Program and Abstracts

Pacific Northwest Chapter

Society of Environmental Toxicology and Chemistry

(PNW-SETAC)

20th Annual Meeting

Bell tower across from the Vancouver (WA) Hilton.

April 14-16, 2011

Hilton Vancouver Washington
301 W. 6th Street
Vancouver, WA 98660

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PNW-SETAC ANNUAL MEETING

April 14 to 16, 2011

Meeting Program

PNW-SETAC
Chapter Meeting Agenda

Thursday, April 14, 2011

12:00 PM - 7:30 PM	**Conference Check-in** (Discovery Pre-Function)
1:00 PM - 5:30 PM	Special Session: *Salmon & Pesticides in the Pacific NW - Science &Policy* (Discovery Ballrooms C, D, and E)
5:30 PM - 8:00 PM	Welcome Reception with Refreshments (Discovery Ballrooms A and B)
7:00 PM - 8:00 PM	PNW-SETAC Board Meeting (Board Room)

Friday, April 15, 2011

7:00 AM - 8:00 AM	Continental breakfast served (Discovery Pre-Function)
7:30AM	Conference check-in/registration (Discovery Pre-Function) Poster setup (Discovery Ballrooms A and B)
8:15 AM - 9:00 AM	Welcome address, Chapter President Fran Solomon (Discovery Ballrooms C, D, and E Report from SETAC NA, SETAC NA Board member John Elliot
9:00 AM - 6:00 PM	Poster viewing (Discovery Ballrooms A and B)
9:00 AM - 11:50 AM	Platform sessions with 30 min break for refreshments and poster viewing (Discovery Ballrooms C, D, and E)
11:50 PM - 1:35 PM	**Lunch, on your own**
12:45 PM - 1:30 PM	Chapter Business Meeting, **All Welcome to Attend!!** (Pine/Spruce Room)
1:35 PM - 5:15 PM	Platform sessions with 30 min break for refreshments and poster viewing (Discovery Ballrooms C, D, and E)
5:15 PM - 6:00 PM	Poster Social (Discovery Ballrooms A and B)
6:00 PM - 8:30 PM	Buffet Dinner (Pre-paid) and Career Panel (Open to all!) (Heritage Ballroom E and F)
7:00 PM - 8:30 PM	Career Panel discussion (Open to all!) (Heritage Ballroom E and F)

Saturday, April 16, 2011

7:00 AM - 8:00 AM	Continental breakfast served (Discovery Pre-Function)
7:30 AM	Conference check-in/registration (Discovery Pre-Function)
9:00 AM - 11:35 AM	Platform sessions with 30 min break for refreshments and poster viewing (Discovery Ballrooms C, D, and E)
11:35 AM	Student Award Presentations (Discovery Ballrooms C, D, and E)
12:00 PM	Adjourn

PNW-SETAC
Meeting Sponsors

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Program Printing

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Student Travel Funds

Azimuth Consulting Group

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Thursday Reception

Newfields Northwest

Friday Morning Break

Pascoe Environmental Consulting

Scientific Notations

Friday Afternoon Break

Exponent

Northwestern Aquatic Sciences

Saturday Morning Break

Azimuth Consulting Group

Nautilus Environmental

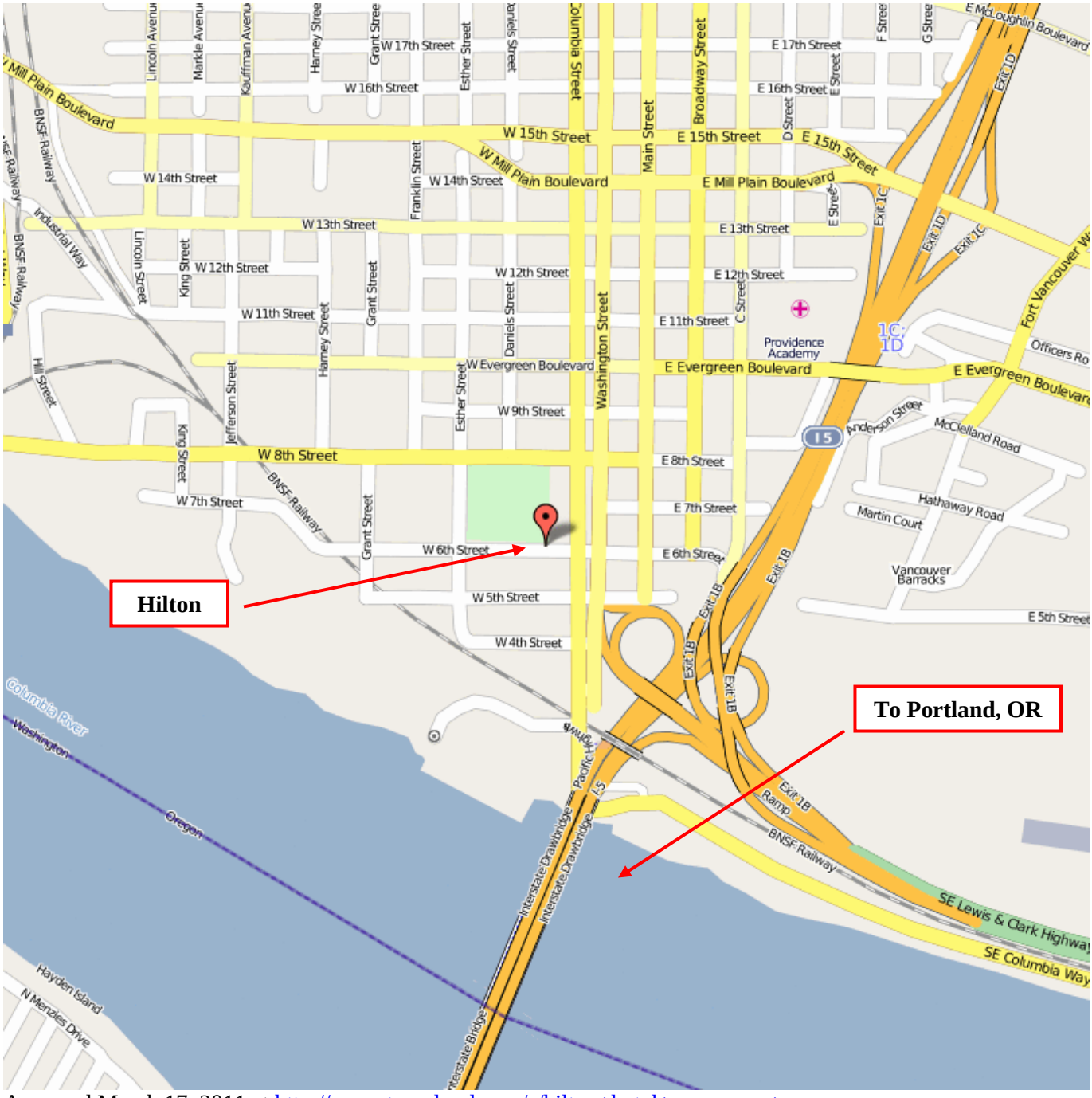
PNW-SETAC
Acknowledgements

Thanks to all of the following who volunteered their time to make this meeting possible:

Conference Organization:	PNW-SETAC Board
Special Session:	Bruce Hope, Oregon Department of Environmental Quality Wendy Hillwalker, Oregon State University
Career Panel:	Teresa Michelsen, Avocet Consulting
Reservations/Food:	Teresa Michelsen, Avocet Consulting Kara Warner, Golder Associates Inc.
On-Site Coordinator:	Fran Solomon, Environmental Teaching International
Abstract Review:	Wendy Hillwalker, Oregon State University Kara Warner, Golder Associates Inc. Vicki Marlatt, Nautilus Environmental
Meeting Program:	April Markiewicz, Western Washington University
Meeting Registration:	Teresa Michelsen, Avocet Consulting
Volunteer Coordinator:	Kate Saili, Oregon State University
Fundraising:	Teresa Michelsen, Avocet Consulting April Markiewicz, Western Washington University Burt Shephard, US EPA Region 10 Vicki Marlatt, Nautilus Environmental Fran Solomon, Environmental Teaching International
Session Chairs:	Kate Saili, Oregon State University Patrick Moran, USGS Jerome Laroulandie, Maxxam Analytics
Career Panel Members:	Maggie Dutch, WA Department of Ecology Bob Gensemer, GEI Consultants Joel Baker, University of Washington Greg Salata, Columbia Analytical Services
Student Awards Coordinator:	Heather Henson-Ramsey, Lewis-Clark State College

Student Award Judges:	Wendy Hillwalker, Oregon State University Bruce Hope, Oregon Department of Environmental Quality Vicki Marlatt, Nautilus Environmental Lesley Shelley, (student) Simon Fraser University Burt Shephard, U.S. EPA Region 10 Steve Sylvester, Washington State University Aaron Todd (student), Washington State University Jeff Wirtz, Compliance Services International
Student Travel Review:	Heather Henson-Ramsey, Lewis-Clark State College Vicki Marlatt, Nautilus Environmental
Media Equipment:	April Markiewicz, Western Washington University

Vancouver Hilton Location and Vicinity Map



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Pacific Northwest Chapter

Society of Environmental Toxicology and Chemistry

(PNW-SETAC)

20th Annual Meeting

Schedule of Platform and Poster Presentations

PNW-SETAC

Thursday Special Session

Salmon & Pesticides in the Pacific NW - Science & Policy

Discovery Ballrooms C, D, and E

Session Chairs: **Bruce Hope**, Oregon Department of Environmental Quality and
Wendy Hillwalker, Oregon State University

1:00	Bruce and Wendy	Welcome and Introductions
1:15	John Stark Washington State University	Pesticides and Pacific Northwest Salmon: An Overview
1:45	Debby Sargeant WA Department of Ecology	Surface water monitoring to assess pesticide exposure to endangered salmon in agricultural land use areas in Washington
2:15	Bernalyn McGaughey Compliance Services Intl.	"All that matters is pure fact and science" – But just what is that?
2:45	Don Brady and Rick Keigwin, U.S. EPA	EPA Perspective: Science and Policy
3:15	**Break**	
3:30	Barbara Harper Confederated Tribes of the Umatilla Indian Reservation	Importance of Salmon and Consequences of Contamination to Indigenous Peoples
4:00	Aimee Code Northwest Coalition for Alternatives to Pesticides	Prompting the Federal Government to Ensure Pesticide Registrations Fulfill Endangered Species Act Requirements
4:30	Jeff Jenkins Oregon State University	Wrap-up
5:30	**Welcome Reception**	Discovery Ballrooms A and B

PNW-SETAC
Friday Platform Presentations
Morning Session

Discovery Ballrooms C, D, and E

Session Chair: Kate Saili, Oregon State University

Up in the Air

9:00	Renata Raina	OP and OP oxon degradation products and selected fungicides in the atmosphere of agricultural regions of Western Canada
9:25	Erika Smith	Triazole fungicides in the atmosphere of the prairie agricultural region of Western Canada
9:50	Nicole Fergus	Carbamates, carbamate degradation products, and phenylureas in the atmosphere in the prairie agricultural region of Canada
10:15	**Break/Poster Viewing**	**Discovery Ballrooms A and B**

Ecotoxicology

10:35	Lesley Shelley	Immunotoxicity of atrazine and nonylphenol in rainbow trout (*Onchorhynchus mykiss*)
11:00	Adam Goulding	Sublethal effects of two pyrethroid pesticides on juvenile rainbow trout (*Onchrhychus mykiss*) swim performance
11:25	Robert Gensemer	Field vs laboratory-based approaches for derivation of aquatic life criteria: just because we can, does it mean we should?

11:50 to 1:35 PM **Lunch – On Your Own**

12:45 to 1:30 PM **PNW-SETAC Business Meeting (Pine/Spruce Rm)**

PNW-SETAC
Friday Platform Presentations
Afternoon Session

Discovery Ballrooms C, D, and E

Session Chair: Patrick Moran, U.S. Geological Survey

Risky Business

1:35	Kendra Zamzow	The waters of the Nushagak and the fish that love them: Independent baseline studies near the proposed Pebble Mine in Alaska
2:00	Heather Summers	The use of a Bayesian network to model the risks of mercury contamination in the South River, Virginia
2:25	Kara Warner	Assessing risk from an environmental application of reclaimed water
2:50	Bruce Hope	Assessing cumulative aquatic toxicity in the Willamette River Basin
3:15	**Break/Poster Viewing**	**Discovery Ballrooms A and B**

Chemical Stressors in the Salish Sea

3:45	Margaret Dutch	Quantification of pharmaceuticals and personal care products in sediments from urban and non-urban locations from Puget Sound, Washington
4:10	Tom Gries	Characterization of toxic chemical in Puget Sound and major tributaries, 2009-10
4:35	Shristi Prakash	Perfluorinated acids in surface waters from Puget Sound
5:00	Richard Wenning	Publishing through SETAC
5:15	**Poster Social**	**Discovery Ballrooms A and B**
6:00	**Dinner (Pre-paid)**	Student Book Drawing (**Heritage Ballrooms E and F**)
7:00	**Career Panel**	Open to all!! (**Heritage Ballrooms E and F**)

PNW-SETAC
Saturday Platform Presentations
Morning Session

Discovery Ballrooms C, D, and E

Session Chair: Jerome Laroulandie, Maxxam Analytics

Environmental Monitoring

9:00	Michael Paine	Effects of the Terra Nova offshore oil development on benthic invertebrate infauna on the Grand Banks of Newfoundland, Canada (1997-2008)
9:25	Jennifer Morace	Reconnaissance investigation of emerging contaminants in wastewater treatment plant effluent and stormwater runoff in the Columbia River Basin
9:50	Robert Johnston	Ambient monitoring to assess environmental quality and the protection of beneficial uses in Sinclair and Dyes inlets, Puget Sound, WA
10:15	**Break/Poster Viewing**	**Discovery Ballrooms A and B**

Thinking Outside the Box

10:45	Frieda Taub	Development of pressure in closed ecological systems
11:10	Kendra Zamzow	Big mines and wild fish: how regulations in Alaska are changing and implications for fisheries
11:35	**Student Award Presentations**	
12:00	**Wrap Up/Adjourn**	

PNW-SETAC
Poster Presentations

Presenter(s)	Presentation
Mariana N. Cains	Toxicity of Chemical Mixtures in Stormwater: Malathion and Benzene Toxicity to *Daphnia magna*
Susannah Edwards Annette Handy Molly Harding	Synergistic Effects of Aluminum and Benzo(a)pyrene on Mortality of *Daphnia magna* in a 48-Hour Acute Toxicity Test
Eric Gillette	Normal Activity of Key Organophosphate Biomarkers in Steelhead Salmon
Tom Gries	Sediment Transport and Contaminant Loading to the Lower Duwamish Superfund Site from the Green River: Application of Innovative Sampling Technologies to Verify Model Predictions.
Louisa A. Hooven	Honey Bee Pesticide Exposures: Risk Assessment in a Eusocial Insect
Christopher LaRocque	Spatial and Temporal Microplastic Concentrations in Puget Sound and Chesapeake Bay
Jerome Laroulandie	Measuring the bioconcentration and biomagnification potential of bifenthrin in *Daphnia magna*
Alexander H. MacLeod Mariana N. Cains Peter P. Duane	Investigation into Synergistic Stormwater Toxicity through the Evaluation of Malathion and Benzene Toxicity to *Daphnia magna*
Shannon Mitchell	Acid and Base-Catalyzed Hydrolysis of Beta-Lactam and Sulfonamide Antibiotics
Lia Murty	Detection of the Mycotoxin Lolitrem B in Bovine Urine and Feces

PNW-SETAC
Poster Presentations

Presenter(s)	Presentation
Robert Neely	NOAA's Climate Assessment and Proactive Response Initiative Puget Sound Pilot
Katerine S. Saili	Non-Classical Estrogen Signaling Influences Bisphenol A - Induced Neurobehavioral Toxicity in Zebrafish
Paul R. Seidel	Sediment Characterization in Oregon's Columbia Slough Using Incremental Sampling Methods
Cassandra Viéville	Development of 'Nanocosms': A High-Throughput Bioassay to Assess Toxicity in Aquatic Ecosystems

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Special Session Abstracts

PESTICIDES AND PACIFIC NORTHWEST SALMON: AN OVERVIEW

Wild salmon populations in the Pacific Northwest have been in decline for some time. This decline has been attributed to several factors, one of which is exposure of young and pre-spawn adult salmon to pesticides and pesticide mixtures in streams. Results of recent studies have indicated that exposure of young salmon to low concentrations of certain insecticides (chlorpyrifos, malathion, and diazinon) results in both lethal and sublethal effects. Furthermore, mixtures of these products act synergistically. These data along with a lawsuit in 2001 have led to a biological opinion on the use of pesticides that have the potential to enter our freshwater ecosystems. EPA has taken action to reduce noncrop uses of chlorpyrifos and diazinon, made modifications to maximum labeled application rates, reductions in the number of applications, and specification of minimum application intervals. In this talk, I will discuss the history of pesticides and their effects on Pacific Northwest salmon, go over the Biological Opinion and present new information about the potential effects of a new generation of insecticides on both salmon and aquatic invertebrates.

Contact Author: John Stark, Washington State University
2606 W Pioneer
Puyallup, WA 98371
T: 253-445-4568, F: 253-445-4571, starkj@wsu.edu

Biography:
John Stark is the Director of the Washington State University, Puyallup Research and Extension Center. He is also a Professor and runs the Ecotoxicology Program at WSU. John's research deals with protection of endangered species and ecological risk assessment of pollutants with particular emphasis on salmon. John has published over 90 peer-reviewed papers in scientific journals, numerous book chapters and a recent book on ecological risk assessment entitled "*Demographic Toxicity: Methods in Ecological Risk Assessment".*

SURFACE WATER MONITORING TO ASSESS PESTICIDE EXPOSURE TO ENDANGERED SALMON IN AGRICULTURAL LAND USE AREAS IN WASHINGTON

Sargeant, D.K.[1]*, Anderson, P.[1], Newell, E.[1]., and Cowles, J.[2], [1] Washington State Department of Ecology, Olympia, WA, [2] Washington State Department of Agriculture, Olympia, WA

When registering a pesticide the USEPA conducts an ecological risk assessment to evaluate the fate, transport and effects of a pesticide in the environment. Typically the assumptions used in a registration risk assessment are conservative and generic so the assessment is representative of as many use scenarios as possible across the country. However, when assessing risk to a species listed for protection under the Endangered Species Act (ESA) more detailed information may be needed to adequately assess exposure for a listed species in relationship to regional pesticide use practices. Washington State has developed a state wide surface water monitoring program to assess pesticide exposure for salmonids listed for protection under the ESA. Monitoring data is collected weekly during the pesticide use season from 16 sites representing urban and agricultural land use and variety of salmonid habitat.

In addition to weekly sampling two intensive surveys have been conducted, consisting of daily sampling for 4 weeks and 1 week. Data and results will be presented for the two intensive survey areas (two agricultural areas) in the study. Results of the routine weekly sampling and the intensive survey sampling will be compared for both agricultural areas. In addition results will be compared to: 1) Pesticide concentrations in relation to salmonid presence, 2) Comparison of pesticide concentrations to available criteria and standards for fish and invertebrate protection 3) Temporal and spatial factors affecting pesticide detections and concentrations, and 4) Possible stressors effecting pesticide toxicity to salmonids, including pesticide mixtures, and environmental stressors such as temperature and dissolved oxygen.

Contact Author: Debby Sargeant, Washington State Department of Ecology
Environmental Assessment Program
PO Box 47600, 300 Desmond Dr. SE
Lacey, WA 98504-7600
T: 360-407-6139, F: 360-407-6884, dsar461@ecy.wa.gov

Biography:
Debby has worked for the state of Washington for 22 years in various agencies including the Departments of Health and Ecology. She currently works as a natural resource scientist with the Environmental Assessment Program at Ecology. For the past four years Debby has been the project manager for a statewide pesticide monitoring program. Her other environmental expertise includes bacterial pollution and microbial source tracking. Debby has a BS from the Evergreen State College. Before going into the environmental field she worked as a radiologic technician for 12 years.

"ALL THAT MATTERS IS PURE FACT AND SCIENCE" – BUT JUST WHAT IS THAT?

MCGaughey, B.D., Compliance Services International, Lakewood, WA

Salmon, having an iconic role in Northwest culture, would seem to be well studied and well understood, and managing their ecosystems and survival in a way that is compatible with the state's economic and agricultural health likewise would seem to be a common goal well addressed by scientific analysis. Why then are there differing scientific views? Where does science and policy intersect, and why is this intersection sometimes seemingly blocked when addressed by different regulatory approaches? Does science stand alone in resolving controversy, or should policy direct science in resolving differing views on risk management? This presentation will explore how differences in interpretation and regulation drive science and ultimately how these differences are manifested when salmon and pesticides are examined in the Pacific Northwest.

Contact Author: Bernalyn McGaughey, Compliance Services International
7501 Bridgeport Way West
Lakewood, WA 98499-2423
T: 509-658-2330, bmcgaughey@complianceservices.com

Biography:
In addition to providing corporate executive oversight to Compliance Services International (CSI), Ms. McGaughey has an extensive regulatory background that can be drawn upon to address issues associated with the EPA registration of FIFRA regulated compounds, emerging regulatory issues in the EU and issues related to endangered species regulation. Bernalyn has over 30 years of experience in data evaluation, chemical research, study monitoring, and project management related to the properties, use, toxicology, and environmental fate of pesticides and other chemicals. Her activities have included original and regulatory research, report design and composition, litigation support and international technical assistance on toxicology investigations and risk assessments. She is a recognized scientific expert witness, a "Generally Recognized Expert in Toxicology" by the Society of Toxicology, endangered species task force manager, and a specialist in data compensation. Prior to founding CSI in 1988, Ms. McGaughey held various regulatory, sales and technical positions with Pennwalt and Shell Chemical Corporation's agricultural chemical divisions.

Looking forward to its 23rd anniversary, Compliance Services International (CSI) provides technical and regulatory services to the crop protection, industrial, consumer, and specialty chemical sectors. The company's structure allows it to serve as a supplementary source of R&D and regulatory expertise or to provide complete support in these areas, if needed. CSI is organized in two principal operational divisions: one in the US and one in the EU (Edinburgh, Scotland). Thirty staff are in offices located there or in France, Tacoma (headquarters); Missouri; North Carolina, California; and near Washington, DC. For more information on the company and its staff, visit the company Web Page at www.complianceservices.com.

EPA PERSPECTIVE: SCIENCE AND POLICY

Presenters: Don Brady, Director, U. S. Environmental Protection Agency
Environmental Fate and Effects Division
Office of Pesticide Programs
T: 703-305-7695, brady.donald@epa.gov

Richard Keigwin, Director, U. S. Environmental Protection Agency
Pesticide Re-Evaluation Division
Office of Pesticide Programs
T: 703-308-8000,keigwin.richard@epa.gov

Biographies:

Don Brady has been the Director of the Environmental Fate and Effects Division (EFED) - composed of world class scientists responsible for conducting ecological risk assessments in EPA's Office of Pesticide Programs since October, 2007. EFED completes risk assessments by analyzing toxicity and fate information for pesticides to determine whether the pesticide is safe for the wildlife and the environment. EFED is also responsible for conducting scientific assessments to determine any impact use of a pesticide may have on endangered species. Don is a long time EPA manager, most recently he served as Chief of the Municipal Branch in EPA's Water Permits Division where he was responsible for managing wet-weather permitting programs under section 402 of the Clean Water Act. Prior to that, he served for ten years as Chief of the Watershed Branch, Assessment and Watershed Protection Division, in EPA's Office of Wetlands, Oceans and Watersheds where he was responsible for management of the Total Maximum Daily Load (TMDL) program required by section 303(d) of the CWA. He has a BA in Political Science from Fordham University, and both a Masters and Ph.D. in Government from Georgetown University.

Rick Keigwin serves as the Director of the Pesticide Re-evaluation Division (PRD) within the Office of Pesticide Programs (OPP). Rick joined EPA in 1990, and has been in his current position since January 2009. As Director of PRD, Rick oversees all activities associated with the re-evaluation of the safety of conventional pesticides. Over the course of the past 16 years, Rick has also held leadership positions in the Biological and Economic Analysis Division and the Registration Division. Rick holds a Master's degree in public management from the University of Maryland and a Bachelor's degree in government from Colby College.

IMPORTANCE OF SALMON AND CONSEQUENCES OF CONTAMINATION TO INDIGENOUS PEOPLES

Harper, B., Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR

This talk will cover (a) documentation of traditional fish consumption rates in salmon-bearing rivers by indigenous peoples along the northern Pacific coast, (2) treaty-intended protections and rights, (3) health consequences of lost fish, (4) health consequences of contamination in the remaining fish, and (5) cultural well-being and the broader public health impacts of ecosystem services that are injured by the combination of lost and contaminated fish; typical agency response actions and the burden of avoiding contamination at the expense of culture, heritage, and identity.

Contact Author: Barbara Harper, Confederated Tribes of the Umatilla Indian Reservation
Department of Science and Engineering
Nixyáawii Governance Center
46411 Timíne Way, Pendleton, OR 97801
T: 541-429-7040, bharper@amerion.com

Biography:
Dr. Harper is a toxicologist (and a Diplomat of the American Board of Toxicology (DABT), 1989 with renewals) in the Department of Science and Engineering at the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). She is responsible for coordinating the Hanford nuclear project work with Department of Energy funding), such as risk assessment review and performance, nuclear waste analysis and disposal plans, regulatory review, and natural resource damage assessment.

She also coordinates several research projects in collaboration with Oregon State University and Eastern Oregon University related to environmental health and tribal rights and resources. Her research includes developing tribal exposure scenarios that reflect traditional lifeways and patterns of resource use. In doing so tribes have a better opportunity to meaningfully participate in EPA risk assessments and remediation, as well as a better chance of achieving equity in the restoration of ecosystem services. She has also published in areas of tribal research ethics, including recommendations for modifying national policy and guidance so that tribal concerns might be regarded more equitably and appropriately.

After receiving her PhD from the University of Texas at Austin, she was a post-doctoral fellow and faculty member in Genetic and Environmental Toxicology at the University of Texas Medical Branch at Galveston. She has served as a state toxicologist, a risk assessment manager at Battelle's Pacific Northwest National Laboratory, and a panel member of the EPA Science Advisory Board Drinking Water Committee. She has published in the areas of tribal risk assessment, cultural risk assessment, tribal research ethics, CTUIR First Foods, environmental justice, genetic toxicology, and environmental health.

PROMPTING THE FEDERAL GOVERNMENT TO ENSURE PESTICIDE REGISTRATIONS FULFILL ENDANGERED SPECIES ACT REQUIREMENTS

Code, A. Northwest Center for Alternatives to Pesticides, Eugene, OR

Ms. Code will discuss the process her organization, NCAP, and allies have undergone to ensure that the U.S. Environmental Protection Agency's regulation of pesticides meet basic requirements of the Endangered Species Act (ESA). More specifically, the first salmonids were listed under ESA in 1989. That listing triggered a responsibility for the U.S. Environmental Protection Agency (EPA) to consult with the National Marine Fisheries Service (NMFS) on any pesticide registrations that could jeopardize listed salmonids. Since 2001, NCAP and our allies have used the courts to prompt both EPA and NMFS to fulfill their ESA requirement to consult on the risks current pesticide registrations have on listed salmonids.

Contact Author: Aimee Code, M.S.
Northwest Center for Alternatives to Pesticides
P.O. Box 1393
Eugene, OR 97440-1393
T: 541-344-5044 ext 27, F: 541 344-6923, acode@pesticide.org

Biography:
Aimee spent two years in the Peace Corps in Honduras promoting organic gardening. She was previously employed at the National Pesticide Information Center, an EPA-funded public education service. At NCAP, Aimee coordinates the Clean Water for Salmon Campaign. She also works with school districts, low-income housing providers and others to implement Integrated Pest Management practices. Aimee earned a Master of Science in Environmental Health at Oregon State University in 2000. She joined the NCAP staff in 2000.

The Northwest Center for Alternatives to Pesticides (NCAP) works to protect community and environmental health and inspire the use of ecologically sound solutions to reduce the use of pesticides. It was formed in 1977 by rural residents and reforestation workers concerned about herbicide spraying in Northwest forests. For 32 years, it has combined community outreach, education, advocacy and organizing to protect the health of people and the environment by advancing alternatives to pesticides.

Currently, the NCAP has a variety of programs benefiting rural and urban communities throughout the Northwest. Primarily, NCAP is urging better protections to keep pesticides out of water, establishing safe, pesticide-free places for kids to live, learn and play, strengthening sustainable agriculture and rural economies, and educating people about using alternatives to pesticides in and around their homes.

WRAP UP

Jenkins, J., Oregon State University, Corvallis, OR

Contact Author: Jeff Jenkins, Oregon State University
Department of Environmental and Molecular Toxicology
331 Weniger Hall
Corvallis, OR 97331
T: 541-737-5993, F: 541-737-5001, jenkinsj@ace.orst.edu
emt.oregonstate.edu/faculty/jenkins.htm

Biography:
Current research activities include field studies and modeling to examine the impact of pesticide use on air and water quality in both agricultural and urban settings. Outreach activities include the development of pesticide risk assessment methodology, tools, and materials to communicate risks to the general public, stakeholders, and policy-makers. This outcome-driven approach strives to promote transparency and dialogue about risks associated with exposure to pesticides and other environmental agents and to improve use of risk information in individual decision-making and public policy.

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Platform Presentation Abstracts

OP AND OP OXON DEGRADATION PRODUCTS AND SELECTED FUNGICIDES IN THE ATMOSPHERE OF AGRICULTURAL REGIONS OF WESTERN CANADA

Raina, R.*, Hall, P., and Sun, L., University of Regina, Regina, SK.

Organophosphorus insecticides (OPs) have been used in agricultural areas to protect crops from pests. In this study we investigate two distinct agricultural regions in western Canada that include: the prairies where grain and oil seeds such as wheat, barley, oats, canola, and flax are dominant and OP applications are expected to be applied more sporadic for grasshopper control; and the Lower Fraser Valley (LFV) in British Columbia (BC) where fruit and berry production dominates and usage of OPs is recommended throughout a longer period of the growing season. New analytical methods were developed to allow for detection of OP, OP oxons, and other OP degradation products with most compounds having method detection limits in the range of 0.2-1.9 pg/m^3. This presentation will focus on the unique differences in types of OPs detected in these two agricultural regions and the relationship of active ingredient (OP) with its OP degradation products, including OP oxons. OP oxons are of greater environmental concern as OP oxons are often more toxic than OP parent insecticides. Seasonal variations in both OP and degradation products in the atmosphere will be presented along with examination of changes in ratio of degradation product/parent insecticide and use of this ratio to aid in characterization of local, regional, and long-range atmospheric transport sources. The dominant OPs detected in LFV were diazinon and malathion, while in the prairies chlorpyrifos dominated with selected detection of malathion. Atmospheric trends for two fungicides, captan and folpet, will also be presented for the LFV. Captan shows a significant particle phase fraction in the atmosphere. Relationship of atmospheric concentrations with available 2003 usage inventories and expected patterns of usage will be illustrated.

Contact Author: Renata Raina, University of Regina
Department of Chemistry and Biochemistry
3737 Wascana Parkway
Regina, SK, Canada, S4S 0A2
T: 306-585-4012, F: 306-337-2409, renata.raina@uregina.ca

TRIAZOLE FUNGICIDES IN THE ATMOSPHERE OF THE PRAIRIE AGRICULTURAL REGION OF WESTERN CANADA

Smith, E.*, Raina, R., University of Regina, Regina, SK.

Triazoles are a class of systemic fungicides characterized by the presence of the 1,2,4-triazole moiety and have been used for their preventative and curative abilities to treat a variety of crop diseases. Among the most commonly used triazoles in Canada and United States are propiconazole (Tilt®) and tebuconazole (Folicur®). This chemical class includes approximately 25 fungicides used in North America or Europe. Triazoles have been detected worldwide in a variety of crop or food products, water samples, and a few atmospheric samples collected in Europe. In North America there is little information available on their usage and there have been no previous studies in Canada examining their occurrence in the atmosphere. Triazoles have a wide range of vapour pressures and water solubilities and thus an individual triazole may preferentially move in the environment in the atmosphere or surface waters. This project is designed to examine the occurrence of triazoles in the atmosphere in the prairie agricultural region where there is known previous usage of common triazoles based on 2003 usage inventories. A new liquid chromatography-positive electrospray ionization-tandem mass spectrometry and SPE clean-up method was developed for approximately 25 triazole fungicides and their key degradation products (1,2,4-triazole and triazole acetic acid). New column choices and additional choices of organic modifier in the mobile phase are used to improve chromatographic resolution and aid in solubility issues. Method detection limits range from 0.25 to 10.0 $\mu g\ L^{-1}$ which are approximately equivalent to 0.25 -10 pg/m^3 for a 7-day air sample. A high volume PS-1 sampler was used to collect air samples of 7-day duration at a prairie agricultural site, Bratt's Lake, SK during 2010. The results of the first measurements of this chemical class of fungicides in the atmosphere will be presented.

Contact Author: Erika Smith, University of Regina
Department of Chemistry and Biochemistry
3737 Wascana Parkway
Regina, SK, Canada, S4S 0A2,
T: 306-585-4833, F: 306-337-2409, smith22e@uregina.ca

CARBAMATES, CARBAMATE DEGRADATION PRODUCTS, AND PHENYLUREAS IN THE ATMOSPHERE IN THE PRAIRIE AGRICULTURAL REGION OF CANADA

Fergus, N.*, Raina, R., University of Regina, Regina, SK.

Carbamates are a chemical class of broad-spectrum systemic plant insecticides that are applied to crops during infestations such as for grasshopper control in the prairies. This project includes the examination of N-methylcarbamates, N,N-dimethylcarbamates, and thiocarbamates in the atmosphere in the prairie agricultural region. Among the most commonly used carbamates in North America are aldicarb, carbaryl, carbofuran, methomyl, and oxamyl. They have been used on a wide range of crops including grains, hay, soybean, cotton, corn, fruit and berry crops. Carbamates can degrade by oxidation or hydrolysis and products include sulfones, sulfoxides, or oximes. Phenylurea herbicides are a less commonly studied class of herbicides, but are used in North America in both agriculture and residential areas for weed control. They are more heavily used in agricultural regions of the United States than the Canadian prairies and have the potential to be used as tracers for trans-boundary long-range atmospheric transport. Carbamates and phenylureas have the potential to be transported in the atmosphere or surface waters. Previous studies on these pesticides have focused on surface waters or food products and this project examines their occurrence in the atmosphere. A new liquid chromatography-positive electrospray ionization-tandem mass spectrometry (LC/MS/MS) and SPE clean-up method was developed for 12 carbamates, 7 carbamate degradation products, and 4 phenylureas. A new column stationary phase was used to improve chromatographic resolution and LC/MS/MS detection limits range from 1 to 30.0 µg L^{-1} which are approximately equivalent to 1 -30 pg/m^3 for a 7-day air sample. A high volume PS-1 sampler was used to collect air samples of 7-day duration at a prairie agricultural site, Bratt's Lake, SK during 2009. The results of the first measurements of these pesticides along with their degradation products in the atmosphere will be presented.

Contact Author: Nicole Fergus, University of Regina
Department of Chemistry and Biochemistry
3737 Wascana Parkway
Regina, SK, Canada, S4S 0A2
T: 306-585-4833, F: 306-337-2409, fergus2n@uregina.ca

IMMUNOTOXICITY OF ATRAZINE AND NONYLPHENOL IN RAINBOW TROUT (*ONCORHYNCHUS MYKISS*)

Shelley, L.K.[1*], Miller, K.M.[2], Kaukinen, K.H. [2], Ross, P.S.[3], Kennedy, C.J.[1],[1] Simon Fraser University, Burnaby, BC, Canada, [2] Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC, Canada, [3] Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, BC, Canada

Atrazine and nonylphenol are commonly identified contaminants in aquatic habitats and have been associated with numerous toxic effects in fish due to their potential to disrupt endocrine processes. Surprisingly, with the increasing recognition of the role of endocrine modulation of the immune system, relatively few studies have considered the potential impact of endocrine disrupters on immune system function. In recent years, microarray technologies have significantly advanced and become more widely available, leading to the regular use of microarrays in assessing alterations at the molecular level in response to environmental changes. Microarrays have frequently been used to examine changes in gene expression in fish following exposure to either pathogens or chemicals individually, but have rarely been applied in immunotoxicological studies in which responses to both pathogen and chemical exposures are considered together. In the current study, rainbow trout, *Oncorhynchus mykiss*, (29.6 g ± 0.4 g) were exposed to either atrazine (0, 5, 50 and 500 µg/L) or 4-nonylphenol (0, 1, 10 and 100 µg/L) for 4 days, followed by a 1 hour immersion challenge with the bacterial pathogen *Listonella anguillarum*, and subsequently monitored for pathogen-related mortality for 14 days. Blood and tissues samples were collected before and after disease challenge. Liver samples from the control, 500 µg/L atrazine and 100 µg/L nonylphenol groups were prepared for use in 32K salmonid microarrays (cGRASP, 32K version 1) to assess genomic responses to both chemical exposure and chemical + disease challenge treatments. Analysis of the study results is currently underway and preliminary findings will be presented. This study will provide insight into the molecular mechanisms underlying the physiological effects of both atrazine and nonylphenol exposure in fish, as well as providing evidence to support the value of utilizing microarray technology in immunotoxicological investigations.

Contact Author: Lesley Shelley, Simon Fraser University
Department of Biological Sciences
8888 University Drive
Burnaby, BC, Canada V6A 1S5
T: 778-782-5634, F: 778-782-3496, lshelley@sfu.ca

SUBLETHAL EFFECTS OF TWO PYRETHROID PESTICIDES ON JUVENILE RAINBOW TROUT (*ONCORHYNCHUS MYKISS*) SWIM PERFORMANCE

Goulding, A.T[1*], Shelley, L.K.[1], Ross, P.S.[2], Kennedy, C.J.[1], [1] Simon Fraser University, Burnaby, BC, Canada, [2] Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, BC, Canada

Deltamethrin and permethrin are potent neurotoxic synthetic pyrethroid insecticides commonly used both agriculturally and domestically, and have been identified as contaminants in sensitive aquatic environments. While pyrethroids are generally considered to present minimal risk of toxicity to terrestrial vertebrates, these chemicals have high lethal toxicity to fish. Except under rare conditions such as spills, the concentrations of pyrethroids in the environment are generally below levels expected to cause immediate lethality; however, sublethal toxicity can also pose significant risk to exposed fish. Pyrethroids disrupt nerve transmission in the central nervous system through effects on voltage-gated sodium channels, which can lead to impairments in muscular function. Since there are no readily available biochemical indicators of pyrethroid-induced neurotoxicity, behavioural assays can provide integrated toxicological endpoints that are ecologically relevant. Changes to normal neuro-muscular function may translate into decreased swim performance and increased predation risk in fish, thus decreasing fitness and increasing mortality, contributing to population-level declines. In the first experiment of the current study, juvenile rainbow trout, *Oncorhynchus mykiss*, were exposed to either deltamethrin (0, 100, 200 or 300 ng/L) or permethrin (0, 0.5, 1, and 1.5 µg/L) for 4 days and subsequently assessed for swimming performance. Additional experiments will determine the temporal effects on swim performance following deltamethrin or permethrin exposure and assess the ability of exposed fish to avoid predation. Analysis of the results of the study is underway and preliminary findings will be presented. This study provides insights into the effects of sublethal exposures to deltamethrin and permethrin on ecologically-relevant endpoints; information that can be useful to regulators in ensuring the protection of fish from pyrethroid pesticide toxicity.

Contact Author: Adam Goulding, Simon Fraser University
Department of Biological Sciences
8888 University Drive
Burnaby, BC, Canada V6A 1S5
T: 778-782-5634, F: 778-782-3496, atg4@sfu.ca

FIELD VS LABORATORY-BASED APPROACHES FOR DERIVATION OF AQUATIC LIFE CRITERIA: JUST BECAUSE WE CAN, DOES IT MEAN WE SHOULD?

Gensemer, R.W.*, Canton, S.P., GEI Consultants, Denver, CO

The current practice for derivation of water quality criteria for protection of aquatic life is to use results from standard laboratory toxicity tests with a range of surrogate test species using defined protocols to calculate both acute and chronic criteria. Such criteria have been used for decades to develop discharge permits for a wide range of chemical pollutants under EPA's National Pollutant Discharge and Elimination System (NPDES) and for other uses, such as 303(d) impairment listings and ecological risk assessments. While derivation of these criteria are intended to provide broad levels of protection for aquatic communities exposed to pollutants, uncertainties exist in extrapolating laboratory toxicity test results to the protection of natural communities. Recently, however, new approaches have been proposed to derive chemical criteria on the basis of empirical relationships between benthic macroinvertebrate community structure and pollutant concentrations in synoptic surveys. The most recent examples of this approach by EPA include derivation of numeric nutrient criteria in Florida and conductivity benchmarks in central Appalachian streams chemically dominated by sulfate and bicarbonate salts. While use of field data are attractive with regards to environmental realism, identifying causality and minimizing the influence of confounding factors makes derivation of such numeric criteria or benchmarks extremely challenging. Using the conductivity benchmark as a case study, this presentation explores the difficulties of using synoptic field survey data in deriving regulatory aquatic life criteria. Such difficulties include statistical methods used, establishing causality, and approaches for identifying or minimizing the influence of confounding environmental factors. We conclude that increases in conductivity (or ions measured by conductivity) have not yet been shown to be causally related to changes in benthic macroinvertebrate community composition. Furthermore, the confounding factors of benthic habitat characteristics, stream flow, and other anthropogenic influences prevent rigorous application of a numeric aquatic life benchmark based on conductivity.

Contact Author: Bob Gensemer, GEI Consultants
Ecology Division
4601 DTC Blvd, #900
Denver, CO 80237
T 303-264-1030, F 303-662-8757, bgensemer@geiconsultants.com

THE WATERS OF THE NUSHAGAK AND THE FISH THAT LOVE THEM: INDEPENDENT BASELINE STUDIES NEAR THE PROPOSED PEBBLE MINE IN ALASKA

Zamzow, K.L.,*[1] Woody, C.A.[2], Bogan, D.[3], Maest, A.[4], [1] Center for Science in Public Participation, Sutton, AK, [2] Fisheries Research Consulting, Anchorage, AK, [3] Environment and Natural Resources Institute, University of Alaska, Anchorage, AK, [4] Stratus Consulting, Boulder, CO

Although Alaska is famous for the gold rush that brought people to the state in the 1890's, no large scale mines existed until 1989. The first world-class copper-gold sulfide mine to be pursued in Alaska, the Pebble mine, is preparing to apply for mining permits. The mine would be located in the headwaters of the Nushagak and Kvichak watersheds that feed Bristol Bay and Talarik Creek that drains into Lake Iliamna. Bristol Bay supports the largest return of wild salmon in North America, and boasts over 125 years of continuous commercial fishing; Lake Iliamna is one of the largest lakes in North America and the largest sockeye salmon rearing lake in the world. Independent scientists are conducting studies on fish, benthic invertebrates and diatoms, water chemistry, and copper bio-availability. The scope of the studies and available results will be presented, along with a discussion of the risks the mine poses.

Contact Author: Kendra Zamzow, Center for Science in Public Participation
PO Box 54, Sutton, AK 99674
T: 907-354-3886, kzamzow@csp2.org

THE USE OF A BAYESIAN NETWORK TO MODEL THE RISKS OF MERCURY CONTAMINATION IN THE SOUTH RIVER, VIRGINIA

Summers, H. M.* and Landis, W. G., Western Washington University, Bellingham, WA

The South River watershed in western Virginia has had a history of mercury contamination from past industrial practices. An environmental risk assessment of the effects of the mercury contamination is being conducted using Bayesian belief networks for the site. A conceptual model has been created for the effect pathways connecting the sources of mercury to the potential environmental impacts by examining the exposure through various habitats. Prior to quantifying risk using Bayesian networks, a method for evaluating data quality was created that characterizes their applicability to the stakeholder defined endpoints and potential uncertainties. The method will be initially applied to a single endpoint, the protection of smallmouth bass (*Micropterus dolomieu*), for which the largest amount of sampling data exists. Eventually the method will be expanded and adapted to amphibian and bird endpoints.

Contact Author: Heather M. Summers, Western Washington University
Institute of Environmental Toxicology
516 High Street, MS-9180
Bellingham, WA 98225
T: 360-650-3511, summerh@students.wwu.edu

ASSESSING RISK FROM AN ENVIRONMENTAL APPLICATION OF RECLAIMED WATER

Warner K.E., Golder Associates, Portland, OR

One consideration regarding environmental applications for water reuse projects is the presence of chemicals of emerging concern in wastewater treatment plant (WWTP) effluent. While the concentrations of these compounds in surface waters are not currently regulated under state or federal guidelines, reports have identified potential aquatic biota toxicity from estrogenic pharmaceuticals, raising scientific and public concern. This presentation focuses on an ecological risk assessment performed for a reclaimed water project in Kitsap County, Washington. The project proposed to deliver reclaimed water from a WWTP to a wetland and fish-bearing stream to benefit both systems. A hydrologic analysis and review of the current scientific literature were performed to develop an ecological risk assessment pertaining to natural and synthetic estrogens potentially present in the WWTP influent, effluent, and receiving stream. The results of the modeled risk assessment and water quality analysis suggest negligible risk from estrogenic compounds to fish in the receiving stream. A discussion of risk assessment considerations for other water quality parameters in water reuse projects is included.

Contact Author: Kara Warner, Golder Associates Inc.
9 Monroe Pkwy. Suite 270
Lake Oswego, OR 97035
T: 503-607-1820, F: 503-607-1825, kwarner@golder.com

ASSESSING CUMULATIVE AQUATIC TOXICITY IN THE WILLAMETTE RIVER BASIN

Hope, B.K., Oregon Department of Environmental Quality, Portland, OR

The Willamette River Basin (Basin) in northwestern Oregon holds 70% of the state's population and 75% of its employment. Associated residential, municipal, industrial, and agricultural activities produce stressors that impinge on its water quality and aquatic ecosystems. This study examined relationships between land use (as stream length) and biological conditions, land use and chemical stressors (as cumulative toxicity), and chemical stressors and biological conditions to assess whether chemical stressors could contribute to differences in biological conditions throughout the Basin. Additive and interactive hazard indices were calculated for all trace metals and organic chemicals detected in Basin waters over the last 40 years. These indices were compared to land use metrics and to vertebrate assemblage tolerance and macroinvertebrate assemblage indices. Results suggest that: (a) conditions for invertebrates and fish improve either as agricultural or urban land decreases or forested land increases, (b) specific land uses, particularly agricultural and urban, may source greater levels of relatively more toxic chemicals than forested lands, and (c) chemical stressors are probably not primary contributors to alterations in biological conditions, but may be important secondary contributors due to their persistent presence at or near acute toxicity thresholds.

Contact Author: Bruce K. Hope, Oregon Department of Environmental Quality
811 SW Sixth Ave.
Portland, OR 97204
T: 503-229-6251, F: 503-229-5675, hope.bruce@deq.state.or.us

QUANTIFICATION OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN SEDIMENTS FROM URBAN AND NON-URBAN LOCATIONS FROM PUGET SOUND, WASHINGTON

Dutch, M.E.[1*], Weakland, S.[1], Chandramouli, B.[2],[1]Washington State Department of Ecology, Olympia, WA ,[2]AXYS Analytical Services Ltd., Sidney, BC, Canada

Concentrations of Pharmaceuticals and Personal Care Products (PPCPs) have recently been measured in influent, effluent, and biosolids from municipal wastewater treatment plants in Puget Sound, WA, but have never been analyzed in Puget Sound sediments. In April, 2010, sediments were collected for two ongoing monitoring programs. Ten long-term ambient monitoring stations were sampled from locations throughout Puget Sound for the Puget Sound Assessment and Monitoring Program. Thirty randomly-selected stations were also sampled from Bellingham Bay, using a probabilistic sampling design developed for the Washington State Department of Ecology's Urban Waters Initiative. Sediments were tested for the presence of 119 PPCPs. Analyses were conducted by AXYS Analytical Services Ltd., Sidney, BC, Canada, using AXYS Method MLA-075. This method uses liquid chromatography with tandem mass spectrometry (LC/MS/MS). Acid and base fractions were extracted, followed by five instrumental analyses in positive and negative electrospray ionization (ESI) modes. PPCPs were detected in <2% (91 of 5536) of all results, while only 12% (14 of 119) of all chemicals were detected. Chemicals most frequently detected include diphenhydramine, triclocarban, and triamterene. Challenges encountered in the analysis of floxacin compounds are discussed. Compounds analyzed in the acid extractable, ESI positive ionization mode were initially qualified due to low surrogate recoveries. Various analytical issues, including solid phase extraction methods and limitations for marine sediment matrices, were examined to determine the cause of these low recoveries. Final concentrations are summarized and presented graphically to indicate the concentration and distribution of PPCPs in Puget Sound sediments at these 40 urban and non-urban study locations.

Contact Author: Margaret Dutch, Washington State Department of Ecology
PO Box 47600
Olympia, WA 98504-7600
T: 360-407-6021, F: 360-407-6884, margaret.dutch@ecy.wa.gov

CHARACTERIZATION OF TOXIC CHEMICALS IN PUGET SOUND AND MAJOR TRIBUTARIES, 2009-10

Gries, T.*, Osterberg, D., Washington State Department of Ecology, Olympia, WA

The Washington State Department of Ecology has been conducting a series of technical studies to inform source control strategies for toxic chemicals entering Puget Sound. Previous studies developed toxic chemical loading estimates and used computer models to predict outcomes of control actions. Recently-completed studies were intended to reduce uncertainties associated with loadings estimates and model predictions. This study collected seasonal water samples from seven sites in Puget Sound and ocean boundary waters, and from near the mouths of the five largest rivers flowing into the Sound. Samples were analyzed for a range of chemicals of concern. Many organic chemicals were seldom if ever detected in marine waters, but concentrations of metals and polychlorinated biphenyls (PCBs) were similar to values previously reported. Organic carbon, copper, and PCB concentrations were higher in outgoing Puget Sound waters than in incoming ocean waters, while the opposite was true for cadmium. Ocean exchange estimates indicated most target chemicals of concern appear were exported from Puget Sound to the ocean. River waters contained concentrations of conventional parameters, nutrients, metals, and some organic compounds that were generally within ranges previously reported. Petroleum-related compounds, semivolatile organic compounds (BNAs), polycyclic aromatic hydrocarbons (PAHs), and chlorinated pesticides were seldom detected. Daily loads for many chemicals were calculated that can be compared to estimated loads from other studies and model simulations. Suspended particulate matter (SPM) samples, collected from deep marine waters and river waters, were analyzed for a suite of chemicals similar to those analyzed for water samples. Hood Canal and South Puget Sound basin sample results were used to estimate loss rates of toxic chemicals from the water column via sedimentation. Toxic chemicals such as PAHs were more often detected in river SPM than in river water. The author will summarize study findings, emphasizing various field and analytical challenges encountered.

Contact Author: Tom Gries, Washington State Department of Ecology
300 Desmond Drive SE
Lacey WA, 98503
T: 360-407-6327, F: 360-407-6884, tgri461@ecy.wa.gov

PERFLUORINATED ACIDS IN SURFACE WATERS FROM PUGET SOUND

Prakash, S., Baker, J.E., Dinglasan-Panlilio, M.J.* Center for Urban Waters, University of Washington Tacoma, WA

Perfluorinated acids (PFCs) are a synthetic class of compounds widely used in the carpet, paper and textile industries to render surfaces both oil and water repellant. Different chain lengths of these compounds are ubiquitous in environmental matrices and are a concern due to their bioaccumulation potential, their persistence and potential toxicity. The Washington State Department of Ecology (ECY) recently published a priority list of Chemical Action Plans (CAPs) as a way to evaluate presence and impact of persistent bioaccumulative toxins within the state with the ultimate goal of proposing reduction initiatives. Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), two of the most commonly detected PFCs, are included in the CAP. To date, there have been limited studies done to measure the concentrations of perfluorinated compounds in the state of Washington. In a recent study by the ECY, water samples from selected rivers and lakes within the state were analyzed for these emerging contaminants. The objective of this study was to measure the concentration of various chain lengths (C4-C13) of PFCAs in surface water samples from different locations within the Puget Sound to enhance the pool of data that can be used to evaluate the occurrence of these contaminants within the region. Water samples were collected in the spring and fall of 2008 and 2009 during sampling cruises along Commencement Bay, Quartermaster Harbor, Hood Canal, San Juan de Fuca, and Clayoquot Sound. The samples were extracted using solid phase extraction (SPE) and analyzed using liquid chromatography tandem mass spectrometry. PFCs in surface water samples were measured at concentrations near or less than 9.16 ng/L. The acid most commonly detected in all water samples analyzed was PFOA. Future work will involve examination of potential sources of these contaminants within the region.

Contact Author: Joyce Dinglasan-Panlilio, University of Washington Tacoma
Environmental Program
1900 Commerce St. Box 358436
Campus Box 358436, Tacoma, WA 98402
T: 253-692-4823, jdingpan@uw.edu

HOW TO GET PUBLISHED: TIPS FROM A SETAC EDITOR-IN-CHIEF

Wenning, R.J., ENVIRON International Corporation, Emeryville, CA

Join Rick Wenning, Editor-in-Chief of the SETAC journal *Integrated Environmental Assessment and Management* (*IEAM*), as he discusses strategies for successfully publishing peer-reviewed papers and offers general information about SETAC journals, as well as benefits of publishing with SETAC and Wiley-Blackwell. There will be a brief presentation followed by a question and answer session. The Society of Environmental Toxicology and Chemistry (SETAC) publishes two journals: *Environmental Toxicology and Chemistry* (*ET&C*) and *Integrated Environmental Assessment and Management* (*IEAM*). *Environmental Toxicology and Chemistry* is dedicated to furthering scientific knowledge and disseminating information on environmental toxicology and chemistry, including the application of these sciences to risk assessment. *Integrated Environmental Assessment and Management* (*IEAM*) focuses on the application of science in environmental decision making, regulation, and management, including aspects of policy and law, and the development of scientifically sound approaches to environmental problem solving. Together, these journals provide a forum for professionals in academia, business, government, and other segments of society involved in the use, protection, and management of the environment for the enhancement of ecological health and human welfare.

Contact Author: Richard J. Wenning, ENVIRON International Corporation
Marketplace Tower
6001 Shellmound Street, Suite 700
Emeryville, CA 94608
T: 510-420-2556, rwenning@environcorp.com

EFFECTS OF THE TERRA NOVA OFFSHORE OIL DEVELOPMENT ON BENTHIC INVERTEBRATE INFAUNA ON THE GRAND BANKS OF NEWFOUNDLAND, CANADA (1997-2008)

Paine, M.D.*[1], DeBlois, E.M.[2], Tracy, E.[3], Crowley, R.[4], Janes, G.[4], [1]Paine, Ledge and Associates (PLA), North Vancouver, BC, Canada, [2]Elisabeth DeBlois Inc., Logy Bay, NL, Canada, [3]Stantec Consulting Ltd., St. John's, NL, Canada, [4]Suncor Energy, St. John's, NL, Canada

This presentation summarizes the effects of the Terra Nova (TN) offshore oil development in the North Atlantic and the Grand Banks, 300 km East of St. John's NL, on local benthic invertebrates. Sediment and invertebrate samples were collected in 1997 ("baseline") prior to drilling, and subsequently in 2000, 2001, 2002, 2004, 2006 and 2008 (=Environmental Effect Monitoring or EEM sample years) after drilling began at several drill centres. The basic spatial monitoring design was a regression/gradient approach, with approximately 50 stations sampled each year at <1 to 20+ km from source (drill centres). Two invertebrate core samples were collected at every station. Summary benthic invertebrate community measures analyzed were total abundance (numbers of organisms per station or area), biomass (wet weight of organisms per station or area), richness (number of families or higher-order taxa collected per station), and multivariate (Non-Metric Dimensional Scaling or NMDS) measures of community composition. Post-operational effects in EEM years on summary invertebrate community measures were generally limited to within 0.5 km of drill centres. Apparent effects of drilling on abundances of individual taxa extended up to 2 km from drill centres, and were a mix of both "positive" (increases in abundance near drill centres) and "negative" (decreases in abundance near drill centres) effects. For the purposes of monitoring and assessing effects of marine developments or discharges on invertebrate communities, the magnitude, spatial extent, and even direction (i.e., increase or decrease in abundance with distance from source) of any effects will vary among taxa and will depend on the original community/taxa present.

Contact Author: Michael Paine, Paine, Ledge and Associates (PLA)
302-1050 Bowron Court
North Vancouver, BC V7H 2X6
T: 604-924-8126, paine.ledge.pla@telus.net

RECONNAISSANCE INVESTIGATION OF EMERGING CONTAMINANTS IN WASTEWATER-TREATMENT-PLANT EFFLUENT AND STORMWATER RUNOFF IN THE COLUMBIA RIVER BASIN

Morace, J.L., USGS, Portland, OR

In order to efficiently reduce toxic loading to the Columbia River basin, sources and pathways need to be identified. Little is known about the toxic loadings coming from wastewater-treatment plants (WWTPs) and stormwater runoff in the system. This study provides reconnaissance data on these sources and pathways throughout the basin. The cities sampled in Oregon and Washington were chosen for their diverse characteristics, including population density. Samples were collected from a WWTP in each of the cities and analyzed for wastewater-indicator compounds, pharmaceuticals, PCBs, PBDEs, legacy compounds, currently used pesticides, mercury, and estrogenicity. Currently, these treatment facilities only sample to meet their permit requirements, which are very limited. The second component of the sampling effort was directed at characterizing stormwater runoff for a slightly different set of emerging contaminants. Nothing is known about the environmental implications of emerging contaminants from these two types of effluent. Results indicate that a majority of these compounds are present in the WWTP effluent and some at environmentally relevant concentrations. Although the grab samples were not time-integrated and the effluent is expected to change in nature throughout time, the continuous input of this number of compounds and at these concentrations can have implications on the receiving waters, the food web reliant on these waters, and the ecosystem as a whole. In contrast, stormwater runoff is sporadic and unpredictable, yet the sudden input of these contaminants can provide significant loadings to the receiving waters and has its own unique implications for the ecosystem.

Contact Author: Jennifer Morace, USGS Oregon Water Science Center
2130 SW Fifth Ave. Portland, OR 97201
T: 503-251-3229, F: 503-251-3470, jlmorace@usgs.gov

AMBIENT MONITORING TO ASSESS ENVIRONMENTAL QUALITY AND THE PROTECTION OF BENEFICIAL USES IN SINCLAIR AND DYES INLETS, PUGET SOUND, WA

Johnston, R.K.[1]*, Rosen G.H.[1], Brandenberger, J.M.[2], Mollerstuen, E.W.[3], Young, J.M.[3], and Beckwith, B.[3], [1]Space and Naval Warfare Systems Center Pacific, Bremerton, WA, [2]Pacific Northwest National Lab, Sequim, WA, [3]Puget Sound Naval Shipyard & Intermediate Maintenance Facility, Bremerton, WA

A network of monitoring stations was established within Sinclair and Dyes Inlets to characterize environmental conditions, assess potential impacts, and establish environmental quality trends. Water, sediment, and biota monitoring locations were selected that were co-located near suspected sources (industrial, waste water, and stormwater outfalls; marinas, stream mouths, and others) and locations that were representative of ambient marine and nearshore conditions for periodic sampling. Water column stations and effluents from industrial outfalls were sampled seasonally for metals (Al, Ag, Cd, Cr, Cu, Hg, Pb, and Zn), conventional parameters (salinity, dissolved and total organic carbon, total and suspended solids, NO_2+NO_3, NH_4, N, and P), and toxicity. Indigenous mussels (*Mytilis* spp.) were sampled semi-annually for contaminant residues of metals and toxic organic compounds (polycyclic aromatic hydrocarbons and polychlorinated biphenyls. Sediment monitoring for metals and toxic organic compounds is being conducted at three-year intervals. Effluent and water column toxicity tests included mysid shrimp (*Americamysis bahia*) 96 hr survival, sand dollar (*Dendraster excentricus*) or purple sea urchin (*Strongylocentrotus purpuratus*) 96 hr embryo development, QwikLite – dinoflagellate (*Pyrocystis lunula*) 24 hr bioluminescence response, *Mytilus* sp. 48 hr larvae survival and development, and kelp (*Macrocystis pyrifera*) 48 hr growth and germination. Key questions include: (1) Are discharges from shipyard industrial outfalls and storm drains protective of beneficial uses of Sinclair Inlet? (2) Are discharges from all sources of contamination into Sinclair and Dyes Inlets impacting the quality of water, sediment, and biota in the Inlets? (3) What is the status and trend of water, sediment, and biota quality in Sinclair and Dyes Inlets? Results from 2009-2010 showed that dissolved metals nearly always met water quality standards, mussel tissue residues were below screening-level benchmarks at most locations, and no toxicity was observed from exposure to whole effluent samples. Toxicity in ambient water samples was highly correlated with the abundance of *Gymnodinium splendens* algal blooms.

Contact Author: Robert K. Johnston, Space and Naval Warfare Systems Center Pacific Code 71752
Marine Environmental Support Office - NW
4228 Fir Dr. NE
Bremerton, WA 98310
T (w): 360-782-0113, (c): 360 961-9072, F: 360-824-6279, johnston@spawar.navy.mil

DEVELOPMENT OF PRESSURE IN CLOSED ECOLOGICAL SYSTEMS

Taub, F B.* and McLaskey, A. K., University of Washington, Seattle, WA

The assumption that gas pressure would remain at approximately atmospheric pressure in Closed Ecological Systems (CESs) because the molar quantities (and volumes) of CO_2 and O_2 would exchange, has been shown to be wrong, at least when $NaHCO_3$ is the carbon source. Earlier attempts to demonstrate pressure increases had failed. However, measurement with quantitative instrumentation has shown that increases in gas pressure are significant. Growth in heavy plastic bags have shown significant gas production when $NaHCO_3$ was the carbon source, which is consistent with a pressure increase. With cellulose as the carbon source, gas production is much slower and of lesser volume, and much less pressure is produced. The low solubility of O_2 in water is partly responsible for the gas and pressure increases, as the equilibrium constant H = [A(aq)]/[A(g)] = 0.0308 for O_2 or ~33 times as much O_2 is in the gas phase as in the water phase. The perceived lack of agreement between O_2 and Dissolved Inorganic Carbon (DIC) in CESs may be explained, at least in part, by recognizing the gaseous O_2 and by potential leakage of O_2 rich air. The ability of cellulose to support algal and *Daphnia* populations with much less O_2 and pressure production is still unexplained. Presumably, the cellulose carbon becomes available to primary production only after degradation by microorganisms. These studies may shed light on arguments about the relative importance of terrestrial inputs to lake metabolism; one group claims that 30% of zooplankton carbon arises from terrestrial inputs, and another claims that leaf litter does not adequately support zooplankton growth and reproduction. The CESs could be developed as sealed toxicity tests of volatile chemicals, those which now remain untested because their fumes would contaminate laboratories.

Contact Author: Frieda B. Taub, University of Washington
School of Aquatic & Fishery Sciences
1140 NE Boat Street (UW Box 355100)
T: 206 484 1229, F: 206 685 3275, taub@u.washington.edu

BIG MINES AND WILD FISH:
HOW REGULATIONS IN ALASKA ARE CHANGING AND IMPLICATIONS FOR FISHERIES

Zamzow, K.L.*, Center for Science in Public Participation

No large scale mines existed in Alaska until 1989, and only a few have been developed since then. Today large gold, copper, and coal-strip mines are proposed in salmon habitat. Precedents that are being considered include: first ever permitting the removal of a salmon stream during mining and the first ever thermal processing of ore in a mercury belt in Alaska. At the same time, new regulations regarding water and air quality need to be interpreted and implemented by the State. The talk will focus on the Donlin gold mine, proposed near one of the largest subsistence rivers in Alaska, and Chuitna coal mine, proposed near one of the best-producing king salmon rivers on Cook Inlet.

Contact Author: Kendra Zamzow, Center for Science in Public Participation
PO Box 54, Sutton, AK 99674
T: 907-354-3886, kzamzow@csp2.org

Pacific Northwest Chapter

Society of Environmental Toxicology and Chemistry

(PNW-SETAC)

20th Annual Meeting

Poster Presentation Abstracts

TOXICITY OF CHEMICAL MIXTURES IN STORMWATER RUNOFF: MALATHION AND BENZENE TOXICITY TO *DAPHNIA MAGNA*

Cains, M.N.*, Landis W.G. Institute of Environmental Toxicology, Huxley College, Western Washington University, Bellingham, WA

Stormwater is comprised of chemical mixtures from multiple nonpoint runoff sources. The increasing urbanization of land use causes contaminants on the impervious surfaces to be carried away in stormwater and into the nearest waterway. The common landscaping and agricultural practice of over-application of pesticides leaves the excess toxicant to be washed away with the field runoff water. While there is information on individual chemical toxicity, little is known about the toxicity of chemical mixtures. In order to manage risk, it is critical to understand how contaminated stormwater can affect the reproduction and survival of non-target organisms. In this experiment 48-hour acute and 21-day chronic *Daphnia magna* toxicity tests were conducting using >98% reagent grade benzene and analytical grade malathion. The chemicals were tested at the following concentration ranges: malathion 2.5 – 40 µg/L and benzene 1800 – 28000 µg/L. A mixture of benzene and malathion was also tested to evaluate the potential additive, synergistic, or antagonistic toxicity: malathion 2.5 – 40 µg/L in the presence of 7000 µg/L of benzene. The survival and reproduction rate data collected will be used to construct an age structured population model to determine how the chemical mixture would change the dynamics of a *Daphnia magna* population.

Contact Author: Mariana Cains, Western Washington University
Institute of Environmental Toxicology
Huxley College of the Environment
516 High Street, MS-9180
Bellingham, WA 98225
T: 509.540.1532, marianacains@gmail.com

SYNERGISTIC EFFECTS OF ALUMINUM AND BENZO(A)PYRENE ON MORTALITY OF *DAPHNIA MAGNA* IN A 48-HOUR ACUTE TOXICITY TEST

Edwards, S.T., Handy A. M, Harding*, M.M., Western Washington University, Bellingham, WA

Certain chemicals produce a synergistic toxic effect when in combination with one another. When multiple toxicants are bioavailable to an organism, the organism's natural resistance to each single toxicant may be compromised due to the compounding effects of each chemical. Alcoa Intalco Aluminum Corporation located in Ferndale, WA, releases a chemical cocktail into the Puget Sound each day, albeit at levels regulated by the USEPA. This experiment was conducted to determine whether two of the chemicals released, aluminum (Al) and benzo(a)pyrene (B(a)P), have synergistic effects. A 48-hour acute toxicity test, using *Daphnia magna* as the test organism and mortality as an endpoint, was performed to establish a dose-response curve for the single chemicals, and the mixture. The lowest concentrations, 0.010 mg B(a)P/L and 0.246 mg Al/L, were chosen because they were comparable to the average levels found in Intalco's effluent. The organisms were also dosed at concentrations of 1,056 and 1,104 mg Al/L and 0.155 and 0.300 mg B(a)P/L to establish a dose-response curve for the individual chemicals, and the mixture of the Al and B(a)P. Mortality increased with increasing concentration of each toxicant in the B(a)P and Al treatments. The B(a)P treatments resulted in highest percent mortality, followed by the mixture treatments, and then the Al treatments. Forty percent or greater immobilization was also measured in the two lower mixture treatments.

Contact Author: Molly Harding, Western Washington University
3015 Kellogg St.
Bellingham, WA 98225
T: 360-927-5765, Hardinm4@students.wwu.edu

MEASURING THE BIOCONCENTRATION AND BIOMAGNIFICATION POTENTIAL OF BIFENTHRIN IN *DAPHNIA MAGNA*

Eickhoff, C.V.[1], Mitchell, G.C.[2], Leggett, M.F.[3], O'Grodnick, J.[2], and Arnot, J.[4]. [1]Maxxam Analytics, Burnaby, BC, Canada, [2]FMC Corporation, Agricultural Products Group, Ewing, NJ, [3]CropLife America, Washington, DC, [4]University of Toronto Scarborough, Scarborough, ON, Canada

Bifenthrin is a synthetic pyrethroid insecticide first registered for agricultural use more than 20 years ago. The bioconcentration and biomagnification potential of bifenthrin in *Daphnia magna* was assessed in two laboratory studies. A 14d bioconcentration test was conducted in which 12.3 ng/L [14C cyclopropyl]-bifenthrin was administered to the test medium via acetone (<0.1%) during a 48h uptake phase. *Daphnia* were transferred to clean medium for a subsequent 12d depuration phase. Bifenthrin was observed to rapidly sorb to *Daphnia*. Within 48 hours of initiation of the experiment concentrations of bifenthrin in, or on, *Daphnia* were at, or near, steady-state. The bioconcentration factor (BCF) was estimated to be 3,361 L/kg-ww. Rapid loss was also observed during the depuration phase. Most of the body burden of *Daphnia* appeared to be shed with the carapace when growing *Daphnia* were molting suggesting that the bifenthrin remained sorbed to organism surface. The estimated $k_{overall}$ was 1.315 d^{-1} and the half-life was calculated to be 0.53 d. The 16 d biomagnification test consisted of a 10 d uptake phase and a 6 d depuration phase. During the uptake phase, [14C cyclopropyl]-bifenthrin was administered in the diet to *Daphnia* at a concentration of ~0.31 ng bifenthrin/mg algae dry weight in a solution consisting of 3 x 10^7 ± 10% cells/mL *P. subcapitata*. During the depuration phase, untreated algae were provided as food for the *Daphnia* at the same rate as during the uptake phase. The overall biomass body burden depuration rate constant (including adults and neonates) was 0.61 d^{-1} corresponding with a half-life of 1.14d. The overall elimination of bifenthrin from *Daphnia* was rapid. The growth corrected half-life of the test item was approximately 18 hrs. The biomagnification factor (BMF) and the lipid normalized biomagnification factor (BMF_L) values were 0.086 ± 0.028 and 0.12, respectively. This provides good empirical evidence that bifenthrin is not expected to biomagnify in *Daphnia*. These studies demonstrate that bifenthrin has low to moderate bioconcentration and no biomagnification potential in *D. magna*.

Contact Author: Curtis Eickhoff, Maxxam Analytics
4606 Burnaby Way
Burnaby, BC V5G 1K5, Canada
T: 604 734 7276, ext. 2240, Curtis.Eickhoff@maxxamanalytics.com

NORMAL ACTIVITY OF KEY ORGANOPHOSPHATE BIOMARKERS IN STEELHEAD SALMON

Gillette E.*, Brown T., Asplund T., Fuller R., Serpa E., Henson-Ramsey H., Lewis-Clark State College, Lewiston, ID

This project is designed to determine normal levels of key xenobiotic degrading enzymes, acetylcholinesterase and carboxylesterase, in steelhead salmon. A correlation exists between the inhibition of AChE and/or the carboxylesterases and increasing concentrations of organophosphates, indicating possible toxicity.

To our knowledge, the normal activities of these enzymes are not known in steelhead salmon. Nor is there information about the degree of variation of these enzymes in unexposed fish based upon seasonality, size, and gender. We have measured enzyme activities in unexposed salmonids each spring for the past two years in order to answer these questions. Preliminary data suggest significant differences in enzyme activities from month to month and a significant difference in enzyme activity between the genders.

Contact Author: Eric Gillette, Lewis-Clark State College
Division of Natural Sciences and Mathematics
500 8th Avenue
Lewiston, ID 83501
T: 208-792-2799, F: 208-792-2064, eagillette@lcmail.lcsc.edu

SEDIMENT TRANSPORT AND CONTAMINANT LOADING TO THE LOWER DUWAMISH SUPERFUND SITE FROM THE GREEN RIVER: APPLICATION OF INNOVATIVE SAMPLING TECHNOLOGIES TO VERIFY MODEL PREDICTIONS.

Gries, T.*, Sloan, J., Helland, B. Washington State Department of Ecology, Olympia, WA

In 2001, government authorities designated a 5-mile long section of the Lower Duwamish Waterway as a sediment cleanup site. A sediment transport model (STM) was developed to predict the fate of suspended sediments and bed load entering the waterway from the upstream Green River, as well as local sources such as stormwater runoff. A bed composition model (BCM) was also developed to predict contaminant concentrations in bottom sediments after remedial actions have been completed. During 2008-2009, the Washington Department of Ecology conducted a study to assess contaminant loading, and evaluate STM and BCM model predictions. Suspended solids were collected from the Green River and analyzed for PCB, PAH, dioxin/furan, and arsenic concentrations. River water was pumped through continuous-flow centrifuges and sieves in the field. Sieved samples underwent separate analyses. Results provided ranges of contaminant concentration associated with different size fractions of suspended solids, and were useful for proposing final BCM input values. In addition, artificial sediment tracers were manufactured to mimic properties of native fine-to-medium silt- and sand-sized particles. The tracers had fluorescent and magnetic properties that facilitated their recovery and quantification. Tracer particles were released near the upstream site boundary, marking the first use of the technology in the Puget Sound region. Fate of the tracers in the water column and bedded sediments was tracked for three months. Recovery sampling involved river water and bedded sediment grabs, but also the deployment and recovery of strong magnets placed throughout the waterway. Analysis of recovered sediment tracers in the water, on magnets, and in sediment samples showed spatial and temporal patterns that supported STM predictions. Sand-sized tracers were recovered only from near-field locations. Recovery of silt-sized tracers showed that native silts, most of the annual sediment load, could easily transit the site or be resuspended after first settling within the site.

Contact Author: Tom Gries, Washington State Department of Ecology
300 Desmond Drive SE
Lacey WA, 98503
T: 360-407-6327, F: 360-407-6884, tgri461@ecy.wa.gov

HONEY BEE PESTICIDE EXPOSURES: RISK ASSESSMENT IN A EUSOCIAL INSECT

Hooven, L. A., Oregon State University, Corvallis, OR

Recent unsustainable honey bee colony losses have focused attention on the effects of pesticides on honey bees. The honey bee hive may be considered a superorganism, with each caste of bees making an important contribution to hive health and survival. The three main castes of adult bees include the queen, who principally remains within the hive laying eggs; drones, whose primary purpose is to mate with the queen; and worker bees. Worker bees pass through multiple behavioral stages, beginning with nurse bees that care for eggs, larvae, and pupae within the hive, and climaxing with foragers that exit and enter the hive multiple times daily to supply the hive with pollen and nectar. These foraging activities and the efforts of beekeepers to control hive pests result in pesticide contamination of wax, stored honey and pollen, and bees. Wax in particular acts as a sink for hydrophobic chemicals. This results in chronic exposures to the two-thirds of the bees which remain within the hive. However, the existing methods required for pesticide registration are restricted to mortality in response to acute exposures to foragers. Here we discuss additional types of exposures each caste of bees is likely to encounter, and propose a dose response method for pesticides in wax. In addition to mortality, behavioral toxicity to any caste or developmental stage potentially affects the entire hive. Circadian locomotor rhythms are a quantifiable measure of behavior in insects, and are well characterized in bees. We propose to measure changes in circadian locomotor rhythms in response to pesticides in wax, which will enable a dose response approach for measuring sublethal pesticide effects in honey bees.

Contact Author: Louisa A. Hooven, Oregon State University
Department of Zoology
3029 Cordley Hall
Corvallis, OR 97331
T: 541 231 5568, E-mail: hoovenl@onid.orst.edu

SPATIAL AND TEMPORAL MICROPLASTIC CONCENTRATIONS IN PUGET SOUND AND CHESAPEAKE BAY

LaRocque, C.J.*, Masura, J., Baker, J.E., University of Washington, Tacoma, Washington.

Plastic debris is found in coastal and marine waters worldwide. Microplastics are defined as particles between 0.3 and 5 mm composed of synthetic polymers. The sources and fate of microplastic debris in the ocean are unclear. Microplastics may remain buoyant or neutrally buoyant, become fouled and sink, or become bioavailable to benthic fauna. Reports of microplastics in the oceans have increased around the globe due to concerns of possible ingestion, transfer of pollutants from plastics to organisms and the slow biodegradation of plastics. The objective of this study was to develop and characterize spatial and temporal variation in concentrations of microplastics in Puget Sound and in the Chesapeake Bay. Samples were collected using a 330µm Manta tow net, sieved between 5 and 0.330mm, and placed in a drying oven. Samples were then processed with a wet peroxide oxidation in the presence of an iron (II) catalyst and density separated using a separation funnel. Microplastics were visually identified and dry weight concentrations were determined. The net tow samples analyzed typically contained from 0.1 to 25 µg-dry weight/L of material in the microplastic size range, of which the extracted microplastic concentrations were between 0 to 0.3 µg-plastic/L. The highest concentrations were found in samples from Thea Foss Waterway in Tacoma, Washington. Expressed as mass of plastic per mass of collected solids, Puget Sound data ranges widely between 0.02% to 22%. The highest concentrations were detected in industrial and urban areas. Spatial and temporal data are needed to understand the sources and fate of microplastics in the ocean.

Contact Author: Christopher LaRocque, University of Washington
Environmental Science Program
326 East D St Tacoma WA 98421
T: 253-678-5322 clarocq@uw.edu

INVESTIGATION INTO SYNERGISTIC STORMWATER TOXICITY THROUGH THE EVALUATION OF MALATHION AND BENZENE TOXICITY TO *DAPHNIA MAGNA*

MacLeod, A.H, Cains, M.N., Duane, P.P., Western Washington University, Bellingham, WA.

To better understand the toxicity of chemical mixtures found in stormwater, a 48-hour acute *Daphnia magna* toxicity test was conducted to examine the synergistic, antagonistic, or additive toxicological effect of chemical mixtures containing commercial grade (50% v/v) malathion and >98% benzene. These experiments were conducted to simulate one of the many chemical mixtures possibly caused by non-point runoff pollution. Benzene is a known carcinogen, present in petroleum products, and was chosen to represent runoff containing gasoline. Malathion is the most commonly used organophosphate pesticide in the US and was chosen to represent runoff from landscaping and agricultural use. The Federal Food, Drug, and Cosmetic Act of 1938 requires the toxicity of pesticide mixtures to be assessed, although as of 2004 this assessment does not consider effects caused in aquatic environments according to the Federal Insecticide Fungicide and Rodenticide Act of 1972 or in the Clean Water Act of 1972. In the chemical mixture toxicity test, an increase in toxicity was observed as the malathion LC50 of 0.127 mg/L was reduced to an LC_{50} of 0.014 mg/L in the presence of 454 mg/L benzene. The observed effect is hypothesized to be synergism with the narcosis induced by benzene facilitating the transport of malathion across the cell membrane causing acetylcholinesterase inhibition. This increase of toxicity at such low concentrations causes concern for aquatic organisms in waterways that are directly drained into by both residential and agricultural lands using malathion and petroleum products with benzene as a constituent.

Contact Author: Alex H. MacLeod, Western Washington University
Institute of Environmental Toxicology, Huxley College of the Environment
516 High Street, MS-9180
Bellingham, WA 98225
T: 360.325.5396, macleoa2@students.wwu.edu

ACID AND BASE-CATALYZED HYDROLYSIS OF BETA-LACTAM AND SULFONAMIDE ANTIBIOTICS

Mitchell, S.M.*, Ullman, J.L., Watts, R.J., Washington State University, Pullman, WA.

Hydrolysis of the antibiotics ampicillin, cephalothin, cefoxitin, ceftiofur, sulfachloropyridazine, sulfadiazine, sulfadimethoxine, sulfamethoxazole, sulfamethazine and trimethoprim was investigated and compared at constant ionic strength (0.01 M acetate or borate buffer), constant temperature (25°C) and different pH (4, 5, 6, 7, 8 and 9). Base-catalyzed hydrolysis rates were faster than acid-catalyzed hydrolysis for all beta-lactam antibiotics. Beta-lactam antibiotics, with two amide functional groups, hydrolyzed significantly faster than the sulfonamide antibiotics and trimethoprim, which do not contain amide, ester or alkyl halide moieties. Cephalothin and cefoxitin, which contain an additional ester functional group, hydrolyzed the fastest with half-lives of less than 13 days at neutral pH. Ampicillin and ceftiofur half-lives were about 40 days at neutral pH. No hydrolysis was observed for any of the sulfonamide antibiotics or trimethoprim after several weeks. The results suggest that the presence of certain functional groups affect hydrolysis. The influence of temperature on ceftiofur hydrolysis was also investigated as a function of pH (4, 5, 6, 7, 8 and 9) at 50°C. The same hydrolysis rate pH dependence at 25°C was observed at 50°C. The half-life for ceftiofur at neutral pH was approximately 2 days. Finally, metal ion-catalyzed hydrolysis of ceftiofur was studied at constant ionic strength (0.01 M) and temperature (50°C). Potassium chloride and sodium chloride solutions did not catalyze ceftiofur hydrolysis at neutral pH, however, magnesium chloride and calcium chloride solutions increased ceftiofur hydrolysis by 22- and 3-fold, respectively. This suggests that antibiotic abiotic degradation rates in the environment could be accelerated based on the metal ion content of the matrix. The results of this research suggest that antibiotics with functional groups and chemical structures that enhance hydrolysis reactions may potentially degrade relatively fast under ambient environmental conditions.

Contact Author: Shannon Mitchell, Washington State University
Dept. of Biological Systems Engineering
PO Box 646120, Pullman, WA 99164-6120
T: 208-301-4411, F: 509-335-2722, mitc4725@wsu.edu

DETECTION OF THE MYCOTOXIN LOLITREM B IN BOVINE URINE AND FECES

Murty, L.D.*, Duringer, J.M., Livesay, S., Galen, A., Stevens, J.F., Craig, A.M., Oregon State University, Corvallis, OR

Perennial ryegrass (PRG) is a hardy cool-season grass used on lawns, parks and athletic fields, for erosion control and animal forage. It is infected with the endophytic fungus *Neotyphodium lolii*, which enables the plant to be insect repellant and drought resistant, lowering the use of insecticides and fertilizers. However, this fungus also produces the compound lolitrem B (LB, *m/z* 686.4) which causes the tremorgenic neurotoxicity syndrome 'ryegrass staggers' in livestock. Further, human health concerns have arisen from a study which found LB in bovine fat after being fed PRG containing LB. However, limited data exists on the fate and metabolism of LB in cattle. Therefore, we developed an LC-MS/MS method to examine LB levels in bovine urine and feces. Urine was diluted 1:1 (v/v) with 0.1M phosphoric acid, followed by solid phase extraction (SPE) on a Waters Oasis HLB cartridge. Feces were dissolved in ethyl acetate and the organic layer applied to a Strata X Silica SPE cartridge. Extracts were analyzed by an Applied Biosystems 3200 Q Trap LC/MS/MS system, (+) APCI, and multiple reaction monitoring using the transitions 686.4→237.9 for quantitation and 686.4→196.3 for qualitative analysis. The limit of detection and quantitation for LB in acetonitrile were 13 ng/mL and 42 ng/mL, respectively. Average retention time of LB in urine and feces was 14.5 minutes with a coefficient of variation (CV) of 0.35% and 0.5% respectively. Urine extraction recoveries from peak area were 54%, 61%, and 76% for 50, 100, and 500ng/mL spikes (*n=5*) respectively. Feces extraction recoveries from peak area were 63%, 75%, and 50% for 50, 100, and 500ng/mL spikes (*n=5)* respectively. Through standard addition, it was determined that the control group contained 2 µM fecal LB. Detection of LB in these matrices will assist in metabolism research and clinical cases of perennial ryegrass staggers.

Contact Author: Lia Murty, Oregon State University
Dept. of Pharmaceutical Sciences
136 Oak Creek Building, Corvallis, OR 97331
T: 541-737-4569, dibiasel@onid.orst.edu

NOAA'S CLIMATE ASSESSMENT AND PROACTIVE RESPONSE INITIATIVE PUGET SOUND PILOT

Steinhoff, M. A., Shorr, B. D., Neely, R. M.* National Oceanic and Atmospheric Administration (NOAA), Seattle, WA.

The mission of NOAA's Damage Assessment, Remediation and Restoration Program (*DARRP) is to protect and restore coastal and marine resources threatened or injured by oil spills and releases of hazardous substances. Hazardous waste facilities and oil infrastructure in coastal areas may be more vulnerable to releases due to climate related impacts. In response, DARRP developed the Climate Assessment and* Proactive Response Initiative (CAPRI) to provide a framework and tool to evaluate potential contaminant impacts in the coastal zone related to climate change. CAPRI's flexible GIS-based framework incorporates an assessment of regionalized climate change forecasts, contaminant threats, and ecosystem and species values and sensitivities into a screening level vulnerability index. The CAPRI framework encompasses four major components: assessment of climate change impacts and related contaminant threats; development of a spatial vulnerability index; use of the web-based, open source Environmental Response Management Application (ERMA) for visualization and analysis of data layers and results; and identification of efficient prevention, response, and restoration options. Selected sites within the Puget Sound are the initial testing ground for the CAPRI framework. This pilot incorporates Puget Sound area-specific datasets. The CAPRI framework is intended to provide a national model that can be adapted to the unique data available in a particular region or coastal area. CAPRI will enable NOAA and other local, state, regional, and federal decision makers to better prepare for and adapt to climate change by improving understanding of contaminant impacts to coastal resources.

Contact Author: Robert Neely, NOAA
NOAA Damage Assessment, Remediation and Restoration Program
7600 Sand Point Way NE, Building 1, Seattle, WA 98115-6349
T: 206-526-6617, F: 206-526-6665, Robert.Neely@noaa.gov

NON-CLASSICAL ESTROGEN SIGNALING INFLUENCES BISPHENOL A -INDUCED NEUROBEHAVIORAL TOXICITY IN ZEBRAFISH

Saili, K.S.*, Corvi, M.M., Przybyla, J., Anderson, K.A., Tanguay, R.L., Oregon State University, Corvallis, OR

Bisphenol A (BPA) is a high production volume chemical found in polycarbonate plastic, resin can linings, and thermal printing paper. Ingestion is considered the primary route of human exposure. BPA is a suspected estrogen disruptor that may interfere with central nervous system (CNS) development. To determine whether environmentally relevant levels of BPA impact CNS development, we assessed the effect of BPA on larval behavior endpoints. To characterize BPA's effects across organ systems, we first conducted early life stage toxicity assays in which zebrafish embryos were exposed to waterborne concentrations of BPA (0.2 - 22,800 µg/L) from 8 to 120 hours post fertilization (hpf). We identified a no observed adverse effect concentration (NOAEC) of 9,100 µg/L. To assess the effects of BPA on CNS development, zebrafish were exposed to BPA concentrations below the NOAEC during neurogenesis (8 – 48 hpf). Exposure concentrations ≤ 228 µg/L resulted in behavioral hyperactivity in 120 hpf larvae. To investigate whether the mode of action by which low dose BPA exposure impairs CNS development involves canonical estrogen signaling, we conducted a microarray analysis comparing gene expression changes in 24 hpf embryos exposed to BPA, estradiol, or GSK4716, an estrogen related receptor (ERR) agonist (8 - 24 hpf). While initial results suggest shared signaling mechanisms underlying the toxic effects of estradiol and BPA exposure, there is also evidence supporting a mechanism of toxicity that involves non-classical estrogen receptors. To further characterize the transcriptional events associated with the hyperactive phenotype, transcripts associated with ER and ERR signaling were measured by qRT-PCR following BPA, E2, or GSK4716 exposure. Taken together, we have demonstrated that transient developmental exposure to BPA likely disrupts neurobehavioral development via non-canonical estrogen signaling. This research was supported in part by NIEHS T32ES7060, ES00210, and an EPA STAR Graduate Fellowship.

Contact Author: Katerine S. Saili, Oregon State University
1007 ALS Bldg. Corvallis, OR 97331
T: 541-737-4665, sailik@onid.orst.edu

SEDIMENT CHARACTERIZATION IN OREGON'S COLUMBIA SLOUGH USING INCREMENTAL SAMPLING METHODS

Seidel, P.R *, Williams, R.K., Miller, S., Sutter J., Cameron, K., and Jett, S., Oregon Department of Environmental Quality, Portland, OR, USA

The Columbia Slough Watershed (Slough) drains approximately 13,200-hectares, within Portland, Oregon and surrounding area. The Columbia Slough has a 30.5-km main channel paralleling the Columbia River. The catchment area includes residential neighborhoods, commercial and industrial development, agriculture, Portland International Airport, and interstate highways. Past sediment sampling in the Lower Slough has shown contamination by polychlorinated biphenyls (PCBs), organochlorine pesticides and metals. The Oregon Health Authority has issued a health advisory discouraging the consumption of fish caught in the Slough due to PCB levels in Carp. In this investigation, both standard composite and incrementally (IS) collected samples were used to characterize shallow sediments. For IS sampling, 50 sample increments were systematically collected using a grid overlaid on the entire study reach. Material from the 50 locations was randomly combined into three replicates such that each of three samples contained sediment from 30 different locations. Analytes included metals, pesticides, PCBs (Aroclors and congeners), semi-volatile organic compounds, tributyltin, and polybrominated diphenyl ethers. Results from composite samples suggest that City outfalls are a source for contaminants entering the Slough. The IS sampling method was successful in reducing sample heterogeneity and provides a defensible means of obtaining an average concentration for sediment samples over a relatively long reach. Using IS sediment analytical results, together with previously collected whole body fish (Carp) analytical data, demonstrates that it is possible to calculate significant regressions between sediment and fish tissue using the ordinary least squares method for bioaccumulative organic contaminants with an excellent correlation.

Contact Author: Paul Seidel, Oregon Department of Environmental Quality
1550 NW Eastman Parkway, Suite 290, Gresham, OR 97030
T: 503-667-8414 x55002, F: (503) 674-5148, paul.seidel@state.or.us

DEVELOPMENT OF 'NANOCOSMS': A HIGH-THROUGHPUT BIOASSAY TO ASSESS TOXICITY IN AQUATIC ECOSYSTEMS

Viéville, C.*, Svoboda, T., and Harper, S.L., Oregon State University, Corvallis, OR

Human exposures to nanomaterials will inevitably only increase with the rapid rate at which nanomaterials are being exploited for their novel properties. The immediate concern is that evaluations of nanomaterial safety are lagging behind the rapid commercialization of consumer products. The most critical need is to establish and validate assays for defining which inherent physicochemical properties are relevant or predictive of biological impacts. Given the enormous diversity of nanomaterials and their dynamic nature when in complex media, these assays need to be highly predictive, as well as time- and cost-effective. Here, we propose the development of 'nanocosms' as a rapid method to determine the potential harmful environmental impacts of nanomaterials on aquatic ecosystems. 'Nanocosms' are based on the principles of larger mesocosms that are often used in environmental impact studies, but with much reduced volume (as little as 5 mls). Multiple trophic levels (i.e., algae, protozoan, and bacteria) are represented in our low-volume 'nanocosm' assay. Preliminary investigations indicate that 'nanocosms' are stable, reproducible and responsive to toxic insult. Acute exposure to $CuSO_4$ and $AgNO_3$ (0ppm, 10ppm, 100ppm, and 1000ppm) resulted in a typical toxicological dose-response. Preliminary studies have also shown typical predator-prey responses among species within nanocosms. Additional investigations have included acute exposures to the nanoparticle yttrium (Y_20_3) in the presence and absence of dissolved organic matter (DOM). The presence or absence of DOM appears to impact organisms in differently, with some organisms becoming more sensitive to Y_20_3 in the presence of DOM. Validation studies and detailed evaluations of impact and environmental fate are currently underway. We believe the development and standardization of 'nanocosms' will provide a rapid method to assess nanoparticle behavior within a controlled simulated ecosystem.

Contact Author: Cassandra Viéville, Oregon State University
Dept. of Chemical, Biological, Environmental Engineering
103 Gleeson Hall, Corvallis, OR 97331
T: 541-602-3612, vievillc@onid.orst.edu

AUTHOR INDEX