

# Amur Goby (*Rhinogobius brunneus*)

## Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2011  
Revised, February 2018  
Web Version, 9/3/2019



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<https://www.inaturalist.org/observations/2497105>. (February 2018).

## 1 Native Range and Status in the United States

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### Native Range

From Froese and Pauly (2017):

“Asia: river basin of the seas of Japan, Okhotsk, the Pacific coasts of Japan, Hokkaido, [*sic*] Ryukyu, Taiwan, rivers of Korea, continental China and the Philippines [Reshetnikov et al. 1997]; Viet Nam [Nguyen et al. 2011].”

## Status in the United States

From Schofield (2018):

“*Rhinogobius brunneus* [...] was discovered in the East Fork Lewis River in western Washington state in 2004 and may be reproducing there. Since then, specimens have been collected from the Columbia River and its estuary. Specimen [*sic*] have also been collected from the Sandy River and the Ramsey Wetland in Portland, Oregon (P. Heimowitz, pers. comm.). The Ramsey Wetland is connected to Columbia Slough and the Willamette River.”

“Status: Reported to be spawning in the East Fork Lewis River, Washington state.”

*R. brunneus* has been in trade in the United States in the past, based on auction data from 2014 on AquaBid (2019). No evidence was found of current trade in this species in the United States.

## Means of Introductions in the United States

From Schofield (2018):

“Probably ballast water, but potentially aquarium trade.”

## Remarks

From Schofield (2018):

“A number of types that are distinguished primarily by body colouration, but also often occupying different habitat types within the same stream are collectively referred to as the *Rhinogobius brunneus* species complex. Species in this complex have different life histories and egg sizes (Katoh 1996). At this time, the taxonomy of this species complex is not resolved. Therefore, it is not clear whether the type(s) introduced to the U.S.A. constitute one or more species of *Rhinogobius*. Specimens have been sent to experts in Japan for identification.”

“In Japan, the *Rhinogobius brunneus* complex it [*sic*] thought to comprise at least ten species (Katoh 1996). A key to the eight species in the *Rhinogobius brunneus* complex from Taiwan is given in Chen and Shao (1996).”

## 2 Biology and Ecology

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### 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 Acanthopterygii  
Order Perciformes  
Suborder Gobioidi  
Family Gobiidae  
Genus *Rhinogobius*  
Species *Rhinogobius brunneus* (Temminck and Schlegel, 1845)”

From Eschmeyer et al. (2018):

“Current status: Valid as *Rhinogobius brunneus* (Temminck & Schlegel 1845). Gobiidae: Gobionellinae.”

### **Size, Weight, and Age Range**

From Froese and Pauly (2017):

“Max length : 10.0 cm TL male/unsexed; [Masuda et al. 1984]; common length : 4.5 cm TL male/unsexed; [Reshetnikov 2003]”

### **Environment**

From Froese and Pauly (2017):

“Marine; freshwater; brackish; demersal; pH range: 7.0 - ? ; dH range: 20 - ?; amphidromous [Riede 2004]. [...] 16°C - 20°C [Baensch and Riehl 1985; assumed to be recommended aquarium temperatures];”

From Yoshie and Honma (1987):

“*Rhinogobius brunneus*, one of the most common gobies throughout the Japanese Islands, is well known as an euryhaline diadromous species.”

### **Climate/Range**

From Froese and Pauly (2017):

“Subtropical; [...] 54°N - 7°N, 106°E - 145°E”

### **Distribution Outside the United States**

Native

From Froese and Pauly (2017):

“Asia: river basin of the seas of Japan, Okhotsk, the Pacific coasts of Japan, Hokkaido, [sic] Ryukyu, Taiwan, rivers of Korea, continental China and the Philippines [Reshetnikov et al. 1997]; Viet Nam [Nguyen et al. 2011].”

## Introduced

From Schofield (2018):

“The species has been found in Turkmenistan (Kara Kum Canal) via introduction from China since 1963 (Sal'nikov 1998). The species has also been introduced to Arabian Gulf via shipping (Wonham et al. 2000).”

From Al-Hassan and Miller (1987):

“The Khwar 'Abd Allah, in the north-west corner of the Arabian Gulf, is a shallow (5-12m), marine (30-34‰) inlet (ca 1500km<sup>2</sup>) flanked by the mouth of the Shatt-el-Arab to the east and Bubiyan Island to the west; [...] A faunal survey of this area has yielded nine examples of a gobiid fish [...]”

“It is not impossible for such a disjunct distribution of *Rhinogobius* to have arisen naturally but, nowadays, a more likely explanation is that the Khwar' Abd Allah has been colonised by a species, here suggested to be *R. brunneus* from Japan, [...]”

According to Froese and Pauly (2019), *R. brunneus* is established in Turkmenistan. According to Wonham et al. (2000), establishment of *R. brunneus* in the Arabian Gulf is unknown.

## Means of Introduction Outside the United States

From Al-Hassan and Miller (1987):

“It is not impossible for such a disjunct distribution of *Rhinogobius* to have arisen naturally but, nowadays, a more likely explanation is that the Khwar' Abd Allah has been colonised by a species, here suggested to be *R. brunneus* from Japan, accidentally introduced in the ballast water of ships, perhaps most likely oil supertankers, plying between the northern Arabian Gulf and Japan.”

## Short Description

From Froese and Pauly (2017):

“Dorsal spines (total): 7; Dorsal soft rays (total): 8; Anal spines: 1; Anal soft rays: 8; Vertebrae: 26. This species is distinguished from its congeners by the following set of characters: D2 I,8; A I,8; pectoral-fin rays fin rays 36-40 (modally 19); longitudinal scale rows 32-35; transverse scale rows 9-10; predorsal scales 11-13 with a trifurcate anterior margin of which point 3 lies above the upper gill opening; vertebrae 10 + 16 = 26; gill opening extending ventrally to the vertical midline of the opercle. Coloration of males and females: males' basal region of body scale pockets with a bright orange spot, somewhat indistinct in females; the lateral side of females with a middle longitudinal row of discontinuous brownish black spots or bars and their dorsal lateral region with 3-4 longitudinal rows of black spots and the caudal fin base with 2 separate, vertical black bars; males with second dorsal fin with 4 longitudinal rows of reddish brown bars or spots and caudal fin with 8-10 waving vertical orange to brown stripes; pectoral fin base with a basal distinct, oblique deep brown stripe; cheek scattered with 16-25 small, orange red spots,

brighter in males; the pectoral fin base of the species with a basal distinct, oblique deep brown stripe, followed by a parallel shorter, lighter stripe or waving mark [van Oijen et al. 2011].”

From Schofield (2018):

“Distinguishing features: Fused pelvic fins, which form a suction-cup structure on the chest of the fish; a red or dark line running from the front edge of the eye to the tip of its snout; and breeding males are red or blue with colorful fins. Breeding males have fleshy mouths, colorful [sic] fins (white margins on anal and dorsal) and bodies are red and blue.”

## **Biology**

From Froese and Pauly (2017):

“Adults inhabit lakes and rivers. Juveniles move into the sea and return to rivers after several months. This species has several types differentiated according to shape, coloration, and life history. Each type is isolated by habitat in the same stream.”

From Schofield (2018):

“In their native range, some species in the *Rhinogobius brunneus* species complex are landlocked, while others have an amphidromous life history, spending portions of their lives in both fresh and saline waters. Spawning occurs in the Spring in freshwaters (Tamada 2000). Males construct nests under stones and entice females to spawn (Katoh 1996). After spawning, males defend and care for the eggs (Katoh 1996; Takahashi and Kohda 2004). Larvae hatch and drift downstream to the sea where they feed and grow. Larval drift occurs nocturnally, and the larvae halt their migration in pools with low flow rates during the day (Iguchi and Mizuno 1990). After a few months in marine waters, juveniles migrate upstream into freshwater for further growth and reproduction, often reaching the headwaters of rivers (Mizuno 1960).”

## **Human Uses**

*R. brunneus* has been in trade in the United States in the past, based on auction data from 2014 on AquaBid (2019). No evidence was found of current trade in this species in the United States.

## **Diseases**

Poelen et al. (2014) lists *Gobioecetes rhinogobius*, *Gangesia parasiluri*, and *Gangesia parasiluri* as parasites of *Rhinogobius brunneus* (Strona et al. 2013, Benesh et al. 2017).

No OIE-listed diseases (OIE 2019) have been reported for this species.

## **Threat to Humans**

From Froese and Pauly (2017):

“Harmless”

### 3 Impacts of Introductions

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From Schofield (2018):

“Unknown.”

### 4 Global Distribution

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**Figure 1.** Known global distribution of *Rhinogobius brunneus*. Map from GBIF Secretariat (2018). A point in the Mediterranean Sea was excluded from climate match analysis because of incorrect location information.

## 5 Distribution Within the United States

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**Figure 4.** Known established distribution of *Rhinogobius brunneus* in the United States. Map from Schofield (2018).

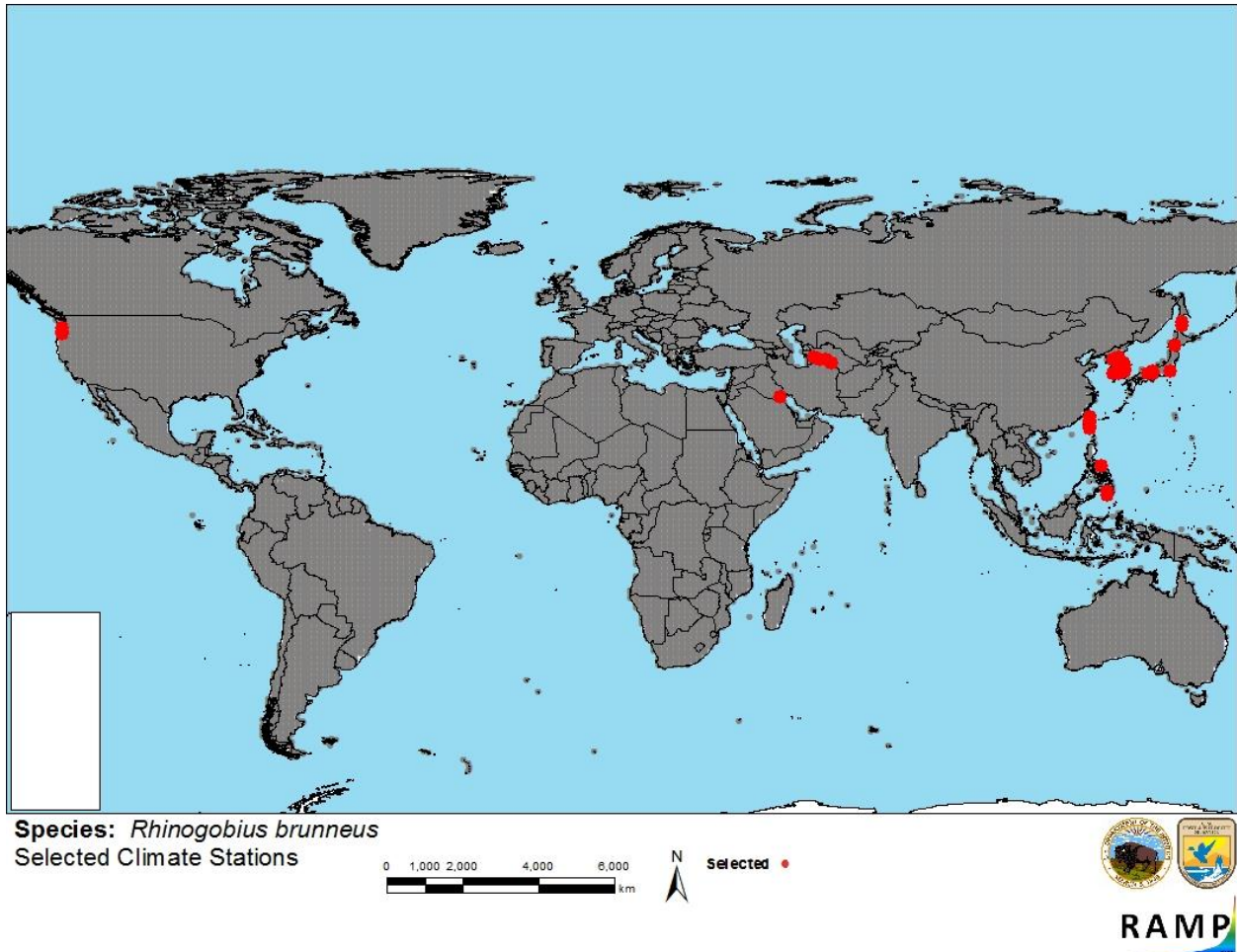
## 6 Climate Matching

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### Summary of Climate Matching Analysis

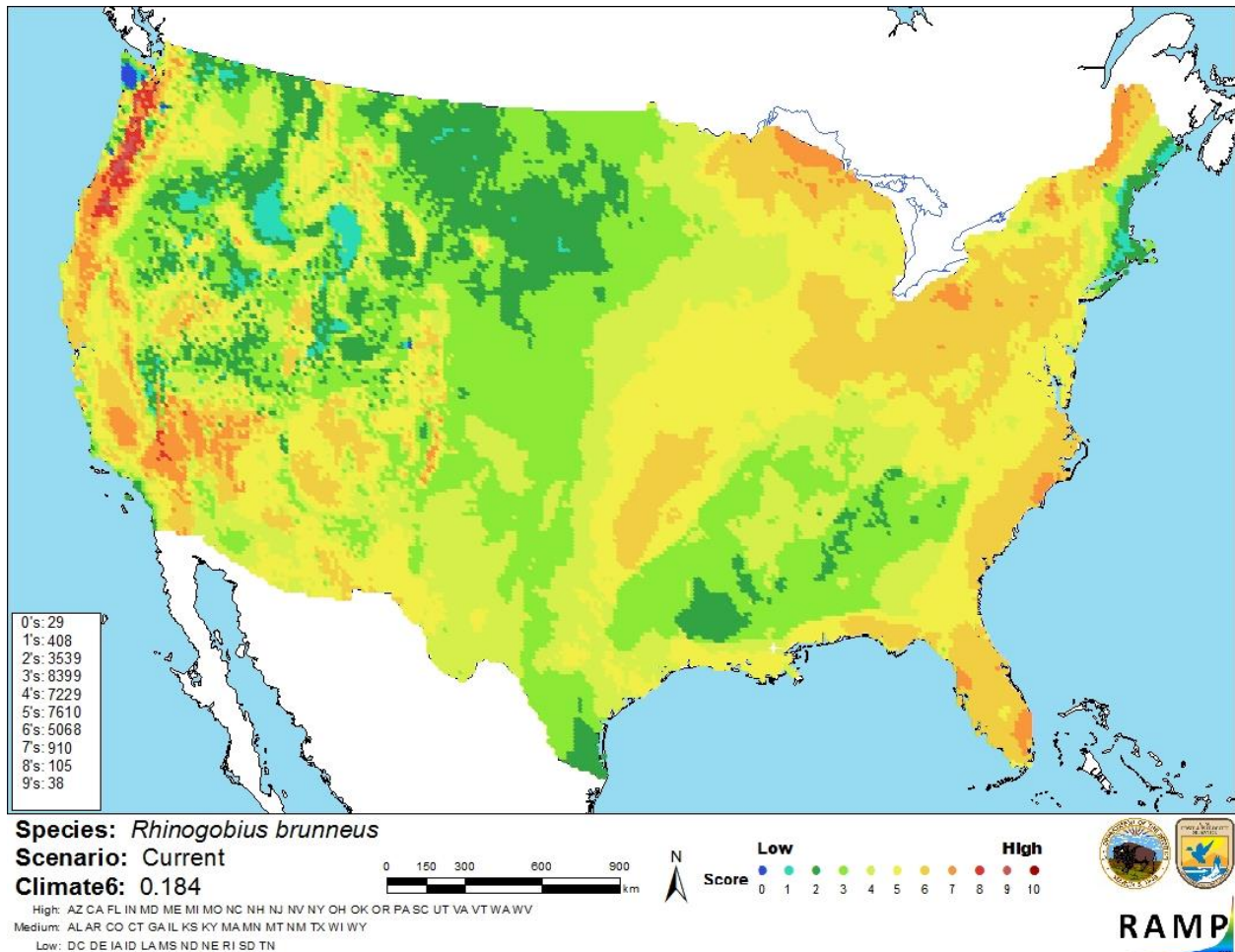
The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous United States was 0.184, which is a high climate match. (Scores of 0.103 or greater are classified as high.) The climate match was medium to medium-high across a wide area of the United States, including most of the Mid-Atlantic states, the Midwest, and parts of the Southwest and West Coast. Coastal New England, the interior Southeast, the Plains States, much of the Rocky Mountain States, and southern Texas had a generally low climate match. The area of highest climate match was in the Pacific Northwest, where *Rhinogobius brunneus* is established, with other areas of high match occurring in California and the Southwest, parts of the Great Lakes region, western Maine, coastal South Carolina, and peninsular Florida.

This climate match is only valid for where the species could survive in brackish or freshwater. It does not apply to saltwater environments where some juvenile stages develop.



**Figure 3.** RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red; Japan, South Korea, Taiwan, the Philippines, Turkmenistan, Saudi Arabia, United States) and non-source locations (gray) for *Rhinogobius brunneus* climate matching. Source locations from GBIF Secretariat (2018), Al-Hassan and Miller (1987), and Schofield (2018).





**Figure 4.** Map of RAMP (Sanders et al. 2014) climate matches for *Rhinogobius brunneus* in the contiguous United States based on source locations reported by GBIF Secretariat (2018), Al-Hassan and Miller (1987), and Schofield (2018). 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
$\geq 0.103$	High

## 7 Certainty of Assessment

There is adequate information available on the biology of *Rhinogobius brunneus*, but the life history and physical characteristics of this species is extremely varied, and it is thought to be a species complex. It is unclear which types of this species complex have been introduced outside of the native range of *R. brunneus*. There are no documented impacts of this species outside of its native range. Further information is needed to assess the risk this species poses. Certainty of this assessment is low.

## 8 Risk Assessment

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### Summary of Risk to the Contiguous United States

*Rhinogobius brunneus*, Amur Goby, is a small, amphidromous fish species native to Japan and coastal areas of East Asia. This species has varied physical and life history traits, and may represent a species complex. *R. brunneus* has been introduced outside of its native range in the Pacific Northwest and the Middle East, but no negative impacts of introductions of this species have been documented. Introductions are believed to have been through ballast water or the aquarium trade. History of invasiveness is classified as “none documented.” *R. brunneus* has a high climate match with the contiguous United States. However, this climate match is only valid for where the species could survive in brackish or freshwater. It does not apply to saltwater environments where some juvenile stages develop. Because of the taxonomic uncertainty of this species and the lack of impacts of introductions from which to base a risk assessment, certainty of this assessment is low. 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): Low**
- **Remarks/Important additional information: May represent a species complex.**
- **Overall Risk Assessment Category: Uncertain**

## 9 References

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**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

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**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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