Shrimping for Answers

Mike Koopal, Founder and Executive Director
Whitefish Lake Institute

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 instead 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 un-noticed by the popular press, anglers and scientists.

Source: NOAA Great Lakes Environmental Research Laboratory, 2009

Mysis relicta

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 hydrogeology (groundwater upwelling) 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.

The shrimp have evolved and adapted a unique life strategy 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 juvenile cutthroat trout and kokanee salmon rely upon as a food source. As a result, most local kokanee populations have been decimated 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 over 90 percent of the fish harvest. By 1992, no kokanee were harvested and lake trout comprised over half the catch. Native westslope cutthroat trout and bull trout comprised only about 5% of the total catch from the 1960s through the 1990s.

While it would be easy to use opossum shrimp as the only scapegoat for the disappearance of popular native species, other impacts in the Flathead Watershed have played a role in reducing populations. Cumulative effects from water level fluctuations from hydroelectric dams, nutrient enrichment, shoreline alteration, increased sedimentation, and fragmentation of key habitat areas are among some of the factors that need to be considered. Fish are not the only species that have been affected by the opossum shrimp introduction. The once popular recreational activity of viewing congregations of bald eagles swooping down to clutch spawning kokanee during the fall on McDonald Creek in Glacier National Park, has been forever lost. Without the salmon, terrestrial species like mink, otters, and bears have also lost an important food source.

We do know that the scientific community has not found an effective method for removing the shrimp, especially in large, deep lakes. The lesson of this story is that it is extremely difficult to remove or suppress an introduced species once established. 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 and fisheries.

Source: Mae Koopal, 2007

Mike Koopal collecting water quality data in the Whitefish area