From Ruin to Recovery

By Jim Johnson, retired Michigan DNR fish biologist

Lake Trout is the top native offshore predator of Lake Huron, and Walleye the top nearshore predator, especially in the Saginaw Bay area.

Both species supported commercial Great Lakes harvests of 10s of millions of pounds annually from the 1830s to the 1940s.

By the late 1940s, Lake Trout and Walleye had collapsed, succumbing to a combination of overfishing and depredation by the invasive Sea Lampreys, which had become Lake Huron's largest aquatic vampire. And in the case of Walleye, the pollution of the Saginaw River and Saginaw Bay was a major cause of their decline.

Like Lampreys, the Alewife colonized Lake Huron by way of navigation canals that bypassed Niagara Falls.

Lake Trout and Walleye had been dominant, top predators in lakes Huron and Michigan. As long as they reigned, the whole ecosystem was stable. In ecological terms, Great Lakes fish communities were “balanced” with the predators (the hunters) balancing prey (the hunted). Lake Trout and Walleye were the “keystone” predators, that groomed the lakes’ prey populations and prevented them from becoming too abundant.

But Sea Lampreys were the final nail in this remarkable fishery’s coffin. The other two ‘nails’ were the incredible amount of commercial fishing going on at the time, and extreme pollution of Saginaw Bay and the Saginaw River system where Walleye once thrived. Their combined effects decimated Lake Trout and Walleye, leaving a void where predators used to be and an opportunity for invasive species like Alewives.

In other words, the absence of keystone predators caused an imbalance between predators and prey which enabled explosive growth of the invasive Alewife and Rainbow Smelt populations.

By the late 1960s, some scientists described lakes Michigan and Huron as "Alewife soup". During the 1960s and 1970s, in Lake Michigan alone, there were an estimated 175 **billion** Alewives. But what caught everyone's attention was the annual spring die-off of alewives.

In 1967, 20 billion dead Alewives washed up on the Michigan shore of Lake Michigan. A pile of dead alewives, a foot high and 300 miles long, went essentially from Chicago to Mackinaw City. Important tourist destination beaches were deemed unsanitary and were closed. Repercussions to the tourist-based economy of coastal communities were enormous.

And there were similar problems on Lake Huron, though not as noticeable to Michiganders because prevailing winds blew most of the dead Alewives over to the Canadian side.

This is what happens when prey fish die of old age. Prey fish are meant to be eaten by bigger fish. They have the reproductive capacity to feed millions of pounds of predators in the Great Lakes. But in the late 1960s, without those predators, that fecundity was unleashed on Michigan's beaches.

Recovery would require four fundamental ingredients:

Sea Lamprey control

The Great Lakes would be mired down with dead prey fish unless something could be done about the Sea Lamprey. Fortunately, scientists at the Hammond Bay Biological Station, after screening over 6,000 compounds, discovered that the pesticide 3-trifluoromethyl-4'-nitrophenol - or "TFM" - would selectively kill sea lamprey larvae without significantly harming other plants or animals, or having any long-term impacts on the ecosystem. Sea Lamprey, like salmon, migrate up tributary streams to spawn, the adults die after spawning, and the juveniles spend several years in the tributaries before transforming into parasitic adults. This was their weak link: treat a few dozen spawning tributaries each year and you can suppress the Sea Lamprey population of Lake Huron. There was just one rub: one of those tributaries is the St. Marys River, the channel that drains Lake Superior into Lake Huron. Gaining control of the St. Marys River would take further research and investment.

Sea Lamprey suppression was the first of four essential ingredients to restoring Lake Trout and Walleye. And for the past 50 years, it's been a key part of fisheries management in the Great Lakes.

Improve regulation of commercial fishing

But Sea Lamprey control was only the first step toward restoring predator-prey balance to the Great Lakes. The resource agencies could not hope to restock the Great Lakes when the lakes were saturated with gill nets. In 1966, 73,000 miles of gill nets were fished in Michigan waters of the Great Lakes, enough to go around the Earth 2.9 times! It would be pointless and a waste of tax dollars to stock fish that would only end their lives in gill nets, dead before they had the opportunity to mature and spawn.

The gill net is a nonselective type of commercial fishing gear: the fish caught in them are likely to die because, as their name implies, the nets work by entangling the fish by the gills, which can damage the delicate gill filaments or cause suffocation. Thus, commercial fishers couldn't release fish that they weren't entitled to and expect them to live.

Thus, in 1973, the DNR proposed banning gill nets in most of Great Lakes' waters (Other states, Ontario, and the tribes chose to take a different approach to gill nets). This did not mean an end to commercial fishing; the solution was to require the fishery to convert to trap nets. The trap net, like an underwater corral, holds fish alive in a confined area. The "pot" of the trap can be raised to the surface and the fish removed and sorted. The commercial fisher can release both

undersized fish and species that they might not be entitled to, such as protected Lake Trout, Walleye, various salmon, and Lake Sturgeon.

Now the resource agencies could begin restocking the Great Lakes with predators.

Massive restocking efforts

This would require hatcheries that in the 1960s were simply not up to the task. Lakes Michigan and Huron, combined, are huge – about 25,000,000 acres. To stock just one yearling Lake Trout per acre would cost about half the budgets of Great Lakes fisheries resource agencies on those lakes. Plus, there were not enough Lake Trout or other eggs available. Then Fisheries Chief Dr. Howard Tanner learned that there were surplus salmon eggs available from the states of Washington and Oregon. Thinking maybe it takes an ocean fish to prey effectively on Alewives, also an ocean fish, Dr. Tanner jumped at the opportunity. But would Chinook or Coho salmon from the Pacific Ocean survive in fresh water? And would they feed on Alewives or would they prey on other more valuable species? The Governor had just pleaded with the DNR, after the massive 1967 Alewife die-off, to "do anything" that might bring the Alewives under control and restore Michigan's beach-based tourism, so Dr. Tanner went for it. This, at the time, was a huge gamble. On the plus side, Chinook Salmon were inexpensive to raise; it cost about the same to raise 6 fingerling Chinook Salmon as one yearling Lake Trout. It took 20 years for a Lake Trout to eat enough alewives to reach 20 pounds. A 20-pound Chinook Salmon was only 3 years old. The Alewife-eating-capacity of salmon was many times that of the native Lake Trout. On the downside were the unknowns and potential unintended consequences of an introduced species from elsewhere.

Here is how Dr. Tanner described the decision to stock Coho Salmon in an interview in 2008*.

> *"A problem is really an opportunity to make something better. And so, the Alewife problem wasn't really a problem. It was a wonderful food supply."*
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> *"I got a call from the West Coast, and for the life of me, I can't remember who it was. He said, you know, there's a surplus of Coho eggs? And it knocked me right off my chair. And I went home that night and couldn't sleep."*
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> *"And there it was. There was a fish that could utilize the Alewife."*

Now the agencies could begin restocking the lakes.

What ensued was one of North America's largest-scaled, successful keystone predator recovery projects.

Control the excessive number of Alewives

The fourth and final issue facing ecosystem restoration of the Great Lakes was to control the excessive number of Alewives in the lower lakes (Alewives were scarce in Lake Superior). Chinook and Coho salmon were stocked each year after 1966. And they did eat Alewives. And at first, they grew exceptionally fast on this cornucopia of prey. On the West Coast, their native range, mature Coho average 8 to 12 pounds. But Lake Michigan fish were commonly coming in

at 16 to 20 pounds. Chinook Salmon seemed to be perfectly designed to prey on Alewives, reaching 20 to 35 pounds, with one recorded at over 40 pounds.

But until 2004, Alewives continued to hamper recovery of Lake Trout (Prescription for Lake Trout Recovery) and Walleye (Walleye Recovery and Saginaw Bay) and suppressed reproduction of the introduced salmon. They did this by feeding on the young of Walleye and Lake Trout and causing serious vitamin deficiency in trout and salmon. The invasion of the Great Lakes by Zebra and Quagga Mussels finally brought the Alewives down, nearly eliminating them from Lake Huron and reducing their numbers in Lake Michigan. The mussels reduced Alewife populations by efficiently filter feeding, which decreased the availability of plankton to Alewives. While suppressing invasive Alewives benefited the native Walleye and Lake Trout, the loss of plankton to mussels proved to be devastating to other fish such as Lake Whitefish and Chinook salmon.

*Video documentary: “Lake Invaders, the Fight for Lake Huron” https://www.lakeinvaders.com/Lake_Invaders.html . Interview by John Schmit, Grand Valley State University.