



Aquatic Invasive Species (AIS) Control Plan: Rusty Crayfish

This control plan is a living document and will be updated, as needed, to reflect the status of the species within Pennsylvania.

Natural History

Description: Rusty Crayfish (*Faxonius rusticus*) are medium to large crayfish (maximum size is ca. 10 cm total length). This species typically contains a dark red spot on either side of the carapace.

Taxonomy

Common name: **Rusty Crayfish**
Family: **Cambaridae**
Species: *Faxonius rusticus*
Integrated Taxonomic Information System (ITIS) Serial Number **97424**

Note: Rusty Crayfish were formerly assigned to the genus *Orconectes* and assigned to *Faxonius* by Crandall and De Grave (2017)

Morphology: Rusty crayfish are generally similar morphologically to other members of the genus *Faxonius*. This species is typified by light brown to green or bluish body coloration with a dark red spot on either side of the carapace, an oval gap in closed chelae, and chelae tips with red or black bands (Durland Donahou et al. 2021; Figure 1). However, some individuals may lack this coloration (Glon 2016) or may have reduced and/or faded red spots (Hartzell 2019). Thus, identification of potential introduced populations may need to be confirmed by examining the gonopods of Form I (mating)

males. A further complication is that Rusty Crayfish may hybridize with native or other introduced congeners (Smith 1981). A smooth, unserrated mandible is typically diagnostic for this species in Pennsylvania (D.A. Lieb, pers. comm).



Figure 1. Rusty Crayfish. Source: National Park Service.

Origin: Rusty Crayfish are native to the midwestern United States within Illinois, Kentucky, Northern Tennessee, Western Ohio, and possibly extreme southern Michigan (Durland Donahou et al. 2021). This species is not native to any portions of Pennsylvania (Ortmann 1906; Lieb et al. 2011).

Food Preferences: Rusty Crayfish are generalists that consume a wide variety of aquatic organisms and detritus, including aquatic macrophytes and algae, gastropods, mussels, other crayfish and benthic macroinvertebrates, small fish, fish eggs, amphibians, and carrion (Prins 1968; Jezerinac et al. 1995; Klockner and Strayer 2004).

Reproduction: Individuals sexually mature at approximately 15 months of age, at about 18 mm carapace length (Prins 1968). Mating may occur in Spring or Fall, with females typically laying eggs in April and carrying eggs and then instars through May (Prins



1968; Jezerinac et al. 1995). Fecundity in females ranges from 42 – 257 eggs, and females display a positive relationship between body size and number of eggs (Prins 1968; Maberry et al. 2017). Mean egg count of 26 females sampled at a site in eastern Pennsylvania was 130 eggs (S.M. Hartzell, unpublished data).

Notable Characteristics: Introduced populations of Rusty Crayfish may exhibit faster rates of growth and higher survival than native populations of Rusty Crayfish; possibly due to hybridization with other members of the genus *Faxonius* (Sargent and Lodge 2014) as well as artificial selection of Rusty Crayfish propagated within the bait trade environment contributing faster growth rates, aggression, and larger body sizes than native populations (Pintor and Sih 2009).

Historic/Current Vectors: Rusty Crayfish are primarily thought to have historically been introduced via “bait bucket” introductions (Durland Donahou et al. 2021). Both historic and current vectors of spread in Pennsylvania are certainly primary through this vector (Lieb et al. 2011). Following introduction, Rusty Crayfish typically can spread throughout a watershed, but may be impeded by barriers such as dams (Lieb et al. 2011).

Preferred Habitat: Rusty Crayfish have been collected in a broad range of habitats, from small ponds to large lakes, and small streams to large rivers (Prins 1968; Olden et al. 2006). Optimal thermal preferences of this species suggest a preference for warmwater habitats (Muhndahl and Benton 1990).

Distribution and Status

Distribution: In North America, Rusty Crayfish have been introduced outside of their native range within at least 27 U.S. States (Figure 2) and three Canadian Provinces (Guiasu and Labib 2021).

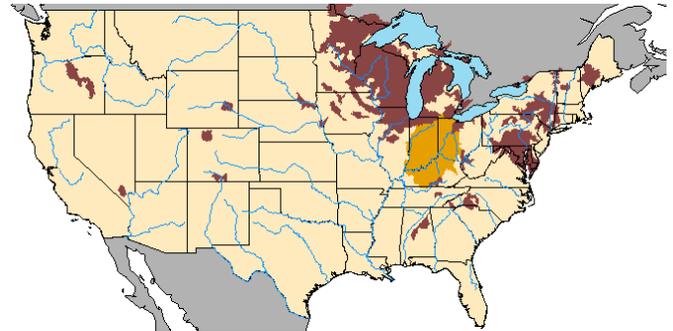


Figure 2. Distribution of Rusty Crayfish in the continental United States. Native range is shaded in yellow and introduced range is shaded in red. Source: USGS.

Within Pennsylvania (Figure 3), Rusty Crayfish are known from at least 21 counties. Populations are primarily known from the Lake Erie basin and parts of the lower Susquehanna and Susquehanna East and West Branch, and lower Delaware watershed. Records are also known from Slippery Rock Creek in Lawrence County and Pymatuning Reservoir in Crawford County (Ohio Drainage). Rusty Crayfish have also been collected from tributaries of the Potomac Drainage in Adams County.

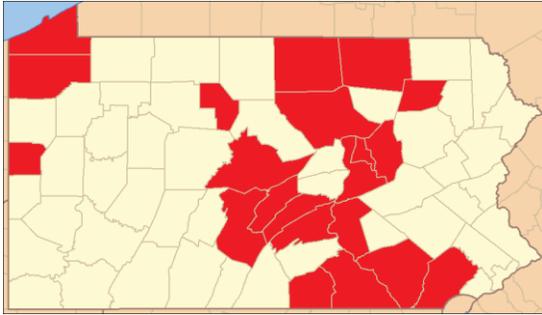


Figure 3. County-level distribution of Rusty Crayfish in Pennsylvania (April 2021).

Pennsylvania Legal Status: Rusty Crayfish are regulated with all crayfish species within 58 Pa. Code §71.6 and §73.1. It is unlawful to possess, introduce, import, or transport in or through the Commonwealth all crayfish species, except when they are either possessed and used as bait on, in or about the water from which taken or possessed or imported for testing and scientific purposes or restaurant consumption, adequate measures have been taken to prevent their escape and they are accompanied by documentation stating the point of origin and the destination to which they are to be delivered. The head of all crayfish species collected as bait must be removed above the eyes unless used as bait within the water from which they were taken.

Threats

Ecological: Numerous studies have demonstrated the negative impacts of Rusty Crayfish on native aquatic species. Rusty Crayfish may have significant impacts on macrophytes, native macroinvertebrates, and both small and large fish (Capelli 1982; Wilson et al. 2004; Kreps et al. 2016). Rusty Crayfish are well-known to displace native crayfish via competition and/or hybridization (reviewed by Bouchard et al. 2007). Within Pennsylvania, taxa of conservation concern most threatened by

Rusty Crayfish (and other non-native crayfish) include native surface water dwelling crayfish species such as the Spiny-cheek Crayfish (*Faxonius limosus*) and a currently undescribed member of the *Cambarus accuminatus* complex (Lieb et al. 2011). Rusty Crayfish can actively displace native Spiny-cheek Crayfish by predation and may also be a superior competitor for resources due to behavioral differences (Klockner and Strayer 2004; Hartzell et al. 2022). Klockner and Strayer (2004) also found that Rusty Crayfish consume native mussels; however, the potential impact of this species towards imperiled freshwater mussel fauna in Pennsylvania appears to be largely unknown. Rusty Crayfish populations in Pennsylvania are known to carry a fungal agent (*Aphanomyces astaci*), but this is thought to be a minor threat to other North American crayfish species (Butler et al. 2020).

Economic: Little information appears to be available regarding the economic impacts of Rusty Crayfish invasion. Most likely, economic impacts relate to the harm of fisheries caused by Rusty Crayfish. For instance, Rusty Crayfish may diminish the average size of sport fish such as Walleye via the displacement of forage fish (Kreps et al. 2016) which could contribute to increased economic costs in order to manage the fishery and some decrease in local economies supported by the recreational value of invaded waters. Rusty Crayfish may also decrease sunfish (*Lepomis sp.*) populations (Wilson et al. 2004), which are important recreational sport fish in Pennsylvania. Further studies assessing the potential ecological and economic impacts to Pennsylvania sport fisheries are needed.



Management

Management Goals: Rusty Crayfish are established broadly within portions of several major watersheds in Pennsylvania. Because little can be done following establishment of Rusty Crayfish in aquatic ecosystems, the primary goal should be to prevent the introduction of this species to novel watersheds.

Containment and Prevention Actions:

- Coordinate with appropriate agency partners to conduct early detection surveys within uninvaded waters, particularly those near introduced populations or at high risk of illicit transfer (e.g., popular fishing areas).
- Bolster public education efforts to acquaint the populace with the threats of non-indigenous crayfish such as Rusty Crayfish and means to prevent their spread. Because the spread of nonindigenous crayfish in Pennsylvania appears to be primarily via illicit bait release, specifically target anglers for education/awareness through presentations, literature, and targeted signage.
- Initiate/support research on the biology of Rusty Crayfish populations in the Commonwealth and the ecological and economic impacts of Rusty Crayfish towards native aquatic species in Pennsylvania, such as freshwater mussels and towards sport fishery resources.
- Because dams may provide barriers to the upstream dispersal of non-native crayfish species such as Rusty Crayfish (Lieb et al. 2011), coordinate with dam

removal planning activities to ensure that dam removal will not facilitate the spread of invasive crayfish.

- Strictly enforce crayfish regulations within 58 Pa Code §71.6 and §73.1.
- Encourage the incident reporting of aquatic invasive/nuisance species such as Rusty Crayfish within Pennsylvania. Online reporting can now be conducted at the following PFBC web site: <https://pfbc.pa.gov/forms/reportAIS.htm> as well as PA iMapInvasives at: <https://www.paimapinvasives.org/> and at the national level, USGS Nonindigenous Aquatic Species website: <https://nas.er.usgs.gov/SightingReport.aspx>

Rapid Response Options:

- Because control options for Rusty Crayfish and other introduced crayfish species are limited in scope and effectiveness and entail a long-term commitment of resources (see below) Rapid Response options are limited. Practical Rapid Response options toward new detections of Rusty Crayfish or other invasive crayfish species should consist of educational efforts to alert the public about preventing spread to other waters. This could be accomplished by press releases or other public announcements and/or posting signs along recently invaded waters.

Control Options:

- Intensive efforts consisting of long-term trapping and stocking of



predatory fish (e.g., Largemouth Bass) may be successful at reducing Rusty Crayfish populations in smaller lakes (Hein et al. 2007). However, this takes a substantial amount of effort and is limited to smaller lentic waterbodies.

- One unique Rusty Crayfish control effort in Pennsylvania is the annual removal of this species by dip-netting in the lower reaches of Valley Creek at Valley Forge National Historic Park (Wasler 2015). Intensive removal by park staff and volunteers over a five-year period (6,000 + hours of effort) was effective at maintaining a Rusty Crayfish biomass at approximately 20% of total crayfish collected (Wasler 2015). However, it is unknown if this effort provided any major benefit to mitigating ecological damages caused by this species.

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