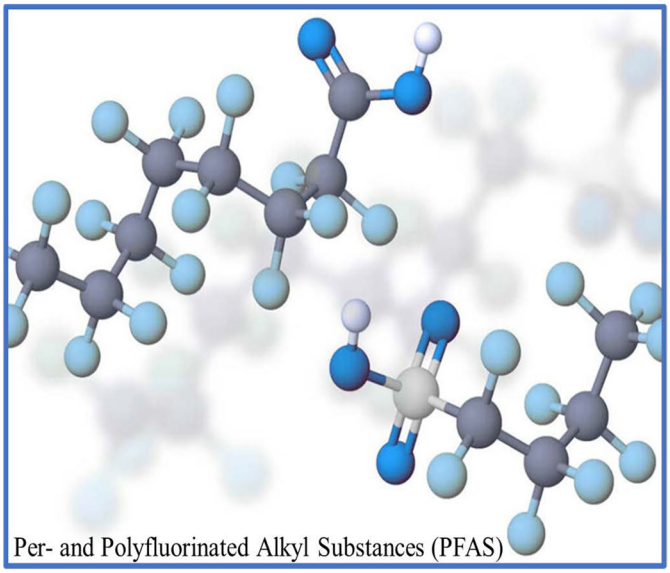
Southern California Regional Chapter of the
Society of Environmental Toxicology and Chemistry

2021 Annual Meeting
Final Program

Monday—Wednesday April 26—28
12:30—5:00 P.M. (PDT)
Virtual Platform

Please go to our website for additional information
https://www.socal-setac.org/2021-annual-meeting


Per- and Polyfluorinated Alkyl Substances (PFAS)

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Conference Agenda

Monday April 26th

12:30 P.M.	Grab a Coffee & Network
12:50 P.M.	Welcome and Announcements **Erika Holland**, SoCal SETAC Co-Past President
	PFAS Special Session Facilitated by **Nicholas Hayman**, SoCal SETAC President
1:00 P.M.	Perfluorooctane Sulfonate (PFOS) Concentrations in Birds Around the World **Andrea Bonisoli-Alquati,** and Raul D. Flamenco, California State Polytechnic University, Pomona
1:20 P.M.	Assessing Site-Specific PFAS Ecological Risks at AFFF Sites **Jason Conder,** Jenn Arblaster and Jeanmarie Zodrow**,** Geosyntec Consultants
1:40 P.M.	The Impact of Precursors on Aquatic Exposure Assessment for PFAS: Insights from Bioaccumulation Modeling **David Glaser,** Elizabeth Lamoureux, Daniel Opdyke, Sarah LaRoe, Deirdre Reidy and John Connolly, Anchor QEA, LLC
2:00 P.M.	GenX Induced Embryotoxicity in *Danio rerio* **Sylvia Gong*,** Boz Life Science Research and Teaching Institute; Goran Bozinovic, San Diego State University Graduate School of Public Health *graduate student presenter
2:25 P.M.	*Break*
2:30 P.M.	Breakout Event – Meet your colleagues! Participants will be randomly assigned to breakout rooms
3:00 P.M.	**General Session #1** Facilitated by **Erika Holland**, SoCal SETAC Co-Past President

3:00 P.M.	Bioaccumulation of PFOS in Freshwater Fish: Evolving Perspectives on an Emerging Contaminant Sarah L. LaRoe**, Betsy Henry**, Daniel R. Opdyke, Jennifer Benaman and John Connolly, Anchor QEA, LLC
3:20 P.M.	Regulatory Status of Cannabis Contaminants in the U.S.: Inconsistencies in Limits, Lack of Relevancy to Agriculture, and Need for Centralized Oversight **Laura Jameson**, Dorina Pinkhasova, Haleigh Boulanger, Kendra Conrow, Michael Simeone, Thomas Cahill and Maxwell Leung, Arizona State University
3:40 P.M.	Environmental Suitability Analysis for Cannabis and Hemp Growth in Arizona **Anastasia Stats*,** Kendra Conrow, Elizabeth Makings, Ken Sweat, Amy Frazier and Maxwell Leung, Arizona State University *undergraduate student presenter
4:00 P.M.	Assessment of Environmental Pollution Associated with Tobacco in an Urban Protected Area in California **Katelyn Nynas***, Srimanti Duttagupta, William Richardot and Dr. Eunha Hoh, San Diego State University *graduate student presenter
4:25 P.M.	*Break*
4:30 – 5:00 P.M.	**Lighting Round Talks and Q&A Session 1** Facilitated by **Erika Holland**, SoCal SETAC Co-Past President
Talk 1-1	Toxicity of PFOS and PFOA to Four Standard Marine Species **Nicholas Hayman,** G. Rosen**,** and M.A. Colvin, Naval Information Warfare Center Pacific; J. Conder and J.A. Arblaster, Geosyntec Consultants
Talk 1-2	GenX Effects on Longevity, locomotion, and Brain Gene Expression in Female and Male *Drosophila melanogaster* **Jeanne Vu*** and Goran Bozinovic, Boz Life Science Research and Teaching Institute and San Diego State University *graduate student presenter
Talk 1-3	Preliminary Toxicity Assessment of Tijuana River Estuary Sediments and Water During a Wet and a Dry Event Using *Strongylocentrotus purpuratus* Embryos **Neya Suresh Kumar**, Boz Life Science Research and Teaching Institute; Damian Shea, Statera Environmental, Chris Stransky, Wood PLC; Richard Gersberg, San Diego State University; Goran Bozinovic, Boz Life Science Research and San Diego State University

Talk 1-4	Evaluation of Sodium Bisulfite for Contribution to Chronic Toxicity of the Water Flea, *Ceriodaphnia dubia* **Peter Arth**, Adrienne Cibor, Eric Green and Katie Payne, Enthalpy Analytical
Talk 1-5	Interlaboratory Calibration Comparisons for Pulsed Exposure Toxicity Testing **Molly Colvin**, NIWC Pacific; Chris Stransky, Wood PLC; Nick Hayman and Rosen Gunther, NIWC Pacific
5:00 P.M.	*Post Meeting Social*

Tuesday April 27th

12:30 P.M.	Grab a Coffee & Network
12:50 P.M.	Welcome and Announcements **Nick Hayman**, SoCal SETAC Presidents
	Wildfire Special Session Facilitated by **Chris Stransky**, SoCal SETAC Co-Past President
1:00 P.M.	Initial CZU Wildfire Effects on Water Quality from Continuous pH and NO3 Measurements **Renee Takesue**, Ferdinand K.J. Oberle, Nancy G. Prouty and Amy E. East, US Geological Survey, Pacific Coastal and Marine Science Center
1:20 P.M.	Post-fire Impacts to Drinking Water Quality **Amanda Hohner,** Washington State University
1:40 P.M.	Turning Up the Heat: Implications for Managing Wildfire and Climate Change Impacts on Long-term Phosphorus in a Large, Shallow Hypereutrophic Lake **Angela De Palma-Dow**, Lake County Water Resources Department; Ian M. McCullough, Michigan State University; Jennifer Brentrup, University of Vermont
2:00 P.M.	Postfire Sediment Source-to-Sink Dynamics in the 2018 Holy Fire Burn Scar

	James Guilinger*, Andrew B Gray and Nicolas C Barth, University of California, Riverside; John D Rudolph and Chris Stransky, Wood Environmental & Infrastructure Solutions; Rebekah Guill, Riverside County Flood Control and Water Conservation District *graduate student presenter
2:25 P.M.	*Break*
2:30	Breakout Event – Meet your colleagues! Participants will be randomly assigned to breakout rooms.
	General Session #2 Facilitated by **Sandra Brewer**, Desert SW SETAC
3:00 P.M.	Southern California Wildfire, Harmful Algal Bloom, and Fish Kill in Lake Elsinore, CA **John Rudolph,** and Chris Stransky, Wood Environment & Infrastructure Solutions, Inc.; Nicole Dailey, City of Lake Elsinore; Heather Boyd, Santa Ana Regional Water Quality Control Board
3:20 P.M.	Wildfire-derived Polycyclic Aromatic Hydrocarbons in a Southern California Coastal Watershed **Scott Hauswirth**, Michael F. Kushner, Christian L. Hoover, Kyle Ikeda, Greg S. Jesmok, Alfredo Estrada and Priya M. Ganguli, California State University, Northridge
3:40 P.M.	Oxidative Stress in the Seaside Sparrow (*Ammospiza maritima*) Following the Deepwater Horizon Oil Spill **Aaron Angel*,** California State Polytechnic University, Pomona; Sabrina Taylor and Philip C. Stouffer, Louisiana State University and AgCenter; Juanita K. Jellyman and Andrea Bonisoli-Alquati, California State Polytechnic University, Pomona *graduate student presenter
4:00 P.M.	Science and Policy: Improving Fish Consumption Advisory Programs in the US and Canada **Rachael King*,** Beth Polidoro and Karen Watanabe, Arizona State University; Trevor Avery, Acadia University *undergraduate student presenter
4:25 P.M.	Break
4:30 P.M.	**Lighting Round Talks and Q&A Session 2** Facilitated by **Nick Hayman**, SoCal SETAC President

Talk 2-1	Pyrethroid Occurrence in California Roadside Catch Basins **Nathan Sy**, and Jay Gan, University of California, Riverside
Talk 2-2	Ryanodine Receptor mRNA Expression in *Danio rerio* exposed to tetra-ortho PCB 202 **Danielle Sandoval***, and Erika B. Holland, California State University, Long Beach *undergraduate student presenter
Talk 2-3	Early Stage Quantitative AOP Model of Acetylcholinesterase Inhibition Leading to Neurodegeneration **Dennis Sinitsyn***, Arizona State University; Kendra Conrow, US Army Corps of Engineers; Natalia Garcia-Reyero and Karen H. Watanabe, Arizona State University *graduate student presenter
Talk 2-4	Stage-dependent and Regioselective Toxicity of 2- and 6-Hydroxychrysene During Japanese Medaka Embryogenesis **Philip Tanabe***, Constance Mitchell, Vanessa Cheng, Qiqing Chen, David Volz and Daniel Schlenk, University of California: Riverside *graduate student presenter
5:00 P.M.	*Post Meeting Social*

Wednesday April 28th

12:30 P.M.	Grab a Coffee & Network
12:50 P.M.	Welcome and Announcements **Chris Stransky**, SoCal SETAC Co-Past President
	General Session #3 Facilitated by **Karen Watanabe-Sailor**, Desert SW SETAC President

1:00 P.M.	California's Path Towards Assessing Risks and Developing Regulations for Microplastics **Scott Coffin,** California State Water Resources Control Board; Steve Weisberg, Charles Wong, Leah Thornton Hampton and Alvina Mehinto, Southern California Coastal Water Research Project; Ezra Miller, San Francisco Estuary Institute; Chelsea Rochman, University of Toronto
1:20 A.M.	Evaluating the Impacts of Restoration Design on the Presence of Contaminants and their Effects on *Ostrea lurida* **Amanda Russell**, Christine. R. Whitcraft, and Judy Brusslan, California State University, Long Beach; Varenka Lorenzi, Institute for Integrated Research in Materials, Environments and Society; Danielle C. Zacherl, California State University, Fullerton; Katie Nichols, Orange County Coastkeeper; Erika B. Holland, California State University, Long Beach
1:40 P.M.	Contaminants in Philippine fish (*Siganus fuscescens*) and their Potential Effects on Public Health **Eryka Molino***, and Beth Polidoro, Arizona State University; Lilibeth Bucol, Negros Oriental State University *undergraduate student presenter
2:00 P.M.	Assessing Halogenated Organic Compounds in California Condors and their Scavenged Marine Mammal Prey: Implications for Reintroduction **Margaret Stack**, Eunha Hoh and Nathan Dodder, San Diego State University; Christopher Tubbs and Ignacio Vilchis, San Diego Zoo Institute for Conservation Research; Jade Johnson, San Diego State University; Jennifer Cossaboon, University of California Davis
2:25 P.M.	*Break*
2:30 P.M.	**Lighting Round Talks and Q&A Session 3** Facilitated by **Nick Hayman**, SoCal SETAC President
Talk 3-1	How to Integrate Sediment Remediation and Ecosystem Recovery? (Hint: They Should Go Hand in Hand) **Robert K. Johnston**, Applied Ecological Solutions; David Moore, U.S. Army Corps of Engineers; Katie Payne, Enthalpy Analytical; Alex Kascak, University of Louisiana; Betsy Henry, Anchor QEA LLC
Talk 3-2	Assessing Functional Impacts of Multiple Contaminants on Marina Benthos **Carlos Neira,** Guillermo Mendoza, Lisa A. Levin, Scripps Institution of Oceanography, La Jolla, CA
Talk 3-3	Assessing Ecosystem Health Through Contamination in the Tijuana River Estuary **Nancy Torres***, University of San Diego; Jeff Crooks, Tijuana River National Estuarine Research Reserve; Drew Talley, University of San Diego; Catherine T. Zeeman, U.S. Fish & Wildlife Service *graduate student presenter

Talk 3-4	Investigation of the Viability and Comparability of the Manila Clam (*Venerupis philippinarum*) to the Bent-Nosed Clam (*Macoma nasuta*) for 28-Day Bioaccumulation Exposures **Peter Arth,** Kasey Skrivseth, Adrienne Cibor and Kirk Cram, Enthalpy Analytical
Talk 3-5	An Evaluation of Bioanalytical Screening Tools to Assess Contaminants of Emerging Concern in Wastewater and in the Receiving Environment **Violet Renick**, Orange County Sanitation District: Ellie Wenger, Southern California Coastal Water Research Project; Vanh Phonsiri, Canh Nguyen and George Robertson, Orange County Sanitation District; Alvina Mehinto, Southern California Coastal Water Research Project
3:00 P.M.	CLOSING CEREMONY: Fun & Games, Board Recognition, Student Presentation Awards, and Prizes
4:00 P.M.	Post Meeting Social

Bold text indicates presenting author(s); ∗ indicates a student presentation

1:00 PM | Monday, April 26th

Perfluorooctane Sulfonate (PFOS) Concentrations in Birds Around the World

***Andrea Bonisoli-Alquati**, and Raul D. Flamenco*
Department of Biological Sciences, California State Polytechnic University, Pomona; Pomona, CA

Perfluorooctane sulfonate (PFOS) is a persistent, bioaccumulative and toxic compound. PFOS is also the end product of the degradation of other per- and polyfluoroalkyl substances (PFASs), potentially upending the efficacy of regulatory actions. Temporal increases and biomagnification of PFOS have been reported in several groups of organisms, in terrestrial and marine food webs. Other studies instead documented its decline in humans and wildlife. No systematic analysis exists of PFOS concentrations in any taxonomic group through time and space. We used PFOS measurements from the primary literature to investigate whether: (I) PFOS concentrations increased through time in birds; (II) different tissues had different PFOS concentrations; (III) higher trophic position and higher longevity predicted higher PFOS concentrations. We collected >500 estimates of PFOS concentrations in eggs, liver, and blood from >100 bird species. Eggs and liver PFOS concentrations were similar, and higher than blood concentrations. PFOS concentrations trends depended on the tissue. Blood PFOS concentrations significantly decreased, while liver PFOS concentrations increased, with no slowdown as a result of the production phase out. In the northern temperate region concentrations were higher than in the Arctic, consistent with the location of most sources of PFOS and its precursors. Diet predicted egg and liver PFOS concentrations, with the lowest concentrations among herbivores, and the highest among opportunists. Longer-lived species had higher liver and egg PFOS concentrations. The association with lifespan also depended on migratory behavior, with egg PFOS concentrations increasing among resident birds and short-distance migrants. The evidence supports PFOS bioaccumulation among birds, with longer lived, opportunistic, and resident bird species at greatest risk. Broad gaps still exist regarding the toxicological significance of the documented PFOS concentrations. The inefficacy of phasing out PFOS in reducing its concentrations in birds should serve as an argument for accelerating regulatory actions and phaseout of nonessential PFASs.

1:20 PM | Monday, April 26th

Assessing Site-Specific PFAS Ecological Risks at AFFF Sites

***Jason Conder**, Jenn Arblaster, and Jeanmarie Zodrow*
Geosyntec Consultants

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) have been widely used in numerous applications since the 1950s, including aqueous film forming foams (AFFFs) used for fire suppression at airports, firefighting training facilities, and other industrial locations. Many AFFF sites host ecological habitat, and may have the potential to affect nearby habitats due to the offsite transport of PFAS. Ecological Risk Assessments (ERAs) may needed at these sites, but standard approaches are unavailable and data gaps are challenging. Nonetheless, decisions are being and will be made. This presentation will provide a state-of-the-science overview of PFAS ERAs for AFFF sites, drawing largely from the authors' recent guidance documents produced for the Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP), experiences with site-specific AFFF investigations, and recent research collaborations. A key part of the overview will highlight the available tools and resources for ecological risk assessors working with AFFF sites, including guidance on PFAS conceptual site models, recommended parameters (exposure factors, toxicity reference values [TRVs], uptake factors) to perform food web model-based ERAs for wildlife species, sources of screening levels, and other practical hands-on tools. For researchers in PFAS ecotoxicology, we will also highlight high-priority data gaps and other critical areas in need of research effort. Additionally, we will make a few predictions with regards to the future assessment and management of PFAS ecological risks.

1:40 PM | Monday, April 26th

The Impact of Precursors on Aquatic Exposure Assessment for PFAS: Insights from Bioaccumulation Modeling

***David Glaser*[1]*, Elizabeth Lamoureux* [1]*, Daniel Opdyke* [2]*, Sarah LaRoe* [3]*, Deirdre Reidy*[4]*, and John Connolly*[1]**

[1]Anchor QEA, LLC, Woddcliff Lake, NJ,
[2]Anchor QEA, LLC, Austin, TX
[3]Anchor QEA, LLC, Saratoga Springs, NY
[4]Anchor QEA, LLC, Syracuse, NY

Risk assessment for per- and polyfluoroalkyl substances (PFAS) is complicated by the fact that PFAS include several thousand compounds. While new analytical methods have increased the number that can be identified in environmental samples, a significant fraction of them remain uncharacterized. Perfluorooctane sulfonate (PFOS) is the PFAS compound of primary interest when evaluating risks to humans and wildlife due to consumption of aquatic organisms. The exposure assessment for PFOS is complicated by the presence of PFOS precursors and their transformation, which can occur both in the environment and within organisms. Thus, the PFOS to which wildlife or people are exposed may consist of PFOS that was discharged directly into the environment and/or other PFOS precursors that were transformed into PFOS. This means that exposure assessment and the development of remedial strategies may depend on the relative concentrations and properties not only of PFOS, but also of other PFAS that are transformed into PFOS. A bioaccumulation model was developed to explore these issues. The model embeds a toxicokinetic component within a larger food web calculation that accounts for uptake from both food and water, complex food web structure, and fish migration and movement. Multiple chemicals are modeled, including parent/daughter reactions. A series of illustrative simulations explores how chemical properties can influence exposure assessment and remedial-decision making.

2:00 PM | Monday, April 26th

GenX Induced Embryotoxicity in *Danio rerio*

Sylvia Gong*[*1,2]**, *and Goran Bozinovic[1,2]

[1] Boz Life Science Research and Teaching Institute, San Diego, CA

[2] San Diego State University Graduate School of Public Health, San Diego, CA

[*]student presenter

Hexafluoropropylene oxide-dimer acid (HFPO-DA; GenX) is a replacement per- and polyfluoroalkyl substance (PFAS), a family of compounds used for waterproofing materials and manufacturing plastics. Legacy PFAS, PFOS and PFOA, were phased out due to their bioaccumulative, carcinogenic, and endocrine-disruptive properties. The ubiquitous use of GenX as an alternative is concerning given its chemical and biological persistence; understanding how GenX affects embryo development is critical to a comprehensive risk assessment. Zebrafish embryos were exposed to GenX at 0.5 – 20000 mg/L from 4 – 72 hours post-fertilization (HPF). Survival, morphology, and cardiotoxicity were assessed at 24, 48, and 72 HPF. The LC50 of 8900 mg/L was established using neutralized GenX media (Probit analysis), which is significantly greater than the LC50 of 61 mg/L measured using un-neutralized media. At 48 HPF, heart beats per minute (HBPM) were significantly increased ($p < 0.05$) relative to control embryos at 2 and 10 mg/L GenX exposures. Pericardial edema and spinal curvature malformations were observed in exposures at and above 8000 mg/L. To explore sublethal GenX-induced differential gene expression, pooled embryos exposed to 0.5, 1, 2, and 10 mg/L will be analyzed using Shallow RNA-sequencing.

3:00 PM | Monday, April 26th

Bioaccumulation of PFOS in Freshwater Fish: Evolving Perspectives on an Emerging Contaminant

*Sarah L. LaRoe[1], **Betsy Henry[1]**, Daniel R. Opdyke[2], Jennifer Benaman[1], and John Connolly[3]*
[1]Anchor QEA, LLC, Saratoga Springs, NY
[2] Anchor QEA, LLC, Austin, TX
[3] Anchor QEA, LLC, Woodcliff Lake, NJ

Fish consumption advisories are often the impetus behind impairment listings of waterways and, ultimately, remedial criteria for sediments and water. In the case of emerging contaminants, such as perfluorooctane sulfonate (PFOS), the relationship between concentration levels in water and fish is often poorly understood. Like other contaminants commonly found to be present in fish tissue, PFOS was initially presumed to be bioaccumulative in the sense that food web uptake is significant. This presumption led to expectations that concentrations would significantly increase from sediments up through the aquatic trophic structure, similar to legacy bioaccumulative contaminants like PCBs. Early studies of PFOS levels in water bodies reinforced this presumption. However, measurements of PFOS depuration rates show that it is too rapidly excreted from fish to allow food web uptake to be an important process and belie the idea that it is significantly bioaccumulative. As the science of PFOS bioaccumulation has progressed, a number of hindrances to the correct derivation of the bioaccumulation factor (BAF), a well-used metric of bioaccumulation, have been overcome and a clearer picture of the behavior of PFOS in the aquatic environment has emerged. These hindrances include incorrect temporal and spatial pairing of water and fish concentrations as well as historical inadequacies in analytical methods used to detect PFOS. Still more inconsistencies remain to be addressed which have large impacts on the interpretation of BAF values found in the current literature. Our evolving understanding of PFOS BAFs has important implications for the remediation of aquatic systems, shifting the focus from correcting contaminated sediments to controlling levels in the water column.

3:20 PM | Monday, April 26th

Regulatory Status of Cannabis Contaminants in the U.S.: Inconsistencies in Limits, Lack of Relevancy to Agriculture, and Need for Centralized Oversight

***Laura Jameson*[1]**, *Dorina Pinkhasova[1,2], Haleigh Boulanger[1,3], Kendra Conrow[1], Michael Simeone[4], Thomas Cahill[1], and Maxwell Leung[1]*
[1]School of Mathematical and Natural Sciences
[2]Pharmacology and Toxicology
[3]Biological Data Science Programs, New College of Interdisciplinary Arts and Sciences
[4]ASU Library Data Science and Analytics, Arizona State University

The inconsistency in regulation of cannabis agriculture presents a potential challenge to the environment. Here, we analyzed the regulatory status of contaminants in medical and recreational cannabis in 33 states and Washington, D.C. to compile complete lists from the legal documents for pesticides, inorganics, solvents, and microbes/mycotoxins.
Twenty eight of the 34 jurisdictions set contaminant limits or action levels, 21 of which created their own contaminant lists. The remaining 7 jurisdictions compiled lists from other sources. These sources included (i) the Herbal Medicine Compendium; (ii) the U.S. EPA 40 CFR Part 180 Tolerances and Exemptions for Pesticide Chemical Residues in Food; and (iii) the pesticides examined by the USDA in its 2010-2011 Pilot Study: Pesticide Residue Testing of Organic Produce. All but one state attempted to categorize contaminants. Yet, many of these contaminants, particularly pesticide-related chemicals, were improperly categorized. Our resulting list of 682 unique contaminants included 565 pesticides, 71 solvents, 26 inorganics, and 17 microbes and mycotoxins. Additionally, we found large variations in action levels that could not be explained by patterns of use, human health risk, or environmental concerns. For instance, three states applied the same action level to all of their regulated contaminants. The top three categories of pesticides are herbicides (153), insecticides (128), and fungicides (112). Since medical and recreational cannabis consumption is increasing in the U.S. and the number of states with some degree of legal use continues to increase, the lack of federal oversite has led to a scattershot approach to the regulation of contaminants and contaminant levels in this industry. This may either confuse growers or encourage overuse of chemicals, resulting in potential health risks to the consumers as well as adverse effects on the environment.

3:40 PM | Monday, April 26th

Environmental Suitability Analysis for Cannabis and Hemp Growth in Arizona

Anastasia Stats*[1], *Kendra Conrow[1], Elizabeth Makings[2], Ken Sweat[1], Amy Frazier[3], and Maxwell Leung[1]*

[1]School of Mathematical and Natural Sciences, New College of Interdisciplinary Arts and Sciences

[2]ASU Vascular Plant Herbarium

[3]School of Geographical Sciences & Urban Planning, Arizona State University

[*]student presenter

With the passage of Proposition 207, the emerging cannabis and hemp industry has become a key environmental concern in Arizona. The potential environmental impact of contaminated water runoff with both cannabinoids and pesticides can be investigated using a geospatial approach to analyze which areas might be more impacted by cannabis and hemp growth. Here, we utilize geographic information systems (GIS) and conduct a preliminary analysis for cannabis and hemp growth in Arizona. We compare geographic information concerning water presence and land ownership to documented cannabis and hemp growth sites. Significant patterns are noted for use in further analysis on weighting how important the identified factors are to cannabis and hemp growth. These factors can then inform hotspot analysis to determine which watersheds are the most vulnerable to runoff from cannabis and hemp growth. Our analysis reveals three relevant significant patterns. First, both hemp and cannabis growth are strongly tied to water presence. Second, hemp growth occurs mainly in agricultural designated land but cannabis growth does not. Third, both cannabis and hemp tend to be grown in proximity to moderately developed areas. Further studies will statistically determine the optimal locations for hemp and cannabis growth. This will inform sediment and fish sampling from surface water in the areas to test for the presence of chemicals as a result of the production of cannabis and hemp, including cannabinoids, fertilizers, and pesticides. The expected outcome of this research will provide the crucial exposure, toxicity, and risk information to support the environmental regulation of cannabis and hemp cultivation in Arizona.

4:00 P.M. | Monday, April 26th

Assessment of Environmental Pollution Associated with Tobacco in an Urban Protected Area in California

***Katelyn Nynas*[1]**, *Srimanti Dutttagupta[1], William Richardot[2], and Dr. Eunha Hoh[2]*
[1]San Diego State University, School of Public Health, San Diego, CA
[2]San Diego State University Research Foundation, San Diego CA
[*]student presenter

Smoked cigarettes are the most common waste picked up in urban and beach cleanups worldwide. Rain and wind cause cigarette butts to migrate to municipal storm drains and are then carried to coastal regions by water channels. They contain a nonbiodegradable filter, paper, and a remaining, burnt tobacco mixture; consisting thousands of chemicals, several of which are carcinogenic to humans. Wetlands are ecosystems flooded by water, either seasonally or permanently. Theses diverse ecosystem play a number of functions, including water purification, water storage, processing carbon and stabilizing shorelines. Due to urbanization, California has lost more than 90% of its wetlands and many are threatened. Kendall-Frost is a protected wetland located in northeast Mission Bay, San Diego. It required constant, active management because is located in an urban setting. There are several storm drains that channel urban runoff into the reserve, making it vulnerable to effects of urban pollution. Kendall-Frost is an ideal place to assess environmental impacts of tobacco product waste. My research involves collecting water and sediment samples from four sites inside Kendall-Frost (from November 2019 – present), two drain outfalls and one point further downstream per outfall. Samples are prepared through solid phase extraction (SPE) and ran for non-targeted analysis by a comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometric detection (GCxGC-TOF-MS). While targeted analysis of nicotine and cotinine are analyzed by liquid chromatography triple quadrupole mass spectrometry (LC-MS/MS). I hypothesize that there are quantifiable amounts of nicotine and cotinine, among other pollutants, in Kendall-Frost and that these amounts are affected by season.

4:30 – 5:00 P.M. | Monday, April 26th

Lightning Talk 1-1| Toxicity of PFOS and PFOA to Four Standard Marine Species

NT Hayman[1], *G Rosen[1], MA Colvin[1], J Conder[2], and JA Arblaster[3]*
[1]Naval Information Warfare Center Pacific, San Diego, CA
[2]Geosyntec Consultants, Huntington Beach, CA
[3]Geosyntec Consultants, Milton, VT

Per- and poly-fluoroalkyl substances (PFAS) are emerging contaminants that are coming under increasing scrutiny. Currently, there is a paucity of effects data for marine aquatic life, limiting the assessment of ecological risks and compliance with water quality policies. In the present study, the toxicity of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) to four standard marine laboratory toxicity testing species, encompassing five endpoints, were evaluated: 1) 96-h embryo-larval normal development for the purple sea urchin (Strongylocentrotus purpuratus); 2) 48-h embryo-larval normal development and normal survival for the Mediterranean mussel (*Mytilus galloprovincialis*); 3) 96-h survival of opossum shrimp (*Americamysis bahia*); and 4) 24-h light output for the bioluminescent dinoflagellate *Pyrocystis lunula*. All species were tested using standard United States Environmental Protection Agency and/or American Society for Testing and Materials (ASTM) International protocols. For both PFOS and PFOA, the order of species sensitivity, starting with the most sensitive, was *M. galloprovincialis, S. purpuratus, P. lunula*, and *A. bahia*. The range of median lethal or median effect concentrations for PFOS (1.1 – 5.1 mg /L) and PFOA (10 – 24 mg/L) are comparable to the relatively few toxicity effect values available for marine species. In addition to providing effects data for PFOA and PFOS, this study indicates these species and endpoints are sensitive to PFAS such that their use will be appropriate for deriving toxicity data with other PFAS in marine ecosystems.

4:30 – 5:00 P.M. | Monday, April 26th

Lightning Talk 1-2| GenX Effects on Longevity, Locomotion, and Brain Gene Expression in Female and Male *Drosophila melanogaster*

Jeanne P. Vu*[1,2]* *and Goran Bozinovic*[1,2]
[1]*Boz Life Science Research and Teaching Institute, San Diego, CA*
[2]*San Diego State University, Graduate School of Public Health, San Diego, CA*
[*]*student presenter*

Per- and polyfluoroalkyl substances (PFASs) are persistent pollutants known for their bioaccumulative properties and prevalence in water supplies and household products. Although legacy PFAS such as PFOS and PFOA are phased out in the U.S. due to public health concerns, a PFAS variant GenX is an emerging replacement. GenX is a potential neurotoxicant causing dopaminergic neurodegeneration in C. elegans and inhibiting proteins that protect the blood brain barrier in rats. We investigate the effects of GenX on the lifespan, locomotor activity, and brain gene expression in female and male *Drosophila melanogaster* (fruit flies). Oregon wild-type D. melanogaster were collected <4 hours post-eclosion and exposed to 10, 100, 1000, or 10,000 mg GenX/kg-day. To measure the effect of GenX on lifepsan, surviving flies from each exposure were recorded every 24 hours. Flies were subjected to a negative geotaxis assay at 3, 7, and 14 days of exposure to measure the effects of acute and chronic exposures on locomotor ability. qRT-PCR was performed on seven neurodegenerative disease-associated genes for exposed (1000 mg/kg-day, 7 days) and nonexposed fly brains, revealing sexually dimorphic brain gene expression but no statistically significant gene expression alterations were due to GenX exposure. Median lifespan was reduced in males at 100 mg/kg-day and 1000 mg/kg-day in females ($p < 0.01$). One-way ANOVA revealed that doses above 10 mg/kg-day significantly decreased locomotor ability ($p<0.01$). To capture GenX-induced sexually dimorphic gene expression responses in the brain we will utilize shallow RNA sequencing at 3 and 14-day exposures.

4:30 – 5:00 P.M. | Monday, April 26th

Lightning Talk 1-3| Preliminary Toxicity Assessment of Tijuana River Estuary Sediments and Water During a Wet and a Dry Event using *Strongylocentrotus purpuratus* Embryos

***Neya Suresh Kumar*[1],** *Damian Shea*[2], *Chris Stransky*[3], *Richard Gersberg*[4], *and Goran Bozinovic*[1,4]
[1]*Boz Life Science Research and Teaching Institute, San Diego, CA*
[2]*Statera Environmental, Inc., Raleigh, NC*
[3]*Wood PLC, San Diego, CA*
[4]*San Diego State University, San Diego, CA*

The Tijuana River Estuary is the largest intact wetland in Southern California. Raw sewage, pesticides, and other pollutants frequently flow through into the Pacific Ocean from Mexico, closing beaches 138 days in 2019 and threatening human and ecosystem health. Although the EPA has allocated $300 million in infrastructure support to divert wastewater flow, research efforts characterizing pollutants in the estuary are essential. We hypothesized that sites closer to the mouth of the estuary are less toxic due to the ocean tidal flow and that rain events exacerbate toxicity at the estuary. Sediment samples from six sites during both a dry and post-rain event were collected, and passive sampling devices (PSDs) were deployed at four sites after a rain event. Sediment and elutriate toxicity for both events was assessed using 72-h Strongylocentrotus purpuratus embryo-larval test; normal development of embryos in the site furthest from the river mouth was significantly altered relative to control embryos for both sampling events (p-value <0.001). Non-targeted and targeted chemical analysis using GC-MS and LC-MS methodology will be conducted on sediments and bio accumulative compounds bound to passive sampling devices. Chemical sediment composition will be correlated to metagenomics microbial data, with an emphasis on antibiotic-resistant microbes. This project is the initial step in identifying key pollutants and mechanisms of toxicity as part of a long-term ecological and human risk assessment in the Tijuana River Estuary.

4:30 – 5:00 P.M. | Monday, April 26th

Lightning Talk 1-4| Evaluation of Sodium Bisulfite for Contribution to Chronic Toxicity of the Water Flea, *Ceriodaphnia dubia*

Peter Arth, *Adrienne Cibor, Eric Green, and Katie Payne*
Enthalpy Analytical, San Diego, CA

Chlorine is one of the most ubiquitous wastewater treatment disinfectants in use today. Although chlorine protects humans from pathogens in water, release of chlorinated water into the receiving environment can have adverse effects to sensitive aquatic life. There are regulations in effect to mandate removal of chlorine prior to effluent discharge, and several methods for dechlorination are readily available. Sodium bisulfite (SBS) is a commonly used chemical reducing agent for neutralization of chlorine in water. As wastewater treatment plants opt to recycle more water, or as flows change based on input (seasonal or otherwise), consistent monitoring and adjustment of SBS dosage is necessary. An excess of SBS present in the final effluent discharge has the potential to deplete dissolved oxygen and alter the pH of the receiving environment. In our work with wastewater treatment plants, we were also able to link SBS to observed reproductive effects in the water flea, (*Ceriodaphnia dubia*), a common freshwater species used for NPDES permit monitoring. A series of SBS spiking studies were undertaken to establish NOEC and EC50 values for water flea survival and reproduction, and a Toxicity Identification Evaluation (TIE) study was also able to identify a treatment that successfully removed the toxicity. Upon successful identification of SBS as a potential constituent of concern for the water flea, SBS spiking studies were also conducted with the green alga (*Selenastrum capricornutum*) and fathead minnow (*Pimephales promelas*) to establish threshold limits for all three principal freshwater chronic toxicity monitoring species.

4:30 – 5:00 P.M. | Monday, April 26th

Lightning Talk 1-5| Interlaboratory Calibration Comparisons for Pulsed Exposure Toxicity Testing

***Molly Colvin*[1]*, Stransky Chris*[2]*, Hayman Nick*[1]*, and Rosen Gunther*[1]**
[1] NIWC Pacific, San Diego, CA
[2] Wood, San Diego, CA

Episodic discharges (e.g. stormwater, dry-dock discharges, and pesticide applications, etc.) require environmentally-relevant, scientifically-defensible, and conservative toxicity test designs to assess potential for receiving water impacts. Currently, permittees in highly industrialized areas are regularly required to conduct 96-hour (or longer) toxicity tests on discharges associated with events that are often less than 24 hours in duration. Existing EPA whole effluent toxicity (WET) test methods developed to assess continuous point source discharges are now being applied to episodic discharges as well. However, these methods do not adequately reflect episodic discharge conditions at either the point of compliance (i.e. storm drain) or as it mixes with the receiving environment (e.g. a riverine or marine system), which can result in an overestimation of toxicity at a given site.

In order to capture representative toxicity at a site, an alternative toxicity test approach is described, incorporating pulsed exposures to end-of-pipe samples. Following pulsed exposures, organisms are transferred to uncontaminated seawater (or receiving water) for the remainder of standard test period. This presentation presents the results of an Interlaboratory Calibration Study conducted in order to assess the ability of the modified methodology to provide consistent and defensible data for the assessment of episodic discharges. The study characterized 1) Completion Rate; 2) False Positive Rate; and 3) Precision on three WET methods that were modified for pulsed exposures and included acute tests with *Ceriodaphnia dubia* and *Americamysis bahia* and the larval development/short-term chronic test using *Strongylocentrotus purpuratus*.

1:00 P.M. | Tuesday, April 27th

Initial CZU Wildfire Effects on Water Quality from Continuous pH and NO_3 Measurements

Renee K. Takesue, *Ferdinand K.J. Oberle, Nancy G. Prouty, and Amy E. East*
US Geological Survey, Pacific Coastal and Marine Science Center, Santa Cruz, CA

The CZU Lightning Complex fire burned over 35,000 hectares in the Central California Coast Ranges, 16-Aug to 22-Sept 2020, consisting of steep forested watersheds primarily underlain by sedimentary rocks. The wildfire moderately and severely burned soil and vegetation in 43% of the area (a high proportion) and destroyed 1490 structures and infrastructure. A multifaceted geochemical study commenced 12-Sept to quantify wildfire-associated contaminants (PAHs, metals), isotopes (d13C, d13N, D14C), and their signatures in ash, soil, and sedimentary organic matter (SOM), export from coastal streams, bioaccumulation, and atmospheric transport. Data are pending. Continuous measurements of stream pH, T, and NO3- began in November prior to the first rains. A submersible ultraviolet nitrate analyzer and pH+T sensor were deployed in a 58 km2 severely burned watershed to explore wildfire effects on water quality, quantify timescales of postfire recovery, and explore linkages with patterns observed by NOAA-NMFS partners monitoring benthic food webs and endangered Coho salmon in a similar watershed. Light rains caused small decreases in pH for 1-2 d, and several-fold increases in NO3- for days to weeks. After initial soil wetting, ratios of NO3- to rainfall generally decreased. A major “first flush” storm on 26-Jan lasting 3 d dramatically decreased pH and increased NO3- for at least two weeks. Suppression of pH diurnal cycles and pH lowering relate to sediment inputs (turbidity) that inhibit photosynthesis. Quick recovery of pH after light rains contrasted with protracted NO3- elevations, indicating differing controlling processes involving surface and subsurface flow. Initial post-fire debris flow likelihood was estimated at 60-100% for 25% of the CZU area, which has received 53% of normal rainfall, and despite steep terrain substantial wildfire ash and debris remain in situ and are being incorporated into soils. These conditions suggest that CZU wildfire effects on surface water, groundwater, and ecosystems could last years.

1:20 P.M. | Tuesday, April 27th

Post-fire Impacts to Drinking Water Quality

Amanda K. Hohner
Washington State University, Pullman, WA

The rise in wildfire activity has raised concerns among drinking water providers that rely on forested watersheds for source water supplies. Wildfire can quickly transform forest floors, char vegetation and soils, and create a landscape susceptible to post-fire erosion and runoff to nearby surface waters. As a consequence, source water quality may be dramatically altered following fire, including elevated, or often extreme, particulate levels and an increase in dissolved organic matter (DOM) and nutrients (N, P). The results of several projects in collaboration with water providers will be discussed. Our approach involves field-based watershed monitoring studies coupled with controlled laboratory experiments to address changes to source water quality and the associated post-fire challenges to water treatment processes and finished water quality. Specifically, we evaluated post-fire changes in the quantity and quality of DOM and the resulting implications for the formation of toxic disinfection byproducts (DBPs) during drinking water treatment. Regulated carbonaceous DBPs (e.g., trihalomethanes) and unregulated nitrogenous DBPs (e.g., haloacetonitriles) were evaluated. Our results suggest that following wildfire and low-temperature soil heating (225□C) DOM character shifted towards a more aromatic, nitrogen enriched, and lower molecular weight composition. As a consequence of post-fire changes in DOM character, coupled with greater turbidity and dissolved organic carbon (DOC) concentrations, nitrogenous DBP precursor reactivity was enhanced and water treatment processes (i.e., coagulation) were challenged. Overall, our findings indicate that drinking water providers need to prepare for greater variability in water quality. Water treatment operations will likely need to be adjusted to account for variable water quality to meet EPA Safe Drinking Water Act regulations, specifically following runoff events in fire-affected areas.

1:40 P.M. | Tuesday, April 27th

Turning up the Heat: Implications for Managing Wildfire and Climate Change Impacts on Long-term Phosphorus in a Large, Shallow Hypereutrophic Lake

Angela De Palma-Dow*[1]*, *Ian M. McCullough*[2]*, and Jennifer Brentrup*[3]
[1]*Lake County Water Resources Department, Lakeport, CA*
[2]*Michigan State University, East Lansing, CA*
[3]*University of Vermont, Burlington, VT*

The Mendocino Complex was the largest wildfire in post-settlement California history, burning 459,123 acres from July to November 2018. The Complex burned 40% of the Clear Lake watershed, raising concerns about fire and fire response effects on water quality. Clear Lake is the largest natural lake entirely within California, is hypereutrophic and is primarily used for recreation, drinking water, tribal use, and supports a tourism-based local fishing economy. Long-term lake monitoring since the 1960s facilitates contextualization of post-fire water quality with respect to long-term trends. We found that Clear Lake total phosphorus (TP) has increased 0.003-0.005 mg/L/yr since the late 1960s across three sample stations (surface), but that for three recent, large fire events, post-fire surface TP was the same or less than pre-fire TP concentrations. When trying to identify the climatic drivers of long-term TP in Clear Lake, we discovered that the number of anoxic and hypoxic events have not changed over the 50 year sample record and that low winter precipitation was mostly associated with higher summer surface TP concentrations. Overall, our results suggest greater vulnerability of large, eutrophic or hypereutrophic lake water quality to long-term climate warming rather than episodic, large wildfires due to high pre-fire nutrient pools. Nonetheless, our study underscores the value of long-term water quality monitoring and the need to study fire effects across a wide range of lake, landscape and fire characteristics to promote more effective future water resource management.

2:00 P.M. | Tuesday, April 27th

Postfire Sediment Source-to-Sink Dynamics in the 2018 Holy Fire burn scar

James J Guilinger*[1], *Andrew B Gray[1], Nicolas C Barth[2], John D Rudolph[3], Chris Stransky[3], and Rebekah Guill[4]*

[1] University of California, Riverside Dept of Environmental Sciences

[2] University of California, Riverside Dept of Earth and Planetary Sciences

[3] Wood Environmental & Infrastructure Solutions, Inc., San Diego, CA

[4] Riverside County Flood Control and Water Conservation District, Riverside, CA

**student presenter*

Two worrying trends have exacerbated wildfire risk in the mountainous western US over the last few decades: increases in the extent and severity of wildfire, and growing human populations along wildland urban interfaces exposed to fire and post-fire hazards. Rainfall events in steep burned terrain can generate large amounts of sediment-laden runoff, which can negatively impact aquatic habitat and water resources downstream. Yet, to date, very few studies exist at the scale needed to illuminate postfire erosion and sediment transfer processes from source locations in burned uplands to terminal waterbodies downstream. In this study, we make use of a unique set of coeval sediment trapping data, hydrometeorological monitoring, and highly-resolved remote sensing datasets to quantify sediment flux from source-to-sink in watersheds affected by the 2018 Holy Fire above Lake Elsinore, CA. Concomitant with sediment pulses entering Lake Elsinore and a fish die off in the Winter of 2018-2019, we found area-normalized erosional volumes on the order of 5-20 mm from steep burned headwater catchments across the burn scar, likely equivalent to decades of weathering product accumulation. Over the period of study, a large proportion of this material was stored both in axial valley bottoms (~40-70%) with remaining bedload sediment stored in control infrastructure maintained by the County of Riverside, with some observations of suspended sediment bypass through spillways. Additionally, we document bank erosion in unlined channels downstream of natural and human-caused depositional zones which may act as the primary contributor of sediment to Lake Elsinore. This case study provides watershed-scale hydrogeomorphic context for the impacts of postfire runoff on downstream waterbodies in mountain-urban interfaces.

3:00 P.M. | Tuesday, April 27th

Southern California Wildfire, Harmful Algal Bloom, and Fish Kill in Lake Elsinore, CA

John Rudolph*[1]*, *Chris Stransky[1], Nicole Dailey[2], and Heather Boyd[3]*
[1]Wood Environment & Infrastructure Solutions, Inc., San Diego, CA
[2]Assistant to the City Manager, City of Lake Elsinore, CA
[3]Santa Ana Regional Water Quality Control Board, Santa Ana, CA

The Holy Fire wildfire in Southern California began on August 6, 2018 and reached full containment on September 13, 2018 with a total burned area of 35.9 square miles. Lake Elsinore lies at the bottom of several large canyons draining the burned area. The following winter the area received numerous storms of varying strength from <0.25 to 5.5 inches, totaling approximately 25 inches of rain from October 2018 through March 2019. Debris flows from the burn area deposited a large sediment delta in the lake. Shortly after the first two major storms in late November 2018, a large fish die-off was observed in Lake Elsinore which continued through January 2019. Based on multiple lines of evidence this die-off was attributed to the Golden Algae, Prymnesium parvum (Haptophyceae), a species not previously observed at high densities in the lake. The City of Lake Elsinore embarked on a study to determine if runoff from the Holy Fire had triggered the Golden Algae bloom and subsequent fish kill. Chemistry and toxicity analyses were performed on both water and sediment samples in and around the fire sediment delta. Samples for phytoplankton taxonomy were also collected in and around the fire sediment delta, as well as during monthly routine mid-lake sampling. A comprehensive analysis of results will be presented showing the magnitude of effect on lake water and sediment quality and potential for long-term impacts.

3:20 P.M. | Tuesday, April 27th

Wildfire-derived Polycyclic Aromatic Hydrocarbons in a Southern California Coastal Watershed

Scott C. Hauswirth, *Michael F. Kushner, Christian L. Hoover, Kyle Ikeda, Greg S. Jesmok, Alfredo Estrada, and Priya M. Ganguli*
California State University, Northridge, Northridge, CA

As wildfires in California become more prevalent and destructive, it is imperative to understand the potential for impacts to water quality in the watersheds they burn. One particularly understudied aspect of wildfire-associated water quality impairment is the generation of polycyclic aromatic hydrocarbons (PAHs), a class of organic contaminants with carcinogenic, mutagenic, and ecotoxic properties. We investigated PAH impacts associated with the 2018 Woolsey Fire, which burned over half of the Malibu Creek Watershed near Los Angeles, California. We collected soil and water samples periodically and during rain events over three years following the fire. Sampling sites were distributed throughout the watershed to incorporate all major tributaries of Malibu Creek, and to capture varying topography, geology, land use, and fire intensity. Total PAH concentrations decreased significantly over the three years of the study, but concentrations of several PAH compounds continued to exceed EPA Ambient Water Quality Criteria through the third year during rain events. Since PAHs have many non-fire sources, we used molecular ratio approaches to evaluate the relative contribution of wildfire sources to total PAH loads in the watershed. We found that the fire "signal" waned into the second and third years, with significant geographical variation, suggesting that topography, land-use, and burn intensity play a role in PAH generation and mobilization in the watershed.

3:40 P.M. | Tuesday, April 27th

Oxidative Stress in the Seaside Sparrow (*Ammospiza maritima*) Following the Deepwater Horizon Oil Spill

Aaron Angel*[1], Philip C. Stouffer[2], Juanita K. Jellyman[1] and Andrea Bonisoli-Alquati[1]
[1]*Department of Biological Sciences, California State Polytechnic University, Pomona, CA*
[2]*School of Renewable Natural Resources, Louisiana State University and AgCenter, Baton Rouge, LA*
[*]*student presenter*

The Deepwater Horizon (DWH) oil spill introduced massive amounts of oil into Louisiana saltmarshes. Seaside Sparrows (*Ammospiza maritima*) incorporated petrogenic carbon into their tissue and showed extensive changes in gene expression, including cyp1a, a gene involved in metabolizing polycyclic aromatic hydrocarbons (PAHs), toxic components of oil. PAH metabolism generates reactive oxygen species, inducing oxidative stress when the antioxidant capacity of an organism is overwhelmed. Our study aims to determine whether DWH oil exposure increased oxidative stress in Seaside Sparrows. We measured plasma reactive oxygen metabolites (ROMs) and antioxidant capacity in sparrows from oiled and control sites (2013-2014). In cardiac tissue, we measured glutathione concentrations and analyzed total protein damage using Western blot (2013-2015). The antioxidant capacity of sparrows from oiled sites was ~50% higher than control sites in 2013, but not 2014. That year, sparrows from oiled sites had 95% higher ROMs than in 2013, with no difference in antioxidant capacity. In 2013 and 2015, sparrows from oiled sites had more protein damage than controls. In 2014, oil exposure was not associated with protein damage, and tissue glutathione concentrations decreased in this year. Additionally, total glutathione concentrations were higher overall in 2013 and 2015. The increase in serum and tissue antioxidants and increase in protein damage in oil-exposed sparrows in 2013 and 2015 suggest that exposed sparrows upregulated or mobilized antioxidants to combat oxidative damage. Increased ROMs in plasma and lower tissue glutathione in 2014, suggest difficulty in oil-exposed sparrows' ability to maintain oxidative balance this year. Ecological variation may be contributing to the variation in their ability to mitigate damage throughout the study period. Our integration of sediment PAH measurements may better explain the variation in stress response across sites and through time. These results will provide insight into the toxicity of sublethal DWH oil exposure in terrestrial birds.

4:00 P.M. | Tuesday, April 27th

Science and policy: Improving Fish Consumption Advisory Programs in the US and Canada

Rachael King*[*1], *Beth Polidoro[1], Karen Watanabe[1], and Trevor Avery[2]*
[1]Arizona State University West, Glendale, AZ
[2]Acadia University, Wolfville, NS
[*]student presenter

Fish consumption advisories are designed to transfer risks of contaminated fish consumption to consumers but are often based on limited fish tissue contaminant testing and communicated ineffectively. This leads to both human health and environmental justice concerns as low-income and minority groups are most likely to use fish as a primary protein source. To identify opportunities for improving fish consumption advisories, the fish consumption advisory programs of all 50 US states and 13 Canadian provinces/territories were reviewed. Arizona and Nova Scotia were selected as case studies to reveal the depth of these programs in the U.S. and Canada. The countries were compared to demonstrate how opportunities and challenges to policy correction are related in both countries. The review of fish consumption advisory programs and policies revealed unequal and insufficient human health and environmental justice protections. In the US, states are only required to monitor fish tissue for mercury under the Clean Water Act, and all other contaminant monitoring is at states' discretion. In Canada, there are no federal requirements to monitor fish tissue for any contaminants. While 49/50 states and 12/13 provinces/territories have developed monitoring programs, lack of federal oversight leads to variation in frequency of monitoring, contaminants monitored, and dissemination of fish consumption advisories across both countries. The US appears to have stronger fish consumption advisory programs than Canada, but neither country systematically protects human health and environmental justice. Additionally, challenges to policy correction abound in both countries, including who will move forward with environmental policy change. The countries can learn from each other's programs and policies to create stronger protections for human health and environmental justice and consult successful programs in the EU for methods to improve environmental policy.

4:30 – 5:00 P.M. | Tuesday, April 27th

Lightning Talk 2-1| Pyrethroid Occurrence in California Roadside Catch Basins

Nathan D. Sy *and Jay Gan*
Department of Environmental Sciences, University of California, Riverside, CA 92521

Urban runoff may frequently transport pyrethroid insecticides from various roads to stormwater outfalls. Pyrethroids have been detected at many outfall sites and downstream waterways, with residential runoff being a significant contributor. Catch basins, which serve as the entry point for runoff into an underground storm drain system, may act as sinks for pyrethroid residues. The accumulation of detritus and sediment in these basins, along with their lower temperatures and sunlight, may lead to pyrethroid recalcitrance. This study, conducted in collaboration with multiple vector control districts in California, sought to observe pyrethroid concentrations in urban catch basins. Sites in multiple regions of California were selected for sampling throughout several summer months. Samples of water and various solids were collected from several basins at each site. Environmental samples were extracted for 8 pyrethroid analytes and analyzed on GC/MS. Pyrethroid occurrence, including concentrations and detection frequency, as well as likely sources and hydrological influences, will be discussed.

4:30 – 5:00 P.M. | Tuesday, April 27th

Lightning Talk 2-2| Ryanodine Receptor mRNA Expression in *Danio rerio* exposed to tetra-ortho PCB 202

Danielle D. Sandoval* *and Erika B. Holland*
Department of Biological Sciences, California State University, Long Beach, Long Beach, CA
**student presenter*

Non-dioxin-like polychlorinated biphenyls (NDL-PCBs) contribute to neurotoxicity in exposed model organisms and are commonly detected in human tissue or serum samples at predicted neurotoxic levels. NDL-PCBs that contain heavy ortho-chlorine substitution will activate the ryanodine receptor, an intracellular Ca2+ channel embedded in the sarco/endoplasmic reticulum (SR/ER) membrane. The ryanodine receptor (RyR) regulates the release of Ca2+ from the SR and ER, which influences neuronal synaptic plasticity or alters excitation-contraction (EC) coupling in cardiac and skeletal muscle. Dysfunction of the RyR is known to contribute to neurodevelopmental disorders (NDD) such as autism spectrum disorder and attention-deficit/hyperactivity disorder (ADHD). Of the 209 congeners, the tetra ortho PCB 202, is the most potent activator of the RyR. However, this previous study was conducted in vitro assays and the effect of this congener in an in vivo experiment has yet to be studied. In this study, the aim is to evaluate the sublethal effects of PCB 202 on mRNA expression during the early development of zebrafish (Danio rerio). It is hypothesized that acute exposure to PCB 202 will alter the mRNA expression of RyR paralogs and related genes that are affected by the modulation of Ca2+. This study will provide an understanding of PCB 202 toxicity and the effects NDL PCB mixtures on human and wildlife health.

4:30 – 5:00 P.M. | Tuesday, April 27th

Lightning Talk 2-3| Early Stage Quantitative AOP Model of Acetylcholinesterase Inhibition Leading to Neurodegeneration

Dennis Sinitsyn*[1], *Kendra Conrow[1], Natalia Garcia-Reyero[2], Karen H. Watanabe[1]*
[1]School of Mathematical and Natural Sciences, Arizona State University
[2]US Army Corps of Engineers, Engineering Research and Development Center
[*]student presenter

Inhibition of acetylcholinesterase (AChE) by organophosphates, carbamates, and some nerve agents lead to numerous adverse outcomes and human health risks. This adverse outcome pathway (AOP), in particular, focuses on the outcome of neurodegeneration caused by excitotoxicity and calcium dysregulation. Our qualitative AOP shows AChE inhibition leads to an excess of acetylcholine (ACh) in the synapse, which overactivates muscarinic acetylcholine receptors (mAChR) within the brain, resulting in localized (focal) seizures. Spreading of the focal seizure and subsequent activation of n-methyl-D-aspartate (NMDA) receptors propagates the excitotoxicity through glutamate and leads to elevated intracellular calcium levels, status epilepticus, and ultimately cell death and neurodegeneration. A quantitative model of this process would help delineate the relationship between exposure to AChE inhibitors, in vitro assays used in chemical toxicity testing, and the cell death and neurodegeneration seen in animal and human studies. Additionally, the quantitative model would help inform and predict the expected neurological outcome of persons affected by potent inhibitors of AChE. Here we present early stage quantitative models describing the first two key event relationships whereby AChE inhibition resulting in ACh accumulation leads to overactivation of mAChRs. Our next steps involve determining quantitative models for the remaining key events in the AOP, from mAChR activation to neurodegeneration.

4:30 – 5:00 P.M. | Tuesday, April 27th

Lightning Talk 2-4| Stage-dependent and Regioselective Toxicity of 2- and 6-hydroxychrysene During Japanese Medaka Embryogenesis

Philip Tanabe*, *Constance Mitchell, Vanessa Cheng, Qiqing Chen, David Volz, Daniel Schlenk*
University of California: Riverside, Riverside, CA
**student presenter*

Exposure to oxygenated polycyclic aromatic hydrocarbons (oxy-PAHs) at critical developmental time-points in fish models impairs red blood cell concentrations in a regioselective manner, with 2-hydroxychrysene being more potent than 6-hydroxychrysene. To better characterize this phenomenon, embryos of Japanese medaka (Oryzias latipes) were exposed to 2- or 6-hydroxychrysene (0.5, 2, or 5 µM) from 4 h-post-fertilization (hpf) to 7 d-postfertilization. Following exposure, hemoglobin concentrations were quantified by staining fixed embryos with odianisidine (a hemoglobin-specific dye) and stained embryos were imaged using brightfield microscopy. Exposure to 2-hydroxychrysene resulted in a concentration-dependent decrease in hemoglobin relative to vehicleexposed embryos, while only the highest concentration of 6-hydroxychrysene resulted in a significant decrease in hemoglobin. All tested concentrations of 2-hydroxychrysene also caused significant mortality (12.2 % ± 2.94, 38.9 % ± 14.4, 85.6 % ± 11.3), whereas mortality was not observed following exposure to 6-hydroxychrysene. Therefore, treatment of embryos with 2-hydroxychrysene at various developmental stages and durations was subsequently conducted to identify key developmental landmarks that may be targeted by 2- hydroxychrysene. A sensitive window of developmental toxicity to 2-hydroxychrysene was found between 52–100 hpf, with a 24 h exposure to 10 µM 2-hydroxychrysene resulting in significant anemia and mortality. Since exposure to 2-hydroxychrysene from 52 to 100 hpf, a window that includes liver morphogenesis in medaka, resulted in the highest magnitude of toxicity, liver development and function may have a role in 2- hydroxychrysene developmental toxicity.

1:00 P.M. | Wednesday, April 27th

California's Path Towards Assessing Risks and Developing Regulations for Microplastics

Scott Coffin*[1]*, *Steve Weisberg*[2]*, Charles Wong*[2]*, Leah Thornton Hampton*[2]*, Alvina Mehinto*[2]*, Ezra Miller*[3]*, Chelsea Rochman*[4]

[1]*California State Water Resources Control Board, Sacramento, CA*

[2]*Southern California Coastal Water Research Project, Costa Mesa, CA*

[3]*San Francisco Estuary Institute, Richmond, CA*

[4]*University of Toronto, Toronto, Canada*

Plastic is a persistent organic pollutant that is becoming increasingly more abundant in the environment, causing concern amongst scientists and regulators due to the potential harm towards humans and ecosystems. The State Water Resources Control Board (State Water Board) is addressing these concerns by taking substantive steps towards regulating microplastics in drinking water and the environment. In collaboration with the Southern California Coastal Water Research Project (SCCWRP), and 40 laboratories, the State Water Board is performing an inter-laboratory validation study to standardize analytical methods for microplastics. Concurrent to the method evaluation study, the State Water Board and SCCWRP are facilitating an expert panel to provide recommendations to California for health-based guidelines for microplastics in drinking water and to protect aquatic ecosystems. Such efforts will directly inform mandatory monitoring efforts orchestrated by the State Water Board, as well as policies recommended by the Ocean Protection Council. This presentation will cover these ongoing efforts and provide key insights and recommendations for additional research into this emerging contaminant suite.

1:20 P.M. | Wednesday, April 28th

Evaluating the Impacts of Restoration Design on the Presence of Contaminants and their Effects on *Ostrea lurida*

***Amanda S. Russell*[1]**, *Christine R. Whitcraft*[1], *Judy Brusslan*[1], *Varenka Lorenzi*[2], *Danielle C. Zacherl*[3], *Katie Nichols*[4], *and Erika B. Holland*[1]
[1]*Department of Biological Sciences, California State University of Long Beach, CA, USA*
[2]*Institute for Integrated Research in Materials, Environments and Society, California State University of Long Beach, CA, USA*
[3]*Department of Biological Sciences, California State University of Fullerton, Fullerton, CA, USA*
[4]*Orange County Coastkeeper, Costa Mesa, CA, USA*

Olympia oysters (*Ostrea lurida*) are a threatened species and are the subject of several different restoration projects on the west coast of the United States. In Upper Newport Bay (UNB), CA O. lurida are being restored at four sites, with each site designed to contain plots with oysters restored alone and oysters restored with adjacent eelgrass. This study investigated how restoration techniques and site selection impacted the distribution of contaminant concentrations in *O. lurida* tissue and nearby sediment from restored oyster beds, and how these concentrations impacted the overall health status of *O. lurida*. Both organic and trace metal concentrations were quantified in *O. lurida* tissue and nearby sediment, and whole transcriptome sequencing was performed on *O. lurida* samples from restored beds and from a laboratory controlled culture. Analysis with artificial neural networks identified which environmental variables and contaminant analytes were most important in determining gene expression. In sediment, significant differences were detected between sites with several metal analytes, including total metals. The contaminant concentrations detected in *O. lurida* tissue were at potentially harmful concentrations, and the only other study assessing contaminants in *O. lurida* detected qualitatively lower concentrations. RNA-sequencing revealed a limited number of differentially expressed genes (DEG) between oyster samples taken from different sites and plots with different restoration techniques in UNB. However, there were a large number of DEG detected between the field collected oysters and laboratory-held oysters, which had overall lower levels of contaminant concentrations. Here, the laboratory-held oysters showed in increase in glutathione S-transferase genes and a decrease in ATP-binding cassette genes, representing conflicting responses to oxidative stress. Further analysis with artificial neural networks revealed that contaminants such as strontium, 4,4'-DDE, 2,4'-DDT, and trans-nonachlor played a significant role in predicting expression levels for a majority of DEGs.

1:40 P.M. | Wednesday, April 28th

Contaminants in Philippine Fish (*Siganus fuscescens*) and their Potential Effects on Public Health

Eryka Molino*[1], Beth Polidoro[1], and Lilibeth Bucol[3]
[1]*Arizona State University, Tempe, AZ*
[2]*Negros Oriental State University, Negros Oriental, Philippines*
[*]*student presenter*

The Philippines relies on a vast biodiversity of fishes as a staple food, but like many countries around the globe, experiences severe "leakages" of contaminants and pollutants in the environment. In order to better understand the relationship between environmental pollutants and public health, this research project measured the concentration of pollutants in a commonly consumed local fish (*Siganus fuscescens*), and then evaluated the potential health risks of eating this fish based on estimated average consumer weight and consumption levels. Fish sampled from four different sites located in Negros Oriental, Philippines were analyzed for organic contaminants using gas chromatography and mass spectroscopy. Pollutants quantified included polycyclic aromatic hydrocarbons (PAHs), pesticides, phthalates, and polychlorinated biphenyl (PCBs). Across the four study sites, fishes from Manjuyod showed the highest frequency of detection of different pollutants. However, phthalates and PAHs were found in similar concentrations in all four sites, with fishes from Dumaguete showing the highest level of PCBs compared to the other sampled sites. The U.S. Environmental Protection Agency's guide for fish contaminants pinpoints several health risks associated with the chronic ingestion of these contaminants. Based on estimated average body weights of Filipino adult men, adult women, and children, and various consumption levels, people who eat the fish at or above the national average consumption level may be at increased risk for chronic health outcomes, such as cancer and/or other adverse effects. Specifically, due to the high concentration of PCBs in Dumaguete, selected populations who eat local fish from this site may be at higher risk than the citizens who eat the fish from other sites at similar consumption rates. These results can help to inform local and national policies on water quality, waste disposal, and fish consumption advisory programs.

2:00 P.M. | Wednesday, April 28th

Assessing Halogenated Organic Compounds in California Condors and their Scavenged Marine Mammal Prey: Implications for Reintroduction

***Margaret Stack*[1]**, *Eunha Hoh*[1], *Nathan Dodder*[1], *Christopher Tubbs*[2], *Ignacio Vilchis*[2], *Rachel Felton*[2], *Jade Johnson*[1], *Jennifer Cossaboon*[3]

[1] *School of Public Health, San Diego State University, San Diego, CA 92182, USA*

[2] *San Diego Zoo Institute for Conservation Research, Escondido, CA 92027, USA*

[3] *University of California Davis, Davis, CA 95616, USA*

Since California condors nearly became extinct in 1987, conservation efforts have focused on reintroducing condors to wild habitats where they can build self-sustaining populations. Healthy diets are critical to supporting wild populations, and different reintroduction sites pose varying dietary health risks. Inland habitats are associated with higher risk of lead poisoning, due to the availability of terrestrial game animals, whereas coastal habitats contain lead-free marine mammal carcasses for condors to scavenge. However, recent evidence shows that marine mammal consumption is associated with increased exposure to halogenated organic compounds (HOCs) that can cause eggshell thinning. Using comprehensive two-dimensional gas chromatography coupled with time-of-flight mass spectrometry (GCxGC/MS-TOF), we identified the HOC profiles of inland and coastal condors to detect compounds unique to coastal condors. We also compared coastal condor HOC profiles with existing HOC data from Southern California (CA) marine mammals to confirm that contaminants are being sourced from a marine mammal diet. Finally, we analyzed and compared HOC profiles of cetaceans from Baja California with CA cetaceans to determine differences in contaminant loads in each location. Results showed that coastal condors contained significantly more HOCs than inland condors (32 ± 5 vs. 8 ± 2). The most abundant chemical classes in the coastal condors were DDT-related compounds and PCBs. Comparisons of coastal condors and CA marine mammals showed similar profiles, such that >98% of HOCs identified in coastal condors were detected in CA marine mammals, confirming that marine mammal consumption leads to HOC exposure. Baja cetaceans contained significantly fewer HOCs than CA cetaceans (58 ± 19 vs. 124 ± 3) and compounds were less abundant in Baja cetaceans, including a 7-fold reduction in DDT levels. Focusing reintroduction efforts to Baja California could be advantageous because Baja marine mammals have reduced contaminant loads that might limit HOC exposure and resulting health effects.

2:30 – 3:00 P.M. | Wednesday, April 28th

Lightning Talk 3-1| How to Integrate Sediment Remediation and Ecosystem Recovery? (Hint: They Should Go Hand in Hand)

***Robert K. Johnston*[1]**, *David Moore*[2], *Katie Payne*[3], *Alex Kascak*[4], *and Betsy Henry*[5]
[1] *Applied Ecological Solutions, Bremerton, WA*
[2] *U.S. Army Corps of Engineers, Vicksburg, MS*
[3] *Enthalpy Analytical, Irvine, CA*
[4] *University of Louisiana, Lafayette, LA*
[5] *Anchor QEA LLC, Syracuse, NY*

Cleanup at many contaminated sediment sites can be very costly, time consuming, and ineffective if larger scale pressures and ecological processes are not adequately addressed by the remedial design. Ideally, a holistic approach is desired for remedies that brings together remediation and reuse (restoration) by exploiting synergies that minimize costs and environmental impacts and achieves whole-system sustainability benefits. Sustainable remediation strategies should be informed not only by considerations of regulatory compliance but also by stakeholder goals, values and expectations. Over the last few decades, remedies selected at contaminated sediment sites have focused on mass removal or the reduction of exposure to sediment-associated contamination to manage human health and ecological risks. At many contaminated sediment sites, assessing contaminant-focused remedy effectiveness measures has been confounded by the complexity of ecosystem processes, the lack of comprehensive monitoring data sets, and the need to align remediation objectives with ecosystem recovery goals for restoring ecosystem processes that support a wide range of ecosystem services and functions that are necessary to sustain ecosystem recovery. Additionally, sediments (whether contaminated or not) are linked to processes occurring within the watershed making them susceptible to, and potential drivers of, chemical, physical and biological stressors from larger scale social and economic pressures (land use change, hydrology perturbations, new and emerging chemicals), climate change (sea level rise, extreme events, invasive species), and other disturbances associated with the Anthropocene. Drawing on the results of case studies, key concepts and lessons learned to better integrate sediment cleanup and ecosystem recovery goals were discussed during a Session sponsored by the Sediment Interest Group at the recent SETAC NA SciCon2 conference and you are cordially invited to join the discussion.

2:30 – 3:00 P.M. | Wednesday, April 28th

Lightning Talk 3-2| Assessing Functional Impacts of Multiple Contaminants on Marina Benthos

Carlos Neira, *Guillermo Mendoza, and Lisa A. Levin*
Scripps Institution of Oceanography, La Jolla, CA

While we have acquired some predictive capacity regarding the impact of Cu on marina assemblage structure, we have limited knowledge of its functional consequences. This limitation is even more extreme when multiple contaminants are considered. Ecosystem functioning is a broad term that includes all the processes in the system, including chemical, physical and biological components. In marina soft sediments, macrofauna are crucial in driving important processes (e.g. bio-irrigation, sediment reworking) that depend on their biological traits (e.g., feeding and mobility modes). Thus, changes at the functional level alter the adaptation of the fauna to the environment and their response to environmental stressors. They also alter the fate of contaminants. This ongoing research approaches the challenge of unraveling the functional impacts of multiple contaminants (e.g., Cu, PAHs, PCBs, DDTs, PBDEs) on soft-bottom communities in San Diego Bay marinas through a trait-based approach. A quantitative matrix was generated by combining community attributes with functional features such as life history, morphological and behavioral characteristics of the taxonomic groups. The trait matrix was related to environmental factors, providing a link between environmental conditions and ecosystem function. Cu appears to be the primary driver of changes within the marina faunal community and functional traits, with PAHs, PCBs, OCPs, and PBDEs playing a minor role. Some traits impacted by high Cu concentrations were habitat, motility, feeding mode, with reduced representation of epifauna, motile, body size and calcification modalities, respectively. The use of functional diversity, in addition to its structural attributes can provide a better ecological understanding of how multiple-stressor impacts on community structure and biodiversity translate into functional consequences in marina ecosystem. Identification of these can promote suitable tools for marina management.

2:30 – 3:00 P.M. | Wednesday, April 28th

Lightning Talk 3-3| Assessing Ecosystem Health Through Contamination in the Tijuana River Estuary

Nancy Torres*[1], *Jeff Crooks[2], Drew Talley[1], and Catherine T. Zeeman[3]*
[1]University of San Diego, San Diego, CA
[2]Tijuana River National Estuarine Research Reserve, Imperial Beach, CA
[3] U.S. Fish & Wildlife Service, Carlsbad, CA
[*]student presenter

Although the Tijuana River Estuary remains the largest, most-intact coastal wetland in Southern California, it has a history of major changes, much of this related to its location immediately north of the US / Mexico Border. One of the primary challenges is cross-border flows from the rapidly growing city of Tijuana, Baja California, and the delivery of wastewater, debris, and sediment to sensitive coastal wetland ecosystems. There is a need to more fully investigate these environmental changes to assess the ecosystem health of the Tijuana River Estuary over time, especially related to pollution impacts. This can inform an understanding of changes in both species and stressors, and can also help assess the effectiveness of past management strategies, such as the initiation of wastewater treatment. Since 1986, the NOAA Mussel Watch Program and California Surface Water Ambient Monitoring Program have periodically collected data on chemical contaminants and biological indicators of water quality in the Tijuana River Estuary. This project aims to build on these past monitoring efforts and established methodologies to assess status and trends of contaminants in organisms, sediment, and water. This work will be accomplished by conducting a thorough review of available datasets and literature to document past changes in the estuary and refine sampling approaches. Sampling will be conducted at three locations in the Tijuana River Estuary to assess spatial variability during both the wet and dry seasons. Overall, this information will improve our ability to document and interpret long-term trajectories of change of contaminants in the ambient environment and key taxa. This project will be developed in coordination with key stakeholders, and the results will offer communication and management tools depicting the estuary's ecosystem health over time.

2:30 – 3:00 P.M. | Wednesday, April 28th

Lightning Talk 3-4| Investigation of the Viability and Comparability of the Manila Clam (*Venerupis philippinarum*) to the Bent-Nosed Clam (*Macoma nasuta*) for 28-Day Bioaccumulation Exposures

Peter Arth*[1]*, *Kasey Skrivseth*[1]*, Adrienne Cibor*[1]*, and Kirk Cram*[2]
[1]*Enthalpy Analytical, San Diego, CA*
[2]*Enthalpy Analytical, Hampton, NH*

The recommended Ocean Testing Manual (OTM; USACE/USEPA 1991) mollusc species for bioaccumulation potential evaluation for dredge material disposal analysis is *Macoma nasuta*, the bent-nosed clam. In recent years, *M. nasuta* has become increasingly challenging to procure consistently and in sufficient quantities. With few commercial suppliers in existence to begin, supplier access to the wild organism can be further restricted by weather, tides, and regulatory restrictions, as well as general seasonality and variable demand. Additionally, the need for bioaccumulation testing as part of dredge material evaluations has become less predictable and project pathways have become more phased in approach, which can expend precious sample holding time. This combination of variables often means that test organisms for bioaccumulation must be obtained by the laboratory on short notice. The OTM does offer alternate mollusc species for use, among them the Manila clam, *Venerupis philippinarum*. However, little if any literature is readily available discussing the comparability of the bent-nosed clam and the Manila clam specifically in bioaccumulation exposures. Our study aimed to investigate the viability and comparability of using the Manila clam as a substitute in place of the bent-nosed clam for 28-day bioaccumulation exposures. Consideration was given to any unique test exposure conditions, differences in organism sensitivity, bioaccumulation potential of common contaminants of concern, and ease of procurement, among other interests.

2:30 – 3:00 P.M. | Wednesday, April 28th

Lightning Talk 3-5| An Evaluation of Bioanalytical Screening Tools to Assess Contaminants of Emerging Concern in Wastewater and in the Receiving Environment

Violet Renick[1], *Ellie Wenger[2], Vanh Phonsiri[1], Canh Nguyen[1], George Robertson[1], and Alvina Mehinto[2]*

[1]Orange County Sanitation District, Fountain Valley, CA

[2]Southern California Coastal Water Research Project, Costa Mesa, CA

Of the hundreds of thousands of chemicals that are produced or found in the environment, only a few hundred are currently regulated and monitored in California's receiving waters. The remainder, known as chemicals or constituents of emerging concern (CECs), can originate from a variety of industrial, residential, and commercial sources and be transported into the environment via discharged wastewater. The ecological and human health impacts of CECs, along with their diversity and complexity, have underscored the need to develop new screening strategies to evaluate and prioritize sites for continued monitoring in receiving environments. In-vitro cell bioassays have received attention as a method of high-throughput bioanalytical screening that can be used to broadly detect unexpected CECs in various environmental matrices. However, their application to the screening of CECs in marine receiving environments remains limited and requires further evaluation as a monitoring tool. The overall goal of this pilot study was thus to conduct a preliminary assessment of untargeted bioanalytical tools to assess bioactive CECs in wastewater and their fate in the receiving environment. Samples were collected from wastewater influent and effluent, seawater, and sediment from stations along a grid with varying proximity to ocean effluent discharge and regional sources of CECs. Samples were analyzed using 3 common cell bioassay lines including Estrogen (ERα), Aryl hydrocarbon (AhR), and Glucocorticoid receptors (GR). Classes of targeted CECs were identified and compared to the bioanalytical signatures in selected samples to determine whether specific CECs could explain bioactivity. The results from this pilot study will be briefly described, along with recommendations to further evaluate and interpret bioanalytical screening tools to track and quantify changes to CEC concentrations in the receiving environment.

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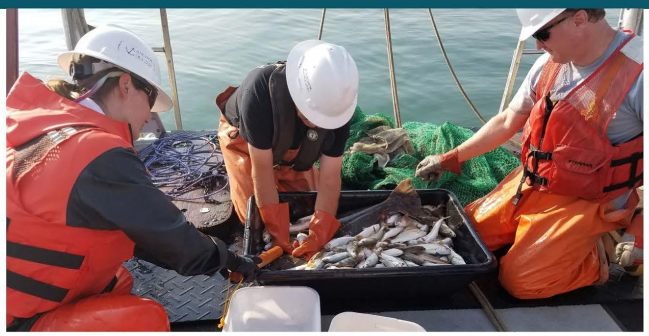

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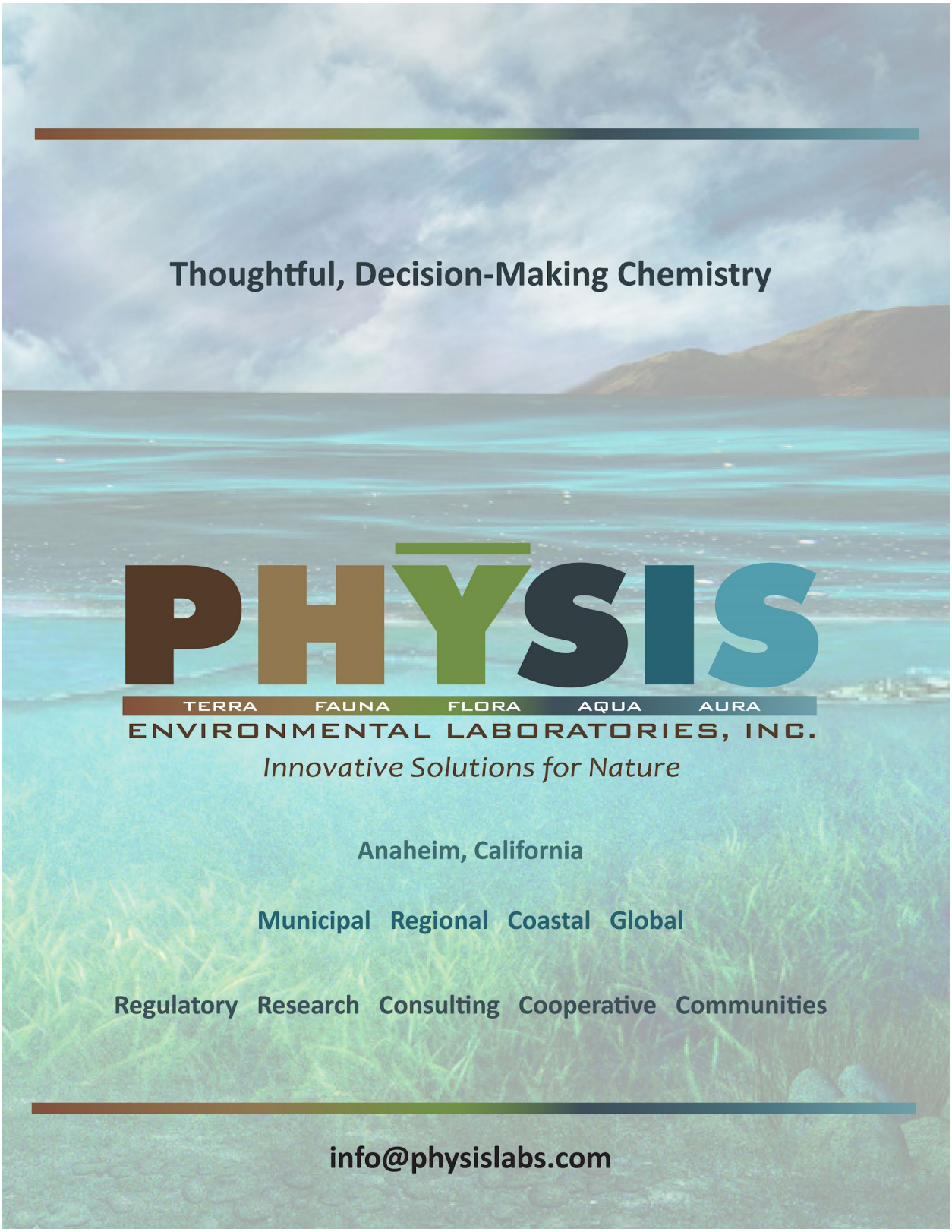
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