

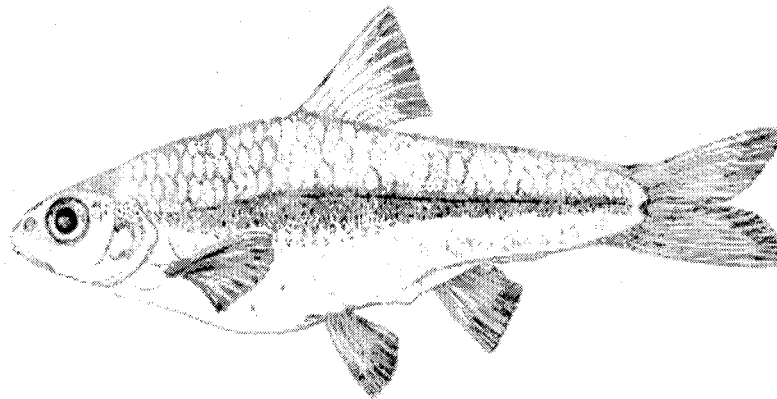
SPECIAL PUBLICATIONS

Museum of Texas Tech University

NUMBER 46

12 May 2003

AQUATIC FAUNA OF THE NORTHERN CHIHUAHUAN DESERT



CONTRIBUTED PAPERS FROM A SPECIAL SESSION WITHIN
THE THIRTY-THIRD ANNUAL SYMPOSIUM OF
THE DESERT FISHES COUNCIL

HELD

17 NOVEMBER 2001

AT

SUL ROSS STATE UNIVERSITY, ALPINE, TEXAS

EDITED BY

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INNOVATIVE APPROACHES TO RECOVER ENDANGERED SPECIES

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ABSTRACT

Texas Parks and Wildlife Department has embarked on a progressive approach to resolving endangered species issues through involvement with local governments and especially private landowners. Work in the Balmorhea area of West Texas involved local citizens, the City of Balmorhea, three universities, four NGOs, five state and three federal agencies. Together we created a natural *ciénega*, made progress towards eliminating a source of genetic contamination, enhanced nature tourism and began developing an improved sport fishery. We are now working on Conservation Agreements in West Texas that will enable the resolution of concerns over two candidate fish species and, if suc-

cessful, will preclude the need to list these species as endangered. With the Devils River minnow, we are working closely with landowners and the City of Del Rio to determine and resolve life history requirements and restore populations to natural levels. In so doing, the cooperating entities will also be protecting the quality of the Devils River and associated streams. A major component of the Pecos Pupfish Conservation Agreement is to create alternate habitats on private land in Texas. By involving individuals and local governments, we are more likely to achieve long-term benefits for natural resources as well as public health and quality of life.

INTRODUCTION

Approximately 25% of the 169 native freshwater Texas fishes are of conservation concern (Hubbs et al., 1991). That is, they are either in danger of extinction or approaching that status. In the Chihuahuan Desert region of Texas, 50% of the native fishes are of conservation concern or already lost to extirpation or extinction (Hubbs et al., 1991). When species are being lost, their predicament is usually indicative of a larger biological problem. Reversing the trend and avoiding extinctions is usually complex, politically volatile and expensive.

Texas Parks and Wildlife Department (TPW) is working with federal, state and local agencies and es-

pecially private landowners to conserve natural resources and resolve endangered species issues. With 97% of the land in Texas privately owned, involvement with the private sector is often the only way to achieve long-term conservation goals.

Herein, I present three case histories of innovative approaches to resolve specific issues. Although each situation has unique elements, these case histories serve to provide examples that have worked and to generate new ideas on how to approach such issues.

COMANCHE SPRINGS PUFFISH AND SAN SOLOMON CIÉNEGA

In 1996, a cooperative effort among private, state and federal entities allowed the creation of a desert-wetland (*ciénega*) habitat for two federally endangered fish species, Comanche Springs pupfish (*Cyprinodon elegans*) and Pecos gambusia (*Gambusia nobilis*). The primary benefit to the fishes is a "natural" habitat criti-

cal to their survival, but which had been eliminated through human modifications for recreation and agriculture. Benefits to area residents included: 1) relaxation of some pesticide regulations for farmers, 2) protection of the water supply and 3) increased tourism.

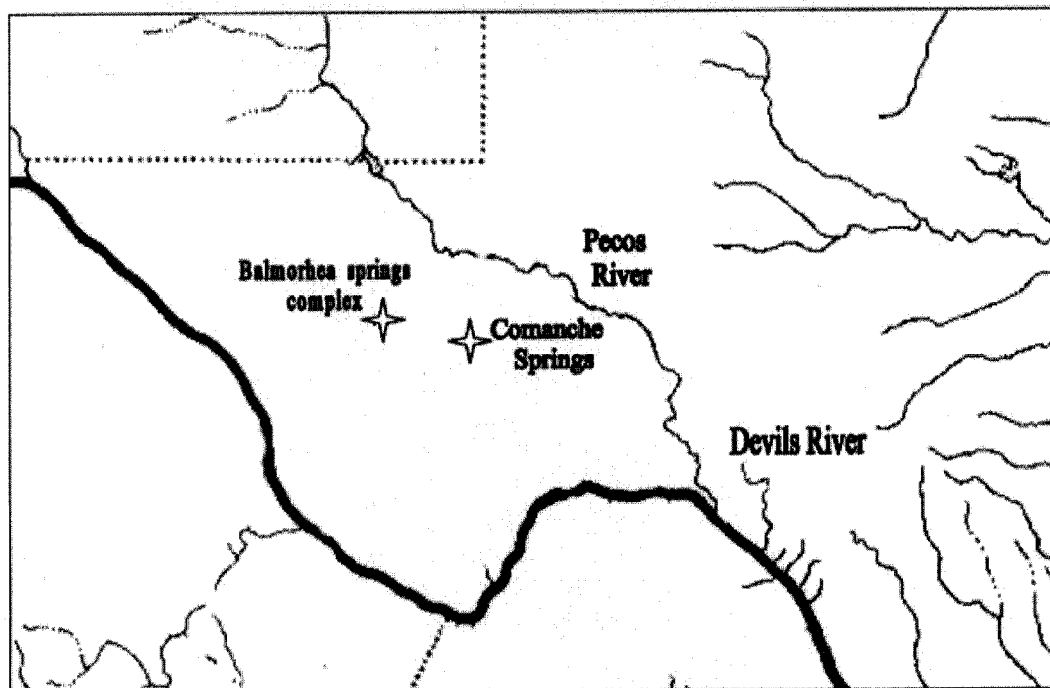


Figure 1. Project locations in West Texas.

Prior to human alterations, Comanche Springs pupfish and Pecos gambusia inhabited two large *ciénega* systems separated by approximately 100 km (Figure 1), one fed by the Balmorhea springs complex (Phantom Lake, San Solomon, Giffin and East Sandia springs), and one by Comanche Springs. San Solomon Springs is the largest spring in the Balmorhea springs complex, producing about 750 liters per second (lps); it is presently the largest spring in the Trans-Pecos and the seventh largest in Texas. Comanche Springs, in Fort Stockton, once flowed at approximately 1,200 lps, but ceased its perennial flows in 1961 due to groundwater pumping (Brune, 1981; Scudday, this volume).

More than 100 farmers depended on surface, irrigation waters flowing out of Comanche Springs and the *ciénega*. Groundwater pumping by 18 land-owners in an area west of Fort Stockton severely diminished the flows from the spring. The local water district sued these pumpers in 1952 in an attempt to

establish their water rights. The pumpers prevailed in the lawsuit by basing their defense on a 1904 case from which had emerged the concept of "right of capture." This concept established that a well owner could pump as much water as desired, regardless of the impact on the aquifer. This was also the case in which the Texas Supreme Court had determined that the intricacies of aquifers were so "secret, occult, and concealed" that it would be impossible to administer a set of rules. Ultimately the flows of Comanche Springs ceased, the *ciénega* dried up, the native flora and fauna disappeared, the surface irrigators lost their farms and their land reverted to desert.

Similarly, farmers also diverted water for agriculture from the Balmorhea springs complex and have been doing so since the mid-1870s (Brune, 1981). In 1915, the Reeves County Water Improvement District No.1 (RCWID) was established and, with water from San Solomon and other associated springs, administered irrigation water for 4,900 ha of farmland.

Ciénegas presumed to have supported large numbers of *C. elegans* and *G. nobilis* were drained and spring flows were diverted into an irrigation network of concrete-lined canals with swiftly flowing water and dredged, earthen laterals. This habitat is highly unnatural, ephemeral and wholly dependent upon local irrigation practices and other water-use patterns. In the 1930s, the Civilian Conservation Corps modified San Solomon Springs into a large swimming pool at Balmorhea State Park. The work of this New Deal program enhanced the park's visitor services, but further disrupted the natural ciénega.

Ciénegas, and their associated springs, provide habitat for a wide variety of plants and animals, some of which are endemic to these systems (Hendrickson and Minckley, 1984). Not only can ciénegas harbor unique species, but also an entire community of interacting organisms depends on these fragile habitats for survival. This is especially true for the increasingly rare desert fishes. Few ciénegas have survived intact to this day. When the original San Solomon ciénega was modified, and for the most part destroyed, the only "aquatic habitat" remaining was in the concrete irrigation canals. Although better than no habitat at all, the irrigation canals, at best, provided a tenuous existence for some life forms. Some indigenous species, such as the Pecos River muskrat (*Ondatra zibethicus ripensis*), did not adapt and were extirpated. The Comanche Springs pupfish and Pecos gambusia managed to survive in the irrigation canals, but their numbers were greatly reduced. Because of the loss of most of their natural habitat, both fishes are rare and on the federal and state Endangered Species lists.

Previous efforts to improve habitat have occurred in the Balmorhea area. A small refugium canal (120 m) was constructed in 1974 at Balmorhea State Park (Echelle and Hubbs, 1978). During a two-year sampling study (Garrett and Price, 1993), Comanche Springs pupfish population size in the park refugium canal was estimated to be as low as 968 (May 1990) and as high as 6,480 (September 1990).

In 1993, a modified canal was constructed at Phantom Lake Springs by the Bureau of Reclamation (Young et al., 1994). Instead of the original concrete walls, the 110-m canal has sloped, earthen, sinuous sides and was designed to resemble a portion of a

ciénega. The Phantom Lake Springs Refugium Canal resulted in an increase in local abundance of Comanche Springs pupfish, resulting in an average of 14.7 pupfish/m² (Winemiller and Anderson, 1997). Unfortunately, the springs have now failed (Hubbs, 2001) and a pump is needed just to maintain water in a small pool at the spring source (N. Allan, U.S. Fish and Wildlife Service, pers. comm.).

People also suffer when their water sources vanish. Farmers who depended on surface irrigation water from Comanche Springs lost their livelihood when the springs went dry. Farmers in the Balmorhea area also rely on surface irrigation from springs, and if the aquifer were diminished, local agriculture would certainly suffer. The effects on the rest of the community of Balmorhea would be devastating since they depend on the aquifer and the spring flows for everything from domestic water to tourism.

Although current state law would allow unrestricted pumping from the aquifer that supports the Balmorhea springs complex, one thing that can prevent overpumping is the Federal Endangered Species Act. The Endangered Species Act protects the fish, the fish need the water, and as long as the water is flowing from the springs it also is available to humans. Through a pragmatic understanding of the basic relationship between the natural and human communities, biologists and Balmorhea community leaders chose to work together on a solution that would benefit all concerned rather than adopt adversarial roles. While the farmers had previously viewed the fish as something that hampered and perhaps threatened their livelihood, the fish may actually be their best insurance for sustained spring flows.

A plan was formulated to create a ciénega to look and function like a natural ecosystem. RCWID and the agricultural community it represents agreed to provide the essential water needed to create a secure environment for the endangered fishes. Water is a rare and precious commodity in West Texas, particularly for farmers, but by each of the users giving up a small amount, they would be providing insurance for future water supplies.

An additional benefit for the farmers was that, because of their help in creating preferred habitat for

the endangered fishes, the Texas Department of Agriculture (TDA), the U.S. Fish and Wildlife Service (USFWS) and the U.S. Environmental Protection Agency (EPA) proposed a plan to allow the benefits of the *ciénega* to offset any potential effects from pesticide use on farms that could impact the endangered species in the irrigation canals. The fish would have a better place to live and the farmers could continue to raise their crops.

Biologists, engineers and resource managers from universities and government agencies joined forces to make the project work. The U.S.D.A. Natural Resource Conservation Service provided soil analysis and, along with staff from the Texas Agricultural Extension Service, TDA, the University of Texas at Austin and the University of Texas-Pan American, gave expert advice on some of the intricacies of the project. The expertise of the Texas Department of Transportation also was crucial. Their surveyors, design engineers and equipment operators transformed biological concepts into reality. The Texas Department of Criminal Justice provided inmates to build the Observation Deck and retaining walls as well as install the plant materials selected for the initial *ciénega* vegetation restoration. Botanists at Sul Ross State University provided container-grown native plants for the project. The one-of-a-kind window wall was designed, built, transported and installed by a beneficent concrete fabrication company located 500 km away.

Funding for the San Solomon *Ciénega* was provided by grants from the Educational Foundation of America and the National Fish & Wildlife Foundation. Additionally, fabrication costs for the window wall were provided by a TDA grant from the EPA and with contributions from the Texas Organization for Endangered Species.

In 1996, construction of the 1-ha San Solomon *Ciénega* was completed. This wetland is situated on Balmorhea State Park land within the boundaries of the original, natural *ciénega*. As a result, the native fish fauna, including Comanche Springs pupfish and Pecos gambusia, has flourished. This location now provides a natural habitat and contains the largest known concentration of Comanche Springs pupfish. Recent monitoring efforts have resulted in average estimates of the summer population of pupfish in the *ciénega* at 270,000 individuals.

Aquatic plants indigenous to *ciénegas*, as well as grasses and shrubs characteristic of the drier aspects of these desert wetland communities, were planted in the *ciénega* and now are well established. Some of the more common species are common cattail (*Typha latifolia*), common reed (*Phragmites australis*), alkali bulrush (*Scirpus maritimus*), hardstem bulrush (*S. acutus*), Olney bulrush (*Scirpus olneyi*), sand spikerush (*Eleocharis montevidensis*), buttonbush (*Cephalanthus occidentalis*), Goodding willow (*Salix gooddingii*), Rio Grande cottonwood (*Populus deltoides* var. *wislizenii*), four-winged saltbush (*Atriplex canescens*), alkalai sacaton (*Sporobolus airoides*), big sacaton (*Sporobolus wrightii*), tobosa (*Hilaria mutica*), granjeno (*Celtis pallida*) and western soapberry (*Sapindus saponaria* var. *drummondii*). Beyond the immediate wetted perimeter of the *ciénega*, the habitat grades into a desert plains grassland that was once common to the region.

Many species of birds, reptiles and mammals began to use the new wetland almost immediately. These include belted kingfisher (*Megaceryle alcyon*), black phoebe (*Sayornis nigricans*), swallows (*Petrochelidon* spp.), white-throated swift (*Aeronautes saxatalis*), green heron (*Butorides virescens*), swamp sparrow (*Melospiza georgiana*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), sora (*Porzana carolina*), yellowthroat (*Geothlypis trichas*), blotched watersnake (*Nerodia erythrogaster transversa*), spiny softshell turtle (*Trionyx spiniferus*), pond slider (*Chrysemys scripta*), javelina (*Pecari angulatus*) and desert cottontail (*Sylvilagus auduboni*).

People of the local and regional community and state park visitors benefit from a living exhibit that shows the importance of the springs and their wetlands for the fishes and other wildlife of West Texas. Because the primary purpose of the *ciénega* is to provide desert wetland habitat, visitor access is limited to only a small portion of the total restoration. However, TPW has tried to maximize the aesthetic and educational experiences available at locations that are accessible to the public. The observation deck provides an unobstructed view of most of the above-water portion of the *ciénega*, and the clear water allows viewing of much of its underwater life. The window wall was custom designed for San Solomon *Ciénega* so that visitors would have a view that few have seen—life in the *ciénega* as its aquatic residents see it.

Another attempt to further protect Comanche Springs pupfish was not so successful. Lake Balmorhea is a downstream, 200-ha storage reservoir for irrigation water from the Balmorhea springs complex and contained an introduced population of sheepshead minnow (*C. variegatus*). This species is known to compete and hybridize with Comanche Springs pupfish (Stevenson and Buchanan, 1973; Echelle and Echelle, 1994). In 1998, the RCWID allowed TPW to partially drain the reservoir and attempt to remove all fish by application of rotenone, a fish toxin. The objective of the project was to eliminate sheepshead minnow from the reservoir in order to remove the threat of hybridization with Comanche Springs pupfish. A large population of sheepshead minnow inhabited the lake; post-rotenone extrapolation of subsamples put the estimate at 5,000,000. Unfortunately and for undetermined reasons, some sheepshead minnow survived the rotenone treatment. They have since begun repopulating the reservoir. Part of the agreement with RCWID was to restock the reservoir with sport fishes in order to improve tourism in the area. These

piscivores should help keep the numbers of sheepshead minnow in check.

The creation of the San Solomon Ciénega was accomplished through willing participation of diverse entities with a common goal of mutual benefit. During the last decade, USFWS developed a formal method of participation in such projects (for non-listed species) through Conservation Agreements. The successful cooperation among private and government entities in the San Solomon Ciénega project served as a precursor to future conservation efforts by TPW. Conservation Agreements are relatively new and some have not worked. Therefore, they are closely scrutinized by not only the USFWS, but also by others from across the political spectrum. In order to be effective, a Conservation Agreement must provide some immediate reduction in threat to the species and provide long-term security against extinction. When well designed, they provide a format and incentives for affected entities to work together to resolve issues and conserve natural resources.

DEVILS RIVER MINNOW CONSERVATION AGREEMENT

A Conservation Agreement among the City of Del Rio, TPW and USFWS was implemented in 1998. Due to the cooperative efforts outlined in the Agreement, Devils River minnow (*Dionda diaboli*) was listed as threatened rather than endangered (USFWS, 1999). The Agreement details a 5-year plan of research and conservation actions that are designed to resolve the threats to the Devils River minnow and lead to its ultimate de-listing. Benefits include protection of water quality and quantity in the Devils River and adjacent streams for both fish and people and creation of a green belt/stream corridor along San Felipe Creek in the City of Del Rio that not only provides quality habitat for fishes, but will also provide a nature-friendly, city park and potential for increased tourism.

The Devils River (Figure 2) is one of the most pristine rivers in southwestern North America. Due to its geographic location and historic stability, the Devils River sustains many indigenous organisms. It remains relatively unpolluted and undammed and although spring flows have diminished, they are still substantial. Lim-

ited access has kept the river from being thoroughly studied by the scientific community; however, collections in the past decade by Garrett et al. (1992) and others indicate a diminution in abundance of most flowing-water species, particularly Devils River minnow. A survey in 1953 showed Devils River minnow was the fifth-most abundant fish species at Baker's Crossing and the sixth-most abundant fish in the upper Devils River (Hubbs and Brown, 1956). In the mid-1970s, Harrell (1978) found it remained the sixth-most abundant fish (in 72 collections, Harrell averaged 24-25 *D. diaboli* per collection). In 1988-1989, collections from 25 locations throughout the historic range in the United States yielded a total of only 7 individuals: Devils River = 2; San Felipe Creek = 3; Sycamore Creek = 2 (Garrett et al., 1992). The numbers had declined such that it was rare where it occurred at all and was probably the least abundant of the approximately 30 species that occur in these streams. In 1979, Devils River minnow made up 6-18% of the *Dionda* population at the Head Spring area of San Felipe Creek. In 1989, none were present there (Garrett et al., 1992).

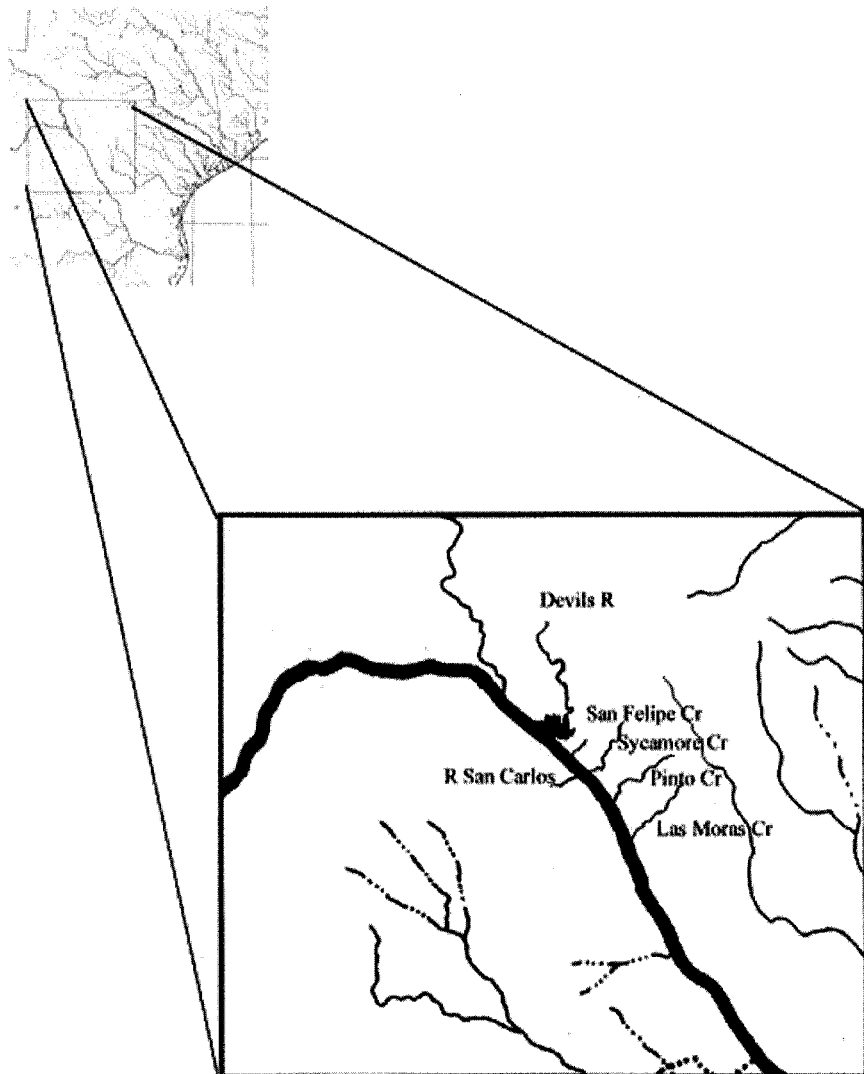


Figure 2. Range map for Devils River minnow.

Members of the genus *Dionda* are specialized for living in spring-fed, flowing waters and are found primarily in Texas and Mexico (Garrett et al., 1992). Devils River minnow is distinguished from other species of the genus by a variety of characters, including distinctive color pattern, narrow head and number of lateral line scales (Hubbs and Brown, 1956). Biochemical work in the past decade has further distinguished unique characteristics of this species (Gold et al., 1992; Mayden et al., 1992).

The Devils River minnow is known to occur in the Devils River, San Felipe Creek and Sycamore Creek, Val Verde County, Texas. It historically occurred in Las Moras Creek, Kinney County, Texas, but was eliminated from that locality sometime before 1980 (Smith and Miller, 1986; Garrett et al., 1992). Extirpation was likely due to periodic failure of the springs from drought and groundwater pumping and from modifications to the spring for construction and maintenance of a swimming pool. There are also historic records of occurrence in two small streams in Coahuila, Mexico, the Río San Carlos and Río Sabinas (Contreras-B. and Lozano-V., 1994). Their current status there is unknown; no collection attempts have been made since the early 1970s.

Although very little is known of the ecology of the Devils River minnow, some threats are apparent. Range reduction has occurred by extirpation of the Las Moras Creek population, minimal flows in Sycamore Creek and inundation of the lower Devils River first by Walk and Devils lakes earlier in the 20th century and ultimately Amistad Reservoir in 1968. Many springs in the area have diminished flows and some have totally stopped (e.g., Beaver Springs, Juno Springs and Dead Man's Hole), thus reducing the overall length of the Devils River as well as the quantity of water flowing in it (Brune, 1981). Many of the area's perennial streams, listed by Gray (1919), no longer flow. In the Devils River, U. S. Geological Service data from the Pafford's Crossing gauging station reveals a general decrease in daily mean discharge for the period between the study by Harrell (1978) and that of Garrett et al. (1992).

The Devils River minnow may be suffering from biological threats as well. Numerous exotics have become established in the area, including common carp

(*Cyprinus carpio*), Gulf killifish (*Fundulus grandis*), redbreast sunfish (*Lepomis auritus*), smallmouth bass (*Micropterus dolomieu*) and blue tilapia (*Oreochromis aureus*). Although fishes throughout the Chihuahuan Desert have been negatively impacted by introduced species (Hubbs, 1990) and such factors as predation and competition may be causing negative impacts on the native fish fauna, specific effects on Devils River minnow are not known. Experiments designed to elucidate these interactions are ongoing.

Much of the water for San Felipe Creek comes from two large springs (San Felipe Springs) within the City of Del Rio. The City also gets its municipal water supply from San Felipe Springs. Conserving the quantity and quality of water from the springs is critical for both the Devils River minnow and the citizens of Del Rio.

The USFWS proposed the Devils River minnow for listing as threatened in 1978 with critical habitat proposed for portions of San Felipe Creek and the Devils River. The USFWS withdrew the proposal in 1980 and retained its designation as a candidate species. The USFWS published a new proposal to list the Devils River minnow as endangered in March, 1998.

During the period 1997-1998, TPW was working with USFWS, Del Rio and private landowners to develop ways to protect the minnow. Landowners and city officials feared repercussions of listing the fish as endangered and came to understand that a cooperative approach to restoring and protecting the ecosystem would be the best for all concerned. The Devils River Minnow Conservation Agreement was signed by the USFWS, TPW and the City of Del Rio in September 1998. The TPW worked closely with city officials and local landowners to develop conservation actions that were beneficial to the species. Those actions in the Agreement include determining the current status of the species throughout its range, maintaining captive populations for reintroductions in nature, protecting the San Felipe Creek watershed, providing technical assistance to landowners on riparian protection and management, revising live bait harvest and selling practices in the Devils River area to prevent the further establishment of exotic, aquatic species and additional ecological research, including interactions between Devils River minnow and smallmouth bass.

The Conservation Agreement provides a positive incentive for cooperative actions by all parties and yields scientific access to previously unavailable locations. The primary motivation for the Conservation Agreement was to remove the threats to the Devils River minnow sufficiently so that protection under Federal law was not necessary. The USFWS carefully considered the Agreement and to what extent it had been

implemented as of the time the listing decision was due. The USFWS concluded that with an accelerated implementation schedule, a listing determination of threatened rather than endangered would be appropriate. If successful, the Devils River minnow and other aquatic fauna will be protected and the quantity and quality of streams throughout the range will also be insured.

PECOS PUFFISH CONSERVATION AGREEMENT

The Pecos Pupfish Conservation Agreement was initiated in 1999. The parties involved are TPW, New Mexico Department of Game and Fish, New Mexico Department of Agriculture, New Mexico Division of State Parks, Bureau of Land Management (BLM) and USFWS. The Agreement provides conservation measures, new bait fish regulations and creation of additional habitat. It is designed to preclude the need to list the Pecos pupfish (*Cyprinodon pecosensis*) as a federally endangered species by reducing threats to the species and establishing populations in newly created habitats adjacent to the Pecos River in Texas. This effort incorporates the help of private landowners through the federally funded, state administered, Landowner Incentive Program. With financial assistance and biological guidance provided by TPW, landowners have modified private ponds to mimic natural desert wetland habitat while still allowing the landowner's original intentions for the water body. Due to the ability of the Agreement to remove immediate threats to the fish, a proposal to list it as endangered was withdrawn by USFWS in 2000.

The Pecos pupfish is endemic to the Pecos River system (Figure 1) from the vicinity of Roswell, New Mexico to the mouth of Independence Creek, Terrell County, Texas (Echelle and Echelle, 1978). It now only occurs in Salt Creek, a small Pecos River tributary in Texas, and at Bitter Lake National Wildlife Refuge and Bottomless Lakes State Park in New Mexico (Hoagstrom and Brooks, 1999; Echelle et al., this volume). It also occurs sporadically in the Pecos River upstream of Artesia, New Mexico (Propst, 1999).

Pecos pupfish can occur in a variety of habitats and water qualities. It can flourish in locations that fluctuate in water quantity and chemistry, ranging from

highly saline sinkholes to typical desert streams. It has been found in locations with dissolved chlorides ranging from 185 mg/l to 8,940 mg/l (Davis, 1981). Age at reproductive maturity, ovary size, egg size and egg number vary among populations, and are apparently associated with population density (Garrett, 1982). The distribution is mostly limited by interspecific interactions and thus, it is typically found in habitats that are low in species diversity (Echelle and Echelle, 1978).

During 1954, Pecos pupfish was the most abundant fish in the Pecos River between New Mexico and Sheffield, Texas (Echelle et al., 1997). Abundance has declined dramatically since the early 1980s, when non-native sheepshead minnow was introduced into the Pecos River in Texas. The original introduction appears to have been a baitfish release in Red Bluff Reservoir (Childs et al., 1996). As a result, Pecos pupfish was eliminated from the lower Pecos River upstream to Loving, New Mexico, and replaced with a hybrid swarm (Echelle and Conner, 1989; Wilde and Echelle, 1992; Echelle et al., 1997). Pecos pupfish is listed as "threatened" by Texas and New Mexico and is considered a "species of concern" by the American Fisheries Society (Williams et al., 1989). Their status is due to habitat loss and especially to hybridization with sheepshead minnow.

The Texas portion of the Conservation Agreement consists of establishing off-channel populations near the Pecos River through a cooperative program with private landowners, developing more restrictive bait-fish regulations, attempting to remove sources of sheepshead minnows from West Texas and monitoring the status of Pecos pupfish in Texas. Progress has been made in all categories.

New Mexico's commitment is similar to Texas, with the addition of ensuring the security of populations on state park lands. The USFWS and BLM are also protecting populations on federal lands as well as providing some funding.

This Conservation Agreement is the most feasible approach to addressing the biological problems of this fish. Although restrictive rules inherent in endangered species status are often necessary to prevent extinction, in the case of the Pecos pupfish, the opposite is true. Creation of new habitat on private lands would likely not be possible if there was a poten-

tial for negative impacts on private enterprise. With the Conservation Agreement, landowners are willing to have Pecos pupfish stocked in their ponds and federal grants can be used to help develop suitable habitat in the ponds. To date, two shrimp farmers, using naturally saline groundwater in West Texas, have joined the program. At each location, a *ciénega* was constructed (1.7 ha and 7 ha) to provide secure habitat and Pecos pupfish from Salt Creek were stocked in 2000 and 2001. The program allows and encourages individuals to participate in the conservation of rare, natural resources without personal risk or liability.

SUMMARY

In each of the above projects, many of the critical conservation actions would not have been possible without the cooperation of public and private entities. These are examples of a positive approach to problem

resolution that provides benefits to each of the cooperators. These "win-win" situations are not always available, but are certainly the most desirable.

ACKNOWLEDGMENTS

These projects were the culmination of long hours and hard work by a large group of people, too numerous to mention individually. However, the contributions of David Riskind (San Solomon *Ciénega*), Gary Graham (Devils River minnow), Jennifer Fowler-Propst (Pecos pupfish), Bob Edwards (all projects), Nathan Allan (all projects) and Andy Sansom (visionary extraordinaire) were essential to the process.

Special thanks to Dr. Clark Hubbs, Professor Emeritus of Zoology, University of Texas at Austin, for his inspirational work on desert fishes, and his insight into the importance of preserving aquatic communities and their habitats.

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