

Shrimping for answers in the lake

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Anglers were ecstatic in the 1960s while fishing in the west arm of Kootenay Lake in British Columbia. Kokanee salmon had never been so plentiful or so plump. Who would have believed that a half-inch invertebrate, the opossum shrimp (*Mysis relicta*), planted in the early 1950s, would allow the kokanee population to gorge themselves as if partaking in an "all you can eat" buffet line?

Originally planted to enhance the appetite of rainbow trout, opossum shrimp boosted the annual kokanee catch from a few thousand fish in the early 1960s to a peak of 110,000 fish in 1975. The successful shrimp introduction model in Kootenay Lake didn't go unnoticed by the popular press, anglers and scientists.

As a result, between 1968 and 1976, fishery managers in the western United States were inspired to plant this shrimp in hundreds of lakes, including Whitefish Lake, Ashley Lake and Swan Lake. Shrimp later drifted downstream into Flathead Lake, where they were first collected in 1981.

What fishery managers didn't understand at the time was that the success found in the west arm of Kootenay Lake was based on some very unique hydrology and lake topography that made the shrimp available to kokanee as a food item. They also didn't understand how different fish communities would react to shrimp introduction or consider other ecosystem processes.

Like all good things that come to an end, the kokanee fishing on Kootenay Lake crashed in the late 1970s. Fingers were pointed at over fishing, degraded stream spawning conditions and a change in the amount of nutrients that entered the lake.

Unlike the delayed negative effect on Kootenay Lake, the introduction of shrimp into many Montana lakes has produced an immediate consequence, and we now find ourselves locking horns with a small, but smart critter.

The shrimp have evolved and adapted a unique behavior to ensure their survival. During the day, the shrimp locate themselves in the dark waters of the lake bottom, where they are better able to avoid predation. At night, the shrimp migrate up in the water column and feed on the plentiful zooplankton near the water surface. Unfortunately, this is the same zooplankton that kokanee rely upon for their food source.

As a result, kokanee populations have been wiped out, and westslope cutthroat trout populations have suffered. Food-web dynamics have shifted to favor bottom-dwelling (benthic) fish species like lake trout and lake whitefish.

This shift is most apparent in Whitefish Lake and Flathead Lake. In Flathead Lake, prior to the establishment of shrimp, kokanee represented more than 90 percent of the fish harvest. By 1992, no kokanee were harvested and lake trout comprised more than half the catch.

Native fish like westslope cutthroat trout and bull trout continue, albeit barely, in the midst of competition from introduced species and environmental degradation to just hang on. Collectively, these two species have only comprised about 5 percent of the total catch from the 1960s through the 1990s.

Kokanee and opossum shrimp do co-exist in some area lakes, like Ashley Lake and Swan Lake (sometimes with hatchery support), with varying success, but generally these lakes don't have lake trout, which benefit from both shrimp and kokanee as food items.

While it would be easy to use opossum shrimp as a "smoking gun" for the disappearance of a popular fishery, other impacts in Northwestern Montana may have played a role in making the kokanee more susceptible to competition from opossum shrimp. Cumulative effects from water level fluctuations from hydroelectric dams, increased fishing pressure, nutrient enrichment and shoreline alteration are all factors that need to be considered.

Fish are not the only species that have been affected. The once popular recreational activity of viewing bald eagles, feasting upon the spawning kokanee during the fall on McDonald Creek in Glacier National Park, has been forever lost. Ducks, mink, otters and bears have also lost an important food source.

So what does this mean for Whitefish Lake? Each lake is unique, based on its physical, chemical, biological and social variables. Therefore, it is hard to draw conclusions for one lake based on the conditions found in another lake.

The opossum shrimp introduction is a classic example of this. The first step will be to determine the life history of the shrimp in Whitefish Lake and how they interact with the food chain.

We do know that the scientific community has not found an effective method for removing the shrimp, especially in large, deep lakes.

Scientific understanding and resource management has become more sophisticated since the 1960s and 1970s, and if we can apply knowledge from our past mistakes, future scientific discovery will provide a road map to guide the management of our lakes.

Next month, Lake Line's article, "An identity crisis for Charles Dickens and bull trout," will begin a three-part series about bull trout, a federally-listed threatened species under the Endangered Species Act.

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