Refugia of hope: Life in submerged karst sinkholes



WITH HARDLY 15% of the Laurentian Great Lakes floor mapped, several submerged sinkholes have been discovered. Karstic sinkholes—with actively venting ground water having no-oxygen, but high-chloride and high-sulfur—nurture vibrantly colored biodiverse benthic microbial mats of photosynthetic cyanobacteria and chemosynthetic microbes, possibly containing a trove of novel species.

In addition to providing a window into life on early Earth, these physiologically versatile mat worlds in sinkhole refugia serve as models for testing ecological theories and phenomena—including life's evolution and biogeography and Earth's carbon burial and oxygenation—across sharp transition zones and within extreme habitats (Biddanda et al. 2023).

Moreover, mat ecosystems where bacteria, archaea, and viruses coexist in close and intense dynamic cooperation, competition, and conflict are likely rich in bioactive compounds of pharmaceutical value. For example, what are occasional large mobile metazoan visitors, such as this Burbot (*Lota lota*) pictured, doing hanging out over these microbes-only mats? Existing and future Great Lakes National Marine Sanctuaries and Marine Protected Areas should incorporate known submerged sinkholes ensuring their long-term protection and conservation.

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Major milestone reached; lake trout (*Chinamekos*) fully restored in Lake Superior

A REMARKABLE CONSERVATION TRIUMPH is unfolding in Lake Superior, or *Anishinaabewi-gichigami* in Anishinaabemowin. After nearly 70 years of dedicated effort, native lake trout populations have been restored in most of the lake. Chinamekos, as the fish are known in Anishinaabemowin, nearly disappeared from Lake Superior in the mid-1900s due to overfishing and predation from sea lampreys. Controlling sea lamprey populations kicked off a series of additional management strategies, including strict fishing regulations and the introduction of diverse lake trout strains through stocking programs. The success of these efforts led to a significant increase in naturally reproducing lake trout populations. Today the lake trout's status in Lake Superior meets an ambitious management goal set in 2003. The lake is now home to genetically diverse self-sustaining populations of lake trout that mirror those found in the lake before 1940.

"Rehabilitating lake trout in the world's largest freshwater lake did not happen overnight," says Great Lakes Fishery Commission Chair Ethan Baker in announcing the news. "It required an unwavering commitment to a shared vision across multiple generations of fishery managers from Indigenous, provincial, state, and federal agencies. It is undoubtedly one of the most successful stories of native species restoration in the world. Lucky for us, we have a front row seat."



Photo courtesy of Great Lakes Fishery Commission.