

# European Crayfish (*Astacus astacus*)

## Ecological Risk Screening Summary

US Fish and Wildlife Service, April 2014  
Revised, June 2015



Photo: © Michal Mañas from EOL (2014).

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

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### Native Range

From CABI (2014):

“is widely distributed in Europe, extending from France in the southeast to Russia in the east, and from Italy, Albania and Greece in the south to Scandinavia in the north (Cukerzis et al., 1988; Holdich et al., 1999).”

## Status in the United States

This species has not been reported in the United States.

## Means of Introductions in the United States

This species has not been reported in the United States.

## Remarks

From Edsman et al. (2010):

“Common Name(s):

English – Noble Crayfish, Red-footed Crayfish, European Crayfish, Broad-clawed Crayfish, Red-clawed Crayfish, Broad-fingered Crayfish, River Crayfish”

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2014):

“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 Astacidae  
Genus *Astacus*  
Species *Astacus astacus*”

Taxonomic Status: Valid”

### Size, Weight, and Age Range

From Edsman et al. (2010):

“Anecdotal measures of longevity indicate this species may live for up to 20 years.”

“It is known that noble crayfish females reach sexual maturity at a size which ranges from 6.2 cm total length in localities with early maturity or slow growth to 8.5 cm total length in localities

with late maturity or fast growth. Males become mature at a size of 6.0-7.0 cm total length (Skurdal & Taugbøl 2002).”

## **Environment**

From Edsman et al. (2010):

“Freshwater”

## **Climate/Range**

From Edsman et al. (2010):

“This species is capable of tolerating lower calcium levels, as low as 2-3 mgL<sup>-1</sup> Ca, where other species of crayfish may be excluded. The optimum temperature for best growth is between 16 and 24°C, although up to 28°C can generally be tolerated. In addition, oxygen content below 3-4 mgL<sup>-1</sup> is deemed unsuitable for this species.”

## **Distribution Outside the United States**

Native

From CABI (2014):

“is widely distributed in Europe, extending from France in the southeast to Russia in the east, and from Italy, Albania and Greece in the south to Scandinavia in the north (Cukerzis et al., 1988; Holdich et al., 1999).”

Introduced

From CABI (2014):

“It has been introduced to England, Cyprus, Spain and Liechtenstein, and also the Siberian River Ob and to Morocco (Cukerzis et al., 1988; Holdich et al., 1999).”

## **Means of Introduction Outside the United States**

From CABI (2014):

“*A. astacus* are mainly cultured in the Nordic and Baltic countries and in the Alpine region; they are mainly produced for stocking, re-establishing lost stocks and to some extent for consumption, involving both the production of juveniles for stocking in natural waters and for the aquaculture industry, and the production of crayfish for consumption (Skurdal and Taugbøl, 2002).”

## **Short description**

From CABI (2014):

“*A. astacus* are usually dark brown or black on the dorsal side, and olive-brown on the ventral side. ... The carapace is smooth but with small granular tubercles on the sides. The rostrum is

flat with two spines near the base. The claws are broad, with well-formed bases, red-brown on the ventral side and rough on the dorsal side.”

## **Biology**

From Edsman et al. (2010):

“This species is found in rivers, lakes, ponds, and reservoirs, in both lowlands and hills, where shelter availability is high (Souty-Grosset et al. 2006). This includes stones, logs, roots and aquatic and marginal vegetation. This species prefers soft bottoms with some sand and is not usually found in water bodies with a muddy substrate. In addition, it prefers soft banks where it constructs simple burrows. The oxygen demands of this species can be quite high, leading to high mortality in shallow, eutrophic ponds during summer months (Souty-Grosset et al. 2006). Habitat of this species is shared by the introduced *Pacifastacus leniusculus*, which is known to competitively exclude this species after a period of establishment (Souty-Grosset et al. 2006).”

“This species is mainly predated upon by the common eel, in addition to small scale predation by mink, perch, otter and wading birds (Souty-Grosset et al. 2006), although predation risk also includes cannibalism. This competition, along with temperature gradients and shelter availability, is the major determinant of this species range (Abrahamsson 1966, Skurdal and Taugbøl 2002).”

“At maturation, males normally mate every year, while female reproductive activity is usually restricted to a single year between periods of sexual inactivity. Thus numbers of sexually active females may vary greatly depending on locality and year (Souty-Grosset et al. 2006).”

“Declines in this keystone species are said to negatively impact both ecosystem structure and function within freshwater environments through loss of: a) provisioning services – food production from fisheries, recreational fishing, b) regulatory and support services – trophic cascades, water purification, nutrient cycling, primary productivity, c) cultural value – recreational fishing, education, heritage. Crayfish are also an important food source to a range of species including otters, salmonids, and birds such as kingfishers (Kettunen and ten Brink 2006).”

From EOL (2014):

“Feeding at night on worms, aquatic insects, molluscs and plants, the noble crayfish spends the day resting in a burrow. It undergoes periodic moults, shedding the hard exoskeleton in order to grow slightly larger, and then forming a new shell. Sexual maturity is reached during the fourth year of life, and breeding takes place between October and November. The fertilised eggs are carried by the female, attached to her legs, over the winter until May, when they hatch and disperse. ... (Well et al. 1983). ”

## Human uses

From CABI (2014):

“*Astacus astacus* is believed to have been an object of trade, commerce and zoological study in Europe since the 1800s (Skurdal and Taugbøl, 2002). They are economically important due to their status as a delicacy (Spitz, 1973; Brinck, 1975; Westman, 1991; Westman et al., 1992). Although *A. astacus* have been exploited and eaten as early as the 1200s in Central Europe, in Scandinavia they were not considered suitable for human consumption until the 1500s (Westman, 1991). Although commercial harvesting of *A. astacus* is thought to have started in the Middle Ages, it only developed into a big industry in the nineteenth century as demand for crayfish increased.”

## Diseases

From Edsman et al. (2010):

“An outbreak of crayfish plague *Aphanomyces astaci* carried by the Signal Crayfish *Pacifastacus leniusculus* has had an impact upon all of Europe's *Astacus* species.”

From Jiravanichpaisal et al. (2004):

“The susceptibility of two species of freshwater crayfish, *Pacifastacus leniusculus* and *Astacus astacus*, to white spot syndrome virus (WSSV) by intramuscular injection was compared and the results show that both species are susceptible to WSSV. ... Crayfish might act as a carrier of WSSV at low water temperature and could develop white spot disease if the water temperature is increased.”

### **Crayfish plague and white spot disease are OIE-reportable diseases.**

From Longshaw (2011):

“*Astacus astacus* bacilliform virus (AaBV): To date AaBV has only been reported from *A. astacus* from Finland at prevalences up to 100% and with variable intensity and no apparent mortality or morbidity (Edgerton et al., [1996]).”

“An important pathogen of fish, infectious pancreatic necrosis virus (IPNV) has been associated with mortalities in salmonid fish. Halder and Ahne (1988) exposed *A. astacus* to IPNV through various routes. They were able to transmit the virus back to naïve rainbow trout fry and eggs. IPNV could be detected in haemocytes of the antennal gland, gills and hepatopancreas of exposed crayfish although no pathological changes were noted in infected crayfish. The virus persisted in crayfish for up to a year after exposure, suggesting replication is possible and raising concerns over the role of crayfish in transmission of the virus to fish.”

“*Thelohania* species in crayfish are generally found within the musculature with infected animals generally appearing opaque or whitish giving rise to the common name of porcelain disease or cotton tail. ... The first *Thelohania* to be described from a crayfish was *Thelohania contejeani* Henneguy, 1892 and has been extensively studied. The parasite caused mass mortalities of

crayfish in Europe; it infects *A. astacus*, *A. leptodactylus*, *A. pallipes*, *P. leniusculus* and *Orconectes (Faxonius) limosus* (Dunn et al., 2009 and Edgerton et al., [2002]).”

### Threat to humans

No information reported for this species.

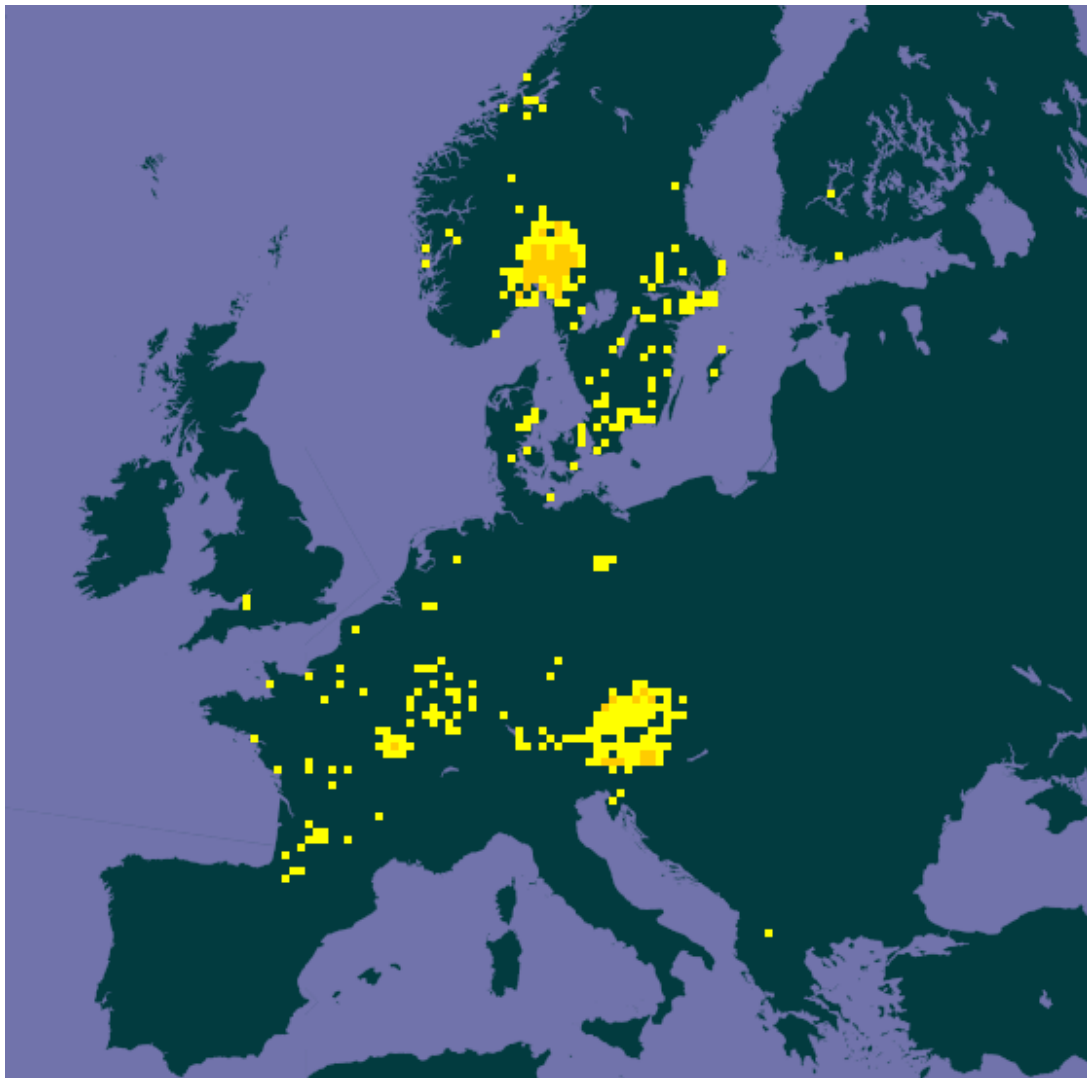
## 3 Impacts of Introductions

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No adverse impacts from introductions of this species have been reported.

## 4 Global Distribution

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**Figure 1.** Map of known global distribution of *Astacus astacus*. Map from GBIF (2014). Locations in South Pacific Ocean, Africa, and the Arabian Peninsula were not included because they were incorrectly located.

## 5 Distribution within the United States

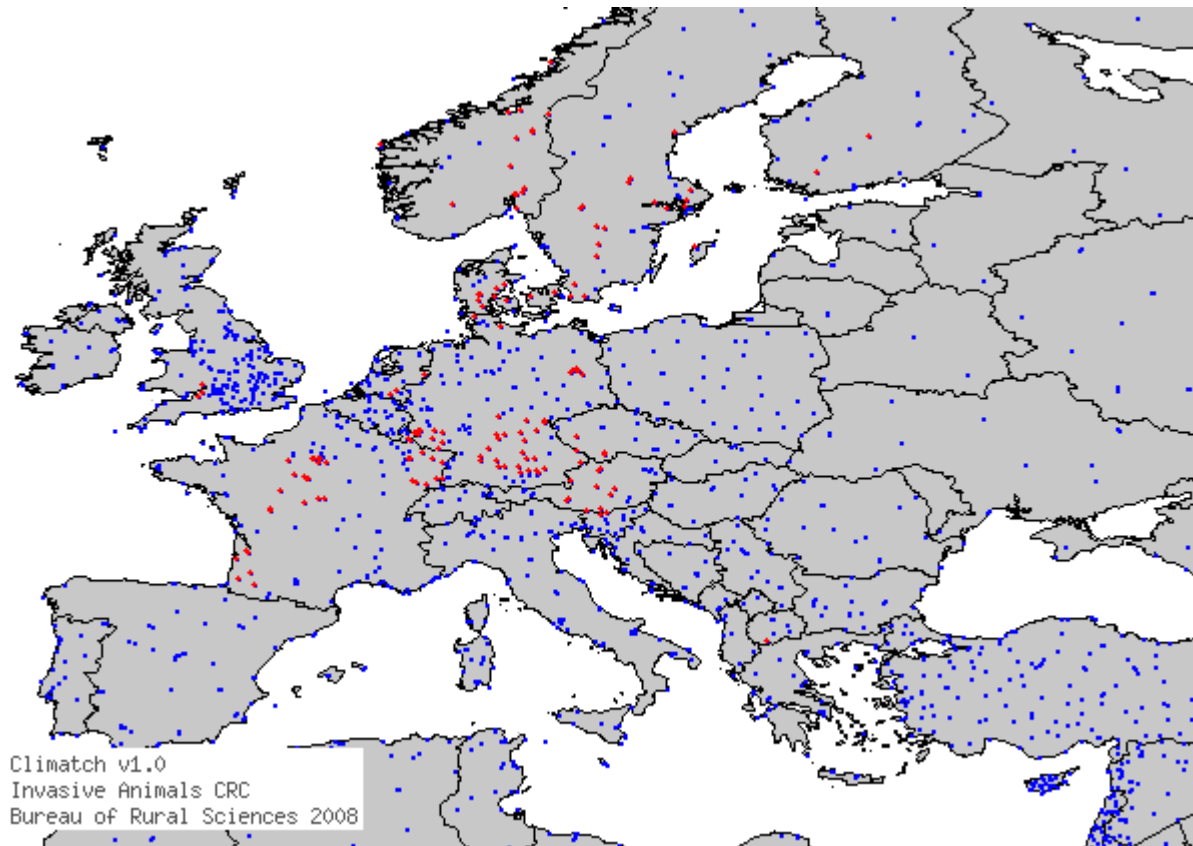
This species is not currently believed to be in United States waters.

## 6 CLIMATCH

### Summary of Climate Matching Analysis

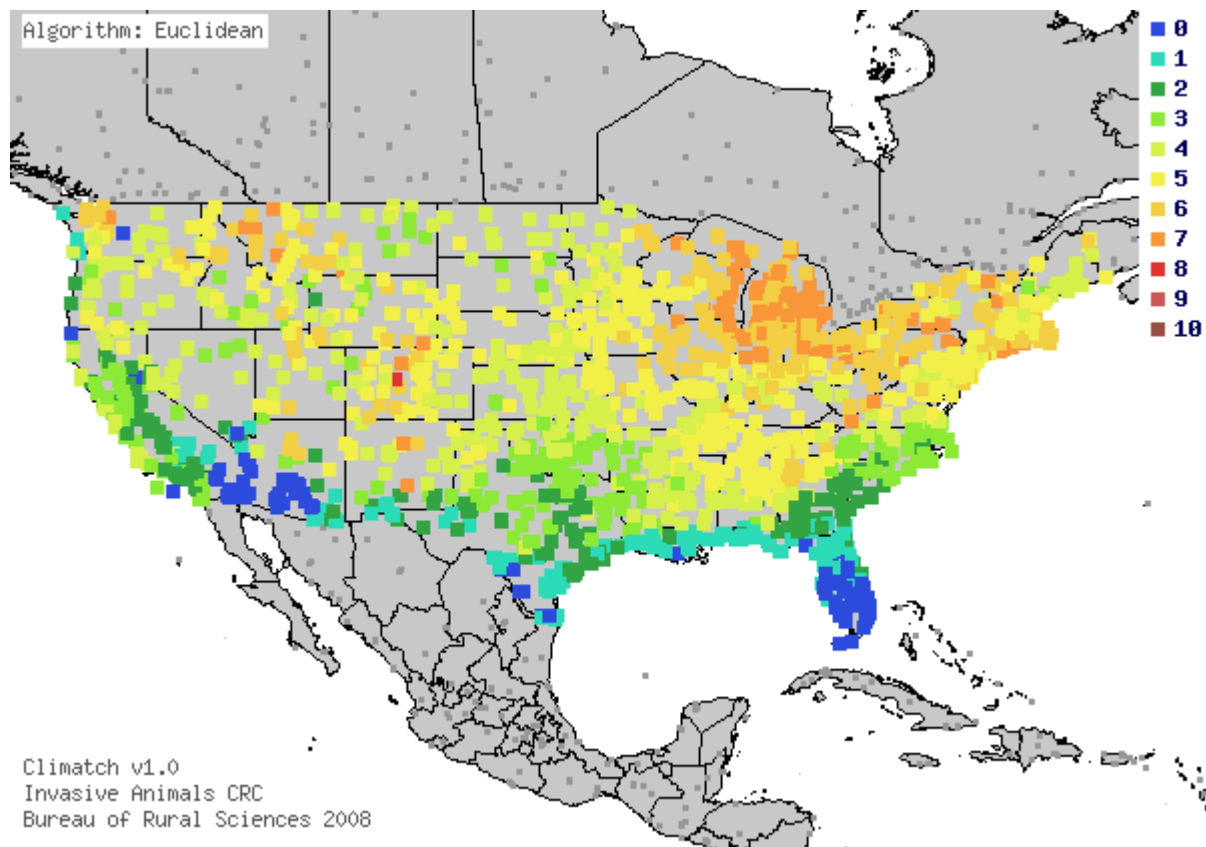
The climate match (Australian Bureau of Rural Sciences 2008; 16 climate variables; Euclidean Distance) was high for the Great Lakes, portions of the New England states and dotted locations in the West and Northwest. Medium match occurred in the Ohio River Valley, upper Midwest and Northern Rockies. Low match was across the extreme southern United States. Highest match occurred in the Great Lakes, New England States and Colorado. Climate 6 match indicated that the Continental U.S. has a high climate match. The range for a high climate match is 0.103 and greater, climate match of *Astacus astacus* is 0.208.

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 *A. astacus*.



**Figure 2.** CLIMATCH (Australian Bureau of Rural Sciences 2008) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *Astacus astacus* climate matching. Source locations from GBIF (2014).





**Figure 3.** Map of CLIMATCH (Australian Bureau of Rural Sciences 2008) climate matches for *Astacus astacus* in the continental United States based on source locations reported by GBIF (2014). 0= Lowest match, 10=Highest match.

**Table 1.** CLIMATCH (Australian Bureau of Rural Sciences 2008) climate match scores.

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Score	117	146	187	226	417	470	297	112	2	0	0
Climate 6 Proportion =		0.208									

## 7 Certainty of Assessment

Information for *A. astacus* is known. It is reported to be introduced in England, Cyprus, Spain, Liechtenstein, and also the Siberian River Ob and to Morocco. Limited scientific information on the impacts of introductions of this species is available. Additional scientific study is needed to fully know the potential and actual impacts the species could be having in introduced areas before certainty of assessment can be anything but low.

## 8 Risk Assessment

### Summary of Risk to the Continental United States

*Astacus astacus* is a freshwater crayfish native to Europe. It is widely distributed extending from France in the west to Russia in the east, and from Italy, Albania and Greece in the south to Scandinavia in the north. It is a popular species for human consumption in certain locations, and is commercially harvested. *Astacus astacus* has been introduced to scattered locations in the UK,



continental Europe, Siberia, and Morocco. There are no reported introductions of this species in the United States. This species is vulnerable to the crayfish plague, which reduces the potential of this species to be able to successfully invade U.S. waters. Climate match with the United States is high, particularly the Great Lakes region. More research is needed to understand the impacts from introductions for this species. Absence of this research makes the certainty of this assessment low. Overall risk posed by this species is uncertain at this time.

### **Assessment Elements**

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

## 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.**

- Australian Bureau of Rural Sciences. 2008. CLIMATCH. Available: <http://data.daff.gov.au:8080/Climatch/climatch.jsp>. (April 2014, June 2015).
- CABI. 2014. *Astacus astacus*. Centre for Agricultural Bioscience International, Wallingford, UK. Available: <http://www.cabi.org/isc/datasheet/92629>. (April 2014, June 2015).
- Edsman, L., L. Füreder, F. Gherardi, and C. Souty-Grosset. 2010. *Astacus astacus*. The IUCN Red List of Threatened Species, version 2015.1. Available: <http://www.iucnredlist.org/details/2191/0>. (June 2015).
- Encyclopedia of Life (EOL). 2014. *Astacus astacus* Linnaeus, 1758. Available: <http://eol.org/pages/1021866/details> (April 2014, June 2015). Photo available: [http://eol.org/data\\_objects/2004336](http://eol.org/data_objects/2004336). Photo license available: <http://creativecommons.org/licenses/by-nc/3.0/legalcode>. (April 2014, June 2015).
- Global Biodiversity Information Facility (GBIF). 2014. GBIF backbone taxonomy: *Astacus astacus* (Linnaeus, 1758). Global Biodiversity Information Facility, Copenhagen. Available: <http://www.gbif.org/species/2226998> (April 2014, June 2015).
- Integrated Taxonomic Information System (ITIS). 2014. *Astacus astacus*. Integrated Taxonomic Information System, Reston, Virginia. Available: [http://www.itis.gov/servlet/SingleRpt/SingleRpt?search\\_topic=TSN&search\\_value=97333](http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=97333) (April 2014, June 2015).
- Jiravanichpaisal, P., K. Söderhäll, and I. Söderhäll. 2004. Effect of water temperature on the immune response and infectivity pattern of white spot syndrome virus (WSSV) in freshwater crayfish. *Fish & Shellfish Immunology* 17(3):265-275.
- Longshaw, M. 2011. Diseases of crayfish: a review. *Journal of Invertebrate Pathology* 106(1):54-70.

## 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.**

- Abrahamsson, S. A. A. 1966. Dynamics of isolated populations of the crayfish *Astacus astacus* Linné. *Oikos* 17:96-107.

- Brinck, P. 1975. Crayfish in Sweden. *Freshwater Crayfish* 2:77-85.
- Cukerzis, J. M., D. M. Holdich, and R. S. Lowery. 1988. *Astacus astacus* in Europe. Pages 309-340 in D. M. Holdich, editor. *Freshwater crayfish: biology, management and exploitation*. Croom Helm Ltd., London, UK.
- Dunn, J. C., H. E. McClymont, M. Christmas, and A. M. Dunn. 2009. Competition and parasitism in the native white clawed crayfish *Austropotamobius pallipes* and the invasive signal crayfish *Pacifastacus leniusculus* in the UK. *Biological Invasions* 11:315-324.
- Edgerton, B. F., L. H. Evans, F. J. Stephens, and R. M. Overstreet. 2002. Synopsis of freshwater crayfish diseases and commensal organisms. *Aquaculture* 206:57-135.
- Edgerton, B. F., P. Paasonen, P. Henttonen, and L. Owens. 1996. Description of a bacilliform virus from the freshwater crayfish, *Astacus astacus*. *Journal of Invertebrate Pathology* 68:187-190.
- Halder, M., and W. Ahne. 1988. Freshwater crayfish *Astacus astacus* - a vector for infectious pancreatic necrosis virus (IPNV). *Diseases of Aquatic Organisms* 4:205-209.
- Holdich, D. M., W. D. Rogers, and J. D. Reynolds. 1999. Native and alien crayfish in the British Isles. Pages 221-242 in F. Gherardi, and D. M. Holdich, editors. *Crustacean issues 11: crayfish in Europe as alien species (how to make the best of a bad situation?)*. A. A. Balkema, Rotterdam.
- Kettunen, M., and P. ten Brink. 2006. Value of biodiversity: documenting EU examples where biodiversity loss has led to the loss of ecosystem services. Final report for the European Commission. Institute for the European Environmental Policy (IEEP), Brussels, Belgium.
- Skurdal, J., and T. Taugbøl. 2002. *Astacus*. Pages 467-510 in D. M. Holdich, editor. *Biology of freshwater crayfish, part 2: crayfish of commercial importance*. Blackwell Science, Oxford.
- Souty-Grosset, C., D. M. Holdich, P. Y. Noël, J. D. Reynolds, and P. Haffner, editors. 2006. *Atlas of crayfish in Europe*. Muséum National d'Histoire Naturelle, Paris.
- Spitz, R. 1973. Crayfish in Austria, history and actual situation. *Freshwater Crayfish* 1:9-14.
- Well, S. M., R. M. Pyle, and N. M. Collins. 1983. *The IUCN Invertebrate Red Data Book*. IUCN, Gland, Switzerland.
- Westman, K. 1991. The crayfish fishery in Finland - its past, present and future. *Finnish Fisheries Research* 14:187-216.

Westman, K., H. Ackefors, and C. Nylund. 1992. Crayfish: biology, aquaculture and harvest. Kiviksgarden, Stockholm.