Pest Risk Assessment for Rusty Crayfish (*Orconectes rusticus*) in Oregon

Identity

Name: *Orconectes rusticus*

Taxonomic Position: order Decapoda, infraorder Astacidea, family Cambaridae

Common Names: Rusty crayfish

Risk Rating Summary

Relative Risk Rating: HIGH

Numerical Score: 6 (on a 1-9 scale)

Uncertainty: Moderate

The moderate level of uncertainty attributed to this risk assessment is due to several factors. The format the risk assessment follows was originally developed for forest pest species and, as such, fails to take into consideration characteristics of invasive species that may be unique to aquatic organisms. Also, the risk of establishment and potential ecological and economic impact for the state of Oregon are not well known because the distribution of rusty crayfish (and in fact all non-native crayfish) is poorly known and generally underreported in and around the state. Lastly, interactions between rusty crayfish and native species of plants, crayfish, and fish important to the ecology and economy of Oregon have not been studied, and are currently unknown.

IDENTIFICATION: The rusty crayfish can grow to be 4 inches long and can be identified by the rust-red spots on each side of its body. It has large, smooth claws that range from grayish green to reddish brown.

Recommendation

Currently, no environmentally sound way to eradicate rusty crayfish without causing harm to native crayfish, fish and amphibians exists, and it is unlikely that any will be developed in the near future (Gunderson, 2008). Even successful eradication of crayfish in a confined area requires extensive hand removal (by snorklers or scuba divers) in addition to extensive trapping efforts as hand removal is the only effective means to target all age classes as trapping efforts tend to capture only larger age classes. Trapping, however, has been shown to be an effective means of controlling crayfish populations in areas where fish predation is high (Hein, et al. 2006). The only successful documented eradication of rusty crayfish occurred in Wyoming in 2006 when four ponds and a small stream reach were treated with Rotenone at a cost of over $36,000 (WDFG 2008). Other efforts targeting crayfish for eradication have utilized both natural and synthetic pyrethrins in areas where fish, amphibians and mammals could be removed prior to application. Theoretically, harvest of *O. rusticus* as a food source could help to control populations and reduce ecological impacts, but may also encourage potential harvesters to transplant invasive crayfish for economic benefit.

The most cost effective method for controlling *O. rusticus* invasions is to prevent their spread and establishment into new environments. Education of both anglers - who may use this species as bait (albeit illegally in Oregon), and teachers - who may purchase this species for use in classrooms, is key to preventing further releases into Oregon lake and stream systems.

Risk Rating Details

<u>Establishment Potential is MODERATE to HIGH</u>

Justification: *O. rusticus* will inhabit lakes, ponds, and streams and prefer areas that offer shelter such as rocks, cobble, gravel, silt and logs or other debris of debris used for cover (Gunderson 2008, USGS 2009). They are able to invade novel aquatic systems and withstand colder temperatures than in their native environment in the Ohio and Tennessee River Basins (Bobeldyk and Lamberti 2008) although they require permanent water, as they do not burrow to escape dry periods. In invaded stream systems, distribution seems to be limited to areas near upstream lakes, possibly because they rely upon the lakes as a food source (Bobeldyk and Lamberti, 2008). Colonization by these invasive crayfish in streams may also be limited by hydrological disturbance further away from lakes because they are not morphologically adapted for high flow environments. This may indicate that areas buffered from high flows, such as dam-regulated rivers and streams, could be more susceptible to *O. rusticus* invasion (Bobeldyk and Lamberti, 2008).

With hydroelectric projects serving as the main source of power, and a landscape defined by countless numbers of waterways, Oregon could be particularly vulnerable to invasion by *O. rusticus*. *Orconectes rusticus* can be found as far south as Tennessee and as far north as Canada (ISSG, 2009), indicating that they are able to tolerate a wide range of habitat types and can spread across a variety of landscapes.

Breeding occurs in the fall while eggs are not laid until the following spring therefore the introduction of one female carrying viable sperm could start a new population (USGS 2009). Females will lay between 80 and 575 eggs, and will store male sperm following mating (in late summer, early fall, or early spring) until the eggs are ready for fertilization. She will then carry viable eggs on her body for three to six weeks, depending on water temperatures, and newly hatched young will cling to the female's swimmerets for three to four molts (Gunderson, 2008). An individual female introduced to a new lake or stream system anytime between the time of mating and when the young leave the security of their mother can effectively create a new colony of invasive crayfish.

Orconectes rusticus are currently known only from one location in the state of Oregon. A population was discovered in the John Day system in 2005 (although it was initially mis-identified as *O. neglectus* and only recently confirmed as *O. rusticus*) primarily located between the towns of John Day and Mt. Vernon (Olden, et al. 2009). Unverified reports of *O. neglectus* have surfaced recently but need to be confirmed as they can be readily confused with *O. neglectus* (known from the Rogue River drainage).

<u>Spread Potential is HIGH</u>

Justification: Native to the Ohio River watershed, *O. rusticus* has spread throughout Illinois, Michigan, Wisconsin, and Minnesota and parts of 11 other states in the U.S. as well as Ontario, Canada (Olden et. al., 2006). Naturally limited to aquatic dispersal, once *O. rusticus* is introduced into a lake or stream system they can travel an average of 58 meters in 48 hours (Byron and Wilson, 2001). It is thought that the main method of introduction to new aquatic systems is by anglers who use the crayfish as bait, but they are also sold to schools for classroom projects and potentially released into the wild by teachers and students (Gunderson, 2008). Even though importation, possession, sale, purchase, exchange or transportation of all members of the order *Cambaridae* is currently prohibited in Oregon without a permit under Oregon Administrative Rule (OAR) 635-056-0050, there is still a risk that they could be imported by out-of-state fisherman or other anglers unaware of the restrictions. To increase the awareness of this issue in 2009 ODFW amended the Statewide Gear and Bait Restrictions to clarify the rules related to the use of crayfish as live bait. Rules now state that only dead crayfish can be used as bait to prevent the spread of bait crayfish into Oregon waters and help to reduce the risk of anglers introducing non-native invasive crayfish into Oregon.

Orconectes rusticus is one of many species recommended for classroom use that is considered a prohibited invasive species in the state of Oregon. Efforts to educate both teachers and biological supply houses nationwide are ongoing but many educators and suppliers remain unaware of the issue. Further complicating the matter, many supply houses simply offer "crayfish" for sale with out providing species names that would help educators make an informed decision about the legality of their purchase.

Classroom specimen should never be released into the wild and teachers and other educators who suspect that they have a nonnative species are encouraged to use this as an opportunity to discuss the impacts of invasive species and alternative methods of disposal. For more information on Aquatic Invasive Species in the Classroom please see the following Oregon Sea Grant publication "Stop the Spread of AIS" [http://seagrant.oregonstate.edu/sgpubs/onlinepubs/g06003.pdf].

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<u>Environmental Impact Potential is HIGH</u>

Justification: Potential and realized environmental impacts caused by *O. rusticus* fall into the following categories: habitat alteration and displacement and predation of native populations.

Crayfish are considered opportunistic feeders. *O. rusticus* in particular are known to feed on aquatic plants, benthic invertebrates, detritus, fish eggs, and small fish (Gunderson, 2008). Often the largest invertebrates in freshwater communities, crayfish can impact entire food webs by acting as important consumers and prey (Kuhlmann and Hazelton, 2007). Studies suggest that *O. rusticus* decrease resource availability, such as leaf organic matter and benthic invertebrates, which can negatively impact both native crayfish and fish populations (Bobeldyk and Lamberti, 2008).

Possibly the most serious impact caused by *O. rusticus* is the destruction of aquatic plant beds (Gunderson, 2008). *O. rusticus* can rapidly reduce or eliminate some species of macrophytes, even at very low population densities, reducing the overall biodiversity in invaded systems (Peters et. al., 2008). Due to their higher metabolic rate relative to other crayfish their size, consumption of aquatic plants can result in negative effects on available invertebrate habitat, shelter and nesting substrate for fish species, and erosion control (Gunderson, 2008).

Displacement of native crayfish species can occur through three mechanisms: direct competition, increased fish predation, and hybridization (Gunderson, 2008). *O. rusticus* compete with native species by excluding them from available shelters and out-competing them for food resources (Hill and Lodge, 1994). Competition for shelter can force native crayfish from hiding places, making them vulnerable to predation by fish. Fish will also typically prefer to prey on native species because *O. rusticus* have larger claws, thicker shells, and assume a more effective defensive posture than native crayfish (Gunderson, 2008). While *O. rusticus* are not known to hybridize with all other species of crayfish, they have been shown to hybridize with some, such as *O. propinquus* in Midwestern systems. The hybrid offspring are neither less reproductively successful nor less fit, and actually are considered more competitive than either parent species (Perry et. al., 2001).

In addition to displacing native crayfish (an important food source for native fish), *O. rusticus* are more likely to compete with juvenile fish species for benthic invertebrates than the native crayfish species. Fish will consume *O. rusticus*, but because of their thick shell and relatively low soft tissue composition, they are not as high quality of a food source as other crayfish, and may reduce fish survival (Gunderson, 2008). *O. rusticus* can also directly harm fish populations by attacking their nests and consuming eggs. Fish species like bluegill (*Lepomis macrochirus*) and pumpkinseeds (*L. gibbosus*) will often nest in the same vicinity as *O. rusticus*, and do a poor job of defending their nests, especially at night when *O. rusticus* are likely to be foraging (Wilson et. al., 2004).

<u>Economic Impact Potential is LOW to MODERATE</u>

Justification: The main negative economic impact of *O. rusticus* is their direct effect on sport-fish in invaded lakes. Keller et. al. (2008) showed that early management of *O. rusticus* in Vilas County, Wisconsin (which has been established by *O. rusticus* since the 1970s) could have prevented about $1,505,205 annually in damage to the fishery industry. This data was based on the value associated with reduced panfish populations, which is only one potential cost, but the easiest to quantify.

Preliminary results from an Oregon Department of Fish and Wildlife and Travel Oregon survey reported that in 2008 alone, sport fishing generated $783 million dollars on travel, recreation expenditures, and equipment for sport fishing (Columbia Basin Fish and Wildlife News Bulletin, 2008). The U.S. Fish and Wildlife Service reported that in 2006, only an estimated 5% of anglers in Oregon fished for panfish (USFWS, 2006a), compared to 24% in Wisconsin (USFWS, 2006b). While sport fishing is an important part of the Oregon's economy, fishing for species that have shown a negative relationship with *O. rusticus* do not constitute a large proportion of that income. It is uncertain whether the environmental destruction and changes in ecosystem dynamics caused by *O. rusticus* in lake and river systems would have a similar negative impact on fish species that are more important to Oregon's sport fishing economy, but it seems safe to assume some change in population structure would occur in invaded systems.

It has been speculated that *O. rusticus* might have a positive economic value in control of Eurasian watermilfoil (*Myriophyllum spicatum*), which forms dense mats and can adversely affect swimming, boating, and fishing in lakes. However, because Eurasian watermilfoil spreads and reproduces vegetatively, *O. rusticus* may actually perpetuate the problem due to their method of cutting plant stems as they feed. Additionally, plant communities disturbed by *O. rusticus* may be more susceptible to colonization by Eurasian watermilfoil (Gunderson, 2008).

Human Health Impact Potential is LOW

Justification: Lakes in Wisconsin and Minnesota that have been heavily infested by *O. rusticus* pose a minor risk to swimmers. Due to their large claws, conspicuousness during daylight hours, and general abundance, there is a higher potential for swimmers to be pinched by *O. rusticus* than by native crayfish (Gunderson, 2008). While a pinch from a crayfish may be painful, it is more of a nuisance than a serious health risk.

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Format

This pest risk assessment (PRA) is based on the format used by the Exotic Forest Pest Information System for North America. For a description of the evaluation process used, see Step 3 – Pest Risk Assessment under Guidelines at: http://spfnic.fs.fed.us/exfor/download.cfm.

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