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The Lake and Reservoir Restoration Guidance Manual

Second Edition

Algae — Additional Procedures for Control

None of these techniques is considered completely ineffective; however, none is well enough understood or has produced enough positive results to be considered an established and effective long-term procedure.

Artificial Circulation

Artificial circulation eliminates thermal stratification or prevents its formation, through the injection of compressed air into lake water from a pipe or ceramic diffuser at the lake's bottom (Fig. 6-4). The rising column of bubbles, if sufficiently powered, will produce lakewide mixing at a rate that eliminates temperature differences between top and bottom waters. Algal blooms may be controlled, possibly through one or more of these processes:

1. In light-limited algal communities, mixing to the lake's bottom will increase a cell's time in darkness, leading to reduced net photosynthesis.

2. Introduction of dissolved oxygen to the lake's bottom may inhibit phosphorus release from sediments, curtailing this internal nutrient source.

3. Rapid circulation and contact of water with the atmosphere, as well as the introduction of carbon dioxide-rich bottom water during the initial period of mixing, can increase the water's carbon dioxide content and lower pH, leading to a shift from blue-green algae to less noxious green algae.

4. When zooplankton that consume algae are mixed to the lake's bottom, they are less vulnerable to sight-feeding fish. If more zooplankters survive, their consumption of algal cells may also increase.

Results have varied greatly from case to case. In most instances, problems with low dissolved oxygen (which can occur with deep discharge dams, for example) have been solved. In about half the cases, and where very small temperature differences from top to bottom have been maintained all summer, algal blooms have been reduced. In other cases, phosphorus and turbidity have increased and transparency has decreased. When artificial circulation is properly used in a water supply reservoir, problems with iron and manganese can be eliminated.

Failure to achieve the desired objective may be caused by lake chemistry or equipment. Lorenzen and Fast (1977) concluded that to adequately mix a lake, an air flow of about 1.3 cubic feet per minute (1.3 ft^3/min) per acre of lake surface is required to maintain oxygen within the lake. Underdesign is a major cause of failure for this technique. This is a highly specialized area; therefore, the system should be designed by a professional who is experienced in artificial circulation. Correct air flow pressure depends on site conditions. Algae control may also depend on a particular lake's water chemistry, including its pH and alkalinity.

Costs are low and will primarily be for the compressor and installation of pipes and diffuser.