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Lakes Which Produce Too Much

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In a world where widespread famine is sometimes predicted within a decade, the concept of a lake being too productive may seem strange. However, lakes are not used by man solely to produce the maximum possible amount of food, and it is these other uses which dictate our definition of the best level of biological productivity.

Thus, when a lake becomes covered with scums of floating algae, its shallows choked with masses of rooted plants, and its fish population dominated by carp, suckers, perch and other fish of this kind, we say that its productivity has exceeded desirable limits. Scientists term a lake with these characteristics *eutrophic* (from the Greek word ''eutrophos'' meaning well nourished) and the process of enrichment *eutrophication.*

The two previous articles in this series have alluded to the causes and some of the consequences of this process. Focusing on the subject of eutrophication, we will review some of these facts and go on to discuss the influences of man and how he may minimize undesirable effects resulting from his activities.

The Symptoms

The eutrophic state cannot be defined in absolute terms. Rather, a continuum exists from very unproductive lakes, termed oligotrophic, to shallow bodies of water so productive that they are effectively passing from existence as lakes.

Most lakes begin life as a result of major geological events, such as glaciation, and at their beginning have clear waters and a paucity of biological life. With the passage of time (usually over the course of thousands or tens of thousands of years) beds of vascular plants reach upwards in the shallower waters from silt-covered bottoms. For brief periods, the water itself may become colored and murky with dense growths of small, free-floating algae. Serving as food for small crustacea and bottom-dwelling insect larvae, these plants form the basis of a food chain which ultimately determines the production of a diverse and abundant population of fish.

The process of increasing plant production continues and marked changes in the kinds of algae produced also occur. The blue-green algae, many of which float at or near the surface due to their positive buoyancy, become dominant during summer. Mats of scum composed of these plants float on the surface where they are subject to stranding in windrows along the shore. Aside from being unsightly, decomposition of these deposited algae is often accompanied by the emission of foul odors.

Aquatic plants rooted in the bottom may become more abundant during the early phases of this process. In the latter stages algae often filter out the light needed by higher plants and the extent of weed beds decreases, although they may still be unpleasantly dense in the very shallow waters.

As a lake becomes more productive fish and fish food organisms respond directly to at least three factors associated with this increase in vegetation: (1) Food, (2) visibility, and (3) dissolved oxygen. In general, more plants mean more food for the animal components of the system. Visibility decreases markedly in the upper waters due to dense suspensions of algae and the depth to which light penetrates is also lessened. During summer, oxygen levels become more variable (very high during the day and lower at night) in the upper waters; and this vital gas may be completely used up in the deeper portions of the lake by the end of the thermally stratified summer season.

Effects for the Fisherman

As a result of these interactions the total quantity of animal production in a lake initially increases along with that of the plants. Then oxygen depletion in the deeper waters exerts its effect, eventually destroying this as a habitat for fish, diurnal oxygen fluctuations in the upper waters may prove hazardous to many species, and

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Adirondack Lakes Water Quality Report Issued

The Adirondack Lakes Survey Corporation has released a five-volume report on its first year of study of the water quality and fish populations of Adirondack lakes.

The Survey Corporation was formed by the State Department of Environmental Conservation (DEC) and the Empire State Electric Energy Research Corporation (ESEERCO) to complete a three-year survey of about 1,200 lakes.

The first report includes field and laboratory data for physical, chemical and biological information collected in 1984 from 418 Adirondack lakes and ponds located in three major watersheds.

It does not, however, statistically treat or analyze the data, and so quantitative information about relationships among water quality, pond, physical characteristics (such as depth and size) and fish communities is not available.

"This first report represents a significant contribution to the scientific community and people of New York State," said DEC Commissioner Henry G. Williams. "Data from the first year of this $4.2 million study have already provided a wealth of reliable information that will be used by resource managers and environmental scientists interested in Adirondack pond and lake ecology for years to come."

Williams serves as chairman of the Adirondack Lakes Survey Corporation Board of Directors.

Copies of the report can be purchased from the Adirondack Lakes Survey Corporation field office in Ray Brook. The location of library reference copies can be obtained by calling the office.

Work on the second year of field studies began May 1 with visits to more than 230 ponds and lakes. It is expected that surveys of at least 400 Adirondack waters will be completed by late fall.

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decreased visibility favors fish that depend upon touch and smell rather than sight for sensory perception.

To the fisherman, qualitative changes in the fish population accompanying the process of eutrophication may have as great or greater significance than total quantity of production. Species most highly valued by the angler dominate in waters with high concentrations of oxygen and good visibility. It is not that trout, salmon, smallmouth bass and other preferred game fish do not respond to the increased food supply reflected by greater plant production. Rather, the problem lies in the fact that other kinds of fish, such as carp and perch, are better adapted to the conditions accompanying eutrophication. Thus, they outcompete more desirable species for living space.

Trout fisheries can be and have been successfully maintained in some eutrophic lakes, but only with intensive management, often including periodic poisoning to remove "trash" fish. This means that during periods of rehabilitation (perhaps as often as every three years) the lake must be removed from the roll of fishable waters in order to reestablish a dominance of the desired game fish.

The Causes

The process of lake overenrichment has accelerated markedly in recent years and scientists have recognized man's responsibility for this by referring to the process as one of "cultural eutrophication." Technological developments and population growth are to blame. Let us first review the factors which normally limit the growth of plants in water.

Aquatic vegetation, like that on land, derives its needed energy from light but is dependent on the environment for many different kinds of chemical building blocks. For example, algae need small amounts of materials such as cobalt, copper, boron and iron, as well as the more common elements, to sustain their growth. However, experience has shown that aquatic plant growth, like its terrestrial counterpart, is most often limited by a lack of available *phosphorus* and *nitrogen*; and of the two, phosphorus is probably more often in critical supply. In other words, if we add these two common fertilizers to a lake, the chances are good that plant growth will increase and this often happens when phosphorus alone is added. The input of both these elements to our lakes has increased markedly over the last 25 years or so.

In 1967 it was estimated that during one year some five billion pounds of nitrogen and one billion pounds of phosphorus were being added to waters in the United States. The significance of these figures can be better appreciated when it is realized that a concentration limit for these elements of 10 parts per billion phosphorus and 0.3 parts per million nitrogen is often used as a eutrophication threshold. Thus, if levels are at these values in early summer, it is likely that a lake will experience algal growths of nuisance proportions.

Although data are not available to make annual comparisons of nitrogen and phosphorus run-off, we do know that the development of detergents, the introduction of more intensive fertilization practices in agriculture and on lawns, and our rapid population growth are major factors contributing to the current great acceleration in eutrophication. For example, the per capita contribution of phosphorus to our waste waters increased threefold when detergent use became widespread in the late 1940's and consumption in nitrogen fertilizers has doubled during each of the preceding decades. Obviously, increases in numbers of people together with developments in our affluent technology have acted to reinforce these dangers. Despite our lack of

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comprehensive information, it is apparent that these same influences are at work to intensify the problem of nutrient contributions from urban run-off, industry, farm animal waste and even in rainfall.

Significance

Returning to the lakes themselves, how much of a problem is eutrophication and what are the prospects for the future? One scientist has estimated that a third of the lakes in the United States are now eutrophic or rapidly becoming so. We have no tally for New York State but do know that many lakes, both bordering and within the state's boundaries, are in trouble. Lake Erie has received national attention and scientists are in general agreement that Ontario's waters will produce increasingly troublesome problems.

Oneida Lake, the largest body of water wholly within the state, has historically been quite eutrophic, but recent symptoms indicate the problem is becoming more critical. For example, the once abundant burrowing mayfly *Hexagenia*, or eel fly as it is sometimes called locally, is now comparatively scarce. This insect requires well-oxygenated water to survive the nymphal periods spent in the bottom mud. In recent years Oneida Lake has developed severe, although temporary, low concentrations of oxygen in its deeper waters. Although data is scarce, both Cayuga Lake and Seneca Lake appear to be developing higher levels of plant production, particularly in the form of watermilfoil (*Myriophyllum*) growths of around their peripheries. The list could be continued to include a host of smaller lakes that are either much too productive or in which production is rapidly increasing.

The end result of the eutrophication process is extinction of a lake as the basin fills with organic sediments. Even under the most extreme conditions this process proceeds slowly, and only the shallowest of lakes pass from existence during a human lifetime. On the other hand, many of the uses of a lake may be impaired or destroyed as a result of eutrophication. These include the more highly valued types of sport fisheries, water supplies and aesthetic enjoyment.

Many of the consequences of eutrophication, such as decreased property values and increased costs of water treatment, can be easily valued in dollars but others cannot. What kind of price tag can we put on the desirability of having a diverse environment? Do we value societal impacts of individuals restored in perspective and mentally rested after a day of fishing on some sparkling lake?

Prevention and Cure

Despite often stated views to the contrary, eutrophication is a reversible process. Evidence indicates that some of the larger English lakes have, before the time when they were subject to man's influence, gone through cyclic changes in their levels of plant production — from oligotrophic to eutrophic and back again. Intensive management practices have resulted in reversing the eutrophication of two lakes in Seattle, Washington, one of which, Green Lake, was naturally eutrophic and the other, Lake Washington, fertilized by the addition of municipal wastes. The rate at which reversal can be accomplished as a function of what limiting nutrients are involved, their rate of recycling from bottom deposits, how comprehensive management practices are, and the flushing time of the lake. Those requiring a longer time to flush require a longer time to recover. This factor indicates that eutrophication of lakes such as Lake Ontario may be particularly disastrous.

The control of eutrophication is dependent upon a series of practices generally identified under the terms of water quality and watershed management. This implies the identification and control of those elements responsible for eutrophication. Despite the obviousness of this statement, such an approach is now being used by governmental agences only in a very broad, and often inefficient manner. Basically, this is due to the failure of planners and managers to take into account two factors: (1) the individuality of each lake and its basin, and (2) the Principle of Limiting Factors.

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Bicarb Relief for Acid Lakes

How do acid lakes spell relief? To find out, two teams of Cornell University researchers are using different "antacids" to return lakes in the Adirondack region, hard hit by acid rain, to their natural state.

James Bisogni, Jr., associate professor of environmental engineering, dropped 14 tons of sodium bicarbonate into 50-acre Wolf Pond last August. The chemical — common baking soda — was donated by Arm & Hammer. Before the drop, the pond's pH (a measure of acidity) was 4.5 — that of dilute vinegar. Within days, it rose to 6.9, almost neutral. And despite the effects of "acid snow" runoff this spring, the pH is still 6.2

Meanwhile, fisheries biologist Carl Schofield and co-worker Steven Gloss have countered acidity in ten Adirondack lakes with agricultural limestone, adding fish as well. Several of their lakes are still hosting brook trout; others have become acidic again. "How quickly a lake re-acidifies depends on its watershed," Schofield says. One lake reverted a month after being treated. Another, treated more than two years ago, is still neutral.

Each neutralization strategy has advantages and drawbacks. Limestone can sink and become covered with sediment before it dissolves, but it is inexpensive and easy to obtain. Sodium bicarbonate dissolves rapidly but is costly.

Both research teams acknowledge that their schemes won't solve the acid rain crisis. They may, however, provide an interim solution for Adirondack lakes, and those elsewhere, crying for relief.

Controlling Surface Runoff in Residential Developments

by JOHN GANNON

When forested land is converted to residential use both the volume and quality of the surface runoff change. Impervious structures such as buildings, driveways and roads are placed over previously permeable soil. The small scale irregularities of the forest are flattened out for lawns and gardens, thus reducing the surface storage area. Natural drainage ways are straightened out and runoff is concentrated into road ditches. These changes combine to significantly increase the amount of water leaving the site in the surface runoff, sometimes by as much as 40%.

When we consider that this increased volume of water also has a higher concentration of phosphorus because of the fertilizers, detergents, road dust and eroded soil particles which it carries, it is evident that significantly more phosphorus is transported from the residential development than from the former forest. Studies have shown that for typical development this increase ranges from two to ten times depending upon the density of development and the suitability of the land for development.

Development, however, can be designed, constructed, and maintained so as to minimize its impact on a lake. The following is a list of practices which can reduce the

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This is exemplified by the current approach of the federal government to the problem of eutrophication. Action programs are centered around: (1) the improved treatment of sewage with special emphasis on the addition of units designed to remove phosphorus, and (2) the principle that all dwellers in a lake basin should have their sewage transported to a central site for treatment. Both courses of action are logical from an engineering but not always from an ecological viewpoint.

True, it has been shown that many lakes have their plant growth limited due to the absence of sufficient phosphorus. In some cases the removal of phosphorus from wastes discharged to the lakes seems to be the only approach currently available for staving off disastrous increases in eutrophication. However, there are also known instances of lakes in which substances other than phosphorus are the factors limiting plant growth. Where this is true, expensive facilities to remove this element are irrational.

Commitment towards the complete sewering of drainage basins and centralized treatment of wastes is common to state and local governments as well as federal. Again, there are many instances where this approach is eminently sensible. But there are others where it is not. Thinly populated areas may not have enough impact on a lake to warrant the sort of investment in time and money required. If soils are of the right types and there is adequate land area for drainage fields, there is no reason why properly installed and well maintained septic tank systems will not meet the needs for waste treatment. Often a lack of zoning to prevent building at the immediate water edge is the only prohibition to this solution. Where treatment plants are at the head end of a lake, as in Ithaca, centralized collection, treatment and discharge are particularly undesirable from an ecological viewpoint since addition at this location will maximize the retention time of the fertilizing elements in the lake.

Perhaps the core of the problem lies in a basic point espoused by most governmental agencies — problems resulting from technology can be solved by technology. In terms of waste water treatment practices this has meant more and more complex and expensive systems. However, an inherent part of this same philosophy is the acceptance that waste waters must be ultimately discharged to some body of receiving water. The ecologist says no, that ways should be found of diverting plant nutrients into terrestrial vegetation where increased growth represents a desirable goal.

In the meantime, we must continue our attempts to accommodate the need for waste disposal with that of a high level of quality in our lakes and streams. Sometimes phosphorus removal from sewage discharges may be necessary, in other instances different management practices, such as modifications in agriculture to minimize nitrogen runoff, should be followed.

The key to the best solution is an understanding of the system which we wish to manage. In many cases an aquatic scientist can identify the real or potential causative factors in eutrophication after a relatively brief and inexpensive study. In others, many years and considerable expenditure of funds may be needed. Once a cause and effect relationship is established, engineers are much more likely to seek and find the best solution to the management problem. The alternative to careful studies of each system is the application of a broad, often expensive, and sometimes ineffective brush — the governmental versus the institutional approach.

For most New York lakes, no matter what action we advocate today, eutrophication trends will continue in their present directions for years to come. However, the means are now available to alleviate some of the problems and a public voice, demanding study and evaluation of eutrophication in our state and ways to combat it, could produce others. A demand for action is urgently needed, action on a national level to develop an understanding of the basic processes and techniques for controlling eutrophication, and action on a state and local level to define problems and to implement their solution. Whether our lakes of tomorrow will be covered with green scum occasionally disturbed by the swirling of a fat and placid carp, or will present a glittering surface broken by the evening rise of a trout is a decision that must be made today.

increase in phosphorus movement from the developed area.

Practices which Reduce Volume of Runoff

The amount of phosphorus leaving a site in its stormwater runoff is proportional to the volume of the runoff. Any reduction in runoff volume through storage or infiltration will result in a concurrent reduction in phosphorus transport.

1. Leave natural, undisturbed wooded areas, called buffer strips, between developed areas and any lakeshores, streambeds, natural or manmade drainageways, or even road ditches. The width of the buffer should depend on the slope of the land and the size of the developed area which drains into it. Buffers in flat, permeable soils need only be 25' wide, but on steeper slopes they should be 50' to 100'. It may be necessary to define the buffer zone as the entire stream bank or gully. Buffer strips intercept runoff from disturbed areas and provide storage for eventual infiltration and/or evaporation of much of the runoff.
2. Restrict the amount of impervious surfaces allowed. This can be done by either putting a square footage limitation on buildings, driveways and roads or by using permeable materials instead of pavement. Reduction in impervious areas increases the opportunity for on-site storage and infiltration of precipitation.
3. Limit the size of the developed area, including areas cleared and graded for lawns and gardens. This can be done on a lot by lot basis, or by best design of the entire development. This will keep as much area as possible in a relatively natural state, thus reducing increases in runoff and also providing incidental buffer zones adjacent to developed areas.
4. Provide on-site detention basins which will store and slowly release water to flat downslope infiltration areas. This can be done on a large scale for drainage from an entire development or on a lot by lot basis. Diversion of up slope natural runoff around disturbed area may be necessary to reduce size required for detention areas. Detention areas provide storage for the initial influx of runoff from a storm and slow release allows time for soil recovery and thus greater infiltration. They will also act as a sediment trap.
5. Attempt to disperse concentrated runoff into flat areas. For instance, culvert outlets can be designed so they disperse flow into flat wooded areas. Once runoff is channelized, most of it will reach the lake unless it is physically intercepted and dispersed. Dispersion to flat areas provides additional opportunities for infiltration and evaporation.
6. Use trapzoidal, not V-shaped road ditches. Trapezoidal (flat-bottomed) ditches provide maximum contact of runoff with soil surface and therefore greatest opportunity for infiltration. They also have a lower erosion potential.

Practices which Reduce Phosphorus Contamination of Runoff

The amount of phosphorus leaving a site in its stormwater runoff is also proportional to the phosphorus concentration in the runoff. Any reduction in phosphorus contamination of the runoff will result in a concurrent reduction in phosphorus transport.

1. Limit the use of fertilizers containing phosphorus. This includes both inorganic and organic (i.e. manure) fertilizers. Fertilizer may be required to get a good vegetative cover established. Applying a liquid foliage fertilizer shortly after sprouting is most preferred because it can be taken up immediately by the vegetation. Solid fertilizers, especially inorganic, can be readily dissolved by precipitation and transported in the runoff.
2. Limit size of lawns and gardens. This indirectly limits use of fertilizers.

Practices which Prevent Erosion and Sedimentation

Much of the phosphorus leaving a developed site is attached to soil particles which have been eroded and are being carried downstream in the stormwater runoff. This is particularly true during the construction phase.

1. Do not develop on steep slopes (20%). Leave them in as near to natural condition as possible. Steep slopes are very vulnerable to erosion.
2. *Immediate* vegetative or mechanical (i.e. rip rap) stabilization of any disturbed soil. It may be necessary to limit the area of soil exposed at any one time to accomplish this. Most unsodded soils are very easily eroded. This erosion is not continuous but is a catastrophic occurence during major, unpredictable and usually infrequent storm events. The best way to be prepared for these events is to minimize the area of disturbed soil exposed at any one time.
3. Placement of hay bales in drainage ditches below construction sites. Properly installed hay bales will filter out the coarser sediments. They have only limited utility, however, since most of the phosphorus will be attached to the finer particles. Hay bales also serve as velocity reducers.
4. Install filter fabric fences on down slopes below construction sites, preferably where runoff will be intercepted before it is concentrated into channelized flow. Filter fabric fences are effective in removing fine as well as coarse soil particles from the runoff.
5. Construct sedimentation basins on drainageways below major construction sites. Properly designed and maintained sedimentation basins settle out coarse and medium sized soil particles and also provide for temporary storage and controlled release of runoff.
6. Diversion of natural upslope runoff around construction sites. Diversions limit the runoff flowing over a site to that derived from rainfall falling directly on the site.
7. Manmade waterways and road ditches should be seeded, sodded, or rip-rapped, depending on the

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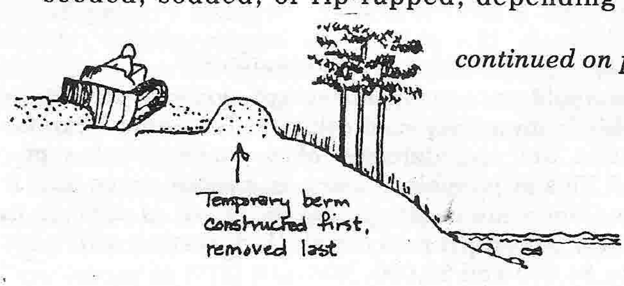

Are New York State Lakes in Trouble?

by JOHN W. LLOYD

All of us are fortunate to live in New York State with its beautiful mountains, hills, valleys, streams and lakes. In many respects our state is a gorgeous place to live. But some perplexing questions arise:

1. Are we using these resources wisely?
2. What subtle things are taking place that may ruin some of these precious resources?
3. Are we polluting?
4. What can and should we be doing?

At this point we all should be concerned with pollution in all its forms, but from a practical point of view it is wise to concentrate our efforts. The common bond that we have is the love of our lakes and the concern to protect them.

What Can Each of Us Do to Help?

Develop an awareness of what is happening. As we recognize what is taking place, we then must involve ourselves in the problem-solving process. It is generally agreed that the single biggest pollution problem in many lakes is human pollution. The single largest controllable source of contamination is human sewage. The most immediate and direct action that each of us can take is to try to eliminate waste water and sewage seepage into our streams and lakes. This requires a continuing vigilance and a change in what some of us have been doing throughout our lives. At this point nearly everyone who doesn't have a connection to a municipal sewage system is hooked to a septic system. The evidence overwhelmingly shows that improper septic systems are the number one problem around many of our streams, ponds and lakes.

An important question:
Why Is Human Sewage Such a Problem?

There are several reasons — sometimes it is just plain willful disregard. Other times it can be carelessness. Often, it boils down to the fact lakefront properties may not be large enough, or the soil conditions may not be proper.

Conventional septic systems are expensive and difficult to install properly, require periodic careful maintenance, and *must* be a distance from water. (the state says a minimum of 100 feet.) For a number of reasons, septic systems may be nothing more than a direct conduit from the toilet into the lake!

What Are the Alternatives?

Some would say municipal sewage systems. In certain cases this is an appropriate solution. How about careful installation and maintenance of a conventional septic system? This is possible if there is enough space and if soil conditions are right. A big negative is that it is estimated that a properly installed system will cost between $4,000 and $8,000.

There is another solution. It is fairly economical — less than $1,000 — and it seems to work well. It is the self-contained humus or composting toilet. It requires no water and nothing flows into the ground. (It does require electricity.) The biggest disadvantage is that the two best known units have a limited capacity. Both indicate on a year round basis that the unit is designed to accommodate a family of four. Increased use is acceptable for a day or two. A large number of people or more than a day or two will swamp these units.

Some say that the ideal solution is to buy two units. They still will be far less costly than the conventional septic system and it is convenient to have two toilets anyway!

From all we gather, these units work well and will largely eliminate the major source of pollution in most lakes. Your federation is focusing attention on solving this pollution problem. A concerted effort is being made to learn as much as possible about this alternative, as well as others. If you have information you would be willing to share about the compost toilet system, or if you would like additional information please write to: John W. Lloyd, Monroe Community College, Rochester, New York 14623.

It is important that each of us actively help preserve and protect our magnificent water resources!

Aeration: A Tool for Managing Lake Barcroft

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The quality of Lake Barcroft can be maintained and enhanced only by controlling the lake as a biological machine. Lake management is certainly not a new idea for Lake Barcroft; since 1960, sediment removal alone has cost $2 million and can be credited with maintaining depth near inflowing streams and removing large quantities of pollutants associated with sediment (e.g., phosphorus, lead, mercury) from the lake environs. Management has recently been expanded to alleviate oxygen depletion using a compressed air system to aerate the lake.

An aeration system was installed in to Lake Barcroft during 1983, following a two-year design and construction effort. The system, which was designed specifically for the lake, begins with a ten horsepower air compressor run by electricity and lubricated by water to avoid contaminating the lake with oil. The compressor forces air into four polyethylene (plastic) pipes which release streams of bubbles into the lake through a series of holes in the last 200 feet of each line. This discharge of air adds vital oxygen to the water and circulates the lake, bottom to top. The system costs about $5,000 annually to operate. A capital investment of $34,000 was required for acquisition and engineering. The system will increase water clarity and, reduce noxious smells, increase sport fish populations, and help digest organic materials (leaves, pet wastes, etc.) which enter the lake from its large watershed.

How Aeration Works

Aeration circulates lake water through the force generated by raising bubbles; Lake Barcroft is completely mixed bottom to top every two weeks. Aeration also oxygenates the watter and thereby reduces phosphorus levels and algae growth. More oxygen renders the deeper areas inhabitable by animal life and may lead to more game fish as both habitat and food items increase. Further, blue-green algae, notorious for causing water quality problems, tend to be inhibited by aeration and green algae often become more abundant. Such a shift from blue-greens to greens was found in Lake Barcroft after only a few months of aeration.

As illustrated in the schematic diagrams, aeration and circulation can have far-reaching effects on aquatic communities in Lake Barcroft. Aeration reduces phosphorus levels by increasing oxygen concentrations and also eliminates the production of foul-smelling and toxic gases. Phytoplankton become less abundant and water clarity tends to increase. Zooplankton can live at greater depths and avoid being driven to extinction by voracious fish; animal plankton ultimately provide more food for fish by greater survival and growing to a larger size. Benthic insects and other critters on the lake bottom can now thrive on the oxygen provided by aeration and can make excellent meals for bass and sunfish. Bacteria can digest organic materials more quickly and completely in an oxygenated setting. Overall, aeration leads to a better balanced lake biologically and a more enjoyable lake aesthetically. Aeration is therefore anticipated to be a long-term partner in maintaining the quality of Lake Barcroft.

Update: 1981-1985

Three growing seasons have passed since aeration began at Lake Barcroft and the lake's condition has greatly improved. Surface scums of blue-green algae have all but disappeared; the phytoplankton now are dominated by more desirable green algae. Benthic insects and scuds (crustaceans) are more abundant as are largemouth bass and bluegill sunfish. Aquatic plants (elodea) are increasing their distribution, providing fine habitat for aquatic life and some annoyance for swimmers. Overall, the lakeside community is pleased with the improved quality of Lake Barcroft resulting from aeration.

Reaction of a Lake Manager

While it is clear to a non-technical person how aeration should work, there are some eye openers:

- It is startling how much the lake's basic ecology can be modified in just two years of aeration. However, this change is not instantaneous. It took six months for the system to consume the biochemical oxygen demand (BOD) that had accumulated in the lake before aeration;
- It is remarkable how the system that directly aerates only four small sections of the lake actually reaches out great distances to serve all areas of the lake, as our multiple-location testing proves;
- Perhaps the most heartening aspect is how economically such a system can achieve these changes, particularly when compared to other more laborious and less effective systems. Aeration makes Mother Nature work for you.

— Stuart Finley
Lake Barcroft
Watershed Improvement District

Article reprinted from NALMS Lake Line, *Sept., 1985*

Lakeside Fertilizer

There is a new product on the market known as Lakeside Lawn Fertilizer. What makes it notable is that it contains no phosphorus!

Especially formulated for lawns adjacent to or nearby water, it is comprised of 16 percent nitrogen, 0 percent phosphorus and 8 percent potash in a 50 pound bag. Of the 16 percent nitrogen, 4 percent is of a slow release variety, sulphur-coated urea. This will slowly release nitrogen into the grass for a period of one to three months throughout the growing season, depending on watering and soil conditions. There are no herbicides for the control of lawn weeds in the fertilizer.

Marketers claim that property owners can maintain a healthy green lawn by applying Lakeside twice a year.

For more information and distribution sources, call Russ James at (716) 842-7631.

Is Development of Your Lake's Shoreline in the Works?

If so, you may want to investigate to make sure that your lake will not be damaged. Some pertinent questions you may want to pose to the developer could include the following:

1. What will be the total acreage of the development?
2. How many separate sites of lots will be developed?
3. How many people (maximum) will be living in the development?
4. What will be the source(s) of drinking water for the residents?
5. What aquifer will supply the drinking water? Is the supply adequate?
6. How will the wastewater from the development be discharged? (Septic systems, lagoons, central sewage system?)
7. If discharged to the groundwater, what precautions will be taken to prevent the migration of wastewater to wells of neighboring properties?
8. Will it be necessary to change the topography o the area to accommodate the development?
9. Will permits from the DEC be sought to fill wetlands?
10. How many boats will the development add to lake use?
11. Will a shelterbelt be maintained between the development and the lake? Will it extend back far enough from the lake to be an effective deterrent to nutrients getting into the lake?
12. Has the State Environmental Quality Review Act (SEQRA) been enacted as part of the review process?

Shoreline Restoration in Canada

A natural shoreline is one of the most important elements of a lake's ecosystem — a fact that may be ignored until development has scarred its natural beauty. And in Ontario, where most of the shoreland is privately owned, it's up to the landowners to protect their lake and its shoreline.

A year ago, cottagers in eastern Ontario took that responsibility seriously as they undertook for the first time in Ontario to reverse the shoreland deterioration that often follows development.

On a medium-sized (646 ha) lake 80 kilometers southwest of Ottawa near the town of Perth, the Christie Lake Association, Inc., joined with the Lands section of the Ministry of Natural Resources (Carleton Place District) to launch a new cooperative pilot project.

The Christie Lake Shoreland Restoration Program is designed to protect nature by copying what nature has been doing ever since the glaciers retreated from the area some 10- to 12,000 years ago — in other words, replanted much needed natural shoreline vegetation.

Aimed at that zone that experiences the most intensive use and visible stress on the lake — the shoreland area between the road or cottage and the water's edge — this program involves planting herbaceous plants and low level shrubs in a narrow band along the shoreland. Eventually, with successive plantings, a 10-meter band back from the high watermark will be revegetated.

Seventeen lakeshore sites and 1,800 individual plants were planted on Christie Lake planting day, May 26, 1984. Planting sites varied from steep embankments with very little ground cover to island properties, grass-fronted cottage lots, and the common cottage lawn frontage with retaining walls.

Plants from a natural nursery were delivered to each cottage site by directors of the association and ministry staff who showed cottagers how to plant their shoreland shrubs.

These plants included red-osier dogwood, shrubby willow, sweetgale, meadowsweet, Virginia creeper, and rough and green alder, all of which grow naturally along the shoreland, but are eliminated or reduced substantially over years of development and recreational use.

Five months later, on October 27, cottagers and ministry personnel got together again for Cutting Day. At that time, 25 cottagers and friends cut stems from several shrubs — enough to produce 40,000 cuttings. These cuttings were then sorted and packed away in a cottager's root cellar until this spring, when they were planted in pots in the shoreland restoration nursery.

One of the cottagers has donated a nursery site near the lake, equipment has been purchased, and the Christie Lake Shoreland Nursery opened this May. Operated jointly by the Christie Lake Association and ministry staff, this natural vegetation nursery will supply native shoreland plants and shrubs for future regeneration programs on Christie Lake and other lakes as the program develops.

Using simple techniques and equipment, the nursery expects to be fully operational in two years, when some 15,000 plants will be produced annually for transplanting to shoreland sites.

Although this concept of cooperation between local communities, lake associations and governmental units is new to Ontario, it has proven highly successful in Quebec where a Lakes Program has been in operation for 19 years.

From a single lake association in 1967, the Quebec program now has over 600 lake associations — representing more than 100,000 people — directly or indirectly involved in managing lake environments as nature intended.

Annual restoration days, cutting days and shoreland surveys are planned for Christie Lake over the next few years. As the program and nursery become established, the program will expand to other lakes in the region.

For more information, contact John Oliver, President Christie Lake Association, Inc., 546 Kenwood Ave., Ottawa, Ontario K2A 0L8.

Article reprinted from Lake Line, *July, 1985*

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 administrative actions which promote the sound management of the waters of New York State.

Membership Categories

Associations with up to 99 members	$30.00/yr.
Associations with 100 to 199 members	$50.00/yr.
Associations with 200 or more members	$100.00/yr.
Individual	$15.00/yr.
Corporate	$100.00/yr.

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

Board of Directors

A regular meeting of the Board of Directors of the Federation of Lake Associations, Inc. and the Federation of Lakes, Inc. was held in Syracuse on October 5. Minutes of the meeting will be sent to the membership in the near future. The board welcomed the following new members:

Ballston Lake Improvement Association
Cassadaga Lake Association
Horton Lake Association
Lake Comm. of Otsego Co. Conservation Assoc.
Seven Springs Country Club
Pelonia Lake Association
Lake Oscawana Civic Association
Greenwood Lake Watershed Management District
Butterfield Lake Cottage Owners Association
Hatch-Bradley Brook Lakes Association
Rainbow Lake Association
Port Bay Improvement Association
F. Jack Buholtz
John Debes
Dona Goldman
Jonathan Simpson
Emily Sillars
R. Warren Flint
Harold Goldstein

No Fish Story . . . County Wants to Import a Weed-eater

by JONATHAN SALTZMAN

Dutchess County legislators went fishing recently — for an underwater creature that feeds on the weeds that choke ponds, lakes and streams.

In a meeting that would have made Jacques Cousteau feel at home, the Legislature Environmental Committee unanimously asked the state to legalize the use of the Triploid White Amur fish for removing weeds.

Peter White, R-Wappingers Falls, introduced the resolution because he said weed-cutting machines have failed to remove vegetation from places like Wappingers Creek.

So, White wants the state to lift its ban on Triploid White Amur in New York waterways. The fish is a genetically altered carp that eats weeds but is prohibited because conservationists worry about its effect on the environment, according to John Grim, a Rhinebeck marine biologist.

Several legislators laughed at White's idea. Meanwhile, Harold Schroeder, R-Millerton, suggested the county import manatee, or sea cows, from Florida. He said the aquatic mammals also eat weeds.

''Of course, they're tropical so we'll have to get them out of the water in the cold weather. We can have a sea cow roundup,'' said Schroeder, a dairy farmer familiar with land-walking cows.

It was unclear whether Schroeder was serious. No matter. White's resolution went through the committee swimmingly.

''I think it's better than most resolutions that commend people for having more children than rabbits,'' White said, apparently referring to routine commendations adopted by the Legislature.

Grim, the head of Northeastern Biologists, Inc. of Rhinebeck, said White had a ''delightfully simple idea'' that has already worked in Florida.

Grim said the Triploid White Amur is a sterilized version of the White Amur, a fish reportedly native to Malaysia.

He said an Arkansas fish breeder, James Malone, has developed a way of breeding sterile fish in an attempt to placate environmentalists who worry that the reproducing kind will threaten other waterlife.

''You take a male and female fish ready to spawn and strip them of their eggs and sperm,'' Grim explained. ''You mix the eggs and sperm in a basin . . . and then shock them with cold water.''

Voila! Fish with three times as many chromosomes. Sterile fish.

And where do you get more Triploid White Amur? From Jim Malone, naturally. Grim said Malone sells them for 50 cents to $4. a fish, depending on their size.

Unfortunately, Grim wasn't at the meeting. Otherwise, he might have been able to answer slippery questions raised by the legislators.

''I'm not sure I understand why they're outlawed,'' Minority Leader Judith ''Kip'' Bleakley said of the reproductive White Amur.

''Because they're horny,'' White responded.

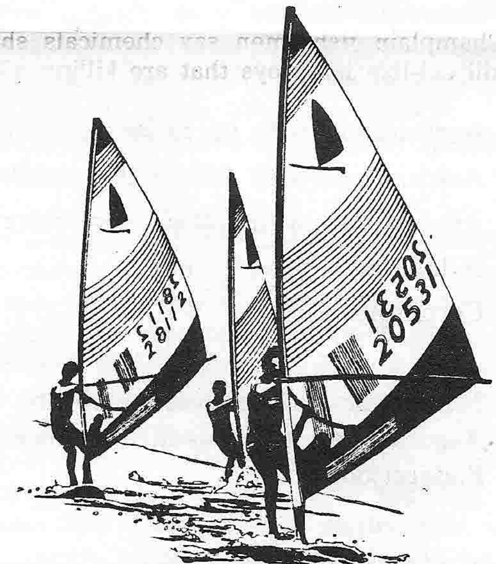
''How do you get more fish?'' asked Sandra Goldberg, D-Wappingers Falls.

''You clone more,'' responded another legislator.

Legislature Chairman Douglas McHoul, R-Hopewell Junction, had a big grin on his face.

''It's one of those crazy little things that Peter digs out, from wherever he digs out those things,'' McHoul said. ''But if it works, that's wonderful.''

Article reprinted from Poughkeepsie Journal
March 7, 1985 issue



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 (   ) ____________

APA Natural Resources Unit Formed

A Natural Resource Analysis Unit has been established at the Adirondack Park Agency by Executive Director Thomas A. Ulasewicz. The five person unit, headed by Raymond Curran, includes David Fleury, soil and water engineering specialist; Karen Roy, physical resources analyst; Daniel Spada, biological resources analyst, and Brian Grisi, a soils resource specialist on loan from the Soil Conservation Service.

In this relatively new field, the combined professional experience of the unit's staff totals more than 44 years working for government, educational institutions and private businesses as scientists and technical specialists.

Although the Resource Analysis Unit reports directly to the Executive Director, its staff provides advice to the other units of the agency on natural resource issues in a variety of subject areas such as terrestrial and aquatic ecology, air and water quality, civil and environmental engineering, plant taxonomy, soil science, limnology, remote sensing and computer assisted cartography and geographic analysis. The unit works closely with the Operations, Regional Planning and Legal staffs when the above expertise is needed for current projects.

Additionally, the staff takes the lead role in special wetlands projects including mapping for regulatory purposes, map promulgation, wetland characterization studies, wetland value and classification and local government communication. Other special projects include the revision of the agency's development standards, outreach to lakeshore associations, information sharing with academia on scientific issues, conservation planning with soil and water conservation districts, characterization of the soils of acidified lake watersheds and the computer assisted analysis of forest land productivity.

Recently, members of the unit's staff have been called upon to share their expertise through professional presentations or data exchange with other institutions in the eastern United States such as the University of Florida Wetlands Center, Cornell University, College of Environmental Science and Forestry at Syracuse and the New England Association of Environmental Biologists.

Lamprey Problem Stirs Debate

Lake Champlain fishermen say chemicals should be used to kill eel-like lampreys that are killing off fish in the lake.

But environmentalists and water supply officials from around the Burlington area say they're worried about introducing new, poisonous chemicals into the lake.

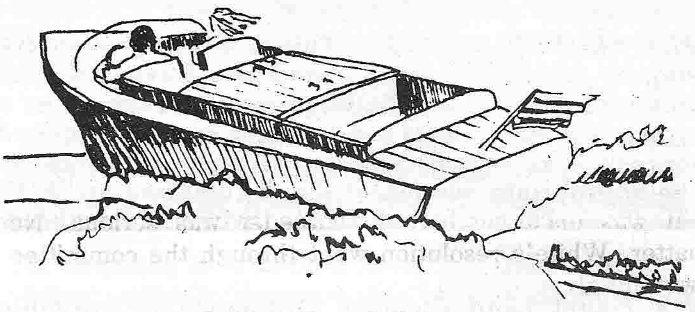
Those two views both got a hearing recently at several area meetings held by DEC to obtain public comment prior to the preparation of a draft environmental impact statement for sea lamprey control in Lake Champlain.

The lamprey is an eel-like fish with undeveloped eyes and a circular, sucking mouth, feared by sportsmen because it can disfigure or kill several types of lake fish and often attach itself to the hulls of boats. A DEC statement said "parasitic lampreys have had a devastating effect on the success of the trout and salmon stocking programs" in Lake Champlain.

The objective of the $2.5 million control program, the statement said, "is to achieve an abrupt and substantial reduction in abundance of Lake Champlain sea lampreys for eight years with two complete treatments of lamprey nursery areas. Lampricides would be applied to 18 tributary streams and five in-lake delta areas . . . The plan also calls for maintaining a stable annual stocking level consisting of 225,000 lake trout yearlings; 325,000 landlocked salmon smelts; 90,000 steelhead smelts; and 50,000 grown trout yearlings, for a total of 690,000 fish."

A monitoring and assessment plan will also be conducted to evaluate the impact and effectiveness of the program.

Further information may be obtained from Daniel S. Plosila, supervising aquatic biologist, DEC, Route 86, Ray Brook, NY 12977.



"Controlling Surface Runoff," from page 5

steepness of the grade and should have the capacity to handle any likely flows. On steep slopes road ditches and drainageways should have velocity reducing structures or should be discontinuous. Culvert outlets should have drop pools to reduce velocity and trap sediment. Underdesigned waterways and ditches will be washed out during major storms and will become chronic erosion problems.

8. Make sure that natural drainage ways and stream beds can handle the increased volume of runoff from the developed area. It may be necessary to artificially stabilize sensitive stream beds well downstream of the developed area. Overloading of natural streambeds and drainages can result in catastrophic erosion downstream of the developed area.

The preceding list is by no means complete. There are many other methods available to minimize the impact of development, especially from erosion and sedimentation. Many of the above practices may be implemented with deed covenants or restrictions.

We are not suggesting that all of the practices listed are necessary on all developments. The practices must be fitted to the needs of the site and the need of the particular lake in question. A development on highly permeable flat soils may have little impact even if none of these techniques are used.

Notes and Publications

Conference October 30-31 — Liming Acidic Waters: Environmental and Policy Concerns, Albany, NY. Contact the Acid Rain Information Clearinghouse, (716) 546-3796.

Conference November 13-16 — International Symposium on Applied Lake and Watershed Management, Geneva, Wisconsin. Contact NALMS office, (202) 833-3382.

Conference June 6-8 — New York State Lake Associations Conference, Colgate University, Hamilton, NY. Conference chairman is Mark Randall, 9 Charles St., Hamilton, NY 13346, (315) 824-2013. Save the date!

CITIZENS' GUIDE TO ADIRONDACK COMMUNITY PLANNING. This booklet provides detailed information on: why is it important for communities to plan at the local level and how to go about it; the relationship of local and regional planning and the State/APA Local Planning Assistance Program. For copies, write or call APA, Box 99, Ray Brook, 12977, (518) 891-4050.

THE SEQR COOKBOOK. This is a comprehensive step-by-step discussion of the State Environmental Quality Review Act (SEQR) process. Designed as a layman's guide, it treats each decision or action required for compliance as a discreet step. Contains references to the appropriate section of the regulations or SEQR Handbook. For copies, call DEC's Division of Regulatory Affairs (518) 457-2223.

A model Land Clearing Ordinance is available through T. Clothier, RR #2, Box 2300, Lake George, New York 12845.

Our resource file on lake management districts is growing. If your lake has formed a district similar to this type, please share a copy of it with us so that we can help lakes in the preliminary stages of formation. You can send them to T. Clothier.

Wood Preservatives — Thought and care should also go into planning the application of wood preservatives to the shoreline structures. DEC notes that the Feder Environmental Protection Agency has banned the manufacture and sale of Creosote, one of the most common wood preservatives. DEC considers that the introduction of a Creosote product in to the lake would constitute an illegal discharge under the Environmental Conservation Law. Clear wood preservatives are now available at most building supply stores, and should be used in place of Creosote. Again, even the clear preservatives should be applied with great care to prevent direct discharge into any body of water.

STREAM CORRIDOR MANAGEMENT: A BASIC REFERENCE MANUAL. These manuals have been sent to each member association courtesy of DEC and the Federation. This guide for lake and stream managers lists specific controls for stormwater runoff, sedimentation, erosion and shoreline protection. Additional copies are available through the writer, Bill Morton, NYSDEC, (518) 457-3656.

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 2300, 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 offic

The Federation of Lake Associations, Inc.
273 Hollywood Ave.
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