



# DIVINING ROD

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

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## Ditch Could Be Perfect Niche for Native Fish

story by Norman Martin, New Mexico State University Agricultural Communications

Hundreds of miles of twisting agricultural irrigation drains and ditches snake their way across the fertile Rio Grande valley in a cascade of links from the 1,900-mile-long waterway. Now, in an ambitious project to monitor New Mexico's native fish, scientists have begun sampling these river offshoots to determine if they can be used to foster conservation of native species.

"I know the idea is a little bit counter to what some people would propose," said David Cowley, project leader and endangered species expert with New Mexico State University's department of fishery and wildlife sciences. "Some just want to keep the water out of the irrigation system and in a river, but our research is looking at ways to use water for both purposes: agriculture and conservation."

Using the Middle Rio Grande Conservancy District as its testing ground, the NMSU team has established a series of monitoring stations in the Socorro division where they intend to sample not only the fish, but also aquatic insects, plants, and algae that might be present. Insect and algae samples are already being taken, while fish collection permits are forthcoming from state and federal agencies. A criti-

cal question the researchers are attempting to answer is whether irrigation systems can provide enough food to support native fishes.

The U.S. Department of Agriculture's Rio Grande Basin Initiative funds the project, which will take three years to complete. The project is also part of NMSU's Water Task Force, a group of 75 university specialists on water-related issues who support research and educational programs to improve irrigation efficiency in agriculture and urban landscaping in the Rio Grande Basin.

In 1994, when the district's irrigation system was last surveyed, scientists found 20 fish species, eight of which were native to New Mexico. The tally included such colorful-sounding native fish as the gizzard shad and the high-profile

Rio Grande silvery minnow.

The silvery minnow, endangered for eight years, is found only in the middle Rio Grande from Cochiti to Elephant Butte, a stretch of river that has gone dry in recent years due to drought.

Recently, a federal judge upheld a ruling that for the first time confirms the Bureau of Reclamation has the authority to use water



Photo by Cliff Hohman

Hundreds of miles of twisting agricultural irrigation drains and ditches snake across the fertile Rio Grande valley in a cascade of links from the 1,900-mile-long waterway. This photo was taken south of Socorro on the Louis Lopez Drain.

(continued on page 2)

### INSIDE

Meet Researcher David Cowley

Page 3

47th Annual New Mexico Water Conference held in Ruidoso

Page 4

Technical Symposium draws researchers to Socorro

Page 7



from the Middle Rio Grande Conservancy District and San Juan-Chama Project, which includes water for the city of Albuquerque's long-term drinking water supply, and to protect minnow habitat if it becomes threatened.

"A potential water alternative is New Mexico's complex agricultural irrigation system," Cowley said. "In terms of miles, there are far more miles of irrigation drains than river within the valley," he said.

The system is divided into two parts that deliver and drain water. Delivery ditches, which originate at major river diversion sites, branch off into smaller and smaller so-called laterals, ultimately ending up in fields. Most of the laterals also have an ending point at an interior drain or riverside drain where irrigation water is returned to the river after it percolates through soil.

Cowley said that casual observations in the Las Cruces region indicated that even during the off-year irrigation season, typically from mid- to late October through February, many delivery ditches stayed wet. Known as siphons, these wet spots can be found underneath another ditch or highway and appear to offer very good conditions for supporting fish.

"We're expecting to find similar sorts of things in the Middle Rio Grande Conservancy District," Cowley said.

The size of native fish in the irrigation system is expected to vary widely, he said. The largest will likely be the river carp sucker at 10 inches in length, while the smallest would be the fertilized eggs of the Rio Grande silvery minnow, which float in the current downstream until they hatch.

Many of the species in the ditches and drains will tend to be smaller specimens since the water level isn't enough to support large fish growth, Cowley explained. "But that's not to say we couldn't make simple modifications to the drains that would make them friendlier to fish," he said.

The NMSU researchers are particularly interested in determining whether once native species (especially those threatened or endangered) get in, can they find their way out of the irrigation system. Alternatively, if the fish are found in the drains, "Can we make those conditions conducive for them to survive for a year or more at a time, especially during times of drought?" Cowley said.

*Editor's Note:* David Cowley has recently been awarded two grants by the U.S. Bureau of Reclamation through the New Mexico WRI. The first, *Early Life History Studies of Rio Grande Silvery Minnow (Hybognathus amarus) Related to Downstream Fish Passage* will study the early life stage biology of the Rio Grande silvery minnow, concentrating on the distribution of eggs and larval fish in the river during spawning. The second, *Water Conveyance Habitat Assessment for the Middle Rio Grande Conservancy District*, will provide wildlife habitat values associated with Middle Rio Grande Conservancy District irrigation ditches and drains, which may be modified under one or more of the anticipated fish passage/river connectivity options being considered.

Professor Cowley addressed participants at the 47<sup>th</sup> Annual New Mexico Water Conference in October on the water requirements of the Rio Grande silvery minnow. Cowley pointed out that, in general, the biology of silvery minnow is poorly known. We lack understanding of its food habits, its cover requirements, where and how it reproduces, what river features improve recruitment of its offspring to breeding adults, and if the species retains sufficient genetic diversity to continue its evolutionary sojourn. In Cowley's talk, he proposed establishment of refuges on irrigation drains that would provide habitat for the minnow, at least in the short-term. His conference paper will be available on the WRI web site (<http://wri.nmsu.edu>) later this year.

## WRI staff receive achievement awards



Each year the Fort Bliss Federal Credit Union recognizes six New Mexico State University faculty and staff based on exceptional service. Darlene Reeves, who has been with the institute for 28 years, received the Professional Staff Award. Among the many supportive comments about Darlene was this: "*Darlene's professionalism and expertise have contributed immensely to the reputation of the WRI. Darlene had a strong role in designing the WRI's proposal submission, evaluation and reporting procedures, which I consider models for a successful research grants program.*" (Robert Bowman, Professor, NM Tech)

Last year, the Fort Bliss Credit Union established a new award, the Professional Staff Achievement in Research. Bobby J. Creel, WRI Associate Director, received the award for his exceptional service to research. John Hernandez, NMSU Professor Emeritus, wrote of Dr. Creel: "*Bobby has never stopped working over these past 35 years. He has authored complex multi-colored maps; he has worked on saline water projects; he has done water-related regional economic studies; he has written uncounted proposals to federal agencies with a very high success percentage; he has presented papers; and he has written all or parts of dozens of research reports...Bobby has an enviable publication record...*"

The WRI is extremely proud of Darlene and Bobby and thankful for their contributions over the last several decades!



# Meet the Researcher

## David E. Cowley

Assistant Professor, Department of Fishery and Wildlife Sciences, New Mexico State University

### Research Focus

Cowley's research interests lie in developing innovative, pragmatic solutions to management problems using the tools of limnology, population biology, and management planning. The objective of his research is to improve conservation and management of aquatic resources in the American Southwest.

### Education

Ph.D. quantitative genetics and applied statistics, Department of Meat and Animal Science, University of Wisconsin-Madison, 1987. Dissertation entitled *Developmental Quantitative Genetics of Drosophila melanogaster (fruit flies)*

M.S. freshwater biology and applied statistics, Eastern New Mexico University, 1979

B.S. wildlife management and agriculture, Eastern New Mexico University, 1977

### Experience

2001-Present: Department of Fishery and Wildlife Sciences, New Mexico State University

1992-2001: Owner/Consulting Scientist, EnviroStat, Albuquerque, New Mexico

1986-1992: Postdoctoral Research Associate to researcher in genetics, Department of Genetics, North Carolina State University, Raleigh, North Carolina

1980-1986: Research Assistant, University of Wisconsin-Madison

1977-1979: Research Assistant, Eastern New Mexico University

### Teaching

Cowley's teaching interests include topics in limnology, fisheries management, wildlife law, and conservation genetics.

### Advising

Currently advising two post-doctoral research associates and four graduate students

### Research

PI, New Mexico Department of Game and Fish, Elephant Butte Fishery Studies (2002-2006) *pending*

PI, U.S. Department of Agriculture, Rio Grande Basin Initiative, Professional Faculty Research Support (2002-August 2003)

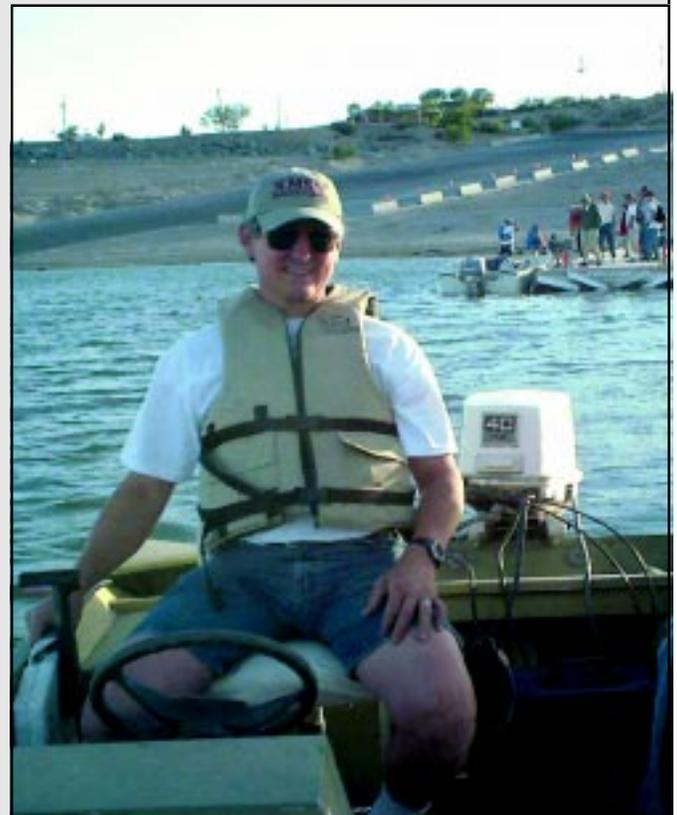
PI, U.S. Department of Agriculture, Rio Grande Basin Initiative, Aquatic Resources in Arid Lands Conference (2002-2003)

PI, U.S. Bureau of Reclamation, Early Life History Studies of Rio Grande Silvery Minnow (*Hybognathus amarus*) Related to Downstream Fish Passage (2002-2003). Funded through the WRRI.

PI, U.S. Bureau of Reclamation, Water Conveyance Habitat Assessment, (2002-2003). Funded through the WRRI.

PI, U.S. Fish and Wildlife Service, Native Fish Community Restoration in Rio Grande Cutthroat Trout Management (2002-2005)

PI, U.S. Department of Agriculture, Rio Grande Irrigation Initiative, Agricultural Irrigation Systems and Conservation of Native Fishes (2001-2004)



PI, New Mexico Department of Game and Fish, Rio Grande Cutthroat Trout Genetics (2001-2003)

### Upcoming Conference

Cowley currently is organizing a conference on aquatic resources in arid lands to be held on the NMSU campus, April 30-May 2, 2003.



# 47th Annual New Mexico Water Conference October 9-11, 2002, Ruidoso



After serving barbecue, the Flying J Ranch Western Stage Show group entertained conference participants Thursday night.



*"It appears that the negative phase of the PDO [Pacific Decadal Oscillation] began in 1998, and will probably continue until 2020 or 2025."*  
(Charlie Liles, National Weather Service)

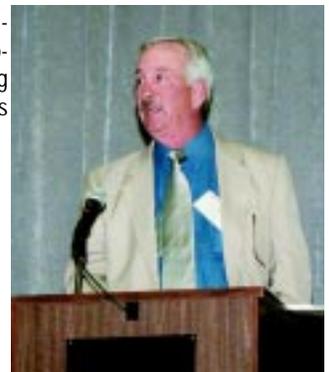


A beautiful fall day greeted nearly 50 visitors to the Carrizo Valley Ranch. Sid and Cheryl Goodloe escorted folks around the ranch, tossed a variety of apples down from trees at snack time, and welcomed everyone into their home.

Chip Groat of the USGS met with various folks during a noon meeting.



Len Stokes described water supply problems facing small municipalities like Ruidoso.

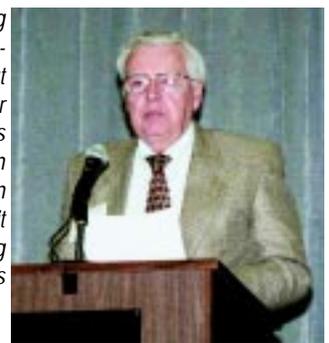


WRRRI Director Karl Wood (left) and Ruidoso Mayor Leon Eggeston welcomed conference participants.



New Mexico Senator Sue Wilson Beffort (right) talked about the newly created Pecos Water Bank below Sumner Lake.

*"Water banking may not be a complete "cure all," but as a remedy to our water ills, it comes much closer than hiding our heads in the sand, trusting it will rain and hoping our water problems will go away..."*  
(Bob Grant)



*"... during extended drought periods, brackish groundwater ... can provide municipalities with an entirely new [water] supply."*  
(Eddie Livingston)



State Engineer Tom Turney pauses to talk with conference participants after addressing the group on water issues facing the state.

Agricultural economist Frank Ward and colleagues have modeled the economic impacts of drought on the uses of Rio Grande water.





# There's No Doubt, We're in a Drought!



Tour participants learn about disk-filter systems for nonpotable water used on Alamogordo's city golf course.



*"The San Juan/Chama diversion to Heron ... is about 100,000 acre-feet of water... This year we are only at about 6,000 acre-feet due to the low flows. The lowest prior to this year that we diverted since the project was built in the 1970s was 20,000 acre-feet."* (Michael Gabaldon, left)

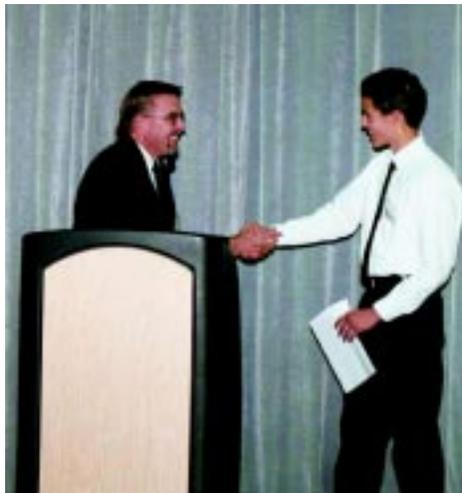
*"Per person consumption in El Paso dropped from 159 gallons per day in 2000 to 155 in 2001, and we are on track for meeting our goal of 140 gallons per day by 2010."* (Ed Archuleta, right)



Chip Groat, Director of the USGS, spoke eloquently on the need to focus on border environmental and health issues.



Letty Belin (left) and Joy Nicholopoulos spoke on protecting endangered species during times of drought.



Gary Esslinger congratulates Marcos Garcia on his first place award in the the junior division of the 2002 High School water essay contest. Students read their essays at the luncheon.



The annual water conference always provides time for networking and seeing old friends.



Water lawyers debated the need to adjudicate water rights in New Mexico. Top from left: DL Sanders, Steven L. Hernandez, Sherry Tippett; bottom from left: Derrick Lente, David Benavides, Fred Hennighausen.



Phil King (left) confers with Edd Fifer. King and Gary Esslinger spoke earlier on EBID's drought response with the goal of minimizing adverse effects of drought on the district's farmers.



Robert Lee of the Petroleum Recovery Research Center describes state-of-the-art innovations for produced waters.



Sid Goodloe (bending down) shows tour participants the vast root system of a juniper tree. The root system affects the growth of anything 40 feet from the trunk.



# Reports Available

## USGS Reports

The U.S. Geological Survey has recently published several reports of interest to New Mexico water experts. Copies are available for inspection at the USGS District Office in Albuquerque (5338 Montgomery Blvd NE, Suite 400). The Water Resources Research Institute library also has the reports on file. They may be ordered from the USGS, Federal Center, Box 25286, MS 517, Denver, CO 80225. You may call 1-888-ASK-USGS for price information.

**User's Guide to SEAWAT: A Computer Program for Simulation of Three-Dimensional Variable-Density Ground-Water Flow** - by Weixing Guo and Christian D. Langevin. Techniques of Water-Resources Investigations 6-A7.

**Occurrence and Status of Volatile Organic Compounds in Ground Water from Rural, Untreated, Self-Supplied Domestic Wells in the United States, 1986-99** - by Mike Moran, Wayne Lapham, Barbara Rowe, and John Zogorski. Complementary copies can be obtained by contacting Erika Schoen at 605-355-4560, ext. 265, or email [eschoen@usgs.gov](mailto:eschoen@usgs.gov). This publication is also available in pdf format on the NAWQA VOC National Synthesis homepage at <http://water.usgs.gov/nawqa/vocs>.

**Summary of Flow Loss Between Selected Cross Sections on the Rio Grande In and Near Albuquerque, New Mexico** - by Jack. E. Veenhuis. Prepared in cooperation with the City of Albuquerque (Water-Resources Investigations Report 02-4131)

**Assessments of Aquifer Sensitivity on Navajo Nation and Adjacent Lands and Ground-Water Vulnerability to Pesticide Contamination on the Navajo Indian Irrigation Project, Arizona, New Mexico, and Utah** - by Paul J. Blanchard (Water-Resources Investigation Report 02-4051)

**Effects of Wildfire on the Hydrology of Capulin and Rito de Los Frijoles Canyons, Bandelier National Monument, New Mexico** - by Jack E. Veenhuis (Water-Resources Investigation Report 02-4052)



**Report of the Rio Grande Compact Commission 2001**  
A limited number of copies is available from Linda Tenorio, (505) 764-3880.

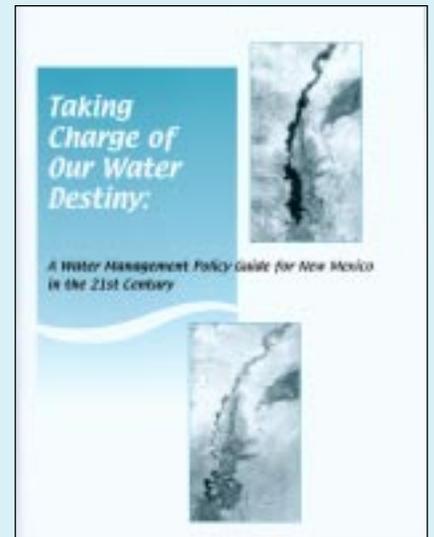
## Report Makes Recommendations for New Mexico's Water

*Taking Charge of Our Water Destiny: A Water Management Policy for New Mexico in the 21<sup>st</sup> Century* was released in July 2002. It is now in its second printing. The 88-page document outlines many of the specific problems that have led to New Mexico's dire water situation and makes recommendations for changes in state law and policy to address the problems.

The report is by Alletta Belin, an environmental attorney in private practice, Consuelo Bokum, director of the water project at 1000 Friends of New Mexico, and Dr. Frank Titus, a hydrogeologist long experienced in New Mexico water affairs and water agencies, now with the New Mexico Bureau of Geology and Mineral Resources.

The report is free to the public at either of the following offices of 1000 Friends of New Mexico: 1001 Marquette, NW, Albuquerque or 320 Aztec, 2<sup>nd</sup> floor, Santa Fe, NM or by mail for a \$5.00 charge to cover postage and handling (contact the Albuquerque office at 505-848-8232).

This report was made possible by the Turner Foundation, the Thaw Charitable Trust, McCune Charitable Foundation and the Wm. C. Kenney Watershed Protection Foundation. The second printing is being made possible by a grant from the Smart Growth Coalition.





## Water Research Symposium draws 175 participants

Water specialists from around the state gathered together on a warm August day at the Macey Center in Socorro to learn about their colleagues' research. The 2002 New Mexico Water Research Symposium was sponsored by the WRI in cooperation with Sandia National Laboratories and Los Alamos National Laboratory as well as the state's universities, Office of the State Engineer, U.S. Geological Survey, John Shomaker and Associates, Inc., WaterBank, and the American Water Resources Association, New Mexico Section.

The one-day symposium began with WRI Director Karl Wood addressing participants on the importance of scientifically sound research, whether the research is conducted by academicians, agency staff, or private sector personnel. Dr. Wood went on to list water entities throughout the state and the research needs they have identified (see page 8).

Concurrent sessions followed opening remarks with participants choosing among 48 presentations given throughout the day. Presentations were clustered in categories including Groundwater and Surface/Groundwater Interactions; Economics and Policy Analysis; Watershed Management and Erosion Control; Water Quality and Pollution Prevention; Water Security; Wetland and Riparian Issues; and Desalination, Water and Wastewater Treatment and ReUse.

In addition to oral presentations, nearly 40 posters detailed water-related research from throughout the state and west Texas. Many of the posters were presented by students with 52 students attending the symposium.

The response to the symposium was very positive with participants encouraging the continuation for such a forum, whether it is done annually or biennially.

Participant comments after the symposium included:

*"...the caliber of the papers and the great contacts I made really made this a worthwhile trip..."*

*"It was very informative...the presentations were short and sweet and it was good to have the backup material on which to take notes."*

*"It was a great way to bring together and enhance collaboration, and I liked the wide variety of topics."*

*"I liked the casual atmosphere and loved the format - the time allotted to presentations was just right."*

*"This should be an annual gathering - and will soon become one of THE EVENTS for folks across the southwest! This has the potential of becoming a premier symposium and avenue for students to present their research."*

*"The papers on desalination were excellent."*

*"The best part was that I met a couple of people I may be able to collaborate with in the future."*

*Researchers, including many students, presented research results during the poster session.*



*"I really liked the fast paced program."*

*"I've already heard from a person I'd never met before working on similar distribution system problems. I also met a person doing a lot of good water conservation work on gray water...I was also impressed that most people actually attended the [presentations] and were interested in the topics. I don't think this is always true of ...meetings."*

*"The...event had a fun, informal, friendly feel; like a community gathering."*

*"It was the most productive day that I have had for a long time. I missed some important papers because of concurrent session scheduling and involvement in the poster presentations."*



*Symposium participants listened to brief presentations on a wide variety of water-related topics.*

*The evening before the symposium, participants gathered at a reception hosted by the American Water Resources Association - New Mexico Section.*



To review abstracts for presentations and posters from the 2002 Water Research Symposium, go to the WRI homepage at <http://wri.nmsu.edu>. Under *Publications*, click on *Technical Research Symposium abstracts*. Stay tuned for plans on the next water research symposium.



# Water entities identify research needs

In conjunction with the 2000 Legislative Water Retreat, coordinated by the WRRRI, entities from around New Mexico identified the following research needs.

### **Acequias**

Water Use Allocation

### **Carlsbad Irrigation District**

Equitability of Water Rights  
Endangered Species  
Water Quality Standards

### **Elephant Butte Irrigation District**

Irrigation Efficiency  
Equity of Water Rights  
Drought Planning  
Water Conservation  
Recreational Impacts  
Federal Water Right Ownership  
Water Quality

### **Middle Rio Grande Conservancy District**

Urban Sprawl  
Endangered Species

### **Lea County Water Users**

State-line Water Depletions  
Domestic Well Impacts

### **City of Alamogordo**

Seasonal Variability of Surface Water  
Groundwater Surveys  
Desalination and Brine Disposal

### **City of Las Cruces**

Aquifer Storage and Recovery  
Water Banking  
Water Conservation

### **City of Santa Fe**

Degradation of Riparian, Aquatic, and Wildlife Habitats  
Domestic Well Impacts  
Groundwater Surveys  
Water Conservation and Recycling

### **City of Albuquerque**

Groundwater Storage and Recovery  
Arsenic Concentrations  
Endangered Species  
Water Conservation and Recycling  
Conjunctive Groundwater - Surface Water Management  
Regional Water Planning

### **New Mexico Municipal League**

Standards for Construction and Abandonment of Wells

### **New Mexico Rural Water Assoc.**

Infrastructure Financing  
Water Quality Regulations and Compliance  
Regional Water Planning

### **San Juan Water Commission**

Endangered Species  
Regional Water Planning

### **New Mexico Office of the State Engineer**

Endangered Species  
Hydrographic Surveys  
Federal Water Right Ownership

### **New Mexico Environment Dept.**

Total Maximum Daily Loads  
Non-point Source Pollution

The *Divining Rod* is published by the New Mexico Water Resources Research Institute.

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