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THE BOTTOM FAUNA OF LAKE NIPIGON

BY

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THE BOTTOM FAUNA OF LAKE NIPIGON

The study of the distribution and economic importance of the bottom fauna of Lake Nipigon, begun in 1921, was continued during the summer of 1922. Essentially the same procedure was followed as in the previous year.

Although a considerable number of dredgings were again taken in the south-eastern area, the study was extended into the south-western and north-eastern sections of the lake. These latter parts included some rather extensive shallow bays, almost shut off from the main body of water, and found to be highly productive of aquatic life.

Food materials from the alimentary tracts of fish from the various localities have been examined, but are not reported upon at the present time.

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The results of the dredging operations are given in the following tables. In these, depths are given in feet and distance from shore in yards, except where otherwise indicated. The character of the bottom is indicated by the abbreviations m-mud, c-clay, o-ooze, s-sand, g-gravel, m/s-mud on sand, etc.

For convenience in considering the results, the groups or classes of organisms will be considered in the following order: *Mollusca, Insecta, Crustacea, Nematoda, Oligochaeta, Hirudinea, Hydracarina, Platyhelminthes.*

Mollusca

Nearly all the species of *Mollusca* obtained in 1921 were again taken in 1922, and it is quite likely that there are several additional species amongst the smaller *Pelecypoda.*

Orient Bay									Series I
Dredging	1	2	3	4	5	6	7	8	Totals
Depth	1½	2	3	2½	3	3	6	9	
Distance from shore	50	100	150	200	250	300	350	400	
Character of bottom	S	S	S	S	S	S	S	S	
Mollusca	1	3	6	10	13	9	12	4	58
Chironomidae	5	39	29	27	57	36	45	15	253
Ephemerida		2	2	4	7		9	8	32
Trichoptera		2	2			1	2		7
Odonata	1								1
Amphipoda				1			2	1	4
Cladocera	50+	3	54	25	11	*a*	*a*	1	144+
Copepoda			1		2				3
Ostracoda				1					1
Nematoda		2							2
Oligochaeta	7	3		5	11	2	5		33
Hydracarina		1	3				4	1	9
Totals	64	55	97	73	101	48	79	30	547+
Average per dredging									68+

Orient Bay									Series II
Dredging	1	2	3	4	5	6	7	8	Totals
Depth	3	6	30	36	23	24	25	3	
Distance from shore	25	50	100	200	300	400	450	500	
Character of bottom	S. & Pebbles	S. & Pebbles	M	M	M	M	M	S	
Mollusca	3	22	4	13		6	8	12	68
Chironomidae	176	158	2	32	6	7	6	16	403
Ephemerida	5	7				1		1	14
Trichoptera	9	13					2	1	25
Coleoptera				2					2
Amphipoda				7	7	11	4		29
Cladocera		1							1
Copepoda	3	2					1		6
Ostracoda	4	15		1					20
Nematoda				2					2
Oligochaeta	13	10		1			3	2	29
Hirudinea				1					1
Hydracarina	4	6		1		1	1	1	14
Totals	217	234	6	60	13	26	25	33	614
Average per dredging									77−

Orient Bay						Series III
						Totals
Dredging	1	2	3	4	5	
Depth	9	15	21	54	66	
Distance from shore	25	50	100	150	200	
Character of bottom	S	S	S	M	M/C	
Mollusca	1			1	1	3
Chironomidae	3		1	7		11
Amphipoda					18	18
Nematoda		1		2	5	8
Oligochaeta				5	9	14
Hydracarina				1	1	2
Totals	4	1	1	16	34	56
Average per dredging						11

Orient Bay						Series IV
						Totals
Dredging	1	2	3	4	5	
Depth	2	6	9	12	18	
Distance from shore	10	20	30	100	150	
Character of bottom	S.&M.	M	M	M	M	
Mollusca	1	60	17	7	7	92
Chironomidae	5	93	83	40	88	309
Ephemerida		2	1		2	5
Trichoptera	1	5	8	4		18
Tabanidae			1			1
Amphipoda	1	2	16	4	1	24
Ostracoda					1	1
Nematoda					3	3
Hydracarina		2	1		3	6
Oligochaeta	1	6	7	5	23	42
Totals	9	170	134	60	128	501
Average per dredging						100

Nipigon River										Series V
										Totals
Dredging	1	2	3	4	5	6	7	8	9	10	
Depth	9	21	42	42	39	30	36	27	18	18	
Distance from shore	20	30	50	100	250	350	450	500	550	570	
Character of bottom	S	S	M	M	M	M	M & gravel	S & R	S & R	S & R	
Mollusca	65	18	5	6	2		1	12	36	17	162
Chironomidae	91	80	6	13	11	8	5	49	91	20	374
Ephemerida	6	7	1	2	2		1	2			21
Trichoptera	3	8		1			1	6			19
Amphipoda			6	1	2	5		33	18		65
Cladocera		1						6			7
Ostracoda	2							19			21
Nematoda	1	1				2					4
Oligochaeta	2	2						2	5		11
Hirudinea			1							1	2
Hydracarina	2	2	2					2		1	9
Totals	172	119	21	23	17	15	8	131	150	39	695
Average per dredging											70

Virgin Islands									Series VI
									Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	6	8	9	15	92	20	14	6	
Distance from shore	10	20	30	75	300	1800	1850	1900	
Character of bottom	S	S	M	M	S/C	S/C	S/C	S&R	
Mollusca	20	51	20	12		7	11	4	125
Chironomidae	41	49	174	43	3	13	89	41	453
Ephemerida	1	4	4	2			4	2	17
Trichoptera		4	2	3		3	2	1	15
Copepoda							1		1
Cladocera							1		1
Ostracoda	1	1	9	1			2		14
Nematoda			1		1				2
Oligochaeta	5	4	21	5		1	7	14	57
Hirudinea			1						1
Hydracarina	1		1				1		3
Totals	69	113	233	66	4	24	118	62	689
Average per dredging									86

Nipigon River									Series VII
									Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	3	6	24	40	39	36	18	12	
Distance from shore	10	20	100	200	300	400	450	470	
Character of bottom	M	M/S	M	M	M & Gr	M	Gr	M	
Mollusca	36	11	12	1			3	6	69
Chironomidae	25	52	45	24	11	3	50	26	236
Ephemerida	2	2	3	1		2	5	1	16
Tricoptera	1						2	2	5
Neuroptera		3							3
Amphipoda	2	3		3	5	4			17
Copepoda			1						1
Ostracoda	13	1							14
Nematoda	1								1
Oligochaeta	6	7	3	3	2	1	6	3	31
Hydracarina	2		3				1		6
Totals	88	79	67	32	18	10	67	38	399
Average per dredging									50

North of Blackwater River — Series VIII

	1	2	3	4	5	6	7	8	Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	3	3	47	17	24	36	57	225	
Distance from shore	20	40	60	150	300	450	600	1800	
Character of bottom	S	S	S	S/C	Gr/C	Gr	M/C	M/C	
Mollusca	1			1	4		1		7
Chironomidae	14	44	8	11	15	5	3	10	110
Ephemerida					2			4	6
Trichoptera					1				1
Amphipoda					2		1	32	35
Ostracoda					1				1
Nematoda			1			1			2
Oligochaeta	7	4	8		1		1	7	28
Hydracarina					1				1
Totals	22	48	17	12	27	6	6	53	191
Average per dredging									24

Black Sturgeon Bay N. — Series IX

	1	2	3	4	5	6	7	8	Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	3	9	12	18	15	21	21	21	
Distance from shore	30	50	150	300	450	600	800	1800	
Character of bottom	M	M	M	M	M	M	M	M	
Mollusca	9	34	57	9	4	2	6	5	126
Chironomidae	3	6	53	26	22	15	30	14	169
Ephemerida	1	14	3		1	1		1	21
Trichoptera		1	1	1	1		1		5
Odonata			1						1
Neuroptera			3						3
Amphipoda	1	1	7	18	30	17	45	53	172
Cladocera	1								1
Ostracoda				1					1
Nematoda		1		1	1	2			5
Oligochaeta	5	2	7	10	2	2	1	1	30
Hirudinea				1					1
Hydracarina		1	1		1			3	6
Totals	20	60	133	67	62	39	83	77	541
Average per dredging									68

Chief Bay (S. End) — Series X

	1	2	3	4	5	6	7	Totals
Dredging	1	2	3	4	5	6	7	
Depth	2½	5	6	9	9	12	27	
Distance from shore	20	40	100	250	500	800	2500	
Character of bottom	S	M	M	M	M	M	O	
Mollusca	34	32	14	30	6	21	46	183
Chironomidae	23	37	19	32	20	20	20	171
Ephemerida		5	6	22	4	4		31
Trichoptera			2		2	1		5
Neuroptera				1				1
Amphipoda			8	12	40	27	96	183
Cladocera		1	1	4				6
Copepoda			*a*	4				4+
Ostracoda		1	6	9		1		17
Nematoda							1	1
Oligochaeta	8	37	21	29	15		1	111
Hirudinea		1	2	1	1	1		6
Hydracarina		1	2	8		3	2	16
Odonata				1				1
Totals	65	115	81	153	88	78	166	736
Average per dredging								105

Chief Bay (N. End) — Series XI

	1	2	3	4	Totals
Dredging	1	2	3	4	
Depth	3	4	15	22	
Distance from shore	50	100	200	400	
Character of bottom	M	M	M	M	
Mollusca	8	27	11	12	58
Chironomidae	11	24	27	10	72
Ephemerida		5		7	12
Trichoptera		1			1
Odonata		1			1
Neuroptera		1			1
Amphipoda	15	13		29	57
Cladocera					1
Nematoda			2	1	3
Oligochaeta	7	6	4	1	18
Hirudinea	1	1			2
Hydracarina	1	1	2	4	8
Totals	43	81	36	64	224
Average per dredging					56

Gull Bay (S.W. End) — Series XII

									Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	3	5	6	9	18	23	30	68	
Distance from shore	150	250	300	400	600	800	1 mi.	2 mi.	
Character of bottom	S	M	M	M	M	M	M	M	
Mollusca	4	10	3			3	8		28
Chironomidae	6	11	18	7	4			2	48
Ephemerida		3	6	6				2	17
Trichoptera							1		1
Amphipoda		9	8			1	3	3	24
Cladocera		7							7
Copepoda								1	1
Nematoda						3			3
Oligochaeta		26	7		5	1			39
Coleoptera		1							1
Totals	10	67	42	13	9	8	12	8	169
Average per dredging									21

Gull Bay (N.E. End) — Series XIII

						Totals
Dredging	1	2	3	4	5	
Depth	3	12	30	51	53	
Distance from shore	100	200	800	1 mi.	2 mi.	
Character of bottom	S	S	M	M	M	
Mollusca	6	15	5	23	10	59
Chironomidae	10	10	6	13	6	45
Amphipoda				56	14	70
Nematoda		1	9	5	1	16
Oligochaeta		1	3	10	6	20
Totals	18	37	26	99	30	210
Average per dredging						42

Gull Bay (S.E. End) — Series XIV

					Totals
Dredging	1	2	3	4	
Depth	5	15	27	42	
Distance from shore	20	100	200	300	
Character of bottom	C	M/Gr	C	S	
Mollusca	31	9	6	17	63
Chironomidae	4	4	6	15	29
Ephemerida	8	6		1	15
Neuroptera	1			1	2
Amphipoda	1	4	6	3	14
Ostracoda				1	1
Nematoda	2	1	3	15	21
Hydracarina		1		1	2
Totals	47	25	21	54	147
Average per dredging					37

North Virgin Islands Harbour and Channel — Series XV

							Totals
Dredging	1	2	3	4	5	6	
Depth	3	5	6	20	72	90	
Distance from shore	10	30	40	200	250	400	
Character of bottom	S	Gr & S	Gr & S	S	S	S/C	
Mollusca	7	14	12	5	1	1	40
Chironomidae	63	75	68	17	5		228
Ephemerida	4	14					18
Trichoptera	5	1		1			7
Coleoptera		1					1
Amphipoda		4	1		2	1	8
Nematoda	1	1		1	1		4
Oligochaeta	35	26	4	1	2		68
Hydracarina	1	1					2
Totals	116	137	85	25	11	2	376
Average per dredging							63

Grant Point (South Harbour)									Series XVI
									Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	3	9	15	18	23	27	35	39	
Distance from shore	50	100	200	400	600	800	1 mi.	1½ mi.	
Character of bottom	S	Gr	Gr	M	M & Gr	M & Gr	M & Gr	C	
Mollusca		8	9	20	7	6	1	6	57
Chironomidae	7	68	56	84	24	27	16	27	309
Ephemerida			2	2	1		1		6
Trichoptera		1	4	2	1				8
Amphipoda	6			1			2	1	10
Nematoda	1	2	2	4				1	10
Oligochaeta	1	2	4	6	2			1	16
Hydracarina		2	2	2	1	1		2	10
Totals	15	83	79	121	36	34	20	38	426
Average per dredging									53

Westward from Blackwater River									Series XVII
									Totals
Dredging	1	2	3	4	5	6	7	8	
Depth	285	303	312	150	198	192	183	186	
Distance from shore	2¼ mi.	2½ mi.	3 mi.	4½ mi.	6 mi.	6½ mi.	7 mi.	7½ mi.	
Character of bottom	C	M	M	C	M	M	M	M	
Mollusca			1	1		1	1		4
Chironomidae	6	4	3	5	21	9	20	23	91
Amphipoda	10	28	7	37	15	10	27	71	205
Ostracoda	2	3	1					2	8
Nematoda				1	1		1		3
Oligochaeta	5	12	7	1	2	2	2	4	35
Platyhelminthes		1						1	2
Totals	23	48	19	45	39	22	51	101	348
Average per dredging									43

Bay North of Sand Point							Series XVIII
							Totals
Dredging	1	2	3	4			
Depth	3	6	17	32			
Distance from shore	15	30	100	300			
Character of bottom	S	S & C	S	S			
Mollusca			17	4			21
Chironomidae	1	3	37	40			81
Ephemerida		1					1
Trichoptera			10				10
Amphipoda			5	1			6
Nematoda		2					2
Oligochaeta			2	1			3
Hirudinea			1				1
Hydracarina			2	1			3
Totals	1	6	74	47			128
Average per dredging							32

S.E. of Humboldt Bay								Series XIX
								Totals
Dredging	1	2	3	4	5			
Depth	3	6	6	6	15			
Distance from shore	400	800	1 mi.	2 mi.	3 mi.			
Character of bottom	M	M	M	M	M & Gr			
Mollusca	17	12	10	67	11			117
Chironomidae	29	238	49	13	36			365
Ephemerida	2	7	3	3	18			33
Trichoptera	1							1
Odonata	1							1
Amphipoda	140	22		12	10			184
Ostracoda	12	28						40
Nematoda	3	5	4	1				13
Oligochaeta	7							7
Hirudinea	2	6	2					10
Hydracarina			1					1
Coleoptera		1						1
Totals	214	319	69	96	75			773
Average per dredging								155

N. End of Humboldt Bay							Series XX
							Totals
Dredging	1	2	3	4	5	6	
Depth	2	14	21	51	96	171	
Distance from shore	100	200	400	800	1 mi.	2½ mi.	
Character of bottom	S	M	M	M	M	M	
Mollusca		63	1	25	24		112
Chironomidae		7	28	13	6	13	67
Ephemerida			5		1	1	7
Trichoptera		2					2
Amphipoda	4	20	10	76	29	8	147
Copepoda	11		3	1		1	16
Ostracoda			22			9	31
Nematoda			9	4	5		18
Oligochaeta		12		1	12	7	32
Hirudinea		1					1
Totals	15	105	77	120	77	39	433
Average per dredging							72

Ombabika Bay							Series XXI
							Totals
Dredging	1	2	3	4	5	6	
Depth	9	12	12	18	15	36	
Distance from shore	400	800	1200	1 mi.	1½ mi.	2½ mi.	
Character of bottom	M	M	C	C	C	M	
Mollusca	19	8	8	5	7	6	53
Chironomidae	9	1		2	2	2	16
Ephemerida	2	3				5	10
Amphipoda					1	10	11
Ostracoda	6						6
Nematoda	4		1			2	7
Oligochaeta	2		1			3	6
Hydracarina	1		1				2
Totals	43	12	11	7	10	28	111
Average per dredging							19

Outermost S.E. Shakespeare Island										Series XXII
										Totals
Dredging	1	2	3	4	5	6	7	8	9	
Depth	6	15	15	30	48	48	52	72	12	
Distance from shore	25	50	100	200	300	400	600	800	2½ mi.	
Character of bottom	S	M & S	M	M	M	M	M	M	M/S	
Mollusca	7	6	4	1	1	1	3	1	5	29
Chironomidae	12	27	10	5	1	1	7	3	2	68
Ephemerida	2	4	2					1		9
Trichoptera	3	4	2						4	13
Amphipoda				2	12	18	12	17	4	65
Nematoda							4	2		6
Oligochaeta	2	11	24	8			1	1	5	52
Hirudinea	1									1
Hydracarina	3						1			4
Totals	30	52	42	16	14	20	28	25	20	247
Average per dredging										27

Channel at Head of Nipigon River								Series XXIII
								Totals
Dredging	1	2	3	4	5	6	7	8
Depth	12	15	105	111	120	123	117	114
Distance from shore	25	50	100	400	800	1 mi.	1½ mi.	2 mi.
Character of bottom	S	S	C	Gr	M/C	M	M	M
Mollusca	10	8						18
Chironomidae	6	10		3	4	1	1	25
Ephemerida	2						1	3
Trichoptera	8	3						11
Amphipoda			3	26	106	77	66	96	374
Ostracoda			1				1		2
Nematoda		1			2				3
Oligochaeta	5	7	1		5	6	8	5	37
Totals	31	29	5	29	117	84	76	102	473
Average per dredging									59

Amongst the *Gastropoda* one species has been added to the list, namely, *Planorbis campanulatus* Say. Like several other species it was peculiarly localized in its distribution, being found only in Humboldt Bay at the north-eastern end of the lake. The larger *Pelecypoda* were found to be quite as scarce in the parts of the lake worked over this year as in those portions of the lake visited previously.

Since the distribution of the various species of *Mollusca* has already been studied in considerable detail,[1] the groups will be here considered as a whole. Table I gives the numbers of specimens obtained at various depths and the curves, Fig. 1 (a and b), illustrate this graphically.

TABLE I

Depth	*Gastro-poda*	Average	*Pelecy-poda*	Average	Depth	*Gastro-poda*	Average	*Pelecy-poda*	Average
0-3	65	3.0	115	5.2	69-72	0	0	2	1
3-6	138	7.3	228	12.0	87-90	0	0	1	1
6-9	134	11.2	121	10.1	90-93	0	0	0	0
9-12	80	9.0	57	6.3	93-96	0	0	24	24
12-15	66	5.1	89	6.8	102-105	0	0	0	0
15-18	74	7.4	41	4.1	108-111	0	0	0	0
18-21	33	4.1	11	1.4	111-114	0	0	0	0
21-24	28	4.0	16	2.3	114-117	0	0	0	0
24-27	21	4.2	57	11.4	117-120	0	0	0	0
27-30	2	.4	16	3.2	120-123	0	0	0	0
30-33	4	4.0	0	0	147-150	0	0	1	1
33-36	6	1.0	15	2.5	168-171	0	0	0	0
36-39	11	2.7	2	.6	180-183	0	0	1	1
39-42	0	0	18	4.5	183-186	0	0	0	0
42-45	0	0	0	0	189-192	1	1	0	0
45-48	0	0	2	.6	195-198	0	0	0	0
48-51	1	.5	47	23.5	222-225	0	0	0	0
51-54	1	.3	13	4.3	282-285	0	0	0	0
54-57	0	0	1	1	300-303	0	0	0	0
63-66	0	0	1	1	309-312	0	0	1	1
66-69	0	0	0	0					

[1] Adamstone, F. B., 1923. The Distribution and Economic Importance of Mollusca in Lake Nipigon. (University of Toronto Studies, Biological Series, Pub. Ontario Fisheries Research Laboratory, No. 14.)

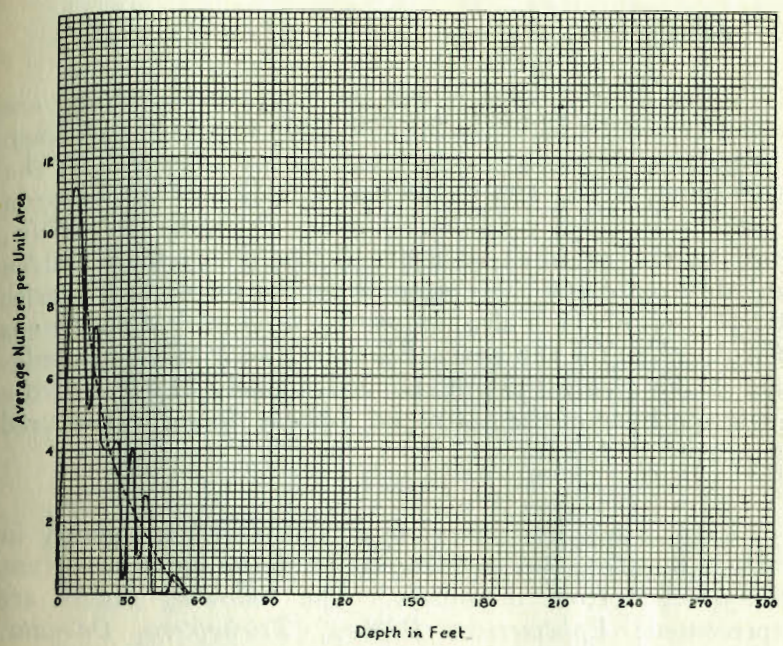

Fig. 1*a*. Distribution according to depth.—Gastropoda.

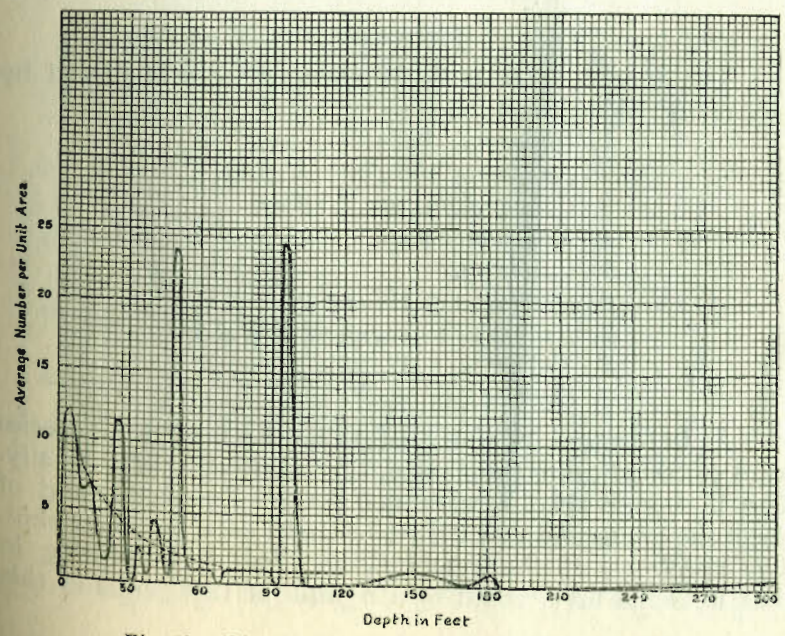

Fig. 1*b*. Distribution according to depth.—Sphaeridae.

From the graphs it is evident that the *Gastropoda* are most abundant within the 30 foot limit of depth, and reach a maximum between 6 and 9 ft. The *Pelecypoda*, on the other hand, were quite numerous in shallow water between 3 and 6 ft. but they were also abundant at depths of 24-27 ft., 48-51 ft. and again at 93-96 ft. These points in the curve probably represent the optimum depths for certain species of *Sphaeridae*. It is also interesting to note that specimens of *Sphaeridae* (of the genus *Fisidium*) were taken in dredgings at the greatest depth sounded, namely 312 ft. Also a single specimen of the gastropod *Valvata sincera* was secured at a depth of 192 ft.

INSECTA

Larvae and nymphs of insects occurred frequently in bottom samples, and constitute one of the most important groups of bottom organisms. The following orders are represented: *Ephemerida*, *Diptera*, *Trichoptera*, *Odonata*, *Coleoptera* and *Neuroptera*.

EPHEMERIDA

The specimens of may fly nymphs were identified by Dr. W. A. Clemens as follows:

1. *Hexagenia bilineata* Say.
2. *Ephemera simulans* Walker.
3. *Caenis diminuta* Walker.
4. *Ephemerella* sp.
5. *Baetis* sp.
6. *Blasturus cupidus* Say.
7. *Ecdyurus maculipennis* Walsh.
8. *Tricorythus* sp.
9. *Centropilum* sp.

As in former dredging operations the first three species were obtained quite frequently, the others only occasionally. The last four species were not found previously, and of these the genus *Blasturus* is represented only by a cast skin. The specimen of the genus *Centropilum* is interesting in that it is the first record of a nymph of this genus in this

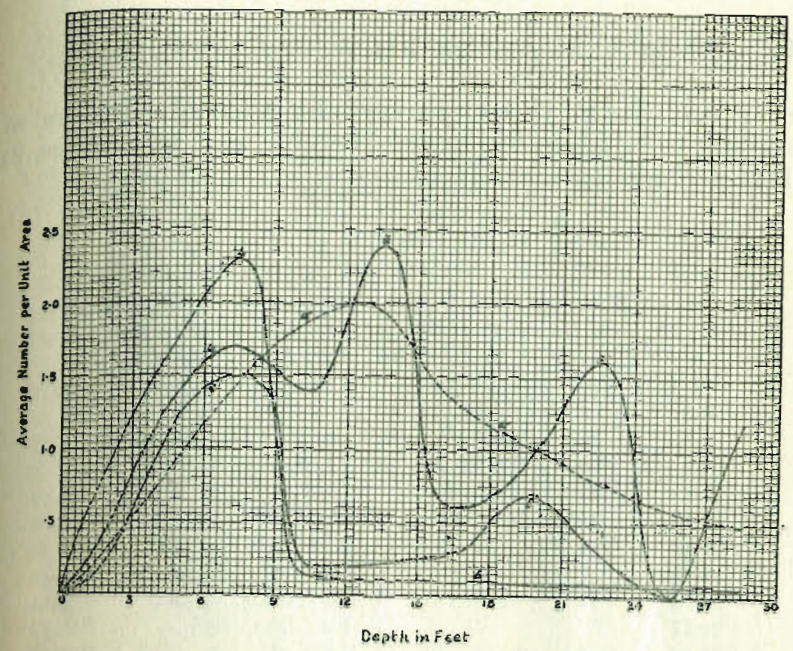

Fig. 2. Distribution according to depth.—Ephemerida: (*a*) Hexagenia bilineate, (*b*) Ephemera simulans, (*c*) Caenis diminuta.

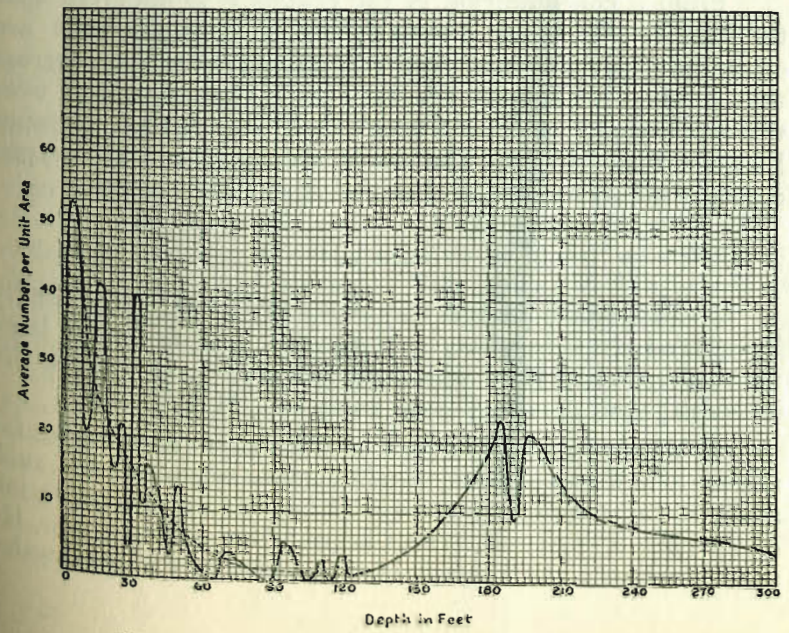

Fig. 3. Distribution according to depth.—Chironomidae.

country. Table II summarizes the average numbers of specimens obtained at various depths, and the curves in Fig. 2 illustrate these results.

TABLE II

Depth	*Hexagenia bilineata*		*Ephemera simulans*		*Caenis diminuta*	
	No.	Av.	No.	Av.	No.	Av.
0-3	6	.3	19	.9	3	.14
3-6	25	1.3	29	1.5	21	1.1
6-9	20	1.7	28	2.3	18	1.5
9-12	13	1.4		0	2	.2
12-15	31	2.4	3	.23	3	.23
15-18	6	.6		0	3	.3
18-21	7	.9		0	6	.7
21-24	11	1.6	1	.14	2	.3
24-27		0	1	.2		0
27-30	6	1.2		0		0

From a consideration of the graphs it is apparent that the species *Ephemera simulans* and *Caenis diminuta* are essentially shallow water forms dwelling near shore, whereas the species *Hexagenia bilineata* is fairly abundant over the whole range of depths down to 30 ft. with an optimum between 9 and 15 ft. The results depicted in these graphs are very similar to those obtained in the previous year.

DIPTERA

1. *Tabanidae:* A few specimens of larvae of the family *Tabanidae* were secured in dredgings, but never in large numbers. When they were found, however, it was usually in some small sheltered bay such as "McL." Bay.

2. *Chironomidae:* Larvae of *Chironomidae* were by far the most numerous of any single bottom organism, and such a large number of specimens was obtained that determination of specific identity has not been attempted. Table III summarizes the average numbers obtained at various depths.

TABLE III

Depth	Total	Average	Depth	Total	Average
0-3	628	28.5	69-72	8	4.0
3-6	1002	52.7	87-90	0	0
6-9	547	45.6	90-93	3	3.0
9-12	184	20.4	93-96	6	6.0
12-15	333	25.6	102-105	0	0
15-18	413	41.3	108-111	3	3.0
18-21	198	24.8	111-114	0	0
21-24	107	15.3	114-117	1	1.0
24-27	108	21.6	117-120	4	4.0
27-30	21	4.2	120-123	1	1.0
30-33	40	40.0	147-150	5	5.0
33-36	63	10.5	168-171	13	13.0
36-39	49	16.3	180-183	20	20.0
39-42	58	14.5	183-186	23	23.0
45-48	10	3.3	189-192	9	9.0
48-51	26	13.0	195-198	21	21.0
51-54	20	6.6	222-225	10	10.0
54-57	3	3.0	283-285	6	6.0
63-66	0	0	300-303	4	4.0
66-69	3	3.0	309-312	3	3.0

The results given in the preceding table are illustrated by the graph Fig. 3.

Chironomidae larvae must be regarded as one of the most important food organisms of the lake, not only because of their abundance, but also because of their widespread distribution. They were found to be very abundant in shallow water, and the graph illustrating distribution shows definitely that the greatest number of individuals occur in depths of less than 35 feet. This agrees with the results obtained in the preceding year. Beyond 35 feet in depth, there is considerable fluctuation in numbers, and the graph does not coincide with that for 1921. It may be that different species are being dealt with, since the dredgings of the two seasons came from different situations. It is interesting to note the abundance at depths between 180 and 220 feet and the occurrence of a few larvae at 312 feet, which was the greatest depth from which dredgings were obtained in this season.

3. *Trichoptera:* Table IV summarizes the average numbers of caddis fly larvae obtained at different depths, and the results are represented graphically in Fig. 4. From

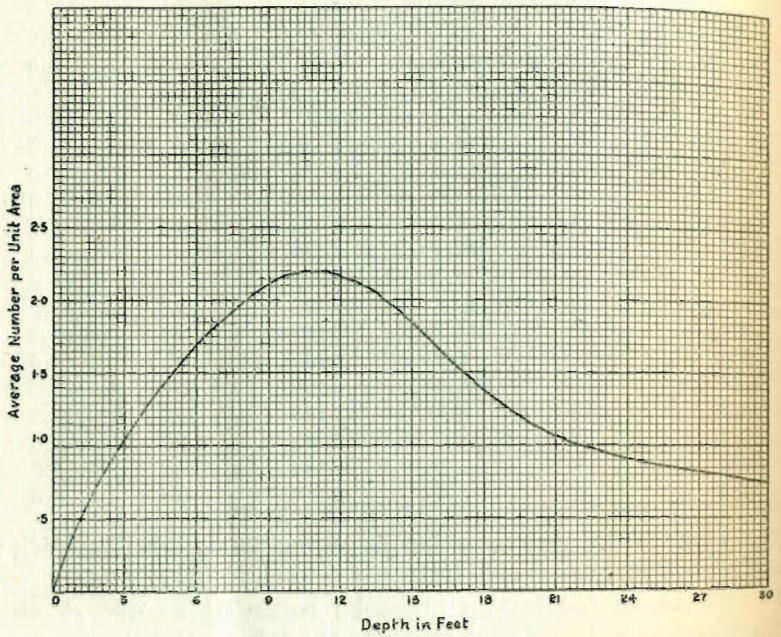

Fig. 4. Distribution according to depth.—Trichoptera.

the curve the optimum depth seems to be between 9 and 12 ft. but there is apparently a fairly large number down to a depth of 30 ft.

TABLE IV

Depth	Total	Average	Depth	Total	Average
0-3	22	1.0	18-21	13	1.6
3-6	28	1.5	21-24	2	.3
6-9	21	1.7	24-27	8	1.6
9-12	20	2.2	27-30	1	1.0
12-15	20	1.5	33-36	1	.2
15-18	15	1.5	39-42	1	.2

4. *Odonata, Neuroptera, Coleoptera:* The number of larvae of these groups of insects secured in dredgings was so small as to be practically negligible. There are certainly large numbers of these organisms in the lake, but they are not readily reached with the dredge. It also appears from the examination of the contents of fish stomachs that they are of minor importance as food organisms.

CRUSTACEA

1. *Cladocera:* Several additional species of *Cladocera* were obtained from dredgings, but their numbers were never very large on account of the fact that they were mostly lost in washing the samples. They are, however, an important source of food especially for very young fish. The species included are:

1. *Alona affinis* (Leydig).
2. *Chydorus sphaericus* (Müller).
3. *Sida crystallina* (Müller).
4. *Eurycercus lamellatus* (Müller).
5. *Ilyocryptus acutifrons* Sars.
6. *Polyphemus pediculus* (Linné).

2. *Ostracoda:* In some 32 dredgings, a number of *Ostracoda* were brought up. On account of the small numbers, specific determinations have not been attempted.

3. *Amphipoda:* Of the three species of *Amphipoda* found the previous year, only two, namely, *Pontoporeia hoyi* and *Hyalella knickerbockeri* were secured last summer (1921).

Pontoporeia hoyi: This species is very numerous and was taken in nearly all kinds of situations and at comparatively great depths. Table Va summarizes its occurrence at various depths.

The graph Fig. 5 drawn from the data given above shows that this amphipod is most abundant in deep water between 90 and 150 ft. This fact is of considerable importance since it shows the existence of a valuable food supply for fish, such as whitefish, at a great depth, and examination of the stomach contents of fish shows that this supply is drawn upon extensively.

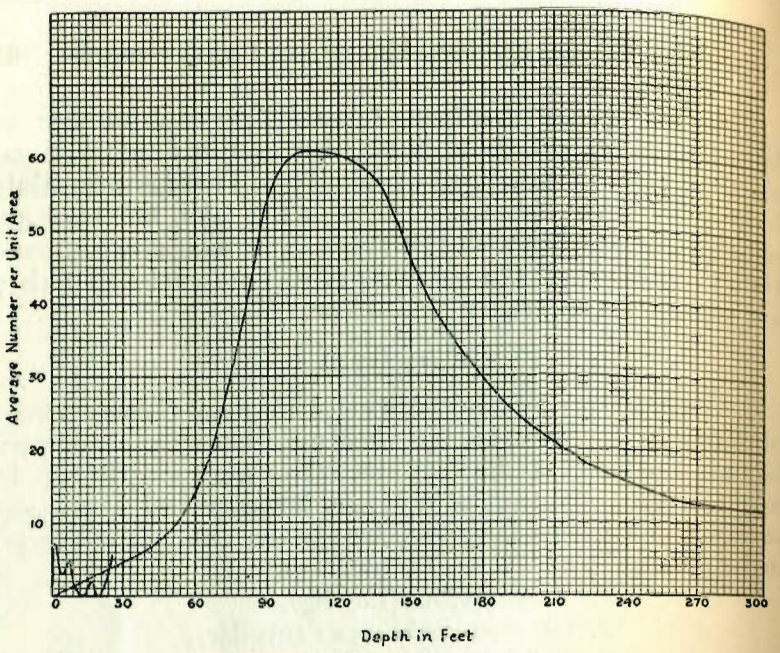

Fig. 5. Distribution according to depth.—Amphipoda: (*a*) Pontoporeia hoyi, (*b*) Hyalella knickerbockeri.

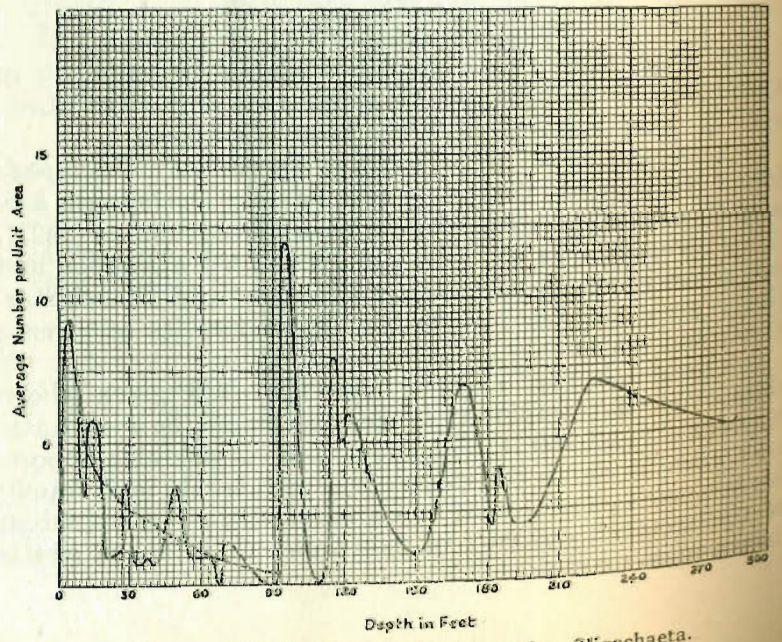

Fig. 6. Distribution according to depth.—Oligochaeta.

TABLE Va

Depth	Total	Average	Depth	Total	Average
0-30	462	4.2	180-210	123	30.7
30-60	234	10.2	210-240	32	32.0
60-90	41	8.2	240-270	0	0
90-120	426	60.9	270-300	10	10.0
120-150	114	57.0	300-330	35	17.5
150-180	8	8.0			

Hyalella knickerbockeri: As in the previous season's work, this species was taken only in shallow water as the following table Vb shows.

TABLE Vb

Depth	Total	Average	Depth	Total	Average
0-3	159	7.2	15-18	20	2.0
3-6	60	3.2	18-21	0	0
6-9	56	4.7	21-24	2	.3
9-12	8	.9	24-27	33	6.6
12-15	1	.1			

The contrast between the restricted distribution of this species as illustrated in Fig. 5, and the widespread distribution of the former, is very remarkable. A similar condition was found in the parts of the lake previously reported upon.

NEMATODA

Although the total number of free-living round worms secured was considerably greater than during the year before, it has still been found impossible to work out an orderly curve representing their distribution. They were, however, more abundant on mud than on any other kind of bottom and were obtained at various depths down to 198 feet. It is also fairly certain that they are most plentiful within the 30 foot limit of depth.

OLIGOCHAETA

Specimens of *Oligochaeta* occurred in a large number of dredgings, and even at the greatest depths sounded. Table VI summarizes the findings.

TABLE VI

Depth	Total	Average	Depth	Total	Average	Depth	Total	Average
0-3	125	5.7	45-48	8	2.6	114-117	8	8.
3-6	176	9.3	48-51	7	3.5	117-120	5	5
6-9	84	7.0	51-54	6	2.0	120-123	6	6
9-12	29	3.2	54-57	1	1.0	147-150	1	1
12-15	76	5.8	63-66	1	.1	168-171	7	7
15-18	57	5.7	66-69	0	0	180-183	2	2
18-21	8	1.0	69-72	3	1.5	183-186	4	4
21-24	8	1.1	87-90	0	0	189-192	2	2
24-27	6	1.2	90-93	0	0	195-198	2	2
27-30	18	3.6	93-96	12	12.0	222-225	7	7
30-33	1	1.0	102-105	1	1.0	282-285	5	5
33-36	5	.8	105-108	0	0	300-303	12	12
36-39	3	1.0	108-111	0	0	309-312	7	7
39-42	3	.7	111-114	5	1.0			

From the data given above a graph, Fig. 6, has been drawn which shows the distribution of oligochaetes with depth. In shallow water down to about 45 feet the relative abundance can be represented by a fairly uniform curve with a maximum between 3 and 6 feet. Beyond this depth there is apparently a large number available even in the deepest water, but the curve representing this is very uneven due likely to the abundance of individual species at certain depths. A larger number of dredgings from deep water is necessary to determine this point.

HIRUDINEA

The number of leeches taken in the dredging operations has been small, and pending specific identifications little need be said concerning them. Occasionally a few leeches have been found amongst the stomach contents of fish, but their value as a food supply must be negligible.

ARACHNIDA

A small number of *Hydracarina* or water mites were brought up in dredgings, but the species have not been identified. They apparently are common and widely distributed throughout the lake, and although eaten by many species of fish, seldom form a large percentage of the food.

PLATYHELMINTHES

In the dredgings taken off the Blackwater River (Series XVII), two specimens belonging to the Phylum *Platyhelminthes* were obtained. One came from a depth of 303 feet, and the other from 186 feet at a point of 5 miles distant. The occurrence of these organisms (apparently of a parasitic type) in such situations is peculiar and difficult to account for.

The following table gives the average number of animals of the various groups for a unit area as found in the two years of investigation.

	1922		1921	
	Av. per sq. yd.	Av. per sq. metre	Av. per sq. yd.	Av. per sq. metre
Mollusca	159	190	138	165
Chironomidae	403	482	253	303
Ephemerida	30	36	20	25
Trichoptera	15	18	8	10
Amphipoda	176	210	131	160
Oligochaeta	74	88	51	63
Misc.	68	76	29	27
Total	925	1100	630	753

The abundant supply of fish food available over the whole lake can perhaps be realized from this summary and some idea gained of its very great economic importance.

CONCLUSIONS

1. The results are largely confirmatory of the work done in 1921.

2. The number of samples secured was less than that obtained in the previous year since many of the areas examined were considerably removed from the base of operations and extended trips were necessary in order to secure them. The total number of organisms obtained was, however, considerably greater, indicating that many of the regions studied were exceedingly productive.

3. One of the outstanding facts brought out by this investigation is that the most productive parts of the lake are, in general, within a limit of 30 feet in depth. This conclusion is amply supported by the curves illustrating distribution of various organisms according to depth. A few animals, such as *Pontoporeia hoyi*, are most abundant in deep water, and form a plentiful source of food for deep-water fish such as the common whitefish.

4. The well-protected bays, such as Humboldt Bay (Series XIX), are very highly productive of food organisms in comparison with more open water (Series XVII). In some of these smaller bays, moreover, certain associations of organisms occur which are not found elsewhere in the lake.

5. The character of the bottom influences the productivity of the lake very decidedly as can be seen in the contrast between Ombabika Bay (Series XXI) and Humboldt Bay (Series XIX and XX).

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FURTHER STUDIES OF THE PLANKTON OF LAKE NIPIGON

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