LAKE BARRINGTON

A WATER QUALITY REPORT WITH MANAGEMENT RECOMMENDATIONS

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EXECUTIVE SUMMARY

Lake Barrington is a 90 acre man-made lake located in the southwestern portion of Lake County. It has an average depth of 7.1 feet, with its greatest depth recorded at 13 feet. The lake volume is about 712 acre-feet. Approximately 172 acres of land drain into the lake, all of which impact the water in one form or another. Nearly 80 percent of this acreage is residential. The next largest land use in the watershed is forested land, covering about 17 percent of the total acreage.

During the summer of 1989, the Lake County Health Department sampled Lake Barrington to determine general water and sediment quality. Fish tissue from selected species found in the lake was analyzed for toxic substances. Water clarity of Lake Barrington surpassed the standard of four feet from April through July. The water was not clear enough, though, to see down four feet in August and September. The amount of plant growth, notably water milfoil and curyleaf pondweed, was overabundant. This was due to several reasons, notably, the shallow depth of the water, but even more important, the concentrations of nutrients in the water and in the sediments. Nitrogen was not excessive in the water, but it was very high in the sediments. The situation with the phosphorus was the opposite: concentrations were low in the sediments, but high in the water. In any case, nutrients were readily available for plant and algae growth in Lake Barrington.

Stormwater entering the lake contained high concentrations of nitrate-nitrogen, and moderately high concentrations of both forms of phosphorus (total and orthophosphate). One of the two sampled rain events had run-off with a high concentration of total solids. On both storm events, the water carried only trace or insignificant amounts of eight heavy metals to the lake. Most of them were found at concentrations that would be considered safe for drinking water.

The quality of the fishery in Lake Barrington is good.

The sediments from Lake Barrington were sampled twice, and had above normal levels of cadmium, copper, nickel and lead along with trace amounts of two organic pesticides, DDT and DDE.

Lake Barrington has good potential to be a well balanced system that meets the recreational needs of the community. It cannot be managed like a swimming pool, but it needs continuing management practices in accordance with realistic goals.

HISTORY OF LAKE BARRINGTON

When managing a lake, it can be both interesting and helpful to delve into its past and discover the events that brought it to its current state. Both cultural and ecological history can reveal much about a lake's condition. The historical search must not be restricted to the lake itself, for the surrounding land that drains into it - the watershed - also has a tremendous impact. Past use of that land is often reflected in the quality of the lake's water and bottom sediments.

Unlike the natural glacial lakes in the county, Lake Barrington is man-made, having been created in 1925 by damming.

The recorded history of Lake Barrington's management is sketchy, providing a glimpse, at best, of activities that have affected the lake. In order to provide useful references for the future, it is recommended that a yearly log of all lake management activities be kept. This will be a helpful tool for future management decisions.

Pre-Settlement Times

With the help of frequent fires, prairie plants and oaks dominated this landscape in pre-settlement times. Wolves and bears existed in Lake County, and the passenger pigeon, now extinct, was common.

A progression of Indian cultures lived here, ending with the Potowatomis, who lived in shelters covered with rushes gathered from lakes and wetlands.

In the 1830s, Indians were forced from the land by the United States Government. The land they had inhabited for hundreds of years had hardly been changed by their presence. They were quickly replaced by white settlers who began a great alteration of the environment. Wetlands were drained, land was cleared, and non-native plants were widely introduced. The degrading quality of the lakes reflected this change.

Farming Days and the Lake's Creation

Early farmers of the land Lake Barrington covers were the Millers (of whom Miller Road is named after) and the Davlins (of whom Davlin Pond is named after). The Davlin's grandson, Charlie, created the lake on the Miller property while working for them as a young man. He had noticed that a natural basin existed on their land and wondered if it would hold water. In 1925, with permission from the Millers, he piled up willows, hay, and dirt at the site of what now is the dam. Though people were skeptical of his experiment, a shallow lake did form, fed by rainfall and a small creek. It was named Indian Lake.

Charlie stocked it with bass and spent two years, with the help of Leroy Miller, lining the shore with rocks hauled in from Fox River Grove.

The land passed into the ownership of C. J. Lord and then G. C. Griswell, who planted 7,000 elms, spruces, and pines near the lake and built the large stone house on the south end that is now the James Construction office. Griswell had the level of the dam raised five feet and had an eighteen foot retaining wall built behind it. The initials GCC were carved into the dam and are frequently misread as CCC. This leads to the false belief that it was a project built during the Great Depression in the 1930s by the Civilian Conservation Corps.

Griswell sold the land to the Bartletts in 1946. Mr. Bartlett changed the name from Indian Lake to Lake Barrington because he believed there were already at least 700 lakes by that name in the country and he didn't want to be the owner of another one. He felt the name "Lake Barrington" better reflected the wealthy estates that were becoming popular in the area.

Changes in the Watershed

In 1972 the Bartletts sold the lake and the surrounding land (450 acres) to the J. S. James Company and Amoco Realty, who began development of the Lake Barrington Shores condominiums the following year. For the next seventeen years, building occurred within the watershed. At the project's end, the community is planned to consist of over 1,300 units.

So, for roughly the first fifty years of the lake's existence, its watershed was dominated by farmland and was home to relatively few residents. But a major shift occurred over the course of the last two decades, with tremendous development and a large influx of people. The change in land use has resulted in a high amount of nutrients entering the lake. Since 1969, records have indicated that the lake had plant and/or algae problems. This is typical for a lake whose watershed has undergone development without the control of nutrient inputs. Unfortunately, problems are even greater for man-made lakes.

MORPHOMETRY AND BATHYMETRIC MAP OF LAKE BARRINGTON

It is extremely important to consider a lake's features, such as the shoreline and depth, when formulating lake management plans. The water, sediment and aquatic life are influenced by a lake's **morphometry,** or physical makeup. For example, the lake bottom can be made up of glacial materials such as rocks and pebbles, or it can be mud, typical of man-made lakes like Lake Barrington. While glacial lakes usually have a variety of plants, those with a mud bottom usually have only a few dominating species growing in dense stands.

Bathymetric maps show the lakes' shoreline and depth contours below the water's surface. These maps provide valuable information to lake managers who wish to assess a lake's condition. The depth contours displayed on these maps show the location and extent of the **littoral zone** (shallow area). This is the area where plant growth is the greatest. The maps can also reveal mid-lake reefs, important for their potential as fish spawning areas. The size and depth of the deepest hole in the lake can indicate the likelihood of fish kill problems. By combining information about the prevailing wind direction and **fetch** (the longest length of open water the wind can travel), clues about the potential for shoreline erosion can be determined. Erosion control practices can then be evaluated and designed to prevent shoreline damage. By periodically updating the bathymetric map, the lake can be monitored to see how quickly sediments are filling in the lake.

Lake Barrington's bathymetric map is illustrated in Figure 1. Over the course of the season, the Health Department noticed an increase in the lake's water level. The water level will fluctuate more in a lake with a small watershed. The watershed draining into the lake is about 172 acres, which is rather small for a lake that is 90 acres in size. Therefore, this seasonal fluctuation in water level is expected and should be considered when examining the bathymetric map.

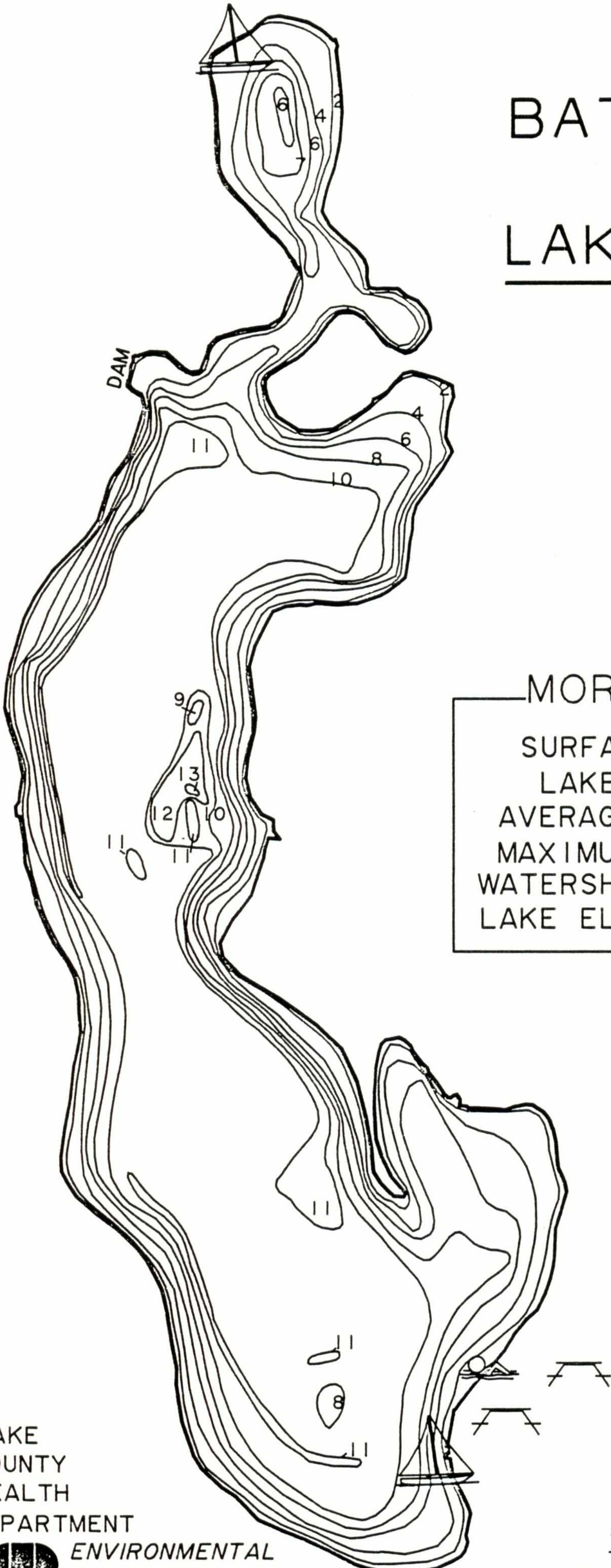
Lake Barrington is a man-made, mud-bottom lake. It is relatively shallow, with an average depth of only 7.1 feet. The lake at its deepest is 13 feet. The average lake volume is 712 acre-feet. The shallow waters and mud bottom are two important factors that have resulted in the lake being overgrown with two types of plants: curyleaf pondweed and milfoil. The littoral zone covers the entire lake. If weed harvesting was not done regularly, nearly 100% of the lake would be covered with plant growth.

Another bathymetric map was completed on Lake Barrington in 1976. The deepest point in the lake at that time was 14 feet. This is in contrast to the Health Department's recording of a deep hole of 13 feet. This slight loss may have been due to numerous factors (e.g., sedimentation, the 1988 drought, or a combination of these and other factors). The lake elevation, unfortunately was not recorded at the time of the 1976 map's production. Therefore, a direct comparison of the lake elevation in each of these years could not be made. However, the lake level did rise approximately .5 feet from May to September of 1989. The Health Department staff was then able to record a 13.5 foot maximum depth.

FIGURE 1:

BATHYMETRIC MAP OF LAKE BARRINGTON

Depth recorded in feet



NORTH

250 0 250
SCALE FEET

MORPHOMETRIC DATA:

SURFACE AREA	= 90.3 ACRES
LAKE VOLUME	= 712.6 ACRE-FEET
AVERAGE DEPTH	= 7.9 FEET
MAXIMUM DEPTH	= 13.0 FEET
WATERSHED AREA	= 140.8 ACRES
LAKE ELEVATION	= 779.66 FEET×

× above mean sea level

= BEACH

= BOAT RAMP

= RECREATIONAL AREA

LAKE COUNTY HEALTH DEPARTMENT
ENVIRONMENTAL ENGINEERING

Prepared from
Lake County Health Department
survey data collected during Sept. 1989.

THIS MAP IS INTENDED FOR WATER QUALITY REFERENCE ONLY, AND NOT INTENDED FOR NAVIGATIONAL, SWIMMING, OR DIVING PURPOSES.

THE GEOLOGY OF THE LAKE BARRINGTON AREA

About five million years ago, glaciers began a slow but powerful cycle of advancing and retreating over much of North America. Walls of ice over one mile thick pushed in from the north, scouring the land of its rocks, soil, and plants. In warm periods their meltwaters were debris-laden, leaving behind loads of rocks and other material in a variety of landforms.

In the Midwest, this period lasted until about twelve thousand years ago, when the last of the Wisconsinan glaciers retreated. In Lake County (and elsewhere) it left behind a thick layer of highly compacted till (unstratified sediment that is a mixture of sizes and shapes) and a series of moraines - long ridges of material deposited along glacial borders. In Lake County these moraines generally run from north to south. East of the Des Plaines River, they are narrow and closely spaced and are referred to as the Lake Border Morainic System. West of the river, they are wide and gently rolling. These western moraines are known as the Valparaiso Morainic System, with Lake Barrington located near its western edge.

The unconsolidated glacial till covering Lake County is thick, ranging from 75 feet near Lake Michigan to 300 feet near the western county border. Beneath this is bedrock, made up of limestone that was deposited millions of years ago when the area was covered by shallow seas. The area near Lake Barrington is characterized by rapidly thinning clayey silt deposits with up to 150 feet of sand and gravel underneath. Lake Barrington itself rests on about 50 feet of clayey silt material, with about 120 feet of sand and gravel underneath. In the area, isolated pockets of sand and gravel (which often hold water) are common. Lake Barrington may transmit water through these pockets. Water may also be transmitted very slowly through the clayey silt material, due to the Valparaiso Morainic System's typically high water table. The water table is generally within five feet of the surface. Because of the clay's poor ability to transmit water, any transfer through this clayey silt material would be very slow.

THE WATERSHED AND LAND USE SURROUNDING LAKE BARRINGTON

People who have visited many different lakes obviously would have the tendency to go back to the "good" lakes: the ones that are clear, the ones with the great fishing, etc. If they happen to live on a lake, they may be more impressed with these other "good" lakes. They may wonder why their lake isn't as nice. Many times, the answer is right in their own backyard. In essence, the water is a reflection of the land that surrounds it. A lake ringed with a forest will be different from a lake surrounded by farm fields or by homes.

A **watershed** is the land that drains into a lake. Rainfall run-off is the connection between the land and the lake. As soon as land is disturbed by human activities such as construction, farming activities, and other land alterations, changes can be seen in the water quality. A forested watershed will probably not have chemical fertilizers or pesticides washing into the water like a developed watershed might. For example, construction sites with poor soil erosion controls can allow exposed soil to erode and wash into a lake. This makes the water cloudy and causes other water quality problems. Farming activities may also cause similar erosion problems. Usually fertilizers and/or pesticides have been applied on the field, and these travel with the soil particles to the water. In addition some residential areas have homes with septic and laundry drains that can adversely impact the lakes.

As mentioned in the above paragraph, the fertilization of lakeshore lawns can be a problem. A lake will act similar to a lawn. For example, if one lot is spread with fertilizer and another is left alone, the one with fertilizer will have thicker and greener growth. The plants in a lake grow with the same ingredients that are found in lawn fertilizer: the nutrients phosphorus and nitrogen. These are the main ingredients for plant growth. Both of these nutrients are made available to aquatic plants by a number of ways, most often by rainfall run-off. As rain flows over land, across fertilized lawns, down street gutters littered with leaves or grass clippings, it brings an assortment of things to the lake, notably these nutrients. Droppings from ducks and geese also have high amounts of phosphorus and nitrogen. More often than not, a pond frequented by these birds will be green from a dense algae bloom.

The factors briefly outlined above are important, but are often overlooked or downplayed. It is crucial to realize that they are the reasons as to why a lake is in its present condition. Recognizing these factors is critical for protecting or rehabilitating any lake.

Lake Barrington's Watershed

Nearly eighty percent (80%) of the Lake Barrington watershed is residential (Figure 2). Seventeen percent (17%) of this acreage is forested. Remember that one of the most common activities that affects a lake in a residential area is lawn fertilization. It was noted that a lawn care service has been used for the past several years. To the Health Department's knowledge, the soil has never been tested for available phosphorus. This is highly recommended before adding any fertilizer to a lawn. Results sometimes indicate that only small amounts of fertilizer are needed, if it is needed at all. The University of Illinois Extension Service analyzes soils for a small fee.

One important watershed feature is the vegetative buffer strip that rings most of the lake and stretches from the water's edge to the walking path. This plays an important role in filtering some of the run-off that flows in from the watershed. The U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS) has standards and specifications for buffer strips. These suggestions would be helpful in order to preserve what is there now.

There are some areas of the shoreline, though, that are not protected by the buffer strip. Here, the lawn meets the water. The lawn service does not fertilize within eight feet of the shoreline, which is good, but would be even better if the non-fertilized zone was at least fifteen feet and mowed not shorter than six inches. The SCS suggests that lawns should not be mowed shorter than two to three inches. Short lawns will not filter the nitrogen, phosphorus, or any other lawn-applied products.

WATER QUALITY OF LAKE BARRINGTON

Common questions asked by someone who lives on lakeshore property are "What is the water like in this lake? Is it good? Is it safe?" The answers need to include many different pieces of information. The quality of a lake includes more than the quality of the water. Linked with the water are the sediments - or the mud on the bottom - the fish and other organisms, and the land surrounding the lake. **THESE ASPECTS OF THE LAKE ARE NOT EXCLUSIVE OF EACH OTHER.** Therefore, it is crucial that lakes be considered systems, with these factors as the major interacting components.

The water from Lake Barrington was sampled at the deepest point (site 1), just across from a small wetland area (Figure 3). At this station, three samples were taken: at three feet deep, at seven feet deep, and at eleven feet deep. Sites 2 and 3, where water samples were collected were, respectively, in the north bay, and from the north inlet in the northeast bay. Stormwater was collected from the same inlet, and from several places along the walking path near and at the Marina. The waters from the lake were tested for water clarity, nitrogen, phosphorus, dissolved oxygen, solids, fecal coliform bacteria, and chlorophyll as well as several other water quality indicators (Appendix B). These waters were sampled once a month from April through September. The stormwater was tested for solids, nitrogen, and phosphorus. Stormwater was sampled twice after rains during the summer.

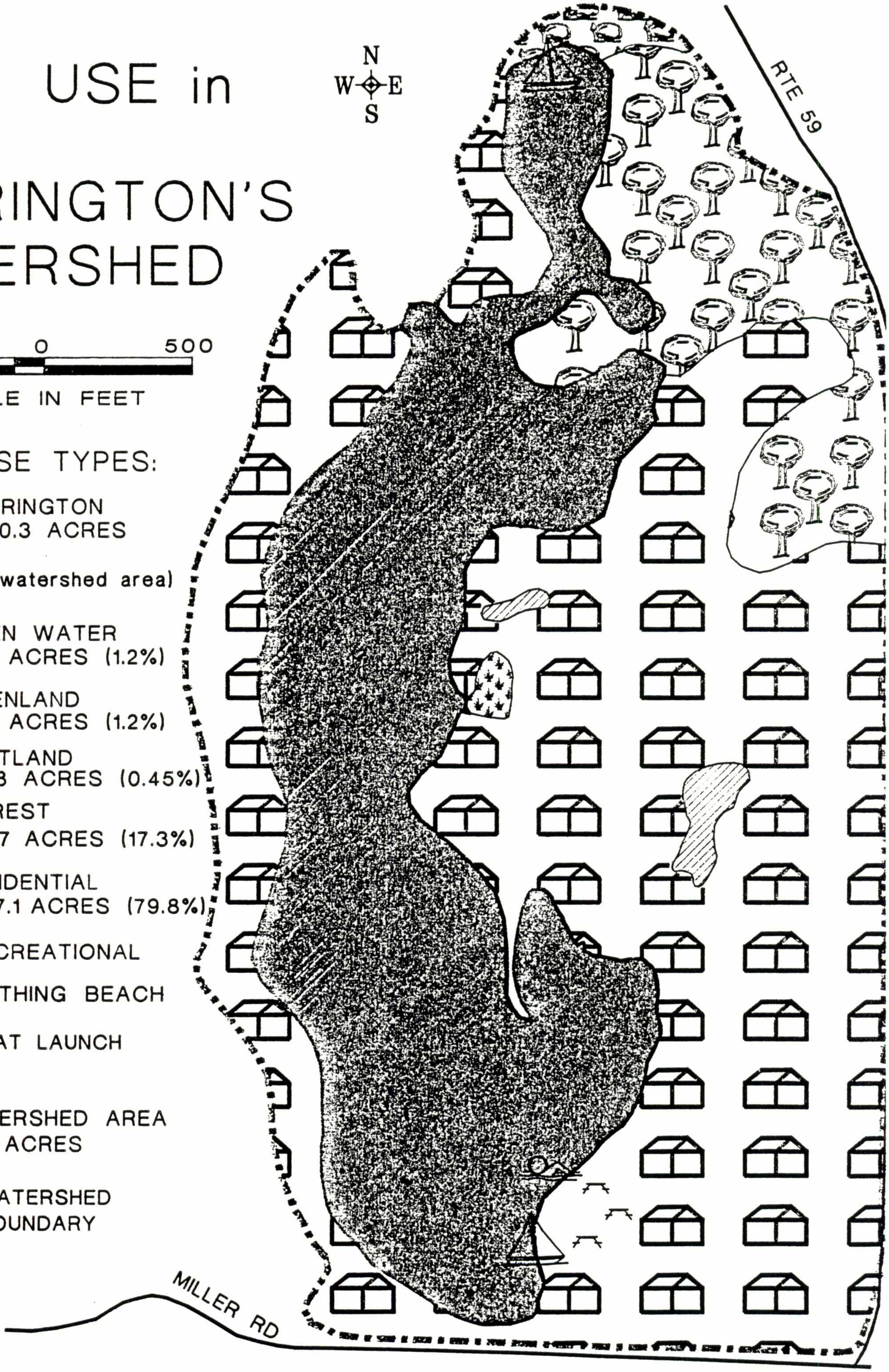
Sediment samples were also collected from sites 1, 2, 3, and from the southern portion of the lake near the beach (site 4). These were analyzed for various metals, pesticides, and other toxics. Sediments were sampled in June and September. These results are discussed in the section entitled "Toxics: Sediment, Fish and Stormwater Contamination."

Water Clarity

Many people look into the water to gain their first impression of a lake's water quality. Even though this may seem too simple of a test, water clarity can actually be a useful tool to understand a lake system. Two substances can cloud lake water: tiny, microscopic organisms called algae, and other **suspended** (floating) bits of soil or decomposing particles, such as leaves and sticks. Too much algae creates nuisance conditions, such as "scummy" water, and can be linked to a poor fishery in the lake. Sediment

FIGURE 2:

LAND USE in LAKE BARRINGTON'S WATERSHED



500 0 500

SCALE IN FEET

LAND USE TYPES:

LAKE BARRINGTON = 90.3 ACRES

(with % of watershed area)

= OPEN WATER - 2.1 ACRES (1.2%)

= OPENLAND - 2.1 ACRES (1.2%)

= WETLAND - 0.8 ACRES (0.45%)

= FOREST - 29.7 ACRES (17.3%)

= RESIDENTIAL - 137.1 ACRES (79.8%)

= RECREATIONAL

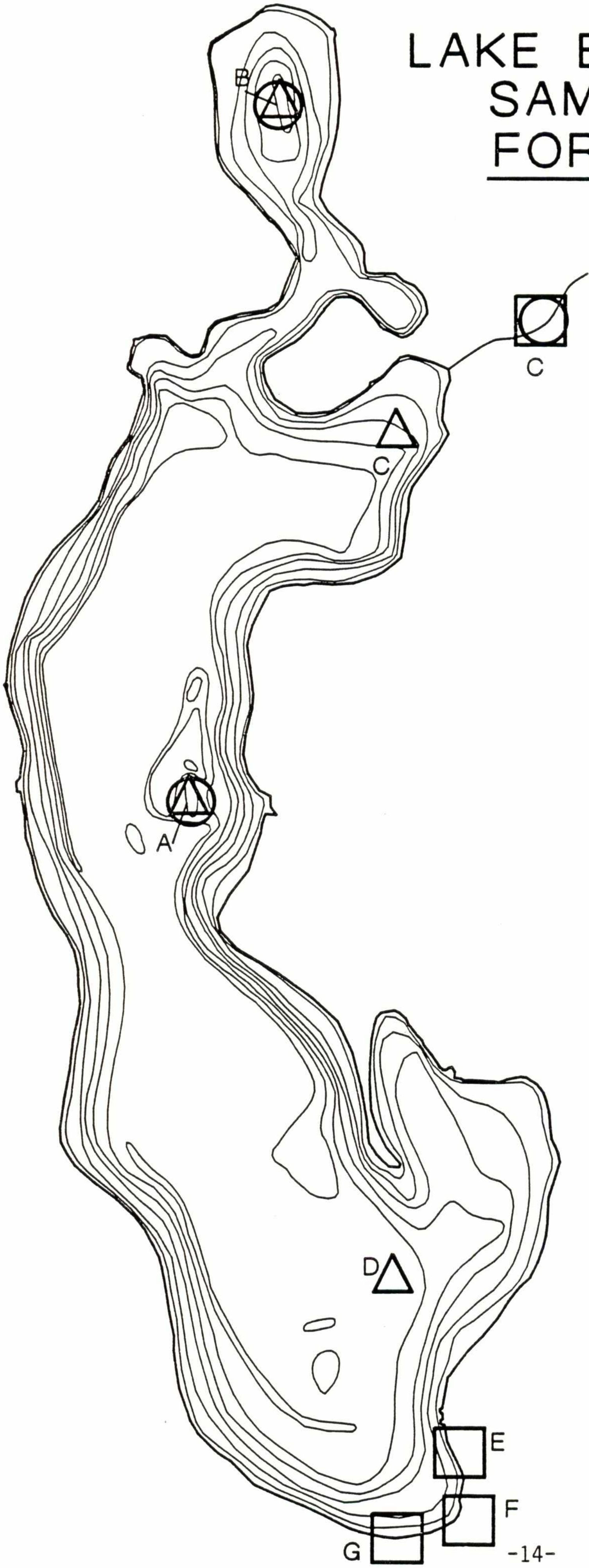
= BATHING BEACH

= BOAT LAUNCH

TOTAL WATERSHED AREA = 231.1 ACRES

= WATERSHED BOUNDARY

LAKE BARRINGTON SAMPLE LOCATIONS FOR 1989 ASSESSMENT



○ WATER

TWO INLAKE LOCATIONS

- A DEEP HOLE
- B NORTH BAY

ONE INFLOW LOCATION

- NORTH INLET

△ SEDIMENT

FOUR INLAKE LOCATIONS

- A DEEP HOLE
- B NORTH BAY
- C NORTH INLET
- D SOUTH BAY

□ STORMWATER

FOUR INFLOW LOCATIONS

GRAB SAMPLE

- C NORTH INLET

COMPOSITE SAMPLE

- E MARINA
- F MILLER RD
- G UN-NAMED

is suspended by a few different actions. It can be the result of soil particles being carried into the lake by rainfall run-off. Or the bottom can be disturbed by wind stirring the shallow areas or by bottom-feeding fish such as carp. The Health Department used a device called a Secchi disc to measure the depth of water clarity (Figure 4). This flat, black and white disc is lowered into the water until it can no longer be seen. The ability to see the disc when it's at least four feet below the surface generally means safer swimming conditions. If water is not clear to this depth, it may be difficult to locate a struggling swimmer or submerged objects. It also may represent unpleasing conditions for many lake uses.

In Lake Barrington, readings taken during the months of April, May, and June were all over eight feet deep. During August and September though, an object could only be seen to a depth of about three and a half feet, and three feet, respectively.

Solids in the Water

What contributed to the **turbidity** (cloudiness) of the water that was observed in Lake Barrington during August and September? Looking at the amount of total solids and its different fractions can provide some clues. The total amount of solids is made up of suspended solids and dissolved solids (See Appendix B). Dissolved solids are not the culprits that cloud the water - they are actually dissolved in the water, and make their appearance as mineral or salt deposits when water evaporates. The suspended solids are what makes the water turbid. Tiny bits of dirt, clay, algae, and dead plant matter are included in suspended solids (Figure 5). A lake with water that has a value over 25 parts per million (ppm) of suspended solids is considered to have impaired visibility. The average amount of suspended solids in Lake Barrington was 10.1 milligrams per liter (mg/L also known as ppm). It is likely that the algae is responsible for the cloudy water.

Chlorophyll a

Chlorophyll is a pigment found in all green plants and algae. The amount of chlorophyll a in the water can be directly related to the amount of algae growth in the lake. When the level of chlorophyll a exceeds 10 milligrams per cubic meter (mg/m^3) the amount of algal production may be excessive. This contributes to the impaired water quality of a lake.

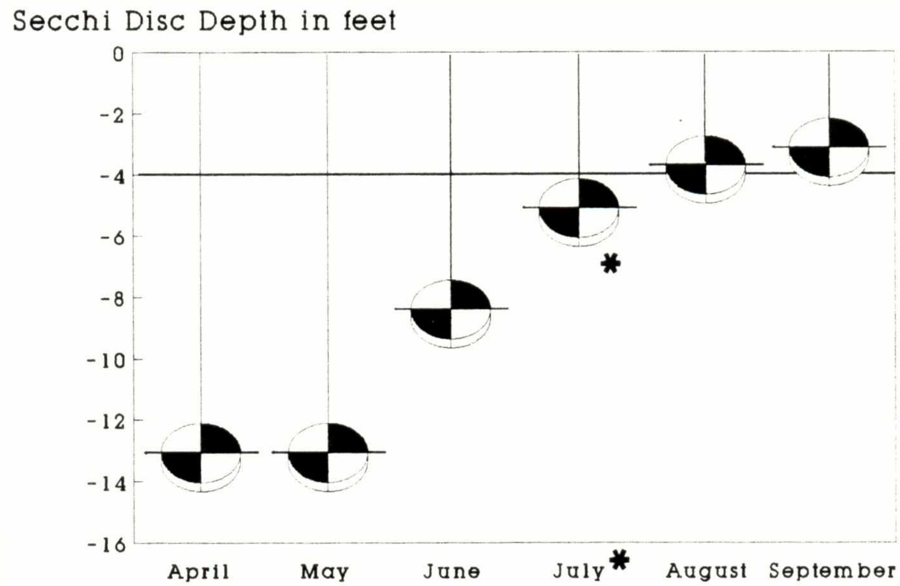


FIGURE 4: SECCHI DISC DEPTH (feet below surface) at the deep hole in Lake Barrington in 1989.

* *July reading taken from Illinois Volunteer Lakes Management Program records.*

Solid line represents suggested criterion of 4 feet.

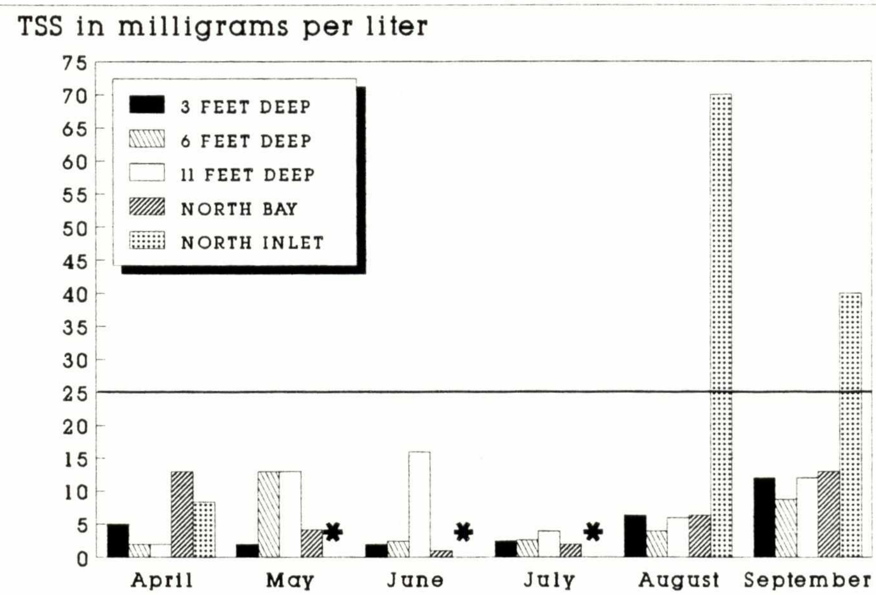


FIGURE 5: TOTAL SUSPENDED SOLIDS (TSS) at three vertical stations and two other points in Lake Barrington in 1989.

* *Indicates no sample due to lack of flow.*

Values above 25mg/liter indicate turbidity problems.

In Lake Barrington, levels higher than this were first noticed in June, at a depth of eleven feet (Figure 6). As summer progressed, the amount of chlorophyll a in the water at all points within the lake escalated above 10 milligrams per cubic meter (mg/m^3). Excess algae, remember, clouds the water (refer to the Secchi disc Figure 4). There is a direct comparison between the months in which the chlorophyll levels were high, and the months of low water clarity. Refer to Figures 4 and 6 and compare the chlorophyll a in the months of August and September with the Secchi disc readings of the same months.

In some circumstances, algae are able to start their **bloom** (heavy growth) after weed harvesting. After the weeds are removed, some of the plant fragments that aren't gathered by the harvester will decompose and release nitrogen and phosphorus into the water. As explained earlier, these are the two key ingredients for plant and algae growth. When excess nutrients are in the water, either plants or algae will result. Without the large plants blocking the sunlight and with nutrients available, the algae are then able to quickly establish a bloom. There was not a large algae bloom in June after Lake Barrington was harvested in late May, probably due to the copper sulfate application after harvesting. However, after the harvest in late July, the algae was clouding the water. Removal of plants through harvesting or herbicides frequently results in an algae bloom.

pH

More noticeable in Lake Barrington is not the algae, but the heavy plant growth. These **macrophytes** (aquatic plants), release carbon dioxide into the water. A large stand of macrophytes produces more carbon dioxide than a small one. If there is a high concentration of carbon dioxide, the pH of the water can rise. The pH is a measure of how acidic or basic (alkaline) the lake water is, and is measured on a scale from 1 through 14. Seven is neutral; a lower number is more acidic, and a higher number is more basic. The pH scale is logarithmic; for example, a pH of 5 is 10 times more acidic than a pH of 6. Most lake water in this area has a pH ranging from 6 to 9. Unlike some parts of the country, acid rain currently does not pose a problem to lakes in Illinois. This is due mainly to the neutralizing capacity of our soils.

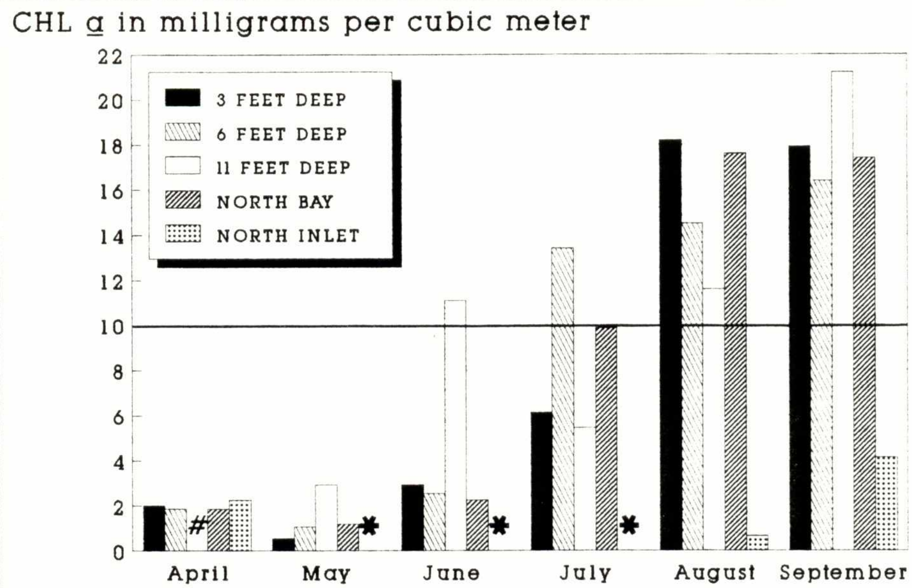


FIGURE 6: CHLOROPHYLL a (CHL a) at three vertical stations and two other points in Lake Barrington in 1989.
* *Indicates no sample due to lack of flow.*
Values above 10mg/meter³ represent nutrient-rich conditions.
Indicates results below detectable limits.

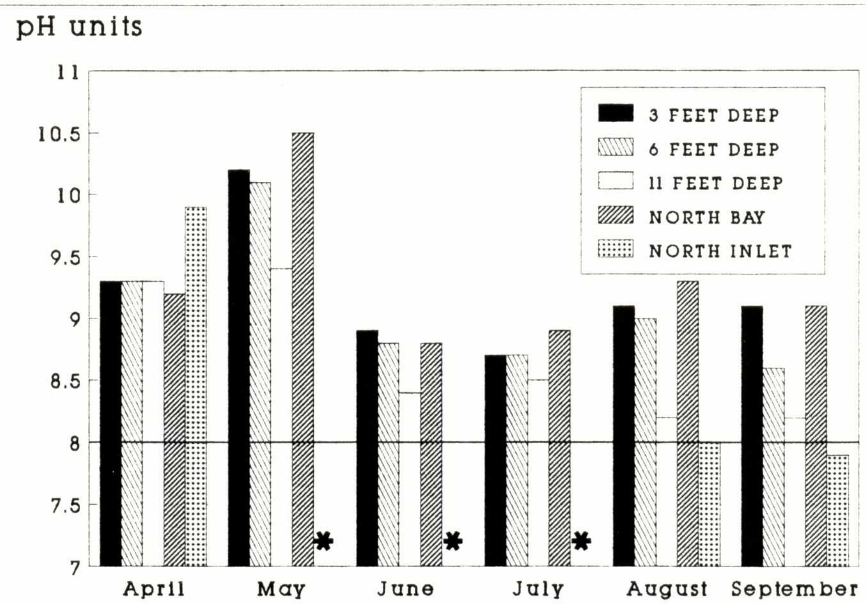


FIGURE 7: pH at three vertical stations and two other points in Lake Barrington in 1989.
* *Indicates no sample due to lack of flow.*
Values above 8 represent moderate/excessive plant growth.

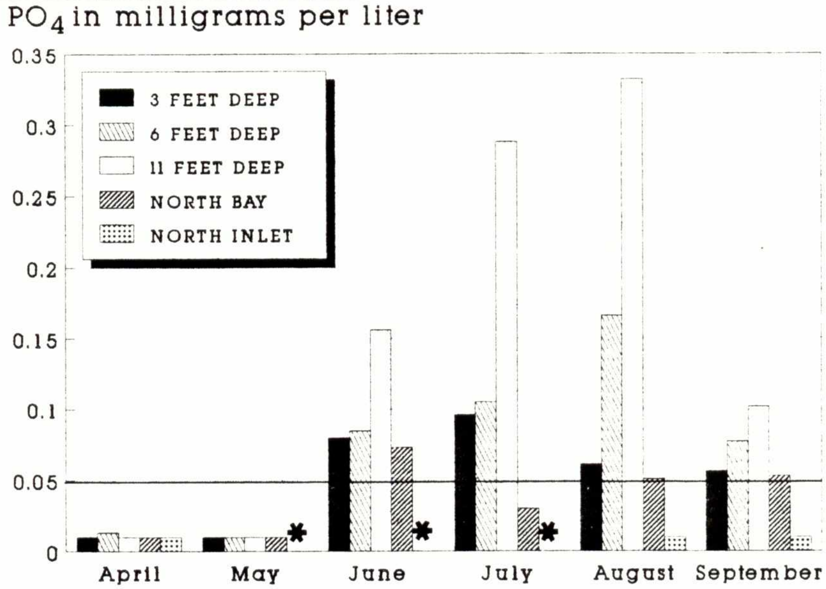


FIGURE 8: ORTHOPHOSPHATE (PO_4) at three vertical stations and two other points in Lake Barrington in 1989.
* *Indicates no sample due to lack of flow.*
Values above 0.05mg/liter represent nutrient-rich conditions

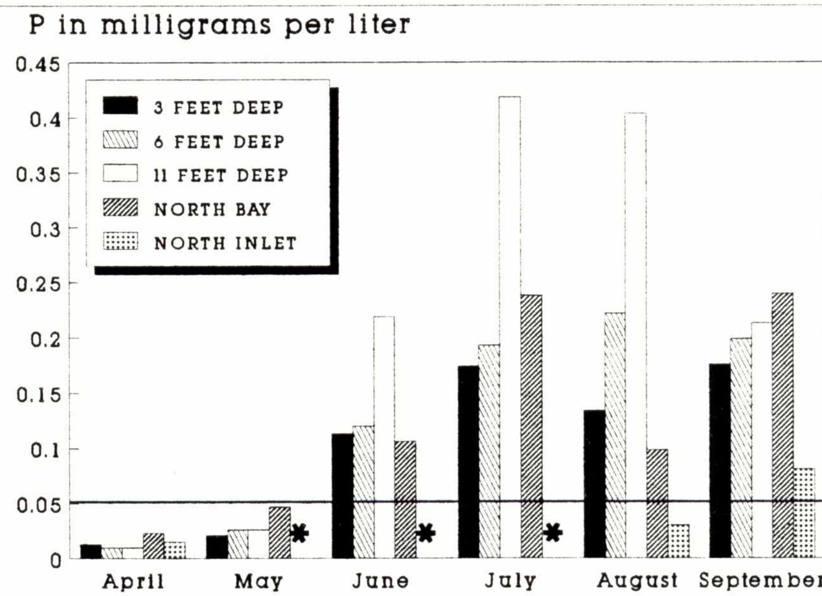


FIGURE 9: TOTAL PHOSPHORUS (P) at three vertical stations and two other points in Lake Barrington in 1989.
* *Indicates no sample due to lack of flow.*
Values above 0.05mg/liter represent nutrient-rich conditions

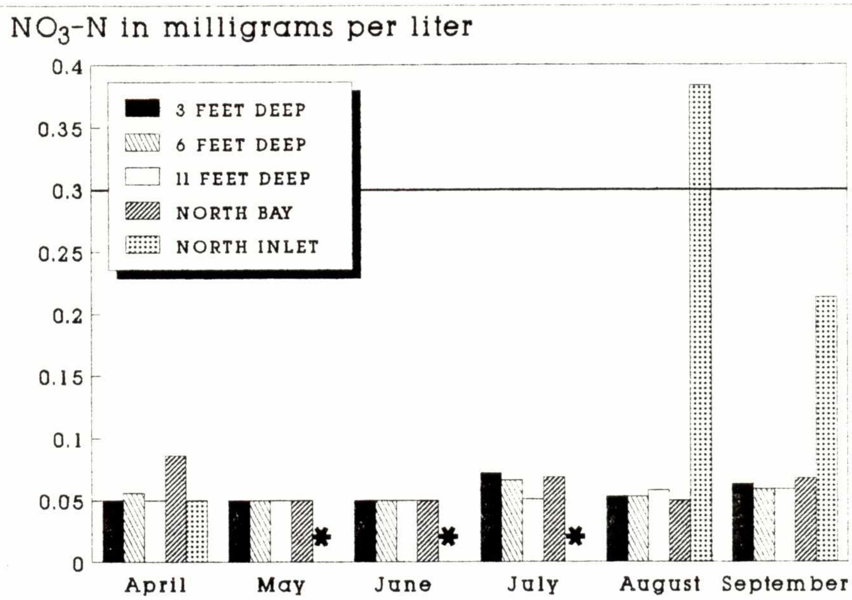


FIGURE 10: NITRATE-NITROGEN (NO_3-N) At three vertical stations and two other points in Lake Barrington in 1989.
✱ Indicates no sample due to lack of flow.
Values above 0.3mg/liter represent nutrient-rich conditions.

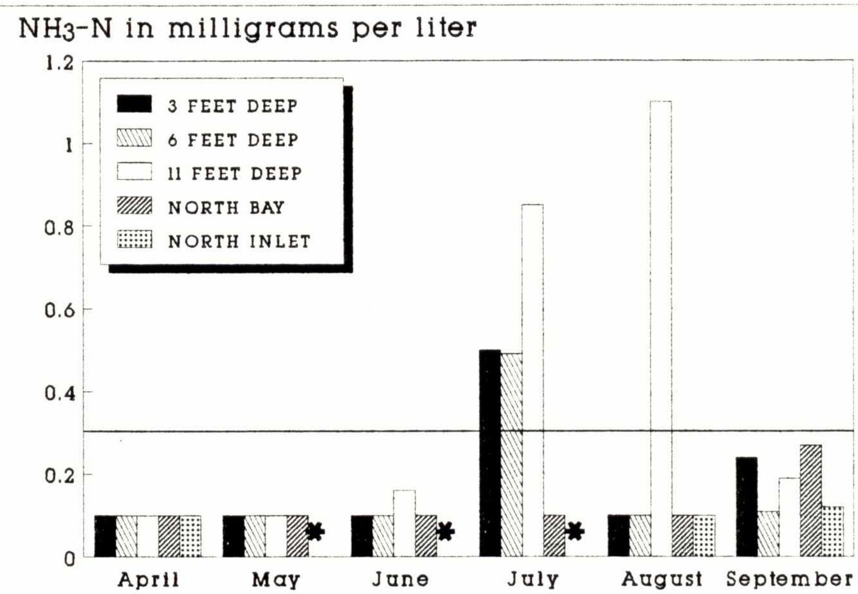


FIGURE 11: AMMONIA-NITROGEN (NH_3-N) At three vertical stations and two other points in Lake Barrington in 1989.
✱ Indicates no sample due to lack of flow.
Values above 0.3mg/liter represent nutrient-rich conditions.

Nutrients in the Sediments

Two of the parameters that were analyzed in the June and September sediment samples were total phosphorus and total nitrogen (Table 1). Phosphorus levels were not above normal according to guidelines set for lakes by the Illinois Environmental Protection Agency (Investigations of Illinois Surface Waters - Chemical Analysis of Surficial Sediments From 63 Illinois Lakes, Summer 1979). Table 2 lists this information. This appears to be encouraging, but remember that the water samples had high phosphorus from June to September (Figures 8 and 9). Also, phosphorus is tied up in the plants themselves. All sources of potentially available phosphorus in the lake system needs to be considered. In addition to the sediment samples and the summer water samples, another water sample taken in very early spring can give a clearer picture of the available nutrients in the lake system. At this time, no plants are growing, and nutrients have not yet been released from the sediments.

The situation was exactly the opposite with nitrogen. It was highly elevated in the sediments, but rather low in the water. The sediment samples in September were significantly higher in nitrogen than the sample taken in June. One reason is that plants are starting to die at this time, and are decomposing and releasing nitrogen on the bottom.

The above information is very important with respect to the overabundance of Eurasian watermilfoil found in the lake. Most macrophytes, particularly milfoil, absorb phosphorus and nitrogen from the sediment as opposed to the water column. Generally, milfoil growth is not limited by the availability of phosphorus, but may be nitrogen limited. This statement has important management implications and will be discussed further in the recommendations.

Table 1. IEPA Classification of Illinois Lake Sediments (1979)

Constituent (mg/Kg)	Below Normal	Normal	Elevated	Highly Elevated
Total Nitrogen	<1650	1650-5775	5775-7850	>7850
Total Phosphorus	< 225	225-1175	1175-1650	>1650

Table 2. Nutrient Results in Lake Barrington Sediments

Location	Date	Total Nitrogen	Total Phosphorus
Deep Hole	June 21	8824 mg/Kg	353 mg/Kg
	September 20	16923 mg/Kg	562 mg/Kg
North Bay	June 21	10909 mg/Kg	427 mg/Kg
	September 20	17000 mg/Kg	410 mg/Kg
North Inlet	June 21	2391 mg/Kg	304 mg/Kg
	September 20	13750 mg/Kg	475 mg/Kg
South Beach Area	June 21	3938 mg/Kg	69 mg/Kg
	September 20	19192 mg/Kg	818 mg/Kg

Dissolved Oxygen

The presence or absence of oxygen affects many different chemical and biological processes in a lake. For instance, phosphorus is bound to the sediment when oxygen is present. As soon as the sediment becomes **anoxic** (depleted of oxygen), phosphorus will be released into the water for plants and algae to use. A lack of oxygen also slows down the decomposition process.

The amount of oxygen in the water compared to plant and algae growth shows an interesting relationship. This relationship changes throughout the day and throughout the year. During the day, as plants and algae make their own energy through photosynthesis, they release oxygen. At night, the plants and algae use some or all of the oxygen to burn the energy they made during the day. Fish, bacteria, and other organisms in the lake are constantly using oxygen. Dissolved oxygen samples were collected during the day, and therefore should reflect peak oxygen concentrations.

Unlike deeper lakes, where water forms layers of varying temperatures and oxygen levels in the summer and winter (also called stratification), Lake Barrington's water is constantly mixed by the wind. The mixing distributes oxygen and nutrients throughout the water. A sharp temperature drop is not seen at any depth in this lake (Figure 12). However, in some months, oxygen levels drop at certain depths. In order to keep healthy fish in a lake, a minimum of 5 ppm of oxygen needs to be in the water. When oxygen levels start to drop below this, fish are stressed, and can die. Some species can withstand low oxygen, but these are species like carp and bullhead, not the prize bass and northern pike.

Lake Barrington had a good oxygen supply in April, with a 13.4 mg/L average. In May, oxygen was fairly good, but fish could not find an adequate supply below nine feet. The month of June saw a dramatic reduction of oxygen - an average of 6.4 ppm was found in the water, but only down to five feet. Below five feet, the level was less than the 5 ppm standard. In July, the condition worsened - the water deeper than three feet had only 3.8 ppm or less. There was a slight improvement in August and September, but oxygen was still depleted at six and seven feet, respectively. Oxygen loss can result in a number of ways. Shallow lakes, for instance, do not normally hold oxygen well in the warmer summer months. Plant management, both chemical and harvesting, can result in an oxygen loss. Again, if herbicides are applied and kill a large stand of plants, the decomposing mass can rapidly deplete the water's oxygen supply. Harvesting will not result in as drastic a loss, but any plants not collected by the machine will use oxygen as they decompose. Large plant stands left in the water will both create and use oxygen. If left alone, large plant masses can take a toll on the oxygen content as they start to die in the fall. If the people wish to pull in those healthy lunker bass, an aeration system should be considered to improve the summer's oxygen-poor waters.

Swimming Conditions (Fecal Coliform Bacteria)

Before someone goes swimming in a lake, they may wonder if the water is safe. The Health Department sampled the beach for fecal coliform bacteria every two weeks during the summer of 1989. The stormwater outfalls and other sampling points in the lake were tested for bacteria. Bacteria did not pose a problem at the beach or at any of the in-lake sample points. Rainfall, however, caused the north inlet to deliver rather high amounts to the lake. The stormwater samples from the marina were also high. This is a common occurrence for any lake; as rain falls and starts to flow over

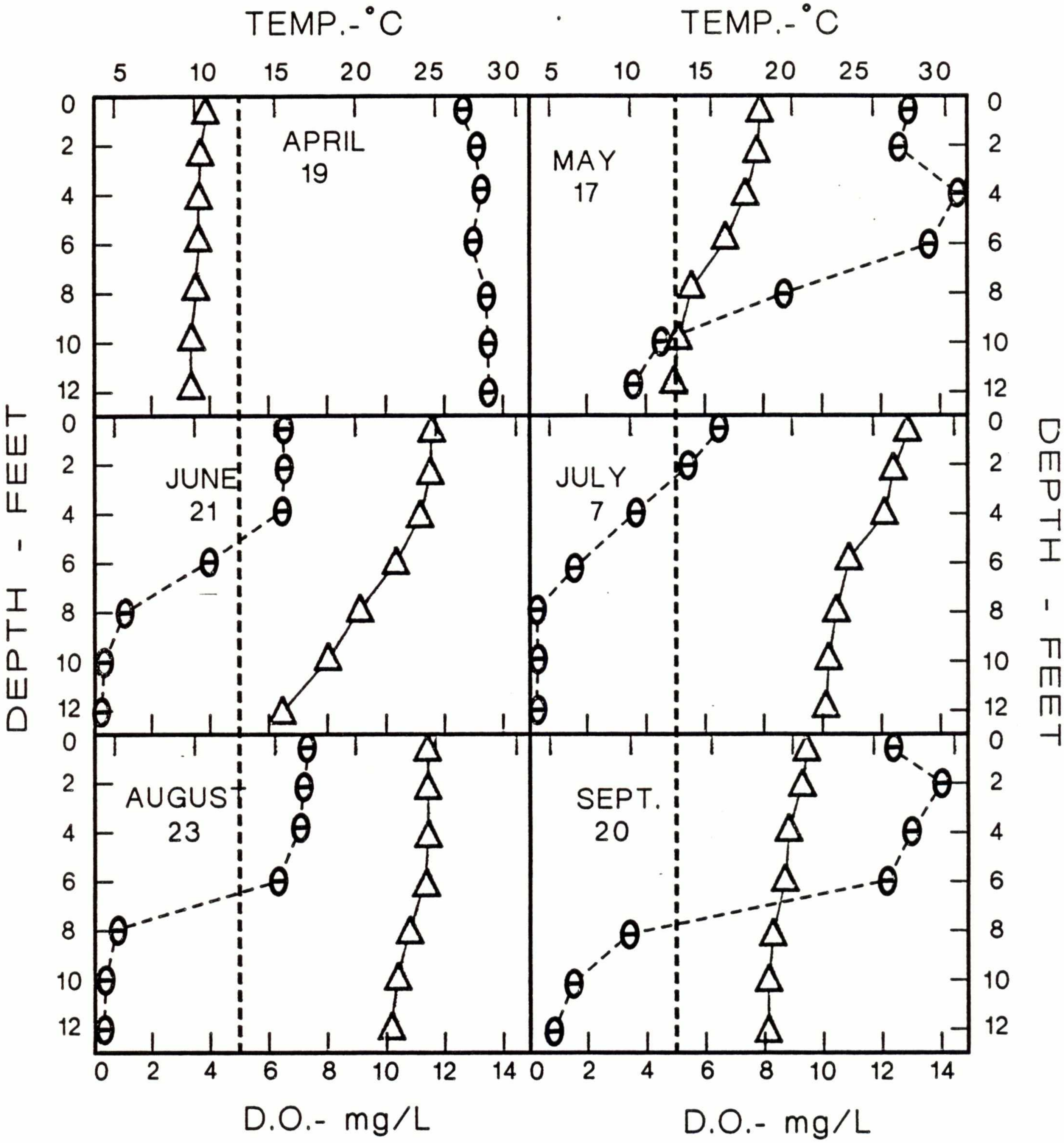


FIGURE 12: DISSOLVED OXYGEN -D.O. (θ) and TEMPERATURE -°C (Δ) in Lake Barrington during 1989. *(Dashed vertical line represents standard of 5 milligrams per liter D.O.)*

land, bacteria are swept up in the run-off and carried to the lake. The Health Department advises people not to swim in any lake just after a rain. The bacteria are short lived, and only survive 24 to 48 hours, after which time the water is again considered safe for swimming. If residents wonder if the beach is safe to swim at, they can contact the Lake County Health Department (708/360-6747).

Stormwater and Nutrients

As mentioned in a previous section, stormwater was sampled twice in the summer for various parameters. The combined sample (marina site and inflows near the launch) had high levels of nitrate and both forms of phosphorus each time it was sampled (See Appendix B). In one sample, the north inlet contained an elevated level of nitrate-nitrogen. These nutrients may have been dissolved in the water, or more likely, may have been attached to soil particles flowing in. It is difficult to say how much impact these inputs will have on Lake Barrington. Again, proper erosion control practices can help prevent some nutrients from entering the lake.

Solids From Stormwater

Two stormwater samples were analyzed for solids. One sample was taken from the north inlet. The other was a composite, made up of water from the marina boat launch and the two rock-lined inflows near the walking path by the launch. One of the storms had the composite and the inlet delivering rather high amounts of total suspended solids into the lake (See Appendix B, under Rain Event Data). The two storms delivered an average of 32 mg/L from these areas. Some erosion control practices would help prevent these loads of sediments from slowly filling the lake.

LAKE BARRINGTON FISHERY

Fish populations are a key component of a lake's ecosystem. They are a part of a system in the lake that includes insects, plants, algae, and bacteria. They provide important recreational and sometimes commercial activities for the community.

The health of the lake fishery also reflects water quality conditions and land use in the watershed. Therefore, it is necessary to regularly monitor the fish populations in the lake. Through this monitoring, either sudden or subtle changes in both the lake and the watershed can be detected. A sudden change may cause a shift in species composition. Monitoring can also reveal if extended exposure to pollutants has occurred, which may cause toxins to accumulate in fish tissues. This may result in tumors or poor reproductive success, as well as make fish consumption undesirable and unhealthy.

Assessments conducted by the Illinois Department of Conservation

The Illinois Department of Conservation (IDOC) has undertaken a regular fishery sampling program. Their sampling techniques include electrofishing, gill nets, and fyke nets. Gill nets are used to sample fish found in the deeper open area of a lake. A fyke net is used in the shallow, littoral zone (the area where plant growth occurs) and is especially useful for sampling smaller fish. Electrofishing is also used along the shoreline. This method temporarily stuns the fish, making them easy to collect.

After the fish have been caught using one or more of these methods, they are measured and weighed in order to determine their condition and growth rate. They are then returned to the lake unharmed. The number of fish collected from each species can be used to determine relative abundance of that species. This is the number of individuals of a particular species compared to the numbers of all other species. The following is a brief overview of the data collected by the IDOC.

1957

The first written record of fisheries information was about an extensive summer fish kill that occurred in August of 1957. A lack of oxygen may have caused this to happen. These fish prior to the kill had been very healthy. Good growth rates were noted, a good diversity of species was present, and all size classes within each species were present. A size class consists of all the fish of one species that are born within the same year.

1973

A fisheries assessment was carried out in the summer of 1973 using electroshocking equipment. Gary Erickson, IDOC's District Fisheries Biologist at the time, was very impressed with the fish populations and the good condition of the individuals. However, some recommendations were given to ensure that these conditions would not change:

1. Maintain fishing pressure on sunfish, and keep all sunfish caught.
2. Release any largemouth bass thirteen inches long or less.
3. Treat vegetation with herbicides only as needed.

1979

The 1979 fisheries assessment was conducted in June. All fish species had good populations, and the individuals were in good condition. Yellow perch were larger than average for a lake of this condition and size. Little reproduction was noted among commercial fish species, indicating good predator control. The District Biologist felt that the ongoing weed harvesting was partly responsible for the good condition of the fish population. He recommended that harvesting be continued. Two other recommendations at this time were geared toward the predatory fish. One was to impose a fourteen inch minimum size restriction on largemouth bass to insure reproduction capability. The other recommendation was to stock other predatory fish species such as northern pike or muskellunge to supplement the bass population.

1982

The assessment in May of 1982 was carried out by District Fisheries Biologist, Joe Ferencak. He observed a subtle deterioration of the bass population and a slight decrease in the average length of the sunfish. The recommendations for 1982 repeated some of those from 1979. It was suggested to limit plants to 25% of the shoreline with a comprehensive aquatic weed control program. The fourteen inch size limit for largemouth bass was again advised, along with the recommendation to increase fishing pressure on the sunfish. It was again advised to stock northern pike and largemouth bass to increase and diversify the predator population.

Health Department Assessment, 1989

The Health Department conducted a limited assessment of the Lake Barrington fishery in June of 1989. A limited assessment consists only of electro-fishing, as opposed to those that include gill and fyke nets for their collections. The conditions in 1989 were similar to those that were found by the IDOC in the past. A large percent of the bass were under twelve inches long. This may have resulted from heavy fishing pressure on this species. Very few carp were found, indicating their population is small and suppressed. The sunfish population was in good condition, indicating adequate population control from predators. The harvesting program may also have helped keep the sunfish population from exploding. Some smaller fish get caught up in the leaves and stems as plants are harvested.

At the time the fishery is in good condition. However, if the bass population is allowed to continue to deteriorate, the fishery as a whole will worsen.

The Lake Fishery and its Relations to the Growth of Eurasian Watermilfoil

Throughout this report mention has been made of the invasive plant species Eurasian watermilfoil. Its presence in Lake Barrington directly impacts the fishery. Nearshore or shallow areas of the lake containing plant beds are excellent habitat for fish as well as invertebrates as compared to open water areas of the lake. Generalizing the influence of milfoil growth on fish production the following can be stated: 1) the production of forage fish increases directly with increasing milfoil density and biomass; and 2) the production as well as the condition of sport fish, e.g., bass, begins to decline after peaking in the presence of intermediate milfoil density and biomass. Smaller fish such as bluegills and sunfish are able to hide in the vegetation. This reduces the predication success by the bass population. The result is reduced bass production.

LAKE BARRINGTON FISH ASSESSMENT TALLY

	1957*	1973	1979	1982	1989
Large Mouth Bass	31	87	24	9	45
Bluegill	784	269	96	62	121
Pumpkinseed		14	10	27	25
Warmouth	3	80	99	52	18
Green Sunfish		1	4	27	
Hybred Sunfish		1		30	
Black Crappie	134	2	3	11	
White Crappie		P			
Yellow Perch	5	P	4	27	
Brown Bullhead				2	
Black Bullhead	2	1	12		2
Golden Shiner	1	2		69	8
Carp					5

P = Present, but no numbers available

* = Sub sample collected from extensive fish kill that occurred on 8/26/57

TOXICS IN SEDIMENTS, FISH, AND STORMWATER

Introduction

The threat of toxics in lakes has become a subject of concern. A lake's bottom is covered with sediments, which can be made up of things such as silt and decaying plants and animals. It is sometimes called muck or ooze. Lake sediments act as a settling basin for toxic chemicals that have made their way to the lake. Examples are Polychlorinated biphenyls (PCB's), Dichloro diphenyl trichlorethane (DDT) and other pesticides, and heavy metals such as mercury.

This has become a topic of international concern because many of these pollutants can make their way from the sediments to the food chain. The results can be devastating. Some people that have eaten enough contaminated fish or waterfowl have developed cancers, tumors, reproductive problems, and neurological disorders. For example, the fish in Minimata Bay in Japan were heavily contaminated with mercury. Women who ate these fish had a high percentage of children born with cerebral palsy.

Thus, the Health Department tested both the lake's sediments and fish to determine if any health threats exist. Though no immediate threats exist in Lake Barrington, some toxics are present in levels that should be closely watched.

How do these chemicals get into the lake? Some are flushed in through industrial or sewage wastes. Others have been spewed into the air by smokestacks and cars. When it rains, they are caught up by the raindrops and fall to the ground or into bodies of water. If they fall to the ground, they eventually flow to the lake. Pesticides and herbicides from farms and lawns are another source. Remember that every time it rains, substances that were in the watershed are flushed to the lake.

Many of the chemicals arrive bound to the dirt and other sediment particles. Once in the lake, these toxics act in a variety of ways, depending on the lake's physical, chemical, and biological conditions. As you may guess, the chemistry involved here is very complex and not fully understood.