TAYLOR LAKE

ROSE TOWNSHIP
OAKLAND COUNTY
MICHIGAN

1984-2002 WATER QUALITY STUDIES

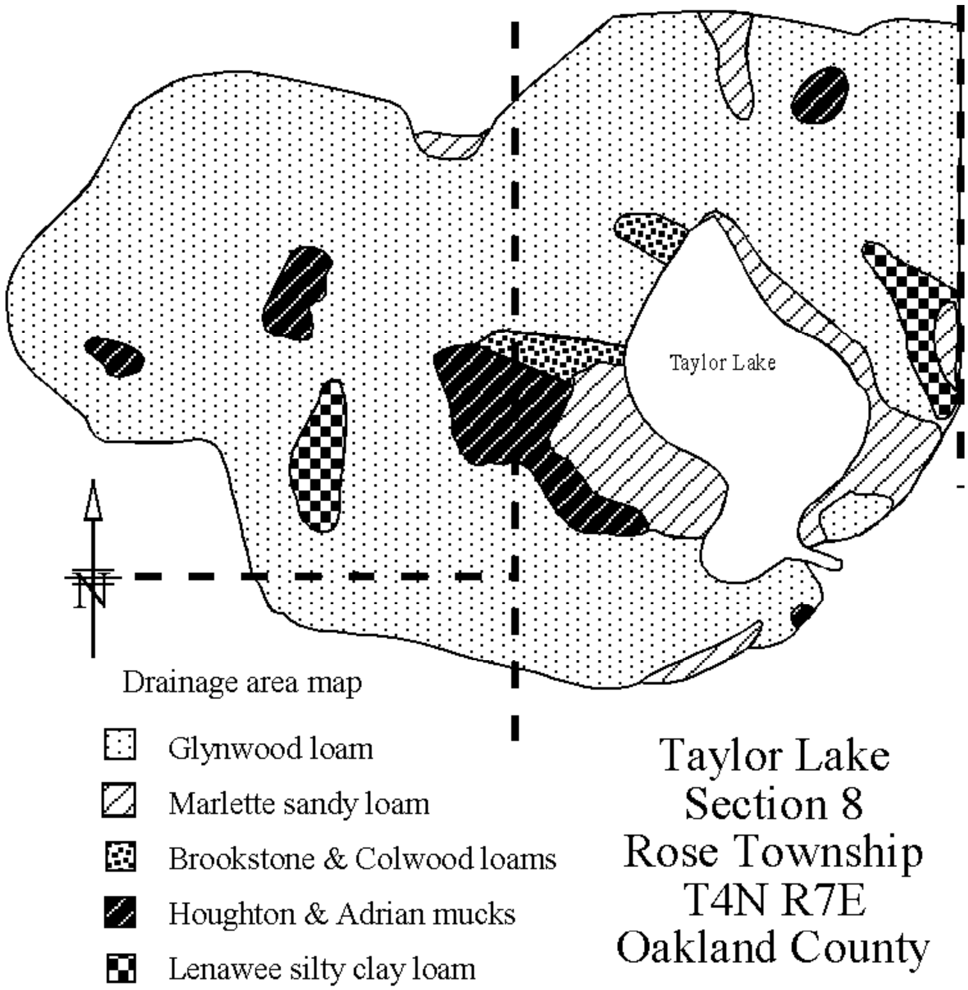
TAYLOR LAKE DATA

Taylor Lake is a 35-acre natural moderately hard-water kettle lake located in Section 8, Rose Township (T4N R7E) Oakland County, Michigan. The lake has a maximum depth of 63 feet, a mean depth of 27.1 feet and contains 948-acre feet of water. The length of the shoreline is 5491 feet. There are no islands in the lake.

There are no inlets. The outlet is on the southeast corner. Water from the Taylor Lake outlet joins the Shiawassee River south of Holly. The Shiawassee River joins the Tittabawassee River south of Saginaw, forming the Saginaw River. The Saginaw River flows into Lake Huron at Bay City.

The elevation of the lake is 996 feet above sea level. The size of the watershed, which includes all the lands that contribute water to the lake, but does not include the lake, is 323 acres. The drainage area, which includes the watershed and the lake, is 358 acres. See map below. The watershed to lake ratio is 9.23 to 1, which is on the high side of normal for a Michigan inland lake. The lake flushes about once every 2.8 years on an average

The latitude (42° 45.356N) and longitude (83° 39.697W) is the approximate location of 63-foot deep hole (Station 8).



THE WATER QUALITY STUDY

During certain periods of the year, Michigan lakes have poorer water quality than the remainder of the year. The water quality sampling is designed to look at two of those poor water quality periods, one in early spring when phosphorus which may released from the bottom sediments is distributed throughout the water column by spring mixing, and a second in late summer when the water is warmest, and the lake is stratified (if it stratifies). During most of the remainder of the year, the water quality is better. Thus if the lake gets high marks for water quality during early spring and late summer, it probably has pretty good water quality all year long.

SAMPLE DATES

Dr Chuck Cubbage and his Wayne County Community College class collected 10 surface samples for water quality testing in both spring and summer 1984. Top to bottom temperature and dissolved oxygen profile data were collected in summer. The lake was mapped by Dr. Cubbage and his students at this time.

WQI limnologists collected ten surface samples plus top to bottom samples every 10 feet for water quality testing April 13, 1988, August 24, 1988, April 30, 2002 and August 8, 2002. Top to bottom temperature and dissolved oxygen profile data were collected each time the lake was sampled. Bottom sediment samples were collected at the ten in-lake stations in 1988 and again in 2002.

Tim Green collected three spring surface samples for water quality testing May 4, 1993 and April 23, 1994. WQI limnologists collected the same three surface samples for water quality testing August 2, 1993 and August 8, 1994

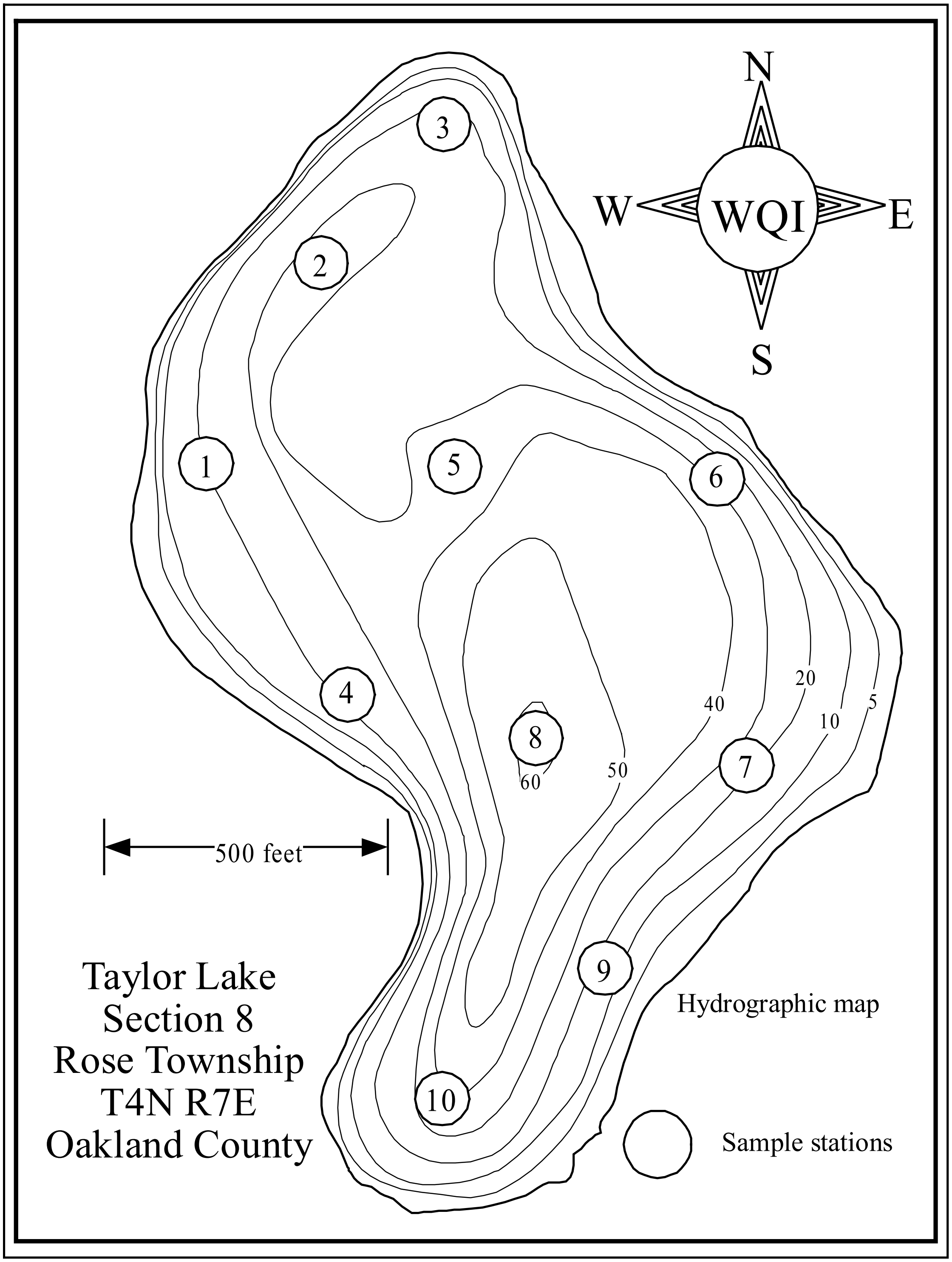
Secchi disk data have been collected on Taylor Lake since 1974. However the 1975-1979, 1981-1982, and 1994-1997 data are missing.

THE SAMPLE STATIONS

The locations of the 1984, 1988 and 2002 sample stations are shown as circles on the map below. The three sites sampled in 1993 and 1994 were Station 1 on the north end, Station 2 over the deep hole and Station 3 on the south end.

THE ANALYSES

Dissolved oxygen, temperature, and Secchi disk transparency measurements were conducted in the field. Total phosphorus, conductivity, alkalinity, total nitrate, chlorophyll a, and pH tests and bottom sediment analyses were performed in the Water Quality Investigators laboratory near Dexter, Michigan. All tests followed the procedures outlined in *Standard Methods for the Examination of Water and Wastewater*, 1989.


N
W
WQI
E
S
3
2
1
5
6
4
8
60
50
40
20
10
5
7
500 feet
9
Hydrographic map
10
Sample stations
Taylor Lake
Section 8
Rose Township
T4N R7E
Oakland County

THE DATA

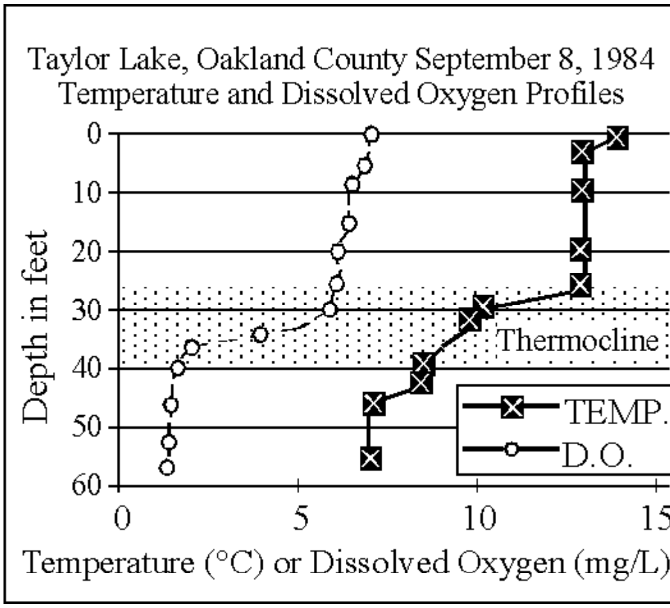
Temperature and dissolved oxygen data discussed below are found on the graphs. Other water quality data are found in the tables at the end of this report and on the enclosed atlas pages.

TEMPERATURE AND DISSOLVED OXYGEN

Temperature exerts a wide variety of influences on most lakes, such as the separation of layers of water (stratification), solubility of gases, and biological activity.

Dissolved oxygen is the parameter most often selected by lake water quality scientists as being important. Besides providing oxygen for aquatic organisms to use, in natural lakes, oxygen is involved in phenomena such as phosphorus precipitation and release from the lake bottom sediments and decomposition of organic material in the lake.

1984

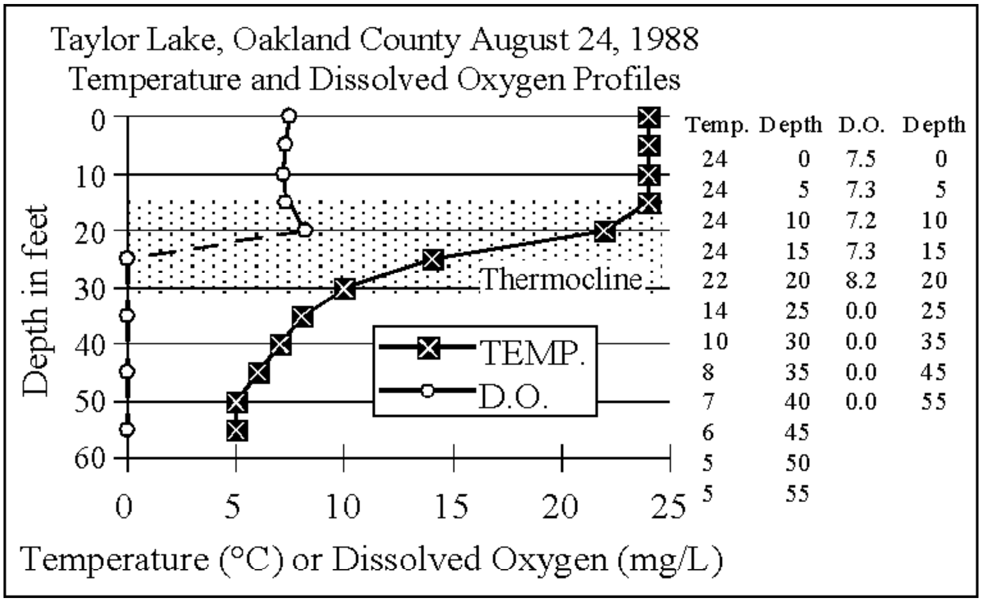


Temp.	Depth	D.O.	Depth
14	0	7.0	0
13	3	7.0	3
13	7	6.8	7
13	10	6.4	10
13	13	6.4	13
13	16	6.4	16
13	20	6.0	20
13	23	6.2	23
13	26	6.0	26
11	30	5.9	30
10	33	5.1	33
9	36	2.0	36
8	39	1.6	39
7	43	1.5	43
7	46	1.5	46
7	49	1.4	49
7	52	1.4	52
7	56	1.4	56

The temperature and dissolved oxygen profile graph shows in late summer 1984 the lake formed a 13-foot thick thermocline (defined as a layer of water in a lake where the temperature changes more than one degree Centigrade per meter of depth, and shown shaded on the graphs) from 26 to 39 feet.

Although the dissolved oxygen concentration started to drop near the top of the thermocline, the lake did not run out of dissolved oxygen at any depth.

1988



The graph shows in late summer 1988 Taylor Lake formed a 15-foot thick thermocline from 15 to 30 feet. Above the thermocline, dissolved oxygen was plentiful. Dissolved oxygen reached a peak of 8.2 mg/L in the thermocline at 20 feet, probably the result of an algal bloom that settled there. This year the lake ran out of dissolved oxygen at 25 feet, and that condition remained to the bottom. The hypsographic (depth-area) graph shows about 52 percent of the lake is deeper than 25 feet.

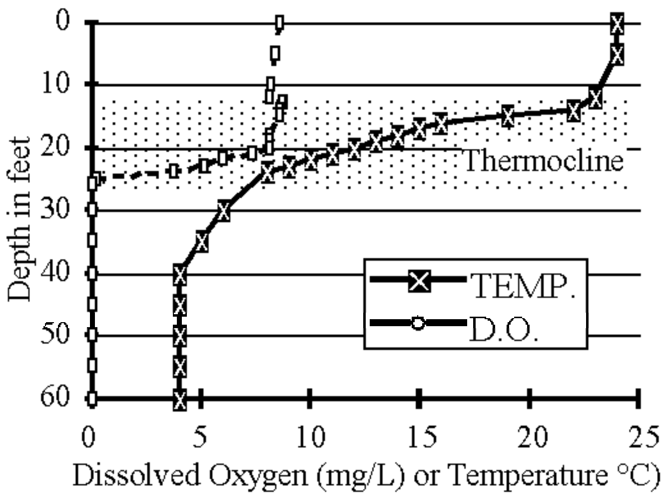
1993

The graph shows in late summer 1993 Taylor Lake formed a 12-foot thick thermocline from 12 to 24 feet. Above the thermocline, dissolved oxygen was plentiful. Dissolved oxygen dropped to zero at 26 feet, and that condition remained to the bottom. About half the lake is deeper than 26 feet.

1994

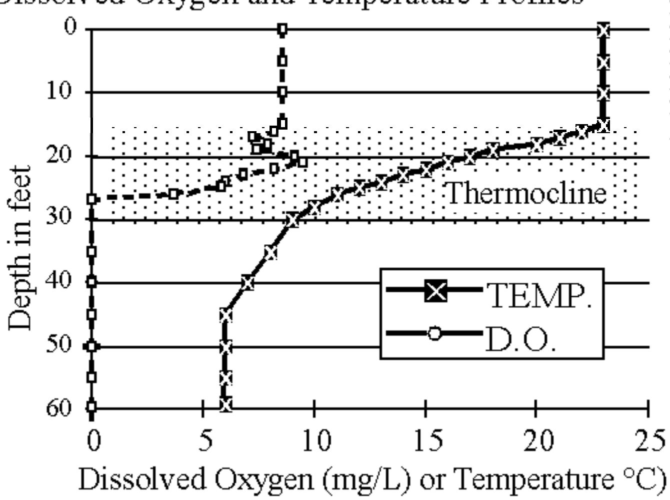
In late summer 1994, a 15-foot-thick thermocline formed, from 15 to 30 feet. This year dissolved oxygen again peaked in the thermocline, then reached zero at 27 feet, and that condition remained to the bottom. About 50 percent of the lake is deeper than 27 feet.

Taylor Lake, Oakland County, August 3, 1993
Dissolved Oxygen and Temperature Profiles



Temp.	Depth	D.O.	Depth
24	0	8.6	0
24	5	8.4	5
24	10	8.1	10
23	12	8.1	12
22	13	8.7	13
21	14	8.6	14
19	15	8.6	15
17	16	8.1	18
15	17	8.1	19
14	18	8.1	20
13	19	7.3	21
12	20	6.0	22
11	21	5.1	23
10	22	3.7	24
9	23	0.2	25
8	25	0	26
6	28	0	30
5	35	0	40
4	40	0	50
4	45	0	55
4	50		
4	55		

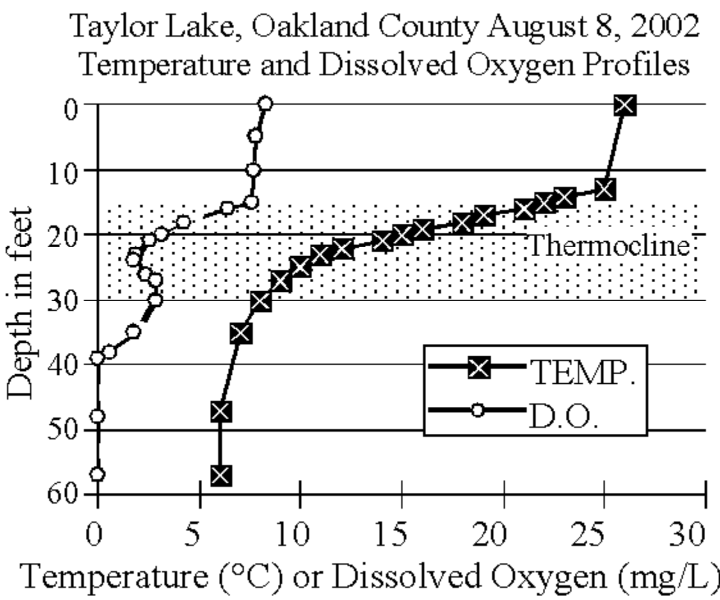
Taylor Lake, Oakland County August 9, 1994
Dissolved Oxygen and Temperature Profiles



Temp.	Depth	D.O.	Depth
23	0	8.6	0
23	5	8.6	5
23	10	8.6	10
23	15	8.6	15
22	16	8.2	16
21	17	7.2	17
20	18	7.9	18
18	19	7.4	19
17	20	9.1	20
16	21	9.5	21
15	22	8.2	22
14	23	6.8	23
13	24	6.0	24
12	25	5.8	25
11	26	3.7	26
10	28	0	27
9	30	0	35
8	35	0	40
7	40	0	45
6	45	0	50
6	50	0	55
6	60	0	60

2002

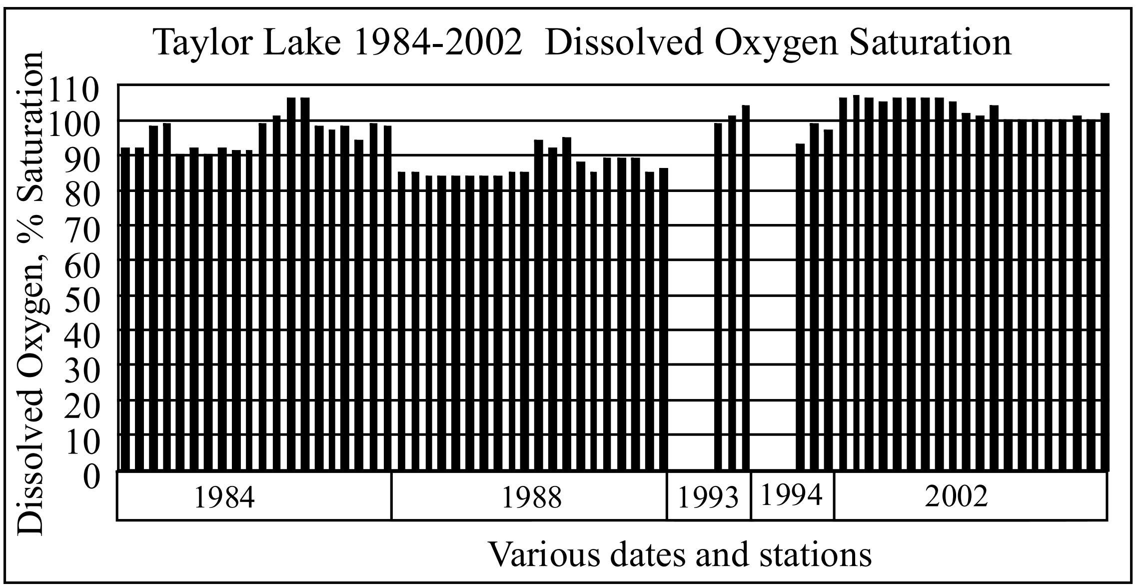
The graph shows in late summer 2002, Taylor Lake again formed a 15-foot-thick thermocline, from 15 to 30 feet. Dissolved oxygen started to drop at the top of the thermocline, to a low of 1.8 milligrams per liter at 24 feet, then increased again to 2.9 milligrams per liter at 27 to 30 feet. It then dropped to zero at 39 feet. About 26 percent of the lake is deeper than 39 feet.



Temp.	Depth	D.O.	Depth
26	0	8.3	0
25	13	7.8	5
23	14	7.7	10
22	15	7.6	15
21	16	6.4	16
19	17	4.2	18
18	18	3.2	20
16	19	2.6	21
15	20	1.9	23
14	21	1.8	24
12	22	2.4	26
11	23	2.9	27
10	25	2.9	30
9	27	1.8	35
8	30	0.6	38
7	35	0.0	39
6	47	0.0	48
6	57	0.0	57

LATE SUMMER DISSOLVED OXYGEN SATURATION

Since dissolved oxygen concentrations in water vary as the temperature varies, with cold water holding more dissolved oxygen than warm water, dissolved oxygen saturation is a better way to judge the amount of oxygen dissolved in the water. The graph of surface dissolved oxygen saturation values shows most of the time Taylor Lake has dissolved oxygen concentrations between 84 and 107 percent of saturation, which is good.

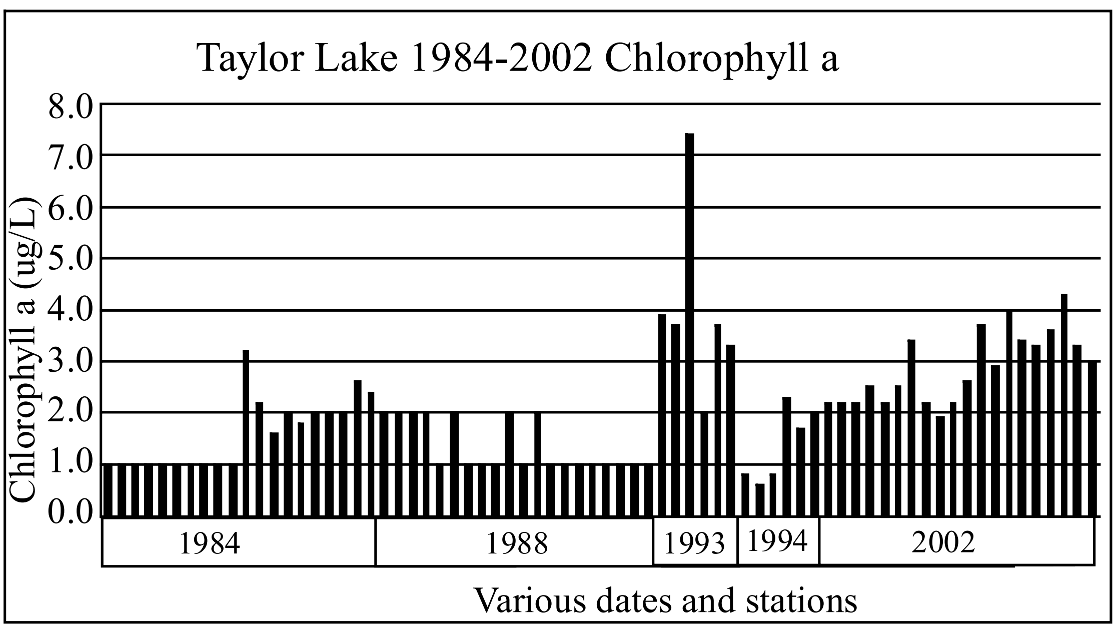


Low dissolved oxygen concentrations (below 4 milligrams per liter) are generally insufficient to support fish life. In most southern Michigan lakes, there is no dissolved oxygen below the thermocline in late summer. (Since we study many Michigan lakes and measure the oxygen depletion below the thermocline in many of them, we are not sure why our depth sounder (and fish finder) shows the presence of fish in the areas with no dissolved oxygen.)

However, as a limnologist, I like to see some dissolved oxygen in the bottom water of a lake, even if it is almost zero. This is because as long as there is some dissolved oxygen in the water at the bottom of the lake, phosphorus precipitated by iron to the bottom sediments will remain there. Once a lake runs out of dissolved oxygen in the water at the bottom, iron comes back into solution, and when that happens, it releases the phosphorus back into the water. This can cause additional algae to grow when the lake mixes.

CHLOROPHYLL A

Chlorophyll a is used by lake scientists as a measure of the biological productivity of the water. Generally, the lower the chlorophyll a, the better. High concentrations of chlorophyll a are indicative of an algal bloom in the lake, an indication of poor lake water quality.



The highest surface chlorophyll a concentration found by this writer in a Michigan lake was 216 micrograms per liter. Best is below one microgram per liter.

Taylor Lake 1984 through 2002 chlorophyll a concentrations range from 0.6 to 7.4 micrograms per liter. The individual high values are not of concern.

However, the graph seems to show chlorophyll a concentrations are increasing. Let's hope that trend doesn't continue.

SECCHI DISK TRANSPARENCY (originally Secchi's disk)

In 1865, Angelo Secchi of Rome, Italy devised a 20 centimeter (8 inch) white disk for studying the transparency of the water in the Mediterranean Sea. Later an American limnologist (lake scientist) named Whipple divided the disk into black and white quadrants which many are familiar with today.

The Secchi disk transparency is a lake test widely used and accepted by limnologists. The experts generally felt the greater the Secchi disk depth, the better quality the water. However, one Canadian scientist pointed out acid lakes have very deep Secchi disk readings. (Would you consider a very clear lake a good quality lake, even if it had no fish in it? It would be almost like a swimming pool.) Most lakes in southeast Michigan have Secchi disk transparencies of less than ten feet. On the other hand, Elizabeth Lake in Oakland County had 34 foot Secchi disk readings in summer 1996, evidently caused by a zebra mussel invasion a couple of years earlier.

Most limnology texts recommend the following: to take a Secchi disk transparency reading, lower the disk into the water on the shaded side of an anchored boat to a point where it disappears. Then raise it to a point where it's visible. The average of these two readings is the Secchi disk transparency depth.

We do it slightly differently. We lower the disk on the shaded side of an anchored boat until the disk disappears, and note the depth, then report the depth to the next deepest foot. For example if the disk disappears at six and a half feet, we report the Secchi disk depth as 7 feet. The reason we do this is that some suggest using a water telescope (a device that works like an underwater mask and eliminates water roughness) to view the disk as it disappears. Since we don't use this device, we compensate for it by noting the slightly deeper depth.

We feel it is only necessary to report Secchi disk measurements to the closest foot. Secchi disk measurements should be taken between 10 AM and 4 PM. Rough water will give slightly shallower readings than smooth water. Sunny days will give slightly deeper readings than cloudy days. However, roughness influences the visibility of the disk more than sunny or cloudy days. Furthermore, it's been reported that most adults can see the Secchi disk disappear at about the same depth, but grand-children see it disappear 3-4 feet deeper than grand-parents.

If there are sample sites where the lake is too shallow and the disk is visible when resting on the bottom, the reading should be taken at a nearby deeper site. Since the sampling procedure is designed to obtain "representative samples" moving the boat to an area where a Secchi disk transparency reading can be properly taken is appropriate. In the case of Secchi disk readings, this procedure is more valid than reporting the disk is visible on the lake bottom.

SECCHI DISK DATA

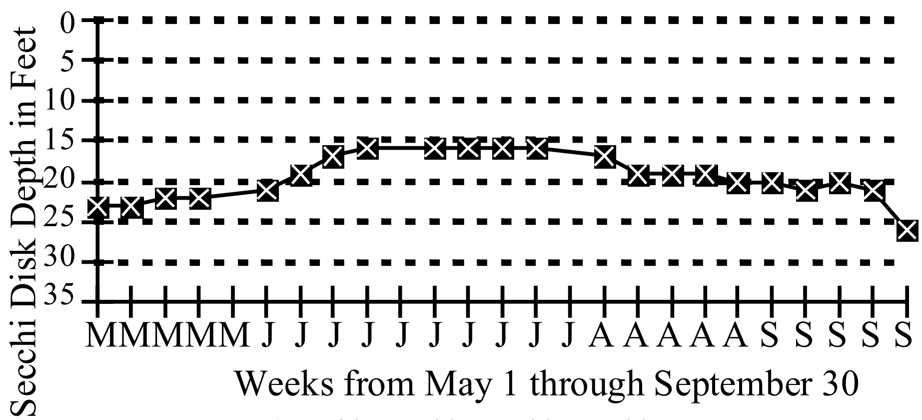
As noted earlier, although quite a bit of Secchi disk data for Taylor Lake exists, there are some gaps. Chuck Pilar did a good job taking Secchi disk readings in 2001 and 2002.

The graphs below show the Secchi disk readings collected by Pilar in 2001 and 2002.

In 2001, spring data range from 21 to 23 feet. As the lake warms in summer, the clarity drops to 16 to 17 feet (probably an algal bloom), then the lake gets clearer (26 feet in October) in fall as the water cools.

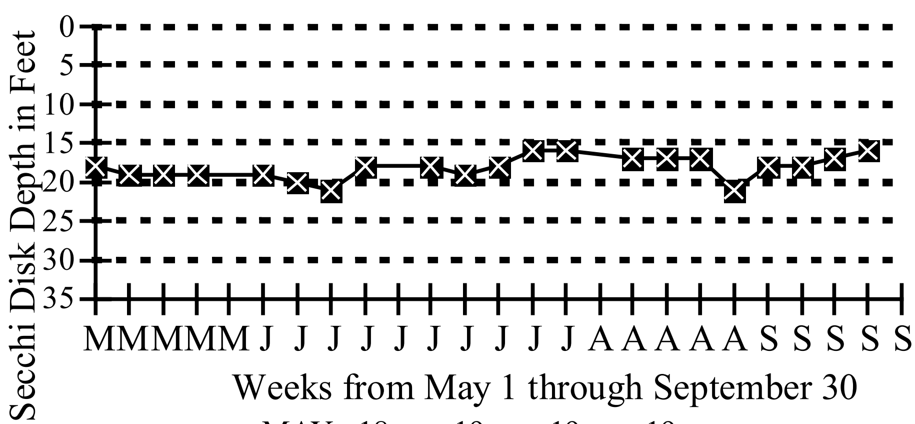
In 2002 Secchi disk readings were much more uniform, ranging from 16 to 21 feet through the warm months. This year the data graphed essentially as a straight line, indicating the clarity of Taylor Lake didn't change as the water warmed from spring to summer. This is a plus.

Taylor Lake, Oakland County 2001 Secchi Disk Readings



MAY	23	23	22	22	.
JUN	21	19	17	16	.
JUL	16	16	16	16	.
AUG	17	19	19	19	20
SEP	20	21	20	21	26

Taylor Lake, Oakland County 2002 Secchi Disk Readings

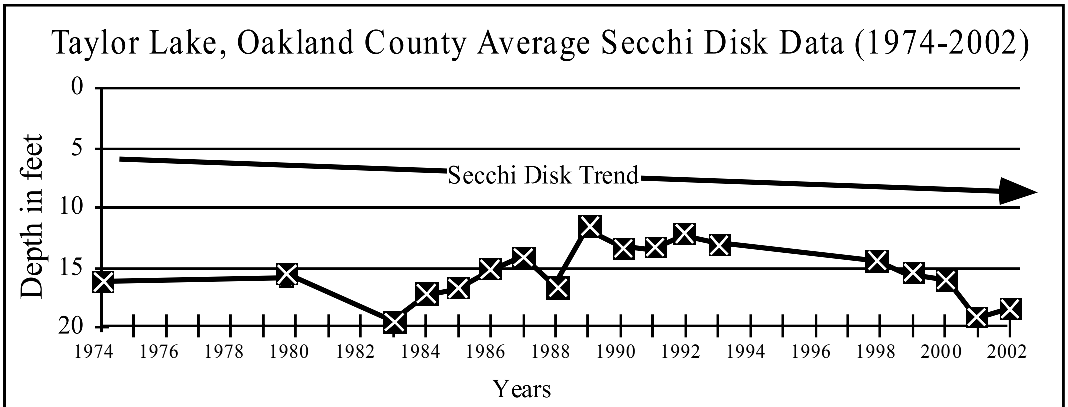


MAY	18	19	19	19	.
JUN	19	20	21	18	.
JUL	18	19	18	16	16
AUG	.	17	17	17	21
SEP	18	18	17	16	.

SECCHI DISK TREND GRAPH

Since Taylor Lake residents have been taking Secchi disk readings on somewhat of a regular basis since 1974 we were able to construct a Secchi Disk Trend Graph based on averaged Secchi disk data for each year we have data for.

The Secchi Disk Trend graph shows the average Secchi disk readings are generally between 13 and 18 feet, which is good. It also shows the lake may be getting clearer, which is also good.



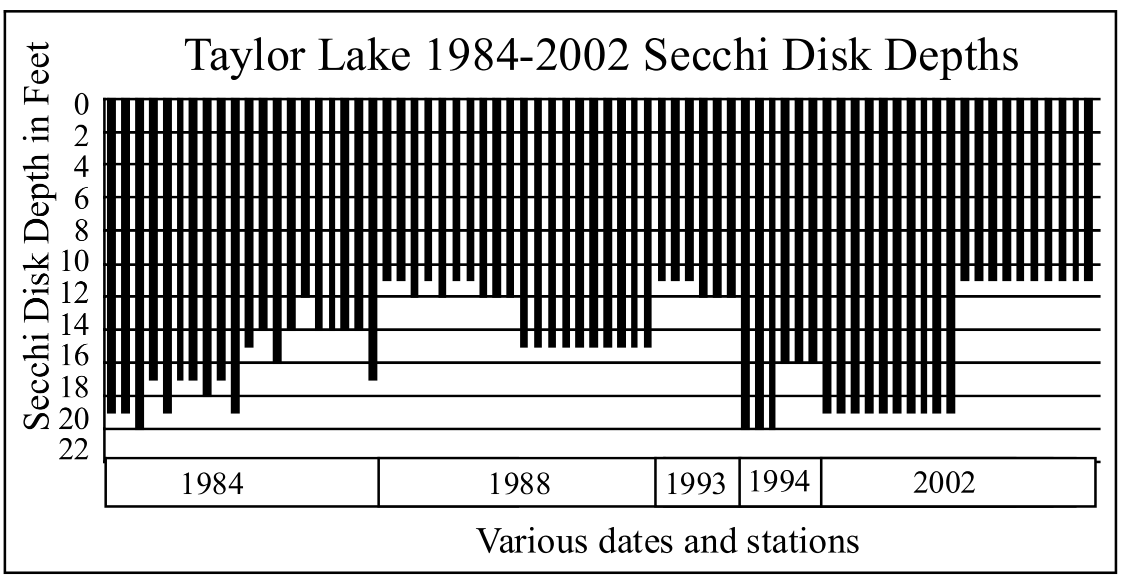
Data:

1974	1980	1983	1984	1985	1986	1987	1988	1989	1990	1991
16.2	16	19.5	17.5	16.8	15.3	14.2	16.5	11.9	13.3	13.6

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
12.4	13.2					14.9	15.6	16.0	19.8	18.1

SECCHI DISK READINGS TAKEN WITH SAMPLES

The graph below shows the Secchi disk readings collected when the samples were taken. The graph does not show any specific trend, except that spring readings were deeper than summer readings in 1984, 1994 and 2002. The opposite was true in 1988 and 1993. The amount of variation in the 1984 data is unusual.

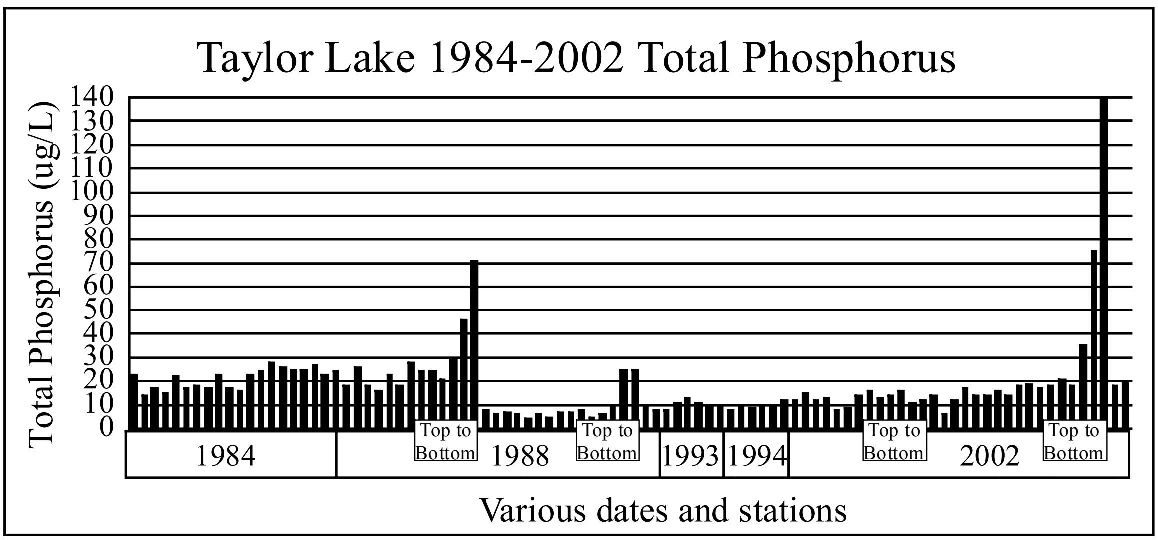


TOTAL PHOSPHORUS

Although there are several forms of phosphorus found in lakes, the experts selected total phosphorus as being most important. This is probably because all forms of phosphorus can be converted to the other forms. Currently, most lake scientists feel phosphorus, which is measured in parts per billion (1 part per billion is one second in 31 years) or micrograms per liter (ug/L), is the one nutrient which might be controlled. If its addition to lake water could be limited, the lake might not become covered with the algal communities so often found in eutrophic lakes.

However, based on our studies of many Michigan inland lakes, we've found many lakes were phosphorus limited in spring (so don't add phosphorus) and nitrate limited in summer (so don't add nitrogen).

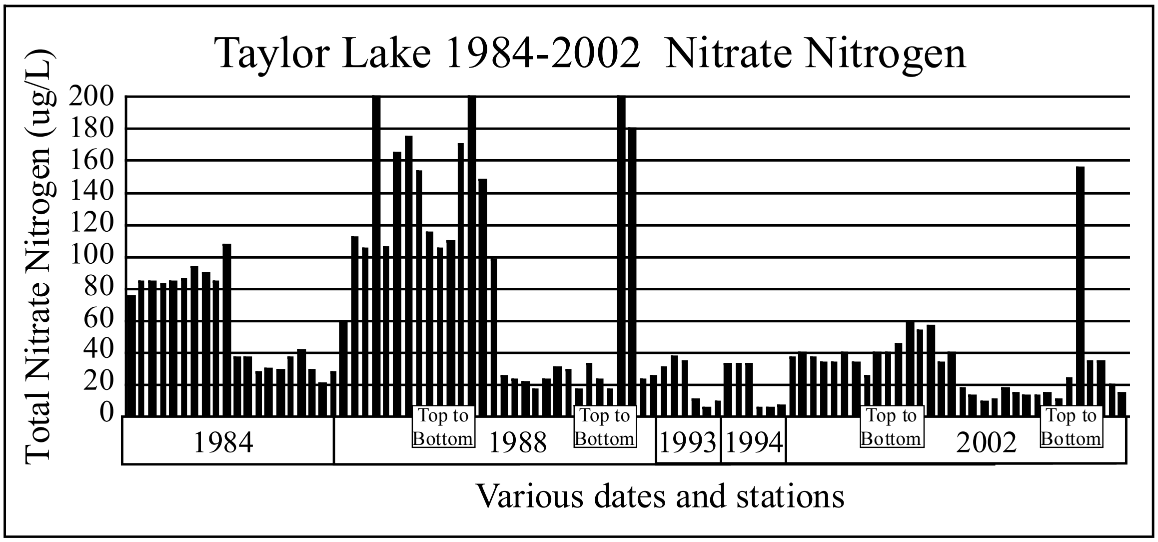
10 parts per billion is considered a low concentration of phosphorus in a lake and 50 parts per billion is considered a high value in a lake by many limnologists.



The graph of Taylor Lake total phosphorus concentrations shows the surface phosphorus concentrations range from 4 to 29 micrograms per liter, but are generally in the 5 to 15 microgram per liter range. These are good phosphorus concentrations. Three of the four top to bottom sample series show higher phosphorus concentrations at the bottom of the lake. This phosphorus is being released from the bottom sediments during anoxic (no dissolved oxygen) conditions in the bottom water. The graph also seems to show phosphorus concentrations may be increasing.

NITRATE NITROGEN

Nitrate, also measured in the parts per billion range, has traditionally been considered by lake scientists to also be a limiting nutrient. The experts felt any concentration below 200 parts per billion was excellent in terms of lake water quality. The highest value found by this author was 48,000 parts per billion in a river which flowed into an Ottawa County lake in Holland, Michigan



On the other hand, we've studied hundreds of Michigan inland lakes, and many times we find them nitrate limited (very low nitrate nitrogen concentrations), especially in summer.

The graph comparing the spring and summer nitrate-nitrogen concentrations from 1984 through 2002 shows spring surface values range from 33 to 200 micrograms per liter, while summer values are much lower, ranging from 6 to 42 micrograms per liter. These are normal nitrate nitrogen concentrations for a Michigan inland lake.

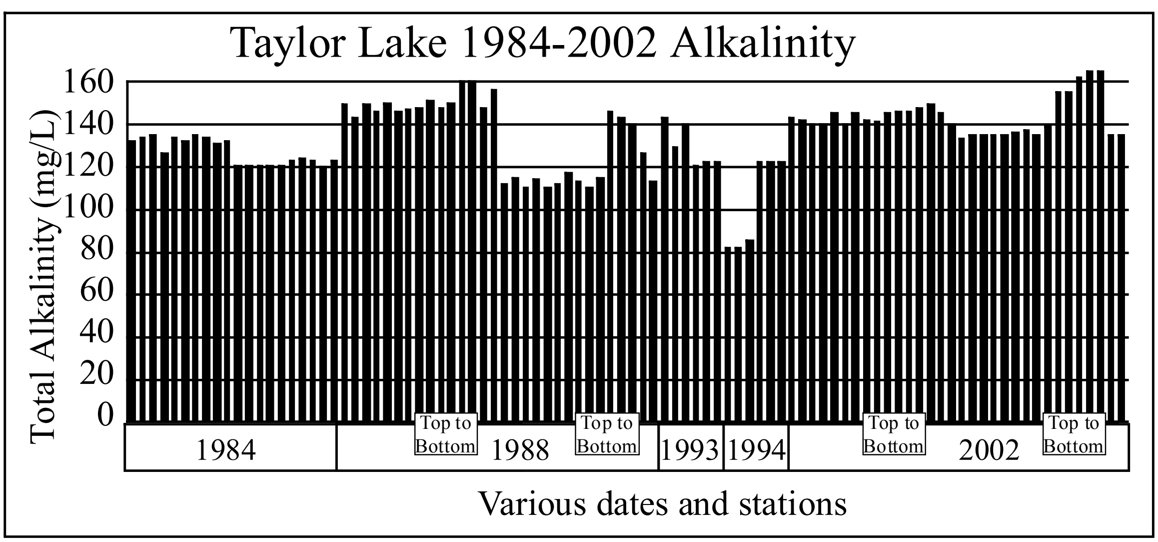
The 1988 and 2002 top to bottom series of samples show higher concentrations of nitrate nitrogen below the surface. We usually find this only in high quality lakes.

We're finding many lakes have lower surface nitrate nitrogen concentrations in summer than in spring. This is probably due to two factors. First, plants and algae growing in lakes as water warms can remove nitrates from the water column. And second, bacterial denitrification (where nitrates are converted to nitrogen gas by bacteria) also occurs at a much faster rate in summer when the water is warmer.

Generally limnologists feel optimal nitrate nitrogen concentrations (which encourage maximum plant and algal growth) are about 10-20 times higher than phosphorus concentrations. The reason more nitrogen than phosphorus is needed is because nitrogen is one of the chemicals used in the production of plant proteins, while phosphorus is used in the transfer of energy, but is not used to create plant material. If the nitrate concentration is less than 10-20 times the phosphorus concentration, the lake is considered nitrogen limited. If the nitrate concentration is higher than 10-20 times the phosphorus concentration, the lake is considered phosphorus limited.

TOTAL ALKALINITY

Alkalinity is a measure of the ability of the water to absorb acids (or bases) without changing the hydrogen ion concentration (pH). It is, in effect, a chemical sponge. In most Michigan lakes, alkalinity is due to the presence of carbonates and bicarbonates which were introduced into the lake from ground water or streams which flow into the lake. In lower Michigan, acidification of most lakes should not be a problem because of the high alkalinity concentrations.



The graph of alkalinity data shows three things.

First, the Taylor Lake surface alkalinity data (82 to 156 milligrams per liter) indicate Taylor Lake is a moderately hard-water lake, which is good. This is because hard water lakes have the ability to precipitate some of the phosphorus that enters the lake to the bottom sediments as calcium phosphate. This pretty much ties up the phosphorus in the sediments. Soft water lakes lack this ability.

Second, spring alkalinities are higher than summer alkalinities, which is what we normally see.

Third, alkalinites appear to be increasing. That's not a problem.

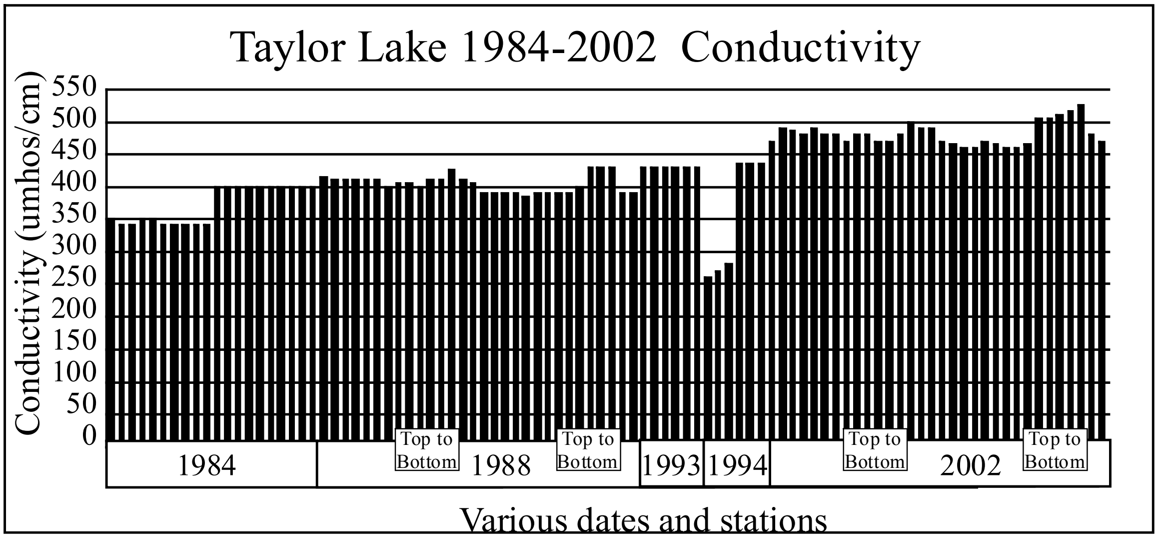
HYDROGEN ION CONCENTRATION (pH)

pH has traditionally been a measure of water quality. Today it is an excellent indicator of the effects of acid rain on lakes. About 99% of the rain events in southeastern Michigan are below a pH of 5.6 and are thus considered acid. However, there seems to be no lakes in southern Michigan which are being affected by acid rain. Most lakes have pH values between 7.5 and 9.0.

Taylor Lake pH values (7.6 to 8.6) are within normal ranges for a high quality Michigan moderately hard water inland lake. pH values of the top to bottom samples shows pH generally decreases with depth. That's normal.

SPECIFIC CONDUCTIVITY

Conductivity, measured with a meter, detects the capacity of a water to conduct an electric current. More importantly however, it measures the amount of materials dissolved in the water, since only dissolved materials will permit an electric current to flow. Theoretically, pure water will not conduct an electric current. It is the perception of the experts that poor quality water has more dissolved materials than does good quality water. We concur.



The graph shows Taylor Lake 1984-2002 surface conductivity data (260 to 490 micromhos per centimeter), which are normal for a moderately hard water Michigan inland lake. The graph also shows conductivity in Taylor Lake may be increasing. Usually the source of salts in lakes is winter road salting activities or salts from regenerating water softeners. The top to bottom samples show in some cases conductivity (and therefore salt concentrations) increase near the bottom. That's normal.

THE LAKE WATER QUALITY INDEX

The Lake Water Quality Index (LWQI) (Fusilier, 1982) used in this study to define the water quality of Taylor Lake was developed for two reasons. First, there was no agreement among lake scientists regarding which tests should be used to define the water quality of a lake; and second, there was no agreement among lake scientists regarding the meaning of the data collected during lake studies.

Development of the index involved two questionnaires which were sent to a panel of 555 scientists who were members of the American Society of Limnology and Oceanography. The panel was specifically selected because they were chemists and biologists with advanced degrees who studied lake water quality.

The first questionnaire asked the scientists to select tests which they felt should be used to define lake water quality.

The tests most often selected by the scientists became the index parameters (or tests). They were:

Dissolved oxygen (Percent saturation)	Total phosphorus
Total alkalinity	pH
Chlorophyll a	Temperature
Secchi disk depth	Conductivity
Total nitrate nitrogen	

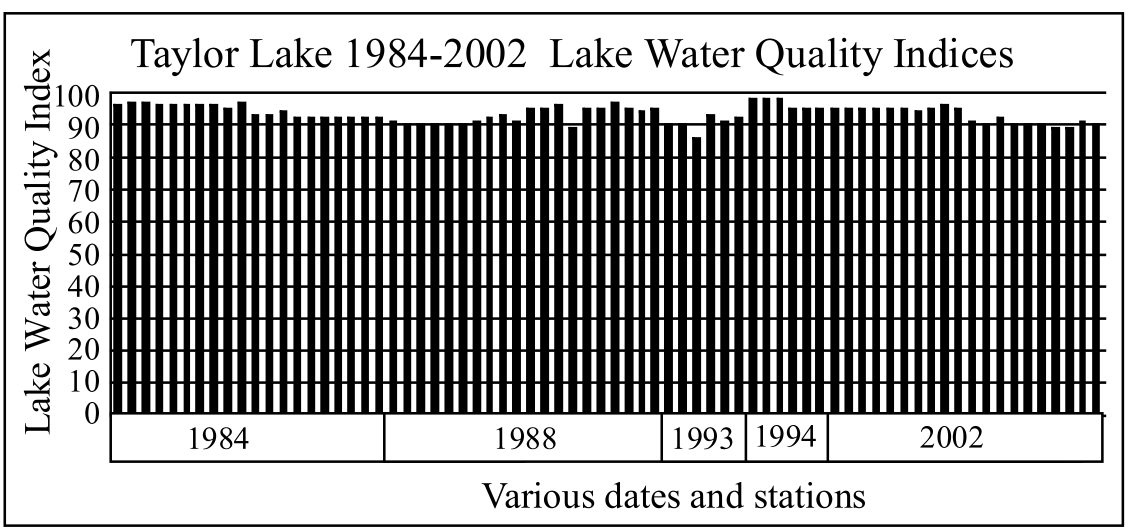
The second questionnaire, sent out after the first was returned, asked the scientists what the results of the tests they selected as good indicators of lake water quality meant.

After the responses to the second questionnaire were tabulated, the nine tests and the accompanying rating curves were combined into a Lake Water Quality Index.

The index ranges from 1 to 100, with 100 indicating excellent lake water quality. The index rated lakes about the same way teachers rate students: 90-100=A, 80-90=B, 70-80=C, 60-70=D, and below 60=E.

The highest index for a Michigan lake studied by the author was Long Lake in Oakland County at 100 in the spring of 1994. The lowest was 16 in an Ottawa County lake.

THE LAKE WATER QUALITY INDICES FOR TAYLOR LAKE



The graph shows the spring and summer Lake Water Quality Indices for Taylor Lake from 1984 through 2002 are, with the exception of a spring 1993 sample and two summer 2002 samples, all 90 or above. These data indicate the water quality of Taylor Lake was in the A range every time it was sampled. The reason the spring 1993 sample was below 90 (actually 86) was a high chlorophyll a concentration. The reasons the two summer 2002 samples were less than 90 was chlorophyll a concentrations, Secchi disk depths and pH values.

THE LAKE WATER QUALITY INDEX (LWQI) CALCULATION SHEETS

The Lake Water Quality Index calculation sheets were developed to show graphically what the results of the nine different lake water quality tests meant in terms of lake water quality.

HOW TO READ THE LAKE WATER QUALITY INDEX CALCULATION SHEETS

Listed across the top of the calculation sheets are the tests selected by the panel of experts as being good indicators of lake water quality.

The figures which look like thermometers are graphs which convert the test results (the values found on the outside of the thermometer) to a uniform 0-100 lake water quality rating (found on the inside of the thermometer).

The calculation sheet combines all nine of the individual quality ratings into a single Lake Water Quality Index. The index ranges from 1 (very poor lake water quality) to 100 (excellent lake water quality).

The index is portrayed in three different ways: as a number ranging between 1 and 100 in the circle marked LWQI, and by a color and position on the sheet edge scale. The purpose of the sheet-edge scale is to review quickly large numbers of lakes or sample sites within a lake and determine how the quality of the various lakes or sites compare.

The position of the red lines on the thermometer rating scales permits determination of the parameter (or parameters) which cause the index to be depressed. The lower the red line, the greater the problem. A glance at the top of the problem rating scale identifies the test and the test results. The rating scales also permit determination of what test results would be considered excellent in terms of lake water quality by the panel of experts surveyed. They are the numbers on the outside the thermometers, near the top.

Since there was not a big difference in the surface water quality at the ten stations in either the spring or summer 2002, only two Lake Water Quality Index calculation sheets are included in this report, one for the ten spring 2002 samples, using averaged data, and one for the ten summer 2002 samples, using averaged data.

The report marked MASTER has all twenty 2002 Lake Water Quality Index calculation sheets. That is the only difference in that report and the others. Lake Water Quality Index calculation sheets for earlier years were included with those reports.

As an added note, we've changed some of the rating curves in the Lake Water Quality Index to more accurately portray high quality lakes. All of the earlier LWQIs have been updated and recalculated for this report.

BOTTOM SEDIMENTS

Many times bottom sediments tell us more about what is happening in a lake than the water quality tests do. That's because bottom sediments provide sort of a history of what's been happening in a lake, while water testing just provides a snapshot.

Bottom sediments are collected with a Pederson dredge, transferred to pint freezer containers and allowed to air dry. Once they are dry, the (usually) shrunken block of material is measured to determine volume, then ground, placed in porcelain dishes, dried at 100 degrees C, weighed, burned at 550 degrees C, and weighed again. Color after air-drying and after burning is also noted.

Bottom sediments almost always come up from the lake bottom black, and many people consider these black sediments "muck". However that's not usually the case.

The bottom sediments are black because no oxygen penetrates them, so the decomposition processes which occur use sulfur rather than oxygen, and in this process, they produce iron sulfides, which are black. However once the sediments are exposed to air, they usually turn some other color.

If the sediments remain black after air drying it usually means they are less than about 65 percent mineral (or more than 35% organic material). Sediments also remain black if they are from soft water lakes, but there's a reason for that.

If the sediments turn gray after air drying it usually means they are made up primarily of carbonates. This is what we usually see in moderately hard water and hard water lakes.

If the sediments turn tan, it usually means they are made up primarily of clays. Further evidence of this occurs when we burn the sediments at 550 degrees C.

We determine how much bottom sediments shrink when they air dry because this information is useful when considering dredging a lake. Normal shrinkage after air-drying is in the range of 50 to 80 percent. However sands and gravels don't shrink at all. Excessive shrinkage is more than 95 percent. In other words, there is only five percent or less of the material remaining after air-drying.

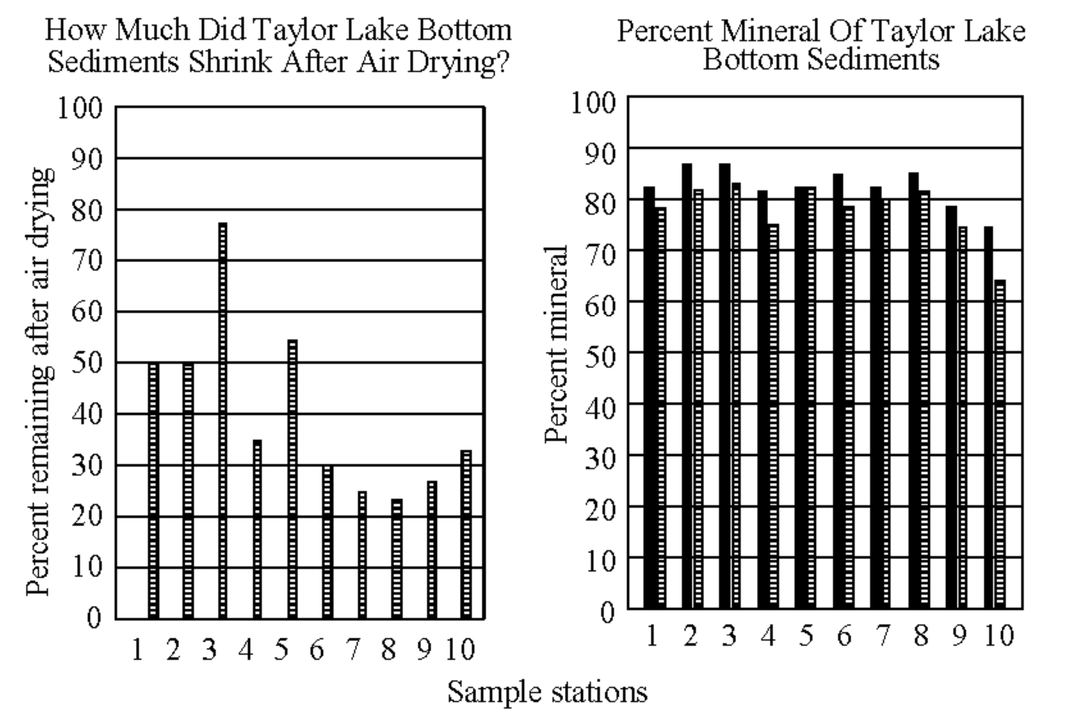
If the gray bottom sediments remain gray after burning they are considered carbonates, and the loss of material during this process is considered organic material. The results are expressed in the percentage of minerals in the bottom sediments.

If the tan bottom sediments turn red after burning, it means the lake is filling with clay. Clay enters the lake from near-lake activities such as road building, home building or farming. Usually clay is not a material that makes up the bottom sediments of most inland lakes.

Highly organic sediments that remained black after air drying usually turn tan after burning, but the mineral content is usually quite low.

I consider high quality bottom sediments from natural lakes to be above 85 percent mineral. And I consider bottom sediments less than 50 percent mineral to be muck.

THE BOTTOM SEDIMENTS OF TAYLOR LAKE



1988 Characteristics of Taylor Lake Bottom Sediments 2002

Sample I.D.	Percent Shrinkage		Percent Mineral		Dried at 100°C Color		Color after burning at 550°C	Depth of water (feet)
	1988	2002	1988	2002	1988	2002	2002	Both years
1	Mod.	50	82	78	Gray	Gray	Red	26
2	Mod.	50	86	81	Gray	Gray	Red	27
3	Mod.	22	86	83	Gray	Gray	Red	25
4	Mod.	65	81	75	Gray	Gray	Red	22
5	Mod.	46	82	82	Gray	Gray	Red	30
6	Mod.	70	85	79	Gray	Gray	Red	20
7	Mod.	75	82	80	Gray	Gray	Red	19
8	Mod.	77	85	81	Gray	Gray	Red	55
9	Mod.	73	78	74	Gray	Gray	Red	25
10	Mod.	68	74	63	Gray	Gray	Red	27
			82%	78%	Average mineral content of bottom sediments			

Bottom sediment samples were taken at the ten in-lake stations in 1988 and again in 2002. Amount of shrinkage was not calculated in the 1998 samples.

None of the 2002 samples shrunk excessively (more than 95 percent is excessive). The graph shows the 1988 and 2002 data.

All 1988 and 2002 samples turned gray after air drying. That's good.

Color after burning was not noted in 1988. In 2002 all samples turned red after burning at 550 degrees C. The red color indicates the presence of clay in the sediments. As noted above, clay is not a normal constituent of Michigan inland lake bottom sediments. The source of clays in lake bottom sediments is usually home building or road building, or farming activities in the near lake areas.

The mineral content of the 1988 samples ranged from 74 to 86 percent and averaged 82 percent.

The mineral content of the 2002 samples ranged from 63 to 83 percent and averaged 78 percent.

These data indicate organic material is building up at a faster rate than the lake can assimilate. Residents need to be aware of this and quit using all fertilizers on near lake areas.

Wallace E. Fusilier, Ph.D.
Consulting Limnologist
Dexter, Michigan
December 2002

Taylor Lake Water Quality Data

Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
4/8/84	1	7	10.8	92	1.0	19	75	132	7.9	350	23	96	A
4/8/84	2	8	10.6	92	1.0	19	84	134	7.9	340	14	97	A
4/8/84	3	8	11.3	98	1.0	20	84	135	7.9	340	17	97	A
4/8/84	4	8	11.4	99	1.0	17	83	126	7.6	350	15	96	A
4/8/84	5	7	10.6	90	1.0	19	84	134	7.9	350	22	96	A
4/8/84	6	7	10.8	92	1.0	17	86	132	7.9	340	17	96	A
4/8/84	7	6	10.8	90	1.0	17	94	135	7.7	340	18	96	A
4/8/84	8	7	10.8	92	1.0	18	90	134	7.8	340	17	96	A
4/8/84	9	7	10.7	91	1.0	17	85	131	7.8	340	23	95	A
4/8/84	10	7	10.7	91	1.0	19	108	132	7.8	340	17	97	A
9/8/84	1	21	8.6	99	3.2	15	37	121	8.5	400	16	93	A
9/8/84	2	21	8.8	101	2.2	14	37	121	8.5	400	23	93	A
9/8/84	3	21	9.2	106	1.6	16	28	121	8.5	400	24	94	A
9/8/84	4	21	9.2	106	2.0	14	30	121	8.2	400	28	92	A
9/8/84	5	20	8.6	98	1.8	12	29	121	8.2	400	26	92	A
9/8/84	6	20	8.5	97	2.0	14	37	123	8.4	400	25	92	A
9/8/84	7	21	8.5	98	2.0	14	42	124	8.4	400	25	92	A
9/8/84	8	20	8.5	94	2.0	14	29	123	8.4	400	27	92	A
9/8/84	9	21	8.6	99	2.6	14	21	120	8.5	400	23	92	A
9/8/84	10	20	8.6	98	2.4	17	28	123	8.5	400	24	92	A
4/13/88	1	12	9.2	85	2.0	11	60	149	8.1	415	18	91	A
4/13/88	2	12	9.2	85	2.0	11	112	143	8.2	410	26	90	A
4/13/88	3	12	9.1	84	2.0	12	105	149	8.2	410	28	90	A
4/13/88	4	12	9.1	84	2.0	11	200	146	8.2	410	27	90	A
4/13/88	5	12	9.1	84	1.0	12	106	150	8.1	410	29	90	A
4/13/88	6	12	9.1	84	2.0	11	165	146	8.3	410	25	90	A
4/13/88	7	12	9.1	84	1.0	11	175	147	8.1	400	28	91	A
4/13/88	8-0	12	9.1	84	1.0	12	153	148	8.2	405	24	92	A
4/13/88	8-10	10	9.5	84	---	---	115	151	8.1	405	24	---	---
4/13/88	8-20	8	9.1	77	---	---	105	148	8.2	400	21	---	---
4/13/88	8-30	5	6.0	47	---	---	110	150	8.1	410	29	---	---
4/13/88	8-40	5	4.0	31	---	---	170	160	8.2	410	46	---	---
4/13/88	8-50	4	2.5	28	---	---	305	160	8.1	425	71	---	---
4/13/88	9	12	9.2	85	1.0	12	148	148	8.1	410	28	93	A
4/13/88	10	12	9.2	85	2.0	12	98	156	8.2	405	266	91	A
8/24/88	1	24	8.0	94	1.0	15	26	112	8.5	390	7	95	A
8/24/88	2	24	7.8	92	2.0	15	23	115	8.5	390	6	95	A
8/24/88	3	24	8.1	95	1.0	15	22	110	8.5	390	4	96	A
8/24/88	4	24	7.5	88	1.0	15	17	114	8.5	390	7	96	A
8/24/88	5	24	7.2	85	1.0	15	23	110	8.5	385	5	95	A
8/24/88	6	24	7.5	89	1.0	15	31	112	8.5	390	7	95	A
8/24/88	7	24	7.5	89	1.0	15	29	117	8.5	390	7	97	A
8/24/88	8-0	24	7.5	89	1.0	15	17	113	8.5	390	7	95	A
8/24/88	8-10	24	7.2	86	---	---	33	110	8.5	390	5	---	---
8/24/88	8-20	22	8.2	94	---	---	23	115	8.4	400	6	---	---
8/24/88	8-30	10	0.0	0	---	---	17	146	7.6	430	10	---	---
8/24/88	8-40	7	0.0	0	---	---	432	143	7.6	430	25	---	---
8/24/88	8-50	5	0.0	0	---	---	180	140	7.7	430	25	---	---
8/24/88	9	24	7.2	85	1.0	15	23	126	8.5	390	10	94	A
8/24/88	10	24	7.3	86	1.0	15	26	113	8.4	390	8	95	A
5/4/93	1	---	---	---	3.9	11	31	143	8.4	430	18	90	A
5/4/93	2	---	---	---	3.7	11	38	129	8.3	430	21	90	A
5/4/93	3	---	---	---	7.4	11	35	140	8.4	430	23	86	B
8/2/93	1	24	8.4	99	2.0	12	11	121	8.3	430	11	93	A
8/2/93	2	24	8.6	101	3.7	12	6	122	8.2	430	10	91	A
8/2/93	3	24	8.8	104	3.3	12	10	122	8.2	430	10	92	A
4/23/94	1	---	---	---	0.8	20	33	82	7.8	260	8	98	A
4/23/94	2	---	---	---	0.6	20	33	82	7.8	270	10	98	A
4/23/94	3	---	---	---	0.8	20	33	85	7.7	280	9	98	A
8/8/94	1	23	8.1	93	2.3	16	6	122	8.2	435	10	95	A
8/8/94	2	23	8.6	99	1.7	16	6	122	8.1	435	10	95	A
8/8/94	3	23	8.4	97	2.0	16	7	122	8.3	435	12	95	A

Taylor Lake Water Quality Data

Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
4/30/02	1	11	11.8	106	2.2	19	37	143	8.4	470	12	95	A
4/30/02	2	11	11.9	107	2.2	19	40	142	8.3	490	15	95	A
4/30/02	3	11	11.8	106	2.2	19	37	140	8.3	485	12	95	A
4/30/02	4	11	11.7	105	2.5	19	34	140	8.3	480	13	95	A
4/30/02	5	11	11.8	106	2.2	19	34	145	8.3	490	8	95	A
4/30/02	6	11	11.8	106	2.5	19	40	140	8.3	480	9	95	A
4/30/02	7	11	11.8	106	3.4	19	34	145	8.3	480	14	94	A
4/30/02	8-0	11	11.8	106	2.2	19	26	142	8.3	470	16	95	A
4/30/02	8-10	11	11.8	106	---	---	40	141	8.3	480	13	---	---
4/30/02	8-20	10	11.8	104	---	---	40	145	8.3	480	14	---	---
4/30/02	8-30	6	10.6	85	---	---	46	146	8.1	470	16	---	---
4/30/02	8-40	6	10.2	82	---	---	60	146	7.9	470	11	---	---
4/30/02	8-50	6	7.8	62	---	---	54	148	7.7	480	12	---	---
4/30/02	8-57	6	7.8	62	---	---	57	149	7.6	500	14	---	---
4/30/02	9	11	11.7	105	1.9	19	34	145	8.3	490	6	96	A
4/30/02	10	11	11.5	102	2.2	19	40	140	8.3	490	12	95	A
8/8/02	1	25	8.5	101	2.6	11	18	133	8.6	470	17	91	A
8/8/02	2	25	8.7	104	3.7	11	13	135	8.6	465	14	90	A
8/8/02	3	25	8.4	100	2.9	11	9	135	8.5	460	14	92	A
8/8/02	4	25	8.4	100	4.0	11	11	135	8.5	460	16	90	A
8/8/02	5	25	8.4	100	3.4	11	18	135	8.6	470	14	90	A
8/8/02	6	25	8.4	100	3.3	11	15	136	8.6	465	18	90	A
8/8/02	7	25	8.4	100	3.6	11	13	137	8.6	460	19	89	B
8/8/02	8-0	26	8.3	101	4.3	11	13	135	8.6	460	17	89	B
8/8/02	8-10	26	7.7	94	---	---	15	139	8.6	465	18	---	---
8/8/02	8-20	15	3.2	31	---	---	11	155	7.8	505	21	---	---
8/8/02	8-30	8	2.9	24	---	---	24	155	7.5	505	18	---	---
8/8/02	8-40	8	0.0	0	---	---	156	162	7.4	510	35	---	---
8/8/02	8-50	6	0.0	0	---	---	35	165	7.3	515	75	---	---
8/8/02	8-57	6	0.0	0	---	---	35	165	7.3	525	140	---	---
8/8/02	9	25	8.4	100	3.3	11	20	135	8.5	480	18	91	A
8/8/02	10	25	8.6	102	3.0	11	15	135	8.6	470	20	90	A