PRAIRIE LIGHTS

KEEPING THE WORLD LIVABLE FOR THE TOPEKA SHINER AND OTHER NATIVE SPECIES THAT RELY ON PRAIRIE STREAMS

"Looking at a little trickle of water or a puddle in a pasture, you might think, 'There's no way there are fish in there.' "

Mags Edwards

"Looking at a little trickle of water or a puddle in a pasture, you might think, *'There's no way there are fish in there.'* Then you'll pull a net through and it will be full of fish," says MN DNR Nongame Wildlife Program biologist Mags Edwards. The fish are gently sorted by hand and identified: orange-spotted sunfish, bullhead, fathead minnow, central stoneroller, sand shiner, southern redbelly dace and—sometimes—the researchers' intended quarry: Topeka shiner.

A type of minnow, this federally listed endangered species averages three inches in length and tips the scale at 0.18 ounces. It is most easily recognized during the breeding season, when the fins, abdomen and cheeks of males turn bright red-orange. "If you get to the right habitat at the right time, when the males are all colored up, they can shine like a spotlight," says Edwards. Positive identification of males outside of the breeding season, females and juveniles requires a practiced eye.

Topeka shiner
Photo by Andrew Herberg, MN DNR

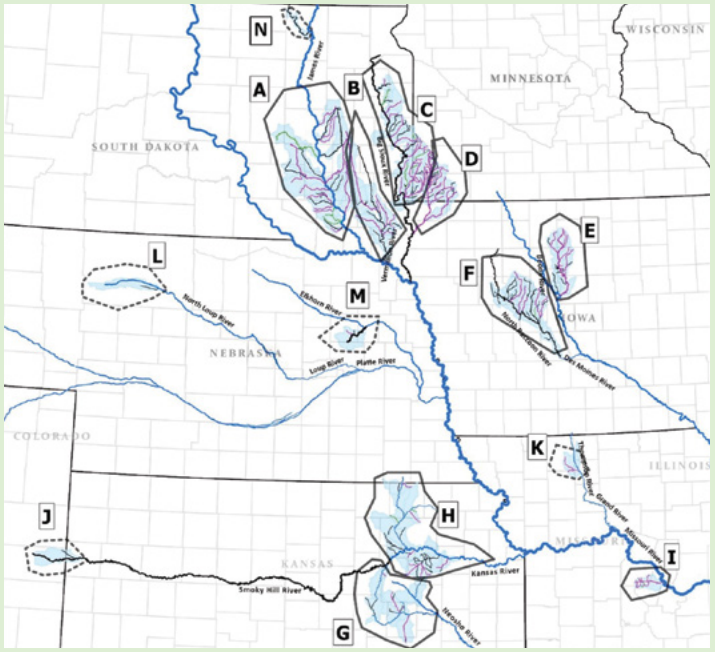
Since 2004, the Nongame Wildlife Program has monitored for the species in the Big Sioux and Rock River drainages, tributaries of the Missouri River in southwestern Minnesota. Field crews sample 20 one-mile stream stretches that are randomly selected each year, within an area designated by the U.S. Fish and Wildlife Service as critical habitat. Other states in the species' historic range (see map) have also monitored for the species.

Sampling work has focused on documenting presence/absence of the species in each assigned stream and assessing watershed values throughout the study area to prioritize sites for restoration.

Crews of two to four go out from late May to early June. Streams are accessed from bridge crossings and, in the case of private lands, with permission of landowners.

Ross Hier

Southwestern Minnesota harbors critical habitat for the Topeka shiner. Historically, this little minnow of prairie streams was widespread and abundant in portions of Iowa, Kansas, Minnesota, Missouri, Nebraska and South Dakota. In 1998, it was federally listed as an endangered species, when its occupied range was thought to have declined by 80%, with most of that loss occurring within the previous 25 years.



Current range of the endangered Topeka shiner. Solid outlined areas (A-I) are the nine population complexes on which the recovery criteria are based. Dotted outlined areas are considered isolated populations and maintain significance for recovery of the species. Map by USFWS (Map from U.S. Fish and Wildlife Service Draft Recovery Plan for Topeka Shiner, *Notropis Topeka*.)

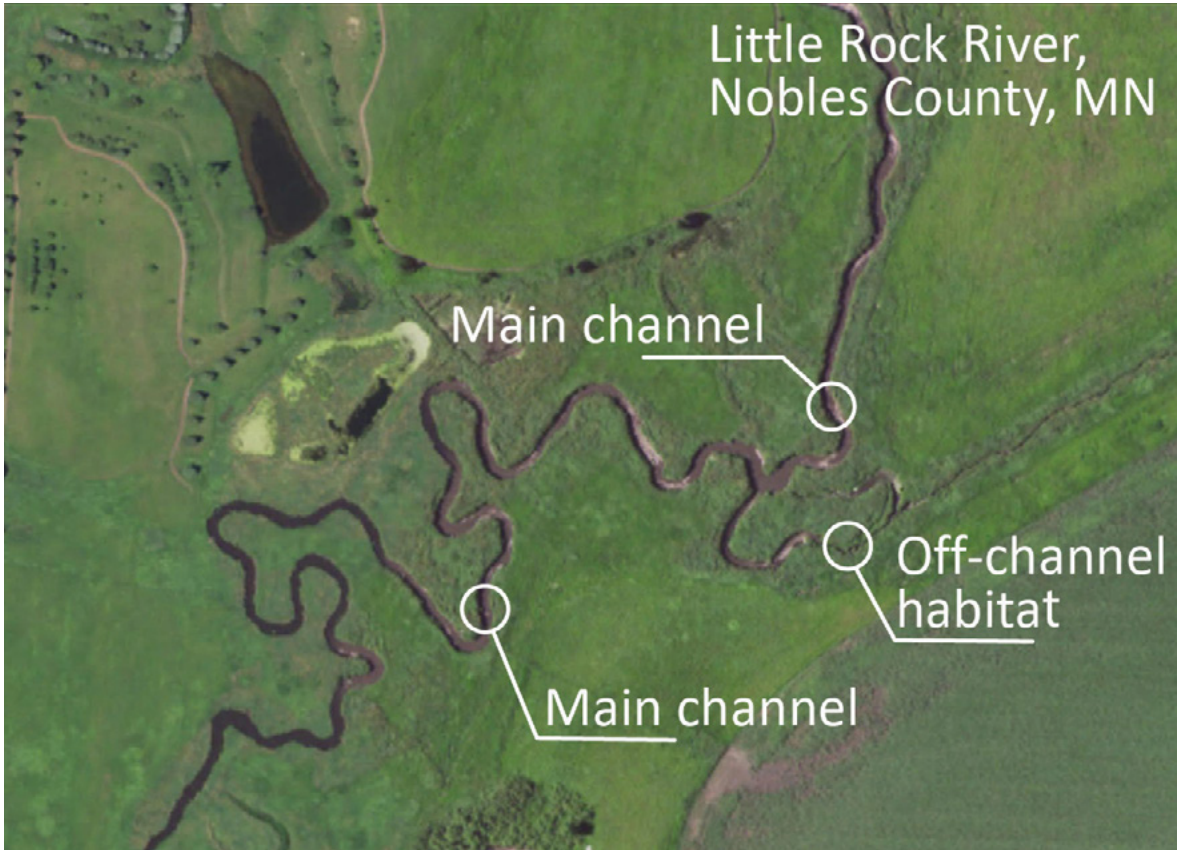
Like Edwards, Nongame Wildlife Program biologist Andrew Herberg has spent many hours in waders drawing hand-held, pole-mounted nets through the water—a method that is only practical for smaller tributaries, the shallower parts of main-stem streams, and pools. Any captured fish are processed and released, then it's on to the next randomly assigned stretch of stream. While the steps are repeated, the work is never routine. Says Herberg, "I wish people recognized the aquatic biodiversity we have in Minnesota—even in these tiny little streams."

One of the truly fascinating things to come out of this work has been the view it offers into the tongue-and-groove relationship between this little fish and its dynamic environment. Topeka shiners have long been known to utilize in-stream pools within the channels of low-velocity, meandering, second-order prairie streams. But in the course of Minnesota's ongoing study, researchers have consistently found the Topeka shiners in seemingly isolated bodies of water as many as 100 meters (greater than 325 feet) inland from streams: in off-channel pools, including oxbow lakes and even murky, waste-laden cattle ponds within the streams' floodplains. "They clearly exist in the streams as well, in order to periodically recolonize these sites," says Edwards, "but we just don't tend to find them there with our current methodology."

A field crew sweeps the sampling net.
Photo by MN DNR

The key is that these off-channel water bodies are not, in fact, isolated. Rather, they are typically fed by groundwater and also replenished by the stream during flood events. These same high-water periods provide opportunity for the Topeka shiners (and other associated species) to disperse between the streams and off-channel pools.

Off-channel aquatic environments are now recognized as important sites for spawning and nursery habitat for this imperiled species in the northern reaches of its range (in particular, Minnesota and Iowa). The fact that the species is still here at all may be due in part to the Topeka shiner's ability to persist—at least for a while—in the high temperature and low dissolved oxygen conditions sometimes associated with these pools.



This Nobles County image of a prairie stream shows Topeka shiner off-channel habitat.

***Oxbows** are the loops in a meandering stream. Crescent-shaped **oxbow-lakes** are created when the stream erodes a shortcut that allows it to bypass and abandon an earlier loop.*

As designed, the monitoring protocols have not generated reliable data on population size. But subjective assessments of the abundance of Topeka shiners relative to other species in those stretches where they've been found have provided opportunity for comparisons between years and an indication of how populations may be trending. An added benefit has been insight into the status of the plains topminnow, a state listed threatened species in Minnesota that utilizes similar habitat.

Minnesota's monitoring work since 2004 has produced interesting—and sometimes startling—findings. For example, observed occupancy in surveyed streams dropped to a low of 30% in 2013 and averaged only 44% in 2010-2014. When averaged over the first 14 years of monitoring (2004-2018), Topeka shiners were present at 66% of surveyed stream stretches in the state. The report, *Topeka Shiner Monitoring in Minnesota: 2019*, prepared by MN DNR biologists Andrew Herberg, Mags Edwards and Melissa Boman concludes, "Overall, our monitoring results indicate that Topeka shiner populations in Minnesota may be relatively stable despite short-term fluctuations in observed occupancy and relative abundance."

While Minnesota and South Dakota are considered to harbor only 20%, in area, of the estimated former range of the species, they stand to play a key role in the fate of the Topeka shiner. A 2018 U.S. Fish and Wildlife Service Status Assessment noted that, "Post-listing, increased survey efforts revealed additional extant populations, particularly in South Dakota and Minnesota, while population losses and/or reductions appear to continue in other states despite listing protections afforded by the Endangered Species Act."

"I wish people recognized the aquatic biodiversity we have in Minnesota—even in these tiny little streams."

ANDREW HERBERG,
Nongame Wildlife Program Biologist

Topeka shiner
Photo by Mags Edwards, MN DNR

Applying What We Know Now

Call in the heavy equipment! It's not the usual rallying cry for restoration. But bulldozers, wrecking balls and front-end loaders are playing a key role in restoring habitat for the Topeka shiner. In an array of projects, channelized and ditched streams have been re-meandered, seasonal connectivity has been re-established between streams and off-channel habitats, and sediment has been excavated from dozens of relic oxbow pools, restoring contact with groundwater. Work has also focused on removal of barriers to fish in streams: stair-steps of "rock riffles" have been built to allow passage over low dams, while other dams have been removed entirely. A wonderful presentation by Windom, Minnesota-based U.S. Fish and Wildlife Service biologist Scott Ralston includes before, during and after images of many restorations (See link, Selected Resources). Among them are a channel shift in Pipestone County's Flandreau Creek that transformed a straight, channelized stream section into a lacework of meanders (see before and after images on page 40), and restoration of a system of oxbow pools associated with Mound Creek in Rock County's Blue Mounds State Park.

Scott Ralston, Fish and Wildlife Biologist
Photo by U.S. Fish and Wildlife Service

Restored oxbows provide habitat for Topeka shiner and associated species.
Photo by Scott Ralston, U.S. Fish and Wildlife Service

Federal funding for the Topeka Shiner Cooperative Recovery Initiative has enabled a host of projects coordinated by the U.S. Fish and Wildlife Service Midwest Region. These cooperative efforts bring together partners at state and county levels, along with landowners. Habitat information gleaned from 14 years of Nongame Wildlife Program surveys has informed the design of these restorations and prioritization of projects. MN DNR contributions have included mapping of stream/floodplain geo-morphology, and LiDAR (Light Detection and Ranging), instrumental in identifying potential project locations. LiDAR reveals relic meanders and oxbows by detecting depressions in the landscape to a degree not possible through interpretation of aerial photography. The good news is that sampling indicates that Topeka shiners are using these restored environments. Ralston cites sampling results from the 2014-2022 period showing roughly 90% of restored oxbows occupied by Topeka shiner, along with 28 other fish species.

Restoration of Flandreau Creek, Rock County, MN. Before (left) and after (right)
Photos by Scott Ralston, U.S. Fish and Wildlife Service

It's the kind of relationship that makes one marvel: a small fish persisting in pools of water in a landscape that is now largely used for cultivation and pasture, whose reproductive success and very existence on the planet are to some extent reliant on seasonal floodwaters that may or may not arrive. The life strategy of utilizing off-channel pools in such a naturally dynamic environment has likely always made Topeka shiner populations vulnerable to variables such as prolonged drought. But climate change, groundwater withdrawals for other uses, chemical run-off, siltation, dams and other widespread alterations to hydrology have further upped the ante for the species.

Nongame Wildlife Program biologist Mags Edwards hopes that, in the future, funding will allow for methodology to better measure abundance. Increased use of eDNA technology—in which a mere sample of water reveals whether the species is present or absent—could make stream surveys more efficient, allowing monitoring work and restorations to extend to likely habitat.

"It's great that our work is contributing to the conservation and recovery of this iconic prairie species," says Edwards. "We recognize that the Topeka shiner's success or failure in Minnesota does not exist in a vacuum. Although it's just one little fish, its struggles to persist represent a common thread for native flora and fauna throughout a changing landscape. The conversion of prairie to cropland and pasture has had profound impacts on our ecosystems as a whole, and the wee Topeka provides us with a lens through which we can interpret and appreciate this change.

"Our efforts to conserve this species will benefit a host of other species that might not be receiving as much attention, such as the plains topminnow and Blanchard's cricket frog, as well as shorebirds and waterfowl, and all the species that evolved as part of the complex, interrelated tableau of the prairie."

"Ideally, a restoration should look like an unaltered stream...like we were never there."

LUTHER AADLAND
(in) *Reconnecting Rivers: Natural Channel design in Dam Removal and Fish Passage*, Minnesota DNR

MN DNR River Ecologist Luther Aadland
Photo by MN DNR

It pays to recall that many of the streams of Minnesota's prairies were initially altered in the interest of improvement. Their flow was regulated, channeled and dammed to serve various purposes, including flood control. As retired MN DNR River Ecologist Luther Aadland relates in the book, *Reconnecting Rivers*, over time, recognition of the impacts of these "improvements" has grown, ranging from channel instability, loss of habitat, impairment of water quality and increases in peak flow. The kinds of restorations undertaken for the Topeka shiner address many of these issues to the benefit of local human communities as well. The re-meandering of streams, for example, has been linked to improved water quality, erosion control and floodwater storage. Topeka shiners and plains topminnows often disappear from streams like Mound Creek upstream of barrier dams. But after the South Dam failed and was later removed and the stream restored, Topeka shiners, plains topminnow and a number of other species returned. It's not so much about turning back the clock as setting the stage for what happens next and thinking carefully about what constitutes an improvement over the long term. Aadland draws from the writings of Ebersole, Frissell and Ralph (see Resources) in defining restoration as "the act of relaxing human constraints on the development of natural patterns of diversity,... identifying and reestablishing the conditions under which natural states create themselves."

Thanks to willing landowners, more oxbow pools now reflect the sky in the southwest corner of Minnesota. In flood seasons, fish will be able to move freely between these pools and nearby prairie streams as they have in years past. There is much that remains to be done. But for now, there are still Topeka shiners growing brighter every spring. And that's no small thing.

"People say, 'Why should I care about Topeka shiners, this little fish that looks like bait?' There's a whole interconnected community of life here in the Prairie Coteau conservation focus area; a community that humans are part of, too. So, if Topeka shiners aren't doing well, that might mean that the rivers and streams or our own water supplies aren't doing well. That's true, but it goes deeper than that. When I was a kid, my parents taught me to be respectful of wildlife: to look at them, love them, learn from them. Statistics have their place, but it's not what makes people care. For that, you can start with wonder."

Nongame Wildlife Program Biologist Lisa Gelvin-Innvaer
Photo by MN DNR

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