JOINT INSTITUTE FOR MARINE OBSERVATIONS
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ANNUAL REPORT DATA INDEX CARD
Reporting Period: July 1, 2008 – June 30, 2009
General Instructions (Online)
Use the links for hypertext instructions/examples on any particular report section.
Before beginning, read all instructions on the last page of this document.

1. PROJECT DETAILS

Project Title: Southern California Coastal Ocean Observing System (SCCOOS)

Principal Investigator(s): Dr. Eric Terrill
Affiliation(s): Scripps Institution of Oceanography, Marine Physical Laboratory, University of California, San Diego

Keywords: coastal observations, ocean observing, ecosystem, water quality, maritime operations, harmful algal blooms, HABs, ROMS, climatology, CalCOFI

Task/Theme: Coastal and Ocean Observing System

NOAA Strategic Goal(s):
(Goal 1: Protect, Restore, and Manage the Use of Coastal and Ocean Resources Through Ecosystem-based Management; Goal 2: Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond; Goal 3: Serve Society's Needs for Weather and Water Information; Goal 4: Support the Nation's Commerce with Information for Safe, Efficient, and Environmentally Sound Transportation.)

NOAA Line Office / Program Officer: Geno Olmi, NOAA

2. RESEARCH OBJECTIVES AND SPECIFIC PLANS TO ACHIEVE THEM: (One to Two Short Paragraphs)

The Southern California Coastal Ocean Observing System (SCCOOS) is one of eleven regional ocean observing systems that contribute to the national Integrated Ocean Observing System (IOOS). SCCOOS monitors and integrates coastal ocean and climate observations in the Southern California Bight to inform water quality management, climate and ecosystem assessment and maritime operations. Ocean and coastal observations, data exchange and dissemination, modeling, research and education are designed to meet the needs of data users in the region. As a science-based decision support system, SCCOOS works interactively with local, state and federal agencies, resource managers, industry, policy makers, educators, scientists and the general public to advance our understanding of the coastal and global environment.

SCCOOS components include nearshore observations of water quality, sub-surface observations (gliders, autonomous underwater vehicles (AUVs), conductivity, temperature, depth (CTD) measurements and moored observations), pier-based observations, satellite imagery, high frequency (HF) radar surface current mapping and data assimilative ocean modeling. The work described in this report represents the multi-disciplinary and collaborative efforts of the research teams that contribute to the design and products of the SCCOOS infrastructure.

3. RESEARCH ACCOMPLISHMENTS (500 Words): (please *refrain from in-text citation or including references* in the report body)

WATER QUALITY – Harmful Algal Bloom (HAB) Monitoring Program

Algal blooms occur frequently along the Southern California coastline in response to inputs of nutrients from both natural and anthropogenic sources. These blooms can be harmful to the environment, public health and the economy and appear to be increasing in frequency and intensity. The SCCOOS HAB team monitors algal species at five pier sites: San Luis Obispo, Santa Barbara, Santa Monica Bay, San Pedro Bay and San Diego. Sampling by the group began the week of 30 June 2008 and continues on a weekly basis at each of the sites. Water samples and net tows are analyzed for potentially toxic species, temperature, salinity, chlorophyll concentration, primary inorganic nutrients and domoic acid concentration. To provide public access to the data, the team launched a "Harmful Algal Bloom and Red Tide" website in June 2009 that displays interactive regional maps with near real time data of pier samples, definitions of algal species, descriptions of blooms and recent news: www.sccoos.org/data/habs/.

In the spring of 2009, the SCCOOS HAB monitoring team detected a widespread domoic acid poisoning event that was the result of

a *Pseudo-nitzschia* bloom in the waters off Southern California. With pier monitoring and autonomous glider mapping, the team was able to detect the event before it became apparent at the surface. They provided an early alert of the developing event to animal rescue centers and coastal managers statewide. There were a substantial number of marine mammal and bird strandings and deaths in the Los Angeles and Orange County areas and approximately half of the marine mammal samples analyzed were positive for domoic acid. The SCCOOS team continues to work with the NOAA-funded MERHAB RADPALERT project at USC, the Center for Embedded Networked Sensing project at USC, the Orange County and Los Angeles County Sanitation Districts, the Pacific Marine Mammal Center, the Fort MacArthur Marine Mammal Care Center, the Wetlands and Wildlife Care Center and the International Bird Rescue Research Center.

CLIMATE AND ECOSYSTEM ASSESSMENT

SCCOOS maintains a climate observation network that includes a nearshore CalCOFI station to complement the routine offshore observations, three glider lines that observe ocean climate such as El Niño detection, operation of the ocean modeling system and the synthesis of a decade's worth of discharger CTD stations with offshore CalCOFI stations. These subsurface observations are complemented by a comprehensive network of HF radar systems that continuously monitor ocean surface currents. Sustained operation of the observing system will provide the necessary backdrop of observations to detect and monitor changes to the ocean climate.

Egg, Larval, Hydrographic Stations

Larvae and egg sampling are used as indices of species and provide a climate-relevant time record of changing biota off the coast of Southern California. CalCOFI surveys collect zooplankton biomass, fish and invertebrate larvae and conduct underway measurements of temperature, salinity, irradiance and fluorescence. Water samples are analyzed for concentrations of macronutrients, conductivity, oxygen and chlorophyll *a* and taxon-specific pigments. Data are provided to the National Marine Fisheries Service (NMFS) and support the Pacific Coast Ocean Observing System (PaCOOS) objectives. Extending the historically offshore stations of CalCOFI closer to the coast also brings relevance to the National Pollutant Discharge Elimination System (NPDES) permit discharge monitoring sites and to California's MPAs planning process.

Ocean Modeling System

Forecasts and nowcasts of ocean conditions are made on a range of space and time scales using the Regional Ocean Modeling System (ROMS). The models make estimates of connectivity on bight-wide scales as a guide to understanding dispersal of materials near and below the sea surface. Real-time ROMS assimilates satellite sea surface temperature, HF radar surface currents and subsurface temperature and salinity profiled from floats and gliders. Based on feedback from researchers and application users, the ROMS data assimilation scheme was enhanced with a multi-scale approach. The glider data and other sparse data sets were first assimilated into ROMS using a larger correlation scale. Using this large-scale analysis, the high-resolution data such as HF radar were then assimilated. This way, both the sparse resolution glider data and high-resolution HF radar data are effectively used in the ROMS nowcast/forecast. In addition, a multi-year model reanalysis is being conducted to assist in the development of dynamical indices that have ecosystem relevance. An interactive model display can be found: www.sccoos.org/data/roms/.

Climatology Development

SCCOOS researchers continue to study the signatures of coastally trapped waves propagating northward along the west coast. The statistical estimates of surface current response to surface currents have been added to those for wind as a proxy for non-local forcing effects. The goal is to separate locally and remotely wind-forced features from signatures of coastally-trapped wave propagation northward along the coast. Time-lagged cross-correlation shows clear signatures of propagation up-coast (and some down-coast) which are to be compared to the propagation of idealized coastally-trapped waves such as Kelvin waves. This work highlights the variable quality of wind estimates available along the coast and examined surface wind variability in the San Diego region using output from the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) model. The ability of the wind to account for surface velocity variability is apparently a measure of the model's quality. Additionally, ROMS with observed winds were used to estimate larval dispersion and a paper on the physical results is in press in the *Journal of Geophysical Research*. An interactive COAMPS wind model can be found at: www.sccoos.org/data/winds/.

MARITIME OPERATIONS

SCCOOS developed a customized interactive website that displays environmental conditions at the entrance to the Ports of Los Angeles and Long Beach Harbor: www.sccoos.org/data/harbors/lalb/. The site integrates the Coastal Data Information Program (CDIP) wave data and surface current maps with NOAA nautical charts, shipping lanes and ferry routes. It provides information on marine conditions that is critical to the safe passage of vessels and efficient harbor navigation for port managers and the maritime community. Energetic wave conditions coupled with long period swell can prove both costly and dangerous for their operations. Users include the Los Angeles & Long Beach Pilots, Catalina Express, U.S. Coast Guard, U.S. Army Corps of Engineers and the public.

SCCOOS launched a partnership with NAVAIR and the U.S. Navy for operational access to the Naval Research Laboratory's COAMPS to provide 48 hour wind and precipitation forecasts on the SCCOOS website. One of the most popular accessed SCCOOS products, COAMPS are used widely by the recreational and commercial boating community. In addition, NAVAIR is increasingly using SCCOOS for SST, wave and surface current data.

In the past, HF radar has received NOAA funds and continues to be a cornerstone of SCCOOS products and operations. The HF radar derived surface currents are used to assess and mitigate impacts of impaired water quality, track oil spills, assist with search and rescue efforts and monitor the physical environment to better understand ecosystem change. After an oil spill occurred in the Santa Barbara Channel, California's Office of Spill Prevention and Response (OSPR) contacted SCCOOS to provide surface current data that was integrated into GIS-based support products and provided to first responders. SCCOOS wind and ocean wave conditions were also communicated to OSPR to assist marine operations.

DATA MANAGEMENT
SCCOOS data management staff worked on a system overhaul to bring the data closer to compliance with national standards, as well as to provide flexibility in adding and retrieving data. The overhaul is necessary to meet the future needs of NOAA's Data Integration Framework. SCCOOS data volumes have grown dramatically in the last four years and data managers report that requests increase monthly. SCCOOS data managers actively participate in the NOAA lead Data Integration Framework (DIF) effort focused on setting standards for data dissemination throughout all Regional Associations and participating Government agencies.

4. HIGHLIGHTS (Bulleted Accomplishments):

- The SCCOOS harmful algal bloom group monitored the occurrence of harmful phytoplankton species at sub-regions near five pier sites: San Luis Obispo, Santa Barbara, Santa Monica, Newport Beach and La Jolla. Sampling by the group began the week of 30 June 2008 and continues on a weekly basis at each of the sites.

- The SCCOOS HAB monitoring team launched a “Harmful Algal Bloom and Red Tide” website in June 2009 that provides interactive regional maps with near real-time data of pier samples, definitions of algal species, descriptions of blooms and recent news: www.sccoos.org/data/habs/.

- In the spring of 2009, the SCCOOS HAB monitoring team detected a widespread domoic acid poisoning event that was the result of a *Pseudo-nitzschia* bloom in the waters off Southern California. Combining measurement tools with glider observations of phytoplankton distributions, they were able to target sampling and provide an early alert of the developing event.

- SCCOOS maintained a climate observation network that includes a nearshore CalCOFI station to complement the routine offshore observations, three glider lines that observe ocean climate such as El Niño detection, operation of the ocean modeling system and the synthesis of a decade’s worth of discharger CTD stations with offshore CalCOFI stations.

- CalCOFI surveys collected zooplankton biomass, fish and invertebrate larvae and conducted underway measurements of temperature, salinity, irradiance and fluorescence.

- Extending the historically offshore stations of CalCOFI closer to the coast brought relevance to the National Pollutant Discharge Elimination System (NPDES) permit discharge monitoring sites and to California’s Marine Protected Areas planning process.

- Forecasts and nowcasts of ocean conditions on a range of space and time scales were made using the Regional Ocean Modeling System (ROMS). The models make estimates of connectivity on bight-wide scales as a guide to understanding dispersal of materials near and below the sea surface: www.sccoos.org/data/roms/.

- SCCOOS researchers continued to study the signatures of coastally trapped waves propagating northward along the west coast. The statistical estimates of surface current response to surface currents were added to those for wind as a proxy for non-local forcing effects.

- SCCOOS developed a customized interactive website that displays environmental conditions at the entrance to the Ports of Los Angeles and Long Beach Harbor. The site integrates wave data and surface current maps with NOAA nautical charts, shipping lanes and ferry routes: www.sccoos.org/data/harbors/lalb/.

- SCCOOS launched a partnership with NAVAIR and the U.S. Navy for operational access to the Naval Research Laboratory's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) to provide 48 hour wind and precipitation forecasts on the SCCOOS website: www.sccoos.org/data/winds/.

- Partnerships with the Marine Exchange to implement a comprehensive array of Automatic Identification System (AIS) receivers for realtime tracking of marine traffic in Southern California waters.

- After an oil spill in the Santa Barbara Channel, California's Office of Spill Prevention and Response (OSPR) contacted SCCOOS to provide surface current data that was integrated into GIS-based support products and provided to first

responders. SCCOOS wind and ocean wave conditions were also communicated to OSPR to assist marine operations.

- SCCOOS data management staff worked on a system overhaul to bring the data closer to compliance with national standards, as well as to provide flexibility in adding and retrieving data.

5. COLLABORATION: (Research linkages and leveraging of NOAA funded research and spin-off to other agencies: Interagency, Partnerships, and Collaborators)

Interagency (Any Federal Agency or Office akin to NOAA. e.g., OGP, ONR, NASA, JPL, DOE, etc.):
NASA/Jet Propulsion Laboratory (JPL)
NOAA Southwest Fisheries
NOAA HAZMAT
U.S. Army Corps of Engineers (USACE)
U.S. Coast Guard
U.S. Environmental Protection Agency
U.S. Geological Survey
U.S. Navy
U.S. Minerals Management Service

Partnerships (Other Academic and Research Institutions, as well as state, local, foreign, and private sector agencies):
California Coastal Commission
California Coastal Conservancy
California Cooperative Oceanic Fisheries Investigation (CalCOFI)
California Current Ecosystem Long Term Ecological Reserve (CCE LTER)
California Department of Fish and Game
California Oil Spill Prevention and Response (OSPR)
California Polytechnic University, San Luis Obispo (Cal Poly)
City of Los Angeles Environmental Monitoring Division
City of Los Angeles Wastewater District
City of San Diego Wastewater District
County Health Agencies of Santa Barbara, Ventura, Los Angeles, Long Beach, Orange and San Diego
Farallon Institute for Advanced Ecosystem Research
Los Angeles County Sanitation District
Marine Exchange of Southern California
Naval Air Systems Command (NAVAIR)
Ocean Institute
Orange County Sanitation District
Scripps Institution of Oceanography (SIO)
Sea Grant
Southern California Coastal Water Research Project (SCCWRP)
University of California, Irvine
University of California, Los Angeles (UCLA)
University of California, Santa Barbara (UCSB)
University of Southern California (USC)
Ventura County Wastewater District

Collaborators (Individual collaborators, include their affiliation):
Dr. Mark Brzezinski, UCSB
Dr. David Caron, USC
Dr. Yi Chao, JPL
Dr. Bruce Cornuelle, SIO
Dr. Russ Davis, SIO
Dr. Ralf Goericke, SIO
Dr. Nicholas Gruber, UCLA
Dr. Robert Guza, SIO
Dr. Alex Hall, UCLA
Dr. Ben Holt, JPL
Dr. Burton Jones, USC
Dr. John McGowan, SIO
Dr. James McWilliams, UCLA
Dr. Art Miller, SIO
Dr. Greg Mitchell, SIO

Dr. Mark Moline, CPSLO
Dr. Carter Ohlmann, UCSB
Dr. Mark Ohman, SIO, CC LTER
Dr. John Orcutt, SIO
Dr. William O'Reilly, SIO
Dr. Cheryl Peach, SIO
Dr. Dan Rudnick, SIO
Dr. George Roberston, OCSD
Dr. Rebecca Shipe, UCLA
Dr. Keith Stolzenbach, UCLA
Dr. Eric Terrill, SIO, CORDC
Dr. Elizabeth Venrick, SIO, CalCOFI
Dr. Frank Vernon, SIO
Dr. Libe Washburn, UCSB
Dr. Stephen Weisberg, SCCWRP

6. COMMUNICATIONS, NETWORKING & OUTREACH (provide as much information on outreach as possible, along with any available photographs)

Activity	Objective	Partners

CeNCOOS and SCCOOS meeting SIO, La Jolla, CA 17 November 2008	Review current projects and pursue future collaborations, including the formation of a joint Strategic Advisory Committee	Francisco Chavez, Kenneth Coale, Toby Garfield, Heather Kerkering, Steve Ramp, CeNCOOS; Burt Jones, USC, Dan Rudnick, SIO, Libe Washburn, UCSB; SCCOOS staff
Workshop planning and training sessions with Ocean Institute SIO, La Jolla, CA 11 December 2008	Develop logic models, audience characterization, process agendas, performance objectives and evaluations	SCCOOS programmers and staff
Jacobsen Pilots Meeting Long Beach, CA 1 February 2009	Collect feedback on customization of LA/LB website	Julie Thomas, SCCOOS; Harbor Pilots
SCCOOS Strategic Advisory Committee Meeting Ocean Institute, Dana Point, CA 24 February 2009	Review SCCOOS projects, activities and accomplishments; discuss future goals and objectives	SCCOOS Strategic Advisory Committee Members and SCCOOS Staff
Meeting with Crystal Cove Alliance and Ocean Institute Crystal Cove State Park Laguna, CA 18 March 2009	Explore future education and outreach collaboration as well as a HF radar site installation	Amanda Dillon, Carolyn Keen, Lisa Hazard, Julie Thomas, SCCOOS; Harry Helling, Crystal Cove and Sue Magdziarz, Ocean Institute
CeNCOOS Council Meeting MBARI, Monterey, CA 20 March 2009	Receive updates on CeNCOOS operations and pursue the formation of a Joint Strategic Advisory Committee for California	Julie Thomas, SCCOOS, Libe Washburn, UCSB and CeNCOOS Council and staff
HABs Working Group Meeting Southern California Coastal Water Research Project (SCCWRP) Costa Mesa, CA 12 April 2009	Review data display and plan the development of HABs website	Burt Jones, David Caron, Meredith Howard, Astrid Schnetzer, Erika Seubert, USC; Steven Weisberg, SCCWRP; John McGowan, Melissa Carter, Jen Bowen, Mary Hilber, SIO; Mark Moline, Sam Rankin, Cal Poly; Mark Brzezinski, Jo Goodman, UCSB; Rebecca Shipe, UCLA
Biological Modeling Discussion USC, Los Angeles, CA May 2009	Consider implementation of a regional nutrient, phytoplankton, zooplankton (NPZ) modeling effort that would facilitate nowcasting of blooms including HABs	Burt Jones, USC
Monterey National Weather Service (NWS) Meeting Monterey, CA 6 May 2009	Discuss models for predicting breaking waves on the San Francisco Bar	Julie Thomas, SCCOOS; William O'Reilly, SIO; Steve Ramp, Heather Kerkering, CeNCOOS; NWS Staff
Meeting with Ocean Institute SIO, La Jolla, CA 10 May 2009	Plan SCCOOS data product training sessions and future collaboration with the Ocean Institute	Amanda Dillon, Lisa Hazard, Carolyn Keen, SCCOOS; Sue Magdziarz and Rick Baker, Ocean Institute
Meeting with PaCOOS and NOAA Fisheries SIO, La Jolla, CA 13 May 2009	Develop projects that connect SCCOOS products and fisheries data	Amanda Dillon, Eric Terrill, Julie Thomas, SCCOOS; Dan Rudnick, SIO; Jonathan Phinney, PaCOOS; NOAA Fisheries staff
Water Quality Meeting with SCCWRP Costa Mesa, CA 14 May 2009	Discuss data management collaboration for harmful algal blooms (HABs) and water quality	Julie Thomas and Lisa Hazard, SCCOOS; Steve Weisberg, Meredith Howard and Shelly Moore, SCCWRP
Meeting with Orange County Sanitation District (OCSD) Fountain Valley, CA 22 May 2009	Outline the use of an alongshore currents prediction tool for tracking the dispersion of bacteria	Julie Thomas, SCCOOS; William O'Reilly, SIO; George Robertson, OCSD
SCCOOS Executive Steering Committee Meeting OCSD, Fountain Valley, CA 27 May 2009	Review SCCOOS background and governance, provide project updates and outline future goals and priorities	Burt Jones, USC; Dan Rudnick, Russ Davis, SIO; Jim McWilliams, UCLA; George Robertson, OCSD; Sheila Semans, California Coastal Conservancy; Libe Washburn, UCSB; Amanda Dillon, Eric Terrill, Julie

		Thomas, SCCOOS
IOOS Meeting SIO, La Jolla, CA 2 June 2009	Review SCCOOS projects, activities and accomplishments; discuss future goals and objectives	Amanda Dillon, Lisa Hazard, Julie Thomas, SCCOOS; Zdenka Willis, IOOS
Catalina Express Ferry Meeting San Pedro, CA 9 June 2009	Collect feedback on customization of LA/LB website	Julie Thomas, Darren Wright, SCCOOS; Joseph Sirard, NWS; Tom Rutter, Catalina Express
Science Applications International Corporation (SAIC) Meeting SIO, La Jolla, CA 29 June 2009	Discuss data management and future collaboration	Julie Thomas, SCCOOS; SAIC staff

7. CONFERENCES, SEMINARS, SYMPOSIUMS, PRESENTATIONS, WORKSHOPS

Conference Name	Dates/Location	Representatives

Rays Workshop (RaDyO)		
National Academy of Sciences Oceanography 2025 Workshop	8-9 January 2009, University of California Irvine, Irvine, CA	James McWilliams, UCLA
Centers for Ocean Sciences Education Excellence (COSEE) Networked Ocean World Workshop	8-9 January 2009, Maryland Science Center, Baltimore, MD	Amanda Dillon, SCCOOS
Conference on Global Warming--The Ocean's Role	12 January 2009, Institute for Advanced Studies, Hebrew University Jerusalem, Israel	James McWilliams, UCLA
San Francisco PORTS Meeting	15 January 2009, Hercules, CA	Julie Thomas, SCCOOS and Heather Kerkering, CeNCOOS
SCCOOS Modeling Workshop	23 January 2009, University of Southern California, Los Angeles, CA	James McWilliams, Charles Dong, Yusuke Uchiyama, Satoshi Mitarai and Alex Hall, UCLA
Climate Change, Natural Resources and Coastal Management Workshop, U.S. Fish & Wildlife Service and U.S.G.S.	29-30 January 2009, San Francisco, CA	Julie Thomas, SCCOOS
West Coast Regional Harmful Algal Bloom Summit	10-12 February 2009, Portland, OR	David Caron, USC and Melissa Carter, SIO
Courant Institute for Math Sciences Seminar	20 February 2009, Courant Institute for Math, New York, NY	James McWilliams, UCLA
IOOS NFRA Meeting	3 March 2009, Washington, DC	Julie Thomas, SCCOOS
San Diego Sector Area Contingency Planning Meeting	5 March 2009, CA Department of Fish and Game, La Jolla, CA	Lisa Hazard, SCCOOS
Los Angeles/Long Beach Harbor Safety Committee Meeting	5 March 2009, Marine Exchange, San Pedro, CA	Julie Thomas, SCCOOS
Integrated Ocean Observing System (IOOS) Regional Data Integration Framework workshop and IOOS Industry Day	9-12 March 2009, Silver Spring, MD	Lisa Hazard and Paul Reuter, SCCOOS
NOAA VIIRS Calibration and Validation of Ocean Color Products for Coastal Waters Workshop	31 March - 1 April 2009, Oregon State University, Corvallis, OR	Burt Jones, USC
IOOS "Small Sea Changes: Big Business Impacts" Workshop	14 April, 2009, Silver Spring, MD	Julie Thomas, SCCOOS
Monterey Bay National Marine Sanctuary Currents Symposium	18 April 2009, Monterey, CA	Brian Zelenke, Cal Poly
Environmental Protection Agency (EPA) National Beach Conference	20-22 April 2009, Huntington Beach, CA	Steven Weisberg, SCCWRP
Joint Institute for Marine Observations (JIMO) Review	21-22 April 2009, SIO, La Jolla, CA	Julie Thomas, SCCOOS
Los Angeles/Long Beach Area Contingency Planning Meeting	23 April 2009, Long Beach, CA	Lisa Hazard, SCCOOS
San Francisco PORTS Meeting	28 April 2009, Hercules, CA	Julie Thomas, SCCOOS; Steve Ramp, Toby Garfield and Heather Kerkering, CeNCOOS
Climate Variability and Predicability (CLIVAR) Working Group On Ocean Model Development Workshop on Ocean Mesoscale Eddies	29 April, 2009, Exeter, United Kingdom	James McWilliams, UCLA
2009 San Diego Area Committee NPREP Table Top Exercise	4 June 2009, U.S. Fish and Wildlife Offices, Carlsbad, CA	Lisa Hazard, SCCOOS
Gordon Research Conference on Coastal Circulation	8 June 2009, Colby-Sawyer College, New London, NH	Libe Washburn, UCSB
Office of Naval Research Annual Review Meeting	9 June 2009, Chicago, IL	James McWilliams, UCLA
West Coast Zooplankton Data Management Meeting	9-10 June 2009, SIO, La Jolla, CA	Lisa Hazard and Jen Bowen, SCCOOS
National Marine Educators Association (NMEA) Conference	29 June - 3 July 2009, Pacific Grove, CA	Amanda Dillon, SCCOOS

8. NOAA EMPLOYMENT (if JIMO supported students/staff gained NOAA employment within this reporting period, provide the

information below)

Name	Degree	Date of Employment	Employing NOAA Lab / Division

9. HONORS AND AWARDS (Include all honors and awards presented to JIMO personnel during the current reporting period)

Award	Recipient	Year

10. PUBLICATIONS (Separate publications by category with full citation. Indicate in a short parenthetical whether Joint Institute (JI) or NOAA (NOAA) Lead Author. Also, indicate peer-reviewed publications in **bold**. Include presentations with no publication outcome in Sec. 7 under Conferences, etc.).

Journal Articles:

Capet, X., J.C. McWilliams, M.J. Molemaker and A. Shchepetkin, 2008: Mesoscale to submesoscale transition in the California Current System. I: Flow structure, eddy flux, and observational tests. J. Phys. Ocean., 38, 29-43.

Capet, X., J.C. McWilliams, M.J. Molemaker and A. Shchepetkin, 2008: Mesoscale to submesoscale transition in the California Current System. II: Frontal processes. J. Phys. Ocean., 38, 44-64.

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Capet, X., P. Klein, B.L. Hua, G. Lapeyre and J.C. McWilliams, 2008: Surface kinetic energy transfer in SQG flows. J. Fluid Mech., 604, 165-175.

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Chao, Y., Z. Li, J. Farrara, J.C. McWilliams, J. Bellingham, X. Capet, F. Chavez, J.-K. Choi, R. Davis, J. Doyle, D.M. Frantaoni, P. Li, P. Marchesiello, M.A. Moline, J. Paduan and S. Ramp, 2009: Development, implementation, and evaluation of a data-assimilative ocean forecasting system off the central California coast. Deep-Sea Res. II, 56, 100-126. doi:10.1016/j.dsr2.2008.08.011.

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Danabasoglu, G., R. Ferrari and J.C. McWilliams, 2008: Sensitivity of an ocean general circulation model to a parameterization of near-surface eddy fluxes. J. Climate, 21, 1192-1208.

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Ferrari, R., J.C. McWilliams, V.M. Canuto and M. Dubovikov, 2008: Parameterization of eddy fluxes near oceanic boundaries. J. Climate, 21, 2770-2789.

Haidvogel, D.B., H. Arango, W.P. Budgell, B.D. Cornuelle, E. Curchitser, E. Di Lorenzo, K. Fennel, W.R. Geyer, A.J.

Hermann, L. Lanerolle, J. Levin, J.C. McWilliams, A.J. Miller, A.M. Moore, T.M. Powell, A.F. Shchepetkin, C.R. Sherwood, R.P. Signell, J.C. Warner and J. Wilkin, 2008: Ocean forecasting in terrain-following coordinates: Formulation and skill assessment of the Regional Ocean Modeling System. J. Comp. Phys., 227, 3595-3624.

Kim, S.Y., B.D. Cornuelle and E. Terrill, 2009: Anisotropic Response of Surface Currents to the Wind in a Coastal Region. J. Phys. Ocean., Volume 39, Issue 6 (June 2009) pp. 1512-1533.

Kravtsov, S., W.K. Dewar, M. Ghil, J.C. McWilliams and P. Berloff, 2008: A mechanistic model of mid-latitude decadal climate variability. Physica D, 237, i584-599.

Kravtsov, S., W.K. Dewar, M. Ghil, P. Berloff and J.C. McWilliams, 2008: North Atlantic climate variability in coupled models and data. Nonlinear Proc. Geophys.,15, 1-12.

Li, Z., Y. Chao, J.C. McWilliams and K. Ide, 2008: A three-dimensional variational data assimilation system for the Regional Ocean Modeling System: Implementation and basic experiments. J. Geophys. Res. 113, C05002 doi:10.1029/2006JC004042.

Li, Z., Y. Chao, J.C. McWilliams and K. Ide, 2009: A three-dimensional variational data assimilation system for the Regional Ocean Modeling System: Formulation. J. Atmos. Ocean. Tech., 25, 2074-2090.

Nagai, T., A. Tandon, N. Gruber and J.C. McWilliams, 2008: Biological and physical impacts of ageostrophic frontal circulations driven by confluent flow and vertical mixing. Dyn. Atmos. and Oceans, 45, doi:10.1016/j.dynatmoce.2007.12.001.

Oram, J.J., J.C. McWilliams and K.D. Stolzenbach, 2008: Gradient-based edge detection and feature classification of sea-surface images of the Southern California Bight. Remote Sensing of Environment, 112, 2397-2415.

Rasmussen L.L., B.D. Cornuelle, L.A. Levin, J.L. Largier and E. Di Lorenzo, 2009: Effects of small-scale features and local wind forcing on tracer dispersion and estimates of population connectivity in a regional scale circulation model, J. Geophys. Res., 114, C01012, doi:10.1029/2008JC004777.

Sullivan, P.P, J.B. Edson, T. Hristov and J.C. McWilliams, 2008: Large eddy simulations and observations of atmospheric marine boundary layers above non-equilibrium surface waves. J. Atmos. Sci., 65, 1225-1245.

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11. FIGURES/PHOTOS/ILLUSTRATIONS Please provide up to two (2) figures/photos/etc. related to your report, along with FIGURE CAPTIONS. Include caption text below, but attach image files as **separate attachments** along with this Word Doc when submitting the report electronically. Be sure to **assign the file name** or indicate relationship below, so caption can be correctly associated with figure.

Figure 1: (Describe Image or Give File Name): SCCOOS Harmful Algal Bloom and Red Tide website (SCCOOS_09_1)
FIGURE 1 CAPTION: The SCCOOS HAB monitoring team launched a "Harmful Algal Bloom and Red Tide" website in June 2009 that provides interactive regional maps with near real time data of pier samples, definitions of algal species, descriptions of blooms and recent news: www.sccoos.org/data/habs

Figure 2: (Describe Image or Give File Name): SCCOOS Wind and Precipitation forecasts (SCCOOS_09_2)
FIGURE 2 CAPTION: SCCOOS developed a customized interactive website that displays environmental conditions at the entrance to the Ports of Los Angeles and Long Beach Harbor. The site integrates wave data and surface current maps with NOAA nautical charts, shipping lanes and ferry routes: www.sccoos.org/data/harbors/lalb

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- Completing the **Annual Report Data Index Card** fulfills the PI's portion of the JIMO Annual Report, as required by JIMO's Cooperative Agreement with NOAA. Additional reporting or funding requirements will depend on your individual project and Program Officer. For an updated look at these requirements, please see pg. 32, section "K. Performance Reports" of the Interim Handbook for NOAA CIs (12/05), which can be found at: http://www.nrc.noaa.gov/ci/docs/fedreg/ci-handbook120505.pdf
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CONTENT REQUIREMENTS

1. **Project Details**

Please include **ALL** of the following information:

- Project Title
- Principal Investigator(s)
- Affiliation(s) (e.g., SIO, UCSB, MBARI, NOAA, etc.)
- Keywords
- Project Task & Theme
- NOAA Strategic Goals Associated with Project
- Program Officer and Funding NOAA Line Office (e.g., Howard Diamond, CPO)

2. **Research Objectives and Specific Plans to Achieve Them** (Please note any significant changes in objectives, methodology or rationale from previous reports)
3. **Research Accomplishments** (500 words)
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5. **Collaboration** (Interagency, Partnerships & misc. Collaborators)
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11. **Figure/Photo/Illustration Captions** (Attach up to 2 figures, including accompanying captions in Sec. 11)

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