plankton B

MORRIS LAKE vs. FOREST SERVICE BOG

Jeanne Grasso
UNDERC 1981
July 3, 1981
Dr. R. W. Greene

Morris Lake vs. Forest Service Bog

Morris Lake and Forest Service Bog are two bodies of water that we studied this past month at UNDERC. These two bodies of water appear to differ. however, with the use of the data gathered, I will extensively compare them in this paper.

Morris Lake, located at the north end of the property, is a fairly small and shallow lake. Water enters Morris from Ward Lake and then drains into Tenderfoot Creek. The topography of Morris Lake consists of conifers and hardwoods, but it is mostly surrounded by a hedge of alder. Many lily pads and other macrophytes grow along the banks and under the water. A few beaver homes are scattered around the lake. A hill to the southeast overlooks the lake; all of the other banks are level.

Forest Service Bog is located at the south end of the property. It appears to be approximately three meters deep, but there is also a meter or two of silt on the bottom.

A hill shelters the bog, which sits at its base. The bog is surrounded by conifers, mostly tamarack and black spruce; the trees closest to the bog are dead or rotted. Vegetation apparently cannot survive in the thick sphagnum mat, however, pitcher plants and lady slippers grow and survive quite well there. There is also a floating sphagnum island in the middle.

WATER CHEMISTRY

Water chemistry tests were done on the lakes we are comparing in order to evaluate the differences and similarities between them. The water chemistry data and the physical characteristics of each body of water determine what is in the lake, quantitatively and qualitatively. These water chemistry tests can be used to determine the future of the lake, for example, whether it will ~~remain a lake or~~ eventually turn into a bog or marsh.

Morris Lake Data

The depths of our Kemmerer samples were chosen after our oxygen readings were complete. We found the oxygen bulge at two meters and therefore sampled from that depth. The other two samples were taken well above and below this area to see how the water chemistry differs with different amounts of oxygen and phytoplankton.

In our data, (see page4&5) Morris Lake shows a higher oxygen reading at the surface of the water than in the air. We assume the reason for this difference is that we took the readings at the peak of the phytoplankton season.

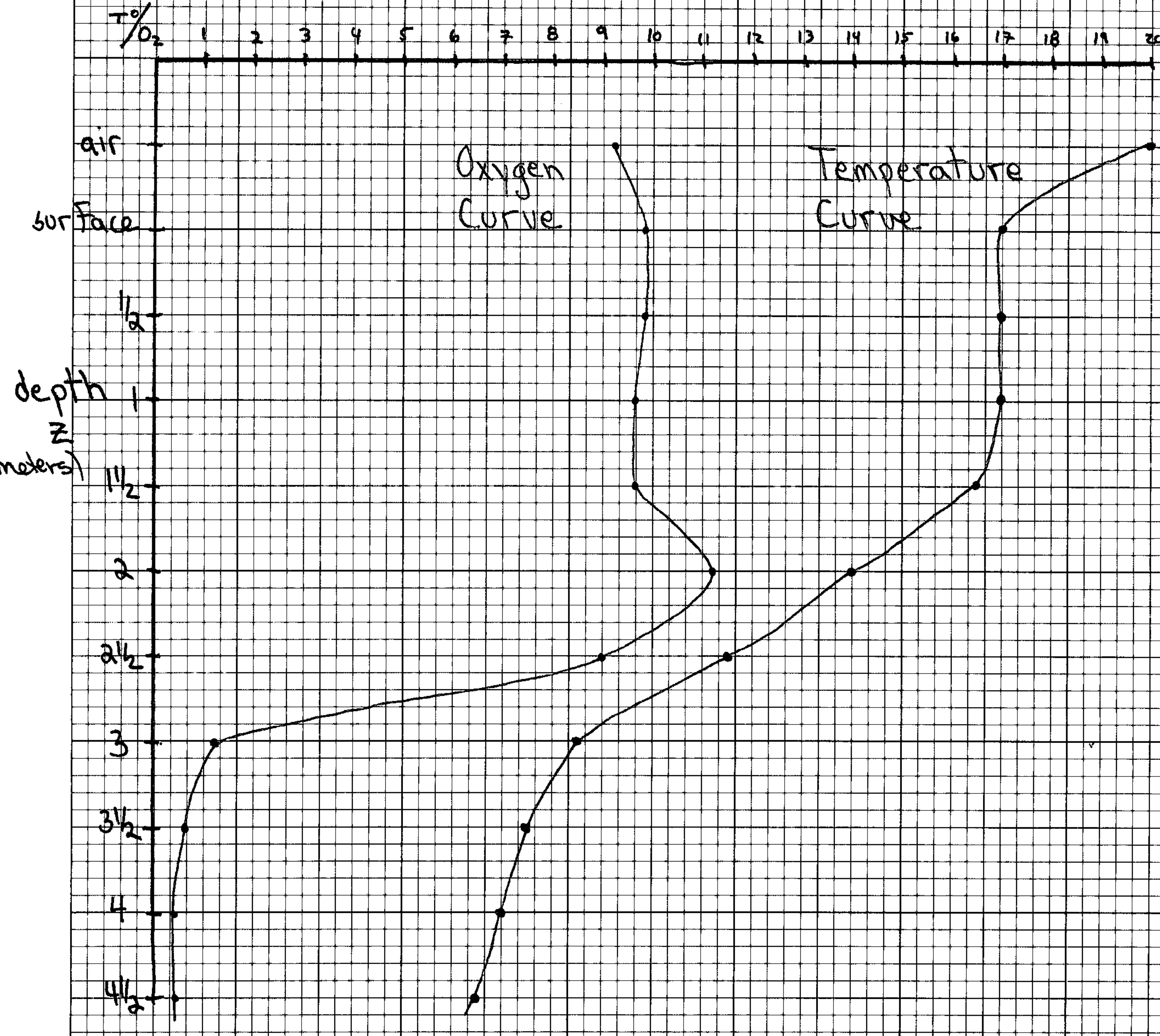
At two meters we have an oxygen bulge, where the oxygen reads much higher than in the air. This is due to a large bloom of phytoplankton. For this lake, two meters would be the ideal depth for phytoplankton to thrive. The amount of sun light that filters through and the nutrients present at this depth is the correct amount for maximum productivity.

There are slightly fewer nutrients in the oxygen bulge, a fact that could be attributed to the over abundance of phytoplankton, which use these nutrients as food. Our Secchi disc reading corresponds fairly well to our oxygen bulge. The phytoplankton bloom starts at approximately 1.5 meters which would make the water somewhat opaque, and our Secchi disc was only visible at a depth of 1.3 meters.

Morris is a fairly shallow lake and evidence of oxygen at the bottom, though very little, would indicate that at some time this lake has turned over.

Morris Lake — YSI Data

Depth	O_2 (ppm)	T°
air	9.2	20°
surface	9.8	17
1/2	9.8	17
1	9.6	17
1 1/2	9.6	16.5
2	11.2	14
2 1/2	9.0	11.5
3	1.2	8.5
3 1/2	.6	7.5
4	.4	7
4 1/2	.4	6.5



WATER CHEMISTRY DATA

Morris Lake

Tests	1 m	2 m	3½ m
Acidity	60 mg/L	47 mg/L	50 mg/L
Alkalinity	50 "	45 "	40 "
Total Hardness	48 "	45 "	50 "
Ca^{++}	38 "	35 "	38 "
Mg^{++}	10 "	10 "	12 "
Sulfate	1 "	0 "	2 "
Nitrate	.7 "	.5 "	.6 "
Specific Conductance	42 mhos	41 mhos	42 mhos
Color (true)	80 units	80 units	80 units
(apparent)	80 "	80	90

Secchi Disc Reading - 1.3 meters

pH - 6

H_2S - none

<u>Forest Service Bog Data</u>

After taking our oxygen readings, we discovered there was a steady thermocline, and an absence of oxygen at the bottom. We took one Kemmerer sample near the top and the other at 2.5 meters, where there was no oxygen.

In this bog the temperature and oxygen both dropped off steadily, the temperature dropped gradually, and the oxygen dropped quickly.

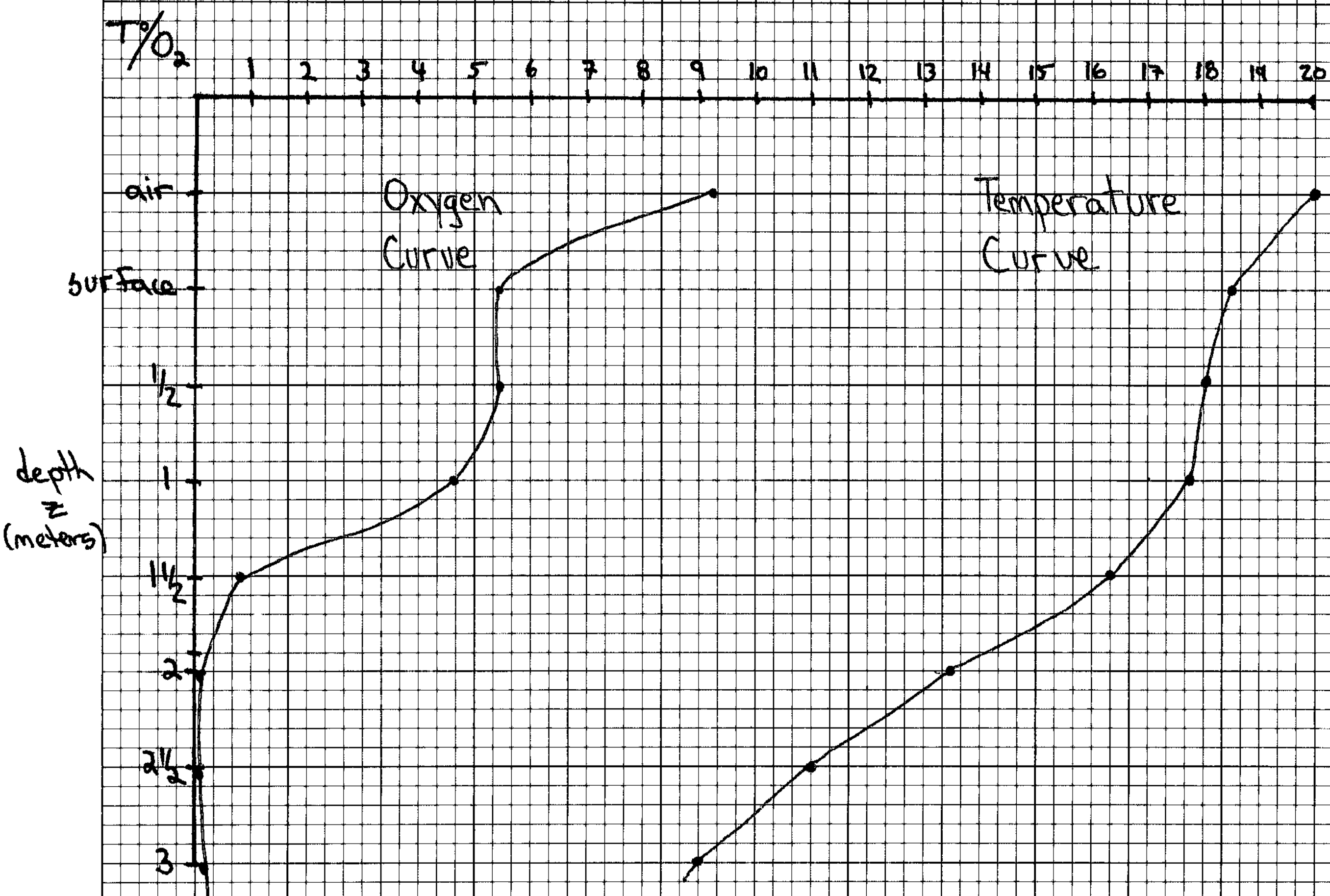
The hardness, conductivity, and alkalinity are all very low. This means that there are few ions in the water and very little buffer. This also causes the pH to be low. (Our reading was 4.8.)

Our plankton tow brought in many beetle larva, which all died very quickly when put in a container. This proves the fact that there is very little oxygen present and what was present was used up quickly.

The data we gathered (see page 7&8) agrees with the fact that Forest Service Bog is definitely a bog, that is it has a sphagnum mat, low hardness, low productivity and an acidic pH.

FOREST SERVICE BOG — YSI DATA

DEPTH	O_2 (ppm)	T°
air	9.2	20°
surface	5.4	18.5°
½	5.4	18
1	4.6	17.8
1½	.9	16.3
2	0	13.5
2½	0	11
3	0	9



WATER CHEMISTRY DATA

Forest Service Bog

Tests	1 m	$2\frac{1}{2}$ m
Acidity (methyl orange)	5.5 mg/L	5.5 mg/L
(phenolphthalein)	130 "	125 "
Alkalinity	3 "	3 "
Total Hardness	5 "	5 "
Ca^{++}	0 "	0 "
Mg^{++}	5 "	5 "
Sulfate	2 "	2 "
Nitrate	.4 "	.5 "
Specific Conductance	11.2 mhos	15.6 mhos
Color (true)	30 units	30 units
(apparent)	40 "	40 "

Secchi Disc Reading - 3 meters

pH - 4.8

H_2S - present at bottom

On the graph on the following page I plotted both the temperature and oxygen curves from Morris Lake and Forest Service Bog against each other to see how they compared.

The two temperature curves correspond almost exactly, even though the oxygen and chemistry differ greatly. Therefore water chemistry and topography have very little or no affect on the temperature of a lake. The weather is the only factor.

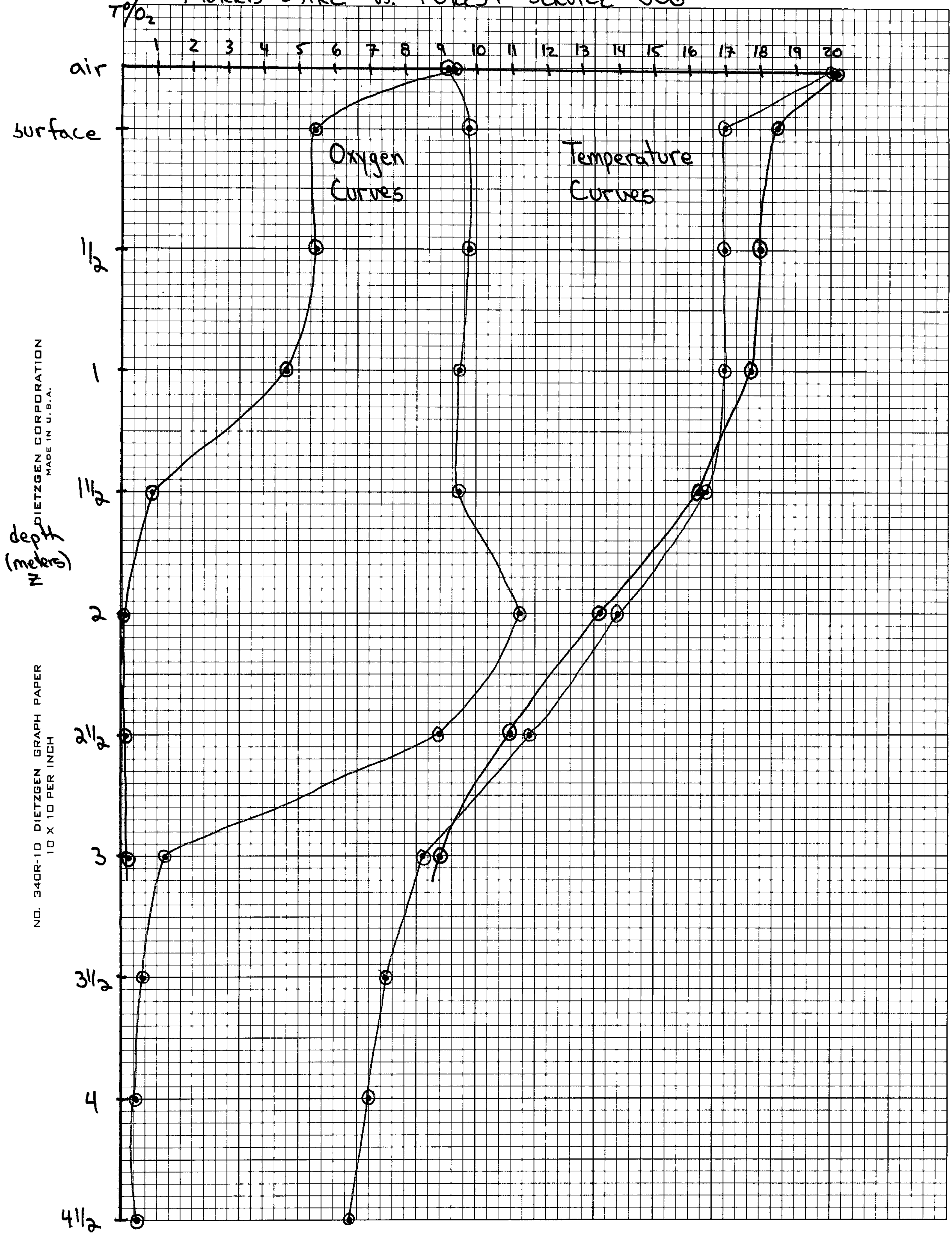
The oxygen curves differ greatly. There is much less oxygen in Forest Service Bog than in Morris Lake. The effect of this is shown in the plankton data. More oxygen and nutrients are found in Morris, which is why it is a more productive lake.

There are also many differences in the results of the chemistry tests. The acidity of Forest Service Bog is very high and the fact that there is very little buffer causes the pH to be low. The acidity of Morris is approximately one half that of Forest Service Bog, but the pH is much higher due to the alkalinity which buffers the acid.

The conductance of Morris is much higher than that of Forest Service Bog because there are many more free ions, for example in the hardness and the alkalinity. If a lake has a high hardness and alkalinity, its specific conductance will usually be high, or relatively so, in the case of Morris Lake.

The color of Morris Lake is much higher than the color or Forest Service Bog. Humic acid from the conifers is the cause of the tea color. Many more conifers are in close proximity with Morris Lake than with Forest Service Bog, so, this could be the cause.

MORRIS LAKE vs. FOREST SERVICE BOG



PLANKTON DATA

Morris Lake	amount
* Keratella cochlearis	8925
Asterionella	2300
Tabellaria	2225, 125, 75, 50
Ceratium hirundinella	1125
* Nauplius larva	975
Dinobryon savaricum	850
* Sinantherina	775
* Asplanchna	150
* Bosmina coregoni	125
Oscillatoria	125
* Kellicottia longispina	125
* Trichocerca	75
Synedra	75
Fragellaria	75
Desmidium	25
* Cyclops bicuspidatus	25

Forest Service Bog	
* Keratella cochlearis	235
* Sinantherina	186
* Holopedium gibberum	90
* Nauplius larva	61
* Epischura lacustrus	36
* Daphnia	26, 19
Dinobryon	20
Volvox	13
Desmidium	10
Oscillatoria	10

The numbers calculated are per milliliter.

* means zooplankton

PLANKTON

Morris Lake

The preceding page lists the types of plankton that were identified from our tows on Morris Lake and Forest Service Bog.

I will begin with the plankton interpretation for Morris Lake. Many more Nauplius larva were identified than specific arthropods. This was probably because arthropods pass through a series of larval stages before reaching adulthood, therefore the larval form would be more prominent. Zooplankton migrates to the bottom during the day and then rises again at night. Our tow was done during the day, which is one explanation why more types of zooplankton were not gathered. The majority of the zooplankton was microscopic, consisting mostly of rotifers.

Proportionally, very few larger zooplankton, or cladocerans, were found. This could be due to the lack of food available for the pike. The Northern pike on this lake are known to be stunted. (The reason that a population will become stunted is that the fish spawn too heavily and there is not enough food to go around to support them.) Because of the lack of larger food types, the pike resort to eating the next largest animal, the cladoceran. The cladocerans are not of enough substance for the pike to grow normally, therefore they remain small, or stunted, even at older ages.

The number of phytoplankton as a whole appears to be relatively large. This could be the cause of the higher oxygen reading at the surface than in the air, since our tow was taken at the surface.

Forest Service Bog

Fewer types of plankton species, and smaller species populations, were found in Forest Service Bog than in Morris Lake. This agrees with the fact that bogs are low productivity bodies of water. Few types of animal life can survive the low pH of a bog. Since the water is not buffered, the acidity usually kills the animal in the egg stage.

Much more zooplankton was in the sample than phytoplankton. Also, the oxygen reading at the surface was low compared to that of the air. These facts correspond to one another. Possibly the phytoplankton has not yet bloomed and the zooplankton is using all the available oxygen at the surface.

Most of the algae in a bog, especially Desmids, are found in the sphagnum mat. This bog has a low Ca^{++} and Mg^{++} content, ~~causing~~ allowing Desmids to be prominent in its waters. Since we did not gather samples from the sphagnum mat, we have no data to confirm this.

The disc in the Secchi reading for Forest Service Bog was visible all the way to the bottom. This means that the sun light could penetrate all the way through and there were no suspensions, such as excess phytoplankton, to obscure the light penetration.

Discussion

The glaciers in Northern Wisconsin (where UNDERC is located) caused two water flows, one going in a northern direction and the other in a southern direction. Because of these two water flows, it was inevitable that the land would become covered by many lakes and streams.

A lake is an accumulation of water in a basin, usually the work of a glacier. Lakes are very transitory bodies of water, and from the moment they are formed they begin to fill in. Due to the watershed, lakes are greatly affected by changing lands around them because most of the material that enters a lake will remain there. Precipitation, erosion, and deposition all contribute to the filling in of the lake, and eventually its death. They turn it to marsh and then dry land, a process that takes thousands of years.

Each year a lake goes through a cycle. It becomes stratified in layers at different densities and temperatures. In the spring the sun warms the surface of the water and the wind mixes the layers. Nutrients from the bottom are carried to the surface, therefore algae soon flourish, while the depths are also supplied with oxygen to dispose of organic matter through decay. The heat of the sun spreads slowly through the water, the top warms quickly but the bottom stays cool. Water becomes less dense as it warms, therefore there is a sharp division between the upper and lower layers. This division is called a thermocline. Oxygen cannot penetrate this thermocline and animals at the bottom may face oxygen depletion or even death. This thermocline also prevents the rise of nutrients, so phytoplankton is limited. As the season progresses the phytoplankton is consumed and more are not produced, thus a decrease in their number results.

In the fall the water cools, the density becomes equal and oxygen is restored to the bottom. The lake then freezes, allowing no more oxygen in, and all life trapped below is slowed for the winter. Spring returns and the cycle begins once again. So, throughout the year there is a fall and a spring turnover, both serving to regenerate nutrients and oxygen to the water.

There are basically two types of lakes, those that are eutrophic and those that are oligotrophic. Eutrophic lakes are very productive and oligotrophic lakes are not, with varying degrees in between, these two being the extremes. Oligotrophic lakes are usually deep, bowl shaped, contain few life forms, and have low hardness, alkalinity, and conductivity. Eutrophic lakes are shallow and rich in dissolved nutrients, thus supporting more organic life. These nutrients come from the rich soils surrounding the lake and also from the watershed. $PO_4^{\equiv}$ is the most important nutrient because it is the limiter for phytoplankton and thus determines the amount produced.

Eutrophic lakes have an abundance of phosphorus and nitrogen, therefore there will be more plant and animal life. This means more will die and collect on the bottom, thus making the lake shallower. These chitinous and siliceous shells of the millions of plankton will eventually fill the lake. As the lake becomes shallower, it becomes more fertile, which produces more life causing the lake to fill in even faster. This usually causes the bottom to be soft and muddy due to decomposition. All lakes will die naturally and a eutrophic lake is in the stage of succession towards turning to marsh and then dry land.

A bog is a body of water quite different from a lake. To form, its basin must be sealed off from the surrounding groundwater so outside influence from other water is minimized. Bogs form in a poorly drained, infertile region, or where a small, northern, fresh water lake becomes overgrown with plants and is choked by their remains.

The sphagnum mat is the major characteristic of a bog. High humidity and acidity starts the plant growth, then sphagnum out competes all the other plant forms. Bogs are seepage bodies of water; all their nutrients come from the land and watershed. The sphagnum mat catches and retains the nutrients before they reach the water and therefore causes the productivity to be low.

A bog never turns over; it is deep and easily stratified. There is no oxygen in the hypolimnion, it contains hydrogen sulfide instead. The acidity of a bog comes from the sphagnum mat.

As one approaches a bog, the trees will become stunted. They can be very old but will remain small due to the sphagnum mat taking the majority of the nutrients. Out of the sphagnum mat grow shrubs, such as Labrador Tea, and various insect eating plants. All plants need nitrogen in order to survive. Bogs have a very low nitrogen content. Insect eating plants are able to acquire their nitrogen and nitrates from the insects that they catch, which is why they thrive in a bog area much better than other types of plants do.

Plankton is a form of small drifting animal and plant life. Many of the animals are protozoa and many of the plants are algae and diatoms. Algae is the base of the food chain and the base of lake life.

There are three basic types of lake life. They are the producers, the consumers, and the decomposers. The producers are the green plants, mainly algae, which take carbon dioxide, water, oxygen, nitrogen, and sulfer and convert it to a food source for other organisms. All other pond life depends upon this. The consumers are the zooplankton and other small animals which eat this phytoplankton as the major part of their diet. Larger animals and fishes then eat the zooplankton, and thus a food chain is formed. The decomposers are also an important part of this cycle because they use the remains of the dead plants and animals for food and release the minerals and nutrients back into the environment, thus recycling them for further use.

An ecosystem is a system composed of both living and non-living parts. The non-living parts are such things as the amount of energy available, the temperature, the type of soil, the topography, etc., and these together determine the type of life that can exist, and its effect on others. These factors affect the water chemistry which determines the types of plants and animals capable of surviving. These plants and animals, upon their death, affect the non-living part of the ecosystem because they drop to the bottom and collect there, thus making the lake more shallow.

Morris Lake and Forest Service Bog are two bodies of water that differ greatly, even though they are both probably of glacial origin and are in fairly close proximity with each other. Morris Lake is in a fairly open area and subject to the wind and harsh weather, whereas Forest Service Bog is in a very sheltered area. A sheltered lake is not able to turn over or circulate as an open area lake is. This stillness has a great affect on the amount of nutrients available.

Both lakes have a hill on at least one side. This affects the water and nutrients that enter the lake due to the watershed. With Morris Lake, the soil and nutrients are washed into the lake, but with Forest Service Bog, the sphagnum mat captures and retains these nutrients, allowing none or very few of them to reach the water. Also Morris Lake is a drainage lake, whereas Forest Service Bog is seepage. Morris Lake has a fresh supply of nutrients and new materials continuously circulating in, whereas Forest Service Bog can only depend on watershed or the soil immediately surrounding it. The amount of nutrients in a body of water determines the productivity. Morris Lake has an abundance of nutrients entering from many sources, and thus is a much more productive lake than Forest Service Bog which is limited in its nutrients, and therefore has a low productivity.

Plants depend on the essential elements and nutrients in order to survive;the different types and amounts of these will produce different kinds of vegetation. Each organism has minimum requirements and maximum tolerances which is why different organisms are found in different environments. The more nutrients, though, the better the productivity, which is confirmed by our plankton data.

Keratella cochlearis is the most abundant type of plankton in both lakes. This animal must have a wide range of adaptive abilities and be able to survive in extremes, since Forest Service Bog is quite acidic and Morris Lake is almost neutral. Sinantherina is also fairly abundant in both. Rotifers as a whole, seem to be the most abundant form of plankton found.

After all the data ~~has~~ have been compared and contrasted, it is easy to see that the lakes are similar in some ways yet differ in many other ways. In years to come Forest Service Bog will be completely taken over by the sphagnum mat until water is visible no longer. Morris Lake is on its way to becoming a marsh and eventually dry land. These processes will take many years and many biological changes, but the death of lakes is inevitable and a natural part of geological succession.

BIBLIOGRAPHY

Bardach, John, Downstream: A Natural History of the River, Harper and Row Publishers, New York, 1964.

Nickelsburg, Janer, Ecology: Habitats, Niches, and Food Chains, J. B. Lippincott Company, New York, 1969.

Pringle, Laurence, Ecology: Science of Survival, Macmillan Company, New York, 1971.

World Book Encyclopedia, volumes 15 and 18, 1972.

These resources were used in addition to any of the books, pamphlets, or other materials supplied at UNDERC.

Water Chemistry Data
UNDERC 1981
Dr. Duman

Jeanne Grasso
Emmanuel Musa
Marty Pallante

Morris Lake (6/2/81)

<u>Topography</u>: Mostly surrounded by conifers with some hardwoods. There is small brush and reeds around the shoreline and there is a large hill to the SE.

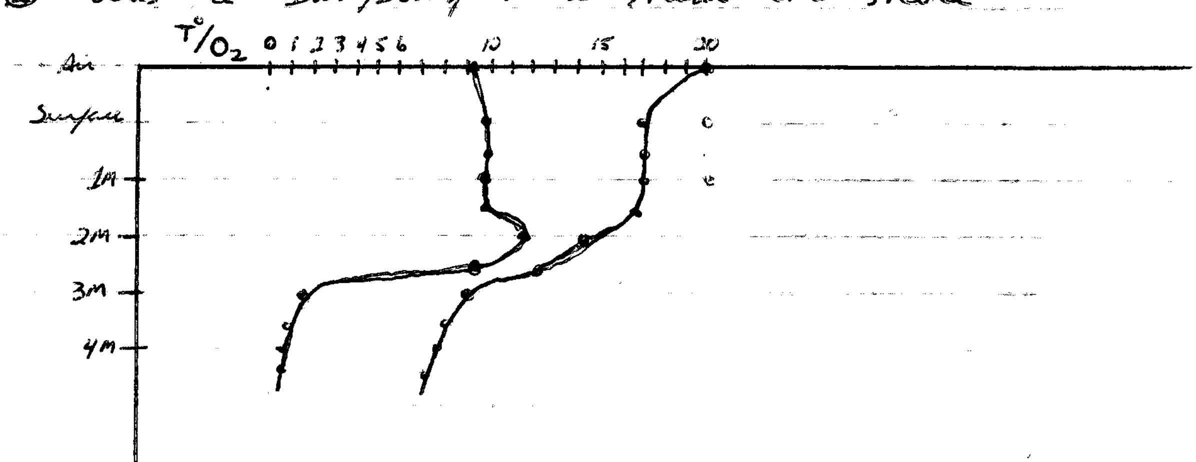
<u>Testing Conditions</u>: Nice day with a slight wind.

YSI Data:

Depth	PPM ①	PPM ②	T°C ①	T°C ②
Air	9.2	9.2	20°C	20°C
Surface	9.8	9.0	17	17
½ M	9.8	9.3	17	17.5
1 M	9.6	9.0	17	17
1½ M	9.6	9.0	16.5	17.5
2 M	11.2	10.2	14	14
2½ M	9.0	5.5	11.5	11
3 M	1.2	.6	8.5	10.5
3½ M	.6	~~NR~~	7.5	~~NR~~
4 M	.4	—	7	—
4½ M	.4	—	6.5	—

① Was a sampling area in the deepest part of the lake

② Was a sampling area near the shore



Jeanne Grasso
Emmanuel Musa
Marty Pallante

Long Lake (6/3/81)

Topography: Surrounded mainly by conifers with a few hardwoods. It is protected well from side to side but may get a lot of wind from end to end.

Testing Conditions: Fairly quiet - little wind

YSI Data

Depth	PPM ①	PPM ②	T°C ①	T°C ②
Air	8.6	9.3	22	19
Surface	9.2	9.0	18	19
½ M	8.8	9.0	17.5	19
1 M	9.0	9.5	18	18.8
1½ M	8.9	8.6	18	18
2 M	8.0	8.6	17	17.5
2¼ M	8.8	—	16	—
2½ M	9.5	9.4	15	16
2¾ M	9.0	—	14	—
3 M	8.2	10.	13	13
3¼ M	8.4	9	11.5	11
3½ M	8.0	8.8	11	10.5
3¾ M	7.0	—	10	—
4 M	4.5	<4	9.5	9
5 M	0	0	8	7.5
6 M	0	0	7	—
8 M	0	—	6.5	—

One sample taken at each end of Long Lake

Secchi Disc 3¼ M (sunny) 2½ M (cloudy)

pH 5.0

H_2S positive at 6 M

Jeanne Grasso
Emmanuel Musa
Marty Pallante

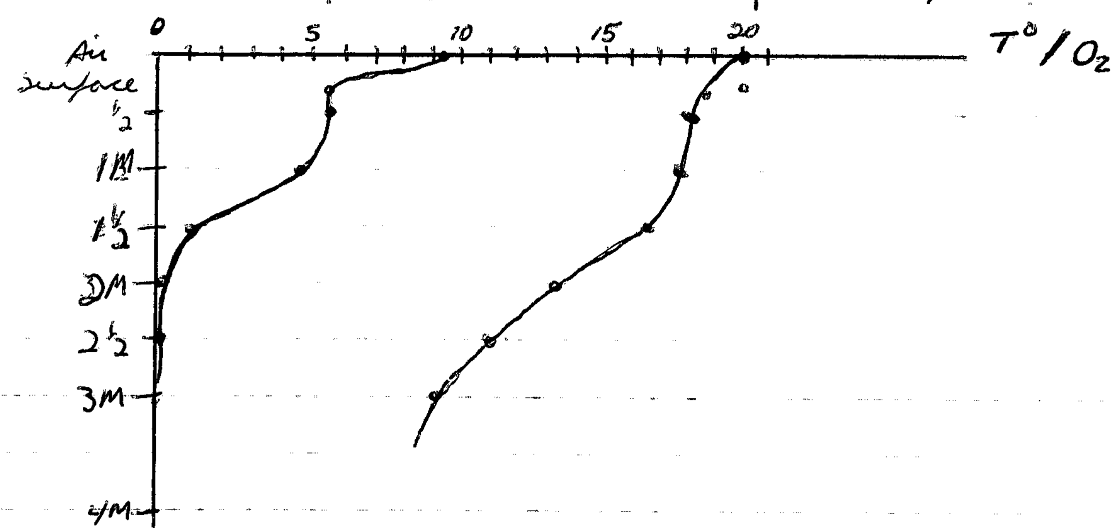
Forest Service Bog (6/4/81)

__Topography__: Sheltered by hills - it sits very low and is very protected. It has a very large bog mat at whose inner edge are dead spruce trees and at whose outer edge are black spruce and larch trees.

__Testing Conditions__: Very Calm and Sunny

YSI Data:

Depth	PPM	T°C
Air	9.2	20
Surface	5.4	18.5
½	5.4	18
1	4.6	17.8
1½	.9	16.3
2	0	13.5
2½	0	11
3	0	9



Secchi disc 3M (Bottom)
PH 4.8
H_2S Negative

Jeanne Grasso
Emmanuel Musa
Marty Pallante

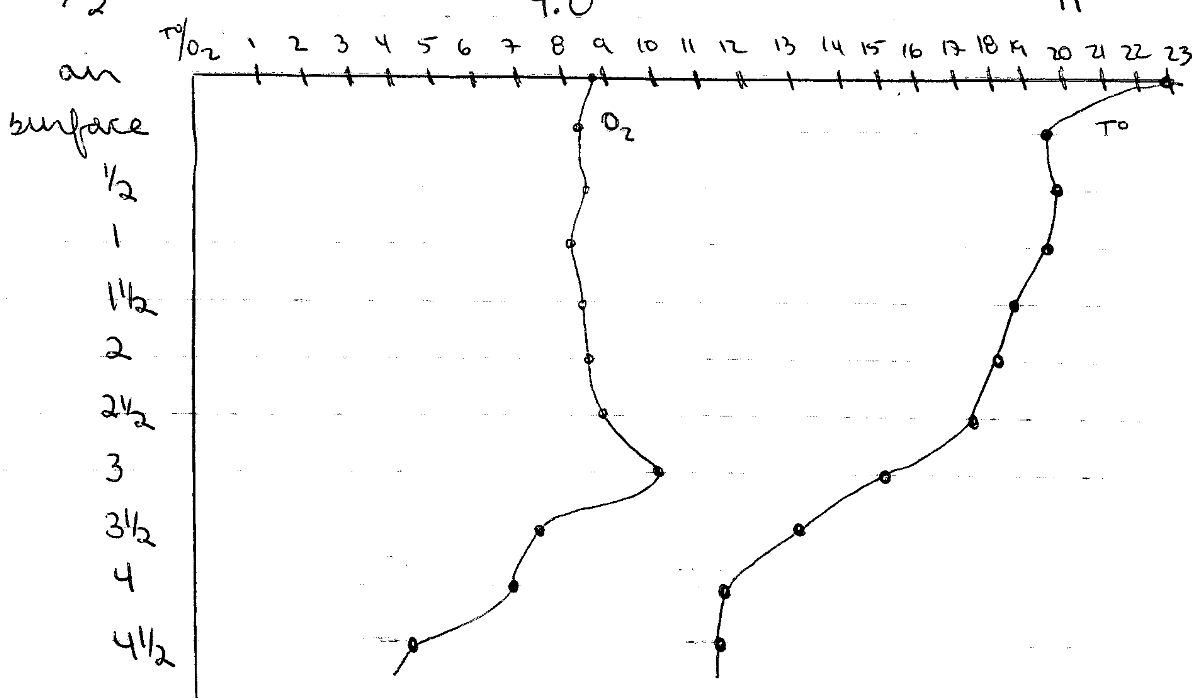
Bay Lake (6/5/81)

__Topography__: Large, fairly open lake with many bays; one sample was done in an arm of one of those bays which is nearly cut off by a part of land.

__Testing Conditions__ - Very Windy, but sunny

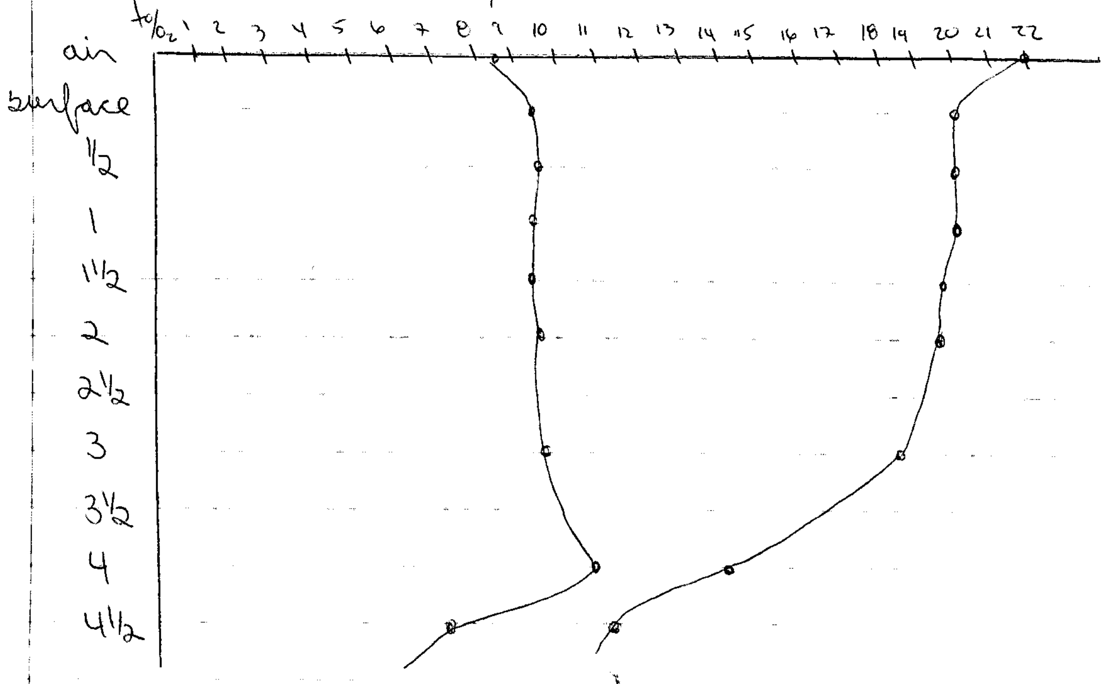
YSI (closed in port)

Depth	PPM	T°C
Air	8.7	23°
Surface	8.3	19.5
½	8.3	19.5
1	8.0	19.2
1½	8.2	18.5
2	8.3	18
2½	8.5	17.5
3	9.9	15
3½	6.9	13
4	6.4	11
4½	4.0	11



Yvonne Grasso (5)
Emmanuel Musa
Marty Pallante

Bay Lake (continued)



Tests	closed in part			outside of closed in part	
	1m	bulge	4m	1m	3½m
acidity	50	45	50	55	55
alkalinity	6	6	6	6	6
color (true)	25	25	25	25	25
(apparent)	25	25	30	25	25
Mg^{++}	6	5	6	6	6
Ca^{++}	8	8	8	8	8
total	14	13	14	14	14
sulfate	5	4	4	4	3
nitrate	.6	.5	.6	.5	.5
conductance	19	19	19	21	19
pH	5.8 ⟶				
secchi		4 m			4m

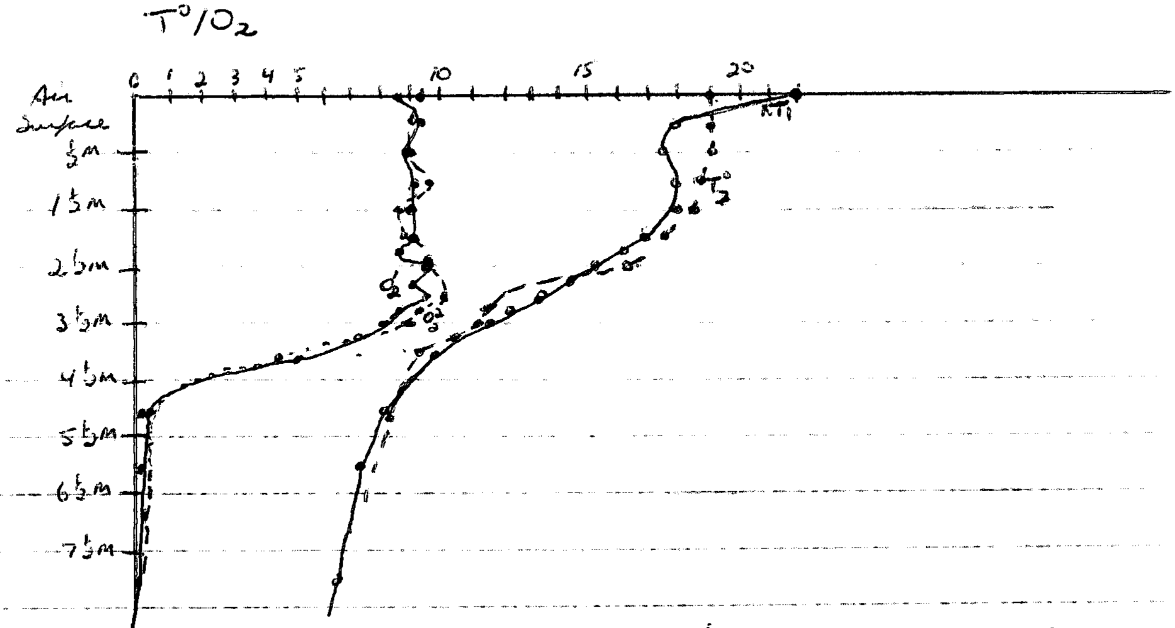
We tested two parts of Bay Lake. One part was becoming closed off by vegetation, and the other was outside of this area. We did both to determine if this segregation would change the water chemistry.

→

Secchi Disc	1.3 M
pH	6.0
H_2S	Negative

Test	1M	2M	3½M
Acidity	60 mg/l	47 mg/l	50 mg/l
Alkalinity	50 mg/l	45 mg/l	40 mg/l
Hardness (Total)	48 mg/l	45 mg/l	50 mg/l
Ca^{++}	38 mg/l	35 mg/l	38 mg/l
Mg	10 mg/l	10 mg/l	12 mg/l
Sulfate	1 mg/l	0 mg/l	2 mg/l
Nitrate	.7 mg/l	.5 mg/l	.6 mg/l
Phosphate (Total)	.2 mg/l	.1 mg/l	.1 mg/l
— Ortho	.075 mg/l	.06 mg/l	.085 mg/l
Specific Conductance	42 units (mhos)	41 units (mhos)	42 units (m s)
Color Apparent	80 units	80.5 units	90 units
True	80 units	80 units	80 units

Plankton	#/ml
Keratella cochlearis	8925
Bosmina coregoni	125
Trichocerca	75
Asplanchna	150
Nauplius Larva	975
Dinobryon bavaricum	850
Ceratium hirundella	1125
Tabellaria	2225, 75, 50, 125
Asterionella	2300
Sinantherina	775
Desmidium	25
Oscillatoria	125
Synedra	75
Fragellaria	75
Cyclops bicuspidatus	25
[illegible]	125



Tests	1M	2½ M	6M
Acidity	125 mg/l	100 mg/l	120 mg/l
Alkalinity	0 mg/l	0 mg/l	0 mg/l
Color Apparent	50 units	50	30
True	48 units	48	48
Hardness (Total)	14 mg/l	15 mg/l	14 mg/l
Ca^{H}	8 mg/l	9 mg/l	8 mg/l
Mg	6 mg/l	6 mg/l	6 mg/l
Nitrate	.5 mg/l	.5 mg/l	.4 mg/l
Sulfate	5.5 mg/l	8.0 mg/l	6.0 mg/l
Specific Conductance	9.6 mhos	9.0 mhos	9.5 mhos

Plankton Sample

	#/ml		
Dinobryon cylindricum	657	Asplanchna	15
Keratella cochlearis	183	Cyclops vernalis	15
Asterionella	126	Oscillatoria	12
Volvox	30	Metanauplius Larvae	9
Tabellaria	48, 24, 12	Holopedium gibberum	12
Desmidium	15	Kellicottia longispina	9
Diatoma	12	Daphnia Longispina	1
Staurastrum	6		

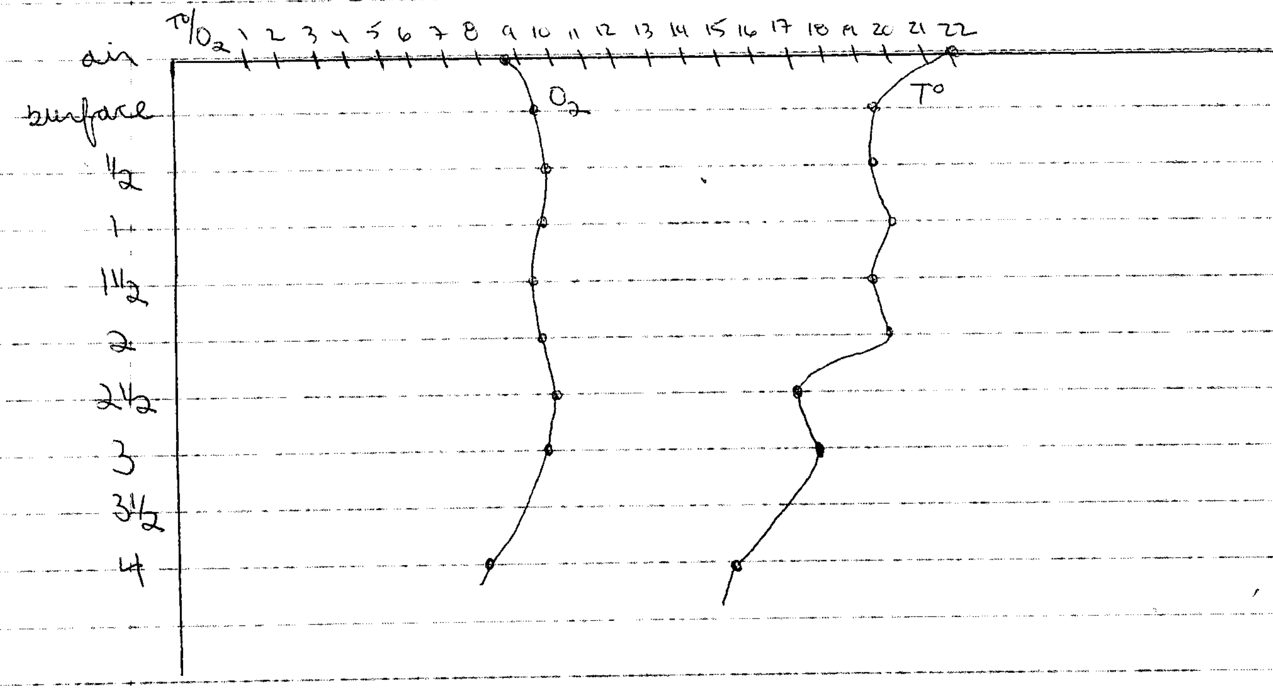
Test	1M	2½M
Acidity MO	5.5 mg/l	5.5 mg/l
Phenolphthalein	130 mg/l	125 mg/l
Alkalinity	3 mg/l	3 mg/l
Hardness (Total)	5 mg/l	5 mg/l
Ca^{++}	0	0
Mg	5 mg/l	5 mg/l
Color Apparent	40 units	45 units
True	30 units	30 units
Nitrates	.4 mg/l	.5 mg/l
Sulfates	2 mg/l	2 mg/l
Specific Conductance	11.2 mhos	15.6 mhos

Plankton Sample

Epischura lacustris	36 / ml
Keratella cochlearis	235 / ml
Oscillatoria	10 / ml
Holopedium gibbernum	90 / ml
Nauplius larva	61 / ml
Sinanthrium	186 / ml
Desmidium	10 / ml
Daphnia	26 / ml
Dinobryon	20 / ml
Volvox	13 / ml

YSI (outside of closed in part)

depth	T°	O_2
air	22°	8.8
surface	19.5	9.2
½	19.5	9.4
1	19.8	9.3
1½	19.2	9.0
2	19.5	9.2
2½	17	9.5
3	17.5	9.4
4	15	7.8



YSI (middle of lake)

depth	T°	O_2
air	22°	8.8
surface	20°	9.3
½	20°	9.4
1	20°	9.3
1½	19.5	9.3
2	19.5	9.4
2½	~~18.2~~	~~9.5~~
3	18.2	9.5
3½	14	10.7
4	[illegible]	[illegible]

Our water chemistry tests came out almost identical for both parts of the lake, but our O_2 readings differed greatly.

The O_2 reading in the closed in part went down to four, whereas ~~the~~ outer part only went down to seven. This means ~~that the~~ inner part stratifies more easily because it is closed in. The outside part is very open and subjected to ~~the~~ wind which turns over ~~the~~ water easily, thus giving us a fairly high O_2 reading as low as 4 1/2 meters