Sharpnose Shiner and Smalleye Shiner
(Notropis oxyrhynchus and *N. buccula)*

5-Year Review:
Summary and Evaluation

Photo: Salt Fork Brazos River, USFWS.

U.S. Fish and Wildlife Service
Arlington Ecological Services Field Office
Arlington, Texas
August 2021

5-YEAR REVIEW

Species reviewed: Sharpnose Shiner and Smalleye Shiner (*Notropis oxyrhynchus* and *N. buccula*)

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1.0 GENERAL INFORMATION

Sharpnose shiner (*Notropis oxyrhynchus*) and smalleye shiner (*Notropis buccula*) (shiners) are small minnows endemic to Texas. The sharpnose shiner is endemic to the Brazos River, Red River, and Colorado River basins whose headwaters lie within the semi-arid High Plains ecoregion. The smalleye shiner is a minnow endemic to the Brazos River only. Both species are currently restricted almost entirely to the contiguous river segments of the upper Brazos River basin in north-central Texas. The two fishes have been of conservation concern since 1982 (47 FR 58454) and in 2014, both were listed as endangered with critical habitat designations under the Endangered Species Act of 1973, as amended (Act).

The U.S. Fish and Wildlife Service (Service) initiated a review of the sharpnose and smalleye shiner in 2019 to address any new information on the species' distribution, status and threats since its listing in 2014. Prior to initiation of the 5-year review, the Service began revisions/updates to the original Species Status Assessment (SSA) that would facilitate development of a draft recovery plan, as well as provide the information necessary to complete the 5-year review. The SSA framework is intended to be an in-depth, all-inclusive review of the species' biology and threats to evaluate its biological status based on whether the species has the resources and conditions it needs to maintain long-term viability. Using the SSA framework, we describe these species' viability in terms of their resiliency, redundancy, and representation.

1.1 Listing History

Species: Sharpnose shiner and smalleye shiner *(Notropis oxyrhynchus* and *N. buccula)*

Date listed: August 4, 2014

FR citation(s): 79 FR 45274

Classification: Endangered

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: Critical habitat 79 FR 45242

1.2 Methodology used to complete the review:

In accordance with section 4(c)(2) of the Act, the purpose of a 5-year review is to assess each endangered species and threatened species to determine whether its status has changed and it should be classified differently or removed from the Lists of Endangered and Threatened Wildlife and Plants. The Service evaluated the biological status of the

sharpnose and smalleye shiner as part of the *Species Status Assessment Report for the Sharpnose Shiner (Notropis oxyrhynchus) and Smalleye Shiner (N. buccula) Version 2* (USFWS 2018; hereafter, SSA Report). The SSA Report is used to inform this 5-year review.

The original SSA Report (USFWS 2014) was revised by a Service technical team based on the best available information. We developed five future scenarios that represent reasonable conditions affecting the viability of the species. The revised SSA Report was independently peer reviewed. Peer reviewers were selected on the basis of having expertise on the species and their life history needs.

1.3 FR Notice citation announcing the species is under active review:

Endangered and Threatened Wildlife and Plants; Initiation of 5-year Status Reviews of 36 Species in Arizona, New Mexico, Texas, Utah, and Mexico, July 26, 2019, 84 FR 36113.

2.0 REVIEW ANALYSIS

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" due to any of the five factors described below.

The identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In assessing whether a species meets either definition, we must evaluate all identified threats by considering the expected response of the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Service recommends whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

2.1 Updated Information and Current Species Status

The SSA Report provides a comprehensive biological status review for the sharpnose and smalleye shiner. A range of conditions that characterize the species' current and future viability were evaluated based on the species' resiliency, redundancy, and representation. Relevant portions of the results of the SSA are referenced or presented below.

2.1.1 Biology and Habitat:

The sharpnose and smalleye shiner currently occupy wide, sandy bottom reaches of the upper Brazos River (Figure 1). They are generalist feeders, eating mostly invertebrates, with a lifespan of less than three years. Both species need resilient populations widely distributed across their range to maintain persistence into the future and avoid extinction. A number of factors influence whether sharpnose and smalleye shiner populations will continue to persist or grow to maximize habitat occupancy and abundance, which increases the resiliency of a population to stochastic events. These factors include (1) wide river channels with diverse habitats including shallow runs, pools, etc., (2) flowing water of sufficient quantity and quality to meet life history and habitat needs, (3) sandy substrates for foraging, and (4) an unobstructed stream reach of sufficient distance to support a successfully reproductive population.

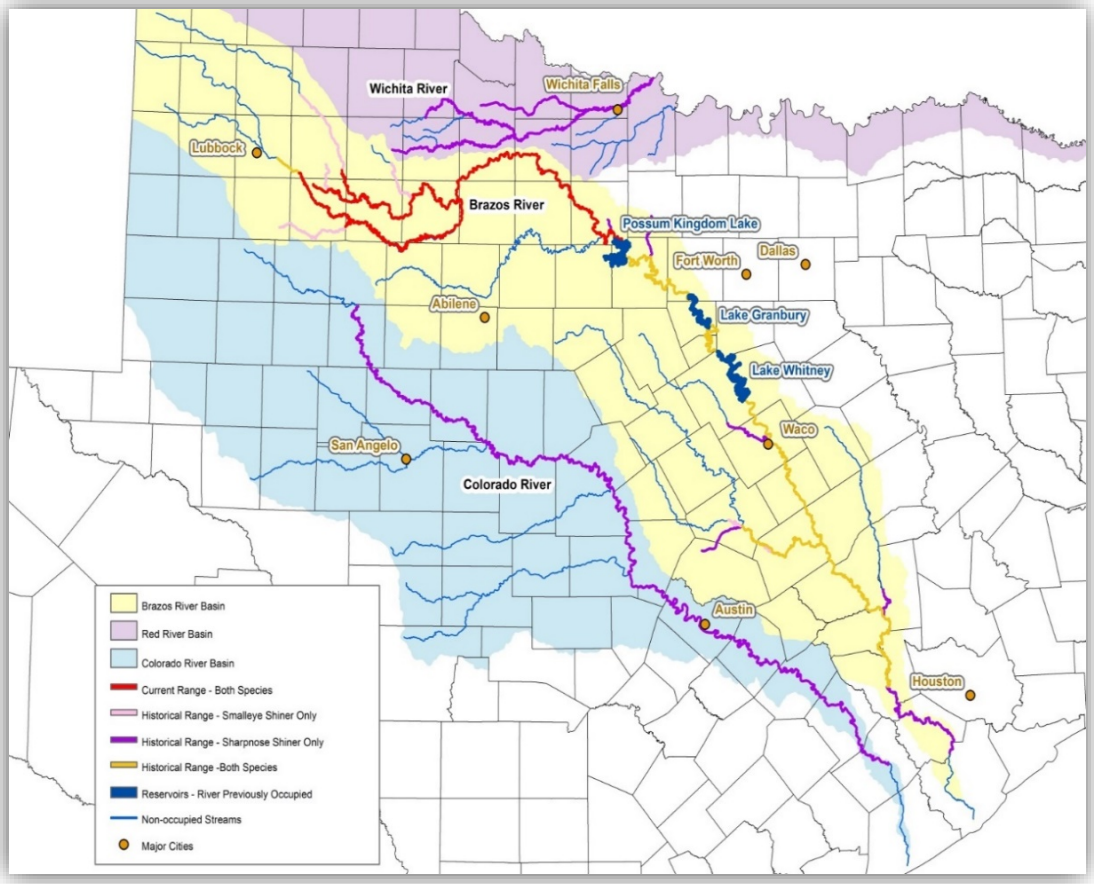

Figure 1. Historical and current ranges of the smalleye and sharpnose shiners within Texas.

Maintaining favorable habitat conditions within the upper Brazos River is imperative to the continued existence of both species. The SSA analysis identified two significant stressors affecting the current and future conditions of these species: river fragmentation (by impoundments and barriers to fish passage) and alterations of the natural streamflow regime (by impoundments, drought, groundwater withdrawal, and saltcedar (*Tamarix spp*.) encroachment) within their range. Secondary factors, such as water quality degradation, likely also impact these species but the extent is not known. These multiple stressors are not acting independently, but in unison as combined stressors, which can result in cumulative effects to lower the overall viability of the species.

The SSA Report includes minor updates to survey information provided in Wilde 2015 and TPWD 2016. These reports document the continued low numbers of the sharpnose shiner in the upper Brazos River, and continued absence of both species in the lower Brazos River (TPWD 2016).

2.1.2 Threats Analysis (threats, conservation measures, and regulatory mechanisms):

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR 424) set forth procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

These five factors are considered, where applicable, to this 5-year review analysis for the sharpnose and smalleye shiner. In the discussion below, we reference the factor for any known threat to the two species.

Long term viability of the shiners depends upon maintaining resilient populations over time within stream segments capable of accommodating their life history requirements, reproduction, and successful recruitment. The availability of these resource needs is affected by potential new reservoir construction (Factor A) within the extant range, increased threats to water quantity such as groundwater withdrawal to meet agricultural and municipal demand (Factor A), changes to water quality from point and non-point sources (Factor A), and enhanced chances and severity of drought due to ongoing climate change and water management (Factors A and E). Although there is uncertainty regarding the immediacy and extent occupied stream segments may experience fragmentation, changes to water quality, and/or altered flow regimes, the SSA Report forecasted what future viability the shiners may have in terms of resiliency,

redundancy and representation under plausible future scenarios and the corresponding conservation actions expected to achieve short- and long-term viability. The SSA Report analysis indicates the intermittent flow conditions within the occupied range appears to be increasing due to these threats, which is expected to reduce species' resiliency.

At the time of listing, commercial bait harvesters were allowed to collect fish in the Brazos River under permit from the State of Texas (Factor B). In 2012, eight permits were active that allowed collection from the Brazos River, including one that permitted bait collection in the upper Brazos River. Currently, Texas Parks and Wildlife Department (TPWD) prohibits commercial bait harvest within the sharpnose and smalleye shiner critical habitat. This factor is likely not substantially affecting the species.

The non-indigenous Gulf killifish (*Fundulus grandis*) has become established in the middle Brazos as a result of bait releases and there is one record within the Upper Brazos River within Possum Kingdom Lake (TNSC 2011). During laboratory testing, this species predates (Factor C) both sharpnose and smalleye shiners (Wilde 2016, pers. comm.). The Gulf killifish is not believed to be currently occupying the range of the shiners; therefore, it is not known to be a threat to the species.

Additional information not included in the SSA Report includes a study on the interaction between surface water and groundwater within the upper Brazos River basin (Factor A). The study provided additional evidence that: 1) groundwater development (i.e., extraction of subsurface water) reduced mean daily flows, peak flows, and zero-flow days; 2) upstream reservoirs increased zero-flow days and reduced mean daily flows; and 3) drought results in lower mean daily flows and peak flows (Wolaver 2019). Future climate projections are expected to adversely affect stream flows needed for sustaining sharpnose and smalleye shiner long term within the upper Brazos River.

A report on the study on the effects of point and non-point source pollution (Factor A) on the sharpnose and smalleye shiner (Kelly and Wilde 2019) was finalized after the SSA Report. This study evaluated water samples and fish tissues collected at four sites on the upper Brazos River. Surrogate species of fish with similar diets and life histories as the shiners were used for tissue samples. One dissolved aluminum sample was above the state acute water quality criteria and seven of the twenty-eight total selenium samples exceeded acute and chronic criteria for both state and federal water quality standards. The source of these metals in water could be natural or anthropogenic, or a combination of both. Within the Salt Fork Brazos River, total selenium in water was measured at concentration levels to produce deformities in fish and birds. However, total selenium in fish tissue at all sites were below laboratory minimum detection limits. Selenium toxicity in fish occurs largely through diet from contaminated food; short longevity of these fish species and/or non-consumption of selenium contaminated food may explain the high water concentrations and low tissue detection. The laboratory minimum detection limits may have also been problematic due to some selenium toxicity levels of fish known to be below the laboratory limits. Elevated levels

of total arsenic, chromium, copper, lead, and mercury were detected in fish tissue at three of the four sites. Based on groundwater data, the source of these metals may be from the geology in the area. Dissolved metals in water and total metals in fish tissue from samples in the Salt Fork were much higher than the other sites. While the study provides data concerning elevated levels of metals within the range of the species, it did not detect changes that could be attributed to wastewater (point source) discharges. However, additional research is recommended due to limitations of the study.

Since listing the species in 2014, conservation actions implemented to reduce threats within the current range have been implemented. Two partial fish barriers that contributed to fragmentation and lower resiliency during low flow conditions were removed. In 2016, a low water crossing constructed of gravel and steel culverts was removed from the Double Mountain Fork in Kent County. In addition to preventing fish movement within the river under low flow conditions, the crossing had been in place long enough to create an erosion/deposition alteration immediately downstream, which altered the morphology of the channel. Restoration of the immediate area was implemented, and the downstream effects from the removed barrier are expected to improve. In 2020, a partial fish barrier was removed from the Brazos River main stem in Throckmorton County. The partial barrier was created by a concrete mattress installed to cover an exposed crude oil pipeline in the river. The concrete mattress elevated the river bottom at the crossing and became a substantial barrier to fish movement under low flow conditions. Habitat parameters within the channel important to the shiners are expected to return to pre-construction conditions providing a substantial increase in river connectivity.

Salt cedar infestation within the upper Brazos River effects channel morphology, water flow velocity, fish passage, and potentially water availability. The TPWD and USFWS began treating salt cedar via helicopter using imazapyr in the occupied range in 2016. From 2016 to 2020, approximately 15,650 acres were treated. Salt cedar management in this area is an ongoing process to reduce the adverse effects to the river.

2.2 Synthesis:

The sharpnose shiner historically occurred in the Brazos River, Red River, and Colorado River basins within Texas, where headwaters lie within the semi-arid High Plains ecoregion (Figure 1). The smalleye shiner historically occurred only in the Brazos River basin. These species are currently restricted to the upper Brazos River and its major tributaries, which represents a greater than 70 percent reduction in range for the sharpnose shiner and a greater than 50 percent range reduction for the smalleye shiner.

Our assessment within the SSA Report found that the viability of both species of shiner has been reduced (low probability of persistence) in the near term (over approximately the next 10 years) largely because of the existing limitations of their life history requirements of long, wide, flowing rivers to complete their reproductive cycle. With a short life span allowing only one or two breeding seasons and the need for long, unobstructed flowing river

reaches, both species are at a high risk of extirpation when rivers are fragmented by fish barriers and flows are reduced from human use and drought-enhanced water shortages. These conditions have already resulted in substantial range reduction, isolating the one remaining population of both fish to the upper Brazos River basin. The extant population of each shiner species is located in a contiguous stretch of river long enough to support recruitment, is of adequate size, and is generally considered resilient to local or short-term environmental changes. However, with only one location, both species lack redundancy and may lack the genetic and ecological representation to adapt to new or ongoing threats.

After reviewing the best available scientific information, we conclude that the sharpnose shiner and smalleye shiner remain endangered species. The evaluation of threats affecting these species under the factors in 4(a)(1) of the Act and analysis of the current conditions in our *Species Status Assessment Report for the Sharpnose Shiner (Notropis oxyrhynchus) and Smalleye Shiner (N. buccula) Version 2* (2018) remains an accurate reflection of the current status of both species.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *The species is extinct*
____ *The species does not meet the definition of an endangered species or a threatened species (i.e., is recovered, or new information on status and threats indicate species does not meet definitions)*
____ *The listed entity does not meet the statutory definition of a species.*
__X__ No change is needed

3.2 New Recovery Priority Number:

No change recommended (5C)

Brief Rationale: The recovery priority number of 5C indicates a high degree of threat, a low recovery potential, the listed entities are species, and conflict exists. The threats are high due to ongoing sources of habitat loss, degradation, and modification, including potential impoundment construction, water management and use, saltcedar encroachment, and lack of water due to drought and climate change. Additional threats include water quality degradation. The sharpnose and smalleye shiner have a low probability of recovery because the severity of future droughts is expected to increase, regional water demand is expected to increase, existing impoundments are unlikely to be removed, future impoundment construction is likely, and captive propagation efforts are still in the experimental phase. Sharpnose and smalleye shiner conservation may compete with potential reservoir development in the upper Brazos River to meet future water demand.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Based on the threats evaluated and reduced range and reproductive strategy of these species, the SSA Report provides a chapter on conservation opportunities. These opportunities are summarized here:

Improve redundancy and resiliency – Both species exist in only a single suitable river segment (the upper Brazos River) within the historical distribution. Redundancy may need to be addressed through a number of alternative means. Three possible means of increasing redundancy in these species are (1) a captive propagation and/or refugia program to ensure that the species are not lost due to catastrophic loss of their only populations; (2) reintroducing these species within their historical ranges and monitoring to determine their success and if minimum requirements have been correctly assessed; and (3) removal of existing fish barriers and restoration of the Brazos River, where feasible and appropriate, to provide additional river length and suitable stream flow in which sharpnose and smalleye shiners could seek refuge from severe droughts and other catastrophic events.

Minimize impacts from impoundments - Despite planning and managing to accommodate the needs of sharpnose and smalleye shiners to the greatest extent possible, future reservoirs within the upper Brazos River basin will negatively impact these species. Depending on the location, design, and management of future reservoirs within the upper Brazos River basin, expected impacts would include at least one or more of the following: decreased water volume in occupied sections of the river, fragmentation or shortening of occupied river segments, changes in water quality, conversion of occupied riverine habitat to lentic habitat, alteration of river channel substrate and sediment transport, altered hydraulic habitat, or alteration of the natural flow regime. Although siting, design, and management of future reservoirs in the upper Brazos River basin could be realized in a way that may reduce adverse impacts to sharpnose and smalleye shiners, the restricted range and current status of these species makes them vulnerable to even slight changes to their remaining occupied habitat. Minimizing impacts could include: 1) adopting rigorous water conservation strategies; 2) implementing water releases from new and existing reservoirs that provide a minimum mean discharge exceeding 227 cubic feet/second in occupied downstream habitat during the spawning season (April – Sept); 3) adopting flow recommendations from the Brazos River Basin and Bay Expert Science Team Report (BBEST 2012); and 4) designing future impoundments to avoid releasing hypolimnetic water that is not representative of the upstream water.

Minimize impacts from saltcedar encroachment - Saltcedar control efforts should be concentrated on dense stands that can be replaced by native vegetation with a lower leaf area—potentially including native forbs, grasses, and cottonwood trees—to maximize the potential for water salvage without eliminating important riparian vegetation communities (Shafroth *et al.* 2005, p. 240). The salvage of any groundwater or surface water runoff that can elevate streamflow within occupied shiner habitat would benefit these species by supporting necessary flows for survival and successful reproduction. Chemical control of

saltcedar is typically performed using imazapyr-based compounds, which are unlikely to be toxic to fish or aquatic invertebrates (USEPA 2006, pp. 17– 18; BASF 2012a, p. 2; BASF 2012b, p. 2).

Implement general water conservation strategies - Improvements to agricultural, municipal, and industrial water use efficiency would decrease water demand and put less pressure on the already strained surface and groundwater resources of the upper Brazos River basin. These conservation measures (including but not limited to the use of high-efficiency household appliances and fixtures, optimization of commercial and industrial water uses, and improved irrigation efficiencies for agriculture) could reduce the need for additional reservoir development, increase groundwater contribution to streamflow, and allow existing reservoirs to release more stormwater runoff than occurs currently. These benefits from general water conservation would likely increase streamflow within occupied sharpnose and smalleye shiner habitat, improving their likelihood for survival and successful reproduction.

Conserve native vegetation adjacent to occupied habitat - Riparian vegetation adjacent to riverine habitat filters surface water runoff and is important in maintaining instream water quality. The ability of riparian buffers to filter surface runoff is largely dependent on vegetation density, type, and slope, with dense, grassy vegetation and gentle slopes facilitating filtration. Due to a lack of dense, grassy vegetation throughout much of the designated critical habitat, a 30-m (98-ft) buffer may be most appropriate to maintain proper runoff filtration (Fischer and Fischenich 2000, p. 8). Conservation of native riparian vegetation along the banks of occupied sharpnose and smalleye shiner river segments is not generally expected to negatively impact farming or ranching activities, nor would it require restricting landowner access to these buffer areas. Allowing cattle access to the river might help remove vegetation that would otherwise have been removed by seasonal floods that are now reduced by upstream impoundments, thereby reducing the likelihood occupied river segments will become further channelized by encroaching vegetation. Regardless, there is no scientific evidence suggesting cattle access to occupied river segments or the riparian buffers is currently a threat to either sharpnose or smalleye shiners.

5.0 REFERENCES

BASF – The Chemical Company. 2012a. Arsenal Herbicide Material Safety Data Sheet, 8 March 2012. 8 pp.

BASF – The Chemical Company. 2012b. Habitat Herbicide Material Safety Data Sheet, 8 March 2012. 8 pp.

Brazos River Basin and Bay Expert Science Team (BBEST). 2012. Environmental flow regime recommendations report. 198 pp.

Fischer, R.A. and J.C. Fischenich. 2000. Design recommendations for riparian corridors and vegetated buffer strips. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-24). U.S. Army Engineer Research and Development Center, Vicksburg, MS. 17 pp.

Kelly M. and G. Wilde. 2019. Effects of altered water quality on populations of smalleye and sharpnose shiner in the upper Brazos River. Texas Parks and Wildlife Department, Final Report TX E-184.

Shafroth, P.B., J.R. Cleverly, T.L. Dudley, J.P. Taylor, C. Van Riper III, E.P. Weeks, and J.N. Stuart. 2005. Control of *Tamarix* in the western United States: implications for water salvage, wildlife use, and riparian restoration. Environmental Management 35(3):231-246.

Texas Parks and Wildlife Department (TPWD). 2016. Final Report: Fish habitat suitability criteria development for the lower Brazos River. November 3, 2016. 22 pp.

Texas Natural Science Center, University of Texas at Austin (TNSC). 2011. Texas Natural History Collections, Texas Natural Science Center, University of Texas at Austin - Ichthyology Collection Database. Texas Natural Science Center, University of Texas at Austin. http://www.fishnet2.net/.

U.S. Environmental Protection Agency (USEPA). 2006. Reregistration eligibility decision for Imazapyr. EPA report 738-R-06-007. 107 pp.

U.S. Fish and Wildlife Service (USFWS). 2014. Species status assessment report for the sharpnose shiner (*Notropis oxyrhynchus*) and smalleye shiner (*N. buccula*). Arlington, Texas Ecological Services Field Office, Arlington, Texas.

Wilde, G.R. 2015. Reproductive Ecology and Population Dynamics of Fishes in the Upper Brazos River. State Wildlife Grant report to Texas Parks and Wildlife Department. 52 pp.

Wilde, G.R. 2016. Personal communication. December 15, 2016 conversation. Professor of fish ecology, fishery management and conservation biology. Texas Tech University, Lubbock, Texas.

Wolaver, B.D. 2019. Surface water-groundwater interactions in the upper Brazos River basin of Teas and quantitative relationship to smalleye and sharpnose shiner reproductive success. Texas Parks and Wildlife Department, Final Performance Report.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Sharpnose Shiner and Smalleye Shiner

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, Debra Bills

Approve DEBRA BILLS Digitally signed by DEBRA BILLS Date: 2021.08.06 11:28:07 -05'00'