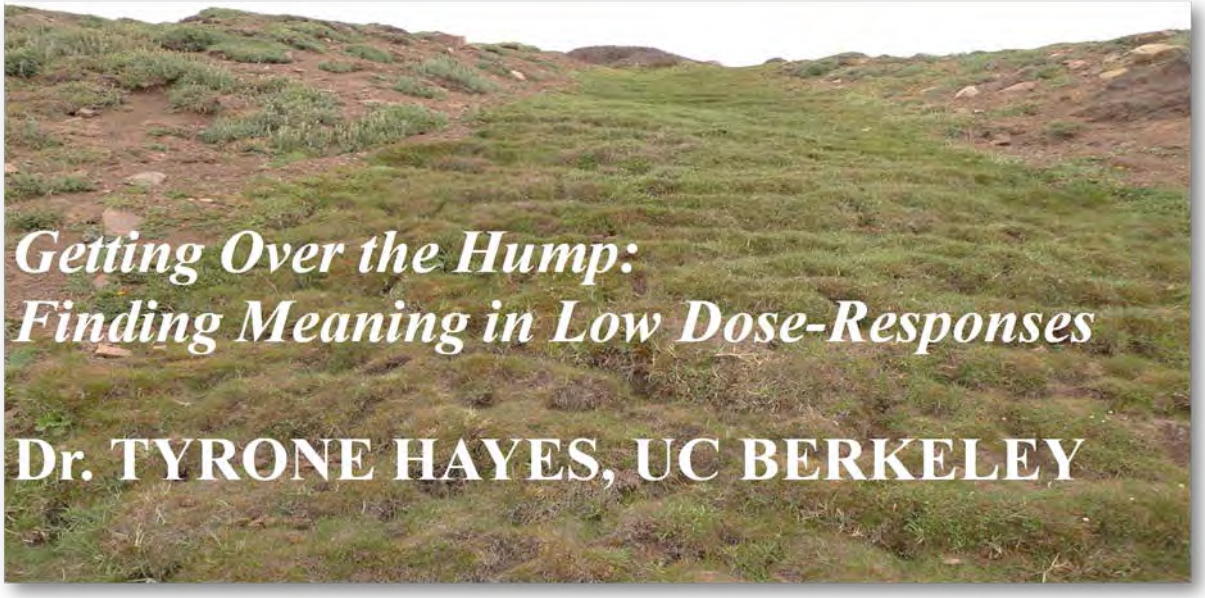
23rd Annual Meeting of the Northern California Regional Chapter of the

Society of
Environmental
Toxicology
And
Chemistry



May 8-9, 2013
CalEPA Building, 1001 I St.
Sacramento, CA

Northern California Regional Chapter
Society of Environmental Toxicology and Chemistry
2451 Estand Way, Pleasant Hill, CA 94523
Tel: (866) 251-5169 x1108
Email: norcalsetac@onebox.com; http://www.norcalsetac.org

Your 2013 NorCal SETAC Board of Directors

2012-13 SUSTAINING MEMBERS

Our gratitude and appreciation go out to the following organizations for their continued support of NorCal SETAC activities and missions.

Thank You!

AQUA Science

ARCADIS

Block Environmental Services

CEL Analytical, Inc.

Central Contra Costa Sanitation District

CH2M HILL

Ecological Risk, Inc.

Environmental Resources Management

International Zinc Association

Pacific EcoRisk

San Francisco Estuary Institute

Sierra Foothill Laboratory

Tetra Tech, Inc.

SCHEDULE

23nd Annual Meeting of the Northern California Regional Chapter of the Society of Environmental Toxicology and Chemistry

May 8-9, 2013
Cal-EPA Building
1001 I Street, Sacramento, CA

Wednesday, May 8, 2013
Day One – Short Courses

Time	Description	Instructor	Location: Room
8:00-8:30	Registration	--	Mezzanine
8:30-12:00	Use of Incremental Sampling for Improved Site Investigation and Remedial Decisions - Module 1 of 2	Jason Brodersen, PG, QSD, Tetra Tech, Inc., and Sara Woolley, Tetra Tech, Inc.	Klamath River Room
9:00-12:30	Biological Objectives: An introduction to California's new tools for measuring the ecological integrity of perennial streams	Dr. Peter Ode, Director of the Department of Fish and Wildlife's Water Pollution Control Laboratory	Sierra Hearing Room
12:00-13:00	Lunch Break Registration	-- --	On Your Own Mezzanine
13:00-16:30	Use of Incremental Sampling for Improved Site Investigation and Remedial Decisions - Module 2 of 2	Jason Brodersen, PG, QSD, Tetra Tech, Inc., and Sara Woolley, Tetra Tech, Inc.	Klamath River Room

- **On street parking and paid parking lots are available in the vicinity.**

SCHEDULE

Thursday, May 9, 2013
Day Two – Conference

Time	Description	Speaker(s)	Location: Room
8:00-12:00	Registration	NA	Mezzanine
9:15-9:25	Welcoming Address	Charlie Huang, NorCal SETAC President	Klamath River Room
9:25-9:35	SETAC N.A. Address	Mary Reilly	Klamath River Room
9:35-9:40	Introduction of Plenary Speaker	David Ostrach, NorCal SETAC	Klamath River Room
9:40-10:25	Plenary Speech: *Getting Over the Hump: Finding Meaning in Low-Dose Response*	Tyrone Hayes, UC Berkeley	Klamath River Room
10:25-11:00	Audience Q&A	Moderator: David Ostrach	Klamath River Room
11:00-12:00	**POSTER SESSION AND BREAK**		Mezzanine
11:30-13:00	Registration		Mezzanine
12:00-13:00	Student -Mentor Lunch	Students, Sustaining Members, Speaker and NorCal SETAC BOD	Training Room 2 East and West
13:00-14:40	Session 1: Communicating Science to the Public	Session Chair: Shakoora Azimi-Gaylon	Klamath River Room
13:00-14:40	Session 2: Toxicity of Pesticides in the Environment	Session Chair: Brad Sample	Sierra Hearing Room
14:40-15:00	**BREAK**		Mezzanine
15:00-16:20	Session 3: Data Capture and Interpretation	Session Chair: David Ostrach	Klamath River Room
15:00-16:20	Session 4: Ecological Risk Assessment	Session Chair: Katie Henry	Sierra Hearing Room
16:20-17:00	**POSTER SESSION AND BREAK**		Mezzanine
17:00-17:15	Members Meeting	All	Mezzanine
17:15-18:00	Social Reception and Student Awards	All	Mezzanine

SCHEDULE

PLATFORM SESSIONS

Sessions 1 and 2 (13:00 – 14:40)

Time	Session 1: Communicating Science to the Public Chair: Shakoora Azimi-Gaylon Room: Klamath River Room	Session 2: Toxicity of Pesticides in the Environment Chair: Brad Sample Room: Sierra Hearing Room
13:00-13:20	**Goodwin P., Delta Science Program, Sacramento, CA:** *The Importance of Communicating Science to the Public*	**Phillips B.M, Anderson B.S., Voorhees J.P., Jennings, L.L., Petersen M.A., Siegler C., Tjeerdema R., UC Davis, Marine Pollution Studies Lab, Monterey, CA, Isorena T.P., Larsen K.L., State Water Resources Control Board, Sacramento, CA:** *General Pesticide Permit Toxicity Study: Monitoring Aquatic Toxicity of Spray Pesticides to Freshwater Organisms.*
13:20-13:40	**Marshack J.B., California Water Quality Monitoring Council, Sacramento, CA:** *Using Web Portals to Present Meaningful Information*	**Beckon W.N., Davis, CA:** *Toxicity of Selenium to Salmonids: Implications for Restoration of the San Joaquin River*
13:40-14:00	**Cooke J., Central Valley Regional Water Quality Control Board, Sacramento, CA:** *Fishing for the Right Message to Communicate Risk*	**Moran K.D., TDC Environmental, San Mateo, CA:** *Pesticides Water Pollution in Urban Areas – What's Next?*
14:00-14:20	***McGuirk A., California State University Sacramento, CA, Azimi-Gaylon S., and Roberts S., Delta Conservancy, W. Sacramento, CA.*: *Educating the Public on how Trash Threatens Wildlife Habitat in the Ecosystem*	***Gaytán B.D., Loguinov A., Lantz S.R. Lerot J.M., and Vulpe C.D., University of California, Berkeley, CA., Denslow N., University of Florida, Gainesville, FL:** *Functional Profiling Discovers that the Dieldrin Organochlorinated Pesticide Affects Leucine Availability in Yeast*
14:20-14:40	**Panel Q & A**	**Panel Q & A**

SCHEDULE

PLATFORM SESSIONS

Sessions 3 and 4 (15:00 – 16:40)

Time	Session 3: Data Capture and Interpretation Chair: David Ostrach Room: Klamath River Room	Session 4: Ecological Risk Assessment Chair: Katie Henrry Room: Sierra Hearing Room
15:00-15:20	***Kuspa Z.E., M.F. Finkelstein M.E., Smith D.R.,UC Santa Cruz, Santa Cruz, CA, Welch A., Pinnacles NP, Paicines, CA, Clark M., Los Angeles Zoo, Los Angeles, CA, and Burnett J., Ventana Wildlife Society, Salinas, CA:** *Investigating a Wildlife Shooting Event with Lead Isotopic Analysis*	**Sullivan J.P., Ardea Consulting, Woodland, CA, Bonnar D.J. Blankinship and Associates, Inc., Davis, CA:** *Models for Estimating Environmental Exposure of Pesticides in Ecological Risk*
15:20-15:40	**Joab B.M. and Anderson, M., California Dept. of Fish and Wildlife, Office of Spill Prevention and Response, Sacramento CA, Amman M., Chevron Energy Technology Company, San Ramon, CA:** *Collect It or Lose It: Harnessing Elusive Ephemeral Data.*	**Willis-Norton E., San Francisco Estuary Institute, Richmond, CA, Ranasinghe A. and Greenstein D., Southern California Coastal Water Research Project, Costa Mesa, CA, Taberski K. and Feger N., San Francisco Bay Regional Water Quality Control Board, Oakland, CA:** *Applying Sediment Quality Objective Assessment Protocols to San Francisco Bay Samples*
15:40-16:00	***De La Rosa, V., Asfaha J. and Vulpe C., University of California, Berkeley, CA:** *Functional Genomics Approach Identifies DNA Damage Response to Trichloroethylene*	**Sample B.E., Ecological Risk, Inc., Rancho Murieta CA, Schlekat C., NiPERA, Durham, NC, Spurgeon D., Centre for Ecology and Hydrology, Wallingford, UK, Menzie C., Exponent, Alexandria, VA., Rauscher J., USEPA Region 6, Dallas TX:** *Recommendations to Improve Wildlife Exposure Estimation for Development of Soil Screening and Cleanup Values*
16:00-16:20	***Panel Q & A***	***Panel Q & A***
*** Student presentation – please remember to fill out an evaluation if you view this presentation** Members Meeting - Students and Non-Members Welcome in the Mezzanine Social Reception and Student Awards in the Mezzanine		

Plenary Speaker

Tyrone B. Hayes, PhD, Professor, Laboratory for Integrative Studies in Amphibian Biology
Dept. of Integrative Biology, University of California Berkeley, CA (tyrone@berkeley.edu)

"Getting Over the Hump: Finding Meaning in Low-Dose Response"

The often quoted phrase, “The dose makes the poison” (attributed to Paracelsus), means that any substance can be biologically harmful at a high enough dose and will be safe (produce no adverse effects) below some dose. This approach also typically assumes a monotonic dose response to the compound of interest. Endocrine disrupting chemicals (EDCs) and their effects challenge this paradigm however. Firstly, like hormones themselves, many endocrine disrupting chemicals are active at levels much lower than levels that are considered “toxic”. In addition, also like hormones, many EDCs do not show a linear monotonic dose response. The herbicide atrazine is an excellent example. Atrazine causes a decline in androgen levels and an increase in estrogens in exposed males in all vertebrate classes examined and can produce this effect at 0.01 ppb in amphibians, well below the level at which atrazine is considered toxic (well below its NOEL and 300 times lower than the current US EPA drinking water standard). This effective dose (0.01) however is also as much as 1000 times higher than levels at which estrogen is known to be biologically active. Furthermore, atrazine’s effects on androgen levels and feminization of gonads show a non-monotonic, parabolic (so-called “inverted U”) response, where effects are strongest at intermediate doses and taper off at either higher or lower doses. Natural estrogens (such as estradiol) show a similar parabolic response in its effects on gene expression in the liver. Many other examples exist. To fully appreciate the impact of EDCs, principals of toxicology and endocrinology are both required.

Platform Presentation Abstracts

Please note: Abstract titles followed 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: Communicating Science to the Public

The Importance of Communicating Science to the Public. P. Goodwin, Delta Science Program, Sacramento, CA.

The role of science is perceived very differently in different countries of the world and some of the factors accounting for these differences are being explored. Yet the facts supporting science as a key driver of economic growth and quality of life are compelling. Most strategies to effectively communicate science to the general public focuses on the structure, content, and delivery style choices that scientists should consider to make their work engaging and understandable for a general audience. It is a responsibility incumbent on all scientists to communicate science and its broader impacts to the public, the media and policy makers. Different tools and concepts are used for delivering effective science messages to different audiences. This presentation will be illustrated through examples of compelling reasons describing why it is necessary for researchers to become involved in educating the public about science.

Using Web Portals to Present Meaningful Information. J.B. Marshack, California Water Quality Monitoring Council, Sacramento, CA.

Government agencies, regulated dischargers, and others spend millions of dollars each year monitoring water quality and aquatic ecosystems in California. Differing organizational mandates result in inconsistent monitoring objectives and methods to collect and assess the data, making it impossible to integrate information from multiple studies. And there is no single user-friendly place to access the information. Pursuant to state legislation and an agreement between the California Environmental Protection and Natural Resources Agencies, the California Water Quality Monitoring Council was established to address these problems. Rather than focus on technical details, the Monitoring Council presented a new solution--provide a platform for intuitive, streamlined access to information that directly addresses users' questions. Under Monitoring Council guidance, collaborative theme-specific workgroups were formed, each developing an Internet portal addressing one high-level question:

- Is our water safe to drink?
- Is it safe to swim in our waters?
- Is it safe to eat fish and shellfish from our waters?
- Are our aquatic ecosystems healthy?

These are accessed from a single website, www.CaWaterQuality.net. Portal development provides the context to effectively evaluate and resolve monitoring design, coordination, and data access problems--highlighting gaps and inconsistencies in monitoring and assessment methods and data management--within and between organizations.

Fishing for the Right Message to Communicate Risk. J. Cooke, Central Valley Regional Water Quality Control Board, Sacramento.
Sometimes, toxicology data point to the need to change human behavior in order to reduce the risk of harm. Creation and delivery of a message that culminates in behavior change are often

aided by involvement of representatives of the target audience. Effective message delivery, in particular, benefits from collaboration with community leaders. I will describe components of effective risk communication using the example of outreach and education to fish consumers. High levels of contaminants, including mercury and PCBs in local waterways can pose an adverse health risk to people to eat them. Identification of sensitive groups, message development, partnerships, and multi-faceted approaches will be discussed.

***Educating the Public about Trash Threatens Wildlife Habitat in the Ecosystem.** A. McGuirk, California State University Sacramento, CA, S. Azimi-Gaylon and S. Roberts, Delta Conservancy, W. Sacramento, CA.

Trash is a continuing aesthetic nuisance and as a serious threat to aquatic life in tributaries and to marine life in estuaries and oceans. Data suggest that plastic from trash persists for hundreds of years in the environment and can pose a threat to wildlife through ingestion, entrapment and entanglement, and plastic can leach potentially harmful chemicals in the water. The Delta Conservancy initiated a cleanup project in Brannan Island State Park. The effort extracted 550 pounds of loose trash, an abandoned boat, and 5 rubber tires along roughly 1 mile of waterway in 2012. Plastics and styrofoam were among the majority of debris collected and most likely came from camping, boating and picnicking.
The Delta Conservancy with other agencies, organization and the community has developed a Water Stewardship Education program to help address the trash and other pollutions in Delta waterways.
The quality of the state waters are reliant on California's environmental regulations. Despite these laws, there is an ongoing problem along the waterways. Trash is a form of water pollution. The Conservancy Stewardship Program raise environmental awareness and help in building knowledge to prevent water pollutions.

Session 2: Toxicity and Pesticide in the Environment

General Pesticide Permit Toxicity Study: Monitoring Aquatic Toxicity of Spray Pesticides to Freshwater Organisms. B.M. Phillips, B.S. Anderson, J.P. Voorhees, L.L. Jennings, M.A. Petersen, C. Siegler, R. Tjeerdema, UC Davis, Marine Pollution Studies Lab, Monterey, CA, T. P. Isorena, K.L. Larsen, State Water Resources Control Board, Sacramento, CA.

Pesticides are applied to state and local waterways in California to control invasive aquatic plants and animals, and insect vectors such as mosquitoes. The State Water Resources Control Board is adopting a National Pollution Discharge Elimination System General Permit to address the discharge of pesticides to waters of the United States resulting from adult and larval mosquito control. Because pesticides used in spray activities have the potential to cause toxicity to non-target organisms in receiving waters the State Water Board funded the current study to determine if toxicity testing provides additional useful environmental risk information beyond chemical analysis in monitoring spray pesticide applications. Monitoring included a combination of aquatic toxicity tests and chemical analyses in agricultural, urban and wetland habitats. Approximately 16% of the post-application water samples were significantly toxic. The toxicity of half of these samples was attributed to the naled breakdown product dichlorvos. Four of the 43 post-application sediment samples were significantly more toxic than their corresponding pre-application sample (chemical analysis pending). In the case of naled in water, analysis of only the active ingredient would have underestimated potential impacts to the receiving system. Toxicity testing provided information that could lead to the inclusion of dichlorvos monitoring.

Toxicity of Selenium to Salmonids: Implications for Restoration of the San Joaquin River. W. N. Beckon, Davis, CA. A review and reanalysis of data since the 1980's indicates that

Central Valley Chinook salmon are not protected by national criteria (current or proposed) that are intended to protect aquatic life from the toxic effects of selenium. Young salmon suffer 10% mortality due to selenium at a fish tissue concentration of about 1.8 µg/g (whole body dry wt.), far below the 7.9 µg/g tissue criterion proposed by EPA. This finding accords with studies of the toxicity of selenium to rainbow trout. Site- and species-specific bioaccumulation data indicate that this LC10 (1.8 µg/g) in young salmon corresponds to about 3.3 µg/L selenium in water, well below EPA's current national criterion of 5 µg/L. These data suggest that selenium may have killed about one quarter of the young Chinook salmon migrating down the San Joaquin River. This study shows that, although discharges of selenium to the San Joaquin River have been reduced over the last 20 years, selenium will pose a substantial risk to Chinook salmon that are reintroduced to restored middle reaches of the river unless selenium loads are further reduced and/or sufficient dilution flows are provided.

Pesticides Water Pollution in Urban Areas – What's Next? K.D. Moran, TDC Environmental, San Mateo, CA.

In recent years, numerous studies have documented the widespread presence of toxicity to aquatic organisms in both water and sediment of California's watersheds—particularly in urban watersheds. This toxicity and is almost exclusively associated with current pesticides (Anderson et al. 2011). In the mid-2000s, urban pesticide market changes (triggered by federal pesticide regulatory actions) shifted urban pesticide usage—and the primary cause of aquatic toxicity in urban watersheds—from organophosphate insecticides to pyrethroid insecticides. Today, regulatory actions addressing pyrethroids are again shifting the market, creating opportunities for less toxic pest management, but also creating a growing market for new insecticides that have been associated with water pollution, such as fipronil. Recent studies (Weston and Lydy 2010; Morace 2012) have revealed the presence of pyrethroids and fipronil in municipal wastewater treatment plant effluent at concentrations potentially sufficient to cause toxicity to sensitive aquatic organisms. The presentation will review new pesticides in the urban marketplace that pose potential threats to water quality in California's urban areas and identify the major pesticide-related scientific information needs for urban water quality management.

***Functional Profiling Discovers that the Dieldrin Organochlorinated Pesticide Affects Leucine Availability in Yeast.** B.D. Gaytán, University of California, Berkeley, CA, A. Loguinov, University of California, Berkeley, CA, S.R. Lantz, University of California, Berkeley, CA, J.M. Lerot, University of California, Berkeley, CA, N. Denslow, University of Florida, Gainesville, FL, C.D. Vulpe, University of California, Berkeley, CA.

Exposure to organochlorinated pesticides such as dieldrin has been linked to Parkinson's and Alzheimer's disease, endocrine disruption, and cancer, but the cellular and molecular mechanisms of toxicity behind these effects remain largely unknown. Here we demonstrate, using a functional genomics approach in the model eukaryote *Saccharomyces cerevisiae*, that dieldrin alters leucine availability. This model is supported by multiple lines of congruent evidence: (1) mutants defective in amino acid signaling or transport are sensitive to dieldrin, which is reversed by the addition of exogenous leucine; (2) dieldrin sensitivity of wild-type or mutant strains is dependent upon leucine concentration in the media; (3) overexpression of proteins that increase intracellular leucine confer resistance to dieldrin; (4) leucine uptake is inhibited in the presence of dieldrin; and (5) dieldrin induces the amino acid starvation response. Additionally, we demonstrate that appropriate negative regulation of the Ras/PKA pathway, along with an intact pyruvate dehydrogenase complex, is required for dieldrin tolerance. Many yeast genes described in this study have human orthologs that may modulate dieldrin toxicity in humans.

Session 3: Data Capture and Interpretation

***Investigating a Wildlife Shooting Event with Lead Isotopic Analysis.** Z.E. Kuspa, UC Santa Cruz, Santa Cruz, CA, M.F. Finkelstein, UC Santa Cruz, Santa Cruz, CA, A. Welch, Pinnacles NP, Paicines ,CA, M. Clark, Los Angeles Zoo, Los Angeles, CA, J. Burnett, Ventana Wildlife Society, Salinas, CA, D.R. Smith, UC Santa Cruz, Santa Cruz, CA.

Lead (Pb) poisoning is threatening the recovery of California condors in the wild, and Pb-poisoned birds require medical treatment on a regular basis, resulting in the close collaboration of managers, veterinarians, and researchers. In 2009, three independent cases of Pb-poisoned condors presented at the LA Zoo for medical treatment; radiographs determined these birds additionally had birdshot pellets embedded in their tissues. No evidence connecting these illegal shooting events existed and the timing of the shooting events was unknown. Using Pb isotopic composition (PbIC) analyses of recovered embedded pellets and tissues, we established several commonalities among these cases: 1) The PbIC of embedded pellets recovered from all three birds were not measurably different ($^{207}Pb/^{206}Pb = 0.8187 \pm 0.0010$SD, n=8), suggesting a common shooting source; 2) Pb exposure histories constructed from growing feathers indicated the shooting(s) occurred in January 2009; 3) Tissue PbIC's suggested two condors were Pb-poisoned from ingesting material isotopically similar to the embedded pellets; 4) one condor was subsequently Pb-poisoned a year later from ingestion of a Pb buckshot pellet, allowing determination of the blood Pb level from ingested Pb (560 µg/dL) versus tissue-embedded Pb (18 µg/dL). These data highlight how PbIC analyses can inform the investigation of Pb-shooting and poisoning in endangered wildlife.

Collect It or Lose It: Harnessing Elusive Ephemeral Data. B.M. Joab and Anderson, M., California Dept. of Fish and Wildlife, Office of Spill Prevention and Response, Sacramento CA, Amman, Michael, Chevron Energy Technology Company, 6001 Bollinger Canyon Road/C1162, San Ramon, CA.

The initial hours of an oil spill response are often chaotic as the response team transitions from an emergency response to management of a project. During this transition period, there is an opportunity to collect critical, time sensitive environmental information that, if not collected, will be forever lost. Such data are referred to as "ephemeral data", and are especially important in the subsequent assessment of injuries to natural resources during the Natural Resources Damage Assessment (NRDA). Trying to complete an ephemeral data collection plan during an actual spill response is sure to result in a missed opportunity, not to mention the loss of information that has important implications for the NRDA. Natural Resource Trustees (CDFW, Office of Spill Prevention and Response, NOAA, the USFWS, and the BLM) in California and Chevron have jointly completed a project to prepare an Ephemeral Data Collection Plan (EDCP) for Chevron's marine terminal located in Eureka, CA. The EDCP includes information on sampling media (e.g., water, sediment, and tissues), sampling and analytical protocols, sampling locations with GPS coordinates, and key contacts such as first responders, consultants, and laboratories. The EDCP also includes photographs of sampling locations to help orient members of the field sampling team.

***Functional Genomics Approach Identifies DNA Damage Response to Trichloroethylene**. V. De La Rosa, University of California, Berkeley, CA, J. Asfaha, University of California, Berkeley, CA, C. Vulpe University of California, Berkeley, CA.

Trichloroethylene (TCE) is an industrial solvent and common drinking water contaminant. TCE is a human carcinogen and highly toxic, yet the molecular events mediating toxicity and cancer

remain convoluted. We aim to utilize a functional genomics approach in model organisms to gain insight on the genes that modulate TCE toxicity. Initial functional studies utilized the yeast deletion library to identify genes important in the response to TCE. This approach identified a subset of mutagenic DNA repair genes, suggesting that TCE damages DNA and requires a repair response to mediate toxicity in yeast. Subsequent functional studies were conducted in transformed avian lymphocyte cell lines to assess if TCE DNA damage and the mutagenic DNA repair response were conserved. Various DNA repair knockouts exposed to TCE exhibited decreased viability and biochemical analysis of post-translational modifications showed initiation of DNA repair during TCE exposure. Results from these functional studies suggest TCE-induced DNA damage and mutagenic repair is conserved in higher eukaryotes. In conclusion, these studies have identified previously unknown cellular targets that potentially modulate TCE toxicity and progression of cancer in humans. Furthermore, we show that a functional genomics approach is a viable platform for understanding toxicity mechanisms in higher organisms.

Session 4: Ecological Risk Assessment

Models for Estimating Environmental Exposure of Pesticides in Ecological Risk. J.P. Sullivan, Ardea Consulting, Woodland, CA, D.J. Bonnar, Blankinship and Associates, Inc., Davis, CA.

The U.S. Environmental Protection Agency has developed a number of models for estimating the concentration of pesticides in various environmental compartments (vegetation, surface water, fish tissues, etc.). These models range in complexity from highly complex (e.g. Pesticide Root Zone Model [PRZM]) to simple (e.g. Terrestrial Residue EXposure [T-REX]). We focus on those aspects of the models that estimate the environmental concentration and only briefly consider those aspects of various models that also estimate risk (i.e. calculate a Risk Quotient). We discuss ease of use for each model and identify underlying assumptions, model limitations, or difficulties in interpreting the model outputs.

Applying Sediment Quality Objective Assessment Protocols to San Francisco Bay Samples. E. Willis-Norton, San Francisco Estuary Institute, Richmond, CA, S. Bay, Southern California Coastal Water Research Project, Costa Mesa, CA, D. Greenstein, Southern California Coastal Water Research Project, Costa Mesa, CA, K. Taberski, San Francisco Bay Regional Water Quality Control Board, Oakland, CA, N. Feger, San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

The California State Water Board recently adopted a set of narrative sediment quality objectives (SQOs) alongside a standardized assessment framework to determine the impact of chemical contamination on benthic communities. The SQO assessment framework was applied to samples from two known toxic hotspots in San Francisco Bay's creek channels and to samples from the San Francisco Bay Regional Monitoring Program's 2011 and 2012 sediment cruise. The framework uses multiple lines of evidence (chemistry, toxicity, and benthic community composition) to assign a station assessment based on the severity of biological effects and the potential for chemically mediated effects. The spatial distribution of the SQO results were examined as well as possible time series trends for the toxic hotspots, Mission Creek and San Leandro Creek. The two creek channels remain clearly impacted, with the extent of the contamination lower in samples closer to the creek mouths. The pollutant impact was greater within the creek channels than in the open Bay; the majority of the open Bay sites (54 percent) were designated as Possibly Impacted with only three out of the 50 sites listed as Likely Impacted. Overall, the narrative SQOs provided a general picture of sediment quality in San Francisco Bay.

Recommendations to Improve Wildlife Exposure Estimation for Development of Soil Screening and Cleanup Values. B.E. Sample, Ecological Risk, Inc., Rancho Murieta CA, C. Schlekat, NiPERA, Durham, NC, D. Spurgeon, Centre for Ecology and Hydrology, Wallingford, UK, C. Menzie, Exponent, Alexandria, VA., J. Rauscher, USEPA Region 6, Dallas TX.

Broad assumptions in wildlife exposure and effects assessments, and in the risk characterization process are included in the USEPA Eco-SSLs, REACH, and other soil assessment approaches. Consequently thresholds for concluding risk are frequently very low, sometimes within the range of natural background. A workshop held in September, 2012 evaluated existing methods and explored recent science about factors to consider when establishing appropriate remedial goals for concentrations of metals in soils. A Foodweb Exposure Workgroup was organized to evaluate methods for quantifying exposure of wildlife to soil-associated metals through soil and food consumption and to provide recommendations for the development of ecological soil cleanup values (Eco-SCVs) that are both practical and scientifically defensible. The conclusion of this group was that existing exposure estimation models are generally appropriate when fully expanded and that methods are available for more robust site-specific exposure estimates. Improved realism in could be achieved by obtaining more realistic estimates for diet composition, bioaccumulation, bioavailability/ bioaccessibility, soil ingestion, spatial aspects of exposure, and target organ exposure. These should be developed on a site-, species-, and analyte-specific basis to the extent that the expense for their derivation is justified by the value they add to Eco-SCV development.

Poster Presentation Abstracts

(by Poster Number)

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

1. **The Stream Pollution Trends (SPoT) Monitoring Program: A Preliminary Assessment of Emerging Contamination and Toxicity Trends in California.** J.P. Voorhees, B.S. Anderson, B.M. Phillips, C. Siegler, L.L. Jennings, M.A. Petersen, R.S. Tjeerdema, UC Davis, Marine Pollution Studies Laboratory, Monterey, CA.

   As part of the Surface Water Ambient Monitoring Program (SWAMP), the Stream Pollution Trends program (SPoT) monitors changes in water quality and land use in major California watersheds. Its three primary goals are to determine long-term trends in stream contaminant concentrations and effects statewide, to relate water quality indicators to land-use characteristics and management efforts, and to establish a network of sites throughout California to serve as a backbone for collaboration with local, regional, and federal monitoring. This poster summarizes the results of the 2008 through 2010 annual surveys, and provides a preliminary assessment of emerging contamination and toxicity trends. The incidence of toxicity remained essentially constant, but detections of pyrethroid pesticides in sediment increased from 55% of the samples in 2008 to 85% in 2010. In addition, pyrethroid associated toxicity increased when samples were tested at 15 ºC. Concentrations of other organic chemicals and metals in sediments decreased or remained unchanged. Concentrations of most measured pollutants in stream sediment increased as urban land cover increased. A preliminary assessment of the relationship between SPoT indicators and SWAMP macroinvertebrate bioassessment metrics showed significant correlations between amphipod survival in lab tests and the percent crustacea and amphipods at SPoT sites.

2. **Collaborative Monitoring of Contaminants of Emerging Concern (COEC) in the Stream Pollution Trends (SPoT) Monitoring Program.** L. L. Jennings, B.S. Anderson, B.M. Phillips, K. Siegler, J.P. Voorhees, M.S. Peterson, and R.S. Tjeerdema, UC Davis, Davis, CA.

   The Stream Pollution Trends (SPoT) monitoring program conducts statewide surveys of stream water quality as part of the Surface Water Ambient Monitoring Program (SWAMP). Sediment samples have been collected annually since 2008 at streams throughout California and analyzed for sediment toxicity and a suite of pesticides, trace metals, organic compounds, and contaminants of emerging concern as they are identified. These data are used by regulatory agencies to evaluate long term water quality trends statewide. As part of a SPoT collaboration with California State University, Monterey Bay (CSUMB), interstitial water from all 100 SPoT sediments will be analyzed for Microcystin L-R using an enzyme-linked immunosorbent assay (ELISA). A preliminary assessment of sediments from Pinto Lake and Corralitos Creek in Santa Cruz County, CA indicate the presence of Microcystin-L-R in interstitial water. The SPoT program is also collaborating with the California Department of Pesticide Regulation (DPR) to conduct intensive monitoring of pyrethroid pesticides in four urban watersheds. This is part of an effort to investigate the effectiveness of new DPR policies to restrict urban pyrethroid use. DPR is also assisting in the analysis of fipronil at selected SPoT sites to track trends in this contaminant of emerging concern.

3. **Time Trends of Perfluorinated Compounds (PFCs) in California Women.** M. Wang, California Department of Toxic Substances Control, Berkeley, CA, S. Encisco, California Department of Toxic Substances Control, Berkeley, CA, S. Harwani, California Department of Toxic Substances Control, Berkeley, CA, P. Reynolds, Cancer Prevention Institute of California, Berkeley, CA, S. Hurley, Cancer Prevention Institute of California, Berkeley, CA, J-S. Park,California Department of Toxic Substances Control, Berkeley, CA, M. Petreas, California Department of Toxic Substances Control, Berkeley, CA.

   In a previous paper we reported time trends of PFCs in some California populations from the 1960s through 2009 [Wang et al 2011]. Here we follow up this temporal trend study by adding the most recent results from samples collected between 2011 and 2012 from the California Teacher Study (CTS). We analyzed 614 serum samples using the same online SPE-LC-MS/MS method described in our previous studies, thereby affording method consistency. Among the 12 PFCs we analyzed, 10 were detected in over 75% of the samples. There was no clear trend for longer-chain PFCAs. As we observed earlier, levels of PFNA appear to have increased. On the other hand, PFUA and PFDA may have slowly decreased since 2000. We observed that PFOS continued the decreasing trend observed since the early 2000s, as expected due to restricted uses and the phase out of the related POSF chemistry during this time period. However, in contrast to national trends (NHANES 99-10, females), PFHxS and PFOA appear to have rebounded in the CTS population compared to our 2009 data, though further investigation is needed to support this observation. When the CTS is complete, we will explore reasons for these potential anomalies. Our study warrants the continuous biomonitoring of PFCs, particularly those building up in California, and the continued investigation for possible new sources that might be contributing to increased PFC levels even after the phase out.

4. **Pyrethroid Detections and Urban Land Cover Classification during Baseflow and Storm Events in California.** J. Nishimura, Department of Pesticide Regulation, Sacramento, California, R. Budd, Department of Pesticide Regulation, Sacramento, California, M. Ensminger, Department of Pesticide Regulation, Sacramento, California, K. Goh, Department of Pesticide Regulation, Sacramento, California.

   Pyrethroid insecticides are commonly applied for structural pest control and landscape maintenance in urban areas, and are frequently detected contaminants in California waterways. Currently, the environmental fate of pyrethroids in urban environments is poorly understood. Artificial impervious surfaces like asphalt and concrete are believed to aid in contaminant transport. In urban areas, impervious surfaces can account for up to 90% of total surface area. This study will identify relationships between land cover composition (impervious and pervious surfaces) and pyrethroid detections in urban runoff during baseflow and storm events at five locations in Northern and Southern California. Land cover analysis will be conducted utilizing 2012 NAIP satellite imagery (1-meter resolution) coupled with ArcGIS Spatial Analyst. Differences in land cover composition at five monitoring stations located throughout California will be examined and related to pyrethroid detections during baseflow and storm events.

5. **Reporting the Results of a Causal Assessment in a Watershed Indicator Report.** K. Pulsipher, W. Wieland, & B. Washburn. Ecotoxicology Program, OEHHA, Sacramento, California.

   A causal assessment analyzing the stressors and sources of impairment of aquatic life in the Dry Creek watershed near Sacramento was recently completed. The analysis was performed to better understand the reasons for the decline in fall-run Chinook salmon and impaired benthic macroinvertebrate metrics. Excessive fines in the streambed were identified as a key stressor, linked to urbanization and increases in impervious cover. Turbidity was identified as a moderate risk stressor. Low risk or unresolved stressors included temperature, dissolve oxygen, pyrethroid pesticides, and lack of in-stream cover. Results of the analysis will be presented in a watershed indicator report, which will include indicators of water quality, physical habitat, or source of stress. An overview of each indicator, targeted to local decision makers, addresses the key findings, reasons the indicator is important, and the factors influencing the indicator in the Dry Creek watershed. A technical section, written for scientists and engineers, provides data analysis details as well as a literature review. Excerpts from this report will be presented at the meeting.

6. **Use of Constructed Wetlands to Mitigate Pesticides in Urban Runoff.** R. Budd, M. Ensminger, K. Goh, Department of Pesticide Regulation, Sacramento, CA.

   Pesticides transported with urban runoff often reach concentrations toxic to aquatic invertebrates. Constructed wetlands have proven an effective best management strategy in agricultural areas. This study is part of a long term monitoring program conducted by the Department of Pesticide Regulation evaluating the efficiency of two small constructed wetlands receiving runoff from residential landscapes to reduce pesticide loading to receiving streams. Water and sediment samples were collected from the inlet and outlets of each wetland. Samples were analyzed for pyrethroids, organophosphates, fipronil, imidacloprid, and synthetic auxin herbicides. The analytes represents a wide range of physiochemical properties, allowing for a more comprehensive evaluation of

analyte transport within the systems. In addition to water quality parameters, toxicities to invertebrates were evaluated. We have installed flow equipment, which will allow calculation of a mass balance of pesticide load. Bifenthrin and 2,4-D will be highlighted in this presentation. Not only are they the two most frequently detected pesticides in our systems, they represent opposite ends of the spectrum in terms of physiochemical properties.

7. **Chlorpyrifos Runoff from a Flood-irrigated Alfalfa Field.** A.Pennell, X. Zhang, X. Deng, California Department of Pesticide Regulation., Sacramento, CA.

   This project aims to quantify pesticide runoff in field crops generated by irrigation. Two checks of 0.85 acre each within a three-year old alfalfa field in Davis, Calif. were chosen as the study sites. Chlorpyrifos was applied by ground at 0.53 kg/ha in April 2012. Mass deposition of pesticides was measured using lab Kimbie® sheets placed at the height of alfalfa. Plant and soil samples were collected incrementally following pesticide application. The sites were each watered by check flood irrigation for 3 times between 42 and 143 days post application. During irrigation events the runoff flow was measured and water samples were collected throughout. Mass deposition sheets that were collected five hours post application contained 36% of chlorpyrifos applied. The significant loss was probably due to drift, equipment loss, volatilization, and degradation. Over 90% of chlorpyrifos was on alfalfa. There were no detections for chlorpyrifos in the soil collected. Foliar degradation half-life was 5 days. Chlorpyrifos concentrations in runoff ranged from non-detects on day143 to 0.631 ug/L on day 42. The first runoff constituted 0.14% of the total chlorpyrifos applied indicating that surface runoff is a less significant pathway compared to initial application loss and on-site degradation

8. **Relative Toxicity of Bifenthrin to the Amphipod *Hyalella azteca* in 10d and 28d Exposures.** M.A. Petersen, B.M. Phillips, B.S. Anderson, J.P. Voorhees, L.L. Jennings, C. Siegler, R. Tjeerdema, UC Davis, Marine Pollution Studies Lab, Monterey, CA, T. Fogut, Central Valley Regional Water Quality Control Board, Rancho Cordova, CA.

   Pyrethroid pesticides are used widely and have been shown to be the cause of sediment toxicity in Central Valley watersheds. The Central Valley Regional Water Board is developing numeric sediment quality criteria for pyrethroids. Bifenthrin criteria are being developed using 10d and 28d toxicity tests with *Hyalella azteca*. UC Davis researchers have conducted an initial series of 10d and 28d bifenthrin dose-response tests with *H. azteca*. Survival LC50s based on nominal concentrations were 10.49 and 9.01 ng/g for the range-finding tests, and 14.74 and 15.41 ng/g for the first definitive tests (10d and 28d, respectively). Bifenthrin IC25s based on 10d and 28d amphipod growth were variable. Chemical analyses are pending and will be used to set LC50s and IC25s based on measured whole sediment and interstitial water concentrations. These concentrations will be used to establish sediment quality criteria for bifenthrin in the Central Valley region.

9. **Current and Planned Restoration in the Delta and Suisun Marsh.** K. Davis Fadtke, Sacramento-San Joaquin Delta Conservancy, West Sacramento, CA, A. Pawley, California Department of Water Resources, Sacramento, CA, D. Craft, California Department of Fish and Wildlife, Sacramento, CA.

   The Sacramento-San Joaquin Bay-Delta estuary has experienced a severe decline in the condition of its natural resources and species that depend on them; thus, the Delta and

Suisun Marsh have been and continue to be high-priority areas for restoration. With numerous restoration efforts having been implemented or being planned in the Delta and Suisun Marsh, it is important to have a spatial overview of these efforts to facilitate coordination and develop ecosystem connectivity. A GIS database of current and planned restoration projects was developed and that spatial information is displayed in this poster. The hope is that this information will assist in the efficient use of resources to facilitate and optimize restoration of natural communities and ecological processes in the Delta.

10. **Risk Assessment Techniques for Compliance with the Consumer Products Regulation.** J. Hedgecock, URS Corporation, San Francisco, CA and Dr. Usha Vedagiri, URS Corporation, Oakland, CA.

California's Green Chemistry Initiative (AB 1879) which is due to be implemented in late 2013 encourages reduction or elimination of toxic chemicals in consumer products at the product design stage. Toxic endpoints that will need to be evaluated in comparing alternative chemicals to current product components include carcinogenicity and reproductive effects, as well as noncarcinogenic and acute impacts. Physical hazards (e.g., reactivity and flammability), as well as environmental fate parameters (e.g., bioaccumulation, persistence and mobility), will also be key components evaluated in the process. Because many of the potential alternative chemicals assessed as substitutes for more toxic components will likely have limited toxicity information, use of structure activity relationship programs may be required. This poster will outline tools and a possible integrated system to assist in identifying threshold values for alternative chemicals based on high, medium and low rankings for multiple hazard endpoints. Using an applied risk-based approach can not only assist in assessing the efficacy of chemical substitution, but could also prove to be a useful tool in avoiding regrettable substitutions.

11. **Pitfalls in Data Collection for Risk Assessment: What to Do After the Fact.** C. Schwach, URS Corporation, Oakland, CA, J. Hedgecock, URS Corporation, San Francisco, CA, H. Loso and U. Vedagiri, URS Corporation, Oakland, CA.

All too often, risk assessors are brought into a project *after* the data collection phase is complete and find themselves asking the question: How can I configure these data to meet the needs of the risk assessment? From soil or sediment data collected on only a dry or wet weight basis to metals data in water collected only as total or dissolved phase concentrations, finding an appropriate solution to addressing data uncertainties can prove challenging. In addition, risk evaluations may require summation of similar chemicals such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) that are a mixture of detected and nondetected chemicals or PCB congener data that co-elute. Multiple detection limits, such as method detection limits versus reporting or practical quantitation limits provide additional opportunities in data management decisions. Other issues that arise include determining the appropriate use of composite samples or combining data derived from different analytical methods that provide different concentrations for the same chemical in the same sample. This poster will provide common solutions for risk assessors that can be used to minimize data uncertainty while still maximizing the use of existing data in an effort to avoid the cost of additional sample collection.

Coffee & Desserts

Quick Bites

57 **Beantrees Cafe**
925 L St / 444-1020 / Patio
7am-5pm (M-F)

58 **Chocolate Fish Coffee Roasters**
corner of 3rd and Q St / 400-4204 / Patio
6:30am-4pm (M-F); 8am-3pm (Sa);
9am-4pm (Su)

59 **Estelle's Patisserie**
901 K St / 551-1500 / Patio
7am-6pm (M-F); 8am-5pm (Sa)

60 **Gunther's Ice Cream**
2801 Franklin Blvd / 457-6646 / Patio
Open Daily 10am

61 **Icing on the Cupcake**
1121 Alhambra Blvd / 736-3600
10am-7pm (M-Sa) / 11am-6pm (Su)

62 **La Bombe Ice Cream & More**
3020 H St / 448-2334 / Patio
11:30am-9pm (M-F)
noon-9pm (Sa-Su)

63 **Temple Coffee & Tea**
1010 9th St / 443-4960 / Patio
6am-11pm 365 days a year

64 **Temple Coffee & Tea**
2829 S St / 454-1272 / Patio
6am-11pm 365 days a year

65 **Vanilla Bean Gourmet Yogurt & Cupcakes**
1809 S Street #103 / 498-9566 / Patio
11am-10pm daily

66 **Vic's Ice Cream**
3199 Riverside Blvd / 448-0892
10am-8pm (M-Th); 10am-9pm (F-Sa);
11am-8pm (Su)

Nightlife

Happy Hour

67 **Capitol Casino**
411 N. 16th St / 446-0700
Games / 24 hrs 365 days a year

68 **District 30**
1022 K St / 737-5770
Nightclub / 9:30pm-3am (W-Sa)

69 **Dive Bar**
1016 K St / 737-5999
Nightlife / 4pm-2am daily

70 **Gallagher's Pub**
1201 K St / 444-3444 / Patio
Pub Grub / 11am-2am (M-F);
5pm-2am (Sa); 4pm-10pm (Su)

71 **Kasbah Lounge**
2115 J St / 442-4388 / Patio
Moroccan / 5pm-midnight (Su-M);
5pm-1am (Th); 5pm-3am (F-Sa)
Live Music & Belly Dancing

72 **The Limelight Bar, Cafe & Cardroom**
1014 Alhambra Blvd / 446-2236 / Patio
Amer / B, L, D daily; LN until 3am (T-Sa)

73 **Oishii Sushi & Karaoke Bar**
1000 K St, Ste 200 / 557-8088
Karaoke / 4pm-2am (Su-Th); 4pm-3am (F-Sa)

74 **Sacramento Torch Club**
904 15th St / 443-2797
Live Music / 2pm-2am (T-Su)

Get local in
Sacramento

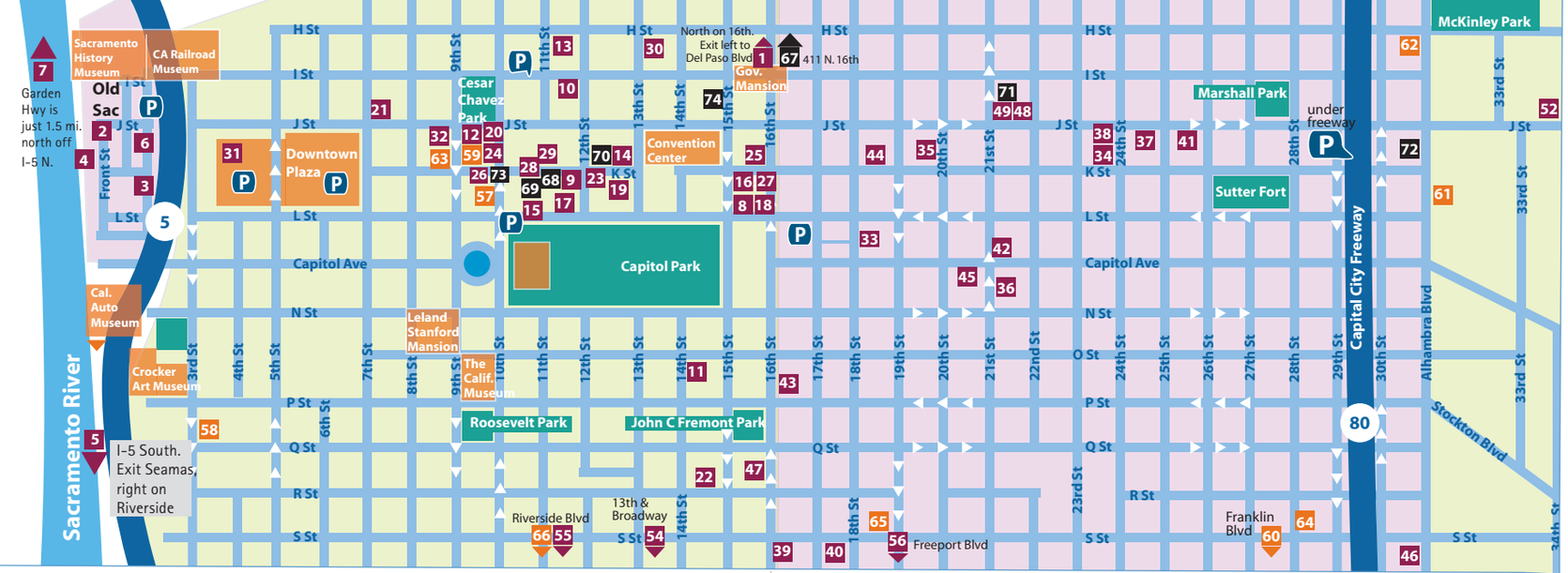
Eat the Grid™

Sacramento's Dining Guide

Kru - Contemporary Japanese Cuisine, 2516 J St / Photo by Rebecca Jane Call Photography

Eat the Grid™ Spring 2013

downtowngrid™



Uptown / Del Paso Blvd

1 **Mama Kim Eats**
1616 Del Paso Boulevard / 515-9971/ Patio
$$-$$$ / New Amer / Br (Su); D (T-Sa)

Old Sacramento and River Dining

2 **Fat City Bar & Cafe**
1001 Front St / 446-6768
$$ / Amer / Br (Sa-Su); L, D daily

3 **The Firehouse**
1112 2nd St / 442-4772 / Patio
$$$+ / New Amer / L (M-F); D daily

4 **Hornblower Cruises and Events**
1206 Front St / 446-1185 / Patio
$$$+ / New Amer / Br (Su); D (Sa)

5 **Scott's Seafood on the River** @ Le Rivage Hotel
4800 Riverside Blvd / 379-5959 / Patio
$$$+ / Seafood / B (M-F); Br (Sa-Su); L, D daily

6 **Ten22 – Eat, Drink, Relax**
1022 2nd St / 441-2211 / Patio
$$-$$$ / New Amer / L, D daily

7 **The Virgin Sturgeon**
1577 Garden Hwy / 921-2694 / Patio
$$ / Seafood / B (Sa-Su); L, D daily

Downtown

8 **3 Fires Lounge**
1501 L St / 267-6823 / Patio
$$ / New Amer / L (Su-F); D daily; LN (F-Sa)

9 **Ambrosia Cafe & Catering**
1030 K Street / 444-8129 / Patio
$-$$ / Amer / B, L daily

10 **Bangkok@12th Thai Restaurant**
900 12th St / 443-5588
$$ / Thai / L, D daily

11 **Bistro Michel**
1501 14th St / 346-4012 / Patio
$$ / French Bistro / Br (Su); L (T-Sa); D (T-Su)

12 **Blackbird Kitchen & Bar**
1015 9th St / 498-9224
$$-$$$ / Seafood / L (T-F); D (T-Sa); LN (F-Sa)

13 **Blue Prynt Restaurant & Bar**
815 11th St / 492-2969 / Patio
$$ / New Amer / L, D daily; LN until midnight (F-Sa)

14 **The Broiler Steakhouse**
1201 K St / 444-3444 / Patio
$$$ / Steakhouse / L (M-F); D daily

15 **Cafe Roma**
1013 L Street / 594-7292 / Patio
$ / Italian / L, D (M-F)

16 **Capitol Garage**
1500 K St / 444-3633 / Patio
$$ / Amer / B, L, D, LN daily

17 **Chops Steak, Seafood & Bar**
1117 11th St / 447-8900 / Patio
$$$ / New Amer / L (M-F); D daily

18 **de Vere's Irish Pub**
1521 L St / 231-9947 / Patio
$$ / Irish Fare / Br (Sa-Su); L, D daily; LN (Th-Sa)

19 **Downtown & Vine**
1200 K St, #8 / 228-4518 / Patio
$-$$ / Small Plates, Wine tastings
noon-8pm (Su-Th); noon-9pm (F-Sa)

20 **Grange Restaurant & Bar**
926 J St / 492-4450
$$$ / New Amer / B, L, D daily; LN (F-Sa)

21 **Lei's Kitchen**
701 J St / 557-8118
$ / Chinese, Amer Breakfast / B, L, D (M-Sa)

22 **Magpie Cafe**
1409 R St, Ste 102 / 452-7594 / Patio
$-$$ / New Amer / B, L, D (M-Sa)

23 **Mayahuel – Tequila Museo and Restaurant**
1200 K St, Ste 3 / 441-7200 / Patio
$$ / Mex / L (M-F); D (M-Sa); LN (Th-Sa)

24 **Megami Restaurant**
1010 10th St / 448-4512 / Patio
$-$$ / Sushi / L, D (M-F)

25 **Monsoon Cuisine of India**
1020 16th St / 469-9999 / Patio
$$ / Indian / L, D daily; LN (F-Sa)

26 **Oishii Sushi & Karaoke Bar**
1000 K St, Ste 200 / 557-8088
$-$$ / Sushi / L (M-F); D daily; LN (Th-Sa)

27 **Petra Greek**
1122 16th St / 443-1993
$ / Greek / L, D daily; LN until 3am (W-Sa)

28 **Pizza Rock**
1020 K Street / 737-5777 / Patio / $$ / Italian
B (Sa-Su); L, D daily; LN (W-Th); LN until 3am (F-Sa)

29 **Pyramid Alehouse & Restaurant**
1029 K St / 498-9800 / Patio
$$ / Amer / L, D daily; LN (F-Sa)

30 **RESTAURANT THIR13EN**
1300 H St / 594-7669 / Patio
$$-$$$/ New Amer / Br (Su); L (M-F);
D (M-Sa)

31 **River City Brewing Company**
545 Downtown Plz / 447-2739 / Patio
$$ / New Amer / L, D daily

32 **Wayside Noodles**
828 J St / 441-4110 / Patio
$ / Vietnamese / L, D daily

Midtown

33 **58 Degrees & Holding Co**
1217 18th St / 442-5858 / Patio
$$ / New Amer /Br (Sa-Su); L, D (W-M); LN (F-Sa)

34 **Anatolian Table**
2319 K St / 737-5767 / Patio
$$ / Turkish / L, D daily

35 **Azul Mexican Food & Tequila Bar**
1050 20th St / 447-4040 / Patio
$ / Mex / Br (Sa-Su); L, D daily; LN (Th-Sa)

36 **Bombay Bar & Grill**
1315 21st St / 441-7100
$$ / Indian / L, D daily; LN (F-Sa)

37 **Chicago Fire**
2416 J St / 443-0440
$-$$ / Pizza / L (Th-Su); D daily; LN (F-Sa)

38 **Cornerstone Restaurant**
2326 J St / 441-0948 / Patio
$-$$ / Amer / B, L, D daily

39 **Ernesto's Mexican Food**
1901 16th St / 441-5850 / Patio
$$ / Mex / B (Sa-Su); L, D daily; LN (Th-Sa)

40 **Ju Hachi by Taka's**
1730 S St / 448-3481 / Patio
$$ / Sushi / L (M-F); D daily

41 **Kru**
2516 J St / 551-1559 / Patio
$$ / Sushi / L (M-Sa); D daily

42 **Kupros Bistro**
1217 21st St / 440-0401 / Patio
$$ / New Amer / Br (Sa-Su); L, D daily; LN (F-Sa)

43 **Nishiki Sushi**
1501 16th St / 446-3629 / Patio
$$ / Sushi / L (M-Sa); D daily; LN (Th-Sa)

44 **The Porch Restaurant & Bar**
1815 K Street / 444-2423 / Patio
$$-$$$ / Southern Fare / Br (Sa-Su);
L, D daily; LN (Th-Sa)

45 **Rubicon Brewing Co.**
2004 Capitol Ave / 448-7032 / Patio
$ / Pub Grub / L, D daily; LN (M-Sa)

46 **Sacramento Natural Foods Co-op**
1900 Alhambra Blvd / 455-2667 / Patio
$ / Deli / L, D daily

47 **Shabu Japanese Fondue**
1730 16th St / 444-6688
$$ / Japanese Fondue / D daily

48 **Tamaya Sushi**
2131 J St / 498-8388
$$ / Sushi / L, D daily; LN (F-Sa)

49 **Tapa the World**
2115 J St / 442-4353 / Patio
$-$$ / Spanish / L, D, LN daily

East Sacramento

50 **Clark's Corner**
5641 J St / 457-5600 / Patio
$$ / New Amer / Br (Sa-Su); L, D daily

51 **Espanol Italian Restaurant**
5723 Folsom Blvd / 457-1936
$$ / Italian / L (T-Sa); D (T-Su)

52 **La Trattoria Bohemia**
3649 J St / 455-7803 / Patio
$$ / Czech, Italian / L, D (T-Su)

53 **Opa! Opa!**
5644 J St / 451-4000 / Patio
$ / Greek / L, D daily

Off Broadway

54 **Iron Grill**
2422 13th St / 737-5115 / Patio
$$-$$$ / New Amer / Br (Sa-Su); L (M-F); D daily

55 **Masullo**
2711 Riverside Blvd / 443-8929 / Patio
$$ / Pizza / L (M-F); D (M-Sa)

56 **Taylor's Kitchen**
2924 Freeport Blvd / 443-5154 / Patio
$$$ / New Amer / Br (Su); D (W-Sa)

Happy Hour · Live Music

Under $10	$
$10-$20	$$
$20 and up	$$$

Breakfast	B
Brunch	Br
Lunch	L
Dinner	D
Late Night	LN past 10pm

Map Listings
Restaurants
Nightlife
Coffee Houses and Desserts
City Parking Garage

Cuisine

American 2,7,9,14,16,17, 29,38,45,67,72
New American 1,3,4,6,8,11,12,13,17, 20,22,30,31,33,42,44,50,54,56
Breakfast (Daily) 5,9,16,20,21,22,38,67,72
Breakfast (Weekend) 1,2,4,7,11,18,28,30, 33,35,39,42,44,50,54,56
Chinese: 21
Czech: 52
Deli/Sandwiches 22,46,59,60,62,66
Fine Dining 3,4,5,14,17,56
French Bistro 10,55
Greek 27,53
Indian 25,36,57
Irish Fare (Modern) 18
Italian 15,28,51,52
Japanese Fondue 47
Late Night (Daily)16,27,28,45,49,67,71,72
Late Night (Weekend)8,12,13,18,20, 23, 25,26,29,33,35,36,37,39,42,43,44,48,
Mexican 23,35,39
Moroccan 71
Pizza 15,28,37,52,55
Pub Grub & Burgers 18,29,45,50, 70,72
Seafood 3,4,5,7,11,12,17
Small Plates 12,19,22,33,49,71
Southern Fare 1,44
Spanish 49
Steakhouse 5,14,17,54
Sushi 24,26,40,41,43,48
Thai 10
Turkish 34
Vege/Vegan 23,46
Vietnamese 32
Wine/Micro-Brews 3,19,29, 31,33,45