



U.S. Fish & Wildlife Service

NMSU Graduate Student Investigates Fish Abundance in Desert Sinkholes

Bitter Lake National Wildlife Refuge

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At the Bitter Lake National Wildlife Refuge near Roswell, New Mexico, over 70 sinkholes of different shapes and sizes are scattered across the land. These isolated oases created by groundwater erosion provide habitat for fish, invertebrates, amphibians, and other wildlife. Between sinkholes, there are extreme differences in depth, temperature, salinity, dissolved oxygen and fish populations.

This disparity prompted Kristin Swaim, a graduate student at New Mexico State University, and her faculty advisor Wiebke Boeing, a professor of fishery and wildlife sciences at NMSU, to explore the relationship between abiotic factors and fish abundance.

"Some of the sinkholes are only a few hundred meters apart, but there is a big difference in fish population," Kristin said. "We hypothesized that abiotic factors would be more influential on fish populations."

Funded by a WRR I student research grant, Sigma Xi, and T&E, Inc., Kristin placed minnow traps in several sinkholes in the refuge in the summer of 2006 to capture Pecos pupfish, the species most commonly found in the sinkholes.

"We set the traps out in the evening, come back the following morning, and mark the fish," Kristin said. "If we collect 200 to 300 fish, it is good to see about 30 marked fish in the next sampling period." She then calculates the fish population using the Lincoln-Peterson and Schnabel methods. The length and weight of individual pupfish are also measured to determine the health of each population.

Along with estimating the fish population, Kristin measured a number of abiotic variables in each of the sinkholes. A Hydrolab, a long probe with a computer

attached, was used to measure temperature, salinity, conductivity, and dissolved oxygen. Some water samples were taken and sent to the Soil, Water, and Agricultural Testing Laboratory on the NMSU campus to be analyzed. Total depth, Secchi depth—a measure of water clarity—and area of the sinkholes were also measured. Using this data, Kristin did a multiple regression to find correlations.



Kristin Swaim holds a Pecos pupfish.

From last summer's data, Kristin found that the presence of other species of fish, chlorophyll-a (an indicator of phytoplankton biomass), total depth, and dissolved oxygen had the most significant impacts on the health and abundance of the pupfish. While most sinkholes only have Pecos pupfish in them, some provide habitat for both Pecos pupfish and Pecos gambusia.

"Where the Pecos gambusia were present, the pupfish populations went way down," Kristin said. "In most sinkholes we would find anywhere from 100 to 1,000 pupfish, but in the sinkholes with Pecos gambusia, we would only find 7 or 30. There was a large difference. There is some sort of predatory or food availability factor at work."

Kristin was unable to collect any data on the Pecos gambusia, because the mesh in the minnow traps was too large. She is working on rigging the traps with smaller mesh to capture and gather data on them this summer, when she samples again to confirm her findings from last year.

In November 2006, Kristin presented her research at the International Center for Arid and Semiarid Land Studies' conference on Water in Arid and Semiarid Lands. She will also present in June at the North American Benthological Society's Annual Meeting in Columbia, South Carolina.

Kristin hopes to graduate with her master's degree this fall and to get a job with a federal agency. Prior to beginning her master's degree, she worked for the USGS for four years and enjoyed it. "I hope to do something like that again," she said. "I would like to do more research on stream restoration and conservation, because that is going to be really important in the future."

For further information

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Kristin collecting pupfish out of a minnow trap at Bitter Lake National Wildlife Refuge.