

Shooting for Better Water

Robert T. Lackey

Department of Fisheries and Wildlife
Oregon State University
Corvallis, Oregon 97331

Citation: Lackey, Robert T. 1969. Shooting for better water. *Colorado Outdoors*. 18(6): 40-42.

Email: Robert.Lackey@oregonstate.edu

Phone: (541) 737-0569

Web: <http://fw.oregonstate.edu/content/robert-lackey>

"Shooting" for Better Water



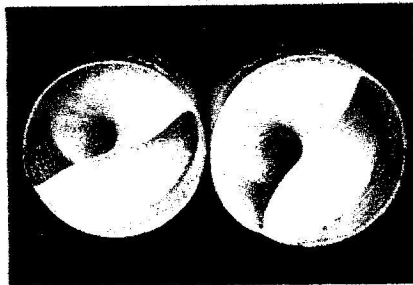
Parvin Lake, west of Fort Collins, is one of the Red Feather lakes. Several fisheries studies are presently being conducted there.

GUNS that shoot bubbles are in place at the bottom of Parvin Lake, one of the Game, Fish and Parks Division's fishery experiment stations. Ammunition is a steady stream of compressed air. The big guns are being studied for their beneficial effects on

the commercial uses of reservoirs, for helping to make swimming and boating more pleasant, and for improving lake and reservoir fishing.

Deep, coldwater Colorado lakes and reservoirs usually separate into three temperature layers during the summer. These nonmixing areas are the warm-water layer (epilimnion), a middle layer of rapid temperature change (metalimnion or thermocline), and a coldwater layer (hypolimnion). The air guns have been brought in to

**A unique project
may benefit the recrea-
tional and commercial
uses of reservoirs**



ABOVE: A top view of "guns" showing the inside coils. **RIGHT:** Over-all view of the guns which actually shoot holes in the thermocline.



literally shoot holes in the thermocline and thus break up the three layers. At the same time the water is aerated much like a home aquarium. A closer look at the yearly temperature changes in lakes shows how fishery management problems can be caused.

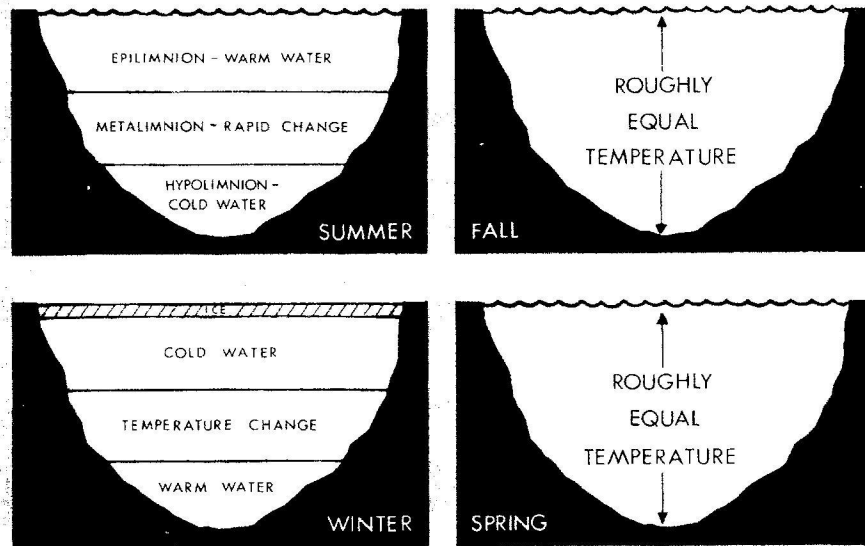
Annual Cycle

Most deep, coldwater lakes follow a fairly predictable yearly temperature cycle. During summer, surface waters are warmer and less dense than the cooler, deeper waters. With such a

temperature and density difference, there is little mixing between surface and deeper waters. The lake is now "thermally stratified," a condition that usually lasts all summer. As surface waters cool in the fall, water temperatures eventually become roughly equal from top to bottom. Water mixing or "turnover" now takes place between all depths of the lake.

Winter air temperatures cool surface water even further and ice may form. Again the densest water (39° F) is

Annual TEMPERATURE STRATIFICATION in a Coldwater Lake



at the lake bottom while surface water is colder, usually near 32° F. The lake is again thermally stratified. Certain chemicals may build up coupled with dissolved oxygen depletion during winter.

Spring air temperatures warm surface waters and eventually create equal temperatures from top to bottom. Chemicals that have built up in the deep waters all winter are now brought to the surface with spring mixing. The upper waters continue to warm in late spring and summer to create a stratified condition. This brings us back to the beginning of the annual thermal stratification cycle.

Problems

So what does all this have to do with fishery management problems? Let's look at three general problem areas: commercial uses of reservoirs, non-fishery recreational uses of reservoirs and lakes, and fishery uses of reservoirs and lakes.

Commercial uses of reservoirs include production of hydroelectric power, drinking water, irrigation water and several others. Drinking water obtained from deep water can be severely affected by the buildup of noxious materials. If water is drawn from surface outlets, there may be an abundance of plankton present. Both water conditions require expensive treatment to make the water fit for human consumption. Irrigation water drawn from a stratified impoundment may have a distinct smell due to build-up of gases and compounds. A third major problem, evaporation rates, is especially important in warm, dry areas. Since much of the evaporation takes place during summer months, cooler surface temperatures would reduce this loss.

Such recreational uses of reservoirs as swimming and boating can be hindered by stratification. Plankton blooms and pollution can be accentuated by periods of stratification. The "cleaning" effect of spring and fall turnovers helps cut down on this prob-

lem, but the effects are most severe during summer.

The yield from some lake and reservoir fisheries is limited in one way or another by stratification. Perhaps the most obvious is winterkill and summerkill. Winterkill is generally caused by depletion of dissolved oxygen which is directly due to lack of water circulation and mixing. Summerkill is usually caused by an oxygen deficiency created by excessive growth of plants aggravated by warmer surface temperatures during summer stratification.

The livable area for fish in many lakes and reservoirs is limited during summer. Fish may be caught in a two-way squeeze. The bottom water may be low in oxygen and surface waters too warm. As a result fish (especially coldwater species) must stay at a narrow, intermediate depth.

A Solution

Air guns offer a new approach and strategy. Compressed air is bubbled from the bottom of the lake or reservoir through specially designed "guns" or aerators. Their design is such that maximum effectiveness of available air is achieved. The result is twofold: oxygen is added to the water and the mixing effect breaks down temperature stratification.

Parvin Lake is being used for an initial evaluation of the system by the Division of Game, Fish, and Parks. Two guns have been placed in the deeper section of this 62-acre lake and are connected by polyethylene pipe to a compressor located on shore.

An intensive pre-aeration study of Parvin Lake has been completed. Eight different chemical nutrients, plankton, bottom life and fish have been studied to obtain an estimate of abundance, distribution and species composition. This information provides a base from which to measure the over-all effect of eliminating thermal stratification. Aerators will run continuously for the following year and we will maintain a close check on their effects. ♦