WATERWORKS

FEDERATION OF LAKE ASSOCIATIONS

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Help protect lakes from exotic aquatic plants

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British Columbia Ministry of Environment and Parks

Introduction

The reduction of nuisance impacts of unwanted aquatic plants is a high priority to recreational users of lakes throughout the world. Nuisance conditions caused by floating or submersed rooted macrophytes may be due to luxuriant growth of native aquatic plants encouraged by physical changes to lake shorelines or substrates or water quality changes. However, the introduction of exotic plants, such as Eurasian water milfoil or Hydrilla, which are notoriously well adapted to a wide range of environmental conditions, may result in sudden and dramatic increases in the density, areal extent, and adverse recreational impacts of aquatic vegetation.

Documentation of introductions of exotic aquatic plants is difficult, mainly because of inadequate scientific inventories of pre-infestation conditions and technical problems in identifying the species involved. In British Columbia, Canada, intensive surveys for Eurasian water milfoil began in 1972; annual surveillance of high priority lakes is continuing while over 1,000 different water bodies have been surveyed during the intervening period. In 1986, Eurasian water milfoil was located in two previously uninfested lakes in British Columbia and further spread was documented within several lake systems. The British Columbia Ministry of Environment and Parks is continuing efforts to prevent further spread of this noxious aquatic weed while implementing Eurasian water milfoil control programs in 13 lakes during 1986. The purpose of this article is to acquaint readers with the British Columbia experience and to encourage lake managers to protect lakes from exotic aquatic plant introductions. While problems with Eurasian water milfoil are addressed here, similar concerns apply to Hydrilla (particularly as it spreads northward) and some other exotic species.

The Problems

In many jurisdictions, baseline documentation of aquatic plants is limited, with virtually no ongoing surveillance to identify new infestations or changes in the species composition or densities of aquatic plants. Also, despite the overwhelming evidence that exotic species will create water quality problems, few efforts have been made to identfy the mechanisms by which exotic plants spread or to reduce the opportunities for spread to uninfested areas.

During the past several years, many inquiries for technical information about aquatic plant control have been received from all over North America. It has been discouraging to note that problematic new infestations of Eurasian water milfoil often are the basis of these requests. This is particularly unfortunate because eradication of this plant is virtually impossible by the time new populations have become large enough to be noticed by the public and are reported to agencies responsible for lake management. Costly perennial control programs are often required within several years of introductions of exotic species.

While some federal, state or provincial governments may have legislated responsibility to prevent the shipment or dissemination of aquatic plants, practical enforcement is minimal because of manpower and funding limitations. Also, the legislated responsibility generally ends at the local borders, and, after the initial infestation, the local agency must take action to contain these exotic plants.

In British Columbia, boaters have been the main source of introducing Eurasian water milfoil to previously uninfested water bodies through movement of vegetative fragments on boating equipment. Boaters are believed to have spread this plant to Wood, Kalamalka and Cultus Lakes from 1974 through 1976. In recognition of the threat to noninfested water bodies, a voluntary boater quarantine operated from 1978 through 1981. This project was valuable in documenting the transport of Eurasian water milfoil on boating equipment and gathering information on boater movements; the main objectives were public information (more than 52,000 boaters were contacted) and reduction of fragment spread (Anon. 1986). Unfortunately, by 1981, Shuswap Lake (a

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frequent destination for boaters leaving Okanagan Valley lakes) was found to support Eurasian water milfoil and the roadside quarantine project was discontinued. The spread of Eurasian water milfoil to Long Lake, Vancouver Island (about 1980) and Christina Lake (about 1985) also appears linked to boaters.

Equipment used to control Eurasian water milfoil (especially aquatic plant harvesters) may be a potential source of fragment spread unless the machines are completely cleaned of viable plant material before they are moved to uninfested areas. Exotic aquatic plants also may be introduced by man to new locations from aquaria (Couch and Nelson, 1986) or by inadvertent transfer with other species. On Vancouver Island, Eurasian water milfoil was introduced to several small, privately owned ponds and at least one public waterbody because of transplantation of water lilies (Nymphaea sp.). Water lilies are frequently cultivated by members of the public and when tubers contaminated with Eurasian water milfoil are shared by friends and neighbors and transplanted, fragments may be introduced to new locations.

What can be done?

Preventive measures to minimize the spread of exotic plants are desirable, but may have limited practicality, depending on local circumstances. Because of numerous technical problems, including the costs of documentation and preventive surveillance, no method can guarantee success. In British Columbia, public education activities since about 1974 have alerted the public to the problems created by Eurasian water milfoil and encouraged public cooperation in identifying possible new infestations and reducing further spread. Major public information activities in 1986 included:

- press releases from the province and local agencies about new infestations and control programs;
- placement of warning signs at 25 strategic locations on major highways and about 285 boat launch ramps throughout the province alerting boaters to clean boating equipment prior to leaving infested areas to avoid spreading Eurasian water milfoil;
- placement of boater warning signs at 18 border crossing points from the United States and Alberta, and distribution of boater warning cards during summer months at Canada Customs entry points from the State of Washington and two Parks Canada entry points to British Columbia from Alberta.

Despite these relatively inexpensive public education efforts, and the earlier publicity generated by the costly roadside quarantine programs, new introductions have continued in British Columbia waters. While it is impossible to quantify the benefits of preventive measures, the combination of public information, surveillance and prompt action has helped to reduce the rate of spread and post-infestation impacts. While slow, further spread appears inevitable, there is some satisfaction in having made a practical effort and in the realization that uninfested areas have been protected, avoiding additional control programs.

Cooperation with citizens groups to protect their local resource also has merit; lakeside resort and marina owners and residents must be educated about the potential for problems with exotic plants. Where practical, restrictions on motor boat access or mandatory inspections of all boating equipment prior to entering the lake may help prevent unwanted introductions. Also, interest appears to be growing in better regulation of the sale and transportation of exotic aquatic plants. Legislators, lake managers and lakeshore residents and users have a responsibility to be more aware of the risks and to find more effective means to reduce further spread of undesirable exotic species.

Reprinted from NALMS LAKELINE

Warnings Posted at Schroon Lake

★★★★★★★★★★★★★★★★

BOATERS!
★ BEFORE LAUNCHING ★

Inspect Your
BOAT — MOTOR
ANCHOR — TRAILER

Put ALL WEEDS In Trashcan

MILFOIL - ENEMY #1
Keep MILFOIL and Other WEEDS
Out of the Water

★★★★★★★★★★★★★★★★

Holistic Approach To Lake Management Urged

In considering the issues facing small lakes in New York State, attention should be paid to foresight capability and interconnectedness of problems that plague the diverse groups of resource users involved with these lakes.

This was a common theme which was repeated throughout the annual June Lake Associations Conference sponsored by the (N.Y.) Federation of Lake Associations and hosted by the Research Center at SUNY Oswego.

Conference chairman Warren Flint urged attendees to support a holistic perspective toward small lake management to guarantee that various problems are not addressed in piecemeal fashion. Flint suggests that lake management plans can be developed with recommendations for insuring a balance between the valuable but diverse uses of a lake and the long-term protection of its resources for enjoyment by future generations. Lake management then, should not imply restricted use of resources but instead should call for knowledgeable use of these resources for optimum social benefit, including the other than economic importance of lakes. Instead of taking reactive measures when a serious problem develops or worsens, proactive practices are developed to maintain a preventative and predictive posture concerning the lake and the most sound uses of its resources.

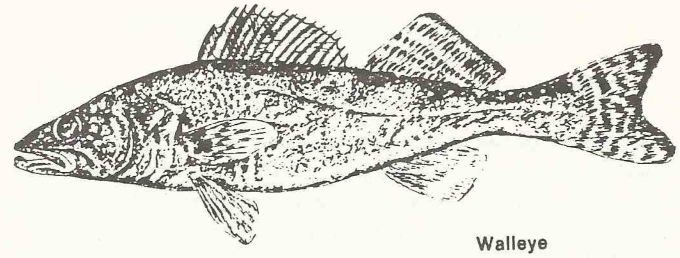
Scott Kishbaugh, NYSDEC, reported on the first year of the Citizens Statewide Lake Assessment Program, a cooperative effort between the NYSDEC and FOLA where citizen volunteers are trained to monitor the water quality in their lakes throughout the course of the summer. Information obtained from the sampling can be used to build a data base for each lake.

The initial twenty-five lakes participating in 1986 has been expanded to thirty-five for the 1987 season and in addition to the water sampling one research project has been assigned to each lake: dissolved oxygen monitoring, lake level and precipitation monitoring, or vegitative surveys. It appears that citizen volunteers can accurately and reliably gather water quality data and that changes that occur over the course of the summer can be detemined, and overall trends in water quality may be identified in subsequent years. At that time, these data may provide the basis for management decisions tailored specifically to each Program Lake.

SUNY Oswego is in the process of transcribing all of the conference presentations from tape to hard copy text. These proceedings will be available in September from the FOLA office in Rochester.

At the Annual Meeting of the membership President Colgan reported that membership has increased to 192. It is comprised of 10 Corporate, 54 Individual, 26 ($100) Associations, 29 ($50) Associations, and 73 ($30) Associations. He welcomed new Board of Directors Margaret Schaefer and Warren Flint. Colgan announced that "Waterworks" newsletter will be produced at a cost of 50 cents per copy as requested by individual lake associations for distribution to their directors, officers and/or entire membership.

Waterworks is published four times a year. Individuals who wish to submit material or articles to Waterworks are welcome to contact the editor: Tracey M. Clothier, RR #2, Box 2319, Lake George, NY 12845. For additional copies of Waterworks and address changes, contact: Dr. John Colgan, President, 273 Hollywood Ave., Rochester, NY 14618, (716) 271-0372. Please note that all mail should be sent through the Rochester office.



Walleye

A Good Idea

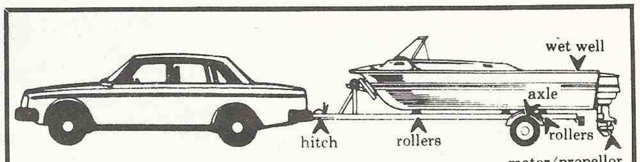
By Bob Rogers

A plant cannot thrive without three critical essentials: nutrients, moisture, and light. You can therefore do something about the weeds in your swimming area, to some extent. You can deprive them of sunlight and thus limit their growth. The use of black plastic sheeting spread on the bottom and weighted down with gravel has been a common practice and an effective one, for a limited time. The trouble is that particles suspended in the water will settle out on the sheeting and become a new bed for weeds.

A better idea is to build platforms of 2x4's, stapling the black plastic to the tops, floating them into place anchored to the bottom with cinder blocks. Set them out early in May and leave them there until the middle of June or until you begin to use your swimming area. By cutting out the sunlight for this length of time the weeds will have been suppressed rendering them incapable of appreciable growth for a good part of the summer season. Look at the lake bottom underneath a boat that is kept tied to the dock and see how few weeds are there. Advantage: you can store these platforms ashore quite easily, particularly if you have made them all the same size.

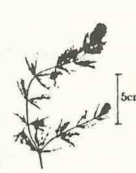
Acid Rain Study Extended to Catskills

The Adirondack Lakes Survey Corporation, established in 1983 by the Department of Environmental Conservation and the Empire State Electric Energy Research Corporation to determine the status of fish problems, water chemistry and physical characteristics of approximately 1,200 Adirondack ponds over a three-year period, is extending its work to include selected waters outside the Adirondacks. Among the 450 sites added to the project are 250 in the Rensselaer Plateau, the southern Catskills and the Hudson Highlands. The remaining new sites are in the Adirondacks.



Locations where aquatic weeds are often found

Boaters can help prevent the spread of Eurasian water milfoil by removing all aquatic weeds from **trailer, boat, motor/propellor** and **anchors** before leaving an infested lake and before launching at a noninfested lake. Special care should be taken to remove aquatic weeds from the wet wells of trailered boats and the interior of cartop boats and canoes.



EURASIAN WATER MILFOIL FRAGMENT

FOAM: A Cause For Concern?

By David Courtemanch
Maine Department of Environmental Protection

A decade or two ago, people became alarmed by the pollution that was obviously occurring in some lakes. A large part of that visible pollution was caused by the ingredients in home laundry agents, and people often felt that pollution was only what one could see. However, the case is more likely what we do not see. Today, although laundry ingredients still have the potential to harm our lakes, their influence is less obvious. Other, non-laundry, uses of detergents also pose a threat to lakes. This article discusses one aspect of the changing nature of lake problems.

• Detergents and Foam. Every summer, one of the most common inquiries made by people is "does foam on the shore of a lake indicate detergent pollution and declining water quality?"

Before answering that question, we need to know a little about detergents and the processes which produce foam.

Foam is created when the surface tension of water (attraction of surface molecules toward the center, which gives a drop of water its round shape) is reduced and air is mixed in, causing bubble formation. Many substances, besides soap detergents, will reduce surface tension.

"Soap" is generally defined as compounds of fats, fatty acids, and caustic soda. These materials, by reducing the surface tension of water, increase its cleansing ability and produce suds.

The term "detergent" usually refers to synthetic compounds which came on the market after World War II. They also work by reducing surface tension but have the added properties of "softening" water and emulsifying (or mixing with) oils. The ability to soften water gives detergents their great advantage over soap. Calcium and magnesium in "hard" waters tend to combine with soap, binding soil particles and causing the characteristic yellowing of clothes. Phosphates in the synthetic detergents tie up the calcium and magnesium, thus increasing cleaning efficiency.

The first synthetic detergents to come on the market were usually compounds of alkyl benzene sulfonate (ABS). In the late 1950s and early 1960s, many communities experienced tremendous foam problems in lakes, rivers, sewage treatment plants, and even water faucets because of contaminated wells. These events were highly publicized, and foam became a common indicator of pollution.

Unlike soap, the structure of the ABS molecule was in a branched form which could not be broken down by bacteria. Hence, the detergent accumulated in the water and was labelled "nonbiodegradable." To combat this problem, the detergent industry changed the chemical structure to a simple linear form, LAS, which **could** be attacked by bacteria. Virtually all detergents today are of this simple "biodegradable" form, and great quantities of foam which had occurred from accumulation are thus prevented.

To answer the original question then: "No, foam on a lakeshore or in a stream probably is not due to detergent contamination." Most foam is a product of nature. Small trout streams often have pools of foam where fish will hide.

"Natural" foaming occurs when small aquatic organisms (such as algae) die and decompose, releasing a variety of organic compounds. Organic compounds leached from soil also cause foam. The Indians were known to have used various materials, such as bark and plant roots, to clean items. Like soap and ABS, these compounds reduce surface tension.

As wind or currents stir the water, foam is produced and may accumulate in quantities on windward shores, in coves, or in eddies. The natural foam has a somewhat earthy or fishy aroma, and it breaks down rather quickly. Foam from silt or erosion is usually a dirty brown color. Foam is often seen in the early morning hours and is gone by midday. Detergent foam, in contrast, will have a noticeable perfumy smell from additives which give your wash that "rosegarden" or "lemon fresh" smell.

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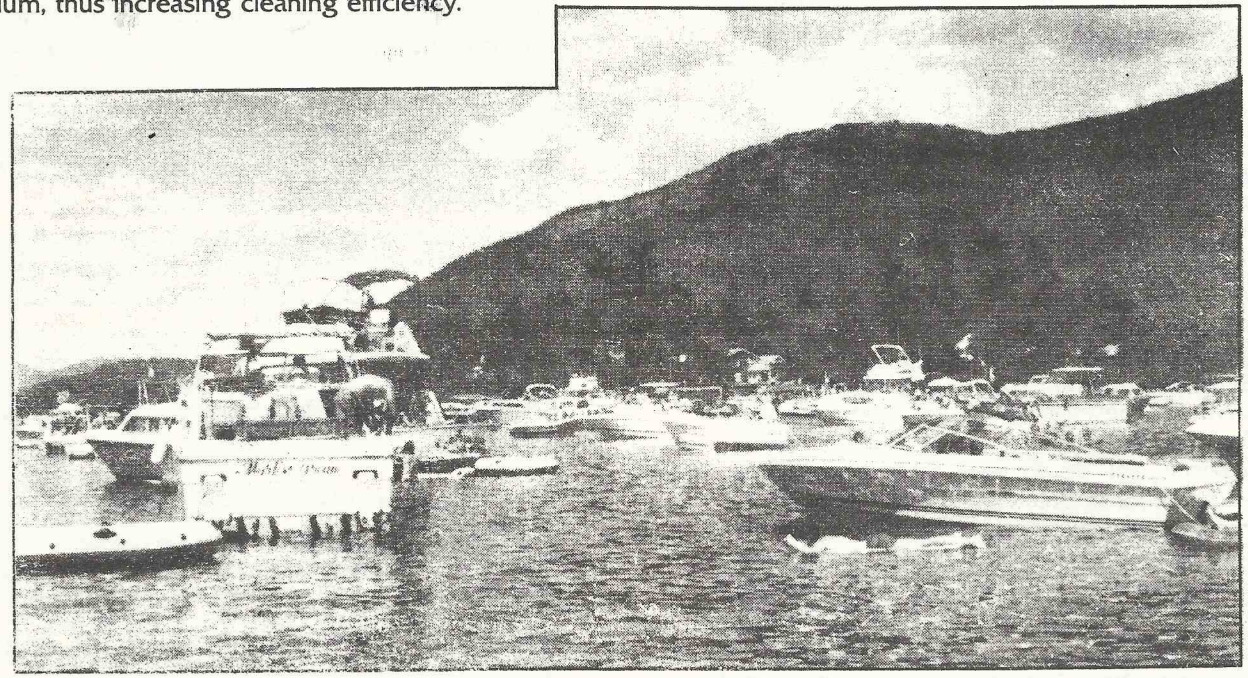

BUSY BAY AT LAKE GEORGE

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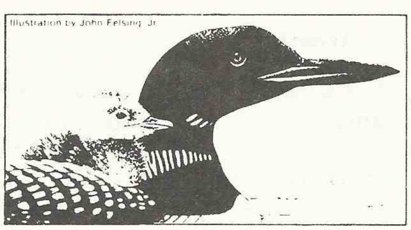
Detergent pollution and foam can be a problem, but the foam will be localized close to the source of the discharge. A simple experiment demonstrates that widespread foaming on a lake is probably not from detergents. Using two common brands of detergent, we found that it took about 0.07 grams of detergent per liter of water to create suds in the laboratory. To put this in terms of a lake, it would take about 43,178 kilograms (95,207 pounds) of detergent to suds-up a 40.5 hectare (100 acre) lake with an average depth of 1.5 meters (5 feet). That's quite a few boxes of detergent!

• Detergents and Phosphate. Although unnatural foam may no longer be a problem in lakes, phosphates in detergents definitely are. Phosphorus has been positively shown to be the most important cause of blooms of algae in lakes. Research has shown that algal blooms may be expected if the concentration of phosphorus exceeds about 15 parts per billion.

Maine's water quality statutes presently restrict the phosphate level of detergents to 8.7 percent by weight. This is still a considerable amount, however, when it comes to preventing eutrophication (premature aging) of lakes.

If we reconsider our hypothetical 100 acre pond, it is easy to see how vulnerable it is to phosphorus inputs. At the 8.7 percent level, there are about 13.1 grams of phosphorus in 0.45 kilograms (1 pound) of detergent. At this rate, it would take only about 20.9 kilograms (46 pounds) of detergent to raise the phosphorus concentration of the pond by one part per billion, assuming all other inputs and outputs remained equal. This is a very realistic threat, considering activities such as laundering, washing boats, cars, and so forth which might occur around a lake.

The potential for phosphate overloading in any of our developed lakes should not be brushed aside, as it is very real. For this reason, people in lakeshore areas should use only non-phosphate detergents, or better yet, take their wash to a laundromat away from the lake. People who like to bathe in a lake should use only plain soap, such as Ivory, which contains no phosphate. They should consider, however, that although bathing may not degrade water quality standards, their neighbors may not appreciate using the same "bathwater" for their activities.



L.A.K.E.

by Bob Rogers, Chairman

Kent is a town of lakes. They are amongst our most precious natural resources. Many of our lakes share common problems. Today more than ever, it is important that we find solutions to these problems in order to preserve and protect these natural treasures, for ourselves and the future.

It is out of love and concern for our lakes that the lake associations of Kent joined together to form a single, unified organization, LAKE, with which to address the many problems that afflict our lakes and lake front communities in the town of Kent.

As you are well aware there are many pressing problems that face our lakes today, and the rivers and streams that feed them and the welands adjacent to them. Some of these are the result of natural processes such as eutrification, the natural aging of lakes. Some are created by man, such as acid rain, or the compounding effects of excessive, or poorly planned development.

The goal of LAKE is to try and address these problems, to promote the sound management, study, protection, enhancement and wise use of the lakes, rivers, streams, wetlands, and their watersheds in the Town of Kent and to provide a clearinghouse for environmental expertise; to disseminate environmental information; to sponsor research; and to educate.

Member Associations include Lake Carmel, ChinaBarrett, Drew Pond, John's Pond, Ninham, Kentwood, Palmer Lake, Pine Pond, Lake Sagamore, South Lake, Seven Hills, Spring Lake, Lake Tibet and Twin Brooks Lake.

Water Quality Board - Activities Underway

Several steps have been taken to bring the new Water Quality Board of the Finger Lakes Association closer to official status. On May 12, a group of representatives met at the F.L.A. office in Penn Yan to discuss the structure and work of the Board. Ten of the 12 counties participating from the Finger Lake Region were represented at the meeting. Also attending were representatives from the Department of Environmental Conservation, N.Y.S., Cooperative Extension, the N.Y.S. Federation of Lake Associations and the Cornell Laboratory for Environmental Assessment and Remote Sensing.

The status of state funding for each participating county was discussed, along with specific support for the work of the new Board. A total of $2.5 million will be directed toward aquatic vegetation control activities in the Finger Lake Region this year, making it one of the largest "lake programs" in the United States. The funding will come from the N.Y. State Budget, thanks to the support of state legislators from the Finger Lakes Region. It is being administered by the N.Y.S. Department of Environmental Conservation.

All 12 counties participating in this program have now agreed to support the work of the Water Quality Board, who will coordinate and encourage the exchange of information between the counties and the F.L.A. Two primary methods are now being explored. The first communication vehicle is a Newsletter, TIE, which stands for "The Information Exchange" and the first issue has already gone out. The second communication vehicle being explored is the development of a computer link between participating agencies through an electronic bulletin board.

A planning committee was also formed at the meeting to develop operating procedures and to help guide decision-making processes during the start-up period.

Understanding Water Quality Testing Parameters

By Scott A. Kishbaugh

All lakes and ponds undergo stages of succession, a process in which lakes experience changes in (biological) productivity, and physical and chemical characteristics. In limnology, the study of fresh waters and their communities, these stages of succession have been divided into a series of trophic levels, or states. These trophic states range from low productivity and high clarity waters (**oligotrophic state**) to lakes with high productivity and low clarity (**eutrophic state**). Intermediate levels of productivity and clarity correspond to a **mesotrophic state**. The progression from oligotrophy to eutrophy, the increase in productivity and decrease in clarity, corresponds to an enrichment of plant and animal life. This process is referred to as eutrophication.

Eutrophication is a natural porcess; since the trophic state is a stage within the natural process of succession, the trophic state is not necessarily indicative of man-made pollution. However, when a lake progresses to eutrophy with the undue influence of man, this progression is referred to as **cultural eutrophication**. Cultural eutrophication, caused by shoreline erosion, agricultural and urban runoff, septic seepage, and other significant pollution problems, can greatly accelerate the natural aging process of lakes and significantly impair the water quality and value of a lake. Successional changes in the plant and animal life within the lake, shoreline and surrounding watershed, and the ultimate extension of aquatic plants and emergent vegetation across the water surface and throughout the lake, result in the transformation of the lake into a marsh, prairie, or forest. Eutrophication, a process which naturally occurs over the course of hundreds and thousands of years, can occur much more rapidly with an increase in man's activities. The extent of cultural eutrophication, and the corresponding pollution problems, can be flagged by significant changes in the trophic state over a short period of time.

By measuring the concentrations of phosphorus and chlorophyll **a** and the clarity of a lake, and by looking at the changes in these parameters over a period of months and years, it is possible to characterize and assign trophic states to lakes.

A number of parameters analyzed in the CSLAP provide valuable information in characterizing lakes. By adhering to a consistent weekly sampling protocol, the Citizen's Program can assess the seasonal and yearly fluctuations in these parameters, and evaluate the water quality in each of the Program waters. A comparison of a specific year's data to existing historical data will pinpoint any trends in these fluctuations, and help to determine if water quality is improving or degrading. Such a determination is critical in devising management strategies for any lake.

Temperature

Many lakes in New York State are covered with an ice layer during the winter time. As soon as the ice melts, the surface water temperature is just above freezing (0° or 32°F). As the air temperature warms, surface water temperature will increase to 4°C. Since water is most dense at 4°C, this surface water will sink to the bottom, to be replaced by colder subsurface water. This process continues until the entire lake is at 4°C. Wind currents allow the lake to mix; shallow lakes can mix for several months, while some deep lakes (meromictic) never mix completely. This is called spring turnover.

Throughout the spring and summer, as the sunlight causes the water temperature to rise, the surface water will begin to warm more quickly than the deeper waters. In many lakes, the temperature difference between the surface and deep waters will become great enough to create thermal and density layers. These stratified lakes often cannot be mixed by winds. The upper warm water layer of a stratified lake is called the epilimnion, and the bottom cold water layer is known as the hypolimnion. The waters within each of these layers are roughly homogenous (of similar composition) and homothermal (of similar temperature). A smaller third layer, called the thermocline, provides an interface between the epilimnion and hypolimnion. The thermocline is characterized by a sharp temperature and density gradient. The depth of the thermocline has a great effect on the number and diversity of plant and animal species present in the lake.

In the fall, as the air temperature falls, surface waters cool until the entire lake once again assumes a constant temperature. Fall turnover occurs as the thermal gradient is broken down. This mixing continues until the water temperature reaches 4°C. As the air temperature continues to drop, water 4°C falls to the bottom of the lake, replaced by cooler surface water. If the air temperature subsists below freezing, the surface water will eventually freeze, forming an ice layer on the surface. Fortunately for aquatic plant and animal life, due to the high density of water at 4°C and the ice enclosure by the surface water, bottom waters remain at or above 4°C, creating an inverse stratification (temperature increasing top to bottom).

Temperature can have a great affect on water quality. As temperature increases, the amount of oxygen that can be dissolved in the water decreases. Certain fish species can only survive in these cold water/high oxygen conditions. Temperature also affects the rate of photosynthesis and metabolism of many aquatic species. Most aquatic organisms can survive in a wide range of temperatures, but severe extremes at either end of the spectrum can prove to be harmful or even fatal. In turn, the amount of shoreline, emergent, and submergent vegetation, and algal populations can have localized effects on water temperature.

Weather Conditions

The amount of sunlight, wind, and precipitation can have a significant affect on water temperature, as noted earlier. However, weather conditions may have other effects on water quality. The duration and intensity of wind can influence the extent of shoreline and watershed erosion in a lake, and can increase the turbidity in shallow lakes by stirring up bottom sediment. Sunlight is a critical element in photosynthesis and in evaporation. Precipitation often deposits airborne particles and pollutants in a lake, carrier silt and nutrients from agricultural fields and city streets via runoff, and in some cases provides a substantial volume increase to the lake. Periods of high wind, sunlight, or rain, or localized unusual "storm" events can have significant short and long term repercussions on the water quality of a lake.

pH

Pure water consists of an equal number of hydrogen (H^+) and hydroxide (OH^-) ions, or charged particles. pH is a measure of the number of hydrogen ions in solution. At a pH of 7.0, the number of hydrogen ions equals the number of hydroxide ions. This solution is considered neutral. At a pH below 7, the number of H^+ ions exceeds the number of OH^- ions, and the water is acidic. In a basic solution, where the pH exceeds 7, there are more OH^- ions than H^+ ions. Solutions one pH unit apart have a ten-fold difference in the number of hydrogen ions (or hydroxide ions).

Most natural waters fall within the range of pH 6-9, which fortunately is an acceptable range for most aquatic organisms. Pure rainwater, which is in equilibrium with atmospheric carbon dioxide (a weak acid), has a pH near 5.6. Acid precipitation (rain, snow, fog, etc.) can have a pH as low as 4, or nearly 40 times more acidic than normal. Conversely, dust particles and other airborne pollutants can bring the pH of precipitation to above 7.

Lakes overlaying limestone or other calcerous (lime or limestone-bearing) deposits have a significant capacity to buffer pH changes brought about by acidic inputs; these lakes are known as hard water lakes and usually have a fairly constant pH of 6.5-8. Lakes in granitic (igneous rock) areas do not have this buffering capacity. These soft water lakes can experience a drop in pH to less than 6 (due to acidic inputs) or a rise to greater than 9 (from algal activity).

pH is best and most accurately measured on-site. However, the equipment required for an accurate measurement in the field is expensive and very delicate. Although not ideal, laboratory measurement of pH can give a good estimate of the hydrogen concentration in a lake.

Specific Conductance

Specific conductance measures the electrical current that passes through a solution. Electrical current is carried by charged particles (ions), so specific conductance is an indirect measure of the number of ions in solution. Values for specific conductance are reported as micromhos per centimeter (μmho/cm).

Soft water lakes, such as those often found in the Adirondack Mountains, have few dissolved ions; as a result, the specific conductance is usually less than 150 μmho/cm. Hard water lakes often have a conductivity exceeding 300 μgho/cm. Specific conductance readings usually remain constant for any given lake during the sampling season; any significant changes in the conductivity usually indicate a significant amount of precipitation or erosion over a short period of time. Waters contaminated by acid often show elevated conductivity; conductance can often be used to flag acid-contaminated pH samples.

Color

All lake water is colored to a certain extent. Color in lakes is classified as either apparent or true. Apparent color is caused by both particles suspended in the water, such as algae or silt particles, and by dissolved matter, usually organic in nature. True color, the standard conventionally used by limnologists, measures only the dissolved portion of color, usually caused by organic matter such as decaying vegetation. It is determined by filtering a water sample (to remove suspended particles) and comparing the filtrate (solution passing through a filter) to a scaled series of platinum-cobalt color standards. Very clear waters would yield a value close to 0 milligrams of platinum per liter of solution, while bog (tea-colored) lakes may have color exceeding 200 mg.Pt./1. In general, waters with greater than 30 mg Pt/1 have sufficient color to be perceived by the human eye. Since true color is predominantly dissolved organic matter, color can often be related to dissolved organic carbon, an important food and energy source for aquatic organisms.

Color is not necessarily indicative of water quality. Highly colored lakes can have water quality comparable to that of very clear lakes. Significant changes in the color of lakes may indicate, however, that an "unnatural" source of color may be polluting the lake.

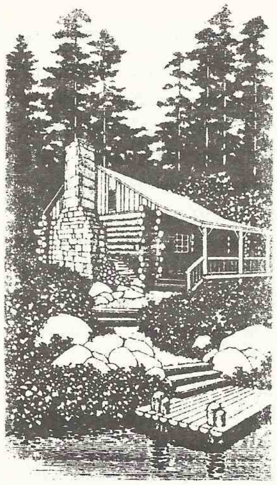
Transparency

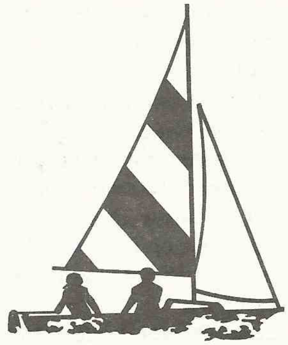
The transparency, or clarity, of a lake can be affected by both dissolved particles and suspended matter. For most lakes with less than 30 color units, the transparency is an indirect measure of the amount of algae present (clarity in highly colored lakes (more than 30 color units) may be influenced by both dissolved organic matter and algae). The standard method for determining clarity is the Secchi disk transparency. The depth at which a black and white 20 centimeter diameter Secchi disk disappears from site is recorded as the Secchi disk transparency.

Although it is a fairly simple test, the Secchi disk transparency can indicate a number of important water quality characteristics. The transparency can be related directly to the trophic state in low color lakes. Secchi transparency values range from a few centimeters, corresponding to low clarity, highly productive hyper-eutrophic lakes, to as high as 40 meters, characteristic of high clarity, very unproductive, hyper-oligotrophic lakes. Values for any given lake are very seasonally dependent; a significant change in the Secchi disk transparency over the course of several weeks may be a "natural" phenomenon, and not necessarily indicative of any significant pollution problem.

Nutrients - Nitrogen and Phophorus

Perhaps the most important element in determining lake water quality is biological productivity. Higher organisms such as fish cannot survive if organisms lower on the food chain do not survive. Thus, organisms lowest on the food chain, such as algae (phytoplankton) and other microorganisms, determine the productivity of a lake. Like other organisms, algae have specific nutritional requirements for survival. If any nutrient is in short supply, algal growth will be limited until the supply of that nutrient is increased. In most lakes, phosphorus and nitrogen are considered to be the limiting nutrients. In some lakes, "natural" inputs of phosphorus and nitrogen (precipitation, groundwater, biological processes, etc.) are sufficient to allow significant algal growth. But for most lakes, excessive algal growth will be retarded without help from man's activities in the watershed. Agricultural and urban runoff, farmland and shoreline erosion, septic system failures, and sewage effluent can contribute fertilizers, detergents, and other sources of phosphorus and nitrogen to a lake. With elevated phosphorus and





nitrogen levels comes the potential for algal growth, though other limiting factors such as light, space, temperature, and other nutrients may preclude the onset of algal blooms even wtih an abundance of phosphorus and nitrogen.

Algae and aquatic vegetation prefer nitrogen in the nitrate (NO_3) form. For most lakes, the concentration of nitrate rately ventures over 100 micrograms per liter (a microgram = one-millionth of a gram), though the actual levels are very seasonally dependent and could approach much higher levels at localized polluted sites. Nitrite (NO_2) can also be utilized by algae, and in most waters concentrations are less than 10 micrograms per liter.

Phosphorus is most frequently considered the limiting nutrient in lakes; therefore, most lake management strategies have been geared toward a reduction of phosphorus inputs. Algae most commonly use phosphorus in the dissolved orthophosphate (PO_4^{-3}) form, though PO_4^{-3} often constitutes less than 10% of the total phosphorus in solution. However, other forms of phosphorus can be used. In most natural waters, total phosphorus concentrations range from 0-50 μg/L. In low productivity, oligotrophic waters, phosphorus levels approach the lower end of this range, while highly productive, hyper-eutrophic lakes often contain phosphorus levels exceeding the upper end of this range.

Chlorophyll a

Chlorophyll a is the primary photosynthetic pigment found in all algae and most photosynthetic organisms. It constitutes approximately 1.5% (by dry mass weight) of the algal biomass. Thus, chlorophyll a measurements can be used to determined standing algal biomass (the total amount of algae present at a given time in a given location).

Most naturally mesotrophic waters have chlorophyll a readings between 2 and 8 micrograms per liter. In highly productive eutrophic waters, these readings can exceed 100 μg/L, while in oligotrophic waters, chlorophyll a values are often less than 1 μg/L. In lakes with less than 30 color units, chlorophyll a and Secchi disk transparency can be directly related; plotted on a logarithmic scale, data points for these parameters form a straight line. In addition, chlorophyll a and phosphorus values show a high correlation.

Phosphorus and (to a lesser degree) nitrogen values can be used to predict the potential for future algal growth; chlorophyll a readings measure actual (present) algal growth. Thus, these parameters are important in determining and predicting water quality conditions and trends. Along with phophorus and transparency readings, chlorophyll a values are used to predict the trophic state of lakes (for clear water with moderate rooted aquatic vegetation).

Focus On The Chautaugua Lake Association

By Helen Mae Smith

1986 Accomplishments

★ Rebuilt and modernized a used Harvester that we purchased in the fall of 1985. The project was accomplished by using in-house capabilities at a total cost of $32,000.00 or 50% of the cost of a new harvester.

★ Constructed a second shoreline work crew conveyor barge in our shop which brought the total number of lake oriented equipment to 15 units.

★ Continued our extensive annual equipment maintenance/rebuilding program at a cost of $30,591.00.

★ After 4 major storms hit our area during the summer, tons of debris washed into the lake. The CLA conducted its most extensive clean-up program in its 41 year history. In connection with our clean-up program, we assisted the Sheriff's Department with recovery of boats set adrift by the storms. We also assisted the NYS Parks & Recreation Navigation Service with recovery of adrift marker buoys.

★ Our harvesting operations removed from 30 - 40 tons of weeds daily from the lake, which was made possible by the use of our 5 harvesters, 2 large capacity heavy dump trucks, and equipment truck, a small dump truck, and two fully automated harvester to shoreline unloading conveyors, 2 shoreline barges and 1 transport barge.

★ We abided by a New York State mandated Hearing Process that cost the Association $6,261.00 to acquire our 1986 Herbicide Permit.

★ With the technical assistance of the NYS Department of Environmental Conservation, the State University of New York at Fredonia, and a Marine Biologist, a 532 acre Herbicide Program was completed at a cost of $31,808.00.

★ With the help of many volunteers we conducted a very successful Business Fund Drive and Individual Fund Drive program raising $74,826.00. Also applied for and received funding from City, County, State, Towns and Villages, in the total amount of $81,103.00. Conducted a harvesting program for Cassadaga Lake generating $11,776.00 in CLA revenues.

★ All funds received in 1986 were applied towards our 1986 Operations which totaled $300,000.00.

★ Applied for and received grants from local Foundations totalling $79,850.00 which was used for special projects and winter shop maintenance programs.

★ Continued the annual Fourth of July Flare Lighting Celebration which netted $4,238.00 to the Association.

★ We conducted our first annual Nautical Auction that netted $2,419.00 for the CLA.

★ Provided jobs for 4 year round employees and 10 summer employees.

Discouraging Canada Geese

Do Not Feed The Geese

Some people feed geese and encourage their presence. Often these handouts are "junk foods" such as popcorn, potato chips and bread. After a few weeks of feeding, the birds will become dependent on people as a food source and forego their natural diet of grasses and clover.

Like humans, a steady diet of junk foods can cause health problems because the nutritional needs of the geese are not met. As a result, the birds become more susceptible to sickness and disease. Additionally, since human handouts also tend to concentrate the geese in a small area, one bird's disease can easily spread to many.

Low Shoreline Barriers

Geese are relatively lazy and prefer to walk, not fly, to and from the water. A low fence, hedgerow, wood cribbing, rock wall, natural vegetation or other physical barrier at least two feet high will discourage geese from frequenting a particular area.

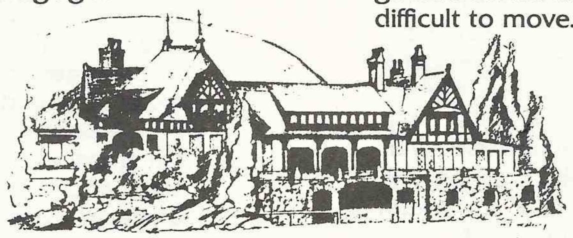
Scare Tactics

Scarecrows, streamers and flags are sometimes effectve for controlling birds. It is important that at least a portion of the scarecrow or other object moves in the wind. Also, the objects must be moved every two or three days so the geese do not become used to them.

Helium balloons are sometimes very effective because waterfowl are wary of moving objects above their heads. Balloons should be inflated to approximately two feet in diameter and tethered on 50 to 75 feet of monofilament line (at least 50 pound test). Again, the balloons should be moved and maintained frequently to remain effective.

Start Early and Be Persistant

It is much easier to drive geese away when they first arrive in a new area. Do not allow a pattern of feeding and loafing to develop. Once they become established geese become more tolerant of disturbances and more difficult to move.



Those Were The Days!

Johnny Biosphere (aka Dr. J. Vallentine, Ph.D.) at Oswego

In 1970, Dr. John Vallentine represented the scientists advising the International Joint Commission for the Great Lakes at the Commission's hearing in Rochester. Sometimes during the next ten years he transfigured into Johnny Biosphere, as he partly related to the Federation at Oswego. Carrying the world on his shoulders (or a replica globe, lighting up on demand) and the sounds of a sampling of representative animals. J.B. has appeared before the International Great Lakes Research Conference as well as elementary school classes.

The performance inspires the diverse span of audience — at the younger end with wonder and new sympathy, and at the academic end — well, he says what is on the minds of many scientists who are restrained to talk and write in hard-hammered language, which can be defended. All of the acts are not for everyone. J.B.'s Whiskey drinking (doubling the dose at every swallow) is presumably not for the pigtail set, and alarmed watchers have sometimes asked him to stop, please! Vallentine has become a competent and adept showman, with a variety of offerings and high skill in thinking on his feet to suit the uncertainty of audience reaction. J.B.'s message is not just kid stuff, even though many adults will have heard the message of "save our home: Earth" before. There is an intellectually and emotionally challenging level below the surface words.

A scientist runs risks when he becomes a showman (or a teacher or an activist) and Vallentine has managed to avoid becoming a clown or (altogether) a preacher. The success of water pollution abatement in the Great Lakes area owes much to him as a scientist and advocate. At the 1970 hearing, the soap and detergent industry (with the highest public relations budgets in the country) had just launched the full force of its counter-attack against the scientist-advocated policy of lowering phosphorus levels in water by lowering the content in detergents. The prize champion for the time being was an industrial chemist who had never studied a lake. He had surveyed written reports and concluded that carbon, not phosphorus limited plant growth in water.

Vallentine stood tall that day, as did Dr. Joseph Shapiro of Minnesota, who came down like a red-bearded Viking god of wrath, to tell the Commissioners what a lake was really like.

I invited John and Joe to dinner that night, and they came to Geneseo a few months later for a conference at which the group of leading lake scientists in North America publically supported phosphorus control. Curiously, I met two others at these meetings with whom I worked in the years which followed. One was Dr. Charles Morrison, who is still applying his genius for democracy to the problem of organizing citizens for achieving environmental quality. Joe Shapiro went on to become the pioneer in identifying biomanipulation in lake management, and he was one of the six or eight of us who though out the ecosystem concept of lake ecology and management: we now should look beyond nutrient control alone, since healthy lakes may also be fertile. Rather, the whole range of physical and biological conditions which affect lake health can be subject to management.

Partly listening between the words, at Oswego, I realized that John Vallentine shared a special deep experience with me, and a few others. We are the veterans of the phosphorus controversy. A handful of scientists stood off the powerful ruthless campaign by ego-driven industry with unlimited finances. While the victory was not complete, we did win phosphorus removal from detergents in the Great Lakes area. We might have won the nation, but one of the president's close associates was a Proctor and Gamble executive.

In our embarrassing flight of fancy, we know how those few remaining pilots of the RAF felt when they realized, incredulously, that they had won the Battle of Britain.

Herman S. Forest

A Look At The Clean Lakes Program

By Jay Bloomfield and Jim Swart
Division of Water, DEC

In 1972, the Federal Clean Water Act was signed into law. Section 314 of the Act created the Clean Lakes Program, providing funds to the states to carry out approved methods and procedures for restoring and protecting publicly owned freshwater lakes. Since 1976, the Division of Water at DEC has administered the Clean Lakes Program in New York State with projects having been conducted in the Albany and Rochester areas, New York City, Buffalo, Niagara Falls, Long Island, and the Adirondack Mountain region. Over the past ten years, total project worth has averaged approximately one million dollars annually.

Funding

Before you rush over to the word processor to type up a grant application for your favorite lake, it should be pointed out that there have been several restrictions over the past four years on the eligibility of projects for Clean Lakes funding. As a result, no new Clean Lakes projects were initated in New York State. However, on February 4, 1987, Congress overrode President Reagan's veto of the Clean Water Act amendments. These amendments provide the potential for substantial new Clean Lakes funds during 1988. Our estimate at this time is that over two million dollars will be available yearly to New York State if Congress appropriates the maximum amount authorized.

With these monies the Clean Lakes Program will continue, but with minor modifications to its scope and purpose. In general, to be eligible to receive funding, the State must classify and inventory all of its publicly owned lakes according to their trophic status (biological productivity); submit to USEPA a description of the methods and procedures which it intends to use to restore or protect its lakes; provide to USEPA a list and description of publicly owned lakes with impaired uses, not meeting applicable water quality standards or whose water quality is impaired by high acidity from acid deposition; and prepare an assessment of the status and trends of water quality in lakes. The assessment must include the nature and extent of pollutional loading from point and nonpoint sources and the extent to which use is impaired as a result of such pollution, especially pollution caused by trace metals and synthetic organics. All of these requirements must be met by April 1, 1988 for a state to be eligible for Federal Funding.

Key Requirements

Assuming that the Clean Lakes Program rules remain essentially unchanged, let's look at some of the key requirements for a project:

1. The lake must have some form of public access, and the more diverse the entries, the better. Public access can be as well defined as a public beach, a public boat launch site or a fishing pier. It can also be a shoreline, public park or even highway right-of-way which affords fishing access.
2. Prior to receiving funds for implementation of a management program for a specific lake, the State must prepare a report documenting the condition and uses of the lake and its water. USEPA will pay 70% of the cost of such a study which must contain an evaluation of various methods and procedures to restore or protect the lake. These methods and procedures include land use controls, stormwater treatment, agricultural Best Management Practices (BMP's), land acquisition, dredging, vegetation harvesting, level drawdown, bottom screening, phosphorus inactivation (bottom sediment treatment with alum), neutralization (acid lakes), biological vegetation controls and improved management of on-site wastewater systems (septic tanks).
3. Clean Lakes funds cannot be used to build, operate or maintain centralized wastewater treatment facilities, since other sections of the Clean Water Act provide for this type of funding. The use of cosmetic measures such as aquatic herbicides, which temporarily reduce the levels of rooted aquatic plants and algae, are also ineligible unless conducted in conjunction with methods or procedures which will provide more lasting results. One lake management technique which has questionable eligibility is fish stocking. To date, no New York State Clean Lakes project has contained fish stocking as an element. Also, a lake that is used solely for potable water supply is not eligible for funding.
4. Nonpoint source pollution must most often be the source of the major pollutional load. USEPA has discouraged the states from submitting applications for funding under the Clean Lakes Program for lakes where point source pollution is a significant factor in determining the water quality of the lake and has not been adequately controlled.
5. Once an acceptable state study has been submitted to and approved by the USEPA, the federal agency will provide 50% of the total cost for implementation. The state or local government or both must agree to provide the remainder of the project cost. In many states, state law provides for state funding of all or a portion of the remainder of the project cost. This is not true in New York, although a few localities have been successful in persuading the State Legislature to include funds for covering the local share of their specific Clean Lakes project in the State Budget. A bill to provide state funding of the local share of NYS Clean Lakes projects has been introduced in the State Legislature again this year, but the chance for its passage this session is considered slim.

Typical Projects

What does a typical Clean Lakes project look like? The project for Saratoga Lake, a large rural lake in Saratoga County, calls for the implementation of a comprehensive management plan for the lake and its watershed along with a water quality monitoring effort and public information program. Control measures have been instituted for agricultural and urban lands. A Lake Protection and Rehabilitation District has been formed, and the lake is drawn down every fall to reduce the extent of Eurasian water milfoil. There is also a substantial plant harvesting program to reduce the extent of the milfoil and experimental treatment of the deep bottom sediments with alum to control phosphorus release.

In contrast to the Saratoga Lake program, the project at Iroquois Lake in Schenectady's Central Park consisted of dredging accumulated bottom sediments in order to increase the usable area of the lake and to control nuisance plant growth that was interfering with swimming, fishing and boating. This type of project is more typical of those funded in urban areas.

As of 1987, the Federal Clean Lakes Program is alive and well, and will continue to provide for improved management of New York State's lakes, ponds and reservoirs with public access.

Winter Drawdown at Lake Sagamore

by Harold Goldstein

Lake Sagamore, in the Town of Kent, has an expanse of 110 acres and has been estimated to hold 300,000,000 gallons. The average depth is 10′, dam containment of earth-work and rock and a spillway of 60′ wide and 20′ high of poured concrete. It is fed by two active streams, one of which flows thoughout the summer, several lesser tributaries and a number of springs.

Some years before the first drawdown, shallower parts of the lake became infested with an aquatic plant resembling what is described in the "Manual of Aquatic Plants" by Norman Fassett as Potomogeton Amplifolius or by a more common name of Bass Weed. According to the author, identification of species of otomogeton are notoriously difficult and it is still possible that we are mistaken about its name. But it seems to lend itself to easy recognition, in that the submersed leaves are curving and the two floating leaves are completely different, eliptically shaped. As the season progresses, a spike rises above the surface of the water bearing a few flowers, evidently, as is suggested by Passett, for wind pollination. "The numerous pencil like erect emersed spikes conspicuous in early summer, and they usually beneath the surface as the fruit matures."

For many years, those who were entrusted with the care of the lake believed that copper sulphate was a cure-all and the old bag and drag technique was employed regularly in early summer and fall, a belief and practice all too common in many areas and in which some people still persist. The copper sulphate eliminated algae, for which we are told it is a specific but in clarifying the water and permitting the light to penetrate to greater depth, it encouraged the weeds to grow more profusely.

On the advice of a local lake consultant, Paul Roland, the Lake Sagamore Association voted to draw down the lake by eight feet, measured at the dam. Since the valve had not been operated in 35 or 40 years, we were concerned that once opened, it might not close. After due consideration, we decided to follow Paul Roland's advice to lower the lake by the installation of a battery of siphon tubes.

The planned procedure was to draw down for 2 consecutive winters and to wait for a period of 5 years and then repeat the drawdown for another 2 years. During this 5 year interval, Chara appeared in unprecedented quantity for one season, seriously affecting the use of the lake for recreation. In the fourth year another aquatic weed manifested itself, Elodea, in such quantity that the residents girded themselves financially to conduct large scale harvesting should the weed appear the following season. Commercial services employing the latest technological equipment were retained for use the following season should the Elodea problem erupt. In the meantime, we set in motion the third scheduled drawdown, again by syphon. That summer there was no problem with weeds. In the fall we set up the fourth scheduled drawdown and again, now in July, 1987, we do not have a weed problem. We would prefer to believe that it is all because of the drawdown.

NOTES AND PUBLICATIONS

Earthwatch, a monthly column by Maurice Hinchey, chair of the Assembly Standing Committee on Environmental Conservation, and of the joint Legislative Commission on Solid Waste Management, is available free of charge to interested organizations and individuals. Contact Paul Miller at (518) 455-4438 for copies.

A State Handbook on Local Government

To influence political/environmental decisions, it helps to understand the workings and authority of government at the federal, state, county, city, town and village levels. The new Local Government Handbook, published by the N.Y.S. Department of State, is a useful refresher for officials and citizens alike.

Its 300 pages include a multitude of facts, figures ad charts. Among major topics discussed are: the federal system; N.Y. State government; village-town relationships; the changing nature of county government; home rule and its limitations; financing local government; land-use regulation; the judicial system; and citizen involvement.

Limited copies of Local Government Handbook are available free of charge from the N.Y.S. Department of State, Bureau of Publications, 162 Washington Ave., Albany, N.Y. 12231, (518) 474-6957.

Lake Management: Three Starting Points

Lakes are the geological fireflies. So begins NALMS' new Lake Management Guide, in its words, "a user's document, addressed to you as a decisionmaker who will influence the natural history and longevity of your lake. It is meant to support you in making sound decisions and bringing them to fulfillment..."

The Guide is one of three new educational tools now available from the Society. An 18-minute videotape and a slide/tape unit may also be ordered from the NALMS office.

All are designed for citizen use - lake property owners, students, lake associations, citizens interested in lakes. They could be used for 4-H and Scout groups, as well as civic and social organizations - or perhaps to convince a local government of the importance of good lake management.

Both audio-visuals use professional-quality color slides of lakes throughout the nation; the videotape was recorded from the slide show. The slide presentation is designed for large-group viewing; the videotape, for individuals and small groups.

To order: phone NALMS on (202) 833-3382, or mail the form below to NALMS, P.O. Box 217, Merrifield, VA 22116.

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