Japanese Mitten Crab (*Eriocheir japonica*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, July 2020
Revised, December 2020
Web Version, 3/24/2021

Organism Type: Crustacean
Overall Risk Assessment Category: Uncertain

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1 Native Range and Status in the United States

Native Range

From Fofonoff et al. (2018):

"*Eriocheir japonica* is native to estuaries, rivers, and lakes of southern Sakhaline Island (Russia), the Amur Lagoon (Russia), Japan, southern China, Hong Kong, the west coast of Taiwan and

extreme southeastern Korea (Golikov et al. 1976; Chan et al. 1995; Guo et al. 1997; Komai et al. 2006)."

From Kobayashi and Matsuura (1995a):

"The Japanese mitten crab *Eriocheir japonicus* (DE HAAN) is distributed in rivers and shallow sea areas throughout Japan, Sakhalin, eastern Korea and Formosa (MIYAKE, 1983)."

Status in the United States

From Fofonoff et al. (2018):

"In July 1997, a mitten crab was caught by an angler at Astoria, Oregon, at the mouth of the Columbia River. It was subsequently identified as *E. japonica* (Jensen and Armstrong 2004). This is the only record of the Japanese Mitten Crab in US waters."

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: […]
All species of genus *Eriocheir*"

All species of the genus *Eriocheir* are listed as injurious under the Lacey Act (18 U.S.C. 42) (USFWS 2020).

The Florida Fish and Wildlife Conservation Commission has listed the mitten crab *Eriocheir japonica* as a prohibited species. Prohibited nonnative species (FFWCC 2020), "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 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).
[…] All species of genus *Eriocheir*, including but not limited to *Eriocheir sinenesis* (Chinese mittencrab)"

From Utah Office of Administrative Rules (2019):

"Asiatic (Mitten) Crab, family Grapsidae (*Eriocheir*, All species) are prohibited for collection, importation and possession;"

All species of the genus *Eriocheir* are considered Prohibited Level 1 species in Washington (Washington State Senate 2014, 2019). A Prohibited Level 1 species "pose a high invasive risk and are a priority for prevention and expedited rapid response management actions."

No records of trade in *Eriocheir japonica* in the United States were found.

Means of Introductions in the United States

From Fofonoff et al. (2018):

"This crab could have been introduced as a larva in ballast water, or as an adult, purchased as seafood. Given the taxonomic difficulties of identifying the various species, and the uncertainties in their status, it is possible that other specimens of *E. japonica* or other species of *Eriocheir* have been released in US waters."

Remarks

There has been some uncertainty as to the specific or subspecific status of the different species in *Eriocheir* with some considering *Eriocheir japonica* and *E. sinensis* to be subspecific variants instead of valid species (Fofonoff et al. 2018). However, the taxonomic authority used by these screenings, as well as most other sources reviewed here, consider *E. japonica* and *E. sinensis* to be separate, valid species (Fofonoff et al. 2018; GBIF Secretariat 2020; WoRMS 2020).

From Lee et al. (2004):

"Furthermore, it has been shown that *E. sinensis* and *E. japonica* can mate and produce hybrid offspring [Peng 1986; Zhao et al. 1998]."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From WoRMs (2020):

"Animalia (Kingdom) > Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > Malacostraca (Class) > Eumalacostraca (Subclass) > Eucarida (Superorder) > Decapoda (Order) > Pleocyemata (Suborder) > Brachyura (Infraorder) > Eubrachyura (Section) > Thoracotremata (Subsection) > Grapsoidea (Superfamily) > Varunidae (Family) > Varuninae (Subfamily) > *Eriocheir* (Genus) > *Eriocheir japonica* (Species)"

"Status [:] accepted"

Size, Weight, and Age Range

From Kobayashi and Matsuura (1995b):

"The CW varied from 34.6mm to 79.8mm in males, and from 38.0mm to 68.4mm in females."

Environment

From Palomares and Pauly (2020):

"Benthic; freshwater; brackish."

From Fofonoff et al. (2018):

"Adult mitten crabs (*Eriocheir* spp.) are catadromous. They spawn in estuaries in brackish-marine waters. […] The planktonic larvae require salinities of 15-30 PSU for successful development to the megalopa stage, and show their best survival at 25 PSU. Megalopae show a preference for intermediate salinities of 15-25 PSU, and tend to seek bottom waters, resulting in upstream transport [Anger 1991]."

From Kobayashi (1998):

"Growth and upstream migration in the tidal area suggest that larvae and young crabs are sensitive to low water temperatures. They cannot grow and migrate upstream in winter when temperature is below 10^{O}C."

Climate

From Palomares and Pauly (2020):

"Subtropical"

Distribution Outside the United States

Native

From Fofonoff et al. (2018):

"*Eriocheir japonica* is native to estuaries, rivers, and lakes of southern Sakhaline Island (Russia), the Amur Lagoon (Russia), Japan, southern China, Hong Kong, the west coast of Taiwan and extreme southeastern Korea (Golikov et al. 1976; Chan et al. 1995; Guo et al. 1997; Komai et al. 2006)."

From Kobayashi and Matsuura (1995a):

"The Japanese mitten crab *Eriocheir japonicus* (DE HAAN) is distributed in rivers and shallow sea areas throughout Japan, Sakhalin, eastern Korea and Formosa (MIYAKE, 1983)."

Introduced

From Fofonoff et al. (2018):

"A genetic survey of Mitten Crabs in Europe found crabs identified as *E. japonica* in the Netherlands, Poland, and Germany. Some of these individuals may represent established populations. The Japanese Mitten Crabs have been overlooked due to their morphological similarity [to other mitten crab species] (Hayer et al. 2019)."

Means of Introduction Outside the United States

No information on means of introduction of *E. japonica* was found.

Short Description

From Fofonoff et al. (2018):

"Mitten crabs of the genus *Eriocheir* are easily recognized as adults and juveniles by the dense patches of setae (bristles or hairs) on their claws. Both males and females have hairy claws, but setae cover more of the claws in the males. The tips of the claws are white, and the claws are roughly equal in size. The carapace is slightly broader than it is long, with four teeth on its front margin. There is a frontal notch between the eyes. Legs are about twice as long as the carapace width, and in adults, the outer segments are lined with long hairs (Guo et al. 1997; Rudnick et al. 2000)."

"Specimens of *E. japonica* (Japanese Mitten Crab) differ from *E. sinensis* (Chinese Mitten Crab) in having a less convex carapace, with a slight central depression over the stomach. The frontal teeth are blunter and less deeply divided than those of *E. sinensis*, with a shallower median notch. The four antero-lateral teeth are less well-defined in *E. japonica* than in *E. sinensis*. The propodus of the fourth walking leg is wider and more flattened in *E. japonica*, 2.2-2.7 X as long as wide, compared to 2.5-3.6 X as long as wide in *E. sinensis* (Jensen and Armstrong 2004)."

Biology

From Fofonoff et al. (2018):

"They spawn in estuaries in brackish-marine waters. Females carry a sponge-like mass of fertilized eggs under their abdomen, until the eggs hatch into spiny larvae (zoeae), which molt through five stages, before molting into a more crablike megalopa stage. The megalopa stage molts into a 1st crab stage, which has a typical crablike form. The megalopa and later stages are attracted to fresh water and tend to move up into low salinity regions."

"Adult crabs migrate downstream for spawning - the males first, followed by the females. Not all crabs may migrate upstream- some may stay in brackish water (Rudnick et al. 2000). Early crab stages may spend their first winter in brackish water and then migrate upstream into non-tidal portions of rivers and streams, where they feed, grow and molt about 10-12 more times. […] When crabs approach maturity, at 2 to 4 years, rapid growth of reproductive organs begins, and crabs develop an urge to migrate downstream for spawning (Herborg et al. 2005). Migration, with a final puberty molt, takes place in the fall, and spawning occurs in late fall. Adults die after spawning (Anger 1991; Hymanson et al. 1999; Herborg et al. 2005; Rudnick et al. 2005)."

From Zhang et al. (2016):

"Our results indicated that a high proportion (more than 26%) of *E. japonica* lost appendages, and autotomy rate was positively correlated with crab size."

From Kobayashi (2009):

"Stomach contents showed that *Eriocheir japonica* was an omnivore and deposit feeder in the Saigo River, mainly feeding on the detritus derived from vascular plants, both in Area I (reproductive area in tidal river and seacoast area) and Area II (growth area in lower freshwater area). In most cases, stomachs were filled with a large amount of decomposing tissues of vascular plants. Most of them seemed to be derived from riparian plants such as *Phragmites communis*, *Phragmites japonica*, *Typha angustifolia*, *Persicaria thunbergii*, etc., growing along the river channel."

From Kobayashi and Archdale (2016):

"Although the individual behavioral mechanism of *E. japonica* megalopa's migration against hydraulic dynamics remained unknown, the present field survey revealed the exact migration process from the open sea into the river. The occurrence pattern of megalopa indicated that cyclic environmental variables determined the timing of its upstream migration. Megalopa presence in the water column and settlement were synchronized with semi-lunar, tidal, and nocturnal rhythms. The invasion of megalopae from the sea into the tidal river occurred mainly on the days near the spring tide, and megalopae migrated upstream from the rivermouth towards the upper tidal river during the flood tide at night. Megalopae that reached the upper tidal river settled down on the river substrate."

Human Uses

From Kobayashi and Matsuura (1995b):

"This species supports a substantial inland fishery, and the effects of fishing on the population structure may be substantial."

Diseases

No records of OIE-reportable (OIE 2020) diseases were found. No further information available on diseases.

Threat to Humans

Palomares and Pauly (2020) reported *E. japonica* as harmless to humans.

3 Impacts of Introductions

Eriocheir japonica has not been reported as established outside of its native range, although introductions have occurred; therefore, impacts of introductions remain unknown.

A congener species *E. sinensis*, the Chinese Mitten Crab, has been introduced and become established in Europe and North America. Because *E. japonica* and *E. sinensis* have been documented to hybridize and possible uncertainties in taxonomy of this genus, the following information pertaining to *E. sinensis'* impacts of introductions has been included as it speaks to the **potential** impacts of *E. japonica*, the subject of this ERSS.

From CABI (2019):

"The burrowing activity of crabs, especially large numbers of juveniles, accelerates the erosion of dykes, stream banks and levées in European countries. *E. sinensis* have affected commercial and recreational fishing. Crabs caught in the nets can damage the nets and kill netted species. They also are responsible for bait loss and damage to fishing gear. Water intakes were reported to be clogged by mitten crabs during mass developments."

"The burrowing activity of crabs, especially large numbers of juveniles, accelerates the erosion of dykes, stream banks and levées in European countries. Crabs probably damage the aquatic food chain of freshwater and estuarine habitats. During 1998, large numbers of migrating adult crabs disrupted endangered fish salvage operations at water diversion facilities in California, USA. The crabs followed moving water into the facility and clogged the fish holding tanks (ISSG, 2004)."

"Crabs probably damage the aquatic food chain of freshwater and estuarine habitats. They are omnivorous and non-discriminatory in their diet. They affect other species through competition, overlapping in dietary and habitat preferences. In the UK they may threaten populations of native crayfish (NHM, 2004)."

4 History of Invasiveness

Eriocheir japonica has not been reported as established outside of its native range. A single specimen was caught at the mouth of the Columbia River, Oregon in 1997 but the specimen is not believed to represent an established population and no further occurrences from the area have been recorded. A few specimens have been identified in Europe but there was no evidence of establishment found. This species is also present in trade as part of a commercial fishery. The history of invasiveness is classified as No Known Nonnative Population.

5 Global Distribution

Figure 1. Known global distribution of *Eriocheir japonica*. Observations are reported from Japan, China, Russia, Korea, Hong Kong and Taiwan. Map from GBIF Secretariat (2020).

6 Distribution Within the United States

This species is not established in the United States; only one individual specimen has been reported from the United States.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match of *Eriocheir japonica* with the contiguous United States was medium to high throughout the majority of the east and into the Northern Great Plains States, with a large area of high match in the northern Midwest. There was a low match throughout the majority of the west. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.256, high (scores greater than or equal to 0.103 are classified as high). The following states had medium individual Climate 6 scores: Alabama, Arkansas, Colorado, Connecticut, Georgia, Illinois, Kansas, Massachusetts, New Hampshire, New Mexico, Tennessee, Texas, and Wyoming. Arizona, California, Idaho, Louisiana, Maine, Mississippi, Nevada, Oregon, Rhode Island, Utah, and Washington had low individual scores. All other States had high individual score. The climate match refers only to where the species can survive and not necessarily to where it can reproduce.

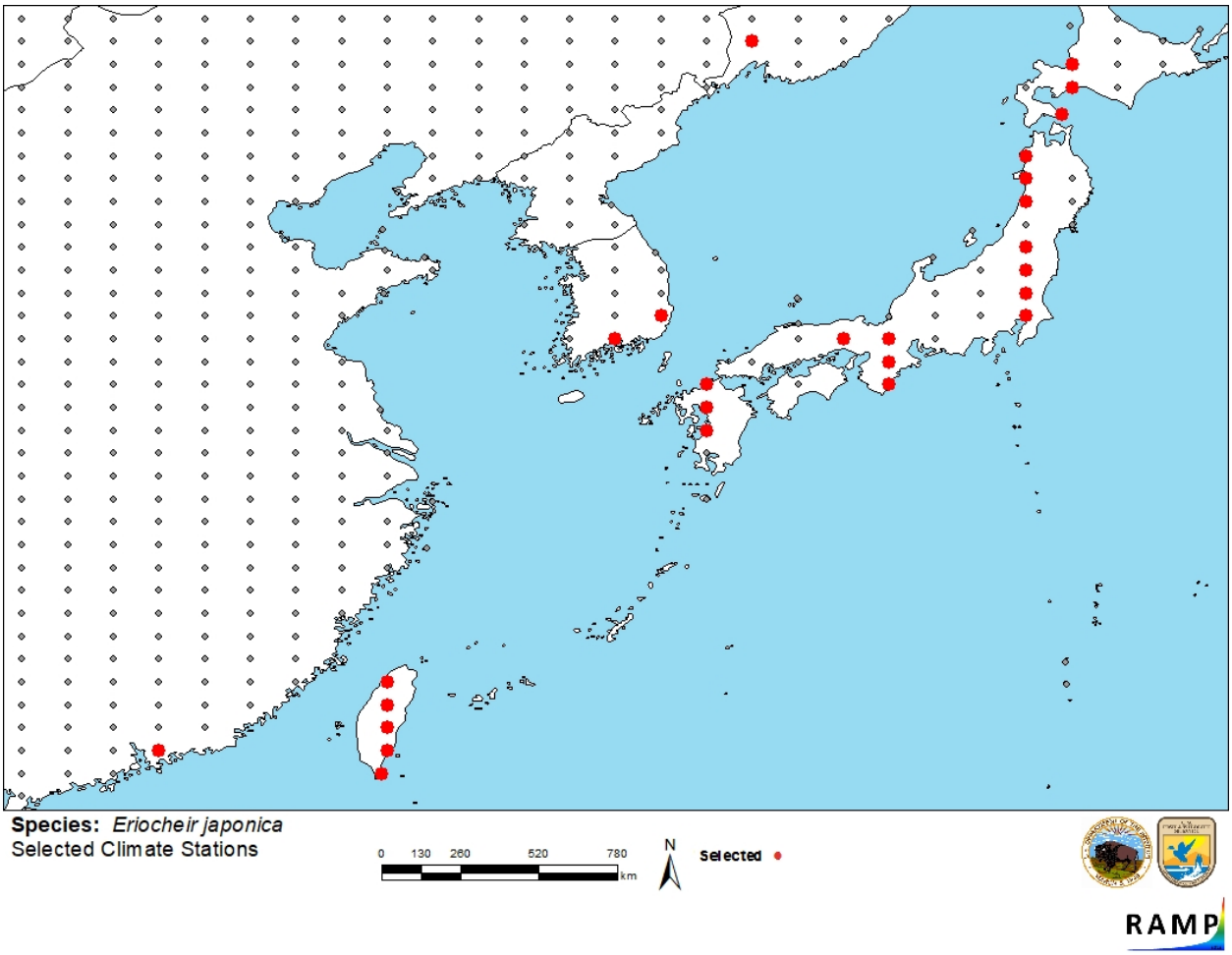

Figure 2. RAMP (Sanders et al. 2018) source map showing selected source locations (red; Japan, China, South Korea, Hong Kong, Russia, Taiwan) and non-source locations (gray) for *Eriocheir japonica.* Source locations from GBIF Secretariat (2020). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

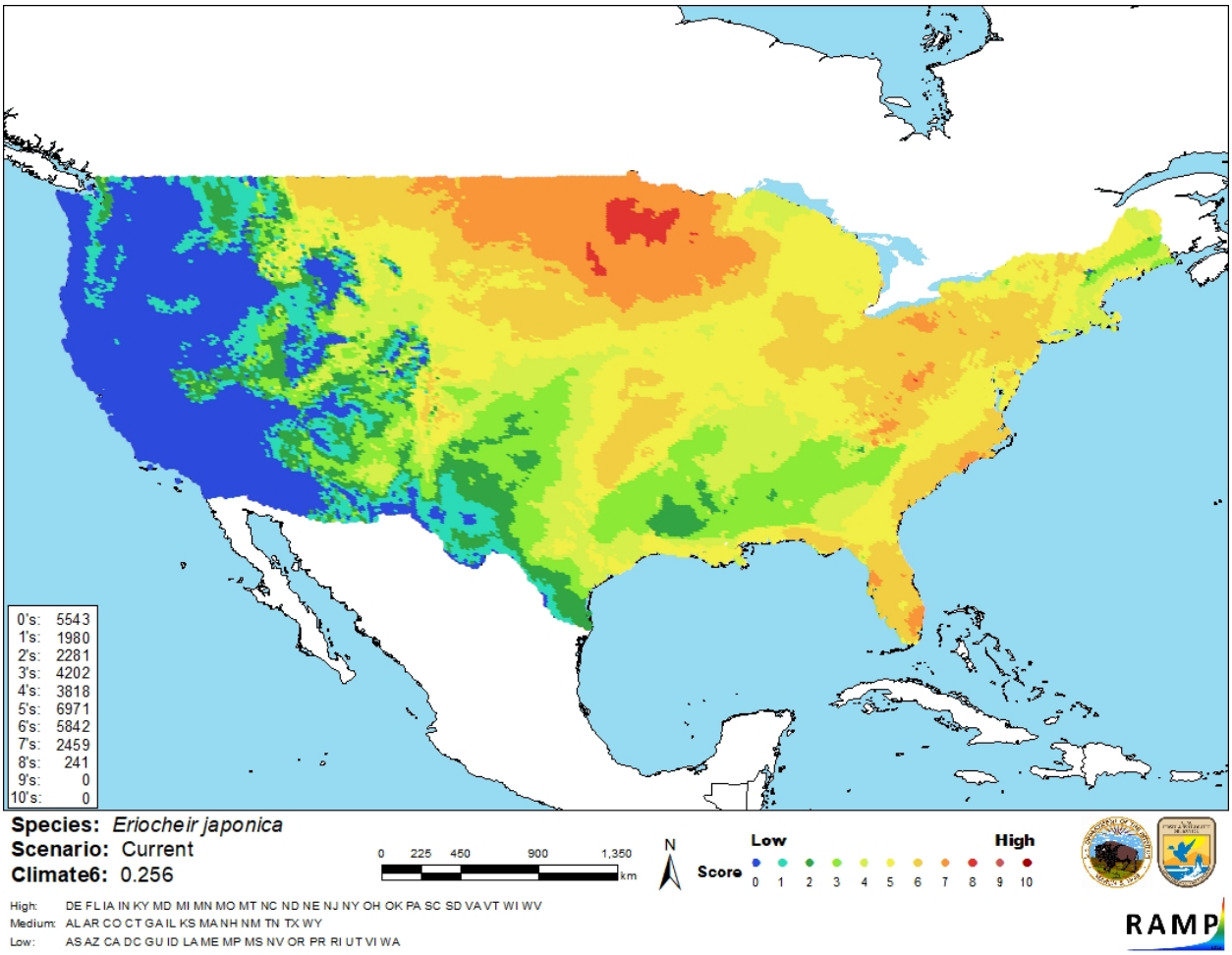

Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Eriocheir japonica* in the contiguous United States based on source locations reported by GBIF Secretariat (2020). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

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

Reasonably complete distribution information, as well as some information regarding the biology and ecology of *Eriocheir japonica,* was available. However, because there were no established nonnative populations, no information was available concerning impacts of introductions for this

species. Some taxonomic confusion exists regarding the speciation of *E. japonica* and *E. sinensis*. Additionally, the climate match refers only to where the species can survive and not necessarily to where it can reproduce, contributing to uncertainty. The certainty of this assessment is low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Eriocheir japonica, the Japanese Mitten Crab, is a catadromous crab species native to Japan, Taiwan, South Korea, eastern Russia, and southern China. This species has commercial value and supports a substantial fishery. There is possible taxonomic uncertainty regarding the specific or subspecifc status of some species within the *Eriocheir* genus. *E. japonica* has been located outside of its native range once in Oregon in 1997, but the specimen is not believed to represent an established population and no occurrences in the area have been documented since. The history of invasiveness is classified as No Known Nonnative Population. The overall climate match the contiguous United States was high, with high match found in the eastern United States and in the northern Midwest and Great Plains. There was a low match throughout much of the West. The climate match refers only to where the species can survive and not necessarily to where it can reproduce. Certainty of the assessment is low due to lack of information, taxonomic uncertainty, and reproductive requirements. The overall risk assessment category is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): No Known Nonnative Population**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks, Important additional information:** Taxonomic uncertainty, can hybridize with *E. sinensis* (Chinese Mitten Crab)
- **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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