Draft Recovery Plan
for the
Topeka Shiner (*Notropis topeka*)

Photo Credit: Bryan Simmons USFWS

August 2019 (Version 3.1)

Approved Kevin E Walsh **Date** 9/19/2019

Regional Director, U.S. Fish and Wildlife Service

DISCLAIMER

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), requires the development of recovery plans for listed species, unless such a plan would not promote the conservation of a particular species. Recovery plans delineate such reasonable actions as may be necessary, based upon the best scientific and commercial data available, for the conservation and survival of listed species. Plans are published by the U.S. Fish and Wildlife Service (USFWS), sometimes prepared with the assistance of recovery teams, contractors, State agencies and others. Recovery plans do not necessarily represent the views, official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director. Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new information, changes in species status, and the completion of recovery actions. Please check for updates or revisions at the website below before using.

Recommended Citation: U.S. Fish and Wildlife Service. 2019. Recovery Plan for the Topeka Shiner (*Notropis topeka*). Draft. March 22, 2019. U.S. Fish and Wildlife Service, Mountain-Prairie Region, Manhattan, Kansas. 21 pages.

This recovery plan can be downloaded free of charge from the U.S. Fish and Wildlife Service website: *https://www.fws.gov/mountain-prairie/es/topekashiner.php*

ACKNOWLEDGEMENTS

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Region 3: Illinois-Iowa ES Field Office, Missouri ES Field Office, Minnesota-Wisconsin ES Field Office, Ecological Services Regional Office

Many great thanks to our Partners who greatly contributed to the completion of the recovery plan:

Richard Baker, Lisa Gelvin-Innvaer, Jane Norris - Minnesota Department of Natural Resources
Steve Schainost, Rick Schneider - Nebraska Game and Parks Commission
George Cunningham - EcoCentrics
John Lott, Chelsey Pasbrig, Dave Lucchesi - South Dakota Department of Game, Fish, and Parks
Mark VanScoyoc, Ryan Waters, Jeff Conley, Jordan Hofmeier, Chris Berens, Keith Sexson - Kansas Department of Wildlife, Parks and Tourism
John Olson - Iowa Department of Natural Resources - retired
Kelly Poole - Iowa Department of Natural Resources
Doug Novinger, Jerry Wiechman, Jacob Westhoff, Kelly Rezac - Missouri Department of Conservation
Dr. Kevin Roe, Dr. Clay Pierce, Alexander Bybel - Iowa State University
Dr. Keith Gido, Sky Hedden, Lindsey Bruckerhoff - Kansas State University
Dr. Jay Hatch - University of Minnesota
Craig Paukert – USGS Missouri Cooperative Research Unit
Scott Campbell – Kansas Biological Survey

I. Introduction

The Topeka Shiner was listed as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq; Act) on December 15, 1998 (63 FR 69008). The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the U.S. Fish and Wildlife Service (USFWS) to develop and implement recovery plans for the conservation of endangered and threatened species.

The USFWS recovery planning process entails developing a Recovery Plan and a Recovery Implementation Strategy (*https://www.fws.gov/endangered/esa-library/pdf/RPI-Feb2017.pdf*). This document provides the draft Recovery Plan for the Topeka Shiner. The plan describes the recovery vision, strategy, and the required elements per section 4(f)(1)(B) of the Act. These elements include:

> (i) A description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species;
>
> (ii) objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and
>
> (iii) estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

The Recovery Implementation Strategy (RIS) is a separate document[1] from the Recovery Plan and is developed in close cooperation with partners. It is an operational plan for stepping down the higher-level recovery actions into specific tasks and specifies where, when, and how those tasks will be accomplished. The specifics of the RIS are updated as new information becomes available through recovery implementation. The RIS will be developed following publication of the final Recovery Plan and will be made available on the USFWS website at that time.

To develop the recovery plan for Topeka Shiner, we conducted a species status assessment (referred to as an SSA) to evaluate the viability of the Topeka Shiner. The assessment entailed first describing the species' taxonomy, natural history, habitats, ecology, and range. Next, we analyzed the individual, population[2], and species requirements, the current condition of the species, and the factors that have led to the species' current condition. We then provided the species' current condition, the state of factors, and their influence on Topeka Shiner numbers and distribution into the future. Lastly, we described potential future viability of the Topeka Shiner under different plausible conservation scenarios to be implemented across its range. We further described how those scenarios might affect the number and distribution of Topeka shiner populations, as well as populations' ability to withstand environmental stochasticity and

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[1] A RIS could be a single strategy covering the entire range of the species or could be multiple strategies geographically based. As explained below, we intend to develop multiple RIS documents for the Topeka Shiner.
[2] Underlined words are defined in glossary.

perturbations, catastrophes, and novel changes in the species' environment. This assessment guided and supports the recovery planning process developed for Topeka Shiner. A summary of the SSA analyses is documented in the Species Status Assessment Report (USFWS 2018; *https://www.fws.gov/mountain-prairie/es/topekashiner.php*)

This recovery plan delineates reasonable criteria for determining when the Topeka Shiner should be considered for reclassification from endangered to threatened or delisted, lists specific actions necessary to meet those criteria, and estimates the cost and timeline for implementing recovery actions. Topeka Shiner experts, including state wildlife representatives, fisheries associates, and others, assisted the Service in drafting ideas. Their expertise was utilized in the creation of the goals and criteria for this plan. The recovery plan includes cursory information on the species biology and status with a brief discussion of factors limiting its populations. A more detailed and comprehensive accounting of these topics can be found in the SSA.

A. **Species Biology**

The following is a brief overview of the natural history of the Topeka Shiner. Please refer to the SSA Report (USFWS 2018) for discussion and a complete list of literature citations.

The Topeka Shiner (*Notropis topeka*) is a small minnow that lives and breeds in pools of low-order prairie streams, oxbows, ponds, and dugouts in the Great Plains states of South Dakota, Minnesota, Nebraska, Iowa, Kansas, and Missouri. Occupied habitats generally have relatively small channels which may flow perennially or intermittently into larger downstream streams or rivers. The species typically occupies pools with varying substrates (i.e., cobble to muck). The Topeka Shiner uses pools with little or no flow that occur either within the stream channel or off-channel. It is generally tolerant of harsh conditions that can occur in these pools (*i.e.* high water temperatures, low dissolved oxygen). Topeka Shiners are small, rapidly maturing, short-lived fishes with early maturation, a protracted spawning strategy, rapid larval growth, and rapid population turnover rates.

Topeka Shiners are broadcast spawners: they release eggs or sperm into the water and fertilization occurs externally. Topeka Shiners do not guard their eggs or larvae. Broadcast spawning without parental protection can result in relatively high egg mortality. Topeka Shiner spawning has been observed in an aquarium setting, captive rearing ponds, and the wild. Topeka Shiner reproduction is also enhanced via the Shiner's relationship with specific co-inhabitants of the prairie streams, namely orange-spotted sunfish *Lepomis humilis* and green sunfish *Lepomis cyanellus*. However, they have been observed to spawn without these co-inhabitants.

Habitat loss, fragmentation, land conversions, and introduction of potential predators are a few of the factors that have impacted Topeka Shiner populations in certain geographic portions of the historic range. The overarching factor most significantly affecting the species is the altered hydrology of prairie streams primarily resulting from land use changes, large numbers of impoundments constructed and physical alterations affecting stream channels. Please refer to the SSA Report (USFWS 2018) for a complete discussion of stressors impacting the species.

B. **Recovery Vision**

The recovery vision for the Topeka Shiner is to have multiple resilient groups of populations (also known as population complexes) distributed across the species' range. Population complexes should encompass adequate geographic and genetic diversity of the species to shield it from extirpation by catastrophic events and preserve adaptive potential. Multiple resilient populations must exist in sufficient numbers, in suitable habitats, within adequate proximity, and with appropriate connectivity to allow for recolonization to support persistence of Population Complexes and isolated populations. Population complexes must also contain adequate refugia to shield the species from stochastic events and ongoing threats, such as altered hydrology, fragmentation, and other stressors.

C. **Recovery Strategy**

The primary strategy for recovery of the Topeka Shiner is to:

1. Engage all conservation partners to collaborate, coordinate and implement recovery actions. Recovery will require the cooperation and dedication of natural resource managers, conservationists, ranchers, farmers, agencies, and those with expertise needed to design and evaluate the effects of recovery actions on the species. This will require clear communication about the species' needs, where it occurs, its conservation challenges, and the potential implications and locations of recovery actions. It will be critical to ensure that recovery goals are met in a manner that is in concert with the missions, objectives, and aspirations of our conservation partners.

2. Conserve adaptive capacity and ecological diversity of the species. The Population Complexes are the surrogates for the ecologic, geographic, genetic diversity, and adaptive capacity across the range. The recovery strategy includes the restoration of gene flow between populations, to the extent possible, by designing and implementing actions that emphasize conservation of genetic diversity within the Population Complexes and isolated populations when the opportunity is presented.

3. Fully quantify and/or qualify population demographics and status within each of nine Population Complexes.

4. Improve population size and viability within each of nine Population Complexes. The Population Complexes are critical for the long-term persistence of the species and provide unique opportunities for restoration of landscape-level ecological processes (i.e., floodplain connectivity) that formerly benefited the species throughout its large historical range.

5. Eliminate threats having the greatest adverse effect on the species within the nine Population Complexes (e.g., habitat degradation and fragmentation, altered hydrology, contaminants, channel stabilization, water diversion, impoundments, agricultural practices, predator removal).

6. Employ a rigorous adaptive management and monitoring framework for implementing recovery that will allow for better and sustainable management for suitable habitat conditions,

protection against wide-ranging and simultaneous population declines due to environmental stochasticity and catastrophes, and responsiveness to adverse effects of climate change.

7. Emphasize land and water stewardship practices that offer the best conservation benefit for the species within each of the nine Population Complexes.

8. Maximize conservation opportunities, such as reintroduction and habitat restoration, with isolated population (please refer to Figure 1).

9. Use captive propagation (i.e., use of ponds and hatcheries) in population complexes and isolated populations to prevent local extirpation where recruitment failure is occurring and for reintroduction within watersheds, given quality habitat exists, with current and/or recent declines or extirpations. Critical to this endeavor is to understand the threats facing the species and instituting mechanisms to ameliorate the sources of such threats.

10. Periodic updates to the SSA and resiliency model as warranted as new data and information becomes available.

II. Recovery Criteria

Recovery criteria provide objective, measurable thresholds for achieving the recovery vision. The recovery criteria were developed to delist the Topeka Shiner when full implementation of the recovery actions occurs and data support that the species has responded to the actions in ways that meet the established recovery criteria. Prior to the introduction of the Recovery Criteria we define Representation, Redundancy and Resiliency, collectively known as the "3Rs", of which are the conservation biology principles to evaluate the current and future conditions of the species.

Representation - Representation is defined as the ability of a species to adapt to changing environmental conditions. Representation can be measured through the breadth of genetic diversity within and among populations and the ecological diversity (also called environmental variation or diversity) of populations across the species' range. The more representation a species has, the more it is capable of adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity information we evaluate representation based on the extent and variability of habitat characteristics within the Topeka Shiner's geographic range (USFWS 2018).

Redundancy - Redundancy is defined as the ability of a species to withstand catastrophic events: rare destructive natural events or episodes involving many populations and occurring suddenly/unexpectedly. Redundancy is about spreading the risk and can be measured through the duplication and distribution of resilient populations across the range of the species. The greater the number of resilient Topeka Shiner populations distributed over a larger landscape, the better able it can withstand catastrophic events (USFWS 2018).

Resiliency - Resiliency is defined as the ability of the species to withstand stochastic events (arising from random factors). We can measure Topeka Shiner resiliency based on metrics of population health, for example, birth versus death rates (i.e., population growth rate), and

population size. Healthy populations are more resilient and better able to withstand stochastic disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities (USFWS 2018).

Criteria:

1. **Representation**: The purpose of this criterion is to maintain the species across a broad portion of its current ecological settings to preserve future adaptive capacity and potential.

> Maintain nine Population Complexes with documented persistence (Population Complexes A through I in Figure 1; however, newly discovered/created Population Complex(s) could count towards the nine if they meet the definition of a Population Complex and have documented persistence).

2. **Redundancy**: The purpose of this criterion is to maintain, increase, and expand populations in currently known occupied habitats to ensure species persistence by mitigating catastrophic events.

> Each of the nine Population Complexes counting towards Criterion 1 must have at least 50-70%[3] of the next lower occupied stream orders (either Hydrologic Unit Code (HUC) 10s or 12s depending on the Population Complex; USFWS 2018) within them confirmed as persistent.

3. **Resiliency**: The purpose of this criterion is to increase the ability of populations in currently known occupied habitats to resist impacts of stochastic events and persist long-term.

> Each of the streams counting towards the 50-70% in Criterion 2 must have at least two separate[4] lower level occupied streams/sites within the continuum of those watersheds confirmed as persistent.

4. **Conservation Plans:** The purpose of this criterion is to ensure future maintenance of Topeka shiner populations.

> Management plans are in place for each of nine Population Complexes or by state, to ensure their future maintenance, as well as that of the populations/sub-populations within them. To meet recovery criteria, the plans will need to be actively implemented, provide guidelines on documenting success on reducing threats, and demonstrate long-term commitment by the agencies thereby ensuring representation, redundancy and resiliency are met.

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[3] The specific percentage of next lower occupied stream orders confirmed as persistent for each complex depends on the characteristics of that complex, and will likely vary among complexes. The percentage for each individual population complex will be determined in the Recovery Implementation Strategy.

[4] The lower level occupied streams should be separated at a distance such that both will not be impacted by a single event (e.g., ammonia spill from concentrated animal feeding operations).

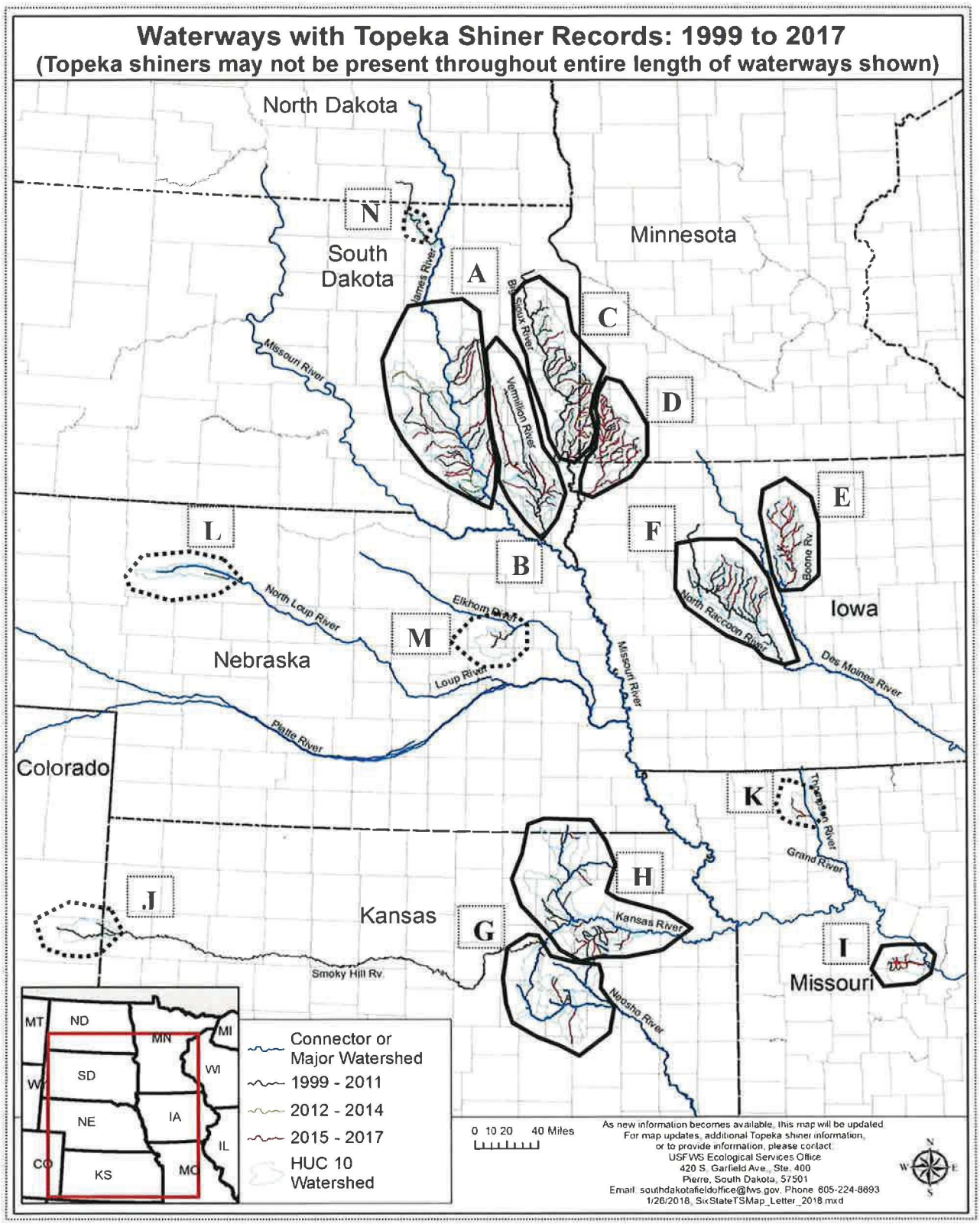

Figure 1. Current range of the endangered Topeka Shiner. Solid outlined areas (A-I) are the nine population complexes for which the recovery criteria are based. Dotted outlined areas are considered isolated populations and maintain significance for recovery of the species. A - James River; B - Vermillion River; C - Big Sioux River; D - Rock River; E - Boone/Des Moines Rivers; F - North Raccoon River; G - Cottonwood River; H - Kansas River; I -

Moniteau Creek; J - Upper Smoky Hill River; K - Sugar Creek; L - North Loup River; M - Elkhorn River; N - Elm River.

III. Recovery Actions

This section describes the broad categories and, in some cases, specific actions that if implemented will contribute to meeting the four recovery criteria outlined in the previous section. To achieve the recovery vision for the Topeka Shiner, the following categories and actions may apply to Population Complexes. Specific implementation may differ geographically (specific tasks will be population-specific). Therefore, specific recovery actions may only be warranted for one or more specific Population Complexes and not necessary range wide. The recovery actions put forth should be considered dynamic and flexible in implementation. These broad categories and actions will be used to develop step-down, geographically-prioritized recovery implementation strategies, which will be developed in coordination with our conservation partners and updated on a continuing basis.

1. Habitat Protection, Management and Restoration - Implement actions to protect, maintain and restore habitat quality and quantity sufficient to achieve and sustain recovery criteria. These actions can be achieved by collaborative planning and prioritizing actions within priority areas that include contingencies for threats and catastrophes. Habitat protection can be maintained through a combination of various mechanisms such as acquisitions, long-term easements, short-term conservation programs, cooperative agreements, and incentives provided through conservation agencies and sustainable organizations. Habitat restoration will provide buffers from threats and act as potential dispersal corridors. Recovery actions will be detailed in the RIS given the specific geographic location in the species range and input from respective state partners. Examples of recovery actions include:

1. Oxbow restoration, riparian and instream restoration, fish passage, and floodplain connectivity at various spatial scales.

2. Creation of riparian buffers to improve water quality through filtration of runoff, improve channel stability, reduce streambank erosion, and enhance habitat diversity.

3. Cattle exclusion from streams and oxbows to improve water quality, improve bank stability, and protect riparian areas.

4. Mitigation of the effects of confined animal feeding operations, smaller feedlots, and overall nutrient reduction.

5. Improve groundwater management and conservation, where applicable by working with groundwater management districts to reduce rates of groundwater depletion and impacts to natural stream flows.

6. Limit the effects of agricultural land uses not conducive to high quality Topeka Shiner habitat, for example production and overgrazing on highly erodible lands, tilling, pond development, overgrazing, eutrophication, and tiling.

7. Removal of man-made structures such as perched culverts or dams which act as barriers to movement of aquatic organisms and materials, significantly alter natural hydrology, or create aquatic habitat that promotes larger predator species.

8. Installations of stream crossings which allow for fish passage, provide grade control for the stream channel, and facilitate responsible land management.

9. Mitigating or eliminating instream gravel mining where applicable.

10. Easements, fee title, mitigation banks, and land acquisition.

2. Population Management, Augmentation, Translocations and Reintroductions - In coordination with partners, develop and implement strategies for population management that is successful to meet the recovery criteria. This may include conservation propagation methods such as augmentation, enhancement, translocation, and reintroductions. After a thorough science assessment, determine locations where augmentation, translocation and reintroduction may be appropriate and coordinate with partners for proper execution. This includes surveys, coordination, and monitoring.

1. Augment or reintroduce populations in states such as Missouri, Kansas, and Nebraska that have small, isolated populations by ensuring that suitable habitat conditions exist.

2. Inventory unoccupied, suitable prairie streams within the species' range for species status updates and potential reintroductions or other recovery efforts.

3. Develop genetic management plans for reintroductions and augmentations.

4. Explore opportunities to conserve genetically unique populations, especially with small isolated complexes or populations, by using other management approaches (i.e., the use of ponds to harbor populations).

5. Develop and implement conservation tools such as Section 10(j) of the Endangered Species Act, Safe Harbor Agreements and the States' Section 6 (i.e., management and cooperative agreements and allocation of funds).

3. Monitoring - It is also critical that Federal, State, and non-government partners are tracking the effects (positive and negative) of their actions in the field through population and habitat monitoring. This entails developing standardized protocols, increased monitoring at the watershed scale, of which includes extant and new sites, conducting appropriate surveys at potential new sites, and improved data sharing among partners.

1. Partners in each state will establish a standardized survey and monitoring protocol to assess and track progress. The sampling design should at a minimum provide estimates of occupancy and detection probabilities with associated error. The USFWS will work with state partners to establish a standardized survey and monitoring protocol.

2. When significant stochastic events occur, partners will assess the impact on habitat conditions and populations, and determine how the change affects recovery of a population (i.e., implementation of recovery actions). Implement adaptive management when necessary.

3. Annually report: USFWS species leads report to each other.
   a. Call between field office species leads to share new data and information, adaptive management strategies, partner's issues and concerns.
   b. Bi-Region Species Lead (Kansas) report out to Recovery Team.

4. Research - Conduct critical research projects, using a rigorous adaptive management framework, that prioritize and optimize recovery actions. Needs include:

1. Fish passage obstruction inventory and prioritization schema for removal or retrofitting.

2. Additional sampling to explore genetic diversity for the purpose of reintroductions and augmentations.

3. Sample for eDNA for the purpose of population and distribution monitoring.

4. Determine Topeka Shiner movement rates and extent to inform population management and guide restoration, and mitigation efforts.

5. Describe impacts of climate change on hydrologic characteristics of streams across the range of Topeka Shiners and consider consequences for reaching recovery goals for fish populations and habitat.

6. Describe impacts of agriculturally-related changes to hydrology and water quality (e.g., tile draining, chemical runoff) in Topeka Shiners streams, species community, habitat response, and options for mitigation.

7. Research the effects of predatory fish on Topeka Shiners and the fish community as a whole relative to reproduction, recruitment, habitat use, movement, foraging, competition, and environmental conditions such as drought.

8. Investigate historical predator distributions and associated diversity at large and small spatial scales and to assess cumulative effects of predator interactions with the Topeka Shiner within watersheds.

9. Investigate the effects of drainage development and anthropogenic hydrological alterations on the suitability of in-stream and off-channel Topeka Shiner habitat.

5. Collaboration - The collaboration of Federal, State and non-government partners is critical in meeting the recovery criteria.

1. USFWS field offices engage and share information with their state partners on a regular basis and work together in the field on surveys, recovery actions, and monitoring of those recovery actions.

2. Work with Federal partners (i.e., Natural Resources Conservation Service and Wildlife Services) to develop conservation conditions and protections for Topeka Shiner in programmatic agreements.

3. Integrate existing state and non-governmental organization (NGO) recovery plans and programs to assist with recovery objectives.

4. USFWS field offices agree upon recovery permit criteria that will be used to assess the qualifications of applicants actively seeking a recovery permit.

5. Involve specific NGO conservation groups that can efficiently and effectively contribute to recovery actions. This could include funding, labor, materials, technical and legal assistance, public relations, or educational contributions. NGOs may be particularly beneficial when working with private lands.

6. Engage the Partners for Fish and Wildlife program regarding projects on private lands that could benefit landowners and at the same time implement recovery actions.

6. Education and Outreach - Develop and foster partnerships to support the conservation of the Topeka Shiner while seeking to understand stakeholders' interests. Work with our partners to improve awareness of the Topeka Shiner and its habitat and provide technical assistance and incentives to private landowners, land managers, and other parties to conserve the species and its aquatic habitat while allowing for continued operation of appropriate activities.

1. Promote management practices and programs (e.g., Conservation Reserve Program, Environmental Quality Incentive Program) that improve both stream health and land management, plus sustain profitability of agricultural lands and ranching operations.

2. Increase and improve collaboration with existing and future watershed projects and initiatives while incorporating continued operations (e.g., agricultural water use, flood attenuation).

3. Inform private landowners and associations of opportunities available regarding safe harbor, Section 10(j), and other agreements.

II. Estimated Time and Costs to Achieve Recovery

The estimates of the time needed to implement recovery actions are a guide for meeting the recovery goals, objectives, and criteria discussed in this plan. The initiation and completion of recovery actions are subject to the availability of funds, as well as other constraints affecting the parties involved. The total cost of recovery stated in this plan is only an estimate and may change substantially as efforts to recover the species continue. Thus, detailed cost breakdowns for each conservation unit with expected annual costs are not known at this time. While we have

the statutory responsibility for developing and implementing this recovery plan, recovery of Topeka Shiner across a large portion of the species' historical range will necessitate the involvement of Federal, Tribal, State, private, and local interests. The continued expertise and contributions of these, and additional agencies and interested parties, is needed to implement the recovery actions identified in this plan. To enhance the effectiveness of this recovery plan, we intend to develop and adopt a Recovery Implementation Strategy (RIS) as a flexible way to update and revise recovery activities as needed.

We anticipate that recovery of the Topeka Shiner could be achieved within 10-30 years with a well-coordinated and collaborative effort, however, this is just an estimate and the timeframe will vary due to the widespread threats, uncertainty about cost/benefit trade-offs to the species from management techniques, likely availability of funds, as well as biological characteristics of the species. If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, recovery criteria for delisting could be achieved in a shorter timeframe. The costs calculated here are estimates and are only extended to ten years of recovery implementation. The time estimate will be refined with the development of the RIS. The total cost of recovery over 10 years is estimated to cost between $17,255,000 and $30,635,000.

Figure 2 – Estimated cost of the draft recovery actions listed above.

ESTIMATED COST DETAIL (Not to exceed 10 years)					
RECOVERY ACTION	**POTENTIAL PARTNERS**	**ESTIMATED COST/YEAR**	**ESTIMATED TIME (YEARS)**	**TOTAL COST**	**PRIORITY**
1.0 Habitat Protection, Management and Restoration					
1.1 Oxbow restoration, riparian and instream restoration, fish passage and floodplain connectivity at various spatial scales.	USFWS, state partners, private landowners, NGOs, DOT, counties, USDA, COE, mitigation bank sponsors	$500,000 – 700,000	10	$5,000,000 -7,000,000	1
1.2 Creation of riparian buffers to improve water quality through filtration of runoff, improve channel stability, reduce streambank erosion,	USFWS, state partners, private landowners, NGOs, USDA, COE, mitigation bank sponsors	$200,000 – 500,000	10	$2,000,000 – 5,000,000	1

and enhance habitat diversity.					
1.4 Mitigation of the effects of confined animal feeding operations, smaller feedlots and overall nutrient reduction.	USFWS, state partners, private landowners, DEQs USDA	$100,000 – 300,000	3	$300,000 – 900,000	2
1.6 Limit the effects of agricultural land uses not conducive to high quality Topeka Shiner habitat, for example production and overgrazing on highly erodible lands, pond development, overgrazing, eutrophication and tiling.	USFWS, NRCS, state partners, private landowners,	$100,000 – 300,000	5	$500,000-1,500,000	2
1.7 Removal of man-made structures such as perched culverts or dams which act as barriers to movement of aquatic organisms and materials, significantly alter natural hydrology, or create aquatic habitat that promotes larger predator species.	USFWS, state partners, private landowners, NGOs, DOT, watershed districts, counties, USDA, COE, mitigation bank sponsors	$500,000 – 700,000	10	$5,000,000-7,000,000	1
1.8 Installations of stream crossings which allow for fish passage, provide grade control for the stream channel, and facilitate responsible land management.	USFWS, state partners, private landowners, NGOs, DOT, watershed districts, counties, USDA, COE, mitigation bank sponsors	$100,000 – 300,000	10	$1,000,000 – 3,000,000	1

1.9 Mitigating or eliminating instream gravel mining where applicable.	USFWS, state partners, counties, COE	$15,000 – 45,000	5	$75,000 – 225,000	1
2.0 Population Management, Augmentation, Translocations and Reintroductions					
2.1 Establish new populations in states such as Missouri, Kansas and Nebraska that have small, isolated populations by ensuring that suitable habitat conditions exist.	USFWS, state partners, private landowners, NGOs	$50,000-75,000	10	$500,000 – 750,000	2
2.2 Inventory unoccupied, suitable prairie streams within the species' range for species status updates and potential reintroductions or other recovery efforts.	USFWS, state partners, private landowners	$10,000 – 30,000	3	$30,000 – 90,000	2
2.3 Develop genetic management plans for reintroductions and augmentations.	USFWS, state partners, NGOs, USGS, academia	$50,000 – 75,000	2	$100,000 – 150,000	3
2.4 Develop and implement conservation tools such as Section 10(j) of the Endangered Species Act, Safe Harbor Agreements and the States' Section 6 (i.e., management and cooperative agreements and allocation of funds).	USFWS, state partners, private landowners, NGOs	$100,000 – 300,000	3	$300,000 – 900,000	1

2.5 Explore opportunities to conserve genetically unique populations, especially with small isolated complexes or populations, by using other management approaches (i.e., the use of ponds to harbor populations).	USFWS, state partners, NGOs, USGS, academia	$50,000 – 75,000	2	$100,000 – 150,000	3
3.0 Monitoring					
3.1 Partners in each state will establish a standardized survey and monitoring protocol to assess and track progress. Implementation will provide estimates of occupancy and detection probabilities with associated error.	USFWS, state partners, academia, USGS	$70,000 – 100,000	10	$700,00 – 1,000,000	1
3.2 When significant stochastic events occur, partners will assess the impact on habitat conditions and populations, and determine how the change affects recovery of a population (i.e., implementation of recovery actions). Implement adaptive management when necessary.	USFWS, state partners, academia, USGS	$70,000 – 100,000k	NA	NA	1
3.3 Annually report: USFWS species leads report to each other.	USFWS, state partners	$25,000 – 50,000	10	$250,000 – 500,000	1
a. Call between field office species leads.					
b. Bi-Region Species Lead (Kansas) report out to Recovery Team.					

4.0 Research					
4.1 Fish passage obstruction inventory.	USFWS, state partners, academia, USGS	$30,000 – 50,000	3	$90,000 – 150,000	1
4.2 Additional sampling to explore genetic diversity for the purpose of reintroductions and augmentations.	USFWS, state partners, academia, USGS	$10,000 – 30,000	3	$30,000 – 90,000	3
4.3 Sample for eDNA for the purpose of population and distribution monitoring.	USFWS, state partners, academia, USGS	$10,000 – 25,000	2	$20,000 – 50,000	3
4.4 Determine Topeka Shiner movement rates and extent to inform population management and guide restoration, and mitigation efforts.	USFWS, state partners, academia, USGS	$30,000 – 50,000	3	$90,000 – 150,000	2
4.5 Describe impacts of climate change on hydrologic characteristics of streams across the range of Topeka Shiners and consider consequences for reaching recovery goals for fish populations and habitat.	USFWS, state partners, academia, USGS	$30,000 – 50,000	3	$90,000 – 150,000	2
4.6 Describe impacts of agriculturally-related changes to hydrology and water quality (e.g., tile draining, chemical runoff) in Topeka Shiners streams, species community, habitat response, and options for mitigation.	USFWS, state partners, academia, USGS	$50,000 – 75,000	3	$150,000 – 225,000	2

4.7 Effects of predatory fish on Topeka Shiners and the fish community as a whole relative to reproduction, recruitment, habitat use, movement, foraging, competition, and environmental conditions such as drought.	USFWS, state partners, academia, USGS	$30,000 – 50,000	3	$90,000 – 150,000	2
4.8 Investigate historical predator distributions and associated diversity at large and small spatial scales and to assess cumulative effects of predator interactions with the Topeka Shiner within watersheds.	USFWS, state partners, academia, USGS	$30,000 – 50,000	3	$90,000 – 150,000	2
4.9 The effects of drainage development and anthropogenic hydrological alterations on the suitability of in-stream and off-channel Topeka Shiner habitat.	USFWS, state partners, academia, USGS	$50,000 – 75,000	3	$150,000 – 225,000	2
5.0 Collaboration					
5.1 USFWS field offices engage and share information with their state partners on a regular basis and work together in the field on surveys, recovery actions, and monitoring of those recovery actions.	USFWS, state partners, private landowners, academia, USGS	$15,000 – 30,000	10	$150,000 – 300,000	1

5.2 Work with Federal partners to develop conservation conditions and protections for Topeka Shiner in programmatic agreements.	USFWS, NRCS, FSA, USGS, COE, FHWA	$30,000 – 50,000	5	$150,000 – 250,000	2
5.3 Integrate existing state and non-governmental organization (NGO) recovery plans and programs to assist with recovery objectives.	USFWS, state partners, NGO	$20,000 – 40,000k	2	$40,000 – 80,000	1
6.0 Education and Outreach					
6.1 Promote management practices and programs (e.g., Conservation Reserve Program, Environmental Quality Incentive Program, Conservation Stewardship Program) that improve both stream health and land management, plus sustain profit ability of agricultural lands and ranching operations.	USFWS, state partners, NGOs, USDA, FSA, academia, county extensions	$15,000 – 25,000	2	$30,000 – 50,000	2
6.2 Inform private landowners and associations of opportunities available regarding safe harbor, Section 10(j) and other agreements.	USFWS, state partners, NGOs	$15,000 – 25,000	2	$30,000 – 50,000	1

6.3 Improve groundwater management and conservation, where applicable by working with groundwater management districts to reduce rates of groundwater depletion and impacts to natural stream flows.	state partners, private landowners, NGOs, counties, USDA, academia, USGS, GMDs	$100,000 – 200,000	2	$200,00 – 400,00	2

Figure 3 – Summary cost table by action category.

TOTAL ESTIMATED COST BY ACTION (NOT TO EXCEED 10 YEARS)		
RECOVERY ACTION	**COSTS /YEAR**	**TOTAL COST (NOT TO EXCEED 10 YEARS)**
1.0 Habitat Protection, Management and Restoration	$1,515,000 to 2,845,000	$13,875,000 to 24,625,000
2.0 Population Management, Augmentation, Translocations and Reintroductions	$260,000 to 555,000	$1,030,000 to 2,040,000
3.0 Monitoring	$165,000 to 250,000	$950,000 to 1,500,000
4.0 Research	$270,000 to 455,000	$800,000 to 1,340,000
5.0 Collaboration	$65,000 to 120,000	$340,000 to 630,000
6.0 Education and Outreach	$130,000 to 250,000	$260,000 to 500,000
TOTAL	$2,405,000 to 4,475,000	$17,255,000 to 30,635,000

Figure 4 – Summary cost table by priority category.

TOTAL ESTIMATED COST BY PRIORITY	
Priority 1	$14,635,000 to 25,205,000
Priority 2	$2,370,000 to 4,990,000
Priority 3	$250,000 to 440,000
TOTAL	$17,225,000 to 30,635,000

References:

USFWS. 2018. Species Status Assessment report for Topeka Shiner (*Notropis topeka*). (Version 1.0). U.S. Fish and Wildlife Service, Region 6, Denver, CO. 281 p.

Glossary

Dugout - Small, water storage reservoirs usually created by excavation that serve as a collection basin for rainfall and snowmelt in areas that typically do not have groundwater available or surface water that is poor quality.

Hydrologic Unit Code (HUC) - Every hydrologic unit is identified by a unique HUC consisting of 2 to 12 digits based on the levels of classification in the hydrologic unit system. A hydrologic unit describes the area of land upstream from a specific point on the stream (generally the mouth or outlet) that contributes surface water runoff directly to this outlet point. Another term for this concept is drainage area. It is delineated by starting at a designated outlet point (usually the river mouth) and proceeding to follow the highest elevation of land that divides the direction of surface water flow (usually referred to as the ridge line). This boundary will follow the basin ridges until connected back at the outlet point. A larger numbered HUC is referring to a smaller stream in the drainage area.

Persistence/Persistent - At least two detections over time, one of which must be within 3 years prior to a delisting decision, and one detection prior to that 3-year period. Two detections over time would suggest that there is a persistent population in the stream. Requiring one detection to

be within 3 years prior to a delisting decision gives confidence that the species is occupying the stream currently. The 3-year period is based on the average lifespan of the Topeka Shiner in its natural environment.

Population - The number of organisms of the same species that live in a particular geographic area at the same time, with the capability of interbreeding.

Population Complexes - Groups of Topeka Shiner populations/sub-populations (within HUC 10s/12s) identified since 1999 that are unlikely to have connectivity with other population complexes, but have the potential for, population connections within them, at an unknown rate or time scale. Conserving multiple complexes throughout the range of the species captures a wide diversity of ecological settings and genetic diversity for preserving adaptive capacity of this species into the future. We consider A-I in Figure 1 to be Topeka Shiner Population Complexes for the purposes of this recovery plan. Other groups of Topeka Shiners (J-M) are considered Isolated Populations.