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Lake Report on Roach Lake in Gogebic Co., Mich./ Vilas Co., Wisc. and Mullahy Lake in Gogebic Co., Mich.

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A. General Descriptive

The two lakes that I will cover in this report are Roach Lake and Mullahy Lake on the UNDERC-Notre Dame Properties in Michigan and Wisconsin.

Roach Lake is an oligotrophic lake that is over 25 feet deep in spots. It has no obvious inputs of water other than land runoff and is probably spring fed. There is no apparent drainage such as channels or rivers and probably has seepage as its source of output. The water is very clear as is indicated by a Secchi disc reading of 4.2 meters on a windy day. The bottom sediments where visible consist of medium to small sized rocks and sand. There was very little sediment on the bottom or much around the shorelines (except around the dock), however there was a large amount of soft sediments found in a Kemmerer sample taken from the bottom at 7 meters. The surrounding land was gently rolling and had rather sparse undergrowth. The trees around the lake were dense and went right up to the waters. These forests consist of white birch, aspen and pines, some of which were relatively large. The aquatic macrophytes which were clustered largely in coves were the Fragrant Waterlily (Nymphaea oderata) and floating mats of an unidentified macrophyte. The macroinvertebrate population was rather sparse probably due to lack of cover and easy predation by the large fish population (largemouth bass, perch and pumpkinseed), in this very clear water. The total surface area is 38.4 hectares.

Mullahy Lake provided a stark contrast to Roach Lake. The most obvious being in size as Mullahy Lake is only 0.5 hectares. Its' water too was relatively clear, however since it was less than 2 meters deep, obvious seasonal variations would occur. This lake appears to receive input from run-off and possibly from Reddington Lake which is northwest of it. Mullahy empties via a narrow, weed-choked channel into Ward Lake. The bottom sediments were very soft and the Secchi disc sank almost a full meter into the muck. The surrounding landscape was rather flat and the lake was surrounded by either low dense shrubs or elsea mat consisting of sedges and other low dense plants but not a typical bog mat. The aquatic macrophytes were mainly the Sedge (Carex sp.) and the Fragrant Waterlily (Nymphaea odorata) which was all over this very shallow lake. The macroinvertebrate population living on the lily pads was quite large, probably due to good, plentiful cover and a small fish population of sunfishes and tadpoles.

B. Water Chemistry

Roach Lake (refer to following pages)

This lake possesses some unique characteristics which are immediately obvious upon consulting the tables for Roach Lake. First of all, the pH is slightly acidic at 5.8. When one views acidity and alkalinity, he sees the phenolpthalein acidity is high at 60-70 mg/l , while the alkalinity is 0 mg/l. Because the bicarbonate and normal carbonate that are bound in this lake are very low, the free CO2 content must be very high to support the vast amount life present in Roach Lake. Due to the aforementioned characteristics, we could term this a soft- water lake. As mentioned before the lake was very clear and this can be seen in the apparent color and Secchi disc readings. The specific conductance was low which means that there were few electrolytes in solution. The hydrogen sulfide values were 0 mg/l at 5 meters but some was found at greater depth. The phosphate values were fairly low compared to most of the other lakes studied by our class as were the amounts of nitrate found. This indicates that Roach Lake is not overnutrified, or becoming eutrophic. The amounts found for hardness were different in that the total hardness was very low- 10 mg/l but Mg# was equivalent to Ca# and this is unusual in that calcium hardness is usually much greater. The dissolved oxygen curve reveals the expected decrease with depth of O2 until 4 meters, the jump after here reveals either the presence

of hydrogen sulfide or a deep water algae bloom which is possible due to the clearness of the water. The temperature profile reveals a lake that has completed turnover and is starting to stratify with the thermocline starting at about 2 meters.

ROACH LAKE — Water Chemistry 5/30/78 AM

Water sampled at shallow (1 m.) and deep (5 m.) depths

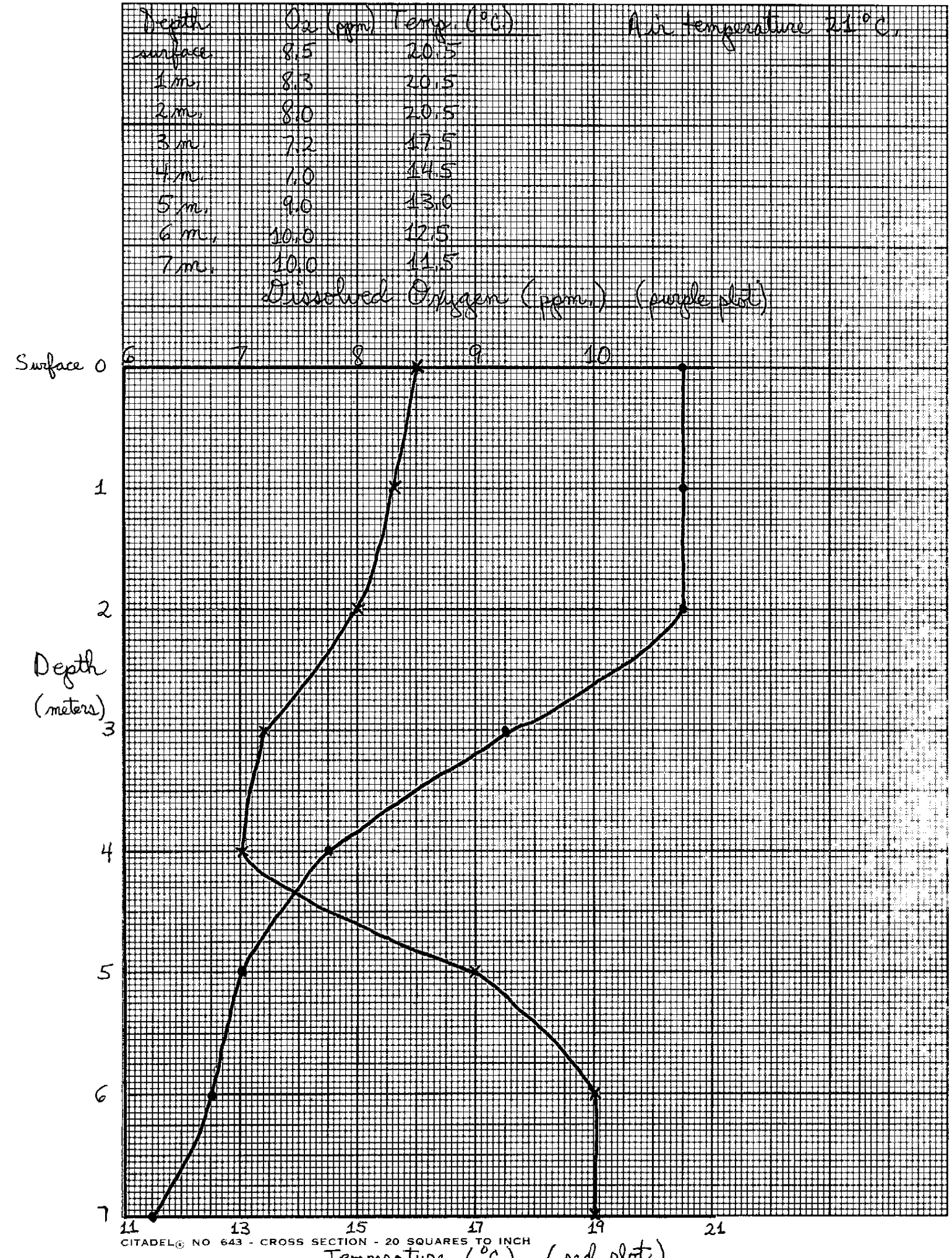
Test	Shallow	Deep
Acidity (mg/l)		
Methyl Orange	0	0
Phenolpthalein	70	60
Alkalinity (mg/l)	0	0
Color (apparent) (units of color)	20	30
Hardness (mg/l)		
Total	10	10
Ca^{++}	5	5
Mg^{++}	5	5
Nitrate (mg/l)	0.30	0.10
Phosphate (total) (mg/l)	0.14	0.14
pH	5.8	5.8
Specific Conductance (micromhos/cm)	19	18
Hydrogen Sulfide (mg/l)	0	0

Secchi Disc (in meters) disappeared at 4.2 meters

ROACH LAKE → Oxygen-Temperature Profile for 5/30/78 AM (6)

Depth	O_2 (ppm)	Temp. (°C.)
surface	8.5	20.5
1 m.	8.3	20.5
2 m.	8.0	20.5
3 m.	7.2	17.5
4 m.	1.0	14.5
5 m.	9.0	13.0
6 m.	10.0	12.5
7 m.	10.0	11.5

Air temperature 21°C.



B. Water Chemistry (continued)

Mullahy Lake (refer to following pages)

The pH for Mullahy Lake was almost neutral at 7.1 and the phenolpthalein acidity and the alkalinity were very close at 50 and 53 mg/l respectively. Like Roach Lake, the water was quite clear as can be seen by the apparent color value and the Secchi disc visibility to the bottom. Care had to be taken not to disturb the bottom sediments as they clouded the water easily. Specific conductance was high which meant a lot of electrolytes were in solution. The hydrogen sulfide was found to be 0 mg/l even in the easily obtainable bottom sediments. This meant that the entire water column was well oxygenated. The phosphate and nitrate values were relatively high compared to other lakes studied and this showed available nutrients for greater productivety which was possible as this lake appeared to be filling in quickly. The total hardness was about average for the studied lakes with the Ca# greatly exceeding the Mg# as is expected. The dissolved oxygen curve reveals a well oxygenated lake from top to bottom. Likewise, the temperature profile shows a very uniform lake with no stratification (or therefore thermocline). Both of these plots would be expected for a lake that is this shallow.

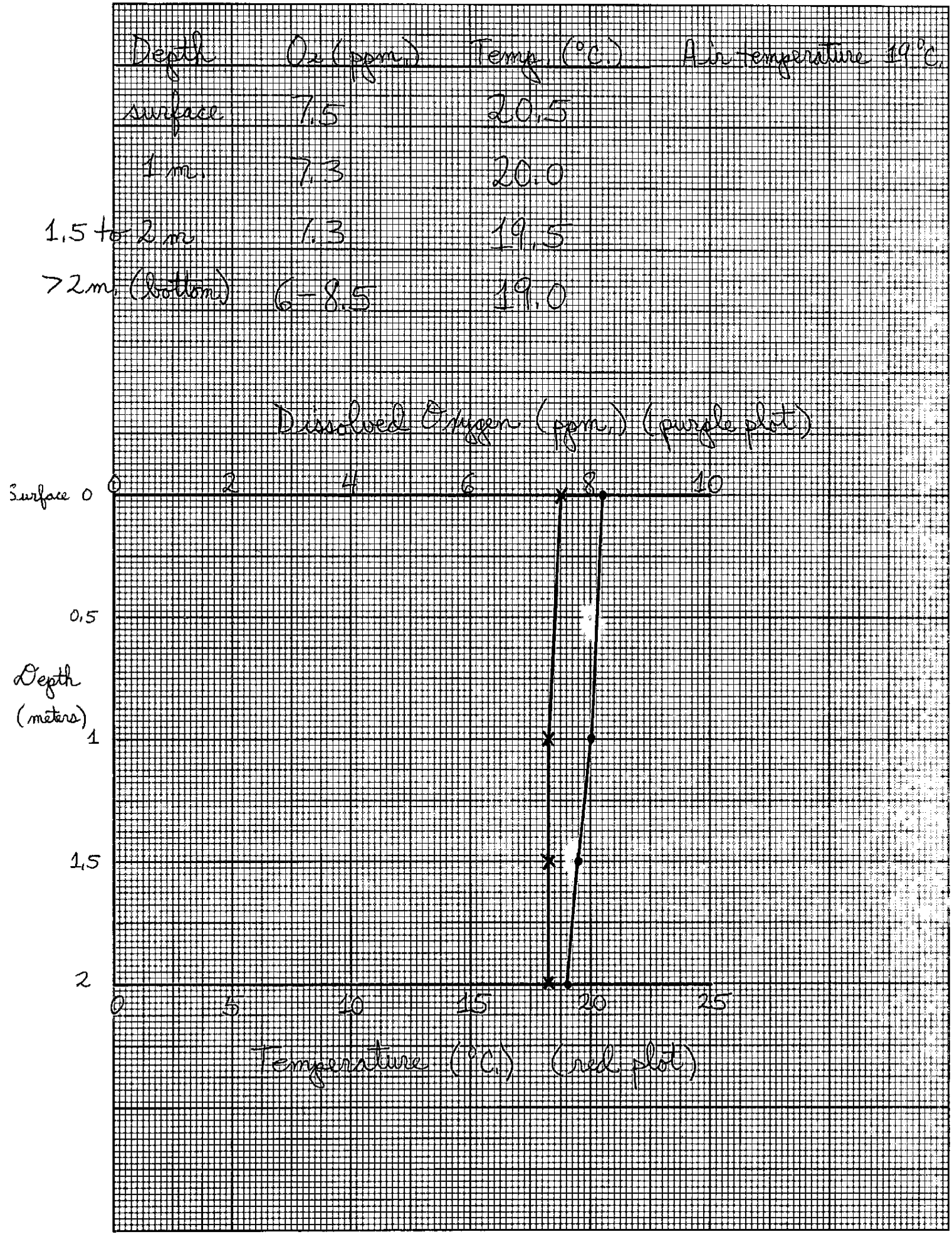
MOHAWK LAKE - Water Chemistry 5/31/78 AM

Water sampled only at 1 meter due to maximum depth of 1.5 meters in lake

Test	Result
Acidity (mg/l)	
Methyl Orange	0
Phenylpthalein	50
Alkalinity (mg/l)	53
Color (apparent) (units of color)	20
Hardness (mg/l)	
Total	55
Ca^{++}	40
Mg^{++}	15
Nitrate (mg/l)	0.60
Phosphate (mg/l)	0.88
pH	7.1
Specific Conductance (micromhos/cm)	98
Hydrogen Sulfide (mg/l)	0 (none detectable)
Secchi Disc (in meters)	visible to bottom at 1.5 meters

Mullahy Lake → Oxygen-Temperature Profile for 5/31/78 AM

Depth	O_2 (ppm)	Temp. (°C.)	Air temperature 19°C.
surface	7.5	20.5	
1 m.	7.3	20.0	
1.5 to 2 m.	7.3	19.5	
>2 m. (bottom)	6-8.5	19.0	



C. Plankton

For both of these lakes, I am not going to talk about the sampling procedure or possible sources of error, because there is no foolproof way to sample plankton. All I will discuss is the contents of the obtained samples.

Roach Lake (refer to following pages)

The AM sample contained 8 genera of phytoplankton, with the majority of them being blue-green algae (52%), similarly the PM sample contained 7 genera of phytoplankton of which 95% were blue-green algae. The difference between the two samples is due to a vast increase in Chroococcus in the PM sample which could be a bloom or the migration to the surface of this algae (which is possible because blue-greens stay deep in the water during the day-sunlight). The overlap between AM and PM is 5 genera and no conclusions can be drawn by me as to the exceptions, except maybe sampling method. The PM to AM phytoplankton ratio of 2.8 to 1 is explained by the large numbers of Chroococcus.

The AM sample contained 7 genera of zooplankton as did the PM sample. Out of the 7 genera, 6 were found in both samples and the AM to PM zooplankton ratio was 1 to 1. No great discrepancies were found in the zooplankton that couldn't possibly be due to sampling methods.

The AM phytoplankton to zooplankton ratio was 9.5 to 1 and the PM samples' ratio was 25 to 1, again the disparity being due to the large numbers of Chroococcus that were in the PM sample.

Roach Lake – AM Sample

Phytoplankton	Number counted	Number per ml.
Blue-Green Algae		
Anabaena	60	1260
Chroococcus	200	4200
Oscillatoria articulata	60	1260
Green Algae		
Pediastrum tetras	2	42
Desmids		
Asterionella	30	630
Staurastrum	20	420
Dinoflaggellates		
Peridinuim	100	2100
Yellow-Green Algae		
Dinobryon	140	2940
Total	612	12852
Zooplankton		
Nauplius larvae	5	105
Rotifers		
Keratella cochlearis	10	210
Testudinella sp.	2	42
Cladocerans		
Bosmina longirostris	4	84
Holopedium gibberum	3	63
Copepods		
copepodites	13	273
Diaptomus	15	315
Orthocyclops modestus (Herrick)	3	63
Senecella calanoides	9	189
Total	64	1344

ROACH LAKE – PM SAMPLE

Phytoplankton	Number counted	Number per ml.
Blue-Green Algae		
Anabaena	40	840
Chroococcus	1500	31500
Polycystis	50	1050
Desmids		
Asterionella	22	462
Staurastrum	5	105
Yellow-Green Algae (Diatoms)		
Dinobryon	60	1260
Navicula	1	21
total	1678	35238

Zooplankton		
Nauplius larvae	14	294
Rotifers		
Keratella cochlearis	10	210
Cladocerans		
Bosmina longirostris	2	42
Holopedium gibberum	4	84
Polyphemus pediculus	6	126
Copepods		
copepodites	5	105
Diaptomus	13	273
Orthocyclops modestus (Herrick)	5	105
Senecella calanoides	7	147
total	66	1386

C. Plankton (continued)

Mullahy Lake (refer to following pages)

The PM sample contained 6 genera of phytoplankton with the blue-green algae Chroococcus representing 91% of the sample. Likewise in the AM test this algae was again dominant showing up as 70% of the sample. When adding on Polycystis (which was absent in the evening), the blue-greens represented 95% of the sample. The reason for the disappearance of Polycystis at evening is unclear to me because I don't have any knowledge of any factor in its biology which could account for this change from day to night. Perhaps we encountered a bloom or a localized population during the day that was missed in the PM collection. The AM sample also contained 6 genera of which 4 were overlaps from the PM sample, the exceptions excluding Polycystis (AM- Staurastrum 2 and PM- Netrium 1, Tabellaria 5) were not dominant phytoplankton and were probably just absent from the samples or counting area. The AM to PM phytoplankton ratio of 1.3 to 1 is very similar, the difference being attributable to Polycystis.

The AM sample contained 6 genera of zooplankton as did the PM sample, with 4 of the 6 genera of each sample being the same. In the AM sample, Diaptomus represented 35%, while in the PM it showed as 32% and in both samples it was the major zooplanktor. The drop from AM to PM of Keretella cochlearis (28.5% of total to 6.5%) should be noted,

but the reason, I can't even hazard to guess. The AM to PM zooplankton ratio was 1 to 1.3, the increase due to more nauplius larvae in the PM count; their appearance here could be due to attempt to escape predation from fellow zooplanktors by night feeding.

The AM phytoplankton to zooplankton ratio was 14.5 to 1 and this larger value (than Roach Lake) could be expected because the phytoplanktors have difficulty hidding in a 1.5 to 2 meter lake. The PM samples' ratio was 8.8 to ! which could show the zooplanktor coming up to feed at night when they are safer from predators.

Mullahy LAKE — AM SAMPLE

Phytoplankton	Number counted	Number per ml.
Blue-Green Algae		
Chroococcus	500	10500
Polycystis	180	3780
Desmids		
Staurastrum	2	42
Yellow-Green Algae (Diatoms)		
Dinobryon	1	21
Navicula	29	609
Synedra	1	21
total	713	14973

Zooplankton		
Nauplius larvae	4	84
Rotifers		
Asplanchna sp.	1	21
Keretella cochlearis	14	294
Cladocerans		
Bosmina coregoni	2	42
Copepods		
copepodites	1	21
Diaptomus	17	357
Orthocyclops modestus (Herrick)	1	21
Senecella calanoides	9	189
total	49	1029

Mullahy Lake - PM Sample

Phytoplankton	Number counted	Number per ml.
Blue-Green Algae		
Chroococcus	500	10500
Desmids		
Netrium	1	21
Yellow-Green Algae (Diatoms)		
Dinobryon	1	21
Navicula	30	630
Synedra	10	210
Tabellaria	5	105
total	547	11487

Zooplankton		
Nauplius larvae	12	252
Rotifers		
Asplanchna sp.	6	126
Enteroplea lacustris	2	42
Keratella cochlearis	4	84
Copepods		
copepodites	3	63
Cyclops	6	126
Diaptomus	20	420
Senecella calanoides	9	189
total	62	1302

D. Discussion/Analysis

Roach Lake is a very clear oligotrophic lake that has an excellent fish population. It possesses some strange chemistry characteristics which were discussed in the water chemistry section. Its' plankton population appears to stay consistent from day to night, however, large blooms do occur in the lake as we witnessed two of them while at UNDERC.

Mullahy Lake is a very small, eutrophic lake with high productivity and seems to be filling in quickly. Its' water chemistry and planktors have already been discussed.

I know that we could not have done more sampling on these lakes with the time that was available. Likewise, I have to withold conclusions or value judgements on these lakes since we sampled them 1 out of 365 days of the year and all studies that I have seen on lakes were done more than once and over long periods of time. If we tried to generalize from our one sampling day, we would be opening ourselves to all sorts of known biases. I think I have said what I could about Roach Lake on 5/30/78 and Mullahy Lake on 5/31/78.

PS It was a great learning experience, thanks !

BIBLIOGRAPHY

Eddy, S. & Hodson, A.C. 1961. Taxonomic Keys to the Common Animals of the North Central States. Burgess Publishing Co. Minneapolis, Minn. 162 pp.

Lind, O.T. 1974. Handbook of Common Methods in Limnology. The C.V. Mosby Company. Saint Louis. 154 pp.

Needham, J.G. & Lloyd, J.T. 1937. The Life of Inland Waters. Comstock Publishing Company, Inc., Ithaca, N.Y. 438 pp.

Needham, J.G. and Needham, P.R. 1962. A Guide to the Study of Fresh-Water Biology (5th ed.). Holden-Day, Inc., San Francisco, Calif. 108 pp.

Pennak, R.W. 1953. Fresh Water Invertebrates of the United States. The Ronald Press Co., New York, N.Y. 769 pp.

Reid, G.K. and Wood, R.D. 1976. Ecology of Inland Waters and Estuaries. D. Van Nostrand Company, New York, N.Y . 485 pp.

Welch, P.S. 1948. Limnological Methods. The Blakiston Company, Philadelphia, Pa. 381 pp.

Wetzel, R.G. 1975. Limnology. W.B. Saunders Company, Phila - delphia, Pa. 743 pp.