CSU The California State University

# CSU COAST Faculty-Student Research Poster Reception Featuring WRPI

January 24, 2012 • Long Beach, CA

Book of Abstracts

## *Welcome!*

On behalf of the CSU Council on Ocean Affairs, Science and Technology (COAST) and the Water Resources and Policy Initiatives (WRPI), we are pleased to welcome you to the second annual Faculty-Student Poster Reception at the Chancellor's Office. Student researchers and their faculty mentors from each of the 23 CSU campuses and the marine consortia are on hand to highlight the excellent and timely research conducted throughout the system. COAST and WRPI are proud to present a suite of projects representing efforts to develop solutions to the complex water and coastal zone challenges we currently face. Each project also demonstrates the commitment of CSU faculty members and students to education and learning while advancing our knowledge of California's natural resources, reinforcing the value of the basic scientific process, and achieving excellence.

Thank you for joining us today, and enjoy!

Krista Kamer, Ph.D.
Director
COAST

David Zoldoske, Ed.D.
Executive Director
WRPI

# COAST
# Abstracts

Note: * denotes student authors throughout

## *CSU Bakersfield*

**Do epibiotic bacteria associated with the marine bryozoan *Watersipora subtorquata* contribute to the invasion process of this invertebrate species?**

**Authors**: Kushwinder Gill*, Yvette Sanchez*, Barbara Chambers*, Lauren Dowell* and Antje Lauer

**Affiliation**: Department of Biology, College of Natural Sciences and Mathematics

**Abstract**: *Watersipora subtorquata* is an invasive marine bryozoan species, that has invaded coastal areas in California and worldwide and seems to be able to outcompete many native marine invertebrates. It is surprisingly well adapted to thrive in human influenced bays and harbours that are polluted with copper from antifouling paints and also by different polyaromatic hydrocarbons released by ships. We have investigated the bacterial diversity of biofilms on *W. subtorquata* from Morro Bay, Monterey Harbour, Marina Del Rey, and Moss Landing, California. Analyses by Polymerase Chain Reaction (PCR) followed by Denaturing Gradient Gel Electrophoresis (DGGE) revealed that the bacterial diversity of *W. subtorquata* is different from the one in the water-column throughout the season and is dominated by different alpha-proteobacteria, especially by members of the Rhodobacteraceae and Phyllobacteriaceae which are known to include important symbionts of other marine invertebrates, such as corals and sponges. We also found proof for the presence of copper efflux genes (copper P-type ATPases) of bacterial origin in DNA extracts from *Watersipora* biofilm which were related to genes found in *Rhizobium* spp. by cloning and sequencing PCR products obtained with primer pair copAUF/copAUR. Furthermore, the presence of genes involved in antibiotic production (nonribosomal peptide synthetases [NRPS] and type I polyketide [PKS] synthases were present in DNA extracts from *Watersipora* biofilms as well, as revealed by PCR with specific primer pairs (A3F/A7R and K1F/M6R). Our results indicate that bacterial epibionts of *W. subtorquata* possess genes that might protect them and their bryozoan host against copper pollution and overgrowth or disease by microorganisms, which may ultimately contribute to the extraordinary invasive character of this invertebrate species.

## *CSU Channel Islands*

**Habitat alteration and the Western Snowy Plover: is Ventura County's population recovering?**

**Authors**: Kevin Dolinar* and Donald Rodriguez

**Affiliations**: Environmental Science and Resource Management Program, Arts and Sciences

**Abstract**: The U.S. Fish and Wildlife Service listed the pacific coast population of Western Snowy Plover (WSP), *Charadrius alexandrinus nivosus*, as a threatened species in 1993 due to the substantial loss of suitable habitat from an increase in anthropogenic pressures. The Snowy Plover was once more widely distributed throughout the entire California coast, but now that their population has declined and they are only being spotted on beaches that meet certain suitability requirements. Ventura County is one of the leaders in protecting this species sandy beach habitat from disturbance and what's learned here can be applied throughout its entire range to further facilitate the recovering population. In comparing WSP population numbers from surveys conducted by the Minerals Management Service in 1994-1997 with a replicated study completed from 2007-2010 by a research team at CSU Channel Islands, noticeable increases in WSP were recorded at previously unpopulated beaches along the Ventura County coast. This study uses aerial photography of study transects to determine if there were significant changes in beach habitat over the two study periods. Aerial imagery reveals the formation of embryonic dunes near study transects on those beaches where new and increased populations of WSP were reported. The formation of embryonic dunes coupled with an aggressive conservation management plan has resulted in increased numbers of WSP on Ventura County beaches.

## *CSU Chico*

**Importance of marine derived nutrients in the diet of Western Pond Turtles**

**Authors**: Mike Castillio* and Tag Engstrom

**Affiliation**: Department of Biological Sciences and Center for Ecosystem Research, College of Natural Sciences

**Abstrac**t: The influx of marine derived nutrients provided by migratory salmon drives food web dynamics in many California rivers and in surrounding terrestrial ecosystems. Western Pond Turtles (*Emys marmorata*), a California species of special concern, coexist with seasonally spawning salmon in much of their range, however the importance of salmon derived nutrients for turtles has not been studied. Our preliminary data from two sites suggest that turtles migrate from warmer backwaters to colder main channels to take advantage of this resource. We are expanding this study to include turtle populations in four areas with varying levels of salmon influence: The Feather River (large salmon run), Butte Creek (moderate) Big Chico Creek (small), and Little Chico Creek (no salmon run). We are examining the importance of salmon as a food source using a combined approach including mark recapture and radio telemetry to assess turtle migration; stable isotope analysis to look for marine signatures in turtles and turtle eggs; and morphometric data and X-rays to determine if use of salmon nutrients confers increased body condition and fecundity compared to turtle populations that don't coexist with salmon. We hope that understanding links between these two sensitive species will confer conservation benefits for both.

## *CSU Dominguez Hills*

**Sustainable seafood in Los Angeles, California: attitudes, perceptions, and recommendations**

**Authors**: Jessica Williams* and Ana Pitchon

**Affiliation**: Department of Anthropology, College of Natural and Behavioral Sciences

**Abstrac**t: The transition from processed, globally-sourced commercial foods toward practices that support locally-produced resources is gaining momentum as a means to reduce environmental impact and work toward sustainability. This research identified the barriers that impede the distribution and consumption of local seafood through a survey of attitudes and perceptions of restaurants and grocery markets in the South Bay region of Los Angeles. California is amongst the highest seafood producers in the nation, yet the majority of its landings are not distributed locally. The dwindling condition of our oceans necessitates the immediate assimilation of locally-derived seafood into the diets of Southern California residents. Applying socially responsible and healthy practices that incorporate local seafood would not only help California fisheries to persist, but would also increase seafood sustainability and carry the potential to enhance local economies. Adopting local production practices has been suggested to abate negative environmental impacts, not only by reducing foreign dependence on trade and lessening transport distances, thus decreasing carbon emissions, but also to promote sustainability in several food sectors. In order to effectively address issues of seafood and fishing community sustainability, energy must be directed towards educating the public on the concept and the benefits of buying local.

## *CSU East Bay*

**The effects of heavy metal contamination on biofilm community composition in San Francisco Bay**

**Authors**: Stephanie L. Molloy[1], Sirma Mihaltcheva*[1], Hy Tran*[1] and Lubo Liu[2]

**Affiliations**: [1]Department of Biological Sciences, College of Sciences, CSU East Bay; [2]Department of Statistics and Biostatistics and Department of Civil and Geomatics Engineering, Lyles College of Engineering, CSU Fresno

**Abstract**: The goal of this research is to understand the community composition of sediment biofilm microbial communities and their adaptation to mercury and other heavy metal contamination in San Francisco Bay. San Francisco Bay is on the USEPA's list of impaired waters for mercury contamination. Historic mining created an immense amount of mercury- enriched sediments along several major rivers in California that were subsequently washed into the Bay. Not all organisms can withstand mercury pollution and so the composition of natural communities, such as in biofilms, can be affected. Sediment biofilm communities were compared using a molecular community analysis technique (Automated Ribosomal Intergenic Sequence Analysis-ARISA). Environmental effects, including temperature, pH, conductivity and mercury concentration, accounted for ~45% of differences in sediment bacterial community composition of South San Francisco Bay. Mercury concentration was significant in explaining a good portion of variation in the ARISA sample profiles ($R^2 = 0.09$), in addition there was an interaction effect with temperature. Genes conferring resistance to mercury, copper and chromium were detected in bacterial genomic DNA, indicating adaptation to the environmental pollution. A better understanding of the relationship between sediment biofilm composition and the effects of anthropogenic activities in coastal waters will help future San Francisco Bay restoration.

## *CSU Fresno*

**Thiol levels in cyanobacteria**

**Authors**: Andrew Strankman* and Mamta Rawat

**Affiliation**: Department of Biology, College of Science and Mathematics

**Abstract**: Industry, agriculture and recreation activities produce toxins that accumulate in watersheds. Cyanobacteria use low molecular weight (LMW) thiols to protect from these stresses. In gram-negative cells like cyanobacteria, glutathione is the major LMW thiol. This tripeptide maintains the cellular redox balance and is crucial for many processes in many organisms. In this study, we show that another LMW thiol, ergothioneine, is also present in the cyanobacteria, *Synechococcus elongatus* (PCC 7942), *Anabaena* (PCC 7120) and *Synechocystis* (PCC 6803). We investigated the effect of metal stress from copper, cadmium and chromate on thiol levels,in these species and demonstrate that metal stress results in an increase in thiol levels. We also determined the sensitivity of PCC 7942 transposon mutants disrupted in gshA and gshB, which code for enzymes involved in glutathione biosynthesis, to photo, metal and oxidative stresses. Previously, Cameron and Pakrasi (2010) had demonstrated that the gshA mutant of PCC 6803 is not viable and the gshB mutant of PCC 6803 is sensitive to a range of stresses. Our studies show that the PCC 7942 gshA mutant is viable and both PCC 7942, gshA and gshBmutants, are more sensitive than wild-type when exposed to photo, metal, and oxidative stress conditions.

References

1) Cameron, J, &Pakrasi, H. (2010). Essential role of glutathione in acclimation to environmental and redox perturbations in the cyanobacterium *Synechocystis* sp. pcc 6803. Plant Physiology, 154(4), 1672-1685.

## *CSU Fullerton*

**If we make their bed, they will lie in it. Restoration of the Olympia oyster, *Ostrea lurida,* in Newport Bay, CA**

**Authors**: Chris Waterston*[1], Shannon Crossen*[1], John Berriman*[1], Christine Whitcraft[2], and Danielle Zacherl[1]

**Affiliations**: [1]Department of Biological Science, College of Natural Sciences and Mathematics, CSU Fullerton; [2]Department of Biological Sciences, College of Natural Sciences and Mathematics, CSU Long Beach

**Abstract:** The Olympia oyster has experienced substantial population declines throughout its range from Alaska to Baja California, Mexico since the early 1900's. In summer 2010, we initiated a restoration study in Newport Bay, CA to test whether augmenting mudflat with dead oyster shells as settlement habitat would increase oyster density and epifaunal community biodiversity. We also explored whether bed thickness and level of shell consolidation affect oyster density, % shell cover, and infaunal and epifaunal community diversity by augmenting intertidal mudflat with dead *Crassostrea gigas* shell into 5 replicate experimental 2mX2m plots of two thicknesses, 4cm and 12cm, and two types, bagged shell vs. loose shell, plus 5 control plots for a total of 25 plots). After one year, adult oyster density on experimental beds increased more than 50X above control plots; but bed thickness and consolidation did not affect adult density. However, the densities of oyster settlers and bay mussels, *Mytilus galloprovincialus*, as well as % cover of shell, were significantly greater on thick beds. Infaunal richness and abundance declined, while epifaunal richness and abundance increased on experimental plots relative to controls. The results of this study will contribute to the design of future restoration efforts in southern California.

## *Humboldt State University*

**Crypsis of *Diaulula sandiegensis* on its sponge prey *Haliclona permollis***

**Authors**: K.M. Korcheck*, J.A. Kelly*, and Sean Craig

**Affiliation**: Department of Biological Sciences, College of Natural Resources & Sciences

**Abstract**: Many marine organisms show polymorphism in color and pattern across environmental gradients. The nudibranch *Diaulula sandiegensis* shows phenotypic variation in color and spot pattern along thePacific Coast of the U.S., from Alaska to Mexico. The spots on the dorsum of this species can be ringed or solid, and range from few (4-10) to many (50-200). Photographs of *D. sandiegensis* were collected from rocky intertidal and subtidal sites along the Pacific Coast, and the size, density, number and distance between spots on all nudibranchs were measured. The spotting pattern for *D. sandiegensis* in juveniles may help them blend in with their prey species, the purple sponge *Haliclona permollis*. To test the hypothesis that *D. sandiegensis* is cryptic on its sponge prey, we quantified the spotting pattern of *D. sandiegensis* and the oscular pattern of *H. permollis* by measuring the area of dark spots with light rings, and dark oscula with light rims on each, respectively. A high product-moment correlation between nudibranchs and a random sample of sponge areas adjacent to the nudibranchs confirms a cryptic relationship.

## *CSU Long Beach*

**Evaluating restoration planting regimes in a newly restored southern California salt marsh**

**Authors:** E.M. Blair*, B.J. Allen, and C.R. Whitcraft

**Affiliation**: Department of Biological Sciences, College of Natural Sciences & Mathematics

**Abstract**: Salt marshes provide functions ranging from erosion reduction and storm surge buffering to toxin filtration and fish nursery provision. Plant cover within the marsh ameliorates harsh abiotic conditions and serves as a nesting habitat for endangered bird species endemic to the area. In this study, we evaluated structural and functional recovery of active restoration in Brookhurst Marsh, Huntington Beach, California by planting poly-culture treatments (which included nine common marsh species) and mono-culture treatments (all *Sarcocornia pacifica*, pickleweed) in a randomized block design on a non-vegetated berm. Both monocultures and polycultures provided physical conditions to support similar macrofaunal communities. Canopy insect communities do not vary by treatment but may be affected by seasonal changes. The benthic invertebrate community shifted from virtually nothing pre-planting to an amphipod-dominated community after five months. This remains constant a year and a half after planting with no differences among treatments in either diversity or abundance. Evaluating how plant community composition drives community trajectory and assessing the most successful planting regime in terms of plant cover and algal and invertebrate abundance has implications for future restoration planning and the regeneration of endemic bird nesting habitat.

## *CSU Los Angeles*

**The fundamental process of ecological disturbance reconceived with a mussel bed mode**

**Authors**: Jenny Aleman-Zometa* and Carlos Robles

**Affiliation**: Department of Biological Sciences, College of Natural and Social Sciences

**Abstract**: Forest trees, reef-building corals, and mussel beds share a common ecological function: they provide a physical matrix sheltering a diverse array of associated species. Violent winds and waves tear gaps in the otherwise dense cover of these foundation species, altering ecosystem function and causing substantial economic losses. Contrary to established theory, which maintains that disturbances occur randomly over a landscape, our research with mussel beds indicates that disturbances happen most frequently in regions of the landscape that support the greatest productivity and hence thickest covers of the mussels. Using innovative GIS surveys featuring high-resolution photo mosaics, we demonstrated that crowding in thick aggregations suppresses the attachment strength of mussels, making the aggregation more susceptible to wave stress. This factor, rather than maximum wave stress itself, proved the best predictor of gap formation. Therefore, disturbances are an aspect of self-limitation (intraspecific competition) that exert the greatest impact when other limiting factors, such as predation and temperature stress, are relatively low. Disturbances occur in a diverse array of ecosystems (e.g. coral reefs, forests, and grasslands). Our landscape approach to disturbance processes promises to provide new insights into a topic that will gain urgency as global climate change increases wind and wave action.

## *California Maritime Academy*

**Ballast Water Treatment Testing Program: Golden Bear Facility – Training Ship Golden Bear**

**Authors**: Brian Maurer*[1], Bill Davidson[2], Rich Muller[2], Veronica Boe[2] and Nick Welschmeyer[1]

**Affiliations**: [1]Moss Landing Marine Laboratories, SJSU; [2]Sponsored Programs and Extended Learning, California Maritime Academy

**Abstract**: Ships' ballast water contains aquatic life from distant ports that is discharged introducing non-native, invasive species into the local ecosystem. These species can have serious environmental consequences. To curb this threat, the International Maritime Organization (IMO) and federal and state agencies are issuing new standards for treating ballast water before it is discharged from ships. The California Maritime Academy in collaboration with its partners, U.S. Maritime Administration (MARAD) and Moss Landing Marine Laboratories, offers the Golden Bear Facility. The Golden Bear Facility is the only shipboard and land-based testing facility for research, development, testing and evaluation of ballast water treatment systems on the west coast. Designed to assist developers in testing and certifying new systems, a test platform has been installed aboard the Academy's training ship. Moss Landing Marine Laboratories provides science team support and consultation to the Golden Bear Facility. The facility is located aboard the 500-foot training ship Golden Bear located in Vallejo, California. The San Francisco Bay and River environments provide a rich mixture of marine organisms and both fresh and brackish water environments. The test platform provides an operational ship with laboratories for researchers working on ballast water treatment solutions and educates a broad community of future mariners, students, industry and agency partners on environmental issues.

## *CSU Monterey Bay*

**Habitat associations of spotted ratfish (*Hydrolagus colliei*) in the Monterey Bay National Marine Sanctuary**

**Authors**: Heather E. Kramp*, James Lindholm and Ashley Knight

**Affiliation**: Division of Science and Environmental Policy, College of Science, Media Arts and Technology

**Abstract**: Improved knowledge of fish-habitat interactions is critical for understanding how species are distributed in the undersea landscape. The spotted ratfish (*Hydrolagus colliei*), is a deep water species of the Chimaeridae family occurring along the west coast of the United States. Despite its apparent abundance, the habitat associations and latitudinal distribution of spotted ratfish are not well understood. Videographic imagery collected via remotely operated vehicle (ROV) and benthic towed camera sled within the Monterey Bay National Marine Sanctuary (MBNMS) between 2006 and 2011 provided an opportunity to quantify the relationship between spotted ratfish and the habitat attributes (e.g., substrate type and relief) over which they were observed. Results to date indicate that spotted ratfish (n = 152) were found across the full extent of the MBNMS, distributed latitudinally and over all substrate types sampled. These results provide an important incremental step in the development of future management plans for species such as the spotted ratfish which are subject to frequent capture and discard by recreational and commercial fishermen but are yet unmanaged.

## *Moss Landing Marine Laboratories*

**Hair concentrations of mercury and selenium and relationship with stable isotopes in Pacific harbor seals (*Phoca vitulina richardii*) off central California**

**Author**: Elizabeth A. McHuron*[1], James T. Harvey[1], Craig A. Stricker[2], and Todd M. O'Hara[3]

**Affiliations:** [1]Moss Landing Marine Laboratories, SJSU; [2] US Geological Survey, Fort Collins Science Center; [3]Institute of Arctic Biology, University of Alaska

**Abstract**: San Francisco Bay (SFB) is an urbanized estuary with a history of environmental contamination, including selenium and mercury. Harbor seals (*Phoca vitulina*) are year-round residents of SFB, and it has been suggested that a proportion of SFB harbor seals may suffer from chronic selenium toxicity. We measured total mercury (THg) and selenium (Se) concentrations, and Se:Hg in hair of harbor seals off central California. Stable isotopes of nitrogen, carbon, and sulfur also were measured in hair of seals from SFB. THg concentrations differed with location ($P < 0.001$; SFB = Tomales Bay > Elkhorn Slough) and sex ($P < 0.001$; males > females), whereas Se concentrations differed with location ($P < 0.008$; Elkhorn Slough > SFB = Tomales Bay). There was no relationship between THg concentrations and trophic level. Differences in THg concentrations among sites were likely due to contamination from historic mining in SFB and Tomales Bay. Greater THg concentrations in males might be explained by the ability of females to offload mercury to their developing fetuses, or by foraging differences between males and females. Results support suggestions that hair serves as an important excretory route for some toxicants, however, do not support the chronic Se toxicosis hypothesis.

## *CSU Northridge*

**Coral-algal interactions: determined by their physical environment**

**Authors**: A.L. Brown* and R.C. Carpenter

**Affiliation**: Department of Biology, College of Science

**Abstract**: Extreme oxygen concentrations can lead to coral tissue necrosis. We examined how water flow and the members of coral-macroalgal interactions influence oxygen concentrations above the zone of interaction between massive *Porites* spp. and algal turf. We exposed coral-macroalgal interactions to three flow speeds (0, 7, 14 cm/s) and measured the height of the diffusive boundary layer (DBL) in light and dark above the surfaces of *Porites*, algal turf and their zone of interaction. Our studies indicate that as water flow increases, DBL height decreases, but remains thicker above algal turf and the zone interaction (500 – 2500µm). Oxygen extremes in light and dark above the zone of interaction were most similar to concentrations above algal turf. To assess the influence of microbes on oxygen conditions above each surface, antibiotic (50µg/ml ampicillin) was added to *Porites*-algal turf interactions; the results suggest microbes play a diminutive role in oxygen dynamics. As the metabolic byproducts of algal turf appear to affect oxygen conditions above the zone of interaction, we suggest future studies explore the role of oxygen extremes on the outcome of coral-algal interactions.

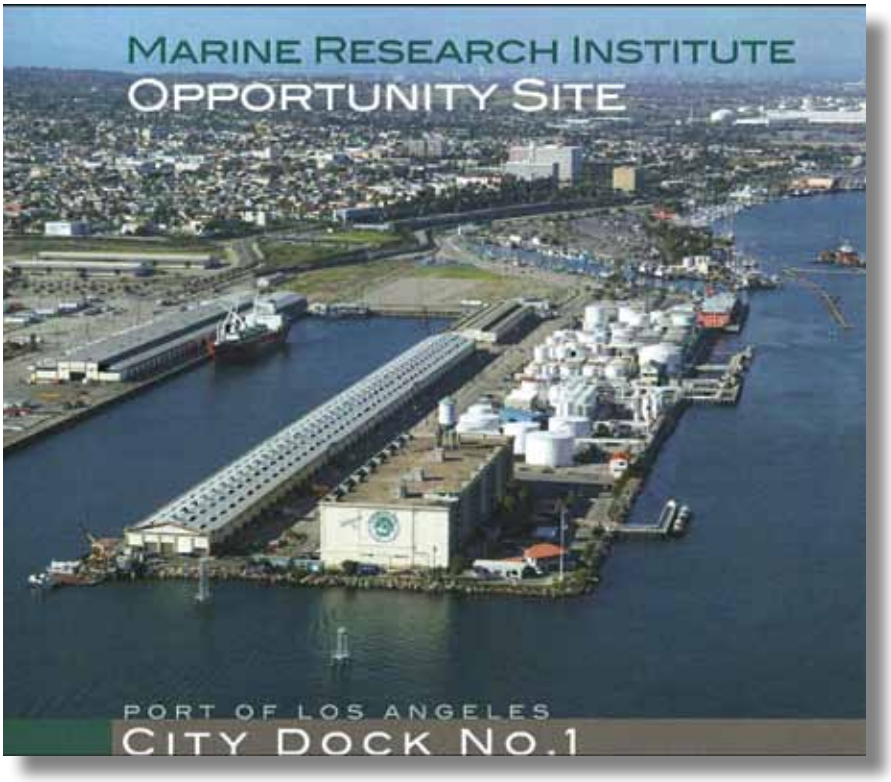
## *Ocean Studies Institute*

**City Dock #1: A New Home for SCMI?**

**Authors**: Larry G. Allen

**Affiliation**: Southern California Marine Institute

**Abstract:** The Port of Los Angeles and Southern California Marine Institute (SCMI), with support from the Annenberg Foundation, and advice and input from area academic and research institutions, the local aquariums, business leaders, environmental organizations and community groups in San Pedro and Wilmington, joined together to develop a City Dock No. 1 vision. The proposed 28-acre City Dock No. 1 project would provide facilities for SCMI, government research agencies, such as the National Oceanic and Atmospheric Administration (NOAA), and businesses to conduct cutting-edge research and education, and develop technologies to address the most vexing problems of the day: climate change, sea-level rise, the depletion of the world's fisheries, and pollution control technologies. City Dock No. 1 would offer on-the-water research facilities with extensive wharf space and water depth for the biggest and best research vessels, extensive storage space for the latest ocean-study robotics, and enough space to bring together all of the top researchers and entrepreneurs in the field. The proposed development of the largest wave-tank in the world – and the only one in natural sea water – would attract researchers from all over the world to California.



## *CSU Pomona*

**Population genetics of *Haminoea japonica*, a widespread invasive sea slug (Mollusca: Opisthobranchia) in North America and Europe**

**Authors**: Dieta Hanson* and Ángel Valdés

**Affiliation**: Department of Biological Sciences, College of Sciences

**Abstract**: The aim of this study was to investigate the genetic population structure of the invasive sea slug *Haminoea japonica* to determine the vector and invasion pathway. *H. japonica* has been hypothesized to spread via shipments of oyster spat for aquaculture. The slug has been found to negatively affect populations of native sea slug species and is the vector for a human parasitic skin disease, cercarial dermatitis. The hypothesized native range of the species is Japan and Korea, whereas the hypothesized invasive range includes Washington State, San Francisco Bay, Canada, Spain, Italy and France. The mitochondrial COI gene was sequenced from 85 specimens covering the full range of the species (except Italy). Results indicate that the most likely explanation for the current range of the species is a single, human-mediated dispersal from Japan, followed by a secondary invasion from North America to Europe. The haplotype network structure suggests that invasive haplotypes mostly likely originated in north-central Japan, which is where most Pacific oyster exports to North America also originated. The results of this study provide important data for the development of policies and regulations for the local aquaculture industry aimed to prevent outbreaks of this dangerous invader in Southern California.

## *CSU Sacramento*

**Scour chain measurement of scour and fill of salmon spawning gravels at the Upper Sunrise restoration site, Sacramento, CA**

**Authors**: Katy M. Janes*, Jay Heffernan* and Timothy Horner

**Affiliation**: Department of Biological Sciences, College of Natural Science and Mathematics

**Abstract**: Stream restoration is a new science, and it is important to measure the longevity of restoration projects. Stream gravel is mobile, and floods or high flows have unplanned effects on restoration projects. For this research, scour and fill from bank-full flows were measured at a restored gravel bar on the Lower American River. Approximately 10,000 $yds^3$ of gravel was added to the Upper Sunrise site in 2010 to create spawning habitat. The Lower American River has become sediment starved, armored and incised due to periodic high outflow from Folsom Dam, thereby degrading the natural channel conditions. In this project we measured total net scour across the restoration site using 15 chains and rods pounded into the gravel. Scour chains were anchored and partially buried in the stream bed during low-flow conditions. Scour (erosion) and fill (accumulation) were determined by measuring difference in the amount of chain exposed before and after a flood event. Results show scour at the upstream edge of the new gravel, where velocity is highest. The downstream edge of the restoration site has lower surface water velocity and some fill. Across the entire site we estimate approximately 20% gravel loss from a single year of moderate flows.

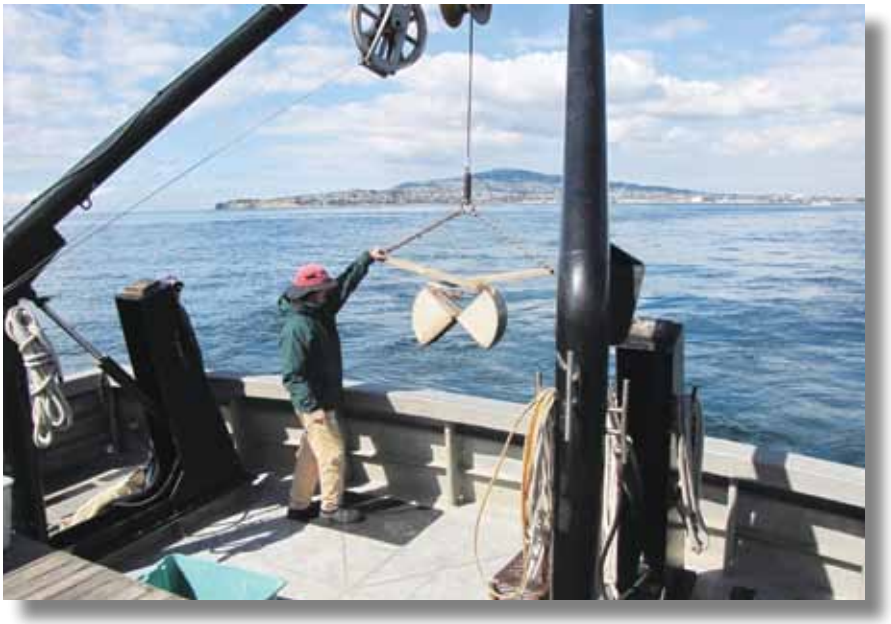
## *CSU San Bernardino*

**Onshore-offshore distribution patterns of anthropogenic debris in sands along the edges of the main shipping lanes for the Port of Los Angeles, San Pedro Shelf, California**

**Authors**: W. Britt Leatham and Lyneé L. LaVoie*

**Affiliation**: Department of Geological Sciences, College of Natural Sciences

**Abstract**: Small anthropogenic particulates (SAP) in marine environments have not received significant scientific attention. SAP accumulate in any sedimentary basin or environment as a byproduct of human activity. As with all particulates, once SAP "invade" an area, they are particularly obedient to the "natural rules" governing that particular sedimentary system. However SAP differ significantly from natural sediment by their manner of inclusion, by their origin, and by their predominantly different composition/shape than other typical natural clasts associated with those systems. SAP can effectively alter and modify the natural dynamics of ecological systems and marine substrates—affecting benthic habitats and communities (including interstitial organisms; suspension feeders, infaunal burrowers, borers, and detritivores). Additionally, mitigation of human alteration of marine benthic landscapes and habitats requires establishment of a SAP baseline for future monitoring. Sand samples from grabs and dredges were collected from "undisturbed substrate" along a six-mile transect across the San Pedro Shelf adjacent to the main shipping lane into the Port of Los Angeles. Sedimentological analysis of those samples indicates that the relative abundance of SAP decreases seaward, and implies potential scenarios for further accumulation. Additionally, SAP composition suggests clues for possible mitigation based on source identification.



## *San Diego State University*

**Do invasive mussels alter the resilience of Southern California estuaries?**

**Authors**: Max C.N. Castorani*[1,2,3], Kevin A. Hovel[1], Susan L. Williams[2], and Marissa L. Baskett[3]

**Affiliations**: [1]Department of Biology, College of Sciences, SDSU; [2]Bodega Marine Laboratory, UC Davis, [3]Department of Environmental Science and Policy, UC Davis

**Abstract**: Disturbance can facilitate colonization by non-native species, but the establishment of introduced species and subsequent interactions with native species are rarely studied within a disturbance framework. We investigated the effects of the non-native Asian mussel *Musculista senhousia* (Bensonin Cantor,1842) on recovery dynamics of eelgrass *Zostera marina L.*, a native marine angiosperm, following disturbance. Previous work suggests that Asian mussels may suppress the clonal growth of eelgrass, a propagation mechanism critical for resilience, by altering the physical structure of the seafloor or modifying sediment and porewater chemistry. To determine how Asian mussels may influence resilience of eelgrass to disturbance, we simulated small-scale disturbances to eelgrass habitat in Mission Bay (San Diego, California) and compared recovery dynamics between treatments with live mussels and treatments with structural mimics of mussels and their byssal mats. Preliminary findings suggest that mussels may impact eelgrass recovery by increasing porewater sulfide concentrations and physically blocking rhizomes, a combination of autogenic and allogenic mechanisms. This project represents a novel contribution to our understanding of the interplay between native species, introduced ecosystem engineers, and disturbance.

## *San Francisco State University*

**Cardiac performance and metabolism of an intertidal limpet under conditions of emersion and immersion**

**Authors**: Brittany E. Bjelde* and Anne E. Todgham

**Affiliation**: Department of Biology, College of Science & Engineering

**Abstract**: Species distribution and abundance are changing in the face of increasing global temperature. The physiological mechanisms underlying these shifts are unclear. Intertidal animals provide valuable insight into how organisms respond to environmental stressors as their environment fluctuates between terrestrial and aquatic conditions with each tidal cycle. We investigated the physiological response of the finger limpet, *Lottia digitalis*, to thermal stress when exposed to elevated temperatures in water or in air. Using measurements of heart rate and metabolic rate as indices of performance, we examined sensitivity to increases in temperature as well as the upper temperature tolerance thresholds of limpets. Thermal limits of heart function were determined by calculating the temperature which caused a drastic drop in heart rate (break temperature) while heating at a rate comparable to a low tide period. Oxygen consumption was also measured in both environments from 15-40°C at 5°C intervals. Final break temperatures in heart rate were significantly higher (3-5ºC) in limpets exposed to increases in temperature in air compared to those exposed in water. Oxygen consumption was higher and more variable in air compared to limpets in water where oxygen consumption decreased with increasing temperature. Field temperature logger data combined with our physiological measurements suggest that *L. digitalis* are currently living close to their temperature tolerance limits and may not have the capacity to keep up with increasing environmental temperatures or increased frequency of heat waves.

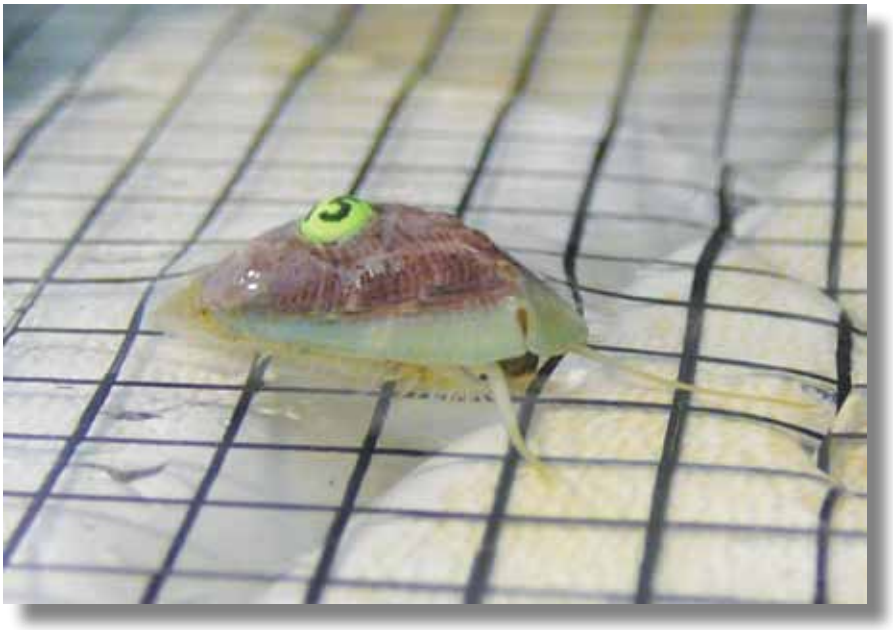
## *CSU San Marcos*

**Upwelling and ocean acidification: effects of high $CO_2$ and low DO on the growth and calcification of the red abalone (*Haliotis rufescens*)**

**Authors**: Lauren A. White*[1], Andrew G. Dickson[2] and Victoria J. Fabry[1]

**Affiliations**: [1]Department of Biological Sciences, College of Science & Mathematics CSU San Marcos; and [2]Scripps Institution of Oceanography

**Abstract:** Upwelling events along the California coast expose invertebrates to low dissolved oxygen simultaneously with high $pCO_2$ levels that are progressively increasing as a result of rising atmospheric $CO_2$. These multiple stressors could potentially impact the growth and calcification of economically valuable molluscs, such as abalone. To evaluate this threat, juvenile red abalone were maintained over a 4-week period in seawater undersaturated with respect to aragonite and containing 85% dissolved oxygen, which simulated an upwelling event. Seawater conditions were then returned to ambient levels for 3 weeks to determine the ability of the abalone to recover from the potential effects of low oxygen and high $pCO_2$ conditions. Data will be presented on the calcium content, shell weights, tissue weights, growth rates, and shell appearance that resulted from exposure to simulated upwelling conditions. The same measurements were analyzed following the return of the abalone to ambient conditions. The findings of this study can be used to maximize aquaculture survival rates, as well as adapt management and recovery efforts of the red abalone in the face of increasing anthropogenic $CO_2$ emissions.



## *California Polytechnic State University, San Luis Obispo*

**Characterization of eelgrass (*Zostera marina*) productivity in a California estuary to help model the effects of sea-level rise on future distributions**

**Authors**: Carolyn J. Ewers*, Lauren B. Seguy*, Mark A. Moline, and Dean E. Wendt

**Affiliation**: Department of Biological Sciences, College of Science and Mathematics

**Abstract**: The decline of seagrass habitats has been well documented for over 50 years; furthermore, climate change is expected to act synergistically with current stressors, resulting in greater losses. In Morro Bay, California, a loss of 50% of eelgrass (*Zostera marina*) acreage has been observed over the past three years. Currently, the San Luis Obispo Science and Ecosystem Alliance (SLOSEA) is developing a three-dimensional hydrodynamic model to forecast the effects of climate change on physical factors in Morro Bay. The model can also be useful for predicting future eelgrass distributions if a quantitative relationship between light, temperature, and productivity can be defined. This study aims to develop photosynthesis versus irradiance (P v. I) curves for eelgrass in Morro Bay. Data for the P v. I curves are being obtained at the Cal Poly Center for Coastal Marine Sciences pier facility using respirometry. Eelgrass samples are subjected to a range of light levels while maintained at one of three temperatures, representing the median, 10th percentile, and 90th percentile of temperature distribution in Morro Bay. Daytime "dark" and overnight measurements will be used to calculate total respiratory demands over a 24-hour period. Respirometry will also be conducted in situ to validate the accuracy of the lab-generated P v. I curves. These curves will make it possible to determine eelgrass productivity in the field by simply measuring light and temperature, and will be invaluable in assessing current bed productivity, predicting future distribution, and identifying appropriate locations to plant mitigation beds.

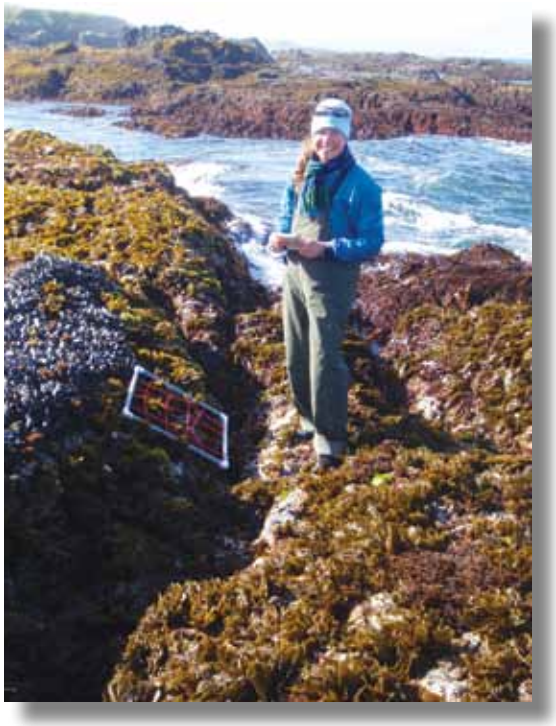
## *Sonoma State University*

**Don't bully the bullate: A new wrinkle on how the two forms of an intertidal kelp enable it to cope with environmental stress**

**Authors**: Jill A. Stokes* and Karina J. Nielsen

**Affiliation**: Department of Biology, School of Science and Technology

**Abstract:** *Saccharina sessilis*, a dominant kelp of the northeastern Pacific rocky intertidal, exhibits two blade morphologies: bullate and strap-like. Bullate *Saccharina* have upright, rugous blades that grow in a cabbage-like form while strap-like ones have smooth, long blades that lie flat on the rock when the tide is out. Researchers have argued the bullate morphology is an adaptive response to living in areas with low water flow (wave-protected shores) because they can facilitate nutrient and gas supply. However, we observed that bullate forms are more prevalent the higher you go on the shore, even in very wave-exposed, high flow locations, and they retain pools of water during low tide. We hypothesized that the bullate morphology ameliorates desiccation stress, allowing *Saccharina* to live higher on the shore. During a sunny and warm low tide, we found highzone bullate kelps remained hydrated longer than low zone strap-like kelps despite longer emersion times. Furthermore, two measures of photosynthetic performance (maximum quantum yield and electron transport rate) were higher in high zone, bullate kelps than low zone, strap-like ones. These differences were less pronounced during a foggy and cool low tide. These results challenge the paradigm that bullae are adaptive for low flow.



# WRPI
# Abstracts

## *CSU Fullerton*

**Detection and quantification of cis-1,2-Dichloroethylene in water using the FTIR-ATR**

**Authors**: Mubashir Sheikh* and Zhuangjie Li

**Affiliations**: Department of Chemistry and Biochemistry, College of Natural Sciences & Mathematics

**Abstract**: cis-1,2-Dichloroethylene (1,2-DCE) has been listed as a water contaminant by the EPA due to its hazardous health effects. Qualitative and quantitative detection of 1,2-DCE in water is important for both water quality monitoring and study of aqueous phase chemistry involving this compound. Detection and quantification of 1,2-DCE in water has been carried out using the FTIR-ATR spectroscopic technique with Ethylene/Propylene polymer (EPCO polymer) as membrane. The absorption peak at 850 $cm^{-1}$ was used to characterize the 1,2-DCE molecules in water. For the most sensitive detection of 1,2-DCE in water, the flow rate and the polymer thickness were optimized in the present work. The optimal flow rate was found to be 15 mL $min^{-1}$, whereas the optimal membrane thickness was found to be 20µm. Furthermore, a calibration curve was prepared, which indicated a linear relationship between peak area and 1,2-DCE concentrations in the range of 1.25 to 25ppm.

## *CSU Sacramento*

**Life or death for the Salton Sea?**

**Authors**: Shannon Waters* and Ronald M. Coleman

**Affiliation**: Environmental Studies Department, College of Social Sciences and Interdisciplinary Studies

**Abstract**: The Salton Sea is a bizarre body of water located in the Imperial Valley of California. Because of a combination of geological, hydrological and human-influenced factors, the Salton Sea is a 35 mile long body of water much saltier than the ocean. And it is dying. Such incredibly high salinities are lethal to most life and yet the Salton Sea is a vital stopover for many migratory birds, such as pelicans, gulls and terns. These birds eat fish. One of the few species of fish able to survive in such hostile conditions is an introduced hybrid tilapia (a kind of cichlid fish native to Africa). The tilapia now serve as a critical food resource for these birds. The Salton Sea is getting saltier. Will the tilapia be able to survive at even higher salinity, and even more critical, will they be able to reproduce to provide a constant source of food for these birds? Our research investigates the reproductive ability of tilapia at extraordinary salinities to understand the tradeoffs these fish make in order to live and breed under such adverse conditions. Understanding these tradeoffs will inform water managers that need to make costly and vital decisions concerning water allocation in California.

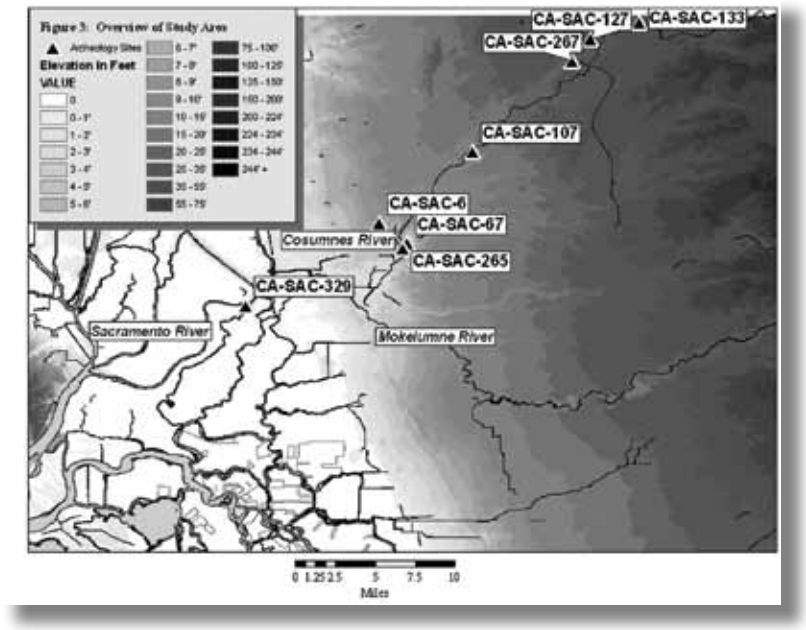
## *CSU Sacramento*

**Fire, floodplains and fish: the historic ecology of the lower Cosumnes River Watershed**

**Authors**: Michelle Stevens and Emilie Zelazo*

**Affiliation**: Environmental Studies Department, College of Social Sciences and Interdisciplinary Studies

**Abstract**: The Cosumnes River is located in the northeastern portion of the Sacramento-San Joaquin Delta of Central California. Our hypothesis is that floodplain biodiversity and native fish productivity benefited from burning and other traditional management practices utilized by the Plains Miwok and other Native Californians prior to European settlement. Ethnographic and archaeological data were used to reconstruct pre-European settlement traditional management practices. Ethnographic data was gathered from historical literature and local Miwok informants. Archaeological data from four Cosumnes River sites dating to the Late Period (1200 to 100 B.P.) were analyzed and compared to records of modern fish abundance and floodplain habitat modifications. The results indicate that traditional management practices, such as burning and harvesting plant materials in the floodplain, may have increased the productivity of floodplain rearing habitat, thereby increasing fish growth and reducing fish mortality. Based on this synthesis of multiple sources of information, it is likely that traditional tending practices optimized habitat productivity and fecundity for California native fish species, contributing to their resiliency to fluctuating environmental conditions. In conclusion, information provided here may provide valuable cultural and ecological data for habitat restoration and conservation of native California fish species.



## *San Jose State University*

**Historical review of US residential water demand**

**Authors**: Stephanie Ann Tanverakul* and Juneseok Lee

**Affiliation**: Department of Civil and Environmental Engineering, Charles W. Davidson College of Engineering

**Abstract**: In the 21st century, water utility professionals and drinking water researchers need to play a key role in designing and implementing creative solutions to the challenges of climate change, increasing population, and consequently increasingly scarce water resources. California Water Service Company (Cal Water) is planning to install approximately 68,000 water meters in the Northern and Central Valley areas of California (mostly in Bakersfield, Chico, and Visalia) within the next 15 years. In this project, the authors are analyzing households' water consumption/ demand changes due to the water meter installation and identifying significant causal factors that influence water consumption changes in California. Backgrounds of this project are elaborated in detail and historical review of US residential water demand analysis is presented. This on-going research outcomes will have broad impacts including, but not limited to, i) provide an innovative solution toward sustainable water resources management, ii) help better understand key elements of water conservation efforts, iii) allow water utilities to project future water demands accurately, and iv) assist water utilities set water rates appropriately.

## *California Polytechnic State University, San Luis Obispo*

**Pismo Beach fecal contamination source identification study**

**Authors**: Melissa Daugherty*, Marie Yeung, Michael Black, and Christopher Kitts

**Affiliations**: Department of Biological Sciences, College of Science and Mathematics

**Abstract**: The primary goal of the project was to identify the biological sources of fecal contamination as well as the physical and environmental factors that influence the levels of bacteria in the ocean waters at Pismo Beach, California. Water samples were collected from 3 sites extending up Pismo Creek, 10 sites along the beach bracketing Pismo Beach pier), 5 sites in the ocean off Pismo Beach and one site over the joint Pismo/Arroyo Grande/Oceano wastewater outfall. Samples were tested for the presence and abundance of fecal indicator bacteria and a variety of tests designed to detect bacteria that could serve as indicators of the biological source of fecal contamination. Physical, chemical and environmental data were also collected during sampling. Hourly, daily, weekly and rain event sampling frequencies were utilized to maximize data coverage in the highly dynamic environment of an ocean beach. In addition, a 60-day volunteer monitoring program was initiated during the summer of 2008 to count visible fecal material on the beach and monitor visitor activity. Our data collectively present a convincing argument for the pigeon flock at the Pismo Beach pier as the main source of fecal contamination in the surrounding ocean water.

## *Sonoma State University*

**Wastewater polishing by a constructed wetland and anaerobic digestion of harvested phytomass for production of bioenergy**

**Authors**: Michael F. Cohen[1], Caden Hare*[1,2] John Kozlowski*[1,2], Rachel S. McCormic*[2,3], Linden Schneider*[1], Zane Knight*[1], Austin Simpson*[1] and Lily Chen[3]

**Affiliation**: [1]Department of Biology, School of Science and Technology, SSU; [2]City of Santa Rosa, Utilities Department, Santa Rosa, CA; [3]Department of Biology, College of Science & Engineering, SFSU

**Abstract**: Constructed wetlands (CW) offer a mechanism to meet increasingly stringent regulatory standards for wastewater treatment while minimizing energy inputs. To optimize CW wastewater polishing activities and investigate integration of CW with energy production from anaerobic digestion we constructed a pair of three-tier channelized modules fed with secondary-treated municipal wastewater and stocked with native aquatic vegetation. Modules that were regularly harvested averaged nitrate removal efficiency of 1.1 g N $m^{-2}d^{-1}$; harvesting, sedimentation and gasification were responsible for 30.5%, 8.0% and 61.5% of the N losses, respectively. Selective harvesting of a module to maintain dominance of filamentous algae had no effect on nitrate removal efficiency but lowered productivity by one-half. The average monthly productivity for unselectively harvested modules was 9.3 ± 1.7 g DW $m^{-2}d^{-1}$(means ± SE). Cessation of harvesting in one module resulted in a significant increase in nitrate removal efficiency and decrease in phosphate removal efficiency. The estrogenic activity of the outflow from the harvested module, determined via a juvenile trout bioassay, was lowered to a level not significantly different from an estrogen-free water medium. E. coli densities were significantly reduced by passage of wastewater through the modules. Anaerobic digestion of the harvested aquatic vegetation mixed with equal parts (wt/wt) of wine lees and crude glycerol by product of biodiesel manufacture produced 0.53 $m^3$ methane per kg of volatile substrate. Remaining solids were composted for use as a soil amendment. Thus, incorporation of constructed wetlands into an integrated treatment system can simultaneously enhance the economic and energetic feasibility of wastewater and organic waste treatment processes.

## *CSU Stanislaus*

**The role of mistletoe in leaf litter decomposition in a lowland river**

**Authors**: Bryan Shragge*, Stuart Wooley, and Matthew Cover

**Affiliation**: Department of Biological Sciences, College of Natural Sciences

**Abstract**: Parasitic plants are an important nutrient resource and possible keystone species in forest communities, but little is known about their role in aquatic ecosystems. We evaluated the role of *Phoradendron serotinum*, a species of mistletoe, in leaf decomposition in the Stanislaus River, a large lowland river in the San Joaquin Valley, California. Mistletoe leaves, cottonwood leaves, and a mixture of both were placed in mesh decomposition bags that were submerged and removed at regular intervals over a three month period during the fall of 2010. We weighed the leaf packs before and after the experiment, and examined the colonization of the three litter types by aquatic invertebrates. Cottonwood leaves decomposed rapidly at first (76% mass loss by end of week 2), but did not lose additional mass by the end of the experiment. Mistletoe leaves decomposed more slowly at first (59% by week 2), but experienced much greater mass loss by the end of the experiment (94%). There were differences in invertebrate communities among the litter types early in the experiment, but the communities became more similar as the experiment progressed. Mistletoe appeared to be longer lasting nutrient resource for invertebrates, however, than cottonwood leaves or mixtures of leaves.

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Cover photograph: Sonoma State University graduate student Jill Stokes in the field.
Image courtesy of Karina Nielsen.

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