

Amur Catfish (*Silurus asotus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, November 2016
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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2016):

“Asia: Honshu, Shikoku and Kyushu in Japan, the Korean Peninsula, Taiwan, China, and Russia.”

From Huckstorf (2012):

“*Silurus asotus* is widely spread in East Asia. It is distributed from the Amur River Basin to Red River basin in northern Viet Nam including Korean Peninsula, Japan and Taiwan and Viet Nam (Berg 1964, Hwang et al.1982, Masuda et al. 1984, Shen 1993, Nguyen 1991, Kim et al. 2005).”

From CABI (2016):

“*S. asotus* is naturally found in lowland rivers, ponds and lakes in Japan, the Korean Peninsula, Taiwan, China and the Amur Basin of Russia (Kobayakawa, 1989; Choi et al., 1990). In Japan, they are widely distributed in the Honshu, Shikoku and Kyushu regions (Kobayakawa, 1989a). In the Korean Peninsula, they are distributed in Korea and North Korea apart from the east coast. (Uchida, 1939; Choi et al., 1990). On Taiwan Island, they are mainly distributed in the southern to northern area from the Central Mountains to the west (Shih-Chieh, 1995). In China, they are widely distributed in the main river systems (Wu, 1982). In Russia, they inhabit Lake Khanka, and the Ussuri and Rasdolnaja rivers in Primorye and the Amur Basin (Boutorina and Ermolenko, 2001).”

Status in the United States

There were no records of *Silurus asotus* introductions in the United States.

Means of Introductions in the United States

There were no records of *Silurus asotus* introductions in the United States.

Remarks

Parasilurus asotus is considered a synonym of *Silurus asotus*, the valid name of the species (Eschmeyer et al. 2016). Information searches were conducted using both names.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Eschmeyer et al. (2016), *Silurus asotus* Linnaeus 1758 is the valid name for this species; it is also the original name. It has been previously known as *Parasilurus asotus* (Linnaeus 1758).

From ITIS (2016):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Siluridae

Genus *Parasilurus*
Species *Parasilurus asotus*”

Size, Weight, and Age Range

From Froese and Pauly (2016):

“Maturity: Lm ?, range 35 - 37 cm

Max length: 130 cm TL male/unsexed; [Novikov et al. 2002]; common length: 37.0 cm SL male/unsexed; [Nichols 1943]; max. published weight: 30.0 kg [Novikov et al. 2002]”

From CABI (2016):

“The maximum size of this species is 130 cm in total length (TL), but it is usually 30-60 cm TL (Kobayakawa, 1989a; Choi et al. 1990), maximum weight 30 kg.”

“Amur catfish are reported to live for a maximum of 12 years (Dulmaa, 1999).”

Environment

From Froese and Pauly (2016):

“Freshwater; demersal. [...] 5°C - 25°C [assumed to be recommended aquarium temperature] [Baensch and Riehl 1997], [...]”

Climate/Range

From Froese and Pauly (2016):

“Temperate; [...] 53°N - 23°N, 95°E - 143°E”

CABI (2016) reports that *Silurus asotus* prefers a warm climate (Warm average temp. > 10°C, Cold average temp. > 0°C) with dry summers and/or dry winters or a continental climate (Warm average temp. > 10°C, coldest month < 0°C) with a dry winter.

Distribution Outside the United States

Native

From Froese and Pauly (2016):

“Asia: Honshu, Shikoku and Kyushu in Japan, the Korean Peninsula, Taiwan, China, and Russia.”

From Huckstorf (2012):

“*Silurus asotus* is widely spread in East Asia. It is distributed from the Amur River Basin to Red River basin in northern Viet Nam including Korean Peninsula, Japan and Taiwan and Viet Nam (Berg 1964, Hwang et al. 1982, Masuda et al. 1984, Shen 1993, Nguyen 1991, Kim et al. 2005).”

From CABI (2016):

“*S. asotus* is naturally found in lowland rivers, ponds and lakes in Japan, the Korean Peninsula, Taiwan, China and the Amur Basin of Russia (Kobayakawa, 1989; Choi et al., 1990). In Japan, they are widely distributed in the Honshu, Shikoku and Kyushu regions (Kobayakawa, 1989a). In the Korean Peninsula, they are distributed in Korea and North Korea apart from the east coast. (Uchida, 1939; Choi et al., 1990). On Taiwan Island, they are mainly distributed in the southern to northern area from the Central Mountains to the west (Shih-Chieh, 1995). In China, they are widely distributed in the main river systems (Wu, 1982). In Russia, they inhabit Lake Khanka, and the Ussuri and Rasdolnaja rivers in Primorye and the Amur Basin (Boutorina and Ermolenko, 2001).”

Introduced

From CABI (2016):

“*S. asotus* was initially introduced in 1932 in Lake Shaksha within the Russian part of the Selenga Basin and thereafter, dispersed into Mongolia, established in the Orkhon and Tuu Gol river basins and became common in Ugy Nur Lake (Manchin and Dgebuadze, 2010).”

Means of Introduction Outside the United States

From CABI (2016):

“As a valuable food and sport fish there is potential for further intentional introduction of *S. asotus*, although the level of risk has not been quantified.”

Short Description

From Froese and Pauly (2016):

“Dorsal soft rays (total): 4; Anal soft rays: 67 - 84. The side of the dorsal is dark grey; white stomach; with irregular white dots on the side. One pair of maxillary barbel, longer than the head; one pair of mandibular barbels, about 1/5-1/3 the length of the maxillary barbel [Liu 1990].”

From CABI (2016):

“Dorsal soft rays: 4-6; Anal soft rays: 59-88 (Kobayak[a]wa, 1990). The stomach is white and it has irregular white dots on its flanks. Immature and adult fish have one pair of maxillary barbels which are longer than the head and one pair of mandibular barbels that are approximately 20 to 30% of the length of the maxillary barbel (Liu, 1990). In juvenile fish (6-7 cm standard length), this species has one more pair of mandibular barbels (Atoda, 1935).”

Biology

From Froese and Pauly (2016):

“Adults feed on all types of fish [Dulmaa 1999].”

“Pairs manifest spawning embrace widely observed in other catfish species [Katano et al. 1989]. Details of reproductive behaviour from Katano, et al (1988): " A male first energetically [sic] pursued a female with its head near to the female's belly (chasing) and then began to cling to the female's body from the side, bending its tail or head (clinging). Finally the male enfolded the female's body, with its anus near to the female's (enfolding). In some cases, 2-4 males pursued a single female and two males enfolded a female at the same time. Although no aggressive behaviour was evident between males, it was always the largest male that could almost frequently approach and enfold the female. The mating pair moved a long distance in a ditch, paddy field and/or creek, performing reproductive activities." The scattering of eggs may reduce the incidence of death of the young.”

From Huckstorf (2012):

“*Silurus asotus* is mostly found in lakes, reservoirs and medium-size rivers and streams with slowly running water and muddy bottom. Hides in swamps and caves during the day time and feeds during the night. Stays in deep waters and muddy places during winter (Liu 1990). Feeds on all types of fish (Dulmaa 1999, Katano et al. 2005).”

“Spawning activity of *Silurus asotus* takes place in temporary water (rice fields) from early evening to midnight, generally in connection with rainfall, from late April to late August. Spawning of the catfish was correlated with hydrographic parameters dependent on rainfall: daily precipitation, turbidity, water depth, and water temperature. The spawning habits of the catfish, and in particular the use of temporary waters such as rice fields that become submerged after rainfall or by irrigation, are presumed to be adaptations to the Asian monsoon climate with a pronounced rainy season. The apparent sex ratio of the catfish was extremely biased toward females. Intraspecific variation in the reproductive ecology, particularly mating behavior, of this species is observed among local populations. Factors that may have caused this variation are discussed in the context of a comparison of mating behavior, reproductive environment, and sex ratio between the Lake Biwa population of *S. asotus* and other conspecific populations, as well as two other species of silurid catfish that occur in the Lake Biwa drainage, *S. biwaensis* and *S. lithophilus* (source: Maehata 2007).”

“In reproductive activities, a male first energetically pursued a female with its head near to the female's belly (chasing) and then began to cling to the female's body from the side, bending its tail or head (clinging). Finally the male enfolded the female's body, with its anus near to the female's (enfolding). In some cases, 2-4 males pursued a single female and two males enfolded a female at the same time. Although no aggressive behaviour was evident between males, it was always the largest male that could most frequently approach and enfold the female. The mating pair moved a long distance in a ditch, paddy field and/or creek, performing reproductive activities (Katano et al.1988, Maehata 2007). It is thought that the spawning site and period of spawning of the fish enable the larvae to avoid the danger of predation and to efficiently feed, firstly on plankton and later on larvae of other fishes which become abundant during the irrigation period. Spawn is scattered over the bottom surface covered with grass (Katano 1988); it is not guarded by the males. The eggs are greenish; their diameter without membran [sic] is 1.6 mm, with membrane 4.3 mm. At the air temperature of 19 ° C, the larvae hatched on the 7th day

after fertilization. Unlike the adults, the larvae have 3 pairs of barbels (Berg 1964). Although some eggs and larvae may die due to the drying out or high water temperatures of such unstable temporary waters, scattering eggs may reduce the incidence of the cannihilation [cannibalism] of the young (Katano et al. 1988).”

From CABI (2016):

“The chromosome number of *S. asotus* is $n=29$, $2n=58$ (Klinkhardt et al., 1995). The total mitochondrial genome of this species is reported in Nakatani et al. (2011).”

“Spawning activity of *S. asotus*, takes place in temporary water (rice fields) in conjunction with the rainy season (late April to late August, depending on location). Thus, spawning tends to [sic] connected with hydrographic parameters dependent on rainfall, where increased daily precipitation, turbidity, water depth, and water temperature initiate spawning (Maehata, 2007); these behaviours are presumed to be adaptations to the Asian monsoon climate that has a pronounced rainy season. The apparent sex ratio of the species is extremely biased toward females. Intraspecific variation in their reproductive ecology, particularly mating behaviour, has been is [sic] observed within local populations (Maehata, 2007), for example the Biwa population shows a fixed sequence of actions, i.e. chasing, clinging, enfolding with squeezing by the male, and circling of the paired fish, and females are always enfolded by a single male (Maehata, 2002), whereas the Ooi-, and Fuefuki-populations do not show such a behavioral sequence; the process of enfolding a female’s body by a male is not so stereotyped, circling by the paired fish has not been recognized, and females are often enfolded by two males (Maehata, 2007). *S. asotus* scatter their eggs during spawning, a mechanism believed to be aimed at reducing juvenile mortality (Katano et al., 1988).”

“In Mongolia, both males and females attain sexual maturity at the age of 4 to 5 years, at lengths of 350 to 370 mm. The spawning season starts in late May and ends at the end of July, peaking in mid-June. At the air temperature of 19°C, the larvae hatched on the 7th day after fertilization (Huckstorf, 2012). In the delta of the Halhin Gol the spawning period is shorter, from the end of May until the end of June, when spawning occurs in the evening and at night at water temperatures of 16-18°C. They lay their eggs in stagnant water on submerged aquatic macrophytes at depths of between 0.1 and 0.7 m. In the Halhin Gol delta, spawning females tend to be 400 to 600 mm and males 300 to 400 mm long, where female fecundity ranges from 29,470 to 70,850 eggs. By contrast, in Lake Buyr, it is 22,190 to 92,750 eggs. In Lake Ugiy in the Selenga catchment, *S. asotus* of 510 to 740 mm and 1200 to 3000 g weight have fecundity of 33,900 to 128,200 eggs (Dulmaa, 1999).”

“*S. asotus* is a piscivorous species, feeding on all kinds of fish; it also consumes frogs and insects (Wu X, 1982; Kobayakawa, 1989a; Dulmaa, 1999).”

Human Uses

From Huckstorf (2012):

“*Silurus asotus* is a high valuable food fish. Used in aquaculture in Japan. In Viet Nam production is very high in middle and lower section of rivers where they are harvested throughout year. Becoming an important aquaculture species.”

From CABI (2016):

“In Mongolia and Japan, *S. asotus* is an important commercial fish species. In the 1920s, during the winter fishing period in Mongolia, the following quantities were captured: in 1923/1924 - 480 t, in 1924/1925 - 430 t, in 1925/1926 - 370 t. In Lake Buyr, during the 1959-1969 period, the average annual catch was 37.7 t. However, by the end of the 1990s, catches of *S. asotus* from Lake Buyr had declined to approximately 10 t/year. In Lake Ugiy, *S. asotus* represents less than 1% of the total catch (Dulmaa, 1999).”

“*S. asotus* is the most common predator of shallow waters. It feeds on all types of fish, and it is important for its regulatory effects on fish such as crucian carp (*Carassius carassius*), ide (*Leuciscus idus*) and wild carp (Dulmaa, 1999).”

“They may also be used in the control of non-native species, as research suggests that the introduction of these catfish into ponds and lakes for the purpose of eradicating bluegill (*Lepomis macrochirus*) is appropriate for areas with few native fish species. In the case that only bluegill and catfish were introduced in ponds in Japan, catfish consumed 4 to 15 g of bluegill per day (Katano et al., 2005).”

Diseases

No records of OIE reportable diseases were found.

From Kuge et al. (1992):

“*Aeromonas hydrophila* and other species of bacteria were isolated from moribund 7-day-old catfish [*Silurus asotus*] larvae,”

From Yu et al. (2009):

“Gill samples from some of the affected fish [*Silurus asotus*] revealed the presence of *Trichodina* sp.,”

“Microbial study on bacterial isolates suggests that the mass mortality that occurred in the farmed Korean catfish [*Silurus asotus*] is associated with an infection of *E[dwardsiella]. tarda.*”

From Nagasawa et al. (2010):

“As many as 1,079 specimens of the branchiuran parasite *Argulus japonicus* Thiele, 1900 were found on the body surface of an Amur catfish *Silurus asotus* in Ehime Prefecture, Shikoku, central Japan.”

From Moravec et al. (2008):

“During recent helminthological examination of some fishes of Lake Biwa, Japan, carried out in April, 2007, two female specimens of the little-known nematode *Philometra parasiluri* Yamaguti, 1935 (Philometridae) were found in the oculo-orbits of the Amur catfish *Silurus* (syn. *Parasilurus*) *asotus* L.”

Threat to Humans

From Froese and Pauly (2016):

“Harmless”

3 Impacts of Introductions

From CABI (2016):

“In Japan and Mongolia, *S. asotus* is a commercially important species (Dulmaa, 1999; Froese and Pauly, 2012) and it may provide an economic benefit as a sport fish because of its large size.”

“Little is known about the environmental impact of this species. However, as *S. asotus* is a large (up to 130 cm long) piscivorous species that feeds on all kinds of fish (Dulmaa, 1999), it may form a threat to native fish species in areas where it is introduced (A Gittenberger, Gimaris, The Netherlands, personal communication, 2011).”

“*S. asotus* is the most common predator of shallow waters. It feeds on all types of fish, and it is important for its regulatory effects on fish such as crucian carp (*Carassius carassius*), ide (*Leuciscus idus*) and wild carp (Dulmaa, 1999).”

“They may also be used in the control of non-native species, as research suggests that the introduction of these catfish into ponds and lakes for the purpose of eradicating bluegill (*Lepomis macrochirus*) is appropriate for areas with few native fish species. In the case that only bluegill and catfish were introduced in ponds in Japan, catfish consumed 4 to 15 g of bluegill per day (Katano et al., 2005).”

4 Global Distribution

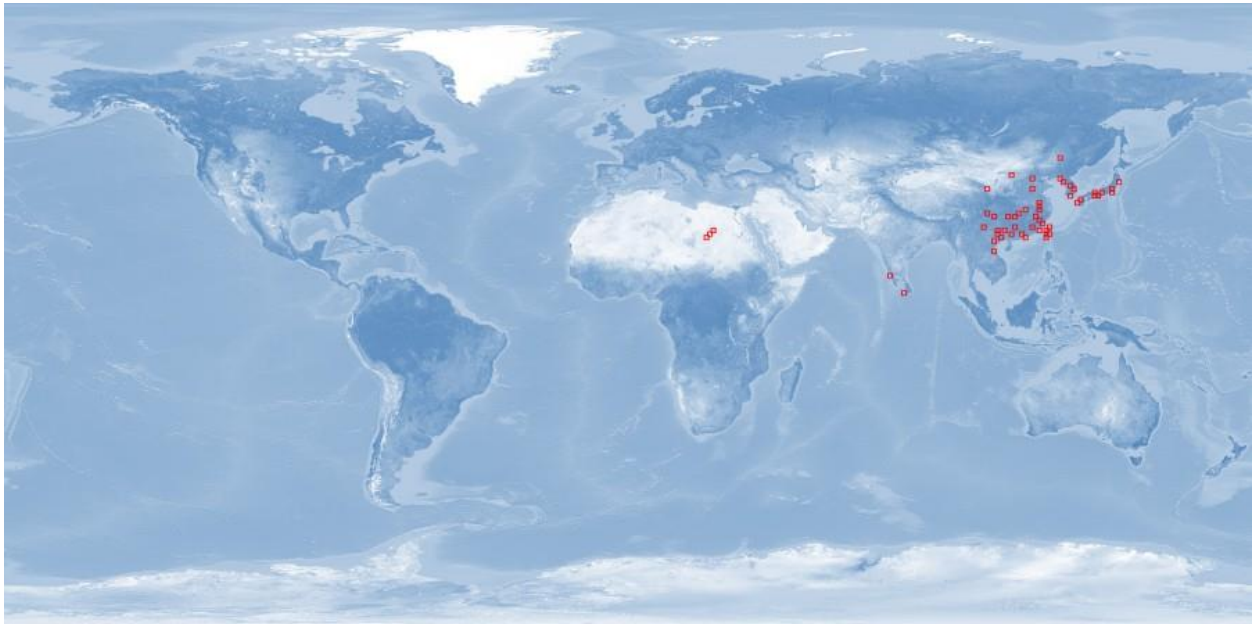


Figure 1. Known global distribution of *Silurus asotus* as reported by Froese and Pauly (2016).

Points shown in Africa are the result of incorrectly recorded longitude. Text descriptions of the location place the points in Taiwan (Froese and Pauly 2016). The points were not used as source locations for the climate match.

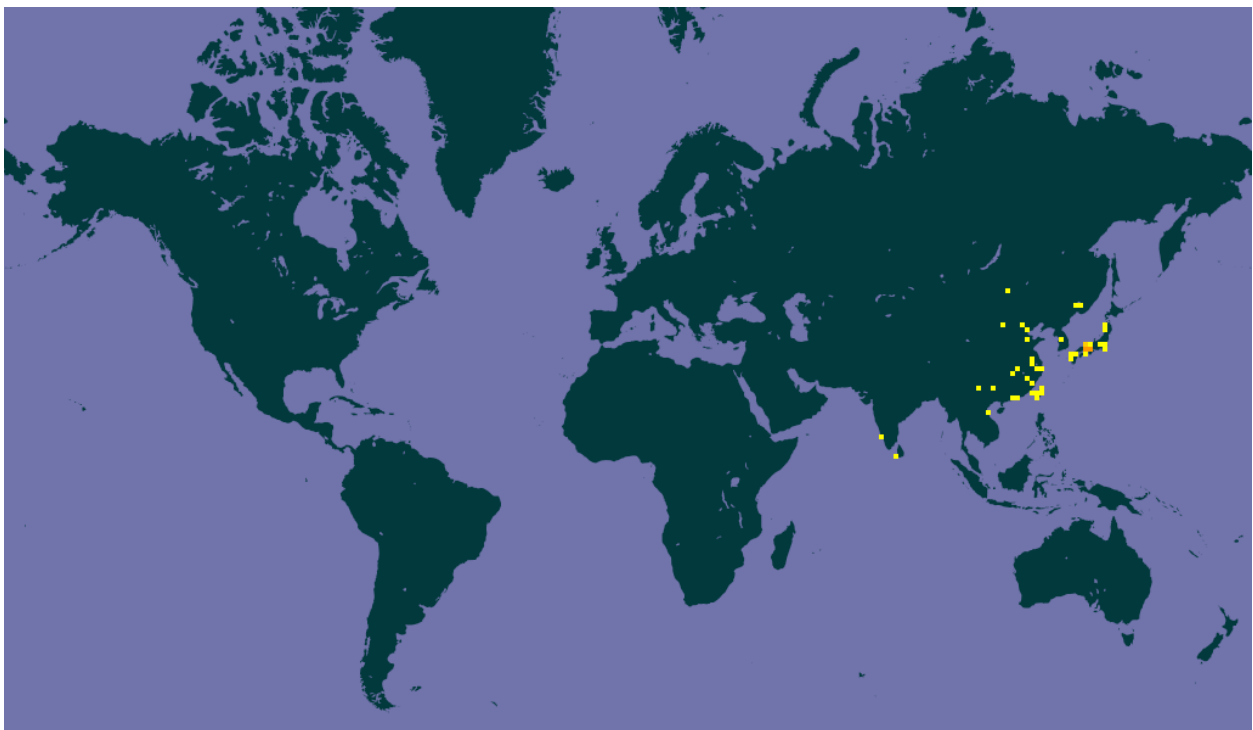


Figure 2. Known global distribution of *Silurus asotus* as reported by GBIF Secretariat (2016).

Point in Sri Lanka is the result of two individuals collected in 1882 (GBIF Secretariat 2016). There are no other records confirming an established population at this location; the point was not used as a source location for the climate match.

The point in India is from a single specimen, no collection date is given. There are no other records confirming an established population at this location; the point was not used as a source location for the climate match.

5 Distribution Within the United States

There were no records of *Silurus asotus* in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Silurus asotus* was highest in the upper Midwest. It was also high along the southern Atlantic Coast, Florida, and through the eastern portion of the middle of the country including areas of Virginia, Tennessee, Ohio, and Indiana. It was especially low in the western third of the country. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous United States was 0.303, high, and individually high in Arkansas, Colorado, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Maryland, Minnesota, Missouri, Montana, Nebraska, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Virginia, West Virginia, Wisconsin, and Wyoming.

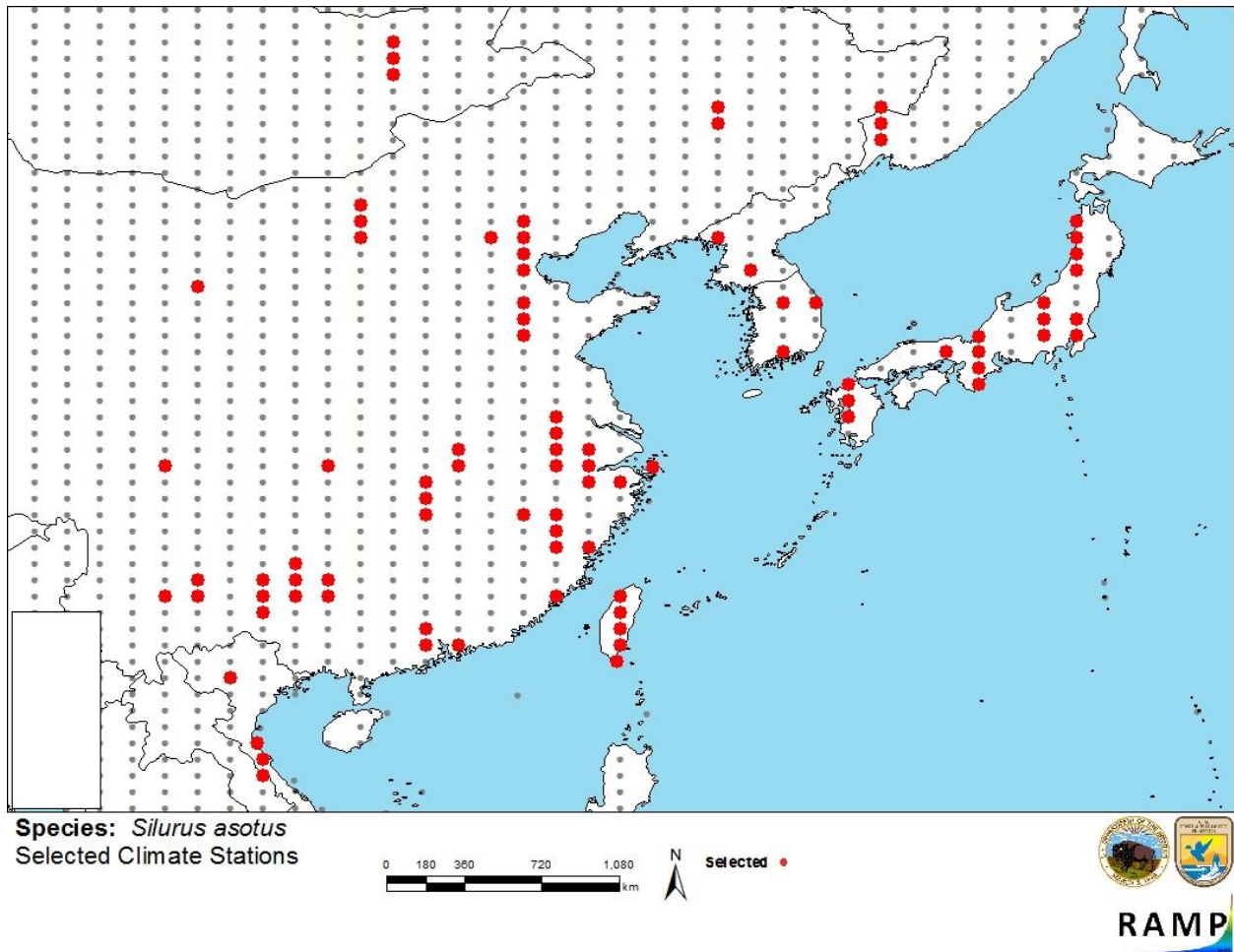


Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected in Southeast Asia as source locations (red) and non-source locations (gray) for *Silurus asotus* climate matching. Source locations from Froese and Pauly (2016) and GBIF Secretariat (2016).

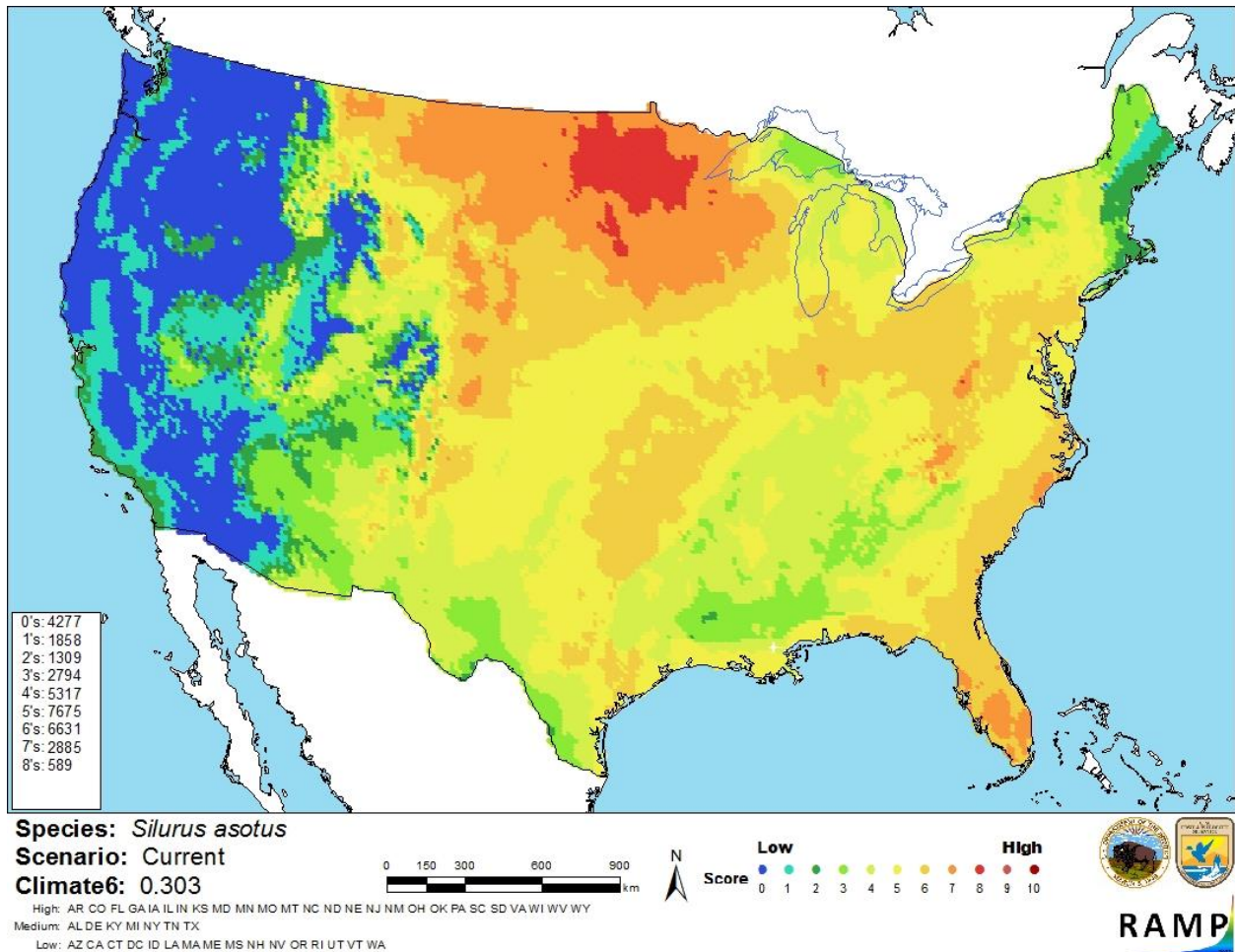


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Silurus asotus* in the contiguous United States based on source locations reported by Froese and Pauly (2016) and GBIF Secretariat (2016). 0 = Lowest match, 10 = Highest match. Counts of climate match scores are tabulated on the left.

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
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of assessment for *Silurus asotus* is medium. There was a large quantity of quality information found about the biology, ecology, and distribution of this species. The confidence in the climate match is high. There was one record of a successful introduction, information on potential impacts of introductions, but no information on actual, demonstrated impacts.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness for *Silurus asotus* is not documented. A successful introduction just outside of its native range was documented but there are no records on any actual impacts of that introduction. Information does exist regarding potential impacts of this species. The climate match is high. The highest match was in the upper Midwest with other areas of high match in the eastern two thirds of the country. The western third had an extremely low match. The certainty of assessment is medium. Information is missing regarding the history of invasiveness. The lack of a documented history of invasiveness precludes an overall assessment category of high even though the climate match is high. The overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** No additional remarks.
- **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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