35th Annual Meeting of the Rocky Mountain Chapter of the Society of Environmental Toxicology and Chemistry

April 17-18, 2024

Fort Collins, Colorado

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Wednesday, April 17, 2024

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TOPO DESIGNS

Day 1: Wednesday, April 17, 2024

Hillside Vineyard & Event Center
3924 Bingham Hill Rd, Fort Collins, CO 80521
Meeting: 9am-4:30pm
Networking Social: 4:30pm-7:30pm

Free parking. *Do not park at Blendings Tasting Room*. Continue north to the large lot on the left. 85 car limit. If lot is full, please call Pete (970-420-8467) for a shuttle from the Watson Hatchery (see page 6).

PLEASE bring cornhole boards, bocce ball, etc. to the evening networking social. Bring your reusable water bottle to reduce waste.

Day 1: Wednesday, April 17, 2024
Morning session agenda

9:00-9:30am	Check in
9:30-9:45am	Welcome & logistics (silent auction) **Pete Cadmus**, *Colorado Parks and Wildlife*
9:45-10:00am	SETAC & RMSETAC '25 Updates **Will Clements,** *Colorado State University* **Dave Bertolatus,** *Adams State University*
10:00-10:42am	Leveraging national-scale monitoring of biological mercury to model Hg risk and source pathways **Chris Kotalik,** *US Geological Survey*
10:45-11:30am	Poster session/break
11:30-11:42am	Burning Questions: Are More Microplastics Found in Unburned Soil Compared to Burned Soil in Kruger National Park? ****Kelsey Craig,** *Adams State University*
11:45-11:57am	An ecotoxicological evaluation of salinity on lethal and sub-lethal effects in invasive mosquitofish and native plains topminnow ****Samuel Lewis,** *Colorado State University*
12:00-12:12pm	Importance and challenges of cumulative impact of environmental contaminants in risk assessments ****Alison Barbee and Hannah Walters,** *Colorado School of Public Health*
12:15-1:45pm	Lunch on your own (Board of Directors lunch meeting)

**To be considered for best student presentation

Day 1: Wednesday, April 17, 2024
Afternoon session agenda

1:45-1:57pm	Quantifying the relative effectiveness of remediation and restoration treatments in the Upper Arkansas River, Colorado **Will Clements,** *Colorado State University*
2:00-2:12pm	A pilot study on the effects of mosquito control insecticides on aquatic invertebrates in Colorado streams **Dan Kowalski,** *Colorado Parks and Wildlife*
2:12-2:27pm	Wildfire in historically mined lands: metal uptake in linked aquatic-riparian food webs **Johanna Kraus,** *US Geological Survey*
2:30-3:00pm	Poster session/break
3:00-3:12pm	A comparison of water sampling methods to evaluate potential bias resulting from enrichment of PFAS in the surface microlayer **Shaun Roark,** *Jacobs*
3:15-3:27pm	Reproductive disruption in male fathead minnow exposed to PFAS-contaminated groundwater at a legacy fire-training area **Alan Vajda,** *University of Colorado Denver*
3:30-3:42pm	Revising Colorado's fish consumption advisory program to protect against the risks of exposure to perfluorooctane sulfonate (PFOS) **Meghan Williams,** *Colorado Department of Public Health and Environment*
3:45-4:15pm	Awards, 2024 Board of Directors, networking social details **Pete Cadmus,** *Colorado Parks and Wildlife*
4:30pm-7:30pm	Networking social at Hillside Vineyard & Event Center Snacks provided. Wine tasting room open. Cheap colorado beers for sale to raise money for student awards. Silent Auction. Bring your bocce ball & corn hole. Bring the family. Grills available. Duck pond and beach (no swimming). White boards.

Day 2: Thursday, April 18, 2024

Watson State Fish Hatchery
4936 W County Rd 52 E, Bellvue, CO 80512
Short course: 8:45am-4:30pm

Please park (free) in the large parking lot (★) southwest of the hatchery building.

Please bring:

- Clean waders (if you have them. not required. email rmsetac@gmail.com if you need some)
- Weather-appropriate attire (hat, rain coat, dress in layers, avoid cotton, bring extra socks [warm ones])
- Water bottle, sunscreen
- Supportive, slightly large boots to wear if you don't have your own waders
- Sunglasses (preferably polarized. It helps you see fish)
- Optional camping chair (in case we have to move inside for weather)
- Fishing License if you plan to fish during the fly fishing lessons

Qdoba lunch provided. Please email RMSETAC@GMAIL.COM if you have dietary needs.

Day 2: Thursday, April 18, 2024 Agenda

Group (pink, orange, green, yellow, purple, or blue) assignments will be made at meeting check-in.

	Station #1: Fly fishing	Station #2: Toxic algae	Station #3: Inverts	Station #4: Lentic fish	Station #5: Lotic fish
8:45-9:00am	Check in & color group assignments				
9:00-9:15am	Welcome				
9:15-10:15am	Pink/Orange	Green/Blue		Yellow	Purple
10:15-11:15am			Green/Blue	Purple	Yellow
11:15-12:15pm	Green/Blue	Purple/Yellow		Pink	Orange
12:15-1:15pm	Lunch				
1:15-2:15pm	Green/Blue		Purple/Yellow	Orange	Pink
2:15-3:15pm	Purple/Yellow		Pink/Orange	Green	Blue
3:15-4:15pm		Pink/Orange	Decon Gear	Blue	Green
4:15-4:30pm	Clean up				

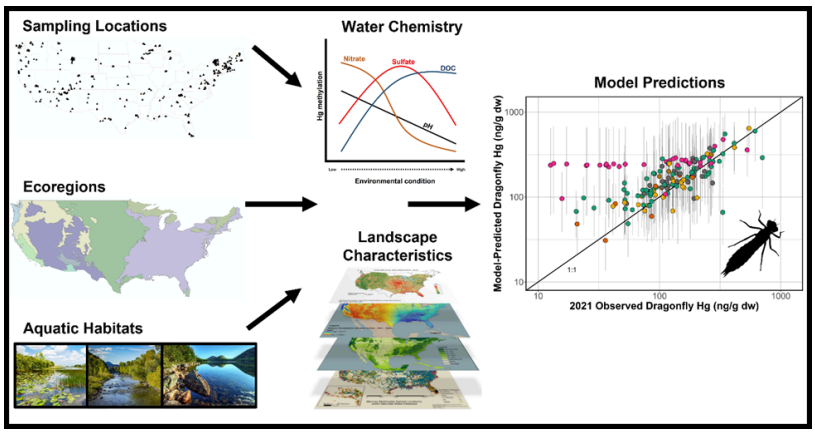
INSTRUCTORS:

Fly fishing: Andre Egli *(Colorado Parks and Wildlife)*
Toxic algae: Andrea Kingcade & David Dani *(Colorado Department of Public Health and Environment)*
Inverts: William H. Clements *(Colorado State University)*, Dave Reese *(Timberline Aquatics)*, & Chris Kotalik *(USGS)*
Fish: Mark Sandersen, Gage Dean, & Adam Koser *(Colorado Parks and Wildlife)*
Support: Pete Cadmus, Dana Musto, Matt Bolerjack, & Riley Halford *(Colorado Parks and Wildlife)*

NOTE: If you are participating in the fly fishing lessons at the short course, please make sure you have a valid fishing license. Day or year long licenses are easy to obtain at hundreds of locations or online. See https://cpw.state.co.us/buyapply/pages/fishing.aspx for more info.

PLENARY SPEAKER

Chris Kotalik, PhD
US Geological Survey
Columbia Environmental Research Center, Columbia, MO



<u>Leveraging national-scale monitoring of biological mercury to model Hg risk and source pathways</u>

Cycling of environmental mercury (Hg) is complex, and numerous extrinsic factors influence Hg bioaccumulation in freshwater ecosystems, including exposure pathways, habitat type, food web structure, and underlying biogeochemical conditions. Predicting Hg risk and identifying Hg sources across large spatial scales is particularly difficult because of the immense variation in these external factors. The Dragonfly Mercury Project (DMP) is a national-scale citizen science program that monitors mercury pollution among protected lands in the United States (U.S.) using dragonfly larvae as biosentinels. With more than 600 waterbodies sampled since 2014, this monitoring effort represents the most spatially extensive and representative biological Hg datasets in North America. In this talk, I will share how we leveraged the DMP to develop Hg risk and source pathway models at a continental scale. Using a Bayesian hierarchical modeling approach, we developed models to characterize and predict Hg bioaccumulation using water chemistry (e.g., pH, nutrients, DOC) and watershed characteristics (e.g., wetlands, forests, soil Hg). Drivers of Hg risk were consistent for certain parameters across the U.S. However, we observed context-dependent effects for other parameters, where the direction and magnitude of effect varied among freshwater habitats, demonstrating the need to account for differences in biogeochemical relationships among and within ecoregions. We also employed the novel application of Hg stable isotopes in dragonflies to identify Hg source pathways and to help inform “where the Hg is coming from.” Isotopic modeling revealed local and regional-scale variation that differentiated atmospheric Hg sources and identified Hg source pathways across a diversity of freshwater ecosystems in the U.S. These modeling tools, coupled with sustained national-scale Hg monitoring, can be used to predict Hg risk at unsampled waterbodies, guide natural resource management, and inform effectiveness evaluations for domestic and international efforts (i.e., Minamata Convention) aimed to reduce Hg loading.

ABSTRACTS

Adams, Bill

Evaluation of Avian Dietary Consumption Rates

William J. Adams, Red Cap Consulting, Lake Point, Utah 84074

Allison Cardwell, Cardwell Consulting, Corvallis, Oregon 98330

Rick Cardwell, Cardwell Consulting, Corvallis, Oregon 98330

A critical part of assessing risk from contaminants to birds is knowing what dietary consumption rate to use when modelling exposure. Risk assessments frequently use consumption rates that have been reported in the literature and are then applied to a species of interest. Actual measurement of avian dietary consumption in wild birds is less common than using previously reported values. The goal of this research project was to expand the avian dietary consumption database with a focus on small birds where the ingestion rates are reported to be high. The European Food Safety Authority (EFSA), in screening-level risk assessments, use ingestion rates equalling100% of body weight for some species and food types. These values are based on energetic calculations. The question is whether this assumption is too conservative or not? Dietary consumption data from more than 300 studies of 30 species was reviewed and used to develop relationships between body weight and consumption rate. The information obtained from this review was compared with the literature EFSA Guidance on Risk Assessment for Birds and Mammals. The results of our study support the commonly held premise that smaller birds consume a greater amount of food on a daily basis as a function of their body weight. However, the amount of food consumed per day appears to be frequently less than 50% and often less than 20% of body weight. This is supported by previously published measurements of wild bird weights in the morning and evening. The data summaries are presented.

Presentation format: Poster

Barbee, Alison and Hannah Walters**

Importance and challenges of cumulative impact of environmental contaminants in risk assessments

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Mallory O'Brien, Colorado Department of Public Health and the Environment (CDPHE), Toxicology and Environmental Epidemiology Office, Denver, CO 80246, mallory.o'brien@state.co.us

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Kristy Richardson, CDPHE, Toxicology and Environmental Epidemiology Office, Denver, CO 80246, kristy.richardson@state.co.us

The Colorado Department of Public Health and Environment (CDPHE) recognizes that, as a result of a history of environmental and structural racism, approximately 40% of Colorado's population is living in a disproportionately impacted community. These communities face a disproportionate share of environmental pollution alongside unequal access to healthcare, public transportation, affordable food options, and decision-making. The cumulative impact of these components results in greater vulnerability to environmentally-caused disease. So, Coloradans, especially those living in disproportionately impacted communities, may be concerned about the impact of exposure to environmental contaminants on their health. This presentation will highlight the approach to risk assessments, the challenges with addressing cumulative impacts, and a few efforts that CDPHE has undertaken to try to capture the experience of cumulative health exposures in disproportionately impacted communities.

Presentation format: Platform

****To be considered for best student poster/presentation**

Clements, William

Quantifying the relative effectiveness of remediation and restoration treatments in the Upper Arkansas River, Colorado

William H. Clements

Pete Cadmus

Christopher J. Kotalik

Remediation and restoration activities in the upper Arkansas River, a historically mining-polluted watershed in Colorado, provided an opportunity to contrast the effectiveness improvements in water quality and restoration of instream habitat. Long-term (1989-2023) monitoring conducted before and after remediation and restoration treatments showed significant differences in responses of benthic macroinvertebrate communities and brown trout (Salmo trutta) populations. Both macroinvertebrates and brown trout responded significantly to improvements in water quality, with macroinvertebrate metrics returning to reference conditions within about 10 years. About 15 years after remediation was completed, a large-scale habitat restoration project that was designed to improve the brown trout fishery in the Arkansas River was initiated. Restoration treatments included planting riparian vegetation, bank stabilization, and installation of instream structures (e.g., boulders and large woody debris) to enhance pools and increase habitat heterogeneity. Habitat restoration significantly increased trout density and biomass; however, consistent with results of previous studies, we observed few changes in benthic macroinvertebrate communities after restoration was completed. Differences in the responses between macroinvertebrates and fish were likely due to different mechanisms that influenced recovery. Because high metal concentrations significantly degraded all biological compartments, we expected that remediation would improve both macroinvertebrate communities and fish populations. In contrast, habitat restoration, which was designed to increase trout populations, also increased macroinvertebrate prey consumption. These results suggest that restoration of streams may be influenced by predator-prey relationships and potential top-down effects of fish on macroinvertebrate communities. Monitoring programs that assess changes in availability and utilization of prey resources by fish provide a more complete characterization of restoration effectiveness on stream ecosystems.

Presentation format: Platform

Craig, Kelsey**

Burning Questions: Are More Microplastics Found in Unburned Soil Compared to Burned Soil in Kruger National Park?

Kelsey Craig, Adams State University, craigk001@adams.edu

Josephine Pegg, Organization for Tropical Studies, josephine.pegg@tropicalstudies.org

Studies of microplastics (MPs) within protected areas are needed to understand the extent to which anthropogenic change affects preserved environments. Previous research has identified the presence of microplastics in the Kruger National Park (KNP); however, very few have focused on their presence in soil environments. To develop the breadth of knowledge on plastic pollution in protected terrestrial environments, our study aims to understand how microplastic presence varies across controlled fire regimes in a savanna ecosystem. We surveyed soil samples gathered from four experimental burn plots near Skukuza in KNP. These plots are burned on a schedule of one, two, and three years, with a control that hasn't been burned for 70 years. A total of 86 microplastic pieces were identified at the sites that varied in color and base type. At the control, one year, two year, and three year burn sites, 36, 20, 14, and 12 individual microplastics were identified, respectively. At all of the sites, blue plastics comprised over 50% of the total found in each sample. Microplastic abundance did not significantly differ in comparing the burned sites to the unburned sites ($p = 0.052$). Ultimately, many biotic and abiotic pathways exist for MPs to enter terrestrial matrices, both directly and indirectly. Prospective studies must concentrate on land as a long-term receptacle for plastic pollution, which may affect soil health and function.

Presentation format: Platform

****To be considered for best student poster/presentation**

Hawkins, Fiona**

Chemical-Gene Interactions of PFAS chemicals

Fiona Hawkins, hawkinsfa@adams.edu

Dr. David Bertolatus, dbertolatus@adams.edu

Per- and polyfluoroalkyl substances (PFAS) are environmentally persistent chemicals that are widely used in many industrial and consumer applications. They break down very slowly because of carbon-fluorine bonds and have been labeled “forever chemicals” in the popular press. They have been found to accumulate in the environment and in organisms. Exposure to these chemicals has been linked to cancer, reproductive issues, and immune system harm. Although, the precise biological mechanisms that cause these outcomes are poorly understood. The goal of this research project is to better understand the genetic consequences of PFAS exposure and to develop genetic fingerprints of exposure to different PFAS. Chemical-gene interaction data was collected from the Comparative Toxicogenomics Database for 23 different PFAS structures.Understanding the chemical-gene interaction can help demonstrate the mechanism by which these chemicals are causing the effects seen in organisms.

Presentation format: Poster

****To be considered for best student poster/presentation**

Kowalski, Dan

A pilot study on the effects of mosquito control insecticides on aquatic invertebrates in Colorado streams

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William H. Clements, Department of Fish, Wildlife and Conservation Biology, Colorado State University, Fort Collins, CO 80523, William.Clements@colostate.edu

Despite the high toxicity of mosquito control insecticides to aquatic species, little is known about their effects on aquatic invertebrates in Colorado streams and rivers. We completed a pilot study on the effects of commercially applied mosquito insecticides on aquatic invertebrate communities through a longitudinal study in historically sprayed and unsprayed areas in the Gunnison River, and through water sampling around an aerial application on the Colorado River. Nine sites in the Gunnison River basin were sampled for aquatic invertebrates, three sites outside of the historically sprayed area and six sites within. Results showed a longitudinal pattern in the distribution and abundance of macroinvertebrates with species richness of most groups significantly reduced in the treated areas. Water sampling occurred in the upper Colorado River basin near Kremmling the night after an aerial mosquito control application. Water, suspended sediment, and bed sediment samples were collected at each site and analyzed for the presence of pesticides with gas chromatography/mass spectrometry. Permethrin, Bifenthrin, and Piperonyl Butoxide were detected in various samples within and downstream of treated areas, but not at control sites. Permethrin was confirmed in 75% of water and bed sediment samples and in all suspended sediment samples in the treated area. Concentrations of Permethrin were generally low in water samples but very high in suspended sediment samples in treated areas. These results indicate that currently used application methods can result in pesticide exposure, especially through suspended sediment, and that invertebrate community composition can differed between historically treated and untreated areas.

Presentation format: Platform

Kraus, Johanna

Wildfire in historically mined lands: metal uptake in linked aquatic-riparian food webs

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B.N. McGee, U.S. Geological Survey, Geology, Geophysics, and Geochemistry Science Center, Denver, CO

M.A. Goldman, U.S. Geological Survey, Geology, Geophysics, and Geochemistry Science Center, Denver, CO

W.E. Dean, U.S. Geological Survey, Geology, Minerals, Energy, and Geophysics Science Center, Menlo Park, CA

C. Baxter, Idaho State University, Department of Biological Sciences, Pocatello, ID

M.N. Croteau, U.S. Geological Survey, Geology, Minerals, Energy, and Geophysics Science Center, Menlo Park, CA

J.M. Holloway, U.S. Geological Survey, Geology, Geophysics, and Geochemistry Science Center, Denver, CO

Large wildfires are becoming increasingly common in drier regions of the world including the western United States. Many of these ecosystems are fire-adapted due to millennia of exposure to natural and anthropogenic fire, with positive outcomes from burning expected. However, increased fire intensity combined with other anthropogenic stressors such as historic mining could lead to negative outcomes for biota. We evaluated the effects of recent wildfire (2022 Moose Fire) on trace metal mobilization, exposure, and accumulation in linked aquatic-terrestrial food webs in an historically mined region of the Rocky Mountains in Idaho, USA. We expected fire to increase mobilization of trace metals into streams. Instead, lead, arsenic, zinc, and nickel concentrations were elevated in biota from streams impacted by placer mining compared with unmined sites regardless of fire history. Because biota from mined lands had the additional stressor of higher tissue metal concentrations, we predict that food webs in watersheds with a history of mining could respond differently after fire compared with unmined areas. Future studies will evaluate the ecological responses of aquatic insects and riparian spiders to these stressors, specifically if mining could reverse the positive effects that fire has on stream food web productivity.

Presentation format: Platform

Lewis, Sam**

An ecotoxicological evaluation of salinity on lethal and sub-lethal effects in invasive mosquitofish and native plains topminnow

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Pete Cadmus, Colorado Parks and Wildlife, Ecotoxicology Lab, 317 W Prospect Rd, Fort Collins, CO 80526, USA

Yoichiro Kanno, Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523-1474, USA

The impacts of salinity on freshwater ecosystems and the species that inhabit them are of increasing concern, particularly considering the impacts of climate change and human activities such as agriculture. Understanding the effects of salinity on native fish species, and their sub-lethal endpoints is critical for the management of these populations.

This study aimed at identifying the impacts of salinity on the survivability and sub-lethal critical thermal maxima (CTM) of native Plains Topminnow (PTM, Fundulus sciadicus) and invasive Western Mosquitofish (MSQ, Gambusia affinis). Both fish species were exposed to six levels of increasing salinity ($CaCl_2$) concentrations (control, 150, 300, 600, 1200, & 2400 mg/L) for 30 days. At days 4, 10, and 30 individuals were removed from each concentration and underwent CTM tests to identify the sublethal effects of salinity and temperature. A Kaplan-Meier survival estimate was calculated to identify the lethality of salinity and an ANOVA was performed to determine the effects of salinity on CTM.

Contrary to our predictions, we did not find evidence that PTM or MSQ experienced lethal effects of salinity during the 30-day exposure. The analysis of CTM confirmed that MSQ have a higher CTM across all exposure levels than PTM, however CTM does decline in relation to increased duration of salinity exposure.

This study provides insight into the invasion dynamics of MSQ and highlight the importance of considering both salinity and temperature interactions in understanding their ecological impacts. PTM were resilient to increased salinity levels suggesting that other factors, such as demography, may play a more significant role in shaping their fitness.

Presentation format: Platform

****To be considered for best student poster/presentation**

Reno, Matthew, Shelby Andersen, & Kamryn Rogers**

Stream microbiome analysis: comparing creeks within the mountain ranges surrounding the San Luis Valley

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Kamryn Rogers, Student, Adams State University, rogerskp@adams.edu

David Bertolatus, Biology Professor, Adams State University, dbertolatus@adams.edu

A microbiome is the makeup of all microorganisms found within a given environment, such as the bottom of your shoe, a puddle after it rained, your stomach, or even a mountain stream. Understanding a microbiome is the backbone of a given ecosystem because the microorganisms provide the foundation of nutrients available to other organisms up the food chain. The goal of our research project was to identify and compare the microbiome communities of streams within the mountain ranges surrounding the San Luis Valley (San Juan to the west and Sangre de Cristo to the east). There are already known differences between these two mountain ranges, such as the amount of cattle grazing, geological and ecological differences, and recreational use. Soil samples were collected from three streams within each mountain range to identify the microbiome within the mountain streams. These samples were run through a DNA extraction and then sequenced using the 16s rRNA gene. This allowed us to identify the operational taxonomic units (OTU) present. Then a statistical analysis was performed where we found the average Shannon diversity index for each mountain range. We hypothesized that there would be a statistical difference within the Shannon diversity index between the mountain ranges. Within this analysis, a t-test was also run to give us a p-value of 0.245. This value rejects our hypothesis.

Presentation format: Poster

****To be considered for best student poster/presentation**

Roark, Shaun

A comparison of water sampling methods to evaluate potential bias resulting from enrichment of PFAS in the surface microlayer

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Amanda Struse, Jacobs, Sioux Falls, SD, 57105, USA, amanda.struse@jacobs.com

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Dorin Bogdan, AECOM, Grand Rapids, MI, 49546, USA, dorin.bogden@aecom.com

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Jennifer Field, Dept. Environ. Molec. Tox, Oregon State University, Corvallis, OR, 97331, USA, Jennifer.field@oregonstate.edu

Per- and polyfluoroalkyl substances (PFAS) accumulate at the air-water interface of the surface microlayer (SML) on marine and freshwater bodies. This investigation was conducted to determine if including the SML when sampling bulk surface water leads to a high bias in measured PFAS concentrations. A pilot study conducted at two sites was aimed at determining the small-scale (~1 m) spatial variability and analytical precision. The full field study was performed at 11 sites where three commonly used bulk surface water sampling methods were compared: (1) peristaltic pump with tubing that excludes the SML, (2) a fully submerged sample bottle that excludes the SML, and (3) a partially submerged sample bottle that allows inclusion of the SML. The SML was sampled using the glass plate method. The samples were analyzed by liquid chromatography tandem mass spectrometry. The pilot study indicated sampling variation was greater than analytical variation and that relatively small differences among sampling methods could be detected. The full investigation indicated there was no evidence of high bias of PFAS concentrations in bulk surface water resulting from inclusion of SML using the partially submerged bottle sampling method. Unexpectedly, there was evidence that samples collected using the partially submerged bottle had slightly lower PFAS concentrations, particularly for less hydrophobic PFAS, than bulk water samples that excluded the SML. Additionally, the PFAS enrichment factor in the SML increased with increasing retention time, although the increase was not evident at all sampling sites for all PFAS.

Presentation format: Platform

Schaffer, Paula and Jenny Buczek

Using AI (Artificial Intelligence) on the fly: catching toxic karyomegaly in Johnny Darters, *Etheostoma nigrum*

Jennifer Buczek, College of Veterinary Medicine and Biological Sciences, Department of Clinical Sciences, Colorado State University, Fort Collins, CO 80523

Catherine M. Adams, Colorado Cooperative Fish and Wildlife Research Unit, Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, CO 80523

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Ryan M. Fitzpatrick, Colorado Parks and Wildlife, Research, Policy and Planning Section, Fort Collins, CO 80526; eCollege of Veterinary Medicine and Biological Sciences, Department of Microbiology, Immunology & Pathology, Veterinary Diagnostic Laboratory, Colorado State University, Ft. Collins, CO 80523

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Wild fish can be sentinels for toxicologic environmental exposure. Histologic review of tissues is a key diagnostic tool for diagnosis of disease, including toxic insults. Hepatic megalocytosis and karyomegaly are a few of the many potential features that can be seen in fish following toxicant exposures. These changes are visually distinctive, which may make them suitable targets for image analysis. We tested whether an image analysis application (App) could be developed to detect and measure hepatic nuclei in a microscopic image and distinguish karyomegaly in histologically prepared fish liver. Microscopic slides were selected from an existing slide database of wild caught Johnny darters (*Etheostoma nigrum*). Ten fish from one site above and one site below a wastewater treatment plant on the Big Thompson were selected. Whole slides were scanned with a Philips slide scanner and microscopic images of liver were exported as TIF files. Visiopharm's nuclei App was fine tuned by a blinded board certified anatomic veterinary pathologist. Nuclear diameters were exported for analysis. The livers were scanned blindly by light microscopy by two anatomic pathologists and the degree of karyomegaly was scored as mild, moderate, or severe. Image analysis can successfully detect hepatic nuclei. No significant difference was detected in the average number of largest nuclear-size classes between upstream and downstream fish, but additional analysis, greater sample sizes, and optimization are needed.

Presentation format: Poster

Vajda, Alan

Reproductive disruption in male fathead minnow exposed to PFAS-contaminated groundwater at a legacy fire-training area

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The use of aqueous film-forming foams (AFFF) at fire-training areas (FTAs) has introduced into ground- and surface waters a complex mixture of per- and poly-fluorinated alkyl substances (PFAS). The toxicity of environmental PFAS mixtures to wildlife is not well understood and presents a knowledge gap that limits accurate risk assessment. To evaluate reproductive biomarker responses to complex environmental PFAS mixtures, we conducted a series of on-site experiments using flow-through mobile laboratories exposing fathead minnow (Pimephales promelas) to groundwater impacted by a legacy FTA and an adjacent reference site (REF). The measured PFAS concentrations at FTA sites included a high proportion of PFOS, PFOA, and PFHxS. Fish reproductive health was evaluated through assessment of secondary sex characteristics, testis histopathology, immunohistochemical detection of cell-cycle biomarkers (PCNA and TUNEL), sperm count, live cell sperm motility analysis, and analysis of testes transcriptomics. The results indicate exposure to PFAS-contaminated groundwater negatively impacts fathead minnow reproductive health.

Presentation format: Platform

Williams, Meghan

Revising Colorado's fish consumption advisory program to protect against the risks of exposure to perfluorooctane sulfonate (PFOS)

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The Colorado Department of Public Health and Environment (CDPHE) and Colorado Parks and Wildlife (CPW) collaborate on a fish consumption advisory (FCA) program. The FCA program is currently focused on mercury contamination and encompasses both a statewide advisory applicable to all water bodies as well as site-specific advisories for water bodies where some fish species contain higher levels of mercury. As PFAS-related actions continue in Colorado, CDPHE and CPW have recognized the need to expand the FCA program to include per- and polyfluoroalkyl substances (PFAS). PFAS are human-made chemicals that exist throughout our environment, are associated with certain negative human health impacts, and can accumulate in fish to levels that can harm human health when the fish are eaten. One type of PFAS called perfluorooctane sulfonate (PFOS) can build up to high levels in fish even when levels of PFOS in the water are relatively low. To assess the extent and magnitude of PFAS contamination in fish, CDPHE and CPW collected fish and surface water samples for PFAS analysis in 2020 and 2023. Based on the results of these efforts, CDPHE will make recommendations to protect public health from PFOS in fish through site-specific FCAs. This presentation will focus on the technical aspects of issuing site-specific FCAs for PFOS, including the process of selecting an oral reference dose, revising exposure parameters (i.e., portion size, body weight), calculating fish consumption limit guidelines (FCLGs), and the process for using FCLGs to issue site-specific FCAs.

Presentation format: Platform