Relationship Between Macrophyte Presence and Chemical Composition of

Ten Bog-Like Habitats and Three Lakes

BIOS 569 - Practicum in Aquatic Biology

Karen Francl
307 Farley Hall
Notre Dame, IN 46556-5609
Dr. Hellenthal
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ABSTRACT

The presence or absence of macrophyte species may be used as indicators of the sites' nutrient availability or degree of productivity and emphasize minuscule distinctions between sites of similar chemical composition. In this study, three lakes and ten bog-like habitats at the University of Notre Dame's Environmental Research Center were examined according to their water chemistry and macrophyte composition. Tests for pH, alkalinity, conductivity, color, sulfide, oxygen, and temperature, as well as a secchi disc reading, were performed. One hundred thirty-one species were identified in the thirteen habitats. Results suggest a relationship between pH and species presence; even a slight change in pH may be reflected in significantly different macrophytes inhabiting the area.

INTRODUCTION

Although their chemical make-up has been well documented, the relationship between the chemical conditions and the aquatic macrophytes that inhabit and surround the bodies of water has yet to be determined. A survey of the plant species specific to each lake, fen, or bog would provide much information about the micro habitats. The ability of certain species to exist within a habitat reveals a great deal about the water's chemical qualities. Amid much interspecific competition and predation lives a variety of macrophytes that have adapted well to the given aquatic conditions.

The best course taxonomically to identify these macrophyte inhabitants is to use a dichotomous, or forking, key. This flow chart-like system is based on morphological or physical characteristics of a specimen that systematically narrow down the species possibilities until the sample can be clearly identified (Woodland, 1991). The presence of flowers, the make-up of the root system, stems, leaf shape or arrangement, and reproductive features are but a few of the topics covered in this pathway to genera or species (Porter, 1967).

At UNDERC, thirty-seven aquatic genera have been identified; in the entire United States, there exists more than thirteen hundred species of aquatic or semi-aquatic macrophytes, grouped into three hundred six genera and sixty-five families. These aquatic plants are more widely distributed than their terrestrial counterparts, primarily because the environmental conditions--temperature and nutrient availability--in which they exist are less variable (Prescott, 1980). Due to this fact, the macrophytes are more specialized within their habitat, often restricted to single niches.

Two important related conditions that subdivide the aquatic macrophytes into their specific niches are light requirements and water depth; regarding the latter, vertical zonation in the littoral area is divided (from deep to shallow water) into the submerged plants, the floating plants (determined by turbulence), deep water emergents, shallow water emergents, and grasses (R. Hellenthal, 1995). While the emergents and floating plants exist at the surface-water interface, the submergent macrophytes are faced with the challenge of limited light availability. Not only does the light penetration decrease with depth, but the submergent plants' habitat is further limited by shading caused by the floating plants at the surface (Riemer, 1984). This shading not only affects the plants within the zone, but also exemplifies the direct impact macrophytes have on the other inhabitants. If there is a solid cover of floating plants, photosynthesis is prevented from occurring below it, decreasing the dissolved oxygen within the habitat. Loss of photosynthesis affects pH by removing free CO_2 and causing a shift in the carbonic acid cycle. The degree of macrophyte impact depends highly on the volume of water that they occupy; the smaller the area that the macrophyte inhabits, the greater the influence. Because of their limited habitat, the aquatic macrophytes have a more profound influence chemically on their habitat than do their terrestrial counterparts (Sculthorpe, 1967).

One cannot assume that the chemical composition-plant interaction is one-way; the plants are also subject to the initial conditions that must exist in the body of water. Specifically, the concentrations of nutrients, such as phosphorus, nitrogen, and sulfur, plus the conductivity, color, temperature profile, alkalinity, and pH are all determining factors in the inhabitability of a lake, fen, or bog. A comparison of measurements of the relative changes in nutrient availability over a few weeks or months can determine the body of water's productivity.

The impact of plants is not limited to the chemical composition of the body of water; the macrophytes serve as a food source for aquatic and terrestrial insects, birds, and mammals. These primary producers are hiding places to reduce predation, and as nest sites for fish and insects. Shoreline vegetation plays a significant role in beach-building, erosion prevention, and filling in of lake margins with eutrophication (Prescott, 1980).

It is possible that the macrophytes' selection of a habitat is correlated to the chemical conditions that exist. Perhaps even the slightest chemical variation between aquatic environments could be emphasized through changes of macrophyte communities. A survey of chemically similar--but not identical--habitats at UNDERC might show the great variety and uniqueness of each micro habitat. Habitats exhibiting bog-like conditions would be a likely choice because of their abundance on the property. More than a dozen habitats have been named bogs because of their acidic environment; however, many of these are actually rich or poor fens that exhibit a higher pH (above 4.0) and very different vegetation. A mensurative study of these bogs and fens over a range of pH and other important chemical factors would provide a basis for further manipulative studies of plant-water chemistry.

MATERIALS AND METHODS

MATERIALS

The materials necessary to perform this project include:

*Plant press with corrugated cardboard, newspapers, and blotter sheets, approximately 12" x18"
*Microscope or hand lens (magnification at least x10)
*Garden tools, such as small spade, clippers, and dandelion digger
*Ziploc storage bags, gallon-size and sandwich bags
*Wax paper
*Water-resistant labeling tape
*Fine point water-resistant marker or pencil
*Hach Chemistry Kit
*Dissolved oxygen-temperature meter
*Kemmermer sampler
*Conductivity meter
*Portable pH meter
*Secchi disc
*6-ft. Rake with mesh wiring on the comb end
*Eckman grab
*500 mL plastic bottles
*Forel-Uhl color kit
*Computer to compile data
*Dichotomous keys for aquatic and terrestrial macrophytes
*Lab notebook to record data

METHODS OF PROCEDURE

Thirteen bodies of water were selected for this experiment--ten bog-like habitats and three lakes. The chosen bogs were Tender Bog, Bolger Bog, Ed's Bog, Bogpot, Forest Service Bog, Tuesday, Hummingbird, Reddington, Northgate Bog, and Cranberry. The lakes included Crampton, Brown, and Morris. All these were found on the UNDERC property.

During the approximately eight weeks of research time, chemical sampling was conducted the first week (late May/early June) and the sixth week(early July). On-site analysis was done for pH, conductivity, Forel-Uhl color, oxygen-temperature profile, sulfide (only presence/absence) and secchi disc. Water samples were collected at each site, and further tests were conducted in the laboratory a few hours later. Hach kits were used to test the samples for alkalinity and color.

The research week following the water chemistry sampling, the macrophyte sampling was conducted. Although the emphasis is placed on the aquatic macrophytes, the terrestrial plants on the peatmats were collected, too, as they are also an integral part of the habitat. The entire plants were collected and placed into separate plastic baggies. Each was numbered, and no number was repeated, to keep track of the sites at which each was found. The collecting was done by using an Eckman grab, by raking if the plants were submerged, or by using garden tools along the shore and peatmats.

Once the samples have been extracted from their sites along the lake, bog, or fen, the samples were returned to the laboratory and placed in a plant press. This allows the plants to flatten safely and remove moisture for later identification. The single sample must be placed between several sheets of newspaper, which itself is placed between two felt or blotter sheets, which absorb moisture. Blotter sheets are then sandwiched between corrugated cardboard to provide sufficient air circulation. This layering process is then repeated for each specimen. In the case of very moist samples, wax paper is placed between the sample and the newspaper. The specimen layering systems are then stacked to heights of twelve to eighteen inches and pressed between a wooden grid and belted into place. The specimens are allowed to dry for several days. If the newspapers become fully saturated, then they must be replaced to speed the drying process. Once dry, the specimens may be examined and identified using a dichotomous key.

RESULTS

WATER CHEMISTRY DATA

pH

As one can see from Table 1, the range extends from a minimum value of 4.1 at Ed's Bog to a maximum value of 8.3 at Brown Lake. Differences of up to 2.2 units (in the case of Bolger) exist within the habitat, while other sites exhibit relative uniformity (Hummingbird, Cranberry, Northgate, and Tender). The readings at each site were not significantly different between the two sampling dates.

Table 1: pH

SITE	pH (location)--1st Sampling	pH (location)--2nd Sampling
Northgate	4.1 (Shore & Middle)	4.3 (Shore & Middle)
Tender	4.3	4.4 (M); 4.5 (S)
Bolger	7.1 (M); 6.5 (S); 5.1 (Boardwalk)	7.1 (M) 7.3 (S) 5.1 (BW)
Ed's Bog	4.6 (S & M) 4.1 (BW)	4.8 (M) 4.7 (S)
Cranberry	4.7	4.9 (M) 4.7 (S)

Hummingbird	4.7	4.9
Bogpot	5.5	6.0 (M) 5.7 (S)
Morris	7.1	7.4 (M) 6.7 (S)
Reddington	5.7 (S) 5.9 (M) 6.2 (Inlet)	6.6 (M) 7.1 (S)
Tuesday	6.0	6.3 (M) 6.4 (S)
Forest Service Bog	4.5 (M) 4.7 (S)	5.3 (M) 5.2 (S)
Crampton	6.1 (Shore at dock & Middle) 8.3 (Shore at collecting site)	6.0 (M) 6.2 (S)
Brown	8.0 (Shore at dock & Middle) 7.7 (Shore at collecting site)	8.1 (M) 8.3 (S)

Conductivity

Data gathered from conductivity measurements indirectly indicate the amount of dissolved ions in the water. As seen in Table 2, readings range from 4.9 in Forest Service Bog to 108.5 uS/cm in Brown Lake. Generally, conductivity increased with lake/bog size. No significant differences were recorded for each lake between the two collecting periods.

Table 2: Conductivity

SITE	Conductivity (uS/cm)--1st reading	Conductivity--2nd Reading
Bolger	30.3 (Middle) 20.0 (Shore)	28.2 (Middle) 28.4 (Shore) 23.4 (Boardwalk)
Ed's Bog	16.0	14.3 (M) 14.1 (S)
Hummingbird	20.3	18.7 (M) 20.2 (S)
Bogpot	13.4	8.1 (M) 15.0 (S)

Cranberry	15.1	10.5 (M) 11.2 (S)
Morris	56.2	63.4 (M) 61.3 (S)
Reddington	22.5	22.7 (M) 23.0 (S)
Northgate	30.8	24.8 (M) 36.0 (S)
Tuesday	11.5 (M) 13.7 (S)	11.3 (M) 12.4 (S)
Tender	26.4	23.0 (M) 20.6 (S)
Forest Service Bog	8.0	4.9 (M) 9.0 (S)
Crampton	14.4	12.6 (M) 14.2 (S)
Brown	101	108.5 (M) 107.5 (S)

Alkalinity

Alkalinity shows the relative buffering capacity of the body of water. From these readings shown in Table 3, all of the sites were poorly buffered (alkalinity less than 10 mg/L), with the exception of Bolger, Morris, and Brown, which exhibits strong buffering capacity. No significant differences were detected between the two sampling periods.

Table 3: Alkalinity

SITE	Alkalinity (mg/L)--1st Reading	Alkalinity--2nd Reading
Bolger	10	14
Ed's Bog	4	2
Hummingbird	2	0
Bogpot	2	2
Cranberry	0	0
Morris	26	28

Reddington	8	12
Northgate	0	0
Tuesday	2	1
Tender	0	0
Forest Service Bog	6	0
Crampton	4	6
Brown	50	50

Sulfide

No sulfide was detected in any of the bogs and lakes in the first round of sampling. However, sulfide was detected in the second round of sampling in Bogpot, Bolger, and Tuesday.

Color and Secchi Disc Readings

Color is another indicator of the amount of suspended particles in the body of water. This is related to the secchi disc reading, which shows the amount of light transparency through the water column. As seen in Table 4, all of the color readings range from 20 parts color in Crampton to 402 parts in Northgate Bog. The secchi disc readings show that little light reaches more than 1.5 meters below the surface at most of the sites. The exceptions are Crampton, whose readings are below three meters, and Forest Service Bog, whose reading doubled in depth at the time of the second sampling. The Forel-Uhl scale, which was used with secchi disc depths below one meter, was another way to measure the color, by sight, as opposed to by machinery. No pattern is apparent with these readings.

Table 4: Secchi Disc and Color

	-------1st Round of Sampling----------			-------2nd Round of Sampling---------		
SITE	Secchi Disc (m)	Color Pt Co	Color Forel-Uhl	Secchi Disc (m)	Color Pt Co	Color Forel-Uhl
Bolger	.9	144	N/A	.95	145	N/A
Ed's Bog	1.2	114	XXI	1.6	140	XIX
Humming-bird	.7	217	N/A	.75	274	N/A
Bogpot	.9	127	N/A	.8	182	N/A
Cranberry	1.2	98	XIX	1.3	95	XXI
Morris	1.0	208	N/A	.7	183	N/A

Redding-ton	.6	298	N/A	.7	246	N/A
Northgate	.8	402	N/A	.7	239	N/A
Tuesday	1.5	63	XVII	1.75	58	XIX
Tender	1.2	151	XIX	1.6	177	XIX
Forest Service	1.2	51	XV	2.3	36	XII
Crampton	3.1	62	XII	3.5	20	XIV
Brown	1.1	104	XIX	1.6	54	XVIII

Oxygen and Temperature Profiles

From the first round of sampling, the graphs of oxygen and temperature versus depth for each site can be seen in Graphs 1-13. In Graphs 14-26, the oxygen-temperature profiles for the second round of sampling can be viewed. As shown in these graphs, the oxygen was depleted at the bottom of the sites in the second round of sampling in Bolger, Bogpot, Ed's, Hummingbird, Tuesday. Concentrations fell to 1 mg/L or less in Cranberry, Forest Service, Reddington, Tender and Morris. When examining the changes in oxygen concentration between the two sampling dates, there is a significant drop in concentration at all sites, but little change in the temperature profiles.

MACROPHYTE SURVEY DATA

In the macrophyte survey of the thirteen sites, a total of 131 species was collected, found in 54 different families. Although the primary focus of the experiment was on aquatic macrophytes, most of the species were collected not in the bog or lake, but along the shore or on the surrounding peatmat. Eckman grabs in the deeper parts of the lakes and bogs were not successful. Raking was especially useful in the larger bodies of water, such as Reddington, Morris, Crampton, and Brown. It produced only decaying matter in most of the smaller sites, including Forest Service, Cranberry, and Ed's Bog.

Concerning species diversity, the number of species found at each site are as follows: Forest Service Bog--13, Northgate--20, Ed's--23, Tender--24, Cranberry--27, Hummingbird--31, Bolger--31, Bogpot--33, Crampton--34, Brown--34, Morris--38, Tuesday--39, and Reddington--43.

In an attempt to find basic trends between species location and water chemistry, the sites were organized in the species identification charts, from left to right, in order of increasing pH (Chart #1), and alkalinity (Chart #2). They were also organized in terms of maximum depth (Chart #3), maximum length (Chart #4), and relative size (Chart #5) of the water basin.

A careful examination of the species chart listed according to pH shows that some families exhibit preferences to a particular range of pH. To prove this point, a look at the families Violaceae and Najadaceae shows that they thrive best in pH of 5.6 or greater. Another example of preference is that of the family Nymphaeaceae (water lilies), which does not exist in habitats with a pH below 4.8. Typha latifolia (Fam. Typhaceae) shows the same preference. Other species that seem to prefer habitats more neutral than acidic are Carex projecta and Eleocharis acicularis (Fam. Cyperaceae), Calamagrostis canadensis (Fam. Gramineae), Potentilla palustris (Rosaceae), Lemna minor (Lemnaceae), Scutellaria integrifolia (Lamiaceae), Sagittaria latifolia (Alismaceae), Galium labradoricum (Rubiaceae), and Sparganium sp. (Sparganiaceae). Species preferring more acidic conditions rather than neutral include Drosera rotundifolia (Droceraceae), Carex limosa (Cyperaceae), the entire family Sphagnaceae, and Waldsteinia fragaroides (Rosaceae). Finally, species existing in most habitats but the extremes include Iris versicolor (Iridaceae), Triadenum fraseri (Hypericaceae), and Lycopus unifloris (Labiatae).

An inspection of the alkalinity versus species location shows similar results as the pH data.

When examining the data according to size and maximum length, many families, especially Gramineae and Najadaceae, are found in larger sites but not smaller ones. No other patterns are obvious, nor can anything be seen when listing the species according to maximum depth.

Learning that Sphagnum magellanicum was present in nearly all sites but Crampton was interesting; Instead, a different species, Sphagnum girgensohnii, was present. This species was found at no other collecting sites.

DISCUSSION

The data from the water chemistry may be useful to explain general characteristics of the aquatic habitat, which can reflect the chemistry of the surrounding peatmat. The one problem was that most of the macrophytes were collected OUT of the water, while the chemical sampling was performed only IN the water. Directly relating such measurements as the oxygen-temperature profile and alkalinity to the plants collected on the peatmat is difficult. An exception is the secchi disc reading, which is extremely helpful. Most of the readings, with measurements of 1.5m or less, show that the transparency in the bogs is so low that macrophyte growth is impossible below, and that raking and performing Eckman grabs would have been useless. Hach color readings might also support this theory, but readings with the Forel-Uhl scale seemed to be inconsistent and not helpful.

pH is another useful chemical test, since it was taken at various sites ON the peatmat while collecting the macrophytes. Therefore, there is sufficient evidence to support the idea that pH has a significant influence on the presence of certain species within a habitat.

Data from this experiment supports that of previous experiments on Sphagnum locations. For example, Sphagnum magellanicum thrives best at pH levels of 3.5 to 4.8, but can exist up to a pH of 6.6 (Gorham and Janssens, 1990). The presence of this species at all collection sites with a pH less than 6.6 is evidence toward Gorham and Janssens' statement. Furthermore, Sphagnum recurvuum var. brevifolium's preference of more acidic sites supports the work of another UNDERC surveyor (Broghammer, 1994).

A look at overall species diversity at shows that sites that are larger or have a larger range of pH can accommodate the greatest variety of macrophytes. Reddington, with the highest number of species collected, had a range of pH from 5.7 to 7.1 over the sampling time. It differed from the rest of the sites because it had a large area of open water (close to neutral pH) PLUS another channel (separated from the main lake by a floating peninsula of peat and shrubs) that had a slightly lower pH and was more overgrown and constricted by vegetation.

Overall, the relatively small bogs--Northgate, Tender, Ed's, Bolger, and Forest Service--showed similarities in chemical make-up, and macrophyte presence. On the other hand, one can see the slight variations in macrophyte richness and abundance caused by the small changes in chemical factors.

The next group of similar bog-like habitats may consist of Hummingbird, Cranberry, and Tuesday. They, too, exhibit similar size and chemical make-up, yet clearly are inhabited by many species unique to each site.

Bogpot, despite its maximum length being one of the greatest in the sites surveyed, takes on the chemical characteristics of a bog more than a large lake. With closer inspection of the maximum depth, Bogpot is the shallowest of all the sampled sites, at 6 ft. This makes it a "special case," where categorizing the body of water with other sites is difficult.

Crampton, Brown, and Morris Lakes, which were supposed to have served as "control" lakes (exhibiting "non-bog-like" characteristics) in this survey, showed a surprising amount of distinction from each other. Concerning macrophyte presence, little overlap was discovered among all three of the lakes. Thus, the word "control" is inappropriate. Differences in size, productivity, pH, and inlets/outlets may contribute to the dissimilarities in biota.

To discuss it further, this issue of inlets or outlets may be an important factor in species composition. Reddington and Morris are connected by such an outlet. Brown and Hummingbird also have outlets to Brown Creek and Bay Lake, respectively. This might be an influence of macrophyte presence, because of the easy transfer between lakes and rivers. A further examination of such relationships might help explain the biota make-up of these sites.

Another factor that was not considered in this study was the quantitative approach to species collection. It was noted at the time of collection which species clearly dominated the habitat, although this was not published in the results. Although many sites contained the same species, the concentration of such species was clearly different. A more intensive study of such quantitative analyses could be helpful in future research.

Another aspect that could be dealt with more intensely is the chemical testing. Measuring concentrations of phosphorus and nitrogen both in the water and in the seepage water on the peatmat would be extremely helpful in identifying in what nutrient concentrations certain macrophyte species may thrive. One must also learn not to rely completely on water chemistry, since the readings may fluctuate greatly in response to patterns of recent precipitation and evaporation. This is especially true in waters that are poorly buffered, which include most sites in this experiment (Gorham and Janssens, 1990).

Gaining an understanding of not only the macrophytes present and the chemical data, but also the algae, invertebrates, and vertebrates inhabiting habitat are important. Only by looking at the "big picture" may one attempt to understand the functioning of the sites and the intricate relationships involved.

ACKNOWLEDGMENTS

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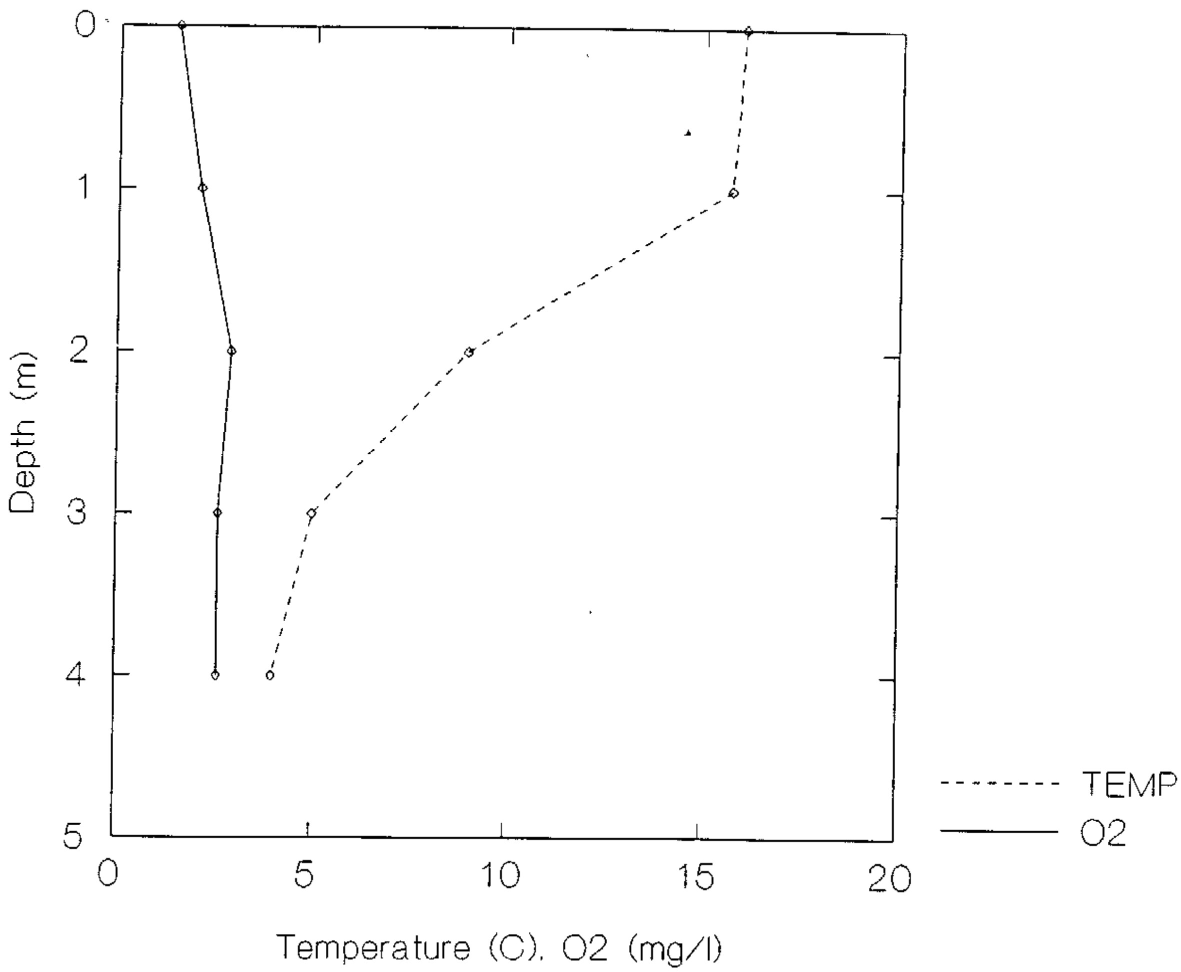
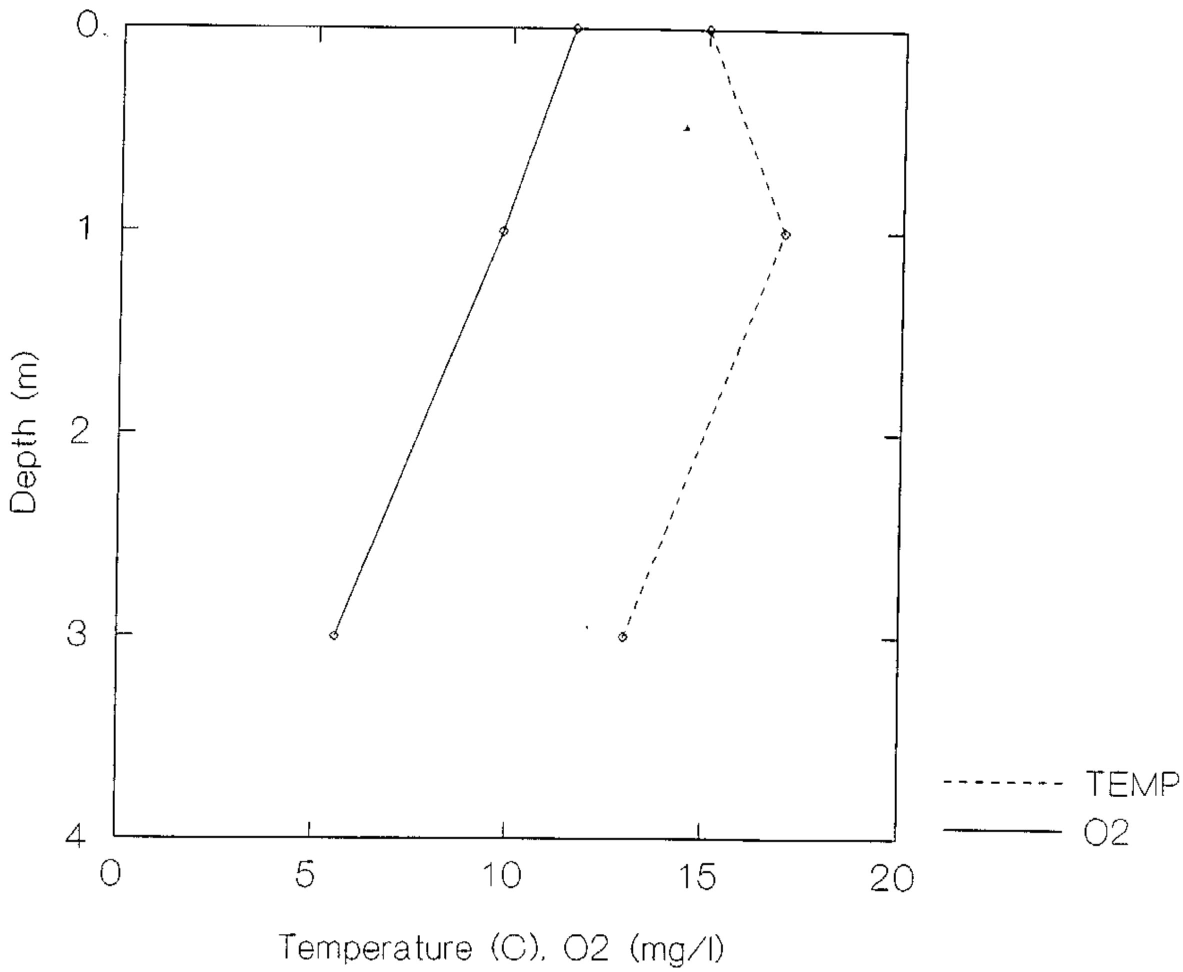
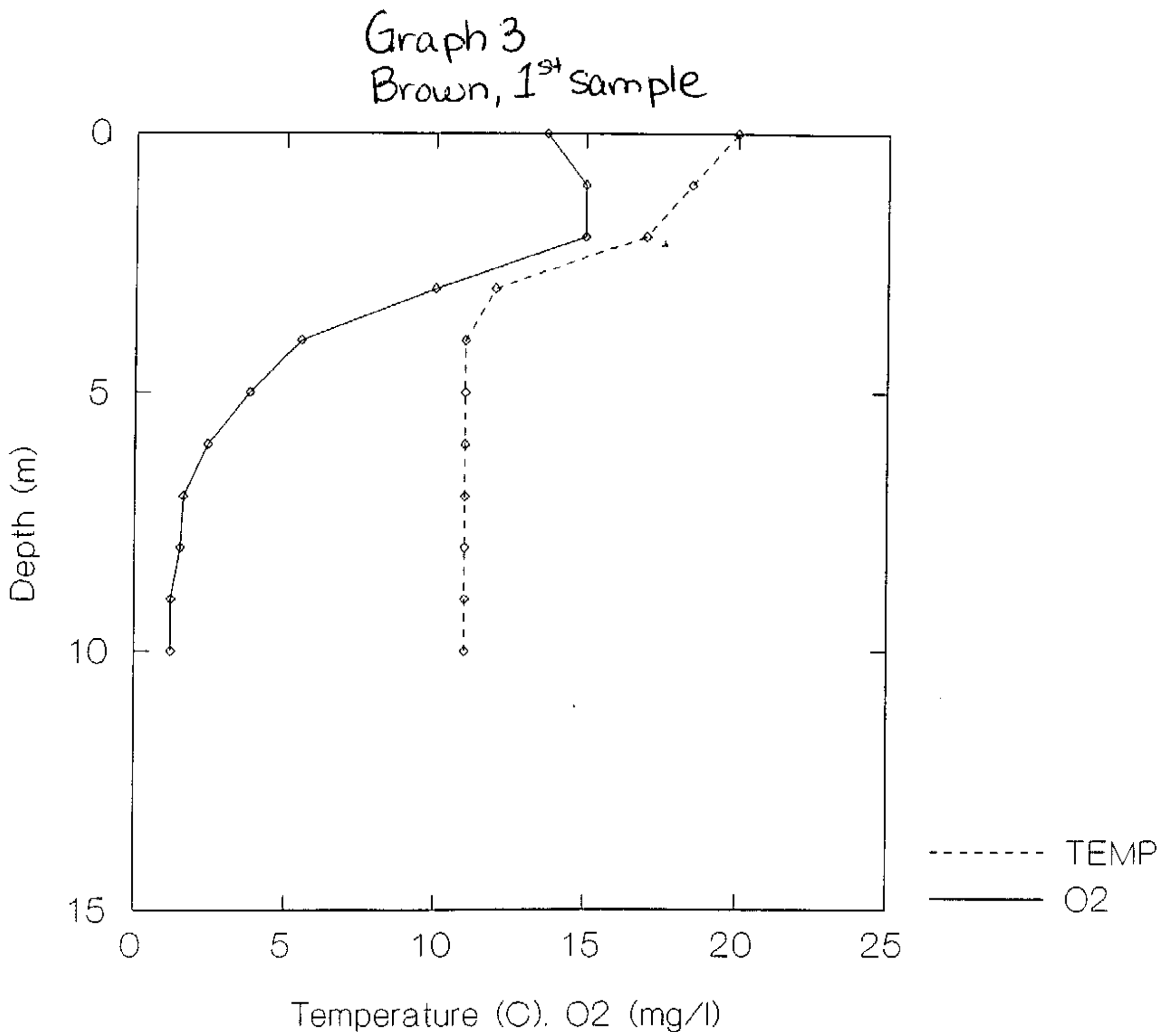
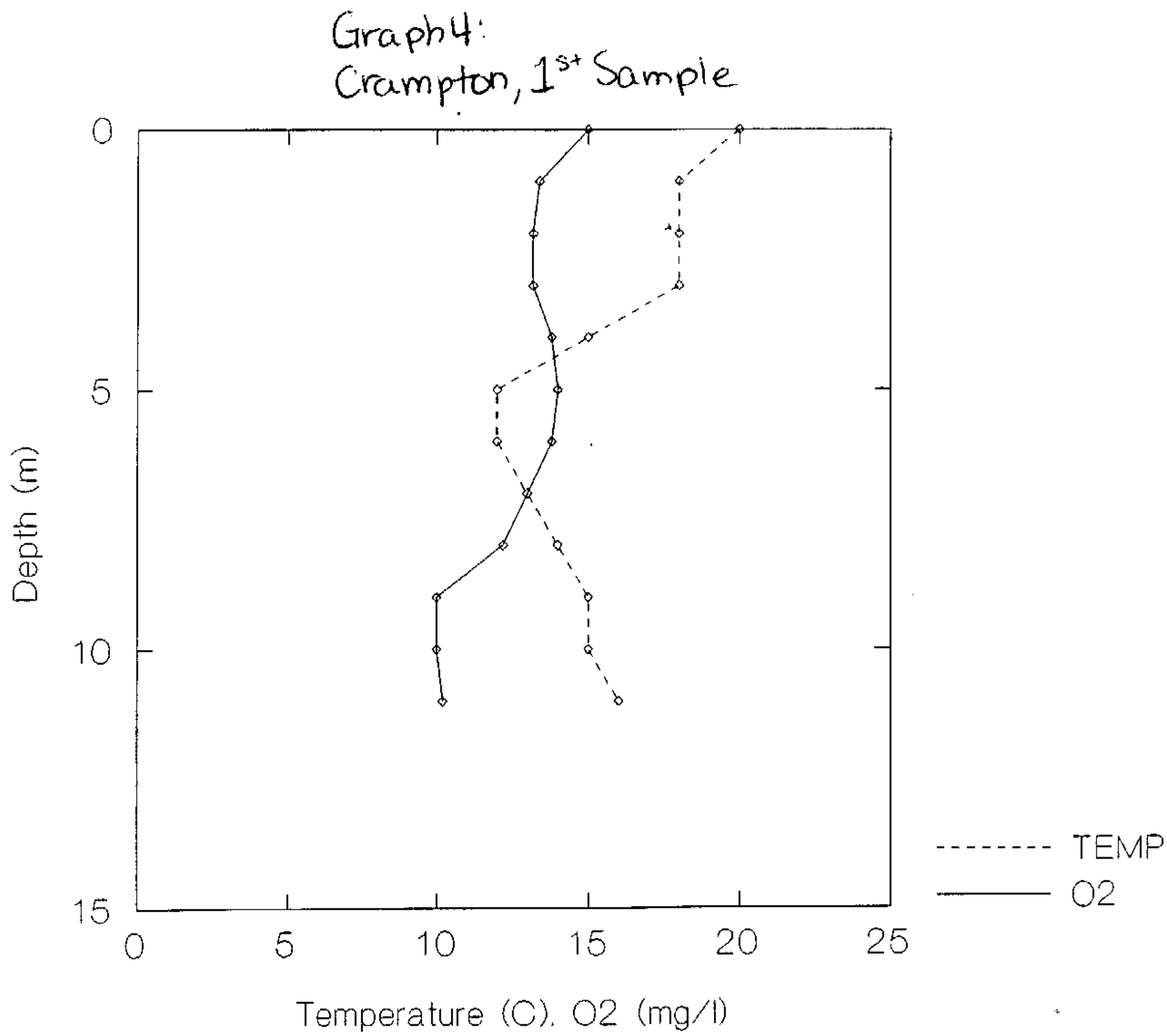
Graph 1:
Bolger, first sample

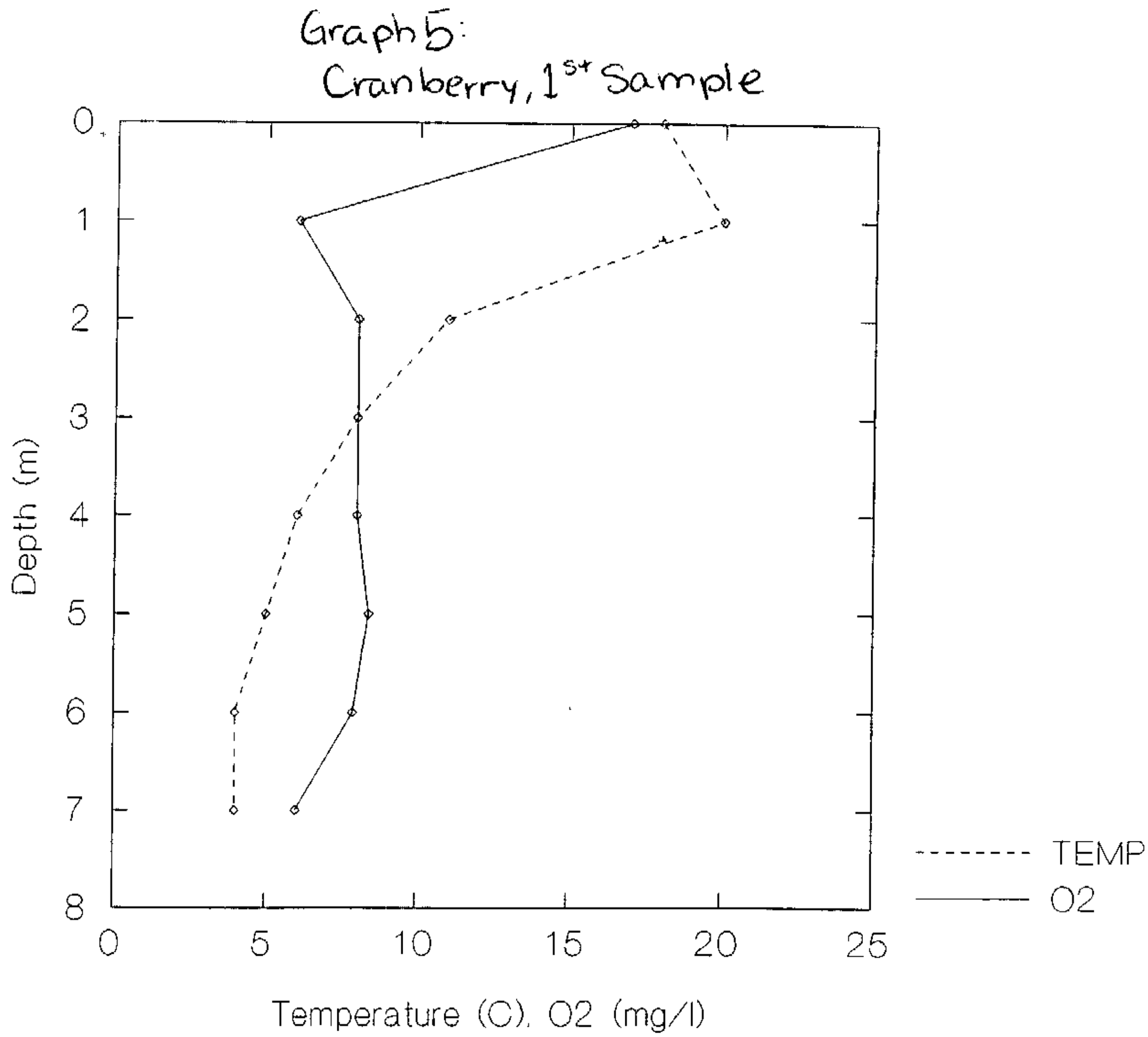


Graph 2:
Bogpot, 1st Sample

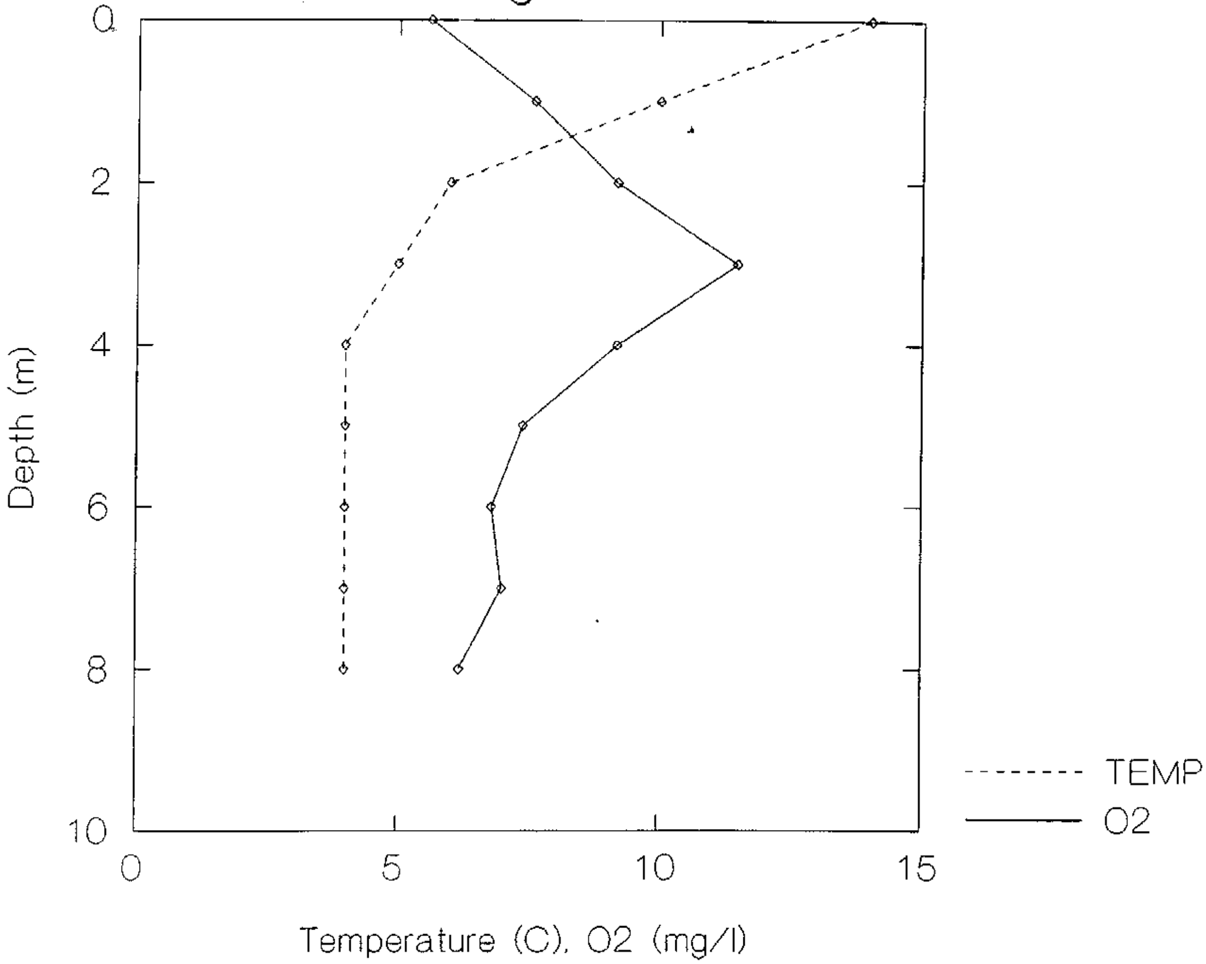



Graph 3
Brown, 1st sample
0
5
10
15
Depth (m)
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2


Graph4:
Crampton, 1st Sample
Depth (m)
0
5
10
15
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2

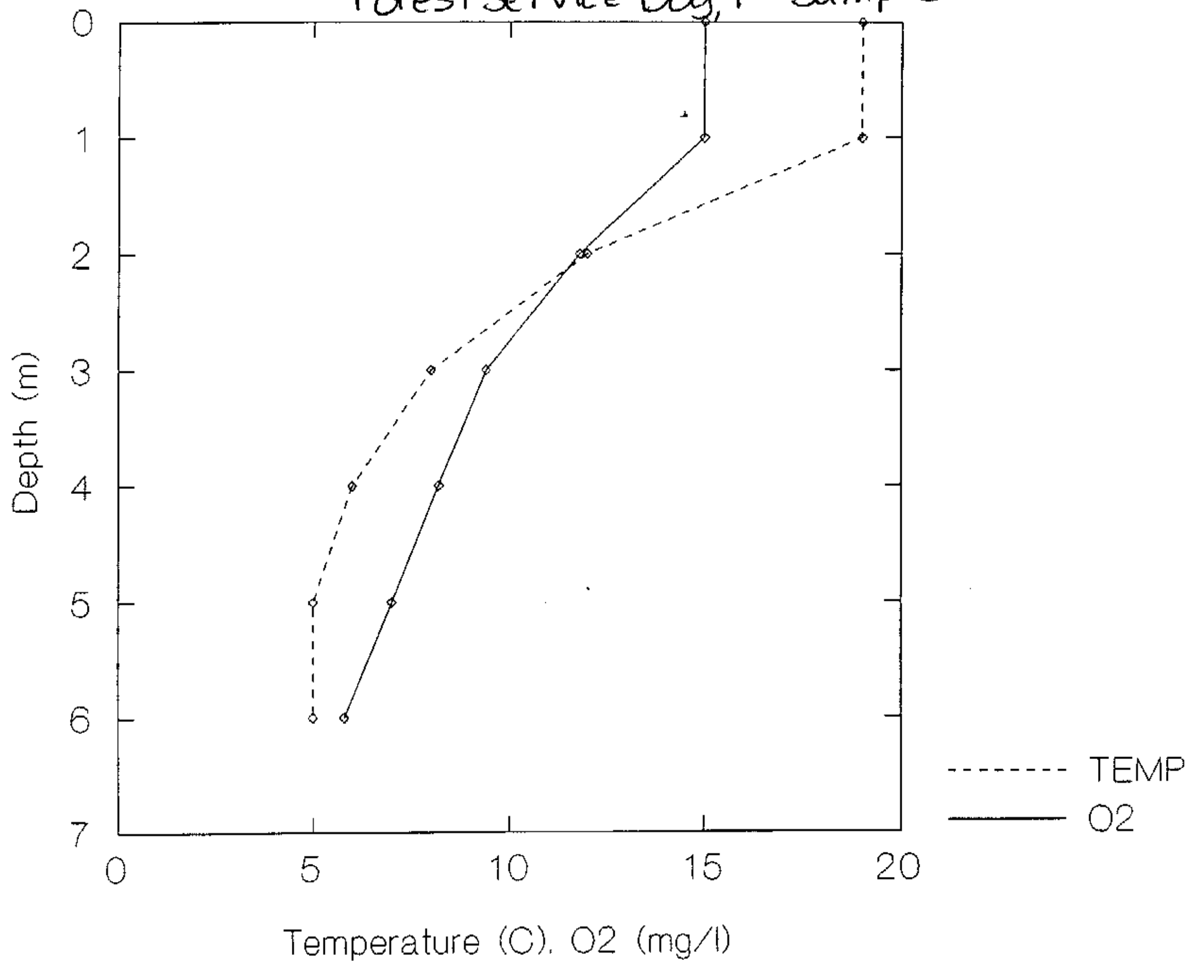

Graph 5:
Cranberry, 1st Sample
Depth (m)
0
1
2
3
4
5
6
7
8
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2

Graph 6
Ed's Bog, 1st Sample

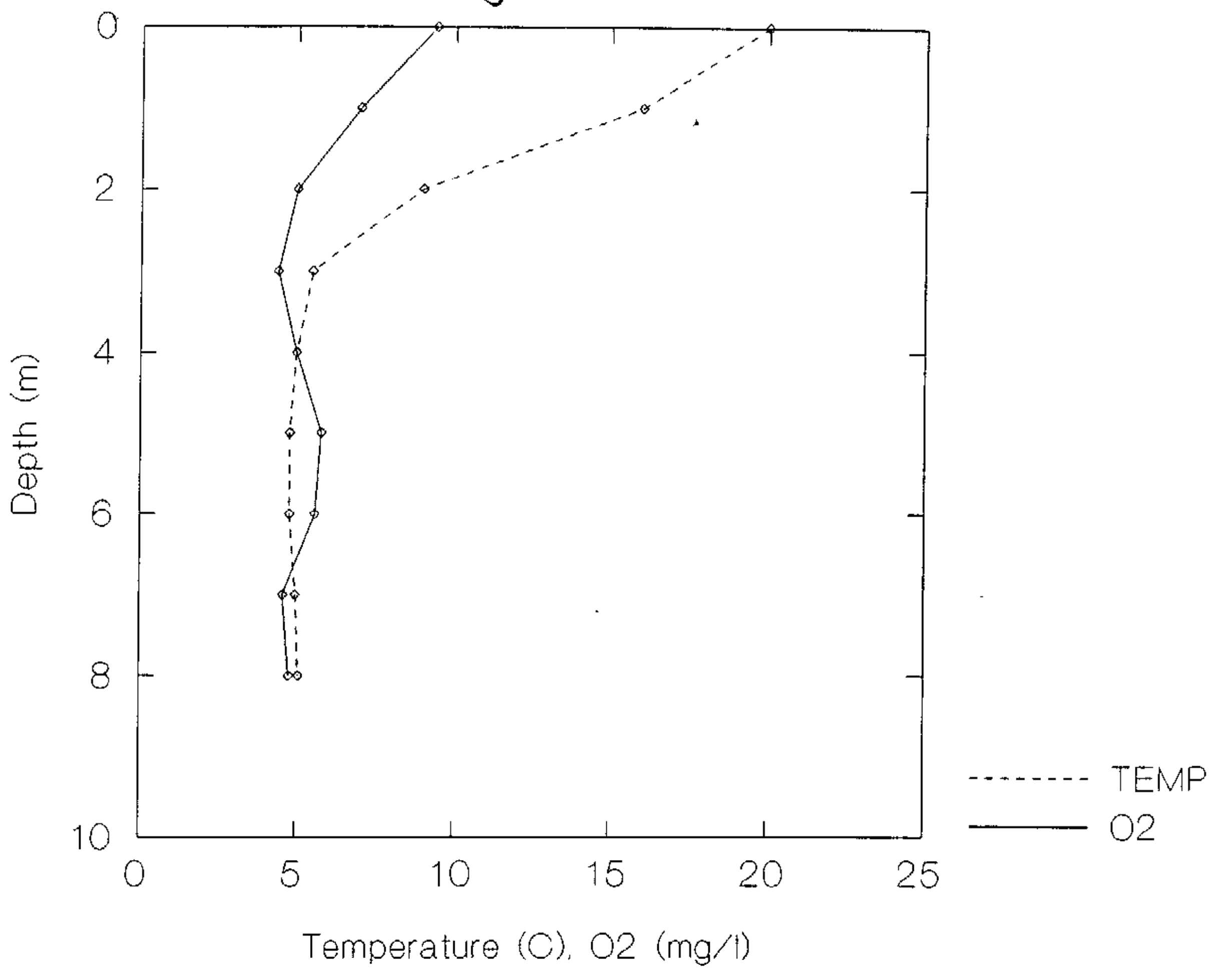


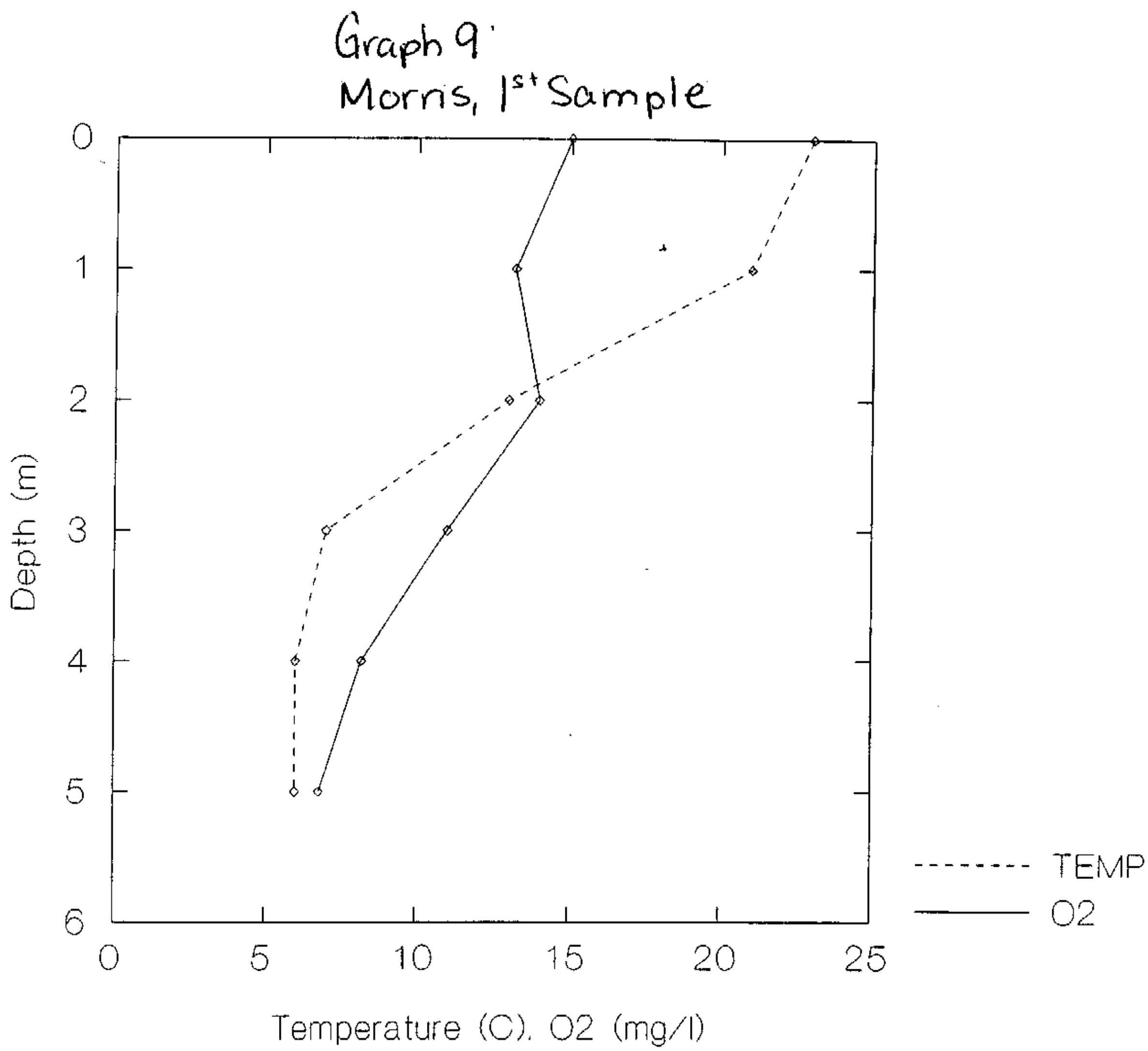
Graph 7

Forest Service Bog, 1st Sample



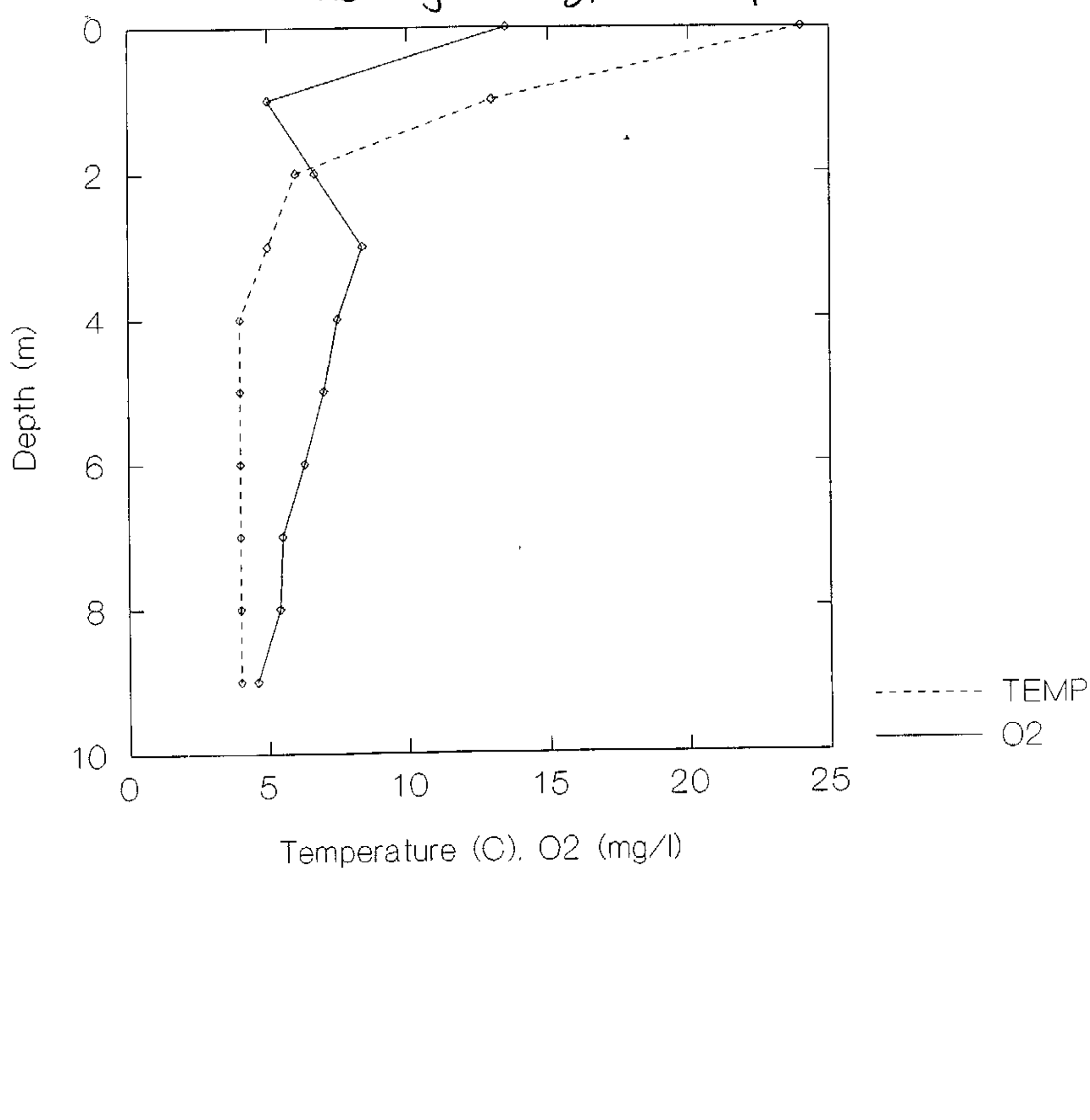
Graph 8:
Hummingbird, 1st Sample



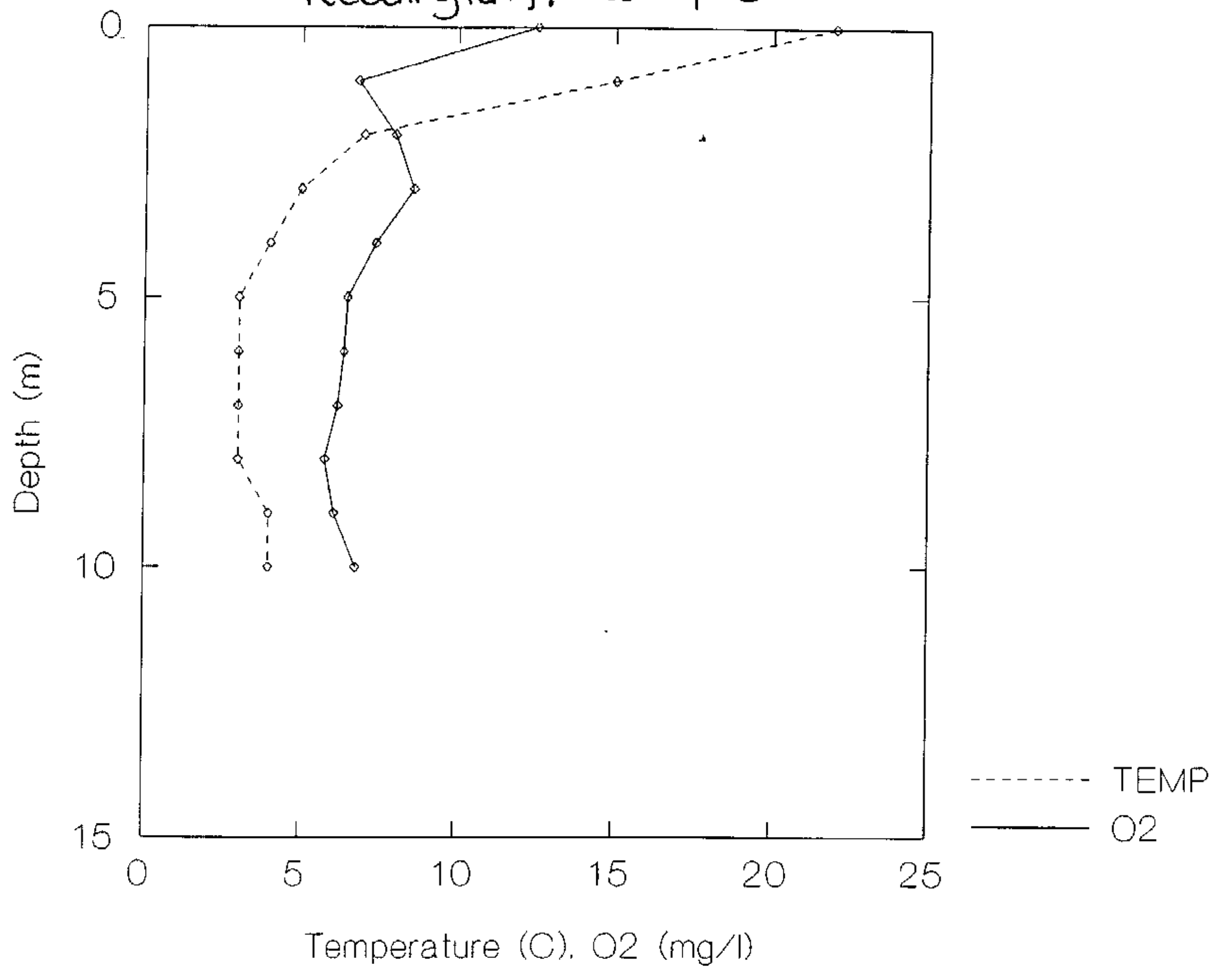


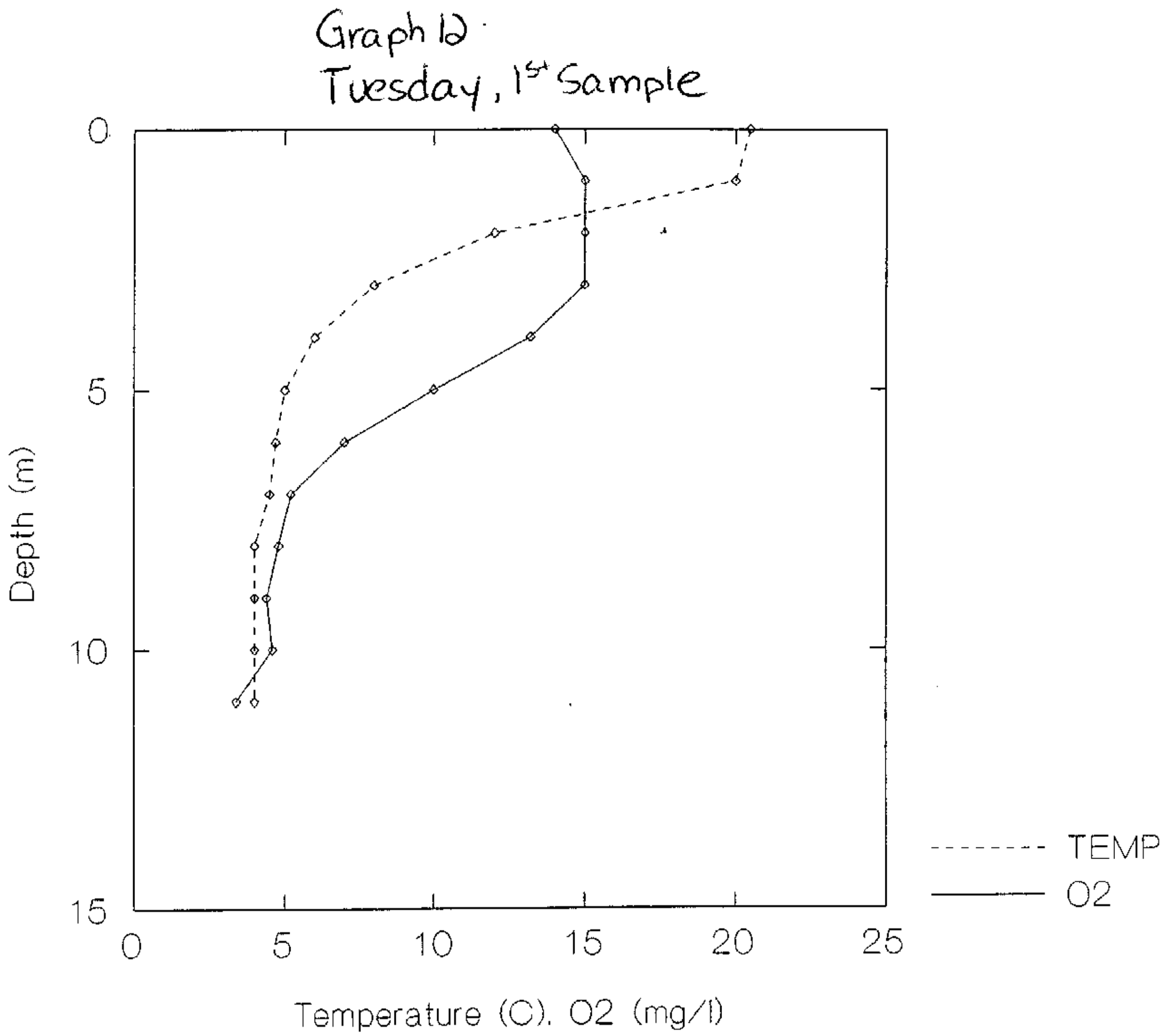
Graph 9
Morris, 1st Sample
0
1
2
3
4
5
6
Depth (m)
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2

Graph 10:
Northgate Bog, 1st Sample

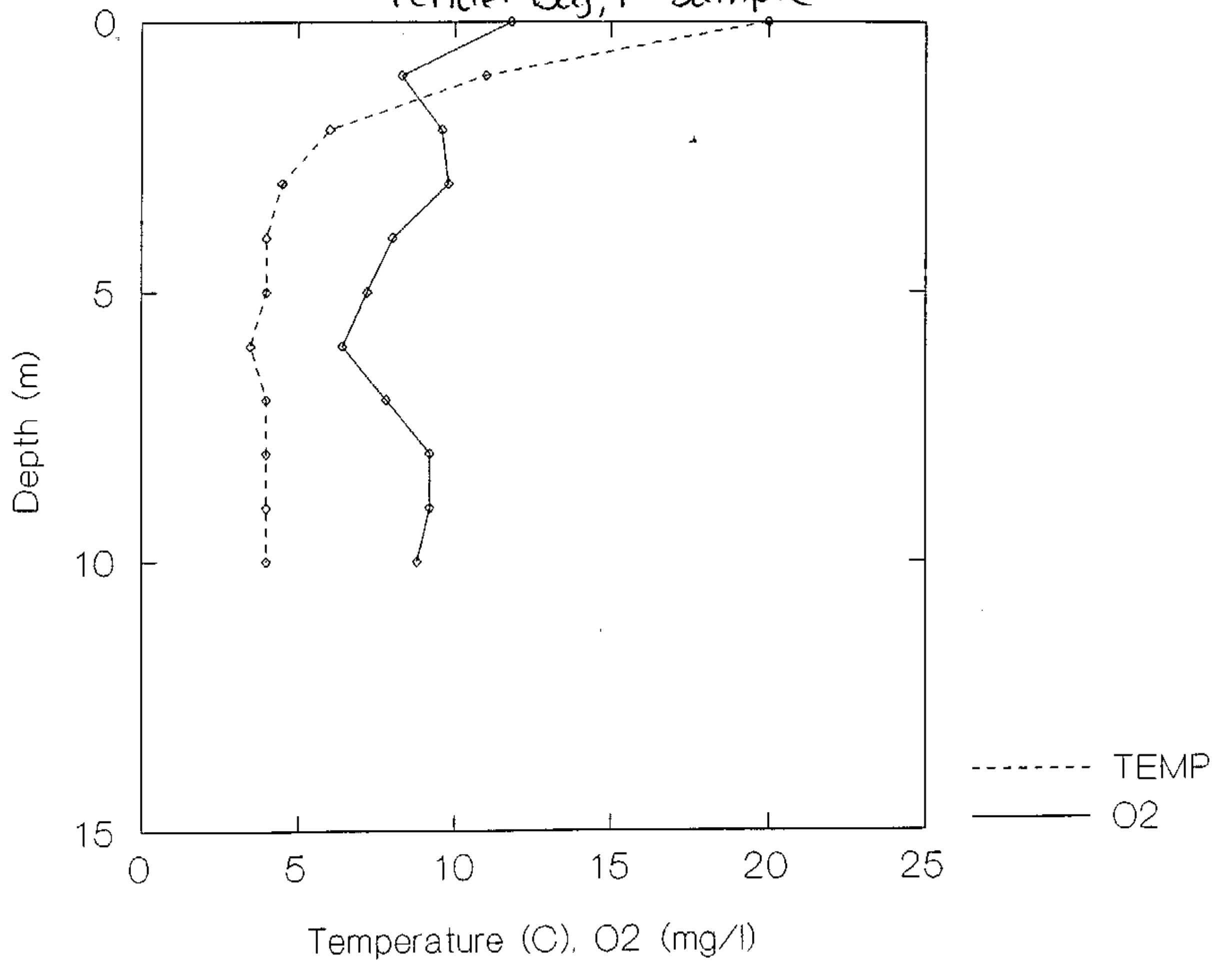


Graph 11:
Reddington, 1st Sample

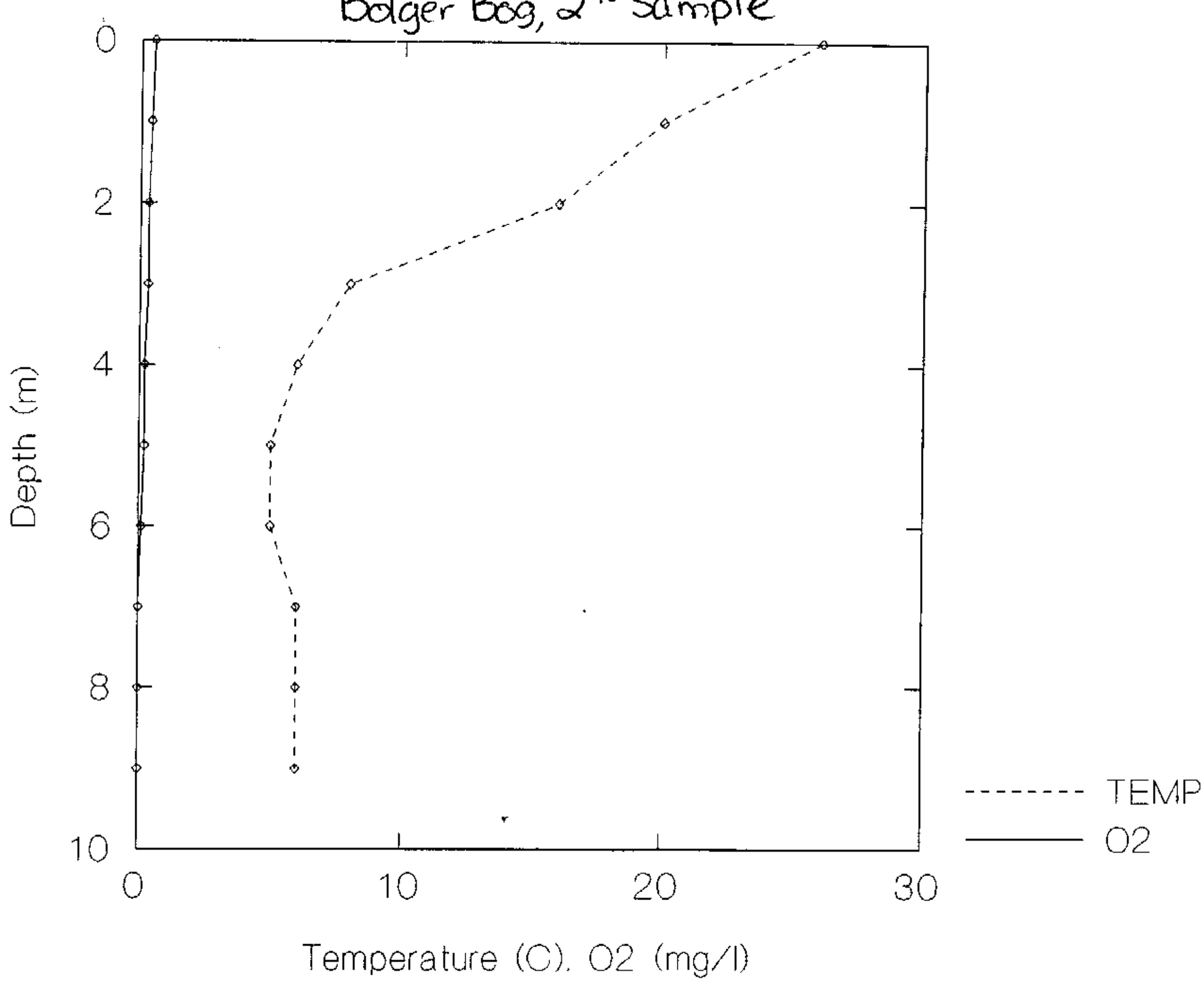



Graph 12.
Tuesday, 1st Sample
Depth (m)
0
5
10
15
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2

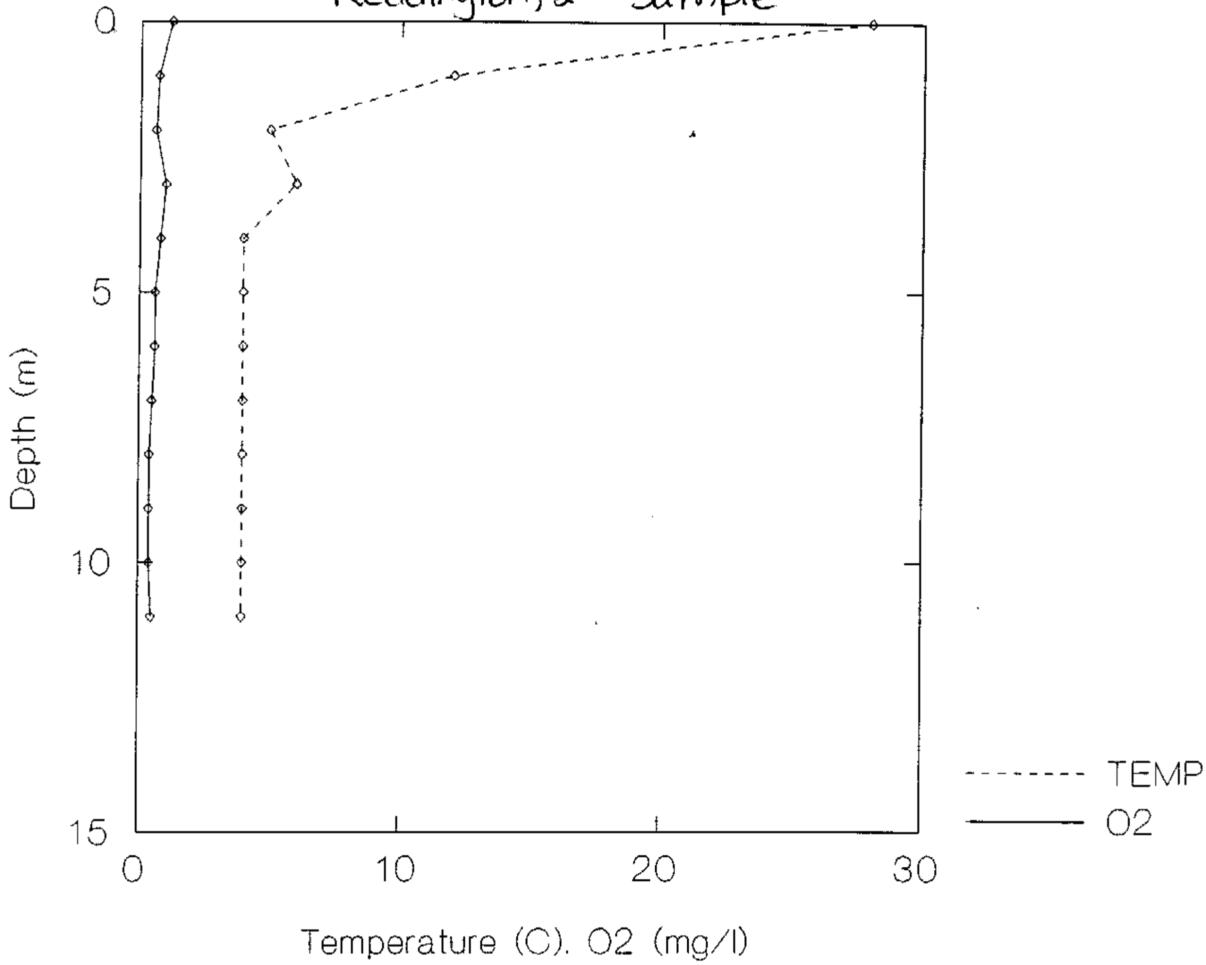
Graph 13.
Tender Bog, 1st Sample



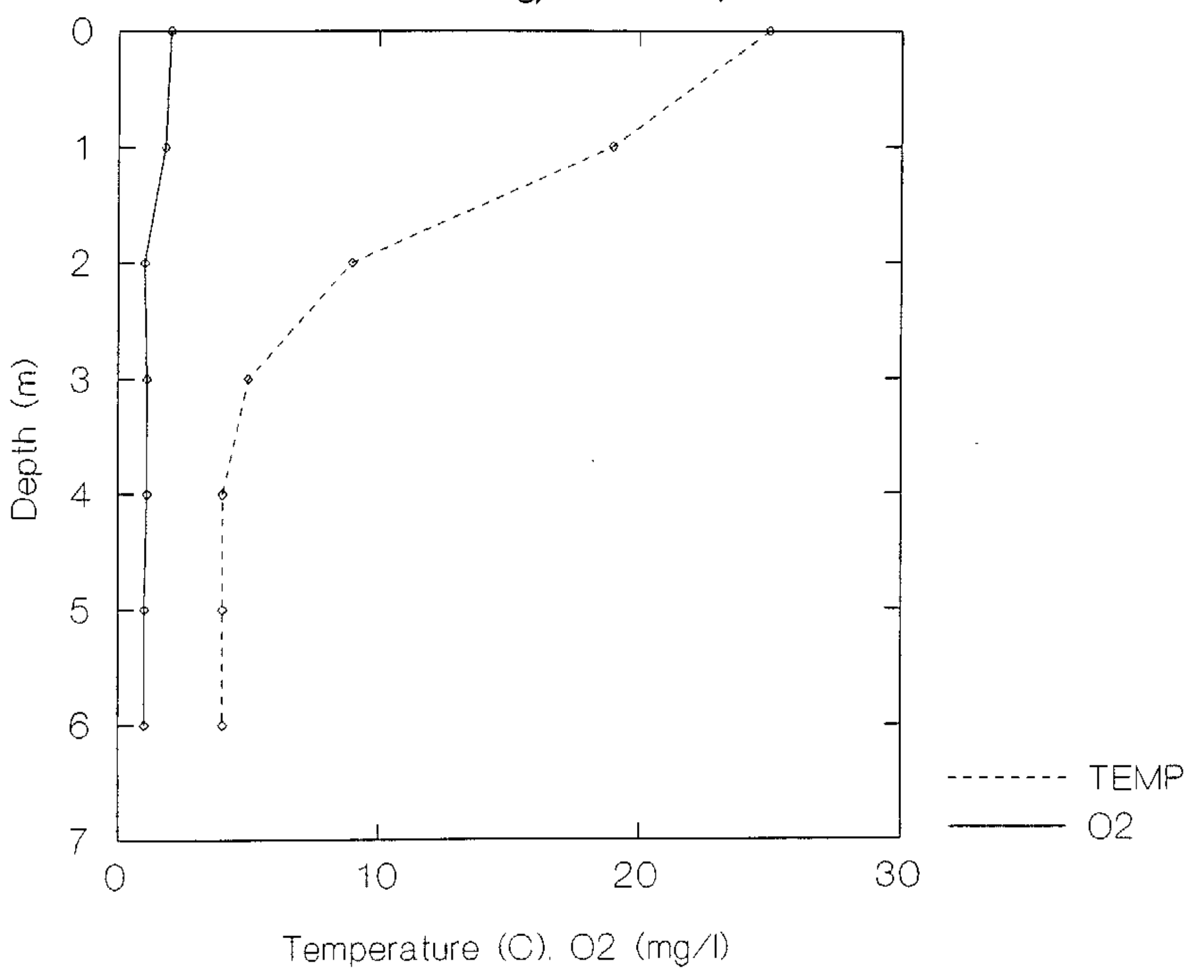
Graph 14:
Bolger Bog, 2nd Sample



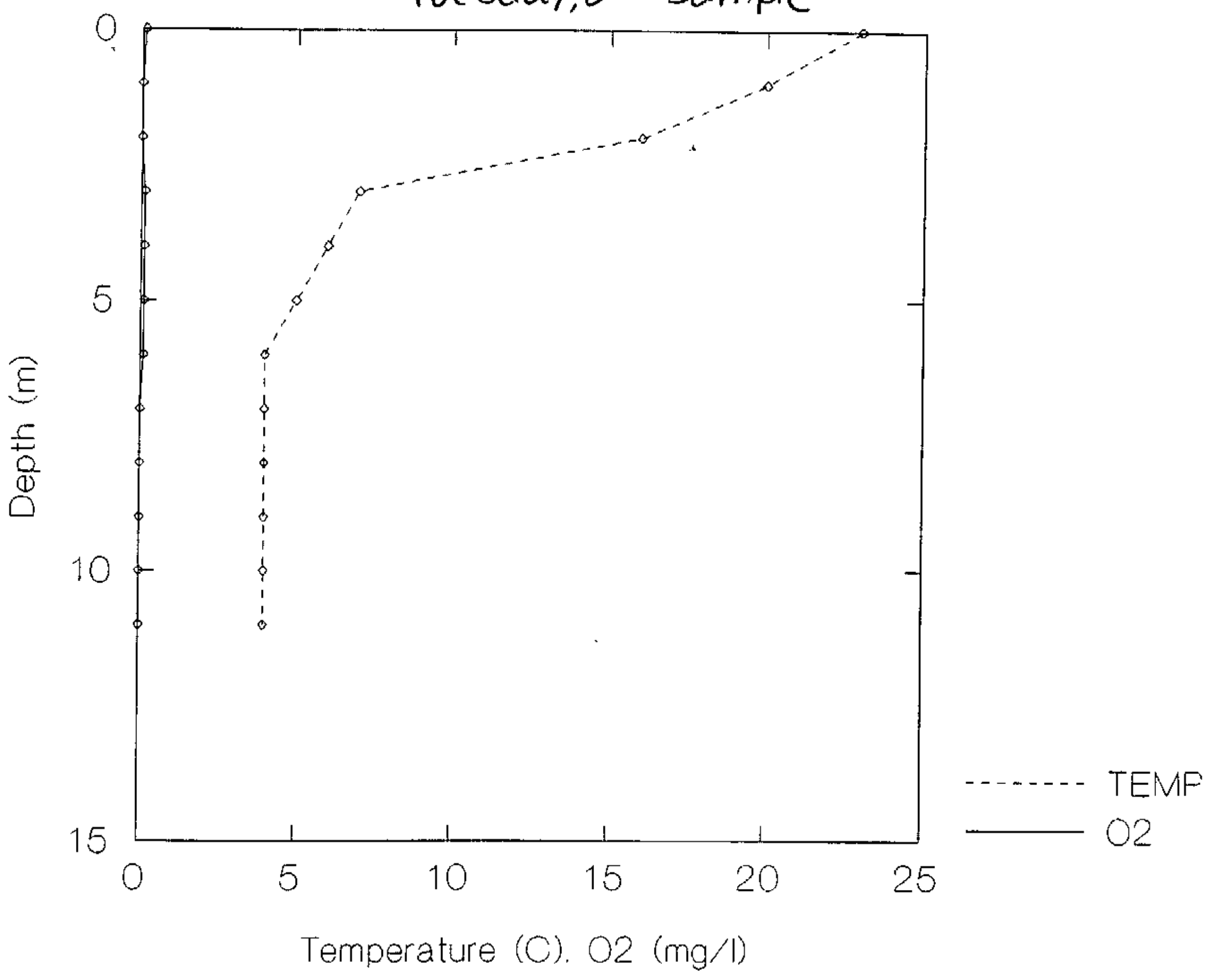
Graph 15:
Reddington, 2nd Sample



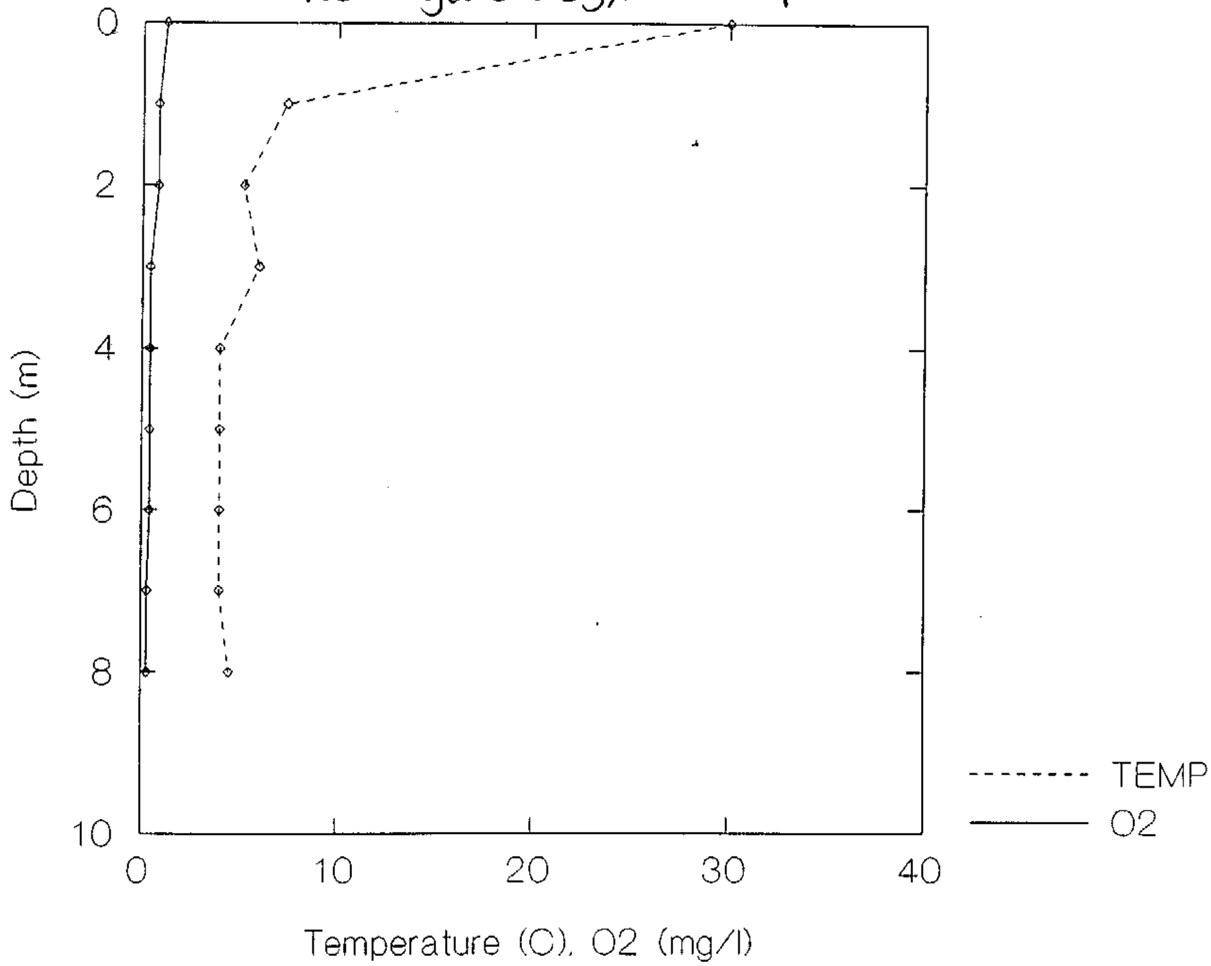
Graph 16.
Tender Bog, 2nd Sample



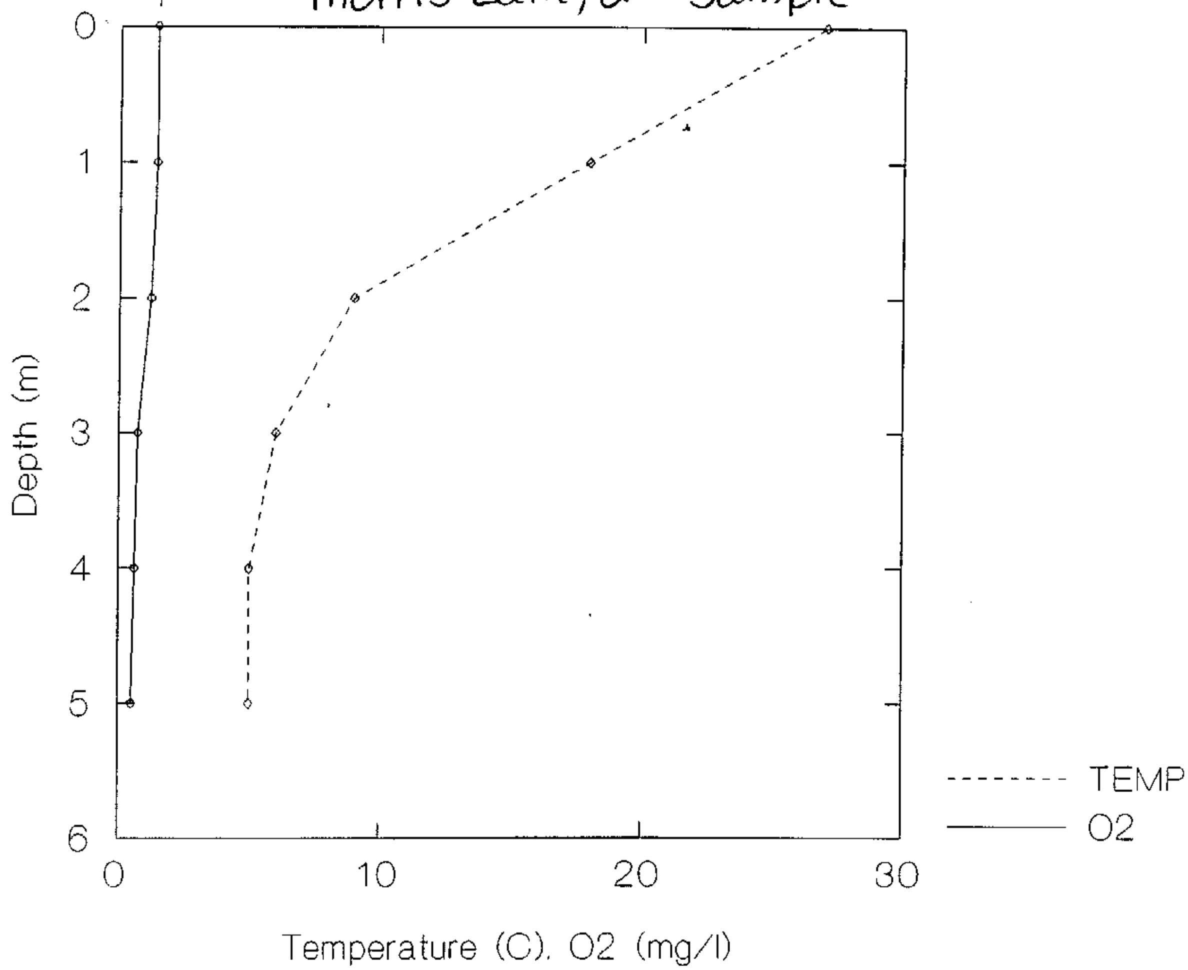
Graph 17:
Tuesday, 2nd Sample



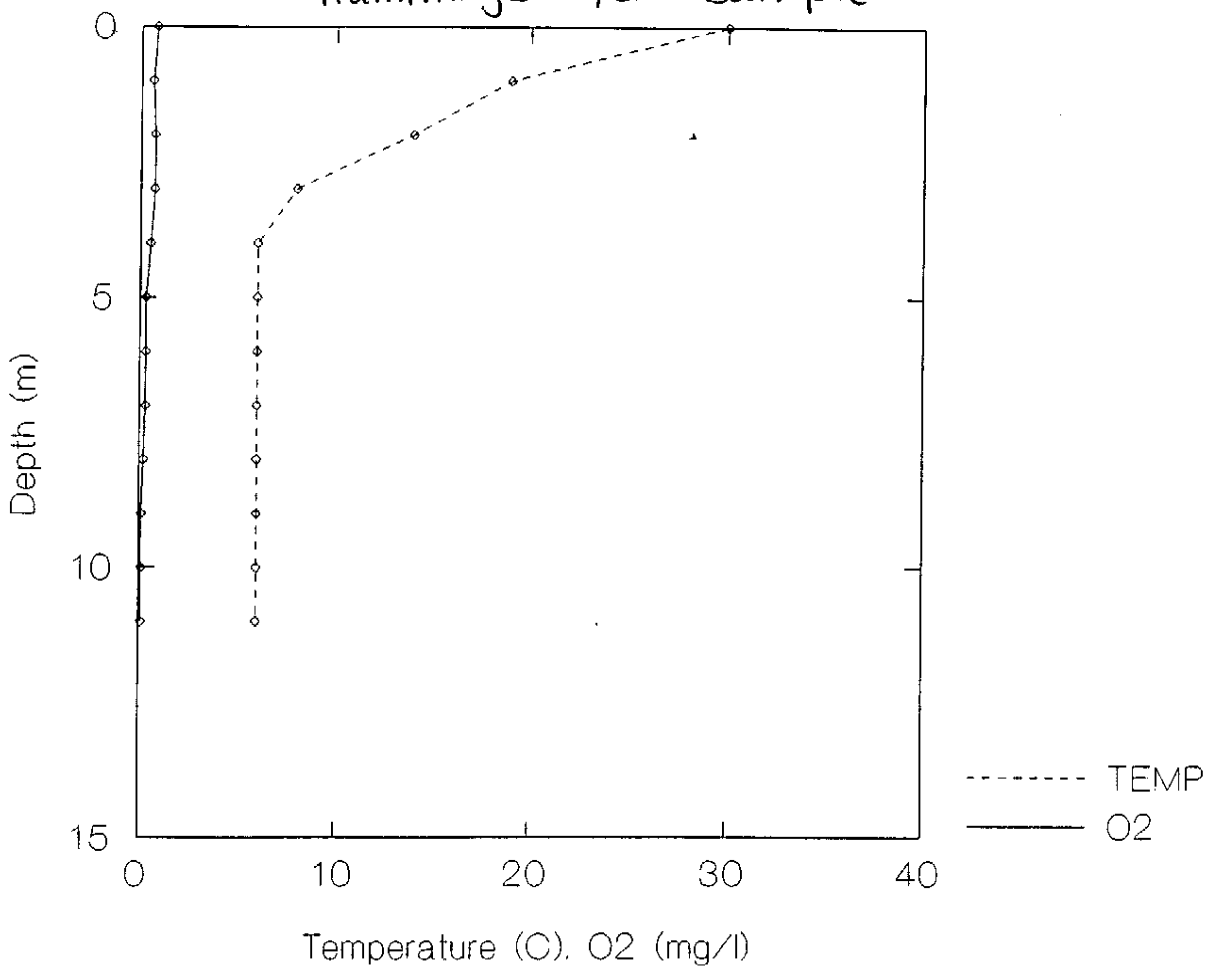
Graph 18:
Northgate Bog, 2nd Sample



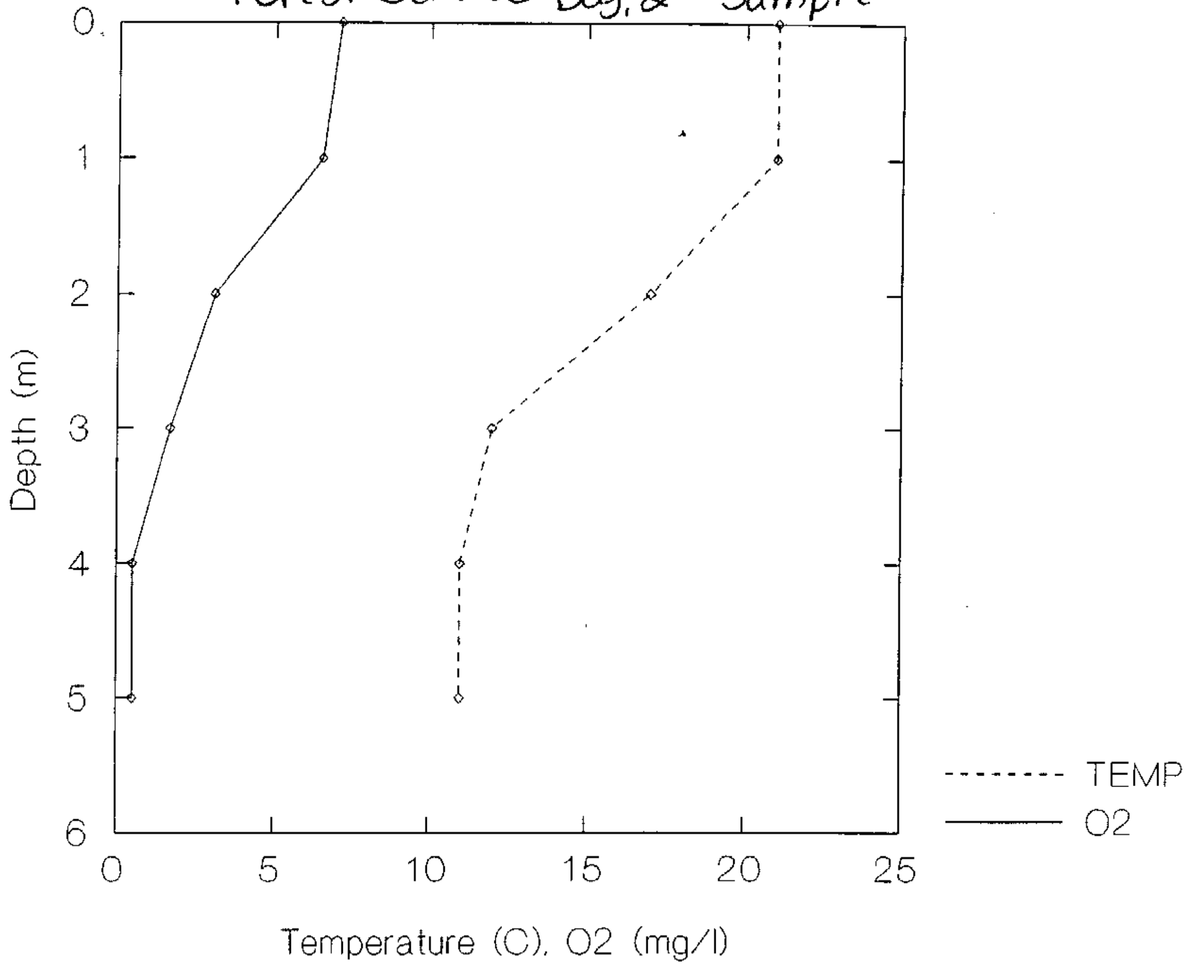
Graph 19:
Morris Lake, 2nd Sample



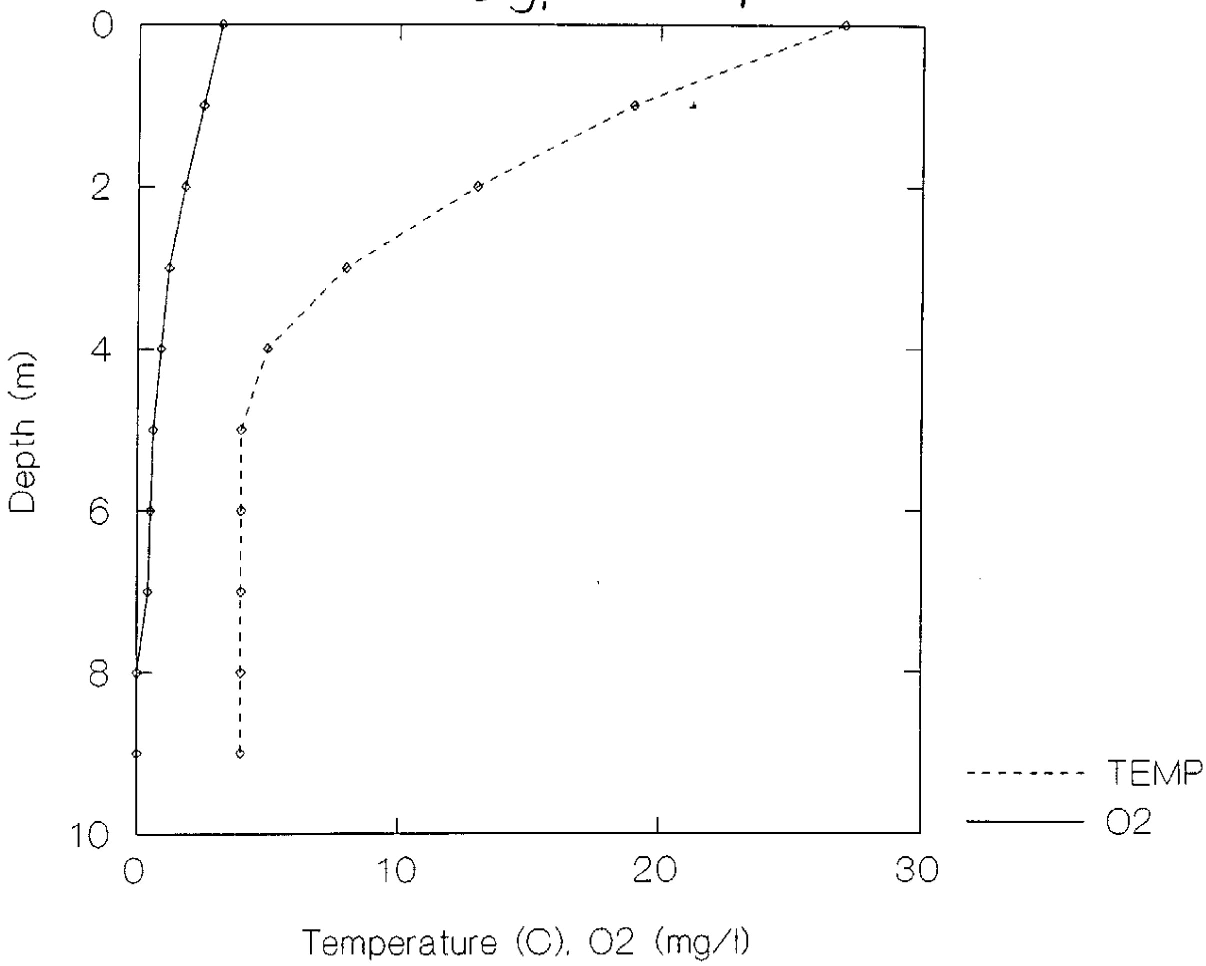
Graph20:
Hummingbird, 2nd Sample



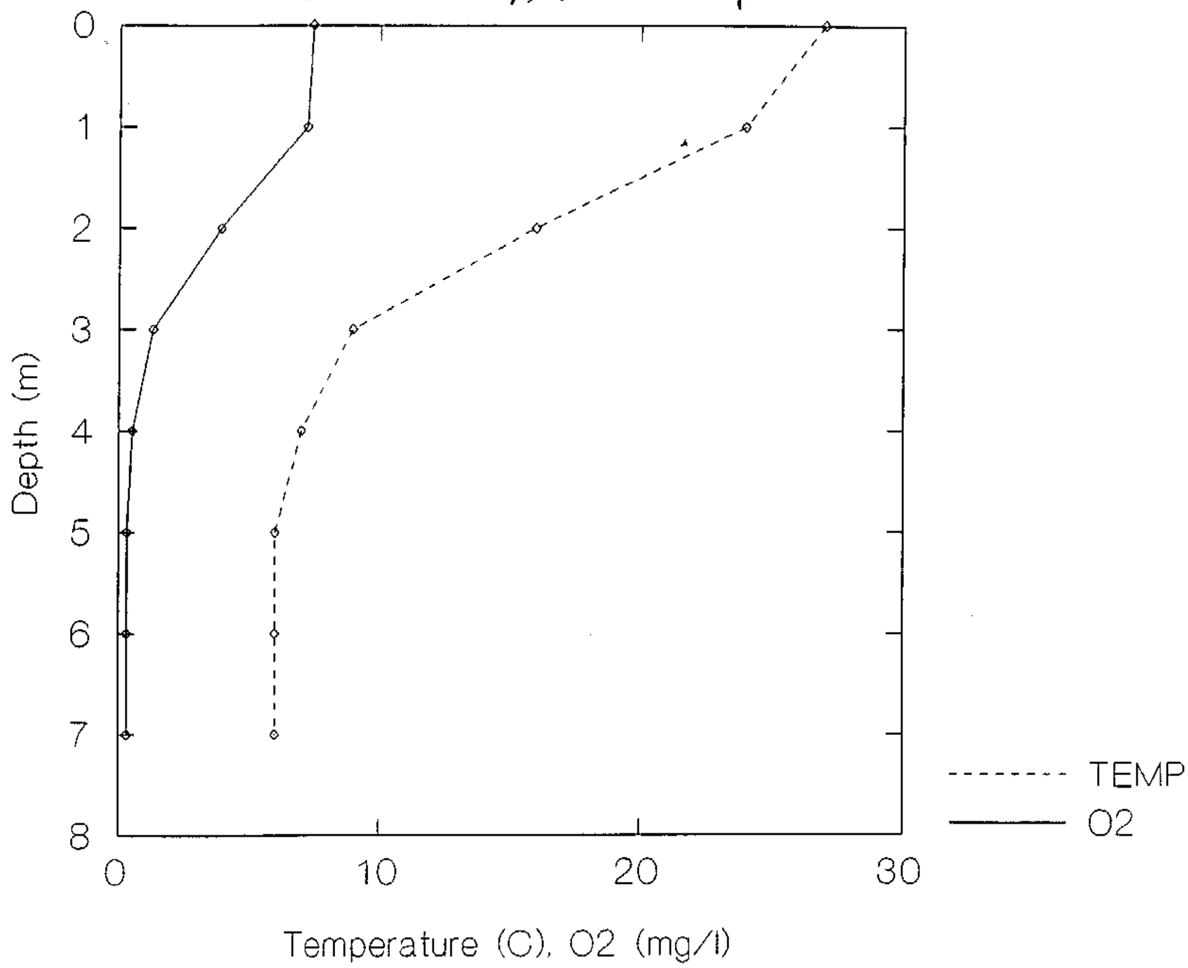
Graph 21:
Forest Service Bog, 2nd Sample



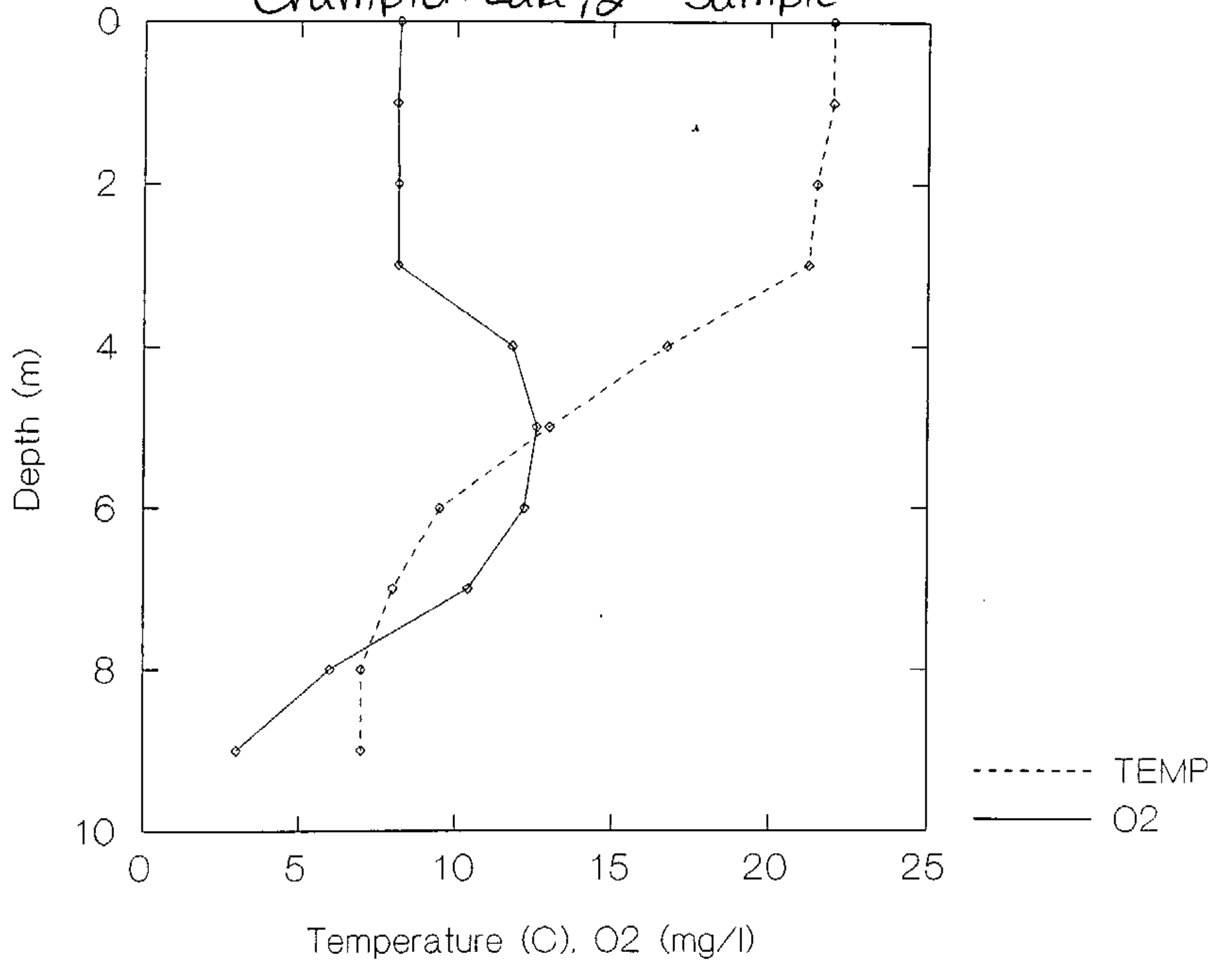
Graph 22:
Ed's Bog, 2nd Sample

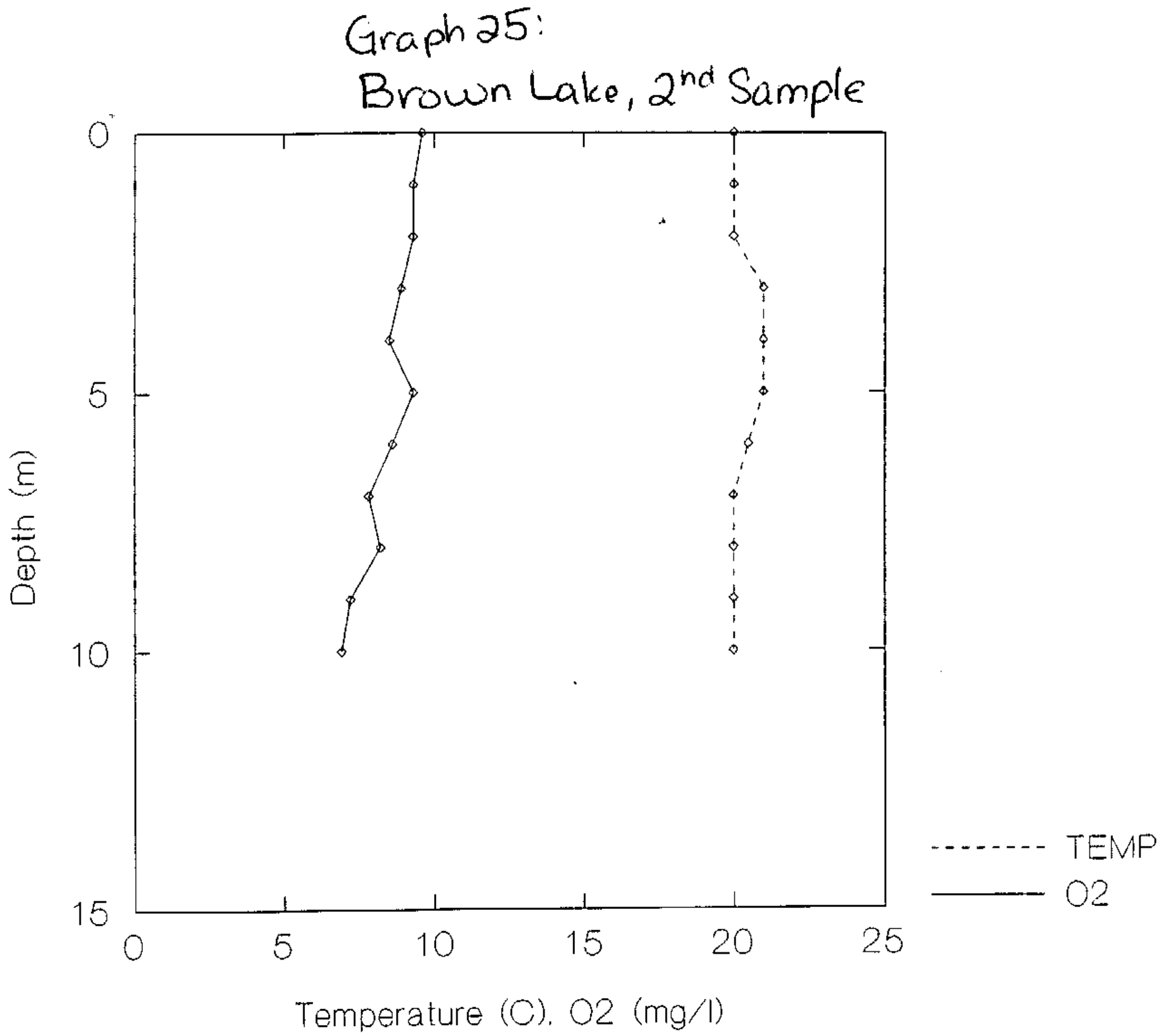


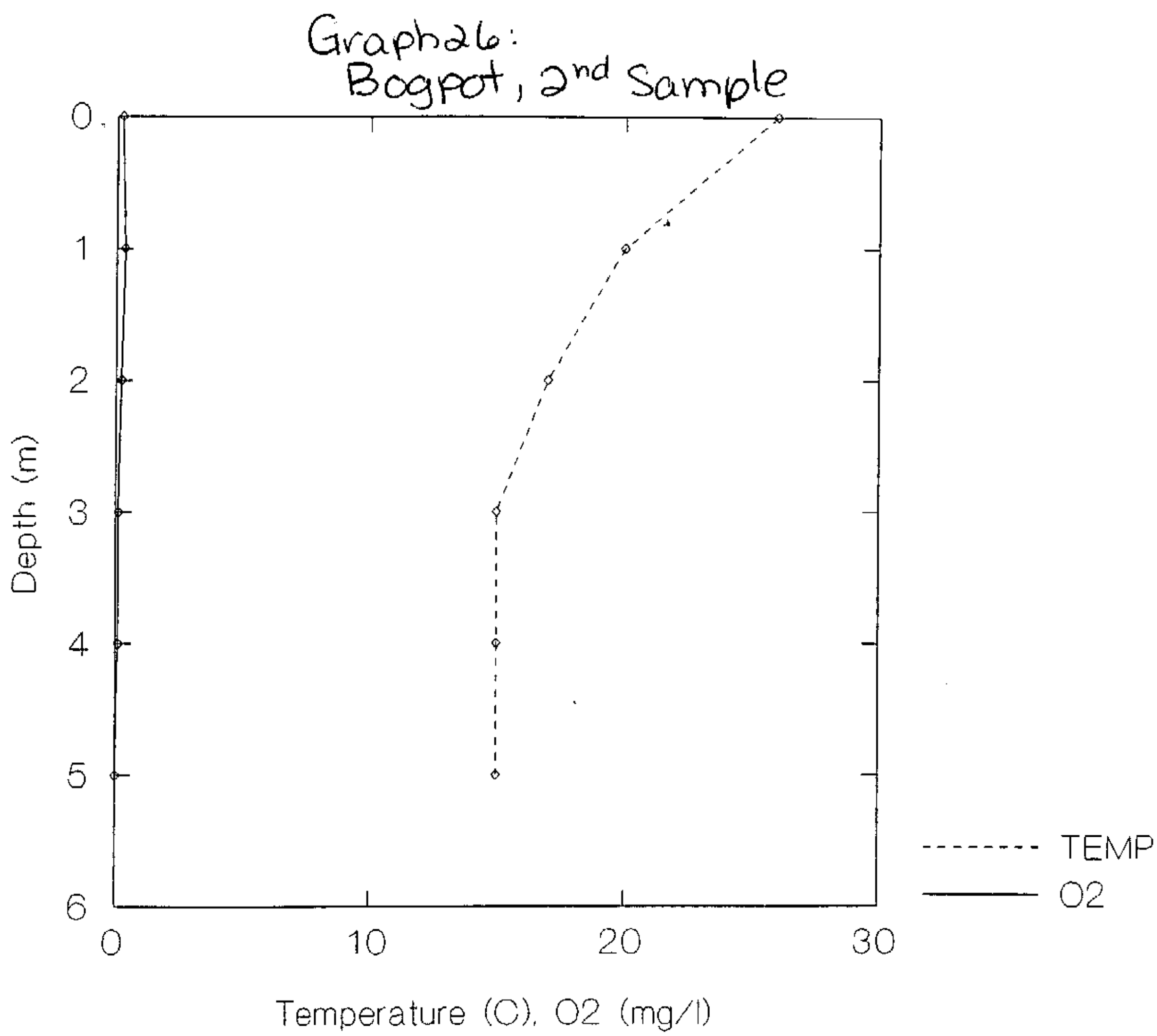
Graph 23.
Cranberry, 2nd Sample



Graph 24:
Crampton Lake, 2nd Sample




Graph 25:
Brown Lake, 2nd Sample
0
5
10
15
Depth (m)
0
5
10
15
20
25
Temperature (C), O2 (mg/l)
TEMP
O2



Graph26:
Bogpot, 2nd Sample
0
1
2
3
4
5
6
Depth (m)
0
10
20
30
Temperature (C), O2 (mg/l)
TEMP
O2

pH

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	**MACROPHYTE SURVEY OF BOGS (AND LAKES) AT UNDERC**				Karen Francl, Summer 1996										
3		Mean pH at Collecting Site	4.2	4.4	4.6	4.7	4.8	4.9	5.7	6	6.2	6.3	6.4	7.1	8
4	**FAMILY**	**GENUS & SPECIES**	N'GATE	TENDER	ED'S	CRANBERRY	HUM'BIRD	FS BOG	BOGPOT	BOLGER	TUESDAY	CRAMPTON	REDD'TON	MORRIS	BROWN
5	Ericaceae	Andromeda glaucophylla	X	X	X	X	X	X			X	X	X		
6		Chamaedaphnia calyculata	X	X	X	X	X	X	X	X	X	X	X	X	
7		Chiogenes hispidula	X	X	X	X	X			X					
8		Kalmia polifolia	X	X	X	X	X	X		X	X	X	X		
9		Ledum groenlandicum	X	X	X	X	X	X			X				
10		Vaccinium macrocarpon	X	X	X	X				X	X				
11		Vaccinium myrtilloides	X		X	X					X		X		
12	Sarraceniaceae	Sarracenia purpurea	X	X	X	X		X		X	X				
13	Droceraceae	Drosera rotundifolia	X	X	X	X	X	X	X		X	X	X		
14	Lentibulariaceae	Utricularia vulgaris	X	X	X		X		X		X		X	X	
15	Orchidaceae	Calopogon pulchellus		X	X	X	X	X	X	X	X				
16		Calopogon tuberosus		X											
17		Cypripedium acaule					X				X				
18		Pogonia ophioglossoides			X	X				X	X				
19	Voilaceae	Viola cucullata							X			X		X	X
20		Viola macloskeyi							X	X		X	X	X	
21		Viola renifolia		X					X			X			
22	Primulaceae	Lysimachia terrestris				X			X	X					
23		Lysimachia thyrsiflora					X							X	
24		Trientalis borealis		X			X					X			
25	Araceae	Calla palustris		X		X	X		X		X	X	X	X	X
26	Cyperaceae	Carex bebbii			X				X		X		X		X
27		Carex brunnescens							X	X					
28		Carex castanea	X		X		X	X						X	
29		Carex crawfordii											X		
30		Carex crinata					X								
31		Carex diandra										X			
32		Carex gracillima		X								X	X		
33		Carex interior	X			X	X			X	X				
34		Carex limosa	X	X	X	X									
35		Carex pauciflora		X				X					X		
36		Carex magellanica var. magellanica					X			X					
37		Carex projecta							X	X			X	X	X
38		Carex pseudocyperus												X	
39		Carex retrorsa													X
40		Carex rostrata			X							X			
41		Carex stipata													X
42		Carex stricta								X					X
43		Carex stricta, diff. subspecies									X				
44		Carex trisperma		X		X				X					X
45		Dulichium arundinaceum					X		X		X	X	X		
46		Eleocharis acicularis									X			X	
47		Eriophorum vaginatum var. spissum	X	X	X			X			X				
48		Luzula acuminata							X						
49		Rhynchospora alba	X	X	X	X				X	X			X	
50		Scirpus americanus													X
51		Scirpus atrovirens										X			
52		Scirpus cyperinus				X				X					
53		Scirpus tabernaemontani			X				X		X				X
54	Gramineae	Agrostis gigantea													X
55		Agrostis perennans							X						
56		Calamagrostis canadensis					X		X	X	X		X	X	X
57		Dactylis glomerata													X
58		Dichanthelium depauperatum											X		
59	Juncusaea	Juncus effusus	X				[illegible]			X	X	X	X		
60		Juncus sp. (tenuis?)									X				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
61		Mean pH at Collecting Site	4.2	4.4	4.6	4.7	4.8	4.9	5.7	6	6.2	6.3	6.4	7.1	8
62	FAMILY	GENUS & SPECIES	N'GATE	TENDER	ED'S	CRANBERRY	HUM'BIRD	FS BOG	BOGPOT	BOLGER	TUESDAY	CRAMPTON	REDD'TON	MORRIS	BROWN
63	Sphagnaceae	Sphag. cappillifolium var. tenellum									X				
64		Sphagnum cuspidatum				X									
65		Sphagnum girgensohnii										X			
66		Sphagnum magellanicum	X	X	X	X	X	X	X	X	X		X		
67		Sphag. recurvuum var. brevifolium	X	X			X	X	X		X				
68		Sphagnum teres											X		
69	Nymphaeaceae	Brasenia schreberi								X	X		X		
70		Nuphar variegatum					X		X	X	X	X	X	X	X
71		Nymphaea odorata						X	X	X		X		X	X
72	Equisetaceae	Equisetum fluviatile							X	X		X	X	X	
73	Ceratophyllaceae	Ceratophyllum demersum								X					X
74	Cornaceae	Cornus alternifolia							X						
75	Typhaceae	Typha latifolia					X		X	X	X	X	X	X	X
76	Araliaceae	Aralia nudicaulis							X						
77	Ranunculaceae	Caltha palustris												X	
78		Coptis trifolia							X						
79	Iridaceae	Iris versicolor					X		X	X	X	X	X		
80	Leguminosae	Melilotis officinalis							X						
81		Trifolium repens												X	
82	Najadaceae	Najas flexilis												X	X
83		Potamogeton amplifolius											X	X	X
84		Potamogeton epihydrus											X		
85		Potamogeton foliosus													X
86		Potamogeton gramineus									X		X		
87		Potamogeton natans											X		
88		Potamogeton oakesianus							X						
89		Potamogeton obtusifolius												X	X
90		Potamogeton pusillus											X	X	
91		Potamogeton robbinsii							X						X
92		Potamogeton zosteriformis												X	
93	Rosaceae	Geum rivale										X			
94		Potentilla norvegica											X		
95		Potentilla palustris					X			X	X	X	X	X	X
96		Rubus sp.									X				
97		Waldsteinia fragarioides		X			X								
98	Lemnaceae	Lemna minor								X			X	X	X
99		Spirodela polyrrhiza												X	
100	Juncaginaceae	Scheuchzeria palustris			X								X		
101	Alismaceae	Sagittaria latifolia										X	X	X	X
102	Polygonaceae	Rumex crispus											X		
103	Lamiaceae	Prunella vulgaris													X
104		Scutellaria integrifolia											X	X	X
105	Pontederiaceae	Heteranthera dubia											X		
106		Pontedaria cordata					X				X	X		X	X
107	Gentianaceae	Menyanthes trifoliata	X							X	X				
108	Lobeliaceae	Lobelia dortmanna										X		X	
109	Asclepiadaceae	Asclepias incarnata												X	
110	Betulaceae	Betula sp.										X			
111	Isoetaceae	Isoetes sp.										X			X
112		Isoetes echinospora										X			
113	Hydrocharitaceae	Elodea canadensis													X
114	Liliaceae	Maianthemum canadense									X				
115		Maianthemum trifolium	X			X				X					
116	Rubiaceae	Gallium labradoricum									X	X		X	
117	Polygonaceae	Polygonum persicaria													X
118	Sparga	Sparganium sp.							X			X	X	X	X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
119		Mean pH at Collecting Site	4.2	4.4	4.6	4.7	4.8	4.9	5.7	6	6.2	6.3	6.4	7.1	8
120	FAMILY	GENUS & SPECIES	N'GATE	TENDER	ED'S	CRANBERRY	HUM'BIRD	FS BOG	BOGPOT	BOLGER	TUESDAY	CRAMPTON	REDD'TON	MORRIS	BROWN
121	Hypericaceae	Hypericum boreale													X
122		Hypericum ellipticum												X	
123		Hypericum sp.				X									
124		Triadenum fraseri				X	X		X						
125	Caryophyllaceae	Stellaria longifolia		X											
126		Stellaria media											X		
127	Umbelliferae	Sium suave											X		
128	Salicaceae	Salix eriocephala							X						
129	Myricaceae	Myrica gale			X										
130	Callitrichaceae	Callitriche palustris												X	
131	Labiatae	Lycopus uniflorus				X	X				X	X	X		
132	Urticaceae	Urtica urens													X
133	BRYOPHYTES														
134	Aulacomniaceae	Aulacomnium palustre			X								X	X	X
135	Ditrichaceae	Ceratodon purpureus										X			
136	Mniceae	Rhizomnium sp.				X	X								
137	ALGAE														
138	Chlorophyceae	Hydrodictyon Sp.													X
139	Characeae	Nitella sp.												X	
140	PORIFERA	Spongilla sp.				X	X						X	X	
141	BRYOZOA					X						X			
142															

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	**MACROPHYTE SURVEY OF BOGS (AND LAKES) AT UNDERC**								Karen Francl, Summer 1996						
3	CHART 2	ALKALINITY (mg/L)	0	0	0	1	1.5	2	3	3	5	10	12	27	50
4	**FAMILY**	**GENUS & SPECIES**	N'GATE	TENDER	CRANBERRY	HUMBIRD	TUESDAY	BOGPOT	ED'S	FS BOG	CRAMPTON	REDD'TON	BOLGER	MORRIS	BROWN
5	Ericaceae	Andromeda glaucophylla	X	X	X	X	X		X	X	X	X			
6		Chamaedaphnia calyculata	X	X	X	X	X	X	X	X	X	X	X	X	
7		Chiogenes hispidula	X	X	X	X			X				X		
8		Kalmia polifolia	X	X	X	X	X		X	X	X	X	X		
9		Ledum groenlandicum	X	X	X	X	X		X	X					
10		Vaccinium macrocarpon	X	X	X		X		X				X		
11		Vaccinium myrtilloides	X		X		X		X			X			
12	Sarraceniaceae	Sarracenia purpurea	X	X	X		X		X	X			X		
13	Droceraceae	Drosera rotundifolia	X	X	X	X	X	X	X	X	X	X			
14	Lentibulariaceae	Utricularia vulgaris	X	X		X	X	X	X			X		X	
15	Orchidaceae	Calopogon pulchellus		X	X	X	X	X	X	X			X		
16		Calopogon tuberosus		X											
17		Cypripedium acaule				X	X								
18		Pogonia ophioglossoides			X		X		X				X		
19	Voilaceae	Viola cucullata						X			X			X	X
20		Viola macloskeyi						X			X	X	X	X	
21		Viola renifolia		X				X			X				
22	Primulaceae	Lysimachia terrestris			X			X					X		
23		Lysimachia thyrsiflora				X								X	
24		Trientalis borealis		X		X					X				
25	Araceae	Calla palustris		X	X	X	X	X			X	X		X	X
26	Cyperaceae	Carex bebbii					X	X	X			X			X
27		Carex brunnescens						X					X		
28		Carex castanea	X			X			X	X				X	
29		Carex crawfordii										X			
30		Carex crinata				X									
31		Carex diandra									X				
32		Carex gracillima		X							X	X			
33		Carex interior	X		X	X	X						X		
34		Carex limosa	X	X	X				X						
35		Carex pauciflora		X						X		X			
36		Carex magellanica var. magellanica				X							X		
37		Carex projecta						X				X	X	X	X
38		Carex pseudocyperus												X	
39		Carex retrorsa													X
40		Carex rostrata							X		X				
41		Carex stipata													X
42		Carex stricta											X		X
43		Carex stricta, diff. subspecies					X								
44		Carex trisperma		X	X								X		X
45		Dulichium arundinaceum				X	X	X			X	X			
46		Eleocharis acicularis					X							X	
47		Eriophorum vaginatum var. spissum	X	X			X		X	X					
48		Luzula acuminata						X							
49		Rhynchospora alba	X	X	X		X		X				X	X	
50		Scirpus americanus													X
51		Scirpus atrovirens									X				
52		Scirpus cyperinus			X								X		
53		Scirpus tabernaemontani					X	X	X						X
54	Gramineae	Agrostis gigantea													X
55		Agrostis perennans						X							
56		Calamagrostis canadensis				X	X	X				X	X	X	X
57		Dactylis glomerata													X
58		Dichanthelium depauperatum										X			
59	Juncusaea	Juncus effusus	X			X	X				X	X	X		
60		Juncus sp. (tenuis?)													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
61	CHART 2	ALKALINITY (mg/L)	0	0	0	1	1.5	2	3	3	5	10	12	27	50
62	**FAMILY**	**GENUS & SPECIES**	N'GATE	TENDER	CRANBERRY	HUM'BIRD	TUESDAY	BOGPOT	ED'S	FS BOG	CRAMPTON	REDD'TON	BOLGER	MORRIS	BROWN
63	Sphagnaceae	Sphag. cappillifolium var. tenellum					X								
64		Sphagnum cuspidatum			X										
65		Sphagnum girgensohnii									X				
66		Sphagnum magellanicum	X	X	X	X	X	X	X	X		X	X		
67		Sphag. recurvuum var. brevifolium	X	X		X	X	X		X					
68		Sphagnum teres										X			
69	Nymphaeaceae	Brasenia schreberi					X					X	X		
70		Nuphar variegatum				X	X	X			X	X	X	X	X
71		Nymphaea odorata						X		X	X		X	X	X
72	Equisetaceae	Equisetum fluviatile						X			X	X	X	X	
73	Ceratophyllaceae	Ceratophyllum demersum											X		X
74	Cornaceae	Cornus alternifolia						X							
75	Typhaceae	Typha latifolia				X	X	X			X	X	X	X	X
76	Araliaceae	Aralia nudicaulis						X							
77	Ranunculaceae	Caltha palustris												X	
78		Coptis trifolia						X							
79	Iridaceae	Iris versicolor				X	X	X			X	X	X		
80	Leguminosae	Melilotis officinalis						X							
81		Trifolium repens												X	
82	Najadaceae	Najas flexilis												X	X
83		Potamogeton amplifolius										X		X	X
84		Potamogeton epihydrus										X			
85		Potamogeton foliosus													X
86		Potamogeton gramineus					X					X			
87		Potamogeton natans										X			
88		Potamogeton oakesianus						X							
89		Potamogeton obtusifolius												X	X
90		Potamogeton pusillus										X		X	
91		Potamogeton robbinsii						X							X
92		Potamogeton zosteriformis												X	
93	Rosaceae	Geum rivale									X				
94		Potentilla norvegica										X			
95		Potentilla palustris				X	X				X	X	X	X	X
96		Rubus sp.					X								
97		Waldsteinia fragarioides		X		X									
98	Lemnaceae	Lemna minor										X	X	X	X
99		Spirodela polyrrhiza												X	
100	Juncaginaceae	Scheuchzeria palustris							X			X			
101	Alismaceae	Sagittaria latifolia									X	X		X	X
102	Polygonaceae	Rumex crispus										X			
103	Lamiaceae	Prunella vulgaris													X
104		Scutellaria integrifolia										X		X	X
105	Pontederiaceae	Heteranthera dubia										X			
106		Pontedaria cordata				X	X				X			X	X
107	Gentianaceae	Menyanthes trifoliata	X				X						X		
108	Lobeliaceae	Lobelia dortmanna									X			X	
109	Asclepiadaceae	Asclepias incarnata												X	
110	Betulaceae	Betula sp.									X				
111	Isoetaceae	Isoetes sp.									X				X
112		Isoetes echinospora									X				
113	Hydrocharitaceae	Elodea canadensis													X
114	Liliaceae	Maianthemum canadense					X								
115		Maianthemum trifolium	X		X								X		
116	Rubiaceae	Gallium labradoricum					X				X			X	
117	Polygonaceae	Polygonum persicaria													X
118	Spargar	Sparganium sp.						X			X	X		X	X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
119	CHART 2	ALKALINITY (mg/L)	0	0	0	1	1.5	2	3	3	5	10	12	27	50
120	**FAMILY**	**GENUS & SPECIES**	N'GATE	TENDER	CRANBERRY	HUMBIRD	TUESDAY	BOGPOT	ED'S	FS BOG	CRAMPTON	REDD'TON	BOLGER	MORRIS	BROWN
121	Hypericaceae	Hypericum boreale													X
122		Hypericum ellipticum												X	
123		Hypericum sp.			X										
124		Triadenum fraseri			X	X		X							
125	Caryophyllaceae	Stellaria longifolia		X											
126		Stellaria media										X			
127	Umbelliferae	Sium suave										X			
128	Salicaceae	Salix eriocephala						X							
129	Myricaceae	Myrica gale							X						
130	Callitrichaceae	Callitriche palustris												X	
131	Labiatae	Lycopus uniflorus			X	X	X				X	X			
132	Urticaceae	Urtica urens													X
133	BRYOPHYTES														
134	Aulacomniaceae	Aulacomnium palustre							X			X		X	X
135	Ditrichaceae	Ceratodon purpureus									X				
136	Mniceae	Rhizomnium sp.			X	X									
137	ALGAE														
138	Chlorophyceae	Hydrodictyon Sp.													X
139	Characeae	Nitella sp.												X	
140	PORIFERA	Spongilla sp.			X	X						X		X	
141	BRYOZOA				X						X				
142															

Depth

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	**MACROPHYTE SURVEY OF BOGS (AND LAKES) AT UNDERC**								Karen Francl, Summer 1996						
3	CHART 3	MAXIMUM DEPTH (M)	2	3.5	4.5	5.5	6	6.71	7	7	7.5	15	15.25	16	19
4	**FAMILY**	**GENUS & SPECIES**	BOGPOT	BOLGER	FS BOG	BROWN	N'GATE	MORRIS	ED'S	HUM'BIRD	CRANBERRY	TENDER	CRAMPTON	REDD'TON	TUESDAY
5	Ericaceae	Andromeda glaucophylla			X		X		X	X	X	X	X	X	X
6		Chamaedaphnia calyculata	X	X	X		X	X	X	X	X	X	X	X	X
7		Chiogenes hispidula		X			X		X	X	X	X			
8		Kalmia polifolia		X	X		X		X	X	X	X	X	X	X
9		Ledum groenlandicum			X		X		X	X	X	X			X
10		Vaccinium macrocarpon		X			X		X		X	X			X
11		Vaccinium myrtilloides					X		X		X			X	X
12	Sarraceniaceae	Sarracenia purpurea		X	X		X		X		X	X			X
13	Droceraceae	Drosera rotundifolia	X		X		X		X	X	X	X	X	X	X
14	Lentibulariaceae	Utricularia vulgaris	X				X	X	X	X		X		X	X
15	Orchidaceae	Calopogon pulchellus	X	X	X				X	X	X	X			X
16		Calopogon tuberosus										X			
17		Cypripedium acaule								X					X
18		Pogonia ophioglossoides		X					X		X				X
19	Voilaceae	Viola cucullata	X			X		X					X		
20		Viola macloskeyi	X	X				X					X	X	
21		Viola renifolia	X									X	X		
22	Primulaceae	Lysimachia terrestris	X	X							X				
23		Lysimachia thyrsiflora						X		X					
24		Trientalis borealis								X		X	X		
25	Araceae	Calla palustris	X			X		X		X	X	X	X	X	X
26	Cyperaceae	Carex bebbii	X			X			X					X	X
27		Carex brunnescens	X	X											
28		Carex castanea			X		X	X	X	X					
29		Carex crawfordii												X	
30		Carex crinata								X					
31		Carex diandra											X		
32		Carex gracillima										X	X	X	
33		Carex interior		X			X			X	X				X
34		Carex limosa					X		X		X	X			
35		Carex pauciflora			X							X		X	
36		Carex magellanica var. magellanica		X						X					
37		Carex projecta	X	X		X		X						X	
38		Carex pseudocyperus						X							
39		Carex retrorsa				X									
40		Carex rostrata							X				X		
41		Carex stipata				X									
42		Carex stricta		X		X									
43		Carex stricta, diff. subspecies													X
44		Carex trisperma		X		X					X	X			
45		Dulichium arundinaceum	X							X			X	X	X
46		Eleocharis acicularis						X							X
47		Eriophorum vaginatum var. spissum			X		X		X			X			X
48		Luzula acuminata	X												
49		Rhynchospora alba		X			X	X	X		X	X			X
50		Scirpus americanus				X									
51		Scirpus atrovirens											X		
52		Scirpus cyperinus		X							X				
53		Scirpus tabernaemontani	X			X			X						X
54	Gramineae	Agrostis gigantea				X									
55		Agrostis perennans	X												
56		Calamagrostis canadensis	X	X		X		X		X				X	X
57		Dactylis glomerata				X									
58		Dichanthelium depauperatum												X	
59	Juncusa	Juncus effusus		X			X			X			X	X	X
60		Juncus sp. (tenuis?)													X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
61	CHART 3	MAXIMUM DEPTH (M)	2	3.5	4.5	5.5	6	6.71	7	7	7.5	15	15.25	16	19
62	**FAMILY**	**GENUS & SPECIES**	BOGPOT	BOLGER	FS BOG	BROWN	N'GATE	MORRIS	ED'S	HUMBIRD	CRANBERRY	TENDER	CRAMPTON	REDD'TON	TUESDAY
63	Sphagnaceae	Sphag. cappillifolium var. tenellum													X
64		Sphagnum cuspidatum									X				
65		Sphagnum girgensohnii											X		
66		Sphagnum magellanicum	X	X	X		X		X	X	X	X		X	X
67		Sphag. recurvuum var. brevifolium	X		X		X			X		X			X
68		Sphagnum teres												X	
69	Nymphaeaceae	Brasenia schreberi		X										X	X
70		Nuphar variegatum	X	X		X		X		X			X	X	X
71		Nymphaea odorata	X	X	X	X		X					X		
72	Equisetaceae	Equisetum fluviatile	X	X				X					X	X	
73	Ceratophyllaceae	Ceratophyllum demersum		X		X									
74	Cornaceae	Cornus alternifolia	X												
75	Typhaceae	Typha latifolia	X	X		X		X		X			X	X	X
76	Araliaceae	Aralia nudicaulis	X												
77	Ranunculaceae	Caltha palustris						X							
78		Coptis trifolia	X												
79	Iridaceae	Iris versicolor	X	X						X			X	X	X
80	Leguminosae	Melilotis officinalis	X												
81		Trifolium repens						X							
82	Najadaceae	Najas flexilis				X		X							
83		Potamogeton amplifolius				X		X						X	
84		Potamogeton epihydrus												X	
85		Potamogeton foliosus				X									
86		Potamogeton gramineus												X	X
87		Potamogeton natans												X	
88		Potamogeton oakesianus	X												
89		Potamogeton obtusifolius				X		X							
90		Potamogeton pusillus						X						X	
91		Potamogeton robbinsii	X			X									
92		Potamogeton zosteriformis						X							
93	Rosaceae	Geum rivale											X		
94		Potentilla norvegica												X	
95		Potentilla palustris		X		X		X		X			X	X	X
96		Rubus sp.													X
97		Waldsteinia fragarioides								X		X			
98	Lemnaceae	Lemna minor		X		X		X						X	
99		Spirodela polyrrhiza						X							
100	Juncaginaceae	Scheuchzeria palustris							X					X	
101	Alismaceae	Sagittaria latifolia				X		X					X	X	
102	Polygonaceae	Rumex crispus												X	
103	Lamiaceae	Prunella vulgaris				X									
104		Scutellaria integrifolia				X		X						X	
105	Pontederiaceae	Heteranthera dubia												X	
106		Pontedaria cordata				X		X		X			X		X
107	Gentianaceae	Menyanthes trifoliata		X			X								X
108	Lobeliaceae	Lobelia dortmanna						X					X		
109	Asclepiadaceae	Asclepias incarnata						X							
110	Betulaceae	Betulla sp.											X		
111	Isoetaceae	Isoetes sp.				X							X		
112		Isoetes echinospora											X		
113	Hydrocharitaceae	Elodea canadensis				X									
114	Liliaceae	Maianthemum canadense													X
115		Maianthemum trifolium		X			X				X				
116	Rubiaceae	Gallium labradoricum						X					X		X
117	Polygonaceae	Polygonum persicaria				X									
118	Spargar[illegible]e	Sparganium sp.	X			X		X					X	X	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
119	CHART 3	MAXIMUM DEPTH (M)	2	3.5	4.5	5.5	6	6.71	7	7	7.5	15	15.25	16	19
120	FAMILY	GENUS & SPECIES	BOGPOT	BOLGER	FS BOG	BROWN	N'GATE	MORRIS	ED'S	HUMBIRD	CRANBERRY	TENDER	CRAMPTON	REDD'TON	TUESDAY
121	Hypericaceae	Hypericum boreale				X									
122		Hypericum ellipticum						X							
123		Hypericum sp.									X				
124		Triadenum fraseri	X							X	X				
125	Caryophyllaceae	Stellaria longifolia										X			
126		Stellaria media												X	
127	Umbelliferae	Sium suave												X	
128	Salicaceae	Salix eriocephala	X												
129	Myricaceae	Myrica gale							X						
130	Callitrichaceae	Callitriche palustris						X							
131	Labiatae	Lycopus uniflorus								X	X		X	X	X
132	Urticaceae	Urtica urens				X									
133	BRYOPHYTES														
134	Aulacomniaceae	Aulacomnium palustre				X		X	X					X	
135	Ditrichaceae	Ceratodon purpureus											X		
136	Mniceae	Rhizomnium sp.								X	X				
137	ALGAE														
138	Chlorophyceae	Hydrodictyon Sp.				X									
139	Characeae	Nitella sp.						X							
140	PORIFERA	Spongilla sp.						X		X	X			X	
141	BRYOZOA										X		X		
142															

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	MACROPHYTE SURVEY OF BOGS (AND LAKES) A		Karen Francl, Summer 1996												
3	CHART 4	MAXUMUM LENGTH (M)	30.5	48	60	60	125	175	190	192	192	460	1300	12050	13000
4	FAMILY	GENUS & SPECIES	ED'S	FS BOG	TENDER	N'GATE	TUESDAY	BOLGER	CRANBERRY	HUM'BIRD	REDD'TON	MORRIS	BOGPOT	BROWN	CRAMPTON
5	Ericaceae	Andromeda glaucophylla	X	X	X	X	X		X	X	X				X
6		Chamaedaphnia calyculata	X	X	X	X	X	X	X	X	X	X	X		X
7		Chiogenes hispidula	X		X	X		X	X	X					
8		Kalmia polifolia	X	X	X	X	X	X	X	X	X				X
9		Ledum groenlandicum	X	X	X	X	X		X	X					
10		Vaccinium macrocarpon	X		X	X	X	X	X						
11		Vaccinium myrtilloides	X			X	X		X		X				
12	Sarraceniaceae	Sarracenia purpurea	X	X	X	X	X	X	X						
13	Droceraceae	Drosera rotundifolia	X	X	X	X	X		X	X	X		X		X
14	Lentibulariaceae	Utricularia vulgaris	X		X	X	X			X	X	X	X		
15	Orchidaceae	Calopogon pulchellus	X	X	X		X	X	X	X			X		
16		Calopogon tuberosus			X										
17		Cypripedium acaule					X			X					
18		Pogonia ophioglossoides	X				X	X	X						
19	Voilaceae	Viola cucullata										X	X	X	X
20		Viola macloskeyi						X			X	X	X		X
21		Viola renifolia			X								X		X
22	Primulaceae	Lysimachia terrestris						X	X				X		
23		Lysimachia thyrsiflora								X		X			
24		Trientalis borealis			X					X					X
25	Araceae	Calla palustris			X		X		X	X	X	X	X	X	X
26	Cyperaceae	Carex bebbii	X				X				X		X	X	
27		Carex brunnescens						X					X		
28		Carex castanea	X	X		X				X		X			
29		Carex crawfordii									X				
30		Carex crinata								X					
31		Carex diandra													X
32		Carex gracillima			X						X				X
33		Carex interior				X	X	X	X	X					
34		Carex limosa	X		X	X			X						
35		Carex pauciflora		X	X						X				
36		Carex magellanica var. magellanica						X		X					
37		Carex projecta						X			X	X	X	X	
38		Carex pseudocyperus										X			
39		Carex retrorsa												X	
40		Carex rostrata	X												X
41		Carex stipata												X	
42		Carex stricta						X						X	
43		Carex stricta, diff. subspecies					X								
44		Carex trisperma			X			X	X					X	
45		Dulichium arundinaceum					X			X	X		X		X
46		Eleocharis acicularis					X					X			
47		Eriophorum vaginatum var. spissum	X	X	X	X	X								
48		Luzula acuminata											X		
49		Rhynchospora alba	X		X	X	X	X	X			X			
50		Scirpus americanus												X	
51		Scirpus atrovirens													X
52		Scirpus cyperinus						X	X						
53		Scirpus tabernaemontani	X				X						X	X	
54	Gramineae	Agrostis gigantea												X	
55		Agrostis perennans											X		
56		Calamagrostis canadensis					X	X		X	X	X	X	X	
57		Dactylis glomerata												X	
58		Dichanthelium depauperatum									X				
59	Juncusae	Juncus effusus				X	X	X		X	X				X
60		Juncus sp. (tenuis?)													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
61	CHART 4	MAXUMUM LENGTH (M)	30.5	48	60	60+	125	175	190	192	192+	460	1300	12050	13000+
62	**FAMILY**	**GENUS & SPECIES**	ED'S	FS BOG	TENDER	N'GATE	TUESDAY	BOLGER	CRANBERRY	HUMBIRD	REDD'TON	MORRIS	BOGPOT	BROWN	CRAMPTON
63	Sphagnaceae	Sphag. cappillifolium var. tenellum					X								
64		Sphagnum cuspidatum							X						
65		Sphagnum girgensohnii													X
66		Sphagnum magellanicum	X	X	X	X	X	X	X	X	X		X		
67		Sphag. recurvuum var. brevifolium		X	X	X	X			X			X		
68		Sphagnum teres									X				
69	Nymphaeaceae	Brasenia schreberi					X	X			X				
70		Nuphar variegatum					X	X		X	X	X	X	X	X
71		Nymphaea odorata		X				X				X	X	X	X
72	Equisetaceae	Equisetum fluviatile						X			X	X	X		X
73	Ceratophyllaceae	Ceratophyllum demersum						X						X	
74	Cornaceae	Cornus alternifolia											X		
75	Typhaceae	Typha latifolia					X	X		X	X	X	X	X	X
76	Araliaceae	Aralia nudicaulis											X		
77	Ranunculaceae	Caltha palustris										X			
78		Coptis trifolia											X		
79	Iridaceae	Iris versicolor					X	X		X	X		X		X
80	Leguminosae	Melilotis officinalis											X		
81		Trifolium repens										X			
82	Najadaceae	Najas flexilis										X		X	
83		Potamogeton amplifolius									X	X		X	
84		Potamogeton epihydrus									X				
85		Potamogeton foliosus												X	
86		Potamogeton gramineus					X				X				
87		Potamogeton natans									X				
88		Potamogeton oakesianus											X		
89		Potamogeton obtusifolius										X		X	
90		Potamogeton pusillus									X	X			
91		Potamogeton robbinsii											X	X	
92		Potamogeton zosteriformis										X			
93	Rosaceae	Geum rivale													X
94		Potentilla norvegica									X				
95		Potentilla palustris					X	X		X	X	X		X	X
96		Rubus sp.					X								
97		Waldsteinia fragarioides			X					X					
98	Lemnaceae	Lemna minor						X			X	X		X	
99		Spirodela polyrrhiza										X			
100	Juncaginaceae	Scheuchzeria palustris	X								X				
101	Alismaceae	Sagittaria latifolia									X	X		X	X
102	Polygonaceae	Rumex crispus									X				
103	Lamiaceae	Prunella vulgaris												X	
104		Scutellaria integrifolia									X	X		X	
105	Pontederiaceae	Heteranthera dubia									X				
106		Pontedaria cordata					X			X		X		X	X
107	Gentianaceae	Menyanthes trifoliata				X	X	X							
108	Lobeliaceae	Lobelia dortmanna										X			X
109	Asclepiadaceae	Asclepias incarnata										X			
110	Betulaceae	Betula sp.													X
111	Isoetaceae	Isoetes sp.												X	X
112		Isoetes echinospora													X
113	Hydrocharitaceae	Elodea canadensis												X	
114	Liliaceae	Maianthemum canadense					X								
115		Maianthemum trifolium				X		X	X						
116	Rubiaceae	Gallium labradoricum					X					X			X
117	Polygonaceae	Polygonum persicaria												X	
118	Spargar e	Sparganium sp.									X	X	X	X	X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
119	CHART 4	MAXUMUM LENGTH (M)	30.5	48	60	60+	125	175	190	192	192+	460	1300	12050	13000+
120	FAMILY	GENUS & SPECIES	ED'S	FS BOG	TENDER	N'GATE	TUESDAY	BOLGER	CRANBERRY	HUM'BIRD	REDD'TON	MORRIS	BOGPOT	BROWN	CRAMPTON
121	Hypericaceae	Hypericum boreale												X	
122		Hypericum ellipticum										X			
123		Hypericum sp.							X						
124		Triadenum fraseri							X	X			X		
125	Caryophyllaceae	Stellaria longifolia			X										
126		Stellaria media									X				
127	Umbelliferae	Sium suave									X				
128	Salicaceae	Salix eriocephala											X		
129	Myricaceae	Myrica gale	X												
130	Callitrichaceae	Callitriche palustris										X			
131	Labiatae	Lycopus uniflorus					X		X	X	X				X
132	Urticaceae	Urtica urens												X	
133	BRYOPHYTES														
134	Aulacomniaceae	Aulacomnium palustre	X								X	X		X	
135	Ditrichaceae	Ceratodon purpureus													X
136	Mniceae	Rhizomnium sp.							X	X					
137	ALGAE														
138	Chlorophyceae	Hydrodictyon Sp.												X	
139	Characeae	Nitella sp.										X			
140	PORIFERA	Spongilla sp.							X	X	X	X			
141	BRYOZOA								X						X
142															

Size

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	MACROPHYTE SURVEY OF BOGS (AND LAKES) A		Karen Francl, Summer 1996												
3	CHART 5	RELATIVE SIZE	SMALLEST												LARGEST
4	FAMILY	GENUS & SPECIES	ED'S	TENDER	FS BOG	N'GATE	BOLGER	TUESDAY	HUM'BIRD	CRANBERRY	REDD'TON	BOGPOT	MORRIS	BROWN	CRAMPTON
5	Ericaceae	Andromeda glaucophylla	X	X	X	X		X	X	X	X				X
6		Chamaedaphnia calyculata	X	X	X	X	X	X	X	X	X	X	X		X
7		Chiogenes hispidula	X	X		X	X		X	X					
8		Kalmia polifolia	X	X	X	X	X	X	X	X	X				X
9		Ledum groenlandicum	X	X	X	X		X	X	X					
10		Vaccinium macrocarpon	X	X		X	X	X		X					
11		Vaccinium myrtilloides	X			X		X		X	X				
12	Sarraceniaceae	Sarracenia purpurea	X	X	X	X	X	X		X					
13	Droceraceae	Drosera rotundifolia	X	X	X	X		X	X	X	X	X			X
14	Lentibulariaceae	Utricularia vulgaris	X	X		X		X	X		X	X	X		
15	Orchidaceae	Calopogon pulchellus	X	X	X		X	X	X	X		X			
16		Calopogon tuberosus		X											
17		Cypripedium acaule						X	X						
18		Pogonia ophioglossoides	X				X	X		X					
19	Voilaceae	Viola cucullata										X	X	X	X
20		Viola macloskeyi					X				X	X	X		X
21		Viola renifolia		X								X			X
22	Primulaceae	Lysimachia terrestris					X			X		X			
23		Lysimachia thyrsiflora							X				X		
24		Trientalis borealis		X					X						X
25	Araceae	Calla palustris		X				X	X	X	X	X	X	X	X
26	Cyperaceae	Carex bebbii	X					X			X	X		X	
27		Carex brunnescens					X					X			
28		Carex castanea	X		X	X			X				X		
29		Carex crawfordii									X				
30		Carex crinata							X						
31		Carex diandra													X
32		Carex gracillima		X							X				X
33		Carex interior				X	X	X	X	X					
34		Carex limosa	X	X		X				X					
35		Carex pauciflora		X	X						X				
36		Carex magellanica var. magellanica					X		X						
37		Carex projecta					X				X	X	X	X	
38		Carex pseudocyperus											X		
39		Carex retrorsa												X	
40		Carex rostrata	X												X
41		Carex stipata												X	
42		Carex stricta					X							X	
43		Carex stricta, diff. subspecies						X							
44		Carex trisperma		X			X			X				X	
45		Dulichium arundinaceum						X	X		X	X			X
46		Eleocharis acicularis						X					X		
47		Eriophorum vaginatum var. spissum	X	X	X	X		X							
48		Luzula acuminata										X			
49		Rhynchospora alba	X	X		X	X	X		X			X		
50		Scirpus americanus												X	
51		Scirpus atrovirens													X
52		Scirpus cyperinus					X			X					
53		Scirpus tabernaemontani	X					X				X		X	
54	Gramineae	Agrostis gigantea												X	
55		Agrostis perennans										X			
56		Calamagrostis canadensis					X	X	X		X	X	X	X	
57		Dactylis glomerata												X	
58		Dichanthelium depauperatum									X				
59	Juncusae	Juncus effusus				X	X	X	X		X				X
60		Juncus sp. (tenuis?)						X							

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
61	CHART 5	RELATIVE SIZE	SMALLEST												LARGEST
62	FAMILY	GENUS & SPECIES	ED'S	TENDER	FS BOG	N'GATE	BOLGER	TUESDAY	HUMBIRD	CRANBERRY	REDD'TON	BOGPOT	MORRIS	BROWN	CRAMPTON
63	Sphagnaceae	Sphag. cappillifolium var. tenellum						X							
64		Sphagnum cuspidatum								X					
65		Sphagnum girgensohnii													X
66		Sphagnum magellanicum	X	X	X	X	X	X	X	X	X	X			
67		Sphag. recurvuum var. brevifolium		X	X	X		X	X			X			
68		Sphagnum teres									X				
69	Nymphaeaceae	Brasenia schreberi					X	X			X				
70		Nuphar variegatum					X	X	X		X	X	X	X	X
71		Nymphaea odorata			X		X					X	X	X	X
72	Equisetaceae	Equisetum fluviatile					X				X	X	X		X
73	Ceratophyllaceae	Ceratophyllum demersum					X							X	
74	Cornaceae	Cornus alternifolia										X			
75	Typhaceae	Typha latifolia					X	X	X		X	X	X	X	X
76	Araliaceae	Aralia nudicaulis										X			
77	Ranunculaceae	Caltha palustris											X		
78		Coptis trifolia										X			
79	Iridaceae	Iris versicolor					X	X	X		X	X			X
80	Leguminosae	Melilotis officinalis										X			
81		Trifolium repens											X		
82	Najadaceae	Najas flexilis											X	X	
83		Potamogeton amplifolius									X		X	X	
84		Potamogeton epihydrus									X				
85		Potamogeton foliosus												X	
86		Potamogeton gramineus						X			X				
87		Potamogeton natans									X				
88		Potamogeton oakesianus										X			
89		Potamogeton obtusifolius											X	X	
90		Potamogeton pusillus									X		X		
91		Potamogeton robbinsii										X		X	
92		Potamogeton zosteriformis											X		
93	Rosaceae	Geum rivale													X
94		Potentilla norvegica									X				
95		Potentilla palustris					X	X	X		X		X	X	X
96		Rubus sp.						X							
97		Waldsteinia fragarioides		X					X						
98	Lemnaceae	Lemna minor					X				X		X	X	
99		Spirodela polyrrhiza											X		
100	Juncaginaceae	Scheuchzeria palustris	X								X				
101	Alismaceae	Sagittaria latifolia									X		X	X	X
102	Polygonaceae	Rumex crispus									X				
103	Lamiaceae	Prunella vulgaris												X	
104		Scutellaria integrifolia									X		X	X	
105	Pontederiaceae	Heteranthera dubia									X				
106		Pontedaria cordata						X	X				X	X	X
107	Gentianaceae	Menyanthes trifoliata				X	X	X							
108	Lobeliaceae	Lobelia dortmanna											X		X
109	Asclepiadaceae	Asclepias incarnata											X		
110	Betulaceae	Betulla sp.													X
111	Isoetaceae	Isoetes sp.												X	X
112		Isoetes echinospora													X
113	Hydrocharitaceae	Elodea canadensis												X	
114	Liliaceae	Maianthemum canadense						X							
115		Maianthemum trifolium				X	X			X					
116	Rubiaceae	Gallium labradoricum						X					X		X
117	Polygonaceae	Polygonum persicaria												X	
118	Spargar	Sparganium sp.									X	X	X	X	X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
119	CHART 5	RELATIVE SIZE	SMALLEST												LARGEST
120	**FAMILY**	**GENUS & SPECIES**	ED'S	TENDER	FS BOG	N'GATE	BOLGER	TUESDAY	HUM'BIRD	CRANBERRY	REDD'TON	BOGPOT	MORRIS	BROWN	CRAMPTON
121	Hypericaceae	Hypericum boreale												X	
122		Hypericum ellipticum											X		
123		Hypericum sp.								X					
124		Triadenum fraseri							X	X		X			
125	Caryophyllaceae	Stellaria longifolia		X											
126		Stellaria media									X				
127	Umbelliferae	Sium suave									X				
128	Salicaceae	Salix eriocephala										X			
129	Myricaceae	Myrica gale	X												
130	Callitrichaceae	Callitriche palustris											X		
131	Labiatae	Lycopus uniflorus						X	X	X	X				X
132	Urticaceae	Urtica urens												X	
133	BRYOPHYTES														
134	Aulacomniaceae	Aulacomnium palustre	X								X		X	X	
135	Ditrichaceae	Ceratodon purpureus													X
136	Mniceae	Rhizomnium sp.							X	X					
137	ALGAE														
138	Chlorophyceae	Hydrodictyon Sp.												X	
139	Characeae	Nitella sp.											X		
140	PORIFERA	Spongilla sp.							X	X	X		X		
141	BRYOZOA									X					X
142															