Report 35.

INTERNATIONAL BIOLOGICAL PROGRAMME

SECTION C7: CONSERVATION OF TERRESTRIAL BIOLOGICAL COMMUNITIES

CHECK SHEET (Plank VII) FOR SURVEY OF IBP AREAS*

To be completed with reference to the GUIDE TO THE CHECK SHEET

Serial Number [| | | | | | |]

For Data Centre Use only

1. 1. Name of surveyor T.G. Northcote, P.G. Haddock

2. Address of surveyor Institute of Animal Resource Ecology and Faculty of Forestry, Univ. of B.C. Vancouver 8, B.C.

3. Check Sheet completed (a) on site ..... (b) from records X

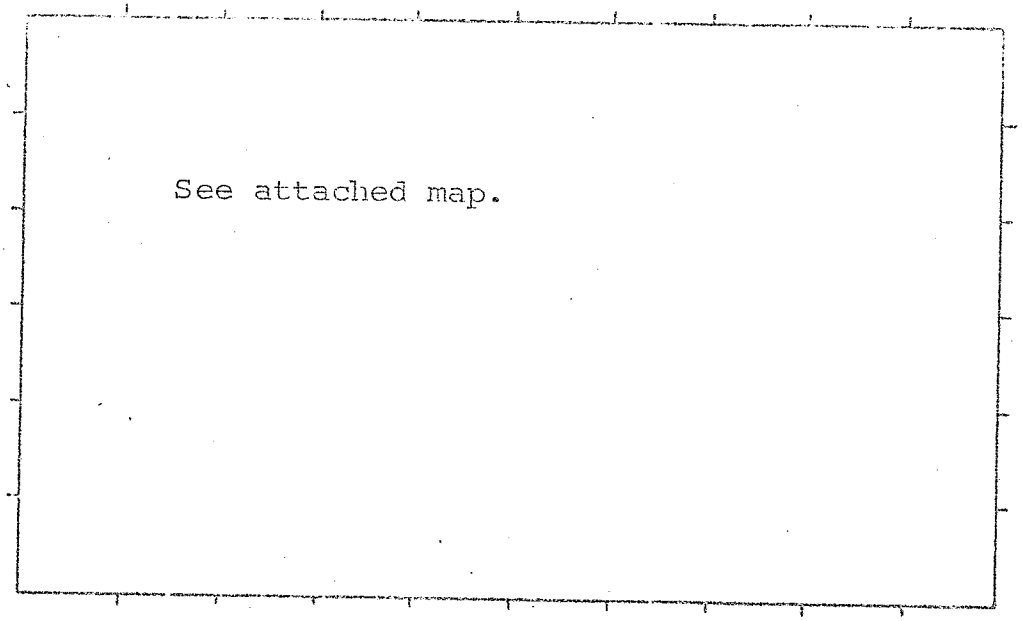
4. Date Check Sheet completed .....

2. 1. Name of IBP Area Lac du Bois, near Kamloops, B.C.

2. Name of IBP Subdivision (or serial letter) D

3. Map of IBP Area* showing boundaries attached? Yes ..... No X

4. Sketch map of IBP Area*. Please mark direction of north, the scale and grid numbers where applicable



* For "IBP Area", read IBP Area and/or IBP Subdivision.

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3. Location of IBP Area* 48' 27' 30"

1. Latitude 50 ° 45 N/S Longitude 120 ° 20 E/W
2. Country Canada
   State or Province British Columbia County .....
   (State or Province ..... County .....)

4. Administration

National 1. Official category .....

2. Address of administration .....

.....

.....

.....

.....

International Class

3.

Included in U.N. List	Rejected from U.N. List	Area with formal conservation status	No formal cons. status
(A)	(B)	(C)	(D)

5. Characteristics of IBP Area* (Lake only)

1. Surface area (state units of measurement) 315,000 ft^2
2. Altitude (state units of measurement) Maximum ca 2800 feet
   Minimum .....

6. Climate

Nearest climatological station :

1. Name Kamloops Airport; Agricultural Research Station
2. Climatological station on IBP Area*? Yes ..... No X
3. If (2) not, distance from edge of IBP Area* (state units) < 10 miles
4. Direction from IBP Area* S
5. Additional data sheet attached? Yes ..... No X

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9. Landscape

1. General Landscape (give brief description) Southern interior plateau; low rolling hills

2. Relief Type

	Flat	Undulating (0)-200 m.	Hilly 200-1000 m.	Mountainous > 1000 m.	%
Sharply dissected					
Gently dissected		x			
Incised					
Skeletonised					
%	Ca 10	Ca 90			100%

3. Special landscape features (list) .....

10. Coastline of ISP Area*

1. Protected bays and/or inlets — Many [ ] Few [ ] None [ ]

2. Substratum. % of coast

Rock	Boulder Beach	Shingle Beach	Sand Beach	Shell Beach	Mud	Coral	Ice

3. Physiography. % of coast

Cliffed	Sloping	Flat

4. Special Coastal Features (list) .....

5. Tide. Maximum range (state units of measurement) .....

6. Total length of coastline :

Less than 1 km. [ ] 1-10 km. [ ] Above 10 km. [ ]

For Data Centre Use only

11. Freshwater within ISP Area*

1.

	Permanent	Intermittent
Covered		
Standing	x	
Running		

2. Standing Water

	Permanent	Intermittent	Unproductive	Productive
Swamps				
Ponds	x	x		x
Lakes	x			x

3. Running Water

	Permanent	Intermittent
Springs, cold		
Springs, hot		
Streams		
Rivers		

4. Special freshwater features ... See attached sheets. ...

12. Salt and Brackish Water within ISP Area*

Salt Lakes		Lagoon		.....	
Estuaries		Salt pools		.....	

13. Adjacent Water Bodies (not within ISP Area*)

1. Fresh [ ] Lake [ ] River [ ] Stream [ ]

2. Salt and Brackish

Estuary	Salt lake	Salt pool	Lagoon	Ocean		

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4. Flora

	Species diversity	Abundance of particular species	Rare species	Threatened/relict species	Spp. of biogeographical interest	Endemic species	Commercial species				
Angiospermae :											
trees											
shrubs											
herbs											
grass											
Gymnospermae											
Pteridophyta											
Bryophyta											
Lichens and Algae											

5. Names of main threatened, endemic, relict and rare species

.....

.....

.....

15. Exceptional Interest of IBP Area*

Representative of freshwater habitat on southern interior grassland area.

.....

.....

.....

.....

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16. Significant Human Impact

1. General : None in entire IBP Area* .....

None in part of IBP Area* ..... x .....

Impact on entire IBP Area* .....

2. Particular

	Past impact	Present impact	Trend			
			Increasing	Decreasing	No change	No information
Cultivation						
Drainage						
Other soil disturbance						
Grazing	x	x	x			
Selective flora disturbance	x	x	x			
Logging	x			x		
Plantation						
Hunting						
Removal of predators						
Pesticides						
Introductions — plants						
Introductions — animals						
Fire						
Permanent habitation						
Recreation and tourism						
Research		x	x			

3. Additional details on each type of impact attached?

Yes ..... No .....

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17. Conservation Status

	Protection			Utilisation			Conservation Management			Permitted Research		
	none	partial	total	none	controlled	uncontrolled	none	to alter status	to maintain status	experimental	observational	prohibited
Flora												
Fauna												
Non-living												

18. References

1. List major biological/geographical references for the IBP Area.

   Sheet attached? Yes ..... No .....

2. List main maps available for the IBP Area.

   List attached? Yes ..... No .....

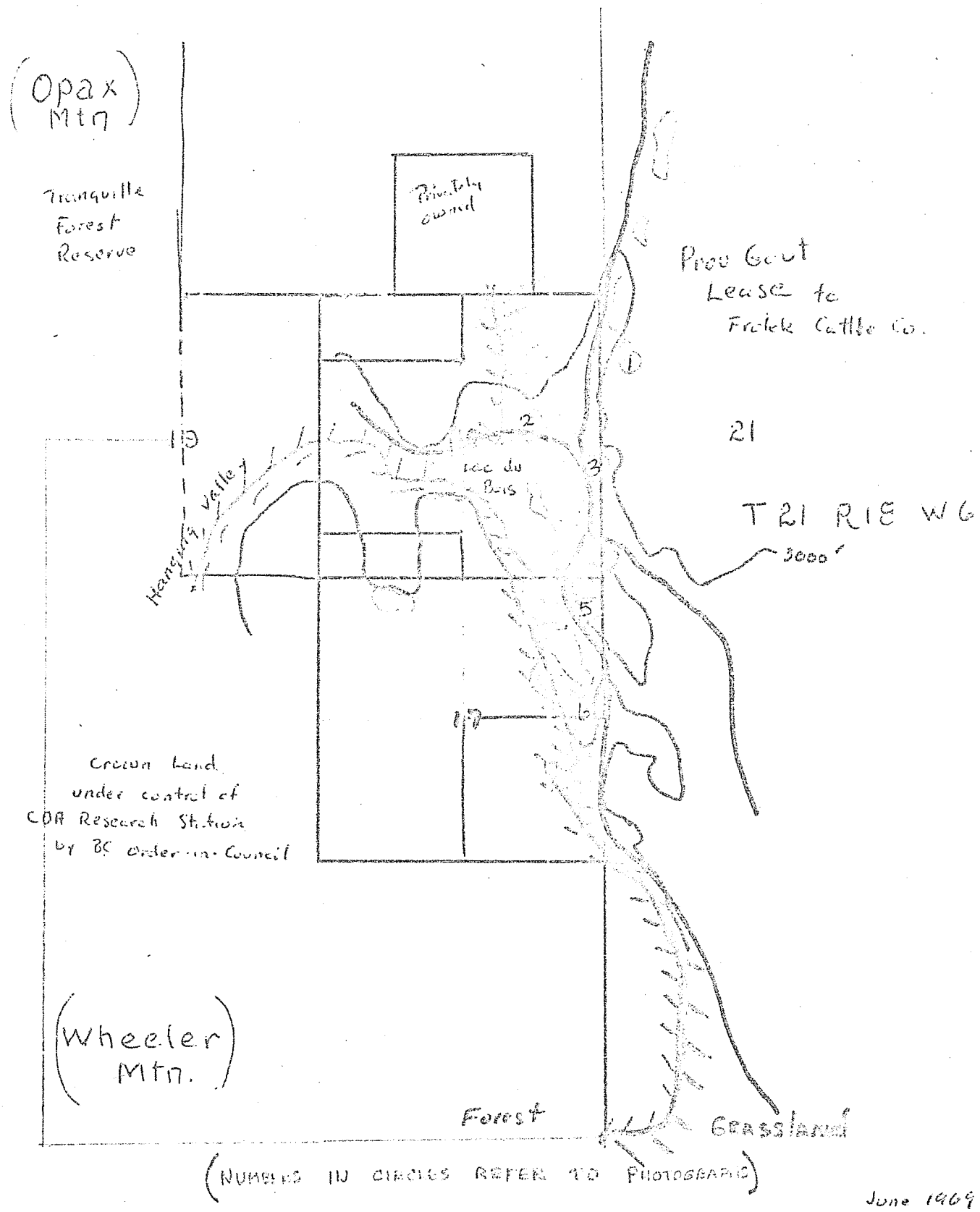
3. Aerial photographs for the IBP Area available?

   For whole area ... . For part of area .... None .....

19. Other Relevant Information

See attached sheets.

Signed T. G. NORTHCOTE
(Surveyor)



(NUMBERS IN CIRCLES REFER TO PHOTOGRAPHS)

June 1969

MAP 1.

FIG. 1

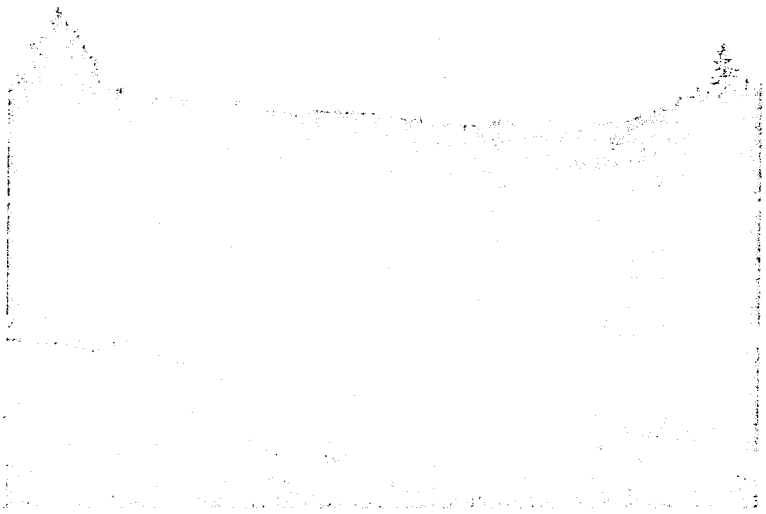


FIG. 2

FIG. 3

FIG. 4

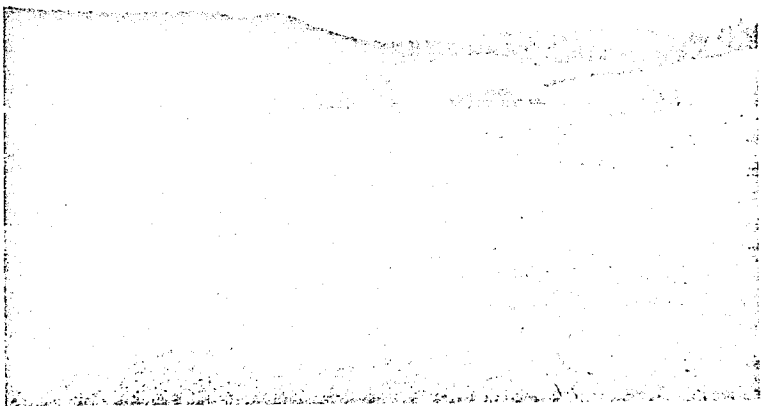


FIG. 5

FIG. 6

TABLE III

	Meters	Feet
Maximum length	896	2940
Maximum effective length	896	2940
Maximum width	823	2700
Maximum effective width	823	2700
Mean width	30.5	170.1
Mean depth	4.9	16.3
Maximum depth	8.5	28
Perimeter	3477	11,400
Mean depth - maximum depth relation	.582	
Shore development	5.73	
Volume development	1.75	

Figure 3 represents depth profiles through the axes of maximum width (A) and maximum length (B). The positions of the axes are shown on the accompanying inserts.

Temperature relations

Figure 4 shows the annual temperature cycle in Lac du Bois. The data exemplify the classical picture for temperate lakes with a spring and fall overturn at isothermal conditions, and a summer period of thermal stratification; in this case, with a very small hypolimnial volume. (The same temperature curves are plotted individually in Figure 10 along with the oxygen conditions present on the same date.) It is important to remember that a single series of temperature records is exactly true only for a particular time and place.

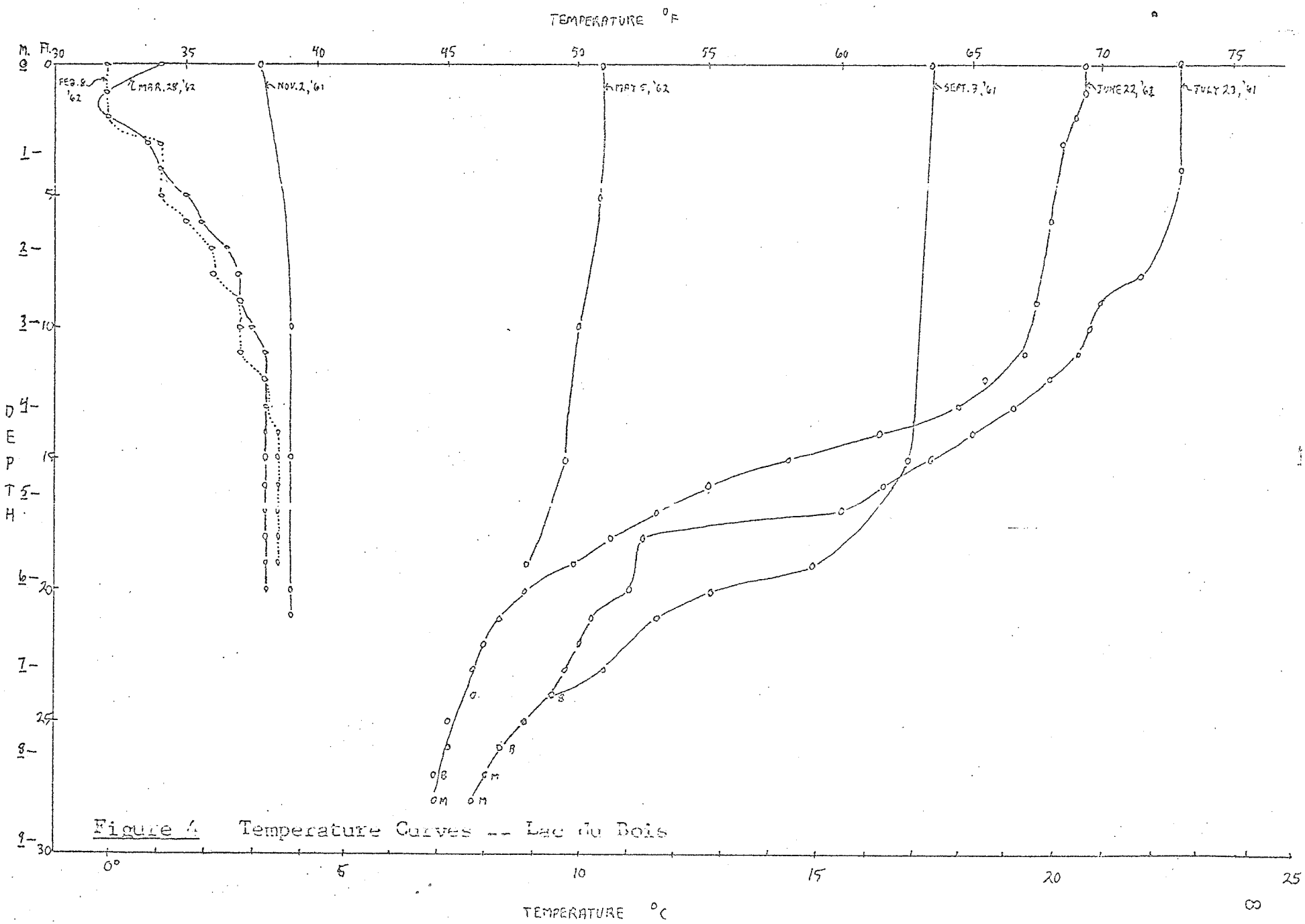


Figure 4 Temperature Curves -- Lac du Bois

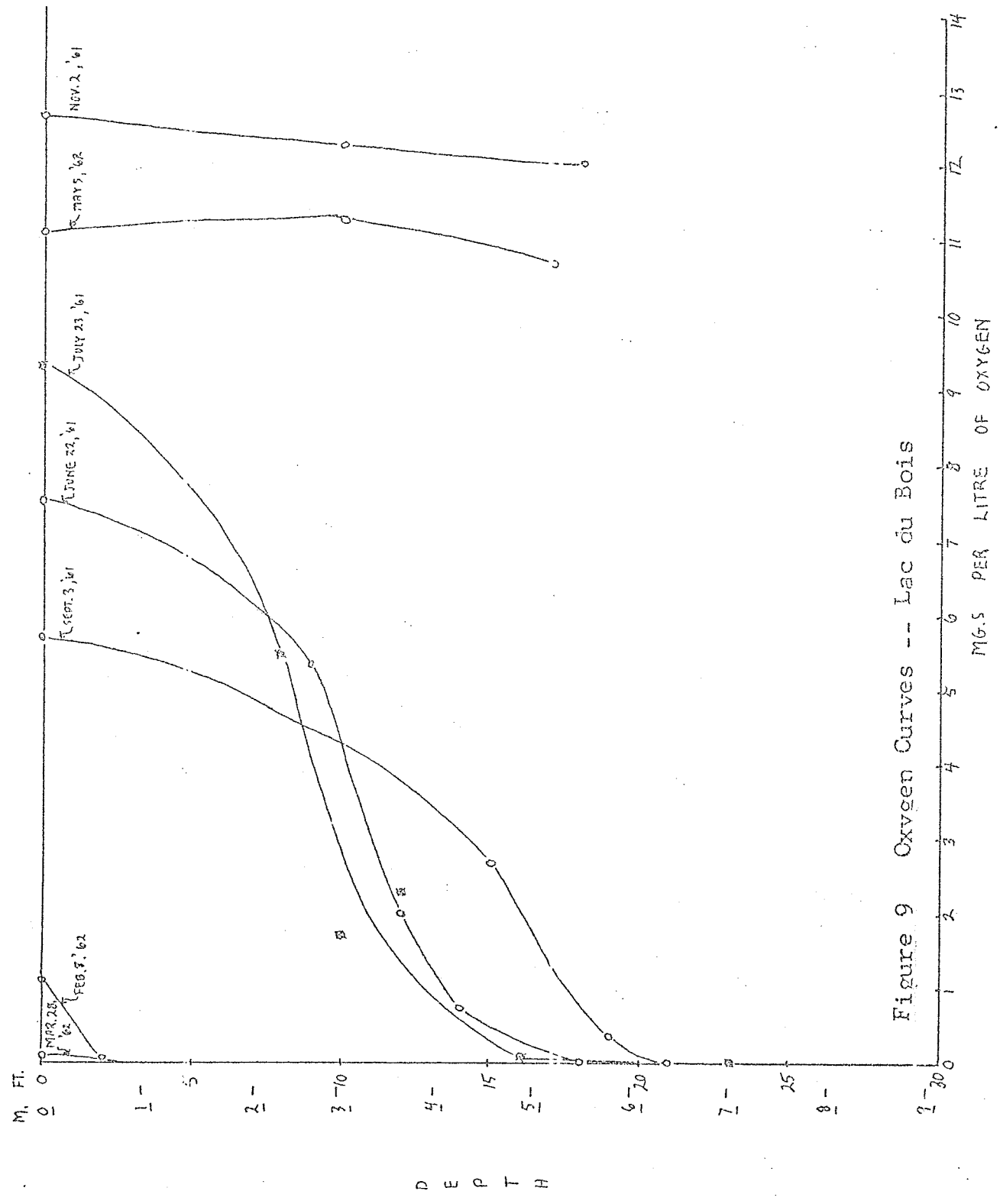


Figure 9 Oxygen Curves -- Lac du Bois

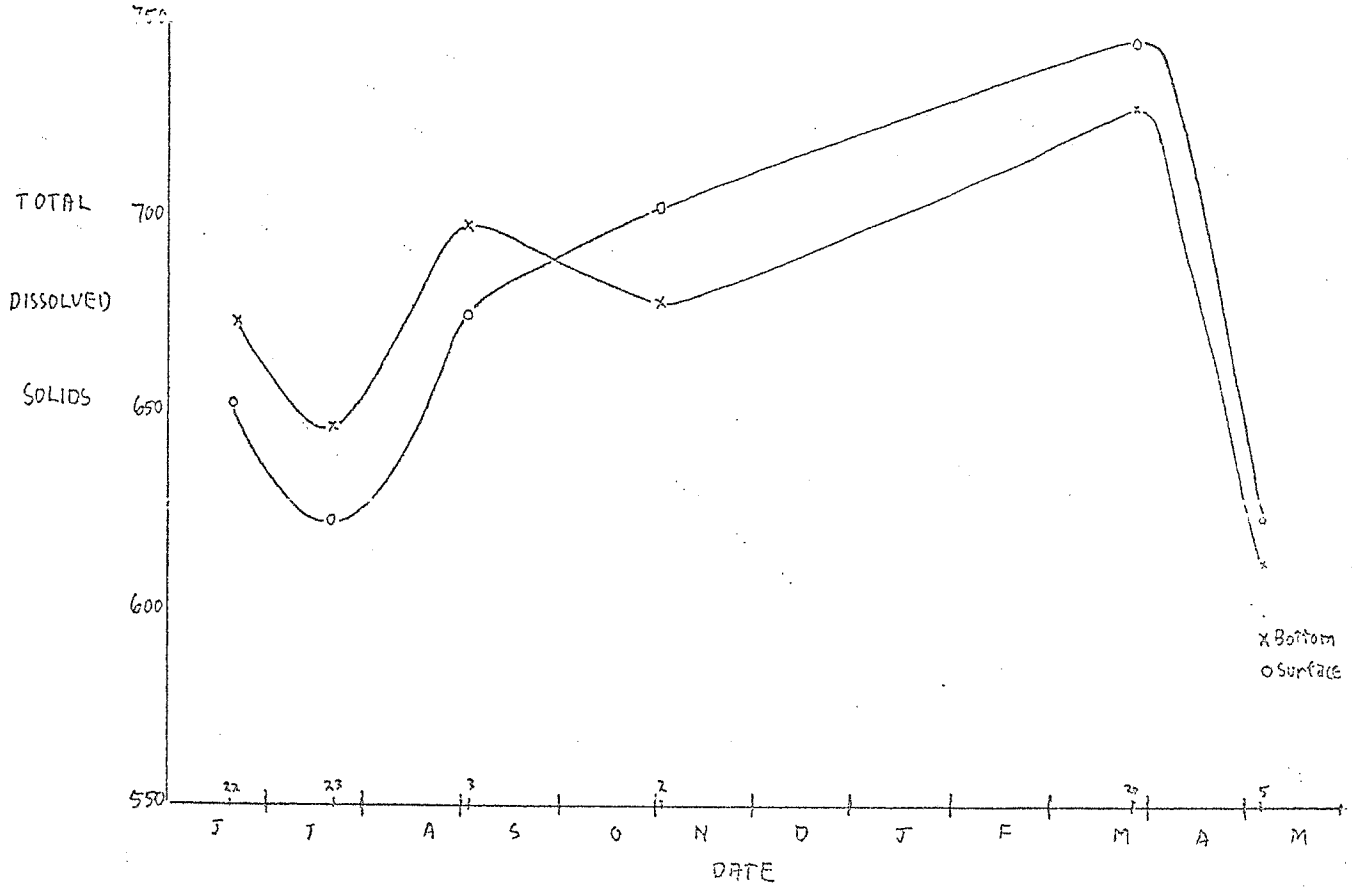


Figure 11 TDS Curves -- Lac au Soie

Alkalinity

Figure 13 records total alkalinity at various depths on six different occasions. With a single exception, the askalinities vary between 430 and 601. The exception is a reading of over 1050 for surface alkalinity on February 8, 1962.

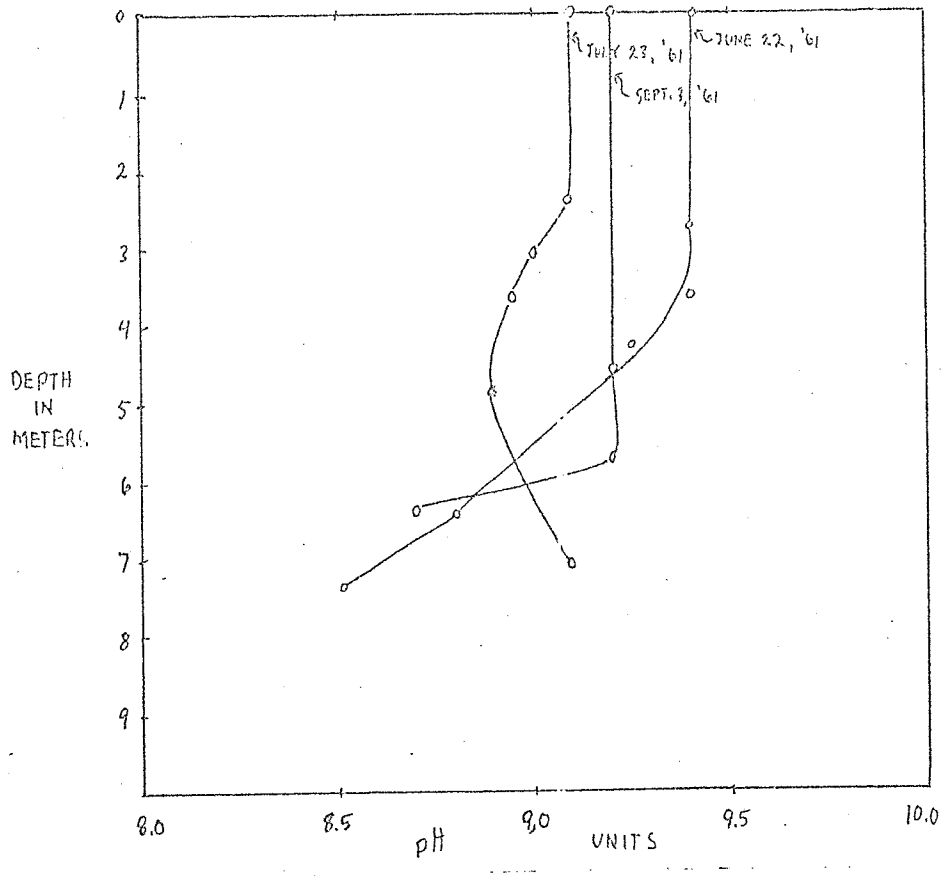


Figure 12 pH Curves -- Lac du Bois

THE BIOLOGY OF LAC DU BOIS

Introduction

The following report is an analysis of material collected during 1961 and 1962. Like the preceeding report on the physical and chemical characteristics of the lake, this one suffers from a paucity of data so that analysis yields only the barest indication of conditions within the lake.

Material and Methods

Plankton samples were taken with a Wisconsin closing plankton net. Plankton counts were made using a binocular microscope and a Sedgewick-Rafter counting chamber. The 1 cc subsamples were taken after the original sample had been agitated using a magnetic stirrer. The final count for each sample was the average of three replications, in most cases. These were recorded as numbers per cubic meter. Settled volumes were also recorded.

A six-inch Ekman Dredge was used to take bottom samples. Total counts were made of each species present. These counts were then corrected to numbers per square meter.

DATE	SAMPLE COLUMN-M	HYALELLA AZTECA	DAPHNIA PULEX	DIAPTOMUS LEPTOPUS	MICROCYSTIS	SETTLED VOLUME
June 22/61	0 - 6.7	5	734	1712	--	9.0 c.c.
	3.7 - 4.3	2	15	101	--	3.0
	0 - 3.7	6	640	2620	--	7.5
July 23/61	0 - 6.7	5	408	2266	--	8.5
	3.7 - 7.0	1	33	29	--	2.0
	0 - 3.7	13	4	312	--	9.5
Sept 3/61	0 - 6.0	7	310	1500	64,048	11.5
May /62	0 - 5.5	9	0	41	--	6.0

TABLE I PLANKTON DATA -- LAC DU BOIS - NOS PER M^3

On several occasions, stationary echo soundings were taken in an attempt to record the depth of the scattering layer.

The Plankton

The phytoplankton

Because of the large size of mesh used, the Wisconsin net did not adequately sample the phytoplankton of the lake. In fact, phytoplankton is recorded in the samples on only one occasion, September 3, 1961. At this time, there occurred a very dense bloom of Microcystis, probably M. flos-aquae. The sample shows a concentration of 269,000 colonies per square meter, if averaged over the entire sample depth (six meters to the surface). However, the colonies also contained pseudo-vacuoles so that the plants float high on the water. (Prescott 1954).

This Cyanophyte genus is one which often causes dense blooms in hard-water lakes (Smith, 1950). According to Prescott (1954)

> "...where these species occur...the water is completely dominated by the plant to the exclusion of almost all other forms."

This may account, in part, for the dearth of phytoplankton in the net hauls. Halsey (pers. comm.) states that local residents report frequent noxious blooms in the lake. The conditions on September 3, 1961 are probably a common occurrence.

The mere fact that water blooms occur frequently is an indication of eutrophy (Rawson, 1956). In the same paper, Rawson, on the basis of many years of observation in Western Canada, including British Columbia compiled a list of the approximate distribution of dominant limnetic algae in the lakes of Western Canada. In this paper, Microcystis flos-aquae is listed as the one alga characteristic of eutrophic lakes. Here then, are biological indicators which substantiate conclusions made on the basis of purely physico-chemical data.

The zooplankton

It is characteristic of the plankton of eutrophic lakes that, although the quantities of plankton is large, the number of species represented is small (Naumann, 1932 and Rawson, 1956). This would seem to be true of Lac du Bois. Although consider numbers of Daphnia pulex, Hyalella azteca and Diaptomus sp. are present, they are, as far as the samples showed, the only zooplankters. Other species of zooplankton might have escaped detection because of the subsampling technique employed, but even so they must have been present in negligible numbers. The Hyalella azteca counts, incidentally, are total counts and were not arrived at by subsampling. The counts for both phyto and zooplankton are given in Table I.

Figure 1 illustrates the vertical distribution of Diaptomus (probably D. leptopus) and Daphnia pulex on June 22 and July 23, 1961. These are correlated with temperature and oxygen curves of the same date.

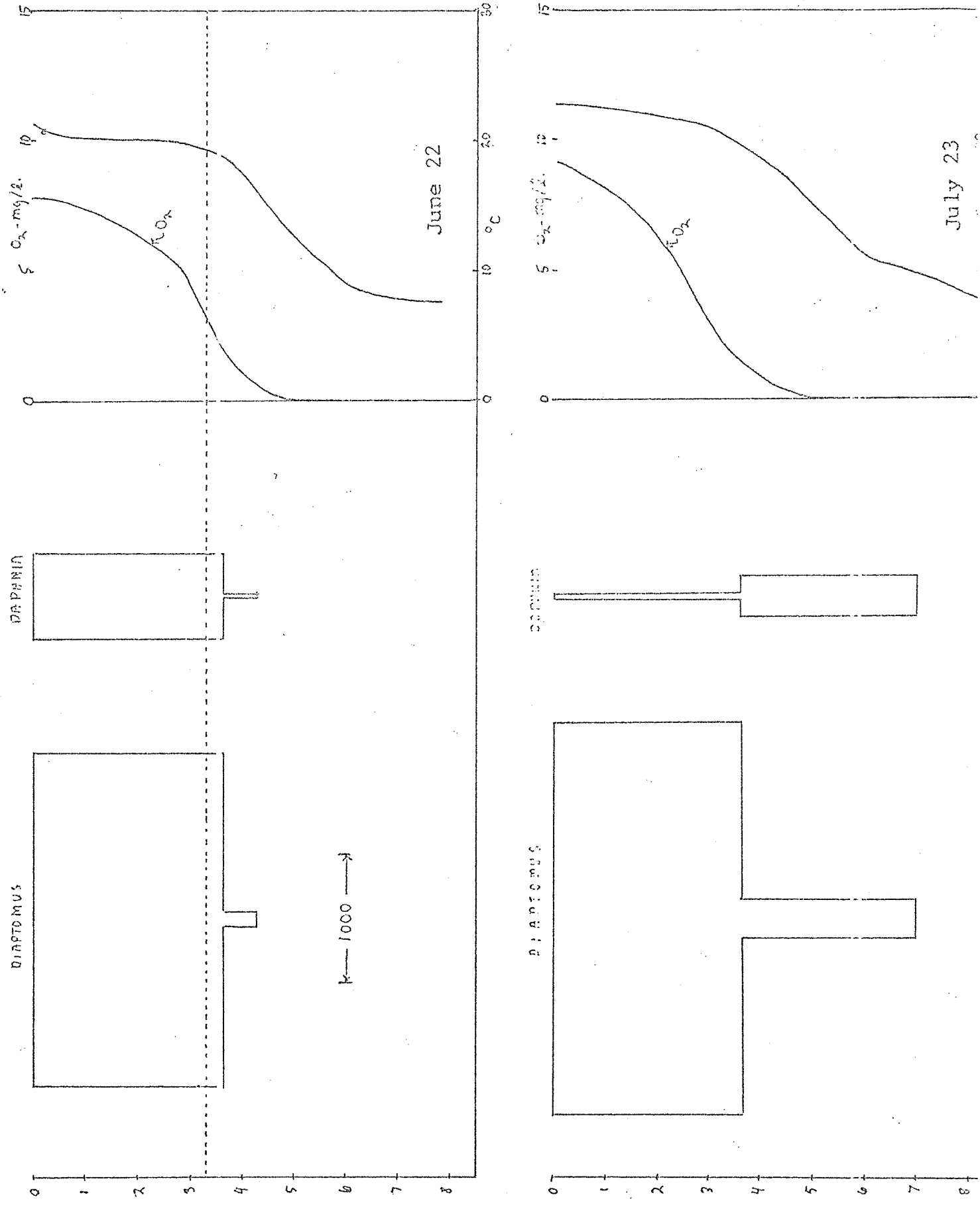


Figure 1 Vertical Distribution of Diaptomus and Daphnia

The Bottom Fauna

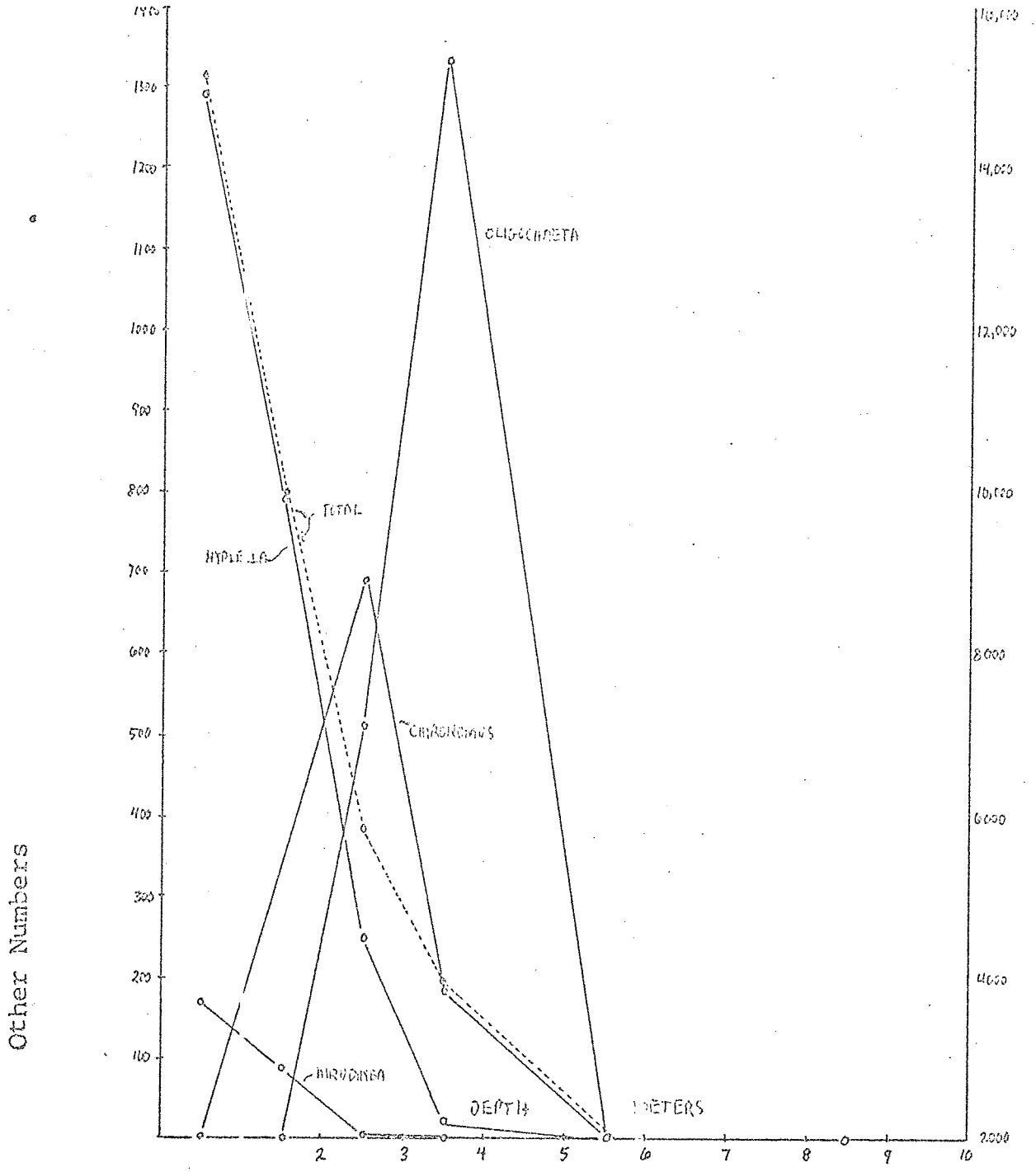
Two series of bottom samples were taken during 1961, on June 22 and July 23. The component species were identified as far as the materials available would allow. The number of animals of each kind taken at depth intervals of one meter are shown in Table II. Note that the table indicates merely the presence or absence of mollusc shells. None of these were living and their significance as indicators of present conditions is difficult to interpret. They may have lain on the bottom mud for long periods of time or have been carried to their resting place from other parts of the lake.

The depth distribution of the various components of the bottom fauna on June 22 are shown in Figure 4. The graph shows that amphipods and leeches reach their maximum abundance close in shore, and that chironomids and oligochaetes reach peaks of abundance at about 2.5 and 3.5 meters respectively. Significantly, there appear to be no animals below about five meters. This means that about twenty per cent of the lake bottom is devoid of macroscopic bottom fauna, in marked contrast to the high population of animals inshore. It may indicate a high degree of eutrophication tending toward dystrophy. It is also possible that some animals adapted to very low Oxygen tensions are present, but in such low numbers they were missed by inadequate sampling. Regardless, there is a very marked decrease in bottom fauna with depth and

GROUP	SPECIES	0-1m	1-2m	2-3m	3-4m	4-5m	5-6m	6-7m	7-8m	8-9m	
Oligochaeta		--	--	513	1327	NS	--	NS	NS	--	
Hirudinea		171	86	1	--		--			--	
Mollusca	Gyraulus sp.	--	P	P	P		P			P	
	Physa sp.	--	--	P	--		P			--	
	Sphaerium sp.	--	P	--	--		P			P	June 1961
Crustacea	Hyalella azteca	14,940	9716	4537	2768		--			--	
Insecta	Ch. chironomus sp.	0	86	685	128		--			--	
	Chironomus sp.	0	0	43	86		--			--	
	Corixid larva	--	--	43	--		--			--	
TOTAL		15,111	9888	5822	3809		0			0	

Oligochaeta		--	--	NS	--	--	
Hirudinea		107	--		43	--	
Mollusca	Gyraulus sp.	--	--		--	P	
	Physa sp.	--	--		--	--	July 1961
	Sphaerium sp.	P	--		--	P	
Crustacea	Hyalella azteca	12,000	856		1155	86	
Insecta	Ch. chironomus sp.	456	--		--	86	
	Chironomus sp.	43	--		--	43	
	Corixid larva	--	--		--	--	
TOTAL		12,606	856		1198	215	

TABLE II NO. OF ORGANISMS PER SQUARE METER IN BOTTOM FAUNA OF LAC DU BOIS



depth in meters

Figure 4 Vertical Distribution of Bottom Fauna

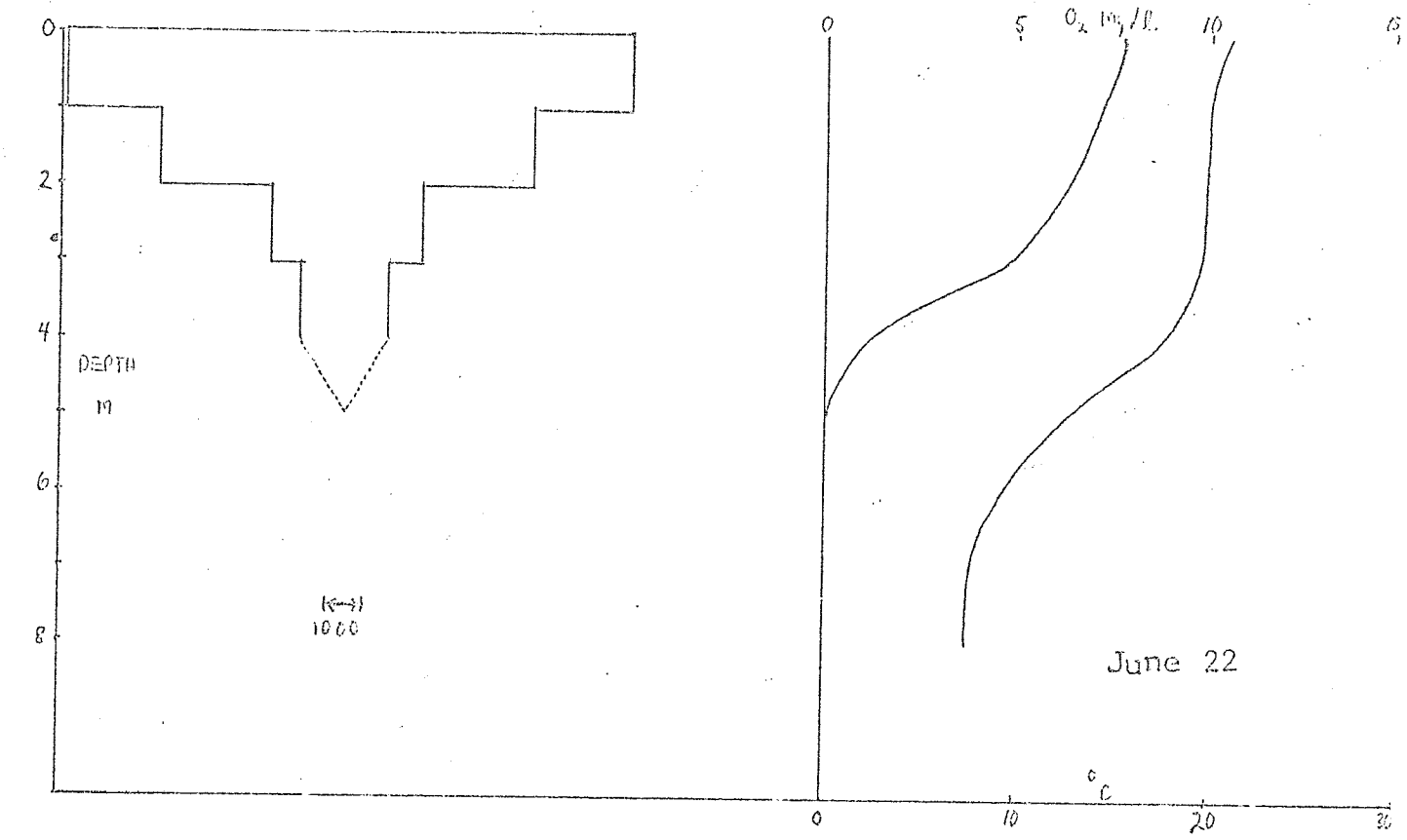
in itself is characteristic of eutrophic waters (Naumann, 1932). Also characteristic of eutrophic lakes is the small species complement of bottom organisms.

In a 1958 paper, Brundin proposed a bottom faunistical lake type system for Northern Europe. The major indicator of eutrophic conditions according to his system is the presence of the genus Chironomus. Two sub genera (one sub genus Chironomus, the other unknown) of this genus occur in Lac du Bois, and if we can assume as does Brundin himself, that his classification applies to North American lakes as well, we have another biological indicator of eutrophy.

The major component of the bottom fauna is Hyalella azteca which makes up more than ninety-five per cent of the total number of organisms and probably a similar proportion of the bio-mass. It is also of some importance in the plankton. Its distribution within the lake seems to be controlled by Oxygen concentration and it disappears from the bottom at about the level of 1 ppm O_2 (Figure 5). Halsey (pers. comm.) reports that during the winter Hyalella is sandwiched in a thin layer just under the ice. This is probably the result of severe depletion of Oxygen in most of the lakewater except that directly under the ice.

Rooted Aquatics

A species of the alga Cladophora appeared in some of the bottom samples but aside from this, no plant material appeared.



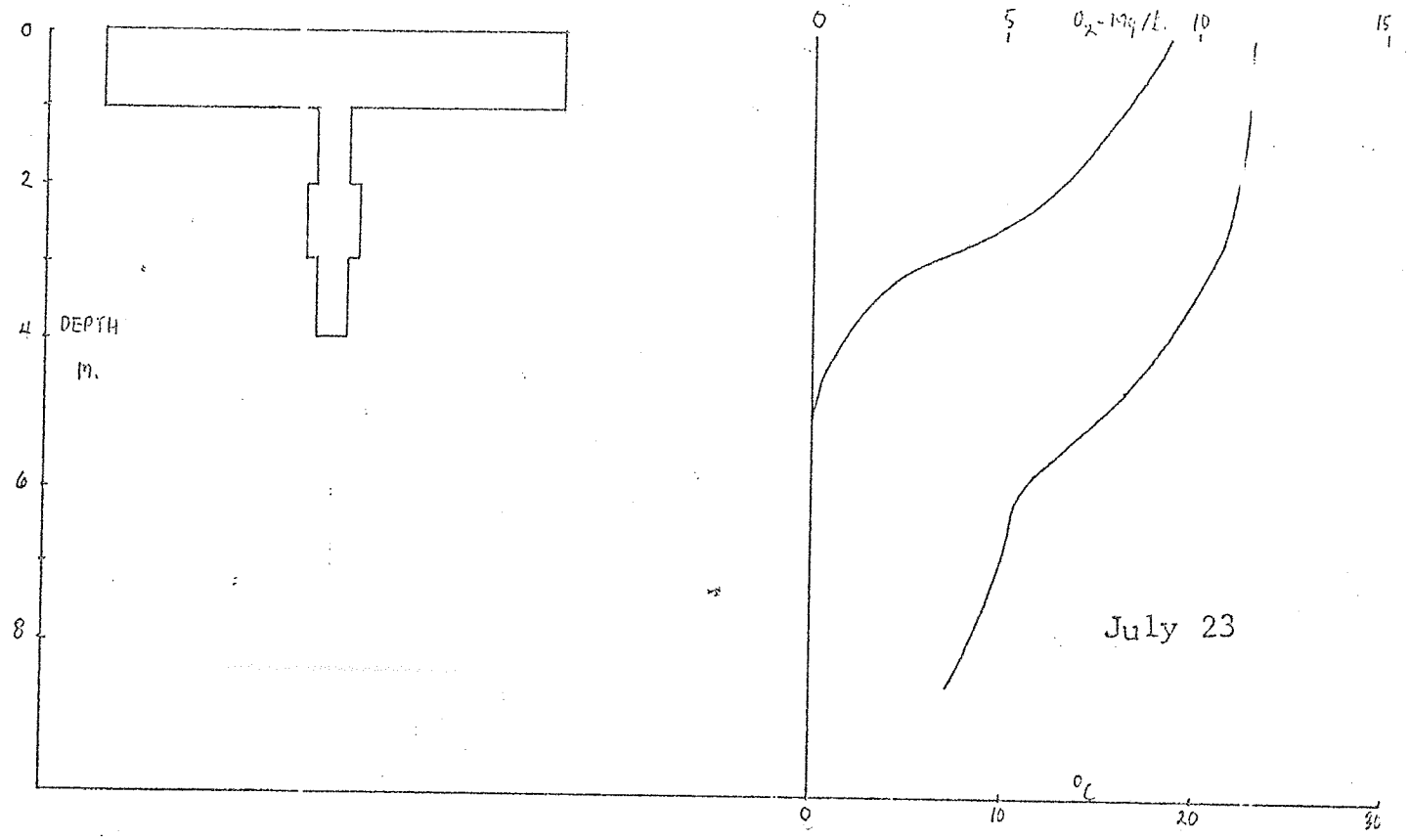


Figure 5 Bottom Distribution of Hyalella azteca