SCCWRP Director's Report

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SUMMER 2016 ISSUE

Surfer rainfall study helps focus water-quality discussion

SCCWRP and its partners have completed a three-year epidemiological study examining the health impacts of entering coastal waters during and shortly after rainfall, a study that has raised important public policy questions about whether existing water-quality standards are protecting beachgoers during wet weather.

The Surfer Health Study, which tracked the illness rates of 654 San Diego-area surfers during the rainy winter season, found that surfers experienced increased rates of both gastrointestinal illness and other illness symptoms when they surfed during rain events and/or in the three days that followed.

However, when the illness data were correlated with quantitative measurements of aquatic microbial contamination at two popular San Diego surfing spots, the rate at which surfers contracted gastrointestinal illness was lower than the illness rate predicted under federal guidelines. The guidelines, which were issued by the U.S. Environmental Protection Agency in 2012, predict the relationship between gastrointestinal illness rates and corresponding microbial contamination levels.

Given these findings, water-quality managers are now tasked with determining what additional clean-up actions are needed to reduce the illness rates documented in San Diego.

Rainfall makes Southern California's coastal zone particularly susceptible to waterborne contamination, as the pathogens that can make people sick wash off the land and travel through storm drains to the beach. Although most Southern California beachgoers heed warnings by public health officials to stay out of the water following rainfall, surfers are a notable exception; thousands are attracted to the favorable surf conditions that accompany storm events.

During the study, which was conducted during the winters of 2013-14 and 2014-15, San Diego surfer volunteers were asked to use a smartphone app to confidentially

Contents

5 | Updates by Thematic Area

11 | New SCCWRP Publications

12 | Quarter in Review

14 | SCCWRP Personnel Notes

15 | SCCWRP Spotlights

Cover photo: Surfers paddle away from shore during a winter day at Ocean Beach in San Diego just one day after a torrential downpour. A new epidemiology study has ascertained the health risks to these surfers from entering coastal waters.

Calendar

Thursday, August 4
CTAG quarterly meeting

Friday, September 9 (9 a.m.-3 p.m.)
Commission extended meeting to discuss findings of the Southern California Bight 2013 Regional Monitoring Program

Thursday, November 3
CTAG quarterly meeting

Friday, December 2
Commission meeting

report their daily surfing activities and symptoms of illness. They received gift certificates to a surfing retailer for their participation.

Study participants logged a combined 10,081 surfing sessions; 13% of these sessions took place during wet-weather conditions, making the beach epidemiology study one of the largest of its kind in the past 30 years.

The study documented an excess gastrointestinal illness risk of 12 cases per 1,000 for surfers who entered the water in wet weather, for a total of 30 cases per 1,000. The EPA's water-quality criteria, however, specify that there are to be no more than 32 to 36 excess cases per 1,000.

The full epidemiology study will be published on SCCWRP's website in early August. For more information, contact Ken Schiff.

San Diego's Tourmaline Surfing Park is at the receiving end of a storm drain channel, making it susceptible to land-based runoff during rainfall.

Method comparison study seeks to assess utility of using DNA to identify stream algae

SCCWRP and its partners have launched a first-of-its-kind study to determine whether DNA-based methods can reliably be used to identify algae in wadeable streams across California, a finding that could pave the way for the incorporation of molecular technology into stream bioassessment monitoring statewide.

Stream managers across Southern California already use the composition of stream algal communities to evaluate overall water body condition, but these assessments are dependent on trained taxonomists to identify algae samples individually. This manual identification process is labor-intensive, costly and prone to backlogs.

Switching to an algal analysis method that allows algae samples to be identified through DNA sequencing could reduce dependence on a limited supply of algal taxonomists, as well as provide important new insights about novel algae species and their habitats.

In January, SCCWRP and its partners began laying the groundwork to compare the effectiveness of morphology vs. DNA-

SCCWRP's Justin Vanderwal and Lisa Zumwalde wade into the Santa Margarita River to collect samples of greenish algal blooms. SCCWRP and its partners are sampling the Santa Margarita River algae through a full boom-and-bust seasonal cycle, which will provide key insights into whether DNA-based methods can reliably be used to identify the algal species present.

SCCWRP's Mayra Molina collects a sample of water in the Santa Margarita River that runs through Riverside and San Diego counties. SCCWRP and its partners are sampling algae in this stream and dozens of others across California for a study that will determine the reliability and effectiveness of using DNA-based methods to identify stream algae.

based algae identification methods. The study is ongoing.

The need for improved stream algae bioassessment methods is growing in California. For the past six years, state water officials have been working to develop a statewide stream biointegrity and nutrient policy that is expected to rely, in part, on algae-based bioassessments.

Algal communities are valuable indicators of human impacts to streams because they are highly sensitive to physical, hydrological and geochemical changes to their environment. Excessive nutrient inputs, for example, can trigger harmful algal blooms (HABs).

Vetting DNA-based algae bioassessment methods also could benefit the state's Surface Water Ambient Monitoring Program (SWAMP), which is developing an algae-based stream scoring tool comparable to the California Stream Condition Index (CSCI). The CSCI, which was co-developed by SCCWRP, uses aquatic insects and other benthic invertebrates as indicators of stream condition. The statewide algal index is being built to complement the CSCI, providing an additional line of evidence for evaluating stream health.

For the method comparison study, SCCWRP and its partners plan to assess the performance of the DNA-based identification methods across a wide range of geographic and geochemical settings. Algae samples are being collected by the Southern California Stormwater Monitoring Coalition, the San Francisco Bay Regional Monitoring Coalition, the statewide Reference Condition Management Program, and the statewide Perennial Stream Assessment. In addition, the Santa Margarita River – a watershed heavily impacted by nutrient loading – is being sampled to assess method performance through a full algae bloom-and-bust seasonal cycle.

Study findings are expected to be released in late 2017. For more information, contact Dr. Susanna Theroux.

Study: Cell bioassays could be effective at screening for potential harm in fish

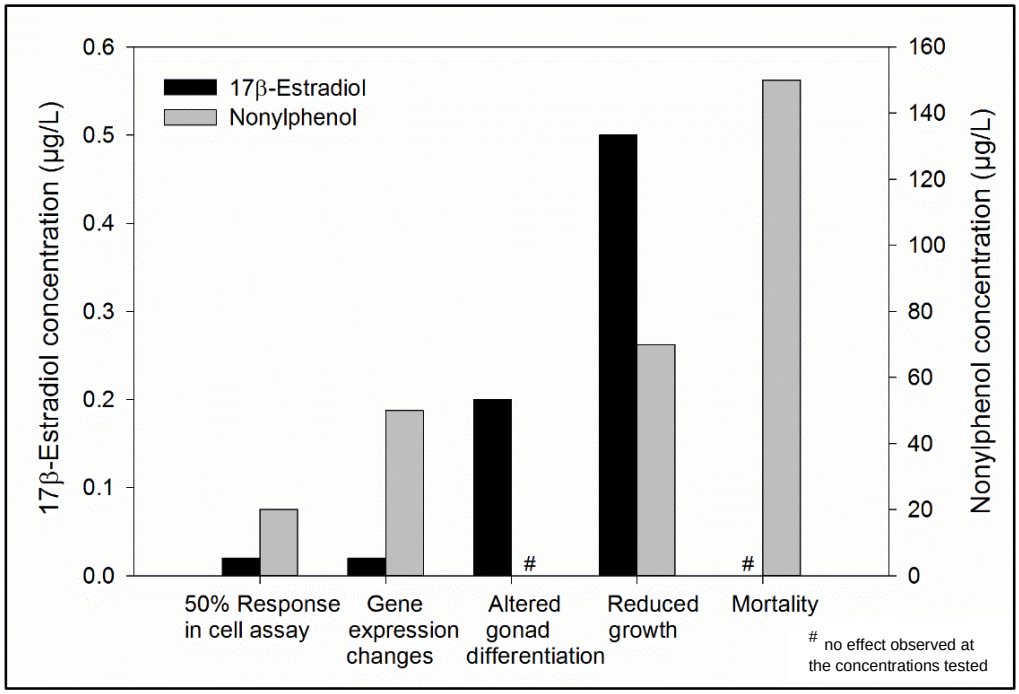
SCCWRP and its partners at the University of Florida have demonstrated in a proof-of-concept study that biological assays built with engineered human cells have the potential to be effective at screening for potential biological harm in fish exposed to differing levels of estrogen-mimicking chemicals.

The finding, obtained in May, involved showing that there is a strong correlation between the way that engineered human cells respond to increasing levels of chemical contaminants, and the way that inland silverside fish experience increasingly severe biological effects when exposed to the same contamination.

The ongoing linkage study – the first of its kind in a coastal marine environment – provides compelling evidence that commercially available cell bioassays are a viable technology for screening receiving waters for potentially harmful levels of CECs. Cell bioassays are commonly used in pharmaceutical and food-industry applications to rapidly screen a wide variety of chemicals for potential toxicity.

SCCWRP and researchers around the world are interested in adapting cell bioassays into a viable CEC screening tool because traditional methods for monitoring the impacts of CECs on aquatic life – such as targeted chemical analysis and whole-organism toxicity testing – tend to be comparatively labor-intensive and costly. These methods also tend to be unable to detect all chemicals of concern, whereas a bioassay is designed to

Water-quality managers need rapid, cost-effective tools to alert them when contamination has the potential to adversely impact fish growth and survival. Above, the Russian River in Northern California is one site where SCCWRP and its partners are testing the utility of using cell bioassays to screen for potential biological effects triggered by CECs.



SCCWRP and its partners have shown that cell-based bioassays can serve as reliable and sensitive tools for screening for the presence of estrogenic chemicals. Above, the cell assay gives a clear response signal (i.e., 50% response) in the presence of relatively low concentrations of the estrogenic chemicals 17β-estradiol and nonylphenol. This response was observed well before chemical concentrations rose to a level that threatens fish growth and survival, indicating that cell bioassays have the potential to be adapted as an effective screening method for estrogenic chemicals and other CECs.

detect dozens of chemicals that share similar biochemical properties.

The next step in the study is to zero in on the precise chemical concentration at which the cell bioassays begin to detect an adverse biological response in fish. Knowing where this threshold lies is crucial to develop a long-term monitoring and management strategy.

Over the long term, researchers hope to develop new bioassays and/or adapt commercially available bioassays to screen for a wide variety of CECs. Already, SCCWRP and its partners have begun working to replicate the estrogenic linkage study with glucocorticoids, a class of steroidal anti-inflammatory drugs commonly used to treat eczema and asthma.

For more information, contact Dr. Alvina Mehinto.

Updates by Thematic Area

SCCWRP Research Themes BIOASSESSMENT • ECOHYDROLOGY • EUTROPHICATION • CLIMATE CHANGE • SEDIMENT QUALITY • CONTAMINANTS OF EMERGING CONCERN • MICROBIAL WATER QUALITY • REGIONAL MONITORING • INFORMATION TECHNOLOGY & VISUALIZATION

BIOASSESSMENT

Arthropods, bryophytes being developed as condition bioindicators for intermittent streams

SCCWRP and California State University, Monterey Bay, in June launched a study to investigate the feasibility of using terrestrial arthropods and bryophytes (e.g., mosses) to assess the biological condition of intermittent streams that run dry for much of the year.

These two biological indicators will be the first to be developed specifically for intermittent and ephemeral streams at the drier end of the hydrologic spectrum. Although intermittent streams make up about 60% of all streams in Southern California, existing bioindicators for perennial streams are not calibrated to generate accurate condition assessments for the driest of these streams.

Matt Robinson of Cal State San Marcos sets up a ramp trap to catch ground-dwelling terrestrial arthropods in a dry stream bed. The greenish chemical propylene glycol is used for preserving trapped organisms. Researchers are collecting and analyzing arthropod data this summer from dry stream beds across the San Diego area.

Assessment tools for intermittent streams are expected to become increasingly valuable as more of Southern California's streams run dry in response to climate change, drought, and increased water conservation and reuse.

Researchers hypothesize that terrestrial arthropods – including insects, arachnids, myriapods and crustaceans – will serve as sentinel indicators of how intermittent streams are impacted by agricultural and urban runoff. Bryophytes like mosses and liverworts, meanwhile, have been shown to be highly sensitive to water quality and siltation, in much the same way that organisms like algae are in perennial streams.

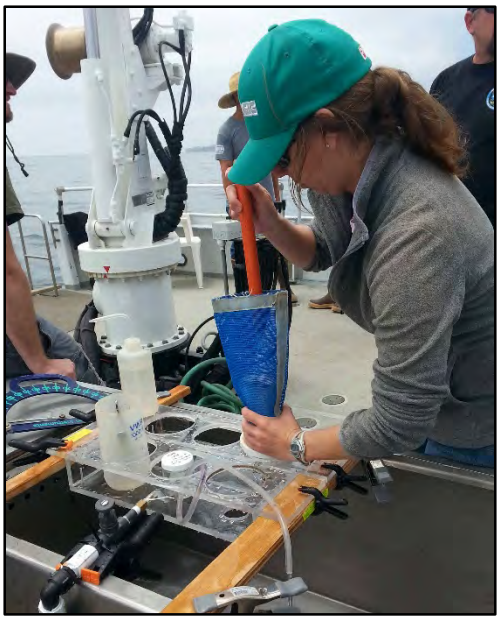
SCCWRP and its partners have developed a set of sampling protocols that they're using this summer to collect and analyze arthropods and bryophytes from across about 30 sites in the San Diego area. The sites represent a range of natural gradients and stress levels.

Researchers anticipate sharing initial data and analyses in spring 2017, which will help guide a multi-year effort to adapt these organisms as bioindicators of stream condition.

Sampling completed for ichthyoplankton project

SCCWRP and two of its member agencies completed field sampling in June for a project that will evaluate DNA-based methods for identifying ichthyoplankton, which are the eggs and larvae of fish.

Ichthyoplankton offer important insights into the condition of the marine pelagic zone, an offshore area heavily impacted by land-based discharges.



Terra Petry of the Sanitation Districts of Los Angeles County extracts ichthyoplankton from a blue-meshed collection bag that was towed through the pelagic zone off the coast of southern L.A. County. The Sanitation Districts of Los Angeles County and the City of Los Angeles Bureau of Sanitation provided expertise, equipment and research vessels during the multi-day sampling effort.

SCCWRP and its partners are working to use DNA-based methods to identify the ichthyoplankton samples, which were collected with help from the Sanitation Districts of Los Angeles County and the City of Los Angeles Bureau of Sanitation. DNA-based identification methods have the potential to generate faster, more insightful results than traditional identification by taxonomists.

Researchers are interested in improving ichthyoplankton analysis methods so that ichthyoplankton can be more effectively utilized as a tool to monitor the condition of the marine environment.

Study to investigate extrapolation limits of stream condition scores

SCCWRP and the California Department of Fish and Wildlife in August will launch a study seeking to clarify how far stream condition scores calculated for a single stream site can be extrapolated upstream and downstream of the site.

Stream managers across California have begun using a new scoring tool called the California Stream Condition Index to evaluate the ecological health of wadeable streams statewide; however, users lack guidance on how far they can extrapolate scores beyond the individual sites where the scores have been calculated.

Understanding the spatial representativeness of stream condition scores is critically important because stream managers don't have the resources to conduct bioassessment work along every kilometer of every stream in California. A stream bioassessment is typically conducted along a site that spans just 150 meters.

The ability to extrapolate California Stream Condition Index scores will become increasingly important as the scoring tool is integrated into regulatory and stream management programs statewide.

The study, expected to be completed by the end of 2016, will use sophisticated statistical analyses and the consensus of an expert review panel to arrive at recommended extrapolation limits.

Stream bioassessment tools adapted for use in depressional wetlands

SCCWRP has completed assessments of the condition of depressional wetlands in Southern California and the San Francisco Bay Area, a pair of twin studies that demonstrates that bioassessment tools originally developed for assessing perennial stream condition can be adapted and applied to depressional wetlands as well.

Freshwater depressional wetlands are the most common wetland type in California, comprising 45% of the state's 3.6 million wetland acres. They are formed in low spots on the landscape where restrictive soil layers allow for extended ponding.

The calibrated bioassessment tools developed through the twin studies can now be applied to depressional wetlands across most of coastal California, providing valuable insights about wetland condition that can help guide protection, restoration and management activities.

The twin studies also documented that there is a significant need to improve management of depressional wetlands. The ubiquitous habitat type is routinely impacted by infrastructure and development activities, and faces particular threats from excessive nutrient loading, variables related to ionic concentration, and direct habitat alteration, according to the study.

Just 26% of Southern California depressional wetlands were deemed intact, and just 30% of Bay Area wetlands were deemed intact.

Zuniga Marsh near Malibu is a depressional wetland that has been deemed intact by a recent SCCWRP study evaluating the condition of this ubiquitous wetland type. Overall, just 26% of Southern California's depressional wetlands were deemed intact.

EUTROPHICATION

Santa Margarita River study offers insights on reducing nutrient loading to estuaries

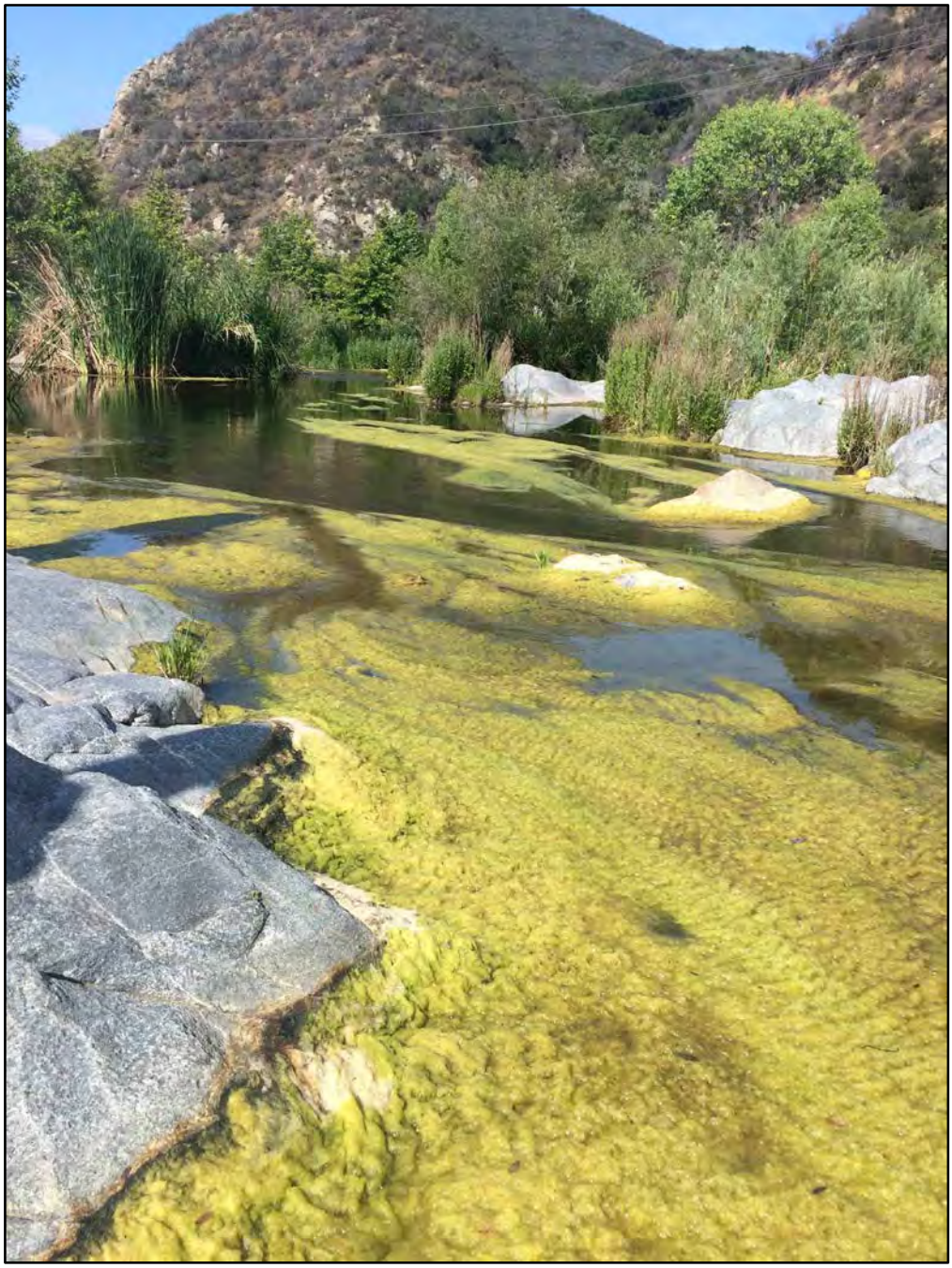
SCCWRP and its partners have completed the first phase of a five-year study exploring how water-quality managers can set appropriate, scientifically defensible targets for reducing nutrient loading in the Santa Margarita River Watershed, an analysis that is expected to have widespread implications for management of similar estuaries across coastal Southern California.

Phase 1 of the study, published in June, involved figuring out how to appropriately apply and adapt mathematical models that predict how nutrients move through the Santa Margarita River estuary and alter its water quality. Nutrient loading to the Santa Margarita River watershed – which spans Riverside and San Diego counties – has led to substantial overproduction of macroalgae in the estuary, impairing water quality and beneficial uses.

San Diego Regional Water Quality Control Board staff is interacting with the study's stakeholder workgroup on how to use its findings and recommendations to design an alternative Total Maximum Daily Load (TMDL) that will manage nutrient loading to the watershed; the Regional Board is expected to consider the proposed TMDL in late 2016.

The Santa Margarita River Watershed study is a pilot project demonstrating a watershed approach to implementing "nutrient numeric endpoints," which are the State Water Board staff's approach to nutrient and eutrophication management of watersheds.

The TMDL for the Santa Margarita estuary will establish an important precedent for how goals get set for California coastal estuaries dominated by macroalgal blooms. Macroalgae are the most common type of algae in Southern California estuaries.



The Santa Margarita River watershed that spans Riverside and San Diego counties is particularly susceptible to overproduction of macroalgae from nutrient loading. SCCWRP and its partners are working to help water-quality managers set appropriate targets for reducing nutrient loading in macroalgae-dominated waterways.

Stakeholder committee provides feedback on West Coast OAH model development

A stakeholder advisory committee of SCCWRP member agencies and other Southern California coastal managers and scientists met for the first time in June to provide feedback on the ongoing development of a model that predicts how nutrient loading along the West Coast is affecting ocean acidification and hypoxia (OAH).

During the all-day meeting hosted at SCCWRP, the stakeholder committee made recommendations on the types of data – including data on river runoff and discharge of treated wastewater effluent – that are most relevant to use to both validate and calibrate the model.

Committee members also discussed the types of nutrient loading scenarios that are specifically applicable to the Southern California region, as well as the assessment endpoints that they might use to interpret the model's outputs.

The West Coast OAH modeling project is a sweeping initiative to help West Coast managers understand which marine habitats are most vulnerable to OAH and to what extent local, land-based sources of pollution are exacerbating coastal OAH conditions. The modeling work involves coupling West Coast physical and biogeochemical ocean models together to predict the relative contributions of global carbon dioxide emissions, natural upwelling processes, and nutrients introduced via local discharges.

A downscaled version of the model is being developed for the Southern California Bight; the Bight will be the only region in which stakeholder feedback is directly solicited for the modeling project through an advisory committee process.

The next meeting, which will be scheduled in fall 2016, will focus on assessment endpoint development, as well as reviewing initial runs of the model and its corresponding outputs.

Year 2 of HABs sampling effort launched in 2 recreational lakes

SCCWRP and its partners in May launched Year 2 of a cyanobacteria and cyanotoxin sampling effort in two Riverside County lakes to chronicle the proliferation of toxic algae through a peak bloom season.

The goal is to determine if routine, ongoing HABs monitoring in the recreational lakes is warranted.

Both years of HABs sampling involve deploying passive sampling devices for six months in Lake Elsinore and nearby Canyon Lake. The sampling work is part of the freshwater HABs program run by the state's Surface Water Ambient Monitoring Program.

Cyanotoxin sampling in the lakes in 2014 detected the presence of multiple types of cyanotoxins, some at concentrations exceeding the state's recreational action thresholds designed to protect human health.

Rachel Adams of Loyola Marymount University deploys a passive sampling device off the Palos Verdes Shelf. SCCWRP is interested in taking the samples obtained by passive sampling methods and directly screening them for potential toxicity using bioanalytical tools.

CONTAMINANTS OF EMERGING CONCERN

SCCWRP seeks to streamline CEC monitoring by combining technologies

SCCWRP in July launched an effort to combine two complementary but distinct technologies for detecting chemical contamination in environmental samples, a plan that has the potential to streamline routine aquatic monitoring of CECs.

SCCWRP's goal is to use passive sampling devices – which are designed to capture "bioavailable" forms of CECs – to concentrate chemical contaminants from water, sediment and possibly even tissue samples, and then to directly screen these samples for potential toxicity using bioanalytical tools, including high throughput cell assays.

Coupling the two technologies has the potential to significantly reduce the effort and expense associated with collecting, processing and preparing the samples for subsequent toxicity screening using bioanalytical tools.

Passive sampling devices are thin, hollow fibers or polymer films that absorb even exceedingly low levels of trace organic contaminants; chemicals sorbed to the devices are then analyzed by gas chromatography.

Because passive sampling devices efficiently concentrate chemicals of interest, they have the potential to eliminate the manual, laborious processing steps that are required to prepare a sample for bioanalytical screening.

The first step is to determine if the materials used to construct passive sampling devices interfere with commercially available cell assays. SCCWRP anticipates this first step will take a year to complete.

Both technologies are part of SCCWRP's long-term CEC research program, which is designed around helping aquatic managers more cost-effectively zero in on the CECs that pose the greatest potential health risks.

MICROBIAL WATER QUALITY

Pair of tools developed to aid in interpreting beach microbial contamination signals

SCCWRP and its partners have developed two mathematical predictive tools designed to improve beach water-quality managers' ability to accurately interpret microbial contamination signals detected during routine beach monitoring.

The three-year study, completed in July, involved investigating whether mathematical models could be developed to predict how much fecal contamination in a water sample is coming from a human source vs. nonhuman animal sources. Human sources of fecal contamination are much more likely to contain the pathogens that make people sick.

However, because water-quality managers measure indicator microbes instead of pathogens themselves, researchers first needed to measure the degradation rates of the pathogens in relation to the degradation rates of a variety of indicator microbes that serve as proxies for specific animal and human sources of contamination. The relative degradation rates of these indicators were measured in different water body types, under different seasonal conditions, and under differing amounts of UV sunlight exposure.

The study found that the only time a simple mathematical relationship can predict the relative decay rates of the various indicator microbes is when the microbial contamination is less than 24 hours old, such as immediately following a raw sewage spill. For these instances, researchers developed a ratio model that enables beach managers to predict how much contamination can be attributed to a fresh source.

Researchers also used the degradation data generated by the study to develop a mathematical model that enables beach managers to predict the level of certainty that microbial contamination at a given beach is at least partially from a human source. The Human Fecal Index uses data obtained from a DNA-based analysis of the water sample to estimate the likelihood that a human source of fecal contamination is consistently present at that beach.

The two tools developed from the study will help California beach managers more accurately interpret water-quality data to better protect the health of beachgoers statewide. Managers can use the tools as they investigate sources of microbial contamination, prioritize remediation efforts and consider which beaches may be eligible for site-specific water-quality objectives.

SCCWRP's Allison Orr retrieves sealed dialysis bags filled with diluted human sewage from Irvine's San Joaquin Marsh in 2014. Researchers exposed the sewage to a variety of environmental conditions to measure the degradation rates of indicator microbes that water-quality managers use to detect contamination that can make people sick.

REGIONAL MONITORING

Study finds widespread chemical contamination at low levels in Bight seabirds

Contaminants have accumulated in the eggs of seabirds across the Southern California Bight at low levels, according to the findings of a Southern California Bight 2013 Regional Monitoring Program bioaccumulation study.

DDTs (dichlorodiphenyltrichloroethane), PCBs (polychlorinated biphenyls), PBDEs (polybrominated diphenyl ethers), mercury and other chemicals were detected in every seabird egg measured, including the endangered California least tern.

The majority of contaminant levels were below risk thresholds of concern. However, because some measurements were above the risk thresholds, and because it is unknown how multiple chemicals may interact at low concentrations, researchers recommend continued monitoring to better understand potential risks.

Eggs were collected from four species representing a range of foraging habits: cormorants, gulls, Caspian terns and California least terns. Only eggs abandoned by their parents were sampled.

Traditionally, the Bight program has focused on monitoring contaminant levels in fish, which serve as prey for many marine organisms. Seabird eggs, however, offer key insights into how contamination may be traveling through marine food webs and bioaccumulating in unhatched offspring at one of the highest trophic levels.

The full Bight '13 bird egg bioaccumulation study will be published in August.

INFORMATION TECHNOLOGY & VISUALIZATION

Master's students show CellScope images can be autonomously identified with 90%-plus accuracy

A team of master's students in statistics at California State University, Fullerton, has demonstrated that statistical classification methods can be used to correctly identify microscopic images of a marine diatom more than 90% of the time.

The semester-long project, which wrapped up in May and was overseen by SCCWRP, provides an important proof of concept in SCCWRP's ongoing efforts to automate analysis and processing for environmental images obtained with the CellScope Aquatic. The CellScope is a microscope prototype co-developed by SCCWRP that uses a smartphone as the viewfinder.

The students tested six different statistical classification methods for distinguishing images that contain the toxin-producing *Pseudo-nitzschia* diatom from images that do not. All six statistical methods produced results that were at least 90% accurate, and three achieved accuracy of more than 95%.

The accuracy rates are comparable to the accuracy rates that taxonomists get when they evaluate and classify these images manually.

The students' work will help SCCWRP design an analytical library capable of rapidly processing and identifying microscopic images for a wide variety of algae and diatoms.

New SCCWRP Publications

Journal Articles (Published)

Stein, E.D., L.G. Lackey, and J. Brown. 2016. How accurate are probability-based estimates of wetland extent? Results of a California validation study. *Wetlands Ecology and Management* 24:347–356. DOI 10.1007/s11273-015-9460-0.

Journal Articles (Online)

Arnold, B.F., T.J. Wade, J. Benjamin-Chung, K.C. Schiff, J.F. Griffith, A.P. Dufour, S.B. Weisberg, J.M. Colford. 2016. Acute Gastroenteritis and Recreational Water: Highest Burden Among Young US Children. *American Journal of Public Health* DOI: 10.2105/AJPH.2016.303279.

Schiff, K., L.L. Tiefenthaler, S.M. Bay, D.J. Greenstein. 2016. Effects of rainfall intensity and duration on the first flush from parking lots. *Water* 8, 320; doi:10.3390/w8080320.

Scott, G.I., D.E. Porter, G.T. Chandler, S. Norman, C.H. Scott, M. Uyaguari, K. Maruya, S.B. Weisberg, M.H. Fulton, E.F. Wirth, J. Moore, P.L. Pennington, D. Schlenk, N.D. Denslow, and G. Cobb. 2016. Antibiotics as CECs: An overview of the hazards posed by antibiotics and antibiotic resistance. *Frontiers in Marine Science* 3:24, DOI: 10.3389/fmars.2016.00024.

Journal Articles (Accepted)

Howard, M.D.A., R.M. Kudela, K. McLaughlin. In press. New insights into impacts of anthropogenic nutrients on urban ecosystem processes on the Southern California coastal shelf: Introduction and synthesis. *Estuarine Coastal and Shelf Science*.

McLaughlin, K., N. Nezlin, M.D.A. Howard, C.D.A. Beck, R.M. Kudela, M.L. Mengel, G.L. Robertson. In press. Rapid nitrification of wastewater ammonium near coastal ocean outfalls, Southern California, USA. *Estuarine Coastal and Shelf Science*.

Mehinto, A.C., B.S. Jayasinghe, D.R. Vandervort, N.D. Denslow, K.A. Maruya. In press. Screening for endocrine activity in water using commercially available *in vitro* transactivation bioassays. *Journal of Visualized Experiments*.

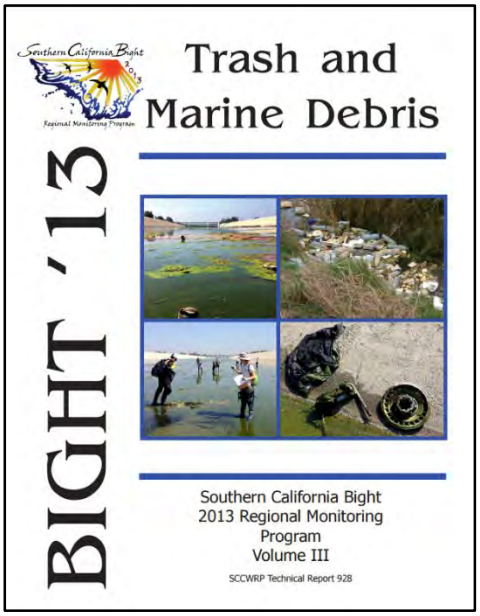
Book Chapters

Hallenbeck, T., T. Welch, S.J. Steinberg, A. Lanier. 2016. Extending Esri Geoportal Server to Meet the Needs of the West Coast Ocean Data Network and Inform Regional Ocean Management. in: Dawn J. Wright (ed), *Ocean Solutions, Earth Solutions: 2nd Edition*. Esri Press. Redlands, CA.

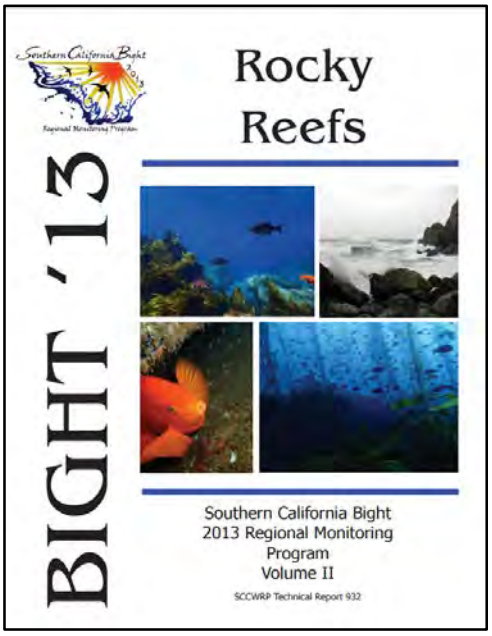
Technical Reports

Anderson-Abbs, B., M. Howard, K. Taberski, K. Worcester. 2016. California Freshwater Harmful Algal Blooms Assessment and Support Strategy. Technical Report 925. State Water Resources Control Board Surface Water Ambient Monitoring Program. Sacramento, CA.

Moore, S., M. Sutula, T.V. Bitner, G. Lattin, K. Schiff. 2016. Southern California Bight 2013 Regional Monitoring Program: Volume III. Trash and Marine Debris. Technical Report 928. Southern California Coastal Water Research Project Authority. Costa Mesa, CA.



The Southern California Bight 2013 Regional Monitoring Program has published its final assessment report for the Trash and Marine Debris element.



The Southern California Bight 2013 Regional Monitoring Program has published its final assessment report for the Rocky Reefs element. All Bight reports are available on SCCWRP's website.

Sutula, M., J. Butcher, J. Boschen, M. Molina. 2016. Application of Watershed Loading and Estuary Water Quality Models to Inform Nutrient Management in the Santa Margarita River Watershed. Technical Report 933. Southern California Coastal Water Research Project. Costa Mesa, CA.

Tiefenthaler, L., M. Sutula, J. Griffith, M. Raith. 2016. Microbiological Water Quality at Non-Human Impacted Reference Beaches in Southern California During Wet and Dry Weather: March 2014-2016. Technical Report 936. Southern California Coastal Water Research Project. Costa Mesa, CA.

Pondella, D., K. Schiff, R. Schaffner, A. Zellmer, J. Coates. 2016. Southern California Bight 2013 Regional Monitoring Program: Volume II. Rocky Reefs. Technical Report 932. Southern California Coastal Water Research Project Authority. Costa Mesa, CA.

Quarter in Review

Conference Presentations

Mazor, R. Research and education lay the groundwork for a paradigm shift in stream management. Society for Freshwater Sciences Annual Meeting. May 22-25, 2016. Sacramento, CA.

Mazor, R. How are Water Boards and other agencies using bioassessment data? Surface Water Ambient Monitoring Program first annual Science Symposium. June 29, 2016. Sacramento, CA.

Mazor, R. Integrating perennial and intermittent rivers into regional ambient assessments in dry climates: Case studies from southern California. Society for Freshwater Sciences Annual Meeting. May 22-25, 2016. Sacramento, CA.

McCune, K. Estimating Long Term Flow Data at Ungaged Locations. Southern California Academy of Sciences annual meeting May 6-7, 2016. Los Angeles, CA.

Schiff, K., D. Greenstein, N. Dodder, D. Gillett. Southern California Regional Monitoring. National Water Quality Monitoring Conference. May 2, 2016. Tampa, FL.

Sengupta, A. From Gaged to Ungaged: Linking Hydrologic Alterations to Biology. Society for Freshwater Sciences Annual Meeting. May 22-25, 2016. Sacramento, CA.

Steele, J. and J.F. Griffith. Quantification of Viruses and Bacteria in Stormwater Discharging to Beaches with Year-round Surfing Populations in San Diego, CA. University of North Carolina Water Microbiology Conference. May 16-19, 2016. Chapel Hill, NC.

Stein, E.D. Resiliency of Southern California Coastal Wetlands to Sea Level Rise. Southern California Society of Environmental Toxicology and Chemistry 2016 Annual Conference. April 19, 2016. San Diego, CA.

Stein, E.D. El Nino impacts on estuaries: a window into the future. Plenary presentation. California Estuarine Research Society Meeting. April 29, 2016. Long Beach, CA.

Stein, E.D. From Cobbles to Causation: Translating Flow Ecology Relationships to Management Actions. Society for Freshwater Sciences Annual Meeting. May 22-25, 2016. Sacramento, CA.

Stein, E.D. Moving Genetic Biomonitoring from a Concept to a Tool. Society for Freshwater Sciences Annual Meeting. May 22-25, 2016. Sacramento, CA.

Steinberg, S.J., S. Moore and P. Smith. A Geospatial Survey of Anglers to Assess Fish Consumption from San Diego Bay. CalGIS 22nd Annual California GIS Conference. May 10-12, 2016. Anaheim, CA.

Steinberg, S.J. Leading the Way to Stronger Links between Imagery and Mapping. Esri Imaging and Mapping Forum. American Society for Photogrammetry & Remote Sensing 2016 Conference. June 25-26, 2016. San Diego, CA.

Steinberg, S.J. and J. Hunt. Temporal Visualization to Inform Wetland Restoration in Southern California. Esri 2016 User Conference. June 27-July 1, 2016. San Diego, CA.

Theroux, S. To salinity and beyond: wetland microbial community response to restoration. California Estuarine Research Society. April 29, 2016. Long Beach, CA.

Other Presentations

Bay, S.M. Sediment stressor identification in Marina del Rey Harbor: results update. Los Angeles Regional Water Quality Control Board. May 12, 2016. Los Angeles, CA.

Howard, M. Orange County Sanitation District diversion. Orange County Sanitation District governing board. April 6, 2016. Fountain Valley, CA.

Mazor, R., and K. Schiff. SCCWRPs bioassessment research agenda. Santa Ana Regional Water Quality Control Board. May 11, 2016. Riverside, CA

Mehinto, A. Linkage of glucocorticoid bioanalytical screens with adverse effects in the inland silverside *Menidia beryllina*. San Francisco Estuary Institute Regional Monitoring Program Exposure and Effects Workgroup. May 16, 2016. Oakland, CA.

Schiff, K. SCCWRP's 2016-17 Research Agenda. California Association of Sanitation Agencies Water Quality Subcommittee Meeting. May 12, 2016. Fountain Valley CA.

Schiff, K. Toxicity Laboratory Intercalibration Study. Central Valley Regional Water Quality Control Board. June 23, 2016. Rancho Cordova, CA,

Schiff, K. Technical Advisory Committee Chair for the San Diego Wet Weather TMDL Cost Benefit Analysis. July 11, 2016. San Diego, CA.

Schiff, K. Water quality at southern California Beaches. JASON Annual Summer Seminar. July 14, 2016. La Jolla, CA.

Sengupta, A. Managing Water Crisis in California: Archetype of Global Water Challenges. International City/County Management Association D.C. Delegation to the Yunnan Conference on International Exchange of Professionals. June 13-16, 2016. Kunming, China.

Stein, E.D. Using performance trajectories to improve wetland restoration. Webinar series on Improving Wetland Restoration Success. Association of State Wetland Managers. May 10, 2016.

Stein, E.D. Applying ecogenomic methods to routine biomonitoring programs: needs and challenges. 2016 International Workshop on Environmental Genomics: Understanding the State of the Science and Research Opportunities. June 2-3, 2016. St. John's, Newfoundland, Canada.

Stein, E.D. Setting Instream Flow Targets in California Using Biological Community Health Indices. Surface Water Ambient Monitoring Program Round Table meeting. June 27, 2016. Sacramento, CA.

Steinberg, S.J. Cellphone microscope for field data collection. Mobile Autonomous Cytometer-Microscope Workshop. June 1-2, 2016. Moss Landing, CA.

Theroux, S. Updates on the Statewide Algae Plan. Surface Water Ambient Monitoring Program Bioassessment Working Group. June 7, 2016. Sacramento, CA.

External Content Featuring SCCWRP

Statewide Monitoring Pilot Study for Contaminants of Emerging Concern. Surface Water Ambient Monitoring Program. Spring 2016.

Improving Mitigation Success through Use of Performance Curves (Trajectories) and Tiered Performance Standards. Association of State Wetland Managers. May 10, 2016.

The West Coast Ocean Acidification and Hypoxia Science Panel: Findings, Recommendations, and Actions (36-minute lecture). Aquarium of the Pacific. June 15, 2016.

The West Coast Ocean Acidification and Hypoxia Science Panel: Findings, Recommendations, and Actions (four-minute podcast). Aquarium of the Pacific. June 15, 2016.

SCCWRP Personnel Notes

Commission and CTAG

Amanda Carr, who was recently hired as Deputy Director of Environmental Resources for Orange County Public Works, was appointed a Commissioner in July, replacing Mary Anne Skorpanich, who retired.

Jim Colston, Director of Environmental Services for the Orange County Sanitation District, was appointed an Alternate Commissioner in May, replacing Ed Torres.

Tom Maloney, Executive Director of the California Ocean Science Trust, was appointed to CTAG in July to represent the California Ocean Protection Council. He replaces Jennifer Phillips, who will continue to serve as an Alternate Commissioner.

Commission Chair **Gerhardt Hubner**, who has served on the Commission since 2005, left his job as Deputy Director for Ventura County Public Works in April to take a new position as District Administrator for the South San Luis Obispo County Sanitation District in Oceano.

Commissioner **John Kemmerer**, who has served on the Commission since 2013, retired in July from his job as Associate Director of the Water Division of the U.S. Environmental Protection Agency, Region IX.

Scientific Leadership

Dr. **Keith Maruya** has been appointed Vice President of the Southern California chapter of the Society of Environmental Toxicology and Chemistry.

Dr. **Alvina Mehinto** has been appointed to the Supervising Toxicology Interview Panel for City of San Diego Public Utilities Department.

Ken Schiff chaired a Special Session at the National Water Quality Monitoring Conference in May in Tampa, Fla.

Dr. **Steve Steinberg** served as Conference Chair for the 22nd Annual California GIS Conference held in May in Anaheim.

Dr. **Steve Steinberg** had been appointed to the M.S. committee of Daniel Gain at Wright State University in Ohio.

Dr. **Martha Sutula** has been appointed a Judge for the U.S. Environmental Protection Agency's Nutrient Sensor Challenge.

Dr. **Martha Sutula** has been appointed to the Scientific and Technical Advisory Committee for the proposed chlorophyll-a criteria for the James River, a Chesapeake Bay tributary.

New Faces

Dr. **Ashley Parks**, who just completed her postdoctoral studies in a U.S. Environmental Protection Agency research lab in Rhode Island, joined SCCWRP in July as a Scientist in the Toxicology Department.

Dr. **Gi Beum Kim**, Professor of Marine Environmental Engineering at South Korea's Gyeongsang National University, joined SCCWRP in July as a Visiting Scientist in the Chemistry Department.

Promotions

Dr. **Alvina Mehinto**, a Scientist in the Toxicology Department since 2013 who specializes in molecular toxicology, was promoted in July to a Senior Scientist.

Scott Martindale, SCCWRP's Editor since 2014, was promoted in July to Communications Coordinator.

Departures

Dr. **Nathan Dodder**, a Senior Scientist in the Chemistry Department since 2010, left SCCWRP in June to become a Research Professor at San Diego State University.

Lorianne Emler, a Research Technician in the Biogeochemistry Department who started at SCCWRP in 2012 as a laboratory assistant, left SCCWRP in July to enroll in a Master's program in hydrology at the University of Arizona.

Lucy Mao, a Research Technician in the Microbiology Department who started at SCCWRP in 2014 as a Laboratory Assistant, left SCCWRP in July to enroll in a Doctoral program in pharmacy at the University of Southern California.

SCCWRP COMMISSIONER SPOTLIGHT

Environmental causes inspire attorney's work

Deborah Halberstadt has spent most of her career advocating for environmental protection and conservation.

Deborah Halberstadt

After finishing her undergraduate education at Stanford, she worked for five years in the California Governor's Office, including as the federal liaison on energy and environmental issues between the State of California, Congress and the White House.

Later, as a Deputy Attorney General in the Environment section of the California Attorney General's Office, she litigated complex civil and criminal enforcement actions against national and multi-national corporations under state and federal law. Her focus was on both environmental and public health issues, including climate change, solar and renewable energy, gas pipeline safety, exposure to carcinogens, hazardous waste prevention and cleanup, protection of open space, and statewide environmental quality.

Now, following her appointment in March as Executive Director for the California Ocean Protection Council and Deputy Secretary for Oceans and Coastal Policy for the California Natural Resources Agency, Halberstadt is building on her past experiences to bring together government agencies, stakeholders and other groups around pressing issues related to California's coast and ocean.

"I've always felt comfortable moving around and communicating with other government agencies," Halberstadt said. "And I've always been interested in protecting the environment – it's this sense that I have to do what I can to protect what we have left."

Halberstadt's love for nature began at a young age. When she moved as a young child from the East Bay suburb of Orinda to the Los Angeles area, she was startled by the sharp contrast between the built environment and nature.

"It was sterile and gray; I missed the openness and the natural world," she said.

By the time she decided to return to school in 2002 to study law, she knew she wanted to work on environmental issues for the rest of her career. In 2006, she became a California Deputy Attorney General in the Environment section; her first case was a lawsuit against nine manufacturers of potato chips and french fries for failing to notify consumers that the products contained cancer-causing acrylamide.

Later, she worked for five years on the 2010 San Bruno PG&E pipeline explosion case alongside federal prosecutors, a case for which she was cross-designated a Special Assistant U.S. Attorney.

As Vice Chair of the SCCWRP Commission, Halberstadt says she's most looking forward solving pressing water-quality issues – including ocean acidification – alongside water-quality managers from diverse backgrounds and interests.

"There's huge value in bringing together people from different sectors to collaborate," Halberstadt said. "It creates a lot of opportunities for education, networking and thinking about your own portfolio in new and different ways."

Deborah Halberstadt, J.D.

Job: Executive Director, California Ocean Protection Council; Deputy Secretary for Oceans and Coastal Policy, California Natural Resources Agency (2016-present)

SCCWRP role: Commission Vice Chair (2016-present)

Prior jobs: Deputy Attorney General, Office of the California Attorney General (2006-16); Law Clerk, Alaska Supreme Court Justice Walter L. Carpeneti (2005-06); Director of Constituent Affairs, then Liaison between the State of California, Congress and White House, Office of Gov. Gray Davis (1998-2002); Legislative and Policy Coordinator, Office of Lt. Gov. Gray Davis (1997-98)

Education: B.A. anthropology, Stanford University (1997); J.D., University of California, Berkeley (2005)

Residence: Sacramento, Calif.

Family: Husband Ari, an MBA student at the University of California, Davis; son Shai, 2; cat Squishie

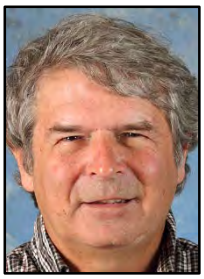
Hobbies: Hiking, camping, backpacking, baking, painting

Deborah Halberstadt enjoys a kayak-camping adventure in Alaska's Glacier Bay during her honeymoon in 2012.

CTAG SPOTLIGHT

Marine biologist drawn to regional monitoring

J. Michael Lyons bounced from one environmental consulting job to the next after earning his master's in biological oceanography in 1978.



J. Michael Lyons

He did analysis work for electric power companies that were using seawater to cool their systems. He prepared environmental impact reports for developers.

A few years later, he was hired to do permit compliance work for wastewater treatment plants in San Francisco.

But it was not until the marine biologist joined the Los Angeles Regional Water Quality Control Board in 1987 that he found his true calling: Designing and managing regional monitoring programs.

"I like making sure people can still enjoy the state's water resources, that they aren't destroying these things," said Lyons, a Senior Environmental Scientist.

Lyons, who has served on CTAG since its inception in 1990, was involved with the creation of the Southern California Bight Regional Monitoring Program, a program that opened his eyes to the value and importance of monitoring at a wide geographic scale.

"Like a lot of folks, I was resistant to Bight at first," Lyons said. "I thought, 'What we're doing is good enough; why should we change it, and how are we going to get everyone to agree?' But it started to make a lot of sense."

Lyons said he particularly likes the Bight program's design because it provides a regional snapshot of condition every five years, which provides ample time for dischargers to do critical site-specific monitoring in the other four years.

Michael Lyons and his wife, Orly, enjoy an al fresco meal while vacationing in Florence, Italy, in 2011.

J. Michael Lyons

Job: Senior Environmental Scientist and Surface Water Ambient Monitoring Program (SWAMP) Coordinator, Los Angeles Regional Water Quality Control Board (1987-present)

SCCWRP role: CTAG Representative (1990-present)

Prior jobs: Water Quality Chemist, City and County of San Francisco (1982-87); Environmental Scientist, Madrone Associates in Novato (1980-81); Environmental Scientist, Ecological Analysts in Concord (1978-79; Environmental Scientist, Conservation Consultants in Florida (1976-77)

Education: M.S. biological oceanography, Florida State University (1978); B.S. biology with emphasis in ecology (1974)

Residence: Westlake Village

Family: Wife Orly, a gynecologist; dog Angel, a Maltese; lovebird; tropical fish

Hometown: Richmond, Calif.

Hobbies: Playing tennis in recreational leagues; traveling to national parks; wine and beer tasting; photography; spending time at second home in Lake Arrowhead

"Without the big picture, it's hard to interpret what's happening around the discharge sites," Lyons said. "But then you still have to drill down with site-specific monitoring to understand the point-source impacts."

About a decade ago, Lyons became the L.A. Regional Board's Surface Water Ambient Monitoring Program Coordinator, a position that allows him to interface and coordinate with regional aquatic monitoring programs statewide. He also continues to work on permitting for discharges and for dredging work.

Lyons, a native of the Bay Area, moved to Southern California in 1987 with his wife, Orly, who had just completed her ob-gyn residency in San Francisco and was setting up a gynecology practice in Westwood Village near her family. The couple had met at a Club Med resort in Mexico a few years prior.

"I met her in the water – we were both dying in the 90-something-degree heat," Lyons recalled.

Lyons, who has been with the L.A. Regional Board for 29 years, says he and his wife plan to retire in the next three to five years. They'd like to spend more time in their second home in Lake Arrowhead, and also try living in Paris for a month or two.

SCCWRP PARTNER SPOTLIGHT

Ecology professor passionate about megafauna

Ever since she participated in a semester-long study-abroad program on a Kenyan wildlife ranch in college, Dr. Rebecca Lewison has known she wanted to study conservation ecology.

Dr. Rebecca Lewison

Lewison became fascinated by the complex relationships between living organisms and their environment and, specifically, by the patterns and signals that can be gleaned from studying megafauna – or, as she puts it, "animals the size of a lunchbox and bigger."

"The thing that really captivates me about megafauna is that you can answer very different ecological questions when you study animals that live longer and grow bigger," said Lewison, a Biology Professor at San Diego State University. "I'm so thankful that there are people who work with organisms at a micro scale, and I'm also thankful I don't."

Lewison's Ph.D. dissertation at UC Davis focused on behaviors and population dynamics of the common hippopotamus, and for the past 17 years, she's served as chair of the World Conservation Union's Hippo Specialist Group to coordinate global science on hippos.

In Southern California, through a research collaboration with SCCWRP and the Southern California Bight Regional Monitoring Program, Lewison is participating in a first-of-its-kind Bight '13 study examining how sediment contaminants build up – or bioaccumulate – in the eggs of Bight seabirds. The bioaccumulation study marks the Bight program's first foray into studying contamination's impacts on avian marine life.

Dr. Rebecca Lewison hikes Norway's famous Her Majesty Queen Sonja's Panoramic Hiking Trail during a June 2016 visit with her family. Lewison, a San Diego State professor, is on a one-year sabbatical in Europe.

Rebecca Lewison, Ph.D.

Job: Professor, Biology Department, San Diego State University (2006-present)

SCCWRP role: Research collaborator for seabird contaminant bioaccumulation study in the Southern California Bight

Prior jobs: Research Scientist, Duke University (2003-05)

Education: Ph.D. ecology, University of California, Davis (2002); B.A. biopsychology, Vassar College in New York (1993)

Current residence: Amsterdam

Permanent residence: San Diego

Family: Husband Rob, a biomedical engineer; children Ava, 11, and Max, 8

Hometown: Tenafly, N.J.

Hobbies: Hiking, bird-watching, camping, learning Dutch

"This level of regional analysis is relatively rare because these analyses are so hard to coordinate," Lewison said. "But we know from an ecological perspective that we need to look across the whole coastline, because that's where we're getting a lot of important patterns and signals."

Lewison, who has been at San Diego State University for a decade, says she loves being part of a broader, interconnected academic research world, as well as teaching itself.

"I love the process of teaching and mentoring – everyone from non-science majors to postdocs in my lab – and watching the transformation from student to scientist," she said.

For the past year, Lewison has been on sabbatical in Amsterdam, which has served as her home base for giving seminars across Europe and meeting face to face with European colleagues she's worked with since the late 1990s. She's been to Greece, France, Switzerland, Norway, Sweden and Denmark.

Lewison, who returns home in mid-August, also has been managing her San Diego State ecology lab remotely through Skype and email.

Meanwhile, the timing of the sabbatical worked out perfectly: Her husband, Rob, a biomedical engineer, temporarily relocated to Amsterdam for his job, and their two young children are enrolled at an international school in Amsterdam.

"We're all trying to learn Dutch, but it's a hard language," she said.

SCCWRP STAFF SPOTLIGHT

Ecologist uses algae DNA for bioassessment

After falling in love with algae while studying marine haptophytes for her undergraduate thesis at Williams College in Massachusetts, Dr. Susanna Theroux knew she wanted to learn more about algae as indicators of stream health.

Dr. Susanna Theroux

Her passion for algae extended to her postdoctoral work, where she studied microbes in San Francisco Bay wetlands to observe how microbial populations responded to salinity and how the salinity affected their ability to produce or consume methane gas.

"I just love using algae as storytellers, and I think they do such a good job because they are so intimately connected to their environments," Theroux said.

Since starting at SCCWRP in January, Theroux has been working on the Statewide Algae Plan to develop a statewide algal index for stream biological assessment.

The project also explores DNA sequencing as a more efficient bioassessment tool for algal communities in streams throughout California. Traditional algal bioassessment methods work well, but the number of morphology-based taxonomy labs is dwindling and consequently processing times are longer, Theroux said.

"With DNA sequencing, you can go out, use similar methods to collect the samples, and then get data back on the order of weeks as opposed to months," Theroux said. "Hopefully, this alleviates this capacity problem where we have been putting a huge strain on these morphology-based taxonomists, and opens up new avenues of getting good algal data on a faster time scale."

Dr. Susanna Theroux explores a lava tube on the Hawaiian island of Kauai with her husband, Jon.

Susanna Theroux, Ph.D.

Job: Scientist, SCCWRP Biogeochemistry Department

Started: January 2016

Prior jobs: Computational Biology Postdoctoral Fellow, U.S. Department of Energy Joint Genome Institute (2012-15); Research Technician for Woods Hole Marine Biological Laboratory (2005-07)

Education: Ph.D. geological sciences, Brown University (2012); M.S. geological sciences, Brown University (2009); B.A. biology and geology, Williams College in Massachusetts (2005)

Residence: Aliso Viejo

Family: Parents Ralph and Karen, recent retirees; sister Kathrin, applied behavioral analyst; husband Jon, mutual funds firm owner; a cat named Miss Daisy

Hometown: Floral Park, N.Y.

Hobbies: Running; hiking and camping with her husband; traveling

In addition to using DNA sequencing as an alternative for algal taxonomy, Theroux says she hopes this method can help scientists discover new algal species that otherwise would have been too elusive to identify using traditional morphology methods.

Theroux first learned about SCCWRP while job hunting as she was wrapping up her postdoctoral work. She knew she wanted to work with algae, so she searched for jobs with that keyword and landed upon SCCWRP and its algal research.

"It was a real Goldilocks-type of situation and really such a perfect opportunity," Theroux said.

Most of Theroux's research has involved some element of exploring the outdoors. Her research has taken her to Ecuador, Greenland and North Dakota for field work involving algal sampling and culturing. Theroux said being outdoors has grounded her in her work and helped remind her that the natural environment is worth trying to protect.

Theroux enjoys the outdoors and spends her spare time running, traveling, and hiking and camping with her husband, Jon.

Recognizing two decades of service

Dr. Steve Weisberg, SCCWRP's Executive Director, was honored in June by the SCCWRP Commission for 20 years of service to the organization. Commission Vice Chair Deborah Halberstadt presented Weisberg with a plaque that reads "Presented to Stephen B. Weisberg, Ph.D., in recognition of your exemplary 20 years of leadership, service and commitment to advancing the field of water-quality management." Weisberg began his tenure as SCCWRP's Executive Director on July 1, 1996.

Dr. Steve Weisberg receives a plaque from SCCWRP Commission Vice Chair Deborah Halberstadt in recognition of his 20 years of service to the agency. The Commission presented the plaque at its June 3 meeting.