PLANKTON PRODUCTION IN A SMALL MISSISSIPPI IMPOUNDMENT, LAKE LAMAR BRUCE

BY

Luther A. Knight, Jr.[1/] and Jack Herring[2/]

INTRODUCTION

Counts alone do not provide an adequate estimation of plankton production. A more complete picture of plankton communities and the roles these organisms play in the overall aquatic food web can be obtained by supplementing plankton counts with information on organic content and photosynthetic activity. In this investigation, plankton crops were examined four times during the year in Lake Lamar Bruce, Mississippi to measure total volatile matter, oxygen production and numbers of organisms.

MATERIALS AND METHODS

Three stations were selected in Lake Lamar Bruce to represent as nearly as possible typical habitats. These were: (1) the deep water near the dam, (2) the mouth of a major cove, and (3) the upper end of the cove. Samples were collected and parameters measured four times during the year to coincide with seasons.

For plankton counts, one liter of water was taken and the plankton organisms killed and preserved with formalin. Plankters were concentrated by sedimentation and total counts made. When certain plankters were too abundant for total counts, enumeration was by field counts (1).

Temperature profiles were recorded for each station and were used in selecting depths at which photosynthetic activity was measured. During periods of thermal stratification sampling was at the surface, thermocline and bottom. At other times sampling was at the surface, mid-depth

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[1/] Department of Biology, University of Mississippi, University, Mississippi.

[2/] Mississippi Game and Fish Commission, Jackson, Mississippi.

and bottom. Light and dark bottle procedures were used to measure oxygen evolution for 24-hour periods and the resulting data were used to calculate total plankton biomass (2).

One liter water samples were also collected concurrently with samples for plankton counts for measuring total volatile matter. These samples were brought to the laboratory and filtered through 0.45µ millipore filters. Filter discs then were ashed at 600C in a muffle furnace to obtain total volatile matter (2).

RESULTS AND DISCUSSION

Plankton biomass as estimated from photosynthetic activity in Lake Lamar Bruce was highest in surface waters (Table 1). In Figure 1 variations in biomass are shown by station and sampling dates. Except for the October samples plankton biomass was greater at Station 1 with a 12-fold increase over the April sample occurring in July. October and January samples indicate reduced productivity.

Weather conditions were clear during the October sampling period. At this time phytoplankton counts were low except for large numbers of Asterionella sp. at the upper end of the cove (Table 2, 3, and 4). Asterionella sp. is a small diatom and would not be expected to produce large concentrations of oxygen, thus, the apparent reduced productivity. Cloudy and rainy weather in January probably accounts for the low values of plankton biomass (oxygen evolution) during that sampling period.

Although certain inorganic substances may also volatilize easily, filtering water samples and ashing the residue nevertheless gives a reasonable estimate of organic materials. This procedure was followed to find the total volatile matter by station, depth and sampling dates and Figure 5 shows variations in total volatile matter.

A yellow floculant substance occurred in samples from near the bottom. This substance was not identified but no doubt contributed to total volatile matter concentrations. The discrepancies between total plankton biomass and volatile matter during January may be related to large quantities of the floc.

Phytoplankton communities were dominated by the Chlorophyta and Chrysophyta. Staurastrum sp. and Asterionella sp. were the dominant species in terms of numbers. Zooplankton populations consisted mainly of rotifers, especially Trichocerca sp., Kellicottia sp. and Keratella sp. Protozoans were represented by Didinium sp., Difflugia sp., and Epistylis sp. Kalff (3) showed that, although net plankton may be conspicuous at times in a body of water, nanoplankton is responsible for much of the photosynthetic activities. As would be expected, phytoplankton populations were denser than zooplankton although neither could be considered overly abundant. Plankton counts are shown in Tables 2, 3, 4, 6, 7, and 8.

Plankton biomass is a function of photosynthesis and the rate of photosynthesis is related to available light. In this study only four samples were taken for calculating the biomass and field notes show that some of these collections were made during cloudy weather. During overcast periods oxygen production was reduced and, consequently, the calculated biomass was considerably lower. A clearer picture of plankton production may be seen in the total volatile matter (Figure 5). Total volatile matter was consistently higher in surface waters from the mouth of the cove. At only one time (January, 1976) was total volatile matter less anywhere in the cove than at the dam.

Based on all three parameters, plankton counts, total volatile matter and total plankton biomass, the quieter waters of the cove appear to be more productive than the area near the dam. Few data, except for plankton counts, are available in the literature on plankton production in Mississippi waters and a reasonable comparison of productivity between large reservoirs and small Game and Fish Commission impoundments cannot be made.

A more frequent sampling program is needed to ascertain more exactly the conditions associated with production in Mississippi impoundments.

ACKNOWLEDGEMENT

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Table 1. Photosynthetic activity as oxygen evolved and plankton biomass in Lake Lamar Bruce, Mississippi by sampling date.

Date	Station	Depth (m)	Oxygen (mg/l)	Plankton Biomass (mg/l)
4/17/75	Dam	0	0.075	0.25
		5	0.000	0.00
		9	0.000	0.00
4/17/75	Mouth of Cove	0	0.009	0.03
		7	0.000	0.00
4/17/75	Upper End of Cove	0	0.004	0.01
		1.5	0.004	0.01
4/23/75	Dam	0	0.022	0.07
		5	0.000	0.00
		9	0.012	0.04
4/23/75	Mouth of Cove	0	0.066	0.22
		8	0.046	0.15
4/23/75	Upper End of Cove	0	0.052	0.17
		1.5	0.029	0.10
7/10/75	Dam	0	1.000	3.00
		3	0.013	0.04
		9	0.000	0.00
7/10/75	Mouth of Cove	0	0.129	0.43
		2	0.050	0.17
		7	0.000	0.00
7/10/75	Upper End of Cove	0	0.113	0.37
		1.5	0.033	0.11
10/22/75	Dam	0	0.042	0.14
		8	0.008	0.03
		9	0.008	0.03
10/22/75	Mouth of Cove	0	0.041	0.14
		4	0.012	0.04
		7	0.000	0.00
10/22/75	Upper End of Cove	0	0.067	0.22
		2	0.038	0.13
1/13/76	Dam	0	0.000	0.00
		4	0.000	0.00
		8	0.000	0.00
1/13/76	Upper End of Cove	0	0.000	0.00
		1	0.000	0.00

Table 2. Phytoplankton counts for Lake Lamar Bruce, Mississippi. Samples collected near dam.

Date	Organisms	Organisms/l Depth (m) 0	5	9
4/16/75	Chlorophyta			
	Arthrodesmus sp.	--	50	--
	Chroococcus sp.	--	--	91
	Closterium sp.	101	150	46
	Colonial sp.	51	200	--
	Cosmarium sp.	--	50	--
	Desmidium sp.	101	50	--
	Kirchneriella sp.	960	300	--
	Palmella sp.	51	50	--
	Quadrigula sp.	4899	200	46
	Staurastrum sp.	24,695	16,700	1274
	Chrysophyta			
	Asterionella sp.	76,407	28,850	2639
	Campylodiscus sp.	--	--	46
	Diatom sp.	--	150	--
	Fragillaria sp.	--	50	--
	Melosira sp.	3485	4750	728
	Synedra sp.	152	150	--
	Cyanophyta			
	Anabaena sp.	152	--	--
	Pyrrophyta			
	Ceratium sp.	253	--	91
	Euglenophyta			
	Phacus sp.	--	--	46

Date	Organisms	Organisms/l Depth (m) 0	3	9
7/ 9/75	Chlorophyta			
	Coelastrum sp.	86	--	--
	Staurastrum sp.	344	210	--
	Chrysophyta			
	Diatom sp.	172	--	--
	Melosira sp.	86	--	--
	Synedra sp.	344	--	--

Table 2 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	3	9
7/ 9/75	Cyanophyta			
	Anabaena sp.	688	--	--
	Oscillatoria sp.	1720	2520	410
	Pyrrophyta			
	Ceratium sp.	946	1260	--
	Euglenophyta			
	Euglena sp.	86	--	82
	Phacus sp.	--	210	--

Date	Organisms	Organisms/l Depth (m) 0	4	9
10/21/75	Chlorophyta			
	Arthrodesmus sp.	--	246	--
	Dictyosphaerium sp.	--	164	--
	Staurastrum sp.	184	738	--
	Chrysophyta			
	Melosira sp.	92	--	--
	Synedra sp.	--	--	115
	Coelosphaerium sp.	276	328	6325
	Cyanophyta			
	Anabaena sp.	92	246	--
	Pyrrophyta			
	Ceratium sp.	92	324	--

Date	Organisms	Organisms/l Depth (m) 0	4	9
1/12/76	Chlorophyta			
	Staurastrum sp.	--	--	240
	Chrysophyta			
	Melosira sp.	--	--	240
	Coelosphaerium sp.	--	--	480

Table 2 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	4	9
1/12/76	Cyanophyta			
	Anabaena sp.	--	--	120
	Polycystis sp.	600	105	--

Table 3. Phytoplankton counts for Lake Lamar Bruce, Mississippi. Samples collected at end of cove.

Date	Organisms	Organisms/l Depth (m) 0	2
4/21/75	Chlorophyta		
	Closterium sp.	180	--
	Colonial form	--	196
	Kirchneriella sp.	450	196
	Quadrigula sp.	9090	2695
	Staurastrum sp.	18,135	28,420
	Volvox sp.	90	--
	Chrysophyta		
	Asterionella sp.	53,550	88,396
	Diatom sp.	45	49
	Fragillaria sp.	--	49
	Melosira sp.	3915	5929
	Navicula sp.	45	--
	Cyanophyta		
	Anabaena sp.	--	--
	Pyrrophyta		
	Ceratium sp.	1035	735

		Organisms/l Depth (m) 0	1
7/ 9/75	Chlorophyta		
	Staurastrum sp.	222	--

Table 3 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	1
7/ 9/75	Chrysophyta		
	Synedra sp.	--	300
	Coelosphaerium sp.	--	--
	Cyanophyta		
	Anabaena sp.	--	49,062
	Polycystis sp.	--	74

Date	Organisms	Organisms/l Depth (m) 0	1
10/21/75	Chlorophyta		
	Arthrodesmus sp.	--	294
	Coelastrum sp.	104	--
	Dictyosphaerium sp.	104	--
	Scenedesmus sp.	104	--
	Staurastrum	624	98
	Chrysophyta		
	Asterionella sp.	936	98
	Melosira sp.	104	--
	Coelosphaerium sp.	2600	98
	Pyrrophyta		
	Ceratium	1352	2842

		Organisms/l Depth (m) 0	2
1/12/76	Chlorophyta		
	Endorina sp.	136	--
	Staurastrum sp.	--	170
	Chrysophyta		
	Melosira sp.	--	85
	Synedra sp.	--	85
	Coelastrum sp.	--	595

Table 3 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	2
1/12/76	Cyanophyta		
	Anabaena sp.	77,656	--
	Polycystis sp.	--	85
	Oscillatoria	--	85

Table 4. Phytoplankton counts for Lake Lamar Bruce, Mississippi. Samples collected at mouth of cove.

Date	Organisms	Organisms/l Depth (m) 0	9
4/16/75	Chlorophyta		
	Closterium sp.	110	82
	Dictyosphaerium sp.	330	--
	Kirchneriella sp.	165	--
	Pleurotaenium sp.	--	41
	Quadrigula sp.	22,110	41
	Staurastrum sp.	22,660	2952
	Ulothrix sp.	--	287
	Chrysophyta		
	Asterionella sp.	61,710	2624
	Diatom sp.	--	123
	Melosira sp.	237	1558
	Navicula sp.	--	41
	Synedra sp.	165	--
	Tabellaria sp.	--	41
	Cyanophyta		
	Anabaena sp.	55	--
	Pyrrophyta		
	Ceratium sp.	55	--

		Organisms/l Depth (m) 0	2	7
7/ 9/75	Chlorophyta			
	Staurastrum	252	231	340

Table 4 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	2	7
7/ 9/75	Chrysophyta			
	Asterionella sp.	--	--	255
	Melosira sp.	--	77	765
	Synedra sp.	84	--	255
	Cyanophyta			
	Anabaena sp.	13,356	847	510
	Aphanizomenon sp.	1680	--	--
	Pyrrophyta			
	Ceratium sp.	168	2387	--

Date	Organisms	Organisms/l Depth (m) 0	4	7
10/21/75	Chlorophyta			
	Arthrodesmus sp.	200	--	--
	Coelastrum sp.	100	--	--
	Dimorphococcus sp.	--	360	--
	Scenedesmus sp.	100	--	--
	Staurastrum sp.	200	120	--
	Chrysophyte			
	Melosira sp.	--	120	--
	Synedra sp.	--	120	--
	Coelosphoerium sp.	1100	4080	16,320
	Cyanophyta			
	Anabaena sp.	100	1440	--
	Pyrrophyta			
	Ceratium sp.	700	480	--

Date	Organisms	Organisms/l Depth (m) 0	4	7
1/12/76	Chlorophyta			
	Scenedesmus sp.	--	120	--
	Staurastrum sp.	--	120	230

Table 4 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	4	7
1/12/76	Chrysophyte			
	Asterionella sp.	--	--	360
	Melosira sp.	--	240	1725
	Synedra sp.	--	120	120
	Coelosphaeriums sp.	--	5280	2875
	Cyanophyte			
	Polycystis sp.	88	--	--
	Pyrrophyte			
	Ceratium sp.	264	--	--

Table 5. Total volatile matter in water samples from Lake Lamar Bruce, Mississippi--1975 and 1976.

Date	Station	Depth (m)	Total Volatile Matter (mg/l)
4/16/75	Dam	0	2
		5	3
		9	8
4/16/75	Mouth of Cove	0	3
		7	5
4/16/75	Upper End of Cove	0	5
		1.5	1
7/9/75	Dam	0	13
		3	16
		9	24
7/9/75	Mouth of Cove	0	16
		2	12
		7	22
7/9/75	Upper End of Cove	0	14
		1.5	6
10/21/75	Dam	0	1
		4	1
		9	59
10/21/75	Mouth of Cove	0	26
		4	23
		7	17
10/21/75	Upper End of Cove	0	22
1/12/76	Dam	0	3
		4	20
		9	24
1/12/76	Mouth of Cove	0	46
		3	30
		7	45
1/12/76	Upper End of Cove	0	1
		1	9

Table 6. Zooplankton counts for Lake Lamar Bruce, Mississippi. Samples collected near dam.

Date	Organisms	Organisms/l Depth (m) 0	5	9
4/16/75	Zooplankton			
	Protozoa			
	Didinium sp.	455	250	--
	Difflugia sp.	354	1600	91
	Epistylis sp.	303	--	--
	Rotifera			
	Conochilus sp.	--	50	--
	Kellicottia bostoniensis	--	150	--
	Keratella cochlearis	53	--	--
	Monostylis sp.	--	50	--
	Polyarthra vulgaris	253	--	--
	Rotifer egg	202	--	--
	Rotifer sp.	--	--	46
	Trichocerca cylindrica	253	--	--
	Trichocerca similis	303	--	--
	Trichocerca sp.	--	50	--
	Copepods			
	Nauplius	51	50	46
	Cladocera			
	Diaphanosoma	51	--	--

Date	Organisms	Organisms/l Depth (m) 0	3	9
7/ 9/75	Rotifera			
	Anaeuropsis	516	490	--
	Conochilus sp.	744	210	--
	Hexarthra mira	172	280	--
	Kellicottia bostoniensis	86	210	--
	Keratella cochlearis	--	70	--
	Pleosoma sp.	86	--	--
	Trichocerca cylindrica	--	70	--
	Trichocerca sp.	86	70	--
	Copepoda			
	Nauplius	86	350	--

Table 6 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	4	9
10/21/75	Rotifera			
	Conochilus sp.	--	82	--
	Filinis longiseta	--	82	--
	Kellicottia bostoniensis	184	246	115
	Keratella cochlearis	--	82	--
	Trichocerca sp.	184	164	--
	Copepoda			
	Nauplius	276	--	--

Date	Organisms	Organisms/l Depth (m) 0	5	9
1/12/76	Protozoa			
	Vorticella sp.	--	105	--
	Rotifera			
	Kellicottia bostoniensis	--	105	120
	Copepoda			
	Nauplius	--	105	--

Table 7. Zooplankton counts for Lake Lamar Bruce, Mississippi. Samples collected at mouth of cove.

Date	Organisms	Organisms/l Depth (m) 0	9
4/16/75	Protozoa		
	Ciliate sp.	--	205
	Didinium sp.	495	369
	Difflugia sp.	110	779
	Epistylis sp.	220	--
	Vorticella sp.	--	82

Table 7 (Continued)

Date	Organisms	Organisms/l Depth (m) 0		9
4/16/75	Rotifera			
	Cephalodella sp.	--		41
	Kellicottia bostoniensis	55		369
	Keratella crassa	--		123
	Polyarthra vulgaris	110		41
	Rotifer egg	110		205
	Trichocerca sp.	55		--
	Copepoda			
	Diaptomus sp.	55		--
	Nauplius	55		82
	Cladocerca			
	Immature form	55		--
		Organisms/l Depth (m) 0	**2**	**7**
7/ 9/75	Protozoa			
	Difflugia	--	--	85
	Rotifera			
	Anaeuropsis sp.	504	539	--
	Conochilus sp.	--	385	--
	Gastropus sp.	--	--	85
	Filinia longiseta	84	--	--
	Hexarthra mira	84	231	--
	Rotifera sp.	252	--	--
	Trichocerca sp.	84	77	00
	Copepoda			
	Cyclops sp.	--	77	--
	Nauplius	84	--	--
		Organisms/l Depth (m) 0	**4**	**7**
10/21/75	Rotifera			
	Anaeuropsis sp.	300	--	--
	Kellicottia bostoniensis	500	480	--
	Keratella cochlearis	300	120	--

Table 7 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	4	7
10/21/75	*Polyarthra* sp.	--	120	--
	Rotifer egg	--	120	--
	Rotifer sp.	--	360	--
	Trichocerca similis	100	--	--
	Trichocerca sp.	100	--	--
	Copepoda			
	Nauplius	200	120	--

		Organisms/l Depth (m) 0	3	7
1/12/76	Protozoa			
	Didinium sp.	--	--	1495
	Vorticella sp.	--	120	2530
	Rotifera			
	Gastropus sp.	--	--	115
	Kellicottia bostoniensis	--	--	230
	Keratella cochlearis	--	240	--
	Monostyla sp.	--	--	230
	Rotifer sp.	--	120	--
	Trichocerca sp.	--	--	115
	Copepoda			
	Nauplius	--	120	--
	Cladocerca			
	Bosmina sp.	--	120	--
	Daphnia sp.	--	120	--
	Ostracoda			
	Ostracod sp.	--	--	575

Table 8. Zooplankton counts for Lake Lamar Bruce, Mississippi. Samples collected at upper end of cove.

Date	Organisms	Organisms/l Depth (m) 0	2
4/16/75	Protozoa		
	Didinium sp.	3015	10,094
	Difflugia sp.	90	--
	Epistylis sp.	90	196
	Vorticella sp.	--	49
	Rotifera		
	Cephalodella sp.	45	--
	Conochilus sp.	--	49
	Kellicottia bostoniensis	45	--
	Keratella crassa	45	--
	Polyarthra euryptera	135	--
	Polyarthra vulgaris	185	441
	Rotifer egg	90	196
	Trichocerca cylindrica	225	245
	Copepoda		
	Cyclops sp.	--	49
	Nauplius	--	98

Date	Organisms	Organisms/l Depth (m) 0	1
7/ 9/75	Rotifera		
	Anaeuropsis sp.	340	222
	Brachionus sp.	136	74
	Filinia longiseta	68	296
	Hexarthra mira	136	148
	Polyarthra euryptera	--	74
	Polyarthra sp.	272	--
	Rotifer egg	--	74
	Trichocerca sp.	68	148

Date	Organisms	Organisms/l Depth (m) 0	1
10/21/75	Protozoa		
	Vorticella sp.	104	--

Table 8 (Continued)

Date	Organisms	Organisms/l Depth (m) 0	1
10/21/75	Rotifera		
	Anaeuropsis sp.	416	588
	Kellicottia bostoniensis	416	--
	Rotifer egg	104	--
	Copepoda		
	Cyclops	--	98
	Nauplius	104	98

Date	Organisms	Organisms/l Depth (m) 0	2
1/12/76	Rotifera		
	Hexarthra mira	85	--

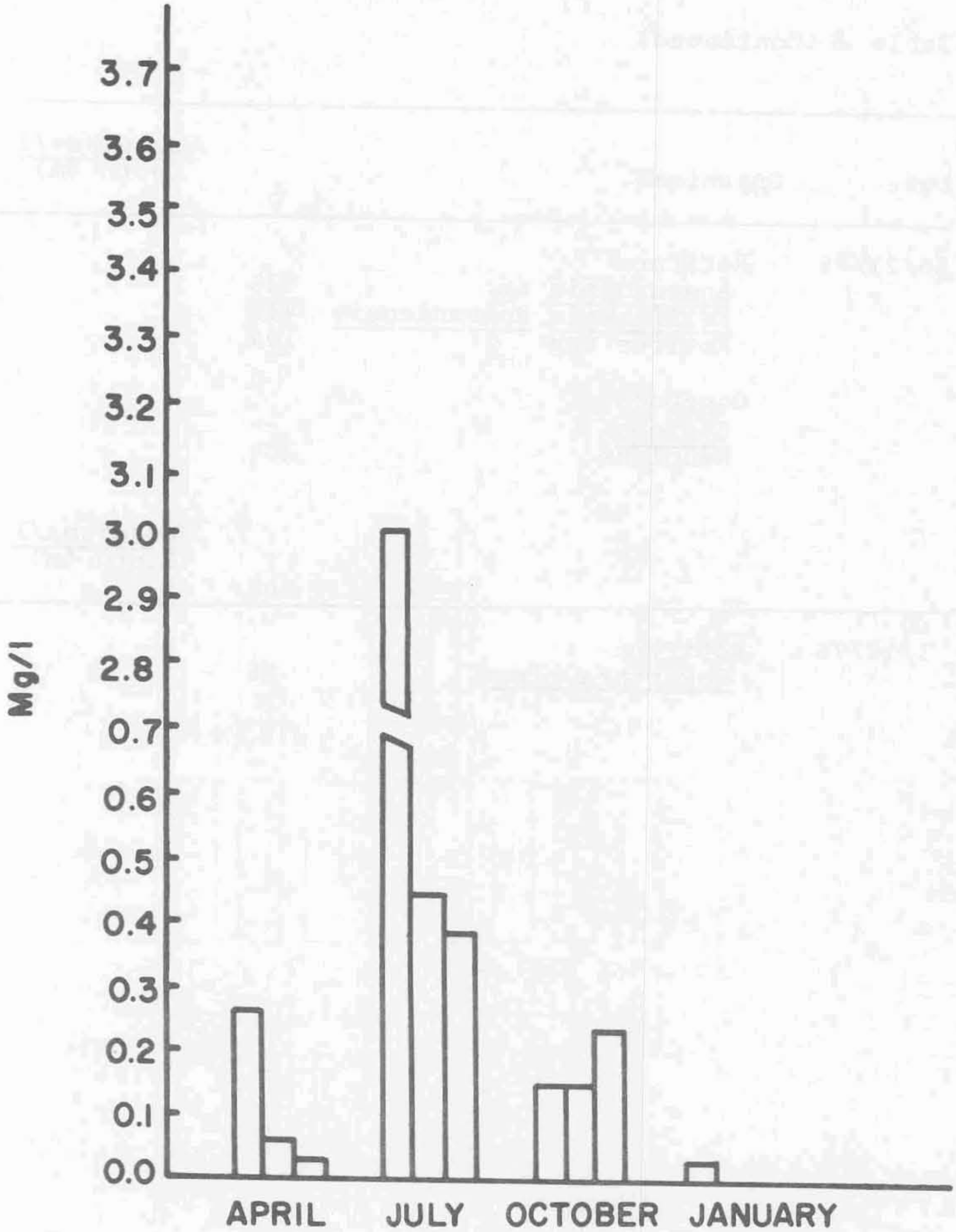

Figure 1. Plankton biomass in surface waters from Lake Lamar Bruce, Mississippi by sampling month. Histogram shows stations in order: dam, mouth of cove and upper end of cove.

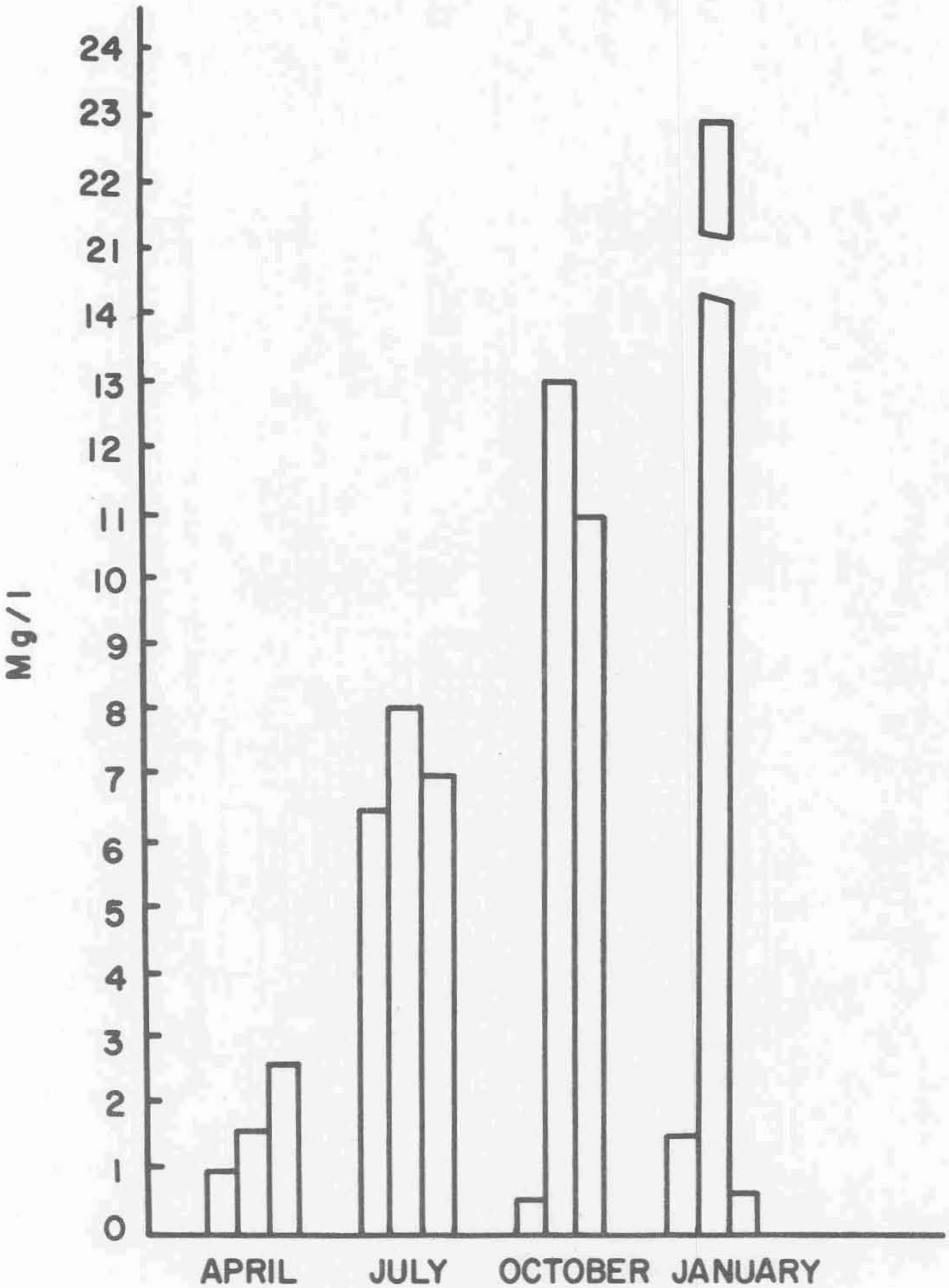

Figure 2. Total volatile matter in surface samples from Lake Lamar Bruce, Mississippi by sampling month. Histogram shows stations in order; dam, mouth of cove and upper end of cove.