Mississippi Valley Conservation

State of the Lake Environment Report 2006

Mississippi Lake

Watershed Watch

"THE RIBBON OF LIFE"
Where the Land Meets the Water

Water quality is affected by many things: erosion and runoff from clearing of shorelines, the use of artificial fertilizers and leachate from sewage disposal systems resulting in too many nutrients reaching the lake. Phosphorus is the key nutrient of concern, too many nutrients can cause weed and algae growth and threatens fish habitat by reducing oxygen levels.

The shallow waters and first 10 metres of shore land form a "Ribbon of Life" around our lakes. This ribbon - where the land meets the water - is where much of the lake life is born, raised and fed. Many landowners, unaware of the importance of this area, have cleared the shorelines of native vegetation and replaced it with lawns, non-native ornamental vegetation, retaining walls and boathouses. This has had a negative affect on fish and wildlife habitat and water quality. Natural vegetation retained or restored along the shoreline helps prevent erosion and improves water quality by binding nutrients before they can enter the lake.

Mississippi Valley Conservation has long recognized the recreational and aesthetic value of lakes within the watershed and is committed to maintaining and protecting water quality and fish habitat. Mississippi Valley Conservation has joined together with volunteer Lake Stewards throughout the watershed to take steps to protect and restore water quality by launching the *Watershed Watch* program in 1998. *Watershed Watch* is an environmental monitoring and awareness program. The objectives of the program are to collect reliable environmental data to document current water quality conditions and use the data as an essential educational tool to encourage residents to adopt sound stewardship practices aimed at preserving and protecting water quality. Together we will encourage and assist shoreline residents, both seasonal and permanent, to become personal stewards of their lake by taking an active role in restoring and enhancing their shoreline to maintain water quality and a healthy lake environment.

Recreational water quality is generally expressed in terms of how clear the water appears. Water clarity is influenced by the amount of phytoplankton or microscopic algae present in the water; **chlorophyll a** is the green pigment in the phytoplankton. Water clarity is measured with a **Secchi Disc**, a 20 cm black and white disk attached to a measured line and lowered into the lake until it is no longer visible. The amount of nutrients entering the lake, in particular **phosphorus**, influences the amount of algae growing in the lake. Water clarity decreases with elevated concentrations of algae and therefore Secchi disc values are less. After the spring warming period there is a continuous supply of algae in the surface waters of the lake to the deep water areas where it decomposes and uses up the natural supply of oxygen. In severe circumstances this may eliminate habitat for fish species which require the cold, deep water portions to survive. Through *Watershed Watch* forty-two base lakes in the watershed will be monitored for these key water quality indicators; **total phosphorus, chlorophyll a, dissolved oxygen and temperature profiles and water clarity.**

Mississippi Lake

Mississippi Lake is a warm water lake situated in portions of Drummond, Beckwith and Mississippi Mills townships, in Lanark County. It is the last in a series of lakes in the Mississippi Valley watershed before the Mississippi river reaches the Ottawa River and is one of the largest inland lakes in South-Eastern Ontario. At last count in 1983, there were 16 resorts, 1498 cottages and 259 permanent houses on the lake.

Mississippi Lake Facts

Elevation: 134.4m. above sea level
Perimeter: 55.9 kilometres
Deepest Point: 9.2m
Fisheries Include: Small / Largemouth Bass
Northern Pike
Walleye

Residents of Mississippi Lake have formed a highly active Lake Association (MLA) and due to their efforts were able to fund the sampling of Mississippi Lake in 2006. MLA has appointed Lake Stewards, who are members of the Mississippi Valley Lake Stewardship Network and Steering Committee. These individuals have volunteered their time in the past, to provide water quality testing, through the Ministry of the Environment (MOE) Self Help Program from 1968 and Lake Partner Program since 1996. This data is extremely valuable and provides a general picture of water quality conditions for the past 38 years. Comprehensive testing in 2002 through Mississippi Valley Conservation's (MVC) *Watershed Watch Program* and in 2006 through MLA funding provides for a comparison between water quality conditions as they exist in 2006, to results obtained 31 years earlier through the MOE Recreational Lakes Program.

In general, the water quality in Mississippi Lake is good**.** There are two sampling stations at the deepest points in the Big and Second Lakes. Each station was sampled three times for 2006. Graphs will follow that show water clarity, as measured by secchi disc. The average for the two stations in 2006 is 3.9 metres indicating Mississippi Lake as a moderately enriched (some nutrients) or mesotrophic lake. Compared to 31 years ago, the average was 2.5 metres and a eutrophic lake environment (enriched, high levels of nutrients).

Directly related to water clarity is the amount of nutrients, in particular phosphorus, entering the lake. The Provincial Objective for phosphorus levels in shield lakes is a maximum of 20 micrograms per litre (ug/L). In 2006, the mean for the two stations in the euphotic zone (depth at which sunlight can penetrate or two times the secchi disc depth) was 13.5 *ug*/L. The mean for the samples taken one metre off the bottom was 13.2 *ug*/L. Thirty-one years ago, the average phosphorus level was 26.4 *ug*/L in the euphotic zone and 26.0 *ug*/L one metre off the bottom of the lake, both over the Provincial Objective. Mississippi Lake decreased its average phosphorus levels by more than 10*ug*/L, changing its trophic status from a eutrophic lake environment (enriched, high levels of nutrients) to a moderately enriched lake (some nutrients) and putting it well below the Provincial Objective.

Chlorophyll a is a measure of the algal density in the lake. The average chlorophyll a density for the two sampling stations is 3.0*ug*/L, indicating a moderate algal density for Mississippi Lake in 2006. In 1975, chlorophyll a levels were extremely high at 13.7*ug*/L, almost five times higher than 2006 levels.

Plants and animals are a direct reflection of their environment. The most critical time of year for conducting dissolved oxygen and temperature profiles is after August 31. Profiles are generally conducted at this time of year and at the deepest point in the lake. Aquatic vegetation and algae that has grown over the summer, has died off and settled on the bottom, using the available oxygen necessary to sustain aquatic life in the lower portion of the lake or the hypolimnion. Three profiles were conducted in 2006, once in May, July and in September, in order to generate a more concise picture of the oxygen content of the lake.

The dissolved oxygen and temperature data, measured at the deepest points in the Big Lake and Second Lake, indicate adequate levels all the way to the bottom during the ice-out season. However, data collected in mid July, revealed that the oxygen although adequate were depleting, this could be due to the high temperatures experience in July. On sampling day surface water temperatures reached 26.1 degree Celsius while air temperatures peaked at 30.1 degrees Celsius, putting a strain on the warm water fish population such as pike and bass. By the end of the summer, the oxygen levels improved and were indicating adequate dissolved oxygen levels in both Big and Second Lakes. Residents and users of Mississippi Lake cannot afford to be complacent. Every effort should be made to reduce nutrient loading into the lake from land use activities.

Mississippi Lake was also tested for invasive species in 2006, in particular, for zebra mussels and spiny water flea, in partnership with the Ontario Federation of Anglers and Hunters. Mississippi Lake did *not* have spiny water flea present in the samples collected but zebra mussel veligers (larvae) and adults were detected. Residents and property owners need to ensure that all

access points to the lake have posted signs indicating the presence of zebra mussels and the precautions they can take to avoid the spread of invasive species to other lakes.

Residents and users of Mississippi Lake should continue a stewardship approach to limit the amount of nutrients entering the lake. There are helpful tips throughout this report to help reduce your impact on Mississippi Lake. Additional water quality data, current and historic, is available for Mississippi Lake and many other lakes in the Mississippi Valley watershed. Contact MVC for more information on how you can become a good lake steward for your lake.

How Does Mississippi Lake Measure Up?

1975-2006 Water Quality Results – Big Lake

Sample Year	Secchi Disk Depth [Metres]	Total Phosphorus Euphotic Zone [Micrograms/litre]	Total Phosphorus 1 Metre off Bottom [Micrograms/litre]	Chlorophyll a Composite [Micrograms/Litre]
**1975	2.5			13.70
1977	4.4			2.40
1978	4.1			3.00
1979	1.7			11.20
1981	2.9			7.60
1995	2.4			9.87
1996	3.2	17.0		
1997	3.3			
1998	3.0	20.0		
1999	3.0	12.0		
*2000	4.3	40.0		
*2001	4.1	13.0		
2002	3.3	17.0	15.5	3.83
2006	4.0	14.7	15.0	3.40
n	14	7	2	8
Minimum	1.7	12.0	15.0	2.40
Maximum	4.4	40.0	15.5	13.70
Mean	3.3	19.1	15.25	6.9
Standard Deviation	0.800961	9.603992	0.35355339	4.32882036

*Mean based on less than 6 measurements **Includes Recreational Lakes Program Data
Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures in filtering, resulting in an increase in chla concentrations by 35%.

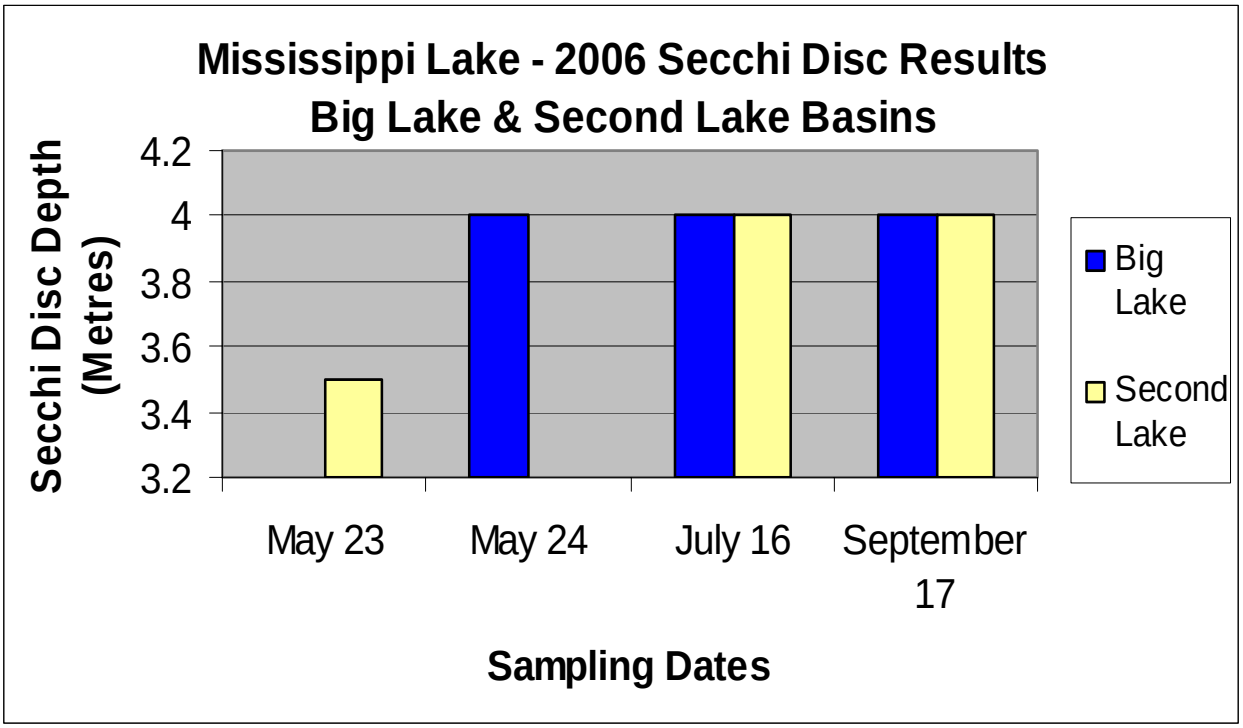
1968 – 2006 Water Quality Results – Second Lake

Sample Year	Secchi Disk Depth [Metre]	Total Phosphorus Euphotic Zone [Micrograms/Litre]	Total Phosphorus 1 Metre off Bottom [Micrograms/Litre]	Chlorophyll a Composite [Micrograms/Litre]
1968	2.1			
1969	3.8			
1973	4.3			3.30
1974	3.7			3.00
**1975	2.5	26.4	26.0	13.70
1977	3.4			2.70
1978	4.1			3.00
1979	3.9			3.20
1980	2.7			4.50
1981	2.5			7.40
1982	2.6			5.40
1983	2.8			2.40
1984	3.1			5.80
1985	3.3			4.20
1986	3.0			3.00
1992	3.5			3.90
1994	3.3			3.20
1995	2.2			9.80
1996	3.1	13.0		
1997	3.3	22.0		
1998	3.3	14.0		
1999	3.5	8.0		
*2001	3.9			
2002	3.9	13.6	13.6	3.38
*2006	3.8	12.3	11.3	2.60
n	25	7	3	18
Minimum	2.1	8.0	11.3	2.40
Maximum	4.3	26.4	26.0	13.70
Mean	3.3	15.6	17.0	4.7
Standard Deviation	0.599917	6.31886819	7.90716974	2.94560091

*Mean based on less than 6 measurements. **Includes Recreational Lakes Program Data
Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures in filtering, resulting in an increase in chla concentrations by 35%.

The higher the Secchi Disc measurement the clearer your lake is!

INTERPRETING YOUR SECCHI DISC RESULTS	
Secchi Reading	**Lake Nutrient Status**
Over 5 metres	Oligotrophic - unenriched, few nutrients
3.0 to 4.9 metres	Mesotrophic – moderately enriched, some nutrients
Less than 2.9 metres	Eutrophic – enriched, higher levels of nutrients

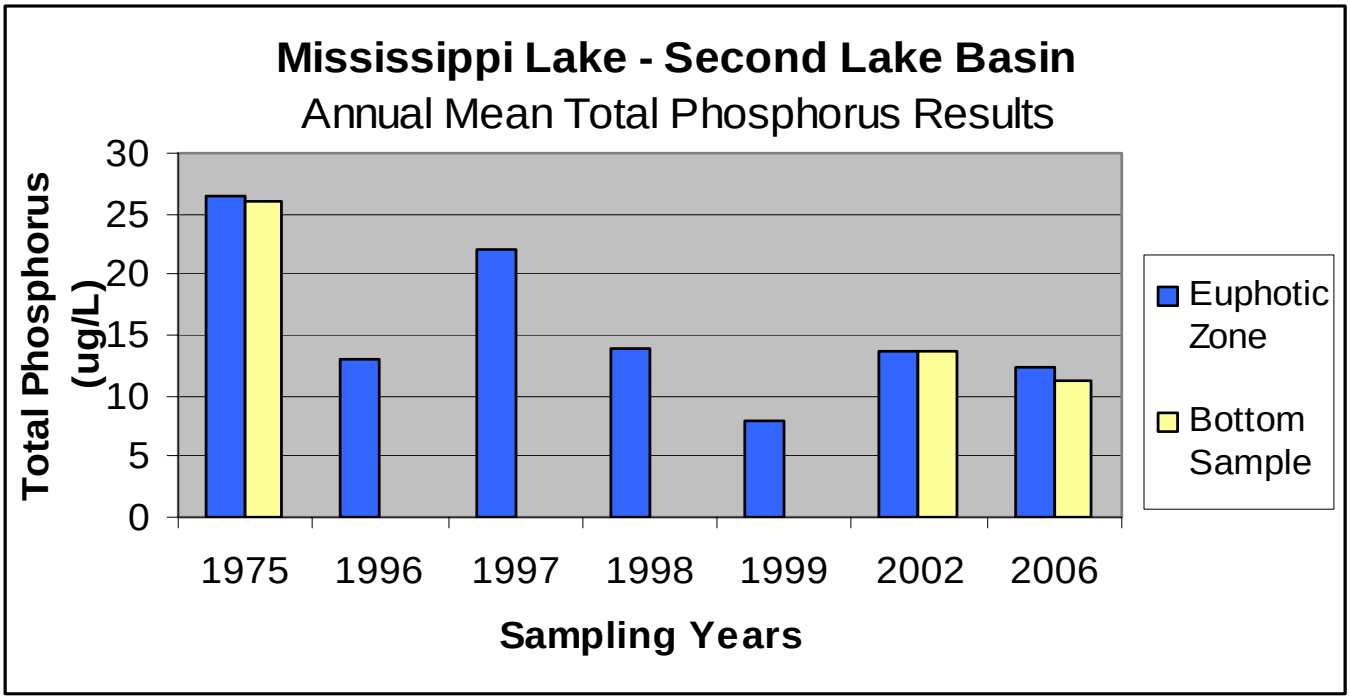


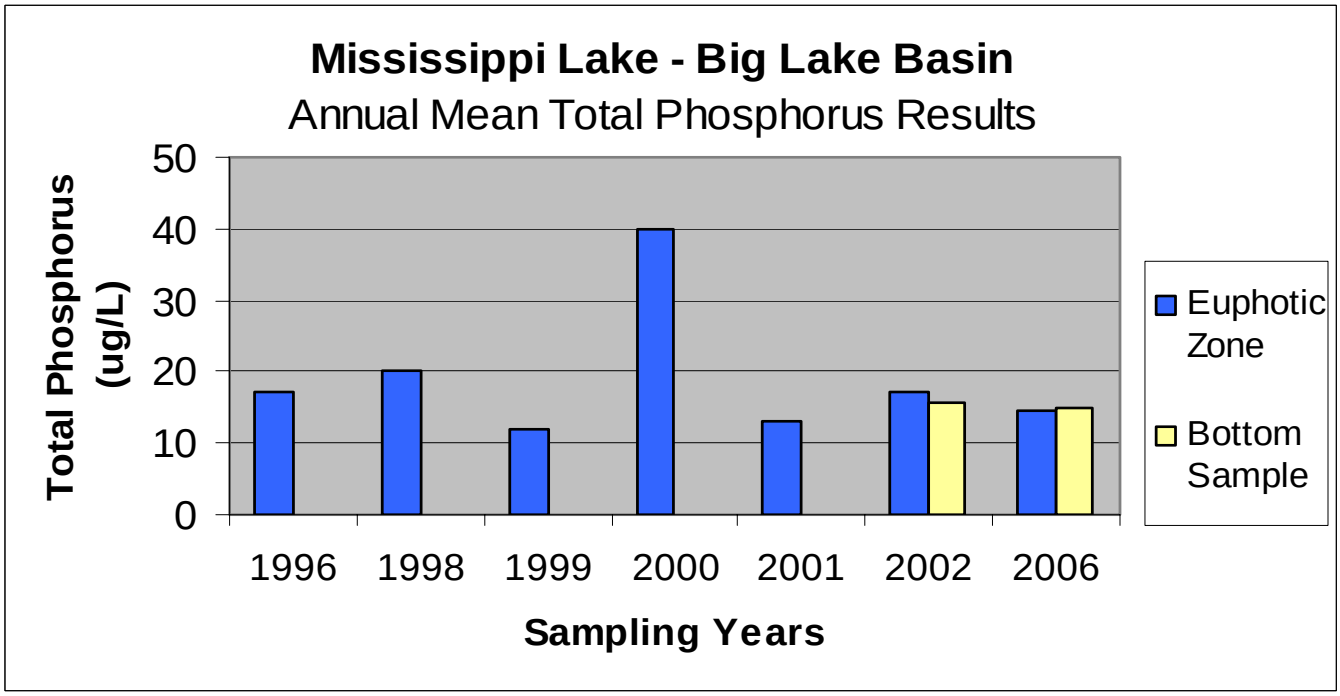
For more information on lakes in the Mississippi Valley Watershed, visit MVC online at

www.mvc.on.ca

The lower the phosphorus reading, the clearer your lake is!

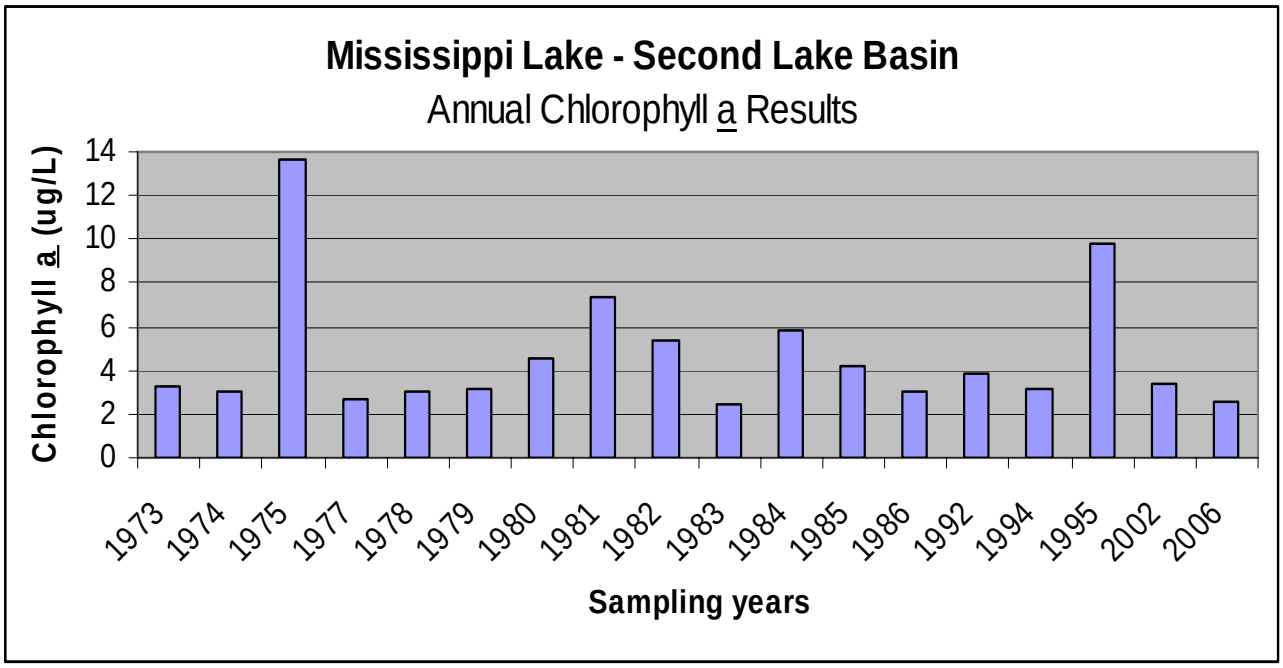
Nutrient Loading and How to Interpret the Water Quality Result : If the Total Phosphorus Reading is…	Your Lake is…
10 ug/L or less	Oligotrophic - unenriched, few nutrients
11 to 20 ug/L	Mesotrophic – moderately enriched, some nutrients
21 ug/L or more	Eutrophic – enriched, higher levels of nutrients

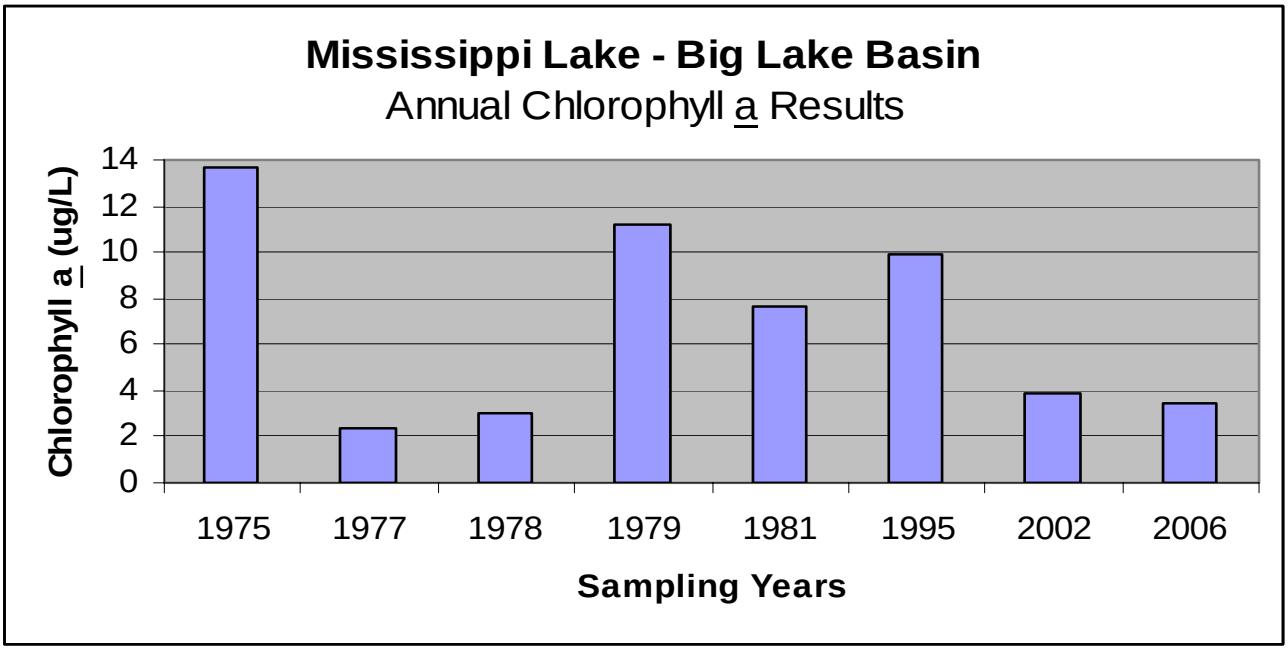




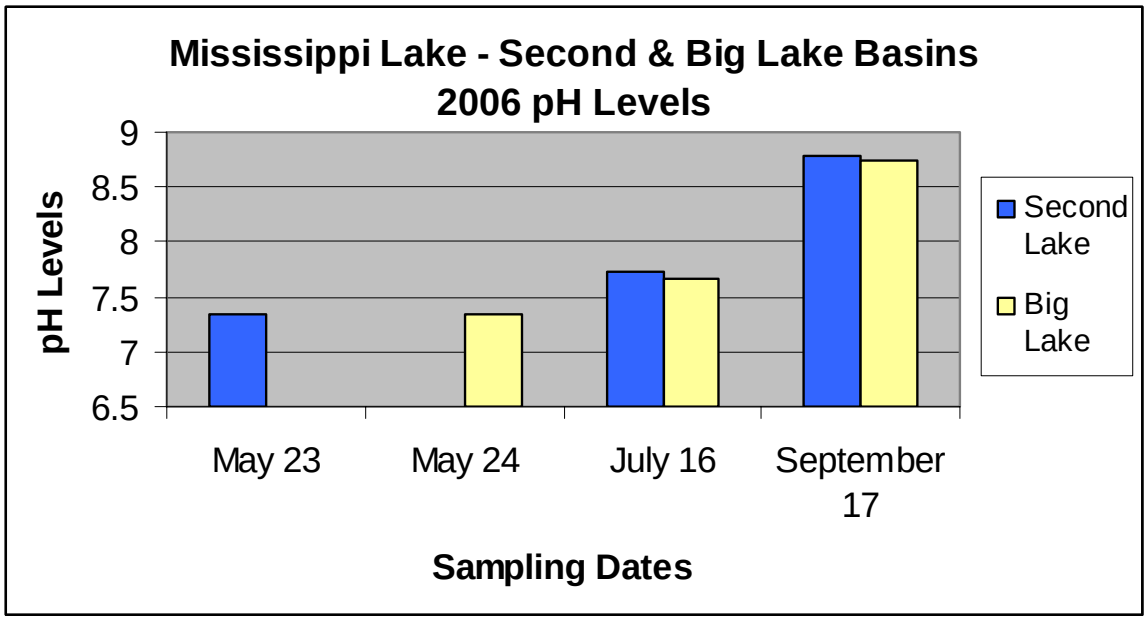
The lower the Chlorophyll a density, the clearer your lake is!

Nutrient Loading and How to Interpret the Water Quality Result : If the Chlorophyll a density is…	Your Lake is…
Up to 2 ug/L (low algal density)	Oligotrophic - unenriched, few nutrients
2 – 4 ug/L (moderate algal density)	Mesotrophic – moderately enriched, some nutrients
More than 4 ug/L (high algal density)	Eutrophic – enriched, higher levels of nutrients



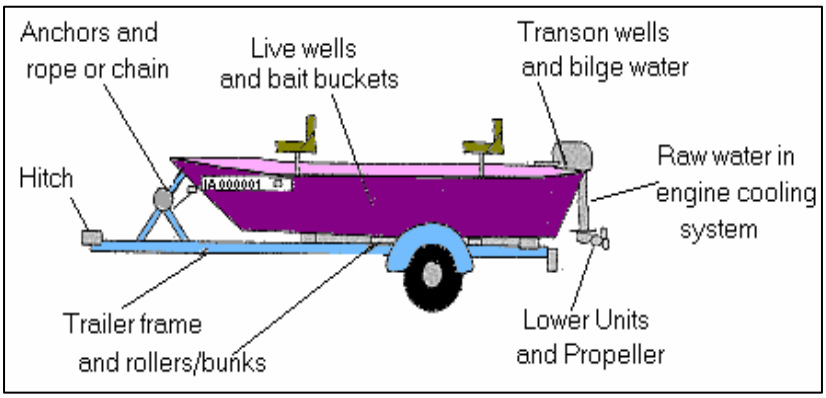


Lakes with pH levels of 7.3 or higher are vulnerable to zebra mussel invasives!



MVC and OFAH need your help to Stop the Invasion!

Check & clean your boat every time you change water bodies



Working with Lake Associations, we hope to improve signage at public launching areas to identify lakes where zebra mussels and spiny water fleas are already present. We hope to focus on an ambitious educational campaign to help reduce their spread to lakes where they are not yet present.

For more information call MVC at (613)259-2421, the Invading Species Hotline 1-800-563-7711.

MISSISSIPPI LAKE – SECOND LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-014-01, MVC Station # 02-11
Date: May 23, 2006
Depth: 7.0 Metres
Euphotic Zone (Penetration of Light) = 7.0 Metres

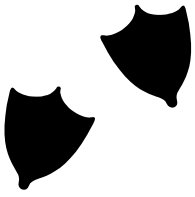
Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	14.2	9.6	90	
1.0	14.2	10.7	101	
2.0	14.2	10.9	103	
3.0	14.1	11.7	110	Epilimnion
4.0	14.1	11.0	104	
5.0	14.1	11.0	104	
6.0	14.0	10.9	103	
7.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – SECOND LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-014-01, MVC Station # 02-11
Date: July 16, 2006
Depth: 7.0 Metres
Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	26.1	8.1	97	
1.0	26.0	8.7	102	
2.0	25.8	8.6	100	Epilimnion
3.0	25.5	8.3	97	
4.0	24.3	6.6	74	
5.0	23.8	5.5	60	
6.0	23.5	5.0	56	
7.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C


MISSISSIPPI LAKE – SECOND LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-014-01, MVC Station # 02-11
Date: September 17, 2006
Depth: 7.0 Metres
Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	17.7	9.5	95	
1.0	17.6	9.5	95	
2.0	17.6	9.6	97	Epilimnion
3.0	17.5	9.6	97	
4.0	17.5	9.6	97	
5.0	17.4	9.6	96	
6.0	17.3	9.5	95	
7.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – BIG LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-735-01, MVC Station # 02-11
Date: May 24, 2006
Depth: 10.0 Metres
Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	14.8	10.1	95	
1.0	14.3	12.0	113	
2.0	14.2	12.5	118	
3.0	14.1	13.1	119	Epilimnion
4.0	14.1	13.2	120	
5.0	14.0	13.1	119	
6.0	14.0	12.6	118	
7.0	14.0	12.6	118	
8.0	14.0	12.0	112	
9.0	13.9	11.9	110	
10.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – BIG LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-735-01, MVC Station # 02-11
Date: July 16, 2006
Depth: 10.0 Metres
Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	25.7	7.8	95	
1.0	25.5	8.15	98	
2.0	25.3	8.2	98	Epilimnion
3.0	25.2	8.0	97	
4.0	25.1	7.6	91	
5.0	23.7	6.4	74	
6.0	23.1	5.3	60	
7.0	22.9	5.0	56	Thermocline
8.0	22.8	4.8	54	
9.0	22.8	4.7	53	
10.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – BIG LAKE
DISSOLVED OXYGEN/TEMPERATURE PROFILES
Self-Help Station # 19-3430-735-01, MVC Station # 02-11
Date: September 17, 2006
Depth: 10.0 Metres
Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth (Metres)	Temperature (Degrees Celsius)	Dissolved Oxygen (Milligrams/Litre)	Percent % Saturation	Thermal Stratification
0.1	17.8	10.0	100	
1.0	17.8	9.9	99	
2.0	17.7	9.8	98	Epilimnion
3.0	17.7	9.9	99	
4.0	17.6	9.8	98	
5.0	17.4	9.6	96	
6.0	17.2	9.3	92	
7.0	17.2	9.2	92	
8.0	17.2	9.0	90	
9.0	17.2	8.9	89	
10.0	Bottom	Bottom	Bottom	

Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

LOW PHOSPHORUS LIFESTYLE	**Amount of Phosphorus**	**HIGH PHOSPHORUS LIFESTYLE**	**Amount of Phosphorus**

	(grams)		(grams)
Human waste	535	Human waste	535
No dishwasher	0	Dishwasher using powdered detergent once per day	650
No fertilizer	0	Lawn fertilized once/year	1960
Trees not cut down	20	Lot cleared of trees	30
Uses phosphate-free products	20	Uses products with phosphate	180
TOTAL	**575 grams**	**TOTAL**	**3355 grams**

How to protect or restore a shoreline depends on the conditions of the site and the energy and resources of the owner.

There are four main strategies to choose from:

1.) **PRESERVATION –** When purchasing lakefront property, a natural shoreline is retained and access to the lake is designed to avoid shoreline damage.

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2.) **NATURALIZATION –** Degraded shorelines are left alone to return to their natural state.

3.) **ENHANCEMENT –** Native species are planted non-native species are removed.

4.) **RESTORATION –** Cleared areas are planted with native species.

Mississippi Valley Conservation

The 2006 sampling of Mississippi Lake was made possible thanks to the funding and hard work from the Mississippi Lake Association including members Ed Carew, Frank Mills and Chris Winters. A special thanks to Melissa Dakers who lent her time and expertise to the collection of the water samples.

For more information regarding *Watershed Watch* or for advice on how you can help protect and enhance your lake environment, contact Susan Lee, Watershed Monitoring Supervisor at Mississippi Valley Conservation. (613) 259-2421 or slee@mvc.on.ca