The California Freshwater Shrimp

A ghost-like crustacean we can't afford to lose

by Larry Serpa

Freshwater Shrimp / Photo by Larry Serpa

Why should we be concerned about a crustacean that is less than 2.5 inches long, and will never be abundant enough to serve on the top of a pizza? Even if you took the trouble to stick your head beneath the surface of the water, you probably wouldn't be able to see one as these creatures are elusive and hard to find. Would it really matter if they just disappeared?

Yes it would. Ecologically, the California freshwater shrimp occupy a role as detritus feeders that no other stream animal could fill. When you rip an important strand out of a food web, there's no way to know how much damage will be done. The shrimp's presence, or absence, can also tell us a lot about the streams. Flowing water is their home, and they are mute witnesses to the condition and history of the streams they inhabit. Continually bathed by the water, they must face whatever flows toward them. Pollution, siltation, introduced species, and other factors will all affect them to some extent. If they disappear, we can be sure that something detrimental has happened to the stream. We will have lost much more than just the shrimp.

California freshwater shrimp (*Syncaris pacifica*) live in lowland perennial streams in Sonoma, Marin and Napa counties. None have ever been found higher than 380 feet above sea level. Before human impacts, the shrimp were probably common in many streams within the three county area. However, a catastrophe which greatly reduces their population can now easily lead to their disappearance from a stream. Channelization, introduced predators, pollution, and water withdrawal have subsequently eliminated them from most of the original habitat, and made re-colonization of streams difficult. By the time biologists began to study the crustacean, they were only known to occur in nine streams. In 1964, the shrimp were eliminated from Santa Rosa Creek, when the stream was channelized and lined with concrete for flood control purposes. By 1975, shrimp were thought to have disappeared from five more streams, apparently leaving populations only in East Austin and Salmon Creeks in Sonoma County, and Lagunitas Creek in Marin County. The closely related Pasadena Freshwater Shrimp (*Syncaris pasadenae*), a native to southern California, disappeared forever in the 1930s. Extinction now also threatened the only remaining species in the

genus! Recognizing this danger, California freshwater shrimp were listed as endangered by the California Fish & Game Commission in 1980.

Fortunately, new populations were discovered in Sonoma Creek in Sonoma County and Huichica Creek in Napa County by 1981. During a subsequent distribution study of the species in the early 1980s, I sampled 146 sites in 53 potential streams, and found the shrimp in six additional streams: Big Austin, Green Valley, Jonive, Yulupa, and Blucher creeks in Sonoma County, and Stemple and Walker creeks in Marin County. However, the populations in many of these streams are small and could disappear even without any additional impacts. For example, only one shrimp was found in Walker Creek, even though several miles of the stream had been waded and sampled with nets. The shrimp were listed by the U.S. Fish & Wildlife Service as endangered in 1988. Since that time, shrimp have been found surviving in the Napa River and its Garnett Creek tributary, Keys Creek (a tributary of Walker), and Redwood Creek (a tributary of Jonive). A total of eleven separate stream systems (sixteen streams) are inhabited, but the future of the species is still uncertain. Thousands of shrimp live in Lagunitas, Salmon, and Blucher Creeks, but even in these streams, a single toxic spill could wipe out the bulk of the population.

The shrimp are found within stream pools, in areas away from the main current, where there are often undercut banks, exposed root systems, and vegetation hanging into the water. They need all of these habitat components for survival. The best habitats have a mixture of willow and alder trees. Some of the shrimp streams are completely enclosed with streamside vegetation, while others have just a few scattered trees along the banks. In the latter case, dark, shaded water is necessary to help protect them from visual predators. Too little or too much water in the stream can present a problem. Most shrimp are found in areas that are one to three feet deep. For the most part, only the sides of the pools are utilized. Shrimp avoid the pool bottoms, and are only found there after being disturbed, or when populations are especially high.

Filamentous blackberry roots sprout from stems wherever they extend beneath the surface, and form an ideal refuge most of the year. At times of higher flow, though, these roots tend to be lifted out of the stream by the rising water, and left in a useless tangle above the bank when the water recedes. Dense, beard-like willow roots, often extending more than a foot out into the water, are more dependable. Alders provide both short filamentous roots, and the coarser hard roots that support the stream banks. As the bank soils partially erode from the force of the current, a network of the rigid roots is exposed. Overhanging the undercut banks, these roots reduce the erosive power of the water, and protect the banks from further damage. The roots form a useful highway system for the shrimp. During the heavy flows of water accompanying storms, the shrimp abandon the softer vegetation and travel close to these sturdy roots, or even move within the undercut banks for protection.

California freshwater shrimp are detritus feeders, feeding on the buffet of small, diverse particles brought downstream to their pools by the current. As the water slows, the particles are filtered out by the exposed roots and other vegetation. The shrimp simply

brush up the food with tufts at the ends of their small claws, and lift the collected morsels to their mouths. Much of this material is picked up indiscriminately, and contains indigestible material along with the more edible items. To get enough useful food, the shrimp have to eat a lot of this detritus. Larger pieces of detritus are picked up or manipulated with the claws. Colonized by algae, bacteria, fungi, and microscopic animals, the particles are more nutritious than they seem. Although shrimp usually walk slowly about the roots as they feed, these crustaceans will undertake short swims to obtain particularly tasty items. In laboratory studies, the shrimp became highly agitated whenever “Tetramin” flake fish food was added to the water. They walked or swam about the aquarium tank until they located a flake, and then broke it into manageable pieces with their claws.

Most of the shrimp are translucent, almost ghost-like, with colored flecks scattered across their bodies. This semi-transparent nature provides ideal camouflage from most native predators, such as salmonid fish. When startled by a potential predator, they remain motionless. Even the intestinal tract, crammed full of detritus, just looks like another root. Some of the large females sport a more dramatic coloration of a deep chocolate brown with a tan dorsal stripe, which serves to camouflage them well against the thick alder roots, or while they hide inside the darkened undercut banks. Non-native fish such as bluegill and bass are not fooled by all this camouflage, since they carefully search vegetation for prey. If grabbed by a predator, a shrimp fights back. With a dramatic flexing of its body, a shrimp can jam its unicorn-like rostral spine into the roof of a fish’s mouth with considerable force, and the pain can cause the fish to spit it out or permit it to escape. Shrimp found with broken spines have probably survived such an encounter. Most of the shrimp that find themselves in a sunfish’s mouth, though, are soon swallowed. Whenever these voracious introduced predators show up, the shrimp population in a stream is in serious trouble.

Although the shrimp breed in September, the females retain the 50-120 fertilized eggs on their abdominal swimming legs throughout the winter. This adaptation insures that the juveniles do not have to face the heavy stream flows of the rainy season. Instead, the females protect the delicate eggs with their own bodies during this perilous period. The young shrimp are finally released as miniature adults in late Spring, after the rainy season is almost over, and the streams are carrying much less water. In this more hospitable environment, the young grow rapidly. California’s prolonged summer drought cuts the stream flow even more, and some shrimp streams are reduced to isolated pools in late summer and fall. As temperatures rise and oxygen diminishes, trapped fish begin to die. This is still good habitat for the shrimp, though, and the dead fish are simply treated as food. As long as some water remains in the pools, the shrimp can survive. The following winter these young shrimp will have to get through a rainy season on their own. They must be about a year and a half old before they in turn are mature enough to breed. Many will be eaten or die of other causes before they reach that age. A few lucky individuals will live for as long as three years. Overall, the California Freshwater Shrimp is a hardy species, and the remaining populations will not give up easily.

The shrimp are not alone in their fight for survival. Dr. Joel Hedgpeth, who studied the shrimp when they were still abundant, has always been a strong and vocal champion of the species. The Marin Municipal Water District regulates the flows in Lagunitas Creek from an upstream dam, insuring that the shrimp have the water they need. Lagunitas is the only shrimp stream on federal and state land, all others are in private ownership. However, private owners have already done a lot for the shrimp. At Blucher Creek, The Nature Conservancy has worked with landowners along the stream to protect and improve their habitat. In a similar manner, the Napa Resource Conservation District interacted with landowners and managers of Huichica Creek to develop the Huichica Creek Natural Resource Protection and Enhancement Plan. Through its implementation, pesticide and sediment movement into the stream has been reduced, and water is only taken out of the stream at times of heavy flow, with screens on the intake structures to prevent shrimp from being sucked along with the water.

Finally, the incredible efforts of the students of Brookside School and their Shrimp Club must be recognized. These elementary school students adopted this endangered species in 1993, and have worked diligently on its behalf ever since. They have helped educate the surrounding landowners, legislators, and general public about the species. In the process, they have also raised over a hundred thousand dollars, and used the funds and their own hands in the work of stream restoration at Stemple Creek. It is reassuring that so many people have come together to help preserve this small crustacean. With this much effort and good will, we can be reasonably confident that the California Freshwater Shrimp will not follow the Pasadena Shrimp into extinction.

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