

28 February 2003

Mackenzie Valley Environmental Impact Review Board (MVEIRB)
Box 938, 5102 – 50th Avenue
Yellowknife, NT X1A 2N7

Attention: Glenda Fratton, Environmental Assessment Coordinator

Dear: Glenda

SUBJECT: Dissolved Oxygen Baseline for Snap Lake – 2003 Program

Please accept the attached technical memo titled "Dissolved Oxygen Baseline for Snap Lake – 2003 Program" for submission to the Public Registry. This memo was compiled in response to issues raised by the Department of Fisheries and Oceans during the MVEIRB Technical Sessions.

Additionally, information contained within this memo should address the outstanding concerns identified by Indian and Northern Affairs Canada in their Request for Ruling to the Board dated 22 January 2003.

Should you have any questions, please feel free to contact the undersigned.

Sincerely,
SNAP LAKE DIAMOND PROJECT

A handwritten signature in black ink, appearing to read "Robin Johnstone".

Robin Johnstone
Senior Environmental Manager



DE BEERS CANADA MINING INC.

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YELLOWKNIFE NT X1A 3S8 CANADA
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TECHNICAL MEMORANDUM



Golder Associates Ltd.

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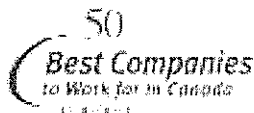
Telephone: 306-665-7989
Fax Access: 306-665-3342

TO:	Robin Johnstone	DATE:	February 27, 2003
FROM:	Dawn Kelly and Rick Schryer	JOB NO:	03-1322-017/5420
Prepared By:	Kevin Himbeault		
RE:	Snap Lake Diamond Project Dissolved Oxygen Baseline for Snap Lake – 2003 Program		

1.0 INTRODUCTION

Dissolved oxygen concentrations in lakes are a balance between processes that introduce oxygen to the water column (e.g., aeration and algal photosynthesis) and processes that consume oxygen (e.g., decomposition of organic matter and nitrification). The environmental assessment report (EAR) for the De Beers Snap Lake Diamond Project predicted that loading from treated minewater discharge will increase the chlorophyll a levels and ammonia concentrations within Snap Lake, which will increase the net oxygen consumption (De Beers 2002). Wind driven mixing, re-aeration and algal photosynthesis during the ice-free period are sufficient to maintain well oxygenated conditions throughout Snap Lake. The development of a continuous ice-cover prevents wind driven mixing and re-aeration within Snap Lake, resulting in a net consumption of oxygen during the winter. It was predicted in the EAR that minimum dissolved oxygen concentrations at the bottom of Snap Lake during the winter could decline by a maximum of 1.0 to 2.2 milligrams per litre (mg/L) as a result of increased nitrification and algal decomposition.

During the Mackenzie Valley Environmental Impact Review Board Technical Sessions conducted in November and December 2002, issues were raised regarding the impact of reduced dissolved oxygen concentrations in the deeper areas of the lake and how this would affect the utilization of these areas by fish (i.e., lake trout) and other aquatic life. De Beers responded to this concern during the Technical Sessions by pointing out that, in a larger lake like Snap Lake, there is better foraging in shallower areas during the winter. Therefore, deeper areas are not critical over-wintering habitat for fish. To provide more baseline data related to these concerns, De Beers collected additional dissolved oxygen measurements in Snap Lake during mid-winter to increase the understanding of present conditions in Snap Lake. The baseline data collected during the February 2003 sampling program are provided in this technical memorandum.



2.0 METHODS

The field program was conducted over a seven day period between February 11 to 17, 2003. Dissolved oxygen was measured at 50 stations in Snap Lake (Figure 1). A bathymetric map of Snap Lake was examined to identify sampling stations prior to commencement of the field program. Stations were chosen to document variability in dissolved oxygen that may occur in different parts of Snap Lake relating to depth, water circulation and the deposition of organic matter. Stations were located at deep holes, shallow areas, small sheltered bays with restricted circulation and open basins (Table 1). Existing baseline water quality sites (WQ1-WQ7) and a few bays receiving inputs of organic material from major streams were included in the program. With the exception of four sites in the northwest arm, all sampling effort focused on the main body of Snap Lake. More sampling sites were located in open basins than in sheltered bays because of their predominance in Snap Lake.

At each station, a four inch hole was drilled with an ice auger and then a sounding ball was lowered to measure ice thickness, water depth and lake bottom composition. Care was taken to minimize disturbance of the water column and bottom sediment when lowering the sounding ball, and it was left in place until dissolved oxygen measurements were completed. A depth profile of dissolved oxygen and temperature was measured at one metre (m) or 0.5 m intervals to within 0.25 to 0.5 m of the lake bottom.

For quality assurance and quality control purposes, duplicate profiles were measured using different dissolved oxygen meters at some stations to verify accuracy and quantify sampling variability. Results from each field day were entered into a spreadsheet and graphically checked for errors and outliers. Sites were repeated if anomalies or steep dissolved oxygen declines were recorded.

3.0 RESULTS

The dissolved oxygen and temperature data collected during the winter 2003 sampling program are graphically presented as depth profiles for each sampling station (Figure 2). Detailed information collected during the survey is provided in Appendix I.

Dissolved oxygen concentrations were high near the surface at all sampling sites and concentrations remained above the Canadian Council of Ministers of the Environment (CCME) guideline for coldwater fish (6.5 mg/L) throughout the water column in 29 of the 50 sampling locations. Dissolved oxygen concentrations in the lower portion of the water column were below the CCME guideline for coldwater fish in 21 of the 50 sampling locations in Snap Lake. Of these 21 sampling locations, 10 locations had minimum dissolved oxygen concentrations below 3.0 mg/L.

Observations of substrate type and basin characteristics were also recorded during the sampling program. On initial review of the data, there does not appear to be any clear correlations between the various physical classifications of the basins and DO concentrations.

4.0 DISCUSSION

Water temperature and dissolved oxygen are the two main factors controlling the depth distribution of lake trout (Martin and Olver 1980). During the summer, this species is typically found in the deep waters of thermally stratified lakes, where the preferred water temperatures is approximately 12°C (US FWS 1984); however, in late fall and winter, lake trout move back into shallower water (Martin and Olver 1980). This general pattern is expected to occur at Snap Lake although Snap Lake does not exhibit thermal stratification in summer.

Some fish species can tolerate low levels of oxygen (i.e., burbot, northern pike); however, most fish attempt to avoid concentrations less than 3.0 to 4.0 mg/L and actively seek habitat with higher levels of dissolved oxygen (Casselman 1978). Lee and Bergerßen (1996) reported that dissolved oxygen concentrations of less than 3.0 mg/L were inadequate for lake trout. Evans (2003) examined the upper threshold required to prevent loss of productivity. He observed that most daily life-support activities in post-larval salmonids are maintained at $\frac{3}{4}$ scope-for-activity (difference between resting and maximum sustainable metabolic rate) which was found to be 7.0 mg/L. The threshold for growth impairment in lake trout also occurs at 7 mg/L. A lake that provides for $\frac{3}{4}$ scope-for-activity of juvenile lake trout should provide long-term habitat protection and prevent the loss of lake trout productivity. Dissolved oxygen levels above 7 mg/L are readily available in the shallower areas of Snap Lake in the winter.

Dissolved oxygen measurements taken from Snap Lake during the mid winter period indicate dissolved oxygen concentrations remain high throughout most of Snap Lake but, in some areas of the lake, dissolved oxygen levels below the 6.5 mg/L guideline for coldwater fish occur naturally. The winter baseline study results show that DO concentrations below 3.0 mg/L near the lake bottom (i.e., 0.25 or 0.5 m above sediments) were encountered in ten of the 50 sample sites. It is likely that fish in Snap Lake already avoid areas which have depressed DO and preferentially move to shallower areas with higher DO concentrations during the winter months.

In response to the intervener concerns that reduced dissolved oxygen concentrations in the deeper areas of the lake could affect the utilization of these areas by fish (i.e., lake trout) and other aquatic life, our preliminary review of these data indicates that areas of reduced dissolved oxygen concentrations occur in Snap Lake naturally. Fish likely avoid these deeper areas under natural conditions and this response is expected to continue during mine operations.

5.0 REFERENCES

Casselman, J. M. 1978. Effects of Environmental Factors on Growth, Survival, and Exploitation of Northern Pike. American Fisheries Society Special Publication 11: 114-128.

Evans, D.O. 2003. A new dissolved oxygen criterion for the protection of lake trout habitat: Linking physiological requirements to recruitment and productive capacity. Canadian Conference for Fisheries Research (CCFFR) 2-5 January 2003. Ottawa, Ontario.

Lee, W. C. and E. P. Bergersen. 1996. Influence of Thermal and Oxygen Stratification on Lake Trout Hooking Mortality. North American Journal of Fisheries Management 16(1): 175-181.

Martin, N. V. and C. H. Olver. 1980. The Lake Charr, *Salvelinus namaycush*. Pages 209-277 in: E. K. Balon, editor. Charrs: Salmonid Fishes of the Genus *Salvelinus*. Perspectives in Vertebrate Science. Volume 1. Dr. W. Junk by Publishers, The Hague. 928 p.

U.S. Department of the Interior, Fish and Wildlife Service (US FWS). 1984. Habitat Suitability Index Models: Lake Trout (Exclusive of the Great Lakes). Report No. FWS/OBS-82/10.84. 12 p.

6.0 CLOSURE

We trust that this report presents the information that you require. Should any portion of the report require clarification, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

Report prepared by:

Report reviewed by:

Kevin Himbeault, M.Sc.,
Senior Environmental Scientist

Mark Digel, M.Sc., M.E.Des.
Associate, Senior Environmental Scientist

TABLES

Table 1
Station Information from the Winter Dissolved Oxygen Survey in Snap Lake, 2003

Station	Depth Classification ^(a)	Circulation Classification	Substrate Classification	Total Depth (m)	Depth Where Concentration < 6.5 mg/L
1	Shallow	Restricted	Soft Bottom	6	5
2	Deep	Restricted	Soft Bottom	12	11
3	Deep	Open	Medium Soft Bottom	7.75	-
4	Deep	Open	Medium Soft Bottom	7	-
5	Deep	Open	Rock Bottom	12.5	-
6	Shallow	Restricted	Soft Bottom	6	-
7	Deep	Open	Soft Bottom	15	14.5
8	Shallow	Restricted	Soft Bottom	5	3.5
9	Shallow	Restricted	Soft Bottom	6	5.5
10	Deep	Restricted	Soft Bottom	14	12
11	Deep	Open	Soft Bottom	14	-
12	Deep	Open	Soft Bottom	15.25	-
13	Deep	Open	Soft Bottom	7	-
14	Deep	Open	Soft Bottom	7.75	6.5
15	Deep	Restricted	Soft Bottom	7.75	7
16	Deep	Open	Soft Bottom	6.75	-
17	Deep	Restricted	Rock Bottom	6.5	-
18	Shallow	Restricted	Soft Bottom	5.75	-
19	Shallow	Restricted	Soft Bottom	6	-
20	Shallow	Restricted	Sand Bottom	5	-
21	Deep	Open	Soft Bottom	12.75	12
22	Deep	Open	Soft Bottom	7.5	-
23	Shallow	Open	Soft Bottom	5.75	-
24	Shallow	Restricted	Soft Bottom	4	-
25	Shallow	Restricted	Soft Bottom	6.25	5
26	Deep	Open	Soft Bottom	12.5	10
27	Shallow	Open	Rock Bottom	6.25	-
28	Shallow	Restricted	Soft Bottom	5.25	-
29	Deep	Restricted	Soft Bottom	4.5	4
30	Deep	Restricted	Rock Bottom	10	-
31	Deep	Open	Soft Bottom	15	12
32	Deep	Restricted	Soft Bottom	9.5	-
33	Deep	Restricted	Soft Bottom	10	-
34	Deep	Restricted	Hard Bottom	26	16
35	Deep	Restricted	Soft Bottom	17.75	17.5
36	Shallow	Restricted	Soft Bottom	5.5	-
37	Shallow	Open	Rock Bottom	6	-
38	Deep	Restricted	Soft Bottom	9	7
39	Deep	Restricted	Soft Bottom	19.25	19
40	Shallow	Restricted	Soft Bottom	5	-
41	Shallow	Restricted	Rock Bottom	4.25	-
42	Deep	Restricted	Soft Bottom	9.25	6
43	Shallow	Restricted	Rock Bottom	4	-
44	Deep	Restricted	Soft Bottom	9	-
45	Shallow	Restricted	Rock Bottom	6.25	-
46	Shallow	Restricted	Sand/Rock Bottom	3.5	-

Table 1
Station Information from the Winter Dissolved Oxygen Survey in Snap Lake, 2003
(continued)

Station	Depth Classification ^(a)	Circulation Classification	Substrate Classification	Total Depth (m)	Depth Where Concentration < 6.5 mg/L
47	Shallow	Restricted	Soft Bottom	6	5
48	Deep	Restricted	Soft Bottom	7	6
49	Deep	Open	Rock Bottom	9.25	-
50	Shallow	Restricted	Soft Bottom	5.25	5

Notes: Sites were considered deep if the maximum depth was > 6 m. Depth is measure from the top of the ice.

Soft bottom – areas with unconsolidated, loose substrate where sounding ball sunk approximately 0.5 m or more.

Medium soft bottom – areas with a firmer substrate and where the sounding ball sunk < 0.5 m

Hard or Sand bottom – firm substrate, likely sand or clay with no rocky material present

Sand/rock bottom – firm substrate area with no sinkage by the sounding ball and some coarse materials.

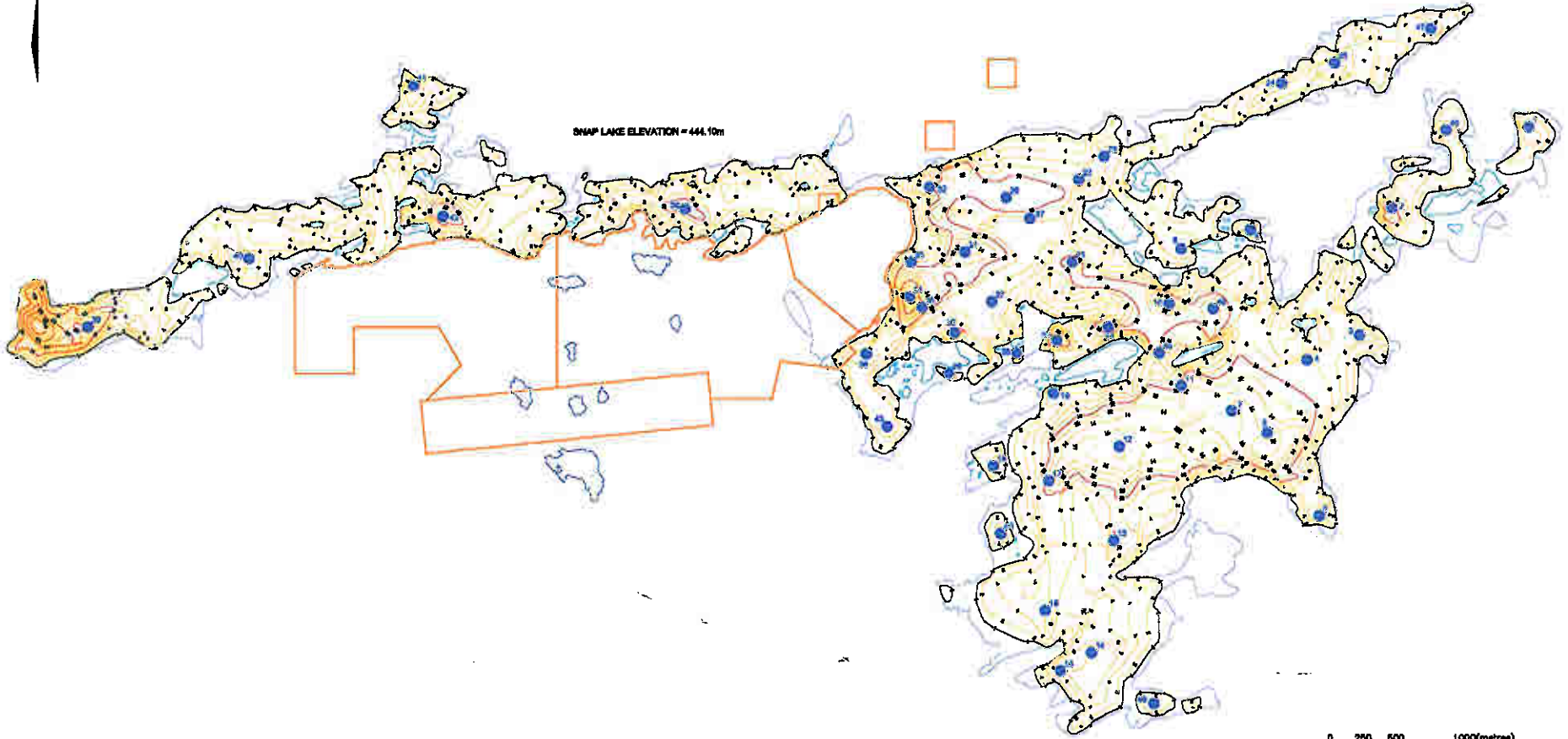
Rock bottom – rocky substrate present, sounding ball could be felt to strike and roll on coarse materials

FIGURES

N:\water\2003\1322\03-1322-017\0420 (finished copy)\Drawing files\1322-017-0400-dissolved oxygen.dwg Feb 21, 2003 3:31pm



SNAP LAKE ELEVATION = 444.10m




0 250 500 1000(metres)
SCALE 1:30000

LEGEND

-  Project Footprint
-  Project Sampling Site

PROJECT		DE BEERS	
TITLE			
SNAP LAKE SAMPLING SITES FOR WINTER DISSOLVED OXYGEN FIELD PROGRAM			
PROJECT 03-1322-017,490		FILE No.	
DESIGN		SCALE	AS SHOWN REV. 0
DWG	ONE	21/02/03	
CHECK			
REVIEW			

 **FIGURE: 1**

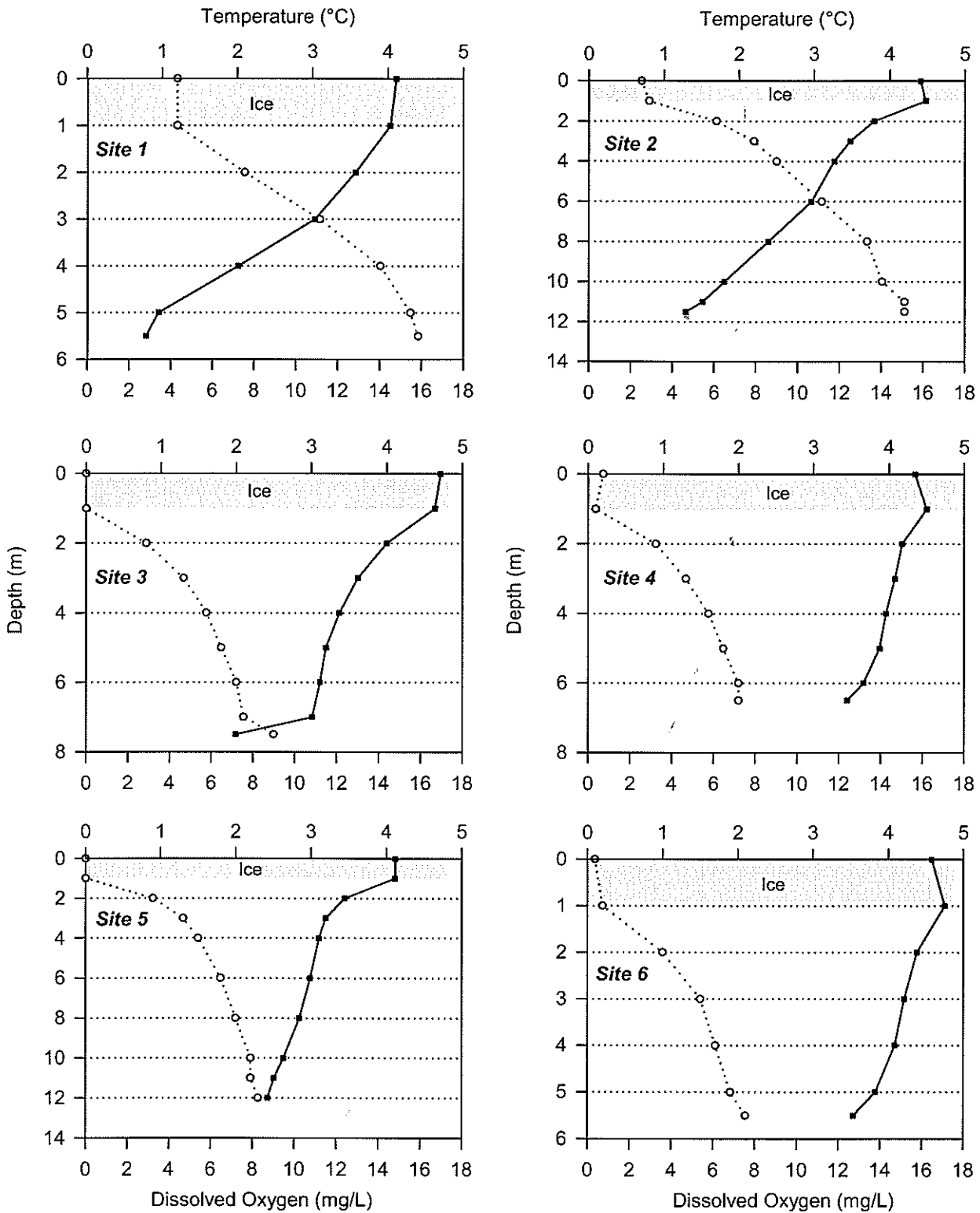


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes).

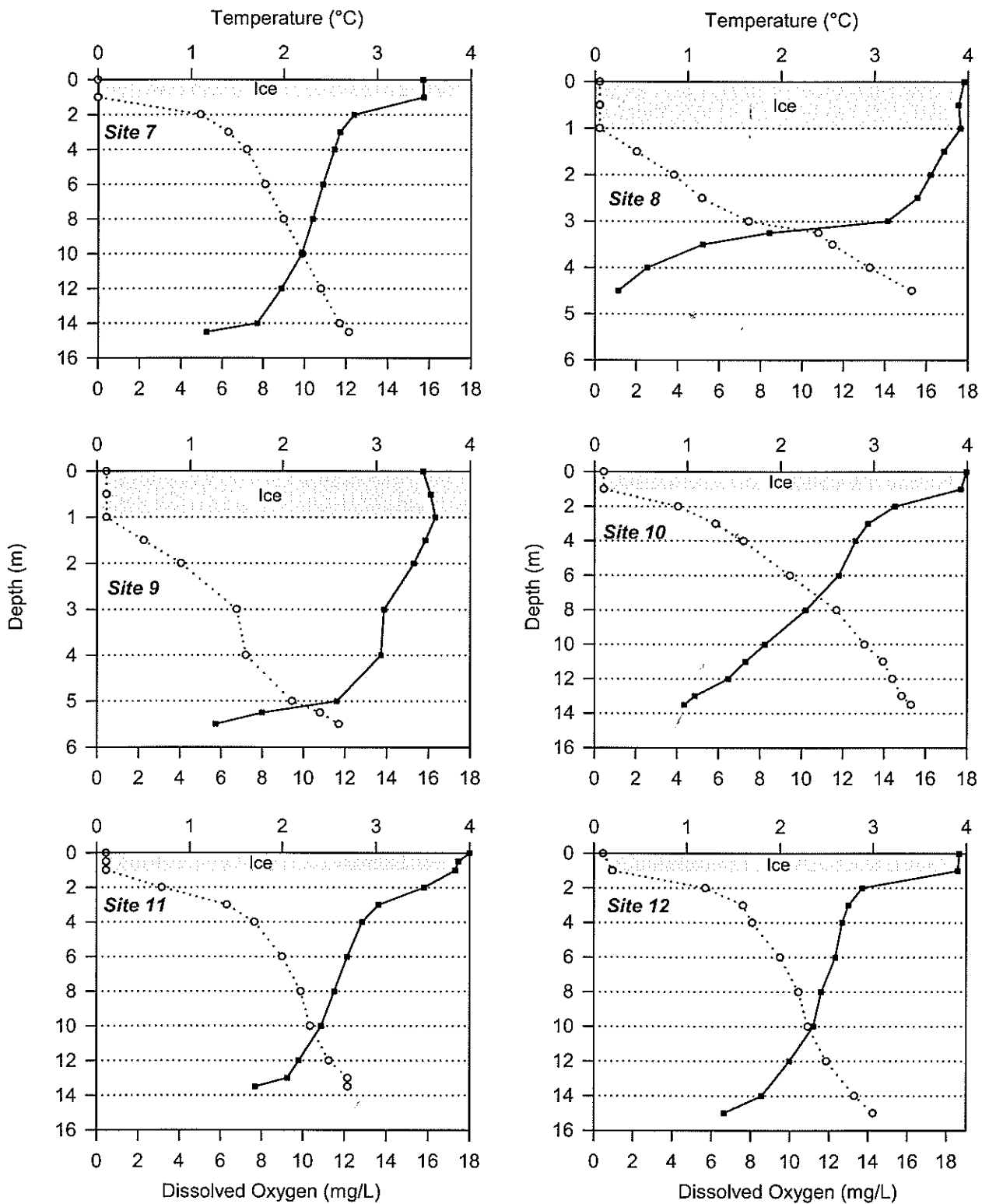


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

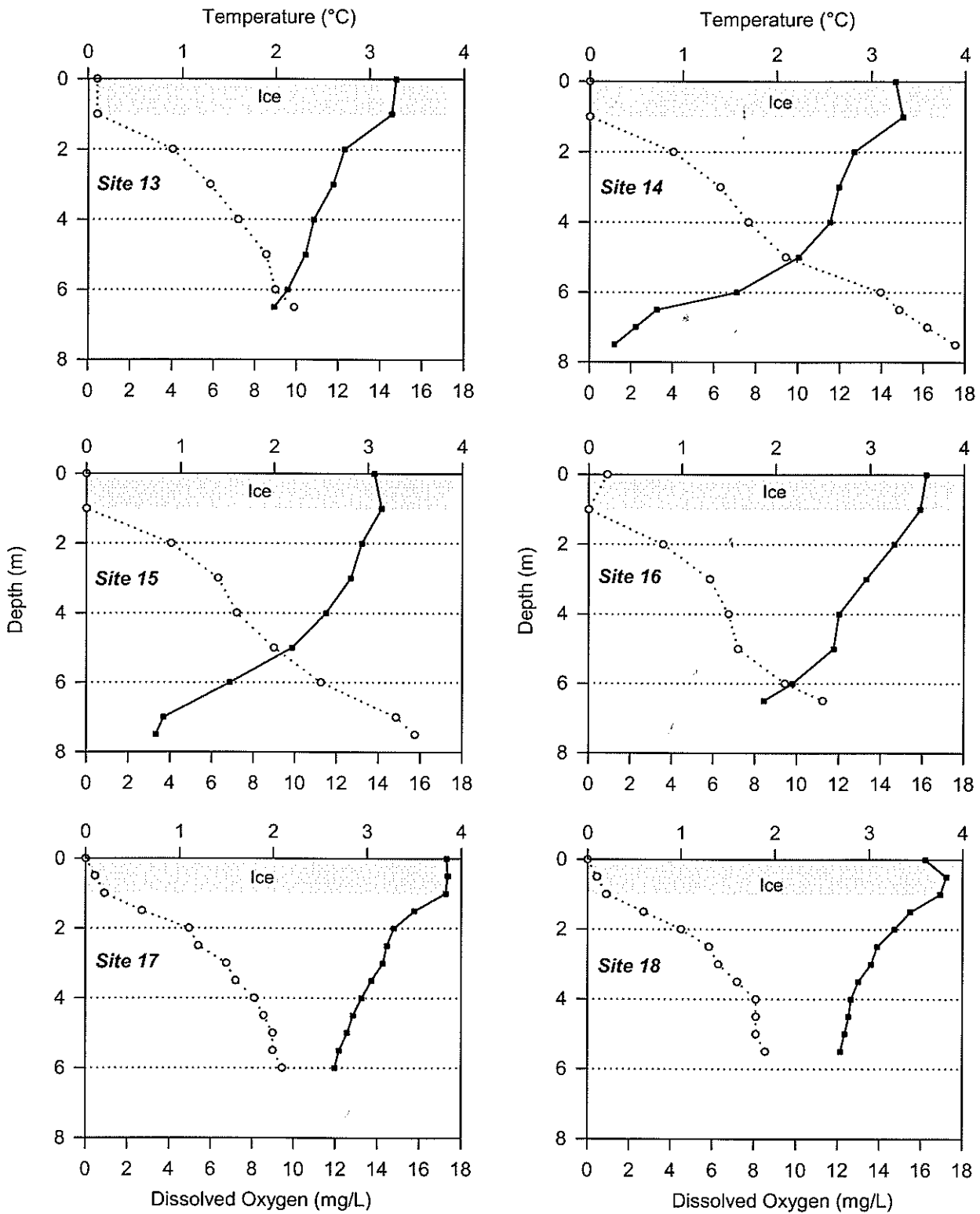


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

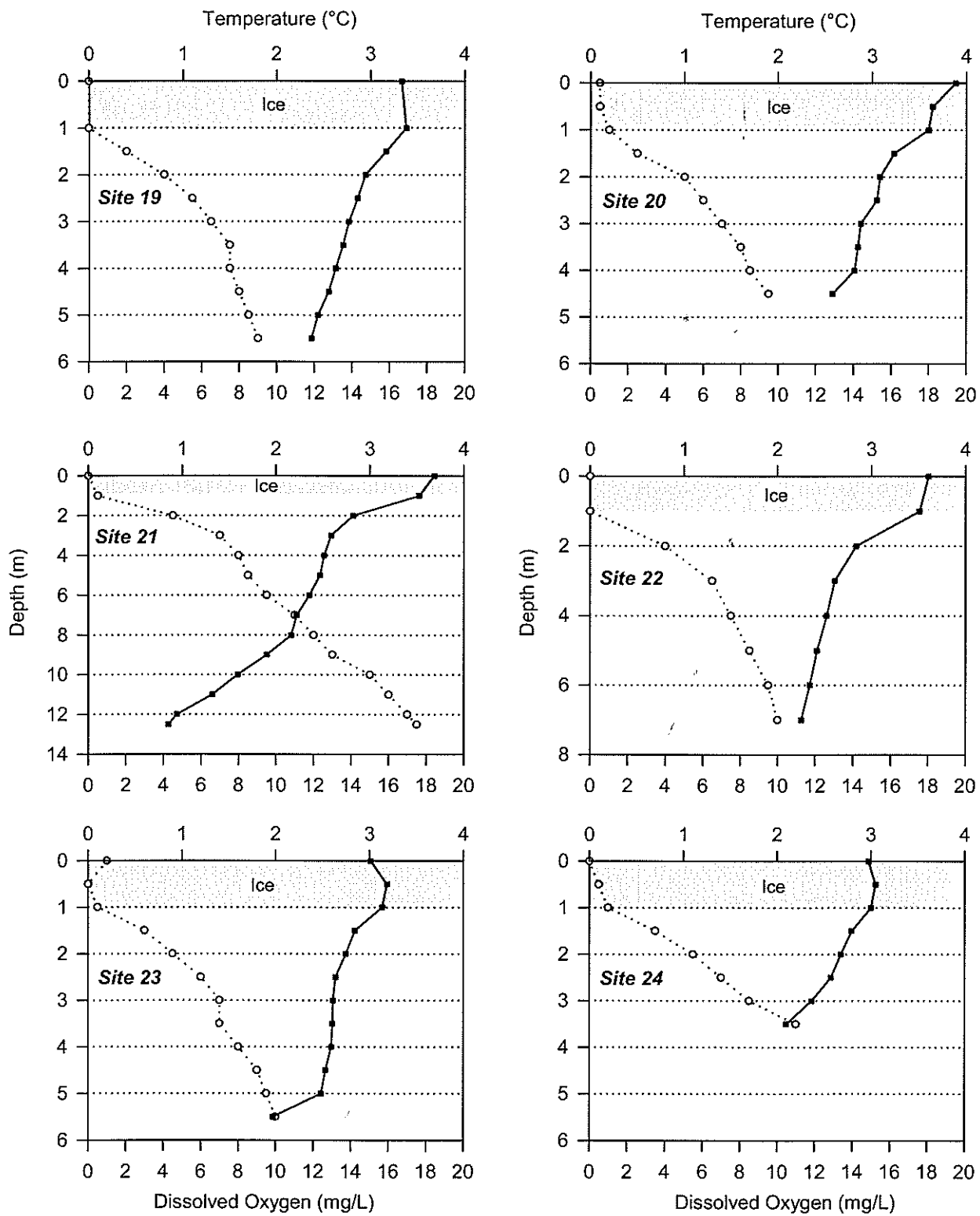


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

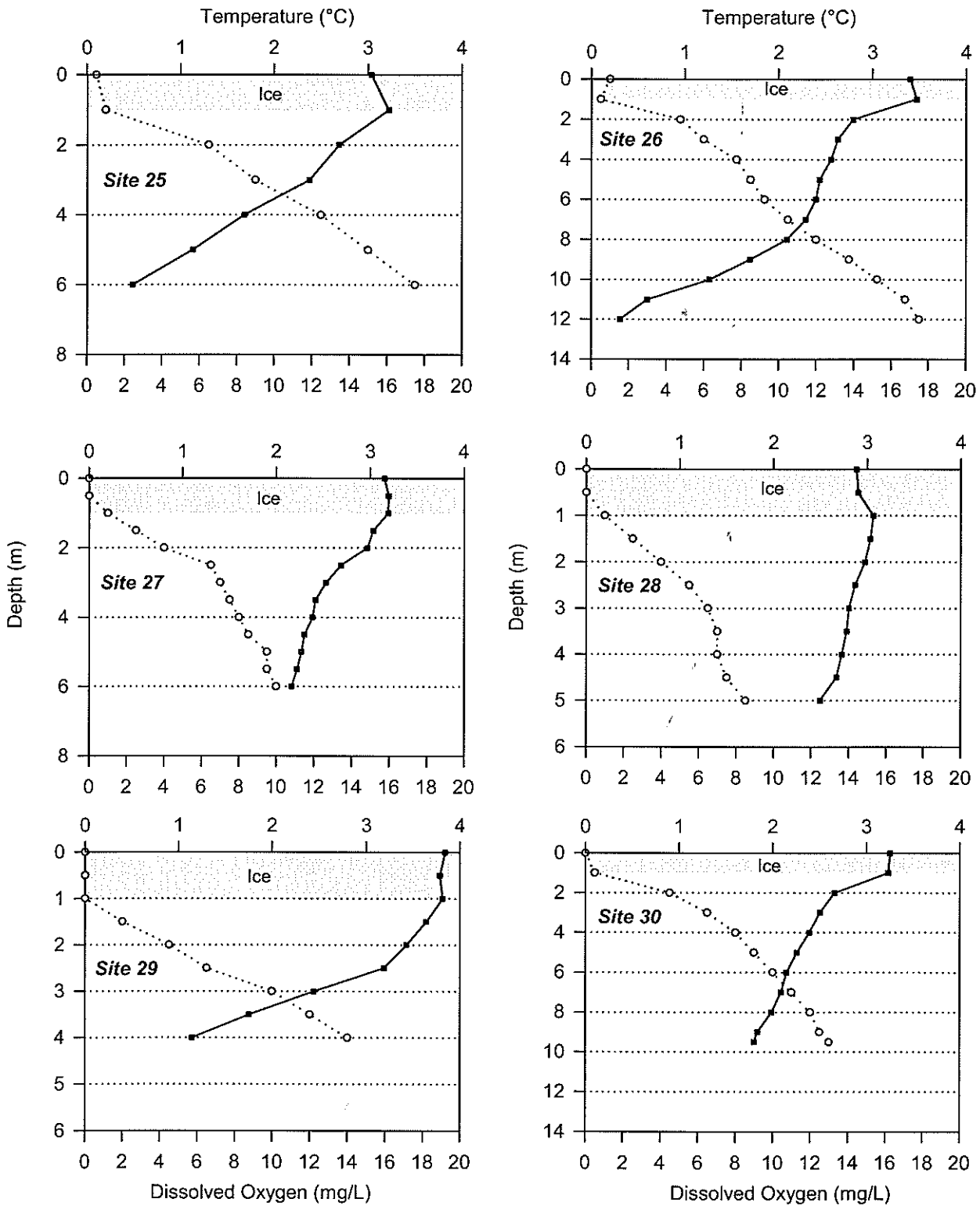


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

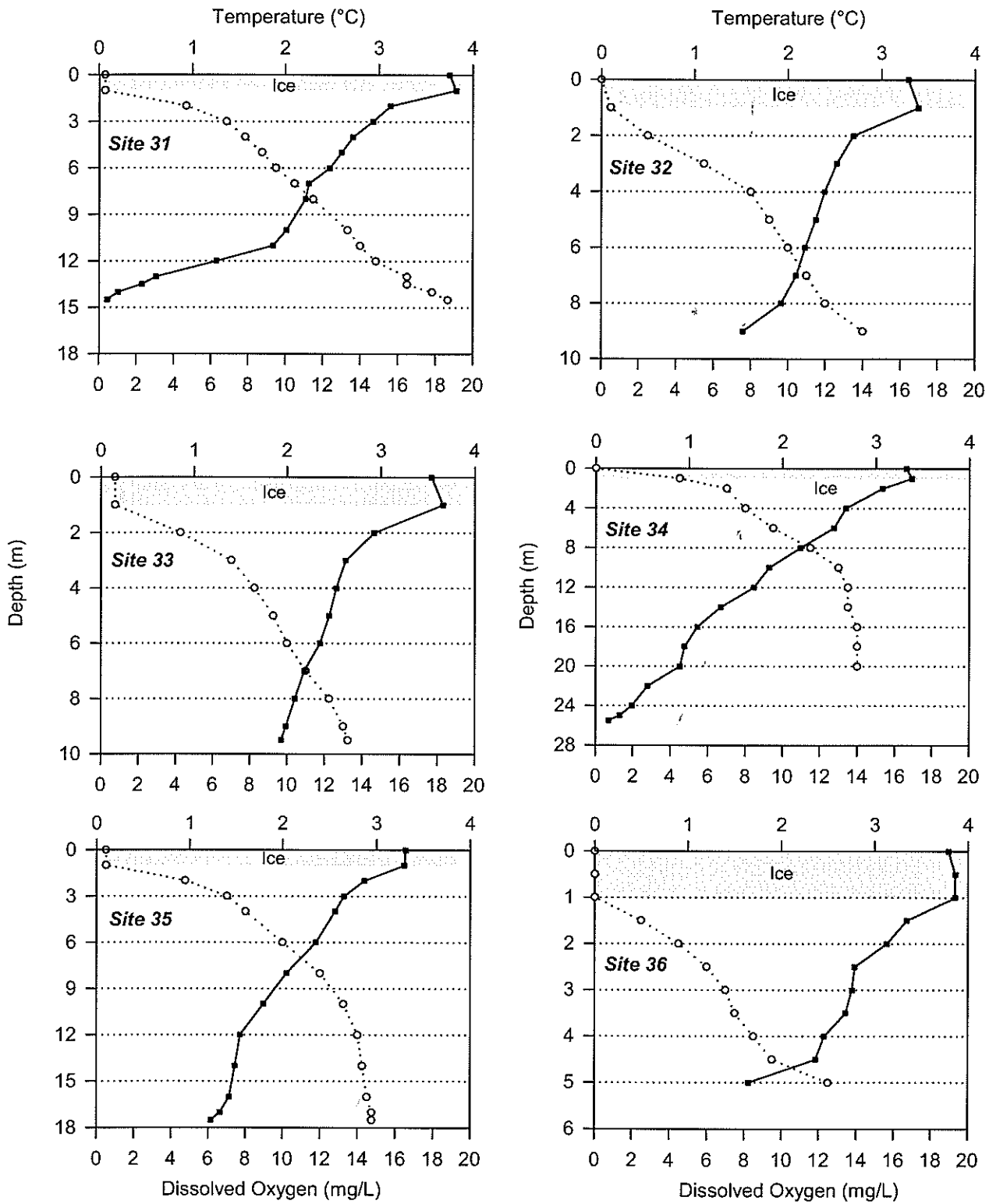


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

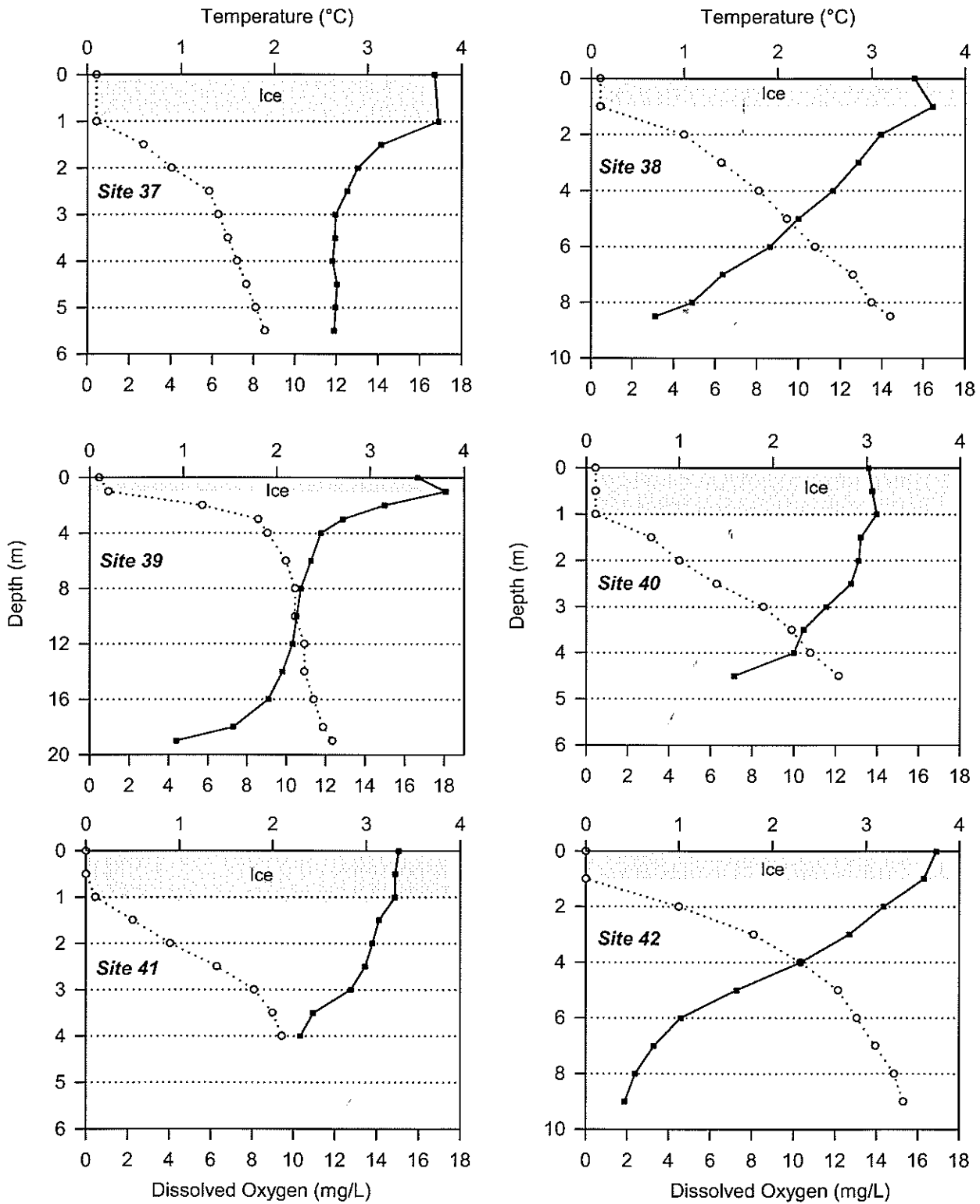


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

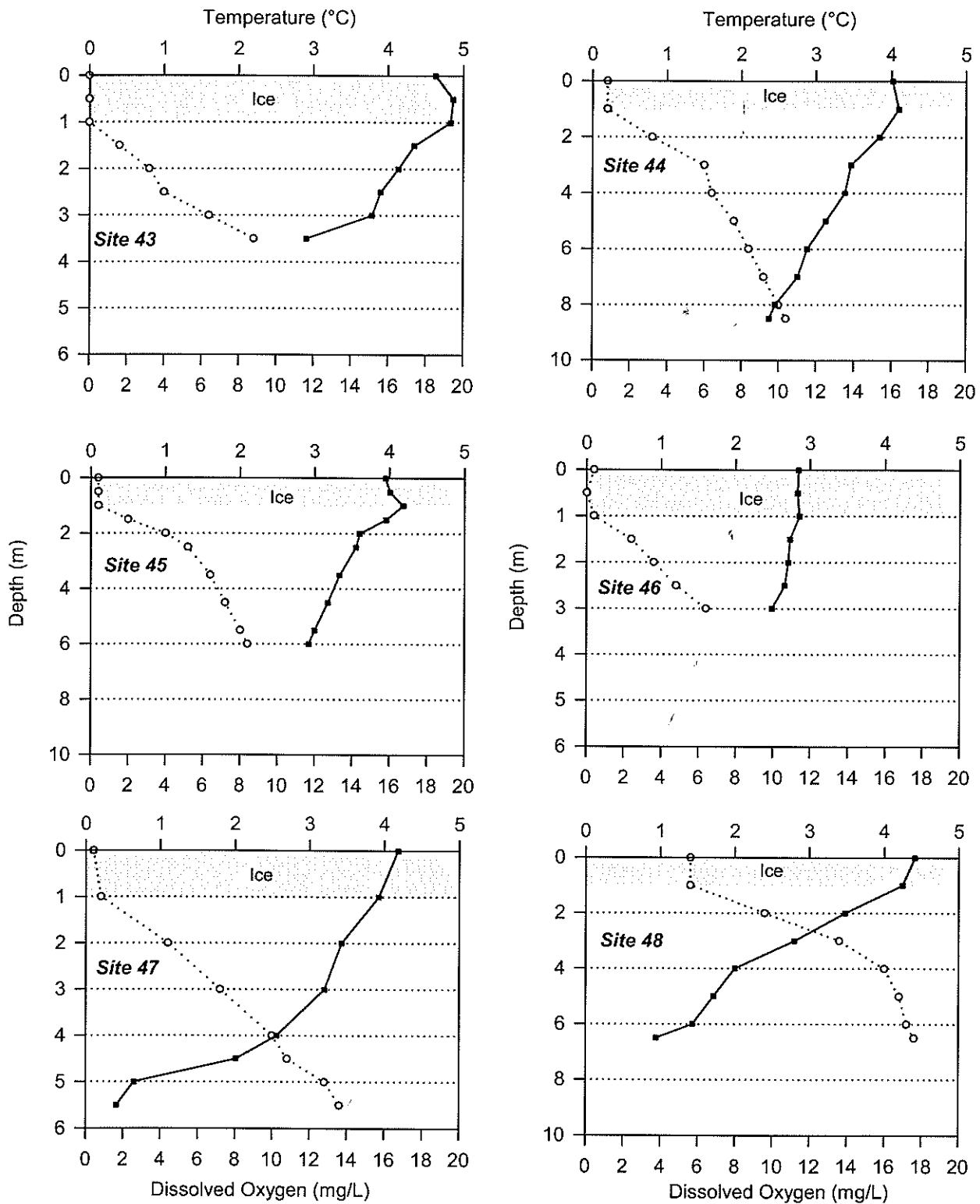


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

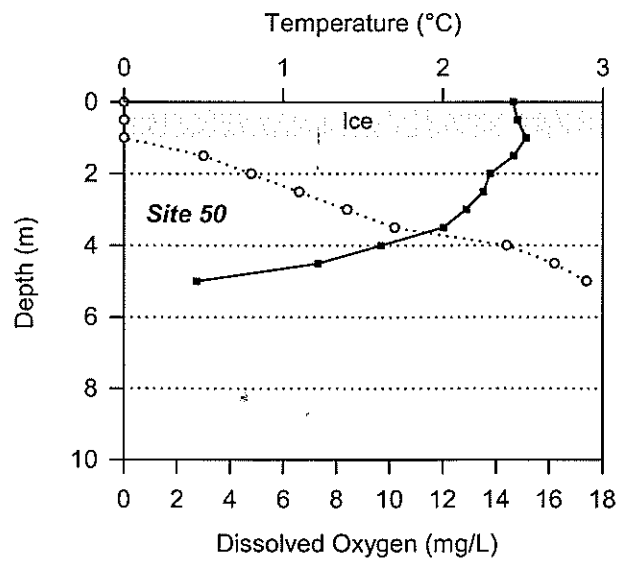
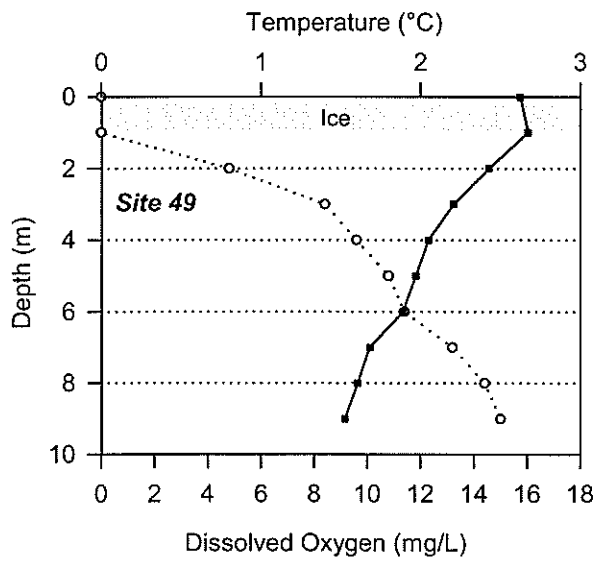


Figure 2 Temperature (top scale; dotted line) and dissolved oxygen (bottom scale; solid line) profiles for Snap Lake, 11 - 17 February 2003. (Note scale change in vertical axes) (continued)

APPENDIX I

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
1	15-Feb-03	10:12	0.18	1.0	0	1.2	14.8
					1	1.2	14.52
					2	2.1	12.85
					3	3.1	10.92
					4	3.9	7.26
					5	4.3	3.43
					5.5	4.4	2.83
					6	Soft Bottom	
2	15-Feb-03	8:45	0.17	1.0	0	0.7	15.88
					1	0.8	16.13
					2	1.7	13.66
					3	2.2	12.51
					4	2.5	11.75
					6	3.1	10.67
					8	3.7	8.61
					10	3.9	6.5
					11	4.2	5.45
					11.5	4.2	4.65
					12	Soft Bottom	
					3	15-Feb-03	13:10
1	0	16.68					
2	0.8	14.39					
3	1.3	13					
4	1.6	12.12					
5	1.8	11.49					
6	2	11.21					
7	2.1	10.83					
7.5	2.5	7.18					
7.75	Medium Soft Bottom						
4	15-Feb-03	13:30	0.11	1.0	0	0.2	15.64
					1	0.1	16.21
					2	0.9	15.03
					3	1.3	14.69
					4	1.6	14.25
					5	1.8	13.95
					6	2	13.18
					6.5	2	12.4
7	Medium Soft Bottom						
5	14-Feb-03	15:45	0.12	1.0	0	0	14.82
					1	0	14.8
					2	0.9	12.41
					3	1.3	11.5
					4	1.5	11.18
					6	1.8	10.76
					8	2	10.25
					10	2.2	9.49
					11	2.2	9.04
					12	2.3	8.73
					12.5	Rock Bottom	

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)					
6	14-Feb-03	14:00	0.35	0.9	0	0.1	16.48					
					1	0.2	17.11					
					2	1	15.77					
					3	1.5	15.17					
					4	1.7	14.71					
					5	1.9	13.77					
					5.5	2.1	12.72					
7	14-Feb-03	16:16	0.20	1.0	6	Soft Bottom						
					0	0	15.7					
					1	0	15.73					
					2	1.1	12.39					
					3	1.4	11.72					
					4	1.6	11.44					
					6	1.8	10.9					
					8	2	10.4					
					10	2.2	9.88					
					12	2.4	8.9					
					14	2.6	7.72					
					14.5	2.7	5.25					
					8	15-Feb-03	15:40	0.10	1.0	15	Soft Bottom	
										0	0.1	17.8
										0.5	0.1	17.6
1	0.1	17.7										
1.5	0.5	16.8										
2	0.9	16.2										
2.5	1.2	15.6										
3	1.7	14.1										
3.25	2.4	8.4										
3.5	2.6	5.2										
4	3.0	2.5										
4.5	3.4	1.1										
9	15-Feb-03	15:15	0.11	1.0						5	Soft Bottom	
					0	0.1	15.74					
					0.5	0.1	16.1					
					1	0.1	16.33					
					1.5	0.5	15.84					
					2	0.9	15.3					
					3	1.5	13.87					
					4	1.6	13.72					
					5	2.1	11.6					
					5.25	2.4	8					
					5.5	2.6	5.74					
					6	Soft Bottom						

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)					
10	15-Feb-03	14:10	0.22	1.0	0	0.1	17.97					
					1	0.1	17.7					
					2	0.9	14.52					
					3	1.3	13.22					
					4	1.6	12.61					
					6	2.1	11.8					
					8	2.6	10.21					
					10	2.9	8.24					
					11	3.1	7.31					
					12	3.2	6.47					
					13	3.3	4.87					
					13.5	3.4	4.35					
					14	Soft Bottom						
					11	14-Feb-03	16:45	0.17	1.1	0	0.1	17.99
0.5	0.1	17.45										
1	0.1	17.31										
2	0.7	15.8										
3	1.4	13.63										
4	1.7	12.84										
6	2	12.12										
8	2.2	11.5										
10	2.3	10.88										
12	2.5	9.8										
13	2.7	9.25										
13.5	2.7	7.7										
14	Soft Bottom											
12	14-Feb-03	13:30	0.22	1.0						0	0.1	18.65
					1	0.2	18.57					
					2	1.2	13.69					
					3	1.6	12.99					
					4	1.7	12.67					
					6	2	12.33					
					8	2.2	11.61					
					10	2.3	11.2					
					12	2.5	9.98					
					14	2.8	8.56					
					15	3	6.64					
					15.25	Soft Bottom						
					13	14-Feb-03	11:00	0.15	1.1	0	0.1	14.77
										1	0.1	14.55
2	0.9	12.3										
3	1.3	11.75										
4	1.6	10.83										
5	1.9	10.44										
6	2	9.59										
6.5	2.2	8.94										
7	Soft Bottom											

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)					
14	14-Feb-03	9:20	0.11	1.1	0	0	14.64					
					1	0	15					
					2	0.9	12.68					
					3	1.4	11.96					
					4	1.7	11.54					
					5	2.1	10.06					
					6	3.1	7.09					
					6.5	3.3	3.26					
					7	3.6	2.23					
					7.5	3.9	1.21					
					7.75	Soft Bottom						
15	14-Feb-03	9:45	0.20	1.1	0	0	13.8					
					1	0	14.14					
					2	0.9	13.2					
					3	1.4	12.68					
					4	1.6	11.49					
					5	2	9.87					
					6	2.5	6.88					
					7	3.3	3.7					
					7.5	3.5	3.33					
					7.75	Soft Bottom						
					16	14-Feb-03	8:50	0.22	1.1	0	0.2	16.2
1	0	15.9										
2	0.8	14.7										
3	1.3	13.3										
4	1.5	12.0										
5	1.6	11.8										
6	2.1	9.8										
6.5	2.5	8.4										
6.75	Soft Bottom											
17	13-Feb-03	15:48	0.15	1.0						0	0	17.3
										0.5	0.1	17.35
					1	0.2	17.25					
					1.5	0.6	15.77					
					2	1.1	14.79					
					2.5	1.2	14.45					
					3	1.5	14.26					
					3.5	1.6	13.72					
					4	1.8	13.25					
					4.5	1.9	12.84					
					5	2	12.55					
					5.5	2	12.17					
					6	2.1	11.96					
6.5	Rock Bottom											

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
18	13-Feb-03	15:30	0.20	1.0	0	0	16.2
					0.5	0.1	17.21
					1	0.2	16.92
					1.5	0.6	15.48
					2	1	14.71
					2.5	1.3	13.89
					3	1.4	13.6
					3.5	1.6	12.99
					4	1.8	12.64
					4.5	1.8	12.53
					5	1.8	12.35
					5.5	1.9	12.14
					19	13-Feb-03	15:05
1	0	16.9					
1.5	0.4	15.82					
2	0.8	14.73					
2.5	1.1	14.31					
3	1.3	13.85					
3.5	1.5	13.54					
4	1.5	13.14					
4.5	1.6	12.77					
5	1.7	12.2					
5.5	1.8	11.85					
6	Soft Bottom						
20	13-Feb-03	16:12	0.17	0.9	0	0.1	19.44
					0.5	0.1	18.22
					1	0.2	18
					1.5	0.5	16.16
					2	1	15.41
					2.5	1.2	15.25
					3	1.4	14.4
					3.5	1.6	14.25
					4	1.7	14.07
					4.5	1.9	12.91
					5	Sand Bottom	
21	12-Feb-03	13:45	0.20	1.0	0	0	18.43
					1	0.1	17.63
					2	0.9	14.12
					3	1.4	12.94
					4	1.6	12.57
					5	1.7	12.35
					6	1.9	11.77
					7	2.2	11.1
					8	2.4	10.81
					9	2.6	9.51
					10	3	7.96
					11	3.2	6.6
					12	3.4	4.72
					12.5	3.5	4.26
12.75	Soft Bottom						

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
22	12-Feb-03	10:30	0.35	1.0	0	0	18.03
					1	0	17.55
					2	0.8	14.19
					3	1.3	13.05
					4	1.5	12.62
					5	1.7	12.11
					6	1.9	11.72
					7	2	11.27
23	12-Feb-03	13:15	0.15	1.0	7.5	Soft Bottom	
					0	0.2	15.06
					0.5	0	15.93
					1	0.1	15.68
					1.5	0.6	14.23
					2	0.9	13.75
					2.5	1.2	13.19
					3	1.4	13.05
					3.5	1.4	13.03
					4	1.6	12.96
					4.5	1.8	12.65
					5	1.9	12.42
5.5	2	9.85					
24	16-Feb-03	14:40	0.12	1.0	5.75	Soft Bottom	
					0	0	14.86
					0.5	0.1	15.24
					1	0.2	15
					1.5	0.7	13.98
					2	1.1	13.4
					2.5	1.4	12.88
					3	1.7	11.84
					3.5	2.2	10.5
25	16-Feb-03	14:20	0.18	1.0	4	Soft Bottom	
					0	0.1	15.18
					1	0.2	16.1
					2	1.3	13.46
					3	1.8	11.9
					4	2.5	8.42
					5	3	5.67
26	12-Feb-03	9:20	0.30	1.0	6	3.5	2.45
					6.25	Soft Bottom	
					0	0.2	17.0
					1	0.1	17.4
					2	1.0	14.0
					3	1.2	13.2
					4	1.6	12.8
					5	1.7	12.2
					6	1.9	12.0
					7	2.1	11.5
					8	2.4	10.4
9	2.8	8.5					
10	3.1	6.3					
11	3.4	3.0					

**Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)**

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
					12	3.5	1.5
					12.5	Soft Bottom	
27	12-Feb-03	14:20	0.20	1.0	0	0	15.75
					0.5	0	15.97
					1	0.2	15.94
					1.5	0.5	15.16
					2	0.8	14.85
					2.5	1.3	13.44
					3	1.4	12.65
					3.5	1.5	12.1
					4	1.6	11.93
					4.5	1.7	11.5
					5	1.9	11.34
					5.5	1.9	11.11
					6	2	10.82
					6.25	Rock Bottom	
28	13-Feb-03	14:45	0.05	1.0	0	0	14.4
					0.5	0	14.5
					1	0.2	15.3
					1.5	0.5	15.2
					2	0.8	14.9
					2.5	1.1	14.3
					3	1.3	14.0
					3.5	1.4	13.9
					4	1.4	13.6
					4.5	1.5	13.4
					5	1.7	12.5
					5.25	Soft Bottom	
29	13-Feb-03	10:00	0.08	1.0	0	0	19.2
					0.5	0	18.92
					1	0	19.06
					1.5	0.4	18.19
					2	0.9	17.13
					2.5	1.3	15.93
					3	2	12.22
					3.5	2.4	8.77
					4	2.8	5.72
					4.5	Soft Bottom	
30	12-Feb-03	15:00	0.15	1.0	0	0	16.26
					1	0.1	16.16
					2	0.9	13.3
					3	1.3	12.52
					4	1.6	11.95
					5	1.8	11.29
					6	2	10.74
					7	2.2	10.44
					8	2.4	9.94
					9	2.5	9.19
					9.5	2.6	9
					10	Rock Bottom	

**Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)**

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
31	11-Feb-03	15:00	0.25	1.0	0	0.1	18.8
					1	0.1	19.1
					2	0.9	15.6
					3	1.4	14.7
					4	1.6	13.6
					5	1.8	13.0
					6	1.9	12.4
					7	2.1	11.3
					8	2.3	11.1
					10	2.7	10.1
					11	2.8	9.4
					12	3.0	6.3
					13	3.3	3.1
					13.5	3.3	2.3
					14	3.6	1.0
14.5	3.7	0.4					
				15	Soft Bottom		
32	11-Feb-03	12:00	0.30	1.0	0	0.0	16.4
					1	0.1	17.0
					2	0.5	13.5
					3	1.1	12.6
					4	1.6	12.0
					5	1.8	11.5
					6	2.0	10.9
					7	2.2	10.4
					8	2.4	9.7
					9	2.8	7.6
				9.5	Soft Bottom		
33	11-Feb-03	14:30	0.30	1.0	0	0.2	17.7
					1	0.2	18.3
					2	0.9	14.6
					3	1.4	13.1
					4	1.7	12.6
					5	1.9	12.3
					6	2.0	11.8
					7	2.2	10.9
					8	2.5	10.4
					9	2.6	9.9
				9.5	2.7	9.7	
				10	Soft Bottom		
34	17-Feb-03	10:20	0.22	1.0	0	0	16.6
					1	0.9	16.9
					2	1.4	15.3
					4	1.6	13.4
					6	1.9	12.8
					8	2.3	11.0
					10	2.6	9.3
					12	2.7	8.5
					14	2.7	6.7
					16	2.8	5.5
				18	2.8	4.8	

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
					20	2.8	4.5
					22		2.8
					24		2.0
					25		1.3
					25.5		0.7
					26	Hard Bottom	
35	13-Feb-03	13:55	0.15	1.0	0	0.1	16.6
					1	0.1	16.5
					2	1.0	14.3
					3	1.4	13.3
					4	1.6	12.8
					6	2.0	11.8
					8	2.4	10.2
					10	2.7	9.0
					12	2.8	7.7
					14	2.9	7.4
					16	2.9	7.1
					17	3.0	6.6
					17.5	3.0	6.2
					17.75	Soft Bottom	
36	13-Feb-03	9:00	0.10	1.0	0	0	18.95
					0.5	0	19.33
					1	0	19.32
					1.5	0.5	16.72
					2	0.9	15.65
					2.5	1.2	13.94
					3	1.4	13.78
					3.5	1.5	13.44
					4	1.7	12.29
					4.5	1.9	11.83
					5	2.5	8.24
					5.5	Soft Bottom	
37	12-Feb-03	9:55	0.30	1.0	0	0.1	16.71
					1	0.1	16.89
					1.5	0.6	14.15
					2	0.9	13.03
					2.5	1.3	12.52
					3	1.4	11.97
					3.5	1.5	11.94
					4	1.6	11.82
					4.5	1.7	12.04
					5	1.8	11.97
					5.5	1.9	11.91
					6	Rock Bottom	

**Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)**

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
38	15-Feb-03	16:30	0.12	1.0	0	0.1	15.56
					1	0.1	16.44
					2	1	13.94
					3	1.4	12.85
					4	1.8	11.66
					5	2.1	10
					6	2.4	8.65
					7	2.8	6.36
					8	3	4.91
					8.5	3.2	3.13
39	16-Feb-03	15:30	0.17	1.0	9	Soft Bottom	
					0	0.1	16.65
					1	0.2	18.06
					2	1.2	14.98
					3	1.8	12.86
					4	1.9	11.76
					6	2.1	11.25
					8	2.2	10.74
					10	2.2	10.53
					12	2.3	10.32
					14	2.3	9.8
					16	2.4	9.08
					18	2.5	7.29
					19	2.6	4.39
40	16-Feb-03	15:55	0.20	1.0	19.25	Soft Bottom	
					0	0.1	13.58
					0.5	0.1	13.76
					1	0.1	13.97
					1.5	0.7	13.21
					2	1	13.11
					2.5	1.4	12.74
					3	1.9	11.55
					3.5	2.2	10.47
					4	2.4	10
					4.5	2.7	7.15
41	16-Feb-03	16:20	0.17	1.1	5	Soft Bottom	
					0	0	15.05
					0.5	0	14.89
					1	0.1	14.87
					1.5	0.5	14.11
					2	0.9	13.8
					2.5	1.4	13.45
					3	1.8	12.77
					3.5	2	10.96
					4	2.1	10.35
4.25	Rock Bottom						

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
42	17-Feb-03	8:15	0.10	1.0	0	0	16.89
					1	0	16.28
					2	1	14.34
					3	1.8	12.68
					4	2.3	10.35
					5	2.7	7.28
					6	2.9	4.6
					7	3.1	3.3
					8	3.3	2.39
					9	3.4	1.88
43	13-Feb-03	9:30	0.32	1.0	0	0	18.53
					0.5	0	19.46
					1	0	19.33
					1.5	0.4	17.4
					2	0.8	16.55
					2.5	1	15.61
					3	1.6	15.15
					3.5	2.2	11.63
					4	Rock Bottom	
44	15-Feb-03	14:55	0.25	1.0	0	0.2	16.07
					1	0.2	16.4
					2	0.8	15.38
					3	1.5	13.86
					4	1.6	13.54
					5	1.9	12.53
					6	2.1	11.54
					7	2.3	11.03
					8	2.5	9.83
					8.5	2.6	9.5
9	Soft Bottom						
45	15-Feb-03	14:35	0.25	1.0	0	0.1	15.79
					0.5	0.1	16.03
					1	0.1	16.73
					1.5	0.5	15.83
					2	1	14.41
					2.5	1.3	14.22
					3.5	1.6	13.34
					4.5	1.8	12.7
					5.5	2	12
					6	2.1	11.68
6.25	Rock Bottom						
46	14-Feb-03	10:10	0.17	1.0	0	0.1	11.38
					0.5	0	11.32
					1	0.1	11.43
					1.5	0.6	10.92
					2	0.9	10.82
					2.5	1.2	10.65
					3	1.6	9.96
					3.5	Sand/rock Bottom	

Table I.1
Dissolved Oxygen and Temperature Data Collected during the
February 2003 Winter Program (continued)

Station	Date	Time	Snow Depth (m)	Ice Thickness (m)	Depth (m)	Temp (°C)	DO (mg/L)
47	16-Feb-03	14:00	0.25	1.0	0	0.1	16.72
					1	0.2	15.7
					2	1.1	13.71
					3	1.8	12.8
					4	2.5	10.24
					4.5	2.7	8.05
					5	3.2	2.59
5.5	3.4	1.64					
				6	Soft Bottom		
48	15-Feb-03	9:30	0.22	1.0	0	1.4	17.64
					1	1.4	16.97
					2	2.4	13.91
					3	3.4	11.21
					4	4	8
					5	4.2	6.85
					6	4.3	5.72
6.5	4.4	3.77					
				7	Soft Bottom		
49	15-Feb-03	13:50	0.35	0.9	0	0	15.74
					1	0	16.03
					2	0.8	14.55
					3	1.4	13.24
					4	1.6	12.3
					5	1.8	11.82
					6	1.9	11.34
					7	2.2	10.1
					8	2.4	9.65
					9	2.5	9.17
				9.25	Rock Bottom		
50	14-Feb-03	13:00	0.15	1.1	0	0	14.64
					0.5	0	14.8
					1	0	15.12
					1.5	0.5	14.66
					2	0.8	13.78
					2.5	1.1	13.52
					3	1.4	12.87
					3.5	1.7	12.03
					4	2.4	9.67
					4.5	2.7	7.31
					5	2.9	2.74
				5.25	Soft Bottom		

Notes: Depth is measure from the top of the ice.