Waterworks

FEDERATION OF LAKE ASSOCIATIONS

Spring 1992 Volume 8 Number 2

Anoxia: The Invisible Problem

One of the most dramatic symptoms of water-quality problems in a lake is a fish kill, with floating corpses everywhere and an awful stench on the wind. Less dramatic, but more common, is the late-summer algae bloom that turns the lake pea-soup green. Both of these events are examples of problems caused by anoxia, or loss of dissolved oxygen in the lake. Anoxia does not always produce visible effects, but may serve as an important early-warning symptom of developing problems in your lake.

What is Anoxia?

Anoxia is the absence of dissolved oxygen (DO) in lake water. As a "working definition," waters with less than 1 part per million (ppm) of DO are often described as "anoxic", since concentrations lower than 1 ppm are difficult to measure accurately in the field. Anoxic conditions make lake water unsuitable for fish, and cause significant changes to the chemistry of deep water and bottom sediments.

Why is Anoxia Important?

There are two important reasons for monitoring and preventing anoxia in lakes. The first is that fish and other aquatic animals need dissolved oxygen for respiration, and become stressed or die under low-oxygen conditions. A sudden or extreme decrease in oxygen concentration can result in a partial or total kill of sensitive game species, and persistent low DO in the lake can reduce growth rates. Trout, in particular, require DO concentrations of 5 ppm or more. Warmwater fishes, such as bass, pickerel, perch, and sunfish are more tolerant, but cannot inhabit low-oxygen waters for long. Bottom feeders such as bullhead, carp, and catfish are the most tolerant of low-oxygen conditions.

The second reason for monitoring anoxia is less obvious than fish kills, but can be very important to the overall health of the lake. Prolonged anoxia at the bottom of a lake can lead to substantial "internal loading" of phosphorus from the bottom mud (sediments), promoting plant growth and nuisance algae blooms. Anoxic conditions alter the chemistry of phosphorus compounds in the lake sediments. When oxygen is present, phosphorus is bound to iron oxides and stays in the sediments. Under anoxic conditions, however, phosphorus is released from the sediment into the water column. Phosphorus released from sediments can be a major nutrient source for a lake. Algae blooms resulting from internal phosphorus loading occur most often in late summer and during fall turnover, when the high-phosphorus anoxic waters are mixed back into the rest of the lake.

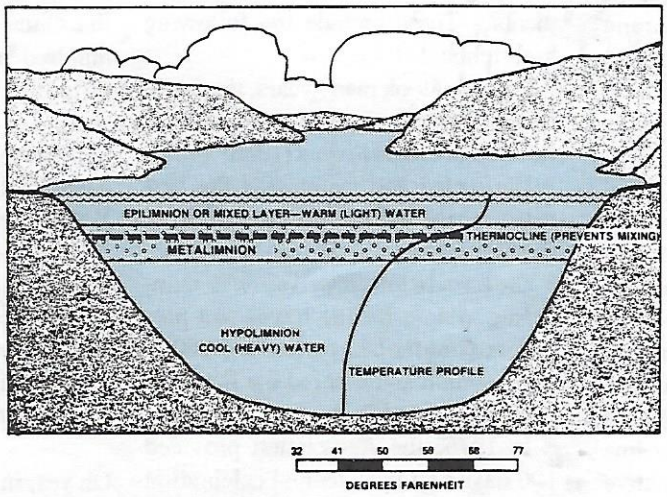


Figure 1. A cross-sectional view of a thermally stratified lake. The curved line (the water temperature profile) illustrates how rapidly the water temperature decreases in the metalimnion compared to the nearly uniform temperatures in the epilimnion and hypolimnion. (From the Lake and Reservoir Guidance Manual)

The cycle of anoxia and excess algae growth is dangerous because it is self-feeding; extensive anoxia leads to internal phosphorus loading, increased phosphorus levels promote greater algae growth, and decomposition of algae and plant tissues leads to increased anoxia. A lake with an internal nutrient loading problem due to anoxia will usually get worse

(continued on page 10)

On The Local Scene

Conesus Lake Association

Sixty Years Old and Going Strong!

The Conesus Lake Association (CLA), an all volunteer organization founded in 1925, celebrates its 60th birthday this year. Of 1800 families, membership is over 1400 member-homes.

The association has 30 directors, 18 section supervisors and 100-plus section representatives. There are 20 standing committees, plus some ad hoc committees. Our purpose is to promote and protect the interests of the residents of the Conesus Lake region in the use and enjoyment of the lake and their properties, to develop and continue a community spirit among the residents, and to secure and promote such improvements.

CLA board members have been involved in the SEQR process of three area development proposals that have potential environmental problems for the lake. The Lake Management committee, in addition to monitoring lake development projects, is reviewing current lake-related zoning laws in the four surrounding towns. The goal is to select the best ones, refine them and promote their adoption. The conclusion is that these towns should have one set of zoning laws for lake protection.

On the down side, zebra mussels have recently been found in Conesus Lake. Since there are about 1000 private water lines around the lake, we could face serious consequences. Plans are made for a late spring survey to find out how many lake residents favor the installation of a municipal water line around the lake. This alternative system could help combat a potential zebra mussel problem. If and when implemented, a second tier of development could occur; hence the need for good watershed zoning.

Where are we located? Conesus Lake is 25 miles south of Rochester. Through the generosity of the Town of Livonia, a building is used by the Association for office space, meetings, displays, brochures and records.

Our activities are well publicized. A local newspaper has a column titled, "Conesus Lake Ripples and Waves" which reports on lake activities and information regarding lake-related issues.

Many special events are held on our lake throughout the year. Our lake residents participate in the annual Lake of Fire where 10,000 flares are lit at 10 p.m. each July 3rd. It's a beautiful sight to see. Almost every year, the Association also has a boat parade around the lake with music and decorative themes.

Association members have worked hard and are proud of our many accomplishments. These include the following highlights:

* Though it took many years, the Association promoted and established the flood control dam project (1948 - 1988);
* We rented and maintained the first patrol boat for the Livingston County sheriffs marine patrol (1953 - 1956);
* The association created a house-numbering system for the towns and post offices along the lake perimeter (1960s);
* We sought and secured the first lake perimeter sewer in the U.S. (1972);
* In 1976, the Association provided 100 days of a bicentennial celebration that included a boat parade, a memorabilia building filled with lake-oriented antiques and artifacts, a history book, "The Diamonds Are Dancing", and an arts and crafts show. This show has since developed into an annual event;
* Because of the Agnes flood and others in the late 1970s, association members created a slide/talk show called, "The Catastrophe of Conesus". This was shown to 18 town and county boards, social clubs and organizations in an effort to promote and secure a flood control structure in the lake outlet;
* The lake association supported and encouraged the formation of a U.S. Coast Guard Aux. flotilla (1979);
* We purchased and donated cold-water rescue suits to area volunteer fire departments (1980s);
* We purchased and erected house number location signs around the lake and on roads approaching the lake. These are important for emergency vehicles and for convenience (1980s);
* In conjunction with SUNY Geneseo's Department of Geography, the Association developed and distributed a survey of several hundred questions;
* In 1989, the Association promoted a party boat tie-up in an effort to make the Guiness Book of Records. One hundred and twenty-one party boats rafted in the middle of the lake for a big party and were photographed from a helicopter. Since then, an independent party boat club has been formed;
* We established the four-town Conesus Compact to discuss community projects and concerns (1988);
* Thanks to a *Waterworks* series on key holing, the CLA has succeeded in having dock laws adopted in three of the four lake towns (1990 - 1992).

Oh yes, in the meantime, we have a lot of fun!

by: Jean F. Meekin, Public Relations, Conesus Lake Association

Federation News

Products and Services Provided by the Federation of Lake Associations

2175 Ten Eyck Avenue, Cazenovia, New York 13035 (315) 655-4760

Diet for a Small Lake: A New Yorker's Guide to Lake Management.....$12.00

Watershed Loading Model GWLF (Generalized Watershed Loading Function): A computer disk and supporting documentation are included. Contact the FOLA office for more information about this useful modeling program.....$20.00

Audio Tapes from FOLA Conferences: Tapes are available from individual presentations at the 1989, 1990 and 1991 Federation conferences. Contact our office for a complete listing.....$5.00/tape

Special mailings: Contact our office if you need literature sent to lake associations, individuals or corporations on the FOLA membership list. Following approval by the FOLA Board, we will distribute your educational or promotional material to our members. Our mailing list can be separated into several categories, such as region, county, and zip code.....cost to be determined

Extra copies of *Waterworks*: Send us a note if you would like to receive extra copies of Waterworks for your lake association board members and other interested individuals in your community.....$.50 each

Back issues of *Waterworks*: An index of articles that have been printed in *Waterworks* since 1985 is available at no charge. Back issues of newsletters or individual articles are available for .....$.50 each plus $1.50 postage and handling.

Information Management Service: Contact the Federation office if you need information on water resource videos, water quality monitoring programs, reference publications, resource hotlines, information clearinghouses, watershed modeling computer programs, national water resource newsletters, computer "on-line" information services, consultants, lake and watershed management reports, ordinances, and much more. This service is available to FOLA members at no charge.

NEWSLETTER CONTEST

Does your lake association have a newsletter? One of the goals of the Federation is to keep the public informed about issues and developments concerning water quality.

In keeping with this goal, FOLA is sponsoring a newsletter contest for its members. FOLA wishes to recognize lake associations that make an effort to inform, educate, involve, and even entertain their members through a newsletter. Please take a minute to send your latest issue to the Federation contest.

The newsletters will be judged on readability (understandable without being too dull), information (pertinent information for the readers), and interest (the appeal that makes it unique). The newsletters will NOT be judged on publication (it doesn't matter whether it is a computer printout or a full color magazine), the number of issues a year, or fancy logos or graphics.

Send your newsletter to: Newsletter Contest, Federation of Lake Associations, 2175 Ten Eyck Avenue, Cazenovia, New York, 13035.
All newsletters will be displayed at the Federation's Annual Conference in June. The winners will be announced and awards presented during one of the sessions. **Entries must be received by June 8, 1992.**

FOLA LEADERS SOUGHT

Energetic individuals with a strong commitment to lake protection and management are being sought by the Federation of Lake Associations, Inc. for three-year terms on the Board of Directors.

Nominations are due no later than June 8, 1992. Nominations should be in writing, and include an address and telephone number of the nominee. Please submit brief supporting documentation for the nominee's candidacy.

Candidates must be nominated by at least two current FOLA members to be eligible. Self-nominations are encouraged if they are supported in writing by two other FOLA members.

Criteria for screening nominees will include: 1) a demonstrated interest and participation in FOLA 2) leadership capability 3) a willingness and ability to attend semiannual board meetings and 4) FOLA membership.

Send nominations to: Nominations Committee C/O FOLA, 2175 Ten Eyck Avenue, Cazenovia, N.Y. 13035

PLEASE HELP US DETERMINE HOW WATERWORKS CAN MEET YOUR NEEDS

1. Does your copy of "Waterworks" go to: _____ an individual?
   _____ business/government office?
   _____ lake association?

2. How many other people read your copy? _____

3. What features do you want to see in "Waterworks"?

   Rank as follows: 1 = absolutely 2 = important
   3 = okay 4 = not interested

   _____ case studies

   _____ educational/principals of lake management

   _____ state/local issues

   _____ advertisements for products & services

   _____ new product information

   _____ literature reviews/search

   _____ Federation news

   _____ professional level technical articles

   _____ federal policy news

   _____ professional listing of environmental consultants

   _____ job listings

   _____ innovative programs - features on specific lakes ("On the Local Scene")

   _____ other _____

4. Would you be interested in serving on a "Waterworks" advisory/planning board? _____

5. Can you contribute regularly to "Waterworks" (write articles, report on lake-related news in your area, submit art work, photography, calendar of events items, etc.)?
   Please specify _____

6. Do you have an article or idea for "Waterworks"? _____
   Please specify _____

If you answered yes to questions 4, 5, or 6, please provide your name, address, and phone number:

_____

_____

Mail to: Federation of Lake Associations, Inc.
2175 Ten Eyck Avenue
Cazenovia, New York 13035

Catherine Creek

Cooperative Efforts to Protect a Valuable Resource

Catherine Creek, famous for its trout fisheries, flows into the south end of Seneca Lake at the village of Watkins Glen. This 18 mile long stream begins its journey to Seneca in the highlands of Chemung County. The southward flow turns north near Horseheads and dissects both Chemung County and Schuyler County through a steep sided valley created by advancing glaciers. The residents of both counties realize the importance of this stream and the need to maintain its present pristine condition.

In 1990, the Schuyler County Soil and Water Conservation District (SWCD), together with the Water Resources Institute at Cornell University, began an indepth study of several small lake watersheds in Schuyler County. The purpose of this study was to identify and assess non-point sources of pollution that may be occurring within each watershed. Once identified, best management practices could be utilized to address sub watersheds or specific areas. For example; if it was determined that agriculture was the primary contributor of nutrients within a sub watershed, specific approaches could be taken to reduce runoff and nutrient losses. But, how do you assess what, if anything, is the primary activity that is the cause for concern?

Using a SWCD based geographic information system (GIS) the SWCD staff input soil and land use data into their GIS database. The GRASS (Geographic Resources Analysis Support System) GIS was developed by the U.S. Army Construction Engineering Research Laboratory and allows the user to simultaneously analyze many different data layers and their spatial relationships. Once the data is entered into the GIS, the information is manipulated and downloaded to the computer generated watershed model GWLF (Generalized Watershed Loading Functions). Developed by Doug Haith and Leslie Shoemaker at Cornell University, the GWLF program does a watershed analysis by combining the data created with the GIS with local weather information. The resulting output provides user tables that assist in identifying the extent of nutrient inputs from the variety of land uses that occur within the watershed. To assess the effects of different management practices or land uses, changes can be made in the input files. This allows the SWCD staff to analyze the benefits and drawbacks of land use or management changes before they occur. Using this type of technology for Catherine Creek, a similar study is beginning to take shape.

In 1991 The Soil and Water Conservation Districts in Chemung and Schuyler Counties were instrumental in formulating local Water Quality Strategy Committees. These committees are comprised of people from both the public and private sectors who possess skills or interest in protecting our water resources. Together they assess water quality needs and recommend approaches for addressing those needs within their respective counties. In each county, priority watersheds, streams, stream segments and water bodies were identified and ranked. Although these committees initially acted independent of one another, one common stream received high priority in each county; Catherine Creek.

These committees paralleled other county committees that were forming around the state. Generally, each committee would chose those areas were water quality was known to be inferior. Catherine Creek is just the opposite. With its clear, cool, trout filled waters, it is considered to be in excellent condition. But the citizens who live in the area are concerned about changes in the watershed that could affect the quality and quantities of waters. Dwindling farm numbers and the development of idle or once farmed land is occurring throughout the watershed. Individually, these homes probably have little effect on water quality. But what is the long term, cumulative affect likely to be?

Working together with the Water Resources Institute and the New York State Soil and Water Conservation Committee, a grant was secured from the Environmental Protection Agency Office of Pollution Prevention. This pilot program will use the technology that was previously utilized in Schuyler County, to evaluate the changes that are likely to occur within the watershed over the next twenty years. Soils maps are being recompiled for digitizing into the GIS. Base maps and aerial photographs are on order to assist with land use mapping.

Working through a sub-committee of the county water quality committees, the entire watershed will be mapped as to the existing land use. This data, together with soils, topographic and weather information, will be used to determine the existing factors that affect water quality for Catherine Creek. Using the knowledge and expertise of local town and county planners, potential development scenarios and probable land use changes for the areas most likely to be developed will be identified. A second model of the watershed will then be run using the anticipated changes in the watershed. This will provide a comparative study of the impacts on water quality from development and will provide a sound technical basis for creating policies regarding future development within the watershed. This type of approach will allow local decision makers the opportunity to protect Catherine Creek while allowing environmentally sound development to occur.

by Tom Brace, District Manager and
Lloyd Wetherbee, District Technician
Schuyler County Soil and Water Conservation District

Federation of Lake Associations, Inc.

1992 Annual Conference

Integrating Watershed Planning Activities

June 12, 13, 14, 1992
State University of New York, New Paltz, New York

Friday, June 12

5:00 p.m.	Registration
8:00 p.m.	Open forum for FOLA membership, Scientific Advisory Board members, and conference speakers

Saturday, June 13

8:30 a.m.	Exhibits Open
9:00 a.m.	Introductory Comments - Welcome

Watershed Planning and Sustainable Development

9:15 a.m.	Watershed Planning Overview
9:45 a.m.	Sorting It All Out - Policy Implications of Watershed Planning
10:30 a.m.	Break
11:00 a.m.	Sustainable Watershed Development
11:30 a.m.	Large Lake Management - Keuka Lake
12:15 p.m.	Lunch / Speaker

Concurrent Sessions - Watershed Management

1:30 p.m.	Three Case Studies 1. Capital District Lake Associations; Progress in Management - Babcock and other lakes 2. Tuscarora Lake 3. Silver Lake
3:00 p.m.	Break
3:30 p.m.	Case Study Reports to the Membership and Panel Discussions
4:30 p.m.	Annual FOLA Membership Meeting
5:00 p.m.	Social Hour
6:00 p.m.	Barbeque/Picnic
7:30 p.m.	Keynote Address
8:30 p.m.	Informal Discussions

Sunday, June 14

Concurrent Sessions

Session 1 - Planning Policy and Regulatory Issues

9:00 a.m.	Stormwater Management Guidelines
9:30 a.m.	Regulations for Water Supply Watersheds
10:15 a.m.	Break
10:45 a.m.	Planning at Lake George
11:30 a.m.	State Open Space Plan
12:00 p.m.	Conference Conclusion

Session 2 - Technical Sessions

9:00 a.m.	Citizens' Statewide Lake Assessment Program Update
9:30 a.m.	Wastewater Treatment at the Lakeshore
10:15 a.m.	Break
10:45 a.m.	Living with Zebra Mussels
11:30 a.m.	Aquatic Plant Survey and Database
12:00 p.m.	Conference Conclusion

1992 CONFERENCE REGISTRATION FORM

( ) $120. Full conference, single room (includes room, meals and registration - 2 nights)
( ) $110. Full conference, double room
( ) $ 90. One night, single room (includes room, meals, and registration - 1 night) ( ) 6/12 or ( ) 6/13
( ) $ 80. One night, double room ( ) 6/12 or ( ) 6/13
Commuters Package:
( ) $ 65. Full conference (includes meals and registration)
( ) $ 55. Saturday only (includes meals and registration)
( ) $ 5. **Optional** - box lunch available Sunday, noon
$_____ **Total Amount Enclosed**

NAME _____ **TITLE** _____
ORGANIZATION _____ **PHONE** _____
ADDRESS _____

Return To: The Campus Conference Center, SUNY New Paltz, New Paltz, N.Y. 12560
Make Checks Payable To: SUNY New Paltz

NOTE: Please use one form per registrant. Registration forms, with fee, must be received at SUNY New Paltz by **May 27, 1992.**

REFUNDS: Full refunds will be made until Tuesday, June 2, 1992. No refunds will be made after that date

The Use of a Master Plan for Lake Protection

Land use planning and lake quality control interrelate as closely as land and water themselves. Dealing separately with each is only a convenience. This convenience cannot be allowed to become a barrier. Persons and organizations engaged in planning and management of either land or water must be fully cognizant of the sensitive interrelationship. Proposed major revisions to the Land Use and Development Ordinance in the Town of Nelson in Upstate New York demonstrate the interrelationship.

Nelson is a rural town, perhaps better imagined as a township. There is no town center or village. Two hamlets form the only concentrations of buildings. The Town contains the fifty acre Tuscarora Lake at its center and shares another similarly sized lake at one edge. The Town Planning Board began major new planning in 1990. Old planning documents from the early seventies were collecting dust, considerable residential development pressures were building, and the reinvigorated Tuscarora Lake Association was asking for help in controlling lake water quality and lake shore development.

The planning board, working with the lake association, scheduled a set of "town planning meetings" to gather public input. A strong preservation mandate emerged.

The Town commissioned Cornerstone Land Planning of Ithaca, New York to administer the master planning process, to consult in all aspects of the project, and to document the process by writing a new Master Plan for the Town. A Master Plan becomes the foundation for decisions made by town government. The Master Plan should be developed with broad and effective citizen involvement. When this is done the government can look to the Master Plan for direction and can point to the Master Plan to validate its decisions affecting environment, economics , land development, and land preservation.

One year and twenty-some meetings later the project is complete. It stands out for the high level of citizen participation encouraged by the Town government and facilitated by the Planner. Also notable are several recommended innovations arising directly from the importance attached by all to land and water quality.

In rural areas where there is little prospect of sewer systems human waste is handled by septic systems on each separate house site. The efficacy of these systems depends very much on soil characteristics. Most soil in Nelson is not ideal for septic systems. The new Master Plan recognizes this fact by recommending extensive rezoning of the Town in a pattern which fits the density of housing to the soils ability to handle septic systems. Lot sizes are to be larger on poorer soil, smaller on better soils. As ordinary as this might seem, it departs sharply from zoning tradition.

To encourage open space, and to foster still other waste system innovation, the Master Plan encourages clustering of houses, especially in the zoning districts with large lots. Houses on poor soils in Nelson would normally be placed on separate five acre lots. This fills the countryside with moderately spaced houses, about 300 feet apart, which does not really preserve space. Clustering permits developers to place houses more closely together on large tracts, but it does not allow a higher number of houses on the overall tract. As much as 75 percent of each tract can thus be left forever with no housing.

Other innovations also address water quality. In the Master Plan each lake watershed becomes a separate Overlay Zoning District. An Overlay District sits on top of whatever other zoning districts might exist, commercial, residential, and so forth. To protect the lakes, regulations for each Overlay District place stricter requirements on excavation, land clearing, and drainage features.

The Master Plan recommends a range of other measures which would protect the lakes:

* Improved road and ditch construction specifications to reduce siltation;

* Investigation into the carrying capacity of the land for large animals such as horses, sheep, llama (that's right llama), and other large animals in nonagricultural situations;

* Protection of lake views by limiting houses heights within the lake overlay districts;

* Controlling density of lake use by regulating the size and number of docks and by establishing house set back distances from lake shores;

* Clarification of the ordinance as it applies to non-residential use of lake shore lots, such as selling lake access across a residential lot;

* New building site design standards to control run off, siltation, and pollution;

* Requirements for "retention" of early rain run off, and "detention" of substantial runoffs apply especially in the Lake Overlay District.

The Town Board adapted the new Master Plan in summer 1991. Cornerstone is now writing new zoning regulations for putting the Master Plan recommendations into action. Much of this became possible because the Nelson Planning Board and the Tuscarora Lake Association forged a political link reflecting the intrinsic link between land and lake.

by Don Ellis, Environmental Planner
Cornerstone Land Planning

NEWS, VIEWS AND OPPORTUNITIES

FOLA Strengthens Ties with Other Lake Organizations Throughout the Northeast

In January, Bob Canfield (FOLA President) and Anne Saltman (FOLA Consultant) attended a meeting in New Hampshire that was sponsored by the EPA Clean Lakes Program and the Terrene Institute. Citizen lake group leaders and state lake program managers from the Northeastern states (Maine, Massachusetts, New Hampshire, and New York) attended this event which was organized by Jonathan Simpson and hosted by the New Hampshire Department of Environmental Services.

The group met for the purpose of opening the lines of communication between the EPA Clean Lakes Program, state lake program managers and state citizen lake managers. Lake organization projects were discussed and prioritized in order to then determine ways to strengthen them to benefit the entire northeast region. The EPA encouraged greater participation by state citizen organizations and later agreed to sponsor individuals from these groups to meet again at a Chicago meeting in May. Opening the lines of communication between these groups was the real strength of this meeting and FOLA supported and encouraged this positive networking effort.

Online Information Sources

COMPUTER BULLETIN BOARD SYSTEM: The nonpoint Source (NPS) Information Exchange Bulletin Board System (BBS) provides state and local agencies, private organizations, businesses, and concerned individuals with timely, relevant NPS information, a forum for open discussion, and the ability to exchange computer text and program files.

You can use the NPS BBS to:

* Read, print, or save to computer disk current, NPS-related articles, reviews and fact-sheets.
* Exchange computer data, including database files, electronic spreadsheets, word-processor files, and software.
* Post your own articles and comments online for the benefit of others.
* Ask questions and conduct discussions directly with NPS experts.
* Exchange private letters and files with other users.

How to access the NPS BBS

To access the NPS BBS, you will need:

* A PC or terminal
* Telecommunications software (such as Cross Talk or Procomm)
* A Modem (1200 or 2400 baud)
* A phone line that will handle modem communications.

The NPS BBS phone number is: (305) 589-0205

PUBLIC ACCESS TO EPA'S ONLINE LIBRARY SYSTEM (OLS): The Online Library System (OLS) is a computerized list of bibliographic citations compiled by the EPA library network. EPA provides this menu-driven, user-friendly system at no cost to support public access to environmental information. The only charges that will be incurred through use of the system are telecommunications charges. OLS consists of several related databases that can be used to locate books, reports, and articles on a variety of topics. The material in OLS is updated every two weeks, and can be searched by numerous access points, such as title, author, and keyword.

For more information about the Online System, please call 1-800-726-LAKE.

New York's Loon Conservation Project

The New York Loon Conservation Project will be conducting the One Day, One Hour Census on Saturday, August 1, 1992. They will also be working on a pilot Survey of Migrating Loons between April 1 and June 1, 1992. For more information contact: New York Loon Conservation Project, c/o NY Audubon, Rt 2, Box 131, Selkirk, N.Y. 12158 or call (518)767-9051.

Waterworks is published four times a year. Individuals who wish to submit articles, calendar items, artwork, or photography to *Waterworks* are welcome to contact the editor, Anne B. Saltman, FOLA, 2175 Ten Eyck Avenue, Cazenovia, NY 13035 (315) 655-4760. For address changes, contact John Colgan, FOLA, 273 Hollywood Avenue, Rochester, New York 14618 (716) 271-0372. Permission to reprint articles is granted with credit.

ANOXIA *(continued from page 1)*

over time, unless steps are taken to break the cycle. Many major lake restoration techniques are focused on reducing nutrient concentrations by eliminating anoxia.

What Causes Anoxia?

Dissolved oxygen is involved in many different processes within a lake. The principal cause of oxygen loss in lakes, however, is decomposition of organic matter. Bacterial and chemical processes that break down organic materials (leaves, dead plants and animals, waste products) all use DO to complete the decomposition process. The more organic material that is present in the lake, the higher the overall rate of decomposition will be and the more DO will be required. Decomposition occurs everywhere in the lake, but the highest rates are found near the bottom, in and just above the bottom muds. Lakes with a thick layer of gooey, rich mud usually have much higher decomposition rates than lakes with sandy or rocky bottoms.

If decomposition is occurring all the time, why isn't all the oxygen used up? Because, in most waters, DO is continually being re-supplied by plant photosynthesis and through contact between the water and the atmosphere. Shallow lakes, rivers, and the surface waters of deep lakes almost never go anoxic because they are constantly exchanging oxygen and other gases with the air. Anoxia occurs only when the rate of decomposition overwhelms the rate of oxygen re-supply, or when part of a water body is cut off from its source of oxygen.

Stratification and Anoxia

Anoxia in deep lakes is closely tied to temperature layering (stratification). Lakes in North America start out at a uniform temperature in the spring and mix from top to bottom (spring turnover). Gradually, the top layer of water warms up from sunlight and warm air, while the dark deeper layers stay cold. The greater the difference in temperature between the warm, light surface waters and the cold, dense deep waters, the more difficult it is to cause these layers to mix. In shallow lakes the temperature differences between the top and bottom are small and winds and wave action can keep the water column mixed throughout the summer. Deep lakes, however, develop larger temperature differences and are too deep to be completely mixed by the wind, so that distinct temperature layers form and remain in place throughout the summer (**Figure 1**). This stratification of deep lakes prevents the deepest layer (or hypolimnion) from coming into contact with the air and cuts off the re-supply of DO. Since most decomposition occurs near the bottom, however, oxygen demand is highest in this layer. At the beginning of the summer, the hypolimnion contains a full DO supply from spring turnover. Gradually, through the summer, oxygen in the deep layer is consumed by decomposition. If the decomposition rate is high enough, and stratification lasts long enough, all of the oxygen is the hypolimnion will be used up and this layer will become anoxic.

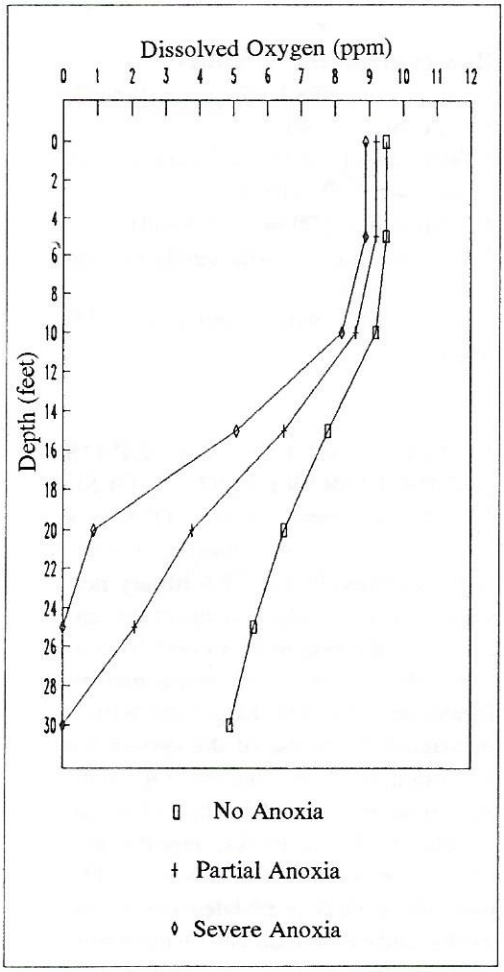


Figure 2. SAMPLE DISSOLVED OXYGEN PROFILE

What Level of Anoxia is a Problem?

Monitoring programs for deep lakes (20 feet deep or more) should always include measurement of temperature and DO depth profiles. These profiles almost always show colder temperatures and lower DO near the bottom of the lake. At what point does anoxia become a problem? In deep lakes, anoxia develops near the bottom at some time after temperature stratification is fully established, and is at its worst in late summer just before fall turnover. As anoxia develops, the depth at which 1 ppm DO is observed will be higher and higher. In a lake with only minor problems, anoxia will not begin until mid-summer and may only affect the deepest few feet of the lake. In a lake with a severe anoxia problem, the very bottom will become anoxic only a few weeks after stratification and by late August, the entire hypolimnion will be anoxic (**Figure 2**). When and where anoxia first develops and the extent of the lake bottom covered by anoxic water are key factors in diagnosing internal phosphorus loading problems. If a preliminary profile taken in mid to late summer shows an anoxic hypolimnion, more detailed monitoring is warranted.

Shallow lakes (10 feet or less) are rarely fully stratified. In these lakes, anoxia is not usually a problem, although DO levels may become too low for trout. Some types of shallow lakes can, however, stratify on a temporary basis during hot, calm periods. If these lakes have very rich sediments, anoxia can develop quickly, releasing a large pulse of phosphorus to be mixed into the water column on the next windy day. This type of intermittent stratification is difficult to detect except by careful measurements made during the stratification episode.

(continued)

If your lake does not have problems with algae blooms or fish kills, you may not have an anoxia problem. Anoxia problems develop slowly, however, and frequently build up for *years* before any visible symptoms occur. The only way to identify and determine the extent of an anoxia problem is by measuring the vertical DO and temperature profile of the lake water, preferably near the lake's deepest point. Since anoxia develops over the course of the summer, a series of DO and temperature profiles taken weekly or monthly from May through October is most valuable. If only one profile can be taken, it should be collected in August or early September when anoxia is at its worst.

In the early stages, the anoxia/internal loading cycle can be slowed by watershed management and reduction of external nutrient loads. Severe anoxia problems generally require substantial and expensive lake restoration efforts to correct. If your lake is experiencing serious anoxia problems, a professional diagnostic/feasibility study and lake restoration plan are called for. If you cannot see any problem, check it anyway! Like most lake management problems, anoxia is much less costly to prevent than to correct.

by M. Elizabeth Conners,
Senior Ecologist
Ichthyological Associates, Inc.

FOLA
Board of Directors
Meeting
June 12, 1992

FOLA
Annual Membership
Meeting
June 13, 1992

The Federation of Lake Associations

We are a coalition of organizations dedicated to the preservation and restoration of all lakes, ponds and rivers throughout New York State. We welcome and encourage the memberships of lake associations, property owner groups, fish and game clubs, corporations and individuals. The Federation is incorporated under two mirror organizations with the same officers and board of directors.

The Federation of Lake Associations, Inc. purposes are:

* to provide a clearinghouse of environmental information and expertise in all matters pertaining to lake management.
* to promote by education the wise use and appreciation of the lakes in New York State.
* to provide a pool of technical knowledge and expertise to advise and assist member associations and individuals.
* to establish liaison with other environmental groups and agencies.
* to provide a coordinating structure for lake-related research projects.

The Federation of Lakes, Inc. purposes are:

* to monitor and report to members on legislation and administrative actions affecting the waters of New York State.
* to support and lobby for legislation and admistrative actions which promote the sound management of the waters of New York State.

MEMBERSHIP CATEGORIES

Lake associations with less than 50 members.....$30.00/year
Lake associations with 50 to 99 members.....$50.00/year
Lake associations with 100 to 199 members $75.00/year
Lake associations with more than 200 members....$150.00/year
Individuals.....$20.00/year Corporations.....$100.00/year
Additional copies of *Waterworks*.....$.50 each

Membership dues over $5.00 are tax deductible contributions to the Federation of Lake Associations, and will be used for educational, scientific, and public information activities of the Federation.

APPLICATION FOR MEMBERSHIP

THE FEDERATION OF LAKE ASSOCIATIONS, INC., 273 HOLLYWOOD AVE., ROCHESTER, NY 14618

Type of Membership (please check) ☐ Association ☐ Individual ☐ Corporate

Association Name: _____

Assoc. Address: Street _____ City _____ State _____ Zip _____ County _____

President/Contact Person: _____

Summer Address _____ Winter Address _____

Summer Phone ( ) _____ Winter Phone ( ) _____

Total number of newsletters requested of each issue: _____

CALENDAR OF EVENTS

National Forum on Water Management - June 28 - July 2, 1992 in Washington, DC. Contact: Martin Reuss, HQ, U.S. Army Corps of Engineers, Office of History, Kingman Bldg., Fort Belvoir, VA 22060. (703) 355-3560

Association of State and Interstate Water Pollution Control Administrators Conference - July 1 - 15, 1992 at the Holiday Inn Old Town in Alexandria, VA. Contact: Roberta Savage, Hall of States, 444 N. Capitol St., NW, Suite 330, Washington, D.C. 20001. (202)624-7833

Pennsylvania Lake Management Society Conference - July 24 - 25, 1992 at the Woodlands Inn & Resort in Wilkes-Barre, PA. Contact: Elinor Eberhardt, PALMS, P.O. Box 3378, Palmet, PA 18043. (215)253-9510

Water Forum '92: Saving A Threatened Resource - August 2 - 5, 1992 in Baltimore, MD. Contact: ASCE Conference Dept., 345 E. 47 St., New York, N.Y. 10017. (800) 548-ASCE

Resource Management in a Dynamic World: 47th Annual Meeting of the Soil and Water Conservation Society - August 9 - 12, 1992 in Baltimore, MD. Emphasizes the role human resources play in using and managing natural resources. Contact: Tony Vrana, SWCS, 7515 Northeast Ankeny Rd., Ankeny, IA 50021. (515) 289-2331

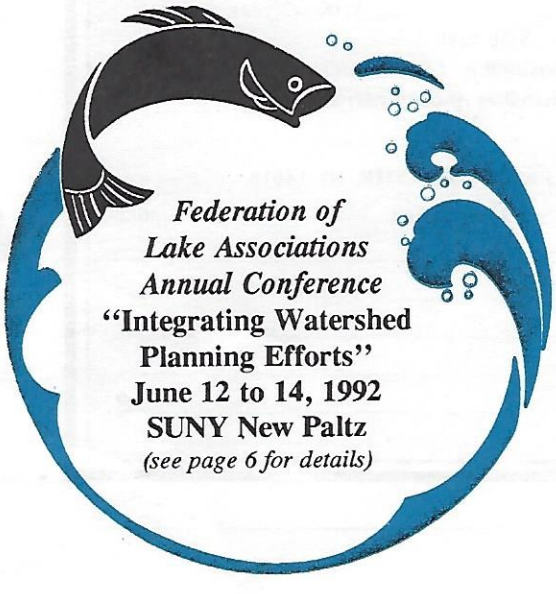
Fourth Annual NPS Program Conference - August 31 - September 3, 1992 in Charleston, SC. Contact: Lisa Grayson, JT & A, Inc., 1000 Connecticut Ave., NW, Suite 802, Washington, DC

Charting The Course For Lake Champlain's Future - September 8 - 9, 1992 at the Sheraton Inn, South Burlington, Vermont. Contact: Kip Potter, Soil Conservation Service, 69 Union St., Winooski, VT 05404, (802)951-6795 **OR** Nancy Jarvis, Cortland County Planning Dept., 60 Central Ave., Cortland, NY 13045 (607) 756-3422.

International Association for Water Pollution Research and Control: Conference on Diffuse (Nonpoint) Pollution: Sources, Prevebtion, Impact & Abatement - September 20 - 24, 1992 in Chicago, IL. Call for abstracts. IAWPRC Conference, Dr. Novotny, Dept. of Civil & Environmental Engineering, Marquette University, 1515 W. Wisconsin Ave., Milwaukee, WI., 53233. FAX (414) 288-7082.

NALMS 12th Annual International Symposium - November 2 - 7, 1992 at the Clarion, in Cincinnati, Ohio. Call for abstracts. Contact: Bob Mason, Hamilton County Park District, 10245 Winton Road, Cincinnati, OH 45231. (513)521-7275 or FAX(513)521-2606.

Federation of Lake Associations, Inc.
2175 Ten Eyck Avenue
Cazenovia, New York 13035



Loon Lake Cottage Owners Assn.
% Helen Sick Pres.
2968 Laf-A-Lot Rd.
Wayland NY 14572