Northern Clearwater Crayfish (*Orconectes propinquus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, June 2015

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1 Native Range, and Status in the United States

Native Range

From Adams et al. (2010):

"Canada (Ontario, Québec); United States (Illinois, Indiana, Iowa, Massachusetts, Michigan, Minnesota, New York, Ohio, Pennsylvania, Vermont, Wisconsin)"

Status in the United States

From NatureServe (2015):

"This species is wide ranging and common. It has historically been abundant and widespread. It is however being outcompeted and replaced by the invasive crayfish species *Orconectes rusticus* in certain parts of its range, including Ohio, Illinois, Wisconsin, Massachusetts, Vermont, Ontario, Quebec and Iowa."

"Introduced populations were discovered in 2010 in Monument Reservoir and nearby North Lake, Las Animas Co., Colorado (C. Taylor, pers. comm., August 2010)."

From Hobbs et al. (1989):

"Magnuson et al. (1975) indicated that *O. propinquus* also is abundant in many lakes in northern Wisconsin. … The current presence also of *O. propinquus* there probably represents introductions rather than a natural invasion."

Means of Introductions in the United States

From Capelli and Munjal (1982):

"Nothing is known for certain of colonization mechanisms, but introduction by humans, most likely from use as fish bait, is strongly suspected. See Capelli, 1975."

Remarks

From Adams et al. (2010):

"By far the biggest threat to this species is the invasive crayfish *Orconectes rusticus*, which has replaced this species in parts of its range and taken it over as the dominant crayfish species in other locations (Olden et al. 2006, Kuhlmann 2008). In Wisconsin, for example, *O. rusticus* has gone from being 7% of crayfish records to 36% in 20 years (Olden et al. 2006). However, this species has stronghold areas where there is good forest cover, such as Conneaut Creek in Ohio (Thoma and Jezerinac 2000). In Illinois, *O. rusticus* has replaced this species in 10-15% of its range, particularly in the Rock River drainage (C. Taylor, pers. comm. 2009). It is known to be losing ground to *O. rusticus* in Ohio (R. Thoma, pers. comm. 2009). Two forms of competition include, "hybridisation and reproductive interference" (Taylor et al. 2005). The increase of the range of *O.rusticus* has caused declines in this species, and in some places they are thought to be locally threatened (Taylor et al. 2005). This species is also threatened by water acidification and pollution (Taylor et al. 2005)."

2 Biology and Ecology

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 Orconectes
Subgenus Orconectes (Crockerinus)
Species *Orconectes propinquus* (Girard, 1852)"

"Taxonomic Status: valid"

Size, Weight, and Age Range

From NatureServe (2015):

"[LENGTH: to 45 TCL; to 90 TL] [WIDTH: to 20]"

Environment

From Adams et al. (2010):

"This species is a habitat generalist, and has been found in habitats such as: small streams, large rivers, ponds, and lakes (Taylor et al. 2005)."

Climate/Range

From NatureServe (2015):

"Environmental Specificity: Broad. Generalist or community with all key requirements common."

Distribution Outside the United States

Native

From Adams et al. (2010):

"Canada (Ontario, Québec)"

Introduced

From Adams et al. (2010):

"Taylor et al. (2005) noted that it has been introduced in north western Ontario."

Means of Introduction Outside the United States

No information available.

Short description
From NatureServe (2015):

"Rostrum acuminate, usually carinate, margins subparallel and terminating in spines; cervical spines present; areola wide with 5-8 punctations in narrowest part; hooks on ischia of male 3rd pereiopods; male 1st pleopod terminating in 2 straight subparallel subequal elements, 25% of total length of pleopod, lacking prominent shoulder on cephalic margin of pleopod (Fitzpatrick, 1967)."

Biology
From NatureServe (2015):

"Generally inhabits the rapid parts of streams with rock/gravel substrate; prefers cool, unpolluted water. In Indiana, it is positively associated with streams with medium flow and large gravel-cobble substrates, lack of fine sediment and macrophyte growth, in wooded riparian areas (Burskey and Simon, 2010).
Adult Food Habits: Detritivore
Immature Food Habits: Detritivore
Food Comments: Opportunistic; mostly detritus. In a diet study, Saffran and Barton (1993) found the macroalga *Chara* was chosen over all macrophytes tested and freshwater macrophytes were not important in the diet of this species. Instead, periphytic diatoms, invertebrates, and plant detritus made up the majority of the materials consumed."

Human uses
From NatureServe (2015):

"No known economic value."

Diseases
From Krugner-Higby et al. (2010):

"In 2005, native crayfish *Orconectes propinquus* from Big Muskellunge Lake were found with ulcerated lesions in the cuticle. … This is the first report of the occurrence of ulcers in wild crayfish associated with *S[aprolegnia] australis* infection in the USA."

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

Threat to humans
No information available.

3 Impacts of Introductions

From Lodge et al. (1986):

"A 1932 survey determined that *O. virilis* was the only *Orconectes* in Trout Lake. In 1973, we found that *O. propinquus* was abundant and *O. virilis* uncommon. Yet between 1973 and 1983 (probably between 1980 and 1983), *O. virilis* became much more widespread and abundant, while the population of *O. propinquus* declined. Between 1973 and 1979, *O. rusticus* invaded the lake, but has remained in low abundance. Both of our predictions are contradicted by our results. *Orconectes propinquus* has declined and *O. virilis* has increased, and while *O. rusticus* has invaded, it has not yet displaced the other species. We suggest that the outcome of interspecific interactions is variable and probably affected by other community structuring forces such as predation, parasitism, and disturbance, in addition to competition."

From Hobbs et al. (1989):

"McKnight (unpubl.) implied that *O. propinquus* was a significant predator of fish eggs (*Salvelinus namaycush* (Waldbaum, 1792) and *Coregonus clupeaformis* (Mitchill, 1818)) in Trout Lake in Vilas County and Magnuson et al. (1975), Horns & Magnuson (1981), and McBride (1983) showed that in some situations crayfishes (*O. propinquus*, *O. rusticus*, *O. virilis*) prey significantly on trout eggs."

From Rosenthal et al. (2006):

"As predicted from small-scale experiments, macrophyte species richness and abundance declined in invaded lakes relative to uninvaded lakes. … Effects on littoral benthos, though not statistically significant, were in the direction predicted from smaller-scale studies. We expected littoral invertebrate populations, especially snails, in invaded lakes to be low in abundance and diversity (Lodge et al. 1994, 1998) … This is the first study to suggest that northern crayfish, in addition to rusty crayfish, can cause community changes at the whole-lake scale. This is not particularly surprising, given the high abundance that northern crayfish achieve. However, other lakes in which this might have been observed have subsequently been invaded by rusty crayfish (Olsen et al. 1991), possibly masking the effects of northern crayfish."

4 Global Distribution

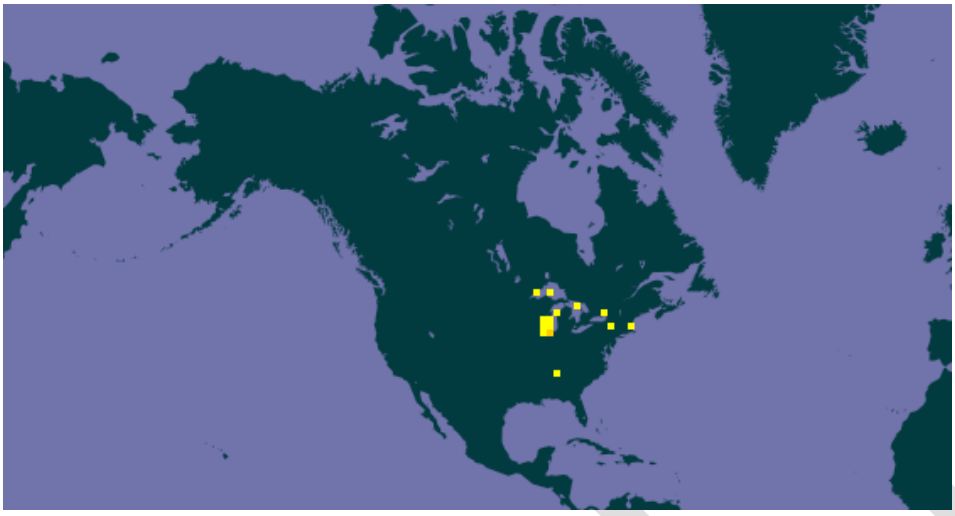

Figure 1. Distribution of *O. propinquus*. Map from GBIF (2015). The observation in Alabama was not used in climate matching (Sec. 6) because of locational uncertainty.

5 Distribution within the United States

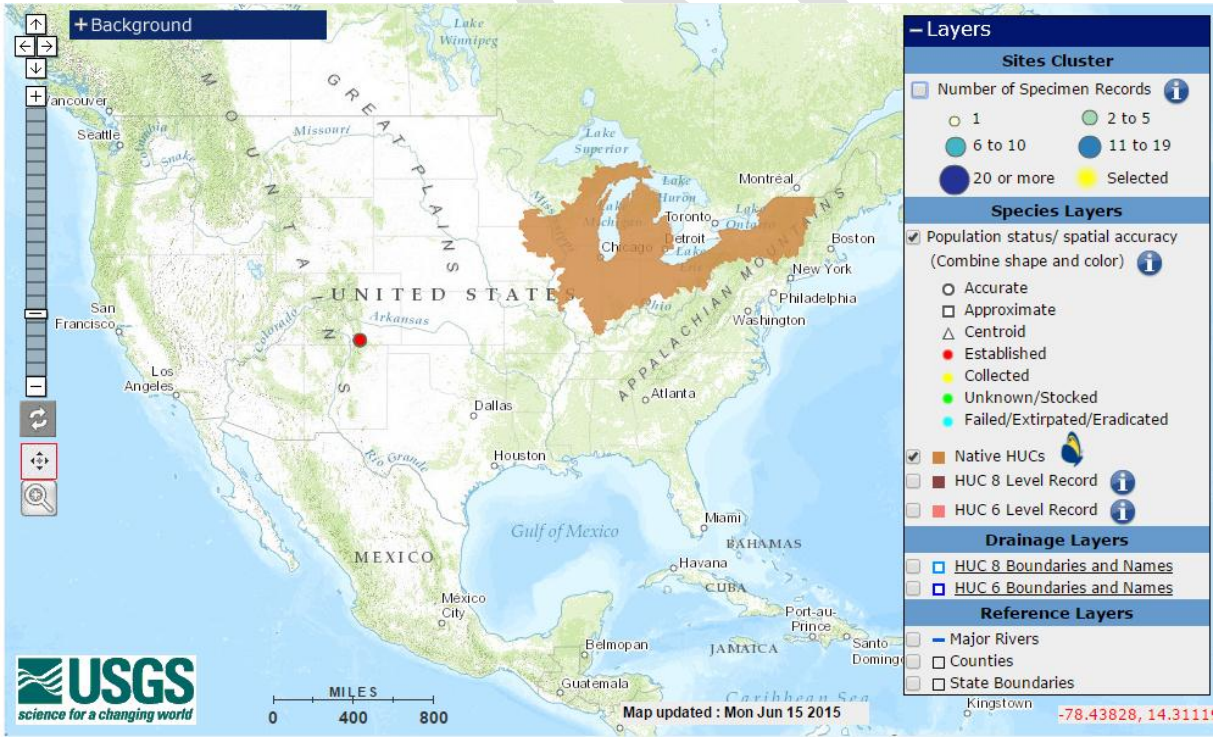

Figure 2. Distribution of *O. propinquus*. Map from USGS (2015).

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 and Great Lakes regions, and in scattered locations in the Interior West. Climate match was medium for parts of the Northern Plains states, and low for most of the South and 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 *O. propinquus* is 0.378.

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 *O. propinquus*.

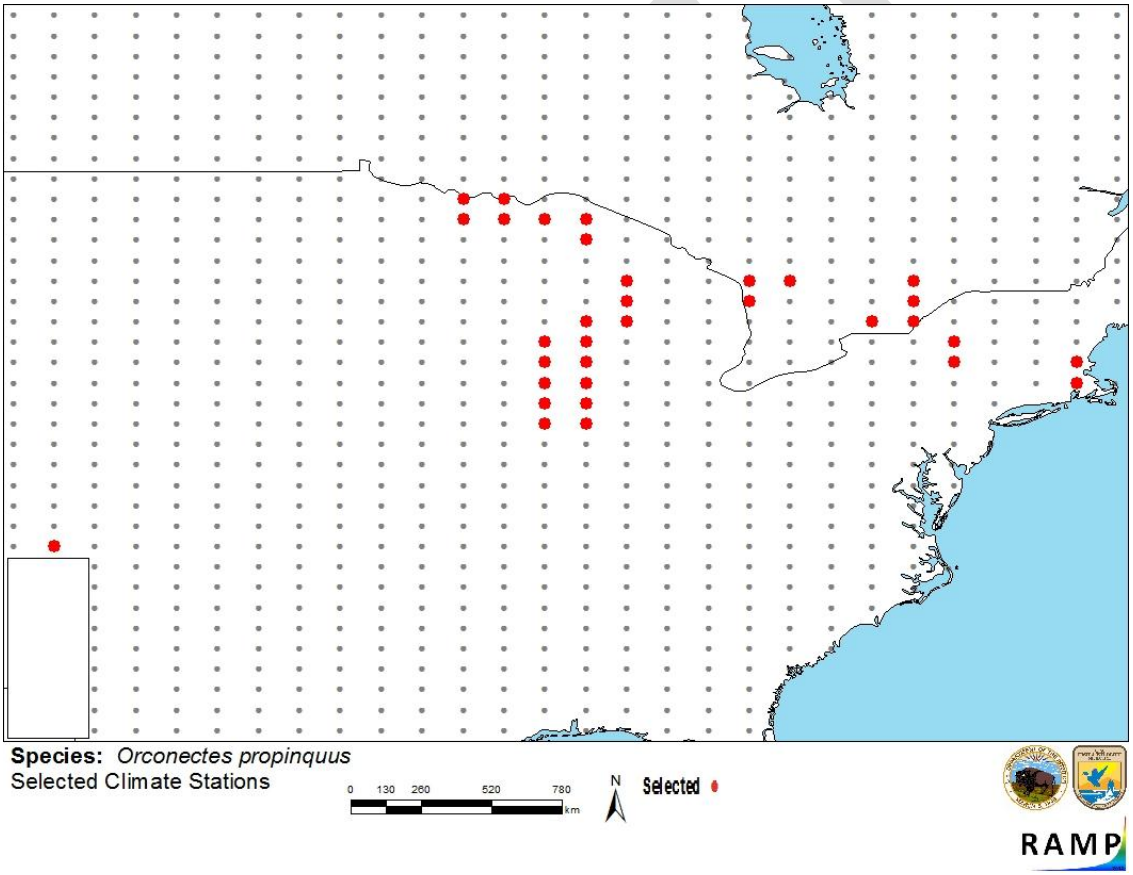

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *O. propinquus* climate matching. Source locations from GBIF (2015) and USGS (2015).

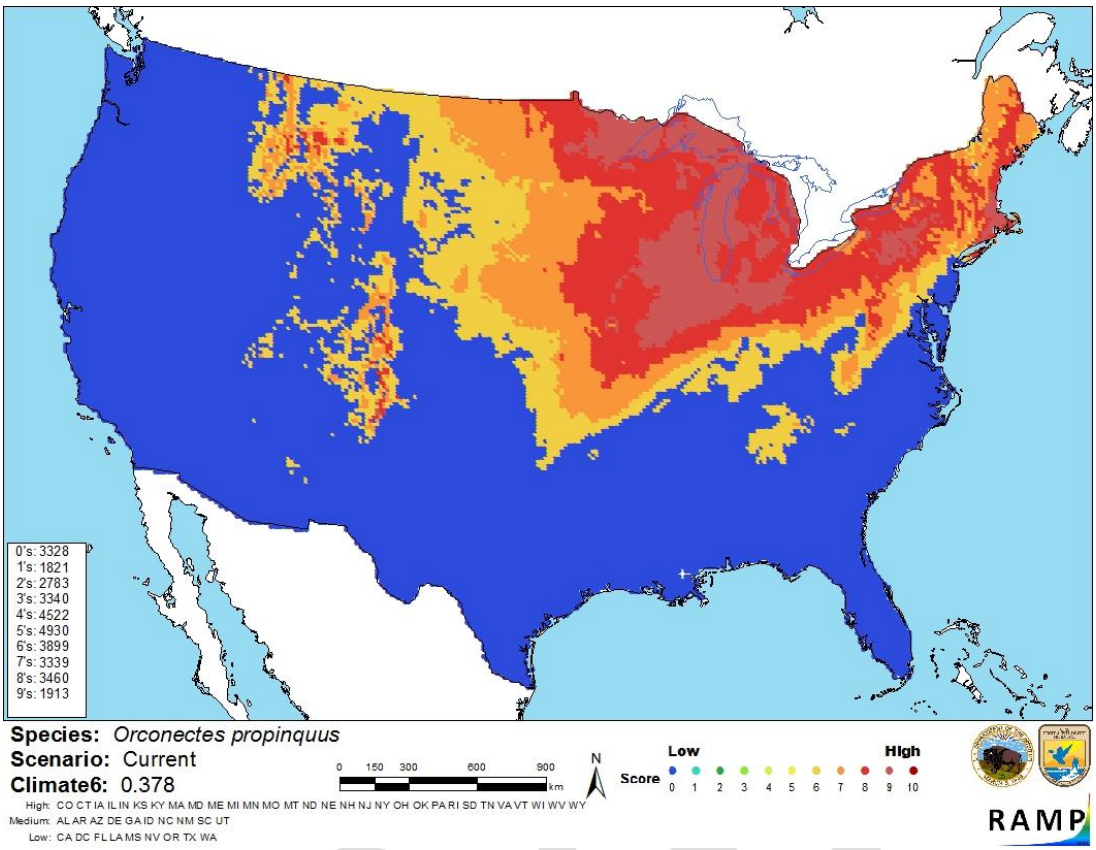

Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *O. propinquus* in the continental United States based on source locations reported by GBIF (2015) and USGS (2015). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

7 Certainty of Assessment

Some information is available on the biology, ecology, and impacts of *O. propinquus*. However, the species has been introduced in only a few isolated locations outside its native range, and knowledge about its potential impacts in non-native environments remains incomplete. Certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Continental United States

Orconectes propinquus is a crayfish species native to the Midwest and Northeast US. It is threatened over parts of its native range by the invasion of rusty crayfish, *O. rusticus*, but some research suggests that *O. propinquus* itself has negative impacts on non-native ecosystems. Where *O. propinquus* has been introduced into lakes in northern Wisconsin and the upper peninsula of Michigan, macrophytes and native crayfish have declined. In 2010, established populations of *O. propinquus* were discovered in Colorado; no studies have been published yet on the potential impacts of the species in this location so far outside its native range. Climate match for the contiguous US is high. Overall risk for this species is high, with medium certainty.

Assessment Elements

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

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.

Adams, S., G. A. Schuster, and C. A. Taylor. 2010. *Orconectes propinquus*. The IUCN Red List of Threatened Species, version 2015.1. Available: http://www.iucnredlist.org/details/153893/0. (June 2015).

Capelli, G. M., and B. L. Munjal. 1982. Aggressive interactions and resource competition in relation to species displacement among crayfish of the genus *Orconectes*. Journal of Crustacean Biology 2(4):486-492.

Global Biodiversity Information Facility (GBIF). 2015. GBIF backbone taxonomy: *Orconectes propinquus* (Girard, 1852). Global Biodiversity Information Facility, Copenhagen. Available: http://www.gbif.org/species/2227030. (June 2015).

Hobbs, H. H. III, J. P. Jass, and J. V. Huner. 1989. A review of global crayfish introductions with particular emphasis on two North American species (Decapoda, Cambaridae). Crustaceana 56(3):299-316.

Integrated Taxonomic Information System (ITIS). 2015. *Orconectes propinquus* (Girard, 1852). Integrated Taxonomic Information System, Reston, Virginia. Available: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=97473. (June 2015).

Krugner-Higby, L., D. Haak, P. T. J. Johnson, J. D. Shields, W. M. Jones III, K. S. Reece, T. Meinke, A. Gendron, and J. A. Rusak. 2010. Ulcerative disease outbreak in crayfish *Orconectes propinquus* linked to *Saprolegnia australis* in Big Muskellunge Lake, Wisconsin. Diseases of Aquatic Organisms 91:57-66.

Lodge, D. M., T. K. Kratz, and G. M. Capelli. 1986. Long-term dynamics of three crayfish species in Trout Lake, Wisconsin. Canadian Journal of Fisheries and Aquatic Sciences 43:993-998.

NatureServe. 2015. *Orconectes propinquus* - (Girard, 1852). NatureServe Explorer: an online encyclopedia of life [web application], version 7.1. NatureServe, Arlington, Virginia. Available: http://explorer.natureserve.org/servlet/NatureServe?searchName=Orconectes+propinquus. (June 2015).

Rosenthal, S. K., S. S. Stevens, and D. M. Lodge. 2006. Whole-lake effects of invasive crayfish (*Orconectes* spp.) and the potential for restoration. Canadian Journal of Fisheries and Aquatic Sciences 63:1276-1285.

Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk Assessment Mapping Program: RAMP. US Fish and Wildlife Service.

United States Geological Survey [USGS]. 2015. *Orconectes propinquus*. USGS Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=2249. (June 2015).

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.

Burskey, J. L., and T. P. Simon. 2010. Reach- and watershed-scale associations of crayfish within an area of varying agricultural impact on west-central Indiana. Southeastern Naturalist 9(sp3):199-216.

Capelli, G. 1975. Distribution, life history, and ecology of crayfish in northern Wisconsin, with emphasis on *Orconectes propinquus* (Girard). Doctoral dissertation. University of Wisconsin, Madison.

Fitzpatrick, J.F. Jr. 1967. The *propinquus* group of the crawfish genus *Orconectes* (Decapoda: Astacidae). The Ohio Journal of Science 67(3):129-172.

Horns, W. H., and J. J. Magnuson. 1981. Crayfish predation on lake trout eggs in Trout Lake, Wisconsin. Rapports et procès-verbaux des réunions / Conseil permanent international pour l'exploration de la mer 178:299-303.

Kuhlmann, M. L., S. M. Badylak, and E. L. Carvin. 2008. Testing the differential predation hypothesis for the invasion of rusty crayfish in a stream community: laboratory and field experiments. Freshwater Biology 53:113-128.

Lodge, D. M., M. W. Kershner, J. E. Aloi, and A. P. Covich. 1994. Effects of an omnivorous crayfish (*Orconectes rusticus*) on a fresh-water littoral food-web. Ecology 75:1265-1281.

Lodge, D. M., R. A. Stein, K. M. Brown, A. P. Covich, C. Bronmark, J. E. Garvey, and S. P. Klosiewski. 1998. Predicting impact of freshwater exotic species on native biodiversity: challenges in spatial scaling. Australian Journal of Ecology 23:53-67.

Magnuson, J. J., G. M. Capelli, J. G. Lorman, and R. A. Stein. 1975. Consideration of crayfish for macrophyte control. Pages 66-74 *in* P. L. Brezonik, and J. L. Fox, editors. The proceedings of a symposium on water quality management through biological control. Rept. No. ENV 07-75-1. University of Florida, Gainesville.

McBride, J. 1983. Meet the rusty crayfish. Wisconsin Sportsman 12(3):42-46.

Olden, J. D., J. M. McCarthy, J. T. Maxted, W. W. Fetzer, and M. J. Vander Zanden. 2006. The rapid spread of rusty crayfish (*Orconectes rusticus*) with observations on native crayfish

declines in Wisconsin (U.S.A.) over the past 130 years. Biological Invasions 8:1621-1628.

Olsen, T. M., D. M. Lodge, G. M. Capelli, and R. J. Houlihan. 1991. Mechanisms of impact of an introduced crayfish (*Orconectes rusticus*) on littoral congeners, snails, and macrophytes. Canadian Journal of Fisheries and Aquatic Sciences 48:1853-1861.

Saffran, K. A., and D. R. Barton. 1993. Trophic ecology of *Orconectes propinquus* (Girard) in Georgian Bay (Ontario, Canada). Freshwater Crayfish 9:350-358.

Taylor, R. M., P. Hamr, and A. Karstaad. 2005. Crayfishes. Pages 222-317 *in* G. Winterton, editor. The comprehensive bait guide for eastern Canada, the Great Lakes Region and Northeastern United States. University of Toronto, Toronto.

Thoma, R. F., and R. F. Jezerinac. 2000. Ohio crayfish and shrimp atlas. Ohio Biological Survey Miscellaneous Contribution 7:1-28.