23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

23rd Annual Meeting of the
Rocky Mountain Chapter of the
Society of Environmental Toxicology and Chemistry
April 15rd & 16th, 2010

U.S. EPA Region 8 Headquarters Building
1595 Wynkoop Street
Denver, CO

Please volunteer to be a judge of student presentations and posters! Contact Andrew Todd atodd@usgs.gov if you would like to be a judge!

Best Student Poster

Jordan Anderson
Bahram Farokhkis
Beth Shedden
Benjamin Wise

Best Student Platform

Kathryn Tenney
Roberta Martinez Hernandez
Emily Lesher
Pete Cadmus
Diem Pham
Valerie Stucker
Keith E. Miller

SUSTAINING MEMBERS:

GEI Consultants

ARCADIS
Infrastructure, environment, buildings

SRC

ENVIRON
www.environcorp.com

QUICKSILVER SCIENTIFIC

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

Thursday, April 15th

Meeting will be held in the conference center on the second floor. Please go through security and sign in at the top of the stairs.

8:00-9:00 AM:	**Registration and Coffee**
9:00-11:30 AM:	**Introduction to Ecological Risk Assessment, Steve Wharton and Kristen Keteles from Region 8 US EPA**
11:30-12:00 PM:	**Break and Lunch Distribution**
12:00-1:00 PM:	**Tapped- Documentary on Bottled Water by Stephanie Soechtig**
1:00- later PM:	**Social Gathering and Networking at Wynkoop Brewery**

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

2010 SHORT COURSE- Thursday, April 15th, 2010

Introduction to Ecological Risk Assessment

Steve Wharton, Region 8 U.S. EPA Risk Assessor
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and

Kristen Keteles, Ph.D., Region 8 U.S. EPA Toxicologist
keteles.kristen@epa.gov

This course will provide an overview of the ecological risk assessment process, with emphasis on hazardous waste site assessments. The instructors will identify recent EPA ecological risk assessment guidance and review advances in exposure and effects assessment related to ecological risk assessment. The class will review a site specific case study and discuss methods for overcoming challenges in each phase of the ecological risk assessment process (Planning/Problem Formulation, Exposure and Effects Analysis, and Risk Characterization). The course will also contrast the goals of ecological risk assessment with those of other types of evaluation, such as environmental impact analysis, natural resource damage assessment, and cost-benefit analysis.

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Rocky Mountain SETAC Presents a Film Screening of:

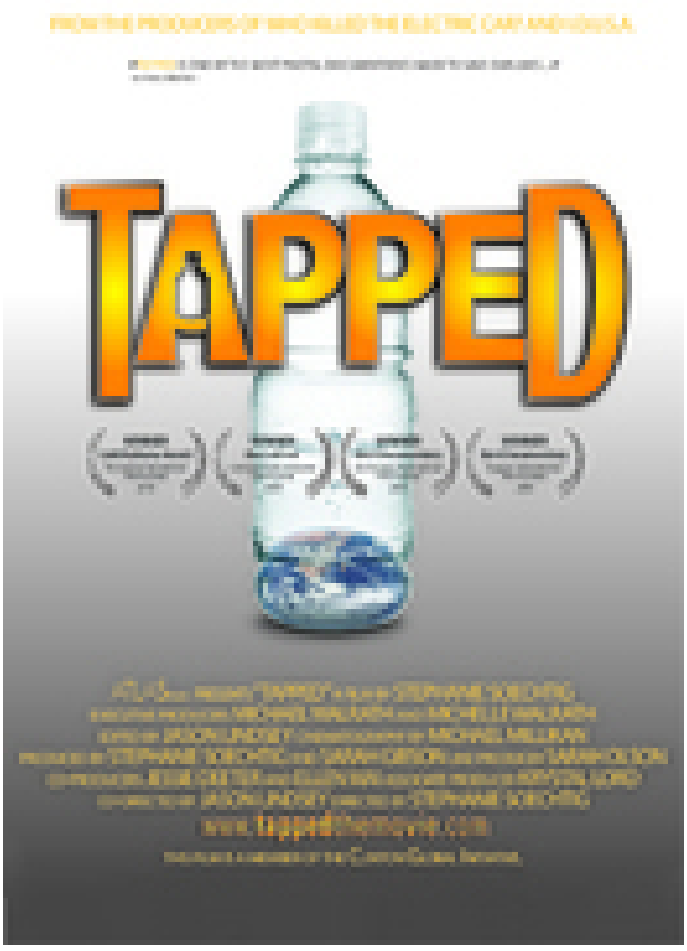
Tapped- A documentary on bottled water.

Description- http://www.tappedthefilm.com/

Is access to clean drinking water a basic human right, or a commodity that should be bought and sold like any other article of commerce? Stephanie Soechtig's debut feature is an unflinching examination of the big business of bottled water.

From the producers of Who Killed the Electric Car and I.O.U.S.A., this timely documentary is a behind-the-scenes look into the unregulated and unseen world of an industry that aims to privatize and sell back the one resource that ought never to become a commodity: our water.

From the plastic production to the ocean in which so many of these bottles end up, this inspiring documentary trails the path of the bottled water industry and the communities which were the unwitting chips on the table. A powerful portrait of the lives affected by the bottled water industry, this revelatory film features those caught at the intersection of big business and the public's right to water.



23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

Friday, April 16th:

Meeting will be held in the conference center on the second floor. Please go through security and sign in at the top of the stairs.

8:00 – 9:00: **Registration and Coffee**

9:00-9:10 **Greeting from EPA**

9:10-9:45 ***Featured Presentation***: **Jackson A Gross-**USGS Northern rocky Mountain Science Center. Innovative conservation technologies for protection and re-establishment of endangered and native fishes.

9:45-10:00 **Norka Paden-** GEI consultants, Inc. Background iron concentrations in the Yampa River Basin (Segments 13d and 13e), Routt county, CO.

10:00-10:15 **Kathryn Tenney**- Colorado School of Mines. Long-term performance of bioreactors treating mining influenced water to achieve reductions in metal loading.

10:15-10:45 **Coffee Break**

10:45-11:00 **Roberta Martinez Hernandez –** Colorado School of Mines. Microbial and substrate characterization of four BLM biochemical reactors in the Coeur D'Alene Idaho area.

11:00-11:15 **Stephanie D. Baker**- GEI Consultants, Inc. Challenges and successes in updating aquatic life criteria for five metals.

11:15-11:30- **Emily Lesher** – Colorado School of Mines. Metal-organic matter complexation: an analytical approach.

11:30-11:45 **Pete Cadmus**- Colorado State University. Dietary exposure of algae scraping insects (*Ameletus spp*. and *Epeorus spp.*) to Zinc.

11:45-1:15 **Lunch (on your own); RMSETAC officers meeting**

1:15-1:30 **Diem Pham and Harold Bergman-** University of Wyoming. Agent Orange/dioxin exposure and effects continue in Vietnamese populations 35+ years after the war.

1:30-1:45 **Valerie Stucker**- Colorado School of Mines. Development and application of a novel in situ technique for passively measuring groundwater and uranium fluxes at former uranium mill site

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1:45-2:00 **Janet Burris**- Update on SETAC North America

2:00-2:15 **Stephen Brinkman**-Colorado Division of Wildlife. Recovery of brown trout following cleanup of metal sources in the Upper Arkansas River.

2:15-2:40 **David Pillard**- AECOM Environmental. Long-term studies to determine the effects of boron on emergent macrophytes. Followed by comments on Colorado's WET chronic standards development.

2:40-3:15 **Poster Social**

3:15-3:30 **Keith E. Miller**- University of Denver. Characterization of nanoparticles and nitrogen heterocycles by hydrodynamic chromatography.

3:30-3:45 **Rami Naddy**- AECOM Environmental. A surrogate sub-chronic toxicity test method for waters with high concentrations of total dissolved solids.

3:45-4:00 **Alan Vajda**- University of Colorado. Reproductive disruption of fishes by endocrine-active wastewater effluent

4:00- 4:15 **Student Judging deliberations**

4:15-4:30 **Student Awards and Raffle**

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

Innovative conservation technologies for protection and re-establishment of endangered and native fishes.

by
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Many native fisheries in the western United States are impacted by introduced or invasive fish. Millions of dollars have been spent on suppression programs, as in many locations throughout the United States Mountain West; these fish have significantly altered both the aquatic and terrestrial ecosystem. To date no current fisheries management strategy such as gill netting, poison application or physical barriers have yielded successful outcomes at eliminating these invasive predators from these or other large lakes. Current methodologies are costly and have significant environmental implications. Unintended consequences include mortality in non-target organisms from by-catch or piscicides, further alterations in food web dynamics, and the impediment of genetic material and nutrient movement in a watershed. Additionally while eradication strategies tend to target adult organisms few methods address other life history stages such as recruitment from the embryo and larval stages of fish. Since studies have shown the introduction of just a few founder fish can establish or rebound a population, new conservation technologies must be employed to address recruitment of new individuals into a population. This presentation will discuss new innovative technologies that offer promise to inhibit recruitment of invasive fish.

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Norka Paden
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Background iron concentrations in the Yampa River Basin (Segments 13d and 13e), Routt County, CO

Paden, N.E. †, Canton, S. †, Baker S. †, Jones D. ‡
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There has been some uncertainty on whether the high ambient levels of iron, above the 1 mg/L table value standard (TVS), in the Yampa River Basin (Segments 13d and 13e) are caused by natural or man-induced causes. Seneca Coal Company (Seneca Coal) manages three reclaimed surface coal mines in the northern Williams Fork Mountains south of Hayden, Colorado. The area in which the Seneca Mine is located is expected to have naturally elevated iron due to geologic formations rich in iron sulfide. Another natural phenomenon that may be triggering the increased natural concentrations of iron in these streams is dust storms coming from western states.

Seneca Coal has been monitoring iron concentrations in these river segments since 1991. The overall objective of this study was to compare historic (pre-mining baseline) total iron concentrations to current (post-reclamation) total iron concentrations. For comparison purposes, we included only 4-5 years of data for pre-mining conditions, similar to the number of years available for current conditions. Based on our analysis, it appeared that precipitation and snowmelt might play an important role in iron concentration patterns at these sites. Thus, we also analyzed the data by season for both pre-mining and current conditions at relevant monitoring sites which showed that pre-mining and current conditions in both segments were not significantly different. A whole segment analysis approach showed statistically significant difference between seasons only in Segment 13d. Site-by-site statistical analysis showed few sites with significantly higher iron concentrations during pre-mining conditions in both segments. Our results suggest that median iron concentrations in Segments 13d and Segment 13 e exhibit naturally elevated iron concentrations, higher than the 1 mg/L table value standard, indicating there is a natural source of iron coming from iron-rich soils.

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Long-term performance of bioreactors treating mining influence water to achieve reductions in metal loading

Tenney, K., Figueroa, L., Colorado School of Mines
Holmes, M. Environmental Protection Agency
Boardman, M. Colorado Department Public Health and Environment

Mining influenced water (MIW) from the National Tunnel drains into the North Fork of Clear Creek in Black Hawk, Colorado. Fifty-five gallon bioreactors were set up in June 2006 to investigate the performance of two different solid phase substrate mixtures and an ethanol fed system with limestone support. The MIW from the National Tunnel in 2009 was near neutral and contained major average dissolved metals of Fe = 40 mg/L, Zn = 6, and Mn = 19. The overall goal was to develop design guidance for a full-scale bioreactor system. All bioreactors were effective in removing at least 95% of influent zinc. Average 2009 iron and manganese removals for the solid phase bioreactors were 80% and 45%, respectively. In contrast, the ethanol fed reactors released iron and manganese at 50 to 300% above influent values. The solid phase bioreactors have consistently been effective at removing zinc and a large fraction of iron since startup. The manganese removal capability began to develop after one year of operation and became relatively consistent after two years of operation. The bioreactors constructed with solid phase substrate have effectively removed a significant fraction of the influent metals in the National Tunnel to reduce overall toxicity to aquatic wildlife in the North Fork of Clear Creek over the three-year operating period.

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Microbial and substrate characterization of four BLM biochemical reactors in the Coeur D'Alene Idaho area

Martínez Hernández R., Figueroa L. Colorado School of Mines
Fortier D. Bureau of Land Management: Coeur d'Alene Field Office

The Bureau of Land Management (BLM) constructed four passive biochemical reactor systems (BCRs) to treat mining influenced water (MIW) in the Bunker Hill Superfund area near Coeur D'Alene, Idaho between 2002 and 2003. Initially, the BCRs operated very effectively. However, in the past couple of years, the zinc removal effectiveness of the four BCRs has declined. These BCRs rely heavily on the presence of sulfate reducing bacteria (SRB), which produce hydrogen sulfide that precipitates dissolved metals out of solution. In order to insure long-term sustainability of passive treatment systems sulfate reduction levels must be sustained. The central objective of this study was to characterize the microbial communities and substrate present within the BCRs and to use these factors to propose strategies to promote sustained sulfate reduction levels. Microbial communities were characterized by quantifying total bacteria and sulfate reducing species. Substrate was characterized by quantifying the percent organic, acid soluble organic, acid insoluble organic, and bioavailable material within the BCR. The results suggest the depletion of bioavailable organic substrates is the primary cause of the decline in metals removal and not the microbial community structure. The ability to assess the amount of bioavailable organic substrate and microbial community is important to the understanding of the sulfate reducing capacity of the BLM BCRs and developing strategies to facilitate performance enhancement. The characterization of organic substrate and microbial community structure are also important to improving design of future passive treatment systems for mining influenced waters.

I would like to be considered for the Best Student Paper Award

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

Stephanie D. Baker
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Challenges and successes in updating aquatic life criteria for five metals

Baker, S.D., Canton, S.P., and Gensemer, R.W. GEI Consultants, Inc., Denver, CO.

While the Clean Water Act requires the EPA to publish water quality criteria that accurately reflect the latest scientific knowledge, many of the EPA-derived aquatic life criteria for metals are considerably outdated. For example, the national criteria for aluminum have not been updated for over twenty years and do not reflect the influence of water hardness on toxicity. We addressed this issue of outdated criteria in New Mexico's Triennial Review of water quality standards in December 2009. As part of our effort, updated criteria for aluminum, cadmium, and zinc were developed to reflect the latest aquatic toxicity studies for each metal, and Colorado's criteria for manganese and new molybdenum criteria were proposed. The scientific basis of these proposed criteria updates will be reviewed, along with some of the regulatory challenges that were faced to help support adoption of these proposed criteria. All five of these metals proposals have the support of the New Mexico Environment Department and are expected to be adopted in the coming months. These updated criteria may have a significant bearing on the basis for current 303(d) listings, TMDLs, and effluent limits for NPDES permittees in New Mexico, especially in basins where ambient concentrations often greatly exceed current regulatory criteria. Because these updated and new criteria represent the most up-to-date science and were developed following EPA methodology, their application in other states is also encouraged.

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Metal–organic matter complexation: an analytical approach

Lesher, EK, Ranville, JF, Honeyman, BD
Colorado School of Mines, Golden, CO 80401 (*correspondence: elesher@mines.edu)

Natural organic matter (NOM) in aquatic environments has long been known to bind metals, often reducing the bioavailable fraction and the overall toxicity. In a natural system, differences in NOM source, functional group concentrations, and transformations that have occurred can affect metal binding. This makes modelling metal speciation in environmental systems difficult.

Flow field flow fractionation (Fl FFF) hyphenated with inductively coupled plasma-mass spectrometry (ICP-MS) can be used to quantitatively measure partitioning of uranium to NOM while simultaneously giving a size distribution of the particle-associated metals. Uranium complexation to Suwanee River humic acid (SRHA) has been studied at varying pHs by the method to determine the applicability. Results are compared to ultrafiltration and modelling.

The method is promising for use in both toxicity and transport studies because it requires little volume, maintains sample integrity, and is able to separate polydisperse nanoparticulate mixtures. Detection limits and relevance to environmental systems will be discussed.

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Pete Cadmus
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Dietary exposure of algae scraping insects (*Ameletus sp.* and *Epeorus sp.*) to Zn.

Clements W.H., Cadmus P.J. – Colorado State University Department of Fish, Wildlife and Conservation, Fort Collins, CO
Vieira N.K.M., Brinkman S.F.- Colorado Department of Wildlife, Aquatic Wildlife Research Group, Fort Collins, CO

Novel techniques were developed to assess the relative importance of dietary and aqueous exposure to heavy metals in laboratory toxicity tests. Two species of grazing mayflies (*Ameletus sp*. and *Epeorus sp*.) were exposed for 10 days to sublethal levels of Zn. Experimental treatments included three levels of aqueous exposure and three levels of dietary exposure including periphyton cultured in Zn-contaminated media. We measured total accumulation of Zn as well as Zn associated with subcellular fractions. Dietary exposure had a significant influence on Zn accumulation in more subcellular fractions than did aqueous exposure. Photoanalysis of periphyton on tiles and behavior measures revealed less feeding at higher exposure. Subcellular concentrations were compared to organism collected across a gradient of Zn contamination in the Arkansas River, Leadville, CO.

Yes, please consider me in the Best Student Paper Award and American Idol Competition

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Agent Orange/dioxin exposure and effects continue in Vietnamese populations 35+ years after the war.

Pham, D.T. and Bergman H.L., Department of Zoology & Physiology, University of Wyoming, Laramie, Wyoming, 82071

Agent Orange was used as a defoliant in Vietnam by the U.S. military from 1961-1971. Large areas of former South Vietnam were sprayed with this or other defoliants one or more times during this period. Agent Orange was contaminated during manufacturing with one of the most toxic chemicals known -- 2,3,7,8-TCDD, or dioxin. Recent studies have concluded that many or most of the areas that were sprayed with Agent Orange no longer have significant dioxin residues in soils. But there are at least eight major "hot spots" that have or may have high dioxin concentrations in soils, sediments, fish and other animals, human blood and human breast milk. These hot spots are mostly on or near former U.S. military bases where spray planes were loaded or at other storage depots. Elevated dioxin concentrations in the soil-sediment-aquatic animal food chain are likely sources of human exposure and very serious human health effects near these sites. Such human health effects are now well documented for U.S. military veterans and include prostate cancer, leukemia and type II diabetes among other disease syndromes in adults. Possibly even more worrisome for the continuing exposure of the human population in Vietnam, physical and mental birth defects in newborns, have been linked to dioxin exposure *in utero* and via breast milk. The U.S. government has only recently begun to take responsibility for various dioxin-related diseases in U.S. military veterans. But so far the U.S. government has only committed minimal resources to the resolution of this issue for the Vietnamese environment and its people. In a recent development, announced on December 16th, 2009, the U.S. and Vietnam's Ministry of Natural Resources and the Environment agreed to a framework for cooperation "to implement health and environmental remediation activities related to Agent Orange/ Dioxin."

Please consider for the Best Student Paper Award

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

Valerie Stucker
Department of Chemistry and Geochemistry,
Colorado School of Mines
Golden, CO 80401

Development and application of a novel in situ technique for passively measuring groundwater and uranium fluxes at former uranium mill site

Stucker, V.K.[1], Ranville, J.F.[1], Newman, M.[2], Peacock, A.[3], Hatfield, K.[2], Cho, J.[4]
1 Department of Chemistry and Geochemistry, Colorado School of Mines, Golden, CO 80401
2 Department of Civil Engineering, University of Florida, Gainesville, FL, 32611
3 Microbial Insights, Rockford, TN, 37853
4 Department of Environmental Engineering Sciences, University of Florida, Gainesville, FL, 32611

Rifle, CO is home to a former uranium and vanadium mill that is now managed by the Department of Energy (DOE). The current remediation strategy employed is monitored natural attenuation; however, acetate injections are being made to biostimulate microbes to reduce uranium from the mobile, soluble form, U(VI), to insoluble U(IV). This work focuses on a novel technique to make in situ measurements of uranium and groundwater fluxes using a passive flux meter (PFM). A sorbent material with a resident tracer is encased in a self-contained cartridge which is installed vertically into predrilled wells at the contaminated site. The amount of contaminant sorbed and tracer eluted can be used to calculate the contaminant flux which is essentially the product of the contaminant concentration and the groundwater flow. Several ion exchange resins were tested in lab scale batch experiments for adsorption/ desorption performance and efficiency in the PFM using simulated and collected Rifle groundwater. Little dependence on aqueous uranium speciation was seen with the resins chosen. Non toxic alcohol tracers were tested in bench scale flow box studies to understand elution properties and flow patterns through the PFM. Initial field studies have been completed. Data has been collected to determine uranium and groundwater fluxes with spatial and vertical profiles at the site. This work can help DOE determine the effectiveness of biostimulation and relate flux variations to the microbial biomass.

Please consider for best student paper.

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Recovery of brown trout following cleanup of metal sources in the upper Arkansas River

Brinkman S.B[1]., Davies P.H[1]., Policky G[1]., and Nehring R.B[1].

[1]Colorado Division of Wildlife

California Gulch, a Superfund site near the historic mining town of Leadville CO is a significant source of metals to the upper Arkansas River. Many metals are present at elevated concentrations but the primary metals of concern to aquatic life are zinc and to a lesser extent, cadmium. Prior to cleanup and remediation activities in the 1990s, density and biomass of brown trout downstream of California Gulch was significantly reduced compared to densities upstream and in tributaries. In 1994, the Colorado Division of Wildlife began a chemical and biological monitoring program to measure changes during and after cleanup of metal sources in and near California Gulch. Cleanup and remediation resulted in a reduced loading of metals and an almost immediate increase in density of brown trout. The observed changes in brown trout densities in response to reduced metal concentrations are consistent with results from laboratory toxicity tests. Reduced levels of cadmium in kidneys and livers of brown trout collected in 2008 compared to 1985 corroborate the reduction in metal exposures following cleanup efforts.

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Long-Term Studies to Determine the Effects of Boron on Emergent Macrophytes

Pillard, D.A.†

Tapp, K. †

†Environmental Toxicology, AECOM, 4303 West LaPorte Ave., Fort Collins, CO, USA

Field observations in a Florida wetland found that some plant species exhibited signs of stress, including browned and necrotic leaves. Although boron concentrations in the wetland were elevated in some samples, with substantial temporal and spatial variability, there was no strong statistical correlation between anecdotal plant damage and boron levels. In order to assess the toxicity of boron to emergent wetland plants, laboratory studies were conducted with *Saururus cernus* (lizard's tail), *Sagittaria lancifolia* (lance-leaved arrowhead), *Pontedaria cordata* (pickerelweed) and *Peltandra virginica* (arrow arum). Shoots of each species were planted in clean silica sand in plastic containers (one plant per container) and the sand was saturated with test water such that there was always standing water in the test container. The base solution was reduced-strength Hoagland's media in which the concentration of boron was adjusted to create a concentration series (control = 0.5 mg/L of boron) up to 2,000 mg/L. Pickerelweed and arrowhead did not grow well in the lab; no effects data were obtained for the former. Arrow arum and lizard's tail, however, performed relatively well after an initial acclimation period, and tests continued for 180 and 90 days, respectively. Both survival and growth (weight) effects were observed. Based on time-weighted average boron concentrations, the survival and growth IC_{25}s for lizard's tail were 10.2 and 3.95 mg/L, respectively. Arrow arum was somewhat more tolerant with survival and growth IC_{25}s of 82.5 and 64.6 mg/L, respectively. These data indicate that boron concentrations may have been high enough to cause the apparent sublethal phytotoxicity at the wetland site, although other physical, chemical or biological stress agents cannot be ruled out as possible contributors to the observed effects.

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Characterization of nanoparticles and nitrogen heterocycles by hydrodynamic chromatography

Sorauf, K. J.; Connors, D. E.; Wells. T.A.; and Miller, K. E.

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The fate and distribution of nanoparticles in the environment is of great interest due to increasing production and use of these materials in many consumer products. How these particles interact with chemical and biological systems, however, is still not fully understood due to the unique properties that these materials possess. Thus, predicting the fate and transport of these materials in the environment is challenging. Measurements typically used to quantify binding interactions (namely, distribution coefficients) between submicron particles and solutes are difficult to perform. We present a technique that measures solute interaction with particles (and colloids) between 25 to 100 nm in diameter. The technique is based on capillary hydrodynamic chromatography principles and techniques that have been employed to characterize colloids and micelle-solute interactions. The modification exploits differences in the size [larger particles elute before smaller particles under certain flow conditions] and diffusion coefficients [small molecules rapidly diffuse forming Gaussian shaped peaks while the larger nanoparticles are asymmetric in nature] that results in a partial separation between the nanoparticles and small molecules. Small molecules that interact with the nanoparticles (through partitioning or electrostatic interactions) assume the flow profile of the larger nanoparticle (or colloid). By monitoring the elution profile at multiple UV wavelengths, the molecule concentration in each phase (free or adsorbed) can be determined. Distribution constants (K_D) can then be determined by completing binding isotherm studies. Model systems, including synthetic clay, caffeine and other xanthines solutes, are presented to demonstrate the technique.

Please consider for Best Student Paper Award

23rd Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry April 16rd & 16th, 2010

R.B. Naddy
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A surrogate sub-chronic toxicity test method for waters with high concentrations of total dissolved solids

Naddy RB, McNerney GR, Tapp K, Pillard DA, AECOM, Fort Collins, Colorado, USA
Parkhurst B, H&F Inc., Centennial, Wyoming, USA
Smith, M, The McConnell Group, c/o USEPA, Cincinnati, OH, USA
Lazorchak J, U.S. Environmental Protection Agency, Cincinnati, OH, USA

A common cause of toxicity in whole-effluent toxicity (WET) testing is high concentrations of total dissolved solids (TDS), which can be especially true in waters of the arid west. One of the primary WET test organisms, *Ceriodaphnia dubia*, is sensitive to high concentrations of certain TDS ion concentrations. This can be problematic when trying to differentiate the toxicity of TDS from those of other co-toxicants in a water sample. Because of this, we needed a test organism that was sensitive to toxicants but less so to TDS ions. *Daphnia magna* was a likely candidate because it was known to be less sensitive to common ion toxicity compared with *C. dubia,* but was still relatively sensitive to other toxicants. We employed a 4-d static-renewal survival and growth method using *Daphnia magna* to help identify the toxicant in an effluent with elevated TDS. The sensitivity of the 4-d *D. magna* test method was compared to the standard short-term chronic 3-brood *C. dubia* method in several mock effluents with targeted TDS ions (e.g., chloride, sulfate), as well as in waters spiked with metals (Cu, Ni, or Ag), and in an effluent sample. In some cases, comparisons were also made with the 21-d *D. magna* chronic study to determine if the 4-d method would be a good surrogate for the longer test. The results showed that endpoints calculated for the 4-d *D. magna* study were similar to the 21-d *D. magna* study but were substantially higher (i.e., less toxic) than for the 3-brood *C. dubia* study. For example, the IC25s for the 3-brood *C. dubia* study, the 4-d *D. magna* study, and the 21-d *D. magna* study were (based on chloride): 377 mg/L, 1,449 mg/L, and 2,108 mg/L, respectively. The results indicate that the 4-d *D. magna* sub-chronic test would be useful for differentiating TDS toxicity from other toxicant(s) in TIEs. Furthermore, this method may be useful as a WET test method for dischargers where the presence of TDS ions is an ongoing issue and there is a high degree of similarity between the TDS ions in the effluent and receiving stream.

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Reproductive disruption of fishes by endocrine-active wastewater effluent

Vajda, A.M.[1], Barber, L.B.[2], Bolden, A.[3], Norris, D.O.[3]
[1] Department of Integrative Biology, University of Colorado Denver
[2] U.S. Geological Survey, Boulder Colorado
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We investigated the impact of a wastewater treatment plant (WWTP) effluent on fish reproduction. This effluent is known to contain endocrine-active compounds including alkylphenols, reproductive steroids, and pharmaceutical contraceptives. Previously, we identified female biased sex ratios, gonadal intersex, asynchronous ovarian development, and other forms of reproductive disruption in feral white suckers (*Catostomus commersoni*) collected downstream of WWTP effluent but not at reference sites.To investigate the putative link between reproductive disruption observed in feral fish and wastewater effluent, we conducted on-site exposure experiments in 2005 and 2006 using a mobile flow-through laboratory. In these experiments, adult male fathead minnows (*Pimephales promelas*) were exposed to either WWTP effluent, reference water from Boulder Creek upstream of the wastewater plant, or mixtures of reference water and WWTP effluent. Exposure to diluted wastewater treatment plant effluent significantly elevated vitellogenin and suppressed primary and secondary sex characters.In 2008, we conducted similar on-site experiments to determine effects of an engineering upgrade (change from trickling filter to activated sludge) on the estrogenicity of the effluent. We report a physiological assessment of changes that have occurred in the endocrine activity (estrogenicity) of the WWTP effluent.

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Differences in total and subcellular accumulation of Zn by aquatic insects of different taxa.

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Aquatic insects from six diverse genera were collected across a gradient of Zn contamination in the Arkansas River, Leadville, CO. Taxa were chosen to compare feeding guilds and phylogenetic similarity. Total accumulation of zinc as well as zinc associated with subcellular fractions was assessed using atomic absorption spectroscopy. Total and Subcellular accumulation was significantly different between Ephemopteran, Tricopteran, Dipteran, and Plecopteran species.

Please consider me in the Best Student Paper Award

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Selenium bioaccumulation by *Hygrohypnum ochraceum* in the Fountain Creek Watershed, Colorado

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Aquatic bryophytes, *Hygrohypnum ochraceum*, were deployed "in situ" at 14 sites in the Fountain Creek Watershed, spring and fall, 2007 to study their accumulation of selenium measured by ICP-MS. Dissolved, total, and pore (sediment derived) water samples were collected and water quality parameters determined while plants were exposed to the water for 10 days. We found that plants accumulated Se showing variable distribution of the metalloid by site and season especially along the stream segment from Colorado Springs to Pueblo, CO. A site at Highway 50 bridge in Pueblo had the highest concentration in plants by site and season and in the three water fractions. Selenium bioaccumulation occurred in the spring between Colorado Springs and Pueblo. Plants bioconcentrated Se from the water >160,000 times total Se in the water in upper Fountain Creek at Manitou Springs, CO in the fall and >100,000 times total Se in the water at Monument, CO in the spring. We found direct relationships between the pore and dissolved Se in water in the spring (R^2 =0.84) and fall ((R^2= 0.95) and dissolved Se and total hardness in the spring (R^2=0.92). We found little differences between Se concentrations in water samples as dissolved vs. total.

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Effects of electricity and altered conductivity on rainbow trout *(Oncorhynchus mykiss)* embryo mortality

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Electricity has been an applied means of facilitating capture and removal of invasive fishes for many years. Current methods involve the use of electrodes to establish a current through which passing fish will be susceptible to a brief shock to stun. This method, however, only affects free swimming individuals and is not inclusive of early life history stages such as embryos within spawning substrate. This study evaluates the susceptibility of embryonic and larval stage rainbow trout to direct DC current between 2-20v/cm in varying conductive waters to determine lethality for eradication efforts. Rainbow trout embryos (n = 10 embryos per exposure) were initially exposed to homogeneous electric fields for 5s with a water conductivity of 220uS/cm from 1 day post fertilization (DPF)/ 27 temperature units (TU) to 15DPF/405TU. Mortality was assessed 24h post exposure and the LV_{50} (Lethal Voltage) at 220uS/cm was determined for each TU. Embryos from six periods of development were then exposed to their respective LV_{50} voltages in varying conductive waters (20-600uS/cm). Susceptibility to direct DC voltages decreased with development. Susceptibility to a constant voltage increased with increasing conductivity and was consistent throughout early development (81TU – 292TU), but the effects of increased conductivity were not enhanced as mortality in eyed embryos after 364TU remained static with the LV_{50} . These data suggest that a combination of direct DC current and increased localized conductivity would be an effective means of eradicating invasive and nuisance salmonids prior to eyed embryonic stages.

Consideration for Best Student Paper Award: Yes

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The Effects of Ultraviolet Light on Rainbow Trout (*Oncorhynchus mykiss*) Embryos

Shedden B, Montana State University, Gross JA, USGS Northern Rocky Mountain Science Center, Webb M, US Fish and Wildlife Service, Gresswell RE, USGS Northern Rocky Mountain Science Center

There currently exists a need to develop new approaches to control aquatic invasive and nuisance species. The effects of light radiation such as ultra-violet wavelengths of light have shown negative effects, such as increased embryo mortality in early embryonic salmonid larvae. This study explores the use of light radiation for eradication of invasive fish. Experiments were conducted to evaluate dose and critical period of sensitivity for mortality of rainbow trout (*Oncorhynchus mykiss*) embryos after exposure to visual and ultra-violet light radiation. Endpoints recorded include exposure intensity, effective distance from source, duration of exposure, and mortality. Introduced light may be an effective and feasible eradication technique of early life history stages of fish and invertebrate invasive species *in situ*, as light can be implemented and removed with minimal environmental impact.

I would like to be considered for the best student paper award.

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Produced water impacts to wetlands of the USFWS Northeast Montana Wetland Management District

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In northeastern Montana, the U.S. Fish and Wildlife Service (USFWS) Northeast Montana Wetland Management District (WMD) is comprised of 44 waterfowl production areas (WPA) and is situated in the continuation of the prairie pothole region of the Dakotas. Additionally, it is located in the Williston Oil Basin, Montana's top oil producing area. Consequently, numerous oil wells exist in close proximity to, as well as within many of the WPA boundaries due to the mineral estates that were reserved during purchasing. By volume, produced water is the largest byproduct of oil production and up until the late 1970s, produced water, as well as other drilling waste disposal occurred in unlined reserve pits. Generally characterized by elevated salinity levels, produced waters of Northeast Montana are some of the most saline in the United States, often exceeding 300,000 µs/cm specific conductance. In an effort to assess the current impacts, as well as predict future impacts of produced waters on wetlands of the Northeast Montana WMD, soil conductivity surveys were conducted using an EM-31 soil conductivity meter and a Trimble GeoXT and mapped using ArcGis to delineate migrating brine plumes. Within identified plumes, monitoring wells were installed and sampled for water quality analysis. Additionally, water quality parameters and chloride concentrations were determined in the field for 80 wetlands, while 10 surface water samples were collected and analyzed for ions in the laboratory. By applying a contaminant chloride index, it was determined that groundwater was largely impacted by produced water and over half of the wetlands sampled showed signs of salinity impacts. Lastly, toxicity to aquatic biota was assessed by implementing an ion toxicity model using the wetland ion data. The model results suggest that aquatic organisms, particularly invertebrates, are vulnerable to produced water impacts.

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Water quality for Wyoming livestock and wildlife

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Water is the single most important nutrient for livestock and big game wildlife species. In the arid, western United States good quality water is scarce, due to competition from human usage, mineral extraction, etc., which leads to animals surviving on possibly sub-standard water sources. This "work in progress" is focused upon domestic wildlife and large charismatic wildlife species that tend to rely upon wells, ponds, streams and other water sources on Wyoming's ranges. A great deal of research has been conducted on the effect of inorganic contaminants upon the health of animals when presented to them through feed or water. The majority of this data is scattered and not easily accessible, and the last concerted effort in the United States to summarize the literature regarding water quality for animals occurred more than 30 years ago. My research involves compiling data about the substances in question followed by converting the collected data into standard units (mg/kg/bw or ppm). Once the data has been collected and analyzed, a report will be produced that can be used to help in the identification of hazards that may be imposed to wildlife and livestock due to elevated levels of inorganic contaminants that occur in the water sources that they use.

I would like to be considered for the best student paper award.