Chinese mitten crab (*Eriocheir sinensis*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, web version – 03/22/2018

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1 Native Range and Status in the United States

Native Range

From Benson and Fuller (2016):

"Pacific coast of China and Korea."

From CABI (2016):

"The Chinese mitten crab originates from the Far East, with a native distribution from the province of Fujien, China, at 26°N, northwards to the Korean Peninsula at 40°N. In China it is found in coastal provinces and cities such as Liaoning, Hebei, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang and Fujian, and inland in Anhui, Jiangxi, Hubei and Hunan. With the continuing expansion of aquaculture of this species in China, most provinces have populations of crabs (Zhao, 1998)."

Status in the United States

From Benson and Fuller (2016):

"California: Established in numerous locations in the Sacramento-San Joaquin Delta since 1991. However, adults are rarely found now in 2012."

"Connecticut: A specimen was found in the Mianus River in Greenwich in June 2012 (N. Balcom, pers. comm.)."

"Delaware: Two specimens were collected from the Delaware River at Liston Point in 2007. A third crab was caught in Delaware Bay off the mouth of the Simons River, also in 2007. Eight crabs were collected in 2010."

"Louisiana: One was caught in the Mississippi River Delta in 1987."

"Maryland: A single male was collected in 2005 from the Patapsco River; another male was collected in 2006 from the mouth of the Patapsco River. In 2007 two more were collected by watermen at Chesapeake Beach and at the southern point of Kent Island."

"New Jersey: In the Hudson River (shared border with New York in the northern third of the state) and along the coast south to the mouth of the Toms River in 2008."

"New York: The first specimen was collected from the Hudson River near Nyack in 2007. Since then numerous mitten crabs have been collected in the river from near Albany to the mouth at New York Harbor (M. DuFour, pers. comm.)"

"Ohio: The first specimen collected in Ohio Was in Lake Erie at the port of Lorain in 1973. Since then, at least two more have been collected in the same vicinity in 1996 and 2007."

"Washington: Columbia River estuary at the Port of Ilwaco in 1997."

"They are established on the California coast, but adults are now rare in San Francisco Bay as of 2012. There is no evidence to show they are establised [sic] in the Great Lakes. However, with all the recent collections from the mid-Atlantic Region of the east coast of the United States, reproduction may be occurring. Until 2007, all mitten crabs collected were males. Since then several female specimens were collected, each containing eggs and sperm stored in a special organ. This is evidence of mating but not necessarily of an established population."

Means of Introductions in the United States

From Benson and Fuller (2016):

"Ballast water on the West Coast and in the Great Lakes. Its presence in Maryland may either be due to releasing crabs purchased as food (only males are sold), or they may be been introduced by ballast water."

Remarks

From GISD (2016):

"Taxonomy of mitten crabs has been problematic and confusing. *Eriocheir* was considered to comprise four species (*E. japonica*, *E. sinensis*, *E. recta*, and *E. leptognathus*) (Chu et al. 2003). However, recent taxonomic revision has recognised [sic] five species and three genera, *Eriocheir* being restricted to *E. sinensis*, *E. japonica*, and *E. hepuensis*, and the establishment of two genera for *Neoeriocheir leptognathus* and *Platyeriocheir formosa*, however, Chu and colleagues (2003) believe the genetic divergence among the crabs provides no support for separating *Eriocheir* s.l. into three different genera. They suggest to retain the mitten crabs in a single genus until more evidence is available. A sixth species, *E. ogasawaraensis*, was recently identified by Komai and colleagues (2006, in Veilleux & de Lafontaine 2007)."

From NOBANIS (2016):

"*E. sinensis* is considered one the 100 worst invasive species by the IUCN Invasive Species Specialist Group (ISSG)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

"Taxonomic Status: Current Standing: valid

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Protostomia
      Superphylum Ecdysozoa
        Phylum Arthropoda
          Subphylum Crustacea
            Class Malacostraca
              Subclass Eumalacostraca
                Superorder Eucarida
                  Order Decapoda
                    Suborder Pleocyemata
                      Infraorder Brachyura

Superfamily Grasoidea
Family Varunidae
Genus *Eriocheir*
Species *Eriocheir sinensis* H. Milne Edwards, 1853"

Size, Weight, and Age Range

From Benson and Fuller (2016):

"3 inch carapace width"

From GISD (2016):

"It can reach a carapace width of 5cm to 7cm, but the maximum carapace width of the adult mitten crab is approximately 10 cm (Czerniejewski et al. 2003, in Gollasch 2006)."

From Hänfling et al (2011):

"*Eriocheir sinensis* requires 2–4 years to reach maturity in San Francisco Bay, 3–5 years in Elbe River (Germany) and 1–2 years in the native Yantze River (China) (Dittel and Epifanio 2009). The recorded size at maturity is most often around 38 mm carapace width, but it is smaller in San Francisco Bay (30 mm) and larger in the Odra Estuary (Poland) (45 mm) (Dittel and Epifanio 2009)."

Environment

From GISD (2016):

"The Chinese mitten crab is a large, catadromous crab, moving from freshwater habitats where it spends its juvenile years to saltwater habitats in order to reproduce (Rudnick Halat & Resh 2000). Estuaries supporting large mitten crab populations are all characterised by large brackish waters for embryonic and larval development and large shallow productive waters for the growth of juveniles (Cohen and Weinstein 2001, in Veilleux & de Lafontaine 2007). The Yangtze River, one of the major rivers of the mitten crab in its native China, is an ideal habitat for the crab, characterised by a long freshwater drainage with warm, slow moving water and a large estuary (Hymanson et al. 1999, in Veilleux & de Lafontaine 2007)."

"Throughout its life, the Chinese mitten crab will occupy different ecosystems depending on its life stage (Veilleux & de Lafontaine 2007). Adult crabs are found in fresh, brackish and salt waters, but oviparous females are normally found in greatest number in saltwater (Rudnick et al. 2003, Veilleux & de Lafontaine 2007). Larval stages are found in the open water of bays and estuaries. Juvenile crabs are uncommon in open water but are found in tidal tributaries within a few kilometres of open water and in freshwater (Rudnick et al. 2003, in Veilleux & de Lafontaine 2007). Around the world, the highest densities of crabs are principally found within estuaries and the lower part of rivers (Cohen & Weinstein 2001, Rudnick et al. 2003, in Veilleux & de Lafontaine 2007)."

Climate/Range

From CABI (2016):

"The Chinese mitten crab originates from the Far East, with a native distribution from the province of Fujien, China, at 26°N, northwards to the Korean Peninsula at 40°N."

"This species is also found in other temperate zones throughout the world."

From DAISIE (2016):

"The crabs are highly tolerant to water temperature changes. The temperature tolerance goes down to freezing point."

From Fialho (2016):

"The Chinese Mitten Crab—*Eriocheir sinensis* H. Milne Edwards is native from temperate and tropical regions between Vladivostock (Russia) and South China (Panning, 1938)"

Distribution Outside the United States

Native

From Benson and Fuller (2016):

"Pacific coast of China and Korea."

From CABI (2016):

"The Chinese mitten crab originates from the Far East, with a native distribution from the province of Fujien, China, at 26°N, northwards to the Korean Peninsula at 40°N. In China it is found in coastal provinces and cities such as Liaoning, Hebei, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang and Fujian, and inland in Anhui, Jiangxi, Hubei and Hunan. With the continuing expansion of aquaculture of this species in China, most provinces have populations of crabs (Zhao, 1998)."

Introduced

From Benson and Fuller (2016):

"Ontario: The first mitten crab in Ontario was collected from the Detroit River in 1965. In 1973, two mitten crab were collected from Lake Erie, offshore from Port Stanley and Erieau, Ontario. It was not until 2005 when another was found at Port Alma in Lake Erie. Te [sic] first crab collected from Lake Superior occurred in Thunder Bay Harbour, Ontario, at Ontario Power generating station on Mission Island in 2005 and another in 2006."

"Quebec: Collected from St. Lawrence River on the south side of Lake St. Pierre (a fluvial lake of the river) in Notre-Dame-de-Pierreville, Quebec in 2004 and St. Lawrence River at St-Romuald (south shore) in Quebec City, Quebec, Canada in 2005."

From FAO (2016):

"*Eriocheir sinensis* introduced to Austria from Germany"
"*Eriocheir sinensis* introduced to Belgium from Netherlands"
"*Eriocheir sinensis* introduced to Denmark from Germany"
"*Eriocheir sinensis* introduced to France from Belgium"
"*Eriocheir sinensis* introduced to Netherlands from Germany"
"*Eriocheir sinensis* introduced to Poland from Germany"
"*Eriocheir sinensis* introduced to Switzerland from Austria"
"*Eriocheir sinensis* introduced to Estonia from China"
"*Eriocheir sinensis* introduced to Portugal from China"
"*Eriocheir sinensis* introduced to Italy from China"
"*Eriocheir sinensis* introduced to Latvia from China"
"*Eriocheir sinensis* introduced to Finland from China"
"*Eriocheir sinensis* introduced to Romania from China"
"*Eriocheir sinensis* introduced to Moldova, Republic of from China"
"*Eriocheir sinensis* introduced to Sweden from China"
"*Eriocheir sinensis* introduced to Lithuania from China"
"*Eriocheir sinensis* introduced to United Kingdom from China / Korea"
"*Eriocheir sinensis* introduced to Czech Republic from China / Korea"
"*Eriocheir sinensis* introduced to Spain from China"
"*Eriocheir sinensis* introduced to Norway from China"
"*Eriocheir sinensis* introduced to Germany from China"

From CABI (2016):

"It was first recorded in the River Aller near the Weser River in Germany in 1912, and during the 1920s and 1930s it spread rapidly throughout northern Europe, in western Baltic and North Sea estuaries. Its present estimated distribution ranges from Finland, through Sweden, Russia, Poland, Germany, the Czech Republic (Prague), Netherlands, Belgium, the UK and France. The southernmost Atlantic coast record is Portugal. It has extended its range via the Garonne canal system to Sigean, Languedoc-Roussillon, southern France (ISSG, 2004). In the UK its range and prevalence in the Thames Basin increased rapidly during the 1990s (Clark et al., 1998), and there have been other sightings in the rivers Medway, Mersey and Tyne, and on the Devon coast (Herborg et al., 2002). there are also single records from Ireland (Minchin, 2006)."

From DAISIE (2016):

"Although the crabs colonised already a wide distribution area in Europe, they continue to spread and new records are reported each year, predominantly in northern Europe."

From Clark et al. (2006):

"Recently Robbins et al. (2006) reported the first Chinese mitten crab from Central Asia. The specimen was a male collected from the River Tazeh Bekandeh, 37º26'54"N. 49º25'07"E., less than 6 km from Caspian Sea, 5.20 km from Ghazian Bridge, Anzali Wetland, Anzali City, Guilan Province, Northern Iran, Baluchi, on 26 October 2002."

"Populations of mitten crabs appear to have become established in the Black Sea (Zaitsev and Öztürk, 2001), and the Sea of Azov (Murina and Antonovsky, 2001)."

Means of Introduction Outside the United States

From GISD (2016):

"Live Chinese mitten crabs are imported for aquarium purposes (Marquard 1926, Peters 1933, in Gollasch 2006).The Chinese mitten crab is introduced via shipping (ballast tanks and hull fouling of vessels) (Marquard 1926, Peters 1933, in Gollasch 2006). Fouling communities on ships are typically composed of sessile species, however sometimes mobile species can hitch a ride too. For example, specimens of *E. sinensis* have been reported in empty cirriped shells on ship hulls. The mitten crab is a delicacy and crabs have been imported live illegally to markets."

From FAO (2016):

"Reasons of Introduction: 1) diffused from other countries"

From DAISIE (2016):

"The most likely introduction vector is shipping (ballast water and hull fouling of vessels) or imports of living species for aquaria and for human consumption. Range extensions (secondary spread) are aided by the enormous migrational behaviour of the species."

From Hänfling et al (2011):

"The canal that links Saint Malo to the River Loire and the Brest–Loire canal has been a possible pathway for the introduction of *E. sinensis* to the River Loire (André 1954)."

"For example, *E. sinensis* was imported into several countries for the production of cosmetics and as agricultural fertilizer (Herborg et al. 2005), […]"

From NOBANIS (2016):

"It is noteworthy that molecular studies have shown that the population in Lake Mälaren is identical to populations from rivers of the Netherlands and Germany (Herborg et al., 2007), supporting the hypothesis that Baltic mitten crabs have migrated from the North Sea as larvae."

"In most European countries there has been an early phase of establishment with slow secondary dispersal, followed by periods of rapid dispersal, several hundred km per year and massive population outbreaks. In some cases, however, human assistance is suspected for some of the most remarkable "leaps" in dispersal (Herborg et al., 2005). Molecular studies show that European populations originate from several invasions (Hänfling et al., 2002)."

Short Description

From Benson and Fuller (2016):

“Adult Characteristics:

+ hairy claws with white tips, normally equal in size
+ notch between the eyes
+ four lateral carapace spines (fourth spine is small)
+ smooth, round carapace or body shape
+ maximum carapace width (distance across the back) is approximately 80 mm (3 inches)
+ legs over twice as long as the carapace width
+ light brown color

Juvenile Mitten Crab Characteristics:

+ notch between the eyes
+ claws may not be hairy if carapace width is less than 20 mm (¾ inch)
+ claws are hairy by 25 mm (1 inch) carapace width
+ four lateral carapace spines (fourth spine is small)
+ smooth, round carapace or body shape
+ legs over twice as long as the carapace width
+ light brown color”

From CABI (2016):

“*E. sinensis* is named the ‘mitten crab’ because of the dense mat of hair which occurs on the white-tipped chela (claws) of larger juveniles and adults. Claws and chelipeds are equal in size. The shell (carapace) is markedly convex, has four acute spines on either side, and a notch between the eyes. It reaches a width of approximately 3 inches (80 mm). The legs of the adult crab are generally more than twice as long as the width of the carapace. The propodus of the last ambulatory legs are narrow and slender, their dactylus sharply claw shaped. Adult crabs are greyish green, light brown orange-brown or dark brown, sometimes with two pale spots on the carapace (ISSG, 2004). Juveniles are frequently lighter coloured than adults. Females have a wide abdominal flap that extends to the edge of the abdomen when fully mature; males have a narrower abdominal flap.”

Biology

From GISD (2016):

“The Chinese mitten crab spends most of its life in fresh or brackish waters (Veilleux & de Lafontaine 2007). Mature adults migrate downstream during the fall to reproduce in brackish or salt waters (Veilleux & de Lafontaine 2007). Both males and females are thought to die following reproduction (Panning 1938, in Veilleux & de Lafontaine 2007). Females brood the eggs and, upon hatching, larvae are planktonic for one to two months. During this marine free-swimming phase, larvae pass through a series of developmental stages: a brief non-feeding pre-zoea stage, five zoea stages and one megalopea stage (Anger 1991, Montú et al. 1996, in Veilleux & de Lafontaine 2007). Following the megalopal stage, the larvae metamorphose into juvenile crabs that settle to the bottom, usually in late summer or early fall (Rudnick et al. 2005a, in Veilleux & de Lafontaine 2007)."

"Although the Chinese mitten crab spends most of its life in freshwater, it needs saltwater to reproduce (Veilleux & de Lafontaine 2007). The reproduction involves a succession of events occurring at various times of the year and at different water salinities (Veilleux & de Lafontaine 2007). The development of gonads seems to be quite variable (Panning 1938, Rudnick et al. 2005a, in Veilleux & de Lafontaine 2007). So far, the smallest reproductive crabs observed in various populations ranged between 30 and 42 mm (Jin et al. 2001, Rudnick et al. 2000 2003, in Veilleux & de Lafontaine 2007). Ovigerous females can brood between 250 000 to 1 million eggs (Cohen & Carlton 1997, in Veilleux & de Lafontaine 2007). Mating usually takes place during late fall and winter and varies little between geographic regions. It occurs in November to March in Chinese rivers, from October to January in the Elbe River in Germany and from October to February in the United Kingdom (Panning 1938, Zhang et al. 2001, Herborg et al. 2006, in Veilleux & de Lafontaine 2007). In the San Francisco Bay estuary, the majority of ovigerous females are usually caught between November and March, with a small proportion between April and June (Rudnick et al., 2003, in Veilleux & de Lafontaine 2007)."

"Chinese mitten crabs feed on a wide variety of plants, invertebrates, fishes and detritus (Gollasch 2006). The mitten crab is known to be predominantly omnivorous, although feeding habits may shift throughout the life cycle (Rudnick Halat & Resh 2000). The larvae feed on phytoplankton and zooplankton, while the diet of newly settled juveniles consists mostly of aquatic plants (Veilleux & de Lafontaine 2007). As they grow, crabs become more carnivorous (Hymanson et al. 1999, in Veilleux & de Lafontaine 2007). A feeding study on crabs from San Francisco Bay using stable isotopes, mesocosms experiments and gut content analysis demonstrated that algae and detritus were the major components of the species' diet (Rudnick and Resh 2005, in Veilleux & de Lafontaine 2007). This was consistent with previous gut content analyses showing that freshwater crabs relied mostly on the plant kingdom for food (Panning 1938, in Veilleux & de Lafontaine 2007). The major vegetation types consumed were filamentous algae, *Potomogeton*, *Elodea* and *Lemna* (Veldhuizen and Stanish, 1999, in Veilleux & de Lafontaine 2007). In its native range in Asia the crab shifts toward a more carnivorous diet as it ages, incorporating items such as shrimp and other benthic invertebrates into its diet (Dan et al. 1984, Zhao 1999, in Rudnick Halat & Resh 2000). Panning's (1938, in Rudnick Halat & Resh 2000) statement that mitten crabs \"eat whatever they can get\" is probably an accurate description of the plasticity of this crab's eating habits. It is likely that the crab's eating habits are dominated by scavenging and detritivory (Rudnick Halat & Resh 2000)."

Human Uses

From GISD (2016):

"The Chinese mitten crab is a traditional food source in China, where it supports an important aquaculture industry yielding high annual production (200 000 tons in 2000; Chen & Zhang, 2006 in Veilleux & de Lafontaine, 2007), worth approximately $1.25 billion (Hymanson et al., 1999 in Veilleux & de Lafontaine, 2007). The reproductive tissues are the most prized parts of the crab, although the muscles are also consumed. The preferred crabs are those captured during the fall, as they have full gonads prior to reproduction and stored energy for the coming winter

(Hymanson et al., 1999). A positive effect of the crabs is their market value as they were and continue to be sold for 1 to 3 € /kg for industrial use and for direct human consumption to Asian markets. During 1994 to 2004 crabs in the value of approximately 3 to 4.5 million € were sold in Germany (Gollasch & Rosenthal, 2006)."

"Crab specimens have also been used as bait for eel fishing, food for cattle and chicken, fertiliser for agriculture and material for the production of cosmetics (Gollasch 1999, in Veilleux & de Lafontaine 2007)."

From Hänfling et al (2011):

"For example, *E. sinensis* was imported into several countries for the production of cosmetics and as agricultural fertilizer (Herborg et al. 2005), […]"

Diseases

Crayfish plague is on the 2018 list of OIE-reportable diseases.

From CABI (2016):

"Species Vectored
Paragonimus pulmonalis
Paragonimus westermani westermani"

From Solovyeva and Bailey (2008):

"They are also a secondary intermediate host of the Oriental lung fluke -- *Paragonimus ringeri*."

From Schrimpf et al. (2014):

"Nine out of 12 (75%) Chinese mitten crabs from the River Rhine, close to Cologne tested positive for crayfish plague [*Aphanomyces astaci*] infection (Table 1 [in source material])."

Threat to Humans

From GISD (2016):

"This burrowing is of particular concern where waterways are controlled by human-made levees; weakening or destruction of such levees from extensive burrowing could pose serious threats to flood control and water supply efforts (Rudnick Halat & Resh 2000)."

"Human Health: Effects on human health in Europe are not reported, however, the crab is the second intermediate host for human lung fluke parasite (*Paragonimus westermanii*) in Asia (Gollasch 2006)."

3 Impacts of Introductions

From Rudnick et al. (2000):

"Our observation of slumping in high burrow-density areas suggests that the burrows may indeed be causing bank slumping to occur. By increasing pore pressure and removing sediment, mitten crab burrows also make bank areas more susceptible to natural erosive forces such as rain and tidal events."

From Hänfling et al (2011):

"Laboratory studies showed that juveniles of *E. sinensis* in the River Thames can successfully exclude similarly-sized crabs of the native *C. maenas* from shelter (Gilbey et al. 2008)."

From GISD (2016):

"Ecosystem Change: Adult crabs migrate out of freshwater systems to reproduce and die in estuaries. This may constitute a substantial vehicle for exporting biomass out of the freshwater ecosystems, which may impact the food web, particularly when very large densities of crabs are migrating (Rudnick and Resh 2005)"

"Reduction in Native Biodiversity: is an opportunistic omnivore which will consume aquatic plants, algae, detritus, fish eggs and a variety of macroinvertebrates (Panning 1939; Hoestlandt 1948; Gollasch 1999; Rudnick et al. 2003)."

"Predation: The predation on fish eggs might be of concern (CMCWG 2003, in Veilleux & de Lafontaine 2007); however, given that fish material made up only 2.4 % of crab gut contents analyzed in Germany (Thiel 1938, in Veilleux & de Lafontaine 2007), the impact on adult fish populations is presumably low. *E. sinensis* could also reduce populations of native invertebrates through predation and alter the structure of benthic communities (Normant et al. 2002)."

"Competition: The crab's consumption of native species, including macroalgae, invertebrates and fish may result in significant declines in these species as well as in the crab's competitors (Gollasch 2006). Crayfish species, particularly rare or endangered ones, could be negatively affected by very abundant crab populations because of the freshwater habitat and diet shared by both species (Veldhuizen and Stanish 1999, Rudnick et al. 2000, in Veilleux & de Lafontaine 2007)."

"Threat to Endangered Species: The Chinese mitten crab's impact on endangered salmonids in California is of concern (IEP undated)."

"Physical disturbance: Burrowing activity of crabs results in damage to dikes and increased river embankment erosion (Gollasch 2006). The significant amount of sediment removed in areas with high densities of burrows can cause weakening and even collapse of banks (Panning 1938, D. Rudnick Pers. Obs., in Rudnick Halat & Resh 2000). This burrowing is of particular concern where waterways are controlled by human-made levees; weakening or destruction of such levees from extensive burrowing could pose serious threats to flood control and water supply efforts (Rudnick Halat & Resh 2000)."

"Economic/Livelihoods: The monetary impact caused by this invader in German waters is approximately 80 million Euro since 1912 (cost calculation adjusted from Fladung Pers. Comm., in Gollasch 2006). In general economic concerns arise over the stealing of bait by the crab and the damage to fishing gear (Panning 1939; Rudnick & Resh 2002). In California (USA) *E. sinensis* has become a major nuisance to anglers, taking a variety of baits including ghost shrimp and shad (Washington Sea Grant Program 2000). *E. sinensis* reproduces and migrates in such numbers as to block water intakes in irrigation and water supply schemes. Large numbers of downstream migrating crabs become trapped in holding tanks meant to keep fish out of turbines of water diversion plants. This has increased fish mortality and high costs are required to prevent the crabs' entry (Siegfried 1999)."

"Human Health: Effects on human health in Europe are not reported, however, the crab is the second intermediate host for human lung fluke parasite (*Paragonimus westermanii*) in Asia (Gollasch 2006)."

"Bioaccumlulation: *E. sinensis* has the potential to bioaccumulate inorganic and organic contaminants that then may be passed up the food chain (Rudnick Halat & Resh 2000). This type of bioaccumulation has been documented in *E. sinensis* populations in Asia (Che and Cheung 1998, in Rudnick et al 2000)."

4 Global Distribution

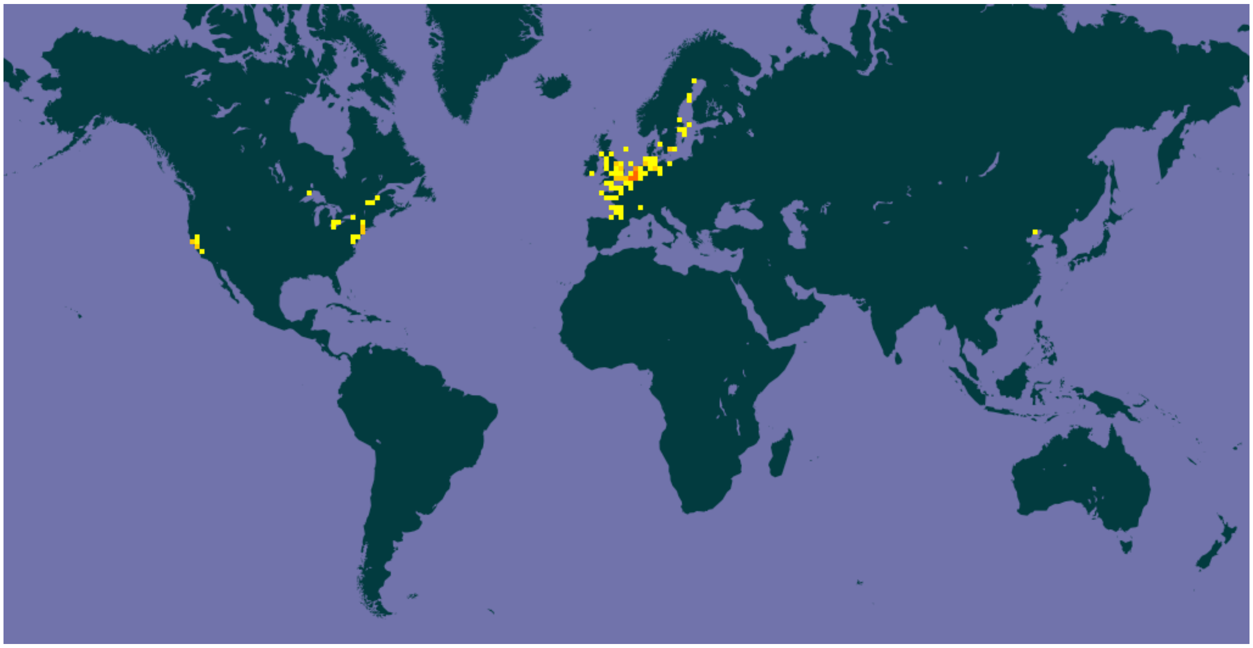

Figure 1. Known global distribution of *Eriocheir sinensis*. Map from GBIF Secretariat (2016).

GBIF Secretariat (2016) only reports one location in China, the native range of *Eriocheir sinensis*. CABI (2016) reported this species from most of the Pacific coast and rivers draining into the Pacific Ocean. Generalized source points were chosen in the provinces where a population of this species was reported to more accurately represent the known native range of the species.

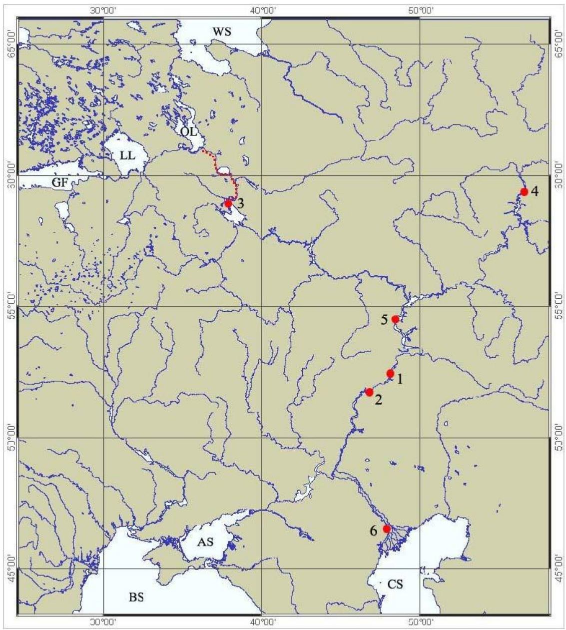

Figure 2. Distribution of *Eriocheir sinensis* in the Volga River System in Russia. Map from Sharkirova et al. (2007, figure 1).

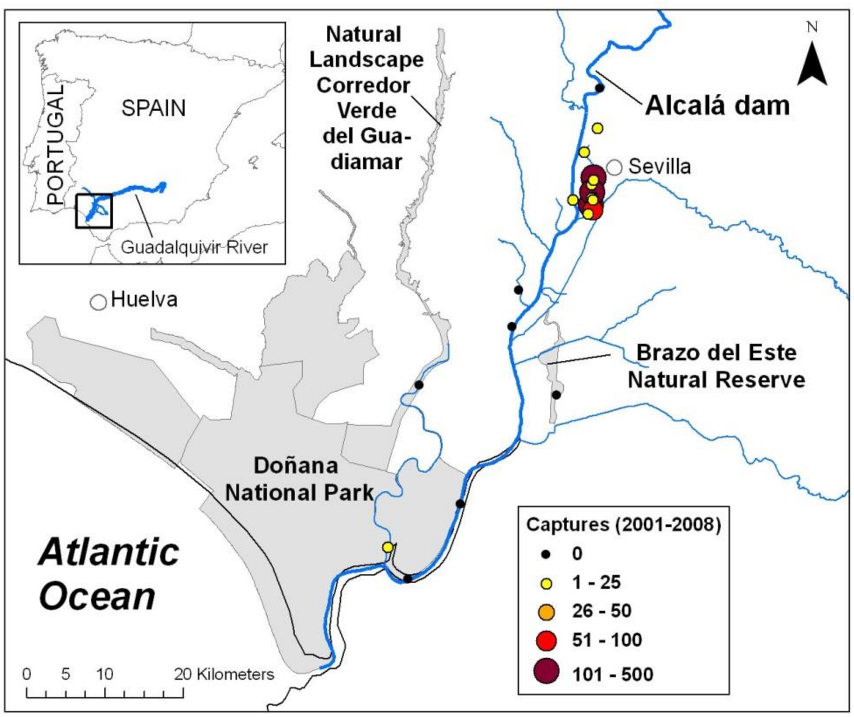

Figure 3. Distribution of *Eriocheir sinensis* in southern Spain. Map from Garcia-de-Lomas et al. (2010, figure 1).

Figure 4. Location of *Eriocheir sinensis* in Iran, given by Clark et al (2006).

5 Distribution Within the United States

Figure 5. Known distribution of *Eriocheir sinensis* in the United States. Map from Benson and Fuller (2016).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Eriocheir sinensis* was low for small portions of the northwest, western Great Plains, and small patches in the southern eastern states. It was high for the mid-Atlantic, Northeast, Great Lakes Basin, portions of the Great Plains and Mid-west, south into Texas, and California; it was medium everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the Continental U.S. was 0.593, high, and high in Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming.

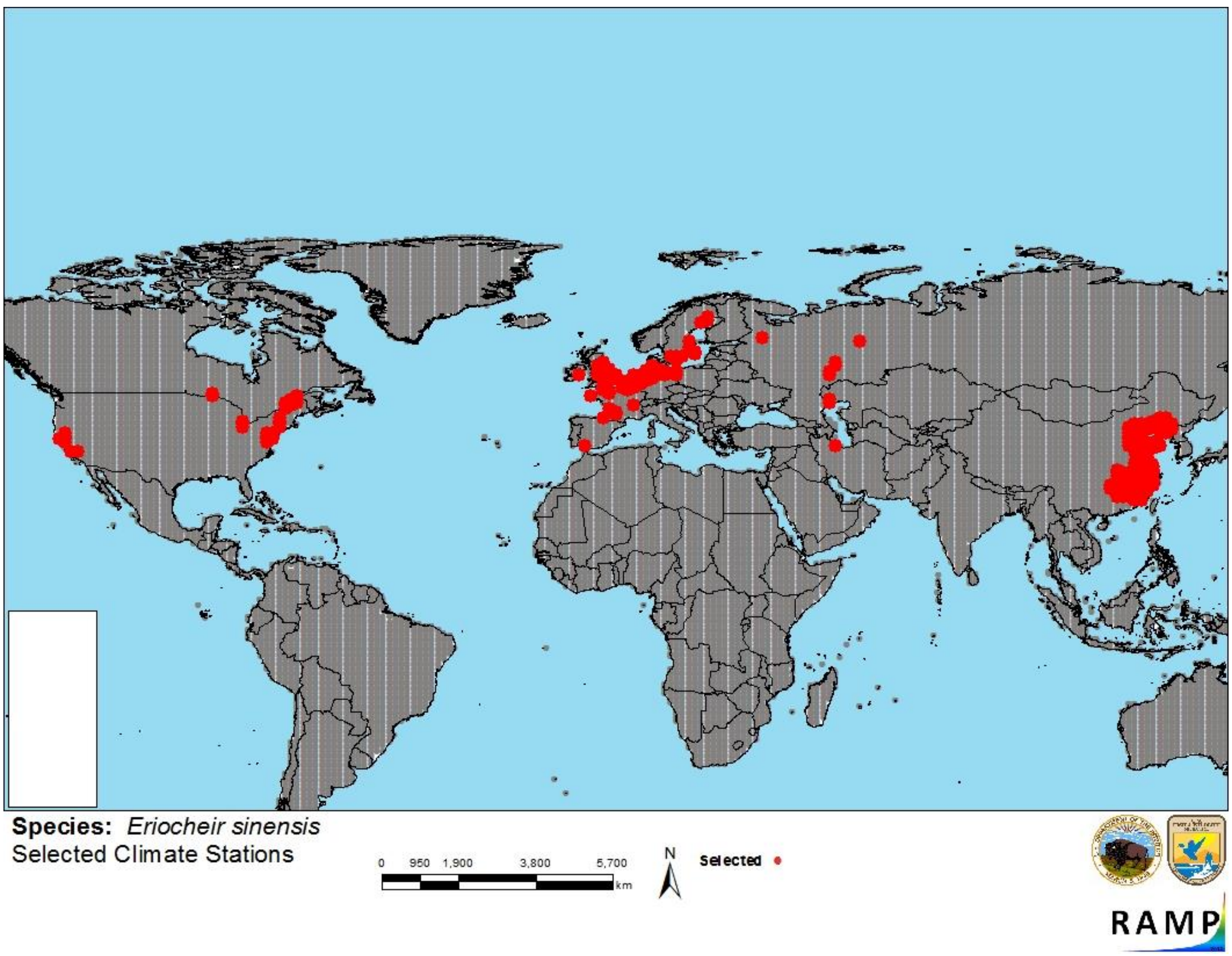

Figure 6. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (grey) for *Eriocheir sinensis* climate matching. Source locations from Clark et al (2006), Sharkirova et al. (2007), Garcia-de-Lomas et al. (2010), and GBIF Secretariat (2016).

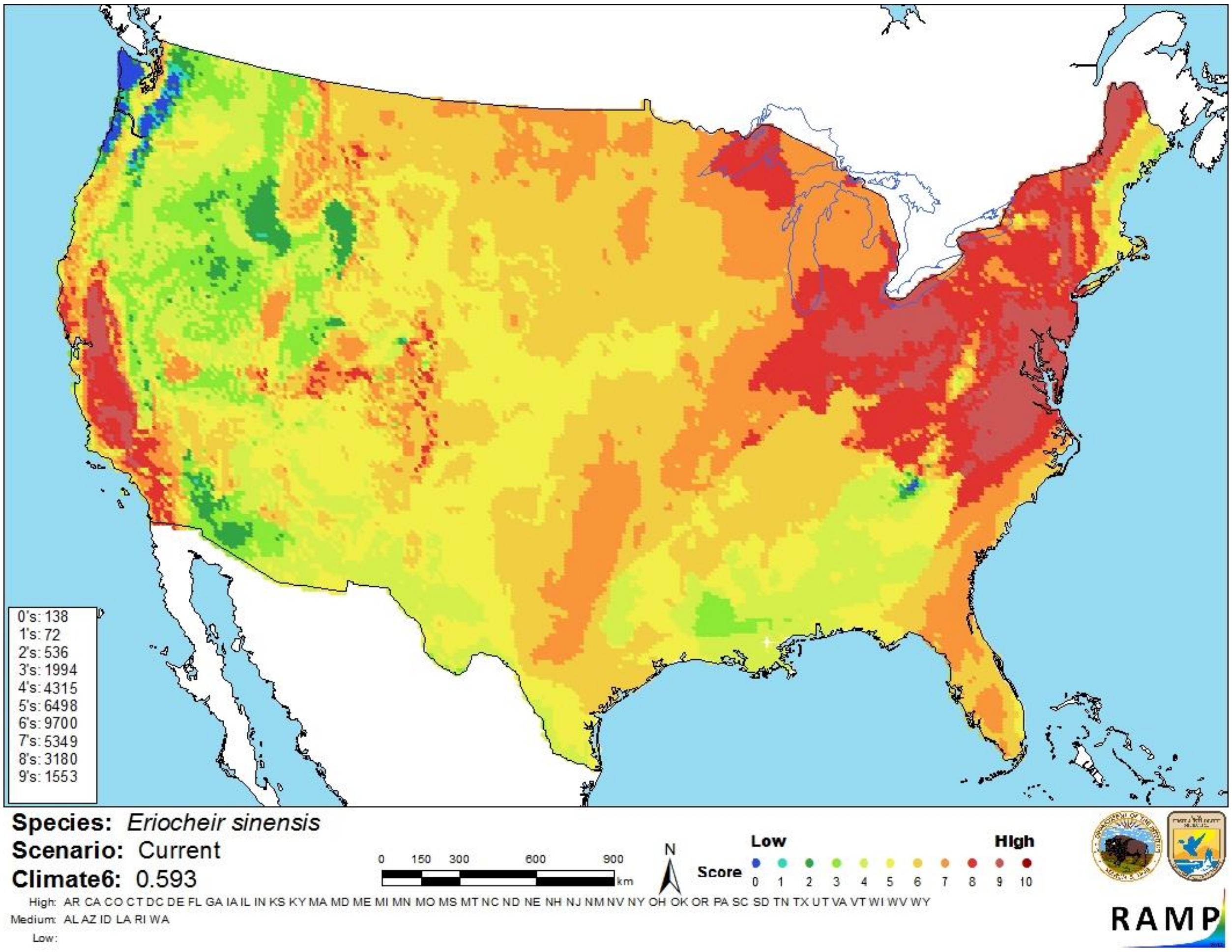

Figure 7. Map of RAMP (Sanders et al. 2014) climate matches for *Eriocheir sinensis* in the continental United States based on source locations reported by Clark et al (2006), Sharkirova et al. (2007), Garcia-de-Lomas et al. (2010), and GBIF Secretariat (2016). Counts of climate match scores are tabulated on the left. 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≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

The certainty of assessment is high. Information on the biology, ecology, and invasiveness of *Eriocheir sinensis* was available. Some peer-reviewed literature was available describing impacts. Some distribution information may be missing but the author does not think it would impact the climate match greatly.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness of *Eriocheir sinensis* is high. It has been introduced and spread to many parts of Europe, Central Asia, and North America. *E. sinensis* has been shown to have negative impacts on the structural integrity of banks and levees in San Francisco. The impacts of this species on not only the ecology of the invaded range but also the regional economies as well has been documented in gray literature. *E. sinensis* is a carrier of the crayfish plague, an OIE-reportable disease. The climate match is high. The many of the areas with the highest matches either already have reproducing populations of *E. sinensis* or have had records of a few individuals without evidence of reproduction. The climate match suggests that there is a possibility for this species to spread further in the United States. The certainty of assessment is high. The overall risk assessment category is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): High**
- **Remarks/Important additional information** No additional remarks.
- **Overall Risk Assessment Category: High**

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