Secrets of the silvery minnow

NMSU scientists went fishing in jars of 130-year-old silvery minnows to better understand the endangered species and its life in the Rio Grande.

The preserved minnows last swam in 1874, when naturalists scooped them up, submerged them in alcohol and sent them to the Smithsonian. But the specimens spoke volumes about water quality on the river, what silvery minnows ate and how long they lived.

"They told us some things we were not expecting," says NMSU aquatic ecologist David Cowley.

Cowley and graduate student Patrick Shirey compared the Smithsonian minnows with Eastern New Mexico University specimens collected 104 years later at the same location and time of year.

Both sets of samples came from the Rio Grande near San Ildefonso Pueblo, just south of Española, where the silvery minnow was once abundant. In fact, before Cochiti Dam was built in 1975, the silvery minnow was regularly the most abundant fish species in the river. It's now listed as endangered.

"Unfortunately, because we don't know a lot about the silvery minnow, we don't fully understand why we're losing it and what can be done," Cowley says.

NMSU researchers dissected the preserved minnows for microscopic information about water quality. Their stomachs still contained thousands of diatoms, single-celled algae that leave behind glassy shells. Sorting out diatoms associated with particular water conditions provided a snapshot of river water quality in 1874 and 1978.

Though worsening water quality has been blamed for the silvery minnow's decline, the fish told a different story.

In fact, the diatoms showed the Middle Rio Grande wasn't pristine in the 19th century, when thousands of people lived along the riverbanks. "In 1874, there were a lot of diatoms associated with human and livestock waste," Cowley says. "That's probably an effect of having raw sewage—livestock and human—in the vicinity.

"If anything, the water was cleaner 104 years later."

In analyzing the minnow's stomach contents, scientists found striking similarities in the 1874 and 1978 specimens. "It was as if the minnows in each sample had been swimming around together, eating the same thing," Cowley says.

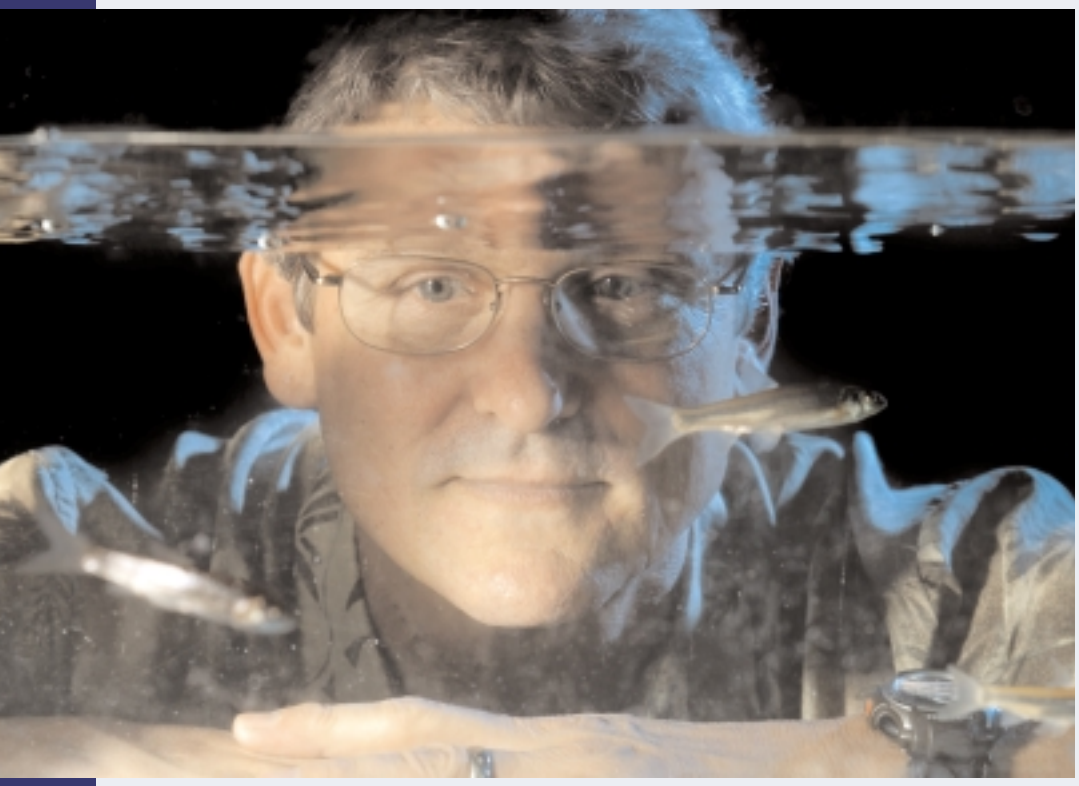
The minnow's muddy menu may help explain why it grows only a quarter- to half-inch annually, he adds. "A large proportion of what we found in the gut was sand and mud."

Leaving no scale unturned, researchers found fresh evidence that the silvery minnow has a longer lifespan than previously thought. Most cold-water fish grow annual rings in their scales and bones, just as trees do, Cowley explains.

"There's been speculation that 99 percent of the minnows die before they're a year old," he says. "But in the 1874 sample, we found fish of different ages, from 1 to 5 years old."

The minnows ranged from less than 2 inches to about 3-1/2 inches long, he says. And that's a true fish story.

D'Lyn Ford



DARREN PHILLIPS

Demystifying minnows: Aquatic ecologist David Cowley knows more about the Rio Grande silvery minnow after examining preserved fish collected more than 100 years ago and comparing them with more recent specimens from the same area.

Go fly a kite

An NMSU scientist has a high-flying plan to monitor his salt cedar plots along the Pecos River using remote-controlled digital cameras on a kite.

Now entomologist Dave Thompson has an aerial view of how effective tiny leaf beetles are against water-guzzling salt cedars. The beetles, which feed on salt cedar leaves, have been used successfully against the invasive trees in several other states.

The kite's perspective is perfect for showing large-scale changes, Thompson says.

"It's already obvious that this is going to be an important new documentation tool. We can do any number of tests on the ground, but a before-and-after picture is just an outstanding way to show plot changes over time."

Most of his photos are taken from a few hundred feet off the ground. The kite can go much higher, but federal regulations require filing a flight plan if the kite is going above 500 feet.

"It's a lot of work to reel that kite in and out," Thompson says. "But once it's up, we can take more than 300 pictures in 30 minutes. After we've filled up a memory card, we bring the kite down and download the pictures to a laptop computer to see what we've got. If we don't have exactly what we want, then we're back in the air."

Thompson's basic equipment includes a lightweight, 4-megapixel digital camera, a specially made equipment cradle and two kites—all for about $1,200.

Normally, a two-person team is needed to get the kite and camera safely into the air. The entire system sets up in less than 30 minutes and can be stored in the trunk of a car.

Thompson uses two kites in his research: a 7-foot by 5-foot Rokkaku kite that operates in winds up to 10 miles per hour, and a bag kite for higher winds. Thompson hand-built a special reel to bring the kite and camera down gently. The reel, which has internal brakes like a fishing reel, holds 1,000 feet of nylon rope an eighth of an inch thick.

The custom camera cradle was specially made for Thompson by California's Brooks Leffler, an aerial photography pioneer. The cradle and camera, which weigh about 2 pounds, feature a radio-controlled guidance system that allows the camera to pivot 360 degrees. The self-leveling camera platform sits about 100 feet below the kite when aloft.

"I never knew there were so many kite designs," Thompson says. "It turns out that they're all related to wind conditions. You really have to understand the wind."

He admits to several Charlie Brown moments while perfecting his kite-flying technique. The team practiced and crashed a few times with 2 pounds of soda bottles before safely launching their electronic equipment.

Norman Martin

Picturesque view: NMSU entomologist Dave Thompson, right, tests the remote controls of his digital camera cradle before launching it behind an already airborne 7-foot by 5-foot Rokkaku kite. Helping are research assistants Kevin Gardner and Esme Tuchfarber.

Immersed in research

International interest: Students from Mexico's Universidad Autónoma de Ciudad Juárez adjust irrigation sprinkler heads as part of a 15-month project assessing beneficial uses of industrial saline wastewater on Las Cruces' West Mesa. NMSU graduate research assistant Alejandro Ruiz, background, helps direct the research of Adelaido Hernández, left, Dulce Chávez and Aldo Piñón.

Three university students from Ciudad Juárez, Mexico, are assisting NMSU scientists in measuring how treated industrial wastewater on Las Cruces' West Mesa affects natural vegetation, primarily Chihuahuan Desert mesquite and creosote.

The 15-month internship program for the undergraduates from the Universidad Autónoma de Ciudad Juárez began in July with laboratory analysis of vegetation from an 80-acre test site west of the city. Scientists' goal is a better understanding of the long-term impacts of applying industrial wastewater containing high concentrations of salt and other nutrients from nearby food processing and light manufacturing plants.

"We're looking at this project as a prototype to evaluate the effectiveness of wastewater irrigation applications," says Geno Picchioni, an NMSU horticulturist who is conducting the three-year project for the university and City of Las Cruces utilities.

The international student internship research program is funded through the city and NMSU's Agricultural Experiment Station, along with grants from the Rio Grande Basin Initiative and the Southwest Center for Environmental Research and Policy.

"These students were selected for their academic skills and professional interest," says Mario Valenzuela-Vazquez, the students' mentor and a biology professor with Universidad Autónoma de Ciudad Juárez. The university, located across the border from El Paso, Texas, is home to more than 12,000 students and is one of Mexico's leading academic research facilities.

The internships open the door for more cooperative research between the two universities, says Valenzuela, who received his doctorate in agronomy from NMSU in 2001. Both communities share environmental and pollution problems, he says.

The students, who are specializing in biology, include Aldo Piñón of Delicias, Adelaido Hernández of Chiapas and Dulce Chávez of Delicias. "It's been a great opportunity to put into practice what we've learned in class," Chávez says. "Hopefully, it will encourage others to participate."

"Our intent is to provide these international students with environmental research opportunities and practical experience that they wouldn't otherwise have," Picchioni says. "Meanwhile, they're certainly augmenting our research in vegetation and soil sampling." Conventional wastewater treatment is costly, Picchioni said. The experimental design and research plot, which was developed by the City of Las Cruces and being studied by NMSU, uses appropriate technology in a cost-effective way to treat wastewater, he says. A primary concern is the salt, which is introduced in manufacturing, because high levels inhibit plant growth.

Program coordinators hope that the collaboration with NMSU will allow the students from Mexico to apply many of the same environmentally friendly techniques in their own country as their biology careers progress.

Norman Martin

Model gardens

Drought is convincing many homeowners and landscapers to ditch water-guzzling lawns and plants, but gardeners are often confused about what to grow instead.

For inspiration, they can visit water-wise demonstration gardens that NMSU's Cooperative Extension Service has started in urban areas across the state.

"Many of our residents are gardeners who know how to garden in wetter states where they came from but not in our dry climate," says Tina Forgrave, a Sandoval County master gardener who helped establish the Rio Rancho Water-Wise Demonstration Garden. "They need someplace to go that's right next door to see what water-wise plants look like and to consider planting them in their own gardens."

The Rio Rancho garden, now in its fourth growing season, shows about 80 water-wise species, including trees, shrubs and native grasses. Master gardeners worked with the city to plant and maintain the 24,000-square-foot garden, located next to the city library.

The Los Alamos County Extension office has a 1.5-acre demonstration garden on the north side of town. About 50 master gardeners volunteer 500 to 700 hours per year to maintain the garden, says Carlos Valdez, county Extension agent. The garden includes dozens of plant and tree species chosen for their adaptability and low water use.

Researchers at NMSU's Agricultural Science Center at Farmington planted a xeric demonstration garden in 2002 with about 90 native species and nearly 500 plants, says Dan Smeal, an agricultural and irrigation specialist at the center.

"It's the first such model xeric garden in the Four Corners area," Smeal says.

Two herb demonstration gardens at the county Extension offices in Santa Fe and Taos show how to conserve water with drip systems and mulch. Extension is also working with the city of Santa Fe to grow a demonstration tree plot with drought- and pest-resistant species next to the Marty Sanchez Golf Course in northwest Santa Fe.

"It will show moderate- to fast-growing native and nonnative species to encourage residents to plant them around their homes and businesses," says agricultural agent Pat Torres.

And in downtown Alamogordo, the Otero County Extension office is planting an 8,000-square-foot xeric demonstration garden with an area for residents to grow vegetables.

Kevin Robinson-Avila

Bright ideas: A 1.5-acre demonstration garden in Los Alamos, maintained by master gardener volunteers, contains dozens of plant species such as colorful but water-stingy *gaillardia*, above.