



Introducing
the
Frost Fish

Biologists work to restore an Adirondack native



DEC fish & wildlife technicians Jennie Sausville and Adam Kosnick tend a trapnet on icy Lower Cascade Lake in Essex County, hoping to catch spawning frost fish.

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photos by James Clayton

Pulling in the gill net one November morning, I began to get excited as a flash of silver caught my eye—a possible sign that frost fish were present in this lake. I'd been working in the Adirondacks for months, trying to identify waters containing this once plentiful fish species, and I was hopeful that today I had some proof that they were still here. Looking down at the net, my excitement grew as I counted more than a dozen frost fish! It was going to be a good day.

Classified as a state endangered species since 1983, the native round whitefish (or frost fish) had once been found in more than 80 Adirondack lakes, but by 2006 was only known to exist in seven of these historical waters. A Cornell Post-Doctoral researcher, I was assisting with a research project by the New York State Department of Environmental Conservation (DEC) to discover the reason for this fish's dramatic population decline and to see whether the recovery plan developed in 1989 was working. This day we were on Buck Pond, a 19-acre lake located south of Stillwater Reservoir and west of Big Moose Lake, in Herkimer County. It was one of the lakes DEC stocked with round whitefish, and the three- and four-year-old fish I just netted were a positive sign the recovery program was helping.

Officially known as round whitefish (*Prosopium cylindraceum*), these medium-size fish are known to many as "frost fish" because they spawn late in the year (November and December), sometimes under the ice. They are olive-brown on top, shading to silver below. Their bodies are long, tubular and nearly round, and their heads are short with small, inferior (snout extends beyond lower jaw) mouths.

Frost fish prefer cold northern lakes, and are an indicator of excellent water quality. They are bottom feeders, eating a variety of invertebrates including mayfly larvae, small mollusks, crustaceans, fish and fish eggs.

Frost fish were held in high esteem during the late 1800s and early 1900s. In fact, early reports from the New York Commissioners of Fisheries spotlighted this importance:

"Give any of the old guides or fishermen of the Moose River Chain his choice between a trout and a frostfish and the chances are 9 to 10 that he will choose the frostfish..." (1882)

"Frostfish [are]...greatly prized by the public...valuable not only for human food, but also for feeding large trout and other game fishes." (1906)

Because of the reverence many people had for round whitefish, more than 10 million round whitefish sac-fry (very small fry) were stocked into a number of Adirondack lakes and ponds prior to 1900. But with the onset of World War I, the state changed its fish culture operations to focus on species like trout, which were easier to catch for dinner. Because round whitefish have very small mouths, anglers do not easily catch them, so their propagation was abandoned during and following the war. In 1933, the state streamlined their hatchery operations, including shutting down the Fulton Chain Hatchery in Old Forge, the last hatchery to raise round whitefish fry. The era of round whitefish stocking came to an end.

In the years that followed, round whitefish populations rapidly declined. By 1979, surveys conducted by DEC

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found them in only 14 Adirondack waters. By 1997, this had dropped to three.

Why did round whitefish disappear from so many Adirondack waters, but not from waters of Maine, Ontario, Quebec and in the upper Great Lakes? Studying DEC's extensive historical records, biologists have come up with several possible explanations for the fish's decline.

The single largest reason for the disappearance of round whitefish populations may be the presence of non-native species, specifically smallmouth bass, yellow perch and rainbow smelt. All three species have been widely introduced into many Adirondack waters, and all are predators of other fish, including round whitefish. In Little Moose Lake, where Cornell University researchers have more than 50 years of fishery records, a smallmouth bass removal program caused

an exponential increase in the number of juvenile round whitefish in the lake. While smallmouth bass had not yet eliminated the round whitefish population, it is clear that they were limiting the survival of young round whitefish. In many other Adirondack waters, the rise of smallmouth bass, yellow perch and rainbow smelt may have coincided with the disappearance of round whitefish and the closely related lake whitefish. This is why DEC has made it illegal for anglers to transport or spread non-native species to new waters. While smallmouth bass and yellow perch can provide exciting fishing opportunities, they can also harm native fish communities.

Another possible explanation for the decline in frost fish populations is the likelihood that many populations observed around the start of the twentieth century were actually introduced. As such, it is possible that their disappearance occurred simply because the stocked fish failed to establish themselves. Lack of suitable spawning habitat, presence of too many competitors, or simply a failed stocking attempt are all likely causes for an unsuccessful introduction.

Acid rain is thought to be another possible cause for the disappearance of frost



Dark spots (called parr marks) on the sides of this fish indicate it is a juvenile. Adult round whitefish average 8-12 inches in length and are olive-brown on top shading to silver on the sides.



As part of the restoration project, DEC raises round whitefish for later stocking efforts. Aquatic biologists (like Richard Preall pictured here) and fisheries technicians capture wild round whitefish in November and collect eggs and milt from ripe females and males. The eggs are fertilized in the field, and then disinfected with an iodine solution mixed in bottled spring water for transportation to DEC's Constantia Hatchery. Round whitefish are raised to fingerling size and released into selected waters the following May.

fish population. This is a problem that has plagued many fishes in the Adirondacks. Scientists believe that frost fish experience developmental problems when waters become too acidic (i.e., pH drops below 6).

Fortunately, there is renewed interest in restoring round whitefish in the Adirondacks. To accomplish this, DEC is directing federal funds called State Wildlife Grants to Cornell University to identify factors that have contributed to the decline of frost fish and to study this fish to better understand its needs. For the last few years, researchers have been conducting surveys of historical round whitefish waters. By the end of the study, 33 Adirondack lakes had been sampled. Of those, native round whitefish were confirmed in four more lakes, bringing the total to seven (eight, including one population established in the 1970s).

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In addition, DEC has introduced round whitefish into eight lakes and ponds in the Adirondacks, including: Evergreen Lake and Buck Pond of Herkimer County; Trout, Little Trout and Deer Ponds of St. Lawrence County; Eighth Lake of Hamilton County; Little Green Pond of Franklin County; and Rock Pond of Essex County. Results are promising. For each of these lake stockings, there has been impressive survival and growth.

Such introductions are being conducted as “experiments” to increase the number of waters with round whitefish, and to determine what conditions are optimal for survival, growth and establishment of self-sustaining populations. For example, these stocked lakes have different fish communities—some have been reclaimed, causing them to be temporarily fishless, while others contain many predators and competitors. The lakes also differ in habitat and water chemistry. In this way, we can determine what conditions are best for healthy round whitefish populations.

Ultimately, the goal is to establish 10 to 15 naturally reproducing populations in the Adirondack region. With seven naturally reproducing populations and eight recently introduced populations, we are well on our way. The hope is that round whitefish from these waters will reproduce and spread to other suitable parts of the watershed, finding homes in traditional round whitefish lakes and ensuring a continued presence in the Adirondacks. Little Green Pond has already been the site of a small victory. An introduced population in the pond, designated to become the primary source for the



Round whitefish have a tubular body shape and a small mouth. They eat small aquatic organisms.

broodstock program, has already spread downstream to Little Clear Lake. However, to date there is no evidence of reproduction in any of the recently stocked waters.

While reestablishing round whitefish in the Adirondacks is a positive step towards maintaining this historically important fish, it is also essential because round whitefish are an important food source for other fish species. While most people are unlikely to catch a round whitefish on hook and line, the next time you catch a large lake trout, think about whether that fish grew so large eating insects, or eating fish like the round whitefish.

In the meantime, researchers like me will continue to check these lakes, hoping to have another good day.

Dr. Geoffrey B. Steinhart is an assistant professor and Co-Director of the Aquatic Research Laboratory at Lake Superior State University. He is continuing his work on round whitefish recovery in New York by examining the genetic diversity within existing native populations in New York and across North America.