Proceedings and Agenda for the 28th Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry

April 16th & 17th, 2015

USGS Fort Collins Science Center
2150 Centre Ave., Bldg. C (Main Conference Room by front door)
Fort Collins, CO 80526
(970) 226-9100

Thursday, 4/16: morning tutorial & afternoon speaker

Friday, 4/17: morning plenary speaker; posters & oral presentations

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Meeting registration and details are also available on the RMSETAC website www.rmsetac.org

AGENDA --- Thursday, April 16th

8:30 - 9:15 am Registration, Refreshments, and Breakfast Snacks

9:15 - 10:30 am Tutorial on R Statistics Software Package, Part 1 – Matt Pocernich

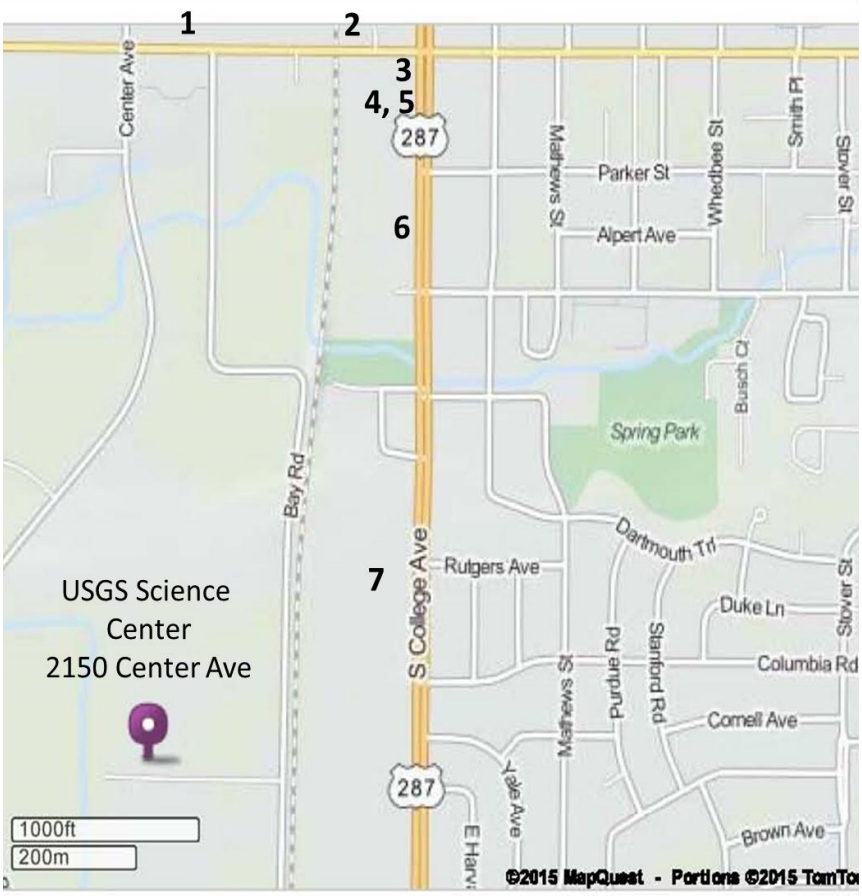
10:30 - 10:45 am Refreshments and Snacks Break

10:45 am - 12:30 pm Tutorial on R Statistics Software Package, Part 2 – Matt Pocernich

12:30 pm – 2:00 pm Lunch in Fort Collins [see map at bottom of this page]

2:00 – 2:45 pm Speaker Presentation: Anticoagulant Rodenticides – Katherine Horak, Ph.D.

2:45 pm – rest of day Networking/Social Mix



1. Paninos Restaurant
310 W Prospect

2. Suh Sushi
200 W Prospect Rd

3. Taqueria Los Comales
111 W Prospect Rd

4. El Monte Grill & Lounge
1611 South College Avenue

5. Black Bottle Brewery
1605 S College Ave

6. Amici Pizzeria
1717 S College Ave

7. Whole Foods Market
2201 S College Ave

Rocky Mountain SETAC Tutorial: ***An Introduction to R for Environmental Scientists***

Thursday, April 16th, 9:15 am - 12:30pm

Matt Pocernich
Neptune and Co.

About the Tutorial:
The R statistical programming language is an open-source language that provides a wealth of tools and capabilities for data analysis, statistics, and data visualization. These tasks can often be accomplished using built-in base functions or by creating new tools. For someone familiar with using spreadsheets to do data analysis, working with R is different. Typically, R is used by creating a script to perform tasks such as reading in data, calculating statistics, and creating graphs and tables. Sound like a lot of extra work? Initially, it may seem so. However, the benefits quickly outweigh additional effort. Conducting analyses using scripts creates a clean, transparent, reviewable, and reproducible record of the steps taken. In essence, a script is a map showing the route from the original data to the figure or table in a report.

This tutorial will be a mixture of lecture, demonstration, and exercises. The lecture portion will provide a high-level overview explaining the strengths and capabilities of the R programming language and provide a map to new users learning a new language. The activities will provide both a basic example of reading in data and doing a relatively routine example of summary statistics and plots. A more complex example will illustrate a real-world example. Time will be too limited to fully explain the real-world example, but hopefully will inspire the new user to dig deeper.

For more information about R visit the R Project website at www.r-project.org . For a fun collection of R related articles and stories see r-bloggers.com.

Prerequisites:
1. Bring a laptop with R installed.
2. A basic understanding of spreadsheet calculations.

About the instructor:
Matt Pocernich works as a statistician and environmental engineer, most recently at Neptune and Co. – a small environmental statistics and risk analysis firm. Previously, Matt was an associate scientist at the National Center for Atmospheric Research (NCAR) working in the Research Applications Laboratory. Throughout his career, Matt has work on projects involving wrangling data – sometimes big and often ugly to address a variety of questions. A common thread in many projects is that often the objectives are not well-defined and the results need to be explained to a variety of audiences.

Matt began using R in 2001, version 0.9, and has continued using it. He has taught courses both at NCAR and the EPA trying to coax scientists out of their comfort zones and away from Excel. Currently, Matt is a co-organizer and frequent presenter at the Denver R Users group.

Rocky Mountain SETAC Speaker Presentation

The complicated story of anticoagulant rodenticides: non-target risk assessment, toxicant development, and changes in legislation

Thursday, April 16th, 2:00 pm - 2:45 pm

Katherine Horak, Ph.D.
National Wildlife Research Center, USDA Animal and Plant Health Inspection Service, Wildlife Services

Abstract
Anticoagulants are a vital tool for the control of damage caused by pest wildlife. However, they can pose risks to non-target species due to persistence in both the environment and tissues of target animals consumed as food. Mitigation of these risks is an important component of their continued registration and use. Using in-vitro and in-vivo studies combined with computer modelling, different baiting strategies can be compared, residues levels can be predicted, and risks to non-target animals can be estimated. These outcomes serve to provide valuable information to users of anticoagulants enabling them to make decisions about the most appropriate compound and baiting strategy to use that will best fit the needs of each individual situation.

About the instructor
Dr. Horak has been performing research at the NWRC since 2006. Her research is centered around non-target risk assessment of compounds used to control wildlife species. Her laboratory is also interested in the development of novel toxicants with improved species specificity and reduced non-target effects. Katherine has developed physiologically-based pharmacokinetic models of anticoagulant rodenticides warfarin and diphacinone for rats and quail. These models generate approximations of rodenticide residues in various tissues and, therefore, provide a means to estimate the sensitivity of non-target species to rodenticide residues.

AGENDA --- Friday, April 17th

8:30 - 9:15 am Registration, Refreshments, and Breakfast Snacks

9:15 - 10:00 am Plenary Speaker: Isotopic insights into biological regulation of zinc in contaminated systems. – Rich Wanty, Ph.D.

10:00 - 10:30 am Oral Presentations

10:30 - 10:45 am Poster Review, Refreshments, and Snacks Break

10:45 - 11:30 am Oral Presentations

11:30 am - 1:00 pm Lunch in Fort Collins [see map on page 1] & Board of Directors meeting

1:00 - 1:15 pm Annual Update from SETAC NA Board of Directors – Will Clements, Ph.D.

1:15 - 2:00 pm Oral Presentations

2:00 - 2:30 pm Poster Review, Refreshments, and Snacks Break

2:30 - 3:45 pm Oral Presentations

3:45 - 4:00 pm Poster Review, Refreshments, and Snacks Break

4:00 - 5:00 pm Oral Presentations

5:00 - 5:15 pm Student judging deliberations

5:15 - 5:45 pm Student Awards and Calling of Raffle Winners

5:45 pm DISMISSAL of MEETING

ORAL PRESENTATIONS AGENDA --- Friday, April 17th

10:00 - 10:15 am **Walters, David**. USGS Fort Collins Research Center. *Methylmercury bioaccumulation in stream food webs declines with increasing primary production*

10:15 - 10:30 am **Kraus, Johanna**. USGS Fort Collins Science Center. *Aquatic pollution increases use of terrestrial prey subsidies by stream fish*

10:45 - 11:00 am **Russell, Philip**. Littleton/Englewood Wastewater Treatment Plant**.** *A major, persistent toxicity problem at a wastewater plant: Solved*

11:00 - 11:15 am **Townsend, Alexander**. Colorado Parks and Wildlife. *Reduced thermal tolerance in Colorado salmonid species after exposure to sublethal concentrations of copper*

11:15 - 11:30 am **Cadmus, Pete**. Colorado Parks and Wildlife. *A recalculation of the chronic iron standard: Laboratory trials and benthic mesocosm experiments suggest a lower value*

1:15 - 1:30 pm **Krueger, Annie**. University of Wyoming. *Determining the realistic toxicity of Imidacloprid for a native bee species, Bombus impatiens*

1:30 - 1:45 pm **Roark, Shaun**. GEI Consultants, Inc. *Tales from the trenches: Lessons learned with the fixed monitoring benchmark*

1:45 - 2:00 pm **Barber, Angela**. Colorado School of Mines. *Development of novel methodology to quantify silver release from polymer nanocomposites*

2:30 - 2:45 pm **Traudt, Elizabeth**. Colorado School of Mines. *Effect of the age of Daphnia magna neonates on metal toxicity*

2:45 - 3:00 pm **Wolff, Brian**. Colorado State University. *Measuring resilience to metals exposures as a tool for evaluating restoration effectiveness*

3:00 - 3:15 pm **May, Mindi**. Colorado Parks and Wildlife. *Testing the EPA draft selenium criteria in Colorado*

3:15 - 3:30 pm **Wang, Jingjing**. Colorado School of Mines. *Detecting single-walled carbon nanotube uptake by Daphnia magna using spICP-MS*

3:30 – 3:45 pm **Jasmann, Jeramy**. Colorado State University. *Overcoming the human health risks and significant remediation challenges of 1,4-dioxane using a novel electrolytic treatment technology*

4:00 - 4:15 pm **Firkus, Tyler**. University of Wyoming. *Winter temperature influence on fish reproduction: Implications for water temperature standards*

4:15 - 4:30 pm **Pillard, David**. TRE Environmental Strategies. *Effects of roadway deicing and anti-icing salts on larval anurans in laboratory studies*

4:30 - 4:45 pm **Ebeling, Katherine**. Colorado School of Mines. *Extrapolating Toxicity Tests from the Laboratory to the Field*

4:45 - 5:00 pm **Seto, Keenan**. Colorado State University. *The effect of abandoned mines on benthic macroinvertebrate communities in Colorado's Snake River Watershed*

ABSTRACTS for POSTER PRESENTATIONS

John P. Haynes
University of Denver, Department of Chemistry and Biochemistry
Olin Hall, Room 202
2190 East Iliff Ave
Denver, CO 80208-0183
303-570-9695
John.Haynes@du.edu

Trimethoprim removal from aqueous solutions by wet air oxidation

Haynes, J.P.[†], Miller, K.E.[†]

[†]Dept of Chemistry and Biochemistry, University of Denver, 2190 East Iliff Ave, Olin Hall 202, Denver CO 80208

Research has identified certain pharmaceuticals that are not effectively removed by sewage treatment plants. Thus, these compounds persist and have been detected in natural water systems. Wet air oxidation (WAO) is a water treatment process that utilizes oxygenated, sub-critical water to degrade organic matter, and WAO has been successfully used as a sewage treatment process. Results of applying WAO to aqueous solutions of trimethoprim using a laboratory test reactor are presented. The removal of trimethoprim from aqueous solutions varies from 20 to 90% as organic matter concentrations are increased. In addition, preliminary data are presented that indicate common metal ions increase the efficiency of WAO in the removal of trimethoprim from the solutions.

Poster --- Consider for Best Student Poster

Jacob L. Williamson
Colorado School of Mines
Golden, Colorado

Method development for *in-situ* acid mine drainage-impacted stream sediment sampling with implications for recovery

Jacob L. Williamson[1], M. Ramiro Pastorinho[2], James F. Ranville[1], Joseph S. Meyer[1],
[1]Colorado School of Mines, Golden, Colorado; [2]University of Aveiro, Aveiro, Portugal

There are numerous sources of legacy acid mine drainage (AMD) throughout the western United States, and these are the result of turn-of-the-century mining of precious metals. There continues to be impacted local fresh-water systems in Colorado. In the City of Blackhawk in central Colorado, two point sources of AMD enter the North Fork of Clear Creek. Compared to an upstream reference site, these inputs result in elevated concentrations of metals (both dissolved and particulate) in the water column of NFCC and on the stream substrate. We have developed a novel *in-situ* method to examine the contamination and recovery rates of AMD impacted sediment. Standardized trays of river stones and cobble were deployed in a heavily-contaminated section of stream to allow for metal deposition. The contaminated trays were

then collected after a few time points and redeployed with clean controls at the upstream reference site. Temporal sampling and subsequent digestion and chemical analysis of residual rock coatings allowed us to examine the kinetics of sediment recovery. Two tray deployment methods were employed. They favored deposition of either primarily fine-grained precipitates or a combination of coarser and fine-grained sediments. The extent of substrate recovery (i.e., return of metals to control concentrations) depended on the nature of the contaminant-deposition process. Combining these approaches with stream water chemistry data, geochemical modeling, and in-stream aquatic toxicity testing will provide a more integrated picture of the fate, transport and bioavailability of metals in a recovering AMD system.

Poster --- Consider for Best Student Poster

ABSTRACTS for ORAL PRESENTATIONS

David M. Walters
USGS Aquatic Ecology and Contaminants Team
2150 Centre Ave. Building C
Fort Collins Colorado 80526

Methylmercury bioaccumulation in stream food webs declines with increasing primary production

David M. Walters[†,*], David F. Raikow[I], Chad R. Hammerschmidt[§], Molly G. Mehling[‡], Amanda Kovach[††], James T. Oris[II]

[†] U.S. Geological Survey, Fort Collins Research Center, 2150 Centre Avenue, Building C, Fort Collins, CO 80526; [I] National Park Service, Inventory and Monitoring, Building 22, 1 Crater Rim Drive, Hawaii National Park, HI, 96785; [§] Department of Earth & Environmental Sciences, Wright State University, Dayton, OH 45435; [‡] 120 Dilworth Hall, Woodland Road, Chatham University, Pittsburgh, PA 15232; [††] GEI Consultants, Inc., 4601 DTC Blvd, Denver, CO 80237; [II] Department of Zoology, Miami University, Oxford, OH 45056

Opposing hypotheses posit that increasing primary productivity should result in either greater or lesser contaminant accumulation in stream food webs. We conducted an experiment to evaluate primary productivity effects on MeHg accumulation in stream consumers. We varied light for sixteen artificial streams creating a productivity gradient (oxygen production = 0.048 – 0.71 mg O_2 L^{-1} d^{-1}) among streams. Two-level food webs were established consisting of phytoplankton/filter feeding clam, periphyton/grazing snail, and leaves/shredding amphipod (*Hyalella azteca*). Phytoplankton and periphyton biomass, along with MeHg removal from the water column, increased significantly with productivity, but MeHg concentrations in these primary producers declined. Methylmercury in clams and snails also declined with productivity, and consumer concentrations were strongly correlated with MeHg concentrations in primary producers. Heterotroph biomass on leaves, MeHg in leaves, and MeHg in *Hyalella* were unrelated to stream productivity. Our results support the hypothesis that contaminant bioaccumulation declines with stream primary production via the mechanism of bloom dilution (MeHg burden per cell decreases in algal blooms), extending patterns of contaminant accumulation documented in lakes to lotic systems.

Platform --- No consideration for Best Student Paper

Johanna M. Kraus
USGS Aquatic Ecology and Contaminants Team
2150 Centre Ave., Building C
Fort Collins, CO 80526
970-226-9436
jkraus@usgs.gov

Aquatic pollution increases use of terrestrial prey subsidies by stream fish

Johanna M. Kraus[1,2], Justin F. Pomeranz[3], Andrew S. Todd[1], David M. Walters[2], Richard B. Wanty[1], Travis S. Schmidt[2,4]

[1]U.S. Geological Survey (USGS) Crustal Geophysics and Geochemistry Science Center; [2] USGS Fort Collins Science Center; [3]Colorado State University, Department of Fish, Wildlife and Conservation Biology; [4]USGS Colorado Water Science Center

Freshwater and terrestrial food webs are spatially linked through cross-ecosystem movements of energy and nutrients, which can augment consumer abundance and alter distribution. Reliance of consumers on cross-ecosystem subsidies depends in part on *in situ* resource availability, which can be reduced by anthropogenic and natural stressors. We tested the research question that as trace-metal pollution in streams increased, and aquatic prey availability decreased, stream fish (mainly *Salmo trutta* and *Salvelinus fontinalis*) would increase consumption of terrestrial insect subsidies in 16 sub-alpine headwater streams in the Colorado Mineral Belt, USA. Salmonids, the dominant fishes in these systems, increased their reliance on terrestrial insect prey (up to 50% by dry mass) as stream metals increased and aquatic prey availability decreased. Salmonid densities were unrelated to metal concentrations in fish-containing streams. Stream fish have the potential to become more dependent on terrestrial prey as aquatic stressors that limit *in situ* food production increase, suggesting a link between preserving aquatic-terrestrial linkages and fish populations in stressed watersheds. Specifically, intact aquatic-terrestrial linkages are likely to be important for maintaining salmonid production in moderately metal-impacted streams.

Platform --- No consideration for Best Student Paper

Philip A. Russell
Littleton – Englewood Wastewater Treatment Plant
2900 S. Platte River Drive
Englewood, CO 80110
303-762-2611
prussell@englewoodgov.org

A major, persistent toxicity problem at a wastewater plant: Solved.

Environmental Services Manager, Littleton/Englewood Wastewater Treatment Plant, 2900 S. Platte River Drive, Englewood, CO 80110

As early as 2002, based on a historical review, the Littleton-Englewood Wastewater Treatment Plant (LEWWTP) has experienced persistent toxicity in its nitrification facility. In 2008 the wastewater plant built a major denitrification facility to remove nitrate produced by a nitrifying trickling filer system. As

part of that effort, the denitrification system (and effluent) were equipped with extensive real-time, high resolution instrumentation. During the process of bringing the denitrification system process online, a number of possible nitrification inhibition (NI) events (toxicity on a large scale) were observed. A summary presentation of the problem was presented at the RMSETAC conference in 2011. From 2007 through 2012 efforts were made to document the events, confirm nitrification toxicity, research literature and other professional sources, and develop a strategy for further research. In 2013 the effort to understand the nature of NI intensified with efforts to better understand the nature of the toxicant and develop a better method to characterize the pattern of toxicity. In late 2013, a possible inhibitory chemical was identified. By early 2014 the chemical was identified as the culprit causing the nitrification inhibition and was determined to come from a single source in our service area. Since the source has been controlled, no further incidents of nitrification toxicity have occurred.

Platform --- No consideration for Best Student Paper

Alexander S. Townsend
Colorado Parks and Wildlife Aquatic Ecotoxicology Laboratory
317 W. Prospect Rd
Fort Collins, CO 80526
303-910-2159
atown@rams.costate.edu

Reduced thermal tolerance in Colorado salmonid species after exposure to sublethal concentrations of copper.

Townsend, A. S. [†, ††], Jordan Anderson [†, ††], Steve Brinkman [†], Pete Cadmus [†]

† Aquatic Research Division, Colorado Parks and Wildlife Aquatic Ecotoxicology Laboratory 317 W. Prospect Rd, Fort Collins, Colorado, 80526,USA; †† Colorado State University, Department of Fish, Wildlife and Conservation Biology, 1474 Campus Delivery, Fort Collins, Colorado, 80523-1474, USA

Acute sublethal Cu exposure was found to reduce the critical thermal maxima (CTM) of Brook Trout *Salvelinus fontinalis*, Rainbow Trout *Oncorhynchus mykiss* and Cutthroat Trout *Oncorhynchus clarkii* at 30 days post swim-up development. To determine if this trend was conserved throughout all Colorado trout species and to determine if this trend changed at older and younger age classes, we conducted acute Cu toxicity trials at subleathal levels on pre swim-up, post swim-up and young of year Mountain Whitefish *Prosopium williamsoni*. Mountain Whitefish are one of two Colorado native salmonids that are currently experiencing loss in distribution possibly due to changing thermal regimes. Directly after acute Cu exposure CTM trials and critical dissolved oxygen minimum trials were conducted. Cu tolerance of Mountain Whitefish differed across age classes. However, regardless of age class statistically significant reductions in CTM values were observed at Cu levels well below the LC_{50}. In the face of global warming these results imply that toxicity experiments examining only mortality overestimate protective concentrations of Cu for salmonid species especially in early developmental stages.

Platform --- Consider for Best Student Presentation

Pete Cadmus
Colorado Parks and Wildlife
317 W. Prospect Rd.
Fort Collins CO 80526
970-472-4332
pete.cadmus@state.co.us

A recalculation of the chronic iron standard: laboratory trials and benthic mesocosm experiments suggest a lower value.

Pete Cadmus [†, ††], Steve Brinkman[†], Will Clements [††]

† Colorado Parks and Wildlife, Aquatic Research Division, 317 W. Prospect Rd, Fort Collins, Colorado, 80526,USA; †† Colorado State University, Department of Fish, Wildlife and Conservation Biology, 1474 Campus Delivery, Fort Collins, Colorado, 80523-1474, USA

At circumneutral pH, iron (Fe) is largely thought to be non-toxic to aquatic life. Colorado's Fe standard of 1 mg/l was based on observational studies. We conducted a series of traditional chronic single species tests exposing *Prosopium williamsoni, Salmo trutta, Hexagenia limbata, Dugesia dorotocephala, Bufo boreas* and *lumbriculus sp.* to ferric Fe. These, with published chronic Fe experiments, were used to compile a sensitivity distribution and derive a new chronic standard value just under 0.6 mg/l. This value was found to be underprotective when we exposed naturally colonized benthic communities to ferric Fe for only 10 days. At the current standard of 1 mg/l numerous aquatic macroinvertebrate taxa were significantly reduced. At only 0.4 mg/l sensitive mayflies and other metricizes were significantly reduced, suggesting a 0.6 mg/l total recoverable Fe standard might be underprotective. The misconception that ferric Fe is non-toxic appears to come from the use of environmentally unrealistic exposure methods and test organisms.

Platform --- No consideration for Best Student Paper

Annie J. Krueger
Department of Ecology
University of Wyoming

Determining the realistic toxicity of Imidacloprid for a native bee species *Bombus impatien*s

Annie J. Krueger, Kennan J. Oyen, Kimberly S. Sheldon, and Michael E. Dillon

Department of Ecology, University of Wyoming

The agriculture industry relies on pesticides for crop production, but growing evidence suggests that sublethal effects of pesticides are a primary factor in the worldwide decline of insect pollinators. Neonicotinoids are a widely-used, advanced class of insecticides that are highly toxic to bees. Even at low levels, neonicotinoids can have pronounced sublethal effects. However, our understanding of bee toxicology comes primarily from studies on honeybees, and the few studies on bumblebees (genus Bombus) have assessed toxicity on a colony level. We investigated how imidacloprid affects individual bumblebees (*Bombus impatiens)* by assessing lethal and sublethal effects after 48 hours of dietary exposure. By taking daily weights, video footage, thermal images and conducting baseline metabolic

assessments, we hope to better understand the physiological response to imidacloprid for bumblebees at a range of field realistic concentrations.

Platform --- Consider for Best Student Presentation

Shaun Roark
GEI Consultants, Inc.
Denver, CO

Tales from the Trenches: Lessons Learned with the Fixed Monitoring Benchmark

Claytor C., Gondek J., Roark S.(presenter), Gensemer R., Canton S.

GEI Consultants, Inc.

The United States (US) Environmental Protection Agency's (EPA) nationally recommended water quality criteria for copper (EPA 2007) suggests use of the Biotic Ligand Model (BLM) for deriving standards. EPA also recently released a probabilistic statistical tool for deriving Fixed Monitoring Benchmarks (FMB; EPA 2012), which compares instantaneous water quality criteria (IWQC) calculated using the BLM with concurrent measured dissolved copper concentrations in the receiving water to derive a single "fixed" benchmark copper concentration that, if not exceeded, ensures that aquatic life uses will be protected using a 1-in-3 year exceedance frequency. From our analysis of the FMB, we conclude it can provide a practical and rigorous method for deriving BLM-based criteria from water quality data sets that vary significantly over time. However, this method is not without its challenges – derivation of reliable FMBs, implementation of those FMBs as site-specific criteria, and application of FMB-based site-specific criteria into discharge permits and impaired waterbodies assessments all pose significant technical and policy questions that need to be answered. Our recent work to derive FMB-based site-specific criteria for multiple Colorado waterways, which are subject to a variety of discharges and hydrological features, has highlighted many such issues that should be thoughtfully considered by any parties seeking to use this method. This presentation will explore potential ways to resolve these issues and should, therefore, provide insight gained via first-hand experience into best practices for use of the FMB to derive site-specific water quality criteria.

Platform --- No consideration for Best Student Paper

Angela Barber
Colorado School of Mines
Department of Chemistry and Geochemistry
1012 14th St.
Golden, CO 80401
970-404-1890
abarber@mymail.mines.edu

Development of Novel Methodology to Quantify Silver Release from Polymer Nanocomposites

Barber, A.[1], Lancone, R.[2], Wang, J.[1], Fairbrother, D.H.[2], Westerhoff, P.[3], and Ranville, J.F.[1]

[1]Colorado School of Mines, Department of Chemistry and Geochemistry, Golden, CO; [2]Johns Hopkins University, Department of Chemistry, Baltimore, MD; [3]Arizona State University, Civil Engineering Department, Tempe, AZ

The incorporation of nanomaterials into polymers can create polymer nanocomposites (PNCs) with desirable properties, such as antimicrobial activity or increased strength. Use and disposal of these PNCs has the potential to release nanomaterials into the environment when the PNC degrades during its life cycle. There is a need for the development of standardized methods to detect, characterize, and quantify nanomaterials released from PNCs. In this study, a novel combination of single particle ICP-MS (spICP-MS) and asymmetrical flow field flow fractionation ICP-MS (AF4-ICP-MS) was used. Nanosilver (nano-Ag) in particles > 30 nanometers (nm) was sized and Ag was quantitatively determined by spICP-MS. AF4-ICP-MS was used to perform size analysis and quantification of < 30 nm nano-Ag and to quantify nano-Ag > 30 nm under no applied field. Ultrafiltration (30K Dalton) and data from both ICP-MS approaches were used to determine dissolved Ag. PNC coupons (Ag-polystyrene, Ag-chitosan, and Ag-polycaprolactone) were subjected to degradation processes (hydrolysis, photolysis) and the release products were quantitatively characterized using this method.

Platform --- Consideration for Best Student Paper

Elizabeth Traudt
Colorado School of Mines, Dept. of Chemistry and Geochemistry
1012 14th Street
Golden, CO, USA 80401
(720) 893-7869
etraudt@mines.edu

Effect of the age of *Daphnia magna* neonates on metal toxicity

Elizabeth M. Traudt[1]; James F. Ranville[1]; Samantha A. Smith[1]; Katherine A. Ebeling[1]; Joseph S. Meyer[1,2]

[1]Colorado School of Mines, Dept. of Chemistry and Geochemistry, Golden, Colorado, USA; [2]ARCADIS, Lakewood, Colorado, USA

As part of a project to assist in developing a multi-site, multi-metal Biotic Ligand Model (BLM), we exposed *Daphnia magna* neonates to binary and ternary mixtures of Cd, Ni, Cu and Zn in acute toxicity tests. When companion 48-h toxicity tests were repeatedly performed with the individual metals in concentrations ranging from non-lethal to lethal, variability of mortality was high in the Cd-only tests (e.g., >10-fold range of median effects concentrations [EC50s]), less in Zn-only tests, and relatively low in Cu-only and Ni-only tests. This same pattern of variability was evident in the binary and ternary mixtures. Although the U.S. Environmental Protection Agency's (USEPA's) protocol includes starting the tests with neonates that are only 0 to 24 h old, we hypothesized that major age-related differences in sensitivity to metals might occur even within that relatively narrow age range. To test this hypothesis, we collected *D. magna* neonates during three 4-h age windows (0-4 h, 10-14 h, and 20-24 h old) and immediately exposed them to each of the four metals for 48 h using the standard USEPA toxicity test protocol. In repeated sets of tests during different weeks, the EC50 of the youngest neonates was approximately 10-fold greater than the EC50 of the oldest neonates (i.e., Cd was less toxic to the youngest neonates), and the EC50 of the 10- to 14-h-old neonates was intermediate. Age-related differences were smaller in Zn-only tests and negligible in Cu-only and Ni-only tests. These results suggest that the

variability in toxicity previously seen for Cd and to a lesser extent for Zn may be the result of variability in neonate age on different days. Especially for Cd, decreasing the age range of *D. magna* used in single-metal and mixture toxicity tests could help to improve the accuracy and precision of metal-mixture toxicity models.

Platform --- Consideration for Best Student Paper

Brian A. Wolff, Ph.D.
Graduate Degree Program in Ecology
Department of Fish, Wildlife, and Conservation Biology
Colorado State University
wolffba@gmail.com

Measuring resilience to metals exposures as a tool for evaluating restoration effectiveness

Brian A. Wolff and William H. Clements

Department of Fish, Wildlife, and Conservation Biology, Colorado State University

Nearly a quarter of the headwater streams of Colorado are impaired due to metals. Thus, restoration of these areas, particularly from historical mining activity, has become an important topic in recent years. Because the monetary costs of restoration can be extremely high in certain cases, effective monitoring of sites undergoing restoration is critical. Aquatic insect communities in the Upper Arkansas River have been monitored for 25 years to assess responses before and after clean-up of the former US EPA California Gulch (CG) Superfund Site, Leadville, CO. In the mid-1990s, installation of water treatment facilities and removal of mine tailings reduced aqueous metals concentrations considerably. However, the aquatic insect communities remained different upstream and downstream of CG. Additionally, previous experimental research suggested that some species of aquatic insects downstream of CG were more tolerant to metals exposures than the same species in upstream reference locations. This suggests that metals exposure presents a selection pressure favoring tolerant individuals, and persistence of that selection pressure suggests that the system may not be fully recovered. For our study we conducted microcosm experiments on communities from sites upstream (reference) and downstream (contaminated) of CG. We tracked the responses of reference vs. contaminated communities to experimental metals exposures over time (2009 and 2014). In 2009, total abundance reductions from upstream vs. downstream communities in response to metals were not significantly different. However, reductions in EPT abundance were greater in upstream sites than downstream sites. Microcosm experiments conducted in 2014 showed that abundance of aquatic insects was reduced by 55% at the reference site, whereas total abundance was reduced by only 35% at the downstream site. We are currently identifying individuals from our 2014 samples, so we do not yet know the response on EPT abundance. Our evidence suggests that downstream communities remain resistant to metals, relative to upstream reference communities, suggesting that these communities may not be fully recovered. We suggest that measurements of resilience will bolster current restoration monitoring, and may provide novel insight into ecological and evolutionary processes not possible through conventional methods (e.g., species richness).

Platform --- Consideration for Best Student Paper

Mindi May
Colorado Parks and Wildlife
6060 Broadway
Denver, CO 80216
303-291-7124
melynda.may@state.co.us

Stephanie Baker
Colorado Department of Public Health & Environment
4300 Cherry Creek Drive South
Denver, CO 80246
303-692-3559
stephanie.baker@state.co.us

Testing the EPA Draft Selenium Criteria in Colorado

May, M.†, and S. Baker✝

†Colorado Parks and Wildlife, Denver, Colorado; ✝Colorado Department of Public Health & Environment, Denver, Colorado

The U.S. Environmental Protection Agency (EPA) is in the process of revising the national ambient water quality criteria for selenium, with a revised draft expected in 2015. The proposed criteria consist of water column and tissue-based thresholds derived using laboratory data and field data collected nationwide. The proposed criteria are expected to be exceeded in Colorado due to naturally-occurring selenium and will likely result in several new impairment listings throughout the state. Water quality and fish tissue data from Colorado reservoirs with varying selenium concentrations will be presented. In addition, a proposed state-wide field and laboratory-based selenium investigation will be discussed. The goal of the study will be to evaluate whether the proposed EPA criteria are appropriate for Colorado and potentially determine a threshold(s) (analogous to the EPA draft criteria) protective of Colorado fish.

Platform --- No consideration for Best Student Paper

Jingjing Wang
Department of Chemistry and Geochemistry, Colorado School of Mines
1012 14th St
Golden, CO 80401
720-320-0686
jinwang@mines.edu

Detecting Single-walled Carbon Nanotube uptake by *Daphnia magna* Using spICP-MS

Jingjing Wang[1], Ronald Lankone[2], Howard Fairbrother[2], Christopher Higgins[3], James Ranville[1]

[1] Department of Chemistry and Geochemistry, Colorado School of Mines, Golden, Colorado; [2] Department of Chemistry, Johns Hopkins University, Baltimore, MD; [3] Department of Civil and Environmental Engineering, Colorado School of Mines, Golden, Colorado

With exciting properties and various applications in industry, the production of carbon nanotubes (CNTs) has increased very quickly in the past few decades. However, their release during the life cycle and the potential human and environmental exposure are not well known. Nanometrology is critical to the risk assessment of CNTs, especially to their potential bioaccumulation. Previous studies introduced ^{14}C labeled CNTs uptake by Daphnia magna, the amount of which were determined by radioactivity. But considering the unlabeled CNTs applied in industry and the limited amount released into the environment, more direct and reliable method is required. Single particle ICP-MS (spICP-MS) is a promising method to detect particles in the ng/L range. Though it cannot detect carbon directly, it has been proved that residual metal nanopoarticles could be used to detect and quantify CNTs. With the optimization of dwell time, more accurate analysis can be achieved. After 48 hours exposure in Carbon Solutions single-walled CNTs (SWCNTs) suspension, 3% of the SWCNTs were absorbed by 10 daphnia adults, despite the original concentrations of the suspensions. Further work includes the verification of uptake and depuration process, using microscopy as addition evidences. SWCNTs released from polymer nanocomposites can also be the uptake resource, which can be more related to the life cycle assessment of materials.

Platform --- Consideration for Best Student Paper

Jeramy R. Jasmann
Department of Chemistry
Colorado State University

Overcoming the Human Health Risks and Significant Remediation Challenges of 1,4-Dioxane using a Novel Electrolytic Treatment Technology

Jeramy R. Jasmann[†], Thomas Borch[†‡§], Tom C. Sale[§], Jens Blotevogel[§*]

[†] Colorado State University, Department of Chemistry; [‡] Colorado State University, Department of Soil and Crop Sciences; [§]Colorado State University, Department of Civil and Environmental Engineering

New water treatment technologies are needed for 1,4-dioxane that are effective and more viable than currently applied advanced oxidation processes like UV/H_2O_2. Improvements in analytical techniques have exposed the widespread abundance and potential carcinogenic risk to humans of the contaminant 1,4-dioxane. This chemical is a stabilizer for certain vapor degreasers, but is also widely used in the manufacturing of many consumer goods such as dyes, personal care products, and plastics. Improper waste disposal, accidental solvent releases, and continuous deposits into our sanitary sewer system due to impurity levels of 1,4-dioxane found in many personal care products have led to 1,4-dioxane contamination problems in both surface and groundwater. 1,4-dioxane is resistant to conventional treatments such as sorption to activated carbon, air stripping, and biodegradation. Our new technology allows for treatment of contaminated water through a permeable electrolytic barrier combined with novel, interelectrode, catalytic titanium dioxide (TiO_2) pellets to accelerate 1,4-dioxane degradation. The environmental impact of electrolytic treatment is minimal since complete mineralization is possible, chemical additives are not needed, and treatment energy demands are low. Our investigations illustrate that electrolytic treatment in combination with catalytically active anatase-TiO_2 pellets is a promising new technology for the treatment of 1,4-dioxane, and may have broader implication for removal of other persistent organic water contaminants as well.

Platform --- Consideration for Best Student Paper

Tyler J. Firkus
University of Wyoming
1000 E. University Ave.
Laramie, WY 82071

Winter Temperature Influence on Fish Reproduction: Implications for Water Temperature Standards

T. Firkus†, F. Rahel†, H.L. Bergman†

†Department of Zoology and Physiology, University of Wyoming

During winter, effluent discharge from wastewater treatment facilities can warm stream temperatures above ambient levels, but the effects of warmer winter temperatures on native fish reproduction are largely unknown. We examined the spawning success of two fish species resident in the South Platte River downstream of an effluent discharge north of downtown Denver, Colorado. In laboratory experiments, we exposed johnny darters (Etheostoma nigrum) and fathead minnows (Pimephales promelas) to three temperature regimes for four months to bracket both elevated temperatures typical of the South Platte River below the effluent discharge (16˚ and 20˚C) and the temperature standard set by the state of Colorado (12˚C) over the winter months. Johnny darters spawned at all three temperatures during the winter, and did not spawn again in the spring. Fathead minnows spawned under the 16˚ and 20˚C temperature regimes but not the 12˚C temperature regime during the winter. Fathead minnows that had not spawned in the winter at 12˚C did spawn during the simulated spring warm-up period. Fathead minnows that had spawned during the winter at 16˚ and 20˚C spawned again in the spring, but had reduced fecundity. Real time PCR analysis for vitellogenin mRNA production supported the spawning data. These results suggest that warm water temperatures, and even temperatures at current water temperature standards, could promote spawning by some native fishes during the winter.

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David A. Pillard
TRE Environmental Strategies
100 Racquette Drive
Fort Collins, CO 80524
970-416-0916
Pillardda.tre@gmail.com

Effects of Roadway Deicing and Anti-icing Salts on Larval Anurans in Laboratory Studies

The use of road salt to melt existing snow and ice buildup as well as prevent additional accumulation is becoming more common throughout the northern United States. Estimates of road salt use in the U.S. range as high as 20 million tons per year. Deicing and anti-icing compounds are known to be elevated in soils adjacent to treated roadways and, along with runoff from melting snow, can significantly raise salt concentrations in nearby wetlands. To determine the relative toxicity of commercial deicer and anti-icer products, as well as their primary active ingredients ($MgCl_2$ and NaCl), short-term laboratory toxicity studies were conducted using various species of anurans, including *Bufo americanus*, *Rana pipiens* and *Rana sphenocephala*. Tests were conducted for seven days beginning with early-stage tadpoles (i.e., Gosner stage 19-21). Survival was monitored as was growth using snout-vent length and body width.

Both survival and growth were affected in all test species at deicer concentrations of 1% or less of what is applied to roads during normal winter treatment operations. These data indicate that, even at high dilution rates that may occur with snow melt or spring rains, deicer salt concentrations may be high enough to cause significant negative effects to amphibian populations in wetlands adjacent to highways. Even distal wetlands may be affected if local streams and waterways channel nonpoint source water directly to lakes and ponds. Elevated salt concentrations may also cause more subtle effects, including changes in growth patterns and malformations.

Platform --- No consideration for Best Student Paper

Katherine Ebeling
Colorado School of Mines, Dept. of Chemistry and Geochemistry
1012 14th Street
Golden, CO, USA 80401
785-221-7652
kaebelin@mines.edu

Extrapolating Toxicity Tests from the Laboratory to the Field

Katherine A. Ebeling[1]; James F. Ranville[1]; Elizabeth M. Traudt[1]; Samantha A. Smith[1]; Joseph S. Meyer[1,3]

[1]Colorado School of Mines, Dept. of Chemistry and Geochemistry, Golden, Colorado, USA; [3]ARCADIS, Lakewood, Colorado, USA

The toxicity of metal mixtures in the environment is important because many waters are impacted by elevated concentrations of multiple metals due to acid mine drainage and industrial and agricultural inputs. These elevated concentrations of metals can be toxic to aquatic life, and there is a need to better regulate metal mixtures in the environment. Laboratory toxicity tests are important for providing data to develop mult-metal toxicity models. However, many laboratory toxicity tests do not closely mimic the aqueous geochemistry that is found in contaminated sites, and it is therefore hard to accurately predict toxicity in the field. This study investigated differences in the toxicity of Zn, Cd, Ni, and Cu to *Daphnia Magna* neonates in both laboratory and field waters. Aquatic chemistry characteristics such as water hardness, alkalinity, and the concentration and composition of dissolved organic carbon exert important controls on aquatic toxicity, and preliminary results suggest that many laboratory studies do not resemble field sites that are contaminated with metals. Laboratory toxicity tests performed in EPA moderately hard reconstituted water with Zn, Cd, Cu, and Ni showed substantially different LC-50 values compared to toxicity tests done in laboratory site simulated water and waters collected from the field. Binary toxicity tests with Zn and Cd in EPA moderately hard water have shown less than additive toxicity. This less than additive toxicity has been observed in laboratory site simulated waters, although the effect is significantly dampened due to the different water chemistry. This study highlights the importance of water chemistry when extrapolating toxicity tests from the laboratory to the field.

Platform --- Consideration for Best Student Paper

Keenan Seto, Undergraduate
Colorado State University
Fort Collins, CO 80521
808-255-1464
keseto@rams.colostate.edu

The Effect of Abandoned Mines on Benthic Macroinvertebrate Communities in Colorado's Snake River Watershed

Seto, K[1], Clements, W[1], Kotalik, C[1]

[1]Colorado State University, Aquatic Ecotoxicology Laboratory, Fort Collins, CO 80521

Extraction of natural resources from mineral mining has many benefits to human society; however, historic and current mining practices can severely degrade water quality in affected aquatic ecosystems. The Snake River Watershed located in Summit County, Colorado has several abandoned mines with persistent inputs of metals occurring today. As a major tributary to Dillon Reservoir, Denver's largest water source, the health of the Snake River's ecosystem has important implications for public health. To quantify the effects of metals from these abandoned mines, we measured water physiochemistry, specifically, heavy metal concentrations, pH, and conductivity and collected benthic community data at six sites: two reference sites, and four contaminated sites downstream of the heavy metal inputs. We found correlations between elevated metal concentrations and reduced aquatic insect abundance and species diversity. This biomonitoring data may provide useful information to guide future management actions regarding water quality remediation and habitat restoration to this area.

Platform --- Consideration for Best Student Paper

LOGISTICS INFORMATION

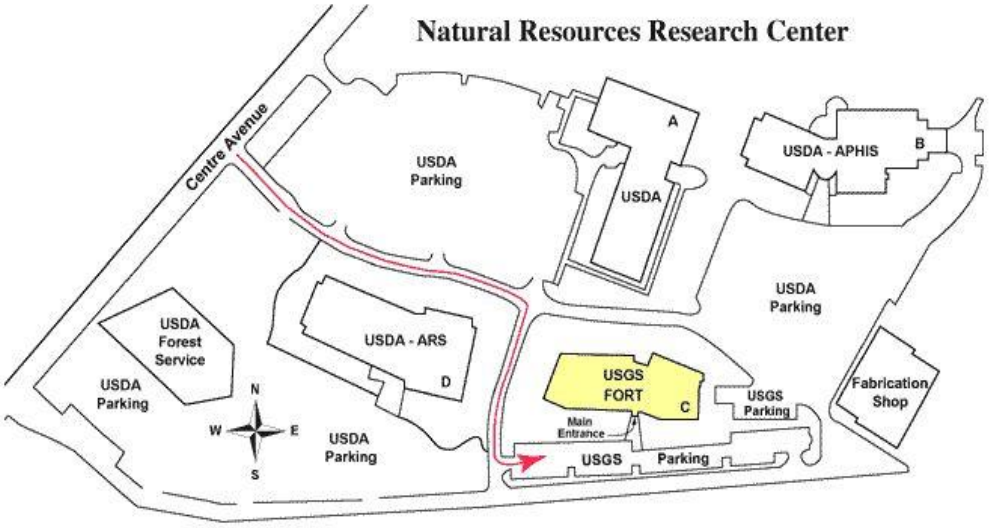
From I-25 Fort Collins Exits to the NRRC and the Fort Collins Science Center (FORT):

- Exit 268 (Prospect Road) off of I-25
- LEFT (WEST) on Prospect Road
- LEFT (SOUTH) on Centre Avenue
- LEFT (EAST) at NRRC stone sign
- Building C (USGS), *south entrance*

Click here for a printable version of this map and directions

Finding Building C

When you turn into the Natural Resources Research Center by the stone sign, you will be heading east on the main driveway. Our USGS building is ahead of you, the second one on the right. Take the second right and then the very next left into our parking area, which lines the south side of our building. Ahead of you and halfway down you will see the main entrance. You will need to park and check in with the receptionist, who will issue you a parking pass. (Vehicles with government plates do not need a pass.) For further information, contact the receptionist at our main number, 970-226-9100.



The Fort Collins Science Center address is:

U.S. Geological Survey
Fort Collins Science Center
2150 Centre Avenue, Building C
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Please consider carpooling or biking whenever possible as parking at the NRRC is limited.

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Society of Environmental Toxicology and Chemistry
April 16 & 17, 2015

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New! RMSETAC will be accepting payment via credit cards the day of the event. If you plan to pay with a credit card, please check the box by the total and email or mail the complete form to the address below.

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