Ecosystem of vanishing lake yields valuable bacterium

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In the salt flats near a slowly vanishing lake, a team of researchers have found never-before-seen bacterium that could clean up some of humanity's pollution. In three scientific papers currently being written, Brent Peyton, a Montana State University chemical engineering professor, his students, and collaborators are describing the unique qualities of Halomonas campisalis, a bacterium Peyton discovered in 1995 near Soap Lake, Wash.

At the time of discovery, Peyton worked for the Pacific Northwest National Laboratory (PNNL) in Richland, Wash., one of nine U.S. Department of Energy labs. The laboratory wanted to develop a treatment to remove nitrate contaminants from alkaline and saline radioactive wastewater. Such a treatment could also be used to clean-up wastewater from fertilizer and explosive manufacturing plants, which is 10 to 15-times saltier than the ocean and laden with polluting nitrates.

Peyton hoped the salty ecosystem of Soap Lake might be home to a bacterium that could live in such high-salt waters and also find nitrates appetizing.

Soap Lake is one of only 11 known meromictic lakes in the United States. The water in meromictic lakes separates into layers of differing mineral concentrations. The upper layer of Soap Lake is a little less than half the saltiness of the ocean, but more than 100-times saltier than river water. The bottom layer is more than twice as salty as the ocean and more than 700-times saltier than river water. These two layers are

thought to have remained unmixed in any significant way for the past 2,000 to 10,000 years. The conditions of Soap Lake are considered so extraordinary the National Science Foundation designated it a "microbial observatory."

Near Soap Lake are salt flats. Water seeping through these flats finds its way into the lake, carrying salt with it. It was in these flats Peyton collected some mud in 1995.

In the lab, he tried to make something grow and something did: the bacterium he would later name Halomonas campisalis. The last part of the name translates from Latin into "salt flats."

Making its home in super-salty water, Halomonas campisalis eats nitrates for breakfast, dinner and lunch. When it's digested its meal, it gives off nitrogen as waste. In the grand scheme of things, nitrogen is pretty harmless. About 80 percent of the air we breathe is nitrogen.

The bacterium was perfect for the treatment of salty, nitrate-bearing wastewater, as well as wastewater from the production of explosives and fertilizers.

"You could pour that salty wastewater in a tank with Halomonas campisalis, add sugar or vinegar for food and let it perk away to create nitrogen," Peyton said.

It might sound simple, but it's taken years of painstaking laboratory work to grow, identify, and characterize all the unique capabilities of Halomonas campisalis. It could take years more for the bacterium to be turned into an industrial process, something Peyton hopes a company will attempt in the future.

His work has been done in close collaboration with microbiologists

Melanie Mormile from the University of Missouri - Rolla in Rolla, Mo., and Holly Pinkart, from Central Washington University in Ellensburg, Wash.

Since first walking in Soap Lake's mud, Peyton's career and his Soap Lake research have taken him from five years at PNNL to eight years at Washington State University in Pullman, Wash., and then to MSU in August 2005. It was a homecoming of sorts: Peyton received his Ph.D. in chemical engineering from MSU in 1992.

During that time, Soap Lake has continued on a course that may lead to its disappearance.

"Many unique and undiscovered organisms have evolved in the extraordinary saltiness of the Soap Lake ecosystem," Peyton said. "But the lake's saltiness is being diluted, likely because of a major irrigation project built in the 1950s. It is already 60 percent less salty than 50 years ago. In another 50 years, Soap Lake as we know it - and the unique life it harbors - may not exist."

Source: Montana State University, By Tracy Ellig