Hairy Marron (*Cherax tenuimanus*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, November 2017
Web Version, 5/8/2018

Photo: Keith A. Crandall. Licensed under Creative Commons BY-NC-SA 3.0. Available: http://eol.org/data_objects/9004134. (April 15, 2016).

1 Native Range and Status in the United States

Native Range

From Austin and Bunn (2010):

"This species is restricted to the upper reaches of the Margaret River in the south-west of Western Australia (Morgan and Beatty 2005, Bunn 2004). This species is currently only known from 11 sites in an area less than 50 km in length (Department of the Environment, Water, Heritage and the Arts 2008). The area of occupancy (AOO) for this species is estimated to be less than 10 km² (Department of the Environment, Water, Heritage and the Arts 2008)."

From Arkive (2017):

"The marron was split into two distinct species in 2002, when it was realised that some individuals were hairy (*Cherax tenuimanus*) and others were smooth (now known as the smooth marron, *Cherax cainii*). The newly-named hairy marron is endemic to the Margaret River in southwest Western Australia [Department of the Environment and Heritage 2005]."

Status in the United States

FAO (2017) lists *Cherax tenuimanus* as introduced to the United States from Australia but gives no further information.

From Anchor Environmental (No date):

"*Cherax tenuimanus* have been experimentally introduced to Louisiana, USA for aquaculture purposes in the 1970s (Shireman 1973) […]"

The Florida Fish and Wildlife Conservation Commission has listed the crayfish *Cherax tenuimanus* as a prohibited species. Prohibited nonnative species (FFWCC 2018), "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."

Means of Introductions in the United States

From Anchor Environmental (No date):

"*Cherax tenuimanus* have been experimentally introduced to Louisiana, USA for aquaculture purposes in the 1970s (Shireman 1973) […]"

Remarks

A taxonomic change occurred in 2002, splitting the original *Cherax tenuimanus* into two species and retaining that name for the more geographically restricted species (ABRS 2017; Arkive 2017). Hence, for records before 2002 it is unknown which species it actually pertains to. This assessment assumed that any information published under the name *C. tenuimanus* pertains to the assessed species; if more information on the correct assignation of the individuals in trade or introduced is published this assessment will need to be revised.

From Arkive (2017):

"The marron was split into two distinct species in 2002, when it was realised that some individuals were hairy (*Cherax tenuimanus*) and others were smooth (now known as the smooth marron, *Cherax cainii*). The newly-named hairy marron is endemic to the Margaret River in southwest Western Australia [Department of the Environment and Heritage 2005]."

From ABRS (2017):

"A request to the ICZN (Case 3267) by Malony et al. (2006) to reverse the type selection for the two species of "Marron", *C. tenuimanus* and *C. cainii*, so as to maintain the name *C. tenuimanus* for the most widespread and abundant species that is used in aquaculture in Australia and overseas, was not upheld (ICZN 2008). However, there is still no valid lectotype or neotype designation for *C. tenuimanus*, and therefore the nomenclatural status of both species still remains potentially unstable."

From Austin and Bunn (2010):

"*Cherax tenuimanus* has been assessed as Critically Endangered using criteria B1ab(ii,iii,v). This species is estimated to have an area of occupancy less than 10 km² and is found at a single location. There are a number of threats resulting in a continuing decline in this species range, number of mature individuals, and quality of habitat. The key threat to this species is hybridization with the Smooth Marron, *Cherax cainii*: evidence suggests as much as 10% of the population may be comprised of hybrids. Conservation measures, such as placing bans on fishing, have been employed to slow this rate of decline, however action needs to be taken with regards to preventing further hybridization."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Crandall (2016):

"Biota > Animalia (Kingdom) > Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > Malacostraca (Class) > Eumalacostraca (Subclass) > Eucarida (Superorder) > Decapoda (Order) > Pleocyemata (Suborder) > Astacidea (Infraorder) > Parastacoidea (Superfamily) > Parastacidae (Family) > *Cherax* (Genus) > *Cherax tenumanus* (Species)"

"Status accepted"

From ABRS (2017):

"A request to the ICZN (Case 3267) by Malony et al. (2006) to reverse the type selection for the two species of "Marron", *C. tenuimanus* and *C. cainii*, so as to maintain the name *C. tenuimanus* for the most widespread and abundant species that is used in aquaculture in Australia and overseas, was not upheld (ICZN 2008). However, there is still no valid lectotype or neotype designation for *C. tenuimanus*, and therefore the nomenclatural status of both species still remains potentially unstable."

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Size, Weight, and Age Range

From Austin and Bunn (2010):

"Generation Length (years): 4"

From Arkive (2017):

"Weight up to 2kg [Department of Fisheries 2005]"

From Invasive Species South Africa (2017):

"Marron are large, freshwater crayfish which can grow to more than 380mm in length. They are one of the largest freshwater crayfish species in the world, with specimens having been recorded in excess of 2kg."

Environment

From Anchor Environmental (No date):

"Growth of *C. tenuimanus* occurs between 11 and 30°C with 24°C representing optimal growth temperatures (Morrissy 1990)."

"*Cherax tenuimanus* is a temperate water species (Read 1985) but will tolerate temperatures as high as 30°C and as low as 8°C, with adults being more resilient to low temperature (Cubitt 1985). It has the ability to tolerate salinities of up to 18‰ but cannot survive very low oxygen concentrations or high nutrient conditions (Cubitt 1985). Preferred pH seems to be acidic as they have been cultured at levels of between 5 and 6.5 (Safriel & Bruton 1984)."

Climate/Range

From Arkive (2017):

"The hairy marron is found in the permanent freshwater tributaries of forested high-rainfall areas [Rural Industries Research and Development 2005]."

Distribution Outside the United States

Native

From Austin and Bunn (2010):

"This species is restricted to the upper reaches of the Margaret River in the south-west of Western Australia (Morgan and Beatty 2005, Bunn 2004). This species is currently only known from 11 sites in an area less than 50 km in length (Department of the Environment, Water, Heritage and the Arts 2008). The area of occupancy (AOO) for this species is estimated to be less than 10 km² (Department of the Environment, Water, Heritage and the Arts 2008)."

From Arkive (2017):

"The marron was split into two distinct species in 2002, when it was realised that some individuals were hairy (*Cherax tenuimanus*) and others were smooth (now known as the smooth marron, *Cherax cainii*). The newly-named hairy marron is endemic to the Margaret River in southwest Western Australia [Department of the Environment and Heritage 2005]."

Introduced

Most of the following reports had dates before 2002 or did not contain dates of introduction. Since *Cherax tenuimanus* was separated from the much more common *C. cainii* in 2002 (Arkive 2017) it is unknown to which of the currently accepted species the introductions should be assigned.

FAO (2017) lists *Cherax tenuimanus* as introduced to but not established in Japan, South Africa, and Tunisia; introduced but probably not established in the United Kingdom; introduced to but status unknown in China, Malaysia, Mauritius, and Panama; and introduced but no further information in Belgium, Egypt, France, Germany, New Caledonia, New Zealand, Sweden, and Taiwan.

NOBANIS (2017) lists *Cherax tenuimanus* as suspected present in Germany.

All species of *Cherax* are listed as Invasive Alien Species on the List of Regulated Living Organisms in Japan (Invasive Alien Species Act 2004).

From Harlioğlu and Harlioğlu (2006):

"In addition to these native crayfish species, four American (*Orconectes limosus, O. immunis, Pacifastacus leniusculus* and *Procambarus clarkii*) and three Australian crayfish species (*Cherax destructor, C. tenuimanus* and *C. quadricarinatus*) have been introduced into Europe (Holdich et al. 1999). Only the Australian species *C. destructor* has become established in the wild (Souty-Grosset et al. 2006)."

Cherax tenuimanus is present in the pet trade in the UK (Faulkes 2015).

From Anchor Environmental (No date):

"They were also kept at Pirie hatchery in King Williamstown, where they managed to escape into the Buffalo River. However, this population did not become established (Picker & Griffiths 2011). There are anecdotal reports of it being found in small streams at Nieu-Bethesda near Graaff Reinet during the mid 1990s (R. Scott, pers. comm.), and at Madam Dam, near Stutterheim (de Moor & Bruton 1988), but it is unclear whether these were viably reproducing populations. It is currently likely to be localised and restricted to a relatively small area in the Eastern Cape (Figure 3 [in source material])."

Means of Introduction Outside the United States

A government agency introduced *Cherax tenuimanus* to Tunisia for aquaculture and fisheries purposes (FAO 2017). It was introduced to China and South Africa for aquaculture (FAO 2017). It was introduced for ornamental purposes in the United Kingdom (FAO 2017).

From Invasive Species South Africa (2017):

"It is spread in running water and through intentional introductions for aquaculture."

From Anchor Environmental (No date):

"*C. tenuimanus* was first introduced into the then Natal province of South Africa in 1976 by a private fish farmer (Borquin et al. 1984). In 1982, the first successfully recorded farm was established in George (de Moor & Bruton 1988). They were also kept at Pirie hatchery in King Williamstown, where they managed to escape into the Buffalo River."

Short Description

From Arkive (2017):

"One of the largest freshwater crayfish in the world, this hairy-shelled species has jet black pincers and a paler olive-green to brown body. The hairy marron's (*Cherax tenuimanus*) underside is brown and females have areas of red colouration on the underside and some splashes of purple [Department of the Natural Resources and the Environment 2005]. […]"

From Invasive Species South Africa (2017):

"They have tufts of hair-like bristles on their carapace and other body surfaces."

From Anchor Environmental (No date):

"The marron crayfish *Cherax tenuimanus* is a robust freshwater species with a distinct prominence running back from the postorbital spine. In addition, the rostrum is characterised by lateral serrations present both sides, that ends in a sharp spine (Picker & Griffiths 2011)."

Biology

From Austin and Bunn (2010):

"This species has undergone a significant decline in population numbers within a very short period of time. Estimates indicate that there are possibly only 10,000 wild individuals left (Bunn 2004). In 2002, Austin and Ryan determined there had been an estimated 70% reduction in the numbers of this species in seven years at just one location, with a near 100% reduction in 13 years."

"This species is found in the deep waters of rivers on sandy stretches with plenty of organic matter. Individuals require access to shelter and refugia (e.g. rocks and tree roots), and good water quality (C.M. Austin pers. comm. 2008)."

From Arkive (2017):

"Hairy marrons require the correct light levels, water temperature and diet for breeding. Mating at the start of spring, the male passes a spermatophore between the female's final pair of walking legs. The female uses this to fertilise her eggs, incubating between 200 and 300 of them on her swimmerets for 12 to 16 weeks. When carrying eggs, females are said to be 'berried' due to the appearance of a bunch of berries on each swimmeret. The eggs hatch into pre-juveniles in early summer and become mature adults within a year [Department of Fisheries 2005].

Hairy marrons do not burrow to escape drought like other freshwater crustaceans and are comfortable on land for short periods. They are omnivorous, feeding on detritus and other small organisms found on the detritus [Department of Fisheries 2005]."

From Invasive Species South Africa (2017):

"Marron breed in spring during their second year of life. The number of eggs produced per individual ranges from 90-900 and is dependent on the size of the female. Eggs are carried by the female beneath its tail (pleopods) for a period of 12-16 weeks, whereafter they hatch and undergo two development stages. After this period, free swimming larvae resembling the adults are released."

From Threatened Species Scientific Committee (No date):

"Marron are crepuscular or nocturnal, being most active for a few hours after sunset, especially around a new moon when water temperatures are above 18°C (Morrissy and Caputi 1981, Molony and Bird 2002). Marron take at least two to three years to reach sexual maturity (Molony et al. 2004) and are brooders with limited dispersal ability (Beatty et al. 2003). Due to this breeding strategy, movement of both adults and juveniles is limited and is estimated to be in the order of several hundred metres (Morrissy 1974, Molony and Bird 2002, Molony et al. 2003) with favourable conditions required (i.e. summer flood events) to assist the downstream movement of the species (Molony et al. 2004)."

Human Uses

From Austin and Bunn (2010):

"This species is harvested by subsistence fishers as a food source."

"Recreational fishing of this species has been prohibited above the 10 Mile Brook Junction (Molony et al. 2004). However, illegal fishing activity still occurs and many fishers find it difficult to distinguish between Smooth and Hairy Marron (Department of the Environment, Water, Heritage and the Arts 2008)."

From Fetzner (2017):

"Known only from limital [sic] area, cultured in Western Australia outside of natural range and in South Australis [sic], also widely cultured in Queensland until the late 1980s but over the last decade most farmers have switched to Redclaws."

Cherax tenuimanus is present in the pet trade in the UK and Germany (Faulkes 2015).

From Anchor Environmental (No date):

"In 2008, there were two small marron farms in South Africa (Britz et al. 2009). The total 2010 production from these farms was listed as was 0.8 tonnes (DAFF 2012a). The growth of marron production in South Africa over the last five years has increased overall (DAFF 2012a) (Figure 5). However, marron farming in South Africa was valued at less than ZAR 0.1 million in 2008 (Britz et al. 2009)."

Diseases

No records of OIE-reportable diseases were found.

Poelen et al. (2014) list *Acineta tuberosa*, *Epistylis* sp., *Lagenophrys darwinii*, *L. deserti*, *L. willisi*, *Pyxicola carteri*, *P. pusilla*, *Setonophrys communis*, *S. lingulata*, *S. spinosa*, *Vorticella ampulla*, *V. calciformis*, *V. convallaria*, *V. flexuosa*, *V. jaerae*, and *V. parastacida* as parasites of *Cherax tenuimanus*.

From Langdon (1991):

"Thus, the marron [identified from *Cherax tenuimanus*] parasite is placed in this genus and named *Vavraia parastacida* sp. nov. in recognition of its pathogenicity for parastacid crayfish."

From Avenant-Oldewage (1993):

"All individuals [of *Cherax tenuimanus*] we examined were found to be infested with large numbers of the turbellarian, *Temnocephala chaeropsis*."

"The presence of the pathogen *Aeromonas hydrophila* [in *Cherax tenuimanus*], which has not been reported previously on crayfish, suggests that it was responsible for the observed liquefaction of muscle tissue and for the oozing of body fluids from moribund and dead marron. It was probably the cause of these mortalities, and not temnocephalid infestation, as previously suggested by Mitchell and Kok [1988]."

Threat to Humans

From Avenant-Oldewage (1993):

"*A. hydrophila* may spread to humans handling the marron and be the cause of meningitis, septicemia and osteomyelitis [Finegold et al. 1978]. It is therefore imperative that all marron intended for human consumption be examined for this infection."

3 Impacts of Introductions

From Anchor Environmental (No date):

"De Moor (2002) concluded that due to the negative impact of introduced parasites that came with *C. tenuimanus*, and its disappointing results in terms of aquaculture, the environmental damage is likely to outweigh economic benefits."

"Potential impacts caused by *C. tenuimanus* are likely to be the destruction of living aquatic macrophytes, resulting in wide ranging ecosystem consequences; possible destruction of adjacent terrestrial vegetation in the riparian zone, a small but possible disturbance to breeding of bottom-spawning fish, introduction of associated undesirable parasites, and lastly far-ranging but slight impacts on benthic macroinvertebrate communities the degree to which would be dependent on the population size of *C. tenuimanus*. It is not likely to hybridize with any indigenous species as there are no native freshwater African crayfish species (de Moor 2002)."

"A significant impact which must be considered is the threat of introduction of undesirable parasites with *C. tenuimanus*. The 'crayfish plague' fungus, *Aphanomuyces astaci* can affect all species in the Parasticidae family (as well as other freshwater crayfish families (de Moor 2002). Also, *C. tenuimanus* is host to a microsporidian parasite, *Thelohania* sp., commonly known as 'porcelain disease' (Morrissy et al. 1990, Langdon 1991) which affects striated muscle fibres in the tail."

"There are various worms which are hosted by crayfish without causing the host any harm, but have the potential to infect other species. For example, temnocephalan worms (which are non-native to Africa) can infect other decapods species and can predate on freshwater invertebrates. *Temnocephala chaeropsis* was introduced with *C. tenuimanus* in the southern Cape and affected the marketability of infected individuals, in some cases causing mortalities (Mitchell & Kok 1988). The worms also have the potential to infect a species of indigenous freshwater crab, *Potomonautes warreni* (Avenant-Oldewage 1993). In addition, *T. chaeropsis* could affect other indigenous decapods, either by killing or by lowering its fitness to a level which would allow *C. tenuimanus* a competitive advantage (De Moor 2002)."

From Invasive Species South Africa (2017):

"They compete with indigenous species."

From Avenant-Oldewage (1993):

"We also observed that the indigenous crab, *Potamonautes warreni*, was readily infested by *T. chaeropsis* in captivity. As the commercial farming of marron [*Cherax tenuimanus*] is likely to increase in South Africa, there is the associated danger of the worm spreading to indigenous animals."

It is unknown if *Cherax tenuimanus* has had any negative ecological effects in Hubei province in China (Lin et al. 2015).

From Chiesa et al. (2015):

"Descriptions refer to *Temnosewellia minor* (Haswell, 1887), introduced with the brown crayfish *Cherax tenuimanus* (Smith, 1912) from Western Australia into Japanese freshwaters (Gelder 1999), […]"

The Florida Fish and Wildlife Conservation Commission and the Washington Department of Fish and Wildlife have listed this species as a prohibited species.

4 Global Distribution

Figure 1. Known global distribution of *Cherax tenuimanus*. Map from GBIF Secretariat (2017).

Locations in Australia outside of Western Australia were not included as source locations for the climate match. According to Arkive (2017), the marron crayfish in Australia was split into two species in 2002, with *Cherax tenuimanus*, the hairy individuals, endemic to the Margaret River and *Cherax cainii*, the non-hairy or smooth individuals, comprising all other populations within Australia.

The location in South Africa is from a fish farm (GBIF Secretariat 2017) and does not represent an established population. The location was not used as a source point for the climate match.

5 Distribution Within the United States

There are records of *Cherax tenuimanus* introduced for aquaculture in Louisiana (Anchor Environmental no date) but no indication was given if any individuals escaped from captivity. No records were found indicating an established, wild population of *C. tenuimanus* in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cherax tenuimanus* was high along the Pacific Coast. The climate match was medium in small pockets of the southwest and western plains. The climate match was low everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.012, medium. California had a high individual climate score.

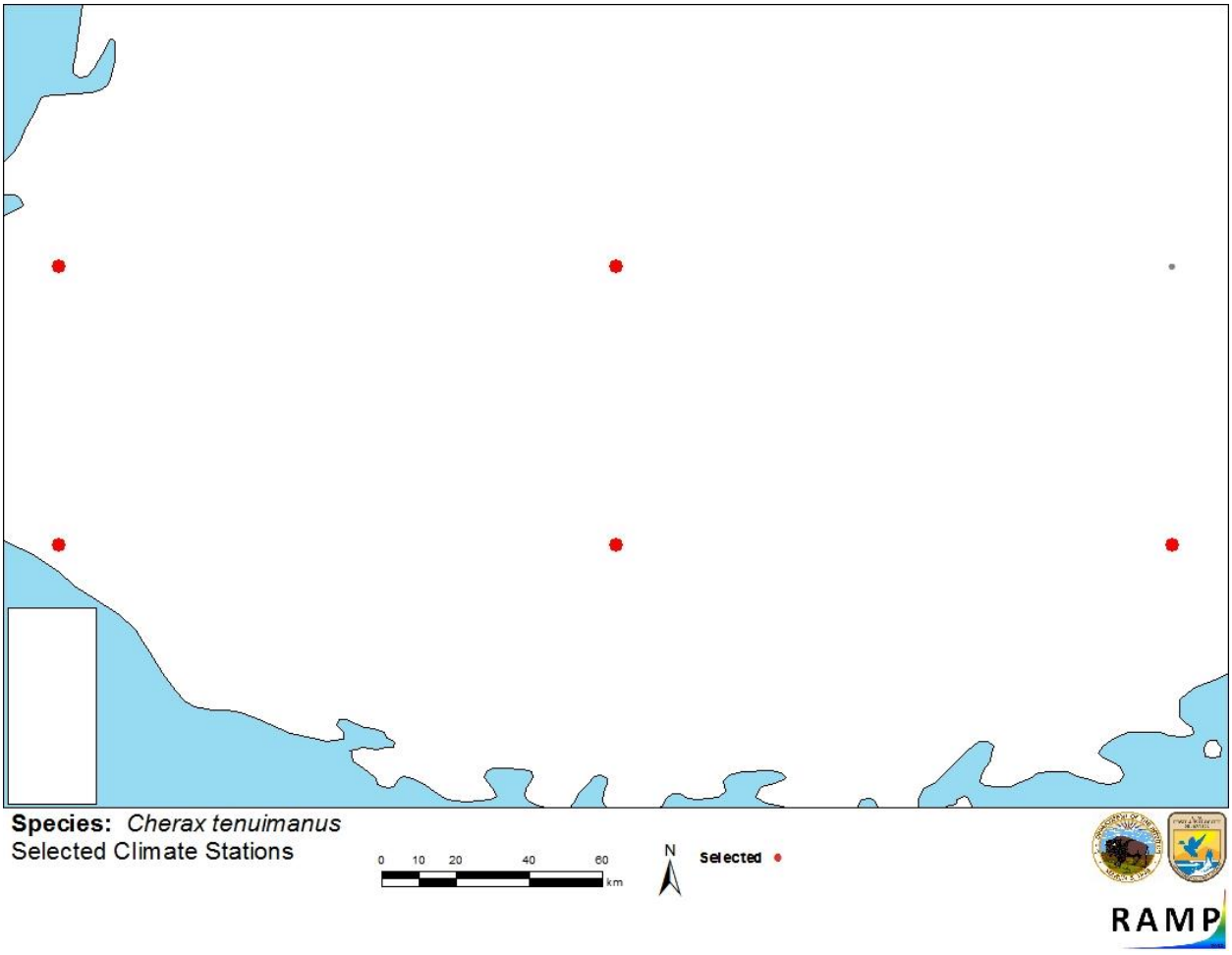

Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations in southwest Australia selected as source locations (red) and non-source locations (gray) for *Cherax tenuimanus* climate matching. Source locations from ABRS (2017), Arkive (2017), and GBIF Secretariat (2017).

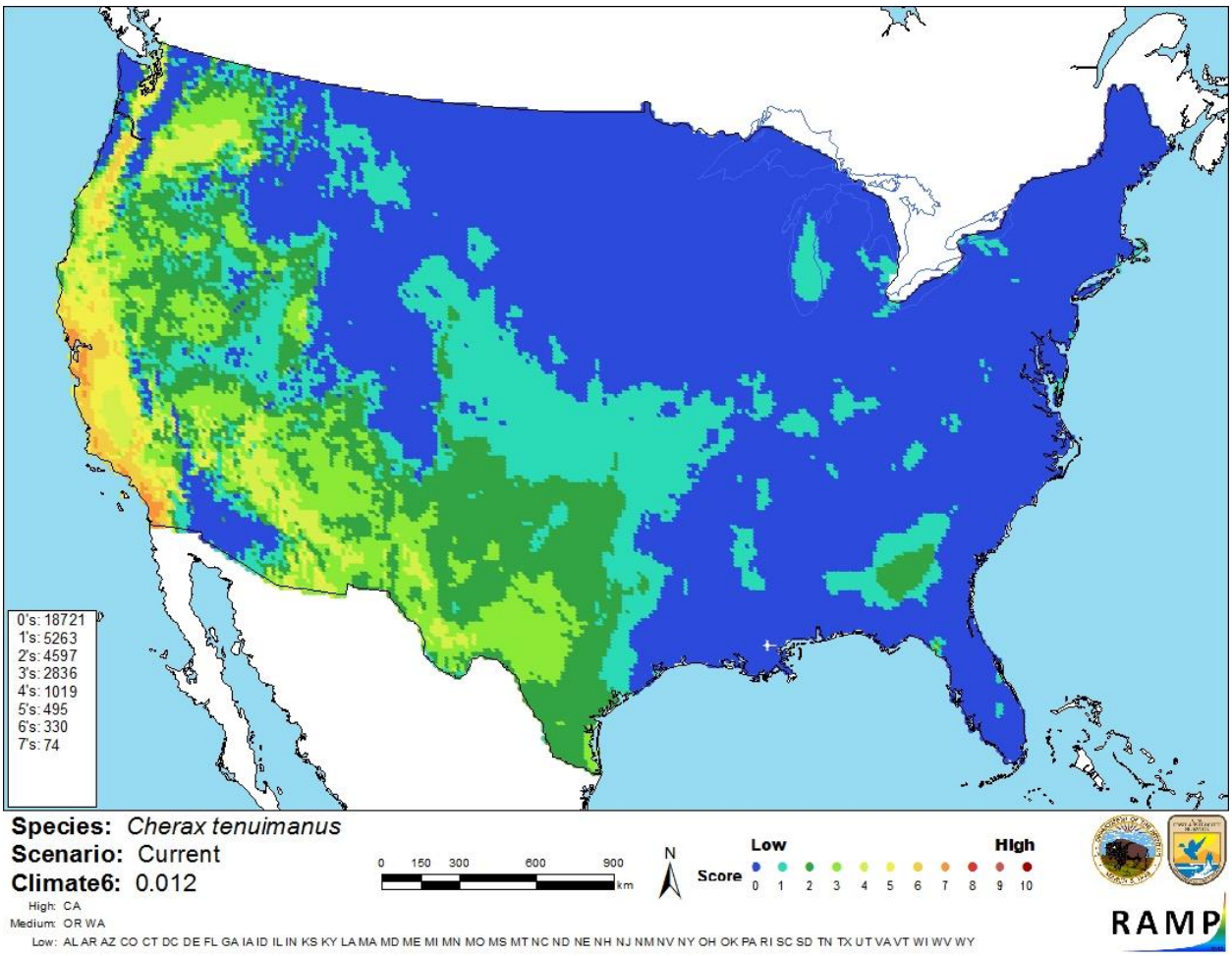

Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *Cherax tenuimanus* in the contiguous United States based on source locations reported by ABRS (2017), Arkive (2017), and GBIF Secretariat (2017). 0 = Lowest match, 10 = Highest match.

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 for *Cherax tenuimanus* is low. There was a good amount of information available for this species. However, due to recent taxonomic changes that split what *C. tenuimanus* into two species and maintaining the original name for the much rarer, geographically restricted type, it is unknown how much of that information still pertains to *C. tenuimanus*. Records of introduction were found. Before the taxonomic split, *C. tenuimanus* was

widely cultivated and transported internationally for that purpose. There are records of a potentially established population of *C. tenuimanus* in South Africa but those records are from before the name split and it is unknown if that potential population belongs to *C. tenuimanus* or *C. cainii*.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness for *Cherax tenuimanus* is uncertain. There were records found of introductions and a potential established population but it is unknown if those records and population are correctly identified as *C. tenuimanus* or *C. cainii*. There was concern expressed in the literature about the potential negative impacts from the introduced population in South Africa, stemming mainly from diseases and parasites that were infecting the introduced individuals. The climate match is medium with California having an individually high climate match. This species is prohibited in Florida. The certainty of assessment is low. This is due to the uncertainty in applying information published under *C. tenuimanus* from before the taxonomic split to the currently recognized *C. tenuimanus*. The overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): Uncertain**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Low**
- **Remarks/Important additional information:** A taxonomic change in 2002 elevated the previously recognized subspecies of *Cherax tenuimanus* to the species level (*C. cainii*) and retained the name *C. tenuimanus* for the much more rare and geographically limited species.
- **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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