Dainties of the First Order

Susan B. Adams

The cray . . . is a handsome crustaceous animal certainly, and its whole tribe I consider as dainties of the first order.

—John J. Audubon

Crayfish—also known as crawfish, crawdads, mudbugs, and other colorful local names—figure prominently in human societies on several continents. In North America, many people carry fond memories of sitting by a lake, patiently catching enough crayfish on a line to fill a bucket, and later savoring the tails as a tasty, if small, appetizer. Others spent endless summer days turning stream cobbles to pursue crayfish just for fun or for bait. And there is nothing like a savory crawfish étoufée on a steamy New Orleans evening. Crayfish even provide the impetus for a good party. Crayfish parties are a highlight of late summer in Sweden and Finland, and a Texas crawfish boil makes for a fine get-together. Given their social importance, it's surprising how little attention is paid to their conservation status and role in natural ecosystems.

When I talk about my research in Mississippi, I often ask people how many crayfish species live in the state. Most guess two, as did John J. Audubon. The great naturalist and painter wrote in reference to the southern United States: "If I mistake not, we have two species at least, one more an inhabitant of rocky streamlets than the other, and that one by far the best, though the other is good, too." The correct answer is sixty-five.

While just a handful of species are typically used in aquaculture or harvested commercially, crayfish are a diverse group found throughout much of the world. Only the continents of Antarctica and Africa lack crayfish, though six species are native to Madagascar.

North America is the hub of crayfish diversity, with over 75 percent of the world's described species. West of the Rockies in the United States and Canada, the native crayfish belong to fewer than ten species in the family Astacidae, with two of those presumed extinct. East of the Continental Divide, from Canada down into Mexico, there are more than four hundred species of crayfish, all in the family Cambaridae, with 80 percent occurring in the southeastern United States. Many crayfish species occur only in a restricted area and are known as narrow endemics. In the southern United States, the species composition often changes dramatically from state to state and several species are known only from a single spring or well.

Crayfish are surprisingly variable in appearance. Although many are a dull brown, gray, or green, others are shiny black, brilliant blue or red, or even completely white. They also vary considerably in size. Australia (the country with the second-highest number of species) is home to the world's largest crayfish species and to its second-smallest. The amazing Tasmanian giant freshwater crayfish (*Astacopsis gouldi*) live in small rivers and reach weights of about eleven

pounds (five kilograms), with older accounts telling of behemoths weighing more than seventeen pounds (nearly eight kilograms). According to Todd Walsh of North West Waterwatch, who works for the conservation of these animals, an eleven-pound individual could break a person's arm with its pincers. Farther north in New South Wales lives a dainty, as-yet-undescribed species of *Tenuibranchiurus*. The largest specimen seen by Jason Coughran, an authority on this species, would fit nicely—pincer tip to tail—on my little finger.

Crayfish also occupy a surprising variety of habitats. In addition to lakes and streams, they live in seasonal wetlands, roadside ditches, springs, caves, and even relatively dry savannahs. Most crayfish have a tendency to burrow, but how they burrow varies widely. Many species dig at least a shallow burrow or hollow under a rock in times of drought or freezing temperatures. Others excavate fancier burrows that they typically occupy during at least one season every year. *Procambarus hayi*, for example, occupies open water in Mississippi from autumn through spring, but retreats to burrows for the summer, regardless of the availability of open water.

A number of crayfish, however, spend nearly their entire lives in their burrows. These burrows may or may not reach the water table or retain water all year and can be elaborate complexes as deep as nine feet (nearly three meters), with multiple tunnels and entrances. Most of these species emerge from their burrows occasionally during wet periods to find mates, forage, or release their young. Sometimes they can be found foraging in open water or prowling about terrestrial habitats on wet nights. But some may breed, forage, and even release young without leaving the burrow. Because of their reclusive habits, these crayfish are among the most mys-

The red swamp crayfish (*Procambarus clarkii*) can survive dry spells of up to four months. It is found in a wide range of habitats, including wet meadows and seasonal marshes. Photograph by Christian Lukhaup.

terious; their diets, their dispersal habits, and their interrelationships with other organisms are largely unknown. They could be important ecosystem engineers, with their burrowing activity influencing soil properties, plant communities, and other animals.

Crayfish in general occupy many trophic roles in ecosystems; they are truly omnivores. As Audubon noted, "They are absolutely little aquatic vultures . . . for they feed on everything impure that comes in their way, when they cannot obtain fresh aliment." They can denude lakes of aquatic plants and serve an important function in processing leaf litter in streams. By an order of magnitude, a robust crayfish population may shred more leaf litter than do aquatic insect shredders. The leaf matter can be digested by the crayfish or left behind as waste for other detritivores to use. Although they are known to eat plants, recent studies of crayfish in streams and ponds suggest that most of the food incorporated into their bodies comes from animals, including other invertebrates, other crayfish, and especially fish. Audubon was correct in his observation: many species will eat just about any flesh that comes along, no matter how nasty.

Their trophic associations, however, are not just one-sided. Crayfish are important food for many animals. They are the most important food source for smallmouth bass, shadow bass, and rock bass in much of North America and are eaten by other fish as well. Raccoons, river otters, mink, and other mammals, as well as birds, snakes, turtles, and frogs and other amphibians all dine on crayfish. Even aquatic insects such as dragonfly nymphs and predaceous diving beetles feed on crayfish.

With some exceptions, the conservation needs of crayfish have been given little consideration. Factors contributing to crayfish declines include habitat loss, pollution, disease, and invasive species. Habitat loss appears to be the major threat to the Tasmanian giant freshwater crayfish and is also particularly critical for species that spend most of their lives in burrows. The introduction of non-native crayfish is a major cause of native crayfish declines worldwide. Several North American species, including

A female crayfish generally carries her babies under her tail for a few weeks. The young molt twice or more before swimming free. Photograph by Christian Lukhaup.

Native to the American Pacific Northwest, the signal crayfish (*Pacifastacus leniusculus*) lives in creeks, rivers, ponds, and lakes. It has been introduced into Europe, where it is an invasive and damaging pest. Photographed in California by Edward S. Ross.

the red swamp crayfish (*Procambarus clarkii*) and the signal crayfish (*Pacifastacus leniusculus*) have been introduced throughout much of the world, and several Australian species are also widely introduced. The North American species are immune to, but carriers of, a crayfish plague that has eradicated many native populations throughout Europe. Transfers of crayfish within North America have led to the loss of native populations, apparently through predation and competition, as well as to the decline of fisheries in lakes of the upper Midwest. Intentionally or unintentionally, nonnative crayfish are introduced in many ways, including escape from aquaculture, use as live bait, and release of animals purchased as live food, pets, or research animals for school classes. The transport and sale of live crayfish is minimally regulated throughout much of the United States, leaving the door open for potentially disastrous introductions of crayfish from anywhere in the world.

State and federal natural resource departments are now taking an interest in crayfish and implementing the first conservation steps by documenting diversity and distributions. This basic but exciting development bodes well for the future of crayfish in the United States. As we learn more about the functional roles of crayfish in ecosystems, more people will come to recognize their value and step up to serve as advocates for their protection. In future years, people may marvel at the amazing lives in this diverse community of aquatic invertebrates, even while they enjoy a rich Cajun crawfish gumbo.

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