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NEW WEST FEATURE

How Non-Native Shrimp Transformed The Ecosystem at Montana’s Flathead Lake

A recent study highlights how the introduction of the opossum shrimp in the 1960s and 1970s created a ripple effect in Flathead Lake that continues today. It’s a thorough survey of how a single wildlife management decision can change an entire ecosystem.

By Brendon Bosworth, 1-21-11

The opossum shrimp, *mysis diluviana*, is a seemingly innocuous creature. So named because females have a pouch on their underside in which they store their developing eggs and offspring, these shrimp are less than an inch in size. But, as detailed in a recent paper published in the Proceedings of the National Academy of Sciences, the nonnative crustaceans have had a major impact on Montana’s Flathead Lake, altering the entire food web and increasing the amount of algae in the lake.



Flathead Lake. Photo by Flickr user [endbradley](#).

The growth of algae increased by 21 percent in 1986, the same year the shrimp population hit its peak, according to the researchers. It has not declined since. This represents a “whopping change” for a lake like Flathead, which is characterized by low nutrient levels and low plant growth, says study co-author Jack Stanford, director of the Flathead Lake Biological Station. “And it wasn’t caused by pollution; it was caused by the change in the food web.”

This sea change began with fisheries managers, who introduced mysis into five lakes upstream from Flathead between 1968 and 1976. They assumed the shrimp would provide food for kokanee salmon, which had been planted in the lake system, along with other nonnative species, in the 1920s, according to the study. Instead, it turned out the mysis were hungry for the kokanee’s food: large types of zooplankton called cladocerans, also known as water fleas.

The mysis population boomed in 1985, hitting its apex in 1986. It then backed off considerably and now fluctuates around roughly one third of its peak level, according to the study. During the boom, the shrimp devoured the kokanee’s food source and triggered a major change in the delicate ecosystem: an explosion in lake trout numbers.

Popular sports fish and fierce fish-eating predators, lake trout were introduced 80 years before the mysis set their spiny legs into Flathead, according to the study. However, since young lake trout feed at the bottom of the lake, where there had previously been little food, their numbers had remained low. Mysis dwell on the bottom of the lake during the day, only migrating upward at night to feed, so they are an easy source of food for young lake trout.

“The baby mysids hatch out at the same time the baby lake trout are looking for forage – and there they are,” says Stanford. He says the increasing number of intermediate size lake trout preyed on the remaining kokanee juveniles and “just hammered them.”

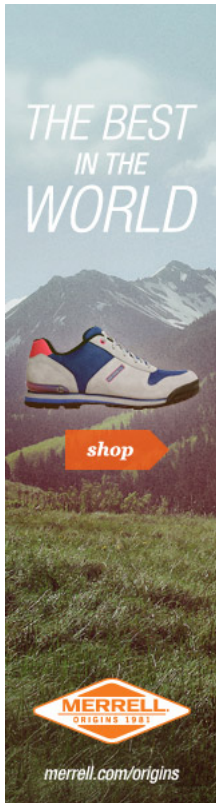
After the mysis explosion kokanee disappeared, bull trout declined, and lake trout came to be the dominant top predator, according to the study.

This led to an increase in algal production because the shrimp ate up larger zooplankton, decreasing their levels and allowing smaller types of zooplankton to proliferate, Stanford explains. He says this changed the way the zooplankton “mow the lawn,” or consume algae: smaller zooplankton are less efficient consumers and allow algae room to grow.

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Native Trout Under Threat

The current population of lake trout is roughly 400,000, says Barry Hansen, a fisheries biologist with the Confederated Salish and Kootenai Tribes and study co-author.

Together with Montana Fish, Wildlife and Parks the CSKT is responsible for managing the fisheries of the Flathead Lake and River System and protecting threatened native fish species, including bull trout and westslope cutthroat trout.

"All the evidence, which is very strong, shows that lake trout are the limiting factor for bull trout," says Hansen.

He says the bull trout numbers have remained the same since 2000, even though regulations for the predatory lake trout have been liberalized and the CSKT has subsidized fishing contests (Mack Days) to help curb the lake trout population.

Last year these contests harvested 49,000 lake trout, but this hasn't put a large enough dent in the population, says Hansen.

The CSKT is currently working on an environmental assessment, which will provide a template for future management work, says Tom McDonald, division manager for CSKT's Fish, Wildlife, Recreation and Conservation Division.

Hansen says the CSKT is looking at a range of lake trout reduction targets, between 25 percent and 75 percent. The Mack Days contests will continue, while additional methods for curbing the population could include putting a bounty on lake trout, allowing commercial fishing, or making use of trap nets or gillnets - with the catch likely donated to food banks, he says.

Flathead Saved by its Pristine Source, For Now

Despite high levels of algae, Flathead is still far cleaner than other lakes close to heavily urbanized and agricultural areas, because most of the water that feeds into the lake comes out of the pristine Glacier National Park and its surroundings, explains Stanford.

If there were more nutrients, such as phosphorous and nitrogen, in the lake, this would also stimulate algal growth, he says.

While phosphorous levels are declining, because of an upgrade to the local sewage treatment plant, nutrient loads will need to be kept low in future, especially as the valley fills up with people, he says.

At the same time, the amount of nitrogen in the atmosphere, much of which ends up in lakes and rivers, is increasing around the globe, as a result of "cars, fires, and wood burning of all sorts."

"We're seeing dramatic increases in nitrogen loading," he says. "So when the phosphorous loading trend reverses and catches up that'll be the big problem, assuming we don't get zebra mussel [an invasive species that has taken over the Great Lakes] or a really bad invader."

While the future might hold unexpected outcomes, for now fisheries managers have their hands full dealing with the legacy of shrimp and a misinformed decision from the past.

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It's incredible how stupid so many fishery managers and fishery agencies are. What did these guys major in, political science?

By george everett, 1-29-11

The story stops short of the truly tragic result of this self-inflicted disaster. Those of us who still remember the gathering of hundreds of migrating bald eagles at Apgar every fall that failed to return when the kokanee disappeared, still shed a tear when we think about those little shrimp bastards.

Nowadays migrating eagles gather to rest and feed near Helena but in much smaller numbers.

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