MICHIGAN DEPARTMENT OF NATURAL RESOURCES

Fish Kills

Dead and dying fish are an ugly sight. Truth is, most species of fish are relatively short-lived and have a high rate of mortality. Even large fish, too large to be eaten by predators such as bass and pike, experience a death rate of approximately 50% per year. Fortunately, the deaths are usually spread-out over the year and are rarely observed or become a problem except when concentrated as a fish kill. Only a fraction of the dead fish are ever observed because many decompose on the bottom or are eaten by scavengers such as turtles and crayfish.

Most of the time, fish kills are due to natural causes over which we have no control, such as weather. Only occasionally is death directly related to pollution or improper use of herbicides or other chemicals. Natural fish kills are of three basic seasonal types: winterkill, which occurs in late winter but may not be seen until early spring; spring kill, which is occurs in late May to early June; and summer kill, which occurs on the hottest days of mid summer.

Winterkill

Winterkill is the most common type of fish kill. When severe, it has devastating effects on fish populations and fishing quality. Winterkill occurs during especially long, harsh winters, such as occurred in northern Michigan during the winter of 1995-96. Shallow lakes with excess amounts of aquatic vegetation and mucky bottoms are prone to this problem. Fish actually die in late winter, but may not be noticed until a month after the ice leaves the lake because the dead fish are temporarily preserved by the cold water. Winterkill begins with distressed fish gasping for air at holes in the ice and ends with large numbers of dead fish which bloat as the water warms in early spring. Dead fish may appear fuzzy because of secondary infection by fungus, but the fungus was not the cause of death.

Actually, the fish suffocated from lack of dissolved oxygen. Trace amounts of dissolved oxygen (measured in parts per million, ppm) are required by fish and all other forms of aquatic life. Even living plants and the bacteria that decompose organic materials on the bottom of the lake require oxygen. As a rule of thumb, the critical level of oxygen is about 2 ppm for most game fish native to warmwater lakes, and levels below 1 ppm for extended periods of time are lethal.

But species of fish vary in their tolerance of low oxygen. Trout are most sensitive; walleye, bass, and bluegill have intermediate sensitivity; and northern pike, yellow perch, and pumpkinseed are relatively tolerant. Bullheads and certain minnows are very tolerant. Lakes prone to periodic winterkill can often be detected from the composition of their fish populations - tolerant species predominate, sensitive species are rare, and prey greatly outnumber predators. Fortunately, usually enough fish survive, either in the lake or in connecting waters, to repopulate the lake in a couple of years. Only for extreme die-offs is fish restocking necessary.

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 (respiration) by living aquatic organisms. During periods of prolonged ice cover, the lake is sealed off from the atmosphere and cannot be recharged with oxygenated air. Furthermore, 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, on-going consumption of oxygen depletes the supply of oxygen stored in the lake when the lake froze over. Shallow, productive lakes are at a disadvantage because they have a low storage capacity and high rates of oxygen-consuming decomposition.

February is usually a critical period and is the best time to check the oxygen content of lakes prone to winterkill. A good midwinter thaw about then often recharges the lake’s oxygen supply by means of photosynthesis and melt water. Conversely, a prolonged winter, with continuous snow cover and late ice-out, increases the chance of winterkill.

A short-term solution to impending winterkill, suitable for ponds and small lakes, is to aerate with commercial devices or outboard motors. A significant improvement can be made in the oxygen content of about 1 acre of water by running a small outboard motor for about 4 hours. Select a relatively warm day to use the outboard method. Mount the outboard on a dock, frame, or small boat and lower the shaft into a large hole in the ice. Tilt and run the motor so as to push water on top of the ice. Then, at the edge of the flooded area, chop more holes so the water can return. Beware of weakened ice! Move to another location before the outboard hole becomes dangerously enlarged or water is no longer pushed onto the ice. Run the motor over relatively deep water so that bottom mud is not stirred up along with the water.

The only long-term solution for winterkill lakes is to reverse the natural process of filling and enrichment (eutrophication). Dredging or sucking bottom sediments can increase the volume of water, reduce the nutrient-rich sediment, and reduce the growth of nuisance plants. However, such projects are extremely costly, require a site for disposing of the bottom material, and may require a permit. Lake residents can help slow down the rate of eutrophication by keeping all types of plant fertilizers out of the lake.

Spring kill

Spring kill occurs in lakes and rivers when fish survive the winter but die as the water warms rapidly in May and June. It rarely claims many fish and is usually over in a couple of weeks. Spring kill is almost always due to natural causes beyond our influence. The usual victims are large bluegills and crappies, and other fish which spawn in the spring such as perch, bass, pike and suckers.

A combination of stresses is usually responsible. Fish come through the winter in a weakened condition because they’ve been eating at a reduced rate. As the water warms, their metabolism increases and they divert much energy to strenuous spawning activities. In lakes, additional stress may be added during "turnover", which is when wave action stirs up bottom water low in oxygen and high in noxious gases. Diseases and parasites also become more active and on a few occasions have been implicated in fish kills. An example is the spring salmon mortality in Lake Michigan caused by bacteria kidney disease (BKD).

Summer kill

Summer kill occasionally occurs in lakes and streams during extremely hot summer weather. High temperature and low dissolved oxygen combine to stress the fish. Most prone to summer kills are pike, perch, suckers, bass, and bluegill living in shallow, productive lakes or bays with excessive amounts of algae or rooted aquatic vegetation. The plants consume large amounts of oxygen at night, causing a temporary shortage of the vital gas just before dawn. A cloudy, calm day extends the critical period by reducing re-oxygenation from photosynthesis and wave action. Apparently, fish in the oxygen-depleted areas do not sense the danger and swim to safety in time.

Summer kill may also occur in deep, unproductive lakes containing trout or cisco. These fish require both cold and well-oxygenated water. During summer they seek refuge in the cold bottom layers where temperatures are less than 72 degrees F. Death results if the oxygen level there declines below about 4 ppm. Trout will also die in streams if they are unable to find cold spring water. Several stream trout mortalities were reported during the hot summer of 1995.

A very unique type of fish kill is caused by a lightning strike on water. Death occurs immediately. Large fish, which draw more electricity than small fish, may be killed selectively.

In conclusion, the risk of some types of fish kills can be reduced by keeping as many nutrients out of the water as possible. Sources of nutrients include septic fields, fertilized lawns and farm fields, and wastes from livestock and waterfowl (including tame geese). Reducing nutrient input starts the following favorable chain reaction: production by aquatic plants is reduced, less decomposition is required, and oxygen will not become depressed to critical levels.

Natural fish kills are obnoxious, and may affect fishing and predator-prey "balance" for years. However, they are often not serious in the long run because lakes contain thousands of fish per acre. They may be thought of as nature's way of thinning out fish populations. Usually, fish kills indicate that the habitat is of marginal quality for certain species because of the broad range of weather conditions we experience in Michigan. Infrequently, fish kills indicate habitat or pollution problems we may be able to correct. And sometimes, fish kills beneficially reduce over-populated, slow-growing panfish and actually increase growth rates and improve fishing.

Please report pollution-related fish kills to PEAS (1-800-292-4706) and extensive natural fish kills to the nearest District Office of the Department of Natural Resources.

--James Schneider, Fisheries Division, April 1996