

Red Shiner (*Cyprinella lutrensis*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, August 2014
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1 Native Range and Status in the United States

Native Range

From NatureServe and Lyons (2019):

“*Cyprinella lutrensis* is widely distributed throughout the Mississippi River basin from Wyoming, South Dakota, southern Wisconsin, and Indiana south to Louisiana (but absent in Ozark and Ouachita uplands), in Gulf drainages west of the Mississippi River to the Rio Grande, Texas, New Mexico, and Colorado, and the Rio Panuco in northeastern Mexico (Page and Burr 2011).”

From CABI (2019):

“Native range of distribution of *C. lutrensis* is throughout the southern Great Plains, American southwest of the United States into Mexico, in tributaries of the middle and lower Mississippi River basin and Gulf of Mexico drainages westward to the Rio Grande, including several endorheic basins in Mexico (Hubbs et al., 1991; DFC, 2010). It has been reported that within the native range in the United States, *C. lutrensis* is found in Oklahoma, Nebraska, Missouri, Minnesota, Illinois, Arkansas, Iowa, Louisiana, South Dakota, and Kansas and throughout Texas (Matthews, 1987; Hubbs et al., 1991; Douglas et al., 1994; Ashbaugh et al., 1996; TPWD, 2012). The distribution of the red shiner throughout Texas has been attributed to a number of drainage units, including the Red River (from the mouth upstream to and including the Kiamichi River in Oklahoma), Sabine Lake (including minor coastal drainages west to Galveston Bay), Galveston Bay (including minor coastal drainages west to mouth of Brazos River), Brazos River, Colorado River, San Antonio Bay (including minor coastal drainages west of mouth of Colorado River to mouth of Nueces River) and Nueces River (Warren et al., 2000; USGS, 2012).”

Status in the United States

According to Nico et al. (2019), nonindigenous occurrences of *Cyprinella lutrensis* have been reported in the following states, with range of years and hydrologic units in parentheses:

- Alabama (1992-2008; Apalachicola Basin; Conasauga; Middle Chattahoochee-Lake Harding; Middle Chattahoochee-Walter F; Middle Coosa; Middle Tombigbee-Chickasaw; Upper Coosa)
- Arizona (1953-2005; Aguirre Valley; Aqua Fria; Bill Williams; Brawley Wash; Lake Mead; Lower Colorado; Lower Colorado Region; Lower Colorado-Marble Canyon; Lower Gila; Lower Lake Powell; Lower Little Colorado; Lower Salt; Lower San Pedro; Lower Santa Cruz; Lower Virgin; Middle Gila; Upper Gila-San Carlos Reservoir; Upper Verde)
- California (1950-2012; Aliso-San Onofre; Imperial Reservoir; Lower Sacramento; Salton Sea; San Joaquin Delta; Upper Cache; Upper Yuba; Whitewater River)
- Colorado (1969-2015; Colorado Headwaters; Colorado Headwaters-Plateau; Gunnison; Lower Dolores; Lower Gunnison; Lower San Juan; Lower Yampa; McElmo; Piedra; Upper Colorado; Upper Colorado-Dolores; Upper Green-Flaming Gorge Reservoir; Upper Gunnison; White – Yampa)
- Georgia (1992-2012; Altamaha; Conasauga; Coosawattee; Etowah; Middle Chattahoochee-Lake Harding; Oostanaula; South Atlantic-Gulf Region; Upper Chattahoochee; Upper Coosa; Upper Ocmulgee)
- Illinois (1958-1979; Apple-Plum; Lake Michigan; Upper Fox)
- Indiana (2003-2003; Ohio Region)
- Massachusetts (1972-1972; Chicopee)
- Nevada (1967-2005; Havasu-Mohave Lakes; Imperial Reservoir; Lake Mead; Lower Virgin; Muddy)
- New Mexico (1980-2015; Chaco; San Francisco; Upper Gila-Mangas; Upper San Juan; Upper San Juan)

- North Carolina (1974-2016; Haw; Lower Dan; Lower Pee Dee; Lower Yadkin; Roanoke; Rocky; South Yadkin; Upper Dan; Upper Pee Dee; Upper Pee Dee; Upper Yadkin)
- Utah (1962-2015; Dirty Devil; Escalante; Lower Green; Lower Green-Desolation Canyon; Lower Green-Diamond; Lower Lake Powell; Lower San Juan; Lower San Juan-Four Corners; Lower White; McElmo; Price; San Rafael; Upper Colorado-Kane Springs; Upper Green-Flaming Gorge Reservoir; Upper Lake Powell)
- Virginia (1986-1986; Roanoke)
- Wisconsin (1962-2004; Apple-Plum; Baraboo; Kickapoo; Pecatonica)
- Wyoming (1982-1982; Upper Green; Upper Green-Flaming Gorge Reservoir; Upper Green-Slate)

From Nico et al. (2019):

“Established in areas outside their native range in Alabama, Arizona, California, Colorado, Georgia, Illinois, Nevada, New Mexico, North Carolina, Utah, and Wyoming. In contrast to Hubbs and Lagler's statement (1958), Becker (1983) found that there was no evidence to substantiate the presence of this species in lagoons of Lake Michigan at Chicago.”

“The origin of most introduced *Cyprinella lutrensis* populations can be attributed to bait bucket releases. [...] The Red Shiner is also in the aquarium trade (Becker 1983, Etnier and Starnes 1993). It has been marketed in a pet shop under the name "rainbow dace" (Moore et al. 1976).”

From CABI (2019):

“Native range of distribution of *C. lutrensis* is throughout the southern Great Plains, American southwest of the United States into Mexico, in tributaries of the middle and lower Mississippi River basin and Gulf of Mexico drainages westward to the Rio Grande, including several endorheic basins in Mexico (Hubbs et al., 1991; DFC, 2010). It has been reported that within the native range in the United States, *C. lutrensis* is found in Oklahoma, Nebraska, Missouri, Minnesota, Illinois, Arkansas, Iowa, Louisiana, South Dakota, and Kansas and throughout Texas (Matthews, 1987; Hubbs et al., 1991; Douglas et al., 1994; Ashbaugh et al., 1996; TPWD, 2012). The distribution of the red shiner throughout Texas has been attributed to a number of drainage units, including the Red River (from the mouth upstream to and including the Kiamichi River in Oklahoma), Sabine Lake (including minor coastal drainages west to Galveston Bay), Galveston Bay (including minor coastal drainages west to mouth of Brazos River), Brazos River, Colorado River, San Antonio Bay (including minor coastal drainages west of mouth of Colorado River to mouth of Nueces River) and Nueces River (Warren et al., 2000; USGS, 2012).

The known introduced range includes Arizona, Utah, New Mexico, Wyoming, North Carolina, Alabama, North Dakota and Colorado within the USA (Brandenburg and Gido, 1999; Douglas et al., 1994; Quist et al., 2004; NatureServe, 2006; USGS, 2012). In contrast to Hubbs and Lagler (1958), Becker (1983) found that there was no evidence to substantiate the presence of this species in lagoons of Lake Michigan in Chicago.”

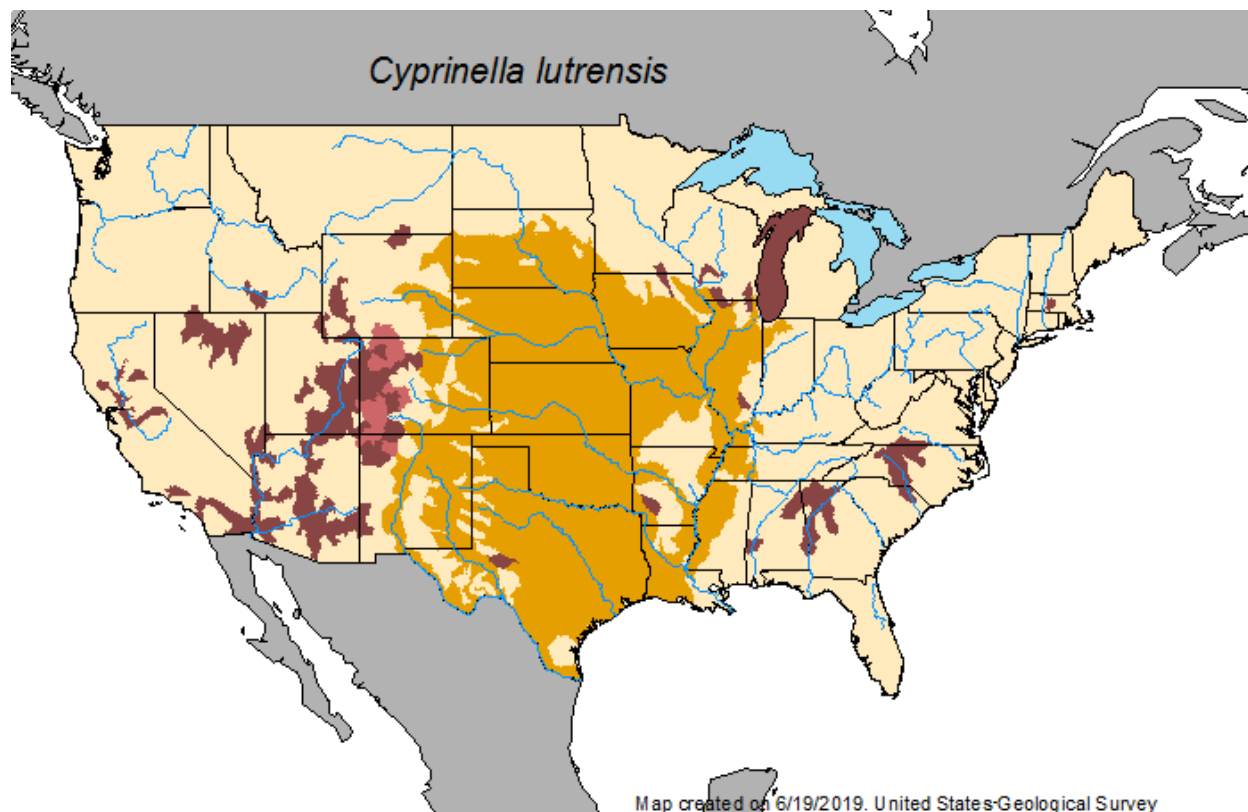


Figure 1. Map of the contiguous United States showing the native (orange) and nonnative (dark and light red) ranges of *Cyprinella lutrensis*. Range information is displayed by HUC (hydrologic unit code). Map from Nico et al. (2019).

Means of Introductions in the United States

From Nico et al. (2019):

“Means of Introduction: The origin of most introduced Red Shiner populations can be attributed to bait bucket releases; however, initial introduction is often followed by the species' rapid multiplication, dispersal, and aggressive colonization (e.g., Hubbs and Lagler 1958; Minckley and Deacon 1968; Minckley 1973). In some areas dispersal of introduced populations has been aided by the presence of irrigation ditches and canals (e.g., Jennings and Saiki 1990). Koehn (1965) mentioned that the species has been introduced as a forage fish. The Red Shiner is also in the aquarium trade (Becker 1983; Etnier and Starnes 1993). It has been marketed in a pet shop under the name "rainbow dace" (Moore et al. 1976).

According to Dill and Cordone (1997), it was introduced into northern California as forage, not as a bait minnow as suggested by Kimsey and Fisk (1964). The introduction into the Yadkin drainage, North Carolina, was possibly the result of an aquarium release (Moore et al. 1976). Hubbs (1954) reported this species as established in the lower Colorado River basin by 1953. He attributed the source of the introduction to escapes from the Arizona Fish Farms in Ehrenburg, Arizona. There apparently has been more than one subspecies introduced into the southwestern United States. Hubbs (1954) also noted that Red Shiners found in the lower Colorado River basin were intergrades between the subspecies *N. l. lutrensis* and *N. l. suavis*. In contrast, Minckley

(1973) reported that the Arizona specimens he examined more closely resembled the typical subspecies, *C. l. lutrensis*. Gilbert (1998) also referred it to the typical subspecies (*C. l. lutrensis*).”

From CABI (2019):

“Use of *C. lutrensis* as a common bait fish facilitated its spread into new areas outside its native range and so its spread has been mainly attributed to bait bucket releases (Hubbs and Lagler 1964; Jennings and Saiki 1990; Walters et al., 2008). Koehn (1965) mentioned that the species has been introduced as a forage fish. According to Dill and Cordone (1997), *C. lutrensis* was introduced into northern California as forage, not as a bait minnow as Kimsey and Fisk (1964) had suggested (USGS, 2012). Use of this species as an aquarium fish may have contributed to its introduction into the Yadkin drainage, North Carolina, through aquarium release (Moore et al., 1976). The wide potential distribution of *C. lutrensis* across the United States demonstrates its adaptation as a site generalist, which facilitates its success in newly invaded habitats. The ability of this species for rapid multiplication, dispersal, and aggressive colonization after initial introduction facilitates its spread (Hubbs and Lagler, 1958; Minckley and Deacon, 1968; Minckley, 1973).

There are records *C. lutrensis* has declined or been extirpated in certain habitats. The extirpation from or decline of *C. lutrensis* in six of seven creeks that are direct tributaries of Lake Texoma, Oklahoma-Texas has been attributed to habitat modification and predation (Matthews and Marsh-Matthews, 2007).”

“*C. lutrensis* is being used as an aquarium and farmed fish and hence, there is a risk of the species spreading through aquarium releases and escapes (Hubbs, 1954; Moore et al., 1976; Jenkins and Burkhead, 1994). Escape from the Arizona Fish Farms in Ehrenburg, Arizona has been attributed to the establishment of this species in the lower Colorado River basin by 1953 (Hubbs, 1954). *C. lutrensis* is among some of the most thermally-tolerant minnows in North America and therefore, has the potential to spread to other hot environments in the United States (Brues, 1928; Matthews and Hill, 1979; Poulas et al., 2012). The predicted habitat is consistent with the wide-ranging habitat associations of this species in its current native and invaded ranges (Marsh-Matthews and Matthews 2000).”

“Natural dispersal (Non-Biotic)

Jennings and Saiki (1990) reported that in some areas dispersal of introduced populations of *C. lutrensis* has been aided by the presence of irrigation ditches and canals.

Accidental Introduction

The origin of most introduced *C. lutrensis* populations have been attributed to their use as bait and subsequent releases from bait buckets. The initial introduction is often followed by the rapid multiplication, dispersal, and aggressive colonization of this fish (Hubbs and Lagler, 1958; Minckley and Deacon, 1968; Minckley, 1973). Accidental escapes from the Arizona Fish Farms

in Ehrenburg, Arizona, USA, in 1953 have been reported as the cause of the establishment of the species in lower Colorado (Hubbs, 1954).

Intentional Introduction

C. lutrensis has been introduced as a forage fish into northern California, USA and not as a bait minnow as Kimsey and Fisk (1964) had suggested (Koehn, 1965).”

Remarks

From Nico et al. (2019):

“Several attempts have been made to eradicate the Red Shiner from a portion of the Virgin River as part of the recovery plan for Woundfin and Virgin River chubs. It was successfully eliminated from the river between Washington Fields Diversion and Johnson Diversion, but have re-invaded below Johnson Diversion (U.S. Fish and Wildlife Service 1995).”

“There apparently has been more than one subspecies introduced into the southwestern United States.”

The name *Notropis lutrensis* has also been used for this species in the past (Fricke et al. 2019).

A previous version of this ERSS was published in 2014. Revisions were done to incorporate new information and to bring the document in line with current standards.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Fricke et al. (2019):

“**Current status:** Valid as *Cyprinella lutrensis* (Baird & Girard 1853).”

From ITIS (2019):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysii
Order Cypriniformes

Superfamily Cyprinoidea
Family Cyprinidae
Genus *Cyprinella*
Species *Cyprinella lutrensis* (Baird and Girard, 1853)”

Size, Weight, and Age Range

From CABI (2019):

“*C. lutrensis* grows to a maximum standard length of 7.5 cm and to a maximum total length of 9.0 cm (Matthews, 1980; Mayden, 1989; Page and Burr, 1991). However, the reported common total length is 4.9 cm (Hugg, 1996). The maximum reported age is 3 years (Carlander, 1969).”

Environment

From Froese and Pauly (2019):

“Freshwater; benthopelagic; pH range: 7.0 - 7.5; dH range: 10 - 20. [...]; 15°C - 25°C [Riehl and Baensch 1991] [assumed to be recommended aquarium temperature]; [...]”

From CABI (2019):

“Matthews (1986) found that there was no significant differences in critical thermal maximum, (35.9-36.3°C at an acclimation temperature of 21°C), among populations of all major river systems occupied by this species across a 1100 km north-south span of its range. It has been reported that for fish acclimated at 30°C, the critical thermal maxima is of 35.4-39.6°C (Rutledge and Beitinger, 1989).”

Climate/Range

From Froese and Pauly (2019):

“Subtropical; [...]; 44°N - 26°N”

Distribution Outside the United States

Native

Much of the native range of *Cyprinella lutrensis* is within the United States, see section 1 for a full description of the native range.

From NatureServe and Lyons (2019):

“*Cyprinella lutrensis* is widely distributed throughout [...] and the Rio Panuco in northeastern Mexico (Page and Burr 2011).”

From CABI (2019):

“Native range of distribution of *C. lutrensis* is [...] American southwest of the United States into Mexico, [...] including several endorheic basins in Mexico (Hubbs et al., 1991; DFC, 2010).”

Introduced

No records of introductions of *Cyprinella lutrensis* outside of the United States were found.

Means of Introduction Outside the United States

No records of introductions of *Cyprinella lutrensis* outside of the United States were found.

Short Description

From Nico et al. (2019):

“Identification: *Cyprinella lutrensis* (Red Shiner) are a deep-bodied minnow that is laterally compressed (Farringer et al. 1979; Page and Burr 2011). The mouth is terminal with a round snout (Page and Burr 1991). This species has silver sides with olive-green to blue coloration above the lateral line and whitish abdomens (Mayden 1989; Page and Burr 2011). A dark stripe runs along the back with a dark dusky colored dorsal fin (Page and Burr 2011). Breeding males have iridescent pink-purple-blue sides and a red crown and fins (except the dorsal fin which remains dark; Mayden 1989; Page and Burr 2011). There are 32-36 lateral scales, and the anal fin usually has 9 rays (Page and Burr 2011).”

From CABI (2019):

“*C. lutrensis* has a deep and compressed body and a sharp and compressed head (Mayden, 1989; Hubbs et al., 1991). There is a tendency for large males to develop a sharply pointed snout that overhangs the terminal to slightly sub-terminal mouth (Miller and Robison 2004). It has an olive-green back, silver coloured sides and a whitish abdomen (Hassan-Williams and Bonner, 2012; TWPD, 2007). The scales on the back and sides are edged with melanophores, which are arranged in a narrow wedge-shaped pattern on the posterior to the upper end of the opercle and in a medial stripe on the gula (Hassan-Williams and Bonner, 2012). The breeding male has red on the top of its head, a purple crescent behind the head and pinkish sides with some blue on the sides and back. It also has a dark dorsal fin and reddish-orange caudal, pelvic and pectoral fins (Sublette et al., 1990). The black median stripe on the lower jaw does not extend posteriorly through the isthmus and pigments are in inter-radial membranes of the dorsal fin (Hubbs et al., 1991). Peritoneum is silvery in colour with numerous large, dark chromatophores (Goldstein and Simon, 1999).”

“It has diamond-shaped scales, outlined in a crosshatch pattern and a slightly de-curved lateral line that extends one third of the way forward (Hassan-Williams and Bonner, 2012; ISSG, 2012). There are 34-36 lateral line scales, 8 dorsal soft fin rays, 8 pelvic soft fin rays, and generally 9 (8-10) anal soft fin rays (Miller and Robison, 2004). The beginning of the dorsal fin is close to the start of the pelvic fin (ISSG, 2012). The nuptial tubercles, in the male are dense and scattered on the snout, top of the head, chin, edges of body scales, and fin rays. Whilst on the female, the weak tubercles are present on the head and on the midline of the back. Nuptial tubercles of the caudal peduncle are largest on the anterior end of the scales. As spawning season progresses, tuberculation increases, progressing from a linear pattern to one that is scattered (Koehne, 1965; Collette, 1977; Sublette et al., 1990).

C. lutrensis typically has a pharyngeal teeth count of 0,4-4,0 but some individuals display 1,4-4,1, and has a short s-shaped intestine (Mayden 1989; Hubbs et al., 1991; Page and Burr, 1991; Goldstein and Simon, 1999).”

Biology

From Froese and Pauly (2019):

“Inhabits silty, sandy, and rocky pools and runs, sometimes riffles, of creeks and small to medium rivers. Can tolerate siltation and high turbidity [Page and Burr 1991; Page and Burr 2011]. Feeds on terrestrial and aquatic insects, and algae [Etnier and Starnes 1993].”

From Nico et al. (2019):

“**Ecology:** Red Shiner are among the most widespread, ecologically general, and environmentally tolerant fish species in North America, and are highly invasive where they have been introduced outside their native range (Marsh-Matthews et al. 2011). The species thrives under harsh conditions (e.g., low flow, high turbidity, poor water quality) and aggressively colonizes severely degraded habitats. For example, introduced Red Shiner have become the most abundant species in degraded, urban streams in metropolitan Atlanta, Georgia (Devivo and Freeman 1995).

The red shiner spawns over an extended period of time from spring into fall months, with a peak from early to mid-summer. Breeding season in Georgia is May through July, and in south central Oklahoma and central Texas is from April to September (Farringer et al. 1979). Spawning may occur on riffles, on or near submerged objects, over vegetation beds, or in association with sunfish nests. Some individuals breed in two successive years, but none breed their year of hatching (Farringer et al. 1979).

Adults typically school in midwater or near the surface. The species is thought to feed primarily on small invertebrates. The fish lives for 2 years in the wild.

Although it has been observed that Red Shiners are reduced in number during flood events in southwestern streams (Schultz et al. 2003). During laboratory tests Red Shiners had equal or greater swimming ability than many of the native species (longfin dace, *Agosia chrysogaster*) tested (Ward et al. 2003).”

From CABI (2019):

“Reproductive Biology

Spawning season of *C. lutrensis* is from spring to fall and the peak is during the mid-summer months (ISSG, 2012). Farringer et al. (1979) reported that in Oklahoma and Texas the spawning occurs in mid-April to September. Spawning occurs most frequently on clean gravel riffles or on submerged objects, such as tree roots and logs. Eggs may then be deposited in a variety of environments; within crevices over a range of different substrates (gravel, sand, mud), near the

surface over beds of submerged aquatic plants, in clear ponds or in association with green sunfish (*Lepomis cyanellus*) and orangespotted sunfish (*L. humilis*) nests (Minckley, 1959; Cross, 1967; Minckley, 1972; Pflieger, 1975; Wang, 1986; TPWD, 2012). Spawning may also occur in midwater as the male and female swim through the water column (Minckley, 1972). The eggs hatch after about 105 hours at a temperature of 24.5°C and the offspring will be sexually mature in 1-2 years (NatureServe, 2006).

C. lutrensis are non-guarders, brood hiders and speleophils (crevice spawners) (Simon, 1999; Hassan-Williams and Bonner, 2012). The male establishes his territory around a crevice and makes display passes along the spawning site. Occasionally males will swim toward females directing them towards the crevice. Males will approach and circle females, flicking their fins forward every few seconds. Courtship can last several hours, with females revisiting the spawning site over 200 times prior to egg release. During spawning the male swims above the female passing directly over the horizontal crevice. The female contorts violently expelling the eggs into the crevice. The first expulsion may be followed by another pass and expulsion. Females produce sounds to attract the males (Delco, 1960).

Females may release up to 16 batches of eggs per day, with up to 71 eggs per batch. An average clutch size may equal around 585 eggs and males and females may spawn 5-19 clutches over the reproductive season (Gale, 1986). Laser and Carlander (1971) reported that 485-684 eggs were laid per gravid female.

C. lutrensis matures at a standard length of 2.4-3.0 cm but some individuals may reach sexual maturity at age 0 (Hubbs and Ortenburger 1929; Cross 1950; Farringer et al., 1979; Marsh-Matthews et al., 2002)."

“Nutrition

C. lutrensis is considered an invertivore as it feeds on small invertebrates, such as insects and crustaceans (NatureServe, 2006). According to Goldstein and Simon (1999) first and second trophic classifications for this species are invertivore or herbivore and benthic, respectively and the trophic mode is a grazer. Hale (1963) considered *C. lutrensis* as omnivorous but opportunistically seized any item available in the average size range.

Main food items include terrestrial and aquatic insects, and algae (Lewis and Gunning, 1959, Carlander, 1969; Laser and Carlander, 1971; Harwood, 1972; Goldstein and Simon, 1999). Wang (1986) found plant leaves in the stomachs of young *C. lutrensis* and Hale (1963) reported that their diet included sediments.”

Human Uses

From Nico et al. (2019):

“The origin of most introduced *Cyprinella lutrensis* populations can be attributed to bait bucket releases. Koehn (1965) mentioned that the species has been introduced as a forage fish. The Red Shiner is also in the aquarium trade (Becker 1983, Etnier and Starnes 1993). It has been marketed in a pet shop under the name "rainbow dace" (Moore et al. 1976).”

Diseases

No OIE-reportable diseases (OIE 2019) were found to be associated with *Cyprinella lutrensis*.

Poelen et al. (2014) lists *Gyrodactylus callawayensis*, *Neascus*, *Rhabdochona canadensis*, and *Bothriocephalus acheilognathi* as parasites of *Cyprinella lutrensis* and *Rhabdochona canadensis* and *Bothriocephalus acheilognathi* as endoparasites of *Cyprinella lutrensis*.

From Nico et al. (2019):

“The introduction of Red Shiner into Utah was probably how the Asian tapeworm entered the Virgin River; subsequent tapeworm infestation of Woundfin, may be primarily responsible for the Woundfin's decline during the 1980s (Deacon 1988). Red Shiner is one of the species that potentially introduced the Asian fish tapeworm (*Bothriocephalus acheilognathi*) to the Lower Colorado River (Choudhury et al. 2004)”

Threat to Humans

From Froese and Pauly (2019):

“Harmless”

3 Impacts of Introductions

From CABI (2019):

“It [*Cyprinella lutrensis*] is well known to prey on eggs and larvae of native fish and is an opportunistic drift feeder (Sublette, 1975; Ruppert et al., 1993). It is a fish species of special concern in the United States as it has been implicated in the decline of native fish populations in the areas to which it has been introduced. *C. lutrensis* occupies nursery habitats of young native fishes, including the Red River pupfish (*Cyprinodon rubrofluviatilis*), Colorado pikeminnow (*Ptychocheilus lucius*), spikedace (*Meda fulgida*) and razorback sucker (*Xyrauchen texanus*), most of which are endangered. They are also adapted to thrive in a variety of environments and as generalists are better able to persist in disturbed habitats than the native species of those areas. They are tolerant of harsh environmental conditions, including low or intermittent flows, excessive turbidity and sedimentation, and natural physiochemical extremes (Poulos et al., 2012). Initial introduction is often followed by the species rapid population growth, dispersal, and aggressive colonization (Hubbs and Lagler, 1964; Minckley and Deacon, 1968; Minckley, 1973).”

From Nico et al. (2019):

“The Red Shiner has created a tenet among some ecologists: where it appears, native fishes disappear (Stolzenburg 1992). Dill and Cordone (1997) called the Red Shiner the second most significant threat to the welfare of indigenous southwestern fishes, after the Mosquitofish (*Gambusia affinis*). The Red Shiner is very aggressive were introduced and have been associated

with impacts on the indigenous fish populations through predation, competition, hybridization, and introduction of parasites.

Predation:

Ruppert et al. (1993) suggested that establishment of Red Shiner in Yampa River and Green River immediately below their confluence in Dinosaur National Monument, Colorado has led to predation on vulnerable larvae of native populations of razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus Lucius*). This assumption was supported by a laboratory study that indicated that Red Shiner are a potential predator of razorback sucker larvae (Carpenter and Mueller 2008). In 2008, Schooley et al. found razorback sucker larvae in the guts of Red Shiners in Salt River and Sycamore Creek, Arizona.

Competition:

The Red Shiner has also affected the distribution and abundance of native fishes. For example, populations in the Moapa and Virgin rivers, Nevada, have been implicated in the decline of the native fish of this region, including Spikedace (*Meda fulgida*), Woundfin (*Plagopterus argentissimus*), and Virgin River Chub (*Gila seminude*) (Moyle 1976; Deacon 1988; U.S. Fish and Wildlife Service 1990a, 1995). Members of this species may compete with and affect growth, condition, or survival of young Colorado Pikeminnow (Karp and Tyus 1990; Muth and Snyder 1995).

Hybridization:

The Red Shiner may dilute the gene pools of native *Cyprinella* via hybridization (Mayden 1989; Burkhead and Hoge 2002). The Red Shiner is hybridizing with the Blacktail Shiner (*C. venusta stigmatura*) in the Coosa River basin, Georgia and Alabama (Mettee et al. 1996; Burkhead and Hoge 2002; Walters et al. [2008], Blum et al. 2010).

Disease:

The introduction of Red Shiner into Utah was probably how the Asian tapeworm entered the Virgin River; subsequent tapeworm infestation of Woundfin, may be primarily responsible for the Woundfin's decline during the 1980s (Deacon 1988). Red Shiner is one of the species that potentially introduced the Asian fish tapeworm (*Bothriocephalus acheilognathi*) to the Lower Colorado River (Choudhury et al. 2004)."

"In degraded streams in Georgia, introduced Red Shiners have become one of the most abundant species (Devivo and Freeman 1995). In a 1985-88 study of the Colorado and Green Rivers adjacent to Canyonlands National Park, introduced Red Shiners made up nearly 50% of the catch per unit effort (Valdez and Williams 1993)."

From NatureServe and Lyons (2019):

"Where introduced, this species may "swamp-out" native *Cyprinella* gene pools through hybridization (Mayden 1989). This species has increased in abundance in the lower Missouri River as a result of human-caused changes in the river (e.g., reservoir construction) (Pflieger and Grace 1987). Introduced populations may be detrimentally impacting native spikedace population in the Gila River system (Douglas et al. 1994)."

From Mooney and Cleland (2001):

“Douglas et al. [1994] have described the apparent niche shift in the native fish *Meda fulgida* when they co-occur with the introduced red shiner (*Cyprinella lutrensis*).”

From Gido et al. (1999):

“In an array of artificial streams we examined effects of red shiner on survival, condition, and reproduction of Red River pupfish. In the presence of red shiner, pupfish successfully produced larvae, but fewer juvenile pupfish survived to potentially recruit.”

From DeVivo (1995):

“*Cyprinella lutrensis* has been introduced into the Apalachicola-Chattahoochee-Flint (ACF) River basin and thrives particularly in the impacted streams near Atlanta, Georgia. Fish samples collected near Atlanta by the National Water Quality Assessment Program of the U.S. Geological Survey in June and November, 1993 have shown *C. lutrensis* to be the dominant or co-dominant species in degraded streams of urban watersheds, representing up to 77 % of individuals and 12.5 % of species at a site. The continued use of *C. lutrensis* as a bait fish and the continued degradation of stream systems within the Atlanta metropolitan area constitute a serious threat to native fishes including the bluestripe shiner, *C. callitaenia*, which is listed as endangered by the state of Georgia and is a C-2 candidate for protection under the Endangered Species Act.”

4 Global Distribution

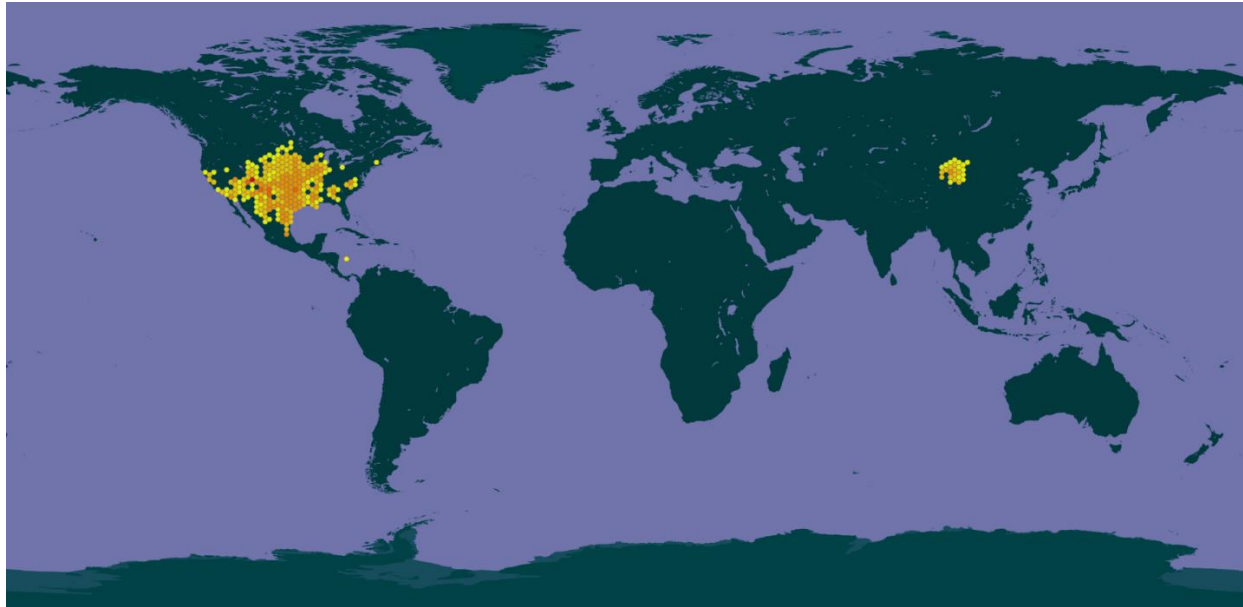


Figure 2. Known global distribution of *Cyprinella lutrensis*. Map from GBIF Secretariat (2019). Locations in Asia and on the island of Providencia (Colombia) off the coast of Nicaragua were not used to selected source points for the climate match as either there were issues with incorrectly recorded coordinates (locations in Asia were actually collected in Nebraska) or no support for the existence of a population at that location (Providencia).

5 Distribution Within the United States

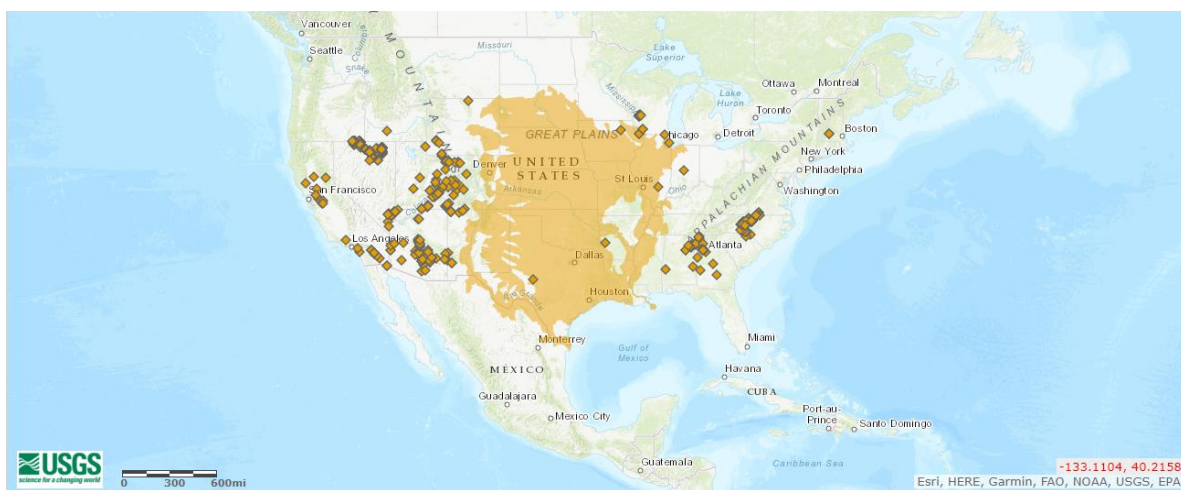


Figure 3. Known native and introduced distribution of *Cyprinella lutrensis* in the United States. Map from Nico et al. (2019).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cyprinella lutrensis* was as expected, high within the native range of the species from Texas north to South Dakota and from Colorado in the west to Tennessee in the east. It was also high outside of the native range in much of the Southwest, upper Great Plains, Southeast, and Great Lakes basin. Maine, New Hampshire, New York, and coastal Oregon, Washington, and northern California had patches of low to medium match. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.939, high. (Scores 0.103 and greater are classified as high.) All of the States had high individual Climate 6 scores except for Maine, which had a medium individual score.

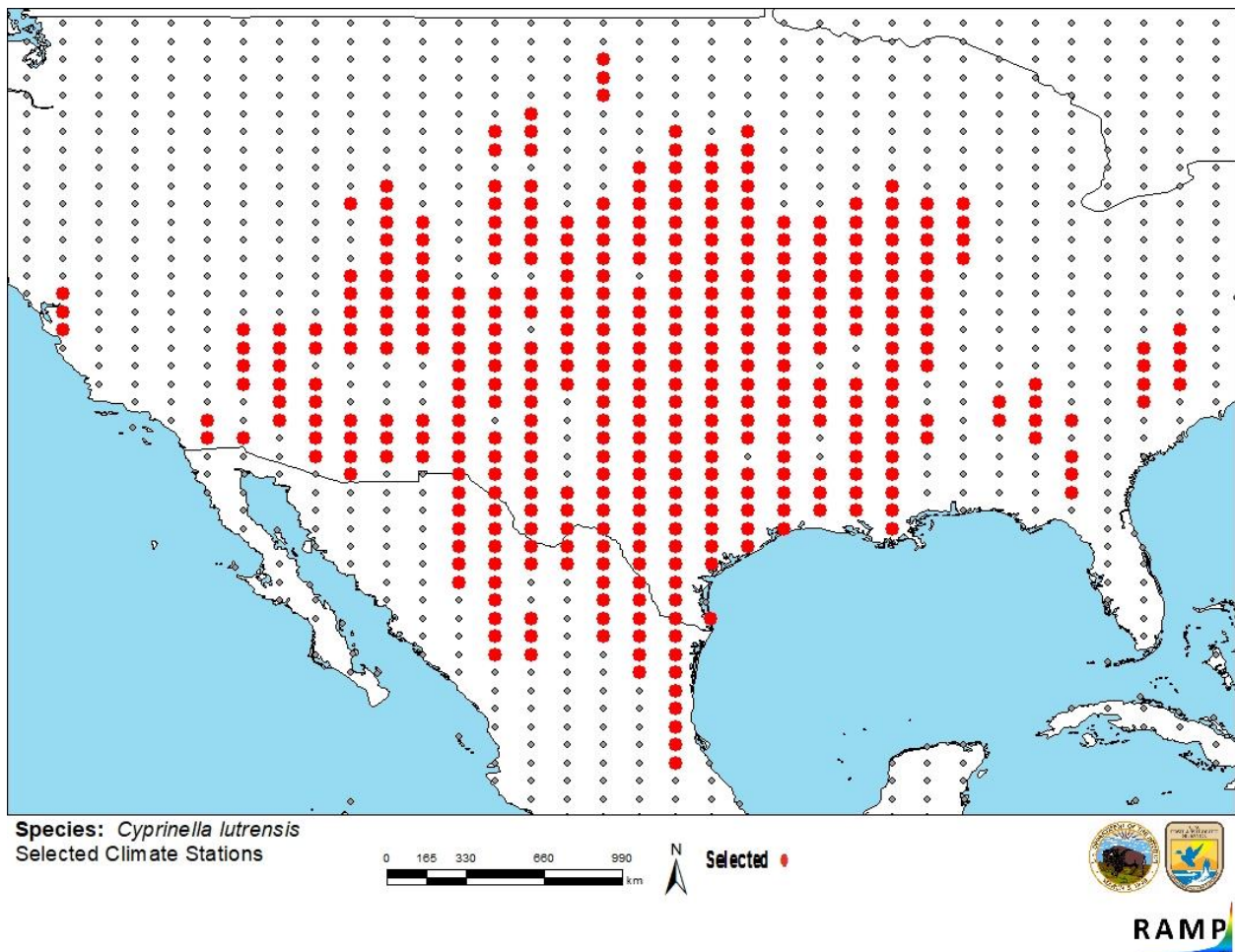


Figure 4. RAMP (Sanders et al. 2018) source map showing weather stations throughout the United States and Mexico selected as source locations (red; United States, and Mexico) and non-source locations (gray) for *Cyprinella lutrensis* climate matching. Source locations from GBIF Secretariat (2019). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

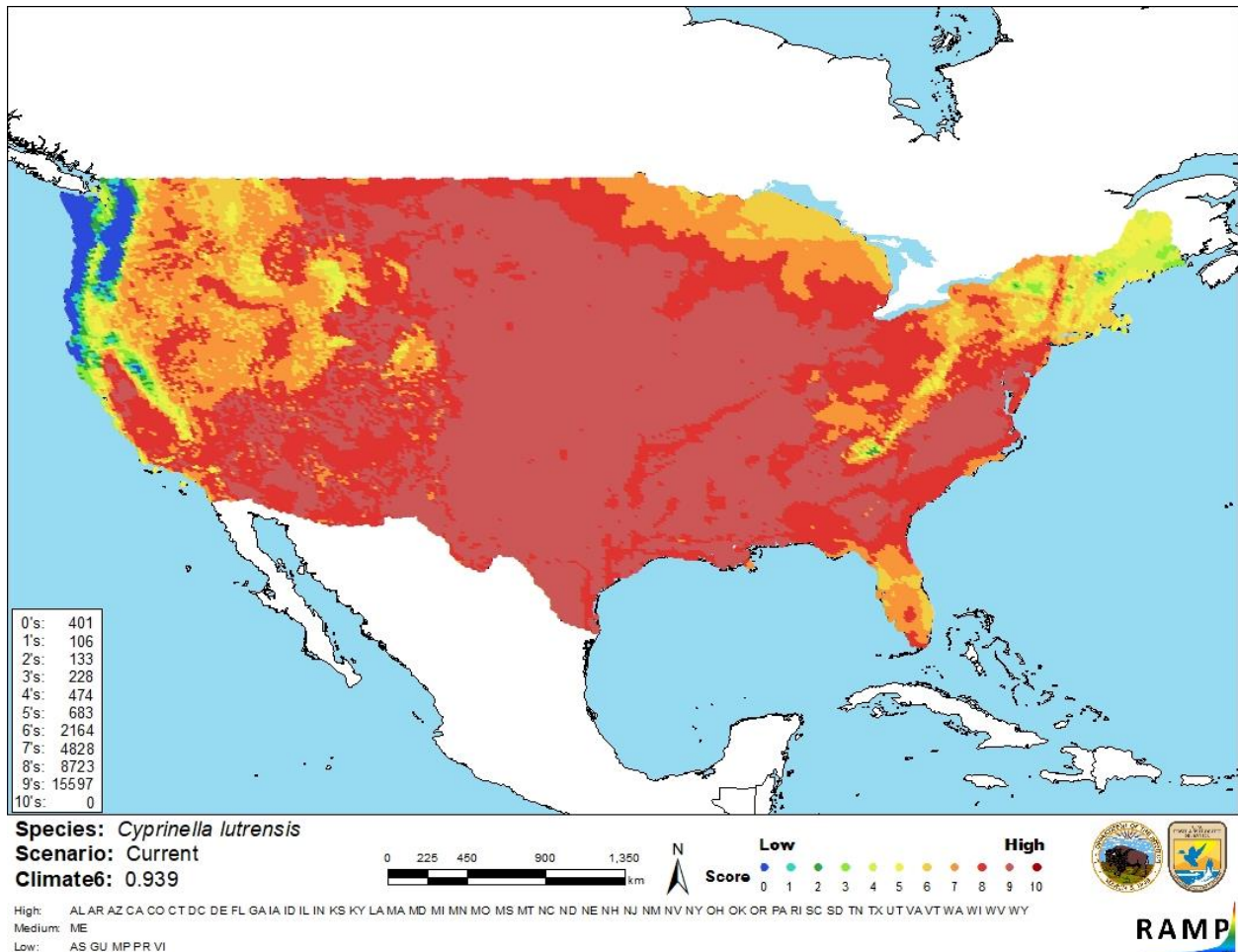


Figure 5. Map of RAMP (Sanders et al. 2018) climate matches for *Cyprinella lutrensis* in the contiguous United States based on source locations reported by GBIF Secretariat (2019). 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
$0.000 \leq X < 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of assessment for *Cyprinella lutrensis* is high. Information on the biology, distribution, and introductions was readily available. A preponderance of evidence for negative impacts from introductions of this species is available from the scientific literature and gray literature.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Red Shiner (*Cyprinella lutrensis*) is a small freshwater minnow native to northern Mexico and much of the central United States. Introductions to other areas throughout the United States have occurred via bait fish movement, aquarium releases, and fish movement through watersheds. *C. lutrensis* is established outside its native range in the United States in Alabama, Arizona, California, Colorado, Georgia, Illinois, Nevada, New Mexico, North Carolina, Utah, and Wyoming. *C. lutrensis* are known to displace native species, as well as dilute the gene pool for native *Cyprinella* via hybridization. History of invasiveness is high. This species has a high climate match with the contiguous United States, including areas where it is native, as well as many other areas. The only areas with medium or low matches were in the Pacific Northwest and parts of New England and New York. Certainty of assessment is high because quality general information is available about the species and there is a preponderance of evidence from reputable sources regarding the history of invasiveness. The overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): High**
- **Remarks/Important additional information:** *C. lutrensis* is native to the central part of the United States and has become established in the West and Southeast.
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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