

Stinging Catfish (*Heteropneustes fossilis*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, April 2021

Revised, April 2021

Web Version, 9/1/2021

Organism Type: Fish

Overall Risk Assessment Category: High



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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2021):

“Asia: Pakistan and Sri Lanka to Myanmar.”

From Frenado et al. (2019):

“Bangladesh; India (Darjiling, Uttaranchal, Andaman Is., Bihar, West Bengal, Uttar Pradesh); Lao People's Democratic Republic; Myanmar; Nepal; Pakistan; Sri Lanka; Thailand”

Status in the United States

This species has not been reported as introduced or established in the United States. This species was not found to be available for sale in the aquarium trade in the United States.

The Florida Fish and Wildlife Conservation Commission has listed all catfish in the family Heteropneustidae, including *Heteropneustes fossilis*, as prohibited species. Prohibited nonnative species (FFWCC 2021), "are considered to be dangerous to the ecology and/or the health and welfare of the people of Florida. These species are not allowed to be personally possessed or used for commercial activities."

From California Department of Fish and Wildlife (2019):

“It shall be unlawful to import, transport, or possess live animals restricted in subsection (c) below except under permit issued by the department. [...] Restricted species include: [...] Family Heteropneustidae (*Saccobranchidae*)-Airsac Catfishes: All species”

From Connecticut Secretary of State (2016):

“The importation or possession of [...] walking catfish of the family Clariidae, genera *Clarias*, *Heteropneustes*, *Dinotoplerus* and *Heterobranchus* is prohibited except that the Commissioner may at his discretion issue permits for the importation and possession, when it is in the public interest, for public display purposes, of specimens of piranha and walking catfish.”

From Mississippi Secretary of State (2019):

“All species of the following animals and plants have been determined to be detrimental to the State's native resources and further sales or distribution are prohibited in Mississippi. No person shall import, sell, possess, transport, release or cause to be released into the waters of the state any of the following aquatic species or hybrids thereof. However, species listed as prohibited may be allowed under a permitting process where environmental impact has been assessed. [...] Airsac catfish Family Heteropneustidae **** [indicating all species within the family are included in the regulation]”

From State of Nevada (2018):

“[...] the importation, transportation or possession of the following species of live wildlife or hybrids thereof, including viable embryos or gametes, is prohibited: [...] All species in the genera *Clarias*, *Heteropneustes* and *Dinotoplerus*”

From Oklahoma Secretary of State (2019):

“The Walking Catfish, (*Clarius batrachus*) and other members of the exotic catfish family Claridae, including but not limited to species of the genera *Clarias*, *Heteropneustes*, *Gymnallables*, *Channallabes*, and *Heterobranchus* are prohibited.”

From Texas Parks and Wildlife (2020):

“The organisms listed here are legally classified as exotic, harmful, or potentially harmful. No person may possess or place them into water of this state except as authorized by the department. Permits are required for any individual to possess, sell, import, export, transport or propagate listed species for zoological or research purposes; for aquaculture (allowed only for Blue, Nile, or Mozambique tilapia, Triploid Grass Carp, or Pacific White Shrimp); or for aquatic weed control (for example, Triploid Grass Carp in private ponds). [...] Air sac Catfishes, Family Heteropneustidae
All species”

From Utah Office of Administrative Rules (2019):

“All species of fish listed in Subsections (2) through (30) are classified as prohibited for collection, importation and possession, [...] [30] (c) Giant walking catfish (airsac), family Heteropneustidae (All species);”

Means of Introductions in the United States

This species has not been reported as introduced or established in the United States.

Remarks

This ERSS was previously published in January 2018. Revisions were completed to incorporate new information and conform to updated standards.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2021), the current valid name of this species is *Heteropneustes fossilis* (Bloch 1794). The original valid name of this species was *Silurus fossilis* Bloch 1794.

From ITIS (2021):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii

Class Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Heteropneustidae
Genus *Heteropneustes*
Species *Heteropneustes fossilis* (Bloch, 1794)

Size, Weight, and Age Range

From Froese and Pauly (2021):

“Max length : 31.0 cm TL male/unsexed; [Afzal Khan et al. 2012].”

Environment

From Froese and Pauly (2021):

“Freshwater; brackish; demersal; pH range: 6.0 - 8.0; dH range: ? - 30; depth range ? - 1m [Ali et al. 2016]. [...] 21°C - 25°C [Baensch and Riehl 1985; assumed to be recommended aquarium water temperature]”

“Adults found mainly in ponds, ditches, swamps and marshes, but sometimes occur in muddy rivers. [...] Can tolerate slightly brackish water.”

Climate

From Froese and Pauly (2021):

“Tropical; [...] 33°N 5°N, 64°E 97°E”

Distribution Outside the United States

Native

From Froese and Pauly (2021):

“Asia: Pakistan and Sri Lanka to Myanmar.”

From Frenado et al. (2019):

“Bangladesh; India (Darjiling, Uttaranchal, Andaman Is., Bihar, West Bengal, Uttar Pradesh); Lao People's Democratic Republic; Myanmar; Nepal; Pakistan; Sri Lanka; Thailand”

Introduced

From Frenado et al. (2019):

“Iran, Islamic Republic of; Iraq”

From Ali et al. (2016):

“In the Middle East, this species [*H. fossilis*] was introduced into Iraq in the late 1950s (FAO, 1997) and reported from the freshwaters of southern Iraq in 1960 by Khalaf (1961) and from the marine waters of Khor Al-Zubair, northwest Arabian Gulf (Al-Hassan and Muhsin, 1986). [...] In the other parts of the Middle East, this species is reported from the rivers and marshes in Khuzestan, Iran (Coad and Abdoli, 1993; Coad, 1996; Abdoli, 2000), and recently was recorded from the Tigris River watershed in Turkey (Ünlü et al., 2011).

In this paper we confirm the occurrence of *H. fossilis* in the waters of Al-Khabur River, Al Hasaka, Syria, which may indicate a range extension through the freshwater systems of the Levantine.”

Means of Introduction Outside the United States

From Ali et al. (2016):

“The idea behind introducing this species into Iraq was to control the snail *Bulinus truncatus*, a vector for the human parasite causing schistosomiasis, but which proved to be ineffectual (Jawad 2003).”

Short Description

From Hossain et al. (2013):

“Body yellow or dark purplish-brown in above and lighter in ventral side, extended backward mouth, pectoral spine attached to rays by membrane with 3-4 antrorse serrae along inner edge at anterior tip, and separated anal-caudal fin by a distinct notch [Tamil Nadu, India]”

From Coad (2014):

“Key characters: The 4 pairs of barbels, short and spineless dorsal fin, absence of an adipose fin, and the long anal fin are distinctive. The head is small and very flattened and tapers both dorsally and ventrally to a terminal mouth.

Morphology: There are two, tubular air sacs extending from the gill cavity almost to the caudal peduncle, enabling this catfish to breathe air. On capture, air from these sacs may escape and cause a peculiar squawking sound.

Dorsal fin with 6-8 rays but no spine, anal fin rays 60-79, pectoral fin branched rays 7-8 after a strong spine serrated on its inner margin, and pelvic fin branched rays 5-6. Fin rays are difficult to count without dissection or x-rays because of the fleshy and heavily pigmented nature of the fins.”

“Colour: Overall colour is yellow or leaden to dark green, grey-brown, rust-brown or even black, occasionally with two yellowish stripes. The flanks may also be spotted. The barbels are darker than the adjacent body. The eye is yellow. Young specimens are reddish and have a pale belly with numerous melanophores.”

Biology

From Froese and Pauly (2021):

“Omnivorous. Breed in confined waters during the monsoon months, but can breed in ponds, derelict ponds and ditches when sufficient rain-water accumulates. Oviparous, distinct pairing possibly like other members of the same family [Breder and Rosen 1966].”

“Eggs are deposited in a depression usually excavated by both parents in mud, in shallow water. Parents guard the eggs and young until they can fend for themselves which lasts for about one month [Pethiyagoda 1991].”

“Venomous fish, from its pectoral spines [Vidthayanon et al. 2005].”

From Frenado et al. (2019):

“Its air-breathing apparatus enables it to exist in almost any kind of water quality. Generally, during the dry season *Heteropneustes fossilis* lives in semi-liquid and semi-dry mud and, even when the mud dries, they take their bodies to the bottom of fissures and crevices formed by the cracking mud. Fertilised eggs are adhesive, demersal and spherical in form. In water bodies, this species will move and feed in schools which are active through the day and night, and normally it occupies the lower quarter of the water column. These fishes are active predators of fish trapped in gill nets and are known to eat the gills of trapped fish (Senanayake 1980, Pethiyagoda 1991, De Silva et al. 2015).”

From Coad (2014):

“It is common in swamps and can survive temperatures up to 39.8°C (Pethiyagoda 1991). Specimens survived 3-6 hours in air. It air breathes every 3-5 minutes but the frequency varies with time of day and weather conditions. On hot and calm days it visits the surface more frequently than during a heavy shower.”

Human Uses

From Froese and Pauly (2021):

“Fisheries: highly commercial; aquaculture: commercial; aquarium: commercial.”

From Frenado et al. (2019):

“It is also cultivated in some parts of its range; fishermen stock tanks with this fish species during the rainy season.”

“A fish of high economic importance. It lives in large shoals in suitable localities and is extensively fished on account of the reported invigorating qualities of its flesh. The fish, which can reach lengths of 30 cm, is in great demand because of its medicinal value in India. In the Calcutta markets the fish is sold in large quantities and is kept alive; boat-loads of living fish are brought from the deltaic districts and the Sunderbans. In the summer months (April-June) about

90% of live fish in the markets in India consists of this fish and *Clarias*. In Sri Lanka as well, *H. fossilis* is utilized for human consumption. It is heavily fished during the dry season by draining water holes (De Silva et al. 2015). A small number are exported in the aquarium trade (Gunasekara 2011).”

Diseases

No OIE-reportable disease (OIE 2021) were found to be associated with *H. fossilis*.

From Froese and Pauly (2021):

“Fish louse Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Intestinal Ligulosis, Parasitic infestations (protozoa, worms, etc.)
Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)
Yellow Grub, Parasitic infestations (protozoa, worms, etc.)
Contracaecum Disease, Parasitic infestations (protozoa, worms, etc.)
Clinostomum Infestation (metacercaria), Parasitic infestations (protozoa, worms, etc.)
Orientocreadium Infestation, Parasitic infestations (protozoa, worms, etc.)
Gnathostoma Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 1, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Disease, Parasitic infestations (protozoa, worms, etc.)
Euclinostomum Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 5, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Disease 2, Parasitic infestations (protozoa, worms, etc.)
Genarchopsis Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Macrolecithus Disease, Parasitic infestations (protozoa, worms, etc.)
Palaeorchis Disease, Parasitic infestations (protozoa, worms, etc.)
Allocreadium Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 6, Parasitic infestations (protozoa, worms, etc.)
Lytocestus Disease (*Lytocestus* sp.), Parasitic infestations (protozoa, worms, etc.)
Pseudocaryophyllaeus Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Pseudocaryophyllaeus Disease, Parasitic infestations (protozoa, worms, etc.)
Ascaridia Disease, Parasitic infestations (protozoa, worms, etc.)
Allocreadium Infestation 7, Parasitic infestations (protozoa, worms, etc.)
Aphallus Disease, Parasitic infestations (protozoa, worms, etc.)
Euclinostomum Disease, Parasitic infestations (protozoa, worms, etc.)
Eumaseia Disease, Parasitic infestations (protozoa, worms, etc.)
Macvicaria Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Neopecoelina Infestation, Parasitic infestations (protozoa, worms, etc.)
Neopecoelina Disease, Parasitic infestations (protozoa, worms, etc.)
Opegaster Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Philopinna Disease, Parasitic infestations (protozoa, worms, etc.)
Bialovarium Disease, Parasitic infestations (protozoa, worms, etc.)
Lernaeocera Disease (*Lernaeocera* sp.), Parasitic infestations (protozoa, worms, etc.)”

According to Poelen et al (2014) *H. fossilis* is a host of the following parasites: *Lytocestus fossilis*, *Crescentovitus biloculus*, *Diplostomulum*, *Myxobolus pfeifferi*, *Trichodina domerguei*, *Ichthyobodo necator*, *Procamallanus spiculogubernaculus*, and *Procamallanus saccobranchi*.

Threat to Humans

From Froese and Pauly (2021):

“Venomous fish, from its pectoral spines [Vidthayanon et al. 2005].”

“Traumatogenic [Halstead 1980].”

From Ali et al. (2016):

“In addition, this species is considered dangerous to humans, as the pectoral fin spine is very strongly serrated and connected to a poisonous gland (Bhimachar, 1944; Zakaria, 1964; Whitemar et al., 1991). Several cases of human envenomation are on record for this species, and the poison [sic] *H. fossilis* poison can be fatal to humans (Coad, 1979; Berra, 2001).”

3 Impacts of Introductions

From Coad (2014):

“[...] [*H. fossilis*, when introduced to Iraq] eradicated *Barbus* (= *Arabibarbus*) *grypus* eggs along the Tigris (F. Kedairy, in litt. 21 December 2005).”

“Zakaria (1964) reported severe swelling involving the whole arm from a hand sting in Iraq. The swelling and pain recede after about a day but the puncture wound can take about two weeks to heal and some pain can be felt when applying pressure to the wound site up to six weeks later. Caras (1964) (probably based on a report in Farsi in Game and Nature, Tehran, ca. 1961) recorded a diminutive black fish found in the Shatt al Arab which reputedly killed 28 people with a venomous bite (sic). Death was said to be swift. This was presumably a garbled report on this species. Verbal and newspaper reports from Tehran (V. D. Vladyskov, in litt. 26 August 1961) maintain that this species could cause death to cattle and humans although Vladyskov (in litt. 30 September 1963) considered fatal cases ‘not well proved’.”

“Numbers around Baghdad 30 years ago were so high that ‘you could not swim without being stung by one. Rather painful’ (F. Kedairy, in litt. 21 December 2005).”

From Ali et al. (2016):

“In addition, this species is considered dangerous to humans, as the pectoral fin spine is very strongly serrated and connected to a poisonous gland (Bhimachar, 1944; Zakaria, 1964; Whitemar et al., 1991). Several cases of human envenomation are on record for this species, and the poison [sic] *H. fossilis* poison can be fatal to humans (Coad, 1979; Berra, 2001). All records of envenomation took place with the resource users of the marsh area in southern Iraq (L. Jawad, personal data)”

From Jawad (2003):

“Individuals of this species [*H. fossilis*] can tolerate the harsh ecological conditions found in the freshwater system of Iraq – and especially in the marsh area, – better than any other freshwater fish species. *H. fossilis* can remain alive in shallow heavily polluted pools for a long time, while other fish species cannot stand such bad conditions even for a few minutes. This species was introduced intentionally to feed on the gastropod mollusk, *Bulinus truncates*, which acts as an intermediate host for the *Bilharzia* parasite (*Schistosoma haematobium*). Unfortunately, this assumption was wrong and instead this fish appeared to feed mainly on the aquatic plants and organic detritus in addition to crustaceans, aquatic insects and mollusks [Menon 1965]. The diet of *H. fossilis* is similar to that of the cyprinid *B. sharpeyi*, but the competition [*sic*] between the two species is less than that between *B. sharpeyi* and the common carp, probably because of the great difference in their ecological niches. *H. fossilis* is well established in the freshwater system in Iraq and it would be very difficult at this stage to get rid of it.”

H. fossilis is regulated in Florida, California, Connecticut, Mississippi, Nevada, Oklahoma, Texas, and Utah.

4 History of Invasiveness

The history of invasiveness for *Heteropneustes fossilis* is classified as High. *H. fossilis* has been introduced outside of its native range where it has become established in Iraq, Iran, and Syria. This species is hazardous to humans due to its venomous spines. A peer-reviewed publication has reported human stings, and possible deaths, in Iraq, where it is introduced and established. In addition, *H. fossilis* can occupy harsh environmental conditions, and reportedly consumes eggs of native species. There is a report in a peer-reviewed journal of *H. fossilis* eradicating *Barbus* (= *Arabibarbus*) *grypus* eggs along a river in Iraq, however it is based on a letter without additional information. This species is listed as prohibited in California, Florida, Mississippi, Texas, and Utah. *H. fossilis* is in the aquarium and aquaculture trade outside of the United States.

5 Global Distribution



Figure 1. Known global distribution of *Heteropneustes fossilis*. Locations are found in Turkey, Syria, Iraq, Iran, Pakistan, India, Nepal, Bangladesh, Myanmar, Sri Lanka, and Australia. Map from GBIF Secretariat (2021). Location in Australia will not be used in the climate match as this species is not reported as introduced or established at that location. Locations in Turkey will not be included in the climate match as it is unclear if this population has become established.

H. fossilis is reported as native in Thailand and Laos, however no georeferenced occurrences or exact location information was found to document these populations.

6 Distribution Within the United States

This species has not been reported as introduced or established in the United States.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for the contiguous United States was generally low. Low match was found throughout a majority of the country while medium and high match was found in the Southwest and peninsular Florida. The areas of high match were found from the Central Valley of California, through the desert into Arizona, and in southern to central Texas. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.066, Medium (scores between 0.005 and 0.103, exclusive, are classified as medium). Arizona, California, and Texas received high individual Climate 6 scores. Florida, New Mexico, Nevada, and Oklahoma received medium individual scores. All remaining States received low individual Climate 6 scores.

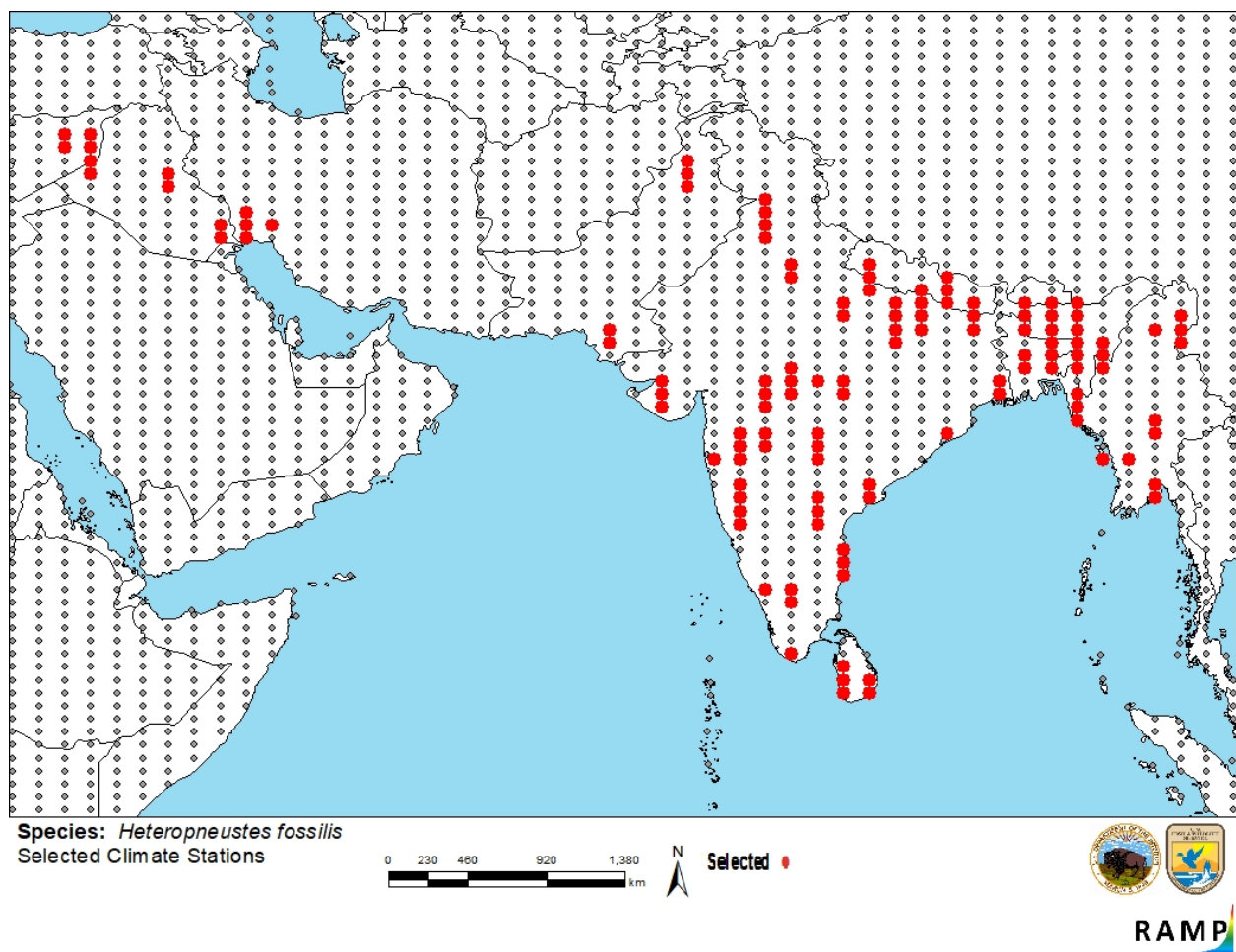


Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations in Asia selected as source locations (red; India, Bangladesh, Bhutan, Myanmar, Sri Lanka, Nepal, Pakistan, Iran, Syria, Iraq) and non-source locations (gray) for *Heteropneustes fossilis* climate matching. Source locations from GBIF Secretariat (2021). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

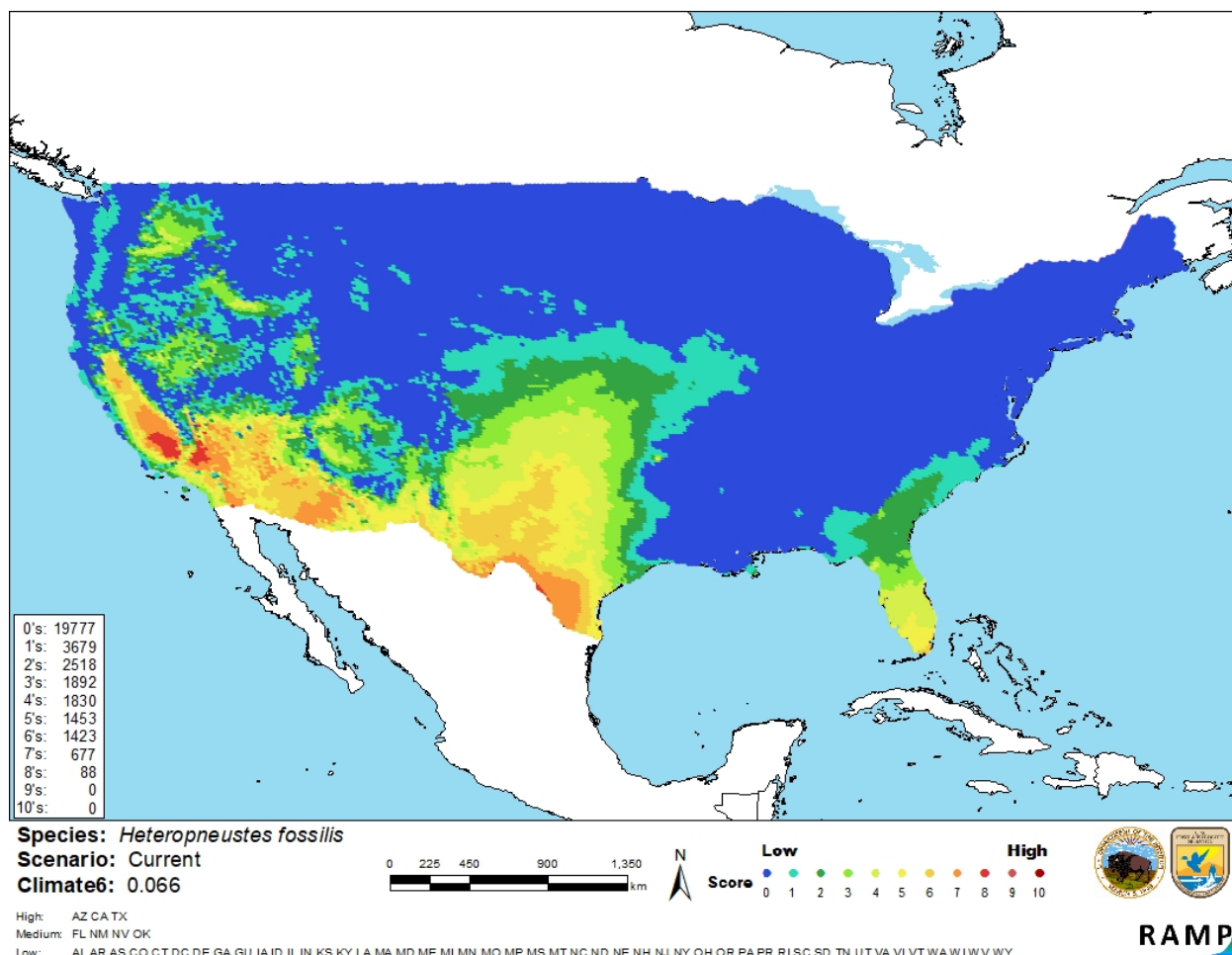


Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Heteropneustes fossilis* in the contiguous United States based on source locations reported by GBIF Secretariat (2021). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

8 Certainty of Assessment

The biology and ecology of *Heteropneustes fossilis* are well known. *H. fossilis* has been introduced outside of its native range where it has become established in some locations however limited information is available on the extent of impacts of introduction. In one area where *H. fossilis* has been introduced, severe stings to humans, and possible deaths, were reported in a

peer-reviewed publication. No georeferenced points were available in the far eastern portion of the range. The certainty of this assessment is High.

9 Risk Assessment

Summary of Risk to the Contiguous United States

The Stinging Catfish, *Heteropneustes fossilis* is an airsac catfish native to southern Asia. This species has venomous spines that can cause serious harm to human health if stung. *H. fossilis* is reported as prohibited in California, Connecticut, Florida, Mississippi, Nevada, Oklahoma, Texas, and Utah. This species has been introduced to Iran, Iraq, Syria, and Turkey. It has become established in all locations, with the exception of Turkey, where the establishment status is currently unknown. This species impacts humans in Iraq, where it has been introduced, because of its venomous sting. *H. fossilis* also is reported to impact native fish in their introduced range through competition and predation of eggs. Although in its native range it is regarded as a species of “high economic importance” because of its use for human consumption, no information on the availability of this species in trade was found. The history of invasiveness is classified as High. The overall climate match for the contiguous United States is Medium, with the areas of high and medium match in the Southwest and Florida. The certainty of this assessment is High because human impacts are reported in a reliable source. The overall risk assessment category for *Heteropneustes fossilis* is High.

Assessment Elements

- **History of Invasiveness (Sec. 4): High**
- **Overall Climate Match Category (Sec. 7): Medium**
- **Certainty of Assessment (Sec. 8): High**
- **Remarks, Important additional information: Hazardous to humans**
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

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11 Literature Cited in Quoted Material

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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