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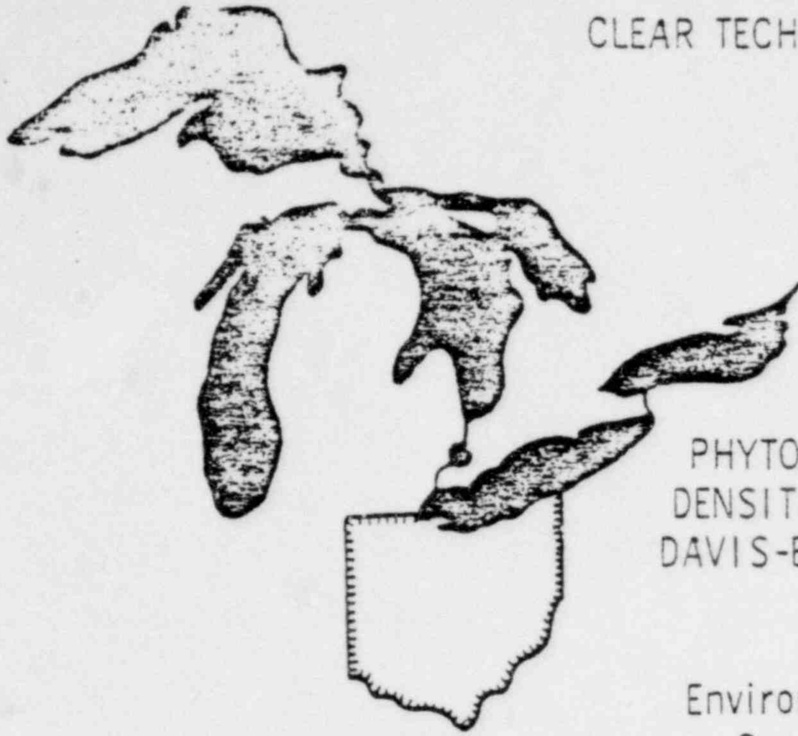

PHYTOPLANKTON AND ZOOPLANKTON DENSITIES FROM LAKE ERIE NEAR THE DAVIS-BESSE NUCLEAR POWER STATION DURING 1978

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

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

Procedures

Plankton samples were collected approximately once every 30 days from May through November from 7 sampling stations in the vicinity of Locust Point (Figure 1). Samples could not be collected during April due to an unusually long winter and the presence of ice. 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 Three 1-ml aliquots were withdrawn from each 50-ml sample and placed in counting cells.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 number 100 or more in 10 Whipple fields, they were not counted in the remaining 15 fields. Identification was carried as far as possible, usually to 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 1978 were divided into 54 taxa, generally to the genus level (Table 1). Fifteen taxa were grouped in Bacillariophyceae, 23 in Chlorophyceae, 1 in Chrysophyceae, 2 in Dinophyceae, 1 in Euglenophyceae, 10 in Myxophyceae, and 2 in Protozoa.

Monthly mean phytoplankton populations ranged from 29,607/l in July to 281,852/l in May (Table 1). The mean density from all samples collected in 1978 was 109,768/l. Phytoplankton densities at individual sampling stations ranged from 3,389/l at Station 8 in June to 504,678/l at Station 1 in May (Table 2). Population pulses were observed in the spring and the fall (Figure 2). The spring pulse was caused by diatoms while the fall pulse was caused by green algae (Figure 3).

Monthly mean bacillariophycean densities ranged from 915/l in July to 280,066/l in May (Table 1). The annual mean bacillariophycean density from all samples collected during 1978 was 46,267/l or 42 percent of the entire phytoplankton density. The dominant diatom taxa were *Melosira* sp. in May, June, and July; *Asterionella formosa* in August; and *Fragilaria crotonensis* in September, October, and November. *Melosira* sp. had the largest annual mean population, 18,972/l. Diatoms were the dominant phytoplankton group in May when they constituted 99 percent of the entire phytoplankton population.

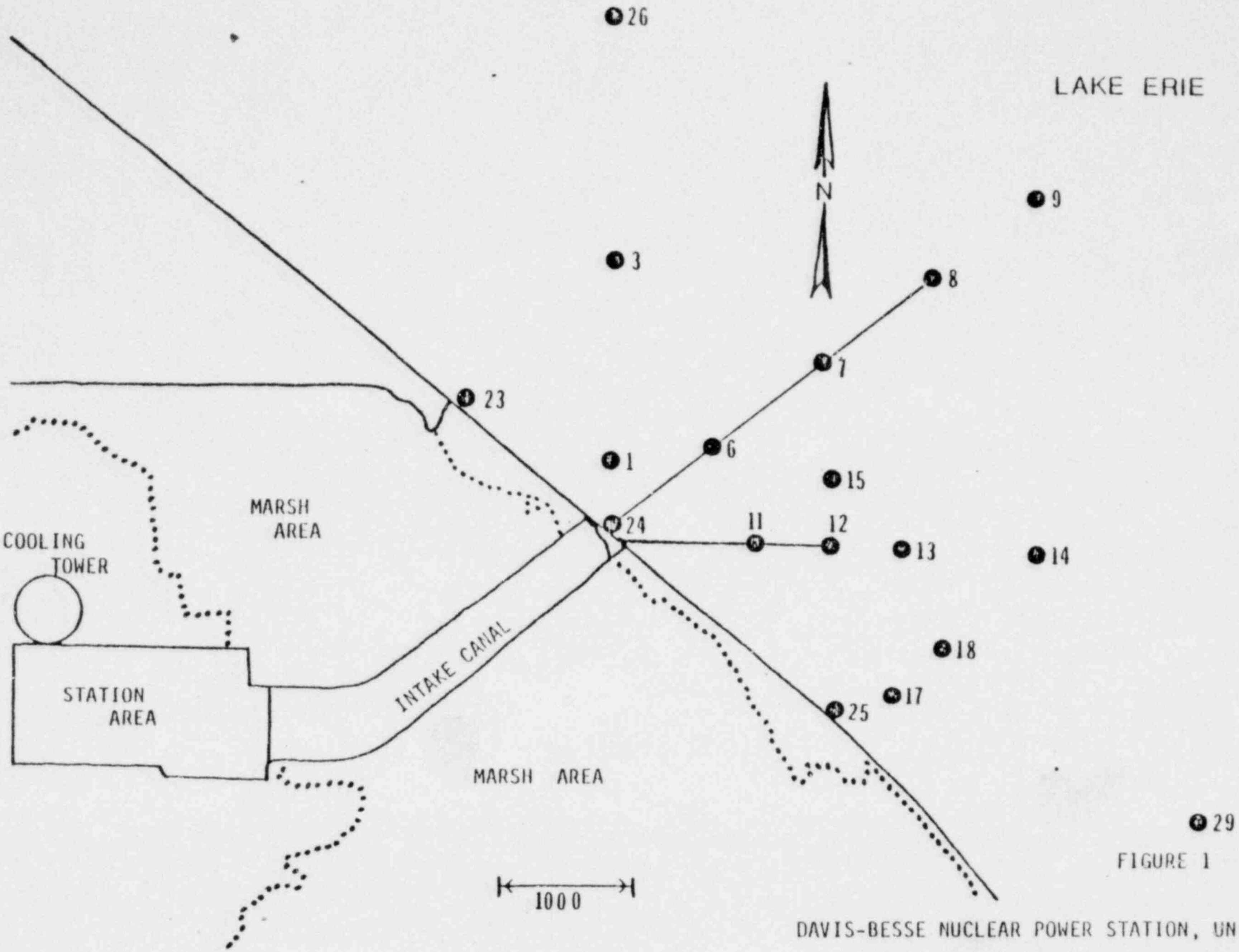


FIGURE 1

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

AQUATIC SAMPLING STATIONS

TABLE 1

MONTHLY MEAN POPULATIONS* OF

INDIVIDUAL PHYTOPLANKTON TAXA AT LOCUST POINT - 1978

TAXA	May 11	June 29	July 25	Aug. 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
BACILLARIOPHYCEAE (Diatoms)								
Asterionella formosa	23896	68	15	1111	354	1159	4841	4492
Diatoma sp.	0	0	0	3	5	0	0	1
Fragilaria crotonensis	10483	676	71	880	3331	8900	9310	4807
Gyrosigma sp.	0	0	0	1	0	0	0	0.2
Melosira sp.	121411	4734	828	927	1040	1882	1977	18972
Navicula sp.	223	34	0	0	0	0	0	37
Nitzschia sigmoidea	0	0	0	3	0	0	0	0.4
Nitzschia sp.	167	0	0	0	0	0	0	24
Sceletonema subsalsa	117382	0	0	0	0	0	0	16769
Stephanodiscus binderanus	3147	0	0	64	65	24	0	471
Stephanodiscus sp.	0	0	0	0	0	0	9	1
Surirella sp.	22	0	0	5	8	0	0	5
Synedra actinastroides	0	0	0	2	0	0	0	0.2
Synedra sp.	673	0	0	40	16	34	18	[illegible]
Tabellaria sp	2662	26	0	336	177	506	315	[illegible]
Subtotal	280066	5539	915	3372	4997	12505	16471	46267
CHLOROPHYCEAE (Green Algae)								
Actinastrum hantzchii	0	0	0	0	2	2	0	1
Actinastrum sp.	0	0	0	0	0	0	7	1
Ankistrodesmus falcatus	0	0	0	1	2	0	2	1
Binuclearia tatrana	0	0	9958	749	1168	23603	114539	21431
Botryococcus sudeticus	0	0	632	2585	413	64	78	539
Closteriopsis longissima	0	0	0	20	47	30	208	44
Closterium acerosum	0	0	0	0	14	0	0	2
Closterium sp.	0	0	0	1	0	0	0	0.2

TABLE 1 (Con't.)

MONTHLY MEAN POPULATIONS* OF

INDIVIDUAL PHYTOPLANKTON TAXA AT LOCUST POINT - 1978

TAXA	May 11	June 29	July 25	Aug. 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
CHLOROPHYCEAE (Green Algae)								
Coelastrum sp.	0	0	138	0	3	0	0	20
Cosmarium sp.	0	0	0	6	8	0	0	2
Dictyosphaerium sp.	0	0	982	1	0	0	0	141
Kirchneriella sp.	0	0	8	0	0	0	0	1
Oocystis sp.	0	7	0	6	4	0	7	4
Pediastrum duplex	102	579	441	312	202	2023	1466	733
Pediastrum simplex	225	36	607	441	916	1434	1166	689
Scenedesmus sp.	105	40	11	4	6	4	28	24
Selenastrum sp.	28	0	0	0	0	0	0	4
Spirogyra crassa	0	0	0	0	7	0	0	1
Spirogyra sp.	0	0	2	0	0	0	0	0.2
Staurastrum paradoxum	20	0	198	62	51	3	89	60
Tetraspora sp.	0	0	32	0	0	0	0	5
Trentepohlia sp.	0	0	18	0	0	0	0	3
Unidentified	0	2117	0	0	0	0	0	302
Subtotal	482	2778	13026	·4192	2845	27160	117566	24008
CHRYSOPHYSEAE (Brown Algae)								
Dinobryon sp.	0	0	0	0	0	0	4	1
DINOPHYCEAE (Dinoflagellates)								
Ceratium hirundinella	7	100	1164	54	11	0	0	191
Peridinium sp.	0	0	2	0	2	0	0	1
Subtotal	7	100	1166	54	13	0	0	192
EUGLENOPHYCEAE (Euglenas)								
Euglena sp.	0	0	0	0	4	0	0	1

TABLE 1 (Con't.)

MONTHLY MEAN POPULATIONS* OF

INDIVIDUAL PHYTOPLANKTON TAXA AT LOCUST POINT - 1978

TAXA	May 11	June 29	July 25	Aug. 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
MYXOPHYCEAE (Blue-green Algae)								
Anabaena spiroides	0	0	0	18	559	198	523	186
Anabaena sp.	0	239	53	15	371	802	446	275
Aphanizomenon flos-aquae	0	18071	13912	68825	74047	52362	15132	34621
Chroococcus sp.	0	0	94	0	0	0	0	13
Coelsphaerium sp.	0	3	0	0	0	0	0	0.4
Merismopedia sp.	0	0	24	0	0	0	0	3
Microcystis sp.	3	510	148	98	98	67	7	133
Oscillatoria sp.	1289	3590	208	85	502	6686	15530	3984
Raphidiopsis sp.	0	372	0	2	0	0	0	53
Unidentified	0	0	0	0	0	53	14	10
Subtotal	1292	22784	14481	69043	75577	60169	3165[illegible]	39278
PROTOZOA								
Domatomonas sp.	5	7	14	26	38	12	6	15
Unidentified flagellate	0	0	0	0	9	0	0	1
Subtotal	5	7	14	26	47	12	6	16
TOTAL	281852	31207	29607	76687	83484	99846	165699	109768

* Expressed as no. of whole organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12 cm diameter, 0.080 mm mesh) from 7 sampling stations on dates indicated.

TABLE 2

MONTHLY MEAN PHYTOPLANKTON POPULATIONS* FROM

SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1978

Station	May 11	June 29	July 25	August 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
1	504678	52904	24934	30122	69070	65157	260749	143945
3	267168	15420	28707	48336	67592	226943	244023	128313
6	298575	33599	47841	36724	86274	88069	172088	109024
8	191915	3389	15871	116805	86739	71015	199435	97881
13	214234	42701	23913	119697	93823	77695	75855	92559
14	251516	33442	28692	95567	83979	64988	118177	96623
18	244880	36995	37254	89559	123929	105053	89567	103891
Grand Mean	281852	31207	29602	76687	83484	99846	165699	109768

* Data presented as no. of whole organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12 cm diameter, 0.030 mm mesh) at each station.

FIGURE 2. MONTHLY M[illegible] I PHYTOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1974-1978

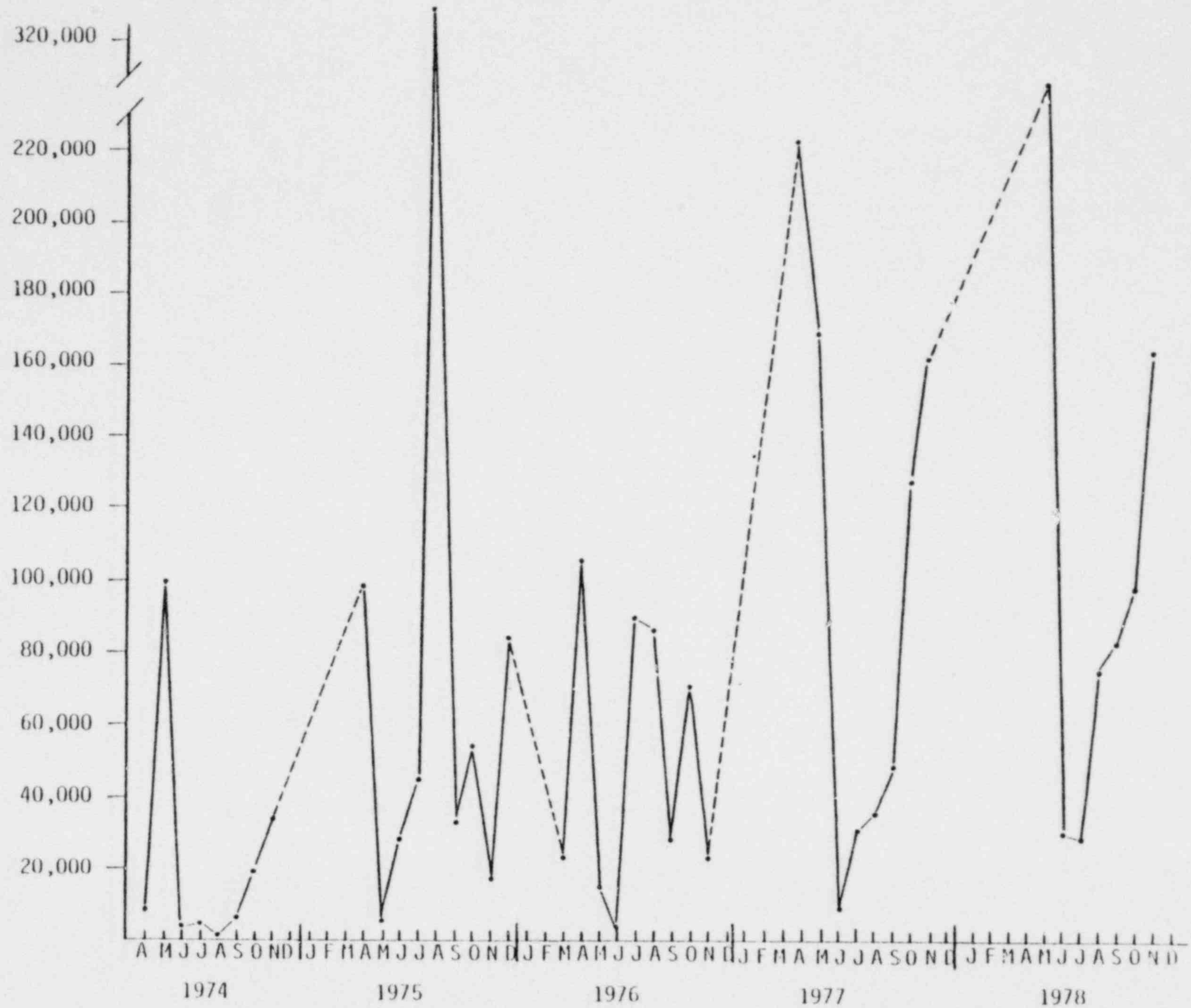
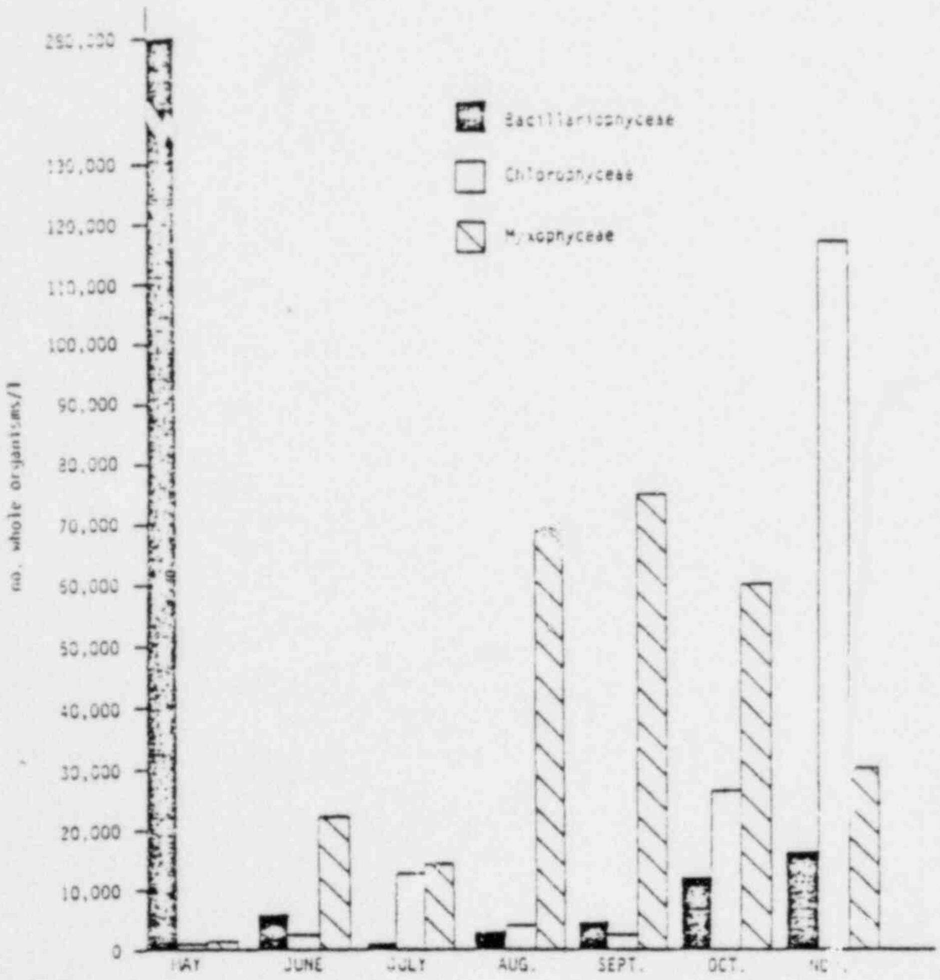


FIGURE 3

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



Monthly mean chlorophycean densities ranged from 482/l in May to 117,566/l in November with an annual mean population from all samples collected during 1978 of 24,008/l or 22 percent of the total phytoplankton population (Table 1). The dominant green algae taxa were Pediastrum simplex in May; an unidentified specimen in June; Binuclearia tatrana in July, September, October, and November; and Botryococcus sudeticus in August. Binuclearia tatrana had the largest annual mean population, 21,431/l. Chlorophyceae was the dominant phytoplankton class in November, representing 71 percent of the entire phytoplankton population.

Chrysophyceae was a rare class represented only by Dinobryon sp. It was present in samples from November, 4/l (Table 1).

Dinophyceans were represented by 2 taxa, Ceratium hirundinella and Peridinium sp. (Table 1). Neither occurred in samples from October or November. Ceratium hirundinella was the dominant of the two during the remaining months.

Euglenophyceae was represented only by Euglena sp. It occurred in September, 4/l (Table 1).

Monthly mean myxophycean densities ranged from 1,292/l in May to 75,577/l in September with an annual mean density from all samples collected in 1978 of 39,278/l, 36 percent of the total phytoplankton mean (Table 1). The dominant myxophycean taxa were Oscillatoria sp. in May and November and Aphanizomenon flos-aquae from June through October. Aphanizomenon exhibited the largest annual mean density, 36,621/l. Myxophyceae was the dominant algal class from June through October, representing 73 percent, 49 percent, 90 percent, 91 percent, and 60 percent, respectively, of the total phytoplankton population.

Protozoa, grouped here with the phytoplankton, was represented by 2 taxa, Domatomonas sp. and an unidentified flagellate. Domatomonas occurred in every collection and was always the dominant of the two.

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).

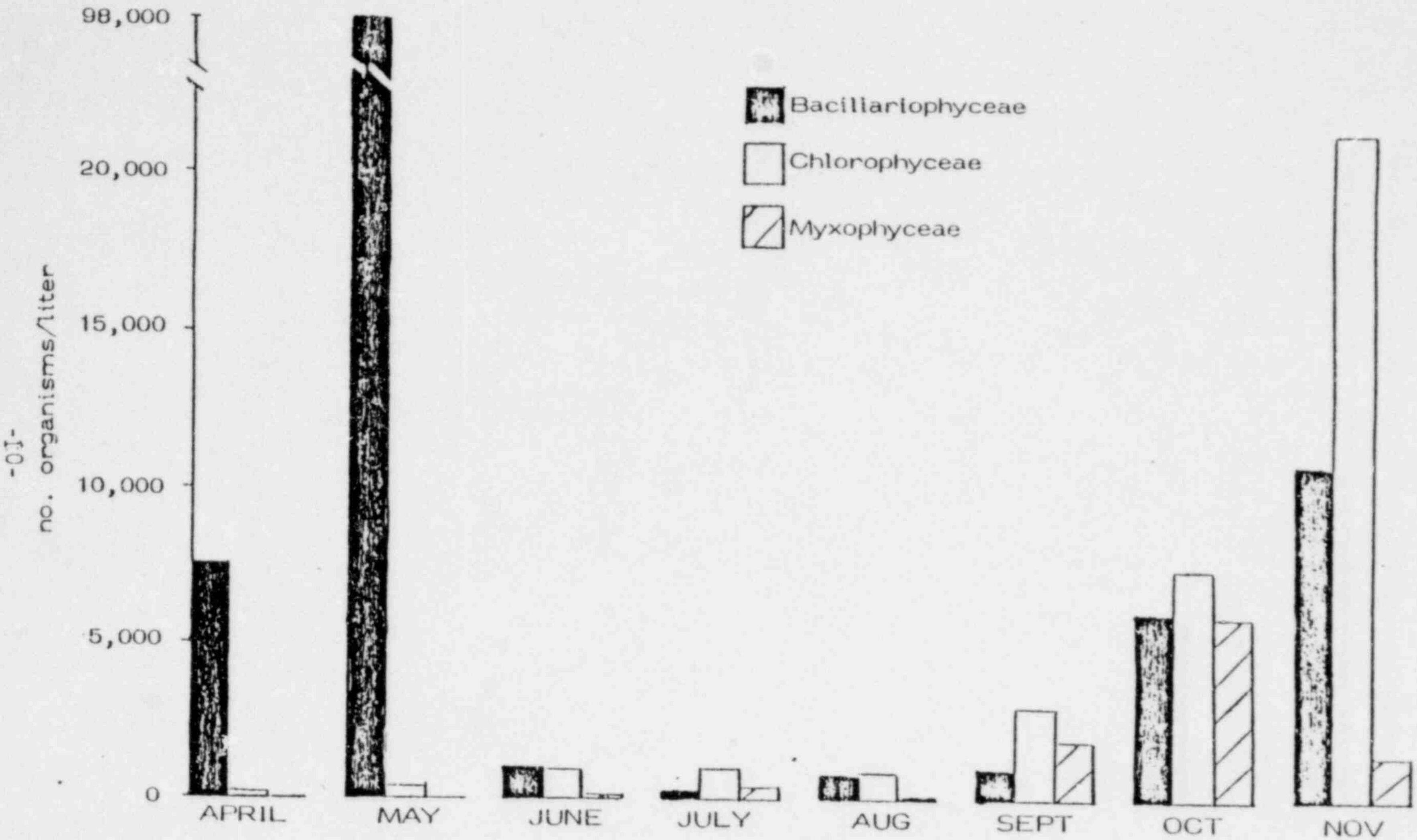


FIGURE 4. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1974.

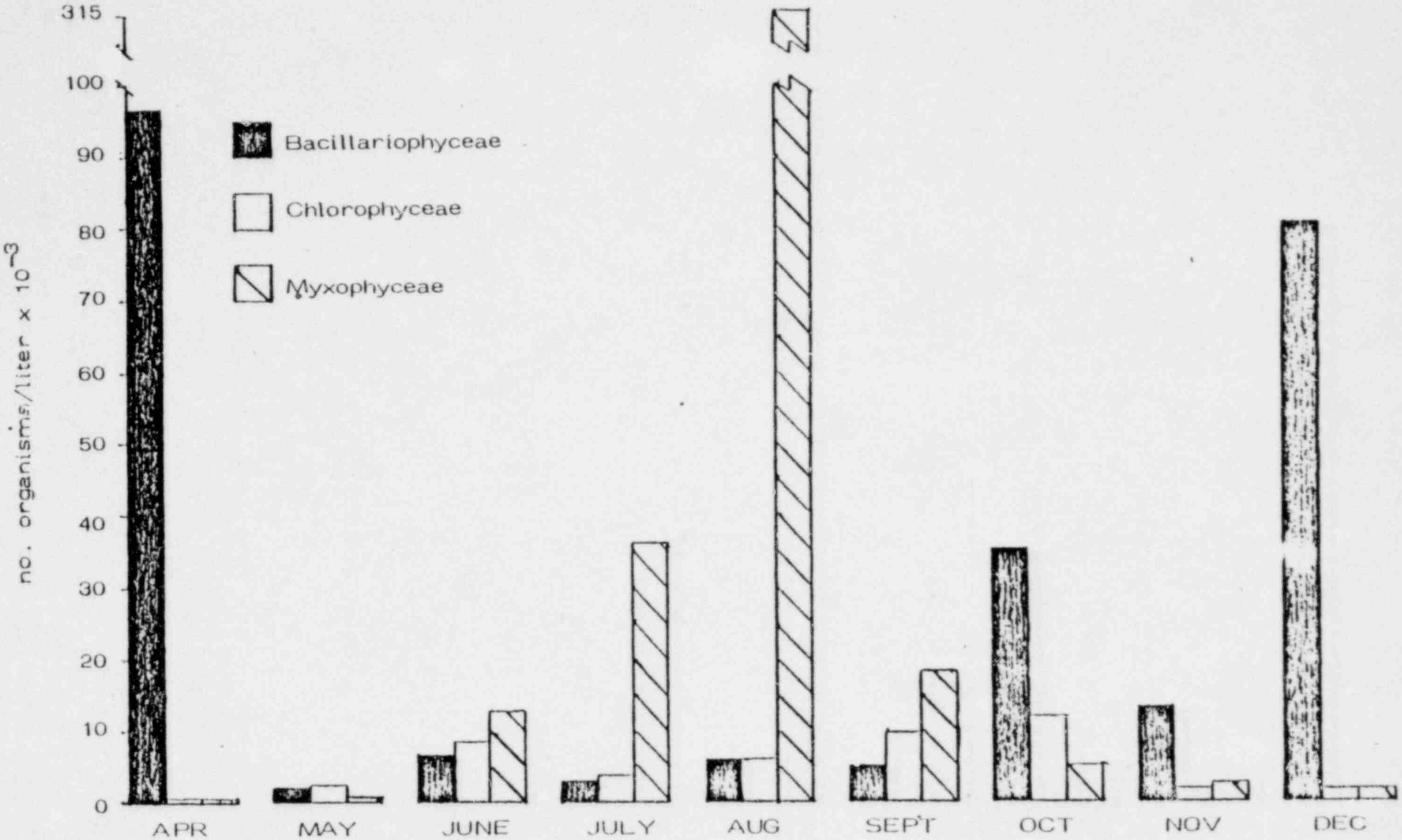


FIGURE 5. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1975.

Bacillariophyceae and Chlorophyceae 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, and 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.

The 1976 Myxophycean population was between the extremes set forth in 1974 and 1975. A bloom of Aphanizomenon sp. occurred in July and August which corresponded well in time of occurrence with the 1975 August bloom, but, though it was slightly longer in peak duration, it was only one third the magnitude of the 1975 bloom and 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). However, the composition of this population was quite different from the 1977 population. All three major components of the phytoplankton, diatoms, greens, and blue-greens, exhibited relatively large blooms during 1978.

The spring diatom bloom was the largest recorded to date, and its composition would indicate that it was probably much larger. The rationale for this statement is that approximately half the bloom was composed of Sceletonema subsalsa which is generally too small to be collected with an 80μ plankton net. Therefore, although large numbers appeared in the sample, even greater numbers were probably present but passed through the net. Consequently, this should not be viewed as a new species in the area, but rather a species which normally is not sampled by these methods. Its presence at this time is probably due to clogging of the plankton bucket with the large Melosira sp. population and suspended sediments.

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

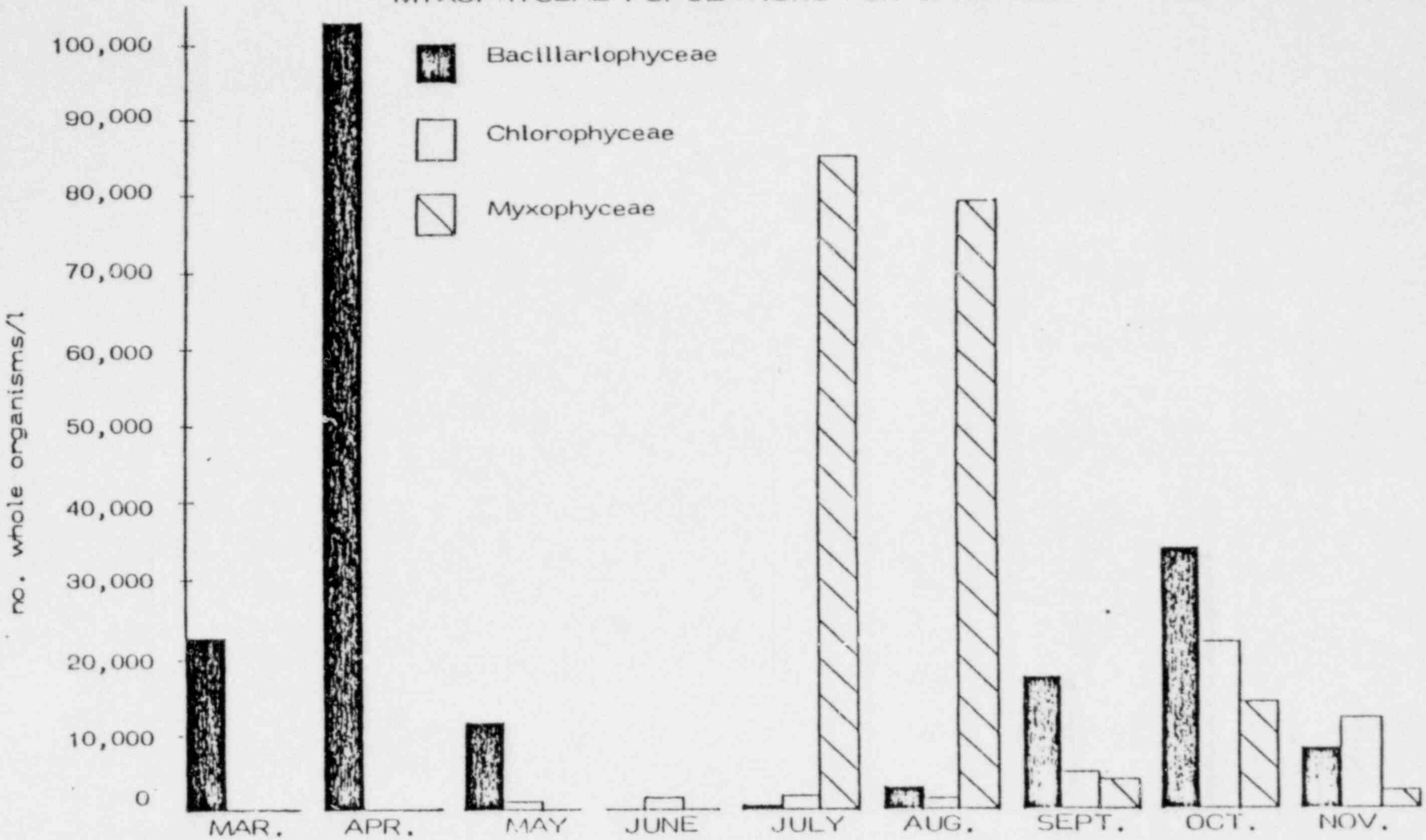
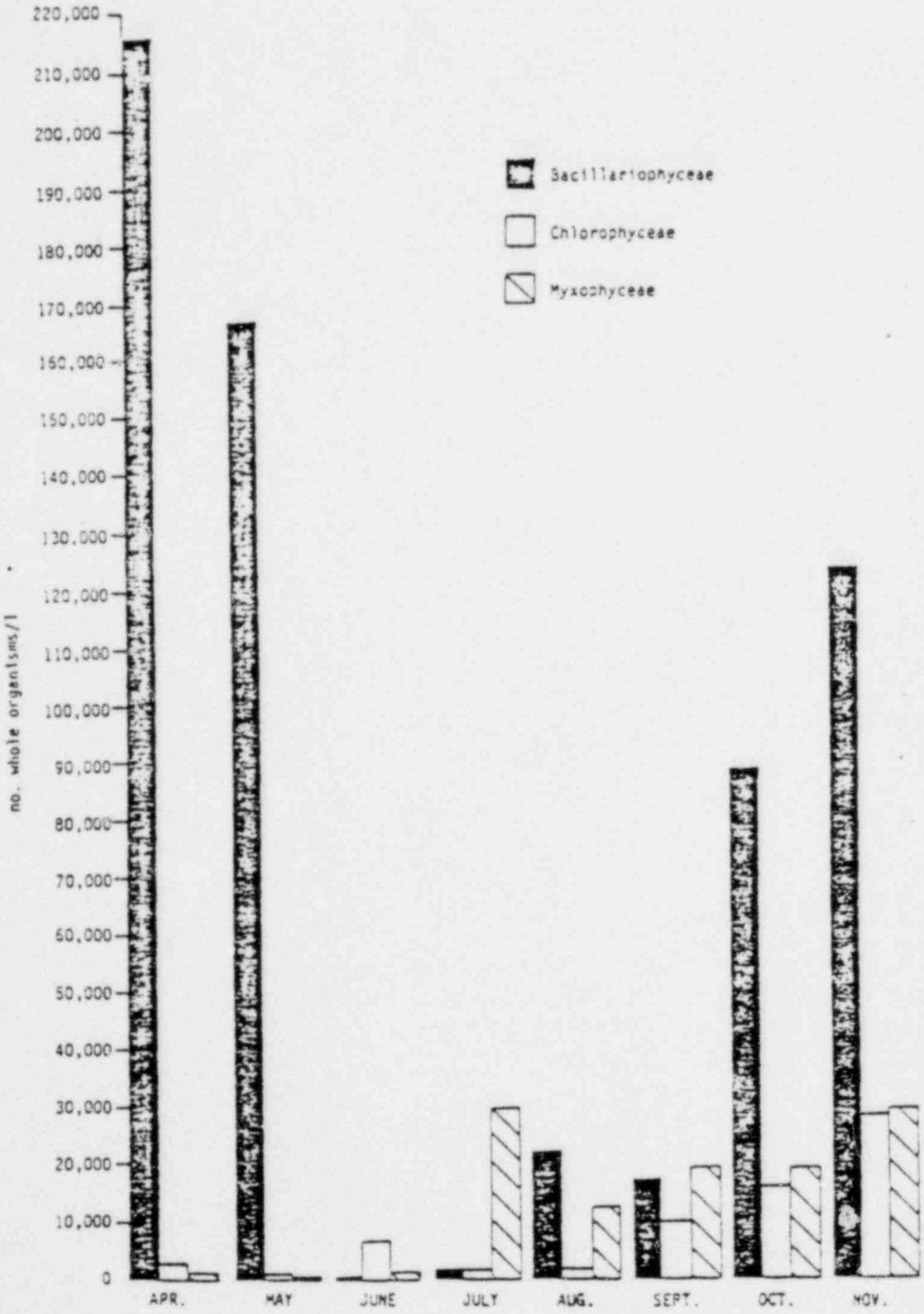


FIGURE 7

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



The chlorophycean population was very similar to that observed in 1974 and 1977. However, the maximum which occurred in November was the highest observed for this group. This peak was almost entirely due to a bloom of Binuclearia tatrana. It should be pointed out that a monthly sampling frequency for plankton can lead to this type occurrence. It is also worth noting that Mougeotia sp. was absent. Although never an extremely abundant taxon, it is usually common. Recounting several samples indicated that although it was present, the numbers were so low that it was most often missed when counting 25 random Whipple Disk fields of view. A check of similar samples collected throughout the Western Basin of Lake Erie for the USEPA by the Center for Lake Erie Area Research, revealed a similar trend.

Myxophycean populations in 1978 were most like those from 1975 and 1976. As usual, the dominant taxa were Aphanizomenon and Oscillatoria.

In summary, phytoplankton populations observed at Locust Point during 1978 are similar to those of previous years and appear typical for those occurring in the nearshore waters of the Western Basin of Lake Erie.

Zooplankton

Results. Zooplankters collected May through November 1978 were grouped in 41 taxa generally to the species level (Table 3). Twenty taxa were grouped under Rotifera, 12 under Copepoda, 8 under Cladocera, and 1 under Protozoa. Monthly mean densities ranged from 135/l in November to 557/l in September. The mean density from all samples collected in 1978 was 339/l. Zooplankton densities at individual sampling stations ranged from 124/l at Station 8 in May to 894/l at Station 18 in September (Table 4).

Monthly mean rotifer densities ranged from 33/l in June to 264/l in May (Table 3). The annual mean rotifer density for all samples collected in 1978 was 108/l or 32 percent of the entire zooplankton density. The dominant rotifer taxa during 1978 were Synchaeta spp. in May; Trichocerca multicrinis in June, July, and August; Polyarthra vulgaris in September and November; and an unknown rotifer in October. Polyarthra vulgaris had the largest annual mean density, 30/l. Rotifera was the dominant zooplankton group during May, September, October, and November constituting 89 percent, 38 percent, 49 percent, and 37 percent respectively, of the total zooplankton population. In contrast to this, rotifers constituted only 6 percent of the June population.

Monthly mean copepod densities ranged from 31/l in May to 141/l in August (Table 3). The mean copepod density from all samples collected in 1978 was 88/l or 26 percent of the entire zooplankton population. Cyclopoid nauplii dominated every month but August when Diaptomus siciloides was the dominant taxon. Copepoda was the dominant zooplankton group in July and August representing 34 percent and 56 percent, respectively, of the total zooplankton population.

Monthly mean cladoceran densities ranged from 1/l in May to 360/l in June (Table 3). The mean cladoceran density from all samples collected in 1978 was 118/l or 35 percent of the total zooplankton population. Cladoceran populations were dominated by Diaphanosoma leuchtenbergianum in May; Eubosmina corregoni

TABLE 3

MONTHLY MEAN POPULATIONS OF

INDIVIDUAL ZOOPLANKTON TAXA AT LOCUST POINT - 1978

TAXA	May 11	June 29	July 25	Aug. 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
ROTIFERA								
Asplanchna priodonta	0.0	0.0	0.0	0.0	1.2	0.9	0.0	0.3
Brachionus angularis	13.6	13.6	4.3	0.1	47.1	3.0	1.0	11.8
B. calyciflorus	19.3	0.0	0.1	0.1	0.0	0.0	0.0	2.8
B. diversicornus	0.0	0.0	0.0	0.0	2.4	0.1	0.0	0.4
Cephadella spp.	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Chromogaster sp.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Filinia terminalis	0.9	0.0	0.0	0.0	0.04	0.0	0.0	0.1
Kellicottia longispina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Keratella cochlearis	16.0	0.2	0.1	0.7	8.9	7.3	12.9	6.6
K. quadrata	12.1	3.4	0.0	0.0	0.2	0.0	0.04	2.3
K. vulga	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1
Lecane spp.	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.01
Lepadella sp.	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.04
Notholca spp.	9.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Polyarthra vulgaris	27.9	0.1	5.2	5.0	104.2	32.5	34.9	30.0
Synchaeta spp.	148.3	0.3	0.5	0.0	0.04	0.8	0.4	21.5
Trichocerca spp.	0.0	0.0	0.0	0.0	47.4	0.0	0.0	6.8
T. multicrinis	0.2	15.6	28.4	30.1	0.0	0.5	0.1	10.7
Unknown Rotifer A	15.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Unknown Rotifer B	0.0	0.0	0.0	0.0	0.0	74.8	0.0	10.7
Subtotal	263.5	33.4	38.5	36.0	212.8	120.0	49.4	107.6
COPEPODA								
Calanoid Copepods								
Diaptomus minutus	0.3	0.3	0.8	0.0	0.1	0.0	0.0	0.2
D. sicilis	0.1	0.2	0.9	2.8	0.2	0.0	0.2	0.6
D. siciloides	0.0	0.03	6.6	50.8	8.4	0.9	0.2	9.6
Eurytemora affinis	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.01
Copepodids, calanoid	3.8	0.1	4.3	28.6	4.0	2.6	0.4	6.2
Nauplii, calanoid	5.1	0.0	21.0	40.0	17.9	5.9	1.5	13.1

TABLE 3 (Con't.)

MONTHLY MEAN POPULATIONS OF

INDIVIDUAL ZOOPLANKTON TAXA AT LOCUST POINT - 1978

TAXA	May 11	June 29	July 25	Aug. 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
COPEPODA								
Cyclopoid Copepods								
Cyclops bicuspidatus thomasi	0.04	0.2	0.0	1.1	1.0	0.1	0.6	0.4
C. vernalis	0.5	24.1	11.4	9.0	9.9	4.3	0.5	8.5
Mesocyclops edax	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.02
Tropocyclops prans nex	0.0	0.0	0.0	0.0	4.0	3.3	3.7	1.6
Copepodids, cyclopoid	3.7	10.2	7.2	3.7	16.5	4.0	9.2	7.8
Naupleii, cyclopoid	17.9	55.2	73.9	5.2	46.8	46.0	32.0	39.6
Subtotal	31.4	90.6	126.1	141.2	108.9	67.1	48.4	87.7
CLADOCERA								
Bosmina longirostris	0.0	0.0	0.0	0.0	0.04	0.1	0.0	0.02
Chydorus sphaericus	0.0	1.3	33.5	30.2	83.7	9.8	11.7	24.3
Diaphanosoma leuchtenbergianum	0.3	0.1	0.1	2.3	4.8	0.6	0.1	1.2
Daphnia galeata mendote	0.0	0.1	0.3	0.1	0.04	0.5	0.2	0.2
D. retrocurva	0.2	71.1	42.7	13.6	44.5	16.2	1.9	27.2
Eubosmina corregoni (mature)	0.0	274.7	45.1	25.7	59.2	28.3	12.3	63.6
E. corregoni (immature)	0.0	12.4	0.0	0.0	0.0	0.0	0.0	1.8
Leptodora kindtii	0.0	0.6	0.2	0.3	0.1	0.1	0.0	0.2
Subtotal	0.5	360.3	121.9	72.2	192.4	55.5	26.1	118.4
PROTOZOA								
Difflugia sp.	0.0	33.4	83.9	0.9	49.9	3.4	10.8	25.0
TOTAL	295.3	517.7	370.3	250.3	557.0	245.9	134.7	338.7

TABLE 4

MONTHLY MEAN ZOOPLANKTON POPULATIONS*

FROM SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1978

Station	May 11	June 29	July 25	August 17	Sept. 15	Oct. 17	Nov. 1	Grand Mean
1	591.9	572.9	436.2	306.5	449.1	298.4	131.9	398.1
3	326.9	534.6	549.7	270.7	541.3	265.3	150.7	377.0
6	309.2	666.1	285.9	216.6	517.5	241.3	131.8	338.3
8	124.4	386.3	318.5	227.8	412.3	252.1	137.3	265.5
13	243.4	497.8	336.5	197.4	513.1	179.3	127.0	299.2
14	240.4	460.8	276.9	270.8	571.3	232.9	135.3	312.6
18	231.2	505.2	406.7	262.3	894.2	252.0	129.1	383.0
Grand Mean	295.3	517.7	370.3	250.3	557.0	245.9	134.7	338.7

* Data presented as no. of organisms/liter and computed from duplicate vertical tows (bottom to surface) with a Wisconsin plankton net (12 cm diameter, 0.080 mm mesh) at each station.

(mature) in June, July, October, and November; and Chydorus sphaericus in August and September. Eubosmina coregoni (mature) had the largest annual mean density, 64/l. Cladocera was the dominant zooplankton group only in June constituting 70 percent of the total zooplankton population.

Monthly mean protozoan densities ranged from 0/l in May to 84/l in July (Table 3). The annual mean density of 25/l was 7 percent of the total zooplankton population. Difflugia sp. was the only protozoan taxon. Protozoa was never the dominant zooplankton group.

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. Zooplankton populations at Locust Point have been monitored since 1972. In 1978, 2 new monthly lows were established for total zooplankton density. Zooplankton densities observed during May and June were the lowest recorded to date although the June density was very similar to that observed in 1973 (Figure 8). Results from the other months of 1978 fell within the ranges established from 1972-1977. Densities in July were slightly larger than 1977, slightly less than 1976, and less than those observed from 1972-1975. Densities observed in August were slightly larger than those observed in 1977, similar to those of 1973, and smaller than those of 1972 and 1974-1976. Densities observed in September of 1978 were greater than those observed during September of 1972 and 1975-1977 and virtually equal to those observed during September of 1973 and 1974. October densities were greater than those of 1972 and 1977 and less than those from October of 1974-1976. November densities were greater than 1977 and less than 1972-1976.

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. From 1973-1978 samples were collected by a vertical tow, bottom to 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 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, while 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, and 1978.

Of the three main components of the zooplankton population, rotifer densities are by far the most erratic and unpredictable (Figure 9). However, densities observed in 1978 were generally within the bounds described by populations from 1972-1977. The one exception was July when the densities

FIGURE 8. MONTHLY MEAN ZOOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1978.

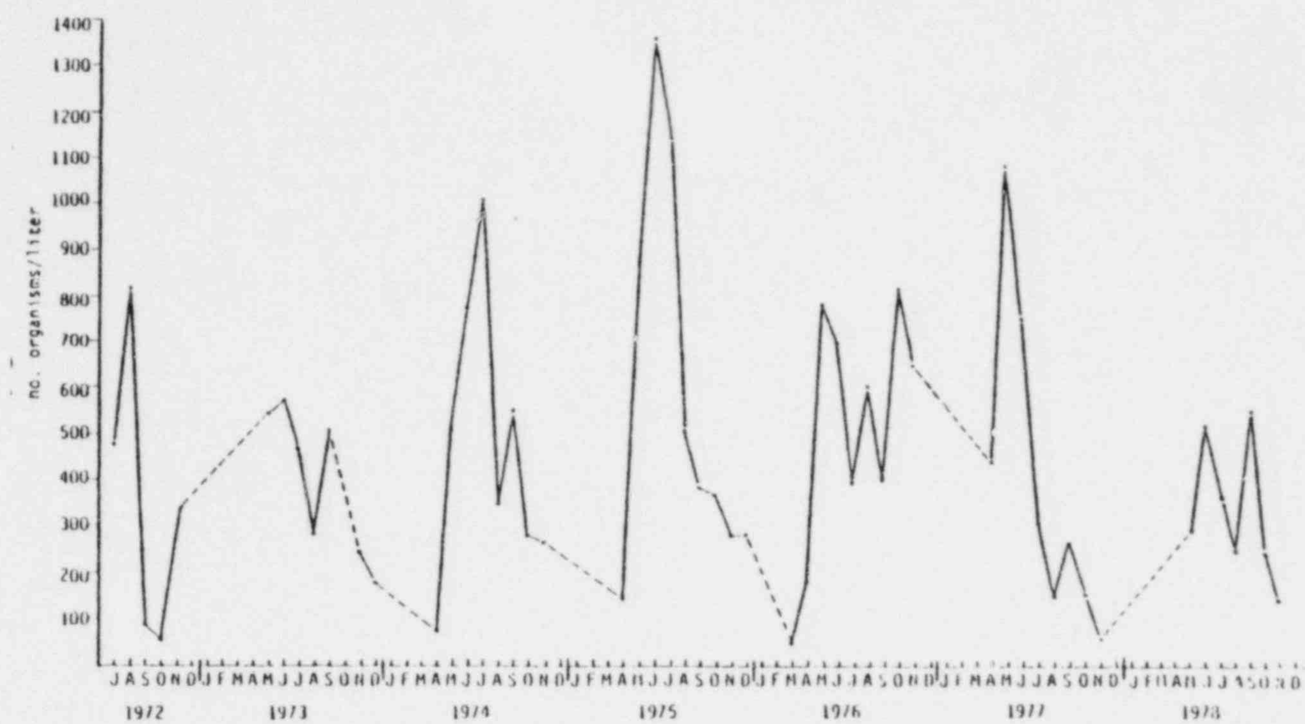
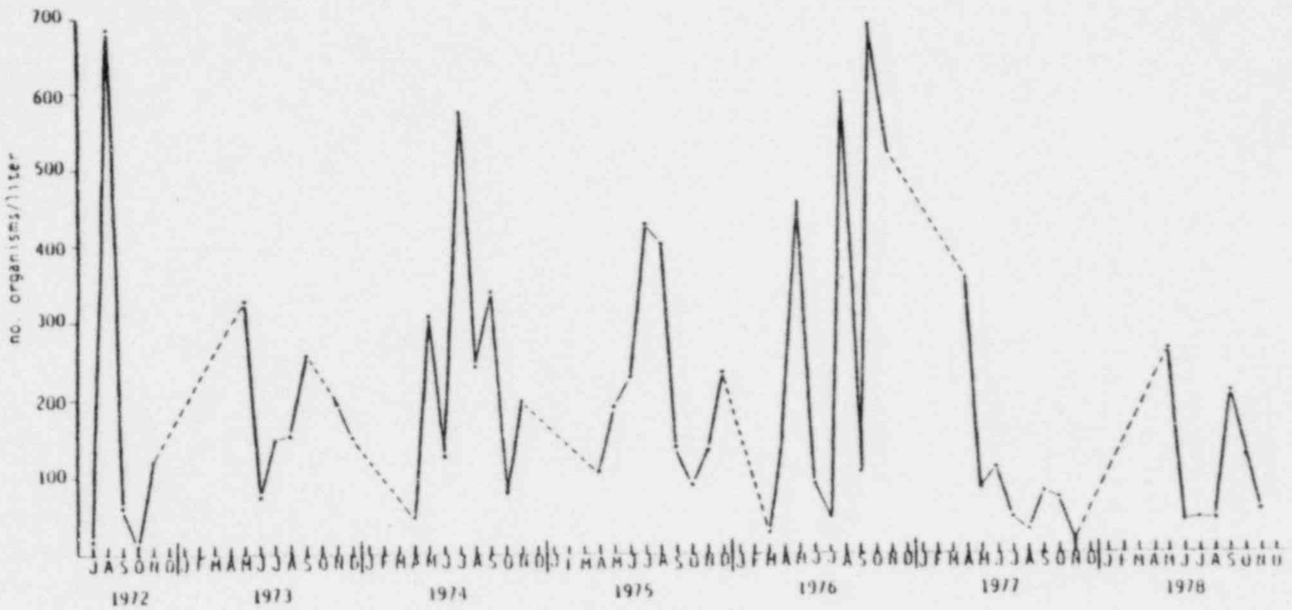


FIGURE 9. MONTHLY MEAN ROTIFER POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1978.



observed were the lowest during the 7 year sampling period. Rotifer densities observed during May 1978 were greater than those observed during May of 1975 and 1977 and less than those observed during May of 1973, 1974, and 1976. July densities were greater than 1972, approximately equal to 1976 and 1977, and less than 1973-1975. August densities were greater than 1977 and less than 1972-1976. September densities were greater than those observed in 1972 and 1975-1977 and less than those of 1973 and 1974. October densities were greater than those from 1972, 1974, 1975, and 1977, but less than those from 1976. November densities were greater than 1977 and less than 1972-1976.

Copepod populations are much more regular and predictable than rotifer populations (Figure 10). They generally exhibit one peak per year and this usually occurs in the May/June period. In 1978, one peak was observed, however, it occurred about two months later, July/August, and was smaller than those from previous years. However, due to the frequency of sampling and the fact that peaks are always controlled by pulses of immature forms, this lower density in 1978 should not be considered too unusual as the peak may have been missed.

As with the copepod densities, cladoceran densities are quite regular and predictable. They often exhibit two peaks, one in the spring and one in the fall (Figure 11). This was the case in 1978 which was extremely similar to 1975 and 1976. In general these three years exhibited the greatest cladoceran densities followed by 1974 and 1977, which were very similar, and 1973 which was a poor year for cladocerans.

In summary, due to the large variability observed in previous years, zooplankton populations observed in 1978 should be considered typical for the south shore of the Western Basin of Lake Erie.

FIGURE 10. MONTHLY MEAN COPEPOD POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1978.

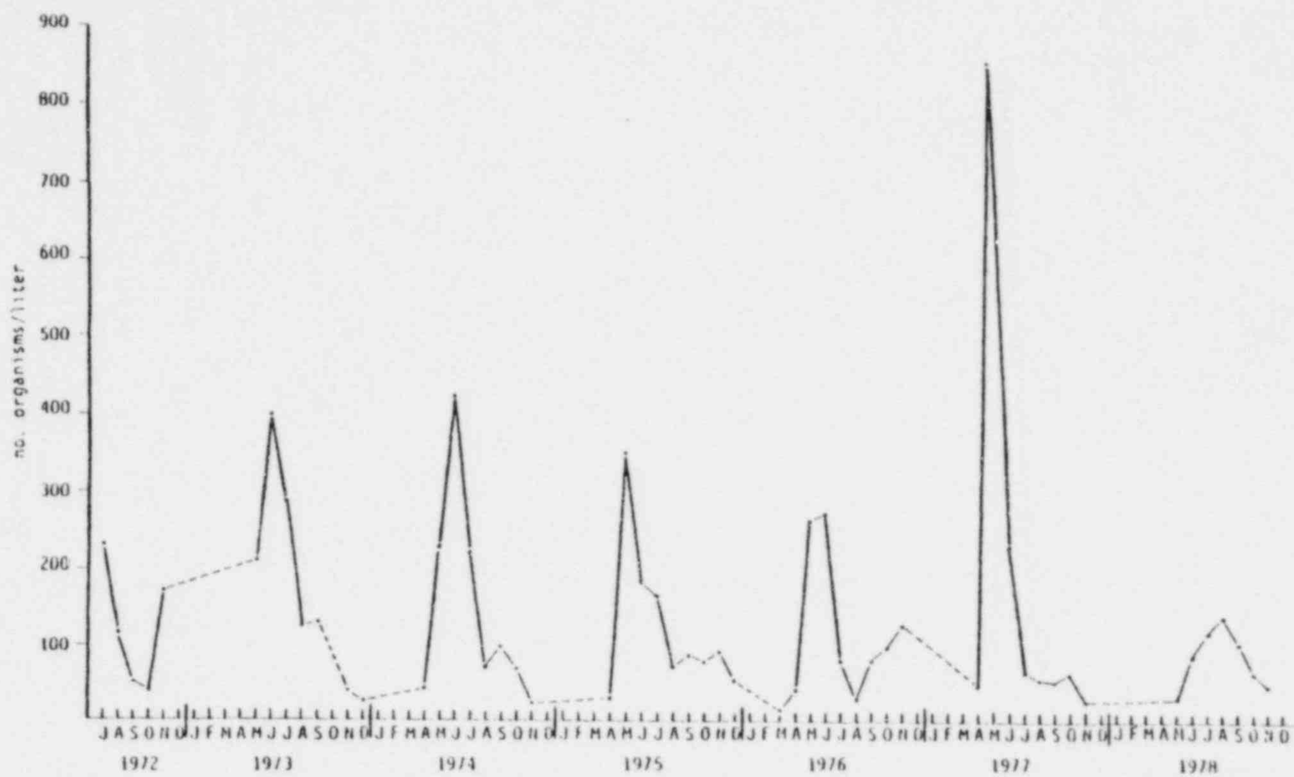
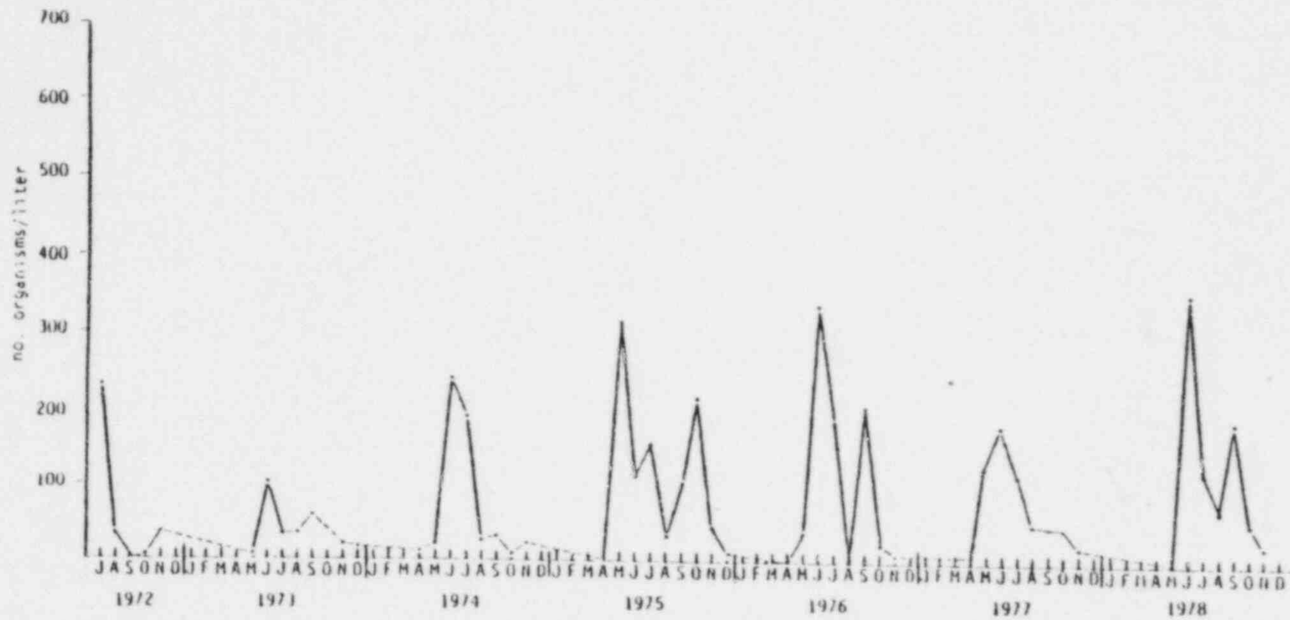


FIGURE 11. MONTHLY MEAN CLADOCERAN POPULATIONS FOR
LAKE ERIE AT LOCUST POINT, 1972 - 1978.



LITERATURE CITEL

Chandler, D.C., and O.B. Weeks. 1945. Limnological studies of western Lake Erie V: relation of limnological and meteorological conditions to the production of phytoplankton in 1942. Ecol. Monogr. 15:435-456.

Hubschman, J.H. 1960. Relative daily abundance of planktonic crustacea in the island region of western Lake Erie. Ohio J. Sci. 60:335-340.

Reutter, J.M. and C.E. Herdendorf. 1977. Pre-operational aquatic ecology monitoring program for the Davis-Besse Nuclear Power Station, Unit 1. The Ohio State University, CLEAR, Columbus, Ohio. 205 pp.

Reutter, J.M. 1976. An Environmental Evaluation of a Nuclear Power Plant on Lake Erie; Some Aquatic Effects. Ph.D. Dissertation, The Ohio State University, Columbus, Ohio. 242 pp.

Reutter, J.M. and C.E. Herdendorf. 1974. Environmental evaluation of a nuclear power plant on Lake Erie. Ohio State Univ., Columbus, Ohio. Project F-41-R-5, Study I and II. U.S. Fish and Wildlife Service Rept. 145 pp.

Wieber, P.H. and W.R. Holland. 1968. Plankton patchiness: effects on repeated nt tows. Limnol. Oceanogr. 13:315-321.

3.1.2.a.2

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SECTION 3.1.2.A.2
BENTHIC STUDIES