Mrigal Carp (*Cirrhinus cirrhosus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, October 2012
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Photo: Thai Department of Fisheries. Public domain.

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2017):

"Asia: native to large rivers in the Indian subcontinent [Rainboth 1996]. Has been so widely transported in connection to aquaculture that its natural distribution can no longer be determined [Roberts 1997]."

From Rema Devi and Ali (2011):

"*Cirrhinus cirrhosus* is presently known in its native range only from the Cauvery River system in India (Menon 2004). Historically the species was wider ranging, being known from the Godavari, Krishna and Cauvery Rivers (Day. F 1978, referenced in Menon 2004)."

Status in the United States

There are no currently known nonindigenous occurrences within the United States.

Means of Introductions in the United States

There are no currently known nonindigenous occurrences within the United States.

Remarks

From Rema Devi and Ali (2011):

"Though Roberts (1997) considered [*Cirrhinus*] *mrigala* a synonym of this species, it is observed that both are quite distinct. *C. cirrhosus* has four barbells whereas *mrigala* has only two barbells; dorsal branched rays are 15-16 in *cirrhosus* vs. 12-13 in *mrigala*."

From Simonsen et al. (2005):

"The Indian major carp species [*Catla catla*, *Cirrhinus cirrhosus*, and *Labeo rhoita*] are known to be able to hybridize, and hybrids are fertile and can be backcrossed to the parental species (Das et al., 1980, 1996; Padhi & Mandal, 1997). […] The results of this study clearly showed that hybridization among the species of Indian major carps must be a rare phenomenon under natural conditions, but at the same time extensive hybridization occurred when the fishes were reared in aquaculture."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Cyprinidae
Genus *Cirrhinus* Oken, 1817
Species *Cirrhinus cirrhosus* (Bloch, 1795)"

"Current Standing: valid"

Size, Weight, and Age Range

From Froese and Pauly (2017):

"Max length : 100.0 cm SL male/unsexed; [Roberts 1997]; common length : 40.0 cm TL male/unsexed; [Pethiyagoda 1991]; max. published weight: 12.7 kg [Talwar and Jhingran 1991]"

Environment

From Froese and Pauly (2017):

"Freshwater; brackish; benthopelagic; potamodromous [Riede 2004]; depth range 5 - ? m [Talwar and Jhingran 1991]."

"Can tolerate high levels of salinity."

Climate/Range

From Froese and Pauly (2017):

"Tropical; 28°N - 7°N"

Distribution Outside the United States

Native

From Froese and Pauly (2017):

"Asia: native to large rivers in the Indian subcontinent [Rainboth 1996]. Has been so widely transported in connection to aquaculture that its natural distribution can no longer be determined [Roberts 1997]."

From Rema Devi and Ali (2011):

"*Cirrhinus cirrhosus* is presently known in its native range only from the Cauvery River system in India (Menon 2004). Historically the species was wider ranging, being known from the Godavari, Krishna and Cauvery Rivers (Day. F 1978, referenced in Menon 2004)."

Introduced

Froese and Pauly (2017) report that *Cirrhinus mrigala* has been introduced and is established or probably established in Pakistan, Mauritius, Malaysia, Philippines, Lao PDR, Cambodia, and Vietnam.

Froese and Pauly (2017) report that *Cirrhinus mrigala* has been introduced and is not established or probably not established in Japan, Zimbabwe, USSR, Thailand, Sri Lanka, and Nigeria.

Froese and Pauly (2017) report that *Cirrhinus mrigala* has been introduced and its establishment status is unknown in China and Bhutan.

Means of Introduction Outside the United States

From Rema Devi and Ali (2011):

"It was introduced for aquaculture to other areas of India beyond its natural range in the early 1940s and in the 1950s and 1960s to other Asian countries."

Short Description

From Froese and Pauly (2017):

"Dorsal spines (total): 0; Dorsal soft rays (total): 12-15; Vertebrae: 39. Body plain greyish; 12-15 branched dorsal rays [Kottelat 2001]."

From Rema Devi and Ali (2011):

"*C. cirrhosus* has four barbells whereas *mrigala* has only two barbells; dorsal branched rays are 15-16 in *cirrhosus* vs. 12-13 in *mrigala*."

Biology

From Froese and Pauly (2017):

"Adults inhabit fast flowing streams and rivers [Menon 1999]. […] Juveniles are omnivorous to about 5 cm TL, adults are almost entirely herbivorous. Feed on plankton, but also grazes on algae. Spawning occurs in marginal areas of the water body with a depth of 50-100 cm over a sand or clay substrate. A 6 kg female can lay a million eggs (of 1 mm diameter) [Pethiyagoda 1991]."

From Rema Devi and Ali (2011):

"In Indian reservoirs, the *C. cirrhosus* comprised 20-47 % of the catch in 1943 - 1944, but declined to 2% of the catch in 1965 - 1966 due to the introduction of the Gangetic major carps *Catla catla* and *Labeo rohita*."

Human Uses

From Froese and Pauly (2017):

"Fisheries: highly commercial; aquaculture: commercial; gamefish: yes"

From Rema Devi and Ali (2011):

"Due to its hardy nature and rapid growth, it is popular as a food fish. It is the most widely farmed species among the Indian major carps and an important component of carp polyculture throughout South Asia. […] It fails to breed naturally in ponds, thus induced breeding is done. In Nepal, *C. cirrhosus*, along with two other cyprinids (*L. rohita* and *C. catla*), makes up a significant share of the total aquaculture production. These species are popular as a delicacy compared to other cultured exotic carps and accordingly fetch much higher prices. This species

has been introduced into many Asian countries as a food source; the percentage of wild harvest compared with aquaculture is not known."

Diseases

From Froese and Pauly (2017):

"White spot Disease, Parasitic infestations (protozoa, worms, etc.)
Cryptobia Infestation, Parasitic infestations (protozoa, worms, etc.) […]
Fish louse Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)
Trichodinosis, Parasitic infestations (protozoa, worms, etc.)
Sporozoa-infection (*Myxobolus* sp.), Parasitic infestations (protozoa, worms, etc.)
Ichthyophthirius Disease, Parasitic infestations (protozoa, worms, etc.)
Neascus Disease, Parasitic infestations (protozoa, worms, etc.)
Myxobolus Infection 3, Parasitic infestations (protozoa, worms, etc.)"

Chaudhary et al. (2013) reports *Cirrhinus cirrhosus* as host of the monogeneans *Dactylogyrus chauhanus*, *Dactylogyrus mrigali*, *Dactylogyrus yogendrai*, *Gyrodactylus elegans indicus*, and *Mazocraes singhi*.

From Muniruzzaman and Chowdhury (2008):

"The highest prevalence of EUS [epizootic ulcerative syndrome] was observed in *C. cirrhosus* (4.7%) […]"

From Sarkar and Rashid (2012):

"*A*[*eromonas*] *hydrophila* were found to cause disease in fishes associated with fungus, *Aphanomyces invadans* to produce EUS [epizootic ulcerative syndrome] (Hasan, 2007). Iqbal et al. (1998) detected *A. hydrophila*, *A. veronii biover sobria* and *A. jandaei* as pathogenic bacteria recovered from EUS affected mrigal."

Infection with *Aphanomyces invadans*/epizootic ulcerative syndrome is OIE-reportable.

Threat to Humans

From Froese and Pauly (2017):

"Harmless"

3 Impacts of Introductions

From Arthur et al. (2010):

"To quantify the impact of tilapia and carp stocking on native fish communities in freshwater wetlands of the Mekong region, we conducted observational and experimental impact–control studies replicated at the wetland level, at a total of 46 sites in Lao PDR. The studies were

designed as paired comparisons of wetlands where the non-native species (Nile tilapia *Oreochromis niloticus*, mrigal *Cirrhinus cirrhosus*, rohu *Labeo rohita* and bighead carp *Hypophthalmichthys nobilis*) were stocked in substantial numbers with similar wetlands where the species were absent. Stocking of these non-native species was associated with significant increases in total fish biomass, by 180% in the observational study and by 49% in the experiment. Native fish biomass was not affected by stocking of the non-native species. No significant impacts on native fish species richness, diversity indices, species composition or feeding guild composition were detected, except for moderately negative effects on Simpson diversity and equitability in the observational study. […] It is important to bear in mind that the results from our study are specific to the non-native species released and the receiving ecosystem and native fish community. The same species could interact significantly with native species if released in a different biogeographic region."

From Froese and Pauly (2017):

"Introduction of mrigal (Indian major carp) caused significant changes in diversifying number of cultured fish species in Vietnam."

4 Global Distribution

Figure 1. Reported known global distribution of *Cirrhinus cirrhosus*. Map from GBIF Secretariat (2017).

5 Distribution within the United States

Cirrhinus cirrhosus has not been reported in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was medium in peninsular Florida, on the Atlantic Coast from Florida to Virginia, in parts of the Southern Plains and Lower Midwest, and in southern Arizona. The remainder of the contiguous U.S. showed low climate match. Climate 6 score indicated that the contiguous U.S. had a low climate match overall. Scores of 0.005 and below indicate a low match; the Climate 6 score of *C. cirrhosus* was 0.002.

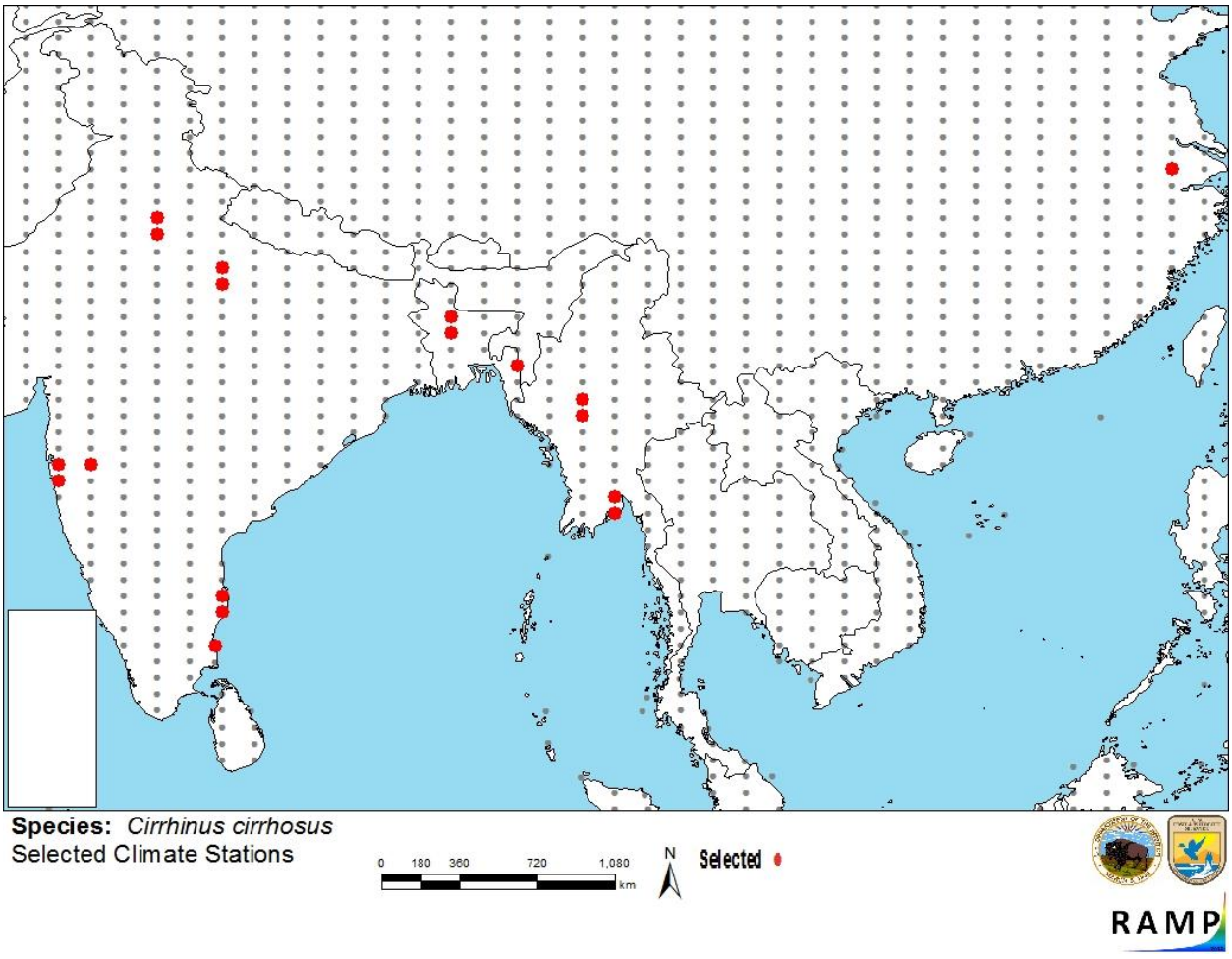

Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *C. cirrhosus* climate matching in southern Asia. Source locations from GBIF Secretariat (2017). Additional source locations from Li et al. (2013; China) and Sharker et al. (2015; Bangladesh).

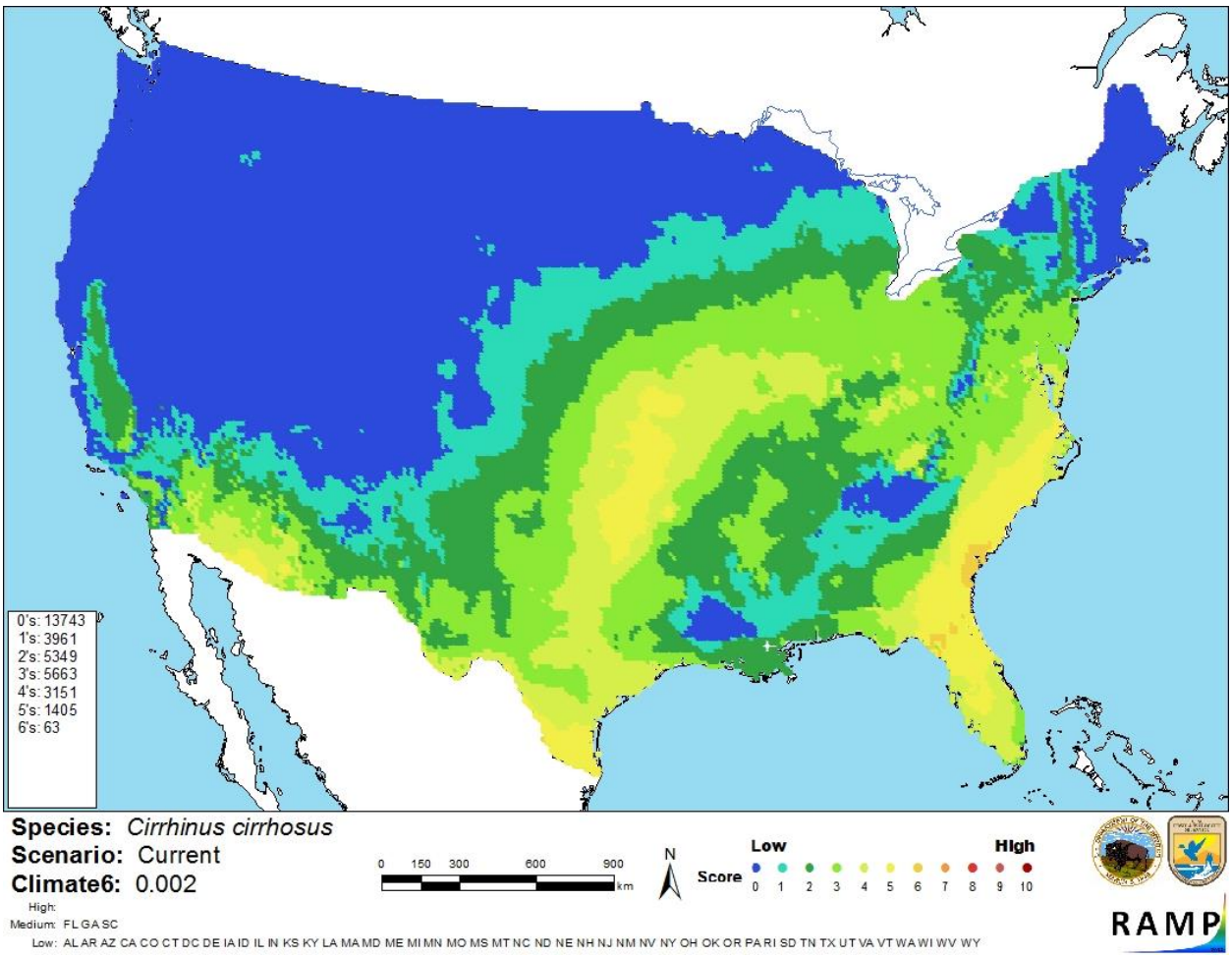

Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *C. cirrhosus* in the contiguous United States based on source locations reported by GBIF Secretariat (2017), with additional source locations from Li et al. (2013) and Sharker et al. (2015). 0=Lowest match, 10=Highest match.

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≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

Peer-reviewed literature on the biology, ecology, and distribution associated with *Cirrhinus cirrhosus* as well as information on its potential invasiveness is sparse. More research is needed on this species, particularly with regards to the impacts of introductions and locations of established populations. The certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Cirrhinus cirrhosus is a cyprinid fish species native to South Asia. It has become popular as an aquaculture species in South Asia and Southeast Asia, and wild populations have become established outside of the native range. While there are numerous parasites and diseases associated with this species, including one that is OIE-reportable, no adverse impacts have been documented due to the establishment of this species, apart from a vague reference to other cultured fish species in Vietnam. Overall climate match for this species with the United States is low. The risk presented by *C. cirrhosus* is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Low**
- **Certainty of Assessment (Sec. 7): Low**
- **Overall Risk Assessment Category: Uncertain**

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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10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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