U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Notropis buccula* Cross

COMMON NAME: smalleye shiner

LEAD REGION: 2

INFORMATION CURRENT AS OF: April 15, 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X_ Continuing candidate
___ Non-petitioned
_X_ Petitioned - Date petition received: May 11, 2004
__ 90-day positive - FR date:
__ 12-month warranted but precluded - FR date:
__ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the smalleye shiner. We continue to monitor smalleye shiner populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

___ Listing priority change
Former LP: ___
New LP: ___

Date when the species first became a Candidate (as currently defined): June 13, 2002

___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Fish, Cyprinidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

LAND OWNERSHIP: The smalleye shiner occurs in rivers, which are owned by the State of Texas. The majority of the riparian land ownership within the documented range of the shiner is private, with minor areas owned by the State (Parks) and Federal (Corps of Engineers) governments.

LEAD REGION CONTACT: Sarah Quamme, (505) 248-6419

LEAD FIELD OFFICE CONTACT: Arlington, Texas Field Office, Omar Bocanegra, (817) 277-1100

BIOLOGICAL INFORMATION

Species Description: The smalleye shiner (*Notropis buccula*) is a small pallid minnow, measuring 3.5 to 4.4 centimeters (cm) (1.4 to 1.7 inches (in)), and is endemic to the Brazos River Basin in Texas. As with other fishes of the minnow family, Cyprinidae, the smalleye shiner can prove difficult to separate from closely related congeners. Moss and Mayes (1993, p. 14) found this confusion in historic collections to be most common with the chub shiner (*N. potteri*), silver band shiner (*N. shumardi*), and sand shiner (*N. stramineus*).

Taxonomy: The smalleye shiner was originally described as a subspecies of the Red River shiner (*N. bairdi*), an endemic of the Red River system in Texas and Oklahoma, and was subsequently elevated to species status (Hubbs 1957, p. 6). Although geographically separated, the smalleye shiner is considered closely related to the Red River shiner and the Arkansas River shiner (*N. girardi*) (Gilbert 1980, p. 242). A review of current literature indicates the species is still a valid taxon (e.g., Nelson *et al.* 2004, p. 74; Jelks *et al.* 2008, p. 391).

Habitat/Life History: Smalleye shiners require habitats similar to those of other fishes native to

Texas prairie streams. Preferred habitat includes fairly shallow water 38 to 82 cm (15 to 32 in) deep in broad, open sandy channels with a moderate current (Moss and Mayes 1993, pp. 21, 37). Smalleye shiners are most often found using the center of the channel, avoiding the shallow depth and slow velocity of the stream edges (Moss and Mayes 1993, p. 23). Their diet consists mainly of aquatic insects, dominated by flies, and includes sand/silt suggesting they forage in the substrate (Marks *et al.* 2001, pp. 329, 332). Although very little is known about the life history of this species, they are thought to be short-lived. Recent evidence suggests spawning occurs asynchronously throughout the reproductive season (between April and September), with the exception of intense, synchronized spawning during periods of elevated streamflow (Durham and Wilde 2008, pp. 536-537; Durham and Wilde 2009a, p. 25).

The Brazos River watershed extends from eastern New Mexico southeasterly to the Gulf of Mexico. The basin is approximately 1,030 kilometers (km) (640 miles (mi)) in length, encompasses approximately 118,103 square km (45,600 square mi) (Dunn and Raines 2001, pp. 3-4), ranges in width from 1.6 to 193 km (1.0 to 120 mi), and drains all or portions of 69 counties in Texas and three counties in New Mexico. The Brazos River originates from the confluence of the Salt and Double Mountain Forks. This upper region of the watershed is highly variable with regard to flow and often becomes intermittent, forming isolated pools within the channel (Echelle *et al.* 1972, pp. 111-112; Ostrand 2000, p. 22).

Historical Range/Distribution: The smalleye shiner historically occurred throughout the Brazos River proper, the Double Mountain and Salt Forks of the upper Brazos River drainage, and in the Lampasas River, a tributary of the Brazos River (Moss and Mayes 1993, pp. 16-18). The type locality is from the main stem Brazos River in Palo Pinto County, where 14 specimens were collected in 1952 (Cross 1953, p. 252). A population may exist in the Colorado River above Buchanan Reservoir and is presumed to be introduced (Hubbs *et al.* 1991, p. 20); however, information on the status of this population is lacking.

Moss and Mayes (1993) conducted an extensive study of the distribution of the smalleye shiner and sharpnose shiner (*N. oxyrhynchus*) in the Brazos River Basin. The study included a review of known museum, university, and other collections (from 1951 to 1986) to determine the historical distribution of both species. Their review indicated the smalleye shiner historically occurred at nine main stem sites, six sites on the Double Mountain Fork of the Brazos River, 14 sites on the Salt Fork of the Brazos River, one site on the North Fork Double Mountain Fork, and one site on the Lampasas River. The collections included specimens from the upper, middle, and lower Brazos River systems (Sellers 1996, pp. 27-30), ranging from the upper reach of the North Fork Double Mountain Fork in Garza County, Texas, to the southernmost site in Brazos County, Texas. The Double Mountain Fork collections consisted of 351 specimens from sites in four counties. The Salt Fork collections contained 492 specimens from five counties. Twenty seven specimens came from the main stem of the upper Brazos River in two counties. The remaining historical records came from one site in the middle Brazos River in 1952 and eight sites in three counties in the lower Brazos River prior to 1977. Two additional, but currently unverified specimens exist in a collection made near Hempstead (Waller County) from the lower Brazos in 1986 (Bonner in litt. 2008).

Current Range/Distribution: Moss and Mayes' (1993) study compared the historical records

with their samples from October 1988 through August 1991. Of 37 sites sampled, 26 were in the upper Brazos River Basin, including 24 sites upstream of Possum Kingdom Reservoir. From these upstream samples, 2,388 smalleye shiners were collected from nine sites in five counties on the Salt Fork, four sites in four counties on the Double Mountain Fork, three sites in one county on the North Fork Double Mountain Fork, and one site on a tributary of the Salt Fork. They did not find smalleye shiners at two sites sampled downstream from Possum Kingdom Reservoir and two sites in two counties on the Clear Fork tributary of the Brazos River (where the smalleye shiner has never been documented). An additional 11 sites sampled by Moss and Mayes (1993) were in the middle (two counties) and lower Brazos River Basin (6 counties), which included two sites on the Lampasas River. No smalleye shiners were found at these sites.

Ostrand (2000, p. 14) estimated the population of smalleye shiners in the upper Brazos River to represent 16.7 percent of the fish assemblage. Smalleye shiners were present at all 13 sites (6,558 collected) where they represented 1 of 7 dominant species within the study area (Ostrand 2000, pp. 13, 34).

Recent surveys that have been made in the middle and lower Brazos River did not find the species (Armstrong 1998; Winemiller and Gelwick 1999; Wilde and Bonner 2002; Winemiller *et al.* 2004, pp. 24, 47-49; Wilde and Durham 2007, p. 69). Downstream from the Possum Kingdom Reservoir, the shiner has not been collected since 1986 and in all likelihood is extirpated (Bonner and Runyan 2007, p. 16), representing a reduction of approximately 54 percent of its historical range.

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Reservoirs. River impoundments adversely affect downstream fisheries by altering temperature regimes, flow rates, substrate, water quality, and nutrient availability (Anderson *et al.* 1983, p. 81; Baxter 1977, pp. 271-274). The downstream effects of impoundments often create homogeneous habitat conditions within the channel, restricting its use to those species that proliferate in deep, incised channels. Significant changes to fish assemblages produced by downstream effects, including the local extinction of species, have been well documented (e.g., Gore and Bryant 1986; Anderson *et al.* 1983). Reservoirs also fragment riverine habitat thereby prohibiting the completion of the life cycle for those species that require an unimpeded stream for spawning and/or migration.

Wilde and Ostrand (1999) studied the effects that creation of the Alan Henry Reservoir on the Double Mountain Fork of the Brazos River had on prairie stream fish. This segment of the Double Mountain Fork is in a semi-arid region where flow is intermittent and dependent on rain events. During the absence of flow, the stream is characterized by isolated pools that provide the only habitat for fish until the next rain event, which may not occur for several months. Following impoundment of the river, the upstream reach showed a dramatic change in the fish assemblage (Wilde and Ostrand 1999, pp. 207-208). This study indicated that the smalleye shiner, has been significantly reduced in numbers and may soon be extirpated. The disappearance of the fish is attributed to the lack of reproduction or survival or both in isolated

pools, combined with the inability of the downstream population to recolonize the upstream reach due to the barrier created by the impoundment.

The downstream effects of three major reservoirs, Possum Kingdom, Granbury, and Whitney, have altered the habitat in the Brazos River, impacting the fish assemblage. The Morris Sheppard Dam, which impounds Possum Kingdom Reservoir in the upper Brazos River Basin, releases cold water from the bottom of the reservoir, which has modified the thermal regime up to 120 km (75 mi) downstream. These cold water releases are likely responsible for the extirpation of at least four species of fish in the downstream reach (Anderson *et al.* 1983, pp. 85-86). The two other major reservoirs are located in the middle Brazos River. Granbury Reservoir, approximately 175 km (109 mi) downstream from Possum Kingdom, and Whitney Reservoir, approximately 92 km (57 mi) downstream from Granbury, have also contributed to habitat modification in the middle and lower Brazos River, which is most likely no longer suitable for the smalleye shiner.

Moss and Mayes (1993) found a distinct difference between the fish assemblage upstream and downstream from Possum Kingdom Reservoir. They suggested the reservoir has modified downstream habitat, excluding many native prairie minnows while generalist minnows have prospered. Anderson *et al.* (1983, p. 86) noted the change in substrate from sandy bottom and high turbidity (typical smalleye shiner habitat) to clear, gravel bottom habitat for a distance of 30 km (19 mi) downstream from the Morris Sheppard Dam. Within this reach, seven species not normally found upstream from the reservoir), including two exotic species, had invaded the modified channel (Anderson *et al.* 1983, p. 86). Restriction of natural stream flow and sediment transport often contributes to channel incision and narrowing. The transport of sand through the Brazos River system has decreased in part due to reservoirs (Mathewson and Minter 1981, pp. 44-45; Dunn and Raines 2001, pp. 25-26). Mathewson and Minter (1981, p. 46) suggested that the major reservoirs trap approximately 76 percent of all sand produced in the Brazos River Basin.

Future Reservoir Development. Texas recently adopted a new water plan, *Water For Texas 2007*, to address water needs through 2060. Among the water management strategies detailed in the plan, eleven potential new reservoirs and five off-channel reservoirs are listed as feasible for future water supply needs within the Brazos River Basin (BGWPG 2006, pp. 4B.12-1-4, B.12-154, LEWPG 2006, pp. 4-200 – 4-201, RHWPG 2006, p. 4B22-1). Of those, three (Double Mountain Fork, Post, and South Bend reservoirs) would impound waters that are currently occupied by smalleye shiners, and the others would affect the species indirectly by influencing water availability, instream flow, and sediment transport within the Brazos River. Double Mountain Fork Reservoir would be located on Double Mountain Fork upstream from the confluence with the Salt Fork; South Bend Reservoir would be located immediately upstream from the confluence of the main stem and the Clear Fork of the Brazos River; Post Reservoir would occur on the North Fork Double Mountain fork and has been authorized by the Texas Commission on Environmental Quality (TCEQ), with a permit allowing completion by 2012. Of the five potential off-channel reservoirs in the Brazos River Basin, one has obtained water rights on the Navasota River authorizing the diversion of 2,500 acre-feet.

The middle and lower Brazos River has effectively been converted to habitat with thermal,

physical, and morphological parameters that no longer suitable to the shiner, largely resulting from impoundments in the basin. Although the last known record of the fish from the main stem downstream of Possum Kingdom Reservoir occurred over thirty years ago, remnant populations may still exist in areas of suitable habitat. However, the remaining habitat may be fragmented to the extent that any surviving populations are no longer viable. The continued effects of the existing impoundments coupled with the potential future water management strategies outlined in the Regional Water Plans discount the possibility of recovery of the shiner in the middle and lower Brazos River.

In the upper Brazos River system, smalleye shiners are most common in higher order streams (Ostrand 2000, p. 21) with suitable flow and conductivity. The flow in the Double Mountain and Salt Forks is commonly intermittent during the summer months and often restricted to large pools within the channel. Under the harsh conditions that accompany the non-flow periods, smalleye shiners are among the first species to be eliminated within the pools (Ostrand and Wilde 2001, p. 746). The isolated pools of the upper Brazos tributaries are also likely unsuitable for successful reproduction of the smalleye shiner (Wilde and Ostrand 1999, p. 208; Ostrand and Wilde 2001, p. 746-747; Durham and Wilde 2006, pp. 1650-1651; Durham and Wilde 2009a, p. 26). Spawning occurs from April to September, but reproductive success is likely greater during periods of high discharge due to increased survival of eggs and young (Durham and Wilde 2009a, pp. 25-26). The shiner's persistence in these upper reaches is most likely the result of recolonization from populations occurring downstream during times of normal flow (Wilde and Ostrand 1999, p. 208; Ostrand and Wilde 2001, p. 747). Reservoir construction on the upper Brazos tributaries (e.g., Post Reservoir and Double Mountain Fork Reservoir) would create a barrier between the base population and the upper reaches, preventing recolonization and potentially reducing reproductive success. Recent population modeling also indicates that reservoir development within the upper Brazos River would substantially reduce stream discharge resulting in a continuous decrease in abundance of smalleye shiner (Durham and Wilde 2009b, p. 672).

The headwaters of the Double Mountain Fork of the Brazos River in Garza County were isolated from the downstream reach in 1991 by the construction of the John T. Montford Dam, which impounds Alan Henry Reservoir. Upstream of the reservoir, the once common smalleye shiner has apparently disappeared following the completion of the dam (Wilde and Ostrand 1999, p. 208). A similar situation could occur on the upper Brazos River and major tributaries should any or all of the Double Mountain Fork, South Bend, and Post reservoir projects be implemented. The potential direct impacts to the shiner resulting from construction of these reservoirs include: 1) the inundation of occupied habitat, 2) the local extinction of upstream populations, and 3) the loss of habitat downstream from the dams due to the modification of necessary abiotic components (flow regime, thermal regime, substrate, conductivity, etc.).

Desalination. The streams of the upper Brazos River Basin have natural salts that originate in salt and gypsum terrain and an underlying brine aquifer in this region. Because the salt entering the Brazos River in this area limits its use as a practical water supply, several studies on the feasibility of salt control have been conducted. Desalination projects include the construction of salt retention reservoirs (e.g., Johnson *et al.* 1982). Recent interests in controlling salt in the upper Brazos River region has resulted in the formation of the Salt Fork Water Quality

Corporation, which is in the planning stages of chloride control well fields. The proposed project includes the construction of well fields and associated pipelines in the Croton and Salt Creek watersheds to reduce the seepage from the underlying brine aquifer. Solar evaporation ponds at undetermined locations may also be constructed.

The smalleye shiner evolved to prosper in the saline and turbid conditions naturally occurring in the Brazos River. Desalination projects proposed for the upper Brazos for the conversion of the natural saline waters to a quality available for human consumption could modify the chemical characteristics conducive to smalleye shiner habitat. Additionally, those projects that require the construction of brine retention reservoirs may also inundate shiner habitat and reduce instream flows to the major tributaries (e.g., the Salt Fork) as well as the Brazos River proper.

Discharges and Sedimentation. Permits held by domestic (municipal wastewater) and industrial facilities allow for the discharge of treated and untreated effluent into the basin. In the upper Brazos River drainage alone, the sum of permitted facility discharges is more than 824 million gallons of effluent per day (TCEQ in litt. 2010). These discharges modify water quality and add to the continued alteration of the Brazos River channel, affecting its morphology and substrate composition. Adverse conditions in the channel, such as low dissolved oxygen, result from these discharges and often cause fish kills when sewage facilities fail.

Silt and sediment entering streams via stormwater runoff is a primary source of impairment to surface waters in the United States (USEPA 2002, p. ES-3). The predominant land use in the Brazos River Basin is agriculture. The practices that accompany agricultural operations, including harvesting, tilling, and native vegetation clearing, contributes to additional sediment entering the Brazos River system and the conversion of the natural substrate to silt and mud bottom. This source, along with other development projects that result in excessive sedimentation in the Brazos River, reduces the available habitat for the smalleye shiner.

Concentrated animal feeding operations (CAFOs) are abundant within the Brazos River Basin (e.g., 329 currently permitted (TCEQ in litt. 2010)). The wastes associated with CAFOs are typically high in nutrients (nitrogen and phosphorus) and, historically, discharges of these wastes to surface water bodies have resulted in degraded water quality and wildlife mortality (e.g., Baker *et al.* 1998). CAFOs are not permitted to discharge into Waters of the State of Texas, or adjacent to waters of the State, except during chronic and catastrophic rainfall (exceeding a 25-year rainfall event in a 24-hour period). During periods of intense rainfall and high flooding, retention structures may fail resulting in catastrophic releases and severe pollution to water bodies, which often results in fish. Although discharges from CAFOs are not allowed by permit under normal conditions, unlawful discharges do occur (e.g., pipe breaks and maintenance failures). For example, from 1993 to 1998, the Environmental Protection Agency (EPA), under the Clean Water Act, documented 24 discharges from permitted CAFOs into Waters of the United States in Texas (Service 1999, pp. 2-3). Thirteen of these discharges were caused by chronic storm events and reported to the EPA, the remaining eleven were illegal discharges. Additional impacts to surface water quality may occur from groundwater contaminated from past or current management activities or both. Discharges from CAFOs may contain contaminants such as endocrine disrupting and pharmaceutical chemicals that are not currently regulated.

Stormwater discharge and increased sedimentation in the Brazos River resulting from rock mining may have contributed to habitat degradation in the middle Brazos River region. Prompted by numerous complaints from private landowners of excessive sedimentation in a portion of the Brazos River in Palo Pinto and Parker Counties, the TCEQ implemented the Clear Streams Initiative to investigate rock mining facilities to determine levels of compliance with existing regulatory requirements (TCEQ 2004, p. 5). Although TCEQ's September 2004 report concluded that rock mining facilities did not significantly affect the state's streams, numerous operational violations among permitted and un-permitted facilities were documented. Common violations were inadequate Best Management Practices, unauthorized discharges, and failure to monitor as required by the permit (TCEQ 2004, p. 10). The continued operation of un-permitted rock mines and un-enforced mine regulations occurring in the Brazos River Basin may pose a threat to the smalleye shiner, especially if these facilities occur in the upper Brazos River.

In-stream Gravel Mining. In the lower Brazos River, sand and gravel operations have mined the channel for many years (Dunn and Raines 2001, p. 26). In addition to the obvious short term direct impacts of dredging a river channel for collecting substrate, which may involve draglines, temporary island construction, removal of trees, excavation of settling pits, and heavy machinery within the channel, changes in the aquatic fauna may also occur. Forshage and Carter (1974, p. 699) found major changes in both macroinvertebrate and fish populations resulting from an in-stream gravel operation in the Brazos River. In the absence of careful planning and appropriate mitigation measures, in-stream mining could also result in long term irreversible effects to the stream (Langer 2002, p. 6). We do not have information on the significance of the effects of these operations to the smalleye shiner in its occupied habitat in the upper Brazos River.

B. Overutilization for commercial, recreational, scientific, or educational purposes. We are not aware of any information regarding overutilization of the smalleye shiner for commercial, recreational, scientific, or educational purposes. Minnows of the genus *Notropis* are used as bait fishes and are harvested in the commercial bait industry. Commercial bait harvesters are required to obtain a permit and report annually on the species and numbers collected. However, the permit does not restrict the quantity of nongame fishes that can be harvested, and furthermore, the list of nongame fishes allowed for harvest under the permit specifies "*Notropis spp*.," which is likely the most detail submitted in an annual report. In 2002, four permits were issued for the harvest and sale of minnows from the Brazos River. Only two permittees reported a harvest in 2001. Currently, there are no active permits for minnow harvest from the Brazos River. The impacts the commercial bait industry may have on the smalleye shiner are unknown.

C. Disease or predation. We are not aware of any information regarding disease or predation on the smalleye shiner. The State stocks game fish in the Brazos River and its impoundments, including some exotic species, which likely prey on smalleye shiners. However, the extent of the effects of predation has not been determined.

D. The inadequacy of existing regulatory mechanisms. State law does not provide protection for the smalleye shiner. There are no regulatory mechanisms for persons harvesting these minnows for use as bait fish, with the exception of a State fishing license and nongame fish permit. Permitted individuals are not restricted in quantity for bait fish harvests. See also the discussion under section B.

E. Other natural or manmade factors affecting its continued existence. The upper Brazos River region (upstream of Possum Kingdom Reservoir) is affected by the invasive exotic saltcedar (*Tamarix* sp.). Saltcedar was introduced in the United States from Eurasia as an ornamental plant in the late eighteenth century and has since escaped from cultivation and spread rapidly throughout the southwestern United States (Robinson 1965, p. A3). The rapid spread of saltcedar is likely an indirect result of reservoir construction and modification of natural river flows (Kerpez and Smith 1987, p. 3). The effects of saltcedar invasion on native ecosystems include alteration of stream and groundwater hydrology, displacement of native plant communities, and degradation of wildlife habitat (Kerpez and Smith 1987, pp. 3-5). As of 1969, saltcedar was the most extensive flood plain community in the upper Brazos River from Possum Kingdom Reservoir to the confluence of the Salt and Double Mountain Forks (approximately 521 river km (324 river mi)), covering approximately 28 percent of the flood plain (Busby and Schuster 1971, pp, 285-286). Blackburn *et al.* (1982, p. 299) estimated saltcedar occupied 57 percent of the original Brazos River channel from the confluence of the main stem and Clear Fork upstream to Seymour, Texas (129 river km (80 river mi)). The establishment of saltcedar in this region has slowed flood water velocity which has resulted in excessive sediment deposition and narrowing of the channel (Blackburn *et al.* 1982, p. 300). The average width of this stretch of the river has narrowed from 157 meters (m)(515 ft) in 1941 to 67 m (220 ft) in 1979 (Blackburn *et al.* 1982, p. 299).

The invasion of salt cedar in the upper Brazos region that has resulted in modification of the channel, excessive sediment deposition, and altered flood stages is a threat to the smalleye shiner. The smalleye shiner requires fairly shallow, broad, open sandy channels with moderate current. The effects of dense saltcedar communities along the main stem, Double Mountain Fork, and Salt Fork over time may render them unsuitable to smalleye shiners. The magnitude of this threat is unknown and dependent on the extent and rate of saltcedar encroachment in the entire upper Brazos River and its major tributaries. However, because the infestation occurs in the portion of the river supporting the majority of the known shiners, the threat may be significant.

In recent years, the Brazos River has experienced massive blooms of golden algae (*Prymnesium parvum*) resulting in several fish kills. The alga releases toxins into the water that have a lethal effect on gill-breathing animals. Although little is known about the causes of golden algal blooms, as with many other algae, they may be triggered by excessive nutrient loading from point source and non-point source events such as industrial and municipal discharges and runoff from agricultural operations. We are not aware of any information indicating that the threat from algal blooms is significant to the smalleye shiner.

The limited distribution of the smalleye shiner in the upper Brazos River Basin makes it vulnerable to catastrophic events occurring in the region. The shiner may recover from droughts, provided some of its habitat remains suitable. Catastrophic events such as the introduction of competitive species or prolonged drought would increase the likelihood of extinction.

The potential for unintentional introduction of competitive species by anglers and commercial bait fishermen is high. For example, the Red River shiner (*N. bairdi*) was apparently introduced

into the range of the threatened Arkansas River shiner, and may seriously threaten its status. The Red River shiner is currently not known from the Brazos River; however, the probability of introduction is high, since the Red River Basin is immediately to the north of the current population of smalleye shiners. Currently, there is no evidence that introduced species in the Brazos River effectively compete with the smalleye shiner.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: None.

SUMMARY OF THREATS:

The primary threat to the smalleye shiner is habitat loss and modification due to current and future reservoir development. Reservoir development in the Brazos River Basin is largely responsible for the modification of habitat in the river that has rendered major portions unsuitable for the smalleye shiner. The three major impoundments of the Brazos River proper have apparently extirpated the smalleye shiner from the middle and lower Brazos. Proposed reservoir development in the upper Brazos region is a significant threat to the extant populations. While only one major reservoir is currently permitted (Post Reservoir) in the upper Brazos River Basin, others are included in the Texas State Water Plan as a potential source to meet the demand for water through the year 2060.

Additional substantial threats to the smalleye shiner are in-stream sand and gravel mining, municipal and industrial discharges, CAFOs, desalination, excessive sedimentation, and the spread of invasive saltcedar. The effect of saltcedar in the upper Brazos region threatens the existing smalleye shiner habitat. Saltcedar encroachment in the upper Brazos and tributaries is likely an indirect result of impoundment of the river. Desalination is a potential future threat in the upper Brazos River Basin. In-stream sand and gravel mining, excessive sedimentation, and industrial and municipal discharges, coupled with the effect of impoundments, reduce the likelihood of the Brazos River sustaining viable populations of the smalleye shiner downstream of Possum Kingdom Reservoir. These threats combined with the substantial reduction in historic range due to anthropogenic factors justify the candidate status of the smalleye shiner.

We find that the smalleye shiner is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:
___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES: The Service recommends continued monitoring of the species, habitat conditions, and threats within its range. Research is needed to understand the requirements of the extant population for maintaining its current range. A concerted effort to develop and identify alternatives to reservoir development and desalination in the upper Brazos River should be a high priority for conservation of the species. Additionally, more information is needed regarding the threat posed by invasive saltcedar and potential

strategies for restoration of areas in the upper Brazos River impacted by saltcedar.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	**5***
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: The reduction in the historical distribution of the smalleye shiner in the Brazos River Drainage is largely attributable to the continued modification of its habitat. The existing modifications to the river may limit the survival of any remaining populations and preclude the recovery of the shiner in the middle and lower Brazos River. The primary threat to the remaining stable population in the upper Brazos region is the documented direct and indirect impacts of potential reservoir development in the basin. Currently, one major reservoir is authorized in the current range of the species. Several additional potential water development projects, including major reservoir sites, and desalination are options for meeting the future water demand in this region. For these reasons, we believe the magnitude of threat to the species is high.

Imminence: The potential water development projects in the upper Brazos River basin, with the exception of the permitted Post Reservoir, are options for meeting the water needs in the area up to the year 2060 or beyond. Large reservoir development is usually a lengthy process that may extend for several years depending on funding, land acquisition, and local opposition. However, the potential for low-priority water projects to be elevated to high priority during subsequent planning cycles exists. At this time, we consider the immediacy of threats to the species is best categorized as non-imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Stable populations of the smalleye shiner currently exist in unmodified portions of its range.

DESCRIPTION OF MONITORING:

Monitoring of the status of the smalleye shiner currently consists of contact with local fisheries biologists (academic researchers and State biologists) who have expertise with the species. A literature search was performed using two or more abstract databases, as well as the internet, to locate newly published articles related to the species and the Brazos River. In 2008, the Texas Parks and Wildlife Department (TPWD) funded a five year study on the reproductive ecology and population dynamics of five upper Brazos River fish species, including the smalleye shiner. When completed, this study should provide information important for the management and conservation of the species. This minimal level of monitoring is sufficient to update the status of the species the species' endemism to the state and the presence of experts employed with the state agency and local universities.

COORDINATION WITH STATES

The Service biologists in Texas regularly work with their counterparts in the TPWD, the State agency responsible for conservation of Texas' fish and wildlife resources, in coordinating conservation and information on candidate species. The Service contacted TPWD by letter dated March 4, 2010, requesting any new information on candidate species in Texas. TPWD provided a written response dated March 30, 2010, which indicated no new information was available for this species. The state wildlife action plan, Texas Comprehensive Wildlife Conservation Strategy 2005-2010, lists the smalleye shiner as a priority species in the Brazos River Basin.

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED

Anderson, K. A., T. L. Beitinger, and E. G. Zimmerman. 1983. Forage fish assemblages in the Brazos River upstream and downstream from Possum Kingdom Reservoir. Texas. J. Freshwater Ecol. 2(1):81-88.

Armstrong, M. A. 1998. A fishery survey of the middle Brazos River basin in north-central Texas. U.S. Fish and Wildlife Service, Region 2. 72 pp.

Baker, D. L., J. D. Lusk, and C. M. Giggleman. 1998. Phase II Contaminants Investigation of Buffalo Lake National Wildlife Refuge, Texas 1993-1994. U.S. Fish and Wildlife Service, Arlington, Texas. 35 pp.

Baxter, R.M. 1977. Environmental effects of dams and impoundments. Ann. Rev. Ecol. Syst. 8:255-283.

Blackburn, W.H., R.W. Knight, and J.L. Schuster. 1982. Saltcedar influence on sedimentation

in the Brazos River. J. Soil and Water Conserv. 37:298-301.

Bonner, T.H. 2008. Electronic mail received from Dr. Timothy Bonner, Associate Professor, Texas State University, San Marcos, Texas (Mar. 11, 2008).

Bonner, T.H. and D.T. Runyan. 2007. Fish assemblage changes in three western Gulf slope drainages. Final Report (2005-483-033) submitted to the Texas Water Development Board. 46 pp.

Brazos G Regional Water Planning Group (BGWPG). 2006. Brazos G Regional Water Planning Area, Regional Water Plan. January 2006.

Busby, F.E., Jr. and J.L. Schuster. 1971. Woody phreatophyte infestation of the middle Brazos River flood plain. J. Range Mgmt 24:285-287.

Cross, F. B. 1953. A new minnow, *Notropis bairdi buccula*, from the Brazos River, Texas. Tex. J. Sci., 5:252-259.

Dunn, D. D. and T. H. Raines. 2001. Indications and potential sources of change in sand transport in the Brazos River, Texas. United States Geological Survey Water-Resources Investigations Report 01-4057. 32 pp.

Durham, B. W. and G. R. Wilde. 2006. Influence of stream discharge on reproductive success of a prairie stream fish assemblage. Trans. Am. Fish. Soc. 135: 1644-1653.

_____. 2008. Asynchronous and synchronous spawning by smalleye shiner *Notropis buccula* from the Brazos River, Texas. Ecol. Freshwater Fish 17:528-541.

_____. 2009a. Effects of streamflow and intermittency on the reproductive success of two broadcast-spawning cyprinid fishes. Copeia 1: 21-28.

_____. 2009b. Population dynamics of the smalleye shiner, an imperiled cyprinid fish endemic to the Brazos River, Texas. Trans. Am. Fish. Soc. 138: 666-674.

Echelle, A. A., A. F. Echelle, and L. G. Hill. 1972. Interspecific interactions and limiting factors of abundance and distribution in the Red River pupfish, *Cyprinodon rubrofluviatilis*. Amer. Mid. Nat. 88:109-130.

Forshage, A. and N. E. Carter. 1974. Effects of gravel dredging on the Brazos River. Southeastern Assoc. of Game and Fish Comm. Proc. 27:695-709.

Gilbert, C. R. 1980. *Notropis buccula* Cross, smalleye shiner. p. 242 in D.S. Lee et. al. *Atlas of North American Freshwater Fishes*. N. C. State Mus. Nat. Hist., Raleigh. i-x + 854 pp.

Gore, J. A. and R. M. Bryant. 1986. Changes in fish and benthic macroinvertebrate assemblages along the impounded Arkansas River. J. Freshwater Ecol. 3(3):333-345.

Hubbs, C. 1957. A checklist of Texas fresh-water fishes. Texas Game and Fish Commission, Inland Fisheries Series 3:1-11.

Hubbs, C. L., R. J. Edwards, and G. P. Garrett. 1991. An annotated checklist of the freshwater fishes of Texas, with keys to identification of species. Tex. J. Sci. 43(4) Supplement. 56 pp.

Jelks, H.L., S.J. Walsh, N.M. Burkhead, S. Contreras- Balderas, E. Diaz-Pardo, D. A. Hendrickson, J. Lyons, N.E. Mandrak, F. McCormick, J.S. Nelson, S.P. Platania, B.A. Porter, C.B. Renaud, J.J. Schmitter-Soto, E.B. Taylor, and M.L. Warren, Jr. 2008. Conservation status of imperiled North American freshwater and diadromous fishes. Fisheries 33(8): 372-407.

Johnson, J. L., R. H. Wiley, R. DeArment, B. Spain, and B. Alexander. 1982. Brazos Natural Salt Pollution Control Project, Texas. U. S. Department of the Interior, Fish and Wildlife Service, Region 2, Area 1, Austin, Texas. 41 pp.

Kerpez, T.A. and N.S. Smith, 1987. Saltcedar control for wildlife habitat improvement in the southwestern United States. U.S. Fish and Wildl. Serv. Resour. Publ. 169. 16 pp.

Langer, W.H. 2002. A general overview of the technology of in-stream mining of sand and gravel resources, associated potential environmental impacts, and methods to control potential impacts. U.S.G.S. Open-File Report OF-02-153. 38 pp.

Llano Estacado Regional Water Planning Group (LEWPG). 2006. Llano Estacado Water Planning Area Regional Water Plan. April 2006.

Marks, D. E., G. R. Wilde, K. G. Ostrand, and P. J. Zwank. 2001. Foods of the smalleye shiner and sharpnose shiner in the upper Brazos River, Texas. Tex. J. Sci. 53(4)327-334.

Mathewson, C. C. and L. L. Minter. 1981. Impact of water resource development on the hydrology and sedimentology of the Brazos River, Texas with implications on shoreline erosion. Bull. Assoc. Eng. Geol 18(1):39-53.

Matthews, W.J. and E.G. Zimmerman. 1990. Potential effects of global warming on native fishes of the southern Great Plains and the southwest. Fisheries 15(6): 26-32.

Moss, R. W. and K. B. Mayes. 1993. Current status of *Notropis buccula* and *Notropis oxyrhynchus* in Texas. River Studies Report 8, Texas Parks and Wildlife Department, Austin. 125 pp.

Nelson, J.S., E.J. Crossman, H. Espinosa-Perez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society, Special Publication 29, Bethesda, MD.

Ostrand, K. G. 2000. Abiotic determinants of fish assemblage structure in the upper Brazos River, Texas. Unpublished PhD dissertation, Texas Tech Univ., Lubbock. 101 pp.

Ostrand, K. G. and G. R. Wilde. 2001. Temperature, dissolved oxygen, and salinity tolerances of five prairie stream fishes and their role in explaining fish assemblages. Trans. Am. Fish. Soc. 130:742-749.

Region H Water Planning Group (RHWPG). 2006. Regional Water Plan. Prepared by Brown & Root/Turner Collie & Braden. December 2005.

Robinson, T.W. 1965. Introduction, spread, and areal extent of saltcedar (*Tamarix*) in the Western States. U.S. Geol. Surv., Prof. Pap. 491-A. 12 pp.

Sellers, K.K. 1996. Survey Report for the Brazos River, 1994. Texas Parks and Wildlife Department Statewide Freshwater Fisheries Monitoring and Management Program, Federal Aid in Sport Fish Restoration Act Project F-30-R. 38 pp.

Texas Commission on Environmental Quality (TCEQ). 2004. Clear Streams Initiative: Report on Investigation/Enforcement Phase, publication AS-196. 103 pp.

Texas Commission on Environmental Quality (TCEQ). 2010. Electronic mail correspondence to Jacob Lewis, U.S. Fish and Wildlife Service, Arlington, Texas.

Texas Natural Resource Conservation Commission. 2000. Texas Water Quality Inventory 2000 (SFR-050/00), Volume 3. 131 pp.

U.S. Environmental Protection Agency (USEPA). 2002. National water quality inventory 2000 report. EPA-841-R-02-001.

U. S. Fish and Wildlife Service (USFWS). 1999. Biological Opinion under section 7 of the Endangered Species Act concerning the National Pollution and Discharge Elimination System General Permit for concentrated animal feeding operations. U.S. Fish and Wildife Service, Arlington, Texas.

U.S. Fish and Wildlife Service (USFWS). 2006. Unpublished data from Texas Pollution Elimination Discharge System Database maintained at the Arlington Field Office, Arlington, Texas.

Wilde, G. R. and T. H. Bonner. 2002. Unpublished data received from Dr. Gene Wilde, Associate Professor, Texas Tech University, Lubbock, Texas, and Dr. Timothy Bonner, Associate Professor, Texas State University, San Marcos, Texas (Feb. 5, 2002).

Wilde, G.R. and B.W. Durham. 2007. Distribution, status, habitat preferences, and reproductive ecology of smalleye shiner and sharpnose shiner in the Brazos River. Final report submitted to Texas Parks and Wildlife Department under USFWS Federal Assistance Grant E-55. 90 pp.

Wilde, G. R. and K. G. Ostrand. 1999. Changes in the fish assemblage of an intermittent prairie stream upstream from a Texas impoundment. Tex. J. Sci. 51(3): 203-210.

Winemiller, K. O. and F. P. Gelwick. 1999. Assessment of ecological integrity of streams in the Brazos-Navasota River watershed based on biotic indicators. Final Project Report to the Brazos River Authority. 32 pp.

Winemiller, K.O., F.P. Gelwick, T. Bonner, S. Zeug, and C. Williams. 2004. Response of oxbow lake biota to hydrologic exchanges with the Brazos River channel. Unpublished report submitted to Tex. Wat. Develop. Board. 59 pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: _____ May 21, 2010

Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ Date: October 22, 2010

ACTING
Director, Fish and Wildlife Service

Do not concur: _____ _____

Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 15, 2010
Conducted by: Omar Bocanegra