25th Annual Meeting of the Northern California Regional Chapter of the

Society of
Environmental
Toxicology
And
Chemistry

Climate and the Environment: A State of Change

April 29-30, 2015
Cal EPA Building, Sacramento
1001 I Street, Sacramento

Northern California Regional Chapter

Society of Environmental Toxicology and Chemistry
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SCHEDULE

25th Annual Meeting of the Northern California Regional Chapter of the Society of Environmental Toxicology and Chemistry

April 29-30, 2015
Cal EPA Building, Sacramento

Wednesday, April 29, 2015
Day One – Half Day and Full-Day Short Courses

Time	Short Course	Instructor	Room
8:00-9:00	Registration		2nd-floor Mezzanine
9:00-12:00	Greener and Cleaner: How can environmental professionals incorporate consumer product safety into their daily work?	Karl Palmer and Anne-Cooper Doherty, California Department of Toxic Substances Control	Coastal Hearing Room
9-10 (download assistance); 10-12:00 hands-on course	Introduction to Data Manipulation, Visualization, and Analysis with R (Full-day course: Part 1 of 2)	Patrick Grof-Tisza, University of California, Davis	Sierra Hearing Room
12:00-13:00	Lunch Break / Registration		2nd-floor Mezzanine
13:00-17:00	Causal Assessment in California (CADDIS Model)	David Gillett and Ken Schiff, Southern California Coastal Water Research Project	Coastal Hearing Room
13:00-16:30	Introduction to Data Manipulation, Visualization, and Analysis with R (Full-day course: Part 2 of 2)	Patrick Grof-Tisza, University of California, Davis	Sierra Hearing Room

SCHEDULE

Thursday, April 30, 2015
Day Two – Conference

Time	Description	Speaker(s)	Location: Room
8:00-13:00	Registration		2nd-floor mezzanine
9:00-9:10	Welcoming Address and Introduction of Plenary Speakers	Michelle Hornberger, NorCal SETAC, President	Byron Sher Auditorium
9:10-9:50	Plenary Speech: Science as our Guide in a State of Change Audience Q&A	Anke Mueller-Solger, U.S. Geological Survey	Byron Sher Auditorium
9:50-10:30	Plenary Speech: Climate Change and the Scientific Community Audience Q&A	Kim Stanley Robinson, Science Fiction Author	Byron Sher Auditorium
10:30-10:50	**BREAK** (Refreshments)		2nd-floor mezzanine
10:50-11:45	**POSTER SESSION**		2nd-floor mezzanine
11:45-13:00	**LUNCH BREAK** (Map of local restaurants provided)		Local restaurants
12:00-13:00	Student -Mentor Lunch		Room 230
13:00-14:00	Session 1: Bioaccumulation	Session Chair: David Ostrach	Byron Sher Auditorium
13:00-14:00	Session 2: Risk Assessment I	Session Chair: Krista Hoffmann	Coastal Hearing Room
13:00-14:00	Session 3: Ecotoxicity of Contaminants I	Session Chair: Simone Hasenbein	Sierra Hearing Room
14:00-14:20	**BREAK** (Refreshments)		2nd-floor mezzanine
14:20-15:20	Session 1: Environmental Change	Session Chair: David Ostrach	Byron Sher Auditorium
14:20-15:20	Session 2: Risk Assessment II	Session Chair: Krista Hoffmann	Coastal Hearing Room
14:20-15:20	Session 3: Ecotoxicity of Contaminants II	Session Chair: Simone Hasenbein	Sierra Hearing Room
15:20-16:00	**POSTER SESSION**		2nd-floor mezzanine
16:00-17:15	Members Meeting, Student Awards, and Reception		2nd-floor mezzanine

SCHEDULE

PLATFORM SESSIONS

Time	Session 1: Bioaccumulation Chair: David Ostrach Room: Byron Sher Auditorium	Session 2: Risk Assessment I Chair: Krista Hoffmann Room: Coastal Hearing Room	Session 3: Ecotoxicity of Contaminants I Chair: Simone Hasenbein Room: Sierra Hearing Room
13:00-13:20	***Peterson M, University of California, Berkeley:** *Persistent Organic Pollutant Accumulation in Northern Elephant Seals*	***Khan, U, McGill University, Montreal, Quebec, Canada:** *Human Health Relevance of Pharmaceutically Active Compounds in Drinking Water*	***Hunt L, University of California, Berkeley:** *Adapting the SPEAR Pesticide Stream Bioassessment Index for Use in California*
13:20-13:40	***Peterson S, University of California, Berkeley**: *Elephant Seals: Integrators of Contaminants in the Deep Ocean*	**Papagni C, California Department of Toxic Substances Control, Chatsworth, CA:** *Evaluating Potential Adverse Impacts from Chemicals in Consumer Products*	***Ma D, University of California, Davis:** *Shampoo Constituent Effects on Heat Tolerance of the Pacific Oyster, Crassostrea gigas*
13:40-14:00	**Beckon W, U. S. Fish and Wildlife Service, Sacramento, CA:** *Estimating Bioaccumulation Lag Time from Trophic Level, and Vice Versa*	**Sullivan J, Ardea Consulting, Woodland, CA**: *Regional Ecological Risk Assessment for Threatened and Endangered Species following Pesticide Applications*	***Kuspa Z, University of California, Santa Cruz***:* *Hormonal Stress Response of the Chronically Lead-exposed California Condor (Gymnogyps californianus)*
14:00-14:20	**Break**		
	Session 1: Environmental Change Chair: David Ostrach Room: Byron Sher Auditorium	**Session 2: Risk Assessment II** Chair: Krista Hoffmann Room: Coastal Hearing Room	**Session 3: Ecotoxicity of Contaminants II** Chair: Simone Hasenbein Room: Sierra Hearing Room
14:20-14:40	**Flint A, U.S. Geological Survey, Sacramento, CA:** *Implications of Climate Change to Hydrology and Water Quality in California*	**Beil R, Blankinship & Associates, Inc., Davis, CA:** *Formidable Projects Made Manageable by Combining Risk Assessment Models in MS Excel*	**Holland-Fritsch E, University of California, Davis:** *Defining the Neurotoxic Potential of Polychlorinated Biphenyl Concentrations Present in Fish from US Lakes*
14:40-15:00	***Jellison B, University of California, Davis:** *The Effect of Ocean Acidification on the Predator Avoidance Behavior of an Intertidal Snail*	**Bonnar D, Blankinship & Associates, Inc., Davis, CA:**.*Generating, Storing, and Presenting Large Quantities of Risk Data – The CRANK/ Dashboard Approach*	***Lam R, University of California, Davis:**.*The Impacts of Polystyrene Plastic and Polycyclic Aromatic Hydrocarbons (PAHs) on the Development of Zebrafish (Danio rerio)*
15:00-15:20	**Green P, University of California, Davis***: GHG and Other Impacts from Direct Land Application of Un-Composted Green Waste*	**Rego J, University of California, Davis**: *Mitigation Strategies for Reducing Aquatic Toxicity from Organophosphate Pesticides in Cole Crops*	***Miller J, University of California, Davis***: Aquatic Copper-Oxide Nanoparticle Exposure May Target Osmoregulatory Plasticity of Fish from Salinity Variable Environments*

*** Student presentation – please remember to fill out an evaluation if you view this presentation**

Plenary Speakers

Anke Mueller-Solger, Ph.D., Associate Director, California Water Science Center, U.S. Geological Survey, and former Lead Scientist of the Interagency Ecological Program

Title: ***Science as our Guide in a State of Change***

Anke Mueller-Solger has a Ph.D. in Ecology from U.C. Davis, and degrees in Biology from the University of Goettingen in Germany. Prior to joining the USGS, Anke was the lead scientist for the Interagency Ecological Program (IEP) for the San Francisco Estuary (Bay-Delta) for six years. Her research has focused on the ecology of lakes, rivers, floodplains and estuaries, and the effects of ecosystem stressors, including invasive species and chemical alterations. At the IEP, she led collaborative Bay-Delta science teams, including a multidisciplinary investigation of the decline of pelagic organisms in the estuary. In 2014, Anke was awarded the Brown-Nichols Science Award. This award is given biennially to honor contributions for significant research as well as active involvement in facilitating the use of science to manage the San Francisco Estuary and watershed. Anke joined the USGS in June, 2014. As Associate Director for Projects, she oversees, develops, promotes, and facilitates research on surface water and groundwater resources by about 150 scientists at the California Water Science Center. Anke says she "loves working for an agency that has science in its motto"— the USGS motto, "Science for a Changing world" coincidently—but aptly—echoes the theme of this year's NorCal SETAC Annual Meeting.

Kim Stanley Robinson (Stand), Hugo and Nebula-Award winning science fiction author of 20 novels, and Time Magazine "Hero of the Environment" 2008

Title: ***Climate Change and the Scientific Community***

Kim Stanley Robinson (Stan) is the author of 20 science-fiction novels, including three alternative futures of California, including the dystopian "The Gold Coast" and the utopian "Pacific Edge;" a trilogy of novels on climate change (starting with "Forty Signs of Rain"); and the internationally best-selling Mars trilogy (starting with "Red Mars"), which describes the terraforming of Mars and the concurrent development of new legal, social and cultural systems. His books have been translated into 24 languages, and he has won 25 literary and professional awards, including the Nebula and Hugo Awards. He was Time Magazine's "Hero of the Environment" in 2008. He has lectured at over 100 institutions, including the Smithsonian, Google, WorldWatch Institute, NASA, the U.S. National Science Foundation, American Academy for the Advancement of Science, and a variety of universities and academic conferences.

Platform Presentation Abstracts

Please note: Abstract titles preceded by an "*" indicate student presenters. Student presenters will also be indentified at the beginning of their talks by the Session Chair. Please remember to fill out an evaluation if you view this presentation.

Session 1: Bioaccumulation

***Persistent Organic Pollutant Accumulation in Northern Elephant Seals.** M.G. Peterson, University of California, Berkeley, Berkeley, CA, S.H. Peterson University of California, Santa Cruz, Santa Cruz, CA, C. Debier Université catholique de Louvain, Louvain-la-Neuve, Belgium, A. Covaci Toxicology Laboratory, University of Antwerp, Antwerp, Belgium, D.P. Costa University of California, Santa Cruz, Santa Cruz, CA.

Northern elephant seals (*Mirounga angustirostris*) travel thousands of kilometers to forage in mesopelagic (200-1000 m) regions of the North Pacific. Lengthy foraging trips interspersed with time on land make elephant seals ideal integrators of difficult-to-study oceanic ecosystems. Our study (1) measured the concentrations of persistent organic pollutants (DDTs, PCBs, and PBDEs) in adult male and female seal blubber and serum before and after their long (4-8 month) foraging trip (2011 and 2012), and (2) calculated total contaminant blubber burdens for females. Female samples were paired (N=24), whereas unique males were sampled before (N=16) or after (N=17) the foraging trip. DDTs, PCBs and PBDEs were detected in all samples, in decreasing mean concentration. Mean concentrations of ∑DDTs, ∑PCBs, and ∑PBDEs in blubber upon arrival to land from a foraging trip were twice as high for males compared with females. While contaminant concentrations decreased over the foraging trip for all seals, blubber burdens increased, indicating contaminant ingestion. Differences in male and female bioaccumulation may be due to behavioral differences in both foraging and reproduction. Our results support elephant seals as an integrator of deep-ocean contaminant exposure, and elephant seal bioaccumulation patterns may reflect threats to more cryptic marine predators.

***Elephant Seals: Integrators of Contaminants in the Deep Ocean.** S.E. Peterson, University of California, Santa Cruz, Santa Cruz, CA, M.G. Peterson, University of California, Berkeley, Berkeley, CA, J. Ackerman, United States Geological Survey Western Ecological Research Center, Dixon, CA, A. Covaci, University of Antwerp, Antwerp, Belgium, C. Debier, Universite catholique de Louvain, Louvain-la-Neuve, Belgium, D. Costa, University of California, Santa Cruz, Santa Cruz, CA.

Northern elephant seals (*Mirounga angustirostris*), mesopelagic (200-1000 m) marine predators that forage in the coastal and open-ocean North Pacific Ocean, integrate contaminants into their tissues while foraging. We used satellite-tracked adult females (with time-depth recorders) as biologgers of mercury and persistent organic pollutants (POPs), to examine links between foraging ecology and contaminant accumulation, as well as to determine how contaminant distribution may vary geographically. At the end of a foraging trip, we sampled 77 seals for total mercury (blood and muscle) and a subset of these (N=23) for POPs (blood and blubber). Total mercury in blood and muscle fell among the highest concentrations reported for marine predators. Moreover, foraging ecology influenced mercury exposure, with the highest concentrations observed in offshore, deep-diving females and the lowest concentrations observed in more northerly foraging females. We observed differences in mercury and some POP compounds across the foraging range of elephant seals, suggesting varying geographic distributions and bioaccumulation of specific compounds. Our results indicate that mesopelagic predators may be at greater risk for contaminant accumulation than previously assumed and provide insight into the potential for contaminants in elusive and vulnerable mesopelagic species.

Estimating Bioaccumulation Lag Time from Trophic Level, and V*ice* V*ersa*. W.N. Beckon, U. S. Fish and Wildlife Service, Sacramento, CA.

Studies of bioaccumulation of have been confounded by a lack of information on the time required for bioaccumulative contaminants to work their way up through food chains, from ambient exposure to the higher-trophic-level organisms that are frequently of most concern. A recently-developed method for calculating this lag time requires an extensive time series of data on ambient concentrations of the contaminant and concentrations in the tissues of the focal organism. However, for selenium, the method has already been applied to a substantial number of species at various trophic levels, yielding a fairly strong relationship between trophic level and lag. This relationship provides a simple way to estimate lag time when information on trophic level is available. On the other hand, in cases where trophic level is not yet known due to inadequate dietary information, calculation of bioaccumulation lag time can provide an alternative, indirect way of estimating trophic level.

Session 1: Environmental Change

Implications of Climate Change to Hydrology and Water Quality in California. A.L. Flint and L.E. Flint, U.S. Geological Survey, Sacramento, CA.

Globally, the climate has become warmer with 2014 being the warmest in recorded history. Hydrologic modeling of California at a fine scale has been completed using historical data to 2014 and future projections for the 21st century. Comparing hydrologic response to climate over the last 60 years shows shifts in the development of snowpack, a major component of California's water supply. Climate change can drive the shift even farther from the mid-century baseline. Warming occurring in California is primarily changing the hydrology by reducing snow pack, melting snow earlier, and increasing plant water demand. Climate projections suggest that warming will continue to increase in the future. Modeled hydrologic response projects major shifts in timing of water supply (recharge and runoff) with both increases and decreases. Landscape stress, however, increases in almost all scenarios, leading to projections of more forest die-off, more fires, and more droughts. The methods developed as part of this study have recently been applied to characterizing the spatial distribution of groundwater quality and estimating local deposition of mercury from a national-scale model. The subsequent changes in precipitation, air temperature, recharge, and runoff can lead to major changes in groundwater quantity, which in turn impacts water quality.

***The Effect of Ocean Acidification on the Predator Avoidance Behavior of an Intertidal Snail.** B. Jellison, B. Gaylord, A. Ninokawa, Bodega Marine Laboratory, University of California Davis, Bodega Bay, CA.

Rising levels of atmospheric carbon dioxide have led to a global drop in average oceanic pH and pose a major threat to marine biota. Previous research has highlighted the physiological consequences of lowered pH on individuals. However, emerging evidence suggests that marine acidification can alter behavior through mechanisms that are not yet well understood. One such mechanism may involve the disruption of an organism's ability to perceive or integrate chemical cues from their environment, which has the potential to lead to unforeseen ecosystem level consequences. We investigated effects of ocean acidification on chemoreception and the "crawl out" behavior of the intertidal turban snail, *Chlorostoma funebralis* (formerly *Tegula funebralis*) as induced by chemical cues from the predatory sea star, *Pisaster ochraceus*. Results indicated that CO_2 did not affect cue detection but did affect decision-making in *C. funebralis*, reducing avoidance to predator cue at elevated CO_2. Values of pH examined in our study arise already in rock pools inhabited by turban snails; however, the low pH conditions that alter snail decision-

making occur exclusively during low tides and periods of upwelling. In coming decades, as lower-pH conditions comprise an increasingly large fraction of a typical day, snails may exhibit a substantial reduction in their ability to avoid predation, with potential consequences not only for themselves but for the trophic web in which they are embedded.

GHG and Other Impacts from Direct Land Application of Un-Composted Green Waste. P.G. Green, X.Zhu and M.Burger, University California, Davis, CA.

The direct land application of un-composted green materials (commonly called green waste, GW) has been an increasing practice in California. We assessed emissions from this material, and compared the emissions between surface application and incorporation of green waste into soil, for volatile organic compounds (VOCs), greenhouse gas (GHGs) emissions, and effects on nutrient nitrogen, soil carbon, and sub-surface delivery of metals and pesticides.

In addition, controlled laboratory studies of the same green material were conducted to understand the mechanisms of green waste application on GHG production in different soils and under different soil moisture conditions. Furthermore, a variety of seven green materials (including the one used in the field and lab studies) from around the state were assessed for nutrient, bacteria, metal and pesticide content to put the current study into the broadest possible context. (The source used was generally in the range of materials statewide.)

VOCs and greenhouse gases N_2O and CO_2 were greatly reduced by soil incorporation compared to surface application. In addition, both GW surface and incorporated treatments led to increased nitrate leaching potential. No other impacts were observed to be of concern, though differences were seen with soil incorporation in a few cases.

Session 2: Risk Assessment I

***Human Health Relevance of Pharmaceutically Active Compounds in Drinking Water.** U. Khan, J. Nicell, McGill University, Department of Civil Engineering & Applied Mechanics, Montreal, Quebec, Canada.

In Canada, as many as 20 pharmaceutically active compounds (PhACs) have been detected in samples of treated drinking water. The presence of these PhACs in drinking water raises important questions as to the human health risk posed by their potential appearance in drinking water supplies and the extent to which they indicate that other PhACs are present but have not been detected using current analytical methods. Therefore, the goal of the current investigation was to conduct a screening-level assessment of the human health risks posed by the aquatic release of an evaluation set of 335 selected PhACs. Risk evaluations based on measurements could only be performed for 17 PhACs and, of these, all were found to pose a negligible risk to human health when considered individually. The same approach to risk evaluation, but based on predicted rather than measured environmental concentrations, suggested that 322 PhACs of the evaluation set, when considered individually, are expected to pose a negligible risk to human health due to their potential presence in drinking waters. However, the following 14 PhACs should be prioritized for further study: triiodothyronine, thyroxine, ramipril and its metabolite ramiprilat, candesartan, lisinopril, atorvastatin, lorazepam, fentanyl, atenolol, metformin, enalaprilat, morphine, and irbesartan.

Evaluating Potential Adverse Impacts from Chemicals in Consumer Products. C.L. Papagni, California Department of Toxic Substances Control, Chatsworth, CA.

The Department of Toxic Substance Control recently created the Safer Consumer Products (SCP) program, which has the unique ability to regulate specific consumer products based on their *potential* to expose people, wildlife, or plant organisms to specific hazardous chemicals and the *potential* for this exposure to contribute to or cause significant or widespread adverse human health or environmental impacts. The SCP Program announced its first three proposed Priority Products in 2014. While this program provides a great opportunity for addressing some of the product sources for contaminants in the environment, it also highlights the need for additional research areas within the environmental chemistry and toxicology realm, such as environmental occurrence and fate of emerging contaminants, long-term toxicology studies, and epidemiological studies. This talk will provide a case study with a summary of the adverse impact and exposure evaluation that supports the listing of specific flame retardants, TDCPP and TCEP, in children's foam padded sleeping products. A description of how toxicology studies and environmental exposure assessments were used to identify the potential for this Priority Product to cause significant and widespread adverse impacts will be presented. The talk will also highlight the research gaps discovered by DTSC during the process and how the SETAC community can help address these gaps for future Priority Product listings.

Regional Ecological Risk Assessment for Threatened and Endangered Species following Pesticide Applications. J.P. Sullivan, Ardea Consulting, Woodland, CA, B.E. Sample, Ecological Risk, Inc., Rancho Murieta, CA , S. Burkholder, Blankinship & Associates, Inc., Davis, CA, D.J. Bonnar, Blankinship & Associates, Inc., Davis, CA.

When conducting a regional risk assessment for pesticides with a focus on threatened and endangered species, the generic methods common to regulatory risk assessments are not adequate. These methods were developed for an assessment completed for a statewide pest control program in California USA. Rather than estimating risk for generic species with simple diets, methods are presented to evaluate risk for species with complex diets. Models developed by USEPA were capable of estimating the individual environmental concentrations necessary to assess exposure following pesticide applications. However, existing methodologies employed by USEPA did not allow complex diets be modeled, as necessary in this assessment. By linking the various existing Excel-based models together in a single Excel workbook, complex diets consisting of both terrestrial and aquatic food items could be modeled and a more detailed assessment performed.

Session 2: Risk Assessment II

Formidable Projects Made Manageable by Combining Risk Assessment Models in MS Excel. R.W. Beil, Blankinship & Associates, Inc., Davis, CA.

When faced with the task of producing large quantities of risk data for a wide variety of scenarios and receptors, the workload ahead can be daunting. Fortunately, the process of moving inputs and outputs from one model to another can be streamlined using the Microsoft Excel-based properties of many commonly used USEPA models. Using Excel, or a similar spreadsheet-based computer program, to link desired models and run calculations automatically can save time and produce accurate results. The Comprehensive Risk ANalysis Kalculator (CRANK), an MS Excel based tool developed by Blankinship & Associates, Inc., contains five (5) models and 107 worksheets and was used to estimate risk for 213 human risk assessment scenarios, including ten (10) human receptors, and 187 ecological risk assessment scenarios, including fifty-one (51) ecological receptors. A project, which at first seemed formidable, was made manageable by combining models and risk equations in Excel.

Generating, Storing, and Presenting Large Quantities of Risk Data – The CRANK/Dashboard Approach. D.J. Bonnar, Blankinship & Associates, Inc., Davis, CA.

Through connecting various USEPA and other Excel-based models in a single Excel workbook, the Comprehensive Risk Analysis Kalculator (CRANK) allows for rapid automation and generation of risk assessment data. These features may be further enhanced to manage large quantities of risk assessment data and scenarios through integration with Microsoft Access databases. These Access databases may be configured to serve as the reservoir for numerous risk assessment scenario inputs, to directly feed these inputs into the CRANK, and to receive, store, and display results from each individual CRANK run. In this presentation, the "Dashboard Database" is presented as an example of how Access databases may be integrated with mass model Excel workbooks to generate, store, and present vast quantities of risk assessment data.

Mitigation Strategies for Reducing Aquatic Toxicity from Organophosphate Pesticides in Cole Crops. J.L. Rego, B.S. Anderson, B.M. Phillips, J.P. Voorhees, C. Siegler, R.S. Tjeerdema, UC Davis, Marine Pollution Studies Laboratory, Monterey, CA, Michael Cahn, University of California Cooperative Extension, Salinas, CA, Rob Budd, Kean Goh, California Department of Pesticide Regulation, Sacramento, CA.

Cole crop runoff containing high loads of the organophosphate pesticide chlorpyrifos has led to impaired water body listings and Total Maximum Daily Loads in central coast watersheds. Chlorpyrifos has been targeted for regulation by the Central Coast Regional Water Quality Control Board. The California Department of Pesticide Regulation and UC Davis have completed a two-year study of treatments designed to reduce chlorpyrifos in agriculture runoff. Year 1 trials evaluated three different ditch installation treatments individually: compost filters, granulated activated carbon filters, and native grasses in a vegetated ditch. Treatments were compared to bare ditch controls. Carbon filters and vegetation provided the greatest reduction of chlorpyrifos concentrations (96% and 82%, respectively). Year 2 trials evaluated an integrated approach combining all three treatments. Three trials were conducted at 50 gallons per minute (GPM) and three at 100 GPM. Chlorpyrifos concentrations were reduced by an average of 97% at 50 GPM and 89% at 100 GPM. Final chlorpyrifos concentrations ranged from non-detect (<50 ng/L) to 82 ng/L. Toxicity to *Ceriodaphnia dubia* was eliminated in three of the six integrated trials. Future work includes investigating the total adsorption capacity of granulated activated carbon, costs associated with carbon disposal, and expanding treatment capacity to include the more water-soluble neonicotinoids.

Session 3: Ecotoxicity of Contaminants I

***Adapting the SPEAR Pesticide Stream Bioassessment Index for Use in California**. L. Hunt, University of California, Berkeley, CA, M. Liess, Helmholtz Centre for Environmental Research, Liepzig, Germany, K. Foit, Helmholtz Centre for Environmental Research, Liepzig, Germany, R. Mazor, Southern California Coastal Water Research Project, Costa Mesa, CA, V.H. Resh, University of California, Berkeley, CA.

The Species at Risk (SPEAR) pesticide index is a trait-based stream bioassessment index developed in Europe that links pesticide concentrations to changes in stream invertebrate communities. Strong correlations between SPEAR values and maximum pesticide toxic unit (TU) values for *Daphnia magna* in water have been found in previous studies ($0.61 < r2 < 0.89$). We are modifying the index for use in California, and testing it using pyrethroid and bioassessment data collected by the Surface Water Ambient

Monitoring Program and by the Stormwater Monitoring Coalition of southern CA. With only slight modifications to the existing SPEAR method, we found a correlation between pyrethroid TUs for *Hyalella azteca* in sediment (n=77, r^2=0.35), but no correlation between pyrethroid TU values for *Daphnia magna* in water even though the sample size was much larger (n=464). The next steps include: (1) updating the pesticide sensitivity values for CA taxa based on most the recent ecotoxicological data available; (2) modifying other trait values for CA taxa, focusing on generation times which are generally shorter in CA than in Europe; and (3) conducting a multiple regression analysis to account for other variables such as habitat quality and site characteristics.

***Shampoo Constituent Effects on Heat Tolerance of the Pacific Oyster*, Crassostrea gigas*.** D. Ma, UC Davis Undergraduate, Davis, CA

Pacific oysters, *Crassostrea gigas*, were used in this experiment to study thermal tolerance effects that shampoo constituents have on oysters. The focus of this study was to see if certain chemicals in shampoo reduce thermal tolerance and induce hsp70 expression in oysters. The two chemicals selected for this study were sodium dodecyl sulfate (SDS) and propylene glycol (PG). Oysters were exposed to 0, 0.5, 2.5 and 8ppm of SDS and PG, and then exposed to 37 ˚C (to induce thermal tolerance) and 43.5 ˚C (to elicit lethality) for one hour each, followed by a 24-hour recovery. Ponceau stains and Western blots were used to analyze and determine heat shock protein 70 (hsp70) expression in gills. As a result, this study found that SDS and PG alone at low concentrations were not toxic. However, SDS and PG were able to induce hsp70. And lethality only occurred when both chemical stress and heat stress were present.

***Hormonal Stress Response of the Chronically Lead-exposed California Condor (*Gymnogyps californianus*).** Z.E. Kuspa, D.R. Smith, M.E. Finkelstein, UC Santa Cruz, CA

Elevated stress can reduce avian reproduction and survival, and lead exposure has been shown to impair the avian stress response. California condors are critically endangered and chronically lead poisoned. Nonetheless, effects of lead on the condor stress response are unknown. Quantifying a stress response via blood hormone sampling in wild birds is problematic, but measuring stress hormones in fecal and feather samples is a promising, non-invasive approach for measuring a stress response and determining contaminant-induced effects. As the stress hormone response and hormone metabolism can differ widely among species, hormone measurement methods should be validated on a species-by-species basis. Here I report development and validation of methods to assess condor-specific stress hormone responses and metabolism, including metabolite stability, using ELISA, RIA, and LC-MS methods. Preliminary results from condor urate and feather analyses show circulating stress hormones are elevated after a defined stress event (i.e. trapping and handling). Additionally ELISA appears to be more susceptible to sample matrix interferences than the RIA, resulting in artificially high hormone measurements. We will build on these findings to investigate lead-induced alterations in the condor stress response and potential impacts to California condor recovery in this chronically lead poisoned population.

Session 3: Ecotoxicity of Contaminants II

Defining the Neurotoxic Potential of Polychlorinated Biphenyl Concentrations Present in Fish from US Lakes. E. Holland-Fritsch and I.N. Pessah, Department of Molecular Biosciences, School of Veterinary Medicine, University of California Davis

Coplanar polychlorinated biphenyls (PCBs) are termed dioxin-like due to their aryl-hydrocarbon receptor (AhR) mediated toxicity similar to the dioxin TCDD. For risk assessment, individual PCBs are assigned

a TCDD equivalency factor (TEF) based on their AhR activity relative to TCDD. Once corrected by congener concentrations present in a mixture TEF values are summed to develop a TCDD equivalent (TEQ) to estimate exposure risks for human or wildlife populations. Non-coplanar PCBs, termed non-dioxin-like (NDL) due to little to no activity at the AhR, constitute greater than 50% of PCB burdens in environmental and organismal samples but are considered non-toxic contributors to PCB mixtures under the current TEQ scheme. A neurotoxic relative potency scheme has been developed for PCBs based in large part on the enhancing activity of NDL-PCBs towards the ryanodine receptor (RyR). The RyR is a calcium channel essential for numerous physiological and pathophysiological processes in the central and peripheral nervous system and its perturbation by NDL-PCBs is associated with neurodevelopmental toxicity and cognitive and behavior deficits in *in vitro* and *in vivo* assays.
We tested the predictability of the quantitative structure activity used to create the RyR based scheme. We have identified PCB202 as the most potent RyR-active NDL PCB, which supports the predictive QSAR model and supports the use of the accuracy of the NEQ scheme. Applying NEQs to environmentally relevant PCB concentrations, we show that greater than 8% of US lakes have fish containing significant PCB neurotoxic equivalents. Together this work suggests that a neurotoxic scheme combined with the established TEQ would likely provide a more inclusive measure of risk presented by environmental PCB mixtures in aquatic systems.

***The Impacts of Polystyrene Plastic and Polycyclic Aromatic Hydrocarbons (PAHs) on the Development of Zebrafish (*Danio rerio*).** R. Lam, Bodega Marine Laboratory, University of California, Davis, Bodega Bay, CA, G.N. Cherr, Bodega Marine Laboratory, University of California, Davis, Bodega Bay, CA, E. Fairbairn, Bodega Marine Laboratory, University of California, Davis, Bodega Bay, CA.

Polystyrene plastic has contributed to the emerging issue of marine debris, and is proving itself to be persistent, ubiquitous and associated with hazardous chemicals. As such, it is acknowledged that plastics pose a threat to wildlife via several mechanisms, one of which includes its susceptibility to the accumulation of contaminants from ambient seawater. However, not much has been researched in regards to its impacts on organismal development. In this study, the model organism, *Danio rerio*, was used to observe physical interactinos and explore the potential toxicity of polystyrene plastics. To observe how plastics interacted with zebrafish embryos, fluorescently labeled polystyrene beads were used. Furthermore, amplified toxicity of polystyrene plastics with sorbed PAHs was tested by spiking phenanthrene to polystyrene beads. Adsorbed beads were then used in conducting a dose-response acute exposure study. Results showed that polystyrene plastic adhered to zebrafish chorion readily, and phenanthrene sorbed beads did not show similar results in toxicity as dissolved phenanthrene. By testing impacts of plastics, environmental implications can be assessed as debris increases and accumulates in aquatic systems. Studying plastic interactions and impacts with organisms, especially in highly sensitive developmental stages, can shed light on wildlife populations and aquatic health threated by anthropogenic stress.

***Aquatic Copper-Oxide Nanoparticle Exposure May Target Osmoregulatory Plasticity of Fish from Salinity Variable Environments.** J.T. Miller, G. Cherr, and A. Whitehead. University of California-Davis, Department of Environmental Toxicology.

Coastal organisms may experience extreme variation in salinity that is influenced by tidal cycles and weather events. A hypo-osmotic salinity challenge (32ppt transfer 0.1 ppt) of killifish *Fundulus heteroclitus* results in alterations to gill morphology and the expression of molecular pathways responsible for returning to plasma ion homeostasis (salinity acclimation). Sub-lethal exposure to copper oxide nano particles (CuO NPs) in aqueous environments may result in the disruption of the same molecular response mechanisms that are important for osmoregulation in salinity acclimation, such as Na+/K+-ATPase. In addition to molecular responses, CuO NP exposure may impact the effective

morphological freshwater transformation of gill tissue due gill injury, inflammation, and mitochondrial mediated apoptosis. Previous studies have indicated concerning interactions of salinity on nano-particulate toxicity and stress. However, it remains unclear if exposure actually impairs the ability of fish to acclimate to an extreme salinity challenge. We will compare osmoregulatory capacity by measuring plasma osmolality and ion concentrations (Cl- and Na+) following a hypo-osmotic salinity challenge. To further understand the mechanism of impairment, we will compare transcription-profiles and histological responses of gills across time and concentrations of CuO NPs. Osmoregulatory function is an extremely important trait for killifish to occupy salinity variable costal environments. If sub-lethal exposure reduces salinity tolerance ranges for killifish, nano-particulate contamination may have unforeseen consequences for coastal ecosystems.

Poster Presentation Abstracts

(by Poster Number)

Please note: Abstract titles preceded by an "*" indicate posters by student presenters. Please remember to fill out an evaluation if you view this presentation.

1. ***Assessing the Effect of Drywell Aided Stormwater Infiltration on Groundwater Quality.** E. Edwards, University of California, Davis, CA, B. Washburn, OEHHA, Sacramento, CA, T. Harter, University of California, Davis, G. Fogg, University of California, Davis, H. Hamad, OEHHA, Ary Ashor, OEHHA, C. Nelson, City of Elk Grove, CA.

Drywells are gravity-fed, excavated pits with perforated casings used to facilitate stormwater infiltration and groundwater recharge in areas comprised of low permeability soils or cover. Stormwater runoff that would otherwise be routed to streams or drains in urban areas is used as a source of aquifer recharge. However, the potential groundwater contamination caused by runoff bypassing surface soil filtration has prevented widespread use of drywells as a recharge mechanism. There is considerable drywell literature indicating that infiltrating contaminants are adequately attenuated in the vadose zone, leaving groundwater quality uncompromised. A study is currently underway in Elk Grove, CA, where two drywells have been constructed: one in a preexisting drainage basin fed by residential lots, and one at an industrial site. Both sites are outfitted with four monitoring wells each: one upgradient and two downgradient water table wells, and one vadose zone well. Results of water quality sampling will determine contaminants of interest, and a model of the fate and transport of these contaminants in the vadose zone will be coupled with hydraulic models to estimate the response of the hydrogeologic system to drywell recharge, with the goal of creating a tool that can be used to evaluate other drywell locations.

2. **WITHDRAWN**

3. **A Comparative Evaluation of Seven Hazard Screening Tools.** J.M. Panko, Cardno Chemrisk, Pittsburgh, PA, K. Hitchcock, Cardno Chemrisk, Pittsburgh, PA, M. Fung, Cardno Chemrisk, San Francisco, CA, P.J. Spencer, The Dow Chemical Company, Midland, MI, R. Zaleski, ExxonMobil Biomedical Sciences, Inc., Annandale, NJ, T. Kingsbury, TKingsbury Consulting, San Ramon, CA, K.O. Goyak, ExxonMobil Biomedical Sciences, Inc., Annandale, NJ.

An increasing number of hazard assessment tools are being used in the marketplace as a means to differentiate or certify 'greener' chemicals and products. To date, no data exist to demonstrate a tool's ability to provide consistent, reliable screening level assessments to inform selection of a 'greener' product. A small pilot was conducted to evaluate several influential hazard screening tools (Design for the Environment/GreenScreen, GreenSuite, GreenWERCS Walmart model, GreenWERCS GreenScreen List Translator, GreenWERCS Green Screen Full Assessment, GreenWERCS ChemRisk model, SciVera Lens Chemical Safety Assessment). The pilot investigated each tool's ability to discriminate among toxicity profiles of seven chemicals with a range of toxicological activity (caffeine, citric acid, ethylene glycol, dibutyl phthalate, benziosthiaxolinone, 1,2,5,6,9,10-hexabromocyclo-dodecane) and determined if there was concordance in outputs between the tools. Results indicated that there was not complete concordance between tool outputs. Some outputs for the same chemical ranged widely, from 'safer' to 'avoid', depending on the tool utilized. We found that the differing outputs from the tools were primarily driven by built-in value judgments regarding endpoints considered, weighting preferences, and sources of information. Our evaluation highlights the importance of understanding influential drivers within chemical assessment tools, and suggests areas that may benefit from enhancements.

4. ***A Novel Approach to Contaminant-Related Health Assessment in Marine Mammals.** M.L.Trego, Southwest Fisheries Science Center, La Jolla, California, San Diego State University, San Diego, CA & University of California, Davis, Davis, CA, E. Hoh, San Diego State University, San Diego, CA, N.G. Dodder, Southern California Coastal Water Research Project, Costa Mesa, CA, K.N. Catelani, C.D. Allen, N.M. Kellar, Southwest Fisheries Science Center, La Jolla, California, A. Whitehead, University of California, Davis, Davis, CA, R.L. Lewison, San Diego State University, San Diego, CA.

Environmental pollutants in marine mammals have been correlated with changes in endocrine hormones commonly associated with reproductive health and stress response. Despite many studies correlating serum hormone levels with contaminant concentrations, existing research has been unable to link exposure to changes in endocrine biomarkers in situ. These studies typically target up to a few known toxic chemicals without examining uncharacterized, potentially toxic contaminants of emerging concern (CECs). As such, standard techniques preclude the early detection of CECs before they pose a significant health risk. An innovative technique using two-dimensional gas chromatography coupled to time-of-flight mass spectrometry enables the detection of contaminants with a non-targeted analytical approach. Additionally, quantification of blubber hormones has the ability to assess endocrine health in wild marine mammals. We integrated these two molecular methods for the first time to validate the use of this approach for contaminant risk-assessment in marine mammals. We are currently identifying a range of contaminants in the blubber of bycaught male short-beaked common dolphins (Delphinus delphis) from the Southern California Bight. The analytical results will then be compared with blubber cortisol and testosterone concentrations. This novel approach to health assessment will allow for the assessment of emerging CECs in wild marine mammals.

5. **Comparison of Pesticide Concentrations in Native Bee Tissue by Gas Chromatography-Mass Spectrometry and Triple Quadrupole Mass Spectrometry.** M.M. McWayne US Geological Survey CA Water Science Center Sacramento, CA, M.L. Hladik, US Geological Survey CA Water Science Center Sacramento, CA.

The combination of gas chromatography with triple quadrupole mass spectrometry (GC-MS/MS) for determination of pesticide concentrations in environmental tissue samples is useful due to the ability to achieve lower detection limits, than a single quadrupole (GC-MS), in complex matrices such as tissue. Many pesticides, such as pyrethroid insecticides, are highly toxic to invertebrates including beneficial insects such as native bees. In this study, composite native bee samples were collected from varying land use areas (rangeland and cropland) in northeastern Colorado and analyzed for over 100 current-use pesticides. Extracts were analyzed by GC-MS and GC-MS/MS. While instrument sensitivity for calibration standards is not much greater (less than one order of magnitude) using GC-MS/MS versus GC-MS, the decreased background levels in dirty matrices (such as bee tissue) allow the GC-MS/MS to quantify lower concentrations in environmental samples (method detection levels were ~ 0.1 to 0.5 ng/bee). The reduced background was especially advantageous by increasing the sensitivity of the instrument for late eluting compounds, such as pyrethroid insecticides (bifenthrin) and strobilurin fungicides (pyraclostrobin).

6. **Changing Patterns in Pesticide-Associated Toxicity in Surface Water**. B.M. Phillips, B.S. Anderson, J.P. Voorhees, R.S. Tjeerdema, University of California Davis, Monterey, CA, X. Deng, K. Goh, California Department of Pesticide Regulation, Sacramento, CA, K. Worcester, Central Coast Regional Water Quality Control Board, San Luis Obispo, CA, J. Geraci, Colorado River Regional Water Quality Control Board, Riverside, CA.

As pesticide use patterns change in California, monitoring needs to evolve to accurately characterize risk to receiving waters. Current surface water monitoring programs often emphasize use of U.S. EPA standardized toxicity testing protocols. These include use of *Ceriodaphnia dubia*, *Pimephales promelas* and *Selenastrum capricornutum*, which are the primary chronic test species used in effluent monitoring (referred to as EPA three-species testing). While these species are sensitive to some constituents, they are less sensitive than alternate species to many current use pesticides and pesticides of emerging concern. The amphipod *Hyalella azteca* is more sensitive to pyrethroid pesticides, and the midge *Chironomus dilutus* is more sensitive to phenylpyrazoles (e.g., fipronil) and neonicotinoids (e.g., imidacloprid). This paper presents results of recent collaborative monitoring conducted on the Central Coast demonstrating that the majority of water samples were toxic to either *H. azteca* or *C. dilutus*. Samples from these sites were not toxic in EPA three species tests. Pesticides measured in these samples were dominated by mixtures of pyrethroids and neonicotinoids. Additional examples from agriculture and urban watersheds will also be presented. The results suggest that surface water monitoring programs should evolve to consider changing use of pesticides to better reflect the potential for impacts on receiving systems.

7. ***Retail Store Survey of Direct to Consumer Indoor Pesticide Products,** R.R.Vander Werf, Department of Pesticide Regulation, A. Aldana, MLJ-LLC, Sacramento California, J. Teerlink, Department of Pesticide Regulation, R.L. Budd, Department of Pesticide Regulation.

The California Department of Pesticide Regulation, Surface Water Protection Program (SWPP) staff conducted a store survey to provide a snapshot accounting of pesticides currently available to the general public for indoor use. Unlike pesticide use by professional applicators, pesticide use by residential users is not reported or tracked. A store survey of available pesticide products for indoor use and associated active ingredients (AIs) was completed in ten retail stores. There were 62 AIs identified through the store survey and 194 products. Based on number of products and associated aquatic toxicity 28 of the 62 AIs are prioritized for developing and validating analytical methods in a wastewater matrix for future monitoring efforts.

8. ***Toxicity Responses of Killifish Embryos Exposed to Saturated, Aromatic, and Polar Fractions of Louisiana Sweet Crude Oil.** R. Struch, University of California Davis, Davis, CA, B. Clark, US EPA Atlantic Ecology Division, Narragansett, RI, R. Ricker, NOAA Office of Response and Restoration, Santa Rosa, CA, C. Aeppli, Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, A. Bertrand, US EPA Atlantic Ecology Division, Narragansett, RI, I. Kirby, US EPA Atlantic Ecology Division, Narragansett, RI, D. Champlin, US EPA Atlantic Ecology Division, Narragansett, RI, D. Nacci, US EPA Atlantic Ecology Division, Narragansett, RI, A. Whitehead, University of California Davis, Davis, CA.

Most oil spill damage assessments focus on the presence of polycyclic aromatic hydrocarbons (PAHs) because they have traditionally been linked to toxicity; however, oxyhydrocarbons and other organic constituents are prominent in crude oils, especially weathered oils. These compounds also persist in the environment, but their toxicity is not well understood. We are analyzing developmental and transcriptomic responses of killifish (*Fundulus heteroclitus*) embryos exposed to whole and fractionated Louisiana sweet crude (LSC) to discover how polarity and functional groups affect oil toxicity. High-energy water-accommodated fractions (HEWAFs) were prepared for animal exposures using whole LSC

and 3 LSC fractions: saturated, aromatic, and polar. Embryos were exposed to daily HEWAF renewals for 6 days post-fertilization and assessed for heart rate, *in ovo* ethoxyresorufin-O-deethylase (EROD) activity, developmental abnormalities, hatching, and survival. Early-to-mid-development embryos were also archived for RNA-seq. HEWAFs produced similar sublethal toxic effects, despite being made with differing amounts of LSC by weight. This result suggests fraction potencies may vary widely, though the bioavailability of compound classes in HEWAFs is not yet known. Ongoing transcriptomic analyses will support mechanistic interpretations that help explain how oil damages living resources and post-video analysis of heart rates may reveal subtle, but potentially important, differences between fractions.

9. ***Cadmium, Malathion and Phenanthrene: The Toxicity to *Chironomus sancticaroli* (Insecta: Diptera: Chironomidae).** D. Rebechi, Federal University of Paraná, Curitiba, Paraná, Brazil, M. Vicentini, Federal University of Paraná, Curitiba, Paraná, Brazil, M. A. Navarro-Silva, Federal University of Paraná, Curitiba, Paraná, Brazil.

Metals, insecticides and polycyclic aromatic hydrocarbons (PAH) are pollutants commonly found in aquatic environments, however little is known about their effects when applied in mixtures. Therefore, the aim of this study was to evaluate the effects of acute exposure of the midge *Chironomus sancticaroli* to the metal cadmium, the insecticide malathion and the PAH phenanthrene, individually and in mixtures. Based on previously determined LC_{25}, LC_{50} values and relevant environmental concentration, three acute bioassays (48h) were conducted for each pollutant and their mixtures as following: cadmium (0.001, 3.2, 7.4 mg L^{-1}); malathion (0.0001, 0.0564, 0.1006 mg L^{-1}) and phenanthrene (0.0025, 1.25, 2.44 mg L^{-1}). The results of the individual exposures demonstrated that malathion is the most toxic compound to *C. sancticaroli* of the three chemicals tested, followed by cadmium and phenanthrene. In the mixture exposures, 53% of mortality was observed in exposures to cadmium x malathion and cadmium x malathion x phenanthrene. This study showed that the mixtures of cadmium, malathion, and phenanthrene were more toxic to *C. sancticaroli* and pollutants with different mode of actions enhance toxic effects on the aquatic biota.

10. **The Effect of Soil Type on the Partitioning of Fungicides and Neonicotinoid Insecticides Used in Seed Treatments.** C. J. Sanders, US Geological Survey CA Water Science Center, Sacramento, CA, M.L. Hladik, US Geological Survey CA Water Science Center, Sacramento, CA, K.L. Smalling, US Geological Survey NJ Water Science Center, Lawrenceville, NJ.

The push towards precision agriculture has led to an increase in the use of pesticide-treated seeds. However, fungicide and neonicotinoid insecticide compounds used in seed treatments may pose a risk of leaching to the underlying groundwater and nearby surface water, due to irrigation and/or precipitation. Additionally, these compounds may sorb to organic carbon present in soil, leading to increased retention time near the application site. To more closely examine the fate of these compounds with regards to water/soil partitioning and the factors that influence it, experiments were conducted using two types of treated seeds (corn and soy) and three types of soil with varying characteristics. The more hydrophilic compounds (e.g., neonicotinoids) remained mostly in the water phase; the fungicides with higher partition coefficients (Log K_{ow} values range from 1.7-4.1 for the fungicides, and < 1 for the neonicotinoids) sorbed more to the soil, and the degree of sorption varied with the percent organic carbon content. This suggests that the amount of organic carbon present is a major driving factor for the sorption of these seed treatment compounds to the soil.

11. **Species Traits as Determinants of Metal Exposure and Uptake in Stream Invertebrates**. T.M. Short, USGS, Menlo Park, CA, M.I. Hornberger, USGS, Menlo Park, CA.

Relations between whole-body metal concentrations and species traits were examined for 40 invertebrate taxa collected over a 200 km segment of a mining-impacted river to determine 1) the extent to which trait-

based characteristics accounted for species-specific differences in metal exposure and uptake, and 2) which traits were most effective in identifying exposure pathways and predicting uptake potential. Traits related to developmental strategies (e.g., generations per year) and habitat use (e.g., fluvial and substrate preferences) generally were poor predictors of metal bioaccumulation. In contrast, metal uptake was positively related to traits characterizing chemical and physical stressor tolerances. Comparison of feeding trait affinities and metal bioaccumulation patterns showed that feeding behavior was the strongest predictor of metal uptake among the traits examined. Metal concentrations increased in taxa relying on filtering (feeding on suspended POM) or gathering (feeding on deposited POM) as part (>40%) of their food acquisition strategy. In contrast, concentrations decreased as predation assumed a greater proportion of overall feeding activity. Application of trait characteristics as predictive tools may help identify taxa that may be at greatest risk in metal-disturbed environments and, accordingly, the most sensitive indicators of ecosystem recovery following remediation.

12. **Prevalence of Cyanotoxin Microcystin-LR in California Freshwater Sediments: Initial Findings From the Stream Pollution Trends (SPoT) Program.** K. Siegler, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, E. Stanfield, California State University, Monterey Bay, Monterey, CA, B. Phillips, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, B. Anderson, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, J. Voorhees, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, S. Blanco, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, J. Rego, UC Davis, Dept. of Environmental Toxicology, Monterey, CA, R. Tjeerdema, UC Davis, Dept. of Environmental Toxicology, Davis, CA, Richard Breuer, California State Water Resources Control Board, Sacramento, CA.

Harmful algal blooms are a growing problem in California. Under certain conditions, cyanobacteria such as *Microcystis* release toxins which can affect diverse taxa, including invertebrates, fish, birds and mammals. Microcystin is a hepatotoxin and recent studies have linked it to sea otter deaths on the Central Coast. Algal toxins can also impact drinking water systems. The Stream Pollution Trends (SPoT) Monitoring Program, in collaboration with California State University Monterey Bay (CSUMB), has identified microcystin-LR presence in sediments monitored statewide using modified extraction methods developed by Chen et al. (2006) and quantified using ELISA. A pilot study with method development began in 2013. In 2014, microcystin-LR was detected at 31% (n= 108) of the sites. In both 2013 and 2014, four of the monitoring sites were sampled four times over the course of a year to evaluate temporal trends. In 2014, ten sites were analyzed in an inter-lab method validation study, using LC-MS. These data will be presented. There is currently no statewide monitoring plan for cyanotoxins, and to date, monitoring in California has focused on water samples. By evaluating sediments at the base of major watersheds throughout the state, SPoT provides a baseline assessment for microcystin-LR prevalence and occurrence statewide.

13. **Risk Assessments at Closed Small Arms Shooting Ranges Need to Consider Total Lead in Soil and Lead Bullet/Shot Sources**. J.L. Spearow, Department of Toxic Substances Control, Cal EPA, Sacramento, CA, C.L. Tsao, California Department of Fish and Wildlife, Sacramento, CA.

Lead bullets/shot [munitions debris (MD)] account for most lead remaining at shooting ranges which continue to weather to more soluble lead compounds (Rooney, 2007). Complete release of lead from one .30 cal bullet containing ≥8000 mg lead, would bring >100 kg soil to the 80 mg/kg lead screening level for residential use. However, conventional grab sampling and analysis of 1gram soil samples with Method 3050B/6010B would likely miss the MD and underestimate total lead in 99.9% samples, which is not sufficient to assess future use. We developed an approach enabling a metal detector to rapidly screen the top 6" of soil for density of lead MD to estimate lead MD and total lead. Screening rifle/pistol ranges with a suitable metal detector easily identified many locations with high density of lead bullets and >10,000 mg/kg total lead missed by sampling using XRF. Our approach involves screening shooting

ranges for lead MD with a metal detector, collecting large samples where ammunition is most concentrated, and sieving to recover and quantitate lead gravimetrically. Lead should also be measured in fine sieved soil using XRF/3050B/6010B. Cleanup decisions regarding future use should be made on total lead in combined lead MD and fine soil.

14. **Characterizing Indoor Pesticide Use Patterns and Mass Loading in a Wastewater Catchment.** J. Teerlink, R.L. Budd, A. DaSilva, Y. Luo, D. Wang, Y. Xie, California Department of Pesticide Regulation.

The California Department of Pesticide Regulation, Surface Water Protection Program (SWPP) is investigating the use patterns and mass loading from indoor pesticide products to a typical wastewater sewershed. Pesticide concentrations of fipronil and pyrethroids have been reported in treated wastewater effluent at concentrations that exceed EPA Aquatic Life Benchmarks, posing potential risks to the surface waters to which they discharge. A source identification sampling study is being designed to better understand the relative mass contribution from residential, industrial, commercial, and institutional indoor pesticide use. Sampling will consist of twelve sampling sites within a sewershed catchment and paired weekday/weekend sampling events in spring, summer, and fall (6 events total). All samples will be taken as 24-hour flow weighted composites to allow for mass loading calculations. Resultant data will be used in conjunction with modeling efforts to better understand indoor pesticide products and uses that may require mitigation.

15. **Long-Term Ambient Air Monitoring For Pesticides in Multiple California Communities: Results for Sampling Years 2011, 2012, and 2013.** A. Tuli, Department of Pesticide Regulation, Sacramento, CA, E. Vidrio, Department of Pesticide Regulation, Sacramento, CA, P. Wofford, Department of Pesticide Regulation, Sacramento, CA, R. Segawa, Department of Pesticide regulation, Sacramento, CA.

Department of Pesticide Regulation (DPR) recently implemented a statewide air monitoring network for measuring pesticides in air from various rural agricultural communities. Among 226 candidate communities in California, DPR selected three communities with high pesticide use: Ripon (San Joaquin County), Salinas (Monterey County), and Shafter (Kern County). A total of 33 pesticides and 5 breakdown products were monitored since February 1, 2011using specific air sampling equipment. Airchek HV30 pumps, SKC Inc® personal sample pumps and SilcoCan® canisters were operated for randomly assigned 24 h air collection period every week at each sampling location. The objective of the study is to develop an overview of monitoring results for identified pesticides in air and their seasonal, annual and multiple year concentration trends between 2011 and 2013. The results document low air concentrations for the pesticides in communities monitored. The hazard index (the sum of the ratios of air concentration for a pesticide to a reference screening level for that same pesticide) for organophosphates was less than one for all exposure periods, indicating a low risk from cumulative exposure. While the acute hazard index was higher for all three communities, in comparison to the subchronic and chronic hazard index, Shafter had a higher hazard index than Salinas and Ripon for all exposure periods.

16. ***Developmental Plasticity Induced by Ethinylestradiol in the Self-fertilizing Mangrove Rivulus.** A-S. Voisin, University of Namur, Belgium, R.L. Earley, University of Alabama, Tuscaloosa, AL, F. Silvestre, University of Namur, Belgium.

Phenotypic plasticity is increasingly emphasized as an important processus for population survival when facing rapid environmental changes. However, still little is known about the molecular mechanisms mediating plasticity. The mangrove rivulus, *Kryptolebias marmoratus*, is one of the two known self-fertilizing hermaphroditic vertebrates. Despite no or low genetic diversity within a strain, this fish displays remarkable levels of plasticity. This study investigates developmental plasticity of the cellular (proteome) and organismal phenotypes induced by 17-α-ethinylestradiol (EE2). Rivulus were exposed

during 28 days post hatching (dph) to control, 4 and 120 ng/L of EE2, then reared in clean water until 168 dph. Exposed fish showed a reduced growth at 28 dph, and were able to recover when raised in clean water. There was no difference in hormone levels at 28 dph while 120 ng/L exposed fish showed higher levels of testosterone and 11- ketotestosterone at 91 and 168 dph. There was no effect on survival, nor on reproductive success. These results indicate that an early-life exposure to EE2 can have delayed effects on the endocrine status of adults but specific mechanisms allow rivulus to maintain reproduction. The molecular mechanisms of EE2-induced plasticity are now being investigated at the cellular level in gonads, brain and liver of 168 dph adults by quantitative proteomics.

17. **Trend Analysis on Chlorpyrifos Concentration in Surface Water of Central Valley, California.** D. Wang, N. Singhasemanon, and K.S., Goh, California Department of Pesticide Regulation, Sacramento, California.

The California Department of Pesticide Regulation placed agricultural use of chlorpyrifos in reevaluation in 2004 because monitoring data revealed that chlorpyrifos concentrations in Central Valley water bodies frequently exceeded water quality criteria. In support of the reevaluation, this study evaluated chlorpyrifos concentrations in surface water samples that were collected by Central Valley Water Quality Coalitions from 2004-2013. The use of conventional trend analysis methods is not ideal for this dataset since concentrations of a large portion of the samples are below the analytical method's detection limit or reporting limit (i.e., censored data). The Nondetects And Data Analysis for environmental data (NADA) package designed specifically for censored data was used in this study. Our analysis identified a downward trend for this pesticide's annual application rate since 2005 and for its exceedance rate since 2008. We also observed a continuous downward trend in this pesticide's concentration level from 2010-2013. In addition, this study revealed that concentration levels and exceedance rates of chlorpyrifos appear to be influenced by application rates and winter storm events.

18. **Methodology for Screening Pesticide Products with High Exposure Potentials to Marine/Estuarine Organisms.** Y. Xie, Y. Luo, N. Singhasemanon, and K.S. Goh, California Department of Pesticide Regulation, Sacramento, CA.

Determination of toxicity endpoint is a critical aspect in characterizing the risk of pesticide product use on sensitive aquatic species. The use of some active ingredients (AIs) in California may merely pose adverse aquatic risks to freshwater species, while the use of other AIs, in contrast, may pose risks to both marine/estuarine and freshwater species. This study develops a methodology to discern pesticide products that may enter the marine/estuarine environment as well as the freshwater environment from those that may rarely enter the marine/estuarine environment. The screening method is composed of two components – use patterns of a pesticide product and chemical properties of the pesticide AI. Use pattern analysis identifies pesticide products with proposed use patterns that are significant in coastal areas and associated with high likelihood of releasing AIs to surface water (i.e., high risk use patterns). Chemical property analysis identifies pesticide products with high potentials to be transported from more remote, non-coastal regions (e.g., the Central Valley) to California's estuarine and marine environments. Products associated with high risk use patterns or high transport potentials are considered to have high potentials to enter the marine/estuarine environment and should be evaluated with the toxicity to both freshwater and marine/estuarine species.

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