

**T**OTAL LAKE management is here to stay. Our philosophy in Wisconsin for conducting this type of program is to develop initially a cordial understanding between the applicator and the people concerned.

We tackle a project by first holding several meetings to describe the problem. We want to determine, among other things, these factors:

—How many people desire treatment?

—What cost can be beneficial to the people and to the applicator?

—Will the group allow an area for experimentation?

—Does the group want treatment in public areas, such as landings and center-of-lake areas?

—Do the people understand the chemical to be used, what it will do, what restrictions on water use will be necessary, what regrowth can be expected, what additional controls (such as algae and itch) can be optional?

A lake survey is necessary to determine immediate and long-range treatment. Normally, each lake community has a lake improvement association. If not, one is set up with our assistance. Representatives of this group are invited to participate in the survey of the entire lake. Sketches are made of acreage and places in the worst condition. Desired treatment areas are then determined.

Some people do not desire treatment for a variety of reasons. They are not disturbed. People wanting treatment are pinpointed on the survey and advised as to the most beneficial type of control indicated.

A form letter is mailed to each interested person. In return, he submits his payment to the lake association treasurer. The letter describes the preparation of treatment. For example: A property owner marks his lot line with flags, places a sign on his dock stating dimensions of the area (100x100—meaning 100 feet from shore along 100 feet of shoreline), posts his name and lot number.

A date for treatment is set, depending on growth rate, type of plant, and weather conditions.

When the treatment begins, a committee member (or two) precedes the treatment boat to locate the lots. This person can also observe the treatment from a safe distance.

Each dock is marked with a card notifying the owner that work has been completed. Local press and radio are willing to give notice of treatment date to the public. Almost always these media are con-

By **NORMAN J. SCHEIN**  
The Lake Biologist, Inc.  
Onalaska, Wis.

## Wisconsin lake biologist tells how to convince public

# TOTAL LAKE

tacted. Public areas and landings are posted.

One of the options on the initial treatment is acquiring additional assessment (usually \$5 to \$10 per owner) for treatment in lake areas or troublesome spots other than along shorelines. The local committee determines feasible locations to be treated.

### The Three-Year Plan

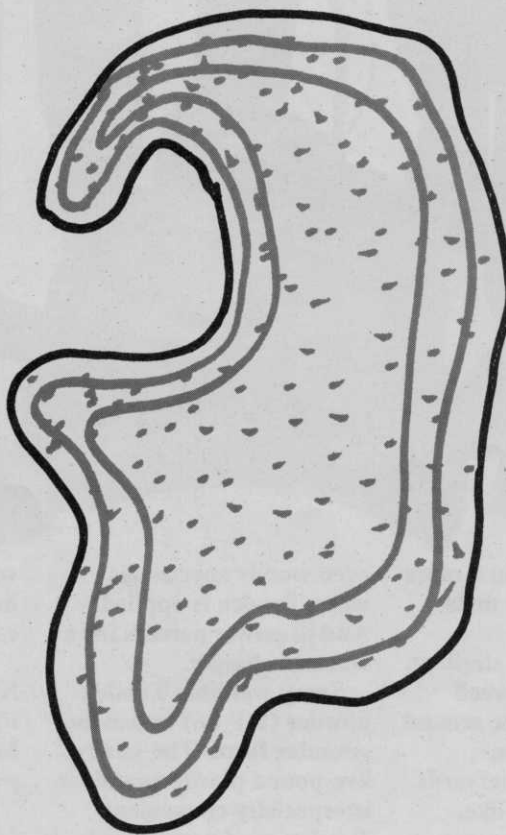
Because growth is sometimes unpredictable, a three-year plan has been devised. According to the condition, areas are treated as needed. Some badly infested areas will not respond to complete control for three years. Others will hold for two years. Therefore, a gradual and continual control is negotiated. This plan calls for routine supervision

and treatment as the need arises. It also includes treatment for filamentous and planktonic algae growth using a copper sulfate (IPPM) on a marginal area.

The complete lake is never treated for any kind of condition, as this would cause a badly unbalanced lake. For algae control, marginal or half-lake control has been successful. Half-lake control is used by watching prevailing winds and algae concentrations. This also eliminates the possibility of a low dissolved oxygen problem.

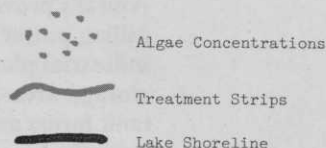
Our lakes are put on a schedule and are visited about once a week or once every 10 days. Treatment is done or skipped as the situation demands. This routine survey keeps us on the problem without letting it get out of control. It is especially

DIAGRAM 1. Double marginal application technique.



Shoreline — 7 miles  
1st marginal width — 150 ft.  
2nd marginal width — 150 ft.  
Acreage of 1st marginal pass — 129 surface acres  
Acreage of 2nd marginal pass — 129 surface acres  
Total acreage to be treated — 258 acres  
Total lake acreage — 3,200 acres  
Copper sulfate used — 1,000 lbs.

A skip of about 200-300 feet is maintained so the dead algae does not concentrate at once. Of course, wind action must be considered. If there is a wind causing a wave action of more than four inches in height, then treatment should be confined to areas unaffected by wind. At no time should algae be sprayed in excessive wind. Control is negligible. A weekly routine spraying of less than 1 ppm of copper sulfate will clear this lake in two to three weeks and keep it clear all summer.

  
Algae Concentrations  
Treatment Strips  
Lake Shoreline

of the need for . . .

# MANAGEMENT

successful on planktonic algae control.

We have controlled algae in a 1,500-acre lake with marginal control by routine spraying of 500 pounds of copper sulfate at about a .05 ppm rate. If a two-week period elapsed between treatments, the algae again got severely out of control. Of course, weather conditions can influence growth.

As an example of a routine inspection: In one lake in the southern part of Wisconsin, the weeds were in need of treatment in late May because of the earlier growing season. Treatment was accomplished, but with the recommendation that a second treatment be done in August to control regrowth. Regrowth did occur but it was chara instead. Therefore, we treated for chara,

with about 4 ppm of copper sulfate using underwater injection.

Unless people understand why a situation like this can occur, you are in trouble. A routine inspection and a complete mutual understanding of seasonal lake management is a necessity.

At the end of the summer, each association plans a business meeting. We attend these meetings to discuss our progress with the management plan. Suggestions for the coming year are made, questions answered, and prices are discussed.

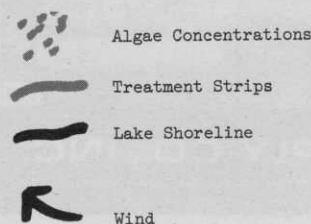
## The Sanitary District

Some lake areas have organized a step beyond the lake association. By law, they have formed a Sanitary District, which has the right to assess a tax for lake improvement.

**DIAGRAM 2. Successful planktonic algae control treating wind-blown concentrations.**

We treated this area with four pounds of  $\text{CuSO}_4$  per surface acre. Our plan was three 150-foot-wide strips about 200 feet apart, which eliminates a severe kill and apparent  $\text{O}_2$  depletion.

The small bay at the upper left is the danger area where algae is compacted. It should never be treated entirely.



A board of directors is elected and it works in conjunction with town and county boards. The Sanitary District is quite effective in bringing about a total lake management program. These men are devoted to improving their lake. The sanitary board controls sewage codes, dredging, chemical control, shoreline development, parks, and landings.

## Partial-Lake Concept

The state of Wisconsin allows no more than 80% of a lake to be treated for aquatic weeds with 20% remaining for fish habitat. In the 10 years as a Wisconsin state lake biologist, I have never seen this much of a lake treated at one time. What I am suggesting is that it is more beneficial to a lake to treat for aquatic vegetation over a period of several years to gain control, rather than treat a large portion or the entire lake in one season. The shock of released available nutrients from decaying plants most assuredly will cause a terrific algae growth. Beneficial results may not result. It took many years to cause an obnoxious weed problem, and restoring the lake balance also could take a carefully plan treatment lasting several years.

Planktonic algae treatment has a varied number of concepts, but we have gained excellent control with copper sulfate at the rate of 1 ppm, thoroughly covering the surface on a marginal basis. In some cases where a lake has a well-mixed bloom along with large acreage and good depth—more than 20 feet—a double marginal treatment is carried out. (See diagram 1)

On the partial lake algae treatment plan, we discovered that there seems to be a chain reaction taking place with aphanizomenon; that is, a copper sulfate treated algal cell appears to be toxic to a living cell and a small area treated results in control over a much larger portion of the lake.

Each lake has its own characteristics. Sometimes the double marginal plan is not needed, usually on smaller lakes.

If a lake has had a bloom for several days and winds have been prevailing from one direction, the resulting situation can be used to the applicator's benefit. (See diagram 2)

At times during any type of marginal control, a concentrated area of algae may be found in the center of the lake. Spot treatment of these concentrations can be effective in gaining control.

Any combination of these ideas



Equipment used: High-speed Homelite pump XL, 1/2-inch nozzle. Mixing (polyethylene) barrel, 2-inch intake hose with foot valve, venturi system with direct flow of chemical into water intake eliminating heavy mixing barrel, and 25 hp, 79 lb. Johnson Outboard with extended shaft. Our boat is an 18-ft. Kenner Ski Barge (fiberglass).



An example of partial control—the outside area to the upper right shows untreated area. No algae resulted from this treatment, and the following year treatment area was increased. In this manner, in three years we had complete control over the entire lake except for untreated fish habitat areas.

can be utilized to avoid total lake algae spraying. Total treatment can lead to disaster. A complete oxygen depletion is possible. The key to good control is an extremely light treatment done in a routinely devised program. It is advisable to stay away from the "shock" treat-

ment of algae as well as for weeds.

#### "On Call" Concept

Our algae control programs usually are scheduled on a once-a-week basis, starting when the first bloom appears. It is necessary to instruct one of the lake residents to recog-

nize the beginning of a bloom and inform us of the condition.

This leads to another concept of total lake management: Being on call.

Calls are made by designated people to keep us informed, so we can schedule changes as needed. We

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Wind-concentrated duckweed presents this unpleasant scene. The picture at left is the same area from a different side two weeks after treatment.

keep in contact weekly with our lakes and know what changes are occurring. This saves time. Some lakes will hold for more than a week, so we can eliminate a trip.

Any aquatic treatment success can be noticeably affected by wind. Chemical drift can occur rapidly, with the result being no control at all. Expense goes up, profits go down, and people are dissatisfied.

#### The Clear Lake Project

Clear Lake in northwestern Wisconsin is illustrative of a typical lake with several problems.

It's about 40 feet below the level of the village by the same name, which includes a large creamery. Below the creamery was a seven-acre pond infested with brush, a variety of submerged weeds, duckweed and filamentous algae.

This pond was treated three times successfully for control of all the above-mentioned problems. The pond's water drains into Clear Lake, covering about 100 acres.

When we first surveyed the problem, the lake was infested with elodea packed solid in the swimming area of six acres, plus scattered masses around the lake. Planktonic algae was heavy throughout.

My first impression was to forget it and concentrate on other jobs. However, the challenge spurred me to tackle it.

The elodea was controlled completely in two years. The first year, I supervised the job as a state biologist. The village crew treated with aquathol-plus pellets at 600 pounds per acre. In three weeks, the entire mass of elodea broke loose and rose to the surface, but eventually decayed.

The algae became worse.

Last year, we took on the maintenance problem, which consisted of elodea treatment, then a weekly routine algae treatment. We used diquat for complete elodea control in the treated areas and 50 pounds of copper sulfate for algae control on a once-around marginal basis. Each week we sprayed using the marginal plan. In three weeks, we had clear water throughout. Planktonic algae disappeared and clumps of clodophora, hydrodictyon and spirogyra occurred. We then changed from marginal to spot spraying of filamentous algae.

The result was a clear, usable lake all summer long. The fishing was excellent, with northern pike, bluegills, perch, and largemouth bass being taken. We never used more than 50 pounds of copper sulfate per week and never spent more than 45 minutes a week on the lake. The rapid growth of filamentous algae was indicative of the high nutrient content of the water.

We skipped one week and a filamentous growth again started and would have gone completely out of control had we not been on call and informed of the condition.

This plan of total lake management has been very successful for us. We plan on using it on most of our jobs.

It is highly important to develop ethical practices on the water, develop a good understanding and working relationship with property owners, and to report failures and successes to chemical companies and state governing agencies.

It also is a feasible way to carry on a continual year-by-year research program of new techniques, chemical mixtures, new chemicals, and new equipment to better achieve a beneficial program for all concerned.

#### Book for Water Specialists

**THE PRACTICE OF WATER POLLUTION BIOLOGY**, Kenneth M. Mackenthun, U.S. Department of Interior. Single copies free from the Office of Public Information, Federal Water Pollution Control Administration, Washington, D.C. 20242. The book also is for sale at \$1.50 per copy from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

This book presents some practical water pollution biological field investigative techniques and practices, procedures to solve problems, data analyses, interpretation and display,

and the development and writing of the investigative report. It is written principally for the biologist inexperienced in these activities, and for sanitary engineers, chemists, attorneys, water pollution control administrators, and others who are interested in broadening their understanding of this discipline.

More than 20 years of biological field investigative experience are represented in the described field and laboratory methods, report writing, and data display. Methodology modifications presented may be of value to other professional biologists.

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