NWRRI - Desert Research Institute

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Nevada Water News

Newsletter written and compiled by Nicole Damon

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RFPs

If you have questions about submitting a NWRRI proposal, email Suzanne Hudson (Suzanne.Hudson@dri.edu).

For current RFP information, visit the NWRRI website (www.dri.edu/nwrri).

Director's Letter

As the Deputy Director of the Division of Hydrologic Sciences (DHS), I'm proud to be taking on the role of the Director of the Nevada Water Resources Research Institute (NWRRI) program. The NWRRI projects featured in past newsletters have highlighted the commitment of DHS to exploring a wide variety of water resources issues that affect Nevada. In addition to the research supported through the NWRRI program, our division also supports many other water resources research projects.

The project featured in this issue, "Using Armored Catfish as an Indicator of Microplastic Pollution in the Las Vegas Wash," explores the effects of plastic contamination in freshwater systems. This project aims to determine the presence and distribution of microplastics in the water and soil of the Las Vegas Wash, as well as their effects on aquatic species. The researchers selected the armored catfish as an indicator of the effects of microplastics on aquatic species because these fish are likely to have a higher incidence of ingesting these contaminants. Understanding the effects of microplastics on freshwater ecosystems will provide valuable insights into their overall effects on the environment and human health.

As climate and population changes continue to affect the availability of potable water resources, research into finding better ways to preserve these resources is even more critical. The projects featured in upcoming issues of the *Nevada Water News* will also show DHS's dedication to all aspects of water resources research and the importance of these projects for our state and other arid regions. I look forward to sharing more of the advanced water research that DHS is conducting, as well as profiles of the researchers and students participating in the NWRRI program.


Photo courtesy of Chuck Russell

Sincerely,
Chuck Russell ■

Using Armored Catfish as an Indicator of Microplastic Pollution in the Las Vegas Wash

The presence of microplastics in freshwater systems is an increasing environmental concern. The Las Vegas Wash is suspected to contain microplastics and their effects on the ecosystem are currently unknown. This is particularly a concern for southern Nevada because the wash empties into Lake Mead, which is the primary water resource for the Las Vegas area. "The accumulation of plastic debris is an increasing environmental concern after decades of global plastic production, much of which is single use," says Dr. John Umek, the principal investigator (PI) of this project that also includes co-PIs Dr. Zoe Harrold and Dr. Monica Arienzo. "Microplastics (MPs, ≤ 5mm) in particular are an emerging environmental contaminate because of their insolubility, durability, and small size, which leads to their ubiquity in aquatic systems" (Baldwin et al., 2016; Kapp and Yeatman, 2018; Sutton et al., 2016). Although many marine studies on microplastics have been conducted, there have been few studies conducted on the effects of microplastics in freshwater environments.

From left to right: Drs. John Umek, Monica Arienzo, and Zoe Harrold (photo courtesy of John Umek).

"Understanding anthropogenic impacts to these freshwater environments is critical to managing water and water quality."
– John Umek

The ubiquitous presence of microplastics and their potentially toxic effects on wildlife are the main reasons they are considered an emerging environmental contaminant. "The effects of microplastics include ingestion and bioaccumulation in vertebrates, invertebrates, and waterfowl," Umek explains. "The physical effects of the ingestion and bioaccumulation of microplastics in fish include choking, internal wounds, impaired feeding capacity, starvation, debilitation, and death. Contaminants absorbed onto microplastics can also be transferred through ingestion and affect organisms at the tissue and organ level" (Eerkes-Medrano et al., 2015; Lusher et al., 2017; Wright et al., 2013).

The objective of this project is to determine the types and amounts of microplastics present in the Las Vegas Wash. The researchers will collect water and sediment samples, as well as tissue samples from armored catfish. They will then assess the types and amounts of microplastics present in all of the samples. The researchers selected armored catfish because they are benthic foraging fish, which have been found to have a higher occurrence of microplastic ingestion. "Because they use their suctorial mouth to attached to surfaces and consume benthic organisms, algae, and detritus, armored catfish have a higher incidence of ingesting microplastics mixed with algae and sediment," Umek adds. "Additionally, if microplastics are present in the fish tissue, it indicates that they are being assimilated into the fish instead of being passed through the fish." Understanding the presence of microplastics in the catfish can

(Project Spotlight continued)

also provide insight into potential microplastic contamination in game fish because much of the fishing in Lake Mead occurs around the outlet of the Las Vegas Wash.

The researchers will collect surface water samples using a battery-powered, field-ready peristaltic pump from Geotech, which is a high-volume, low-impact, remote sampling method. The water samples will be collected upstream from where the fish will be sampled. Once the water samples are collected, they will be stored in petri dishes for laboratory analysis. The sediment samples will be collected using metal trowels from an undisturbed area between the water-sampling location and the fish-sampling location. The sediment samples will be dried in the laboratory, and then sieved and processed to separate out any microplastics.

The methods developed for this study to separate microplastics from the fish tissue will also support future bioaccumulation studies on microplastics. "Zoe Harrold and Monica Arienzo are developing the methods to separate microplastics from fish tissues, which will provide us with a detailed understanding of the presence of microplastics in freshwater aquatic environments," Umek says. "This information is critical to have an accurate understanding of the environmental impacts of this emerging contaminate." The researchers will flush the stomach contents of the catfish for microplastic analysis and take samples of gill and muscle tissues for microplastic and stable isotope analyses.

Because Lake Mead is the primary water source for the Las Vegas area, understanding the effects of microplastics in this freshwater system is vital to environmental and human health. "The Colorado River system, which flows into Lake Mead, provides water to approximately 27 million people in the United States and Mexico, including much of Las Vegas (approximately 90 percent) and southern Nevada," Umek says. "Understanding anthropogenic impacts to these freshwater environments is critical to managing water and water quality."

Las Vegas Wash drains into Lake Mead , the primary water source for the Las Vegas area. Therefore, understanding potential microplastic contamination is critical for conserving Lake Mead's water quality (photo by Stan Shebs).

The methods used in this study will not only provide a more comprehensive understanding of microplastic contamination throughout Lake Mead, but they will also be applicable to a range of studies and locations. The researchers will use the preliminary data from this project to create a larger proposal that will expand the scope of the project. "Hopefully, we can identify certain microplastics and their sources to gain a better understanding of how we might tackle decreasing microplastics in our freshwater supplies," Umek says.

References:

Baldwin, A., S. Corsi, and S. Mason, 2016. Plastic Debris in 29 Great Lakes Tributaries: Relations to watershed attributes and hydrology. *Environmental Science & Technology*, 50(19), pp. 10,377-10,385.

Eerkes-Medrano, D., R.C. Thompson, and D.C. Aldridge, 2015. Microplastics in Freshwater Systems: A review of the emerging threats, identification of knowledge gaps and prioritization of research needs. *Water Research*, 75, pp. 63-82.

Kapp, K.J., and E. Yeatman, 2018. Microplastic Hotspots in the Snake and Lower Columbia Rivers: A journey from the greater Yellowstone ecosystem to the Pacific Ocean. *Environmental Pollution,* 241, pp. 1,082-1,090.

Lusher, A., N. Welden, P. Sobral, and M. Cole, 2017. Sampling, Isolating and Identifying Microplastics Ingested by Fish and Invertebrates. *Analytical Methods*, 9(9), pp. 1,346-1,360.

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Wright, S., R. Thompson, and T. Galloway, 2013. The Physical Impacts of Microplastics on Marine Organisms: A review. *Environmental Pollution*, 178, pp. 483-492. Review. ■

PI Spotlight: Dr. John Umek

Dr. John Umek's interest in researching the presence of microplastics in freshwater ecosystems was sparked by his previous research on Lake Mead. "The opportunity to study the Las Vegas Wash, the major inflow for the Las Vegas Bay, and understand the amount of microplastics in a freshwater ecosystem sparked my interest in this project," he says. "Monica and Zoe previously observed armored catfish in the Las Vega Wash while conducting studies on the wash in March 2019, and they approached me about working on this project too. I was also intrigued because this project gave me a chance to work with fish again." Umek also appreciates the interdisciplinary nature of this project. "Working with Monica and Zoe has been great," he says. "It has been very rewarding working with two outstanding scientists and gaining an understanding of the impacts to an entire ecosystem rather than just focused aspects, particularly because microplastics is an area of growing concern for environmental researchers."

In addition to his interest in the effects of microplastics in fresh water ecosystems, Umek is fascinated by benthic organisms in springs. "One of my long-term goals is to determine the biodiversity patterns of benthic invertebrates in springs on a large geographical scale," he says. "The most interesting aspect of water research in the West is how it provides a unique oasis for multiple types of organisms. It has been interesting to see the biodiversity, differences in community structure, and number of rare species in such small desert springs. The effects of even slight changes to a system can have large-scale consequences to the spring ecosystem."

Photo courtesy of John Umek

Umek's other main research interest is the effect of invasive species on aquatic ecosystems. "Invasive species are one of the greatest threats to aquatic biodiversity," he explains. "Unfortunately, I believe that many of the aquatic ecosystems I'm studying now (and will study in the future) will have invasive species, so this is an aspect that I'd like to incorporate into my research." ■

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Student Interview: Adam Clurman

We asked undergraduate research assistant Adam Clurman about his current studies and plans for the future. Here's what he had to say:

1) What field are you currently studying and what sparked your interest in that field?

I am currently an undergraduate student of environmental resource science. My interest in the field was sparked by working with Erick Bandala, PhD, and my instructors at Nevada State College. I feel that some of the most concerning and challenging aspects of science today are directly related to the environment, especially clean, drinkable water sources.

2) What research project are you currently working on and what research are you doing?

I am currently working on projects that involve producing free radicals using differentially heat-treated biochar and Fenton-like reactant metals encased in a matrix of biochar to remove emerging contaminants from water samples.

Photo by Nicole Damon

3) What do you hope to learn more about from this project?

I hope to discover the ideal material to generate Fenton-like reactions or produce free radicals that degrade emerging contaminants in water sources.

4) What are you looking forward to most about working on this project?

I'm looking forward to finding possibly greener and more reliable ways to treat water contaminated with emerging contaminants, which will improve overall water quality.

5) What are your goals for the next steps in your studies/career?

I plan to complete my bachelor's degree and continue my research into carbon nanotubes and their ability to generate free radicals.

6) What is one of your favorite movies or books and why?

My favorite movie is *The Professional*, internationally known as *Léon: The Professional* or *Léon*, because the juxtaposition of existential themes and classical music set to intense visuals make it a masterpiece. My favorite book is *The Neverending Story* by Michael Ende—which was originally written in German and became a best seller, and later spawned a hit film—because it tries to show how intangible ideas can be addressed with tangible constructs to simplify difficult concepts and themes.

7) What is something that we might not know about you (hobbies, interests, etc.)?

I love hobbies and I have quite a few, such as card magic and artwork. I think hobbies are a wonderful way to express yourself and make new friends. ■

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Upcoming Events

Please keep an eye on the event websites for changes in conference schedules.

WEBINAR: The War on the EPA: America's Endangered Environmental Protections
April 22, 2020
www.awra.org/Members/Events_and_Networking/2020_Webinars/WEBINAR_The_War_on_the_EPA.aspx

WEBINAR: Why Geophysics is Needed for Water Resources Management
May 20, 2020
www.awra.org/Members/Events_and_Networking/2020_Webinars/WEBINAR_Why_Geophysics_is_Needed_for_Water_Resources_Management.aspx

EWRI Watershed Management Conference
May 20-21, 2020
Henderson, NV
www.watershedmanagementconference.org/

SEG-AGU Advances in Distributed Sensing for Geophysics Workshop
June 2-4, 2020
Houston, TX
seg.org/Events/Distributed-Sensing-for-Geophysics

2020 June Well & Water Week
June 8-11, 2020
Reno, NV
www.nvwra.org/2020-june-well-water-week

Fate of PFAS: From Groundwater to Tap Water Conference
August 5-6, 2020
Durham, NH
www.ngwa.org/detail/event/2020/08/05/default-calendar/20aug5010

Water Rights in Nevada Class
September 15, 2020
Winnemucca, NV
www.nvwra.org/2020-sept-water-rights-class

Advanced Water Rights in Nevada Class
September 16, 2020
Winnemucca, NV
www.nvwra.org/2020-sept-advanced-water-rights-class

2020 Marlette Lake Water System Tour
September 22, 2020
Carson City, NV
www.nvwra.org/2020-marlette-lake-tour


Photo by Kyle Hendrix, BLM

2020 UNR/NWRA Dinner Forum
September 24, 2020
Sparks, NV
www.nvwra.org/2020unr-nwradinnerforum

GSA 2020
October 25-28
Montreal, Quebec, Canada
community.geosociety.org/gsa2020/home

UCOWR 2020 Annual Conference
October 27-29, 2020
Minneapolis, MN
ucowr.org/

2020 Annual Water Resources Conference
November 9-12, 2020
Kissimmee, FL
www.awra.org/Members/Events_and_Networking/Events/2020_Annual_Water_Resources_Conference.aspx

2021 Land and Water Policy Specialty Conference
July 19-21, 2021
Denver, CO
www.awra.org/Members/Events_and_Networking/Events/2021_Summer_Conference.aspx

2021 NWRA Annual Conference Week
January 25-28, 2021
Sparks, NV
www.nvwra.org/2021-ac-week

Tour of the Nevada National Security Test Site
March 31, 2021
Las Vegas, NV
www.nvwra.org/2021-march-nnss-tour

18th Annual Truckee River Field Study Course
May 6 & 7, 2021
Reno, NV
www.nvwra.org/2021-truckee-river-tour

Success and the dedication to quality research have established the Division of Hydrologic Sciences (DHS) as the Nevada Water Resources Research Institute (NWRRI) under the Water Resources Research Act of 1984 (as amended). As the NWRRI, the continuing goals of DHS are to develop the water sciences knowledge and expertise that support Nevada's water needs, encourage our nation to manage water more responsibly, and train students to become productive professionals.

Desert Research Institute, the nonprofit research campus of the Nevada System of Higher Education, strives to be the world leader in environmental sciences through the application of knowledge and technologies to improve people's lives throughout Nevada and the world.

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www.dri.edu/nwrri

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