# Crayfish Role: **Prey**

*Photo: Brocken Inaglory CC BY-SA 3.0*

- Over 200 animal species eat crayfish, including mammals, birds, reptiles, amphibians, fishes, and insects, like dragonfly larvae (DiStefano, 2005).
- Fish, such as bass, are especially prominent crayfish predators (Probst et al., 1984; Rabeni, 1992).
- A wide variety of other fish species, from brook trout to creek chubs, also consume crayfish (Newsome & Gee, 1978; Gowing & Momot, 1979).
- Crayfish are a vital food source for other important animals in freshwater ecosystems, such as the hellbender, an endangered salamander (Wiggs, 1976).

*Photo: Brian Gratwicke CC BY-SA 2.0*

- Crayfish are also consumed by many land-based animals including minks, raccoons, and wading birds (Baker et al., 1945; Toweill, 1974; Martin & Hamilton, 1985).

# Crayfish Role: **Consumers**

**Crayfish compete with other invertebrates, such as snails, for food. Crayfish also eat them!**

*Photo: Mlogic CC BY-SA 3.0*

- Crayfish are **omnivores**: They eat a wide variety of food items, from tiny phytoplankton to fish.
- Crayfish are also important **scavengers** of dead animals and dead plant matter, such as leaves.
- Crayfish eat producers such as algae (Goldman, 1973) and aquatic plants (Creed, 1994). Crayfish can eat so much algae and plant material that they strongly impact the densities of these organisms (Goldman, 1973).
- Crayfish also feed on many different types of invertebrate prey, including snails (Kreps et al., 2012), insects and their larvae (Parkyn et al., 2001), and even other crayfish (Nakata & Goshima, 2006).
- Crayfish also eat vertebrates such as fish (Rahel & Stein, 1988) and amphibians, especially their eggs and larvae (Axelsson et al., 1997).

# Crayfish Role: **Ecosystem Engineers**

**A burrowing crayfish peeks out of its burrow.**
*Photo: Mlogic CC BY-SA 3.0*

Crayfish can impact habitat quality for other organisms (Reynolds et al., 2013). This can happen through:

- **Burrowing**: Many species of crayfish build burrows. These create spaces that can be used by other organisms (Creed & Reed, 2004). Burrowing can also increase erosion rates (Statzner et al., 2000; 2003). Burrowing crayfish species can construct complex networks of tunnels and chambers deep into the soil. These can help water and gases to move, adding oxygen and draining soils (Richardson, 1983; 2007).
- **Consuming detritus**: Crayfish can also eat large amounts of leaf litter and other dead plant and animal matter (Huryn & Wallace, 1987; Schofield et al., 2001). The processing of detritus by crayfish can change the number of insect larvae, which can be an important food source for fishes and other aquatic vertebrates (Creed & Reed, 2004; Hoopes, 1960). Removing detritus can also help keep water clean.

# Impact of Invasive Crayfish: **Displacement + Loss of Biodiversity**

**An invasive red swamp crayfish**
*Photo: National Park Service CC 0*

Invasive crayfish are aggressive and fast-growing. This threatens native crayfish biodiversity. In fact, the introduction of nonnative crayfish may be the single greatest threat to global crayfish biodiversity (Lodge et al., 2000a).

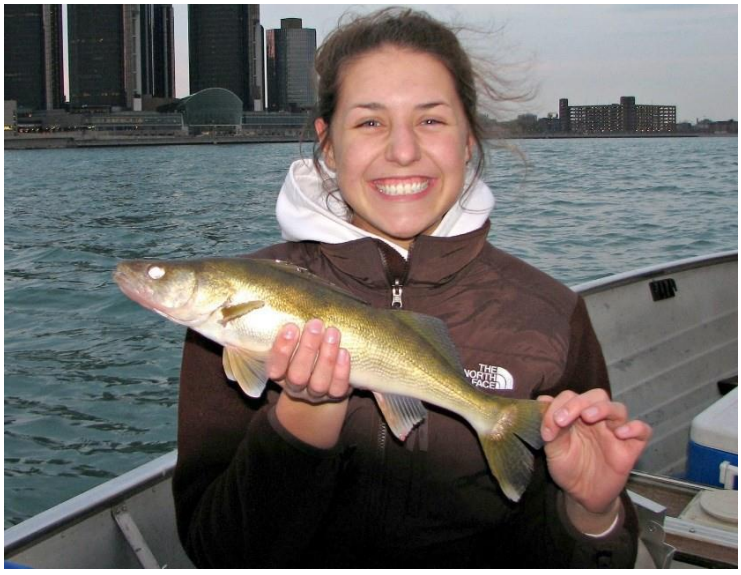
In the Great Lakes region, invasive crayfish such as the rusty crayfish (*Faxonius rusticus*), have displaced native species from large portions of their natural ranges (Momot, 1996; Taylor & Redmer, 1996; Olden et al., 2006).

# Impact of Invasive Crayfish: **Effect on Other Aquatic Invertebrates**

**A mayfly nymph: important food for fish**
*Photo: National Park Service CC 0*

- Invasive crayfish can cause populations of other aquatic macroinvertebrates (like insect larvae) to decline (Charlebois & Lamberti, 1996).
- Invasive crayfish have also been shown to reduce macroinvertebrate biodiversity in stream ecosystems (Stenroth & Nyström, 2003).
- A long-term study in Wisconsin showed a dramatic decline in snail densities after rusty crayfish were introduced (Wilson et al., 2004). The same study also reported big declines in insect species such as dragonflies and caddisflies.

# Impact of Invasive Crayfish: **Declines in Native Fish Populations**



**Humans and wildlife depend on native fish, like this walleye, for food.** *Photo: Pverdonk CC BY-NC 2.0*

Invasive crayfish can reduce native fish populations by:

- Competing with native fishes for similar prey species.
- Reducing the density of aquatic plants used by young fish as cover (Wilson et al., 2004).

Invasive crayfish may also reduce the breeding success of fish by eating their eggs (Dorn & Mittelbach, 2004).

# Impact of Invasive Crayfish:
# **Negative Impacts on Amphibians**

**A northern leopard frog**
*Photo: Brian Gratwicke CC BY 2.0*

Invasive crayfish have reduced native amphibian species around the world.

- For example, red swamp crayfish have contributed to the decline of some amphibian species by eating their eggs (Gamradt & Kats, 1996).
- In ecosystems where native crayfish are present, red swamp crayfish can consume amphibian eggs at a higher rate than native crayfish species (Renai & Gherardi, 2004).
- Invasive crayfish can also reduce food availability, which could impact amphibian growth and survival (Cruz et al., 2006).

# Impact of Invasive Crayfish:
# **Destruction of Aquatic Plants**

**Duckweed: a tiny but important aquatic plant**
*Photo: Mokkie CC BY-SA 3.0*

Aquatic plants provide habitat for fishes, amphibians, and aquatic macroinvertebrates.

- Crayfish can reduce biomass and biodiversity of aquatic plants (Lodge & Lorman, 1987; Wilson et al., 2004; Rosenthal et al., 2006).
- Invasive crayfish consume plant material at a faster rate than some native crayfish species.
- Such changes can strongly affect ecosystem structure and function. This could result in the decline or displacement of other species in freshwater ecosystems.
- Invasive crayfish can also reduce the density of aquatic plants used for cover by young fish (Wilson et al., 2004).

# Impact of Invasive Crayfish: **Disease Transmission**


**Signs warning of the dangers of disease transmission by invasive crayfish in Europe**
*Photo: Kevin Higgins CC BY-SA 2.0*

- Invasive crayfish can transmit diseases to native crayfish species. For example, crayfish plague *(Aphanomyces astaci)* has caused major population declines and range reductions in native European crayfish. The disease was introduced to Europe through invasive North American crayfish *(Lodge et al., 2000a)*.
- While introduced diseases have not yet been reported for native crayfish in the Great Lakes, the potential for disease transmission exists.
- A study in California showed that invasive crayfish lead to more mosquitoes and risk of mosquito-borne diseases: newsroom.ucla.edu/releases/invasive-crayfish-lead-to-more-mosquitoes-and-risk-of-disease-in-southern-california

# Introduction Pathway of Invasive Crayfish: **Bait**

**A bucket of live invasive red swamp crayfish**
*Photo: Defense Visual Information Distribution Service CC 0*

- Invasive crayfish sometimes spread when they are used as bait.
- Live crayfish that are left over after fishing are sometimes released.
- These “bait bucket” introductions are one of the ways non-native crayfish invade new areas (Ludwig & Leitch, 1996).

# Introduction Pathway of Invasive Crayfish: **Aquariums**

**A young blue crayfish in an aquarium**
*Photo: xcalibur8OP CC BY 3.0*

- Crayfish and other freshwater crustaceans have become increasingly popular as pets *(Chucholl, 2013)*. This is partly due to their striking colors.
- Live crayfish are transported across state borders, and even internationally, for the pet trade.
- Some crayfish can grow to a large size quite rapidly, leading to overcrowding or aggression towards other organisms in a tank. For this reason, crayfish pets are often released into nearby water bodies.

# Introduction Pathway of Invasive Crayfish: **Aquaculture**

**A crayfish farm**
*Photo: Natalie Maynor CC BY 2.0*

- Crayfish are grown and sold for a variety of purposes, including for food or for use as bait in recreational fishing.
- Aquaculture facilities that supply crayfish to food and bait vendors can spread invasive species such as red swamp crayfish.
- Facilities farming non-native crayfish can accidentally spread these species to nearby water bodies by overland migrations or during flood events.
- Even facilities that raise other organisms, such as fish in ponds, can risk transporting invasive crayfish if crayfish make their way into the ponds and then are accidentally included with shipments of live animals.

# Introduction Pathway of Invasive Crayfish: **Classrooms**

**Students hold invasive rusty crayfish in a classroom.**
*Photo: Jennifer England*

- Crayfish are used in classrooms as pets or as tools to enrich learning. This can lead to accidental or intentional release of live organisms, negatively impacting local environments.
- Red swamp and rusty crayfish are common in biological supply kits provided to teachers for science lessons. It is estimated that 25% of elementary schools in the US purchase and use live crayfish in their science classes (Patton, 2011).
- It is important to be aware of the alternatives to releasing classroom animals and plants into the wild. Even native crayfish species that are caught in the wild and brought into the classroom should never be re- released into the wild.