programs focused on science research and education.
3) Enhance the profile of ocean sciences within local school districts.
4) Help teachers access educational resources online and through informal science centers.

Contributions Beyond Science and Engineering:

1) Make the public more aware of the importance of the ocean to the health of the planet and its impact on their lives.
2) Develop and strengthen links among universities, K-12 schools, informal science educators and the home school audience.

Conference Proceedings

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal
Any Book
Any Conference

OCE-0753224

COSEE-West Community-Based Ocean science Education
YEAR 2

PROJECT ACTIVITIES
(Evaluation findings provided by Patricia Kwon, COSEE-West program evaluator)

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1. Goals of COSEE-West

COSEE-West (Centers for Ocean science Education Excellence) Community-Based Ocean Science Education is a partnership between USC and UCLA, building on their extensive experience in ocean science education programs. The College of Exploration, a former sub-contractor to USC in the original COSEE-West program, became a full partner with USC and UCLA in the renewal program. COSEE-West serves as a hub for ocean science education for scientists, formal and informal educators, teachers, students, and the general public in the greater Los Angeles county area.

USC and UCLA have a long history of excellence in ocean science research, education, and outreach activities. COSEE-West staff at USC specialized in ocean science curriculum development and informal science education programs for students and teachers through Island Explorers, QuikSCience Challenge, Edison Challenge, and the Sea Grant Program. COSEE-West staff at UCLA specialized in K-12 science teacher enhancement programs such as MSTEP (ESI 91-53769, Marine Science Teacher Enhancement Program), LIMS (ESI 94-54413, Leadership in Marine Science), and SSWIMS (ESI 98-19424, Science Standards with Integrative Marine Science). Both universities have coastal teaching and research facilities, and foster strong ties with local informal science centers. The College of Exploration (COE) is a non-profit organization partnering with other organizations to create innovative and exploratory learning programs about the environment, earth, ocean, technology, leadership, learning and creativity. It offered online workshops for students, teachers, educators, and researchers.

COSEE-West is dedicated to three general goals: 1) greater awareness of ocean science in the general public, 2) use of ocean science as a strategy to increase general science literacy, and 3) attracting more students to choose science and ocean science careers. COSEE-West's objectives are:

1. Establish and expand linkages among ocean scientists, educators, and students in the areas of ocean science research, education, and outreach.
2. Sponsor and deliver public research lectures and workshops on ocean science themes to educate K-12 teachers, informal science educators, K-12 students, and the public about current issues in ocean science research, environmental concerns, and the impact of the ocean on daily life.
3. Leverage prior National Science Foundation (NSF) Teacher Enhancement programs to provide Mentor teacher leadership for the implementation and further dissemination of ocean science education.
4. Produce a comprehensive west coast website as the digital focus for current ocean science education materials and methods.
5. Stimulate careers in ocean science through a USC/UCLA College Mentorship program in ocean science and increase the number of students in underserved groups entering the sciences or ocean science.
6. Improve K-12 ocean science curriculum development in science and ocean science at the local, state and national levels.
7. Conduct ocean science education outreach in K-12 schools.
8. Participate in the national COSEE network for ocean science education outreach, policy issues, and evaluation of the COSEE network.

COSEE-West established linkages with partners to deliver current ocean science research through a lecture and workshop series; leveraged past NSF programs for teachers; and provided K-12 ocean science education outreach programs to school districts and informal science centers since the first year (9/02-8/03). In the second year (9/03 – 8/04), COSEE-West participated in the COSEE network to further ocean science education outreach, policy issues and curriculum development activities. COSEE-West developed its distance learning program and began planning and data collection for the COSEE Network evaluation in the third year of COSEE-West (9/04-8/05). Expansion of the distance learning program and evaluation of COSEE-West's contribution to the COSEE Network occurred in the fourth year of COSEE-West (9/05-8/06). In the fifth program year (9/06 – 8/07), COSEE-West received a one year no-cost extension and a five year renewal grant. In the first year of the renewal award, COSEE-West expanded its program activities to include five-day intensive workshops in Ocean Observing Systems/Ocean Literacy and Introduction to Marine Science. In the second year of the renewal award, COSEE-West conducted two online workshops to expand its distance learning activities and spent the remainder of its no-cost extension funds from the first grant. The Project Activities and Findings provided in this report represent second year activities and findings (2008-2009) for the COSEE-West renewal award.

2. Objectives of COSEE-West

COSEE-West staff engaged in an ongoing process of refining goals and identifying measurable objectives for each goal. COSEE-West's activities were viewed as a catalyst for promoting greater ocean science education and awareness in the Los Angeles ocean science community.

In designing program activities for the second year of the renewal program, COSEE-West built upon the strengths of successful program activities in its first grant. The lecture and workshop series for K-12 teachers and informal educators continued. In addition, program staff dedicated staff resources to the following program activities outlined in the renewal grant proposal, some of which began in the first year:

- Increased number of online workshops to twice per year. Compared various online workshop models used by COSEE-West and started planning process for delivering online workshops at California State Universities in Los Angeles, Fullerton, and Northridge.
- Hosted a five-day summer teacher workshop on Introduction to Marine Science for grades 5-9 with science content lectures from scientists and hands-on, integrative activities applicable to the California Science Content Standards.
- Hosted a five-day summer teacher workshop on ocean observing systems (OOS) using Ocean Literacy (OL) principles for grades 6-12 to capitalize on involvement in OOS through the Santa Monica Bay Observatory (SMBO) and the Southern California Coastal Ocean Observing System (SCCOOS). Teachers from other COSEE Centers also participated.
- Mentor teachers trained by COSEE-West taught workshops at the Introduction to Marine Science and OOS/OL summer workshops, as well as at the Grant Writing workshop.
- Institutionalized the Communicating Ocean Science to Informal Audiences (COSIA) course with the goal of becoming a regular faculty-led course at USC as part of the

Marine Environmental Biology graduate curriculum and providing a broader option of outreach opportunities for graduate and undergraduate course participants.

- Reorganized resources on the COSEE-West website into teaching units based on Ocean Literacy Principles and Concepts and development of an Ocean Tube website component featuring ocean sciences animations created by scientists and animation students.

COSEE-West will again partner with the Jet Propulsion Laboratory (JPL) for Climate Day 2009 in the fall. Last year's event was attended by almost 1,000 students from school districts affiliated with the East San Gabriel Valley Regional Occupational Program and Technical Center (ESGVROP/TC) who participated in an all-day event of lectures and hands-on activities related to climate change. COSEE-West also continued ongoing participation in science events such as the Hollenbeck Middle School Science Fair, the Animo Leadership Charter High School Science Fair, Los Angeles Regional Ocean Science Bowl, and the Los Angeles County Science Fair.

2.1 Expand Linkages between Scientists, K-12 Teachers and Educators

COSEE-West continued its efforts to connect research scientists with K-12 teachers and informal science educators by inviting scientists to present lectures on their research, recruit teachers from more school districts to participate in the lecture and workshop series, and bring scientists, K-12 teachers, and informal educators together at retreats and roundtables on specialized topics such as Ocean Literacy, OOS, and concept mapping. COSEE-West also helped scientists develop the broader impacts sections of their grant proposals by matching the subject area interests of scientists, K-12 teachers, and educators and wrote letters of support for collaborative proposals incorporating education outreach.

- *Lecture and Workshop Series*

COSEE-West actively recruited ocean scientists and conservationists who could effectively present information to a mixed audience of scientists, teachers, informal science educators, and the general public. All speakers participated in a question and answer session which created additional opportunities for participants to interact with the speakers, with questions asked individually in an informal setting. In the 2008-2009 program year, COSEE-West hosted five 1.5 hour lectures (including one with the Santa Monica Pier Aquarium on marine protected areas with Dr. Satie Airame). Speakers included Dr. Joshua Willis of the Jet Propulsion Laboratory, Dr. Peggy Fong of UCLA, Dr. Nina Karnovsky of Pomona College, and Dr. Sabrina Drill of University of California Cooperative Extension.

COSEE-West hosted five 6-hour long Saturday workshops. At these workshops, scientists and their graduate students came and provided science content, with COSEE-West staff providing activities related to the lecture series. These scientists presented their research, observed activities, answered questions, and provided additional background material related to the workshop topic. Researchers who addressed teachers and informal educators at these workshops included Dr. Chris Lowe of California State University Long Beach, Ms. Susan Zaleski of University of Southern California Sea Grant, Dr. Joshua Willis of the Jet Propulsion Laboratory, Dr. Carolynn Culver of University of California Cooperative Extension and the California Sea Grant program and Dr. Heather Nevill (DVM) of the International Bird Rescue Research Center.

Alfonso Montiel from Cabrillo Marine Aquarium shared his "What's the Catch" curriculum at the February 2009 fish workshop, as part of fulfilling his education outreach requirement for his NOAA MSRP grant.

- *Professional Development Series for Informal Educators*

Based on the needs of its informal science center partners, COSEE-West redesigned its professional development series for informal educators. Informal science centers identified specific needs in professional development and exhibit interpretive needs that will be addressed individually by centers, with staff from other informal science centers invited to participate. Informal educator workshops will be small and customized to the needs of each informal science center, concentrating on content knowledge in a particular area. Each workshop will be 2-3 hours long, with an hour long content lecture, question and answer session with the scientist, and demonstration/participation in selected hands-on activities. While informal educators expressed a great deal of interest in a professional development series, lecture/workshop events were re-scheduled several times due to conflicting schedules. Informal educators from Cabrillo Marine Aquarium, Santa Monica Pier Aquarium, and Aquarium of the Pacific agreed to participate in next year's educator professional development series. For the current year, informal science centers relied upon COSEE-West workshops to connect inoformal educators with current research and develop tools to integrate research into messages for the public through programs and portable interpretives developed from the workshop.

- *Retreats*

COSEE-West did not hold any informal science center retreats this year but plans to do so in the next program year. Future retreats will continue the work of previous retreats in bringing together scientists and informal educators to develop ocean science exhibits that incorporate recent research findings or showcase new or emerging fields of research. Linda Chilton from COSEE-West will work with Redondo SEA Lab and Santa Monica Pier Aquarium on informal science exhibitry, particularly on the Marine Life Protection Act Initiative. In preparation for next year's informal science center retreat(s), the Santa Monica Pier Aquarium is currently conducting a survey of their visitors as to what they already know and what they are interested in learning, which will be used in the retreat that focuses on their center.

- *Roundtables*

Ocean Literacy:
See section on Collaborative Efforts among COSEE Centers, COSEE Network, and Outside Agencies.

Informal Science Center Exhibits:
COSEE-West began focusing efforts on the Santa Monica Pier Aquarium and the Redondo SEA Lab in an effort to help informal science educators create a product (lesson plan, staff/volunteer training, interactive, exhibit, presentation, etc.) that is feasible and cost effective to utilize at their center and deliver effective ocean science content. COSEE-West assisted their informal science center partners in evaluating their needs and interests of their audiences and helping educators

decide which ocean science content would be most relevant. After completion of a needs assessment at each center, two retreats will be held with educators and scientists on adapting and implementing research content.

High School Biology Working Group:
Last year, a group of twelve high school biology teachers and COSEE-West participants formed a working group to identify and write up lesson plans and hands-on activities correlated to all ten high school California Science Content Standards for biology. These standards included cell biology, cellular chemical reactions, cell division, ecology, evolution, marine mammal physiology, and the scientific method. The goal was to collect enough lesson plans and teaching materials to teach all of the high school biology California State Science Standards through marine biology so that students could take marine biology in lieu of their biology course. Otherwise, high school students interested in marine biology must wait until their senior year to take it as an elective class. Curricula will be posted on the COSEE-West website for teachers to use in creating their own marine biology course and biology teachers could use parts of the curriculum in standard biology courses for grades 9 and 10.

Mentor Teacher Workshop:
Mentor teachers trained by COSEE-West hosted a grant writing workshop for educators at Marina del Rey Middle School's Marine Science Academy in March 2009. This workshop focused on informing teachers about what grants are available, how to write a grant, and ideas for how teachers would be able to incorporate more scientific research and field trips into their K-12 classroom.

- *Assisting scientists with outreach education projects*

Several scientists collaborated with COSEE-West to fulfill their outreach requirements for their NSF Criterion II activities. Examples included:

- Dr. Pat Krug from California State University Los Angeles spoke during the Introduction to Marine Science workshop in June 2009.
- Dr. Carl Carrano, chair of the Department of Chemistry and Biochemistry at San Diego State University, was referred to Dr. Cheryl Peach at COSEE California at Scripps Oceanographic Institute on developing an education outreach plan as part of an upcoming NSF proposal.
- Dr. Katrina Edwards, University of Southern California, wrote a Science and Technology Center (STC) proposal to NSF for the Center for Dark Energy Biosphere Investigations (--DEBI) focused on "*Microbial Life in the Deep Sea Floor and Crust."* COSEE-West PI Duguay will be a participant in the Center and COSEE-West will be a major player in the education and outreach activities for the Center.
- Kathleen Ritterbush, University of Southern California graduate student in earth sciences, sought assistance with implementing her lesson plan on Darwin.
- Assisted two graduate students at Hopkins Marine Station, Stanford University, with education outreach efforts on dissecting Humboldt squid based on a kit they developed and web resources. COSEE-West will recruit teachers to provide feedback on the web resources, and the graduate students will speak at a future COSEE-West squid lecture or workshop.

COSEE-West also supported collaborative proposals as part of a request for Proposals from NSF. One of two collaborative proposals for which COSEE-West wrote letters of support last year received funding - Dr. Lesley Smith at the University of Colorado in collaboration with COSEE-West on providing ocean science scientist-teacher workshops to inland audiences, the COSEE Colorado Collaborative. COSEE-West also partnered on 3 proposals for the COSEE call for proposals for 2009 for funding from the stimulus package. Decisions on these proposals have not yet been released.

- *Connecting teachers/educators with researchers*

COSEE-West facilitated many connections between scientists and teachers/educators to connect them with the ocean science resources they needed:

- Janice McDonnell from COSEE NOW referred Teresa Tucker, a K-12 teacher from Michigan, to COSEE-West. She is writing her masters thesis on incorporating OOS content in the classroom. As part of her thesis, she will be creating an OOS website for teachers and students, and potentially including it on the Santa Monica Bay Observatories website. She also received a travel stipend from MSELA (Michigan Science Education Leadership Association) to attend the COSEE-West OOS summer workshop. MSELA requires presentation of lesson plans to MSELA.
- Lynn Whitley and Peggy Hamner of COSEE-West wrote letters of support for COSEE-West teacher Scott Sperber to participate in several teacher research opportunities including School of Rock Deep Earth Academy on ocean drilling, NOAA Pacific Islands Fisheries Science Center on their Coral Reef Ecosystem Integrated Observing System, Teacher at Sea, and the ARMADA Project.

- *OceanList listserv*

OceanList is an electronic listserv that allows program participants and others interested in using ocean science in education to network and keep informed about current issues in ocean science and professional development opportunities in ocean science education. Currently, there are 671 OceanList subscribers (as of June 2009), including K-12 teachers, informal science educators, scientists, and undergraduate/graduate students. Most subscribers were from southern California but others were from other parts of the United States and overseas (Costa Rica, Croatia, India, Mexico, and Iran). OceanList disseminated information on ocean science curricula, resources (television broadcasts, news articles, video/DVD, books, websites), events (conferences, lectures, workshops), professional development and employment opportunities, grant availability, and provided a forum for subscribers to network with their peers. OceanList acted as a primary conduit for disseminating information about COSEE-West and related ocean science programs. COSEE-West partners frequently used OceanList for event announcements (100%), professional development opportunities (86%), communication with other subscribers (86%), online resources (71%), and opportunities for K-12 students (43%). Over half of current COSEE-West participants (72%) are subscribed to OceanList.

In response to OceanList announcements, several teachers were accepted into professional development programs such as EarthWatch, Teacher at Sea, and School of Rock Deep Earth

Academy programs this year. OceanList also advertised events for multiple informal science centers including: Aquarium of the Pacific, Birch Aquarium, Cabrillo Marine Aquarium, California Science Center, Channel Islands Marine Sanctuary, Manhattan Beach Roundhouse Aquarium, Santa Monica Pier Aquarium, Ocean Institute, Redondo SEA Lab, Sea World Park San Diego, Ty Warner Sea Center and the Channel Islands Marine Sanctuary. The Aquarium of the Pacific offers a discount to their lectures for COSEE-West participants.

2.2 Sponsor/Deliver a Lecture and Workshop Series in Ocean science

Five 1.5 hour lecture/discussion sessions and six 6-hour workshops were offered between October 2008 and May 2009. (See Table 1 in Appendix for a calendar of events with topics, speakers, locations, and attendance numbers.) Lectures and workshops were held at informal science centers and schools around the greater Los Angeles to encourage participation of teachers and the public from a broad and diverse area of greater Los Angeles County. Having the lectures and workshops in different areas of the Los Angeles region (downtown Los Angeles, East Los Angeles, South Bay) made it easier for teachers from those areas to attend. Changing the location enabled COSEE-West to take advantage of the existing audiences of informal science centers to increase attendance of the general public, as well as bring new audiences to informal science partner facilities.

Participants received free classroom materials and were offered the opportunity to sign up for UCLA Extension credit. The six-hour Saturday workshops were open to Los Angeles area teachers and informal science educators. A content lecture, included in each workshop, was open to the public when the venue allowed (e.g., access to JPL was restricted to a guest list provided in advance). Each workshop had two concurrent hands-on, inquiry-based sessions, one with activities appropriate to elementary school and middle school grades and the other appropriate to middle school and high school grades. Presenters of activities at these workshops included COSEE-West K-12 mentor teachers, informal educators, COSEE-West staff, and education staff of various informal science centers.

Teachers also frequently brought their students to lectures or workshops. Mark Friedman from Animo Leadership Charter High School (Lennox Unified/Green Dot Charter School) brought several students from his marine science club. Benjamin Kay from Santa Monica High School (Santa Monica-Malibu Unified School District) brought his students to the lecture hosted at the Santa Monica Public Library. Christina Engen from Crescenta Valley High School (Glendale Unified School District) also gave extra credit to her students who attended COSEE-West lectures.

2.3 Leverage prior NSF-TE training to deliver high quality ocean science materials

COSEE-West continued to utilize resources from other NSF Teacher Enhancement and informal education programs (such as SSWIMS, MSTEP, LIMS, Sea Grant, Island Explorers), school districts and informal science centers. COSEE-West continued to have teachers and educators act as workshop presenters (mentor teachers).

- *Introduction to Marine Science Summer Teacher Workshop*

Dr. James Fawcett of University of Southern California Sea Grant, Dr. Doug Capone of University of Southern California, Dr. John Dorsey of Loyola Marymount University, Dr. Karen Martin of Pepperdine University, Dr. Patrick Krug of California State University Los Angeles, Lauri Green from University of California Los Angeles, Julie Bursek from Channel Islands National Marine Sanctuary, Kathy Omura from the Natural History Museum of Los Angeles County, and COSEE-West mentor teachers Kurt Holland and Joy Tanigawa teachers taught at the five-day *Introduction to Marine Science* workshop at Marina del Rey Middle School Marine Science Academy in late June 2009. Mentor teachers as well as four administrators/teachers at Marina del Rey Middle School Marine Science Academy were former participants of MSTEP, LIMS and SSWIMS, programs funded through NSF. The seminar included science content lectures from scientists from various institutions and hands-on, integrative activities related to the lecture topics applicable to the California Science Content Standards for grades 4-9. It also included a presentation on Ocean Literacy Essential Principle and Fundamental Concepts and the OLEPFC connections to the workshop content and classroom applications. There were 24 participants who received a stipend of $375 and optional LAUSD salary point credit. Topics presented were history of the Marina del Rey Harbor, research in the local wetlands, evolution, marine invertebrate parasites, grunion, seabirds, algae, estuaries and invertebrates, microbes, and pseudoscience, bad science, and misconceptions.

- *Ocean Observing System Summer Teacher Workshop*

COSEE-West was heavily involved in exposing teachers and educators to the work conducted by the ocean observing systems (OOS) network. COSEE-West will again host a summer teacher workshop in August 2009 on ocean observing systems (OOS) to include Ocean Literacy discussions to help teachers develop middle and high school ocean science curricula and incorporate near real-time data into their classrooms. Curricula developed by last year's participants were posted on the COSEE-West website for use by other educators. Demonstrations and hands-on activities will present different ways to use data produced by OOS sensors and samplers and incorporate Ocean Literacy Principles to enhance classroom lessons and build student understanding of ocean systems and the importance of the ocean in their daily lives. Lessons formulated at the OOS workshop supplements work by the high school biology teacher working group identifying ocean science content and activities applicable to high school Biology courses. In prior years, several COSEE-West participants were involved in the Santa Monica Bay Observatory (SMBO) education outreach program conducted by NSF-funded UCLA researchers Dr. Nicolas Gruber and Dr. Anita Leinweber. These teachers developed K-12 curricula for the SMBO education portal using SMBO data, took their students on a research trip to the buoy in the Santa Monica Bay, and visited the UCLA laboratories of SMBO researchers.

The summer teacher workshop will involve up to 25 middle school and high school teachers from California, Michigan and Illinois. Last year, a teacher from Queen Anne's County in Maryland working with COSEE Coastal Trends also participated and may do so again this year. Teachers will be paid a $500 stipend for their participation and an additional $200 stipend upon presenting their own three-hour follow-up workshop based on workshop content to other

teachers. Workshop events will take place at USC and UCLA in Los Angeles, the Ocean Institute in Dana Point, Cabrillo Marine Aquarium in San Pedro, and the Jet Propulsion Laboratory in Pasadena. At USC, participants will receive an introduction on AUVs/gliders from Dr. Burt Jones, and COSEE-West staff will provide an introduction to Southern California Coastal Ocean Observing System (SCCOOS) and Ocean Literacy. At the Ocean Institute, staff will introduce its Sea Floor Explorer Program using remotely operated vehicles (ROV), and participants will construct and test model ROVs. Last year, Dr. Laura Murray from COSEE Coastal Trends presented on the use of real-time data recorded by underwater ocean observatories based on her work in the Chesapeake Bay at the Horn Point Laboratory in Cambridge, Maryland, and may do so this year. At the Jet Propulsion Laboratory, one of their scientists will lecture on research using satellite observations of oceans. The last day of the workshop will be conducted at UCLA where Dr. Rebecca Shipe from the SMBO program will discuss the local applications of OOS.

2.4 Ocean science Website and Distance Learning

- *COSEE-West Website*

The COSEE-West website (www.usc.edu/org/cosee-west/) served as an outreach and informational and instructional tool to complement COSEE-West face-to-face activities, as well as enhanced and expanded COSEE-West services to broader audiences. The COSEE-West website contained the schedule of COSEE-West lectures and workshops (with downloadable flyers); announcements of events hosted by partner institutions; online workshops; resources that include downloadable field trip guides, ocean science curricula, ocean science literacy/standards correlations, and an Oceanography Bibliography prepared by LAUSD Library Service; and supplemental resources distributed during the lectures and workshops. The website featured links to USC's Wrigley Institute for Environmental Studies, Sea Grant, QuikSCience, Edison Challenge, and Island Explorers websites, and the UCLA SSWIMS and OceanGLOBE websites.

A link for teacher created lesson plans presented curricula developed by COSEE-West teachers. COSEE-West archived five years of virtual lectures (2002-2007) from the COSEE-West lecture series on the College of Exploration website (link on COSEE-West website), as well as classroom lesson plans and classroom activities for those lectures. College of Exploration also filmed lectures by Dr. Peggy Fong and Dr. Josh Willis during the COSEE-West lecture series and Dr. George Matsumoto during the NMEA Conference in June 2009.

COSEE-West staff started a blog in December 2008 with multiple postings by COSEE-West staff each month on COSEE-West and ocean related events, conferences, and science articles of interest. In May 2009, COSEE-West staff created a facebook page, which as of June 2009 had 10 fans and 150 views on its page.

- *Online Workshops*

COSEE-West conducted two three-week online workshops in the same program year. In November 2008 COSEE-West held an online workshop on Weather, Sea Level Rise, and Climate Change. Keynote presentations were by Dr. Yi Chao (Jet Propulsion Laboratory) on

"Changing Climate and the California Coastal Ocean," Dr. Eric Rignot (Jet Propulsion Laboratory/UC Irvine) on "Glaciers and Global Sea Level Rise," and Dr. William Hamner (UCLA) on "Some Biological and Oceanographic Consequences of Changing Climate and Global Sea Level Rise."

The second online workshop was held in March 2009 on Marine Protected Areas. The keynote presentations were by Dr. Steve Murray on "Science, Policy, and Protecting our Coastal Oceans," Dr Satie Airame on "The Science of Marine Protected Areas," and Dr. Chris Lowe on "The Marine Life Protection Act (MLPA) is Coming to Southern California." There was also a presentation by Phyllis Grifman, USC Sea Grant program and a member of the MLPA Southern California stakeholders panel who presented on "Inside the MLPA Process."

COSEE-West is also working with Dr. Pat Krug on developing an online workshop based on one of his evolution or marine invertebrate undergraduate courses at California State University Los Angeles, similar to the model workshop conducted previously by Dr. William Hamner.[1]

2.5 Mentorship Programs

- *Summer Science Camps*

USC conducted Summer Science Camps in which it mentored middle and high school students by connecting them with undergraduate and graduate students in science, as well as professionals in fields that utilize science in obvious and unexpected ways. USC also mentored middle and high school students via the Island Explorers program, which brought graduate students into the program to talk with upper elementary and middle school students about research and ocean science careers. Jane Lee from COSEE-West will be giving presentations in July to the middle and high school summer camps on her work using science as part of the *Women in Science* series. The *Women in Science* Program seeks to promote young women to take on leadership roles in science such as the California Science Framework committee, GLATSA, NMEA, and Ocean Literacy efforts. COSEE-West staff made a concerted effort to ensure that graduate students were involved in all outreach programs that serve K-12 students, even though some of these educational efforts may be funded by other grant funds such as Sea Grant or incorporate funding from private donors such as the Quiksilver Foundation as well as gifts by other entities such as Edison International.

- *Communicating Ocean Science to Informal Audiences*

COSEE-West and COSEE California partnered for a third year in offering the Communicating Ocean science for Informal Audiences (COSIA) course to the Los Angeles area through a NSF grant to UC Berkeley and COSEE California. COSEE-West implemented a new model for the COSIA course, which focused on ocean science graduate students and served as a template for other universities interested in enhancing education outreach opportunities for their graduate students. USC faculty and graduate students in ocean science partnered with informal educators at the Aquarium of the Pacific (AoP). COSIA helped scientists communicate their research more effectively to the general public, steer science majors into science education professions, and

[1] *Developing Online Workshop Models*. Paper presented at NARST conference, April 2009.

create greater awareness among scientists and future scientists about the importance of education outreach. COSIA offered universities and informal science centers an opportunity to partner in presenting cutting edge ocean science research and provided a model for establishing substantive, long-term partnerships between scientists and informal science centers for education outreach. USC institutionalized the COSIA course to become a regular faculty-led course at USC as part of the Marine Environmental Biology graduate curriculum and provide a broader option of outreach opportunities for course participants.

The COSIA course was taught in Fall 2008 (September – December) by Dr. Myrna Jacobsen and Dr. Cornelius Sullivan of USC, with David Bader and Emily Yam of AoP. Several guest lecturers from USC departments (Inter-media, Animation, and Education) also participated. Dr. Jacobsen participated in the COSIA training session in June 2008. USC and AoP will offer the COSIA course in September 2009.

For the fall of 2008, the course was offered as a graduate level (and advanced undergraduate) 4-unit special topics course. Three marine science graduate students and one biology undergraduate student were enrolled in the course. The class met once a week for four hours. Several sessions were held at AoP to familiarize students with the Aquarium and their floor activities. Travel time to the Aquarium was used to do COSIA interactive exercises. Each student completed 15 practicum hours in leading activities as an interpreter at AoP. All guest lectures were recorded at USC for national COSIA distribution.

Feedback on the course was very favorable and included having students ask that the final project be introduced earlier. One of the most positive outcomes was the level of engagement that students exhibited for assisting AoP in enhancing some of their exhibits. Students were interested in continuing their interaction at AoP after course completion. Former students may show their floor exhibits at AoP in September 2009 to facilitate early initiation of projects at AOP. An additional COSIA activity may be designed around Dr James Fawcett's expertise in interacting with scientists and the public, aimed at bridging communication styles between science, sociology, and politics.

2.6 K-12 Curriculum Development

Curriculum development efforts were always under discussion by COSEE-West, its partners, and the Education Advisory Committee. COSEE-West continued to work at the State of California level to encourage the infusion of ocean science content into science textbooks to be adopted by the State. Lynn Whitley was recently appointed to be on the California State Science Framework review committee. COSEE-West staff recruited mentor teachers to write and/or review ocean science units for the K-12 Model Curriculum mandated by the California Environment and Education Initiative (EEI). Since its passage in 2003, the EEI mandated the inclusion of environmental education principles into state approved curricular materials. Sponsored by Heal the Bay, a non-profit ocean science and environmental advocacy group, EEI created a formal mechanism to integrate ocean science into K-12 classroom education. COSEE-West staff familiarized teachers with EEI principles and concepts through lessons that were created and presented in the educator workshop trainings. Examples included fish contamination education, climate change and invasive species lessons. COSEE-West staff also helped analyze effective

presentation strategies and methods for implementation through professional development and worked with Heal the Bay to pursue a stronger leadership role in integrating ocean science in the classroom. One of the guidelines for the California State Science Framework review committee is to address inclusion of the EEI principles into the new Framework.

Other curriculum development efforts included work on Ocean Literacy in developing a Scope and Sequence (S&S) guide for high school teachers based on the Ocean Literacy Essential Principles and Fundamental Concepts. COSEE-West staff member Lynn Whitley collaborated with colleagues in COSEE-California for the final educator review of the Ocean Literacy S&S held at Lawrence Hall of Science in Berkeley, California. S&S has been under development for several years and has had national input to the process. COSEE-West provided supporting funds for the attendance of a high school teacher, Beth Jewell from Virginia who is involved in NMEA, who has been involved in the S&S development from the inception. Lynn Whitley also attended the review held on June 8-10, 2009. Publication of the S&S is anticipated by the end of this year.

COSEE-West staff member Gwen Noda, K-12 teacher Mark Friedman, and Marine Mammal Care Center Director Todd Shattuck also developed a marine science course, which they presented at NMEA in June 2009 and will present at CSTA in October 2009.

Research from graduate student Sarah Bryson's (Dr. Peggy Fong's lab) Antarctica trip was used by others for educational purposes. Her research on snow algae was used by IPY_ROAM (International Polar Year- Research and Educational Opportunities in Antarctica for Minorities) for outreach about Research in Antarctica. Sarah Bryson was a part time assistant for COSEE-West and worked with Gwen Noda, Todd Shattuck, and Mark Friedman on designing their marine biology course.

2.7 K-12 Ocean Science Education Outreach Efforts

- *Scientist Education Outreach*

Dr. Peggy Fong's (COSEE-West) entire lab participates in the URC/CARE (Center for Academic Research) and MARC (Minority Access to Research Careers) at UCLA which mentors undergraduate students in research. Graduate student Tonya Kane participated in the Take Your Child to Work Day at NOAA and presented wetland activities for children ages 6 years and under (April 2009), volunteered at the National Ocean Science Bowl championship for high school students in Washington D.C. (April 2009), and spoke to a 6th grade class from Dryden, MI (during the National Ocean Science Bowl championship) about going to college, marine biology, and NOAA. Students were provided with NOAA learning materials and teachers were provided with education packets on Ocean Literacy and Climate Literacy. Graduate student Sara Painter helped in the summer education program at the Wrigley Marine Science Center at USC by giving lab tours to the general public and helping with the science camps for high school girls, Boy Scouts, and other groups. Dr. Peggy Fong's education outreach activities usually involved giving tours, short research presentations, and taking groups kayaking or snorkeling.

- *Grunion Gala*

COSEE-West was awarded the Dr. Susanne Lawrenz-Miller Education Award by The Friends of the Cabrillo Marine Aquarium for its "significant contributions to ocean science education in Southern California" at Cabrillo Marine Aquarium's black tie fundraiser, the Grand Grunion Gala. "My colleagues and I are honored to receive this education award from the Cabrillo Aquarium. COSEE-West and the Cabrillo Marine Aquarium share similar goals in bringing ocean science research to a broader audience. We have enjoyed our excellent collaboration with them to enhance ocean science education in the greater Los Angeles area and to continue our work in building an ocean literate community." said Linda Duguay, principal investigator on the COSEE-West project at USC, director of research for the Wrigley Institute for Environmental Studies, and director of the USC Sea Grant Program. In 2007, the same award was presented to Linda Chilton, a former educator at the Cabrillo Marine Aquarium who is now the education coordinator for the USC Sea Grant Program and is also working on the COSEE-West program.

- *LAUSD Ocean Science Education Outreach*

In the past, LAUSD had committed "Professional Expert" funding to two secondary teachers for after-school and Saturday dissemination of marine science content and to a third science teacher to serve as a COSEE-West secondary school teacher adviser. However, due to the State and County budget crisis, LAUSD was unable to provide funding for the teachers out of its budget. These "professional expert" teachers were participants in UCLA's previous Teacher Enhancement programs and presenters for COSEE-West. Rachel Espinoza, a middle school teacher at Hollenbeck Middle School, continued to provide technical assistance to teachers whose students participated in the school's science fair and served as an LAUSD Literacy Coach. While LAUSD was unable to provide Professional Expert funding, it provided loans of laptop computers and microscopes for professional development workshops. One of LAUSD's Science Specialists, Henry Ortiz, helped organize the LAUSD salary-point course for the Introduction to Marine Science Seminar at Marina del Rey Middle School Marine Science Academy in June 2009 and serves on the COSEE-West Advisory Board, as well as on the COSEE-West Advisory Board Education subcommittee.

- *USC Parent Child Program*

COSEE-West facilitates the process of bringing parents and children together to learn about the ocean science and career opportunities through the USC Sea Grant Parent Child Program (PCEP). Through the innovative PCEP learning process parent-child teams gain an elementary understanding of ocean science and develop an increased regard and sense of responsibility relating to local marine environmental issues through exploring the urban/ocean connection. University-based marine scientists as well as graduate students participated as speakers in the career component. Undergraduate students serve as co-educators teaching the lessons and guiding the families. While the PCEP has often been based at inner city schools, it was successfully piloted at the Exposition Park Intergenerational Community Center in Los Angeles, a large community center serving primarily a Latino and African-American population. USC's Sea Grant Program received a grant through USC's Neighborhood Outreach program to expand

and establish the program permanently at this site. Four sessions were provided this year at the Expo Center in a partnership with the City of Los Angeles Recreation and Parks including Cabrillo Marine Aquarium. This model program is adapted and transferred to other environments and geographic locations. This year the Woodlawn Elementary School in Bell restructured the monthly Family Library Night to be a parent child program and will continue to build ocean literacy including their connection to the ocean with parent child teams. In the future, COSEE-West plans to work with Hawaiian Avenue Elementary, Alexander Science Center School and other schools to build a parent child program component.

- *Linking with Pre-Service and Intern Teacher Education Programs*

COSEE-West is working with LAUSD to restructure the pre-service and intern teacher education program so that more teachers can take advantage of COSEE-West lectures and workshops. Jim Keisel at California State University Long Beach, who serves on the COSEE-West Advisory Board as well as on the COSEE-West Advisory Board Education subcommittee, arranged to have intern Teachers in science education receive class credit for attending COSEE-West lectures and workshops. COSEE-West staff also worked with the California State Universities in identifying ways in which informal science centers can more effectively meet the needs of pre-service and intern teachers.

COSEE-West participant Renee Klein served as a Science Advisor with LAUSD's Beginning Teacher Support and Assessment Program (BTSA) as well as with the Jane Goodall Institute's Roots and Shoots Program. She worked with ten LAUSD Title I schools on service-learning, teacher training, and education outreach programs including Venice High School, Curtis Middle School, Burbank Middle School, Jefferson High School, Hawaiian Elementary, Woodlawn Elementary, Animo Venice High School, Hamilton High School, and Santa Monica High School in her education outreach activities. BTSA is a two-year program for beginning teachers to receive additional content and pedagogy instruction, and it is approved by the California Commission on Teacher Credentialing to fulfill requirements for obtaining a Professional Clear Teaching Credential. Renee Klein taught ocean science content and hands-on activities from COSEE-West tailored to grade-specific science content standards to intern teachers in her BTSA workshops.

Throughout the academic year, district interns received COSEE-West lecture and workshop instructional materials to enable them to develop stronger science curricula and hands-on integrative activities. Interns also subscribed to OceanList to receive information regarding other ocean science education outreach opportunities.

- *GLOBE-COSEE-West Carbon Cycle Workshop*

Linda Chilton (COSEE-West) facilitated a three-day professional development carbon cycle workshop with 18 middle and high school teachers from LAUSD. The workshop is provided by GLOBE trainers from New Hampshire through an NSF grant and cosponsored by COSEE-West. The workshop utilized ocean concepts helped build relationships with the teachers who have not previously participated in COSEE-West program activities.

- *Scientific and Educational Conferences*

COSEE-West staff attended and presented at various scientific and educational conferences. Linda Duguay attended the Climate Change and the Oceans Summit sponsored by the Packard Foundation in Monterey in December 2008. ,Peter Tuddenham and Tina O'Kane Bishop of attended the ASLO Aquatic Sciences Meeting in Nice, France in January 2009.

COSEE-West staff attended the California Ocean Communicator's Alliance Workshop in August 2008 organized by NOAA's National Marine Sanctuary Program, California Resources Agency, and various aquarium partners, and the Satellites and Education Conference at California State University Los Angeles in August 2008.

Lynn Whitley (COSEE-West) presented on the *USC Parent Child Education Program* at the International Pacific Marine Educators Network Conference in Townsville, Australia in October 2008. Lynn Whitley (COSEE-West) presented at the national COSEE network session at the NSTA Conference in New Orleans in March 2009 on *COSEE-West Opportunities for Teachers and Students in the Online World and Beyond*. Patricia Kwon (COSEE-West) presented at the NARST Conference in Anaheim, California in April 2009 on *Developing Online Workshop Models*. Linda Chilton (COSEE-West), Lynn Whitley (COSEE-West) and Jane Lee (COSEE-West) presented *COSEE-West Online Workshops, Marine Science Resources, Classroom Activities and You!* and Gwen Noda (COSEE-West), Mark Friedman (Animo Leadership Charter High School), and Todd Shattuck (Center for Marine Studies at the Marine Mammal Care Center at Fort MacArthur) presented on *Comprehensive Marine Biology Course -- Teaches all Required California/National Biology Standards*! at the NMEA Conference in Monterey, California in June 2009.

- *Regional Ocean Science Fairs, Contests*

COSEE-West staff served as judges at the Hollenbeck Middle School Science Fair, Woodlake Elementary School Science Fair, Animo Charter Leadership High School Science Fair, LAUSD Science Fair, and Los Angeles County Science Fair. They also helped recruit judges using OceanList, UCLA Cruising Classroom, UCLA Ecology and Evolutionary Biology Department, and Southwest Marine Educators Association (SWMEA) listservs. COSEE-West staff served on the Judges Advisory Committee for the California Science Fair. COSEE-West staff also participated in the Los Angeles Environmental Education Fair at The Arboretum of Los Angeles County. Ismael Cueva (former SSWIMS and COSEE-West participant), a K-12 science teacher at Hollenbeck Middle School and in charge of the Hollenbeck Middle School Science Fair emailed: "I'm very proud to say that the young ladies you personally coached last year on the LA River project were the only 6th graders that made it to the state science fair from our school. There were more than 25 judges at our science fair from many different organizations. Thank you again for spreading the word."

COSEE-West helped organize and run the Surf Bowl, the Los Angeles Regional competition for the National Ocean science Bowl (NOSB) in February 2009. Sixteen schools participated in 2008, involving a total of 84 coaches and high school students and 40 volunteers (scientists and graduate students mainly from USC and JPL) in the day long competition. The USC Wrigley

Institute for Environmental Studies, in collaboration with NASA's Jet Propulsion Laboratory, acted as the host for this regional competition of the NOSB. The NOSB competition is intended to increase knowledge of the oceans on the part of high school students, their teachers, and parents, as well as to raise the visibility and public understanding of the national investment in ocean-related research. Several COSEE-West staff volunteered as moderators and science judges.

- *QuikSCience and Edison Challenge*

The QuikSCience Challenge is a competition for middle and high school students who work with their teachers to develop innovative ocean science curricula for use in the classroom. The Challenge emphasizes leadership and encourages students to become actively invested in their own learning. Forty-seven schools (35 teachers and 282 students) enrolled in the southern California 2009 QuikSCience Challenge, which utilizes a unique format to help attract students underrepresented in the sciences. The winning teams traveled to the USC Wrigley Marine Science Center on Catalina Island. Leticia Escajeda of Marina del Rey Middle School Marine Science Academy won first prize at the middle school level and Mark Friedman of Animo Leadership Charter High School won the Best Community Service award at the high school level. The Marina del Rey Middle School Marine Science Academy used the Long-Term Monitoring Program and Experimental Training for Students (LiMPETS) marine protocol as the basis for their project, which Leticia had learned about from a COSEE-West workshop. LiMPETS is an environmental monitoring and hands-on education program developed to monitor ocean and coastal ecosystems funded by NOAA. QuikSCience also recognizes educators making outstanding contributions to K-12 ocean science education with its QuikSCience COSEE-West Ocean Leadership Awards. These awards are given in the areas of formal teaching, informal teaching, early career award, and commitment to education award. This year, two COSEE-West participants, Susan Singh of Farmdale Elementary School, and Jill Grace of Palos Verdes Intermediate School, were given QuikSCience COSEE-West Ocean Leadership Awards in the area of formal teaching.

The Edison Challenge was quite successful for teachers, students, and mentors involved in the program. A record number of 61 teams from Los Angeles and Orange counties signed up for the Edison Challenge for 2009 (44 middle school and 17 high school teams). As with the QuikSCience Challenge, many team projects became a continuing element in their respective school curricula and extracurricular activities. The program also incorporates teacher workshops for team coaches, and is modeled after the COSEE-West teacher workshop model. Winning teams traveled to the Sierra Nevada Mountains and to USC's Wrigley Marine Science Center on Catalina Island. Feedback on all program activities associated with the Edison Challenge was overwhelmingly positive and many participants expressed strong interest in continuing their involvement next year. Teachers and students felt that the science content of the Edison Challenge workshops and its focus on energy and environmental issues was interesting, fun, boosted their science content knowledge, and promoted a greater sense of environmental stewardship and community service. This year, COSEE-West participant Benjamin Kay from Santa Monica High School and his Team Marine won second place in the high school competition.

- *JPL/COSEE-West Climate Day*

Climate Day 2008, organized by the Jet Propulsion Laboratory (JPL) and COSEE-West in March 2008 represented a unique opportunity to partner with JPL and the East San Gabriel Valley Regional Occupational Program and Technical Center (ESGVROP/TC) in an all-day event of lectures and hands-on activities. The goals of the event, hosted by the ESGVROP/TC on their Del Norte Campus in West Covina, California, were to bring high school students together with climate scientists to learn about the science of climate and climate change, the role that NASA satellites play in monitoring Earth and its climate, and to learn how they could reduce their own impacts on global climate. Climate Day 2009 will be held later this year.

- *Team Marine*

Team Marine is a group of eco-minded students from Santa Monica High School who have participated in various environmental sciences competitions such as the QuikSCience Challenge, Edison Challenge, and the Solar Cup since 2006. Team Marine was coached by Santa Monica High School teacher and COSEE-West participant Benjamin Kay, and assisted by COSEE-West participant Renee Klein. Team Marine and Santa Monica High School partnered with the Surfrider Foundation to launch an educational water quality monitoring and advocacy program (Teach and Test) that teaches students about the importance of water quality and provides hands-on lab experience and the opportunity to affect positive change in their community. The California Coastal Commission awarded Team Marine a $39,135 Whale Tail Grant for their work with the Teach and Test program. The Jane Goodall Institute's Roots and Shoots Program and Surfrider also awarded Team Marine grant funding for additional testing materials and equipment. Since then, Surfrider has taken their Teach and Test program to a national level. Team Marine constructed a solar boat for the Solar Cup Program, a race sponsored by the Metropolitan Water District of Southern California in which high school students design and construct a solar powered boat. For the 2008-2009 school year, Team Marine has done the following: attended numerous conferences, workshops and lectures, and taught community members about marine debris, storm drain transport and runoff, sustainable products and practices, renewable energies, and global climate change. Team Marine's eco-projects included: beach cleanups, school-wide plastic bottle cap drive, REthink Art Display on the Third Street Promenade made out of 34,727 collected bottle caps, two student marches against single-use plastic products, testifying at City Hall to support the ban on plastic bags from all retail stores in Santa Monica, building a solar-powered boat for the Solar Cup, joining Jane Goodall's Roots and Shoots Program to spread ideas and network, partnering with the Surfrider Foundation in their Teach and Test ocean water quality monitoring program, advocating for the preservation of the Ballona Wetlands, restructuring the Team Marine website to facilitate updates by future Team Marine students, and several student presentations (i.e Generation Earth Water Pollution Prevention Workshop) at different schools.

2.8 Participation in COSEE network

- *Fine Tuning COSEE Network Goals*

COSEE-West actively participated in the COSEE Network Council. Dr. Linda Duguay served as the voting member and Peggy Hamner served as the alternate to the council. Council members and alternates participated in Council meetings and conference calls. COSEE-West staff attended COSEE Council sessions at the AGU meeting in December 2008 and the NMEA conference in June 2009. COSEE-West participated in the COSEE Council web working group (WWG) effort to develop a more uniform and integrated website for the COSEE Network, evaluation working group (EWG) to work on the Network evaluation and prepare for the decadal review, and the diversity working group (DWG) to explore and recommend ways to extend COSEE efforts in engaging members of underserved and underrepresented groups in ocean literacy.

The Central Coordinating Office (CCO) organized an evaluators workshop at the University of Rhode Island in September 2008 in order to share evaluation goals and strategies among the Centers, determine areas of expertise, discuss common instruments and metrics, provide guidance to the National Network Evaluation (NNE), discuss how Center evaluators could contribute to the decadal review, discuss cross-COSEE collaborations, and review the mission and scope of the EWG and Center Evaluators group.

In January 2009 the WWG announced the successful launch of the new COSEE sites for the Network, COSEE California, COSEE Central Gulf of Mexico, COSEE Coastal Trends, COSEE Ocean Systems, COSEE Pacific Partnerships, and COSEE West.

The EWG took on a more prominent role as it reconstituted its membership in January 2009 to include a representation of regional evaluators. The EWG worked actively on discussing issues associated with the Network evaluation, a working plan for the NNE, and creating agreed upon definitions and ways of measuring COSEE audiences, activities, and products. This involved the input of PIs and evaluators from multiple Centers and the testing of various rubrics of categorization and measurement. The goal was to have future data collection efforts by the Centers be standardized across Centers to the extent possible and effectively leverage Center data collection efforts to be of maximum use towards Network data collection.

The annual COSEE Network meeting took place at Hilton Head, South Carolina in May 2009. The purpose of the Network Meeting was to strategize how to measure and improve the Network's impact through sharing the various Centers' well evaluated and successful activities, brainstorming new approaches for reaching key target audiences, increasing the sharing of resources and effective practices among Centers, and exploring opportunities for greater collaboration and identifying programs with transferability potential. Over 80 individuals attended the meeting, with several representatives from each COSEE Center. Program Officers from both NSF and NOAA attended along with members of the National COSEE Council Advisory Board.

Don Elthon of NSF prepared a COSEE decadal review planning document to establish a framework for NNE and EWG planning and data collection. The decadal review will eamine the evidence for COSEE's effectiveness, including a description of the Network, service and engagement with the scientific and ocean science education community, diversity of outreach activities, development of human capital, development of knowledge and resources for ocean

science education, and enduring impacts on the ocean science community. Linda Duguay, PI of COSEE-West agreed to Chair the Decadal Review Committee for the coming year. She was also elected COSEE Council Chair elect at the Council Meeting in May 2009.

As a COSEE Center, COSEE-West continued progress towards its regional goals. The regional evaluator is a member of the EWG which discussed issues related to the Network evaluation and decadal review. Several COSEE center evaluators met at the May 2009 Network meeting to discuss evaluation issues at their Centers and for the Network. There will also be an evaluators meeting in September 2009 hosted by the CCO at the University of Rhode Island. COSEE-West is working with the CCO to set the agenda for the evaluators meeting. As part of an effort to further disseminate evaluation results from the COSEE-West program, COSEE-West has been working with other Center evaluators to present at the upcoming AGU Ocean science Meeting in Portland, Oregon in February 2010. COSEE-West and other Centers also presented evaluation results at the National Association of Science Research in Teaching (NARST) Conference in Anaheim, California in April 2009.

COSEE-West also worked with the COSEE Network on ocean policy issues, gathering information and providing input on policy issues such as infusing ocean science into K-12 schools, state science standards, science assessments, and science textbooks.

- *Collaborative Efforts Among COSEE Centers, COSEE Network, and Outside Agencies*

Ocean Literacy:
COSEE-West actively worked with other COSEE Centers to promote Ocean Literacy nationwide. An online public review of the Ocean Literacy Scope and Sequences for grades K-12 occurred in November 2008 for grade bands K-2, 3-5, 6-8, and 9-12, sponsored by COSEE, NOAA, NMEA, and College of Exploration. COSEE-West also worked with COSEE California on developing a national Ocean Literacy index to inform and improve strategic choices of scientists' education outreach activities, guide future development of educational exhibits and curricula, help assess the impact of COSEE activities, and measure national trends in the awareness and understanding of ocean concepts. COSEE-West also worked with COSEE-California in continuing to move forward on national efforts in Ocean Literacy, most specifically advising and participating in the final reviews of the Ocean Literacy Scope and Sequence, including the final scientific review held in May 2009 and the final educator review in June 2009. Publication of the Ocean Literacy Scope and Sequence is anticipated by the end of this year. COSEE-West and COSEE-California also presented an Ocean Literacy professional development workshop at the NMEA conference in June 2009 in Monterey, California. This workshop piloted a model Ocean Literacy workshop to be shared with other COSEE centers and NMEA.

COSEE-West worked with COSEE-California in January/February 2008 in developing a curriculum unit for grades 3-5 based on Ocean Literacy principles as part of a NOAA Environmental Literacy grant. COSEE-West teacher Steve Seal (LAUSD, Eshelman Elementary School) will be testing the curriculum in the fall of 2009.

Concept Mapping:
In Spring 2008 COSEE-West worked with Annette deCharon of COSEE Ocean Systems in co-hosting a concept mapping workshop at USC while it was still in its prototype phase. Based on feedback from the spring 2008 workshop, a workshop model and software system was developed and subsequently tested at the Darling Marine Center at the University of Maine in November 2008 and at University of New Hampshire in March 2009. COSEE Ocean Systems developed an Educator-Scientist Collaborative Workshop model that centered on scientist-educator teams (one scientist per three educators) creating online learning resources to align with National Science Content Standards, Climate Literacy Principles, and Ocean Literacy Principles. Teams created online concept maps that dynamically evolved over the course of the workshop. Scientists learned another way of interacting and working collaboratively with educators. In March 2009, COSEE-West wrote a collaborative proposal to NSF with COSEE Ocean Systems, COSEE California, and COSEE NOW to do a two-day workshop on climate change in which scientists and graduate students from USC, UCLA, and local California State Universities would use concept mapping to explain their research.

COSEE-West Colorado Collaboration:
In October 2008, NSF funded the COSEE-West Colorado Collaboration with Dr. Lesley Smith at the University of Colorado. In April, May, and June 2009, the COSEE-West Colorado Collaborative conducted three half-day teacher workshops on the effects of the ocean on climate, in which a scientist presented a lecture on cutting edge research and teachers worked on related hands-on activities. This was followed by a five-day teacher workshop of scientist lectures and hands-on activities in which teachers were taught how to develop their own curricula for their classroom. COSEE-West staff has begun working with staff at the COSEE-West Colorado Collaborative in sharing best practices learned from running a similar lecture and workshop series in Los Angeles. For the May 9 workshop held at the University of Colorado's Cooperative Institute for Research in Environmental Sciences, two Los Angeles K-12 teachers interacted with the scientist via video conferencing. The May 9 workshop included two activities - Weather Stations and Observing Clouds - and a lecture by NOAA scientist Dr. Ola Persson on *The Disappearing Arctic Sea Ice and the Role of the Atmosphere*.

Fall AGU Meeting:
COSEE is organizing a session at the upcoming Fall AGU Meeting titled *Improved Broader Impacts = Enhanced Scientific Impacts.* The session is designed to provide examples of transferable and tractable activities, which broaden the awareness of outreach activities such as work with citizen scientists groups, the media, and formal and informal science education institutions. Presentations will include online educational activities and/or resources, activities that may inspire and empower other scientists to reach out to diverse audiences, and broader impact activity successes of value to the scientific community. Dr. Gail Scowcroft (CCO) and Liesl Hotaling (COSEE NOW) are conveners of the session. COSEE-West staff and scientists will be participating in the meeting.

AAAS Meeting:
COSEE-West is organizing a strand at the upcoming American Association for the Advancement of Science (AAAS) meeting in San Diego, California in February 2010. Gwen Noda, Dr. Linda Duguay, Dr. Chris Lowe (California State University Long Beach), Lynn Whitley (COSEE-

West), and Amy Hill (Chadwick High School) have submitted an abstract on *COSEE-West: Building Bridges between Ocean Scientists, Educators, and Students*.

Ocean Science Meeting:
COSEE is organizing a strand at the upcoming ASLO Ocean Science Meeting in Portland, Oregon in February 2010. COSEE-West will be submitting abstracts for the meeting. Evaluators Patricia Kwon (COSEE-West), Chris Parsons (COSEE NOW), Dr. Rena Dorph (COSEE California), and Dr. Mark St. John (COSEE Network, Inverness Research) submitted an abstract on *COSEE Evaluations: What We've Learned*.

CSTA Ocean Science Strand:
COSEE-West and the Southwest Marine Educators Association (SWMEA) will co-sponsor an ocean science strand at the California Science Teachers Association Conference in Palm Springs, California in October 2009, with one three-hour short course and four one-hour workshops. COSEE-West staff will serve as moderators for the short course and workshops. Linda Chilton (COSEE-West) will present on *Families Learning Together*. Gwen Noda (COSEE-West), Mark Friedman (Animo Leadership Charter High School), and Todd Shattuck (Marine Mammal Care Center) will be presenting on *Comprehensive Marine Biology Course -- Teaches all Required California/National Biology Standards*!

NSTA COSEE Strand:
COSEE presented a short course and a COSEE strand at the National Science Teachers Association (NSTA) Conference in New Orleans in March 2009. Lynn Whitley (COSEE-West) presented on *Opportunities for Teachers and Students in the Online World and Beyond*. COSEE NOW, COSEE Great Lakes, COSEE Coastal Trends, COSEE Southeast, and the CCO also gave presentations. The COSEE Network plans to maintain a presence at the NSTA conference for 2010 and 2011. Nine concurrent session and four short course proposals were submitted to NSTA on behalf of the COSEE Network for Philadelphia. For the 2010 conference, there will be a similar format for the conference, including an exhibition hall booth, short courses, a COSEE strand of concurrent sessions, and a COSEE sponsored luncheon. Dr. Scott Glenn and Dr. Oscar Schofield of Rutgers University, Institute for Marine and Coastal Studies, have agreed to serve as the luncheon speakers. Lynn Whitley (COSEE-West) submitted an abstract for the 2010 conference on *COSEE-West workshops: access to scientists, educators, resources, and classroom activities while enhancing skills in the digital world*.

NMEA COSEE Presentations:
COSEE-West staff and K-12 teachers presented their work at the NMEA conference in Monterey, California in June 2009. Dena Deck (Stephen Foster ES), Henry Ortiz (LAUSD), Gary Scott (LAUSD) and Cynthia Carmolinga and Lenny Jones (Redondo SEA Lab) received funding from COSEE-West for conference expenses. Gwen Noda (COSEE-West), Mark Friedman (Animo Leadership Charter High School), and Todd Shattuck (Marine Mammal Care Center) will be presenting on *Comprehensive Marine Biology Course -- Teaches all Required California/National Biology Standards*! Lynn Whitley (COSEE-West) and Jane Lee (COSEE-West) will be presenting on *COSEE-West Online Workshops, Marine Science Resources, Classroom Activities and You!* Linda Chilton (COSEE-West) will be running the Elkhorn Slough field trip.

Co-Hosting Lectures and Workshops:
Several lectures and workshops were co-hosted by various partners. Last year, three lectures were co-hosted by the Santa Monica Pier Aquarium as part of their lecture series. This year, the Santa Monica Pier Aquarium hosted their own lecture series (the most recent lecture was on the oceans and climate change) and co-hosted a lecture with COSEE West on marine protected areas with Dr. Satie Airame at the Santa Monica Public Library in October 2008. The Jet Propulsion Laboratory co-hosted a lecture on the ocean in a warming climate with Dr. Josh Willis at the Natural History Museum of Los Angeles County in February 2009. The Friends of the Los Angeles River co-hosted a lecture on conserving fish with Dr. Sabrina Drill at the Los Angeles River Center. The Cabrillo Marine Aquarium co-hosted a lecture on marine protected areas with Dr. Chris Lowe in October 2008. The Marine Mammal Care Center and the International Bird Rescue Research Center co-hosted a workshop on pelagic birds with Heather Nevill in May 2009. The Marina del Rey Middle School Marine Science Academy co-hosted the teacher grant writing workshop in March 2009 and the five-day Introduction to Marine Science Workshop in June 2009.

OOS Summer Teacher Workshop:
Dr. Laura Murray of COSEE Coastal Trends tested an OOS module based on their online workshops with a group, three of which were K-12 teachers from COSEE-West (Robert Perry SMMUSD, Dominique Evans-Bye, and Joan Macomber – both OOS workshop participants last year). A high school teacher from COSEE Coastal Trends may also participate in the August 2009 OOS workshop.

Greater Los Angeles Teachers' Science Association:
Greater Los Angeles Teachers' Science Association (GLATSA) was in need of restructuring and COSEE West staff led the process in working with the remaining Board members in developing and implementing a survey to assess teachers' needs and how to best meet them. COSEE West staff are recruiting new potential board members and working to help those teachers develop their leadership role through this process.

No Child Left Inside Coalition:
The COSEE Network worked with the No Child Left Inside Coalition (NCLI), a diverse organization of more than 1100 member organizations across the United States that promotes a greater amount of environmental education in K-12 schools. NCLI seeks to work with COSEE on garnering support for passage of the federal No Child Left Inside ACT, legislation that would authorize major new funding for states to provide high quality environmental instruction. Funds would support outdoor learning activities at formal and informal education centers, teacher training, and the creation of state environmental literacy plans.

California Regional Environmental Education Community:
COSEE-West participated in an educator survey designed to reveal current needs and constraints to teaching environmental education inside the classroom and outdoors. The survey was developed to support the CREEC Network in disseminating environmental education resources

and services to California's K-12 educators. The Survey results were made available at the 2008 CSTA Conference in October and posted on the CREEC.org web site. The Survey data was used to determine programmatic and funding priorities to implement the strategic initiatives identified in California's state plan for environmental education, *Education and the Environment: Strategic Initiatives for Enhancing Education in California*. Linda Chilton and Gwen Noda attend meetings of CREEC-LA.

California Department of Toxic Substances Control:
Patrick Movlay, a hazardous substances scientist who participated in UCLA's LIMS science education program in 1998, contacted COSEE-West staff and offered to speak on green chemistry. California passed AB 1879, which requires the assessment of alternatives to chemicals of concern in all products sold in California, and SB 509, which sponsors the creation of an online toxins clearinghouse to provide information on chemicals and their toxicity. AB 1879 and SB 509 are the first green chemistry laws to be implemented worldwide. The California Department of Toxics Substances Control will be in charge of writing these regulations.

Helping to Set Ocean Science Policy:
Lynn Whitley, co-Director of COSEE-West at USC was appointed as a member of the new California Science Curriculum Framework and Evaluation Criteria Committee (CFCC) for California public schools in March 2009. The CFCC will meet every four weeks between June and October 2009 for five meetings to draft the framework and review revisions. A draft science framework will be available for a 60-day field review in January 2010; the Curriculum Commission will revise the draft framework based on field review results in April 2010; the Curriculum Commission will have a public hearing and recommended action on the framework in May 2010; a 60-day public review period in June 2010; with adoption taking place as soon as November 2012. Earlier in the process, there were teacher focus groups and public meetings held in October 2008 to take comments on the proposed framework process. One COSEE-West participant, Mark Friedman, was selected as a member of the teacher focus group. COSEE-West staff and COSEE-West participants also spoke at the public meetings.

3 COSEE-West Collaborative

COSEE-West conducted program activities through a collaborative that includes USC, UCLA, College of Exploration, informal science centers, K-12 school districts, and other educational partners. Many of these organizations were involved in COSEE-West through their representation on the COSEE-West Education Advisory Committee. Other partners provided speakers, workshops, curricula and informational materials, and/or informal science center environments for students to experience hands-on ocean science activities in the field.

3.1 USC

USC has been involved with ocean science for over 100 years. USC has strong links with local K-12 schools in the greater Los Angeles area through its informal science center programs for students as well as online ocean science curriculum. The Sea Grant Program funded research, disseminated results to government agencies and users, and provided information to the public

on the "Urban Ocean." The Island Explorers program used a hands-on activity-based ocean science curriculum for upper level elementary and middle school students. USC also conducted ocean science workshops for K-12 teachers, summer science programs for middle school and high school students interested in science, and an intergenerational program for parents and fourth to sixth grade students. USC's programmatic focus for COSEE-West was developing strong relationships with informal science partners, organizing roundtables and retreats, creating the website and distance learning activities, and developing K-12 student mentorship programs that increase the participation of students in underserved groups. It also collaborated in the lecture and workshop series, curriculum development efforts, and policy initiatives. USC administered the QuikSCience Challenge and Ocean Leadership Awards sponsored by surfing company Quiksilver and the Edison Challenge sponsored by Edison International. Elements of the Sea Grant Parent-Child Education Program were adapted for use by LAUSD.

3.2 UCLA

UCLA has over a decade of experience in conducting NSF K-12 Teacher Enhancement programs, including MSTEP, LIMS, SSWIMS, and COSEE-West. These programs involved enhancement of content knowledge and pedagogy in ocean science, including earth and space sciences, and physical, chemical and biological oceanography. Ocean science was presented as an integrative, articulated, inquiry-based curriculum. Approximately five hundred teachers in the greater Los Angeles area participated in MSTEP, LIMS, and SSWIMS. Many former participants continue to be advocates for ocean science curricula as teachers or administrators in K-12 schools. UCLA's programmatic focus for COSEE-West was running the lecture and workshop series and directing K-12 ocean science outreach education efforts at Los Angeles Unified School District (LAUSD). It also collaborated in planning extended retreats and workshops and roundtables on specialized topics. Education outreach activities such as curriculum development efforts and policy initiatives were conducted jointly by UCLA and USC.

3.3 College of Exploration

The College of Exploration (COE) became a full partner in the COSEE-West renewal program to host COSEE-West online distance learning courses and virtual lectures from the COSEE-West lecture series for online viewing. COE archived five years of video-taped and live webcasts of the lecture series and facilitated the implementation of two online workshops on climate change and marine protected areas.

3.4 Informal Science Centers

Both UCLA and USC have long-term partnerships with informal science centers in the greater Los Angeles area. These included Aquarium of the Pacific, California Science Center, Cabrillo Marine Aquarium, Natural History Museum of Los Angeles County, Ocean Institute, Redondo SEA Lab, and Santa Monica Pier Aquarium. These informal science centers hosted public lectures, K-12 teacher workshops, K-12 student field trips, community events, and education outreach programs. Each center has unique qualities. Santa Monica Pier Aquarium offered beach, pier and indoor ocean-oriented preK-secondary classes, Aquarium of the Pacific has large

teacher education outreach programs, California Science Center offered a virtual link to the Wrigley Marine Science Center, and the Natural History Museum and Cabrillo Marine Aquarium have research scientists and strong education outreach programs. These informal science centers were locations for the COSEE-West lecture and workshop series and for retreats to introduce teachers and educators to available resources. As part of their partnership with COSEE-West, Aquarium of the Pacific and Cabrillo Marine Aquarium admitted COSEE-West participants to their ocean science lecture series at a discount. Robin Savoian with the Natural History Museum (and COSEE-West participant) worked with COSEE-West to revise the SeaMobile program to give priority to COSEE-West participants for SeaMobile visits to K-12 schools. The Huntington Library also co-hosted an evening science lecture this year for the first time.

3.5 School Districts and Charter Schools

UCLA and USC have close working relationships with several school districts, notably LAUSD. LAUSD funds ocean science in-service professional development programs and provides support for LAUSD teachers with salary points for attendance at lectures and workshops, instructional materials and staff support through its two science centers. LAUSD provided loans of laptop computers and microscopes for professional development workshops. One of LAUSD's Science Specialists, Henry Ortiz, organized the LAUSD salary-point course for the Introduction to Marine Science Seminar at Marina del Rey Middle School Marine Science Academy in June 2008.

The Marina del Rey Marine Science Academy started in September 2008, with 60 sixth grade students. In September 2009, the Academy will add seventh grade students and in 2010 it will add eighth grade students. Leticia Escajeda (Coordinator for the Academy), one of the Academy teachers, the Assistant Principal, and the LAUSD Science Coach for the Academy participated in COSEE-West and were former participants of UCLA teacher enhancement programs MSTEP, LIMS and SSWIMS.

COSEE-West received assistance from the Los Angeles County Office of Education to expand its program to other Los Angeles area school districts. Other school districts which participated with UCLA and USC include Compton, El Rancho, Hawthorne, Inglewood, Long Beach, San Marino, and Santa Monica/Malibu School Districts. COSEE-West also had participants from charter and independent schools such as Animo Leadership Charter High School and Marina del Rey Middle School Marine Science Academy, which integrated ocean themes throughout its entire curriculum.

3.6 Quiksilver

Quiksilver formed the QuikSCience partnership with USC's Wrigley Institute for Environmental Studies to improve K-12 science and environmental education, striving to make science more approachable through an exploration-based ocean science curriculum ($1.25 million over five years). QuikSCience sponsored activities to stimulate interest in science by working in partnership with universities, informal science centers and K-12 schools. QuikSCience activities included the QuikSCience Challenge, QuikSCience Ocean Leadership Awards, and a

COSEE/QuikSCience IMAX screening of *Coral Reef Adventure* at the California Science Center. The QuikSCience Challenge is a competition for middle and high school students to work with their teachers to develop innovative ocean science curricula for use in the classroom. Approximately 650 students, over 75 teachers, and over 23 schools were enrolled in the southern California 2008 QuikSCience Challenge, which utilizes a unique format to help attract students underrepresented in the sciences. Additionally students meeting their project requirements reached thousands of community members, students, and visitors to their websites and YouTube. The QuikSCience Ocean Leadership Awards provided recognition for K-12 teachers and informal science educators in formal teaching, informal teaching, early career, and commitment to education categories. In May 2009, Quiksilver renewed its commitment with a new two year gift for $400,000 to continue this successful program.

3.7 Southern California Edison

USC's Wrigley Institute for Environmental Studies was awarded a grant ($1 million over four years) from Southern California Edison to administer the Edison Challenge. The Edison Challenge leveraged effective components of both COSEE-West and the QuikSCience Challenge, combining a team-based competition for middle and high school students with a series of teacher professional development workshops. Edison Challenge themes were energy and environmental policy issues such as air quality, technology advancement, alternative energy, and ocean science. The program also offered professional development workshops for teachers. Jane Lee from COSEE-West assisted in conducting several of the teacher workshops. The Edison Challenge was offered to school districts within the Edison service area, focusing on underserved groups and underrepresented students in the sciences. In the third year, 61 teams around Southern California registered for the competition.

3.8 Other Partners

Science education organizations and agencies involved in the planning of COSEE-West activities and objectives through their members' participation in the Education Advisory Committee were Heal the Bay, Los Angeles County Office of Education, Los Angeles Zoo, Santa Monica Bay Restoration Commission, and STAR Education/ECO Station.

3.9 Other Collaborators

Other science education organizations which collaborated with COSEE-West included: California Science Teachers Association, Catalina Island Education Consortium, Channel Islands National Marine Sanctuary, Conservation Corps, Redondo SEA Lab, Girl Scouts of America, Los Angeles Educational Partnership, Monterey Bay Aquarium Research Institute, National Geographic Society, National Marine Educators Association, National Ocean Science Bowl, Resource Conservation District of the Santa Monica Mountains, Santa Catalina Island Conservancy, Satellite Educators Association, Southern California Academy of Sciences, Southern California Marine Institute, and Southwest Marine Educators Association.

University collaborators included California State University Dominguez Hills, California State University Fullerton, California State University Los Angeles, California State University Northridge, University of California Berkeley, and University of California Santa Cruz.

Research institutions included NASA's Jet Propulsion Laboratory.

Collaborating agencies included the California Coastal Commission, Los Angeles County Department of Beaches and Harbors, Los Angeles County Fire Department (Lifeguard Division), Los Angeles County Sanitation District, National Science Foundation, National Oceanographic and Atmospheric Administration, Orange County Coastal Commission, Ports of Los Angeles and Long Beach, Santa Monica Baykeeper, and Surfrider Foundation.

3.10 Advisory Board

Thirty-four members from COSEE-West's partners were selected for the Advisory Board, comprised of scientists, K-12 teachers and administrators, and informal science educators and administrators. The Advisory Board was concerned with clarifying the role and direction of COSEE-West. Areas of immediate concern for the Advisory Board included: getting the online workshop model into the California State University system, work on a program to translate OOS data so it can be easily used by K-12 teachers in the classroom, work on getting supplemental funding from NSF through the Communicating Research to Public Audiences (CRPA) grants for exhibitry related to education outreach, create breakout sessions for informal educators after the Saturday workshop lectures as part of an informal educator professional development series, offer COSEE-West lectures and workshops to Teach for America teachers, hold a five-day summer workshop using Fluid Earth content similar to the Introduction to Marine Science workshop, consider combining Climate Day with an Ocean Day event, and offering graduate credit for lecture and workshop participation. The Advisory Board met in September 2008 and February 2009 to discuss the year's activities, and set priorities for the next year. The next meeting is tentatively set for early October 2009.

APPENDIX I: Lectures and Workshops, 2008-2009

Date	Topic and Location	Speaker	Attendance
9/08	Offshore Natural Gas and Oil Seeps	Boat trip Santa Barbara	42
10/08	Lecture: *Marine Protected Areas* Santa Monica Public Library	Dr. Satie Airame University of California Santa Barbara	20
	Workshop: *Marine Protected Areas* Cabrillo Marine Aquarium	Dr. Chris Lowe California State University Long Beach	20
11/08	Online Workshop on Weather, Sea Level Rise, and Climate Change: - *Changing Climate and California Coastal Ocean* - *Glaciers and Global Sea Level Rise* - *Some Biological Oceanographic Consequences of Changing Climate &Global Sea Level Rise*	Dr. Yi Chao Jet Propulsion Laboratory Dr. Eric Rignot Jet Propulsion Laboratory Dr. William Hamner University of California Los Angeles	360
1/09	Lecture: *Phase Shifts, Alternative Stable States, and the Loss of Ecosystem Function in Southern California Lagoons* University of Southern California	Dr. Peggy Fong University of California Los Angeles	35
	Workshop: *Algae Around Us* Marine Mammal Care Center	Susan Zaleski University of Southern California Sea Grant	20
2/09	Lecture: *Ocean in a Warming Climate* Natural History Museum of LA County	Dr. Josh Willis Jet Propulsion Laboratory	48
3/09	Workshop : *Ocean in a Warming Climate* Jet Propulsion Laboratory	Dr. Josh Willis Jet Propulsion Laboratory	51
2/09	Lecture: *Conserving Fish from the Mountains to the Sea* Los Angeles River Center	Dr. Sabrina Drill University of California Cooperative Extension	25
	Workshop: *Fish, Fishing, and Fisheries* Redondo SEA Lab	Dr. Carolynn Culver University of California Cooperative Extension and Sea Grant	21
3/09	Online Workshop on Marine Protected Areas and MLPA: - *Science, Policy, and Protecting our Coastal Oceans* - *Marine Protected Areas* - *MLPA is Coming to Southern California*	Dr. Steven Murray California State University Fullerton Dr. Satie Airame University of California Santa Barbara Dr. Chris Lowe California State University Long Beach	163
3/09	Workshop: *Grants, Grant Writing, Field Trips, and Teacher Field Experiences* Marina del Rey Marine Science Academy	Renee Klein (LAUSD Beginning Teacher Support and Assessment Program (BTSA)), Linda Hoffman (Palms MS), Dena Deck (Stephen Foster EL)	21
5/09	Lecture: *Asking the Auks about Climate Change in the Arctic* Huntington Library	Dr. Nina Karnovsky Pomona College	24
	Workshop: *Migrating Threats to Pelagic Birds* International Bird Rescue Research Center	Heather Nevill, DVM International Bird Rescue Research Center	14

Date	Topic and Location	Speaker	Attendance
6/09	Summer Workshop: *Introduction to Marine Science* Marina del Rey Marine Science Academy	Dr. James Fawcett University of Southern California Dr. John Dorsey Loyola Marymount University Dr. Karen Martin Pepperdine University Dr. Patrick Krug California State University Los Angeles Lauri Green University of California Los Angeles Julie Bursek Channel Islands National Marine Sanctuary Kathy Omura Natural History Museum D9. Doug Capone University of Southern California	
8/09	Summer Workshop: *Ocean Observing Systems/Ocean Literacy* USC, UCLA, JPL, Ocean Institute, Cabrillo Marine Aquarium	Dr. Burt Jones University of Southern California Dr. Rebecca Shipe University of California Los Angeles A Scientist from the Jet Propulsion Laboratory Dr. Laura Murray (TBD) COSEE Coastal Trends	

APPENDIX II: COSEE-West Products, 2008-2009

SCIENTIFIC AND EDUCATION CONFERENCE PRESENTATIONS:

Sarah Joy Bittick, Sarah Bryson, and Peggy Fong. UCLA Biology Research Symposium. May 2009. *Growth of Salicornia virginica into salt pannes through facilitation by Batis maritima in southern California salt marsh*.

Sarah Bryson and Peggy Fong. Coastal and Estuarine Research Federation Conference. November 2009. *Facilitation of vegetation into salt marsh salt panes*.

Sarah Bryson and Vanessa Lougheed. SACNAS Fall 2008. *Snow algae of the western Antarctic peninsula*.

Linda Chilton. NMEA Conference. June 2009. *Topic.*

Rachel Clausing and Peggy Fong. Coastal and Estuarine Research Federation Conference. November 2009. *Nutrient Limitation in Tropical Macroalgae Depends on Life History Strategies and Watershed Influences*.

Lauri Green and Peggy Fong. American Ornithilogical Union Conference. August 2009. *Macroalgal Mats Alter Foraging Behavior of Shorebirds in a Southern California Estuary.*

Tonya Kane and Peggy Fong. Coastal and Estuarine Research Federation Conference. November 2009. *Tidally influenced nitrogen fixation and denitrification rates vary widely across eutrophic southern California estuaries*.

Patricia Kwon. NARST Conference. April 2009. *Developing Online Workshop Models.*

Ranjan Muthukrisnan and Peggy Fong. Coastal and Estuarine Research Federation Conference. November 2009. *Do coral reefs exist as alternate stable states? Preliminary evidence from two contrasting reef systems*.

Gwen Noda (COSEE-West), Mark Friedman (Animo Leadership Charter High School), and Todd Shattuck (Center for Marine Studies at the Marine Mammal Care Center at Fort MacArthur). NMEA Conference. June 2009. *Comprehensive Marine Biology Course -- Teaches all Required California/National Biology Standards*!

Peter Tuddenham (COSEE-West), Kristina Bishop (COSEE-West), William Bragg (College of Exploration), Melissa Ryan (College of Exploration), Scott Carley (College of Exploration). ASLO Aquatic Sciences Meeting, Nice, France. January 2009. *Adult Free Choice Learning about Ocean Sciences in Online Learning Communities at the College of Exploration.*

Lynn Whitley. International Pacific Marine Educators Conference. October 2008. *USC Parent Child Education Program.*

Lynn Whitley. NSTA Conference. March 2009. *COSEE-West Opportunities for Teachers and Students in the Online World and Beyond*.

Lynn Whitley and Jane Lee. NMEA Conference. June 2009. *COSEE-West Online Workshops, Marine Science Resources, Classroom Activities and You!*

UPCOMING CONFERENCE PRESENTATION/PROPOSALS:

Linda Chilton. CSTA Conference. October 2009. *Families Learning Together*. [accepted]

Gwen Noda (COSEE-West), Mark Friedman (Animo Leadership Charter High School), and Todd Shattuck (Center for Marine Studies at the Marine Mammal Care Center at Fort MacArthur). CSTA Conference. October 2009. *Comprehensive Marine Biology Course -- Teaches all Required California/National Biology Standards*! [accepted]

Gwen Noda, Dr. Linda Duguay, Lynn Whitley from COSEE-West, Dr. Chris Lowe from California State University Long Beach, and Amy Hill from Chadwick High School. AAAS Meeting. February 2010. *COSEE-West: Building Bridges between Ocean Scientists, Educators, and Students*. [accepted]

Dr. Rena Dorph, Dr. Mark St. John, Patricia Kwon, Chris Parsons. American Geophysical Union Ocean Science Meeting. February 2010. *COSEE Evaluations: What We've Learned*.

Lynn Whitley. NSTA Conference. March 2010. *COSEE-West workshops: access to scientists, educators, resources, and classroom activities while enhancing skills in the digital world.*

SCIENTIFIC AND EDUCATION PAPERS:

Fong, P. 2008. *Macroalgal-dominated ecosystems*. In: Nitrogen in the Marine Environment. E. J. Carpenter and D.G Capone (eds). Academic Press.

Lin, D.T. and P. Fong. 2008. *Macroalgal bioindicators (growth, tissue N, $\delta^{15}N$) detect nutrient enrichment from shrimp farm effluent entering Opunohu Bay, Moorea, French Polynesia*. *Marine Pollution Bulletin* 56:245-249.

Smith, J.R., P. Fong, and R.F. Ambrose. 2009. *Spatial patterns in recruitment and growth of the mussel Mytilus californianus (Conrad) in southern and northern California, USA, two regions with differing oceanographic conditions*. *Journal of Sea Research,* 61: 165-173.

Smith, J.R., R.F. Ambrose, and P. Fong. 2008. *The impacts of human visitation on mussel bed communities along the California coast: Are regulatory marine reserves effective in protecting these communities? Environmental Management,* 41: 599-612.

SCIENTIFIC AND EDUCATION PAPERS (IN REVIEW):

Smith, T.B., P. Fong, R. Kennison, and J. Smith. In review. *Refuges, defenses, and La Niña promote harmful blooms of the alga Caulerpa sertularioides onto coral reefs*. *Oikos*.

Armitage, A.R., Gonzalez, V., and P. Fong. In review. *Decoupling of nutrient and grazer impacts on a benthic estuarine diatom assemblage*. *Estuarine and Coastal Shelf Science*.

Kennison, R. L., K. Kamer, and P. Fong. In revision. *Rapid uptake rates and large storage capacities enable green macroalgae to bloom in enriched estuaries subject to pulsed N supplies*. *Journal of Phycology*.

SCIENTIFIC AND EDUCATION PAPERS (TO BE SUBMITTED):

Kwon, P.S., Bishop, T., Lemus, J. *Developing Online Workshop Models*. NARST conference. 2009.

OCE-0753224
COSEE-West Community-Based Ocean Sciences Education

YEAR 2

PROJECT FINDINGS

(Evaluation findings provided by Patricia Kwon, COSEE-West program evaluator)

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1. Summary

For the second year of its renewal program, COSEE-West continued program activities from the first five-year grant ─ acting as a catalyst to find new ways of bringing ocean scientists and educators together, helping ocean scientists conduct broader impact projects and outreach, assisting in proposal development for informal science centers and scientists, and working on broader policy issues such as promoting the use of ocean sciences curriculum materials in K-12 schools and developing Ocean Literacy guidelines. There was also an increased emphasis on activities related to distance learning through online workshops, Ocean Observing Systems (OOS) and Ocean Literacy (OL) through its five-day summer workshop. COSEE-West continued to seek the input of its collaborative partners, its Educational Advisory Committee and the Los Angeles Unified School District (LAUSD). COSEE-West strengthened its partnership with LAUSD to continue ocean sciences outreach programs for K-8 schools through LAUSD's interest in USC's Sea Grant Parent Child Program, and offered course credit for pre-service, interns, and regular teachers for participation in the Introduction to Marine Science Workshop at the Marina del Rey Middle School Marine Science Academy. For the first time, COSEE-West conducted two online workshops per year, one on climate change and one on marine protected areas (MPAs) and California's Marine Life Protection Act Initiative (MLPA). COSEE-West expanded its outreach by archiving videos of the first seven years of its live public lectures on the College of Exploration (COE) website.

2. Program Implementation

COSEE-West is dedicated to three overarching goals: 1) increase awareness of ocean sciences, 2) use ocean science as an incentive to increase general science literacy, 3) increase the number of students that choose science and ocean science careers. In Year 2 of the renewal program, COSEE-West (Center for Ocean Sciences Education Excellence) continued to work toward its objectives for achieving these goals. Implementation of these objectives is detailed in this report.

1. Facilitating linkages between scientists, K-12 teachers and informal educators
2. Providing a lecture and workshop series
3. Leveraging past NSF Teacher Enhancement programs
4. Developing a website/distance learning program
5. Creating a mentorship program
6. K-12 curriculum development
7. K-12 ocean science outreach efforts to K-12 students
8. Participation in the National COSEE network

2.1 Degree of Implementation, Year 2

COSEE-West conducted two online workshops, one on climate change and one on MPAs and California's MLPA with the COE. It also expanded the involvement of its informal science center and school district partners, broadened the audience served by COSEE-West programs to include more pre-service and in-service teachers and K-12 students of underserved groups, and expended the remaining funds from the no-cost extension of the first grant on various programs.. It continued current program activities such as the lecture and workshop series, online

workshops, informal science center retreats, mentorship programs, K-12 curriculum development, ocean sciences education outreach, and participation in the COSEE network. It also continued offering one-week intensive OOS and Introduction to Marine Science workshops incorporating OL principles. COSEE-West expanded the involvement of graduate students by continuing its partnership in the NSF-funded course Communicating Ocean Sciences to Informal Audiences (COSIA) through COSEE California. It also continued its work with Quiksilver and Edison International with the QuikSCience Challenge and the Edison Challenge.

2.2 Evaluation of the COSEE-West Program, Year 2

Evaluation of the success of the COSEE-West program is based upon a thorough analysis of qualitative and quantitative data. An implementation evaluation conducted in the second year of the renewal program indicates that COSEE-West conducted its activities on schedule and achieved its program goals. Based upon the stated goals and objectives of COSEE-West, the following outcomes were investigated:

1. Scientist engagement with K-12 science teachers and informal science educators, K-12 students, and the general public
2. Quality of collaborative relationships within COSEE-West
3. Effectiveness of distance learning in the ocean sciences for the COSEE-West audience
4. K-12 student involvement in the sciences and ocean sciences, particularly for under-performing schools and students of underserved groups
5. Integration of ocean sciences themes in K-12 schools and informal science centers by teachers and educators

At the end of each program year, a formative evaluation assesses the short-term and long-term program effectiveness, degree of implementation of program activities, and program sustainability. The evaluation of COSEE-West uses a combination of established qualitative and quantitative methods. Qualitative methods include field observation; staff, participant, and key informant interviews; focus groups; and planning meetings. Quantitative methods include survey administration and development, and analysis of data. New and existing survey instruments were developed and revised, including the pre/post online workshop surveys, year-end participant survey, introduction to marine science workshop survey, OOS/OL workshop survey, scientist survey, and collaborative partner survey.

3. Participation by Collaborative Partners

COSEE-West expanded its network of partners involved in planning and executing program activities. Partners included universities, research institutions, school districts and informal science centers. COSEE-West facilitated the process of introducing scientists to teachers and educators by inviting scientists to be speakers for the lecture and workshop series. University scientists also sought assistance from COSEE-West in designing broader impacts programs for their NSF proposals to conduct more effective ocean sciences education outreach. COSEE-West assisted scientists by reviewing the education outreach portion of their proposals, serving on

advisory committees, and linking scientists and teachers/educators in ocean sciences education outreach projects.

Collaborative activities among COSEE-West partners increased in the areas of recruitment, connections to K-12 schools, promoting public awareness of COSEE-West, and work with various types of partners, based on partners surveyed in May 2009. To better capture collaborative activities and the concerns of partners, the collaborative partner survey was revised to incorporate concerns of informal science centers, school districts, teachers, and scientists. Partners surveyed (n=11) were K-12 teachers (10%), school district administration/staff (20%), informal science educators/staff (50%), and scientists/university faculty (20%).

Collaborative partners were involved in COSEE-West program activities as a lecture/workshop venue (36%), sending staff to attend lectures/workshops/retreats (46%), staff presentations (9%), serving on the Education Advisory Committee (90%), and assisting in planning COSEE-West program activities (27%). Most partners were generally involved in recruiting K-12 teachers (73%), K-12 students (9%), and informal science educators (46%) as participants. Partners worked with K-12 schools in a variety of ways including providing information to K-12 teachers on pedagogy (70%) or science content (80%), working with K-12 teachers on science activities (70%), and mentoring students on science activities (86%). Partners also collaborated with university researchers (43%), K-12 teachers/students (57%), or informal science centers (100%) on COSEE-West program activities. Partners participated in lectures (90%), workshops (80%), summer workshops (20%), online workshops (30%), or other UCLA/USC science education outreach programs (100%). Survey results on collaborative activity for informal science centers and school district/education partners are shown in Table 1.

Table 1—Level of COSEE-West Collaborative Activity, Year 2

Collaborative Activity	Partners Responding Directly Involved (%)
Recruit K-12 teachers as program participants	73
Recruit K-12 students into program participants	9
Recruit informal educators as program participants	46
Work with K-12 teachers in science related activities	67
Mentor K-12 students in science related activities	50
Provide information to K-12 teachers on teaching methods	70
Provide information to K-12 teachers on science content	80
Work with K-12 teachers or students on science activities	70/86
Work with university researchers on COSEE-West activities	43
Work with K/12 teachers/students on COSEE-West activities	57
Work with informal science centers on COSEE-West activities	100
Participated in lectures	90
Participated in workshops	70
Participated in summer five-day workshops	20
Participated in online workshops	30
Participated in other UCLA/USC education outreach programs	100

Number of survey respondents in May 2009 is 11.

All partners spent time in ocean sciences education outreach ranging from part-time (44%) to half-time (22%) to almost all of the time (33%). Partners were either extremely involved in education outreach to underserved groups (67%) or somewhat involved (33%). They also regarded ocean sciences education outreach as extremely important (100%).

The majority of partners strongly agreed that COSEE-West program activities gave them opportunities to interact with other scientists and educators (77%) though half of the partners wanted additional opportunities for interaction. Partners regarded COSEE-West meetings (Education Advisory Committee bi-annual meetings, roundtable discussions, organizational meetings for specific events) as extremely important (91%), as well as lectures (64%), workshops (64%), one-day retreats (55%), multiple-day retreats/summer workshops (18%), and online workshops (27%). Informal science center partners reported that retreats and roundtables are an important opportunity to bring together partners with common interests and they expressed a strong desire to work on collaborative projects and attend future retreats and roundtables.

Distance learning was seen as very effective (27%) or somewhat effective (46%) by partners. Partners thought online resources[1] (55%) and online workshops (27%) were very useful. Online resources were used fairly often (60%) or sometimes (30%). Online resources that partners used most frequently included resources page (78%), event publicity (67%), curricula links (67%), Ocean Literacy page (56%), archived lectures (44%), and online workshops (22%).

Partners believed that COSEE-West is very effective (40%) or somewhat effective (30%) in integrating ocean sciences themes into K-12 schools and informal science centers, and very effective (40%) or somewhat effective (20%) in improving science education.

- The workshops and lectures are helpful to teachers to be used in the classroom.
- COSEE-West staff has helped plan events, create resources, offer lectures, expand content knowledge and generally brainstorm on future activities.
- I think that we are beginning to have more of an integration, but for years we have talked about integrating ocean education exhibits at informal centers and that hasn't happened as of yet. However, in the past few months we have been working with COSEE-West members to do just that.

Partners believed that COSEE-West is very effective (36%) or somewhat effective (18%) in involving students of underserved groups in sciences or ocean sciences. One partner did express the desire to see more scientists from under-represented groups as speakers in COSEE-West lectures or workshops.

- COSEE-West helps our center to expand our knowledge base, which we then use with teachers who are serving under-represented students and the students themselves. I see this ripple effect throughout the CW lectures and workshops. Additionally, CW seems to reach a large number of teachers who serve under-represented groups and are looking for ways to better engage their students in science and CW provides them with effective ocean science methods to do so.
- It has been useful to interest students in both science projects and careers.

[1] Online resources refer to resources on the COSEE-West website but do not include online workshop content.

- I think that we should continue to search for under-represented scientists/lecturers to speak at the lecture series, conduct workshops and act as mentors. Until children can "see" themselves in the leaders that we bring forward, it will be harder for them to understand that this is a field for them to go into and succeed.

Issues of particular concern to partners included concerns about budget cuts in schools and the impact on science education, lack of support for elementary school teachers to teach science, and the lack of engagement and understanding by their administration and the general public regarding the bigger picture in ocean science and its impacts.

- Lack of engagement of middle school and above students in science topics, appreciation of ocean science as it relates to ocean conservation, general understanding of the importance of the ocean and its health to humanity, and gender, socioeconomic, ethnic inequalities in science education in the US.
- The effects of inner-city pollution on the immediate environment and how it affects the ocean health. Educating inner-city youth and families about the ocean and science as a whole.
- Issues which are facing ocean science education [such as] budget cuts, lack of science education in schools, schools' focus on student test scores.
- Concerned about the effect of school budget cuts on science education in general and ocean science education in particular.
- Lack of support for elementary teachers to teach science. Limited use of student-centered instruction in many secondary science classrooms.

4. Participation by Teachers/Educators

For year 2, there were 703 registered participants, including 367 K-12 teachers, 155 informal science educators, 110 scientists/university professors, 6 K-16 administration/staff, 8 university/K-12 students, and 57 members of the general public. Participant data is shown in Table 2 and includes individual school district data.

Table 2—Distribution of Participants by Level and District/Organization Year 2

District	Elementary	Middle	High	Informal/ K-16	Total
Antelope Valley Union High SD			1		1
Bellflower USD	2				2
Chaffey Joint Union High SD			1		1
Compton USD			1		1
El Rancho USD			1		1
Garvey USD	1				1
Glendale USD			2		2
Hawthorne USD			1		1
Independent Schools	4		5		9
Inglewood USD		1			1
LAUSD	15	10	16		41
Lennox USD			2		2
Long Beach USD		1			1
Redondo Beach USD			1		1
San Marino USD			3		3
San Gabriel USD		1			1
Santa Monica/Malibu USD			1		1
Tustin USD			2		2
Visiting Teachers (Japan)			1		1
Intern Teachers					0
K-16 Staff					1
University/K-12 Students					0
University Professors/Scientists					8
Informal Science Educators				39	39
General Public					57
Online Workshops					
K-12 Teachers	45	64	183		292
K-16 Staff					5
Informal Educators					116
Professors/Scientists					102
University/K-12 Students					8
TOTAL Teachers/educators at (lecture/wks/online	**67**	**79**	**221**		
TOTAL PARTICIPANTS					**703**

Registered participants completed surveys at each event. In May a general survey was sent out to 119 teachers and informal educators and 38 individuals responded. Ninety-seven percent of respondents surveyed in May 2009 recommended COSEE-West to their colleagues. The majority of participants agreed that the ocean science theme is appropriate for their work (96%). Seventy-two percent of participants previously participated in COSEE-West for one or more years, while thirty-six percent had participated for four years. Repeat attendance was high, at 86% for lectures and 75% for workshops. On average, participants attended four lectures and four workshops this year. Many are former participants of a UCLA or USC teacher enhancement program─SSWIMS, MSTEP, LIMS, Sea Grant, or Island Explorers (52%). Almost three-quarters of participants were female (72%) while one-third were minorities (33%). Over half of the participants were from LAUSD (56%). COSEE-West participants were primarily K-12 teachers (69%) or informal science educators (26%). Participants had an average of 14 years of teaching experience. Survey results on participant feedback are shown in Table 3.

Table 3—Participant Characteristics

Participant Characteristic	Participants (%)
Recommend C-W to their colleagues	97
Thematic OS appropriate for their work	92
Repeat attendance for lectures	86
Repeat attendance for workshops	75
Former MSTEP, LIMS, SSWIMS participant	52
% Female	72
% Minority	33
% LAUSD	56
% K-12 teachers	69
% informal educators	26

Number of survey respondents in May 2009 is 39.

Most participants subscribed to Oceanlist (72%) as a means of communication about ocean science events, programs, and resources. Participants used COSEE-West resources more than once per week (11%), weekly (20%) or monthly (51%), with an average of 5 other teachers at the participant's school using COSEE-West content and resources. COSEE-West lecture content (83%), hands-on activities (69%), and content for discussions with students (64%) were used most frequently. COSEE-West resources were frequently (50%) or somewhat frequently (42%) shared by participants with other teachers and educators. Online resources were seen by participants as very useful (71%) or somewhat useful (20%) while online workshops were very useful (26%) or somewhat useful (26%). Online resources that participants used most frequently include resources page (93%), curricula links (77%), Ocean Literacy page (60%), archived lectures (57%), event publicity (47%), and online workshops (27%). Distance learning was regarded as either extremely (23%) or somewhat (43%) effective by participants. Participants said that online resources were useful in many ways.

- The workshops are very valuable and generally connect directly to the lectures. They support the teachers' ability and resources to teach Marine based standards based in their classroom.
- The COSEE staff organizes an excellent set of materials related to each topic. Saves me search time online. If I can't find something in my own pile of papers, I know that the online archive is there for me.

- I'm grateful to COSEE-West's OceanList for keeping me in touch with long-time friends and contacts in the National Marine Educators Association...we're about to go back to Asilomar, where NMEA's founding took place over 30 years ago.
- Resources have provided supplemental information to give to others presenting the material.
- Expanded my span of knowledge and networking of ideas. Integrating Ocean Literacy into education under sail, youth adventure...especially the principles related to "there is one ocean...that all life shares and depends on..."
- I have been able to support my students with better information and resources to achieve their goals and learning.
- I have been able to bring ocean based science into my classroom on a regular basis and have a series of resources to use. Also I have been able to be a part of other programs I heard about through the program
- I regularly look at the online resources when developing new resources and curricula myself for content and inspiration. The online workshops have expanded my content knowledge in ways I never even would have thought it needed expanding.
- Easy to locate information that I received at lectures and pertinent links to topics I am seeking information.
- I enjoy the online workshops which are always informative, enriching, and most interesting with the diversity educators and scientists.

All of the participants regarded lectures (82%) and workshops (97%) as extremely important opportunities for interacting with other teachers, educators, and scientists. Retreats (15%) and online workshops (29%) were also extremely important. Participants thought that the quality of interaction with scientists was excellent (58%) or very good (31%) at these events. Selected comments from participants about their interactions with scientists:

- It is great to meet actual scientists! Normally we have very little contact with scientists, but through COSEE-West and their lectures/events we are able to hear about their current projects and science currently happening and influencing our world. The Educator Q&A periods/social time allows teachers to discuss/network with the scientist & fellow teachers. With all the budget cuts & science center closures in LAUSD, there are few opportunities for teachers to meet and support each other in science education.
- Speakers and presenters at 99% of my COSEE-West experiences have been excellent. I appreciate the informative lectures, very well done.
- Partnerships with SWMEA networked me with new knowledge, new groups and volunteers for LA Maritime Institute TopSail Youth Program, locally; and for American Sail Training Association, nationally. ASTA has had COSEE related workshops at our conferences. Seals Life workshop at Cabrillo Marine Aquarium introduced LAMI to funding to better involve our groups from 'at-risk' communities.
- Getting the opportunity to have discussions with colleagues at meetings, lectures, and workshops. Being able to ask clarifying questions of the Lecturer when needed makes for a valuable experience.
- Both the Q&A time and the mingle time have been the most valuable interactions for me with scientists. The mingle time and the group activity time have been the most valuable interactions for me with educators.

- However because my school is an entrepreneurial school I love the contact with the scientists and the ability to bring back the new jobs I have come in contact with. You can not be something if you do not know about it.
- In general when attending workshops and lectures the time we get to share information with other teachers. I enjoy the after dinner/questions with the speakers. A different insight is given than the lecture.
- Getting to know the Directors and their colleagues through participating has been enlightening. I believe that I have a better understanding of what it takes to be a relevant scientist in the current political climate than I did before, which makes the idea all the more valuable to me. The experience has made me want to encourage and support more of my students to become scientists. Bringing the MLPA process into focus helps me to understand how important it is for students to be taught about public responsibility for stewardship of our resources. Dr. Chao's lecture and the workshop at JPL were so powerful, and the staff so helpful and welcoming that I felt like part of the community and was really inspired to learn more about climate and weather dynamics-it has helped me to teach more effectively because I really do understand more about the way that climate can and does change due to changing conditions that humans have an impact on. I can help the students understand because of this.

Participants thought their involvement in COSEE-West was extremely useful in developing instructional or content expertise (92%), continuing professional development (86%), obtaining salary points or salary increase (19%), obtaining a new teaching or administrative position (19%), or achieving a master's degree (3%).

A majority of participants believe that COSEE-West curricular materials are very good at supporting the State Science Standards at their teaching level (74%), improving science education programs at K-12 schools and informal science centers (77%), and helping teachers/educators integrate ocean science themes into their teaching (77%). Most participants also thought that COSEE-West is very helpful in increasing their understanding of ocean sciences scientific research (82%), understanding human impacts on the ocean (88%), depth of ocean sciences content knowledge (88%), quality of teaching of science (70%), and amount of ocean sciences taught in the classroom (64%). Their involvement in COSEE-West is also very influential upon their approach to teaching science (46%), assessment and evaluation methods (27%), and interactions with colleagues and students (56%).

Participants view COSEE-West as being extremely beneficial to their students. Teachers believe their students' interest (71%) and content knowledge (62%) in ocean sciences significantly increased after exposure to COSEE-West curricula. Selected comments from participants are included in Appendix II. COSEE-West is also seen by participants as being very effective in involving students of underserved groups in science (52%).

Participants are extremely involved in developing new ocean sciences curricula (59%), teaching science collaboratively (49%), mentoring teachers (47%) and students in science related activities (55%), providing information to teachers on teaching or science content (59%), and promoting ocean sciences in schools and informal science centers (68%). Participants' educational activities are shown in Table 4.

Table 4—Influences of COSEE-West on Participants

Participant Activity	Responding Often (%)
Develop or pilot new curricula	59
Conduct in-service or training workshops	22
Make presentations to non-teaching groups	33
Present at a science conference	21
Conduct individual or collaborative research	27
Mentor K-12 teachers in science related activities	47
Mentor students in science related activities	55
Provide info to K-12 teachers on science content	59
Promote ocean science with schools or informal science centers	68
Sponsor ocean science programs	41
Collaborate with other agencies on ocean science programs	46
Teach science collaboratively	49
Participate in distance learning	27
Implement integrative ocean science	56
Share COSEE-West information with other colleagues	68
Use OceanList	72
Influence teaching style	46
Influence assessment methods	27
Influence interactions with colleagues, students	56
Increase level of ocean science content knowledge	88
Increase level of teaching of science	70
Increase amount of ocean science taught	64
Increase student level of interest in science	71
Increase student level of content knowledge in science	62
Increase involvement of underserved students in science	52
Increase administrative support to participate in COSEE-West	30
Support of State Science Content Standards	71
Increase understanding of ocean science research	82
Increase understanding of human impacts on the ocean	88

Number of survey respondents in May 2009 is 39.

In general participants are extremely satisfied with the program activities offered by COSEE-West and only wish there were more of them. As stated by participants:

- I am extremely grateful that a teacher at another workshop mentioned COSEE-West to me back in 2005. The quality has been excellent and has opened me up to worlds of information I otherwise wouldn't have been exposed to. And the more I get opened up and exposed to information, the more I can share with my students.
- Thank you for keeping me connected to this wonderful program!
- COSEE-West is such a valuable resource for the Los Angeles area - really connecting disparate groups in meaningful and valuable ways. I cannot possibly count the number of times the COSEE-West workshops and staff have connected me and my center with people I needed to be connected to. It's very enumerative of ways in which COSEE-West activities and staff have strengthened our programs and offerings.

- COSEE-West has transformed my job into a real career! I have gone from 4th grade teacher to 6th grade science teacher and Science chair with the task of building a cohesive middle school science department (unfortunately on a very small budget).
- As an informal educator that works with the public, I use COSEE-West mostly to keep myself educated about what is going on in the world of Ocean Science. I only see visitors for short interactions (a few minutes) rather than students in a classroom. I only do Ocean Science/Environmental education and COSEE-West is a great supplement to make sure my knowledge base is current.
- I am very grateful to have COSEE-West supporting my teaching. What a professional and caring group!

5. Perception of Lecture Series

In Year 2 (September 2008-August 2009), 703 individuals were involved in COSEE-West programs. Attendance of participating teachers, informal educators, and the general public at evening lecture/discussion sessions averaged 30, with a maximum number of 48 in February 2009 for the *Ocean in a Warming Climate* lecture at the Natural History Museum.

Survey data, field observations, and interviews indicated extremely positive feedback for the lecture series. The majority of those surveyed (86%) had attended previous lectures. Participants surveyed strongly agree that they would attend future lectures (73%) and recommend (67%) the lecture series. Most participants strongly agree on a number of criteria on the lectures, ranging from the preparation of the lecturer (89%), quality of audiovisuals and materials (79%), increased their interest (60%) and knowledge (65%) in ocean science, and that they would share the information with other teachers/educators (65%). The majority of participants felt that the content was applicable to California (65%) and National (72%) science standards. Survey results are shown in Table 5. See also lecture feedback in Appendix II.

Table 5—Participant Feedback to Lecture Series

Question	Responding Strongly Agree (%)
Lecturer was well prepared	89
Quality of materials, AV were appropriate	79
Questions and answers were handled well	80
Lecture increased my interest in ocean science	60
Lecture increased my knowledge in ocean science	65
I will attend other lectures in this series	73
I will recommend this lecture series to others	67
I need more opportunities to learn ocean science	60
Able to use lecture information in my classroom	68
I will share this information with other teachers	65
Lecture materials and the lecture were well linked	66
Content applicable to CA science standards for my grade	65
Content applicable to Nat science standards for my grade	72

Number of survey respondents for lecture programs is 61.

6. Perception of Workshop Series

In year 2, the average number of participants/workshop in the series was 25, with a maximum of 51 participants in March 2009 workshop for the Ocean in a Warming Climate at the Jet Propulsion Laboratory. Ninety-nine of the participants thought that the workshops were helpful in understanding the lecture material and in presenting information to their students. Two-thirds of the participants strongly agreed on the organization, content, timing and usefulness of workshop information. Workshops were held at informal science centers or universities and led by K-12 mentor teachers and informal science educators familiar with the issues facing teachers in the classroom and translating ocean sciences curriculum into hands-on activities. The majority of participants attended previous workshops (75%). Most participants are familiar with ocean science either at an awareness level (47%), demonstration level (41%), or mastery level (10%). Participants are generally elementary school (20%), middle school (19%), or high school teachers (39%) or informal educators (19%) seeking instructional or content expertise (88%), instructional materials (72%), or professional development credit (19%). Workshop presenters are perceived as knowledgeable (70%), interesting (79%), useful (64%), and able to integrate practical application of the content (69%). Workshop speakers are seen as being very knowledgeable (83%) and able to present content information effectively (89%). Survey results are shown in Table 6.

Table 6—Participant Feedback to Workshop Series

Question	Responding Strongly Agree (%)
The session met my expectations.	68
Session content was well organized around clear goals.	67
Time was planned carefully and used effectively.	64
Content presented using a variety of learning modalities.	64
Session enhanced my professional expertise in this area.	70
Speaker was knowledgeable about content.	83
Speaker presented content information effectively.	89
I will implement what I learned at my own school site.	49
Using what I learned will be supported at my school site.	47
I will share information with teachers in my school.	59
I will share information with teachers at other schools.	51
Session content appropriate for students at grade level.	49
Workshop activities correlated to California science content standards	58
Workshop activities correlated to National science content standards	58
Presenters knowledgeable	70
Presenters integrated content	69
Presenters interesting	67
Presenters useful	64
Workshop materials helpful in presenting information to students	99

Number of survey respondents for workshops is 42.

Participants reported that resources/hands-on activities presented in the packets distributed at each workshop were greatly appreciated, especially considering California and school district budget cuts. Comments from participants about the workshop series:

- I found all the information wonderfully presented. I loved the intimate, non-threatening atmosphere as well.
- I really appreciate the effort that went into this. Hearing directly from teachers is very powerful. It was also very important to hear about managing the money because LAUSD is not trustworthy with money and may not allow the grant to be used by the grantee [grant writing workshop].
- Always great to hear from the scientists. The team as always did a great job.
- The presenter was very knowledgeable and provides lots of clarity to the topic. It was a really lovely talk. I found this very informative. The activities were also very useful and I will be proud to use them in my class.
- Thanks for putting everything in the packet/online. This is my fifth experience with a COSEE event and it was a fun learning experience.
- I was in awe of the generous gift of knowledge presented in here today and JPL's tour and all the people involved with logistics of putting this workshop/lecture on this information. Has taken individuals hours of hard research and it was given to us on a silver platter!
- I liked the speaker Dr. Willis presentation and the hands-on practice labs. Thank you for the opportunity to do modifications and extensions- it was good to share ideas among the group. The reference materials are awesome! I think the networking/other teachers is very important.

7. Perception of Online Workshops

- *Organizational Structure of Workshop*

There were two online workshops, one in November 2008 (climate change) and one in March 2009 (MPAs and the MLPA). In November, the scientists were available to answer online participants' questions during the week in which their keynote presentation was featured. However, for the MPA/MLPA workshop in March, although lectures were given by Drs. Murray, Airame, and Lowe on MPAs and the MLPA process, they were not available to answer questions during the online workshop since they were busy reviewing the first draft maps of the South Coast Study Region for the MLPA. Dr. Chris Lowe was able to interact briefly online but not during the entire week his lecture was featured in the online workshop. For the March 2009 online workshop, there was a team of seven scientists, researchers, and members of the MLPA stakeholder group involved in work on marine protected areas available to answer questions; the team included Dr. Jayson Smith (California State University, Fullerton), Kelly Sayce (MLPA Initiative), Sarah Sikich (Heal the Bay and MLPA south coast regional stakeholder), Brent Scheiwe (SEA Lab and MLPA south coast regional stakeholder), Phyllis Grifman (USC Sea Grant and MLPA south coast regional stakeholder), Julie Bursek (Channel Islands National Marine Sanctuary MLPA south coast regional stakeholder alternate), and Kim Anthony (California State University, Long Beach). Dr. Steven Murray of California State University Fullerton served as an advisor for Dr. Jayson Smith.

- *Participant Background Information*

There were 360 actively engaged participants in the November 2008 online workshop and 163 participants in the March 2009 online workshop. Three scientists participated in the November 2008 online workshop and 8 scientists participated in the March 2009 online workshop. Eight undergraduate students participated in the March 2009 online workshop. Thirty-eight teachers received graduate level college credit from California State University Fullerton for their participation in the November 2008 online workshop, and 15 teachers received graduate credit for the March 2009 online workshop. Participants were surveyed before and after the online workshop (respondents were n=373 for the pre-survey and 112 for post survey for the November 2008 workshop and n=165 for the pre-survey and n = 43 for the post-survey for the March 2009 workshop. We had more pre-survey respondents than final participants. Of the participants surveyed, 78% and 63% were from other parts of the United States, while 9% and 14% were from overseas[2]. There were no teacher mentors for either online workshop. Workshop participants heard about COSEE-West online workshops through several sources. For the March 2009 workshop, this included email listservs such as National Science Teachers Association (30%), COSEE-West (25%) or College of Exploration (18%) websites, shown in Table 7.

Table 7—How Participants Heard about Online Workshops

	Participants (%)	
Outreach method	11/08	3/09
Another workshop participant	19	11
OceanList	12	13
COSEE-West website	22	25
College of Exploration website	20	18
Other COSEE website	7	3
Other*	32	30

Pe-Survey respondents in November 2008 is 373 and March 2009 is 165. *Other responses were from many websites too numerous to list individually.

Most participants had done previous online workshops (42% and 76% respectively). Slightly over half of the participants were K-12 teachers (56% and 55%) or informal science educators (21% and 25%). Most participants also believed that distance learning served as an effective method to engage teachers about science (56% and 65%). Seventy-eight percent of participants from the March 2009 workshop taught science. Many of these participants had good (34%) or excellent (3%) knowledge of marine protected areas prior to the workshop. Information from the workshop was viewed as being extremely useful (27%) or useful (45%) in their work. Participant demographic information is shown in Table 8.

[2] Survey results from both workshops are presented with the first percentage referring to the November 2008 workshop and the second percentage referring to the March 2009 workshop. At times, survey questions were only asked for the March 2009 workshop.

Table 8—Participant Demographic Information

	Participants (%)	
Demographic Information	11/08	3/09
K-12 teachers	56	55
Informal educators	21	25
Participants from U.S. (outside LA)	78	63
Participants from overseas	9	14
Female participants	72	74
Minority participants	12	19
Online workshop experience	42	76
Previous COSEE-West workshop	5	27
Previous COE workshop	21	22
Prior knowledge about workshop topic	N/A	37
Workshop content useful for their work	N/A	72
Distance learning effective to engage about science	56	65

Pre-survey respondents in November 2008 is 373 and March 2009 is 165. N/A indicates survey items that were not asked of participants for that online workshop.

Participants were surveyed prior to each online workshop regarding their reasons for participation. Participants hoped to learn about the content area (88%) and interact with scientists and educators (51% and 62%) through their participation in COSEE-West online workshops. Participants surveyed prior to the March 2009 planned to utilize content from the online workshop as part of a larger science lesson in the classroom (65%); as a way to incorporate science, environmental or conservation issues in the classroom (81%); or a way to add additional science curricula (67%). Table 9 shows reasons for online workshop participation.

Table 9—Reasons for Online Workshop Participation

	Responding Yes (%)	
Teacher Activity	11/08	3/09
Learn about content area	N/A	88
Personal interest	65	71
Enjoy taking online workshops	20	30
Relates directly to science standards for your grade	34	24
Relates to your area of expertise	27	32
Will help you develop science curricula	56	51
Helpful information for your work	54	50
Opportunity to interact with scientists and educators	51	62

Pre-survey respondents in November 2008 is 373 and March 2009 is 165. N/A indicates survey items that were not asked of participants for that online workshop.

Participants surveyed prior to the November 2008 online workshop cited a variety of reasons for participating in this online workshop. The climate change online workshop related to their interest in environmental issues, their work in other programs, the ability to incorporate real-time

data in their classroom, learn about the latest scientific research, and communicate with a larger ocean science community.

- I am participating in this online workshop because I am eager to see how the information is presented online. I have completed several environmental classes in a traditional classroom setting and so now I would like to see how comprehensive the information will appear online. Also, I am hoping that from what I learn in this workshop I will be able to build more information and learn how to develop curricula from what I have learned.
- The COSEE online classes have been great opportunities to learn from experts in their scientific fields. It not only stimulates my science teaching but I also use the lectures/materials to connect my students with the real people who are studying these fascinating scientific questions. It is like a fieldtrip to an active research station for my home school students! My sister in law is an atmospheric chemist who has travelled to Antarctica to analyze ice and designs computer models, but it is sometimes hard to schedule her to meet with my students. The online format gives us availability to the information if personal scheduling does not allow for face to face experiences. THANKS for keeping the content fresh and relevant for science educators and their students!
- Accurate and relevant knowledge - Michigan has recently adopted new Science standards and water and ocean content has been greatly decreased, especially at the primary levels. I need to be able to be a voice that can demonstrate the need to make ocean curricula important.
- I am working to develop a broad Sea-Level Rise Learning Network for The Nature Conservancy. We are in early stages of determining what this will consist of and I think it will be extremely informative for me to see how this particular approach works...and to learn about whether it might be right for us.

Participants surveyed prior to the March 2009 online workshop indicated online workshops were an alternative way of continuing their professional development and increasing their content knowledge. They were also able to meet and connect their students with scientific experts in a way that would not otherwise be possible.

- I would like to learn new things and be able to relate the information back to my students. I also want to keep up with data of new data and/or modeling of data from current researchers in the field.
- This will allow me to fulfill professional development and increase my current knowledge of the content in the workshop. Interacting with others out of my own country is always beneficial as it allows me to become more global in my thinking.
- The COSEE online classes have been great opportunities to learn from experts in their scientific fields. It not only stimulates my science teaching but I also use the lectures/materials to connect my students with the real people who are studying these fascinating scientific questions. It is like a fieldtrip to an active research station for my home school students! My sister in law is an atmospheric chemist who has travelled to Antarctica to analyze ice and designs computer models, but it is sometimes hard to schedule her to meet with my students. The online format gives availability to the information if personal scheduling does not allow for face to face experiences. Thanks for keeping the content fresh and relevant for science educators and their students!
- I would like the opportunity to learn all that I can from anywhere I can. I am extremely interested in marine ecosystems and their preservation as well as connections to other scientists that are equally interested in this topic.

- *Participant Feedback*

Teachers reported that the most important places in the online workshop environment are the keynotes room (92% and 97%), resources room (84% and 80%), and credits room (52% and 37%). One participant commented, "Keynotes, Resources, Personal Tales or highlights, & the Cafe with intros. Everything really! Many favorite areas - beauty was in being able to enter at random & according to time and mood." Teachers typically spent an average of 15 hours on each online workshop. Favorite areas in the online workshop are shown in Table 10.

Table 10—Favorite Areas in Online Workshop

	Responding Very Important (%)	
Workshop Area	11/08	3/09
Keynotes room	92	97
Resource center room	84	80
Reception room	29	27
Credit room	52	37
Café	19	26

Post-survey respondents in November 2008 is 112 and April 2009 is 41.

Over three-quarters of participants surveyed gave the online workshops an A rating (84% and 83%). Participants experienced some difficulties with the November 2008 climate change workshop due to problems hearing the online lectures, problems with using Real Player, and November being a busy time of the school year. Despite some technical issues, participants still responded that online workshops and distance learning are very important (97%), that they would be interested in participating in future online workshops (96% and 97%), they are effective at engaging teachers about science (88% and 90%), and that the speaker presentations were very interesting (87% and 90%), and useful (86% and 91%). Participants reported learning a great deal (87% and 90%), and that their participation in the online workshop would increase ocean science content presented in the classroom (81% and 84%). Participant feedback on online workshops is shown in Table 11.

Table 11—Participant Feedback on Online Workshops

	Responding Agree and Strongly Agree (%)	
Participant Feedback	Nov 2008	Mar 2009
Online workshop met my expectations	87	90
Thematic ocean science appropriate	93	97
Learned very much from workshop	87	90
Workshop answered my questions	86	86
Content information presented clearly	84	94
Graphics presented effectively	86	92
Participation increased awareness of ocean sciences	92	92
Will increase ocean science content in class	81	84
Computer access worked well	77	89
Felt comfortable navigating online environment	85	91
Technical problems resolved quickly	76	86
Length of time for workshop was appropriate	91	87
Time to interact in workshop appropriate	84	78
Will share workshop information with others	95	94
Interested in future online workshops	96	97
Online workshops, distance learning very important	97	97
Effective in engaging teachers about science	88	90
Online presentations were very interesting	87	90
Online presentations were very useful	86	91
Online presentations relevant to content standards	N/A	80
Overall grade of A for workshop	84	83
Workshop structure facilitates interactions among participants	N/A	81
Workshop structure promotes my learning process	N/A	92

Post- survey respondents in November 2008 is 112 and April 2009 is 41. N/A indicates survey items that were not asked of participants for that online workshop.

March 2009 participants felt that the workshop structure helped promote interactions (81%) and their learning process (92%):

- We were able to interact with the speakers and then discuss among ourselves further in the cafe later so we had time to digest content.
- It allowed me to interact with other educators around the country and see what they are doing and how they use this information in their classrooms. That information allows me to design effective and meaningful experiences for my kids.
- Loved reading the insights and questions of other teachers. Many of the scientist's answers came with more links and other clarification that really helped deepen my understanding of their presentation! Fabulous.
- The "rooms" offered many opportunities for interactions.
- I really appreciated the blogs. Reading the responses of others also helped me to understand their different points of view. It helped me to develop questions and to follow the track of the discussions. I appreciated being able to go back and review discussions and parts of the presentations because sometimes I had a different understanding than

other participants from the first review of the presentation. It was also interesting to consider the three different presentations as a whole and have the scientists referring to each other's work to unify it to a theme. Reading the questions of the other participants, and their background was also very interesting.

- I like the videos and the alternate text and pictures. Having the transcript helped me follow along the videos.

- *Scientist Feedback*

All of the participating scientists felt that distance learning in the form of online workshops was either somewhat or very effective. Two-thirds of scientists surveyed planned to participate in future online workshops. Scientists felt that interacting with teachers in the online workshop environment allowed them to learn from their questions and comments, and create a better understanding of adapting their research to the K-12 classroom and general public. Scientist involvement in COSEE-West is shown in Table 12.

- I appreciate this opportunity to work with you and learn from your questions and comments. In summary, I enjoyed very much this online lecture experience. Hopefully the lecture materials and the question/answer session will make a difference in our effort in understanding, educating, adapting and ultimately mitigating the global climate change.
- Best of luck with your teaching. Your job is very very important. Thank you!
- I honestly believe that you will be the key to MPA success. The State can implement the perfect MPA plan, have the best enforcement, use the best scientific data, but if the public doesn't understand or appreciate why we have to do this - it will fail. I honestly believe education is the key.
- I think face to face is the best kind of interaction. It is easier to become distracted during online workshops. But I think this is a great tool to help connect scientists with educators on a specific topic or issue.
- While it's better than nothing, I think science is best learned while actually doing it! I'm not convinced that a student can truly appreciate the challenges of doing marine science without having to get their feet wet and their hands dirty. However, online workshops do reach out to more people.

Table 12—Scientist Involvement in COSEE-West Program Activities

Scientist Feedback	Responding Yes (%)
Gave online lecture	40
Answered questions	80
Distance learning very effective teaching method	25
Distance learning somewhat effective teaching method	75
COSEE-West online workshops very helpful	27
COSEE-West online workshops somewhat helpful	18
Used online workshop resources frequently	22
Would participate in future online workshops	67

Number of survey respondents in year 7 is 6. Until year 7, scientists were only surveyed annually. Starting in year 7, scientists surveyed after each online workshop.

- *Quality of Interactions*

Participants took advantage of the open format teacher chat rooms for online contact with other participants, occasionally wandering through different chat rooms and joining in the conversation. Participants enjoyed the opportunity to ask questions of the scientists on each of their presentations in the keynote discussion room, and were impressed with the quality of interactions with scientists. The scientists went to considerable efforts to address all questions asked by participants during the online workshop.

- Scientists were great but I need to organize my time to view the material and interact.
- I thought the scientists did an excellent job answering the questions and doing it in a timely manner.
- The scientists were so available. It was humbling.
- I think the interaction between scientists was excellent considering the amount of questions that they were asked.
- I thought that the lecturers gave a lot of feedback to those who asked questions. Don't know if it can be improved on!
- I thought the interactions worked well. It was nice that we could see the other questions and answers as well as our own.
- Scientists were very willing to give feedback to participant questions.
- I am very happy with the way in which my questions were answered in the current format.
- The scientists were outstanding. They answered all of the participants' questions in a very timely manner.
- I thought it was excellent the way it was done.
- I am impressed by the dialogue and interactions...no improvements necessary.

Almost all of the participants and scientists agreed or strongly agreed that the quality of interactions with scientists, workshop staff, and participants was at a high level for both online workshops. Roughly half of participants and scientists surveyed for the March 2009 marine protected areas workshop rated online workshop interactions as more in-depth (49% and 50% respectively) than traditional in-person learning methods. However, these interactions were not viewed as more effective than traditional methods. Results are in Table 13.

Table 13 —Quality of Interactions

	Responding Agree or Strongly Agree (%)		
Survey Statement	Participants 11/08	Participants 3/09	Scientists
Quality of interactions with scientists high	81	76	100
Quality of interactions with science team high	N/A	85	N/A
Quality of interactions with workshop staff high	84	88	67
Quality of interactions with participants high	58	71	67
Interactions more effective than traditional methods	N/A	38	0
Interactions more in-depth than traditional methods	N/A	49	50

Post-survey respondents in November 2008 is 112, and April 2009 is 41. Number of scientists responding is 6. N/A indicates survey items that were not asked of participants for that online workshop. Science team only for March 2009 workshop.

COSEE-West staff assisted the learning process by stepping in to answer questions posed by teachers and remained very involved during the entire online workshop to provide any assistance required. In addition, COSEE-West staff supplemented the information provided by scientists, dealt with technical or administrative issues, and served as facilitators to promote online interaction among participants.

- Staff was always available to help answer questions regarding course requirements and tech issues. They answered questions in great detail and made this experience an excellent one.
- They were gracious in their approach to direct our questions and/or concerns to the appropriate places or people.
- More than would fit here - they were knowledgeable and helpful - I've taken quite a few online workshops and things, and this workshop ranks pretty much at the top. (I love the platform you use)
- I appreciate that they always try to extend your knowledge on a topic. I have noticed that this is done from the simple questions to the very complex.
- They had great responses to other peoples questions and I gained a great deal of trivia as well as receiving clarification by reading other peoples discussion questions and their responses to those questions
- The staff gave the info that supplemented the presenters' information.
- I felt at first "cheated" because the keynote presenters were not available to answer questions, but as the workshop continued, I found the individuals that were responding to be quite knowledgeable and quite willing to give additional resources. I don't feel "cheated" now!

- *Integration of Workshop Content into Teaching*

All participants of the online workshops were able to integrate content learned from the workshop into their teaching. Over 80% of participants reported that participation in COSEE-West online workshops would increase the amount of ocean science content in their classroom. Participants planned to use workshop content in developing curricula, related activities, and engaging their students in independent research projects. One teacher used content in his Question of the Week activity in his classroom.

- Oceanography is a course in the NHCS System. Most is focused on off-shore SE United States. There is much info in this workshop that will be used. I will also use material in Earth & Environmental Science and Biology classes.
- I will soon begin interpretive walks as an island naturalist for Channel Islands National Park. We are able to tailor our interpretive talks and I will make effort to infuse information gained form the workshop.
- Absolutely - I am developing a year long project that this relates to, and many of the resources are readily accessible and will be engaging for my students (HS chemistry).
- Some of my students have actually taken some of the material that I have presented and gone to the library to find books on the topics. Pretty amazing for second graders!
- I will definitely require my students to develop a research project and presentation on the MLPA presentation on our local Orange County MLPA's. I think I may develop a lesson where students are divided into different stakeholder groups and have to create their own.

- I have used some of the lessons given, the Tragedy of the Commons for example. I plan to modify some of the materials given for my ESL class and for teachers in my department. I want to work with the Social Studies department next year to use lessons from the MPA and connect to some ancient cultures that did not have enough food and relied on the ocean to provide for them.
- I hope to use all or part of the lesson I prepared with a summer camp I am doing this summer. And, I have an idea of incorporating the notion of protected areas and the time it takes to implement them on a presentation I will be giving to a group of divers participating in a beach clean-up.
- I might consider conservation studies such as "case studies" showing how to design a scientific project that addresses ecological and environmental management questions.

- *Suggested Improvements to Online Workshops*

Participants were asked how to improve future online workshops. While they considered their interactions with scientists quite good, they wished for more time to ask questions, improvements in the format of the presentations to make them easier to view/listen to online, and an alternative format in the way that questions and answers were presented to make them easier to follow. Participants also wanted to have an opportunity for a live chat session with the scientist or to know when the scientists would be online ahead of time. Being able to download the scientists' PowerPoint presentations would also make it easier to view the content offline. Having smaller discussion rooms might also help in promoting greater intimacy of interactions. Participants suggested several ways to improve interactions with scientists:

- Knowing when someone would be online to have more of a discussion than question/answer posting would be interesting.
- The format of the presentations was extremely frustrating. The slides were very congested, and too small to appreciate. Simple is better. So, to improve this, I would like to hear the presenter (loud and clear) and view the slides being discussed. The first two presenters were only partially audible and to dark to see anyway.
- Time should be longer to allow participants ask and interact with scientists.
- If there were a different structure to the exchanges, where you could see the response directly under the topic we to which we are responding, it would help clarify responses.
- In the discussion board, directly link the scientists answers right below the participants questions so that you don't have to scroll around looking for answers and referring to different numbers.
- Break down into smaller discussion rooms.
- Find a more fluid venue for communicating with the scientist (i.e. questions & answers should be together not in a lengthy, scrolling document).
- Having a better structure to the discussion area. Having the responses follow a linear pattern is not conducive to response/conversation flow.
- Live response session to questions.
- Perhaps to have a web somewhere updating what the grad students are working on specifically so that we might get our students more interested in following their work. I really appreciated the scientists answering our questions. Getting the High School students involved in research might be a good way to add to the workshops. Some of the ways that students can and have been participating will be interesting for us to consider.

Participants also suggested other improvements to the online workshops such as expanding the workshops to include K-16 participants, providing hands-on activities for students, and an area where ideas could be written down and edited and then transferred to the discussion window. Several participants were cognizant and very appreciative of the many improvements to online workshops that staff enacted over time. Other notable suggestions including featuring younger scientists to inspire students to consider scientific careers, daily assignments to encourage more interaction, offering graduate credit for other products such as podcasts, posting supplementary reading material, posting other opportunities to interact with scientists/participants, incorporate a live component to keynotes and participant interactions, and giving a certificate of participation.

- Would appreciate having on-line resources as .pdf files.
- Provide hands on activities for the students.
- Maybe make the workshops from K-16, rather than just K-12, so that more post-secondary teachers could benefit from the interactions.
- It would be nice to have a window where my ideas could be written down and edited. Then I could transfer the product to the discussion window.
- Have a quick clear explanation of available opportunities and how to take advantage of them - for example, how/when to interact with scientists and with other participants.
- You seem to be tweaking these workshops to an extent that amazes me and I appreciate those who astutely criticize those little things that make it so much better.
- A previous workshop had daily assignments that moved things along a bit.
- Give the graduate credit students another option besides a lesson plan. (Research paper, podcast, online assignment, etc.)
- Incorporate a "live" component to Keynote presentations for questions, and incorporate a "live" component to participant interactions.
- You might consider posting optional background readings so teachers not familiar with the presentation topics could read and be better prepared to learn from the presentations.
- Continue to do these surveys to learn how to grow even more.
- Extend the topics for ocean science as the blueprint for ocean literacy standards reflect them.
- Many workshops (online or otherwise) that I have attended have a way that you can receive a certificate of attendance or "completion" in exchange for a certain amount of hours of involvement.

- *Participant Benefits of Online Workshops*

Participants report that the resources and ability to gain a large amount of information in a short time, as well as the ability to go back and reference material in the future, are huge benefits of participating in online workshops. Participants said they would be able to implement information they learned in a variety of ways.

- No cost of travel or time to travel. This makes the information accessible and heightens the chance for using the information in a classroom setting.
- I gained an awareness of ocean components I had no idea were relevant and came to understand their significance through the life's work of the scientists. Others will come to know the people, their effort, and their use of technology to answer questions facing earth's health.

- I've participated in previous COSEE workshops, which emphasized the Great Lakes and the Atlantic to some degree. The focus herein on the Pacific Ocean and the world ocean was what I found most interesting.
- I personally enjoy gaining information from your workshops. Since I teach second grade, much of the material is above my students' reading level. I take much of the information and present it in an easier format. My students love the information gained.
- I like reading other educators ideas for how to implement what they are learning (i.e. websites they come across in their surfing, videos they know of, etc).
- I had very little prior knowledge on this topic. I felt a little overwhelmed at first, but grew confidence as the weeks went on. I gained an appreciation for the "big picture" connecting science and society. I think this will benefit my students as I hope to connect them an excellent example of science in society.
- It is very important to me to improve my current scientific understanding and knowledge. The area of ocean science is extremely interesting to me, a life-long Missourian. The COSEE workshops have provided me with a high-quality and convenient way to explore this content. I truly appreciate this opportunity.
- I had the opportunity to ask questions that may not have been able to be answered except by people actively engaged in scientific work in this field. I had the opportunity to share with others, including students, the presentations and insights I gained from participating.
- As an informal educator and student, I am constantly working to educate myself while maintaining my necessary day-to-day schedule. Workshops such as these help me stay up-to-date and knowledgeable so that I may not only share information with my students in future lessons, but also to gain a valuable place in discussion with any future experts, scientists, educators, or enthusiasts that may cross my path.

Participants in the March 2009 marine protected areas workshop strongly agreed that there were many benefits to online workshops. Participants became more interested in marine protected areas as a result of participating in the online workshop (88%), planned to use workshop content to implement curricula (88%), and to share information from this workshop with students (94%), as shown in Table 14.

Table 14—Participant Benefits of Online Workshops

	Responding Agree and Strongly Agree (%)
Participant Benefits	3/09
Became more interested in this subject area	88
Learned additional content I can use in my teaching	84
Will use workshop content to implement curricula	88
More confident to teach in this subject area	92
Able to share info from this workshop with students	94

Number of post-survey respondents in April 2009 is 41.

- *Scientist Benefits of Online Workshops*

Scientists also benefited from participating in the marine protected areas workshop. Scientists responded that they were able to interact more with K-12 teachers and informal educators (100%), learn more about presenting content to K-12 teachers and informal educators (50%), and how K-12 teachers and informal educators present content to K-12 students (50%), as shown in Table 15. One scientist commented that participating in an online workshop was helpful in gauging his ability to communicate effectively with K-12 teachers and educators: "I got to see where my message missed the mark."

Table 15—Scientist Benefits of Online Workshops

	Responding Agree and Strongly Agree (%)
Scientist Benefits	3/09
Able to interact more with K-12 teachers and informal educators	100
Learn more about presenting content to K-12 teachers and informal educators	50
Learn more about how K-12 teachers and informal educators present content to K-12 students	50
More likely to work with K-12 teachers, informal educators, or K-12 students on science projects	50

Number of scientist survey respondents in April 2009 is 6.

8. Introduction to Marine Science Summer Teacher Workshop

Mentor teachers will be involved in teaching in-service workshops at the Introduction to Marine Science Workshop to be held in June 22-26, 2009 at the Marina del Rey Middle School Marine Science Academy. Participant feedback will be presented in the September 2009 Project Findings and Activities Final Reports for the no-cost extension grant.

9. OOS Summer Teacher Workshop

Mentor teachers, scientists, and participants from the COSEE/OOS community will be involved in teaching workshops at the OOS Summer Teacher Workshop to be held in August 10-14, 2009 at USC, UCLA, the Ocean Institute, the Jet Propulsion Laboratory, and Cabrillo Marine Aquarium. Participant feedback will be presented in the September 2009 Project Findings and Activities Final Reports for the no-cost extension grant. Nine participants from last year's OOS workshop also submitted an OOS related lesson plan that was posted on the COSEE-West website. Christina Engen, a K-12 teacher at Crescent Valley High School in Glendale Unified School District presented her lesson plan developed from content learned at the OOS workshop at a staff meeting and had teachers test drive the lesson plan. A comment from one of last year's OOS workshop participants:

- I really appreciated the week. It was a great experience to see everyone in the education field at the university level working so hard to help us at the secondary level develop the future scientists. I have some great ideas and activities and you gave me back my inspiration for what I do; that was a gift that helps me enjoy every day. I have a wonderful group of new students so I can't wait for the spring semester when I plan to use the great lessons and resources you shared with us. I am experimenting with cheap shampoos and conditioners for the modeling of the coastlines. This is really one of the best ways I've seen for helping students understand currents. I did not think they had a good understanding before. I am really excited to tie in the east coast with ocean currents because it's so exciting—hurricane watch! Thanks for keeping the network going.

10. Informal Science Exhibit Retreats

An informal science exhibit retreat was not held in this program year. The next informal science exhibit retreat is planned for later in 2009. Survey findings for informal science exhibit retreats will be included in future Findings reports.

11. Professional Development Series for Informal Educators

Professional development workshops for informal educators were not held in this program year due to scheduling conflicts. COSEE-West staff is working with informal educators to determine appropriate times to schedule workshops for staff at the respective informal science centers. COSEE-West's informal science center partners are seeking ongoing professional development for their informal educators. While it is helpful for educators to attend the ongoing lecture and workshop series, these events are often conducted during evenings and weekends when informal science centers are at peak demand and informal educator needs differ from those of K-12 teachers. Survey findings for informal educator workshops will be included in future Findings reports.

12. Climate Day 2009

Based upon the success of Climate Day 2008, which was cosponsored by COSEE-West, the Jet Propulsion Laboratory, and the East San Gabriel Valley Regional Occupational Program and Technical Center, another Climate Day event is being planned for the fall of 2009.

13. Use of COSEE-West Website Resources

Visitors worldwide accessed and downloaded ocean sciences material from the COSEE-West website for use in K-12 classrooms and informal science centers. Participants reported that online resources helped them implement ocean sciences curricula in their classrooms or informal science centers. When the COSEE-West website premiered in January 2003, it had 860 visitors and in June 2009 it had 43,992 visitors. The QuikSCience website had 14,978 visitors in June 2009. The Edison website had 9,979 visitors in June 2009. With additional online resources on the COSEE-West website, online traffic is anticipated to increase overall with monthly fluctuations. COSEE-West started a blog in January 2009 and a Facebook page in May 2009. The facebook page has had 150 page views between May 9 (publish date) and June 6 and there

are currently 10 fans. The COSEE-West blog has served as an excellent means of providing information on upcoming ocean related events and as a forum for informal feedback to program activities (see Appendix II for student comments on a recent COSEE-West lecture). Table 16 shows visitor traffic for the COSEE-West website.

Table 16—COSEE-West Website Resources

	Website Visitors						
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
COSEE-West	860	3,848	6,179	24,600	46,522	29,159	43,992
QuikSCience			1,175	2,352	5,535	9,754	14,978
Edison					475	9,950	9,979

14. Participation by Scientists

Scientists participating in lectures, workshops, or online workshops were surveyed to assess their perceptions of COSEE-West and their participation. Based on scientists surveyed, scientists come from public universities (50%), research institution (17%), or other institutions (33%). Most scientists participating in COSEE-West specialized in ocean or marine sciences (75%). Both male (67%) and female (33%) scientists participated, with 33% of the scientists being minorities. Scientists specialized in ocean science (67%) or physical science (33%). Scientists receive their funding from a variety of sources, NSF (75%), NOAA (33%), Sea Grant (50%), private funding sources (17%), state funding (17%), and other federal sources (50%). As a percentage of their time, scientists spent time teaching (14%), interacting with students (22%), seeking outside funding (13%), research (24%), and administrative tasks (30%). Seventy-five percent of the scientists reported that their involvement in COSEE-West gave them some additional opportunities to interact with K-12 teachers and informal science educators. Most scientists discussed COSEE-West with their colleagues (80%). Scientists primarily participated in COSEE-West by giving a presentation at either a lecture or workshop (25%) or participating in an online workshop (100%). Scientists recruited K-12 teachers (50%), graduate students (100%), undergraduate students (50%), and faculty (50%) into COSEE-West program activities. Most scientists worked with K-12 teachers on workshop activities (50%), mentored K-12 students on science activities (50%), provided science content information to K-12 teachers/educators (50%), provided information on pedagogy to K-12 teachers/educators (50%), worked with K-12 teachers/students through an internship program (50%), and had K-12 teachers/students visit their lab (50%). Scientists collaborated with a variety of partners on COSEE-West activities including COSEE-West staff (33%), university scientists (100%), K-12 teachers/students (33%), informal science centers (67%), and other partners (33%). Scientist involvement in COSEE-West is shown in Table 17.

Table 17—Scientist Involvement in COSEE-West Program Activities

Scientist Involvement	Responding Yes (%)
Female scientist	33
Minority scientist	33
Additional opportunities to interact with teachers and educators	75
Discussed COSEE-West with colleagues	80
Participate in COSEE-West lectures or workshops	25
Participate in COSEE-West online workshops	100
Recruit K-12 teachers	50
Recruit graduate students	100
Recruit university faculty	50
Recruit K-12 students/undergraduate students	50
Work with K-12 teachers in workshops	50
Mentor K-12 students	50
Provide info to teachers/educators on pedagogy	50
Provide info to teachers/educators on content	50
Collaborate on ocean science programs with faculty	100
Collaborate on ocean science programs with K-12 schools	33
Collaborate on ocean science programs with informal science centers	67
Collaborate on ocean science programs with other agencies	33

Not surveyed in Years 1, 2. Number of survey respondents in years 3 and 4 is 6, year 5 is 9, year 6 is 4, and year 7 is 6.
*Scientist responded yes on survey items on benefits of education outreach in year 7.

Scientists generally had instructional duties (67%) and most had grants requiring them to do education outreach (80%). All of the scientists surveyed believed that including education outreach plans in their proposals increased their chances of funding. These scientists believed that participation in ocean sciences education outreach is very important (100%), but needed greater institutional support to conduct education outreach (100%). Despite needing more support for education outreach, all of the scientists encouraged graduate students they taught or supervised to be involved in education outreach. All scientists believed the best way to involve the public in their research is through presentations, field research, and participation in the National Ocean Science Bowl (100%). Scientists agreed that they needed help in carrying out education outreach activities and were willing to allocate funds in their proposal budgets towards education outreach (100%). Scientists associated tangible benefits with conducting science education outreach, such as increasing the understanding of science (80%), providing accurate information (80%), and increased attention on environmental issues (80%). All scientists felt that lack of time was the greatest barrier in conducting more education outreach. Scientist attitudes and involvement in education outreach are shown in Table 18.

Table 18—Scientist Attitudes and Involvement in Education Outreach

Attitudes on Education Outreach	Responding Strongly Agree (%)
Participation in ocean science education outreach very important	100
Grants require education outreach*	80
Including education outreach increased chances of funding*	100
Need greater institutional support to conduct education outreach*	100
Attitudes on Education Outreach	**Responding Agree (%)**
Need help carrying out education outreach activities*	100
Willing to allocate funds in proposal budget for education outreach*	100
Benefits of Education Outreach	**Responding Yes (%)**
Increase understanding of science	80
Provide accurate information	80
Increase appreciation of science	40
Attention on environmental issues	80
Motivator for teachers and students	60
Assist teachers and students	40
Present relevance of research	60
Assist in policymaking	60

Number of scientist survey respondents in year 7 is 6. * New questions added to Scientist Survey, not asked of all scientists in year 7.

Scientists enjoyed interacting with participants with a high level of interest in their research, and learning more about issues faced by teachers and educators (also shown in scientist feedback to online workshops). Scientists were able to share their technical expertise, promote the importance of ocean sciences for teachers and educators to share with their students, provide an understanding of specific policy issues, and share their enthusiasm for science. All of the scientists wished to continue conducting education outreach. Stated one scientist: "We're planning a marine outreach facility in Long Beach that will be directly associated with the CSULB Marine Program. We will be working directly with our Science Education faculty."

15. COSEE Network

COSEE-West staff participated in several Network activities. Linda Duguay (COSEE-West) served on the COSEE Council as the COSEE-West representative. Jane Lee (COSEE-West) participated in the Web Working Group and Patricia Kwon (COSEE-West) participated in the Evaluation Working Group. Lynn Whitley (COSEE-West) presented at a panel at the Network meeting. Jane Lee (COSEE-West) also submitted several articles to the COSEE Network Newsletter *CNN*. COSEE-West also collaborated extensively with a number of other Centers in developing the Scope and Sequence for Ocean Literacy, testing OOS modules for COSEE NOW, testing concept mapping workshops for COSEE Ocean Systems, and presenting at numerous

COSEE strands for conferences such as NMEA, CSTA, NSTA, AGU, AAAS, and Ocean Science Meeting. Further details on collaborative efforts with other COSEE Centers and agencies is given in the Activities report.

The COSEE Network meeting was held at Hilton Head, North Carolina on May 4-6. All 12 regional COSEE Centers, the Central Coordinating Office (CCO), National Advisory Board (NAB), and staff from NSF and NOAA were represented. Over 80 individuals attended the three-day meeting. Survey feedback on the Network Meeting at Hilton Head (n=32 respondents) was overwhelmingly positive with 59% of those surveyed rating it as excellent or good (38%). All participants interested in attending future Network meetings. Several participants also expressed interest in hosting future Network Meetings (32%). The next Network meeting will be hosted by COSEE Ocean Learning Communities in Seattle, WA. COSEE Great Lakes and COSEE Alaska indicated interest in holding future COSEE network meetings. Holding Network meetings at COSEE Centers was seen as a great opportunity to view the work of other Centers.

COSEE-West program evaluator Patricia Kwon developed a network meeting survey last year (which was revised for this year's meeting) and presented results to the CCO. Attendees cited informal discussions (29%), ideas for collaboration (29%), and breakout discussions (29%) as the most beneficial aspects of the meeting. Formal presentations (22%) were viewed by some attendees as the least useful aspect of the meeting. Of the formal presentations, the Different Centers, Same Boat was seen as most useful (38%), followed by Storytelling as a Communication Tool (24%), Effective Evaluation and Research on COSEE (14%), Strategies for Engaging Scientists (14%), and Citizen Science (7%). Overall, the Network meeting received extremely positive feedback. Participants strongly agree that the strands on engaging multicultural audiences at COSEE (81%), teaching and learning in cyberspace (65%), role of informal centers in COSEE (30%), climate change (43%), STEM education (54%), and new areas of collaboration for COSEE (44%) discussed important issues. Survey results from the Network Meeting are shown in Table 19.

Table 19—Feedback on Network Meeting

Network Meeting	Responding Strongly Agree (%)
Network meeting met overall expectations	35
Report out from sessions provided actions and focus	28
Concurrent strand format worked well	31
Will share information with others	45
Meetings bring Centers together to discuss common issues	72
Technical/logistical problems solved quickly	45
Length of time for Network Meeting sufficient	24
Enjoyed having Network Meeting at COSEE location	28
Sufficient time for discussion/reflection on meeting topics	14

Number of survey respondents is 32.

Network meeting strands also received extremely positive feedback based on the discussion of important issues, whether appropriate time was allocated for the strand, the need for additional follow-up, and end products or actions identified. The Different Center, Same Boat strand

received the most positive feedback overall, followed by Strategies for Engaging Scientists, Effective Evaluation and Research on COSEE, and Storytelling as a Communication Tool. These results are shown in Table 20.

Table 20—Feedback on Network Meeting Strands

	Responded Strongly Agree (%)			
Network Meeting Strands	**Discussed Important Issues**	**Appropriate Time Allocated**	**Need for Additional Follow-up**	**End Products or Actions Identified**
Effective Evaluation/Research on COSEE	59	31	17	18
Review of Strategic Business Plan	28	7	25	15
Strategies for Engaging Scientists	41	30	48	17
Engaging Business/Industry Sector	14	7	7	4
Citizen Science	22	20	8	4
Storytelling as Communication Tool	36	25	33	27
Different Center, Same Boat	66	30	56	58

Number of survey respondents is 32.

Attendees planned to integrate information from the Network meeting by engaging in more cross-Center collaborations, contributing towards Network goals and products (decadal review, Network evaluation, strategic business plan, web development), and improving Center programs based on information learned or exchanged from presentations or informal discussions.

- I've integrated some of the information on scientist engagement in revising some online scientist surveys based on the work of other regional centers. Also the storytelling workshop was quite valuable in figuring out potential case stories on COSEE-West that can be used to illustrate impacts on teachers, educators, and scientists.
- There were many opportunities to connect with participants from the different COSEE organizations and learn about what they do and the personnel with whom I would be able to share and collaborate. Also, the meeting really helped me to see how our COSEE work fits into the whole mission of the larger COSEE group and a better vision for how we can share our work and collaborate as a larger group.
- Talking to others that do the same thing has given us a chance to sort of form our own group to keep bouncing ideas off each other and work together in the future. We are working on the plans we set forth in the Different Center, Same Boat session.
- Will implement new cross-Center collaborations.
- We'll update all the PIs at our next meeting. And we already are scheduling for folks from other COSEEs to come out to us and us out to them for doing some workshops.
- I am working to collaborate more formally with other COSEEs and their specific professional development coordinators/facilitators. We would like to have calls once a month or so to share ideas, problems and identify network specific projects that COSEEs can engage in.
- Many of the network level activities (i.e. effective practice establishment, storytelling, enabling virtual collaborations) are similar to those we are trying to implement in our Center, but specifically geared towards the OOS community.

- Already have made some changes in how we will be conducting our teacher workshops this summer looking at implementation of COSIA course.
- I will be following up on further development of the strategic business plan for the National COSEE Network, including development of an implementation plan.

Suggestions made by meeting attendees for the next network meeting included using the meeting location as an opportunity to learn more about a COSEE Center and its work, using working groups as a way of getting network products finished and to prepare for the decadal review, and keeping the same meeting format and developing capacity building tools and identifying key members of the Network to take charge of specific issues. Some attendees wished to have fewer presentations and more opportunities for group discussion, while others wished for more opportunities for informal discussion and networking.

- That we continue to use working groups as a way to get COSEE network products done and in ongoing preparation for the decadal review. It will be good to build upon the sessions of this past Network Meeting to illustrate how we are accomplishing this (i.e. present a case study on scientist impact or teacher professional development).
- I would like to be able to interact with the participants online during the session in some way so that we may be able to complement our face to face interaction with an online presence as well.
- Reporting out should be in writing or immediately followed up with written notes.
- I found the evaluation session useful...however it was a long chunk of time to listen to the same overarching topic. Maybe divide these types of topics up throughout the agenda?
- Should be located closer to the actual COSEE Center, or at least, take advantage of the proximity and highlight that center's programs. Didn't really learn about the SE center.
- More time to work on network level initiatives, whether it's specific programs that many centers share, or just collaborating with same-boat colleagues.
- More close-quarters: at Hilton Head we were so spread out that I didn't really get to mix with different COSEE members. Much better mixing on Catalina where we had no other place to go. I spent most of my first day at Hilton Head figuring out how to live there. More detailed pre-trip info would have helped me prepare better.
- I feel that the Network is becoming more familiar with the format and more willing to participate on the necessary levels to move forward as a "Network", so all good. I also think that if more people get into that mind set, we will see a continued willingness to share and work together, which in turn will allow for more sessions like the ones held this year, but it will take time. My suggestion for next year is that we keep the same format, continue to encourage collaboration and start to layer on some capacity building tools and opportunities, like identifying key people within the network leading to take charge of an issue on behalf of the network (paid or otherwise) so we do not become an unwieldy hydra.
- Less presentations and more group discussion. Allow each COSEE to tell some highlights of their activities to the whole group.

APPENDIX I: School Demographic Data

Table 1—Student Body Demographics, LAUSD Schools, COSEE-West Year 2[3]

SCHOOL	American Indian	Asian	Pacific Islander	Filipino	Hispanic	African American	White	Multi
Belmont HS	0.1%	3%	0%	3.5%	90.1%	2.2%	0.4%	0.6%
Birdielee Bright ES	0%	0.3%	0%	0%	75.1%	24.3%	0%	0.4%
Budlong Ave ES	0.1%	0.2%	0%	0%	72.6%	26.2%	0.5%	0.5%
Burbank Blvd ES	0%	4.3%	0%	3.7%	54.8%	10.1%	26.2%	0.9%
Calvert Street ES	0.5%	5.5%	0.3%	5.7%	38.4%	12%	36.3%	1.3%
Central HS	3.5%	1.9%	0.5%	1.2%	77.4%	14%	1.4%	0.2%
Charnock Road ES	0%	11.5%	0.3%	2.3%	59.2%	15.8%	10.5%	0.5%
Curtiss MS	1.4%	0.5%	1%	0.9%	32.4%	63.7%	0.6%	0.5%
Eagle Rock HS	0.7%	4.7%	0.2%	17.3%	65.8%	1.5%	8.5%	1.3%
Eshelman Ave ES	1.2%	2.9%	1.2%	1.9%	65.2%	13.6%	13.6%	0.5%
Farmdale ES	0%	4.5%	0%	0.2%	93.8%	0.7%	0.9%	0%
Gledhill Street ES MST	0.4%	3.4%	0.3%	7.9%	71.3%	5.3%	11.1%	0.3%
Hamilton HS	0.4%	4.1%	0.4%	0.8%	43.9%	32.8%	16.7%	0.9%
Haskell ES MST	0.2%	4.4%	0.5%	6.1%	68.4%	3.6%	16%	0.8%
Hollenbeck MS	0%	0.2%	0%	0.2%	98.7%	0.4%	0.2%	0.1%
James Monroe HS	0.2%	2.7%	0.2%	5.2%	82.2%	3.5%	5.2%	0.8%
Limerick Ave ES	0.2%	6.7%	0.2%	3.8%	77.4%	4.1%	7.6%	0.1%
Marina del Rey Marine Science Academy MS	0.6%	1.5%	0.3%	1.2%	69.4%	22.8%	3.8%	0.8%
Marlton HS	0%	1.6%	0.6%	0.9%	62.9%	31.1%	2.2%	0.6%
Millikan HS	0.8%	3.3%	0.3%	2%	34.1%	10.4%	48.3%	0.9%
Ninth Street ES	0.3%	0.5%	0%	0.3%	85.8%	13.2%	0%	0%
North Hollywood Zoo Magnet HS	0.2%	5.4%	0.1%	1.5%	70.7%	3.9%	17.1	1.2%
Palms MS	0.2%	11.7%	0.3%	2%	39.7%	26.6%	18.3%	1.1%
Poseidon HS	No data available on this school							
Reseda HS	0.4%	3.9%	0.3%	3.1%	72.5%	6.9%	10.8%	2.1%
Roosevelt HS	0.2%	0.3%	0%	0.1%	98.6%	0.3%	0.2%	0.4%
San Pedro Marine Science Magnet HS	0.9%	1.9%	0.6%	1.5%	65%	8.8%	20.7%	0.5%
Southgate MS	0.3%	0%	0%	0.1%	99%	0.2%	0.4%	0.1%
Virginia Road ES	0%	0.2%	0%	0%	58.5%	40.6%	0.6%	0.2%
Wilson HS	0.4%	4%	0.1%	0.4%	92.9%	1.4%	0.6%	0.4%
Woodlake ES	0.3%	9.7%	0.2%	2.8%	17%	8.1%	60.5%	1.4%
Average--all schools	**0.5%**	**3.5%**	**0.3%**	**2.6%**	**67.8%**	**13.6%**	**67.7%**	**0.7%**

[3] Based on 2007-2008 enrollment data from California Department of Education. Data on new and private schools are unavailable.

Table 2—Student Body Demographics, non-LAUSD Schools, COSEE-West Year 2[4]

SCHOOL	American Indian	Asian	Pacific Islander	Filipino	Hispanic	African American	White	Multi
Antelope Valley Union High SD								
Lancaster HS	0.5%	2.3%	0.5%	3.1%	36.4%	26.2%	30.8%	0.2%
Bellflower USD								
Frank Woodruff ES	0.4%	1.6%	0.8%	2.8%	68.8%	13.7%	8.7%	4%
Stephen Foster ES	0.1%	3.3%	1%	4.7%	34%	7.8%	35.9%	13.1%
Chaffey JUHSD								
Montclair HS	0.3%	3%	0.2%	0.7%	83.5%	3.9%	7.7%	0.6%
Compton USD								
Centennial HS	0.1%	0%	0.1%	0.1%	59.1%	40%	0.3%	0.3%
El Rancho USD								
El Rancho HS	0.1%	0.4%	0%	0.5%	96.5%	0.5%	1.7%	0.4%
Garvey USD								
Rice ES	0.1%	52.8%	0%	0%	45.7%	0%	1.2%	0.1%
Glendale USD								
Clark Magnet HS	0.1%	8.3%	0%	5.9%	5.5%	0.1%	78.8%	0.2%
Crescenta Valley HS	0.3%	30.7%	0.1%	2.7%	8.2%	0.8%	56.6%	0.6%
Hawthorne USD								
Hawthorne MST HS	0.4%	6%	1%	5%	69.9%	12.9%	2.7%	2.1%
Independent								
Almansor Center HS	Data not available on private schools							
Archer School for Girls HS								
Brawerman ES								
CALS Early College HS/PUC Schools								
Chadwick School HS								
Mesivta Birkas Yitzchok HS								
St. Callistus ES								
Inglewood USD								
Monroe Magnet MS	0%	0.1%	0.6%	0.1%	73.3%	25.3%	0.5%	0.1%
Lennox USD								
Animo Leadership Charter HS	0%	0%	0.4%	0%	98.9%	0.8%	0%	0%
Long Beach USD								
Colin Powell Academy MS	0%	1.5%	5.2%	1%	65.4%	25.1%	1.9%	0%
Redondo Beach USD								
Redondo Union HS	0.6%	9.5%	0.7%	2.2%	22.6%	7%	56.7%	0.7%
San Gabriel USD								
Jefferson MS	0.4%	49.4%	0.2%	2.5%	36.3%	1.4%	7.4%	2.3%
San Marino USD								
San Marino HS	0%	66.3%	0.3%	0.5%	4.6%	0.4%	26.7%	1.1%
Santa Monica-Malibu USD								
Santa Monica HS	0.2%	5.9%	1.7%	0.4%	33.3%	8.6%	48%	2%
Tustin USD								
Beckman HS	0.5%	26.4%	0.4%	2.6%	29.2%	3.2%	36.4%	1.4%
Average--all schools	**0.2%**	**14.9%**	**0.7%**	**1.9%**	**48.4%**	**9.9%**	**22.3%**	**1.6%**

[4] Based on 2007-2008 enrollment data from California Department of Education. Data on new and private schools are unavailable.

APPENDIX II: Selected Participant and Student Comments

Feedback from participants on COSEE-West program activities:

- With the budget cuts and science center closures in LAUSD there are few opportunities for teachers to meet K-12 and support each other in science education. COSEE-West is one of the few opportunities / supports in science teachers have left now. It is valuable and essential to all of us teachers (especially Elementary) to have science background knowledge. The marine based science programs like SSWIMS and COSEE-West is one of the reasons and got so much into science and became a science leader - teaching science at a district level with workshops/institutes and pre-service teachers. I have also conducted workshops at several Science Conferences - GLATSA and CSTA.
- I can't tell you how much the opportunities that you have made available have really kept me sane. With all of the lack of support at our school district for science, It is so comforting to know that the scientists, who I really admire greatly, are deeply committed to education, and are willing to give so much of their time to us, for our students. I look forward to participating in the future, and hope to teach a marine science elective next year at our middle school. Thank you to everyone for all of your hard work to make COSEE-West so wonderful.
- COSEE-WEST is a valuable resource to me as a Marine Biology & AP Environmental Science teacher. Each workshop and lecture offers a wealth of information. And, the hands on activities are great learning opportunities that usually end up being used for a lab in the classroom. Thanks so much!
- Great to see a most recent and important topic covered, nicely done and timely!
- The inspiration I have received from so many fine and self realized people-in many different roles-has really given me new insights on the impact of each person-and how each student must be given the idea that he or she can make a contribution that is welcomed to our world. The excellent resources and up to date information is a reason to keep attending events and try to make all of the workshops and lectures-because there is a myriad of topics and concepts to learn about.
- Just wanted to include a personal note of thanks for a wonderfully executed workshop. Both Scott and I were very impressed with the quality of the presentations, educational materials, and resources that were provided. Although only two of us were able to attend this event, the rest of our group is looking forward to future events.
- It has been a great learning experience and the friendships I have developed have been very valuable.
- COSEE-West has been insightful, provocative, and creative with all the activities that I attended.
- Beautifully organized and always engaging. It's always good to get new lesson ideas. The speaker was excellent and the JPL tour was unexpected and terrific!

Feedback [taken from COSEE-West blog] posted by high school students who attended Dr. Peggy Fong's lecture "Phase Shifts, Alternative Stable States, and the Loss of Ecosystem Function in Southern California Lagoons:"

CVHSstudent said:
I attended this COSEE lecture at USC, by Dr. Peggy Fong. At first I went in with the heart only for extra credit, and the mind only to learn the bare minimum about the subject at hand. But, as I sat there in the middle of the room, I started to take notes on things that were interesting to me. I had learned about wetlands in our APES [Advanced Placement Environmental Science] class, but not in as much detail as Dr. Fong began to explain to us.

As I sat there, I realized that other GROWN men/women were sitting alongside me, listening to Dr. Fong as she spoke of her research in the wetlands of Southern California. In my mind I was thinking "Oh great, another lecture for intellectual professors, which means I won't understand any of this..." But, to my surprise, Dr. Fong explained her research in a way in which I could understand. I took notes, listened carefully, and drew my full attention to Dr. Fong's lecture. By the end, I was engulfed in a new way of thinking about the effects of the diminishing wetlands of our "beautiful" Southern Californian coastline.

Dr. Fong explained her research from the very beginning to the end and explained her final discoveries, which helped me, a high school student, understand the complexities of her lecture. She had pictures for those who learn better with visuals, and she talked about the graphs of the experiments she did in the field herself for those who learn by listening. In the end, I actually had two pages full of notes, and a brain that had retained most of the information Dr. Fong spoke on. It was a very enjoyable lecture, and one that will surely influence me into going to other COSEE lectures.

cchristinej said:
I attended the COSEE lecture with the intention of fulfilling my first semester APES [Advanced Placement Environmental Science] "Keep Up". A Keep Up is where a student has to actively participate in an event that relates to the class. Visiting USC's campus, I marveled at the vast school and I presumed that the lecture would be filled with scholarly students. However, upon entering the room, my friend and I saw that most of the attendees were professors and more learned people. We sat down, and turned to each other, feeling extremely out of place.

However, when Dr. Peggy Fong was introduced, she graced the front of the room with such charisma and a zeal for science. The lecture had my full attention; I left with a full three pages of notes. She covered her research of Southern California wetlands and how they were diminishing. These shifts were due to a broad spectrum of reasons, and the adverse effects of this degradation would have a heavy blow upon the wildlife in the wetland areas. From the decrease of productivity to the loss of biodiversity, our actions impacted our coastal wetlands tremendously.

Dr. Fong's research reinforced the idea that as a student, I needed to take to heart my lessons and apply them to my own life. Conservation of any ecosystem is vital because their benefits are irreplaceable. The Southern California ecosystem is where many migratory birds visit during their long journey. If these wetlands were lost, then the birds would be affected. One mistake can result in a countless number of possibilities, and as students, we should do our best to prevent biological mistakes from happening. Dr. Fong's lecture was engaging and easy to understand. I look forward to the opportunity to attend another COSEE lecture, as should any student, professor, or environmentally conscious individual.

Noemy said:
USC, along with COSEE-West lectures, have provided once in a lifetime opportunities for me. The information I have obtained in these meetings has proven to be a great asset to me. I have learned background information for my personal theories and hypotheses. For example, in the most recent lecture I attended on January 21, 2009, speaker Dr. Peggy Fong educated me on salt marshes and how slight changes can alter the food chain as well as shift the abundance of certain species such as seaweed.

This information has not only helped me in recent school projects, but has also helped me understand our world's ecological balance. Dr. Peggy Fong is clearly an expert in her field and it is beautifully exemplified in her interactive presentation. I have become a fan of COSEE-West meetings and I hope to continue to attend beyond my high school years.

Hector said-
My name is Hector and I am a senior at Animo Leadership Charter High School. I am an active member in our school's Marine Biology Club and have been attending COSEE-West lectures since my sophomore year. The lectures are very informative and they allow me to gain a deeper understanding of certain oceanic topics that I can then use during club presentations and competitions such as the National Ocean Sciences Bowl (NOSB).

To be exposed to research and professional findings through COSEE-West lectures early on in life is very rewarding. COSEE-West has given me the opportunity to broaden my knowledge and also to converse with adults and not be looked down upon or taken lightly just because I am only a high school student. COSEE-West lectures bring together different people and connect us in a way where we all share a common goal: to learn from one another.

Jasmine said:
The COSEE-West lectures are some of the most informational lectures I have attended. Through these lectures, my knowledge about the environment has increased. I am now more aware of the harmful changes that our world is going through and am inspired to share that knowledge with others. They have been events that have allowed me to interact with others and have helped me to extend my social skills.

The information that we have been exposed to has also been great background information that I have used on a daily basis, as well as in my science based classes. Overall, COSEE-West has been an inspiring group that has contributed to my desire to continue learning about how to help maintain the stability of our environments.

Dr. Peggy Fong's response:
Wow. I am thrilled to have gotten my points across and honored that they resonated with them. I tried to tell them about my research program as it developed in my mind over the last 20 years – and show them that any of them could have done it… this means a lot to me.

Feedback from participants on online workshops:

- The most current information about this topic and a sense of "learning community" to keep me going when I feel like slacking off in keeping up to date myself and engaged.

- It was easy to respond to others' comments in the workshop; much like having an actual dialogue, minus the wait time between my log-in sessions. It was amazing to see the variety of participants' teaching levels and their locations. It provided for a rich environment for learning and sharing.

Integration of online workshop content into teaching:

- I teach chemistry but often we have discussions about global warming and its causes and effects. What I learned will help me better inform my students and perhaps make them curious and do some research on their own.
- I have already used some of the graphics as overheads to illustrate concepts during class discussions.
- I will use information about climate change that I have learned, and some of the slides presented in my classroom. Also, I plan to incorporate the jellyfish information for a class activity while teaching evolution. Also, I will use the lesson plan I submitted for this course in my classroom.
- I am continually using new ways to incorporate environmental issues into my science lessons. The topics of study are current and relevant, and provide some terrific insight into careers in science, as well.

Suggestions for improvements to online workshops:

- Maybe a time for satellite distance learning lab could be set up to interact directly in real time?
- It would be nice if the presentations would be available earlier. It would then be easier to digest the information and still have time to interact with the scientists.
- Sometimes it seemed that the scientists were not expecting the volume of questions and the time needed for answering. Maybe show them an example of this workshop as an example of what they can expect.
- Dr. Rignot's presentation had difficulties with the level of volume throughout the lecture. May I suggest a microphone that is attached to his shirt instead of one on the podium? This would allow the speaker to be more mobile.
- It'd be great if we could do synchronous interaction; however, the reality of that sort of time drain on the participants, not to mention the presenters would be prohibitive.
- Maybe have more scientists involved who cover a wide range of related topics in order to offer up more information for learning opportunities. Knowing something already about climate change, oceanography, and glaciers, it was hard to come up with questions to send to the scientists. A wider variety of topics might solve that problem so everyone learns a little something regardless of the background.
- I would like to see a bulletin board where we could write up responses & the paste them to the blue boxes. I've seen this done in on-line math courses produced by the Math Forum out of Drexel University.
- Outstanding workshops-we have to get more people in the teaching community to participate! Perhaps partnerships with school districts-they could more openly support and communicate your efforts to teaching staff and parents. I would love to see some workshops involving younger scientists closer to college age to get the students interested in considering careers in science. They could tell their own stories which might be very

interesting to the younger students. The three scientists featured here all had interesting life stories as well -I don't mean to criticize them!

- Maybe require that two participants that teach the same subject (that are taking the course for credit) discuss some ideas they will incorporate in their classroom.

Participant benefits of taking online workshops:

- I gained a deeper knowledge about oceanic changes and the environment. I don't teach science, but I am able to incorporate much of what I learn in my geography and history classes. I take these online workshops to broaden my personal perspectives.
- I learned more about the process of setting up MPAs. They are not just a stab in the dark (or on a map!) of where they should go. Watching an actual meeting was very enlightening!!
- The workshop provided me with background knowledge in this content area in order to be more comfortable presenting to my students. Many of the PowerPoint slides were useful as real world data and information on the topic to support teaching.
- I learned more about ocean science than I have had in the past and it helped to clear up any confusion or misconceptions that I still had about different topics.
- I learned so many things I didn't know from the presenters and from other participants. Living in Kentucky, you don't have many chances to experience ocean areas. Right now it is cool to be green and concerned for the environment so it fits in with what kids and parents are talking about.
- I developed a deeper understanding of the issues and content and became more interested in further study and skill development to better understand the research (ways that scientists use math to calculate and develop their own ideas for example). I also learned something from a comment Dr. Rignot made about the Chesapeake Bay region, the geology of that region I find very interesting. His comment made me think about the ice age and their affect on bays in particular differently. These insights are exciting because they allow us to become interested in searching out more information, and making connections that we hadn't thought of before.
- I learned a lot about things I would not be able to learn about in a traditional classroom setting as universities do not offer coursework of this type in our area.