

A NANFA EDUCATION GRANT REPORT

The Fishes of Traders Creek in Northwestern Oklahoma

David L. McNeely and William Caire

(DLM) Biology Department, Langston University, P. O. Box 1500, Langston, OK 73050, dlmcneely@lunet.edu; (WC) College of Mathematics and Science, The University of Central Oklahoma, 100 N. University Ave., Edmond, OK 73034, wcaire@ucok.edu

Fishes in small prairie streams of central and western North America are surprisingly poorly known, and the fish fauna in northwestern Oklahoma has been explored less than in any other part of the state, as reflected in collections of the Sam Noble Oklahoma Museum of Natural History. One small prairie stream in northwestern Oklahoma, Traders Creek, was represented there by one collection made in 1960 by Carl Riggs of the University of Oklahoma. The collection included nine fish species. Such a paucity of information is typical of broad pockets within a generally well-explored North American ichthyofauna.

Fishes in North American prairie streams have declined greatly in recent years, and some prairie stream species are now threatened or endangered. Two minnow species and one darter species known from the Cimarron River and its tributaries in northwestern Oklahoma are among them. Speckled chub (*Macrhybopsis aestevalis*) remains common in one stretch of the South Canadian River in Texas, but is extremely rare or extirpated from other portions of its range (Echelle et al., 1995). Arkansas River shiner (*Notropis girardi*) was last seen in its very large range throughout the Arkansas River drainage including most of the Cimarron River more than 12 years ago (Echelle et al., 1995; A. A. Echelle, pers. comm., 2003). Arkansas darter (*Etheostoma cragini*) has always been rare and sporadically distributed, especially in the western portion of its range, and has declined substantially (Eberle and Stark, 2000). In Oklahoma, the Arkansas darter is known from the northeastern part of the state in spring-fed Ozarkian streams (Miller and Robison, 1973; Martinez, 1996) and from a handful of prairie streams in the northwestern part of the state in Harper and Beaver counties (Miller and Robison, 1973; Pigg et al., 1985; Eberle and Stark, 2000).

NANFA's
Gerald C. Corcoran
Education Grant
is made
possible by the
members of NANFA
and the generous
financial support of
the Corcoran Family.

Most of the decline of these species, and the decline of prairie streams as fish habitat generally, is due to dewatering and change from constant flow, groundwater-fed streams with periodic spates, to streams that alternately flood and go dry or nearly so (Cross et al., 1985; Cross and Moss, 1987; Echelle et al., 1995; Eberle and Stark, 2000). The change in hydrology is mostly due to water use for irrigation, domestic and public water supplies, and to heavy grazing that depletes grass cover. When the grass cover is lost, water runs off rapidly rather than infiltrating to the groundwater and replenishing stream flow.

Study Location and Habitat

Traders Creek is a small, spring-fed stream in the Gyp Hills in northwestern Oklahoma. The Gyp Hills is a rolling to rugged region underlain by thick deposits of gypsum. The other main geological substratum in the area is a heavy, red sandstone. Gypsum dissolves in water, and the sandstone erodes readily. Consequently, sinkholes, caves, and steep-sided canyons characterize the area. Most of the terrain is unsuitable for crops, and has been used for grazing since European settlement in the late 19th and early 20th centuries. Mixed grass prairies cover most of the hills, with narrow riparian woodlands of hackberry, eastern red cedar, soapberry, cottonwood, elm, oaks, and shrubs in the narrower, more moist canyons. Rock outcrops, especially gypsum, are common, and soils are shallow. Mesquite, eastern red cedar, plum, and sumac shrubs occur as a thin cover on some of the upland areas of the watershed.



Traders Creek forms from a series of tributaries that emerge from the cave mouths, seeps and springs. Some of these are perennial, while others cease flowing in most years, depending on the relative importance of the contributions of groundwater and runoff. Traders Creek itself is perennial over about 15 km, and is tributary to the Cimarron River near Freedom, Oklahoma. The stream is generally 1-3 m wide over most of its perennial reach, but near the mouth it is about 10-15 m wide. Traders Creek is quite clear over most of its length, except for the reach immediately upstream from the mouth at the Cimarron River, and except for a day or two following rains. Traders Creek water is moderately salty (1.8 to 2.4 ppt total salinity). The salinity includes both chlorides and sulfates derived from the gypsum substratum. The streambed is mainly fine sand, but small amounts of gravel occur, and there are gypsum boulders in the headwaters canyon areas. Silt occurs at the mouth, covered partly with cyanobacterial mats, and where beavers have dammed the stream at two locations, forming sizable ponds. Silt also occurs in headwaters areas where cattle have trampled the banks and waded in the

Fig. 1.
The Traders Creek Valley and Canyon at the Selman Living Laboratory in the Gyp Hills of Woodward County, Oklahoma. Photograph by David McNeely.

stream. Part of the stream supports dense stands of aquatic vegetation, including sedges, rushes, watercress, cattails, and algae. Willow and tamarisk line much of the stream bank outside the narrow canyons.

Objectives

A part of the Traders Creek headwaters, including most of its spring- and cave-fed tributaries, occurs on the Selman Living Laboratory (SLL), a property of approximately 130 ha that the University of Central Oklahoma operates as a field station for biological research and education (Fig. 1). The biota at the laboratory, except for the plants and the mammals, is poorly documented. We undertook a series of activities to develop a species list of fishes for Traders Creek, and to provide field and research experience for students from Langston University. We further aimed to develop a series of educational materials, including a Web page and posters for museums, schools, and libraries in order for students and citizens to better understand the nature and conservation status of fishes and other aquatic resources of small prairie streams using Traders Creek as a model. In addition, we planned to construct a permanent sign at the dormitory and



astronomy complex of the laboratory, located on a public road and overlooking the Traders Creek valley. An interpretive poster there would then help laboratory students and visitors learn more about Traders Creek, its fishes, and conservation concerns. While doing the fieldwork, we also hoped to determine if any of the rare and declining species known from the Cimarron River watershed occurred in Traders Creek. This report documents the ichthyological results of the field work, and reports on the educational activities and materials.

Methods

During the summer of 2002, we inventoried the fish fauna of Traders Creek by seining with a 1.2 m x 4.6 m, 4.7 mm mesh seine on three dates at seven locations from the headwaters to the creek mouth, and by collecting with a dip net (0.4 m x 0.25 m, 4.7 mm mesh) in heavy vegetation at three of the headwaters and midreach locations. Three Langston University students, Argenia Doss (Fig. 2), Victor Harris, and Toure Rider, and a local volunteer, Paul Barby, participated in the fieldwork. We identified the fishes in the field and returned many of them to the stream alive. However, we retained and preserved samples from each location, and

Fig. 2.

Argenia Doss and Toure Rider (off-camera) hold a Traders Creek channel catfish (*Ictalurus punctatus*). Most channel catfish in Traders Creek show the characteristic thin body of small stream catfish, but are healthy nevertheless. Photograph by Victor Harris.

deposited them in the Sam Noble Oklahoma Museum of Natural History (University of Oklahoma), and in the fish collection of Oklahoma State University. The students helped us photo-

graph the fishes, both in the field and using preserved specimens in the laboratory. All photographs were taken with a Nikon Coolpix 950® digital camera. We made some of the photographs using a black box similar to that described by Kuehne and Barbour (1983).

Ichthyological Results

We found 17 native and three non-native fish species in Traders Creek (Table 1). The middle stretch of the stream had the greatest species richness (19 species at the location where Riggs collected in 1960). We did not find either of the two rare minnow species, but we did find *Etheostoma cragini* (Fig. 3) in the headwaters (including the tributary that originates on and flows through the Selman Living Laboratory) and

Table 1. Fish species found in Traders Creek in June and July 2002. Locations range from the stream headwaters (1 and 2) to the confluence with the Cimarron River (7). Locations 3 through 6 were in the midreaches of the stream. Location 4 duplicates Carl Riggs's 1960 location according to Sam Noble Oklahoma Museum of Natural History collection records. Abundance scores: A = abundant, numerous in most seine hauls; C = common, present in most seine hauls, or numerous in at least one or two seine hauls; U = uncommon, absent from most seine hauls, and 20 or fewer individuals overall were found; R = rare, present in only 1 or 2 seine hauls, 5 or fewer individuals overall were found; 0 = not found. * = non-native to the Cimarron River basin.

| Species | Common Name | Locations | | | | | | |
|---------------------------------------|-----------------------|-----------|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <i>Campostoma anomalum</i> | central stoneroller | U | U | C | U | U | U | 0 |
| <i>Cyprinella lutrensis</i> | red shiner | C | C | A | A | A | A | A |
| <i>Cyprinus carpio</i> * | common carp | 0 | 0 | R | U | 0 | 0 | 0 |
| <i>Hybognathis placitus</i> | plains minnow | C | 0 | A | A | C | A | A |
| <i>Notropis atherinoides</i> | emerald shiner | C | 0 | A | A | C | A | A |
| <i>Notropis bairdi</i> * | Red River shiner | R | 0 | 0 | R | 0 | 0 | A |
| <i>Notropis stramineus</i> | sand shiner | U | C | A | A | A | A | 0 |
| <i>Phenacobius mirabilis</i> | suckermouth minnow | 0 | R | R | R | 0 | 0 | 0 |
| <i>Pimephales promelas</i> | fathead minnow | 0 | U | C | U | U | C | C |
| <i>Ameiurus melas</i> | black bullhead | C | U | C | R | U | R | C |
| <i>Ictalurus punctatus</i> | channel catfish | 0 | 0 | R | U | 0 | 0 | 0 |
| <i>Fundulus zebrinus</i> | plains killifish | C | C | A | A | A | A | A |
| <i>Gambusia affinis</i> | western mosquitofish | A | C | A | A | A | A | A |
| <i>Cyprinodon rubrofluvialtilis</i> * | Red River pupfish | 0 | 0 | 0 | C | 0 | 0 | A |
| <i>Lepomis cyanellus</i> | green sunfish | C | 0 | 0 | 0 | U | 0 | 0 |
| <i>Lepomis humilis</i> | orangespotted sunfish | 0 | 0 | 0 | C | 0 | 0 | 0 |
| <i>Lepomis macrochirus</i> | bluegill | U | 0 | 0 | U | C | 0 | 0 |
| <i>Lepomis megalotis</i> | longear sunfish | C | 0 | 0 | C | C | 0 | 0 |
| <i>Micropterus salmoides</i> | largemouth bass | 0 | 0 | R | C | U | 0 | 0 |
| <i>Etheostoma cragini</i> | Arkansas darter | U | 0 | 0 | U | R | 0 | 0 |

midreaches in heavily vegetated habitat with silt and sand substrate (Fig. 4). On 21 June 2002, the darters were in spawning coloration, but two weeks later most individuals had faded.

Because of its rarity and its habitat loss elsewhere, finding the *Etheostoma cragini* population in Traders Creek is significant. It is the easternmost prairie population in Oklahoma (populations are known from the Ozark uplands in eastern Oklahoma over 200 km away), and the fish was not known before from Woodward County (Pigg et al., 1985; Eberle and Stark, 2000; Sam Noble Oklahoma Museum of Natural History Catalog as of July 2002). Since that part of Traders Creek and tributaries where the darter was found is relatively well protected by the Selman Living Laboratory and by the Oklahoma Department of Wildlife Conservation, which protects a bat cave along one stream reach that harbors the darter, the population should be safe from immediate threats.

Failure to find the two rare minnow species in Traders Creek was not surprising, given their status. We expected that if we found them it would be at the creek mouth, since their preferred habitat was the strongly flowing portions of medium sized and large prairie rivers (Echelle et al., 1995).

We did find one unexpected species in Traders Creek. Red River pupfish (*Cyprinodon rubrofluvialtilis*, Fig. 5) had previously been reported from the Cimarron River basin on the basis of one specimen (Pigg et al., 1995), and two other specimens had been collected there by Anthony and Alice Echelle (pers. comm., A. A. Echelle). Both the Pigg and the

Echelle collections were from locations far downstream from the mouth of Traders Creek. The specimens were believed to be strays, possibly from contamination of wild-collected bait released by commercial bait dealers (Pigg et al., 1997), and this non-native species was not thought to be established in the northern parts of Oklahoma (Pigg et al., 1995, 1997). The species has long been established in the Canadian River, the next major stream to the south of the Cimarron River (Echelle et al., 1977; Pigg et al., 1995). Oklahoma law allows bait dealers to collect baitfish from state waters, and they evidently dump their hauling tanks after selling the bait to retailers.

We collected several hundred juvenile and adult specimens of Red River pupfish from the creek mouth, and 37 from a midreach location (McNeely et al., in press). These data convince us that the species has become established in the Cimarron River drainage. Since members of this genus are

Fig. 3.

A Traders Creek Arkansas darter (*Etheostoma cragini*). The Traders Creek population of this rare and declining species was unknown prior to this study. This male probably recently finished spawning, judging by the concave belly and bright coloration. Photograph by David McNeely.





usually found with only a few other species (Echelle et al., 1972a, 1972b; Minckley, 1979), and the Red River pupfish is intolerant of strong competition or predation (Echelle et al., 1972a; Gido et al., 1999), finding it succeeding in such a rich fauna (with 18 other species at one location, eight at another) is unusual.

Educational Products

We created a web page with text explaining the importance of prairie streams, their fauna, their conservation status, and the causes of their decline, along with digital images of most of the Traders Creek fishes:

www.biology.ucok.edu/SelmanLL/SelmanFishPage

Using these digital images and text, we also developed a poster with the same aims as the Web page that we have now distributed to museums, libraries, public schools, and conservation organizations, including NANFA (Table 2), and we displayed it at the 2003 Annual Meeting of the Southwestern Association of Naturalists in Norman, Oklahoma. We will continue to distribute the poster so long as interest persists.

Fig. 4.

David McNeely looking for Arkansas darters in heavily vegetated habitat of a Traders Creek tributary. Photograph by Toure Rider.

Some of these images are included in this report.

Two of the students developed posters reporting the research results, with the remaining participants as coauthors (Doss et al., 2003; Harris et al., 2003) and displayed them at research meetings including the Southwestern Association of Naturalists 50th Anniversary Meeting in Norman, Oklahoma, the Oklahoma Academy of Science Fall 2002 Technical Meeting in Edmond, Oklahoma, the Research Day for Regional Universities in Edmond, Oklahoma, and the Oklahoma Alliance for Minority Participation Research Meeting in Tulsa. Both students received awards for their research contributions at the Langston University Arts and Sciences 2003 Research Day, with Doss getting third place and Harris second.

Finally, we constructed a large, permanent, two-sided sign (1.22 m high x 2.44 m long) and mounted it on posts at the entrance to the dormitory and astronomy complex at SLL (Fig. 6). Students, lab visitors, and members of the public passing by now can learn about Traders Creek and its fishes, as well as other laboratory activities.



Fig. 5.

Female Red River pupfish (*Cyprinodon rubrofluviatilis*) from the middle reach of Traders Creek. Photograph by David McNeely.

We are pleased with what we and the participating students have been able to accomplish in this activity, which combines field research and education. The students wholeheartedly express satisfaction with the opportunity and their experience, especially the fieldwork and the research presentations. Ms. Doss, who had never participated in any field work prior to this, stated that she felt like she was in a Discovery Channel or *Nature* program. The media we have created will continue their educational function well into the future, and we hope that through them people will become better acquainted with prairie streams, their fishes, and their needs, and will contribute to their conservation.

The results of this project illustrate that distributions of the Arkansas darter, and perhaps other prairie species, are poorly known in western Oklahoma, and further exploration of small prairie streams is needed. The biology of the Arkansas darter in such streams also needs investigation. The extent of the invasion of the Red River pupfish in northwestern Oklahoma requires delineating, and investigations into the mechanisms of its establishment in a complex fauna should be

Table 2. Organizations that have received posters describing Traders Creek and its fishes as of 10 June 2003.

Alabaster Caverns State Park (Freedom, OK)
 Ft. Worth Nature Center and Refuge (Ft. Worth, TX)
 Freedom Public School (Freedom, OK)
 High Pointe School (Oklahoma City, OK)
 Langston University, Aquaculture Facility (Langston, OK)
 Langston University, Biology Dept. (Langston, OK)
 Leonardo's Discovery Warehouse (Enid, OK)
 Martin Park Nature Center (Oklahoma City, OK)
 Mooreland High School (Mooreland, OK)
 The Nature Conservancy of Oklahoma (Oklahoma City, OK)
 Todd Crail, NANFA (Toledo, OH)
 Jan Jeffrey Hoover, NANFA (Vicksburg, MS)
 Oklahoma City Zoo, Educational Center (Oklahoma City, OK)
 Oklahoma Dept. of Wildlife Conservation (Oklahoma City, OK)
 Oklahoma State University, Zoology Dept. (Stillwater, OK)
 Physics Dept., Northwestern Okla. State University (Alva, OK)
 Pioneers Museum (Woodward, OK)
 Sam Noble Oklahoma Museum of Natural History (Norman, OK)
 Selman Living Laboratory (Freedom, OK)
 University of Central Oklahoma, Biology Dept. (Edmond, OK)
 U.S. Fish and Wildlife Service, Ecological Services (Tulsa, OK)
 Woodward Middle School (Woodward, OK)

carried out. We hope to involve students in such investigation in the future.

Acknowledgments

We are most grateful to the North American Native Fishes Association for a Corcoran Education Grant to support this work. Ms. Argenia Doss was supported during her participation by an Oklahoma Alliance for Minority Participation internship, and Victor Harris was supported during his participation by a Langston University Biomedical Education Program internship. Paul Barby freely volunteered his help in the field. The Selman Living Laboratory of the University of Central Oklahoma, Betty Selman, James Hepner, and James Gillenwaters provided stream access, and were helpful in the field. Jay Rankin guided us to field sites, and assisted in erecting the sign at SLL. Langston University Physical Plant personnel Larry Kjordy and Randall Warren constructed the sign, and Bill Harris of the Physical Plant assisted in acquisition of materials and supervised the sign construction. Phillip C. Cloud helped to install the sign.

Literature Cited

- Cross, F. B., and R. E. Moss. 1987. Historic changes in fish communities and aquatic habitats in plains streams of Kansas. *In*: Matthews, W. J., and D. C. Heins (Eds). *Community and evolutionary ecology of North American stream fishes*. Norman, Ok.: University of Oklahoma Press.
- Cross, F. B., R. E. Moss, and J. T. Collins. 1985. Assessment of dewatering impacts on stream fisheries in the Arkansas and Cimarron rivers. Report to Kansas Department of Wildlife and Parks, Contract No. 46, Pratt, KS. 161 pp.
- Doss, A. L. N., D. L. McNeely, W. Caire, V. M. Harris, and T. Rider. 2003. *Cyprinodon rubrofluviatilis*, Red River pupfish (Teleostei, Cyprinodontidae) is established in the Cimarron River in Oklahoma. 50th Anniversary Meeting, Southwestern Association of Naturalists.
- Eberle, M. E., and W. J. Stark. 2000. Status of the Arkansas darter in south-central Kansas and adjacent Oklahoma. *Prairie Naturalist* 32 (2): 103-113.
- Echelle, A. A., A. F. Echelle, and F. B. Cross. 1977. First records of *Cyprinodon rubrofluviatilis* from the Colorado and Arkansas River Systems, Texas. *Southwestern Naturalist* 22: 142-143.
- , ———, and L. G. Hill. 1972a. Interspecific interactions and limiting factors of abundance and distribution in the



Fig. 6.

Members of the Oklahoma Native Plant Society examine the newly erected sign at the SLL dormitory complex.
Photograph by David McNeely.

- Red River pupfish, *Cyprinodon rubrofluviatilis*. *American Midland Naturalist* 88: 109-130.
- , C. Hubbs, and A. F. Echelle. 1972b. Developmental rates and tolerances of the red river pupfish, *Cyprinodon rubrofluviatilis*. *Southwestern Naturalist* 17: 55-60.
- , G. E. Luttrell, R. D. Larson, A. V. Zale, W. L. Fisher, and D. M. Leslie, Jr. 1995. Decline of native prairie fishes. In: LaRoe, E. T., G. S. Ferris, C. E. Puckett, P. D. Doran, and M. J. Mac (Eds.). Our living resources, a report to the nation on distribution, abundance, and health of U.S. plants, animals, and ecosystems. U. S. Department of the Interior National Biological Service. <http://biology.usgs.gov/s+t/pdf/Plains.pdf>.
- Gido, K. B., J. F. Schaefer, K. Work, P. W. Lienesch, E. Marsh-Matthews, and W. J. Matthews. 1999. Effects of red shiner (*Cyprinella lutrensis*) on Red River pupfish (*Cyprinodon rubrofluviatilis*). *Southwestern Naturalist* 44: 287-295.
- Harris, V. M., D. L. McNeely, W. Caire, A. L. N. Doss, and T. Rider. 2003. The fishes of Traders Creek, a hardwater tributary of the Cimarron River in Northwestern Oklahoma. 50th Anniversary Meeting, Southwestern Association of Naturalists.
- Kuehne, R. A., and R. W. Barbour. 1983. *The American darters*. Lexington: University Press of Kentucky.
- Martinez, D. 1996. Status survey of the Arkansas darter in eastern Oklahoma. Oklahoma Department of Wildlife Conservation Federal Aid Project E-28. 53 pp.
- McNeely, D. L., W. Caire, A. L. N. Doss, V. M. Harris, and T. Rider. In press. *Cyprinodon rubrofluviatilis*, Red River pupfish (Teleostei, Cyprinodontidae) established in the Cimarron River in Oklahoma. *Southwestern Naturalist*.
- Minckley, W. L. 1979. *Cyprinodon rubrofluviatilis* Fowler Red River pupfish. In: D. S. Lee, et al. *Atlas of North American freshwater fishes*. Raleigh: North Carolina State Museum of Natural History.
- Miller, R. J., and H. W. Robison. 1973. *The fishes of Oklahoma*. Oklahoma State University Museum of Natural and Cultural History. Series No. 1. 246 pp.
- Pigg, J., W. Harrison, and R. Gibbs. 1985. Records of the Arkansas darter, *Etheostoma cragini* Gilbert, in Harper and Beaver counties in Oklahoma. *Proceedings of the Oklahoma Academy of Science* 65: 61-63.
- , R. Gibbs, and G. Cottam. 1997. A record of the Red River pupfish, *Cyprinodon rubrofluviatilis* (Fowler), from the Salt Fork of the Arkansas River in Oklahoma. *Proceedings of the Oklahoma Academy of Science* 77: 122-122.
- , ——, and G. R. Luttrell. 1995. Distribution of the Red River pupfish, *Cyprinodon rubrofluviatilis* Fowler, in the South Canadian River in Texas and Oklahoma. *Proceedings of the Oklahoma Academy of Science* 75: 59-60. 🐟