**Showcasing the DNR: Breathing under the ice**

*DNR fisheries staffers conduct UP late winter dissolved-oxygen surveys*

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Deep winter snow and prolonged ice cover on Upper Peninsula inland lakes can create conditions that present unique habitat challenges to fish.

Staffers from the Michigan Department of Natural Resources Fisheries Division, specifically the Northern Lake Michigan Management Unit and Lake Superior Management Unit, annually survey a subset of U.P. trout lakes in late winter.

They do this to determine if habitat variables, such as dissolved oxygen levels, are suitable for survival of fish stocked by the DNR.

**Fish need oxygen**

Trace amounts of dissolved oxygen are required by fish and other aquatic life in Michigan’s inland lakes throughout the year. Fish need dissolved oxygen to breathe through their gills.

Dissolved oxygen during the winter – after ice covers the lake – got into the lake during the seasons of open water.

The dissolved oxygen content of water depends primarily on three variables. These are the amount of mixing with the air above the lake, the rate of oxygen production by plants and the rate of oxygen consumption by living aquatic organisms.

During periods of prolonged ice cover, lakes are sealed off and cannot be recharged with oxygen from the air. Additionally, ice and snow reduce the amount of sunlight reaching aquatic plants, thereby reducing photosynthesis and oxygen production. During photosynthesis, living plants use sunlight energy and carbon dioxide to make plant tissue and dissolved oxygen.

Meanwhile, ongoing consumption of dissolved oxygen by aquatic animals and natural processes, like decomposition of plants, depletes the dissolved oxygen supply stored in the lake when the lake froze over.

“The top challenge fish and aquatic commu­nities face in winter is the threat of running out of oxygen before the ice cover melts in spring,” said Jennifer Johnson, a DNR fisheries biologist at Norway in Dickinson County.

Different fish species vary in their tolerance of low dissolved oxygen conditions. Brook, brown and rainbow trout are most sensitive, and walleye, bass and bluegill have intermediate sensitivity. Northern pike and yellow perch are relatively tolerant, while other fish, like bullheads and some minnow species, are very tolerant.

Late winter is usually a critical period for fish in U.P. inland lakes, as this is when dissolved oxygen concentrations typically reach their lowest levels. So, this is the best time of winter to investigate if these low dissolved oxygen conditions are present and possibly limiting the survival of fish.

“Over the past several years, we have been checking dissolved oxygen levels in stocked trout lakes in the eastern, central and western U.P. to update habitat information needed to guide future management,” said fisheries technician Brad Shucha, from the DNR’s Crystal Falls office in Iron County.

**The process**

Surveying dissolved oxygen under ice cover during the late winter is a relatively straightforward process for DNR Northern Lake Michigan and Lake Superior Management Unit fisheries technicians from the Newberry and Crystal Falls field offices.

However, managed trout lakes are often located far off main roads and require a snowmobile for access.

Once at a lake, a GPS unit or a smart-phone and lake-mapping application are used to determine the deepest location in the lake. When that location is found, a hole is drilled with an ice auger and the snow and slush is cleared away from the hole.

Next, a probe with sensors is lowered into the open water in the hole. The probe is cylindrical, roughly 2 inches in diameter and about 18 inches long. The probe is linked to a hand-held meter via a long cable.

As the probe is lowered slowly from the surface to the bottom of the lake, the meter records water depth and dissolved oxygen concentrations along the way. Once a profile of the water column has been completed, it is time to pack up the equipment and move on to the next lake.

**Management decisions**

When the surveys have been completed and the data has been downloaded to a database, fisheries biologists can analyze the information to determine the current habitat conditions and the future direction of trout management for each lake.

Often, late winter habitat conditions are found to be suitable for trout, and the recommendation is made to continue fish stocking to support the recreational fishery for anglers.

If lakes are found with low dissolved oxygen concentrations, then these waters are monitored in subsequent years to determine whether this is a temporary or persistent late-winter condition that may warrant a change in management.

“Most of the stocked trout lakes often have really good dissolved oxygen concentrations all winter long and thus support multiple year-classes of trout,” said John Bauman, a DNR fisheries biologist at Escanaba in Delta County. “However, long and cold winters with high levels of snow (like the winter of 2013-2014) can present challenging habitat conditions, until the spring melt.”

Dissolved oxygen is a critical habitat component of successful trout management and the creation of recreational fisheries.

Annually monitoring a subset of U.P. trout lakes is crucial to update information needed by fisheries biologists to wisely use stocked fish to create popular recreational fisheries for anglers.

Therefore, it is not surprising that future monitoring of late-winter dissolved oxygen levels in U.P. inland trout lakes will continue to be a regular survey activity for DNR fisheries staff in the region.

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