Acheilognathus macropterus (a fish, no common name)

Ecological Risk Screening Summary

U.S. fish & Wildlife Service, July 2020
Revised, September 2020
Web Version, 2/5/2021

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

1 Native Range and Status in the United States

Native Range

From Fricke et al. (2020):

"Distribution: China, Korea and northern Vietnam."

From Froese and Pauly (2020):

"Asia: China and northern Viet Nam [Kottelat 2001]. Reported from Amur River drainage in Russia [Bogutskaya and Naseka 2002]."

From Huckstorf and Freyhof (2011):

"In China, it is recorded from the drainages of Dong Jiang and Bei Jiang in Guangdong Province and drainages in Hainan Island and their river mouths; Heilongjiang to Red River basin; Guangdong (Lianzhou, Yangshan); Jiangxi Fanyang Lake; Shanghai City; Jiangsu Tai Lake;

Anhui Linghuaiguan; Hubei (Dong Lake, Liangzi Lake, Hong Lake, Shashi); Hunan (Dongting Lake); Shanxi Zhouzhi, and Heilongjiang Songhuajiang."

Status in the United States

No records of *Acheilognathus macropterus* in the wild or in trade in the United States were found.

A. macropterus falls within Group I of New Mexico's Department of Game and Fish Director's Species Importation List (New Mexico Department of Game and Fish 2010). Group I species "are designated semi-domesticated animals and do not require an importation permit." With the added restriction of "Not to be used as bait fish."

Means of Introductions in the United States

No records of *Acheilognathus macropterus* in the wild or in trade in the United States were found.

Remarks

From NIES (2020):

"Invasive alien species (Invasive Species Act) Keeping and release of this species in Shiga Pref. are controled [*sic*] by a prefectural ordinance."

From Seriously Fish (2020):

"*A. macropterus* appears in the ornamental trade on an irregular basis […]"

Even though Seriously Fish (2020) states that *A. macropterus* can appear in the ornamental trade it could not be found for sale in the United States.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2020), *Acheilognathus macropterus* (Bleeker 1871) is the current valid name for this species.

From ITIS (2020):

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 *Acheilognathus*
Species *Acheilognathus macropterus* (Bleeker, 1871)

Size, Weight, and Age Range

From Froese and Pauly (2020):

"Max length : 27.5 cm SL male/unsexed; [Nichols 1943]"

Environment

From Froese and Pauly (2020):

"Freshwater; brackish; benthopelagic. […] 15°C - 25°C [Baensch and Riehl 1997] [assumed to be the recommended aquarium temperature]"

Climate

From Froese and Pauly (2020):

"Subtropical"

Distribution Outside the United States

Native

From Fricke et al. (2020):

"China, Korea and northern Vietnam."

From Froese and Pauly (2020):

"Asia: China and northern Viet Nam [Kottelat 2001]. Reported from Amur River drainage in Russia [Bogutskaya and Naseka 2002]."

From Huckstorf and Freyhof (2011):

"In China, it is recorded from the drainages of Dong Jiang and Bei Jiang in Guangdong Province and drainages in Hainan Island and their river mouths; Heilongjiang to Red River basin; Guangdong (Lianzhou, Yangshan); Jiangxi Fanyang Lake; Shanghai City; Jiangsu Tai Lake; Anhui Linghuaiguan; Hubei (Dong Lake, Liangzi Lake, Hong Lake, Shashi); Hunan (Dongting Lake); Shanxi Zhouzhi, and Heilongjiang Songhuajiang."

Introduced
From NIES (2020):

"Lake Kasumigaura and Lake Kitaura, Ibaraki Pref. Reservoirs along the Tone River including Chiba, Tokyo, Saitama and Tochigi prefecture."

"The first record in Japan was in 2001, at Lake Kasumigaura, and it is assumed that establishment was by 1999. In Lake Kitaura, recorded since 2003."

Means of Introduction Outside the United States

From NIES (2020):

"Possibly deliberate: release of pet animal, or accidental: Hitchhiking on carp seedling or pearl bivalve for aquaculture."

From Hagiwara (2008):

"Casual removal of *Unio douglasiae* [freshwater mussel species in which *A. macropterus* is known to deposit eggs] from Lake Kasumigaura by bitterling enthusiasts may also contribute to the spread of the exotic species to other waters."

Short Description

From Hagiwara (2008):

"The body is in a [sic] compressiform, which becomes more noticeable as the fish matures. A distinct blue spot is visible on a scale located about 5 rows from the gill cover. During the spawning period, a male bitterling produces an additional spot on the tip of its snout. White spots on the anal fin, the first node, and the midpoint between the body and the first node become prominent and form 3 distinct white lines aligned from front to end. Little nuptial coloration develops on the body in contrast to the anal fin. The body presents a somewhat darkened color with pale pink metallic luster depending on the condition of light and the viewing angle. The abdomen also darkens […] The female anal fin turns yellow during the spawning period […] The female ovipositor is colorless at the base and somewhat darkened at the tip […] When extended further, the ovipositor turns colorless and the thick base protrudes outside the body, with the front edge of the pelvic fin turning white […] The barbels are extremely short […] on smaller individuals they are difficult to detect by the naked eye. […] The dorsal fin shows 3 spiny fin rays […] The dorsal fin soft rays numbered between 15 and 18, the vertebrae between 34 and 37, and the lateral line scales between 34 and 37."

Biology

From Froese and Pauly (2020):

"Female has an ovipositor which is used to deposit eggs inside bivalves. Young remain in the bivalve until they can swim [Kottelat 2001]."

From Yu et al. (2020):

"Its diet is characterised by high plasticity and consists of a variety of food items including zooplankton, plant material, benthic invertebrates and periphyton (Koutrakis et al. 2003; Usui et al. 2018). This means that bitterlings [*Acheilognathus macropterus*] can influence aquatic systems through both top-down (zooplankton consumption) and bottom-up (mobilisation of benthic nutrients) effects."

From Kim and Kim (2012):

"[*A. macropterus*] mainly inhabited in slow water with sand and mud bottoms. The standard length of this population indicated that below 48 mm group is one year old, 48~58 mm group is two years old, 58~64 mm group is three years old and longer than 66 mm group is regarded over four years old. […] Spawning season from April to June with the water temperature in 15~20°C. The average number of eggs in ovary was 680±209. The matured egg size was 1.92×1.60 mm. Stomach contents were mainly phytoplanktons such as the genera *Navicular, Cymbella, Fragilaria*."

Human Uses

From Huckstorf and Freyhof (2011):

"Likely to be included in subsistence fisheries."

From Seriously Fish (2020):

"*A. macropterus* appears in the ornamental trade on an irregular basis […]"

From Practical Fishkeeping 2020:

"A lesser known bitterling, this species has recently appeared in a few shops across the UK."

Diseases

No records of OIE-reportable diseases (OIE 2020) were found for *Acheilognathus macropterus*.

Poelen et al. (2014) list *Pseudacolpenteron* sp., *Dactylogyrus acanthorhodei*, *Acolpenteron* sp., *Gyrodactylus rhodei*, *Echinochasmus japonicus*, *Dactylogyrus* sp., *Echinostoma hortense*, and *Clonorchis sinensis* as parasites of *Acheilognathus macropterus*.

In addition, Sohn and Na (2019) also list *Clinostomum complanatum* as a parasite of *A. macropterus.*

Threat to Humans

Froese and Pauly (2020) reported *Acheilognathus macropterus* as "Harmless" to humans but Park et al. (2009) do report a potential for illness due to consumption of this species (see below).

From Park et al. (2009):

"*Clinostomum complanatum* is a digenetic trematode which usually infects fish-eating water birds. If a human consumes raw fish, the fluke is accidentally attached on the surface of mucus membrane of the throat and causes a clinical syndrome called halzoun. Since the first human infection with *C. complanatum* was reported in Japan [Yamashita 1938], many cases have been described in Japan and other countries."

3 Impacts of Introductions

Acheilognathus macropterus was introduced to Lake Kasumigaura in Japan around 2000. First investigations indicated that there may have been an impact from this introduction to native bitterlings (see information from Hagiwara 2008 below) but subsequent investigation determined that the reduction in native bitterling species was due to a loss of unionid mussels which are required for native bitterling reproduction (see information from Hagiwara et al. 2017 below). Information from both studies are presented here to increase clarity in the decision making of this screening.

From Hagiwara (2008):

"*A. macropterus* is gradually expanding its habitat over the entire lake area of Kasumigaura. Even though the population of the bitterling subfamily as a whole is not increasing, this species has become more dominant. Based on this observation, it is considered to be invasive and increasing its population by overwhelming other species."

"Therefore, it can be concluded that the population of the native bitterlings is on the decline at both sites according to the increase in the number of *A. macropterus*."

From Hagiwara et al. (2017):

"Four bitterling species, *Tanakia lanceolata*, *Acheilognathus typus*, *A. melanogaster* and *A. tabira erythropterus*, are native to Lake Kasumigaura, Japan. Although their local extinction is a matter of concern, the reasons for recent population declines and their underlying mechanisms have been poorly understood. In this study, we conducted field research on the population dynamics of these species from 1999 to 2011, to determine the cause of the population decline. Special attention was paid to the ecological impact of non-native bitterlings and the availability of unionid mussels as their spawning hosts. During the study period, *T. lanceloata* and *A. typus* were not collected at all around the lake basin. Populations of *A. tabira erythropterus* and *A. melanogaster* gradually disappeared by the year 2010. In contracts, a non-native bitterling, *A. macropterus*, which newly invaded around year 2000, showed steady increase in its population after 2005. Of the other non-native bitterlings, *Rhodeus ocellatus ocellatus* showed a population decline, which *A. rhombeus* was rarely found throughout the study period. Generalized additive mixed model (GAMM) analysis revealed that the non-native bitterling, *A. macropterus*, has no impact on native bitterling populations. Since there was a remarkable decrease in the abundance of unionids by 2006, the population decline of the native bitterlings can be attributed to the decreased availability of their spawning hosts. In spite of the unionid mussels' absence, the non-native *A. macropterus* population expanded. It is likely that

A. macropterus can utilize as its spawning host a cultivated freshwater pear mussel, which is a hybrid between a Japanese *Hyriopsis schlegeli* and a Chinese *H. cumingii*, suggesting the possibility that its population is supported by pearl culture."

From NEIS (2020):

"Competition, hybridization with native fishes.
Native organism(s) affected: Native bitterlings."

4 History of Invasiveness

There were records of introduction found for *Acheilognathus macropterus* in Japan, where the species has been recorded in two lakes since the early 2000s. This species is considered established and has been considered invasive in Lake Kasumigaura in the past, and evidence suggests that their population is increasing. *A. macropterus* has expanded its range within Lake Kasumigaura, and has been reported to outcompete native congeners. More recent work from Lake Kasumigaura revealed that the reductions in native species were due to the loss of the unionid mussels required for reproduction and not to an impact from *A. macropterus*. No peer-reviewed sources in English or with an English abstract regarding the potential hybridization reported by the Invasive Species of Japan database (NEIS 2020, see section 3) or any impact in Lake Kitaura was found. Regulations currently exist in one Japanese prefecture to control keeping and release of this species. This species is sporadically found in the pet trade and was found for sale in 2009 in a few stores in the United Kingdom (Practical Fishkeeping 2020). The history of invasiveness for this species is considered Data Deficient.

5 Global Distribution

Figure 1. Known global distribution of *Acheilognathus macropterus*. Observations are reported from eastern Asia. Map from GBIF Secretariat 2020.

6 Distribution Within the United States

No records of *Acheilognathus macropterus* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Acheilognathus macropterus* was medium to high across most of the contiguous United States, with the highest matches occurring in the upper Midwest and peninsular Florida. The lowest matches were found in the Northeast, the Appalachian Mountains, and from the Rocky Mountains west to the Pacific Coast. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.198, High (scores equal to or greater than 0.103 are classified as High). The following States had high individual Climate 6 scores: Florida, Georgia, Iowa, Minnesota, Missouri, Montana, North Carolina, North Dakota, Nebraska, Oklahoma, South Carolina, South Dakota, Texas and Wisconsin. The following States had medium individual Climate 6 scores: Arkansas, Colorado, Kansas, Michigan, New Mexico, Virginia and Wyoming. All other States had low individual climate scores.

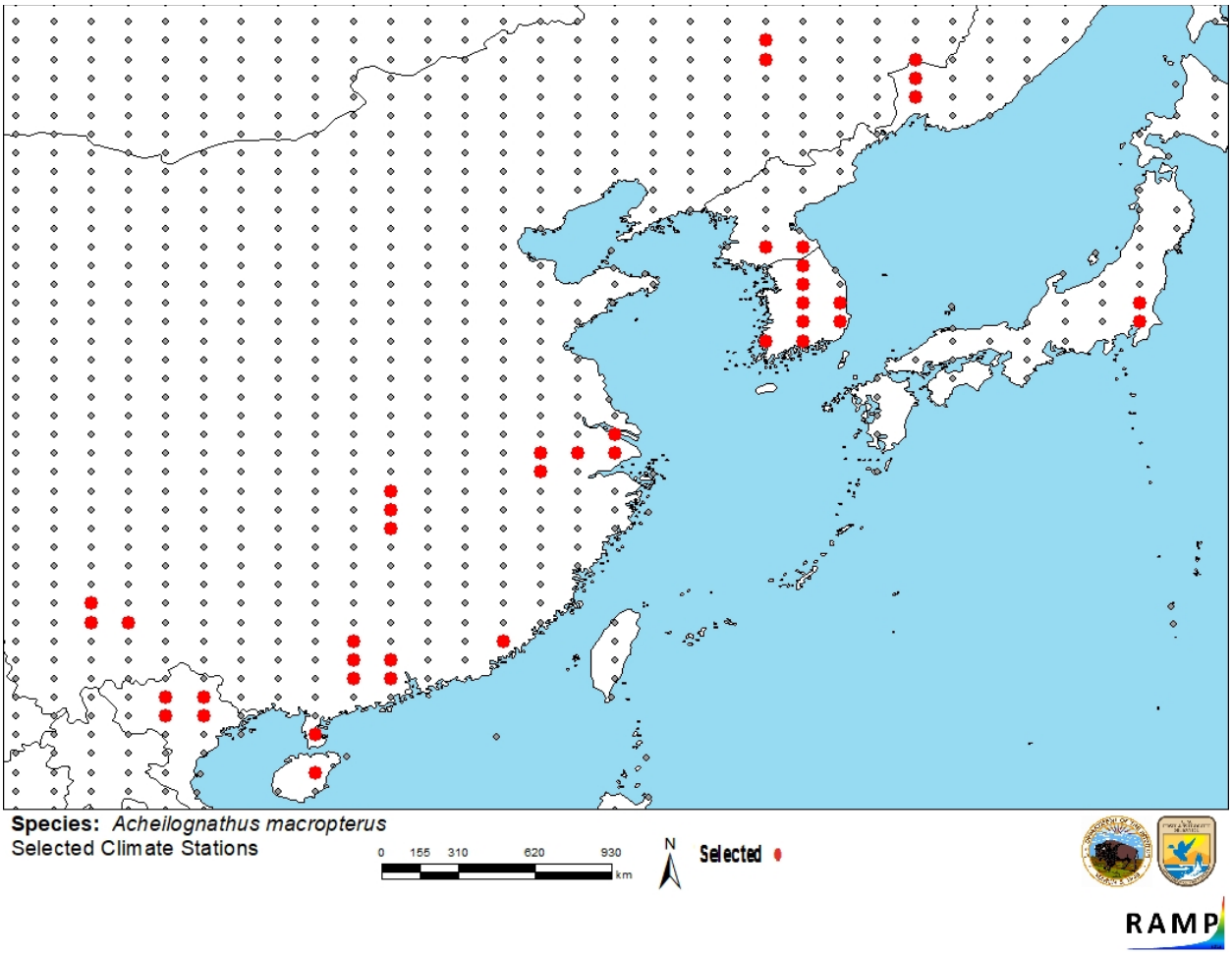

Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations in eastern Asia selected as source locations (red; China, South Korea, North Korea, Russia, Japan, and Vietnam) and non-source locations (gray) for *Acheilognathus macropterus* climate matching. Source locations from GBIF Secretariat 2020. Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

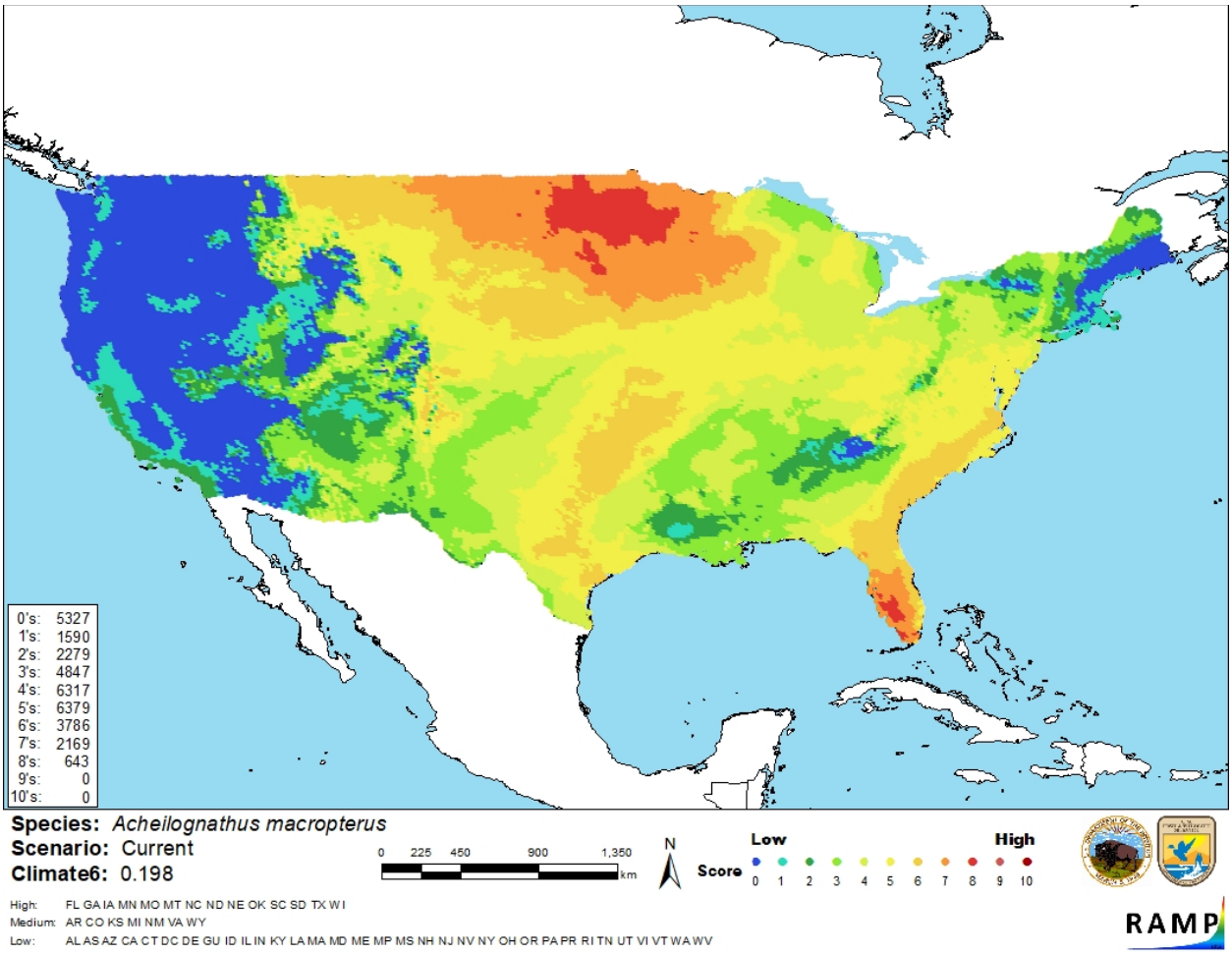

Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Acheilognathus macropterus* in the contiguous United States based on source locations reported by GBIF Secretariat 2020. Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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

8 Certainty of Assessment

There is sufficient information available on range, biology, introductions, and establishment for *Acheilognathus macropterus*. Records of introduction were found in Japan, and the establishment and growth of those populations has been well documented. Information on impacts has been conflicting or is unsupported by scientifically defensible information. The

range data for the species appears to be complete and the overall climate 6 score was High. Because of the amount of information available but the contradictory or unsupported impact information, the certainty of assessment is medium for *A. macropterus*.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Acheilognathus macropterus is a small omnivorous cyprinid native to China, Korea, Vietnam, and southeastern Russia. This species is in the subfamily *Acheilognathinae*, commonly referred to as the bitterlings, and is occasionally found in the pet trade in countries such as the United Kingdom. It is also sometimes a part of local subsistence fisheries. *A. macropterus* is restricted via an Invasive Species Act in at least one prefecture in Japan, after it has become established in two lakes there. There are established populations in two lakes in Japan but the available information regarding impacts has been either indicates no impact or does not have any scientifically defensible supporting information. Therefore the history of invasiveness is classified as Data Deficient. The overall climate match for *Acheilognathus macropterus* in the contiguous United States is High. The areas of highest match were found in Florida and the upper Midwest and Great Plains states. The available information on range, biology, and non-native populations is sufficient, but there is conflict and unsupported claims in the impact information, resulting in a medium certainty of assessment. Based on the history of invasiveness of Data Deficient and High overall climate match, the overall risk assessment category for *Acheilognathus macropterus* is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Medium**
- **Remarks, Important additional information:** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

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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