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SUMMER PLANKTON DYNAMICS IN ACTON LAKE, OHIO[1]

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ABSTRACT. Plankton was quantitatively sampled from Acton Lake during July-September 1982. Eighty-two species of phytoplankton and 18 species of zooplankton were identified. Species of Cyanophyta dominated the phytoplankton, and overall the most abundant species during the study was the blue-green alga *Schizothrix calcicola.* Rotifers dominated the zooplankton. The diversity index, species number and density of phytoplankton progressively increased whereas the same parameters for zooplankton were highest in August. Midday photosynthesis (carbon assimilation) ranged from an average of 20.7 mgC/m^3/h in October to 100.4 mgC/m^3/h during June.

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INTRODUCTION

The plankton dynamics of most small Ohio lakes have not been thoroughly investigated or reported. Information on the composition and distribution of phytoplankton in Ohio is scarce (Littler and Graffius 1974). For example, the benthos, limnology and cladocera of Acton Lake have been described previously (Winner et al. 1962, Winner and Haney 1967, Daniel 1972), but no detailed study on the phytoplankton community has been reported. For this reason, a study was initiated to determine basic limnological characteristics of Acton Lake and to characterize the plankton populations and midday photosynthetic activity during several summer months.

Acton Lake, an impoundment of Four Mile Creek, is located in Preble and Butler counties approximately 60 km northwest of Cincinnati, Ohio (fig. 1). The 250-ha impoundment was formed in 1956 primarily for recreation and is contained within Hueston Woods State Park. The lake has a drainage area of approximately 221 km^2. Contaminants are primarily eroded soils, septic tank seepage, sewage effluent and agricultural runoff.

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METHODS AND MATERIALS

WATER CHEMISTRY. A chemical and physical profile of the lake was determined during May-October 1982 using an automated analyzer

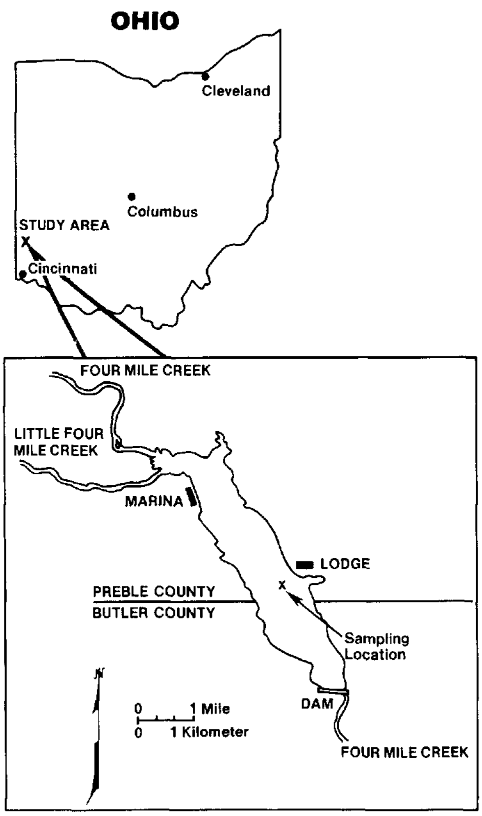

FIGURE 1. Study area on Acton Lake located in Hueston Woods State Park, Ohio.

(Hydrolab Corp., Austin, TX) for pH, conductivity, dissolved oxygen and temperature and an irradiometer (Kahl Scientific Instrument Co., San Diego, CA) for light intensity. In addition, total alkalinity, total hardness, metals, and pesticides were determined for composited water samples collected from the photic zone.

PHOTOSYNTHESIS. The photosynthetic activity of the phytoplankton was determined at several lake locations during June-October 1982 using the ^{14}C light-dark bottle technique (Steeman-Nielsen 1952). Studies were conducted in triplicate during each month on at least 4 separate days. Lake water was collected from various depths of the photic zone with a rubber diaphragm pump and mixed in a 100-liter polyethylene tub under shade. One clear glass-stoppered BOD bottle (300 ml) and one black bottle were filled with the mixed lake water. In addition to lake water, 3 μCi of Na $H^{14}CO_3$ also were added to each bottle. The bottles were then capped, the contents mixed and the bottles suspended in a horizontal position at a 1-m depth in the lake. The bottles were incubated for 3 h (1100-1400 h) and then were removed and chilled until analysis. The contents of the bottles were passed through a 0.45 μm pore size filter and ^{14}C activity on the filter was determined with a scintillation counter. The rates of photosynthetic and non-photosynthetic carbon assimilation were calculated following Lind (1979) and are expressed as $mgC/m^3/h$.

PLANKTON. The plankton populations were determined at several lake sampling stations during July-September 1982. Lake water was collected from various depths of the photic zone in a manner similar to that for the photosynthesis studies. These waters were mixed and separate composite samples of the mixed water were preserved in either Lugols solution and 1% buffered formaldehyde (phytoplankton) or 5% buffered formaldehyde (zooplankton). Plankton in 8 composite samples were identified and enumerated for each of the following months: July, August, and September.

Zooplankton were concentrated prior to preservation by passing each sample through a 44 μm Nitex screen. The concentrated zooplankton samples were diluted to 75-100 ml depending upon the seston concentration. Replicate subsamples of rotifers were counted on a Sedgewick Rafter counting cell. Subsamples for Cladocera and Copepoda were obtained by splitting the total sample with a Folsom zooplankton splitter. Identifications were made with the keys of Brooks (1959), Wilson and Yeatman (1959), Smith and Fernando (1978), and Pontin (1978).

Phytoplankters in each sample were settled for 72 hr, centrifuged and concentrated to a final volume of 10 ml (total concentration approximately 100 : 1). Except for diatoms, phytoplankton were counted in a Palmer-Maloney chamber. Diatom densities were determined by species proportional counts based on the original total phytoplankton cell counts (including diatoms) in the Palmer-Maloney chamber using standard methods (APHA 1975). Identification was made using keys by Bourrelly (1966, 1968, 1970), Drouet (1968, 1973, 1978, 1981), Drouet and Daily (1956), Hustedt (1930), Patrick and Reimer (1966, 1975), Prescott (1951), and Smith (1950).

The diversity of the plankton was determined using the Shannon-Wiener index (Shannon and Wiener 1963):

$$\bar{d} = \sum_{i}^{S} \frac{ni}{N} \log 2 \frac{ni}{N}$$

where $\bar{d}$ = species diversity index, ni = number of individuals per taxon, N = number of organisms per sample and S = total number of species.

RESULTS

WATER CHEMISTRY. The typical dissolved oxygen and light intensity profile for Acton Lake during the summer months of 1982 appears in fig. 2. This profile is a composite of 28 measurements for each depth increment taken between June and October at mid-lake. The photic zone typically extended to 3.9 m where light intensity ranged from an average of 9.6 ($\pm$1 standard deviation = 4.6) lux at 0.3 m to 0.09 (0.07) lux at 3.9 m. Dissolved oxygen at a 0.3-m depth averaged 11.7 (2.7) mg/l and 5.9 (2.6) mg/l at 3.0 m. The dissolved oxygen concentration progressively decreased below 3.0 m to an average of 0.4 ($\pm$1 standard deviation = 0.5) mg/l at 6 m. On only 2 occasions were anoxic conditions observed at lake bottom (6.2 m). This is attributable to the "lotic" nature of the lake. Heavy discharge from the lake's 2 main tributaries after heavy seasonal rainfall thoroughly mixed and partially renewed the water volume of this relatively small lake several times during the study.

Several water chemistry parameters varied during the summer months (table 1). Water temperature ranged from 13-29 °C while alkalinity and hardness varied from 110-141 mg/l as $CaCO_3$ and 108-202 mg/l as $CaCO_3$, respectively. Conductivity varied from 370-450 μmhos while pH ranged from 6.8-8.0. No organophosphates or chlorinated insecticides were detected. Potentially toxic metals

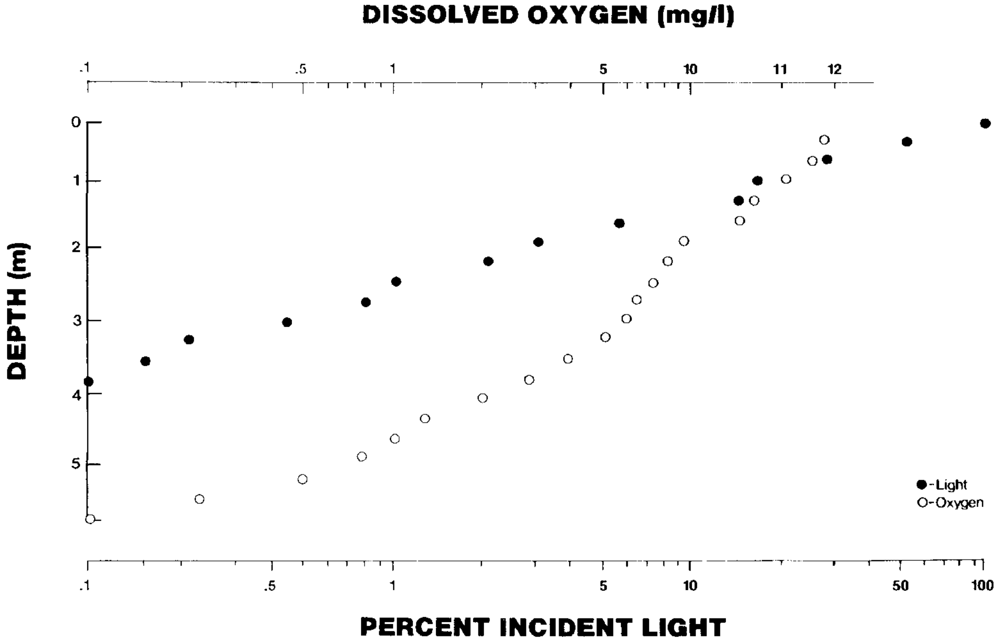

FIGURE 2. The average dissolved oxygen and light profile of Acton Lake during the summer of 1982.

TABLE 1

Water chemistry of composite samples from the photic zone of Acton Lake.

Parameter	Mean	(±1 S.D.)	Range	N
Alkalinity (mg/l)*	125	(24)	110-141	22
Hardness (mg/l)*	142	(51)	108-202	22
pH (units)	—	—	6.8-8.0	30
Conductivity (μmhos)	419	(25)	370-450	30
Temperature (°C)	24	(4)	13-29	30
Organophosphates (μg/l)**	< 0.50		—	1
Chlorinated pesticides (μg/l)†	< 0.05		—	1
Mercury (μg/l)	< 0.5		—	1
Arsenic (μg/l)	< 1.0		—	1
Silver (μg/l)	< 1.0		—	1
Cadmium (μg/l)	< 4.0		—	1
Nickel (μg/l)	15.0		—	1
Boron (μg/l)	84.0		—	1
Manganese (μg/l)	40.0		—	1
Copper (μg/l)	< 5.0		—	1
Zinc (μg/l)	19.0		—	1
Lead (μg/l)	< 80.0		—	1

*as $CaCO_3$
**Includes Vapona, Thimet, Diazinon, Methyl Parathion, Ronnel, Malathion, Parathion
†Includes DDE, DDD, DDT, PCB, Dieldrin, Lindane, BHC, Endrin, Mirex

(Pb, Zn, Cu, and Hg) were low or below detection limits and were within recommended U.S. EPA and Ohio EPA criteria to protect freshwater aquatic life (U.S. EPA 1976, American Petroleum Institute 1980).

PHOTOSYNTHESIS. Carbon assimilation during the study ranged from 10.9 to 122.3 $mgC/m^3/h$ (table 2). The mean values for June, July, and August were relatively similar and greater than those for September (35.8 $mgC/m^3/h$) and October (20.7 $mgC/m^3/h$). The wide range in values for each month is attributable in part to the variable cloud cover during the studies and subsequent reduction in light intensity. The light intensity at 1 m averaged 3.4 lux and varied approximately 7-fold ranging from 0.8 to 6.2 lux.

PHYTOPLANKTON. Overall, 82 species representing 39 genera of phytoplankton were identified (table 3). Densities progressively increased averaging 5532, 6918 and 10,470 cells/ml, respectively, for July, August, and September. Species of Chlorophyta, Cyanophyta and Chrysophyta dominated comprising on the average 99% of the total cell volume (fig. 3). For all months the blue-green species were the most numerous averaging 52% of the total cell volume with the maximum of 62% occurring in September. The Chlorophytes comprised 37% of the phytoplankton in July but then declined to an average of 25% for the remaining months. The relative abundance of the Chrysophyta was similar throughout the study ranging from 11 to 18%. On the average 17 (6)% of the total cell volume could not be identified. These undetermined species were miscellaneous flagellated ultraplankton (5 μm or less in length) too small for accurate genus or, in many cases, division identification.

TABLE 2

Carbon assimilation (mg C/m³/h) by phytoplankton in Acton Lake during 1100-1400 h.

Month	Mean	S.D.	Range	*N*
June	100.4	49.7	26.5-122.3	12
July	75.3	22.2	13.7-99.8	15
August	69.4	23.9	16.8-96.8	24
September	35.8	10.3	20.2-51.3	36
October	20.7	5.8	10.9-29.4	21

The most abundant blue-green species, regardless of the sampling period and overall the most numerous species in the study, was *Schizothrix calcicola* (Agardh) Gomont (table 3). Mean density of this species increased from 2004 cells/ml in July to 5220 cells/ml in September. The highest density observed in any single sample was 10,617 cells/ml. Two other cyanophytes were consistently seen but at lesser mean densities, *Agmenellum quadruplicatum* (range = 32 to 1351 cells/ml) and an unidentified *Anacystis* sp. (range = 169 to 665 cells/ml).

Centric diatoms dominated the Chrysophyta and species of *Cyclotella* were the most numerous (table 3). *C. pseduostelligera* and *C. glomerata* were the more abundant of the *Cyclotella*. The average density of *C. pseudostelligera* was highest during July (508 cells/ml) and then progressively declined to an average of 64 cells/ml in September. The mean density of *C. glomerata* was also lowest in September (184 cells/ml) relative to the densities for July (311 cells/ml) and August (376 cells/ml). *Melosira distans* v. *alpigena* was an abundant diatom, however, only in September (mean density = 762 cells/ml). Overall, the maximum density of centric diatoms was observed in September, averaging 1386 cells/ml.

More species of pennate diatoms were identified (29) than centric species (11); however, they were less abundant (table 3). The overall mean density of these species steadily increased from 105 cells/ml in July to 530 cells/ml in August. The ratio of pennate to centric forms likewise increased from 10% in July to 38% in September. The major pennate species were *Nitzschia frustulum* v. *perminuta* and *Nitzschia kuetzingiana*.

The dominant species of green algae were typically *Ankistrodesmus falcatus*, a

TABLE 3

Phytoplankton densities (cells/ml) in Acton Lake during July-September 1982. Values represent mean (standard deviation) of 8 samples collected during each month. Species without values averaged less than 1 cell/ml.

DIVISION Species	MONTH July	August	September
Chlorophyta			
Actinastrum hantzschii Lagerheim	27(48)		199(168)
Ankistrodesmus falcatus (Corda) Ralfs	232(165)	303(229)	356(297)
Chlamydomonas sp.	5(8)	35(56)	22(28)
Closterium sp.			3(7)
Cosmarium sp.	8(6)		5(8)
Cosmarium corda			1(4)
Crucigenia crucifera Collins	21(59)	11(30)	29(46)
Crucigenia quadrata Morren		21(39)	
Crucigenia tetrapedia (Kirchner) West and West	5(15)	12(30)	11(16)
Dictyosphaerium ehrenbergianum Naegeli		101(106)	111(116)
Eudorina elegans Ehrenberg			
Golenkinia radiata Chodat			
Kirchneriella sp.	487(853)	164(93)	288(151)
Microactinium pusillum Fresenius	29(82)	58(112)	8(13)
Oocystis sp.	24(29)	8(12)	16(25)
Pediastrum duplex Meyen			
Scenedesmus sp.	212(130)	331(207)	410(175)
Scenedesmus acuminatus (Lagerheim) Chodat	24(36)	64(50)	67(55)
Scenedesmus acutus Chodat	8(22)		
Scenedesmus denticulatus Lagerheim	85(91)	120(104)	145(72)
Scenedesmus ecornis (Ralfs) Chodat	10(19)	1(4)	17(32)
Scenedesmus quadricauda (Turpin) Brebisson	376(195)	321(136)	595(246)
Scenedesmus spinosus Chodat		29(44)	28(25)
Sphaerocystis schroeteri Chodat	426(477)	49(47)	75(79)
Tetraedron minimum (A. Braun) Hansgirg		47(28)	132(52)
Tetrastrum staurogeniaeforme (Schroeder) Lemmerman			21(32)
Chrysophyta			
Achnanthes lanceolata (Brebisson) Grunow	1(1)		
Achnanthes minutissima Kuetzing		4(8)	16(13)
Amphora perpussilla Grunow			
Cyclotella atomus Hustedt	18(22)	16(21)	72(28)
Cyclotella glomerata	311(207)	376(253)	184(150)
Cyclotella meneghiniana Kuetzing	5(10)	21(13)	82(31)
Cyclotella pseudostelligera Hustedt	508(468)	204(122)	64(129)
Cyclotella stelligera Cleve In Grunow	6(8)	8(12)	8(5)
Fragilaria vaucheriae Petersen			
Fragilaria vaucheriae (Kuetzing) Petersen			
Gomphonema parvulum Kuetzing			
Melosira distans V. *alpigena* Grunow	15(10)	79(65)	762(1216)
Melosira italica V. *tenuissima* Grunow			21(18)
Melosira granulata (Ehrenberg) Ralfs			
Navicula bicephala Hustedt			1(4)
Navicula cincta V. *rostrata* Reimer			
Navicula cryptocephala V. *veneta* (Kuetzing) Husted			
Navicula graciloides A. Mayer			
Navicula gregaria Donkin			
Navicula lyra Ehrenberg			
Navicula luzonensis Hustedt			
Navicula minima Grunow			
Navicula ochridana Hustedt			
Navicula pelliculosa Hilse			

TABLE 3 — *Continued*

Phytoplankton densities (cells/ml) in Acton Lake during July-September 1982. Values represent mean (standard deviation) of 8 samples collected during each month. Species without values averaged less than 1 cell/ml.

DIVISION Species	July	August	September
Navicula pupula V. *mutata* (Krasske) Hustedt			
Navicula salinarium V. *intermedia* (Grunow) Cleve			
Navicula tripunctata V. *schizonemoides* Van Heurck	1(1)		
Nitzschia acicularis W. Smith	20(21)	9(12)	9(9)
Nitzschia baccata Hustedt	1(2)	36(25)	23(19)
Nitzschia capitellata V. Sibirica Skvortzow		3(5)	16(26)
Nitzschia dissipata (Kuetzing) Grunow			1(4)
Nitzschia frustulum (Kuetzing) Grunow	1(4)		
Nitzschia frustulum V. *perminuta* Grunow	16(18)	82(35)	393(138)
Nitzschia frustulum V. *subsalina* Hustedt	1(1)	1(4)	
Nitzschia kuetzingiana Hilse	16(4)	81(42)	68(45)
Nitzschia palae (Kuetzing) W. Smith		1(4)	2(5)
Rhoicosphenia curvata (Kuetzing) Gran			
Stephanodiscus astrea V. *minutula* (Kuetzing) Grunow	21(17)	105(57)	77(33)
Stephanodiscus hantzschii Grunow			
Stephanodiscus invisitatus Hohn & Hellerman	6(16)	4(8)	6(5)
Stephanodiscus minutus Grunow	90(67)	31(18)	110(52)
Synedra tenera W. Smith	45(50)	16(19)	64(35)
Cyanophyta			
Agmenellum quadruplicatum (Meneghini) Brebisson	32(89)	1351(2420)	280(273)
Agmenellum thermale (Kuetzing) Drouet & Daily			169(273)
Anacystis montana (Lightfoot) Drouet & Daily			5(2)
Anacystis sp.	396(664)	665(385)	169(122)
Gomphosphaeria lacustris Chodat			
Nostoc commune Vaucher		16(45)	1.0(1)
Schizothrix calcicola (Agardh) Gomont	2004(1299)	2059(944)	5220(1545)
Euglenophyta			
Euglena sp.	9(15)	23(21)	29(38)
Phacus sp.	1(4)	4(8)	9(16)
Trachelomonas sp.	13(15)	16(25)	18(17)
Pyrrhophyta			
Glenodinium sp.		3(7)	9(9)
Gymnodinium sp.	16(37)	19(19)	33(37)
Gymnodinium fuscum (Ehrenberg) Stein		7(9)	10(15)
Peridinium inconspicuum Lemmerman		1(4)	

Kirchnierella sp., *Scenedesmus quadricauda*, and an unidentified *Scenedesmus* species (table 3). These 4 species comprised on the average 70% of the total cell volume of the Chlorophyta. With the exception of *Kirchnierella*, maximum densities of these abundant forms occurred in September. For example, the mean density of *S. quadricauda* was 595 cells/ml in September relative to an average of 376 cells/ml in July and 321 cells/ml in August. *Sphaerocystis schroeteri* was also very abundant but only in June (426 cells/ml) and declined substantially in the remaining sampling periods with densities averaging 49 cells/ml in August and 75 cells/ml in September.

Dinoflagellates (Pyrrhophyta) and Euglenophytes were consistently identified but comprised usually less than 1% of the phytoplankton (fig. 3, table 3). Dominant genera were *Gymnodinium, Euglena*

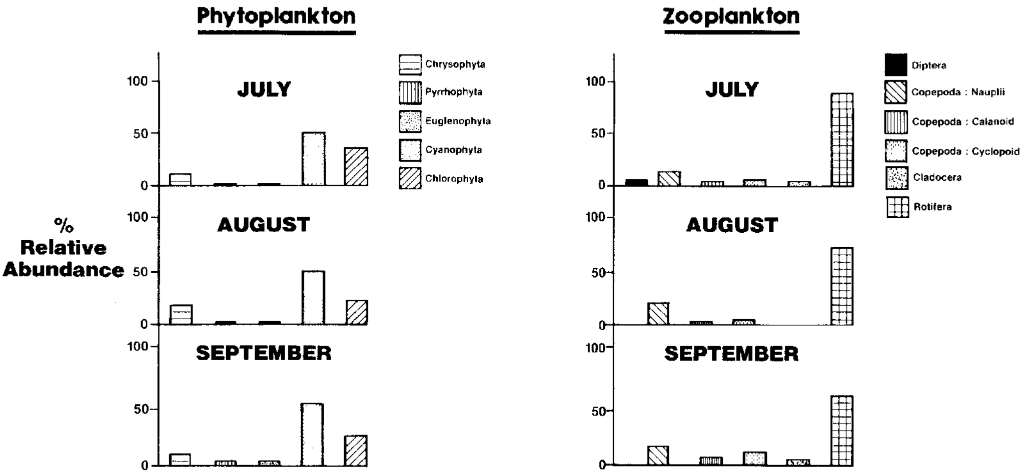

FIGURE 3. Percent relative abundance of phytoplankton and zooplankton for July, August, and September 1982.

and *Trachleomonas*. Overall, densities of these species progressively increased from an average of 49 cells/ml in July to 108 cells/ml in September.

The mean diversity index ($\bar{d}$) and mean number of species progressively increased during the 3-month sampling period. The mean diversity indices were low and ranged from 0.84 (0.19) in July to 1.66 (0.66) in September. The value for August was 0.86 (0.02). The average number of species collected from the photic zone ranged from 34 (2) in June to 46 (2) in September. An average of 43 species were identified for samples collected in August.

The phytoplankton community of Acton Lake, based on the taxa reported here, is indicative of an organically enriched water. Values for a "genus pollution index" (Palmer 1969) for July, August, and September were 13, 30, and 23, respectively. A value exceeding 20 is indicative of "high organic pollution." When the index is based on the species, the values are lower, not indicating as high of an organic enrichment. Using the indicator species concept, the relatively abundant, *Agmenellum quadruplicatum* and *Scenedesmus quadricauda*, are commonly attributed to organically enriched waters (Palmer 1962) whereas only one abundant species in Acton Lake, *Ankistrodesmus falcatus*, was classified as being a clean water type.

ZOOPLANKTON. A total of 18 species of zooplankton representing 15 genera were identified in the photic zone (table 4). Zooplankton densities were highest in August averaging 1211 organisms/l relative to 998 organisms/l in July and 455 organisms/l in September. Rotifers were the most common zooplankton averaging 87% of the species with the most abundant form being an unidentified *Epiphanes* species (fig. 3). *Epiphanes* were not observed in July water samples but dominated the zooplankton in August (mean density = 745 organisms/l) and were a major component (with *Branchionus angularis*) in September. The dominant rotifer genus was *Branchionus* represented by 3 species of which *B. angularis* and *B. quadridentatus* were the more abundant. *B. calyciflorus* was collected only in July. *B. quadridentatus* was consistently collected during all sampling periods. It dominated the zooplankton in July attaining a maximum mean density of 308 organisms/l after which it declined considerably. *B. angularis* attained maximum density in September, 160 organisms/l. Other common rotifers,

TABLE 4

Densities of zooplankton (organisms/l) in Acton Lake during July-September 1982. Values represent a mean of 8 samples for each month. ( ) = Standard Deviation.

Species	July	MONTH August	September
Diptera			
Chaoborus sp.	1		
Copepoda: Nauplii	38(13)	140(65)	38(4)
Copepoda:			
Calanoida			
Skistodiaptomus pallidus	4(3)	17(6)	4(1)
Copepoda:			
Cyclopoida			
Acanthocyclops vernalis	8(5)	13(8)	8(1)
Eucyclops speratus		1	
Cladocera			
Diaphanosoma leuchtenbergianum	9(3)	4(3)	2(1)
Daphnia catawba	1		
Daphnia parvula		2(1)	1(1)
Chydorus sphaericus			
Rotifera			
Branchionus angularis	99(12)	40(5)	160(10)
Branchionus calyciflorus	23(4)		
Branchionus quadridentatus	308(240)	46(28)	7(7)
Keratella cochlearis			
Lepadella sp.	10(8)	11(13)	
Epiphanes sp.		745(239)	159(3)
Asplanchna priodonta	37(1)	95(8)	68
Synchaeta sp.	20(13)	6(1)	
Polyarthra vulgaris	190(11)	91(52)	8(3)
Filinia longiseta	250(130)		

especially in July, were *Polyarthra vulgaris* (mean density = 190 organisms/l) and *Filinia longiseta* (mean density = 250 organisms/l).

Copepods and, to a greater extent, cladocerans were minor constituents of the Acton Lake zooplankton (fig. 3; table 4). Copepods, including nauplii, averaged 12% of the zooplankton and were most abundant in August averaging 19% of the total cell volume. The only identifiable calanoid species was *Skistodiaptomus pallidus* while the dominant cyclopoid was *Acanthocyclops vernalis.* Mean densities of these species were low relative to the nauplii regardless of the sampling period. For example, the average density of *A. vernalis* ranged from 8 to 13 organisms/l. Cladocerans, mainly *Diaphanosoma leuchtenbergianum,* comprised less than 1% of the zooplankton.

The mean diversity indices for the zooplankton varied from 1.66 (0.1) in September to 2.20 (0.5) in August. The diversity index in July averaged 1.79 (0.60). On the average 9-10 species of zooplankton were identified for an Acton Lake water sample.

DISCUSSION

There have been several studies describing the plankton and limnology of small water bodies in Ohio. The results of this study are compared to some of these; however, any comparison must be tempered with the realization that photosynthesis and plankton dynamics are highly dependent upon seasonal, physical, chemical, and biological factors.

PHYTOPLANKTON. Overall, the diversity of plankton in Acton Lake (54 genera, 100 species) was greater than the 27 genera reported for Turkeyfoot Lake (Kraatz 1941), but similar to the 117 species found in Buckeye Lake (Tressler et al. 1940). Eighty-two species of phytoplankton were identified in Acton Lake which were fewer than the 90 taxa identified for Penrod Pond (Littler and Graffius 1974) and the 100 species found in Buckeye Lake (Tressler et al. 1940). Acton Lake had more phytoplankton, however, than did Sandy Lake, 50 species (McMurray and Olive 1975) and Aurora Lake, 69 species (Marshall 1965).

The reported dominant phytoplankton in Ohio Lakes has varied as well as carbon assimilation and phytoplankton diversity. Species of Chlorophyta and Cyanophyta were the dominant summer forms in Penrod Pond, whereas the major summer species in Hodgson (Olive et al. 1968) and Aurora Lakes were from the Cyanophyta. The Euglenophyta were dominant in Sandy Lake.

The only known published study detailing the phytoplankton of Acton Lake is that by the U.S. Geological Survey and Ohio EPA (Tobin and Youger 1977). A limited biological survey of the lake was conducted on 30 April and 9 September 1975. In April 1975 the dominant phytoplankton were Chrysophytes (95% of the cell volume) with the major genera being *Cyclotella* (50%) and *Melosira* (30%). In September, the blue-green algae dominated comprising 99% of all phytoplankton with *Raphidiopsis* (58%) and *Agmenellum* (17%) being the more numerous of these forms. The predominance of the blue-green species in late summer 1975 is similar to that observed in this study although not to the same extent or for the same genera. For the 1975 spring (April) sampling period no comparison can be made.

ZOOPLANKTON. The number of summer zooplankton species found in Buckeye Lake was 17 (16 genera) relative to 18 (15 genera) in Acton Lake. Of those in Buckeye Lake, 9 species were cladocerans and 6 were rotifers. Winner and Haney (1967) found 4 species of planktonic Cladocera in Acton Lake. Two of these, *D. leuchtenbergianum* and *D. parvula,* were identified in the present study but not *Bosmina longirostris* and *Ceriodaphnia quadrangula*. Two additional species are reported here, *D. catawba* and *Chydorus sphaericus*.

WATER CHEMISTRY. The water chemistry reported here is comparable to that reported elsewhere. The pH range in the current study was 6.8-8.0 which was slightly less than that reported by Winner et al. (1962), 7.9-9.0, but almost identical to the range of 6.5-7.9 observed by Tobin and Youger (1977). Measurements of total hardness (mean = 140 mg/l $CaCO_3$) and conductivity (range = 227-502 μmhos) in the USGS-Ohio EPA study were also like those reported here. Finally, the total alkalinity in this study ranged from 110 to 141 mg/l as $CaCO_3$ which was less than that detected by Winner et al. (1962), 117-215 mg/l.

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The 1983 Paper Of The Year Award

was presented at the 93rd Annual Meeting of the OAS at Case Western Reserve University on 28 April 1984 to:

Dr. M. W. Boesel

Department of Zoology
Miami University, Oxford, OH

for his paper

"A Review of the Genus *Cricotopus* in Ohio, With a Key to Adults of Species of the Northeastern United States (Diptera, Chironomidae)"

The Ohio Journal of Science 83: 74–90.