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

SCIENTIFIC NAME: *Fundulus sciadicus*

COMMON NAME: Plains topminnow

LEAD REGION: Region 6

INFORMATION CURRENT AS OF: August 15, 2013

STATUS/ACTION

_X_ Species assessment - determined that the information on threats does not support a proposal to list the species and, therefore, it was not elevated to Candidate status
__ New candidate
__ Continuing candidate
__ Non-petitioned
___Petitioned - Date petition received: _____
____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)? _____
b) To date, has publication of a proposal to list been precluded by other higher priority listing actions? ____
c) If the answer to a. and b. is "yes," provide an explanation of why the action is precluded.

__ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined): _____
___ 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, Fundulidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Wyoming, South Dakota, Minnesota, Colorado, Nebraska, Iowa, Kansas, Missouri, Oklahoma

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Wyoming, South Dakota, Minnesota, Colorado, Nebraska, Iowa, Missouri, Oklahoma

LAND OWNERSHIP: The plains topminnow (*Fundulus sciadicus*), currently occurs on mostly on private lands. Public land where the plains topminnow occurs currently includes the Pawnee National Grassland in Colorado, Thunder Basin National Grassland in Wyoming, Nebraska National Forest in Nebraska, and Buffalo Gap National Grassland in South Dakota (Rahel and Thel 2004). The species is present on the Fox Ranch near Wray, Colorado, which is owned by The Nature Conservancy (TNC).

LEAD REGION CONTACT: Sarah Fierce, (303) 236-4388

LEAD FIELD OFFICE CONTACT: Nebraska Field Office, Lourdes Mena, (308) 379-6592, extension 23

BIOLOGICAL INFORMATION

Species Description

The plains topminnow (*Fundulus sciadicus*) is a small fish that normally averages 32 to 64 millimeters (mm) in total length when mature, but can be up to 70-75 mm (Cross and Collins 1995, p. 176; Pflieger 1997, p. 243; Rahel and Thel 2004, p. 19). Plains topminnows have protruding jaws and tilted mouths for surface feeding heads that are dorso-ventrally flattened with scales and plates, which are traits indicative of surface feeding (Eddy and Underhill 1978, p. 135; Tomelleri and Eberle, 1990, p. 141). Other distinctive characteristics include a rounded caudal fin, a dorsal fin situated slightly ahead of the anal fin, and large scales (Woodling 1985, p. 63; Pfleiger 1997, p. 243). Plains topminnows are primarily olive-green in color with a silvery-white ventral side and bluish reflections along the sides in the summer (Woodling 1985, p. 63; Cross and Collins 1975, p. 19; Pflieger 1997, p. 243). A characteristic golden stripe is present and often quite apparent on adults in front of the dorsal fin (Pflieger 1997, p. 243; Rahel and Thel 2004). The fish have faint bluish-green cross hatchings along the body, and adults have a prominent gold streak along the mid-line of the dorsal side (Pflieger 1997, p. 243). Fins of immature individuals, females, and non-reproductive males may have faint yellow hues but are most often colorless (Pflieger 1997; Rahel and Thel 2004; Cross and Collins 1975). Adult plains topminnows exhibit some degree of sexual dimorphism (differences in appearance between male and females), with males displaying a red-orange fin tip during spawning (Pflieger 1997).

Taxonomy

The plains topminnow was first described as *Fundulus sciadicus* by Cope in 1865 (Rahel and Thel 2004, p. 13). The plains topminnow is one of 40 species in the *Fundulus* genus in North America (Parenti 1981, p. 495; Rahel and Thel 2004, p. 13) and is a member of the killifish family, Fundulidae (Parenti 1981, p. 495). Topminnows have jaws adapted for surface feeding (Cross and Collins 1995; Pflieger 1997; Rahel and Thel 2004). Two clades for this species are known, including one from the Osage, Gasconade, and Spring River drainages in Missouri and one from all populations north of the Republican River in Nebraska and the Lamine River in Missouri (O'Hare 1985, p.1; Li et al. 2009, pp. 1041-1046). The divergence in diversity in the populations is a product of the Pleistocene glaciation (O'Hare 1985, pp. 2-3). The plains topminnow also has a small distribution in southwest Missouri, southeastern Kansas, northwest Iowa, and northwestern Oklahoma. Genetic characterization of populations from Missouri and Nebraska has not demonstrated a basis to classify any subspecies of the plains topminnow (Parenti 1981, p. 495; Rahel and Thel 2004, p. 13). Physical variation in some traits has been documented between clades but without any distinct patterns, and the variation does not warrant a need for subspecies classification (O'Hare 1985, pp. 14-15, 27). However, we recognize the plains topminnow as a valid taxon at the species level, and therefore as a listable entity under the Endangered Species Act (Act).

Habitat/Life History

The plains topminnow inhabits clear water streams, isolated pools, backwater areas, sloughs, and overflow pools of larger streams (Pflieger 1997, p. 243; Rahel and Thel 2004, p. 17). The water in these areas is typically clear and with minimal current (Woodling 1985, p. 63; Pflieger 1997. p. 243; Rahel and Thel 2004, p. 17). Plains topminnows are thought to prefer areas with a muddy to sandy substrate and water with dense aquatic vegetation to avoid predator fishes and for foraging (Stribley and Stasiak 1982, p. 17; Woodling 1985, p. 63; Weitzel 2002, p 38; Rahel and Thel 2004, p. 17). The plains topminnow can tolerate water with low dissolved oxygen and warm temperatures (Smale and Rabeni 1995), and tends to be collected in low densities, which may be due to its aggressive temperament (Probst 1982; Rahel and Thel 2004, p. 16). The species commonly occurs in isolated colonies, likely because its preferred backwater habitat is not contiguous in nature (Labbe and Fausch 2000, Scheurer *et al.* 2003; Pflieger 1997, p. 243; Rahel and Thel 2004, p. 27). This species has been shown to have a negative correlation with undercut banks and overhanging vegetation, but often is associated with increased conductivity and increased macrophyte coverage (Fischer and Paukert 2008a; Heatherly unpub. data).

The plains topminnow has a life span of four years and reaches sexual maturity in its second summer (Pflieger 1997; Stribley and Stasiak 1982, p. 18; Rahel and Thel 2004, p. 19). The mean weight and length of females is slightly greater than males of the same age class (Stribley and Stasiak 1982). Females lay one egg brood per year between late April and early July when water temperatures are between 18 and 24°C (Kaufmann and Lynch 1991, p. 44; Pflieger 1997, p. 243). Females may lay eggs singly or in strings, with an average of 30 to 50 eggs in each brood. Eggs are adhesive, allowing attachment to aquatic vegetation or algal mats (Baugh 1981; Kaufman and Lynch 1991, pp. 43). Eggs hatch after eight to 14 days (Kaufman and Lynch, 1991, pp. 41-43; Kinney and Lynch 1991). During the spawning season, the fins of males

become bright red, and males display aggressive behavior (Kaufman and Lynch 1991, p. 42). Males enlarge the gular region (region between the sides of the lower jaw) to lure females for mating (Kaufman and Lynch 1991, p. 42).

The first-year survival is very important to population viability, but the species is also sensitive to stochastic fluctuations (Rahel and Thel 2004, p. 19). The peak reproductive contribution for plains topminnow occurs at second age class or 1-year old individuals, thus females of this age are important to local populations; however, they represent a limited portion (4%) of the populations (Rahel and Thel 2004, p. 21). Thus, habitat health and food availability are very important during the first year. The plains topminnow's diet is varied and consists of organisms captured at the water surface and has been known to include crustaceans, snails, and insects (Stribley and Stasiak 1982; Cross and Collins 1995, p. 176; Pflieger 1997). Invertebrates are thought to be an important part of their diet (Stribley and Stasiak 1982, pp. 17-18; Cross and Collins 1995, p. 176; Pflieger 1997).

Historical Range/Distribution

The plains topminnow is endemic to the Great Plains (Fischer and Paukert 2008b; Bessert 2011). Historically plains topminnow occurred in nine states including Wyoming, South Dakota, Minnesota, Colorado, Nebraska, Iowa, Kansas, Missouri, and Oklahoma (Cross and Collins 1975, p. 119; Rahel and Thel 2004, p. 14; Pasbrig 2009, pp. 43-44) (Figure 1). Historically, the largest distribution was centered in Nebraska and extended to northeastern Colorado, southeastern Wyoming, southern South Dakota, southwestern Minnesota and Iowa (Baxter and Stone 1995; Weitzel 2002; Rahel and Thel 2004, p. 14; Fischer and Paukert 2008a; Pasbrig *et al.* 2012, p.51; Schumann 2012). A second population was centered in Missouri and extended from Kansas south to Oklahoma (Cross and Collins 1995, p. 176; Pflieger 1997; Rahel and Thel 2004; Pasbrig *et al.* 2012; Schumann 2012).

In Nebraska, historical populations were found on the Elkhorn, Platte, Niobrara, Loup, and Dismal River drainages (Johnson; Kaufman and Lynch; Pasbrig 2009), with the Platte supporting 25 percent of all Nebraska populations (Pasbrig 2009, p. 47). Along the Republican River in Nebraska, the plains topminnow was thought to have been impacted the hardest with a decline of up to 70%, but new occupied sites have since been identified (Pasbrig et al. 2012, p. 242). In Wyoming, it is known from four drainages including the Niobrara, North Platte, South Platte, and Cheyenne Rivers (Pasbrig 2009, p. 47; Moan *et al.* 2011; Bear and Barrineau 2007; McGree *et al.* 2011; Barrineau *et al.* 2010; Barrineau *et al.* 2007). In South Dakota, the plains topminnow has been observed from 41 locations in seven drainages including: the Cheyenne, Keya Paha, Little White, Big Sioux, Niobrara, Vermillion, and James River drainages (Pasbrig 2009, p. 53). Before 1973 the plains topminnow was unknown in the state of Minnesota (Anderson et al. 1977, p. 3). Surveys in the 1990s-2000s increased the known sites to 16, all still within the Rock River system (Hatch et al. 2003, p. 21). In Colorado, the plains topminnow has been detected in three drainages including the Big Thompson, Cache La Poudre, and South Platte Rivers at 131 sites (Pasbrig 2009). From Iowa, there are five historical records of the plains topminnow along the Little Sioux, Floyd, and Rock River basins, although two of these records are likely in error (Harlan and Speaker 1956; Pasbrig 2009, p. 48). It is thought that the Rock River and potentially the Floyd River drainages were the only areas to support the plains

topminnow in Iowa (Harlan and Speaker 1956, p. 365; Pasbrig 2009, p. 48). The plains topminnow was presumed to be extirpated from Iowa as of 1941 (Harlan and Speaker 1956, p. 365; Pasbrig 2009, p. 48).

Kansas, Missouri, and Oklahoma comprise the most southeastern range of the plains topminnow. From Kansas, only one record for the plains topminnow exists, from Shoal Creek in Cherokee County in the southeastern portion of the state (Cross and Collins 1975, p. 119; Pasbrig 2009, p. 48). The plains topminnow may have also occurred within the Republican River drainage in northwestern Kansas, but no voucher specimens exist (Cross and Collins 1975, p. 119; Pasbrig 2009, p. 49). In Missouri, there are 74 historical records for the plains topminnow from the Gasconade, Missouri, Osage, and Spring River drainages (Pasbrig 2009, p.52). The plains topminnow mostly occurs along the north and western edges of the Ozarks in southwestern Missouri within Lost and Shoal Creeks (Pflieger 1997, p. 243; Pasbrig 2009, p. 50).

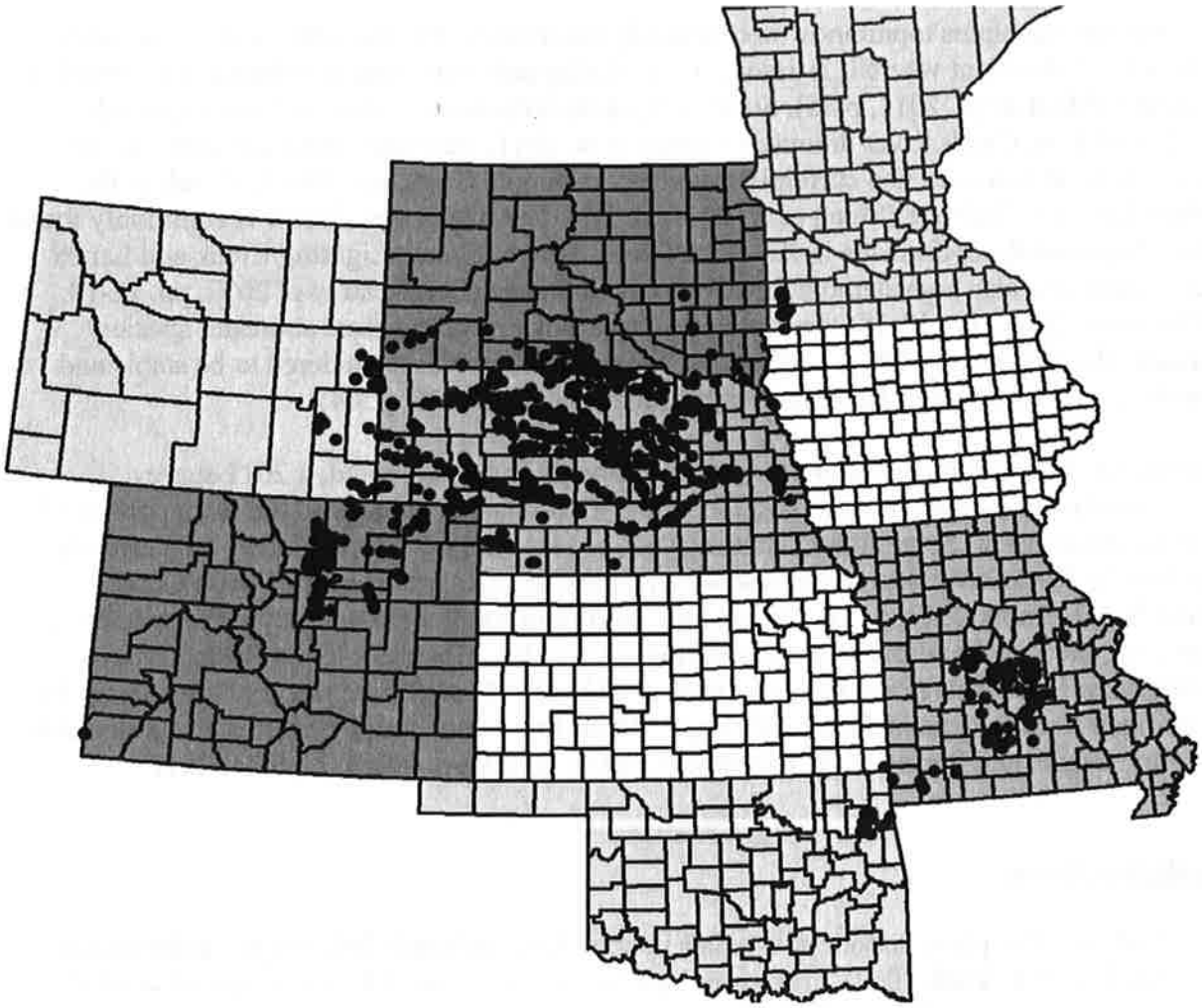

Fig. 1. Historical locations of plains topminnow occurrence across their 9-state geographic range. *Taken from Pasbrig et al. 2012.*

Current Range/Distribution

As mentioned above, Nebraska supports the most widespread distribution for the species with populations on the Elkhorn, Platte, Niobrara, Loup, and Dismal River drainages. Kansas, Missouri, and Oklahoma comprise the most southeastern range of the plains topminnow. In Colorado, the plains topminnow is native only to the South Platte River basin (Crockett 2012) and Colorado Parks and Wildlife (CPW) does not consider any area outside of this basin to have conservation value for the species. The species is also currently documented in the Rio Grande River (Bestgen *et al.* 2003, CPW unpublished data). The most recent efforts from CPW have documented plains topminnow in 10 percent of the sites sampled in the South Platte basin and in 11 of 17 known occupied sites, which could be an indication of some range contraction, but not a severe decline as previously thought by Pasbrig *et al.* (Crockett 2012, pp. 1-6; Pasbrig *et al.* 2012, p. 243). CPW has also translocated plains topminnow in three areas with suitable habitat within the species' range in the South Platte River basin (Crockett 2012, p.4).

In Wyoming, the plains topminnow is commonly found in the Niobrara River drainage where it is considered abundant where it is associated with silty substrates and the absence of nonnative piscivores (Moan *et al.* 2011, p.35). Sustained populations are found in the Lower Laramie River, and Horse Creek River drainages (Moan *et al.* 2011; Bear and Barrineau 2007, p. 25). The plains topminnow is also currently found in Lodgepole Creek and Muddy Creek in the Lodgepole Creek drainage (Moan *et al.* 2011, p. 22). The plains topminnow is commonly found in the Cheyenne River drainage in Antelope Creek, Beaver Creek, Lighting Creek and Lance Creek where it is also considered nonnative to the drainage (Barrineau *et al* 2007, pp. 12-18; McGree *et al.* 2011, pp. 12-38). In Antelope Creek it is one of the most abundant species captured (Barrineau *et al.* 2007, p. 15). The plains topminnow is considered to be stable and expanding in the Cheyenne River drainage (Barrineau *et al.* 2010, p. 84).

In Iowa, where the plains topminnow was once thought to be extirpated, a 2011 survey documented plains topminnows at five locations in off-channel habitats in the Iowa portion of the Rock River basin (Schmidt and Hrabik 2012, p. 11-12). Plains topminnows are currently found on the Rock River and on the Kanaranzi Creek; all sites are located in Lyon County (Schmidt and Hrabik 2012, p. 11-12). Recent surveys in Kansas did not record the species. In Minnesota, the species is found in 40 sampling sites within tributaries to the Rock River in southwestern Minnesota (Pasbrig *et al.* 2009, p. 241). In Missouri, the range of the species has not changed from the known historical range. Plains topminnows still persist in the Gasconade, Missouri, Osage, and Spring River drainages (Pasbrig 2009, pp. 49-50; Ziehmer 2012).

Population Status

South Dakota. The plains topminnow exists in abundance in South Dakota (Hoagstrom *et al.* 2007, pp. 161-184; Vonk 2012). They continue to occur in most of the previously recorded drainages except for the Missouri River drainage, from which there is only one record from 1953 (Vonk 2012).

Minnesota. In Minnesota, there are at least 25 known locations within eight streams where the

plains topminnow exists (Hatch et al. 2003, p. 21; Pasbrig 2009, p. 49; MDNR 2012, p. 58). All of the records are from rivers and tributaries within the Rock River in southwestern Minnesota. Although the species' occupied locations increased with recent surveys, the State believes the species is found in low abundances when compared to Topeka shiners within the same habitat (MDNR 2012, p.58).

Colorado. In Colorado, plains topminnows were collected from 131 stream sites within the South Platte and the Cache La Poudre Rivers in the 1990s. Additional surveys were done in 25 sites from 2000 to 2009. Plains topminnow has never been found in high abundance in the South Platte drainage (Propst and Carlson, 1986). Previously, plains topminnow was found to be present in 14 of 17 hydrologic units in the drainage, and surveys in the last decade have continued to record them in 11 of the 17 hydrologic units in the drainage, indicating minimal contraction, however, the populations are still present and stable (Crockett 2012). CPW has also established three new populations in suitable habitat within the species' range and is continuing monitoring to determine their persistence. Efforts in Colorado show that the species is stable in most areas, and it is being translocated to other suitable areas to strengthen its range.

Wyoming. In Wyoming, the plains topminnow is abundant within the Niobrara River drainage, South Platte River drainage and North Platte River drainage (Barrineau *et al.* 2010, p. 84; Weitzel 2002). Recent surveys indicate that the plains topminnow appears consistently in the Niobrara River drainage (McGree *et al.* 2011; Barrineau *et al.* 2010; Moan *et al.* 2011; Barrineau *et al.* 2007; Bear *et al.* 2007). Distribution of the plains topminnow was previously thought to have declined in Wyoming (Patton 1997), but the most recent surveys indicate that the species distribution remains stable in the Niobrara River, North Platte and South Platte River drainages and has expanded in the Cheyenne River basin (Barrineau *et al.* 2010, p. 86; Moan *et al.* 2011, p. 31). Plains topminnows have been recorded in Horse Creek during the latest consecutive survey efforts, indicating that the population is currently occupying this area successfully, where it was not recorded in an earlier survey in 1993 (Patton 1997; Moan *et al.* 2011, p. 29; Bear *et al.* 2007, pp. 23-27). In Lodgepole Creek, plains topminnows are found consistently during surveys (Moan *et al.* 2011, pp. 31-32; Barrineau *et al.* 2007, p. 26). Recent surveys show the plains topminnow further upstream in the Lodgepole drainage than previously sampled and may indicate population expansion in this area (Moan *et al.* 2011, p. 31).

Nebraska. Survey efforts from 2000-2010 found that plains topminnow populations in Nebraska showed a reduction of close to 65 percent in the number of historical locations that were supporting plains topminnow (Pasbrig *et al.* 2009, p. 242). However, recent efforts show the plains topminnow to still be present in all nine major drainages within the plains topminnow range (Schumann 2012, pp. 136-139; Turek et al. 2012). This recent effort also found that the local occurrence of the plains topminnow was significantly dependent on the other fish species present in those drainages, and that generally invertebrate feeders and western mosquitofish were in some cases negatively associated with plains topminnows (Schumann 2012, pp. 136-146).

Plains topminnows were introduced at 17 sites in Nebraska in four different stocking events, and have been shown to persist in 7 of the sites (Schumann 2012). Monitoring in these sites show that movement of plains topminnow from release sites and sampling reaches is greater than what was previously known. This information calls into question some of the data that some of the

states (e.g. Nebraska) have collected on the species range, because they have used small scale sampling and/or sampling in the same stretch of a stream repeatedly to determine the presence or absence of plains topminnow. Consequently, attempting to predict distribution of plains topminnow by sampling habitat at only small scales underrepresents the species' range, since the home range of many individuals may be larger than the standard small-scale study reaches (Schumann 2012, pp. 269-270). Schumann (2012) found that plains topminnow migrated from the central release sites upstream and downstream and that the species has large defined home ranges. This could be vital to recolonization of habitats lost to stochastic events or anthropogenic activities. Due to new findings of plains topminnows in sites where the species was previously recorded as absent, it is most likely an indication that predicting distribution of plains topminnow by sampling at small scales, as it has been done in past decades, is not accurate. Small scale and repeated sampling in a small reach does not detect plains topminnow present in low abundances, and has most likely underestimated the true status of the species in Nebraska (Schumann 2012, p. 271; Hoagstrom *et al.* 2007, pp. 161-184).

Iowa. As mentioned above, the plains topminnow was thought to be extirpated from Iowa, but new information indicates otherwise (Schmidt *et al.* 2011). The plains topminnow was found in 2011 in five locations in the Rock River basin, within off-channel habitats with good connectivity to the Rock River. The species was not found in off-channel habitats with infrequent connection to the parent river, and therefore we suspect it may have dispersed from Minnesota during floods in 2011. Future surveys will determine whether reproduction is occurring and whether the species is established in Iowa.

Kansas. Kansas has a single historical collection, and the species was not found in recent surveys in 2009 (Cross and Collins 1975, p. 119; Pasbrig *et al.* 2009, pp. 238- 241). All efforts in Kansas indicate that the plains topminnow has been extirpated from the State, and that it was never a common species historically.

Missouri. In Missouri, plains topminnow populations are still found in the Gasconade, Missouri, Osage, and Spring River drainages in significant numbers (Pasbrig 2009, pp. 49-50; Ziehmer 2012). In addition, the plains topminnow co-exists with western mosquitofish in Missouri and the Midwest without detriment to the former (Hrabik 2012).

Oklahoma. Eighteen sites previously known to be occupied by plains topminnows were sampled in Oklahoma in 2009 with no success (Pasbrig *et al.* 2009, p. 242). However, the plains topminnow was found in two new locations during that sampling effort. In Oklahoma, this species is commonly found in confined areas but usually the species is very abundant in the areas where it is found. Presently, records show plains topminnows in high abundance in Spavinaw and Spring Creeks (Pasbrig *et al.* 2012). We believe that further survey efforts could show other areas where the plains topminnow exists in Oklahoma.

In summary, we believe that the available data show that the plains topminnow is still present in the majority of its range (see Table 1 for summary). Populations of plains topminnow in Colorado, Wyoming, Missouri, Nebraska and South Dakota still exist in most if not all of the drainages where the species was historically recorded, and additional populations have been recorded in Iowa, Wyoming, Oklahoma and Minnesota. Efforts in Colorado and Nebraska have

also increased the populations in areas with suitable habitat. Currently, the only drainage in which the plains topminnow has not been found recently is the Missouri River drainage in South Dakota, and it has been extirpated from the Little Blue and Nemaha River drainages in Nebraska (Schumann 2012, p .136). Kansas has never had a robust population, and it is now believed to be extirpated there (Pasbrig 2009, p. 49).

Table 1. Current Distribution of Plains Topminnow

State	Current Distribution
South Dakota	Present in 43 tributaries within 5 river basins
Minnesota	Known occupied sites increased to more than 20 within the Rock River basin in the 2000s.
Colorado	Present in 14 of 17 hydrologic units within the South Platte River Basin. Conservation efforts have increased populations in additional plains topminnow habitat.
Wyoming	Distribution stable in the Niobrara River, North Platte and South Platte River drainages. Distribution has increased in the Cheyenne River basin and the Lodgepole drainage.
Nebraska	Present in all nine major drainages with decreases in distribution within the Republican River basin.
Iowa	Thought to have been extirpated, recently found in five locations within the Rock River basin
Kansas	Thought to be extirpated, never abundant historically
Missouri	Still found in all historical drainages: Gasconade, Missouri, Osage and Spring River drainages
Oklahoma	Recently found in high abundances in Spring Creek and Spavinaw Creek watersheds. Fewer numbers have been recorded in the Neosho River.

Threats Evaluation

We evaluated several potential stressors to the plains topminnow to see if any stressors rise to the level of a threat to the species as a whole. The following is a listing of stressors to the plains topminnow by category, which could significantly affect the species in the future; however we have not found that any of these individually or collectively constitute a threat to the species.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

The following potential stressors that may affect the habitat or range of the plains topminnow are discussed in this section: (1) water use and agricultural practices; and (2) urban and suburban development.

(1) Water use and agricultural practices

Eastern regions of the Great Plains have experienced greater changes to native terrestrial vegetation (e.g., Iowa, Illinois) and significant declines in native tallgrass prairie due to land alterations for agricultural use (82-99%) (Samson & Knopf 1994, p. 418), while northern and western regions have more native rangeland, less urbanization and lower human density (Fischer and Paukert 2008a, p. 598). Although we do not have specific studies identifying effects of water withdrawal for agricultural practices, it is known that prairie stream fish are affected by alterations to land and water use, primarily driven by agricultural practices, but also physical modifications, such as impoundments, irrigation, channelization, and bank stabilization among other changes (Cross & Moss 1987; Pflieger & Grace 1987; Matthews 1988; Dodds *et al.* 2004, p. 205; Gido *et al.* 2004, p. 127).

Habitat degradation of plains topminnow habitat can result from feedlot runoff, intense livestock grazing, and pumping of saline groundwater. The states within and near the Great Plains are known for the largest concentration of feedlots in North America, with Nebraska, which has the largest distribution of plains topminnow, having the largest concentration of feedlots and cattle ranches in the country located within the range of the species (NASS 2007, 07-M134 and M135). Kansas, Nebraska and Wyoming are among the top nine states with the highest amount concentrated animal feeding operations (feedlots). Feedlot runoff can cause eutrophication and lead to low oxygen conditions and high ammonia concentrations while intense livestock grazing can result in increased stream intermittency, increased turbidity (which reduces the aquatic macrophytes that are an important habitat component for plains topminnow), and accumulation of manure in pools degrading the water quality (Platts 1991; Rahel and Thel 2004, p. 27). Cattle overgrazing can cause bank erosion, and coupled with extensive use of waterways by cattle, could reduce water clarity to the point where the aquatic plants that are an important component of plains topminnow habitat would be lost (Platts 1991). Furthermore, livestock trampling of stream banks can result in wide, shallow channels that are prone to drying up (Rahel and Thel 2004, p. 24).

In a recent analysis of current presence and absence of plains topminnow at 11 major drainages in Nebraska heavily impacted by agricultural practices and feedlot runoff, plains topminnows were found to have a negative correlation with undercut banks and overhanging vegetation, but were associated with increased conductivity and increased macrophyte coverage (Heatherly unpub. data; Fischer and Paukert 2008a, p.607). Other environmental variables that were not found to affect plains topminnow presence were discharge, turbidity, pH, percent canopy cover, and row crop and pasture land-use in the riparian areas (Heatherly unpub. data; Schumann *et al.* 2012, pp. 76-77). Runoff discharge and changes brought on by agricultural and feedlot runoff do not seem to impact plains topminnow populations (Schumann et al 2012, pp. 76-77). On the other hand, erosion and habitat changes in streams may be playing a role in habitat modification. However, plains topminnow populations are present and stable in Sand Hill streams where livestock grazing heavily occurs (Fisher and Paukert 2008a, p. 597). Therefore, we have determined that although drastic land use changes have occurred, and agricultural practices have been implemented within the plains topminnow range, they are not significantly affecting plains topminnow at a population level.

Water use in the Ogallala-High Plains aquifer in the Great Plains has moved the water table down to a degree that streams that had a flow year round are now dry most of the year (Dodds *et*

al. pp. 214-215), which hinders fish movement throughout a drainage. Although water use and water withdrawal for agricultural practices in the Great Plains is high, plains topminnow inhabits most of the drainages from where it has been recorded, demonstrating that these drainages still maintain connectivity (Schumann 2012). Furthermore, plains topminnows spawn between spring and early summer (breeding season of about 60 days) when temperatures are between 18 and 22°C (Kaufmann and Lynch 1991; Kinney and Lynn 1991, pp. 103-104), at a time of year when water use in the Great Plains is still minimal.

Flooding and drying are characteristic of the Great Plains, but with increased dewatering due to surface water diversion and groundwater pumping, they could become concerns within the plains topminnow range (Dodds *et al.* p. 214). Plains topminnows inhabit naturally intermittent prairie stream reaches, making them vulnerable to drying of streams and drought (Rahel and Thel 2004, pp. 3-23; Schumann 2012, p. 77). However, plains topminnow persists in streams where desiccation has recently occurred, further indicating that the species is well adapted to intermittent, drying stream conditions (Schumann 2012, p. 192). Although the High Plains aquifer water level has declined 14.2 feet from pre-development to 2011, a rise of 8.5 feet occurred in individual wells in Nebraska, and a 16 foot rise occurred in Colorado between 2009 and 2011 (McGuire 2013, pp. 10-13). We believe that although there have been some increases and decreases in groundwater levels over the years in the plains topminnow range, this species persists in areas where overall declines in groundwater have been observed (Colorado – 16.9%, Oklahoma – 9.4%) and in areas where groundwater recovers every year after the irrigation season (Nebraska, South Dakota, Wyoming) (McGuire 2013, p. 10).

(2) Urban and Suburban Development

When reaches of a stream dry out, drainage connectivity is needed for plains topminnows to be able to move up and downstream for migration within the basin and recolonize areas where they have been locally extirpated. Barriers such as highway culverts and dams can hamper fish movements (Schumann 2012, pp. 27-29). Many projects in areas of degraded streams create earthen dams or road dams to avoid further degradation and downcutting of streams and prevent future flooding, creating a barrier for fish movement and preventing recolonization of areas after local extirpations occur. In some cases, road culverts are not designed with fish passage in mind and can also interrupt the connectivity in the stream. Cyprinids (small freshwater fish such as minnows and shiners) are twice as likely to move upstream of box culverts than low-water crossings (structures that provides reasonable access as a stream crossing but will be flooded periodically and therefore closed to traffic) and 1.4 times as likely to move upstream of control reaches than any crossing type (Bouska and Paukert 2010, p.220). In addition, low-water crossings act as stream constriction points which restrict the transport of water, sediment, and debris during high flows and are related to decreased fish movement through crossings (Bouska and Paukert 2010, pp. 219-220; Bouska 2008, p. 19). Some of the roads crossing designs tested in the Great Plains also demonstrate that prairie fishes may be able to pass through various crossing designs at water velocities up to 1.1 meters/second, including Topeka shiners (a federally listed species) which exhibited greater movement with increasing water velocity (Bouska and Paukert 2010, p. 220).

Road dams, bridges, and culverts have been built with minimal considerations for aquatic movement throughout the plains topminnow range. Road dams have been used for flood control and grade stabilization in some areas within plains topminnow habitat. However, these structures are being built less frequently than in the past. In addition, recent efforts are improving conditions where these projects are built, and are including conditions for low flow fish passage and improvements to new and existing structures that may impede aquatic species movement (USACE 2012, p. 29; Cochnar 2013). With these changes, we expect conditions for plains topminnow movement to improve in streams. Development and construction of roads near wetland and riverine habitats results in habitat degradation as sediments, nutrients, and pollutants are introduced into the habitat (Dahl and Johnson 2000, pp. 26-29). It has been shown that gaps in riparian vegetation along streams correlate with decreased fish health and microinvertebrate communities (Stewart *et al.* 2001, pp. 1485-1486) and that the establishment of green spaces and buffer areas of at least 50 meters wide may minimize the impacts of urbanization in streams (Wang *et al.* 2001, p. 264). In most of the states within its range, plains topminnow populations are found mostly in suburban areas near agricultural or forested areas with streams in various stages of degradation (from healthy to degraded streams). We currently have no information that indicates large scale developments exist and we do not anticipate large developments in the future in areas where plains topminnow are found, therefore we do not believe that plains topminnow are threatened by urban and suburban development.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.

The available information does not indicate that collection of the plains topminnow by professionals or anglers is a problem. Some states (e.g., Colorado) have taken steps to protect plains topminnows by prohibiting take of the species and use as baitfish. Plains topminnows may be vulnerable in other states when taken as a bait species for recreational fishing, but not to a degree that will threaten the species as a whole, as this fish is not targeted for use as baitfish and studies have not indicated that the species is overharvested for this use (Rahel and Thel 2009, pp. 12-13). Scientific and educational efforts are ongoing in many states (Colorado, Wyoming, Iowa, Missouri, Nebraska, South Dakota, and Minnesota), including collections, translocations and survey efforts. These efforts are being done for the evaluation of management practices for the species (Colorado, Wyoming and Nebraska). It is possible that plains topminnows may be collected by professionals and hobbyists because of its aesthetically pleasing coloration, but it is not considered a good community aquarium fish due to its aggressive behavior. Voucher collections are still ongoing as specimens from newly identified locations in research studies and population surveys are collected for confirmation, as mentioned above. Nevertheless, we have no information indicating that overutilization of plains topminnow is happening at a level that will threaten the species.

C. Disease or Predation.

Introductions of nonnative species have occurred in inland systems (Tyus and Saunders 2000; Jeschke and Strayer 2005) and their effects include reduction or elimination of native fish due to predation and competition, transmission of foreign parasites and disease, or physical disruption of habitat (Elton 1958; Rahel 2000; Reynolds *et al.* 2002; Olden and Poff 2005). Displacement

of native fishes by nonnative species is a frequent occurrence throughout the world (Minckley 1991; Lydeard and Belk 1993; Clarkson *et al.* 2005) and on occasion local extirpation and extinction of native species results (Meffe 1985, p. 180). This replacement of native species by invasive fishes is likely among the most influential factors leading to decreased distributions of native fishes (Olden *et al.* 2004, p. 22).

Overall, native fishes are frequently successfully in response to threats from single invasive species and able to persist by shifting morphology, behavior, or life history (Gurevitch *et al.* 2000; Gido and Brown 1999, pp. 393-394; Gido *et al.* 2004, pp. 128-130; Clarkson *et al.* 2005). However, when multiple nonnative species colonize habitats, native species can be at risk. Nonnative game fish and nongame fish introductions have been implicated in the declines and habitat impacts of aquatic species (Wilcove *et al.* 1998; Hrodey *et al.* 2009). Predation and competitive pressures are often cited as the most frequent mechanism for displacement of native fish introduced to nonnative species (Wilcove *et al.* 1998; Hrodey *et al.* 2009; Tyus and Saunders 2000). In the presence of some nonnative fish, native fish are unable to recruit new year classes due to direct predation pressures on early life stages (Tyus and Saunders 2000; Clarkson *et al.* 2005). Predation as well as competition can apply concurrent pressure to both large and small size individuals (Mills *et al.* 2004). For the plains topminnow, the introduction of sport fish and western mosquitofish (*Gambusia affinis*) in their habitat has been associated with localized declines in their populations (Haas 2005, p. 80; Pasbrig 2012, pp. 244-245; Schumann 2012, pp. 231-250). Although sport fish and western mosquitofish introductions are causing pressure on populations by competing with plains topminnows in their habitat, the plains topminnow still cohabits with sport fish and western mosquitofish successfully (Hrabik 2012).

Introduced species in the Great Plains are often sport fish species (Gido *et al.* 2004, p. 122) that are top predators (e.g., largemouth bass, pike) and have a negative impact on native fish such as plains topminnow. In a study done by Fischer and Paukert (2008a) in Nebraska and Kansas within plains topminnow habitat, they found from 5 percent to 60 percent of individuals in their samples were introduced species at certain sites in what they considered regions of minimal disturbance (i.e., low rowcrop agriculture, low population density, and low number of impoundments). This study illustrates that fish assemblage shifts can be influenced by introduced and generalist species expansion. However, in relatively undisturbed areas, such as the Sand Hills of Nebraska, plains topminnow are found in more than 60 percent of historical sites, even though sport fish have been introduced in those areas, indicating that recruitment is still occurring when good environmental conditions exist (Fischer and Paukert 2008a, p. 607). Furthermore, populations of plains topminnow in South Dakota, Oklahoma, Wyoming, and Minnesota are being supported in new locations where they coexist with sport fish (Pasbrig *et al.* 2012, pp. 240-242). Introduced species alone may not have a significant effect on plains topminnow, but the combination of habitat degradation and introduced species may be shifting plains topminnow in their habitat to locations with better environmental conditions and fewer stressors.

Western mosquitofish introductions have been sporadic but have resulted in a nearly global dispersal of the species, and western mosquitofish are now considered the most widely distributed freshwater fish in the world (Krumholz 1948, p.35; Lynch 1988, p. 66; Chipps and Wahl 2004, p. 1150). Western mosquitofish have been extensively introduced in an attempt to

biologically control mosquito larvae; however, unintended consequences to the functioning of the receiving systems have regularly occurred (Pyke 2006, p.341). In the United States alone, western mosquitofish have been introduced in 36 states beyond their native range which include at least seven of the nine states in the plains topminnow range (Meffe 1985, pp. 173-174; Nico *et al.* 2013). It is believed that the introduction of western mosquitofish has contributed to the decline of some threatened and endangered fishes including the desert pupfish (*Cyprinodon macularius*), Gila topminnow, and the Yaqui topminnow (*Poeciliopsis occidentalis sonoriensis*) (Meffe *et al.* 1983, p. 135; Marsh and Minckley 1990, p. 265).

In the Great Plains, western mosquitofish have been implicated in the reduction of plains topminnow populations in some streams by some researchers (Rahel and Thel 2004, p. 23; Haas 2005, pp.78-80; Lynch & Roh 1996; Schumann 2012, pp. 136-146). Impacts of western mosquitofish on plains topminnows are primarily explained by predation and aggressive interactions directed towards juvenile life stages, which may cause significant mortality (Rahel and Thel 2004, p. 23; Haas 2005, pp.78-80; Lynch & Roh 1996, p. 76; Schumann 2012, p. 142).

Although western mosquitofish have been negatively correlated with plains topminnow absence in historically occupied sites (Schumann 2012, pp. 136-142), no other biotic or environmental factors were measured to determine if habitat changes were also responsible for the absence of plains topminnow at those sites. The species has been translocated successfully in Colorado and Nebraska to locations where it is coexisting with western mosquitofish (Pasbrig *et al.* 2012, p. 245; Schumann 2012, p. 178; Crockett 2012 pers. comm.). In addition, other populations of plains topminnow (e.g., populations in the Sand Hills in Nebraska) have not been significantly affected by the presence of western mosquitofish (Fischer and Paukert 2008a, p. 607; Hrabik 2012). Furthermore, reintroduction efforts of plains topminnow in Nebraska were successful in four of six sites with western mosquitofish (Schumann 2012, p. 178). In conclusion, predation from sport fish introductions are causing pressure on populations of native fish, and introduced western mosquitofish are believed to compete with plains topminnow in their habitat; however, the plains topminnow still cohabits with sport fish and western mosquitofish successfully at many locations and we do not believe that there is evidence that shows that plains topminnow populations are being impacted at a level that threatens the species as a whole.

In addition, there is no evidence to suggest that disease or parasites are major factors impacting survival or reproduction of the plains topminnow (Rahel and Thel 2004, p. 24). There has only been one report on parasites of this species; Ferdig (1990) studied the ecology of parasites in populations of plains topminnows from three streams in eastern Nebraska, and found a poor parasite assemblage (few parasites present). As there is no significant evidence of diseases in the plains topminnow, we conclude that diseases are not known to be a threat to plains topminnow populations.

D. The Inadequacy of Existing Regulatory Mechanisms.

Regulatory mechanisms affecting the species fall into two general categories: (1) Federal mechanisms, and (2) State mechanisms.

(1) Federal Mechanisms

Federal land management across the range of the plains topminnow includes the U.S. Forest Service, Bureau of Land Management (BLM), National Park Service (NPS) and U.S. Fish and Wildlife Service. Some Federal lands provide protection to the species. The Pawnee National Grassland has designated the plains topminnow as a Management Indicator Species (MIS) for aquatic environments and has initiated a monitoring program for this species and the plains killifish (*Fundulus zebrinus*) (Rahel and Thel 2004, p. 13). MIS species are used by the Forest Service to focus management in the direction of alternatives developed, provide a means to analyze effects on biological diversity, and serve as a reliable feedback mechanism during forest plan implementation by monitoring population trends in relationship to habitat changes. Where the plains topminnow is found on Federal lands such as wilderness areas, refuges, and national parks, it is protected from development.

However, most of the populations of the plains topminnow exist in privately owned areas. Therefore, most of the federal mechanisms for protection of plains topminnow and its habitat are through Clean Water Act (CWA) permits and land management. The U.S. Army Corps of Engineers (Corps), acting under the authority of the Clean Water Act (CWA), regulates the placement of fill materials into waters under federal jurisdiction. Section 404 of the Clean Water Act regulates placement of dredged and fill materials into waters of the United States which include the construction of dams and levees, development, bank stabilization, and infrastructure developments (such as roads and bridges).

Plains topminnow habitat includes waters regulated by section 404 of the Clean Water Act. Activities that result in fill of waters of the U.S. require a section 404 permit. Applications for these permits can be reviewed and recommendations are provided to avoid and minimize impacts to fish and wildlife resources, including native fish species such as the plains topminnow. However, the incorporation of these recommendations is at the discretion of the Corps. Some activities, such as fill above the ordinary high water mark, are not regulated by the Corps, but can still impact plains topminnow habitat. Section 402 of the CWA authorizes EPA to grant National Pollutant Discharge Elimination System (NPDES) permits to regulate point sources that discharge pollutants into waters of the United States. There are thousands of NPDES permits in each State within the plains topminnow range that monitor the release of pollutants into streams. There is no regulation for non-point sources but there are incentive programs, such as the U.S Department of Agriculture's continuous Conservation Reserve Program, which allows farmers to enroll seasonal or perennial streams into riparian buffer strips for the benefit of protecting water quality, preventing soil erosion and improving wildlife habitat. Although changes in plains topminnow habitat may be detrimental to the species, sedimentation of the habitat may not have a negative impact due to the fact that the plains topminnow is known to prefer areas where silt, muck or sand are the dominant substrates (Schumann 2012, p. 172). In addition, nationwide permits through Section 404 of the Clean Water Act (33 CFR 330.1-330.6) conditions projects so that no activity substantially disrupts the necessary life cycle movements of indigenous aquatic life in a waterbody (USACE 2012, p. 29). At this time, we have not identified threats that would require regulatory mechanisms to protect the species, and therefore we believe that existing federal protections are adequate for the protection of the plains topminnow.

(2) State Mechanisms

The plains topminnow is state-listed only in Minnesota as a threatened species, and is designated a species of concern or a rare species in other states. Most States do not have regulations in place to protect the plains topminnow directly except Colorado, where the collection and take of plains topminnow as a bait fish is prohibited (Title 33: Wildlife and Parks and Recreation). CPW is also developing a state management plan for plains topminnow that is currently undergoing internal review (Crockett 2012, p. 4). Minnesota decided to list the plains topminnow as threatened in Minnesota's List of Endangered, Threatened, and Special Concern Species, where it is now given protections under Minnesota's Endangered and Threatened Species Statute (MDNR 2013). In this State, the plains topminnow has been commonly found in low abundances. Concerns for water quality degradation in streams inhabited by plains topminnow and their limited distribution are part of the reason why the species has been elevated to threatened status in Minnesota (MDNR 2012).

Most States where the plains topminnow exists have some conservation measures that benefit the species. Some of the stream reaches where the plains topminnow occurs in Wyoming are managed under the Wild Fish Management Concept. These streams are not stocked with gamefish and promote wildfish production. Also, regulations in Wyoming protect native fish populations in the Platte River Basin by limiting seining in some of the areas where the plains topminnow exists and in the Niobrara River drainage where seining for baitfish is not allowed.

All of the states in the plains topminnow range have laws and regulations for groundwater control and withdrawal. For example, as part of Nebraska State law LB 962, passed by the Nebraska Legislature in 2004, groundwater well permits and surface water permits are carefully managed so that river flows do not reach the over-appropriated designation. Nebraska has recognized that surface flows are tied to groundwater levels near the river and vice versa and impact surface stream flows. Furthermore, Minnesota regulates the use of groundwater in amounts over 10,000 gallons a day, or one million gallons a year (Minn. Stat. § 103G.271). Although groundwater use is regulated, groundwater is used extensively for agriculture in this region (USGCRP 2009). In the Great Plains, where groundwater levels are of high concern, the Ogallala aquifer is a major source of water for irrigation, but this resource is being depleted (Rosenberg *et al.* 1999; USGCRP 2009). State regulatory mechanisms are changing and working towards the protection and management of prairie fish including the plains topminnow. We believe that for now, the state statues are working towards better management of the species. In addition, we have not identified threats that would require regulatory mechanisms to protect the species, and therefore we consider state regulatory mechanisms to be adequate.

E. Other Natural or Manmade Factors Affecting Its Continued Existence.

We evaluated whether loss of genetic variability, or drought and climate change may be other natural and manmade stressors to the plains topminnow. The plains topminnow has been in existence for thousands of years and has persisted despite the flood and drought events characteristic to the Great Plains. After the floods in 2011, the plains topminnow was collected in the Rock River Basin in Iowa, indicating a positive population response and movement caused by flood events. During increases of precipitation, we believe that the species will spread in

areas where there are no barriers to movement, and during times of drought it will most likely be extirpated locally where the species lacks isolated pools or adequate passages to migrate towards pools or groundwater fed backwaters.

Genetic Diversity

The genetic diversity of the plains topminnow was evaluated by Li *et al.* (2009). The results showed that plains topminnows from 21 sites throughout its range split into two subgroups. Their data describes four distinct populations within the two subgroups: Niobrara–Platte, Lamine, Osage–Gasconade and Spring River with the Lamine population being more closely related to the Nebraska populations. One subgroup includes haplotypes from only the southern portion of the distribution, the Osage River, the Gasconade River and the Spring River in Missouri. The second subgroup includes individuals from the Niobrara River and the Platte River in Nebraska and the Lamine River in Missouri (See Figure 2).

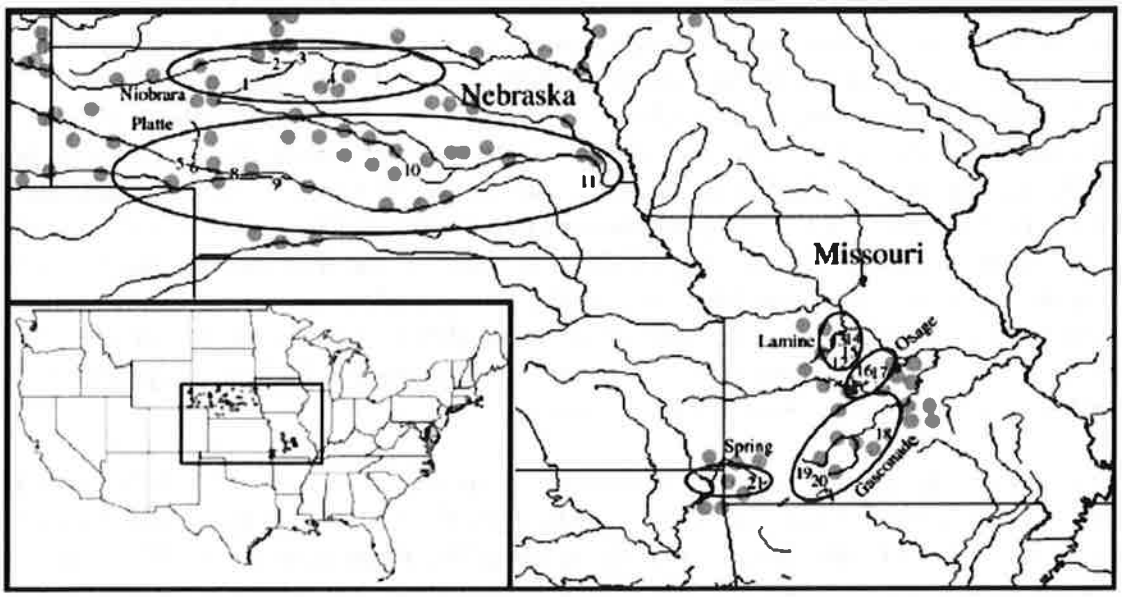

Fig. 2. Map of native range and drainages assessed for genetic diversity by Li *et al.* 2009. *Map taken from Li et al. 2009.*

Most plains topminnows from Nebraska showed a single genetic pattern, except for samples from Arkansas Flats (Niobrara River drainage) and Blue Creek (Platte River drainage) which contained additional haplotypes in their genetic pattern (Li *et al.* 2009, pp. 1044-1045). Although limited variation exists in genetic makeup of the plains topminnow, the results reveal a strong indication of population structure among drainages and indicates a past population expansion.

Translocation of plains topminnow specimens is being done by the Nebraska Game and Parks Commission (NGPC) and CPW. Both of these state agencies are using broodstock ponds where wild specimens have been collected and bred to establish populations that will then be transported to historical sites where there is still good habitat and plains topminnow is no longer

found (Koupal and Pasbrig 2010, pp. 3-5; Schumann *et al.* 2012, pp. 360-363; Crockett 2012, p. 4). The wild populations of plains topminnow are providing the genetic identity and variability of the area. Fish from local established wild populations are preferred since they would be closely related genetically and have similar ecological traits to the original extirpated population (Griffith *et al.* 1989; Minckley 1995; IUCN 1998; George *et al.* 2009). Both Colorado and Nebraska have been following these methods so that genetic diversity is maintained in the wild. In conclusion, wild populations of plains topminnow are similar within drainages and show low levels of genetic variability within drainages, but the species shows enough genetic variability between the four distinct populations to maintain and establish healthy populations. In addition, it is possible that translocation efforts are helping to maintain the genetic identity of the wild populations in the different groups.

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

In the Great Plains, the average annual temperature has increased by 0.83 °C (1.5 °F) since the 1970s and is expected to increase 2.5 °C (4.5 °F) by 2050 (USGCRP 2009) and between 4.2 °C (8 °F) and 5.0 °C (9 °F) by the 2080s across the range of the plains topminnow. With the projected rate of increase of GHG, average annual precipitation is expected to increase in the northern regions of the high plains and decrease in the southern regions (Kunkel *et al.* 2013). Most of the Great Plains region is expected to have an increase of up to 27 percent on the annual number of days with precipitation exceeding 1 inch; however, consecutive days with little or no precipitation are also expected to increase in the south and decrease in some areas of the northern high plains, creating sustained drought periods that may extend to the northern regions of the Plains (USGCRP 2009; Kunkel *et al.* 2013). In the Midwest, an increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer is expected, causing longer periods of drought and drying of small streams in the summer due to the increase in evaporations rates.

Sustained droughts will decrease water availability and cause drying of streams and keep intermittent streams dry for longer periods of time. Increasing air temperatures and evaporation rates will also increase water temperatures in streams in some cases making streams too warm

for some prairie stream species during the reproductive season of most prairie fish. Also, if longer drought periods occur, we expect that groundwater use will increase significantly putting at risk groundwater fed streams that are plains topminnow habitat. There are many examples of local extinctions and recolonizations of fish in Great Plains streams that are attributed to stream water level and flow changes (Fausch and Bestgen 1997, p. 158). Fishes that inhabit intermittent streams and streams in the Great Plains are continually exposed to disturbances from drought, floods, fluctuating flows, high turbidity and high temperatures (Fausch and Bramblett 1991, pp. 659-660). Although desiccation is a natural process in the arid Great Plains region, lowering of ground water levels through irrigation pumping has increased the magnitude of stream dewatering (Fausch and Bestgen 1997, pp. 135-149; Dodds *et al.* 2004, p. 205; Rahel and Thel 2004, p. 24). The plains topminnow evolved in systems where stream intermittency is prevalent which suggests that they have mechanisms to tolerate extreme abiotic conditions and to recolonize areas once stream flows are re-established. This species has been recorded in shallow pools and extreme conditions (high and low water temperatures) with their survival being dependent, in some of those instances, on the availability of small shallow streams and pools (Brinkman 1994, pp. 307-308; Rahel and Thel 2004, p. 16). This characteristic also allows plains topminnows to survive periods of drought and then recolonize areas when water flows return (Rahel and Thel 2004, p. 18; Brinkman 1994, pp. 307-308). In areas of extreme drought, plains topminnow has gone locally extinct (Brinkman 1994, pp. 307-308; Rahel and Thel 2004, pp. 15-17), and it has also been known to recolonize areas during flood events (Schmidt and Hrabik 2012, p. 11-13; Matthews and Marsh-Matthews 2003, pp. 1236-1242).

In the last two years (mid-2011 to early 2013), precipitation and soil moisture in the plains topminnow's range has decreased as drought has persisted (Kunkel *et al.* 2013, pp. 73-75). However, plains topminnow re-introductions done in Nebraska between fall of 2010 and spring of 2011 were done during drought conditions and have been deemed successful in at least 7 of 17 sites (Schumann 2012, pp.166-175). Droughts are part of the natural climate cycle, and are expected to increase in the future due to changes in climate. However, as a prairie fish, plains topminnow have adapted and survived long droughts in the Great Plains and we believe that they will be able to persevere through future droughts. We conclude that, although we expect increases in temperature in streams and a decrease in temporary habitat (intermittent streams) for the plains topminnow, this species can tolerate warm temperatures, inhabits a broad range with various climate change projections, and has most likely survived extensive drought periods before and therefore will not be significantly threatened by projected changes in climate.

Cumulative Impacts

Researchers have determined that introduced and non-native fish are impacting our native freshwater stream fishes at different scales (Gido et al. 2004, pp. 127-130; Fischer and Paukert 2008a, p. 607; Fisher Huckins et al. 2000, pp. 612-625; Pasbrig et al. 2012; Schuman 2012, pp. 136-146). In the Great Plains, the introduction of western mosquitofish and sport fish has also impacted the plains topminnow. Models have shown that the presence of introduced sport fish and non-native species negatively or positively correlates with historical sites of plains topminnow (Guido et al. 2004, pp. 127-130; Schumann 2012, pp. 136-146). Some of these studies have also demonstrated that with good environmental conditions, including quality

habitat, plains topminnow populations occur in high abundances (Fischer and Paukert 2008a, p. 607). In addition, in streams where good quality habitat exists, environmental conditions that result in periodic stream desiccation and above normal water temperatures were able to have sustained plains topminnow populations (Schumann 2012, p. 192). The Great Plains experiences periods of droughts and high rainfall events, which impact streams. Since the plains topminnow is a prairie stream species, its life history includes sedentary and mobile behaviors that have allowed the species to persist and adapt in extreme environmental conditions and habitat changes. At this time we believe that localized factors are considered stressors to the plains topminnow, and scattered, small-scale developments and water diversions have affected individual populations of this species. However while these factors have effects on local populations, we believe that they are not sufficient in magnitude such that the impacts are working collectively and threatening the species' resilience.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

After a symposium convened in 2009 in Nebraska to discuss the status of plains topminnow populations, many agencies in those states within its range increased or started survey and monitoring efforts. In Colorado, CPW initiated management and research efforts that include rigorous surveys of populations and habitat, translocations to establish new populations in suitable habitat within the historical range of the species, establishment of broodstock sources in isolated ponds, and field and laboratory studies to determine interactions between the western mosquitofish (*Gambusia affinis*) and the plains topminnow, and the completion of a draft plains topminnow conservation plan (Crockett 2012, p. 4). CPW has also conducted aerial and biological surveys to identify other potential translocation sites, and is collaborating with the U.S. Forest Service to create translocation opportunities on the Pawnee National Grassland. Several additional translocations are anticipated for 2013. In addition, CPW recently completed a draft conservation plan for plains topminnow that includes draft recovery goals, a step-down outline of specific recovery actions, and a 5-year timetable.

In Wyoming, Iowa, Missouri, South Dakota, Nebraska, Colorado, Kansas Minnesota, and Oklahoma, surveys and monitoring have improved our understanding of the true population status of the plains topminnow. Nebraska has also created broodstock sources and has reintroduced plains topminnow in at least 17 historical sites and so far has been successful (plains topminnow has persisted) in seven of those sites (Schumann 2012, p. 173). New records in Iowa, where the species was once thought to be extirpated from the state, have also stimulated future surveys for plains topminnow in the Rock River Basin (Schmidt *et al* 2011).

SUMMARY OF THREATS

The plains topminnow is still present in most of its range from Wyoming to Missouri. Populations of plains topminnow in Colorado, Wyoming, Missouri, Nebraska and South Dakota still exist in most if not all of the drainages where it was historically recorded and additional populations have been recently recorded in Iowa, Wyoming, Oklahoma and Minnesota. Translocation efforts in Colorado and Nebraska have also increased the population in areas with suitable habitat, and surveys continue to help clarify a more accurate population status of the

species. The following is a summary of stressors that we evaluated that could potentially affect the plains topminnow throughout its range.

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range.

Water use in the Ogallala-High Plains aquifer in the Great Plains has moved the water table down to a level that streams that used to flow year round are now dry most of the year (Dodds *et al.* pp. 214-215) hindering fish movement throughout a drainage. Although water use and water withdrawal for agricultural practices in the Great Plains is high, the plains topminnow still inhabits most of the drainages from which it has been recorded historically, demonstrating that these drainages still maintain connectivity (Schumann 2012, p.133). In addition to stream reaches drying out due to water use, many projects in plains topminnow habitat have created earthen dams, installed road culverts that are not designed to allow for fish passage, and interrupted stream connectivity. In some cases, the abundance of plains topminnows was found to have a negative correlation with undercut banks and overhanging vegetation, but had a positive relationship with increased conductivity and increased macrophyte coverage (Heatherly unpub. data; Fischer and Paukert 2008a, p.607) and was not affected by water discharge, turbidity, pH, percent canopy cover, and row crop or pasture land-use in the riparian areas (Heatherly unpub. data; Schumann *et al.* 2012, pp. 76-77). Currently, we have no information that indicates that large scale developments exist in areas where plains topminnow are found or that water use in its range has reached a degree where the species resilience will be threatened.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.
The plains topminnow is not a targeted fish for recreational purposes. Currently, there is focus on research for the species and voucher specimens are being collected in a variety of studies, but this is thought to be only temporary until the status of the plains topminnow is determined and more about the species is learned to determine any conservation measures needed. Collection by fish enthusiasts is not expected since the plains topminnow is not considered a good community aquarium fish. Thus, we believe that there is no information that indicates that overutilization is a concern or threat to the species.

C. Disease or Predation.
Plains topminnows are considered a fairly disease free species. There is only one recorded parasite that affects the species (Li *et al.* 2009) and no major die-offs have been recorded for the species. Sport fish and other introduced species in plains topminnow habitat are associated with localized declines due to competition for habitat and predation on the species. The presence of four introduced fish families (i.e., Catostomidae, Fundulidae, Esocidae, and Centrachidae) was associated with the absence of plains topminnow in Nebraska, but the plains topminnow was still found in some reaches in the presence of species from these families, indicating that the presence of the species alone may not cause the absence of the plains topminnow. At this time we do not fully understand the interactions of western mosquito fish and plains topminnow in their habitat. However, plains topminnows still cohabits with sport fish and western mosquitofish successfully and we do not believe that at this time the species is being impacted at the species level.

D. The Inadequacy of Existing Regulatory Mechanisms
State and federal regulatory mechanisms provide some protection to the plains topminnow on

both Federal lands and state and private properties. States, such as Colorado, are working towards the protection and management of plains topminnow by prohibiting the use of plains topminnow as a bait species and prohibiting its take. However, we have not been able to identify threats that would require regulatory protection of the species, and recognize the positive efforts that most of the states (i.e., Minnesota, Colorado, Nebraska, Missouri, Iowa, etc.) are making towards the conservation and management of the species.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Droughts are part of the natural climate cycle, but are expected to increase in the future due to human-induced changes in climate. However, as a prairie fish, plains topminnows have adapted and survived long droughts in the plains and we believe that they will be able to persevere through future droughts. There is evidence that the species is resilient and can recolonize areas after short term droughts. There is also evidence that indicates that the species takes advantage of groundwater fed pools and backwaters to reproduce when streams dry out. The Great Plains region is predicted to have more frequent sustained droughts that will cause a decrease in water availability and drying of streams. Air temperatures are also expected to increase which in turn will increase water temperatures in streams and in some cases make streams too warm. Although we expect increases in temperature in streams and a decrease in temporary habitat (intermittent streams) for the plains topminnow, the species can tolerate warm temperatures; it occupies a broad geographic range with various climate change projections of temperature and precipitation changes, and is well adapted for extreme conditions.

We have reviewed and analyzed all the data and literature that has been made available to us regarding the plains topminnow within its range. The information reviewed shows that the above mentioned stressors have either individually or collectively stressed the plains topminnow at the local level. However, we have determined that these stressors are not individually or collectively impacting or will impact the plains topminnow at a species level in the foreseeable future.

RECOMMENDED CONSERVATION MEASURES

Although we believe the species is stable, conservation actions can help maintain and enhance its status to ensure its continued stability and persistence. We recommend continued protection of the habitat and watershed where the plains topminnow is found. Buffers around development areas and agricultural lands will help ensure that streams do not continue to degrade, and are still able to provide the habitat and food needed to support plains topminnow populations. Based on the study by Li *et al.* (2009), the Arkansas Flats of the Niobrara drainage, Blue Creek in the Platte drainage and Haw Creek in the Lamine drainage and Saline Creek in the Osage drainage are important populations to conserve and utilize in propagation efforts since they hold a larger number of haplotypes (most variable genetic makeup) than other intra-drainage areas (Li *et al.* 2009). Also, we believe that water use in a changing climate should be managed so that there are adequate quantities of water in streams in the Great Plains for prairie fish species to persist. We recommend that Nebraska and Colorado continue their efforts toward the reestablishment of plains topminnows in areas with suitable habitat and that other states continue to monitor and protect areas where the plains topminnow is found. In addition, we recommend further study of

the relationship between western mosquitofish and the plains topminnow in plains topminnow habitat. We also recommend that sampling methods are modified so that longer stream reaches or actual plains topminnow habitat is surveyed to accurately determine the status of this species in all parts of its range.

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: N/A

Imminence: N/A

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**. The populations are stable. Translocation efforts are successful and new sites are being found supporting plains topminnow populations. Stream restoration efforts in some areas of its range, such as in Minnesota, are targeting the reduction of siltation and decreases in stream channelization, which benefits the plains topminnow. Populations in Wyoming are managed under the Wild Fish management concept where the streams are not stocked with gamefish to promote wildfish reproduction.

DESCRIPTION OF MONITORING

As mentioned in the species status section, plains topminnows have been monitored on a frequent basis by state and Federal agencies in most of its range. Surveys from 2000 to 2009 have demonstrated that the plains topminnow is found in substantial numbers in Nebraska, Wyoming, Oklahoma, South Dakota, Minnesota, and Colorado with fewer numbers in Iowa and

no collections in Kansas. Additional surveys continue in Nebraska and Colorado to determine the success of ongoing translocation efforts, and in other routine monitoring in all states to determine presence of plains topminnow. Minnesota has observed an expansion of known locations of plains topminnows to approximately 25 locations in eight streams in the Rock River drainage after an increase in survey efforts and possibly the effects of a habitat reclamation project in 2004 that reduced siltation and decreased stream channelization restoring backwater habitats and riparian and instream vegetation in this drainage (Pasbrig *et al.* 2012; Hatch *et al.* 2003, MDNR 2012). Due to the plains topminnow's new state status as threatened in Minnesota, , future surveys in Minnesota will target this species.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment—Nebraska, Wyoming, South Dakota, Minnesota, Colorado, Iowa, Kansas, Oklahoma and Missouri.

Indicate which State(s) did not provide any information or comments—
None.

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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: Deputy _____ 8·26·13

Regional Director, Fish and Wildlife Service — Date