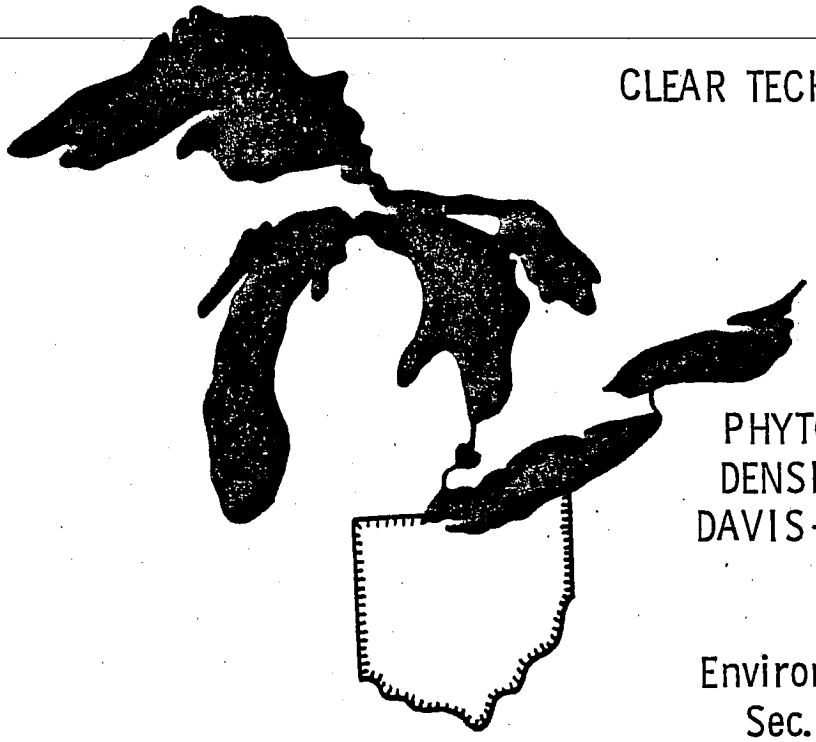

CLEAR TECHNICAL REPORT NO. 160

PHYTOPLANKTON AND ZOOPLANKTON DENSITIES FROM LAKE ERIE NEAR THE DAVIS-BESSE NUCLEAR POWER STATION DURING 1979

Environmental Technical Specifications Sec. 3.1.2.a.1 Plankton Studies (Phytoplankton and Zooplankton)

Prepared by

Jeffrey M. Reutter
and
James W. Fletcher

Prepared for

Toledo Edison Company
Toledo, Ohio

THE OHIO STATE UNIVERSITY

CENTER FOR LAKE ERIE AREA RESEARCH

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3.1.2.a.1 Plankton Studies (Phytoplankton and Zooplankton)

Procedures

Plankton samples were collected monthly (approximately once every 30 days) from May through November from 7 sampling stations in the vicinity of Locust Point (Figure 1). Actual sampling dates were determined by weather conditions and the availability of personnel and equipment. Samples could not be collected during April due to an unusually long winter and the presence of ice and/or inclement weather. Four vertical tows, bottom to surface, were collected at each station with a Wisconsin plankton net (12 cm mouth; no. 20, 0.080 mm mesh). Each sample was concentrated to 50 ml. Two samples were preserved with Lugol's and used for phytoplankton analysis. Soda water was added to the remaining 2 samples to relax the zooplankters prior to preservation with 5% formalin. The volume of water sampled was computed by multiplying the depth of the tow by the area of the net mouth. Three 1-ml aliquots were withdrawn from each 50-ml sample and placed in counting cells.

Whole organism counts of the phytoplankton were made from 25 random Whipple Disk fields in each of the three 1-ml aliquots from 2 samples. When filamentous forms numbered 100 or more in 10 Whipple fields, they were not counted in the remaining 15 fields. Identification was carried as far as possible, usually the genus or species level.

All zooplankters within each of the three 1-ml aliquots from 2 samples were counted by scanning the entire counting cell with a microscope. Identification was carried as far as possible, usually to the genus or species level.

Phytoplankton

Results. Phytoplankters collected from May through November 1979 were divided into 50 taxa, generally to the genus level (Table 1). Twenty one taxa were grouped in Bacillariophyceae, 18 in Chlorophyceae, 2 in Dinophyceae, and 9 in Myxophyceae.

Monthly mean phytoplankton populations ranged from 4,595/l in June to 734,777/l on May 1 (Table 1). The mean density from all samples collected in 1979 was 224,008/l. Phytoplankton densities at individual sampling stations ranged from 1,945/l at Station 8 in June to 889,947/l at Station 13 on May 1 (Table 2). Population pulses were observed in the spring and the summer (Figure 2). The spring pulse was caused by diatoms while the summer pulse was caused by blue-green algae (Figure 3).

Monthly mean bacillariophycean densities ranged from 1,628/l in June to 733,663/l on May 1 (Table 1). The annual mean bacillariophycean density from all samples collected during 1979 was 109,293/l or 49 percent of the entire

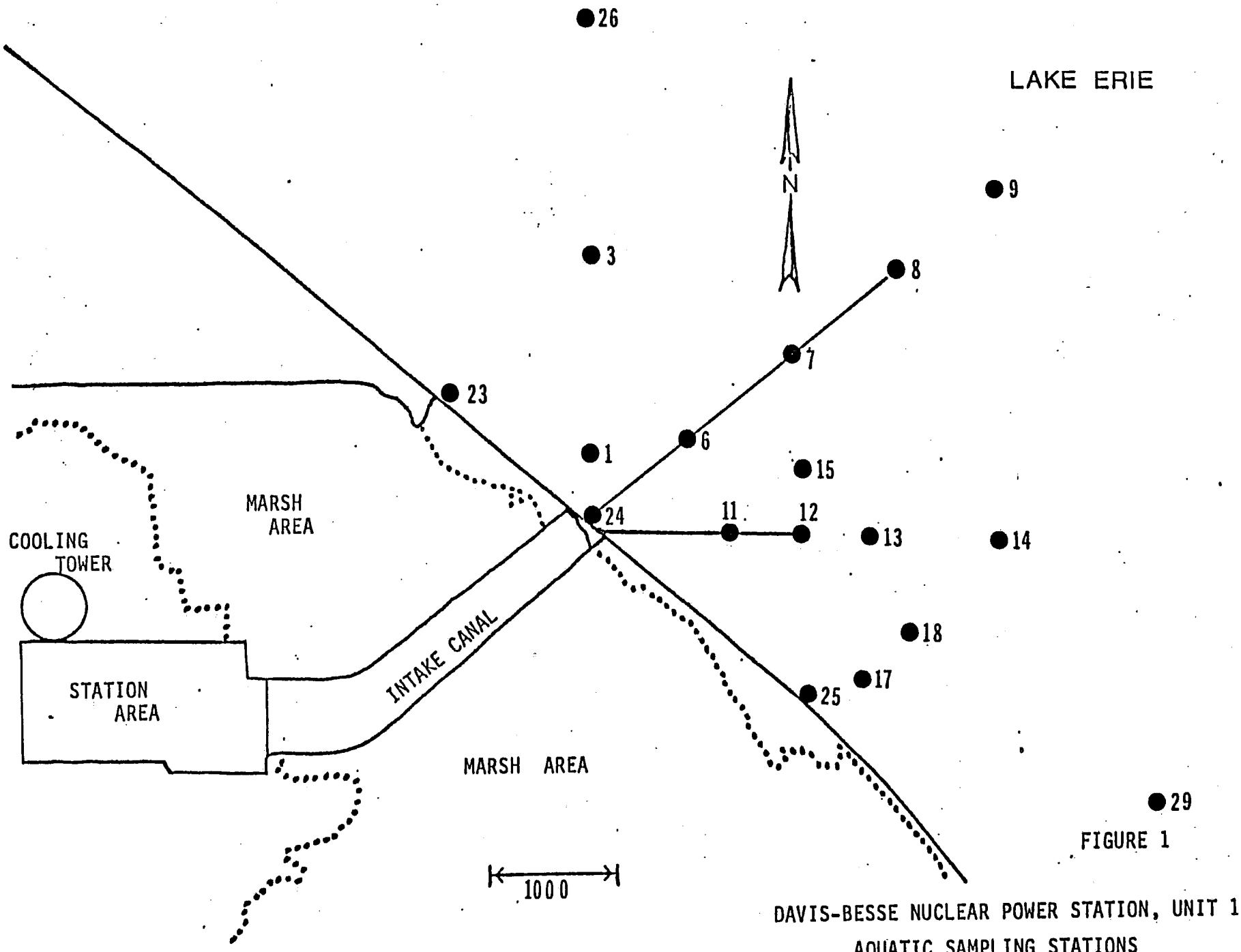


FIGURE 1

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1
AQUATIC SAMPLING STATIONS

TABLE 1

MONTHLY MEAN DENSITIES* OF INDIVIDUAL PHYTOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
BACILLARIOPHYCEAE (Diatoms)									
Asterionella formosa	680123	14439	221	111	0	0	30211	10187	91912
Cosinodiscus spp.	0	0	0	0	0	0	17	0	2
Cyclotella spp.	6	0	0	0	0	0	0	0	1
Cymatopleura spp.	7	0	0	0	0	0	0	0	1
Diatoma spp.	8	16	0	0	0	0	0	0	3
Fragilaria spp.	2706	7415	106	7276	5571	6365	9161	3071	5209
Gyrosigma spp.	0	0	0	7	0	0	0	0	1
Melosira spp.	39353	5308	700	3422	68	5548	11930	489	8352
Navicula spp.	86	0	0	34	0	0	0	0	15
Nitzschia spp.	12	0	0	0	0	0	0	0	1
Penularia spp.	0	0	0	0	0	0	8	0	1
Pleurosoma sp.	0	7	0	0	0	0	0	0	1
Rhizosolinia spp.	5	0	0	0	0	0	0	0	1
Sceletonema subsalsa	0	0	481	0	0	0	0	0	60
Stephanodiscus binderanus	10142	5847	11	0	23	0	5175	2833	2948
S. spp.	7	0	0	0	0	0	8	0	2
Surirella spp.	0	0	17	32	44	0	8	0	13
Synedra spp.	87	17	53	0	0	0	70	1034	158
Tabellaria spp.	1014	2492	39	0	0	0	113	798	557
Unidentified Centric	0	33	0	0	6	17	0	0	7
Unidentified Centric Filament	109	281	0	0	0	0	0	0	49
Subtotal	733663	35855	1628	10882	5712	11930	56703	17967	109293

TABLE 1 (Cont'd)

MONTHLY MEAN DENSITIES* OF INDIVIDUAL PHYTOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
CHLOROPHYCEAE (Green Algae)									
Actinastrum spp.	0	0	13	0	0	0	93	0	13
Ankistrodesmus falcatus	0	0	50	0	14	0	0	0	8
Binuclearia tatrana	0	0	338	255	195	57144	11069	44	8631
Botryococcus sudeticus	0	0	0	1360	1977	59	0	0	424
Closteriopsis longissima	11	184	7	13	0	0	9	21	31
Closterium spp.	0	0	6	17	0	0	0	0	3
Coelastrum spp.	0	0	0	79	47	0	0	0	16
Cosmarium spp.	0	0	0	35	0	0	0	0	4
Dictyosphaerium sp.	8	17	0	0	0	0	0	0	3
Micractinium sp.	6	0	0	0	0	0	0	0	1
Mugeotia sp.	146	1958	111	84	85	12747	8068	385	2948
Oocystis spp.	0	0	0	47	0	11	5	0	8
Pediastrum duplex	18	151	899	716	955	355	241	0	417
P. simplex	28	85	67	1018	422	636	224	84	323
Scenedesmus spp.	26	7	42	64	0	17	10	0	21
Schroederia sp.	0	0	8	0	0	0	0	0	1
Staurastrum paradoxum	10	14	34	404	75	23	78	0	80
Tetraspora spp.	7	0	0	0	0	0	0	0	1
Subtotal	261	2416	1574	4092	3791	70992	19798	534	12932

TABLE 1 (Cont'd)

MONTHLY MEAN DENSITIES* OF INDIVIDUAL PHYTOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
MYXOPHYCEAE (Blue-green Algae)									
Anabaena spiroides	0	0	13	129	259	17	22	10	56
A. sp.	45	8	129	26	15	277	0	0	63
Aphanizomenon flos-aquae	18	0	110	215464	96118	405876	2198	0	89973
Aphanothece spp.	0	0	0	0	5	0	0	0	1
Chroococcus spp.	0	524	0	147	0	0	0	0	84
Gomphosphaeria spp.	0	0	0	0	8	0	0	0	1
Merismopedia spp.	0	0	7	21	0	0	0	0	4
Microcystis spp.	0	0	0	1071	189	0	0	0	158
Oscillatoria spp.	779	689	984	100	103	12128	40903	945	7079
Subtotal	842	1221	1243	216958	96697	418298	43123	955	97417
DINOPHYCEAE (Protozoa)									
Ceratium hirundinella	0	5	149	34372	40	147	0	0	4339
Peridinium sp.	11	0	0	197	5	0	0	0	27
Subtotal	11	5	149	34570	45	147	0	0	4366
TOTAL	734777	39497	4595	266502	106244	501368	119624	19456	224008

* Expressed as number of whole organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12cm diameter, 0.080mm mesh) from 7 sampling stations on dates indicated.

TABLE 2

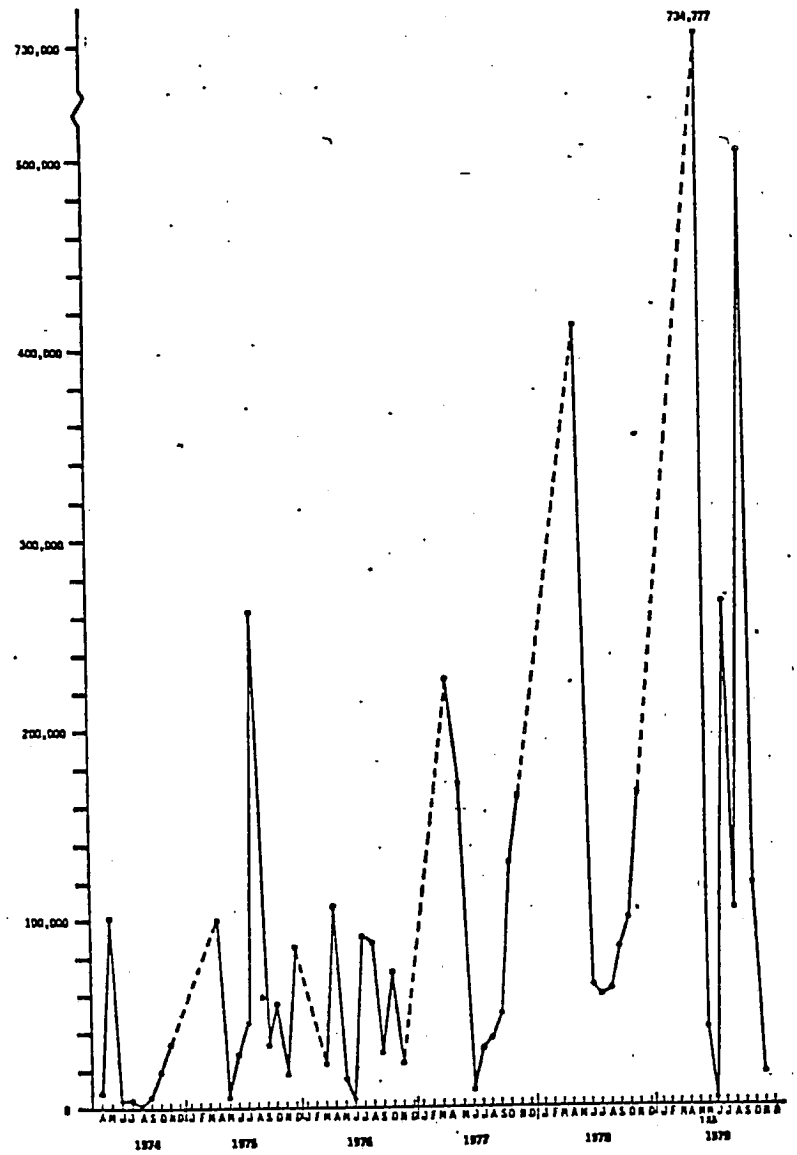
MONTHLY MEAN PHYTOPLANKTON DENSITIES* FROM

SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1979

STATION \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	GRAND MEAN
1	630647	52546	7624	317485	81514	406729	120938	38020	206938
3	737866	45212	8252	327506	94904	517548	145597	21221	237263
6	633462	48808	3851	440997	79302	444691	134103	13662	224859
8	872472	28665	1945	94904	181824	481395	100882	17527	222452
13	889947	36594	3961	260850	96672	692887	133682	12320	265864
14	672223	28405	2762	206194	185327	363659	112627	12497	197962
18	706825	36252	3773	217577	24168	602667	89539	20943	212718
GRAND MEAN	734777	39497	4595	266502	106244	501368	119624	19456	224008

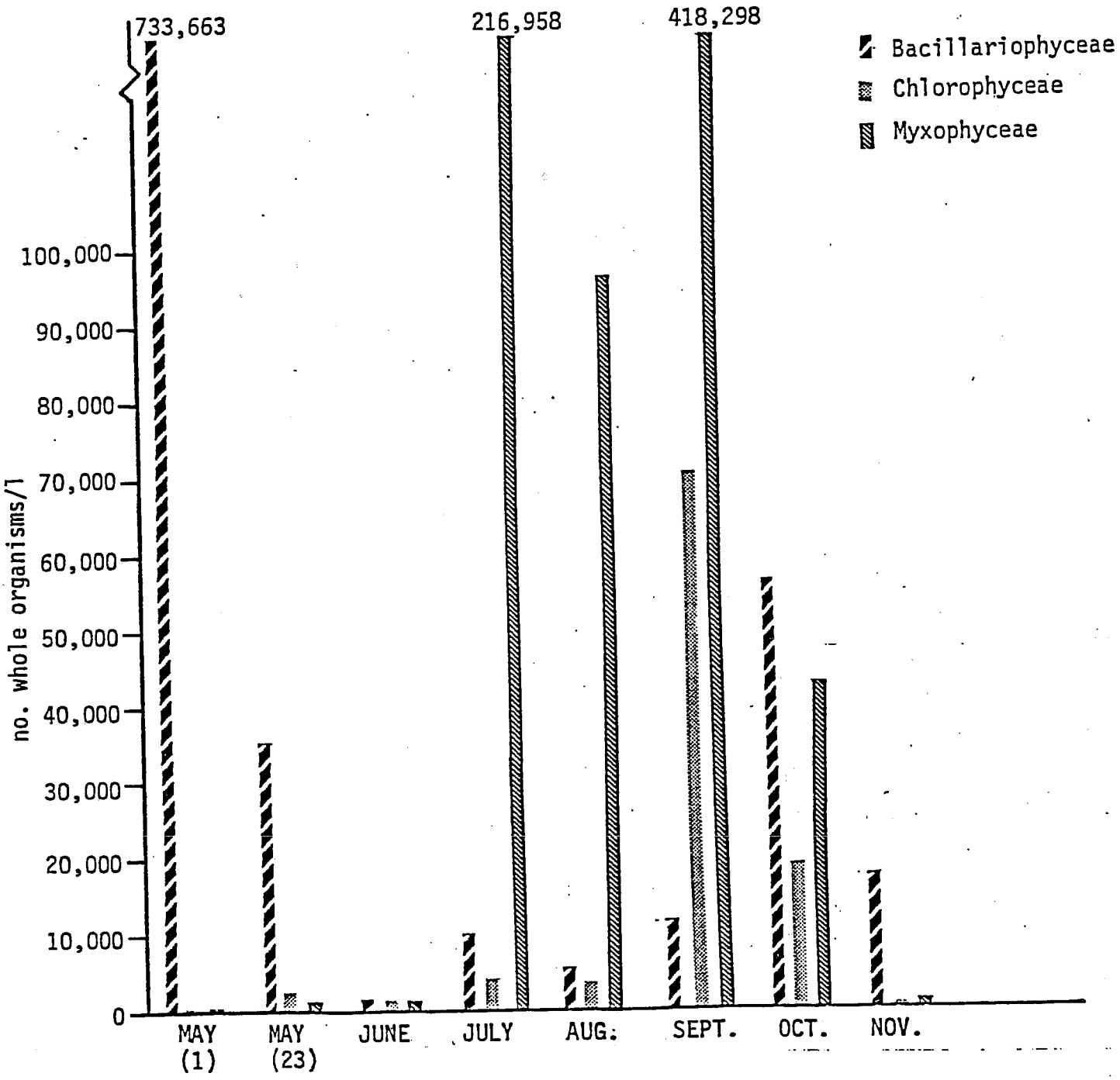
* Data presented as the number of whole organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12cm diameter, 0.080mm mesh) at each of the indicated stations.

FIGURE 2. MONTHLY MEAN PHYTOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1974 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 3. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1979.



phytoplankton density. The dominant diatom taxa were Asterionella formosa in May, October and November; Melosira spp. in June; and Fragilaria spp. in July, August and September. A. formosa had the largest annual mean population, 91,912/l. Diatoms were the dominant phytoplankton group on May 1 and May 23 and in June, October and November when they constituted 99.8, 90.8, 35.4, 47.4, and 92.3 percent, respectively, of the total phytoplankton density.

Monthly mean chlorophycean densities ranged from 261/l on May 1 to 70,992/l in September with an annual mean population from all samples collected during 1979 of 12,932/l or 6 percent of the total phytoplankton population (Table 1). The dominant green algae taxa were Mugeotia sp. on both dates in May and in November, Pediastrum duplex in June, Botryococcus sudeticus in July and August, and Binuclearia tatrana in September and October. Binuclearia tatrana had the largest annual mean population, 8,631/l. Chlorophyceae peaked in September but was never the dominant phytoplankton group.

Monthly mean myxophycean densities ranged from 842/l on May 1 to 418,298/l in September with an annual mean density from all samples collected in 1979 of 97,417/l, or 43 percent of the total phytoplankton mean (Table 1). The dominant myxophycean taxa were Oscillatoria spp. on both dates in May and in June, October and November, and Aphanizomenon flos-aquae from July through September. Myxophyceae was the dominant phytoplankton group in July, August and September representing 81.4, 91.0, and 83.4 percent, respectively, of the total phytoplankton density.

Dinophyceans were represented by 2 taxa, Ceratium hirundinella and Peridinium sp. Ceratium was more abundant than Peridinium and reached its greatest density in July at 34,372/l (Table 1).

All raw data were keypunched and are stored in Columbus, Ohio at the offices of the Center for Lake Erie Area Research on the campus of The Ohio State University.

Analysis. The Center for Lake Erie Area Research has monitored phytoplankton populations at Locust Point since 1974 (Figure 2). Radical differences were noted between populations in 1974 and 1975, but 77 percent of the variation was explainable by variation in physical and chemical parameters of water quality (Reutter, 1976). Bacillariophycean and chlorophycean populations observed in 1974 and 1975 were quite comparable (Figures 4 and 5). The myxophycean component of the populations accounted for the differences between the 2 years. No myxophycean bloom occurred in 1974, whereas a huge Aphanizomenon sp. bloom occurred in August 1975. This bloom was highly correlated with increased transparency (80 percent greater than in 1974) and decreased turbidity (20 percent of that observed in 1974) (Reutter, 1976). A correlation of this type was first hypothesized by Chandler and Weeks (1945).

Bacillariophycean and chlorophycean populations in 1976 were similar in size and composition to those observed in 1974 and 1975 (Figures 4, 5, and 6). The diatom population, especially, was strikingly similar from year to year, with 1976 most resembling 1974. Populations were always greatest in spring and fall, pulses which began and ended abruptly were commonplace. Chlorophycean populations tended to increase in the fall. A very small pulse was observed in June 1975 which was not observed in 1974 or 1976.

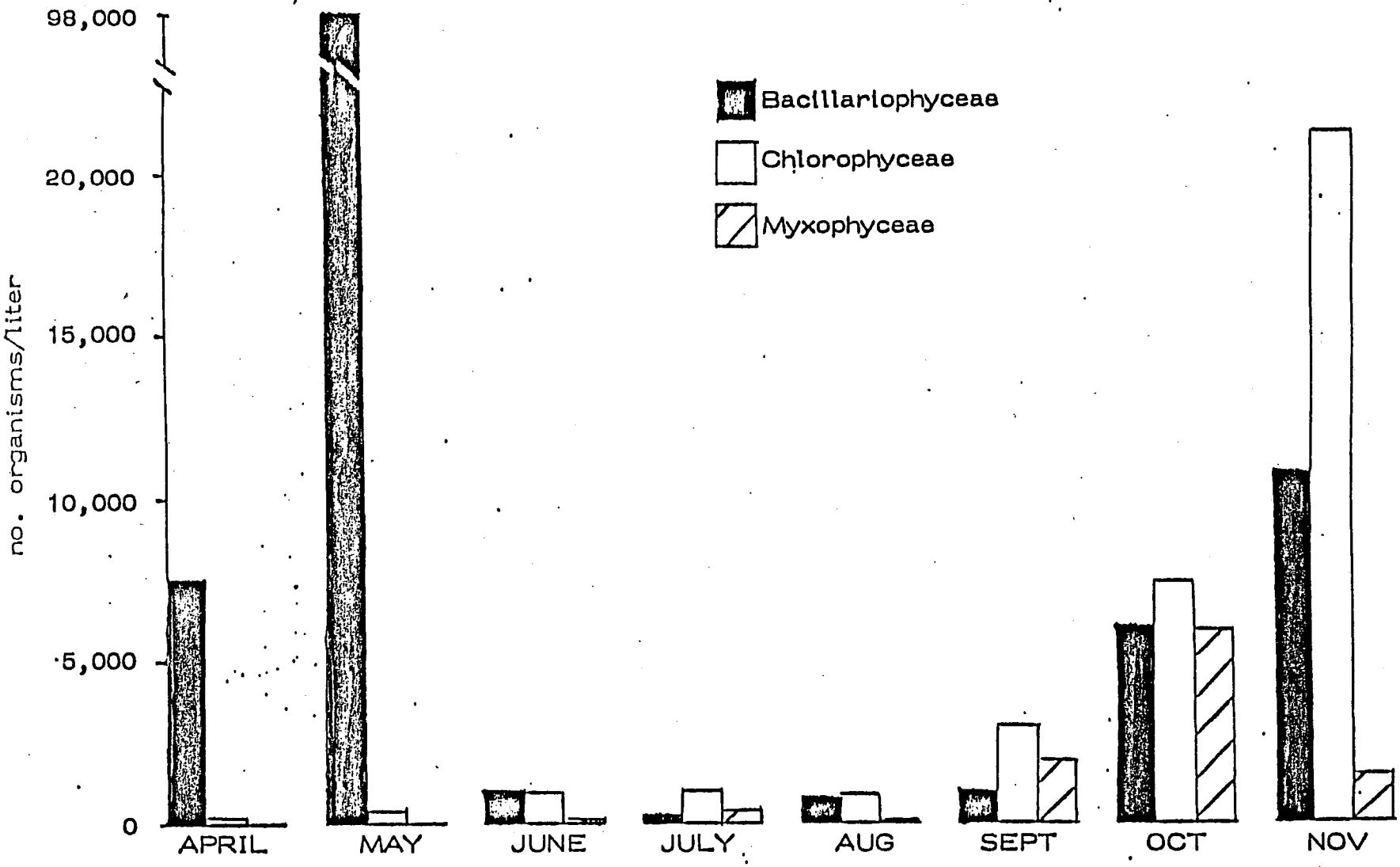


FIGURE 4. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1974.

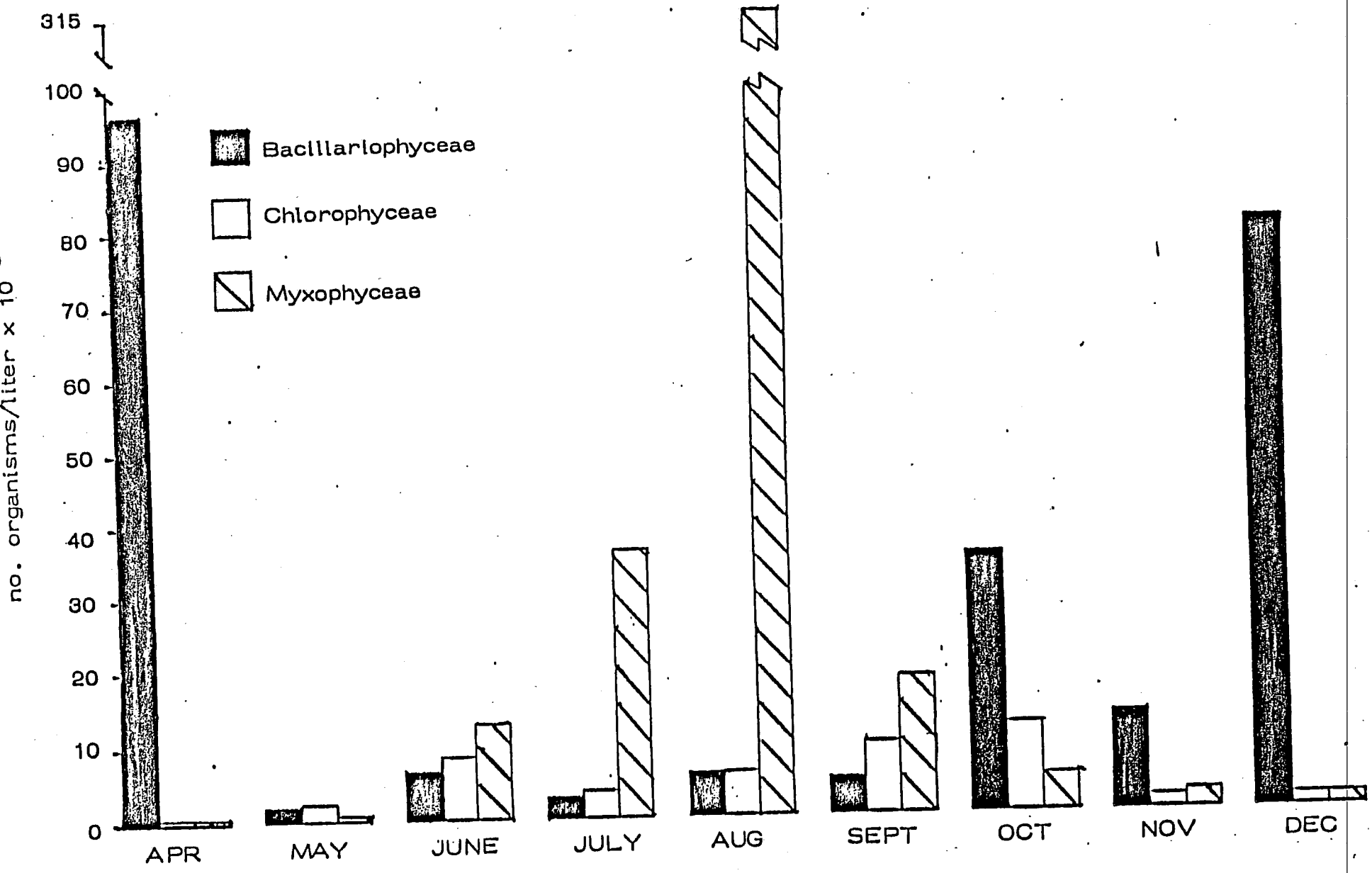
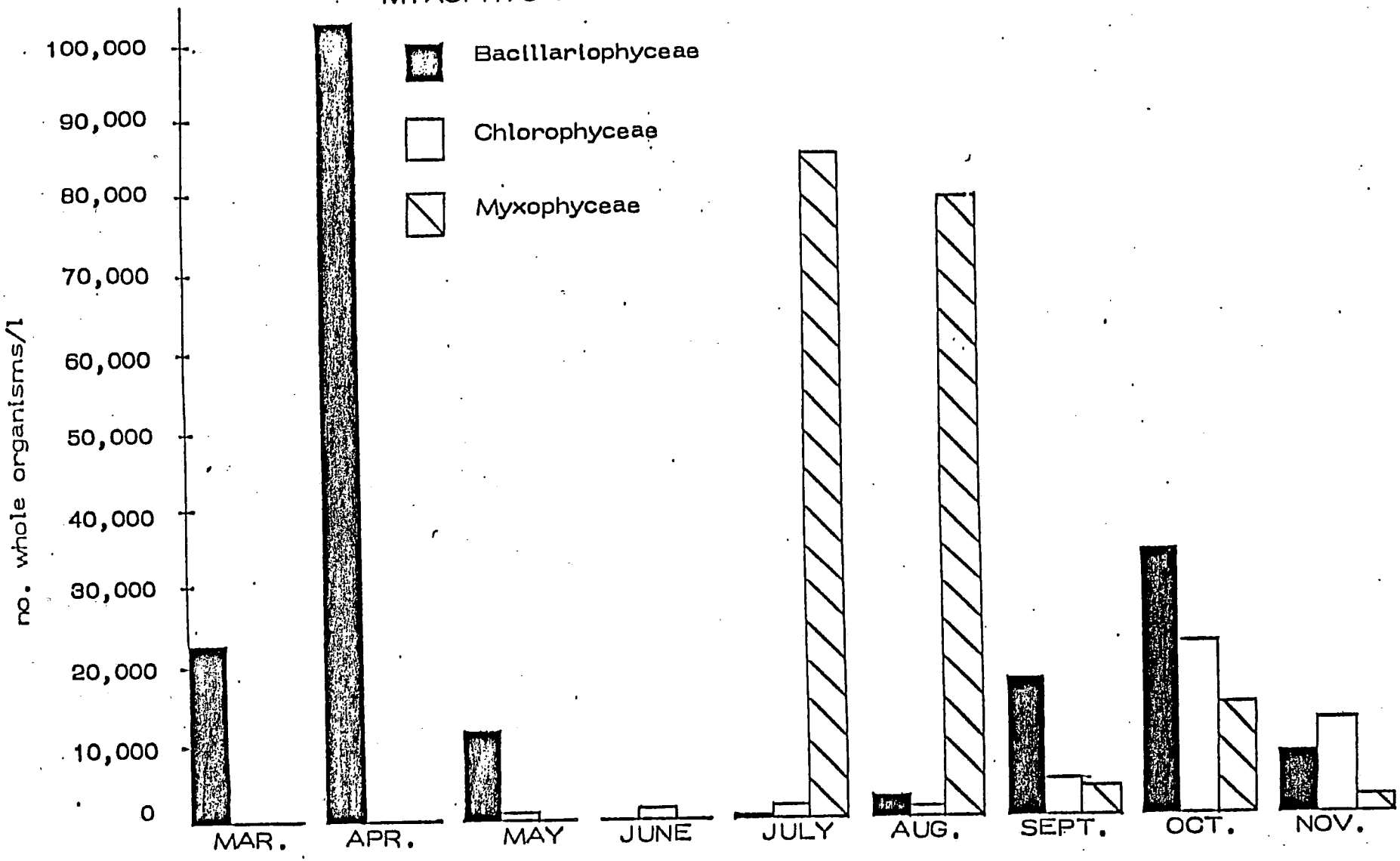


FIGURE 5. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1975.

FIGURE 6. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1976.



The 1976 myxophycean population was between the extremes set forth in 1974 and 1975. A bloom of Aphanizomenon sp. occurred in July and August. This corresponded well in time of occurrence with the 1975 August bloom, but, it was slightly longer in peak duration, it was only one-third the magnitude of the 1975 bloom and it started and ended much more abruptly. Again, these pulses appear to be explainable by variation in transparency and turbidity. Transparency in 1976 was similar to 1975 and much greater than 1974, while turbidity, though more variable than in 1974 or 1975, reached a low in July similar to that observed in 1975 and below that of 1974 (Reutter and Herdendorf, 1977).

The 1977 phytoplankton population exhibited diatom blooms in fall and spring as in preceding years, however, the spring bloom was approximately twice as large as those observed from 1974-1976 (Figure 7). The myxophycean population showed pulses in summer as in 1975 and 1976, but blue-greens also increased in the fall which was only hinted at in previous years. Chlorophycean populations were generally low and were very similar to those observed in 1974 and 1976.

The major differences between 1977 and previous years were in the size of the spring and fall diatom pulses and the summer myxophycean pulse. However, lack of a large summer blue-green bloom was not unusual (1974) and the unusually long and cold winters of 1976-1977 and 1977-1978 undoubtedly had a large influence on diatom densities as they are cold water forms. Furthermore, the increase in the myxophycean densities in the fall of 1977 was due to Oscillatoria sp. which is also a cold water form.

The 1978 phytoplankton population exhibited spring and fall blooms and was very nearly a mirror image of the 1977 population (Figure 2). All three major components of the phytoplankton, diatoms, greens, and blue-greens, exhibited relatively large blooms during 1978 (Figure 8).

Although no unusual taxa were observed during 1979, phytoplankton densities were the largest observed to date and exhibited pulses in the early spring and mid- to late-summer. Diatoms (Asterionella formosa) caused the spring pulse, and their densities were more than 10 times greater than the fall pulse and more than twice as large as any previous diatom (or any group) bloom (Figure 3). The summer bloom was caused by blue-greens, Aphanizomenon flos-aquae, in July, August and September with green algae (Binuclearia tatrana) making significant contributions in September. The myxophycean densities were also the largest recorded to date. When divided into its three major components, Bacillariophyceae, Chlorophyceae, and Myxophyceae, the 1979 population, though much larger, was very similar to the 1976 phytoplankton population (Figures 3 and 6).

The large diatom and green algae densities observed in 1979 should be considered natural phenomena as the pulses were caused by species which have been shown to bloom every year. Furthermore, it is highly unlikely that monthly

FIGURE 7

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1977.

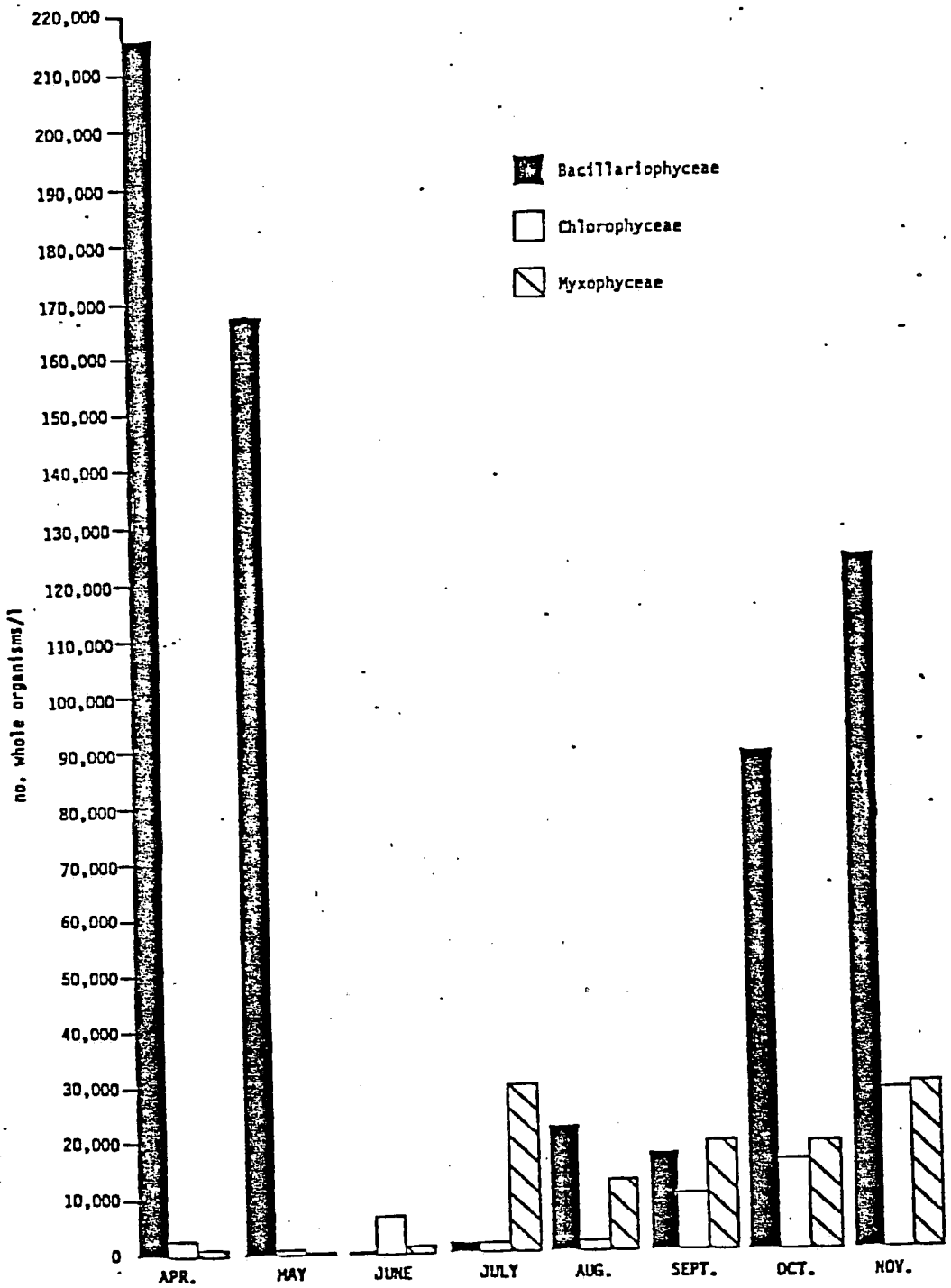
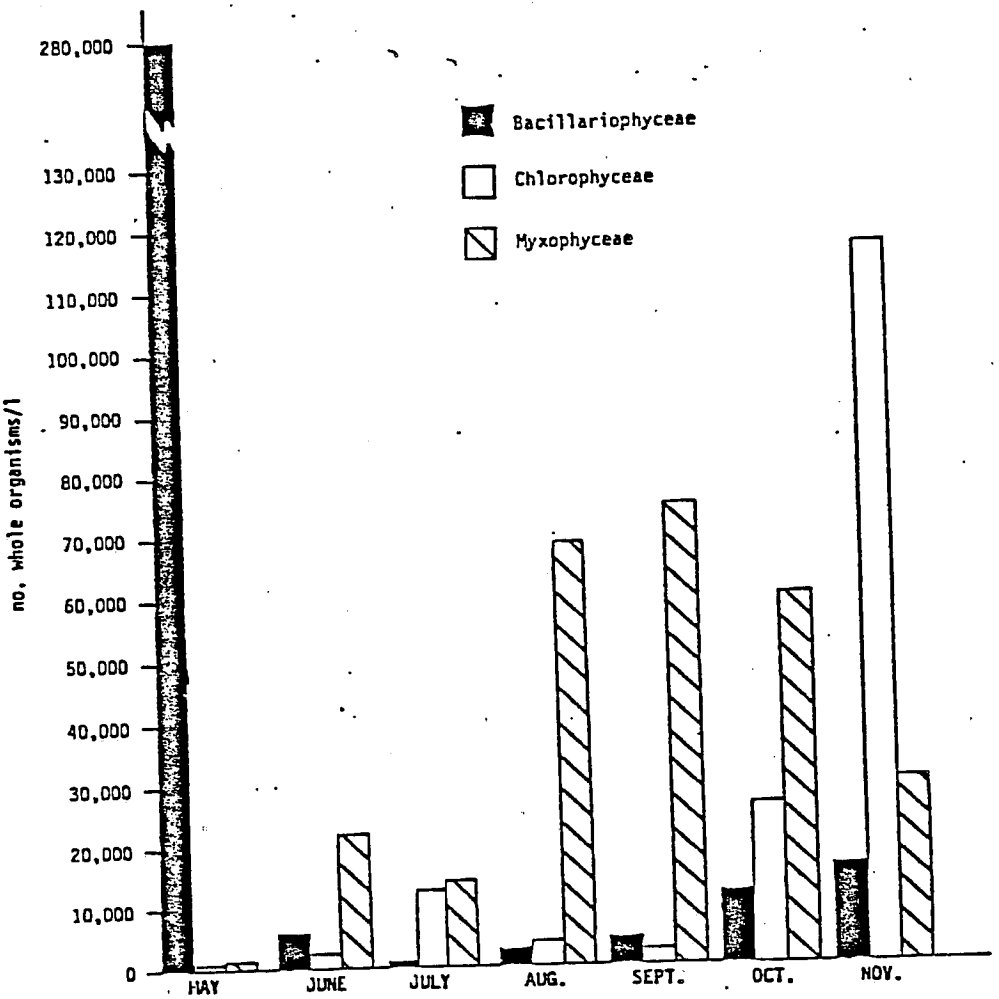


FIGURE 8

MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1978.



sampling would detect the maximum value reached during these short duration pulses caused by phytoplankton species with patchy distributions. Personal observations by the authors indicate that to date during the common summer blue-green blooms, samples have not been collected from the areas of greatest density due to the chance distribution of these populations around the sampling stations. Consequently, it is probable that at some time in the future even greater densities will be recorded.

In summary, phytoplankton populations observed at Locust Point during 1979 are similar to those of previous years and appear typical for those occurring in the nearshore waters of the Western Basin of Lake Erie. No adverse impact due to unit operation was detected.

Zooplankton

Results. Zooplankters collected May through November 1979 were grouped in 47 taxa generally to the species level (Table 3). Eighteen taxa were grouped under Rotifera, 17 under Copepoda, 9 under Cladocera, 1 under Protozoa, 1 under Ostracoda and 1 under Tardigrada. Monthly mean densities ranged from 22/l in November to 1,252/l in July. The mean density from all samples collected in 1979 was 475/l. Zooplankton densities at individual sampling stations ranged from 10/l at Station 13 in November to 1,597/l at Station 18 in July (Table 4).

Monthly mean rotifer densities ranged from 11/l in November to 346/l in September (Table 3). The annual mean rotifer density for all samples collected in 1979 was 131/l or 27.6 percent of the entire zooplankton density. The dominant rotifer taxa during 1979 were Synchaeta spp. on May 1 and in October and November; Keratella quadrata on May 23; Polyarthra vulgaris in June, August and September; and Keratella cochlearis in July. Polyarthra vulgaris had the largest annual mean density, 41/l. Rotifera was the dominant zooplankton group on May 1 and in collections from September and November representing 81.3, 60.3 and 49.1 percent, respectively, of the total zooplankton density. In contrast to this, rotifers represented only 8.1 percent of the July zooplankton density.

Monthly mean copepod densities ranged from 10/l in November to 262/l in June (Table 3). The mean copepod density from all samples collected in 1979 was 115/l or 24 percent of the entire zooplankton population. Cyclopoid nauplii was the dominant copepod taxon during every collection. Copepoda was the dominant zooplankton group in the May 23 collection and the June collection representing 36.4 and 54.3 percent, respectively, of the total zooplankton density.

Monthly mean cladoceran densities ranged from 1/l in November to 162/l in May (Table 3). The mean cladoceran density from all samples collected in 1979 was 59/l or 12 percent of the total zooplankton population. Cladoceran populations were dominated by Chydorus sphaericus on May 1; Daphnia retrocurva on May 23 and collection dates in June and July; and Eubosmina coregoni in August, September, October and November. Daphnia retrocurva had the largest annual mean density, 28/l or 6 percent of the entire zooplankton density. Cladocera was never the dominant zooplankton group.

Monthly mean protozoan densities ranged from 0/l in May and November to 901/l in July (Table 3). The annual mean density of 170/l was 36 percent of the total zooplankton population. Difflugia sp. was the only protozoan taxon.

TABLE 3

MONTHLY MEAN DENSITIES* OF INDIVIDUAL ZOOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
ROTIFERA									
Asplanchna priodonta	0.1	2.2	0.2	0.1	5.4	0.0	0.0	0.0	1.0
Brachionus angularis	6.5	0.8	10.5	15.2	4.0	5.1	0.3	0.0	5.3
B. calyciflorus	27.8	0.7	0.3	0.0	0.0	0.0	0.0	0.0	3.6
B. caudatus	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	<0.1
B. diversicornus	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	<0.1
B. havanaensis	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	<0.1
Cephalodella spp.	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	<0.1
Filinia terminalis	2.0	0.4	0.8	0.1	0.0	0.0	0.0	0.0	0.4
Kellicottia longispina	0.0	14.4	4.6	0.0	<0.1	0.0	<0.1	0.4	2.4
Keratella cochlearis	16.5	30.2	9.9	38.6	1.4	102.8	13.8	1.5	26.8
K. quadrata	16.0	112.5	9.7	<0.1	<0.1	0.0	0.3	0.0	17.3
Lecane spp.	0.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Notholca spp.	16.8	4.2	0.0	0.0	0.0	0.0	0.1	0.1	2.6
Polyarthra vulgaris	37.2	3.3	15.0	13.6	20.4	208.7	25.9	0.8	40.6
Synchaeta spp.	76.1	1.0	14.5	8.3	0.4	7.4	68.1	7.9	23.0
Trichocerca multicrinis	0.0	0.6	4.5	25.5	9.1	22.1	0.0	0.0	7.7
T. similis	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	<0.1
Unidentified Rotifer	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Subtotal	199.5	170.3	70.2	101.8	40.8	346.2	108.5	10.6	131.0

TABLE 3 (Cont'd)

MONTHLY MEAN DENSITIES* OF INDIVIDUAL ZOOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
COPEPODA									
Calanoid Copepods									
Diaptomus ashlandii	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
D. minutis	<0.1	0.8	0.1	1.4	1.2	0.0	0.0	0.1	0.4
D. oregonensis	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	0.2
D. sicilis	0.0	1.5	0.0	0.1	<0.1	0.0	0.0	0.0	0.2
D. siciloides	0.1	0.2	6.9	6.8	5.4	2.0	0.0	0.7	2.8
Eurytemora affinis	0.0	0.1	<0.1	0.0	0.0	0.0	0.0	0.0	<0.1
Copepodids, calanoid	3.4	25.5	3.8	3.0	8.5	8.9	0.7	0.0	6.7
Nauplii, calanoid	2.0	11.8	4.5	4.8	1.2	21.0	0.4	0.0	5.7
Cyclopoid Copepods									
Cyclops bicuspidatus thomasi	0.2	8.4	1.1	0.0	0.1	0.0	0.2	0.1	1.3
C. vernalis	0.0	2.8	51.2	0.9	4.2	2.5	0.4	0.0	7.8
Mesocyclops edax	0.0	0.0	0.0	1.4	0.2	0.0	0.0	0.0	0.2
Tropocyclops prans nex	0.0	0.1	0.0	0.1	1.3	0.0	0.0	0.0	0.2
Copepodids, cyclopoid	3.7	20.9	19.1	3.6	16.3	13.8	7.3	1.6	10.8
Nauplii, cyclopoid	33.1	119.2	175.5	153.6	47.9	54.0	30.4	7.2	77.6
Harpacticoid Copepods									
Canthocamptus robertcokeri	0.4	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Copepodids, harpacticoid	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Nauplii, harpacticoid	0.5	2.6	0.0	0.0	0.0	0.0	0.2	0.0	0.4
Subtotal	43.7	195.0	262.3	176.3	87.4	102.0	39.7	9.6	114.5

TABLE 3 (Cont'd)

MONTHLY MEAN DENSITIES* OF INDIVIDUAL ZOOPLANKTON

TAXA AT LOCUST POINT - 1979

TAXA \ DATE	May 1	May 23	June 21	July 28	Aug. 29	Sept. 27	Oct. 30	Nov. 28	MEAN
CLADOCERA									
Alona spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	<0.1
Bosmina longirostris	0.2	2.2	0.6	0.0	0.0	0.0	1.4	0.4	0.6
Ceriodaphnia lacustris	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	<0.1
Chydorus sphaericus	0.7	13.5	5.1	4.4	34.6	18.6	8.0	<0.1	10.6
Daphnia galeata mendotae	0.0	0.1	0.0	26.3	0.0	0.0	0.0	0.0	3.3
D. retrocurva	0.6	121.5	48.7	33.1	15.8	6.5	<0.1	0.0	28.3
Diaphanosoma leuchtenbergianum	<0.1	0.1	0.0	0.1	0.8	0.4	0.0	0.0	0.2
Eubosmina coregoni	0.5	24.6	9.3	8.3	41.0	23.5	19.6	0.8	15.9
Leptodora kindtii	0.0	0.3	<0.1	0.7	0.0	0.0	0.0	0.0	0.1
Subtotal	2.0	162.3	63.8	72.9	92.2	49.0	29.3	1.2	59.1
PROTOZOA									
Difflugia spp.	0.0	8.6	86.9	901.3	114.0	76.8	175.4	0.0	170.4
OSTRACODA	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
TARDIGRADA	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
TOTAL	245.3	536.1	483.1	1252.2	334.4	574.1	352.9	21.5	475.0

* Data presented as number of organisms/liter and computer from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12cm diameter, 0.080mm mesh) from 7 stations in Lake Erie at Locust Point in the vicinity of the Davis-Besse Nuclear Power Station.

TABLE 4

MONTHLY MEAN ZOOPLANKTON DENSITIES* FROM

SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1979

STATION \ DATE	May 1	May 23	June 21	July 28	August 29	Sept. 27	Oct. 30	Nov. 28	GRAND MEAN
1	238.2	645.3	537.9	1,374.9	340.4	936.5	265.9	20.3	544.9
3	206.9	568.1	488.7	802.0	257.0	362.2	385.2	22.9	386.6
6	200.8	405.3	421.0	1,117.3	158.2	575.1	452.8	16.0	418.3
8	217.9	657.0	336.7	1,285.4	290.9	312.8	334.9	22.1	432.2
13	287.4	354.3	563.2	1,433.0	402.6	753.6	440.3	10.3	530.6
14	255.2	617.6	478.9	1,156.3	312.7	198.7	302.6	18.3	417.5
18	310.9	505.5	555.6	1,596.5	578.8	879.8	288.8	40.3	594.5
GRAND MEAN	245.3	536.1	483.1	1,252.2	334.4	574.1	352.9	21.5	475.0

* Data presented as number of organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12cm diameter, 0.080mm mesh) at each station.

Protozoa was the dominant zooplankton group in July, August and October representing 72.0, 34.1, and 49.7 percent, respectively, of the entire zooplankton density.

Two other groups, Ostracoda and Tardigrada, appeared in collections during 1979. An ostracod was found on May 23, while a tardigrad was found on May 1.

All raw data were keypunched and are stored in Columbus, Ohio at the office of the Center for Lake Erie Area Research on the campus of The Ohio State University.

Analysis. Zooplankton populations at Locust Point have been monitored since 1972. Densities observed in 1979 were very similar to the densities observed during 1978, except that the large July pulse observed in 1979 was more representative of densities observed in 1974, 1975, and 1977 (Figure 9). Monthly zooplankton densities were within the ranges established during previous years with the exception of June, July and November. The June total of 483/l, although it was the lowest recorded to date, was very close to the 1978 density, 518/l. The July total of 1,252/l was the largest recorded to date. However, it should be noted that this July pulse would have fallen within the range of previous years were it not for a sudden pulse of the dinoflagellate Difflugia spp., 901/l. The November density, 22/l, although it was the lowest recorded to date, was similar to densities in 1977, 55/l.

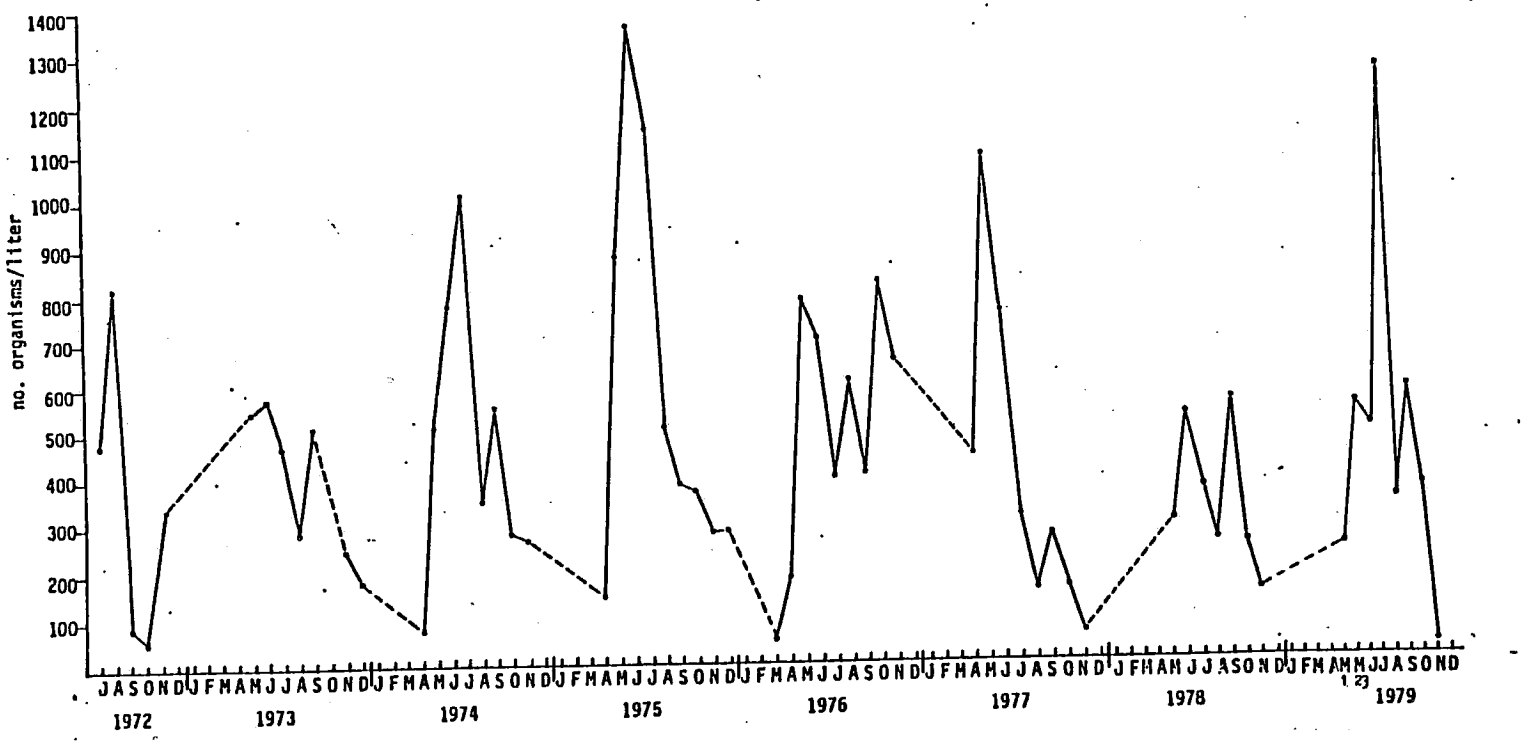
Of the three major components of the zooplankton population, rotifer densities are by far the most erratic and unpredictable (Figure 9). On Figure 10 1976 results illustrate this vividly. However, with the exception of November when all zooplankton densities were the lowest recorded to date, rotifer densities observed during 1979 were within the range established during the previous years of study at Locust Point.

Copepod populations are much more regular and predictable than rotifer populations (Figure 11). They generally exhibit one peak per year and this usually occurs in the May/June period. This also occurred in 1979. With respect to population size, 1979 copepod densities were relatively low compared to 1973, 1974, 1975 and 1977. However, 1979 densities were larger than 1978 and very similar to 1976.

As with the copepod densities, cladoceran densities are quite regular and predictable from year to year. They often exhibit two peaks, one in the spring and one in the fall (Figure 12). This was the case in 1979. Cladoceran densities during 1979 were lower than those observed during 1974, 1975, 1976, and 1978. However, they were similar to 1977 densities and greater than 1973 densities. The months of May and August produced new highs, while June and November produced new lows.

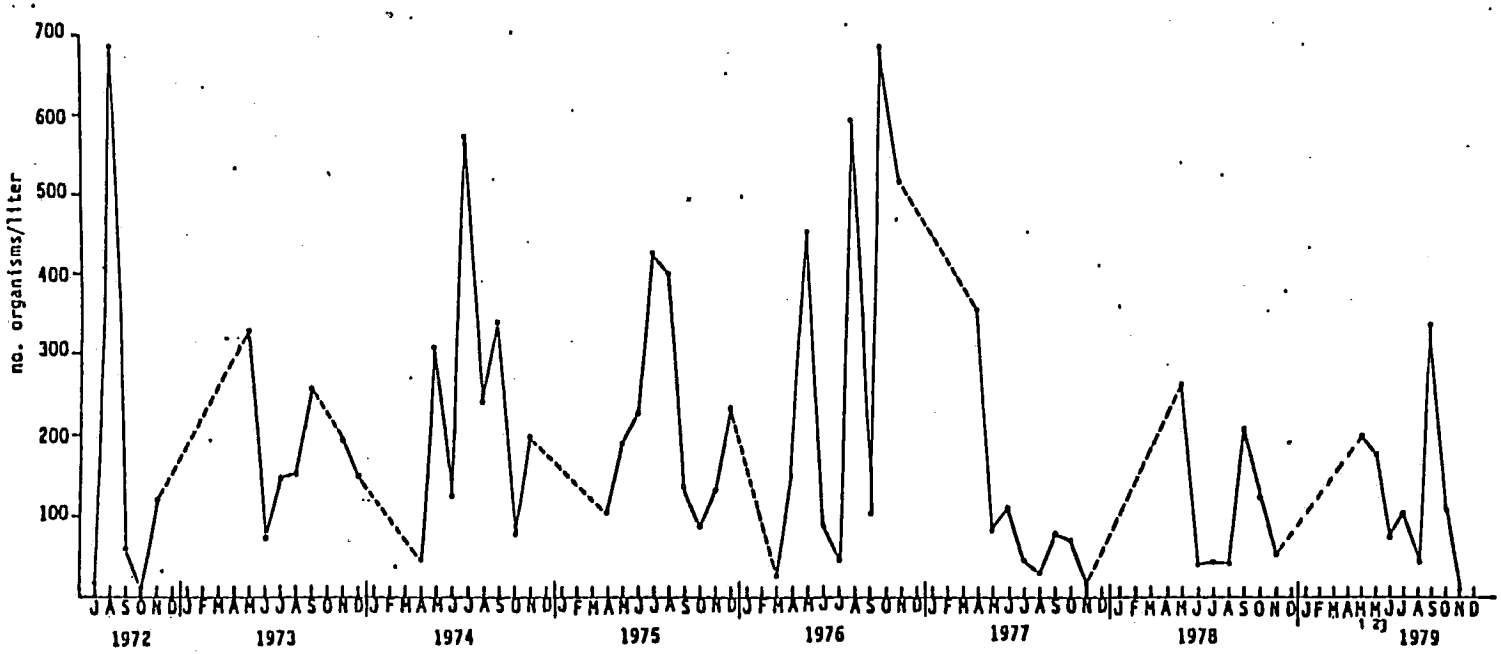
There are several plausible explanations for the variation which has occurred. Samples in 1972 were collected with a 3-l Kemmerer water bottle at the surface, with a Wisconsin plankton net. A brief comparison study in 1973 showed that the vertical tow captured approximately 50 percent more taxa than a 3-l grab (Reutter and Herdendorf, 1974). The actual stations sampled have varied from year to year. In 1973 the intake and discharge pipelines were being dredged, and in 1972, tropical storm Agnes affected the weather. Due to the

FIGURE 9. MONTHLY MEAN ZOOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

FIGURE 10. MONTHLY MEAN ROTIFER POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1979.*



*Dotted lines connect points (sampling dates) separated by more than a full calendar month. Solid lines connect points (dates) in consecutive months.

weather, samples were neither collected on the same day of the month each year nor spaced exactly one month apart. Hubschman (1960) pointed out the tremendous differences which occurred between daily samples, and these samples were taken monthly. Wieber and Holland (1968) showed that even with replication, wide variation can occur due to patchiness in population densities. The high spring populations from 1975 were undoubtedly largely due to early warming and lower turbidity as the total zooplankton population was significantly correlated with both temperature and turbidity ($r = 0.587$ and -0.328, respectively) (Reutter, 1976). Finally, operation of station circulating pumps was common in 1976, 1977, 1978, and 1979.

It should be noted that the occurrence of a new monthly maximum or minimum is not a particularly noteworthy or unusual event, and should not be interpreted as being due to unit operation. By chance alone, every year would have an equal probability of producing several new monthly minima or maxima even if the power station were not present.

In summary, due to the large variability observed in previous years, zooplankton populations observed in 1979 should be considered typical for the south shore of the Western Basin of Lake Erie. No adverse impact due to unit operation was detected.

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