

# Big water crayfish (*Cambarus robustus*)

## Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, June 2015



Photo: © Jan Bosselaers, in Loughman and Simon (2011). Licensed under CC by 3.0.

## 1 Native Range, and Status in the United States

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### Native Range

From Cordeiro et al. (2010):

“This widespread species' range centres around the Great Lakes-Ohio River drainages in northeastern America (Taylor et al. 2005). It is found in Ontario, Quebec, and New York, down south to Tennessee, North Carolina, and Virginia (Hobbs 1989, Taylor et al. 2005). In the southern portion of its range the species is found along the strike of the Appalachian Mountains (R. Thoma pers. comm. 2010).”

### Status in the United States

From Guiaşu (2002):

“Hobbs (1989) reported that *C. robustus* was found in the US states of Connecticut, Illinois, Indiana, Kentucky, Michigan, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia. However, Page (1985) stated that this species is now most likely

absent from Illinois, where it had last been recorded in 1912 from only two small areas, and rare in Indiana.”

From NatureServe (2015):

“Although probably not native east of the Hudson River drainage, records exist for New England including the Thames River drainage in Connecticut (1950s), the Connecticut River, Thames River, Mount Hope Bay drainage systems in Massachusetts, Connecticut and Rhode Island; also populations are known from the West Branch of The Farmington River, Otis, Connecticut; Slocum Brook, Tolland, Connecticut; Dickinson Brook, Granville, Massachusetts; Sawmill Brook, Monson, Massachusetts; and Sucker Brook, Fall River, Massachusetts (Smith, 2000).”

From Guarino et al. (2012):

“This alien species was discovered in the mainstem of the White River in Bethel [Vermont] and in the Green Mountain National Forest in Rochester [Vermont] in summer 2010. More research is needed to determine whether it could become invasive.”

## Means of Introductions in the United States

From United States Geological Survey (2015):

“released bait; unknown”

## Remarks

From Cordeiro et al. (2010):

“*Cambarus robustus* is a species complex. Southern populations that are found to be undescribed species will likely require elevated conservation status (R. Thoma pers. comm.2010).”

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2015):

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

Infraorder Astacidea  
Superfamily Astacoidea  
Family Cambaridae  
Subfamily Cambarinae  
Genus Cambarus  
Subgenus Cambarus (Puncticambarus)  
Species *Cambarus robustus* Girard, 1852”

“Taxonomic Status: valid”

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

From Hamr and Berrill (1985):

“With little growing time in their first summer, they measured only 5- 10 mm in carapace length (CPL) before growth ceased for the winter. At the end of their second summer the still immature crayfish measured 17-26 mm CPL in *C. robustus* ... Maturity was therefore not attained until the end of the third summer, when most *C. robustus* matured at 34-45 mm CPL.”

## **Environment**

From Loughman and Simon (2011):

“*Cambarus robustus* ... inhabits 3rd through 5th ordered streams that dissect the floodplain. Preferred microhabitats included leaf packs, boulder fields, and spaces beneath large slab boulders.”

## **Climate/Range**

From Guiaşu (2002):

“Can tolerate a wide range of water temperatures and pH values ... During field-work, the author has found that *C. robustus* were quite active at water temperatures ranging from 4°C, in early November, to 23°C, in July and August. Crocker and Barr (1968) reported that this species remained semi-active during the winter, in very cold water under thick ice.”

## **Distribution Outside the United States**

Native

From Cordeiro et al. (2010):

“Canada (Ontario)”

Introduced

From Cordeiro et al. (2010):

“Canada (Québec - Introduced)”

## Means of Introduction Outside the United States

No information available.

## Short description

From Guarino et al. (2012):

“This is a large crayfish species, with some individuals having a carapace length of more than 5cm (2in).

- Corners on the rostrum are rounded (with no sharp corners like the other species).
- Large chelae (claws) with wide palms that are somewhat dome-shaped with a depression on the outer margin.
- Chelae have two rows of bumps on the inner margin of the palm.
- The body is greenish-brown [Hamr and Berrill, 1985].”

## Biology

From Guiaşu (2002):

“This species is usually found associated with rocky substrates. Lodge and Hill (1994) reported that a rocky substrate, in both lotic and lentic bodies of water, was the habitat where both juvenile and adult *C. robustus* were most abundant.”

“Shortly after becoming free-living, very small *C. robustus* juveniles have been shown to filter-feed on algal suspensions (*Chlorella* sp.). ... Adult *C. robustus* can feed on a variety of food items, including aquatic vegetation, mayfly nymphs, chironomid and caddisfly larvae (Jezerinac et al., 1995), smaller crayfish and aquatic beetles (Hamr, 1998).”

“*Cambarus robustus* individuals, unlike those of *Orconectes*, appear to lack a well-defined, synchronous, annual mating and moulting cycle (Crocker & Barr, 1968). Adult *C. robustus* crayfish may moult and breed during a relatively long period of time, between April and September or October (Hamr & Berrill, 1985). Adult males of both form I (breeding form) and form II (non-reproductive form) coexist in the same populations throughout the year (Guiaşu, unpublished data; Hamr, 1998).”

From Hamr and Berrill (1985):

“Late summer rather than early spring breeding by [*C. robustus*] appears to be the key event influencing the rate of growth of new juveniles, the onset of sexual maturity, the timing of molting by adult males and females, and the degree of sexual selection operating. Delayed breeding may be then an adaptation to the seasonal stresses of swift water environments where major fluctuations in physical conditions are a frequent occurrence. The costs of such a delay appear to be smaller broods, less first summer growth, and slower growth to sexual maturity.”

## Human uses

From Guiaşu (2002):

“Wild populations of cool-water crayfish species such as *C. b. bartonii* and *C. robustus*, which are fairly common and widespread, can be harvested for commercial purposes. The harvesting of wild stocks is the most effective way of using this resource (Momot, 1991).”

## Diseases

There are no known OIE-reportable diseases for this species.

## Threat to humans

No information available.

## 3 Impacts of Introductions

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From Tricario et al. (2010):

“The Freshwater Invertebrate Invasiveness Scoring Kit (FI-ISK) is proposed as a screening tool for identifying potentially invasive freshwater invertebrates. ... Using receiver operating characteristic (ROC) curves, FI-ISK was shown to distinguish accurately (and with statistical confidence) between potentially invasive and noninvasive species of nonnative crayfish (Decapoda: Astacidae, Cambaridae, Parastacidae) ... Under Scenario I, the maximum value for Youden’s index (0.769) was attained at a cut-off score of 15.5, hence the “high-risk” (rejection) threshold was set at  $\geq 16$ . The low-risk species were the: stone crayfish *Austropotamobius torrentium*, white-clawed crayfish *Austropotamobius pallipes*, big water crayfish *Cambarus robustus*, bottlebrush crayfish *Barbicambarus cornutus*, common crayfish *Cambarus bartonii bartonii*, and noble crayfish *Astacus astacus*. ... Under Scenario II, the maximum value for Youden’s index (0.912) was attained at a cut-off score of 0.5, hence the “high-risk” (rejection) threshold was set at  $\geq 1$ . Based on this cut-off value, only three of the six low-risk species were previously classed as noninvasive (namely, *A. torrentium*, *A. pallipes*, and *A. astacus*)”

## 4 Global Distribution

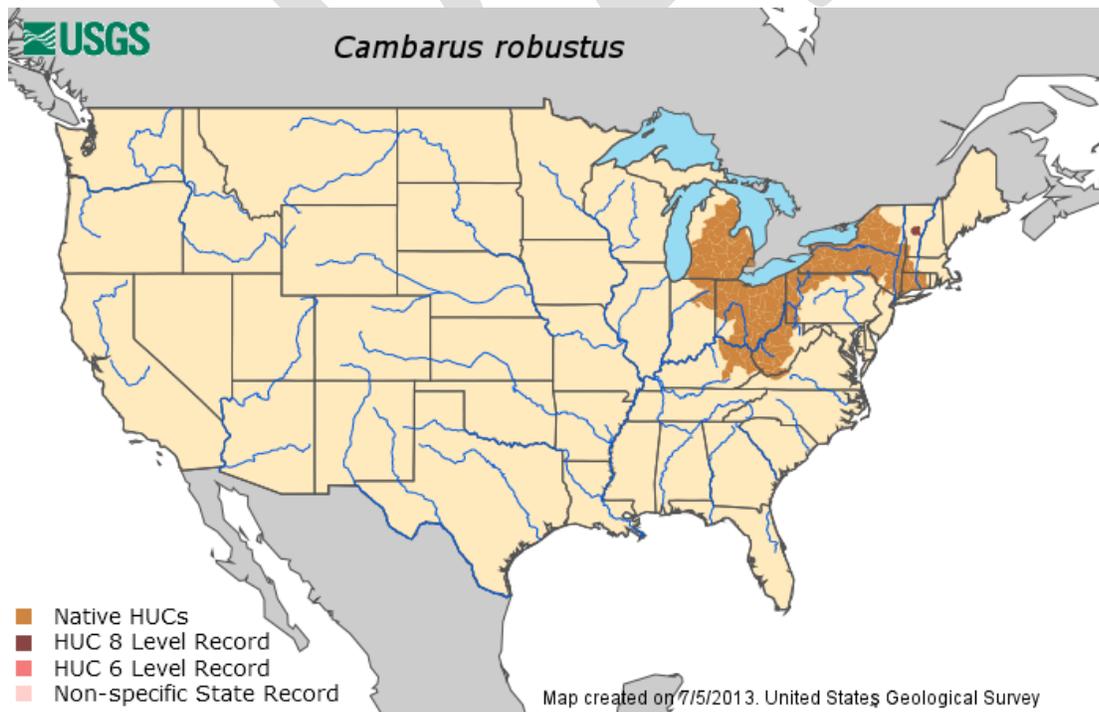
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**Figure 1.** Distribution of *C. robustus*. Map from GBIF (2015). Location in Louisiana was not a live observation and therefore was not used in climate matching (Sec. 6).

## 5 Distribution within the United States

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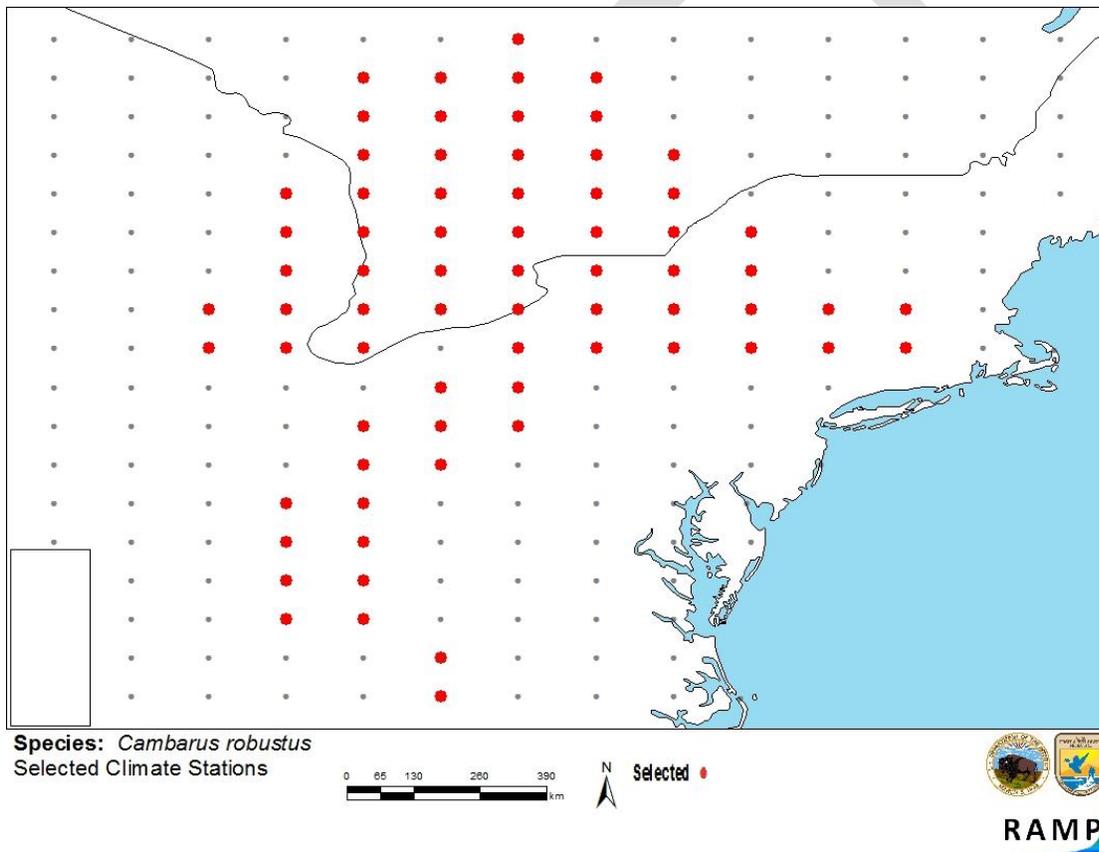
**Figure 2.** Distribution of *Cambarus robustus* in the US. Map from United States Geological Survey (2015).

## 6 Climate Matching

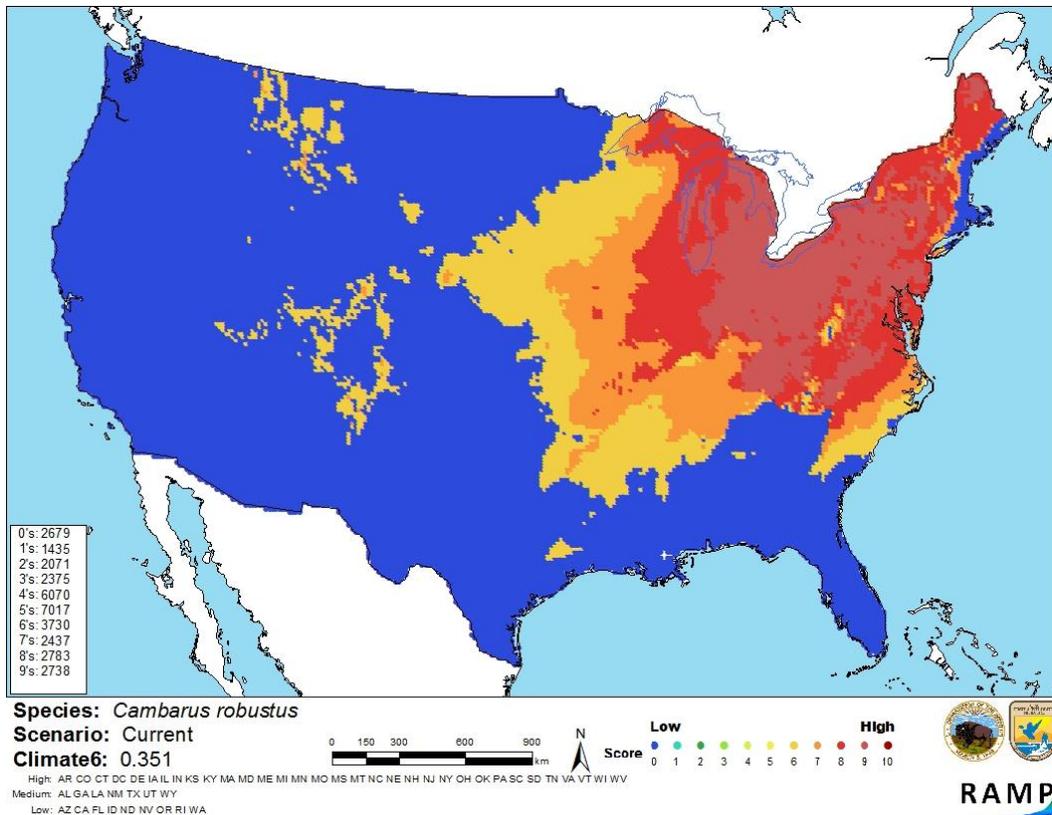
### Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high in the Northeast, Mid-Atlantic, and Great Lakes regions of the contiguous US. The climate match was low in the West, South, and most of the Plains states, except for isolated pockets of moderate climate match in the Interior West. Climate 6 proportion indicated that the contiguous U.S. has a high climate match. The range for a high climate match is 0.103 and greater; the climate match of *C. robustus* is 0.351.

Crayfishes have been observed to establish populations in climates different from that found within their native range (M. Hoff, U.S. Fish and Wildlife Service, personal communication). The climate match shown here may be an underestimate of climate suitability for the establishment of *C. robustus*.



**Figure 3.** RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *C. robustus* climate matching. Source locations from Jezerinac et al. (1985; cited in Crandall et al. 2001), GBIF (2015), North Carolina Wildlife Resources Commission (2015), and Pennsylvania Natural Heritage Program (no date).



**Figure 4.** Map of RAMP (Sanders et al. 2014) climate matches for *C. robustus* in the continental United States based on source locations reported by Jezerinac et al. (1985; cited in Crandall et al. 2001), GBIF (2015), North Carolina Wildlife Resources Commission (2015), and Pennsylvania Natural Heritage Program (no date). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

## 7 Certainty of Assessment

Information on the biology and ecology of *C. robustus* exists in the scientific literature. However, the potential impacts of its introduction remain unknown. Certainty of this assessment is low.

## 8 Risk Assessment

### Summary of Risk to the Continental United States

*C. robustus* is a large-bodied crayfish species native to eastern North America, with a broad distribution centered on the Great Lakes-Ohio River drainages. Isolated introductions of *C. robustus* have been documented in Quebec, Connecticut, Massachusetts, and most recently, Vermont. Much confusion surrounds the mechanism of these introductions and no scientific research has yet been conducted on the impacts of *C. robustus* on native species in these locations. One risk analysis suggested that *C. robustus* has moderate invasiveness potential, becoming invasive under some scenarios and not others. Climate match of *C. robustus* to the continental US is high. The overall risk of this species is uncertain.

## **Assessment Elements**

- **History of Invasiveness (Sec. 3):** Uncertain
- **Climate Match (Sec.6):** High
- **Certainty of Assessment (Sec. 7):** Low
- **Overall Risk Assessment Category: Uncertain**

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## 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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