

Newsletter written and compiled by
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Project Spotlight: Testing the Mortality and Settlement of Quagga Mussel Veliger under Various Chemical Treatments

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The quagga mussel (*Dreissena bugensis*) is an aquatic invasive species that is spreading throughout Lake Mead and other waterways in the western United States. The mussels overtax the already drought-stressed lower Colorado River system and Lake Mead reservoir. The objective of this project is to understand how to control and eventually eradicate quagga mussels to help stabilize Nevada’s valuable water resources.

Quagga mussels can tolerate a wide range of environmental conditions. They also reproduce quickly and spread rapidly. Lake Mead’s year-round warm water temperatures, high calcium levels, and lack of

natural predators make it a perfect habitat for the mussels to grow and spread. “In recent years, quagga mussels have posed a serious threat to the ecological stability of the Lake Mead ecosystem,” explains Michael Zhou, the student researcher for the project. “Quagga mussels threaten to drive native species to extinction because of the stress they put on the aquatic environment. Their continued presence in Lake Mead might also change the lake’s water chemistry and nutrient balance.”

For this project, the researchers assessed the mortality of quagga mussel veligers, which are the

RFPs

If you have questions about submitting a NWRRRI proposal, e-mail Amy Russell (Amy.Russell@dri.edu).

For current RFP information, visit the NWRRRI website (www.dri.edu/nwrrri).



Lake Mead is a valuable water source for southwestern states, but the quagga mussel infestation could affect its water quality.

(Project Spotlight continued)

mussels in their larval stage, under various chemical treatment conditions. High school student Alicia Sun assisted Zhou with the experiment and Desert Research Institute research assistants Sachiko Sueki and Yuzhen Feng helped collect field samples. To avoid excessive trihalomethane (THM) formation from chlorination, they tested the effectiveness of potassium permanganate and copper sulfate solutions to kill and prevent the settlement of veligers in intake pipes and treatment plants. “The objective of this project is to find solutions for dealing with this nasty invasive species, especially in the western United States where quagga mussels have become a growing threat,” Zhou adds.

Quagga mussels affect water resources at multiple levels. They filter large amounts of water, which removes algae and other food sources for zooplankton that in turn



Quagga mussels colonize on underwater infrastructure, which can damage the intake pipes used by water treatment facilities.

negatively affects food resources for fish. The large quantities of pseudofeces produced by the mussels also adversely affect the lake’s water chemistry. The change in water chemistry threatens the

quality of the water as a drinking water source and creates an inhospitable environment for other organisms, such as good forms of phytoplankton. Quagga mussels also colonize and reproduce on hard surfaces, which can significantly degrade water delivery systems. “Quagga mussels clog intake pipes and attach themselves to underwater infrastructure, which could cause millions of dollars in damages,” says Zhou.

Over the past year, the researchers tested various chemical treatments on quagga mussel veligers and have made progress toward better understanding their effects on veliger mortality. “We are still in the process of testing the viability of treating mussels with commonly used disinfection chemicals, which will help us come closer to finding the optimal concentration needed for total veliger mortality,” Zhou



Sample cones that contain veligers and water from Lake Mead.

(Project Spotlight continued)

explains. “So far, we have found that the disinfection chemicals are effective but only at high concentrations.”

Once the laboratory experiments are complete, the researchers will conduct field-scale tests to assess the viability of these chemical-treatment control strategies to deal with the quagga mussel infestation in Lake Mead. “Our hope is to validate our findings in the laboratory experiments so that we can develop real-life control options for quagga mussels in intake pipes and water

Over the duration of this project, the researchers will use the results to determine whether commonly used disinfection products can be used at water treatment plants to prevent the spread of quagga mussels.

treatment plants,” says Zhou. Over the duration of this project, the researchers will use the results to determine whether commonly used disinfection products can be used at water treatment plants to prevent

the spread of quagga mussels. The results of this project could also lead to further research into managing quagga mussels across the western United States. ■

Upcoming Events

NVWRA 2015 Fall Symposium; Reno, NV

October 19-20: www.nvwra.org/2015-fall-symposium

Water Rights in Nevada Class; Reno, NV

October 21: www.nvwra.org/water-rights-seminar-october

Advanced Water Rights in Nevada Class; Reno, NV

October 22: www.nvwra.org/advwater-rights-seminar-october

GSA 2015; Baltimore, MD

November 1-4: www.geosociety.org/meetings/2015

ASA, CSSA, and SSSA 2015 Annual Meeting; Minneapolis, MN

November 15-18: www.acsmeetings.org

AWRA 2015 Annual Water Resources Conference; Denver, CO

November 16-19: www.awra.org/meetings/Denver2015



5th International Alluvial Fans Meeting; Christchurch, New Zealand

November 30-December 4: www.alluvialfans.co.uk

AGU 2015 Fall Meeting; San Francisco, CA

December 14-18: fallmeeting.agu.org/2015/

2015 Groundwater Expo; Las Vegas, NV

December 15-17: groundwaterexpo.com

PI Spotlight: Dr. Kumud Acharya

Dr. Kumud Acharya's interest in water resources research was spurred by the increasing demand and diminishing supply of the Earth's valuable water resources. "Being able to develop solutions to more sustainably manage water resources is what I find most interesting about water resources research," Acharya says. "In arid and semiarid environments such as Nevada, it is even more important to find new ways to preserve the quality and quantity of these resources both in the environment and for human consumption."

Researching water sustainability also inspired Acharya's interest in how watershed management affects aquatic organisms. "Aquatic invertebrates face particular evolutionary challenges because of anthropogenic effects on their environments," he explains. "The

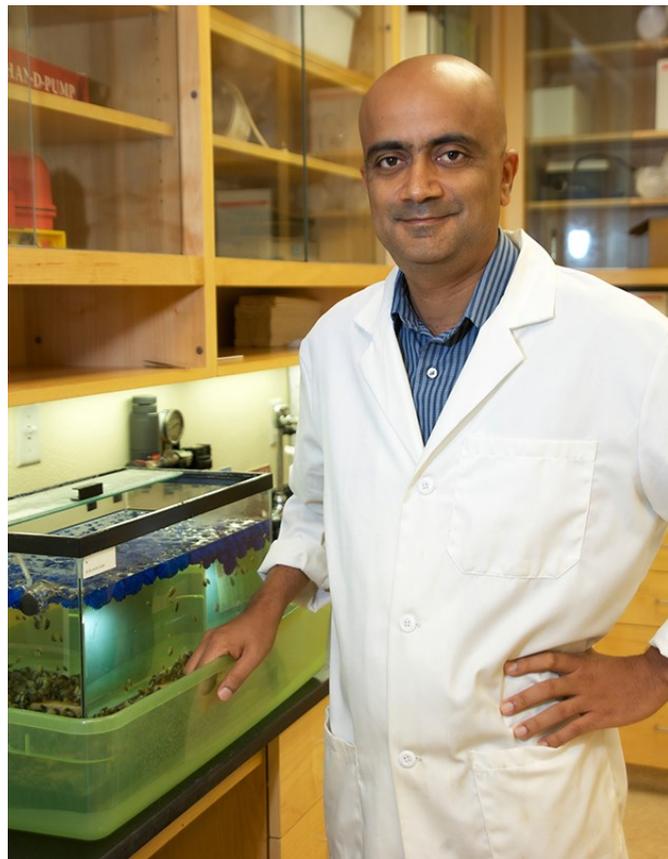
research I'm doing for NIWR allows me to find ways to control or eradicate invasive species and help preserve water quality for both human use and for the other aquatic species."

In addition to his other research projects, Acharya is the principal investigator for the NIWR-funded project "Testing the Mortality and Settlement of Quagga Mussel Veliger under Various Chemical Treatments." The goal of the project is to control and

potentially eradicate the invasive quagga mussels in Lake Mead. "Once we know which disinfection products can eradicate the invasive mussels, water treatment agencies will know how to keep them from damaging their systems and

affecting water quality," Acharya says. "What we hope to learn as we continue our research is if the chemicals will still eradicate the mussels at concentrations that do not exceed common-use levels."

Although the project focuses on quagga mussels in Lake Mead, the results will help resolve quagga mussel infestations in other states and countries. "For example," Acharya adds, "quagga mussels have also recently invaded waters in the United Kingdom and Switzerland." In addition to researching environmental changes on aquatic invertebrates, Acharya is interested in the effect that climate change has



Quagga mussels compete for food sources with other species, which greatly affects the aquatic environment.

(PI Spotlight continued)

on water quality issues and resource management. “There are many ways that these interests are interrelated,” Acharya says, “particularly with respect to the impacts of hydrological conditions on nutrient cycling, aquatic biology, and water management.”

When it comes to lab work or field work, Acharya doesn’t have a preference. “We do both lab work and field work depending on the scales of testing that we are doing,” he says. “The lab is convenient for benchtop-scale work, especially during the summer heat.” If Acharya had six months with no

“The research I’m doing for NIWR allows me to find ways to control or eradicate invasive species and help preserve water quality for both human use and for the other aquatic species.” – Kumud Acharya

obligations or financial constraints, he would travel around the world and explore new countries, meet new people, try new foods, and learn about new cultures. When asked what he would hope to have with him

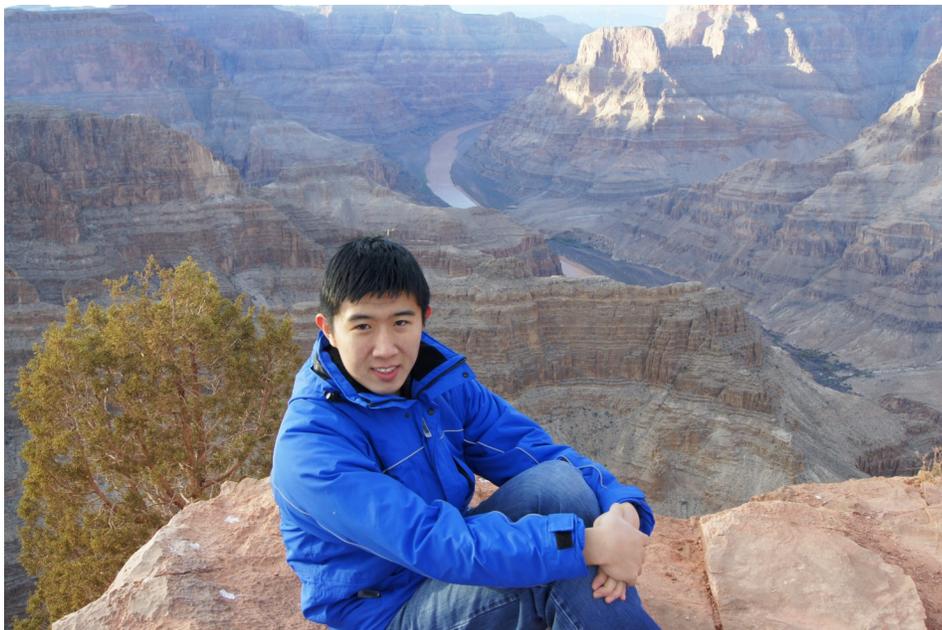
if he was stranded on a desert island, Acharya answered, “The books that I have been wanting to read but haven’t had time for yet.” ■

Student Interview: Michael Zhou

We asked bachelor’s student Michael Zhou about his current studies and his plans for the future. Here’s what he had to say:

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

I am currently working toward a bachelor’s degree in molecular biology with an emphasis on aquatic ecology at Princeton University. I grew up touring the forests and lakes of North America, which allowed me to appreciate nature at its simplest. Because my dad is a hydrologist, I also took trips with my family to Lake Tahoe and Lake Mead, so I guess it was natural for me to become interested in aquatic biology research. Having the chance to study aquatic biology has allowed me to combine my passions for nature and science. What I enjoy most about the field is the challenge of trying to gain a better understanding of our



planet and improve our relationship with our world.

How did you get involved in this NIWR project and what research did you do for the project?

As an undergraduate student, I wanted a summer internship that would incorporate my passion for aquatic biology. That’s why I applied to work on a project that dealt with water

(Student Interview continued)

management and invasive species. My research focused on developing alternative treatment options for controlling the spread of quagga mussel populations in Lake Mead and throughout the lower Colorado River watershed (“Testing the mortality and settlement of quagga mussel veliger under various chemical treatments”).

We tested various chemical treatment conditions that could be used at water treatment plants to determine their effect on quagga mussel mortality and settlement. We then measured the relative survivorship rates among veligers in relation to chemical dosage levels, which gave us an understanding of how effective these alternative chemical treatments will be as part of the new containment strategies being launched at water treatment plants for this invasive species.

What have you learned from working on this project?

Working on this project, I learned how aquatic biology research can be intricately tied to other research fields, such as environmental engineering and limnology. Additionally, I learned that it’s always good to be prepared for the unexpected because you can’t expect everything to work as planned. It also seems that veligers, like many aquatic organisms, can be quite sensitive to even the tiniest changes in their environment.

How can you apply what you learned from this project to your degree?

Invasive species management has always been a big concern for biologists, but especially those involved in aquatic

biology and ecology. I believe that what I have learned concerning the growing problem of quagga mussel invasions in the western United States can help put things in perspective. It serves as a reminder that we need this type of research to help solve real-world problems. Knowing this keeps me inspired as I work toward my degree and seek new research avenues in the years to come.

What have you enjoyed most about working on this project?

Taking lake samples for veligers around Lake Mead during the summer was an unforgettable experience. It was exciting to connect my scientific research in the laboratory with the real system that I was researching.

It was also important to see aquatic biology in a different light because it allowed me to value the impact of the research I was doing.

What are your goals for the next step in your career?

My goal after graduation is to apply to graduate schools so that I can continue my research in aquatic biology and ecology.

If you could go on vacation anywhere in the world, where would you want to go, why would you want to go there, and what would you want to do there?



Zhou collecting water samples from Lake Mead.

I would probably go to Thailand. The country seems so vibrant but still quaint with its famous beaches, lush jungles, and amazing food. I would probably travel through Thailand on foot to fully enjoy its natural beauty and cultural heritage.

Cake or Pie?

Both! Especially if the choice is tiramisu or pecan pie. ■

“It was exciting to connect my scientific research in the laboratory with the real system that I was researching.” – Michael Zhou

NWRRI - Desert Research Institute

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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Page 1: Boulder Basin, Lake Mead; National Park Service
Events, page 3: Mojave Desert Tortoise, U.S. Geological Survey/photo Ken Nussear