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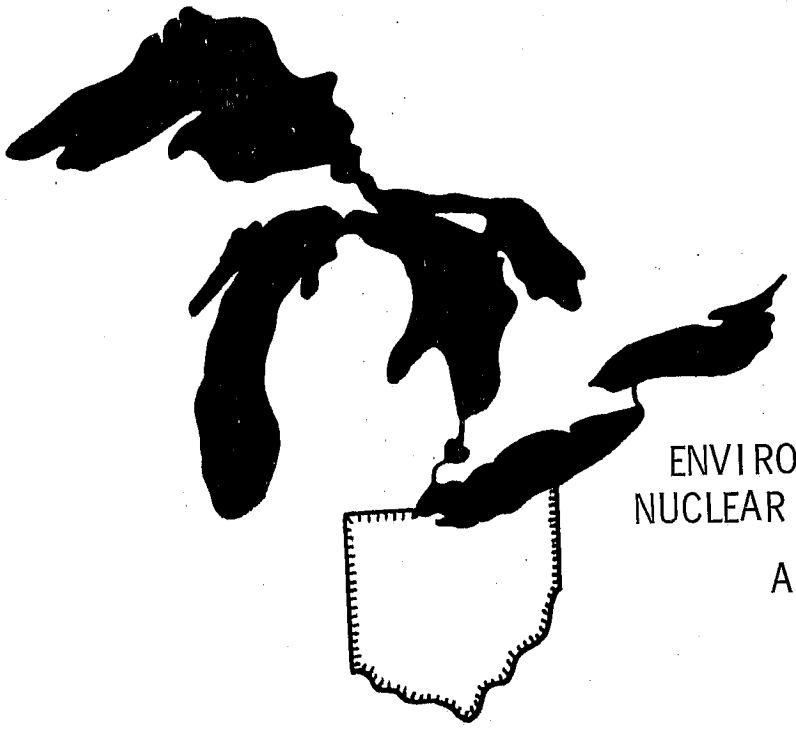

ENVIRONMENTAL EVALUATION OF A NUCLEAR POWER PLANT ON LAKE ERIE

ANNUAL REPORT - 1978
STUDY I
F-41-R-9

Prepared for

U. S. Fish and Wildlife Service
and
Ohio Department of Natural Resources
Division of Wildlife

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THE OHIO STATE UNIVERSITY
CENTER FOR LAKE ERIE AREA RESEARCH
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FEDERAL AID IN SPORT FISH RESTORATION

ANNUAL PERFORMANCE REPORT

Study 1

June 1, 1977 - June 30, 1978

PROJECT F-41-R-9

ENVIRONMENTAL EVALUATION OF A NUCLEAR POWER PLANT ON LAKE ERIE

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September 1978

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ANNUAL PERFORMANCE REPORT

STATE OF:	Ohio
PROJECT NO.:	F-41-R-9
PERIOD COVERED:	June 1, 1977 - June 30, 1978
DATE:	September 26, 1978
STUDY NO.:	1
STUDY TITLE:	Response of Fish and Invertebrates to the Heated Discharge from the Davis-Besse Reactor, Lake Erie, Ohio
PREPARED BY:	Jeffrey M. Reutter and Charles E. Herdendorf

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Lynwood A. MacLean

Center for Lake Erie Area Research
The Ohio State University

September 1978

The Ohio State University
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ENVIRONMENTAL EVALUATION OF A NUCLEAR POWER PLANT ON LAKE ERIE
Federal Aid Project F-41-R-9

PERFORMANCE REPORT

State: Ohio

Prepared by: Jeffrey M. Reutter
Charles E. Herdendorf

Study No.: 1

Date prepared: 26 September1978

Study Title: Response of Fish and Invertebrates to the Heated Discharge from the Davis-Besse Reactor, Lake Erie, Ohio

Period Covered: 1 June 1977 to 30 June 1978(1)

ABSTRACT

The Toledo Edison Company and the Cleveland Electric Illuminating Company are currently building the Davis-Besse Nuclear Power Station on the southwest shore of Lake Erie at Locust Point. This plant will utilize water from Lake Erie to replenish the cooling tower blowdown which will be returned to the lake with a maximum temperature increase of 11.1^{o}C. Phytoplankton, zooplankton, benthic macroinvertebrates, and fish populations along with the water quality and primary productivity in the vicinity of Locust Point were monitored during 1977. These results were compared to the results of previous years in an effort to develop annual trends and accurately characterize the existing aquatic environment so that changes which occur after the plant becomes operational can be measured.

(1) All work scheduled for this project segment was done as planned. The spring 1978 work will be reported in the Annual Performance Report for the next project segment.

Water quality as observed at Locust Point since 1972 was typical of that found on the south shore of western Lake Erie. Temperature and dissolved oxygen have shown typical seasonal trends for each year with only minor variations from one year to the next. Dissolved oxygen appears to have undergone more depletion in 1976 and 1977 than in previous years. Hydrogen-ion concentration and alkalinity remained fairly stable over the four-year period. Transparency, turbidity, phosphorus and conductivity values have shown radical variations over the years which were probably due to storms and dredging activities that disturbed the bottom sediments.

Phytoplankton populations in 1974 were characterized by diatoms, Melosira sp. In 1975 the diatom population was similar to 1974 but the myxophycean population, Aphanizomenon sp., increased tremendously during the summer and became the dominant algal taxon. It appeared that these differences were due to changes in the water quality. In 1975 the water warmed sooner and was less turbid and more transparent than in 1974. These conditions favor myxophycean populations. The bacillariophycean and chlorophycean components of the 1976 population were quite similar to those observed in 1974 and 1975. The 1976 myxophycean population was between the extremes of 1974 and 1975. The 1977 bacillariophycean population was the greatest observed to date, whereas myxophycean and chlorophycean were similar to previous years.

Zooplankton populations at Locust Point have been monitored monthly during ice-free periods since 1972. In general, the populations observed at Locust Point in 1974 and 1975 were higher than those observed in 1972 and 1973. Densities in 1976 were intermediate between the 2 groupings while densities from April-June 1977 were similar to those observed in 1974 and 1975 and those from the remainder of 1977 were similar to those observed in 1972 and 1973.

Benthic macroinvertebrate populations collected at Locust Point during 1977 were typical for populations along the south shore of western Lake Erie. Species composition, mainly immature oligochaetes and chironomids, was similar to that observed from 1972-1976.

Results from previous years indicated that although 47 fish species have been captured at Locust Point since 1963, only 10 species, Alosa pseudoharengus, Aplodinotus grunniens, Cyprinus carpio, Dorosoma cepedianum, Ictalurus punctatus, Morone chrysops, Notropis atherinoides, N. hudsonius, Perca flavescens, and Stizostedion v. vitreum, were of any real commercial or numerical importance. Populations of the individual species vary greatly from year to year. Although tremendous variability was also observed in the number of larvae and eggs observed from year to year, there appear to be 4 species, yellow perch, emerald shiners, walleye, and gizzard shad, which contribute significantly to the Locust Point ichthyoplankton populations.

Fish at Locust Point appear to be opportunistic feeders utilizing zooplankton populations most extensively.

Primary productivity varied directly with illumination and inversely with depth. The control station, Station 3, appeared to have lower productivity than the 3 test stations.

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PROJECT STAFF

Charles E. Herdendorf - Principal Investigator; Analysis of Water Quality and Physical Parameters

Jeffrey M. Reutter - Co-Principal Investigator; Analysis of Biological Parameters

Dolores Adair - Secretarial Services

Margarita Apanius - Statistical and Clerical Aid; Keypunching

William C. Bartholomew - Field Sampling

David L. Bean - Plankton Identification

Donald L. Breier - Field Sampling

Charles A. Bowen - Field Sampling and Ichthyoplankton identification

Walter E. Carey - Primary Productivity

C. Lawrence Cooper - Ichthyoplankton Sampling and Identification

Norma J. Darnell - Secretarial Services

Donald H. Davis - Head of Sampling Team and Ichthyoplankton Identification

James Fletcher - Plankton Identification

Laurie Fletcher - Drafting, Secretarial Services, Keypunching

Jo Ann Franks - Administrative Assistance

Richard Froelich - Identification of Benthic Macroinvertebrates

John Hansley - Statistical and Clerical Aid

Patricia B. Herdendorf - Primary Productivity

Donna Larson - Plankton Identification

Lynwood A. MacLean - Field Sampling and Identification of Fish Stomach Contents

STUDY OBJECTIVE

To be able to specify the actual effects on the aquatic biota of the Davis-Besse nuclear power plant at Locust Point, Ohio.

JOB I-a
FISH, PLANKTON, AND BENTHOS POPULATIONS PRIOR TO DISCHARGE

Objectives

To be able to specify fish, plankton, and benthos populations, natural variability in these populations, and primary productivity prior to operation of the Davis-Besse Nuclear Power Station.

Procedures

Sampling Station Location

In 1974 and 1975 field data were collected from 25 stations, 18 along 4 transects in the open lake, 2 stations in the intake canal, 2 stations in the marshes, and 3 stations along the shoreline (Figure 1). Of the 4 transects, one followed the intake conduit, one the discharge conduit, while control transects were set up on the east and west sides of the entire intake and discharge complex. Control west ran due north from the shore-end of the intake conduit with sampling stations located at 500 ft (150 m) (Station 1), 1000 ft (300 m) (Station 2), 2000 ft (610 m) (Station 3), and 3000 ft (910 m) (Station 4) from the shoreline. Sampling stations on the intake were located at 500 ft (150 m) (Station 5), 1000 ft (300 m) (Station 6), 2000 ft (610 m) (Station 7), 3000 ft (910 m) (Station 8, proposed intake), and 4000 ft (1,220 m) (Station 9) from shore. Along the discharge transect sampling stations were at distances of 500 ft (150 m) (Station 10), 1000 ft (300 m) (Station 11), 1500 ft (460 m) (Station 12, proposed diischarge), 2000 ft (610 m) (Station 13), and 3000 ft (910 m) (Station 14) from shore. Additional stations were placed 500 ft (150 m) due north of Station 12 (Station 15) and 500 ft (150 m) south of Station 12 (Station 16). Control east ran perpendicular to the shoreline, parallel to the intake, and approximately 2500 ft (760 m) east of the intake. Stations were located 500 ft (150 m) (Station 17) and 1000 ft (300 m) (Station 18) from shore. Station 19 was located in the center of the intake canal, 1000 ft (300 m) from the lake shore. Sampling at Station 20 discontinued when it was drained of all water in 1974. Stations 21 and 22 were located in the northwest and southeast marshes, respectively. Stations 23-25 were on the shoreline at the intersection of the intake conduit and 1500 ft (460 m) to either side.

In 1976 this sampling format was altered slightly to provide control stations on either side of the intake and plume area and to sample the plume area more thoroughly (Figure 2). Stations 2, 4, 5, 10, 19, and 20 were eliminated and Station 26 to 29 were added. In 1977 it was indicated that Stations 7, 11, 12, 16, and 27 could be

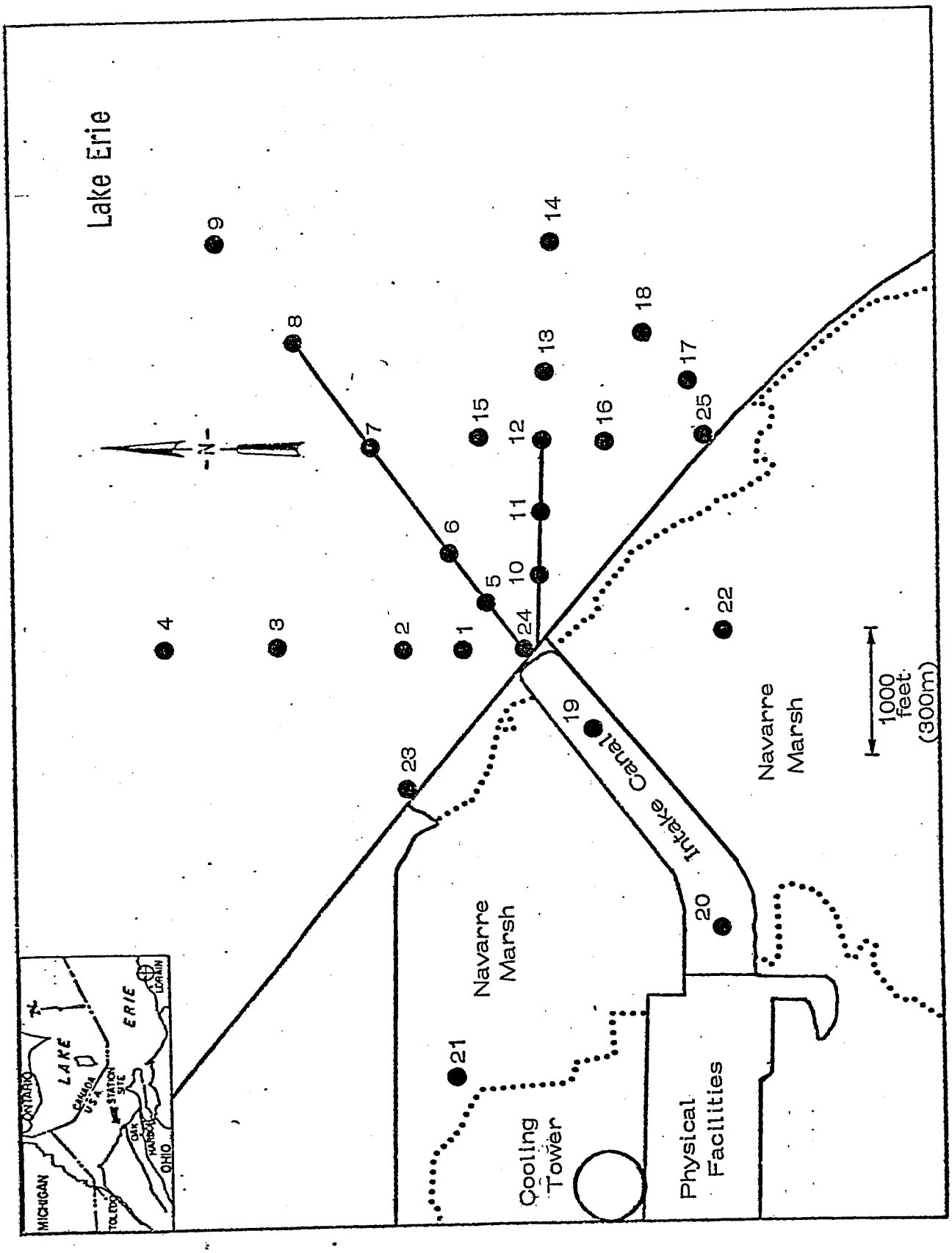


FIGURE 1. BIOLOGICAL SAMPLING STATIONS AT THE DAVIS-BESSE NUCLEAR POWER STATION PRIOR TO 1976

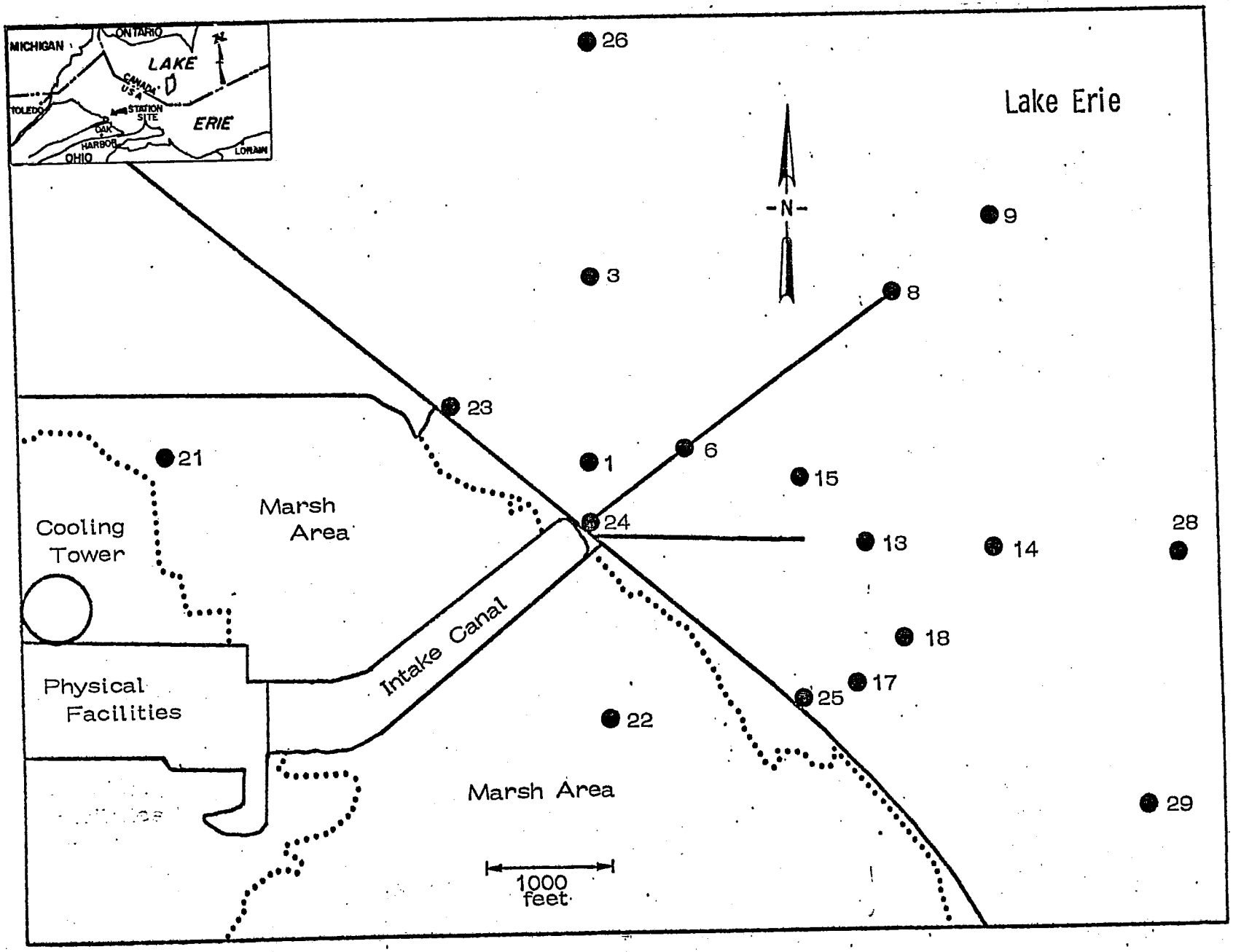


FIGURE 2

REVISED SAMPLING STATIONS AT THE DAVIS-BESSE NUCLEAR POWER STATION

eliminated without jeopardizing results. Station 26 is on the control west transect and located 3800 ft (1,170 m) from its intersection with the shoreline. Station 26 serves as a control station 3000 ft (910 m) northwest of Station 8 (intake) and the same distance offshore as Station 8 (3000 ft). Station 28 is on the discharge transect 4,500 ft (1,380 m) from its intersection with the shoreline. Station 28 also serves as a control station for Station 8 as it is 3000 ft (910 m) southeast of Station 8 and equidistant offshore. Station 29 provides a control 3000 ft (910 m) southeast of Station 13 (plume area). Station 3 is the control to the northwest of Station 13. Stations 3, 13, and 29 are approximately equidistant from shore.

Plankton

Plankton samples were collected approximately once every 30 days from April through November from 7 sampling stations in the vicinity of Locust Point (Table 1). 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.

Benthos

Benthic macroinvertebrates were collected approximately once every 60 days from April through November (Table 1). Three replicates using a Ponar dredge (Area = 0.052 m^2) were collected at Stations 1, 3, 8, 9, 13, 14, 15, 17, 18, and 26 on each date (Figure 2). Samples were sieved on the boat through a U.S. #40 soil sieve, preserved in 10% formalin and returned to the laboratory for identification and enumeration. Individuals were indentified as far as practicable (usually to genus; to species when possible). Results were reported as number of organisms per m^2 and computed by multiplying the number of each species in each replicate grab sample by 19.1.

TABLE 1

AQUATIC MONITORING PROGRAM SAMPLING DATES - 1977

SAMPLE	April	May	June	July	August	September	October	November
PLANKTON	26	24	22	13	30	12	26	22
BENTHOS	27		22		16		3	
FISH								
Gill Net	18-19	16-17	13-14	12-13	9-10	13-14	20-21	*
Shore Seine	18	16	13	12	9	13	20	*
Trawl	3	18	23	19	23	27	24	8
Fry Net	20,29	21	2,13,25	5,13,20,27	12,22	2		
WATER QUALITY	26	24	22	13	30	12	25	22
SOLAR RADIATION		12		18,28	19		11	
PRIMARY PRODUCTIVITY		12		18,28	19		11	

* Inclement weather prohibited sampling.

Fish

Adult fish populations at Locust point were sampled by 3 methods, gill nets, shore seines, and trawls, from April through November 1977 (Table 1). All fish captured were weighed, measured, and identified to species (Trautman, 1957 and Bailey et al., 1970). All results were keypunched and stored on magnetic tape at The Ohio State University Computer Center. Results were reported as catch per unit effort (CPE).

Gill Nets. Experimental gill nets were set parallel to the intake pipeline at Stations 8, 26, and 28 and parallel to the discharge pipeline at Stations 3, 13, 29 (Figure 2). Stations 3 and 26 control stations, were positioned 3000 feet northwest of Station 13 (plume area) and 8 (intake), respectively, while Stations 29 and 28 were positioned 3000 ft to the southeast. Each gill net measuring 125 ft x 6 ft and consisting of five 25-ft contiguous panels of 1/2, 3/4, 1, 1-1/2, and 2 inch bar mesh, was fished for approximately 24 continuous hours monthly (Table 1). One unit of effort consisted of one 24-hr set with one of these gill nets. The direction of travel was also recorded for fish entering these nets.

Shore Seines. Shore seining was accomplished monthly (Table 1) with a 100-ft bag seine (1/4 inch or 6 mm bar mesh) at Stations 23, 24, and 25 (Figure 2). The seine was stretched perpendicular to the shoreline until the shore brail was at the water's edge. The far brail was then dragged through a 90^{o} arc back to shore. Two hauls were made at each station. One unit of effort consisted of two hauls with the above mentioned seine.

Trawls. Four 5-minute bottom tows with a 16-ft trawl were conducted monthly (Table 1) on a transect between Stations 8 (intake) and 13 (thermal plume area) at a speed of 3-4 knots/hr. For comparative purposes similar tows were conducted on trasects between Stations 3 and 26 and Stations 28 and 29. One unit of effort consisted of four 5-minute tows. Stomachs were collected from a representative number of freshwater drum, white bass, emerald shiners, spottail shiners, and yellow perch collected from transects 3-26 and 8-13. Stomachs were also collected from walleye as few perch were captured.

Ichthyoplankton.

Duplicate ichthyoplankton (fish eggs and larvae) samples were collected from the surface and bottom of Stations 3, 26, 28, 29 (control stations), 8 (intake), and 13 (plume area) (Figure 2) using a 0.75 meter diameter heavy-duty oceanographic plankton net (No. 00, 0.75 mm mesh) equipped with a calibrated General Oceanics flow meter. Each sample consisted of a 5-minute tow at 3 to 4 knots/hr with this net. Samples were collected on 13 occasions (approximately 10-day intervals) between 20 April 1977 and 2 September 1977. Sampling was terminated after 2 September as only one sample on 22 August and none of the samples from 2 September contained ichthyoplankters. It should be noted that U.S. EPA (Grosse Ile office) terminates their Western Basin sampling on 15 July each year. Samples were preserved in 5%

formalin and returned to the laboratory for sorting and analysis. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b) and Nelson and Cole (1975). Results were reported as the number of individuals per 100 m^3 of water calculated from the volume filtered (flow meter) and the number of individuals within the sample.

Water Quality

Water quality samples were collected and related sensor measurements were made at six stations (Figure 2) in Lake Erie during the ice-free period of 1977 (April through November). The nineteen parameters measured and the analytical methods employed for these determinatiions are listed in Table 2.

Field Measurements. Water quality measurments were made monthly in the field at Stations 1, 8, and 13 (Figure 2). Temperature, dissolved oxygen and conductivity were measured from a small survey boat with submerged sensors and shipboard readout meters. Dissolved oxygen was determined with a YSI model 51 meter and conductivity with a Beckman RB3-3341 solubridge temperature-compensated meter; each meter was equipped with a thermistor for temperature readings. Sensor readings were taken 10 cm below the surface and approximately 50 cm above the bottom. Transparency was determined with a 30 cm diameter Secchi disk lowered on a marked line until it was no longer visible (Welch, 1948). Solar radiation was measured at five stations (3, 8, 13, 14, and 28) from May to October with a Kahl Scientific Instrument Corp. submarine photometer, model no. 15M2-02, at the surface and at one-half meter depth intervals. This meter measures the amount of sunlight, expressed as an electrical current, reaching various depths.

Laboratory Determinations. Surface and bottom (50 cm above) water samples were taken at Stations 1, 8, and 13 with a 3-liter Kemmerer sampler at the same time that field measurements were being made. These samples were placed in polyethylene containers and taken to the laboratory for analysis; in most cases, analyses were completed within 24 hours of the sampling time. Fifteen water quality parameters (Table 2) were determined using the procedures prescribed in Standard Methods for the Examination of Water and Wastewater, 14th Edition (American Public Health Association, 1975); "ASTM Standards, Part 23, Water" (American Society for Testing and Materials, 1973); and Water Analysis Procedures (U.S. Environmental Protection Agency, 1974).

Primary Productivity

Primary productivity was measured quarterly from April to November at Stations 3, 8, 13, and 14 (Table 1). Water samples collected from 0.5, 1.0, and 2.0 or 3.0 m (depending on the depth) at each station with a water bottle were placed in 300-ml B.O.D. bottles with a known quantity of sodium bicarbonate tagged with C^{14}. The bottles (2 light and 2 dark) were then suspended for 2 hours at the depth from

TABLE 2

ANALYTICAL METHODS FOR WATER QUALITY DETERMINATIONS

Parameter	Units	References for Analytical Methods
1. Temperature	^{o}C	APHA (1975): Sec. 212
2. Dissolved Oxygen	ppm	APHA (1975): Sec. 422B
3. Conductivity	μmhos/cm (25^{o}C)	ASTM (1975): D1125-64
4. Transparency	meters	Welch (1948): Secchi disk
5. Calcium (Ca)	mg/l	APHA (1975): Sec. 306C
6. Magnesium (Mg)	mg/l	APHA (1975): Sec. 313C
7. Sodium (Na)	mg/l	ASTM (1973): D1428-64
8. Chloride (Cl)	mg/l	APHA (1975): Sec. 408B
9. Nitrate (NO_3)	mg/l	ASTM (1973): D992-71
10. Sulfate (SO_4)	mg/l	ASTM (1973): D516-68C
11. Phosphorus (Total as P)	mg/l	APHA (1975): Sec. 425F
12. Silica (SiO_2)	mg/l	ASTM (1973): D859-68B
13. Alkalinity (Total as $CaCO_3$)	mg/l	APHA (1975): Sec. 403
14. Biochemical oxygen demand	mg/l	APHA (1975): Sec. 507
15. Suspended solids	mg/l	APHA (1975): Sec. 208D
16. Dissolved solids	mg/l	USEPA (1974)
17. Turbidity	F.T.U.	APHA (1975): Sec. 214A
18. Hydrogen-ion conc.	pH units	ASTM (1973): D1293-65
		Field Procedure
19. Solar radiation	μamps/ft candles	Kahl Scientific Instrument Corp. submarine photometer model 15M2-02

which the sample was collected. The contents of the bottles was then filtered. The radiation on the filters was counted using liquid scintillation techniques.

Findings

Plankton

Phytoplankton. Phytoplankters collected April to November 1977 were divided into 97 taxa, generally to the genus level (Table 3). Twenty-six taxa were grouped in Bacillariophyceae, 46 in Chlorophyceae, 1 in Chrysophyceae, 1 in Cryptophyceae, 3 in Dinophyceae, 2 in Euglenophyceae, 16 in Myxophyceae, and 2 in Protozoa.

Monthly mean phytoplankton populations ranged from 9,914/l in June to 224,075/l in April (Table 4). The mean density from all samples collected in 1977 was 100,922/l. Phytoplankton densities at individual sampling stations ranged from 3,176/l at Station 3 in June to 400,135/l at Station 1 in November. Population pulses were observed in the spring and the fall (Figure 3). These pulses were caused by diatoms (Figure 4).

Monthly mean bacillariophycean densities ranged from 771/l in June to 216,609/l in April (Table 3). The annual mean bacillariophycean density from all samples collected during 1977 was 77,526/l or 77 percent of the entire phytoplankton density. The dominant diatom taxa were Stephanodiscus binderanus in April, May, and October; Melosira islandica in June and July; Fragilaria spp. in August and September; and Melosira ambigua in November. Stephanodiscus binderanus had the largest annual mean population, 39,219/l. Diatoms were the dominant phytoplankton group during April, May, August, October, and November constituting 97 percent, 99 percent, 58 percent, 71 percent, and 65 percent, respectively, of the entire phytoplankton population. In contrast to this, diatoms represented only 8 percent of the June phytoplankton density. As mentioned above, large pulses were observed in the fall and spring (Figure 4).

Monthly mean chlorophycean densities ranged from 852/l in May to 27,141/l in November with an annual mean population from all samples collected during 1977 of 8,554/l or 8 percent of the total phytoplankton population (Table 3). The dominant green algae taxa were Binuclearia sp. in April and June; Pediastrum duplex in May; P. simplex in July; Mugeotia sp. in August, October, and November; and Ulothrix sp. in September. Binuclearia sp. had the largest annual mean population, 2,212/l. Chlorophyceae was the dominant phytoplankton class in June, representing 77 percent of the total phytoplankton population. However, chlorophyceans reached their greatest densities in November, 27,141/l, but constituted only 17 percent of the total phytoplankton population due to a large diatom pulse.

Chrysophyceae was a rare class represented only by Dinobryon sp. which occurred only in November, 366/l (Table 3).

TABLE 3

MONTHLY MEAN POPULATIONS* OF INDIVIDUAL PHYTOPLANKTON TAXA AT LOCUST POINT - 1977

TAXA	April 26	May 24	June 22	July 13	August 30	Sept. 12	Oct. 26	Nov. 22	Grand Mean
BACILLARIOPHYCEAE									
(Diatoms)									
Asterionella sp.	8126	0	0	12	0	0	0	0	1017
A. formosa	9198	4810	20	0	7	0	435	9919	3049
A. gracillima	0	0	0	0	38	0	0	0	5
Cyclotella sp.	3566	336	20	43	0	0	0	0	496
Cymatopleura sp.	312	10	0	4	0	2	0	0	41
Diatoma sp.	27	0	0	0	0	0	0	0	3
Fragilaria spp.	8702	14365	73	32	18187	8638	0	0	6250
F. crotenensis	8389	929	13	116	763	433	664	2941	1781
F. vaucheriae	0	0	0	0	0	0	23583	18722	5288
Gyrosigma sp.	60	0	0	0	8	3	0	0	9
Melosira sp.	0	0	0	0	34	1575	192	9	226
M. ambigua	0	0	0	0	0	0	1183	59744	7616
Melosira granulata	0	5	0	0	273	3110	349	1360	637
M. islandica	23194	48879	321	1315	984	3270	713	7578	10782
M. varians	0	10	0	0	0	0	0	0	1
Naviculoid	0	0	0	0	13	30	6	0	6
Nitzschia sp.	0	0	0	0	6	23	0	0	4
Rhizosolenia sp.	0	0	0	0	0	0	0	707	88
Stephanodiscus sp.	0	5	0	16	0	0	15	0	5
S. astrea	0	0	0	0	0	11	0	0	1
S. binderanus	150742	97042	302	5	161	1021	62517	1963	39219
Surirella sp.	99	0	0	4	7	22	0	36	21
Synedra sp.	132	36	3	4	0	0	91	35	38
Tabellaria sp.	4062	1147	19	8	0	0	0	0	655
T. fenestrata	0	0	0	0	0	0	56	2236	287
Tropidoneis sp.	0	0	0	19	0	0	0	0	2
Subtotal	216609	167574	771	1578	20481	18138	89804	105250	77526
CHLOROPHYCEAE									
(Green Algae)									
Actinastrum sp.	96	16	0	0	43	204	120	427	113
Ankistrodesmus falcatus	0	0	0	0	101	368	1559	1267	412
Binuclearia sp.	1144	63	5347	119	238	587	3895	6304	2212
Chlamydomonas sp.	0	0	0	0	6	7	0	0	2
Closterium sp.	133	91	5	28	15	9	3	0	36
C. aciculare	0	0	0	0	0	0	200	217	52
Coelastrum sp.	0	0	138	229	26	17	0	34	56
C. microporum	0	0	0	0	0	5	0	0	1
C. naegelianum	0	0	0	0	0	2	0	0	0.3
C. reticulatum	0	0	0	0	18	359	182	79	80
Coelosphaerium sp.	11	11	2	0	0	0	0	0	3
Cosmarium sp.	0	0	1	3	0	0	6	2	2
Crucigenia sp.	0	0	0	0	2	0	3	6	1
C. rectangularis	0	0	0	0	0	7	0	0	1
Dictyosphaerium sp.	0	0	4	0	6	16	6	80	14
Elaktothrix sp.	0	0	0	0	0	0	17	8	3
Errerella bornhemiensis	0	0	0	0	0	2	0	0	0.3
Eudorina sp.	5	0	2	0	0	0	0	0	1
Franceia droescheri	0	0	0	0	0	4	0	0	1
Golenkinia sp.	0	0	0	0	4	5	2	0	1
Kirchneriella sp.	0	0	0	0	7	13	37	50	13
K. lunaris	0	0	0	0	0	23	16	57	12
Lagerheimia sp.	0	0	0	0	0	2	0	9	1
Micractinium sp.	28	0	90	8	0	0	0	42	21
Microspora sp.	0	0	0	0	26	0	0	0	3
Mugeotia sp.	815	158	290	30	298	3159	8497	15892	1855

TABLE 3 (CON'T.)
MONTHLY MEAN POPULATIONS* OF INDIVIDUAL PHYTOPLANKTON TAXA AT LOCUST POINT - 1977

TAXA	April 26	May 24	June 22	July 13	August 30	Sept. 12	Oct. 26	Nov. 22	Grand Mean
Oedogonium sp.	0	0	0	0	0	0	0	54	7
Oocystis sp.	0	0	24	11	26	66	49	68	31
Pediastrum biradiatum	129	70	809	163	98	0	0	0	159
P. boryanum	0	0	0	0	2	2	39	146	24
P. duplex	162	236	763	215	197	155	945	1132	446
P. simplex	207	69	86	475	245	339	357	415	274
Scenedesmus sp.	56	0	5	0	11	5	5	0	10
S. acuminatus	0	0	0	0	2	18	52	130	25
S. denticulatus	0	0	0	0	2	7	0	5	2
S. quadricauda	37	124	27	20	22	80	140	187	80
Schroederia sp.	0	10	0	0	20	41	87	96	32
Selenastrum sp.	0	0	0	0	3	17	38	0	7
Sphaerocystis sp.	0	0	0	0	2	0	0	0	0.3
Spirogyra sp.	26	0	0	0	0	0	0	0	3
Staurastrum paradoxum	26	4	28	257	3	18	87	173	75
Tetraedron sp.	0	0	0	0	3	15	18	3	5
Tetrastrum sp.	0	0	0	0	2	10	27	19	7
Treubaria sp.	0	0	0	0	3	7	0	0	1
Ulothrix sp.	0	0	0	0	179	4465	278	239	645
Unidentified	13	0	54	5	0	0	0	0	9
Subtotal	2888	852	7675	1563	1610	10034	16665	27141	8554
CHRYSOPHYSEAE (Brown Algae)									
Dinobryon sp.	0	0	0	0	0	0	0	366	46
CRYPTOPHYCEAE (Golden-brown Algae)									
Cryptomonas erosa	0	0	0	0	27	135	692	446	163
DINOPHYCEAE (Dinoflagellates)									
Ceratium hirundinella	3478	0	550	164	42	108	6	6	544
Diplosalis acuta	0	0	0	0	0	3	0	0	0.4
Peridinium sp.	0	0	0	3	0	0	0	0	0.4
Subtotal	3478	0	550	167	42	111	6	6	545
EUGLENOPHYCEAE (Euglenas)									
Euglena sp.	0	0	0	0	0	0	0	28	4
Trachelomonas sp.	0	0	0	185	0	0	0	0	23
Subtotal	0	0	0	185	0	0	0	28	27
MYXOPHYCEAE (Blue-green Algae)									
Anabaena sp.	0	0	4	11	51	0	0	0	8
A. planctonica	0	0	0	0	10	291	29	13	43
A. spiroides	0	0	0	24	333	2285	564	454	458
Anacystis sp.	0	0	0	0	87	0	0	0	11
Aphanizomenon sp.	0	0	743	28106	8565	12645	6806	8628	8187
Aphanocapsa sp.	0	0	62	2	70	104	0	0	30
Aphanothece sp.	0	0	0	4	0	2	0	0	1
Chroococcus sp.	0	10	24	5	13	57	0	0	14
Gloeothece sp.	0	0	0	0	8	0	0	0	1
Gomphosphaeria sp.	5	11	0	0	2	0	0	0	2
Merismopedia sp.	0	0	0	0	6	55	0	10	9
Microcystis sp.	40	5	74	772	445	0	0	0	162
M. aeruginosa	0	0	0	0	131	676	84	28	115
M. incerta	0	0	0	1	242	333	3	2	73
Oscillatoria sp.	909	68	11	241	3081	3491	11303	18863	4632
Raphidiopsis sp.	0	0	0	0	4	15	840	221	135
Subtotal	954	94	918	29166	13048	19954	19629	28219	13998
PROTOZOA									
Acineta sp.	0	10	0	0	0	0	0	0	1
Saccate protozoan	147	369	0	0	0	0	0	0	65
Subtotal	147	379	0	0	0	0	0	0	66
TOTAL	224076	168899	9914	32659	35208	48372	126796	161456	100922

* Expressed an no. of whole organisms/l 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 4

MONTHLY MEAN PHYTOPLANKTON POPULATIONS*
FROM SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1977

STATION \ DATE	April 26	May 24	June 22	July 13	August 30	September 12	October 26	November 22	GRAND MEAN
1	314406	206334	20205	27636	24242	71216	62534	400135	140839
3	188717	201735	3176	30451	26614	40281	152681	149954	99201
6	302004	171276	15272	34736	19381	48313	83864	172664	105939
8	142686	124782	3598	34028	22641	36743	116363	93383	71778
13	193221	191170	9919	35046	29499	46421	136376	111081	94091
14	205610	167678	6265	33071	35838	43416	150130	80593	90325
18	221878	119267	7801	32535	88200	52222	185656	122409	103746
Grand Mean	224075	168892	9913	32658	35202	48374	126800	161460	100922

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

FIGURE 3. MONTHLY MEAN PHYTOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1974-1977

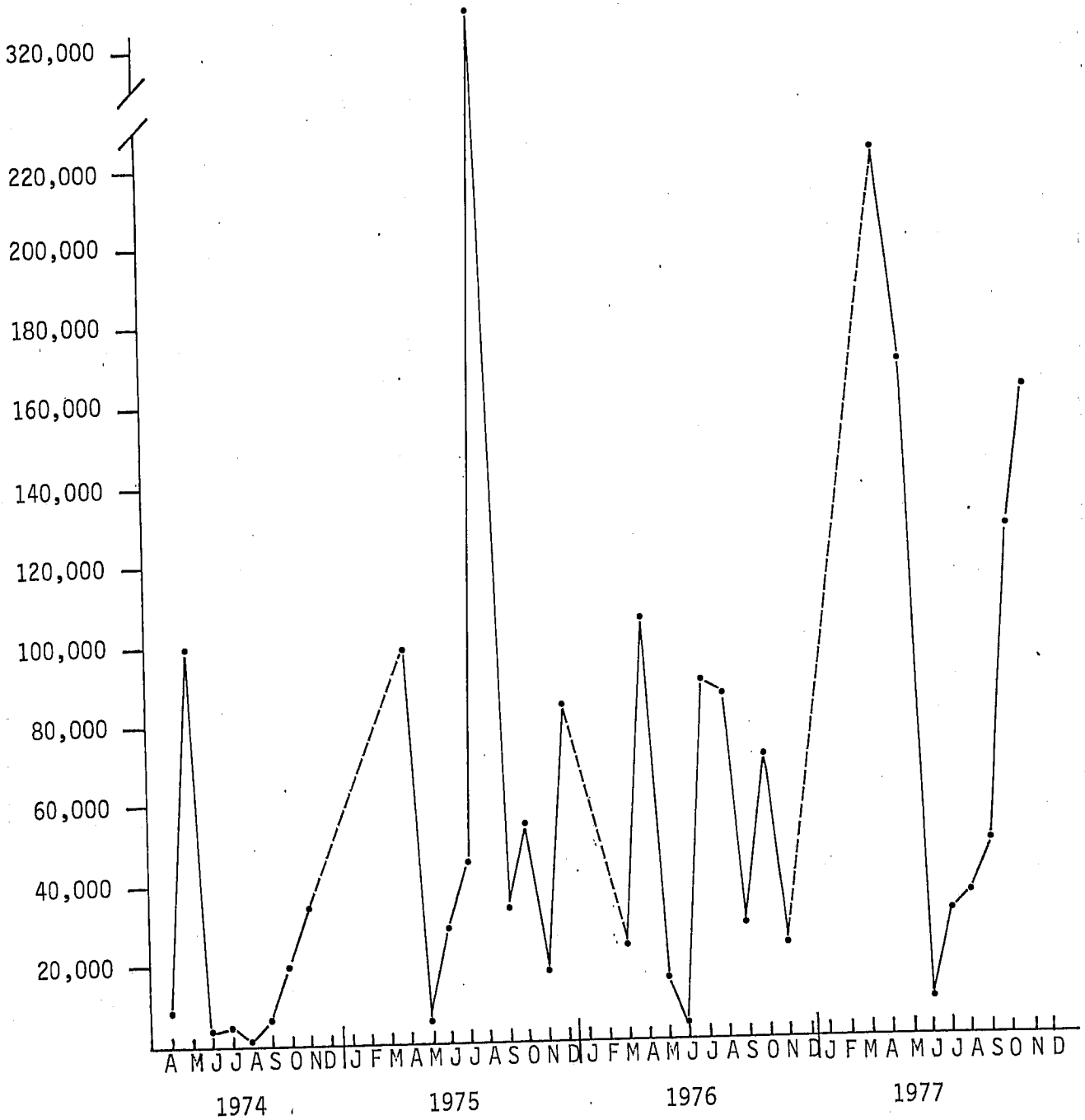
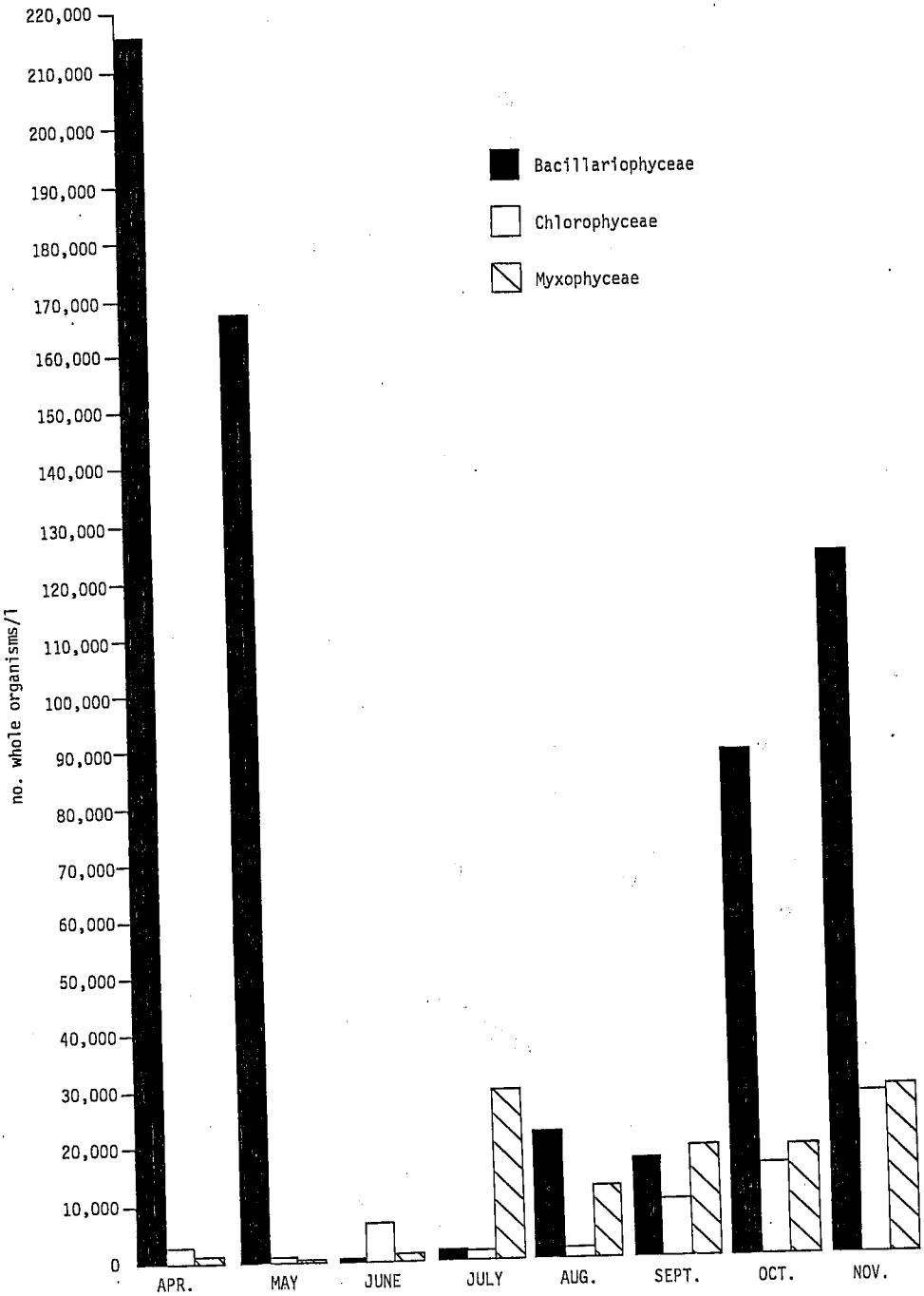


FIGURE 4

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



Cryptophyceae was another relatively rare class represented only by Cryptomonas erosa which occurred at low densities from August through November (Table 3).

Dinophyceae, grouped here with the phytoplankton, was represented by 3 taxa of which Ceratium hirundinella was the most abundant (Table 3).

Euglenophyceae was represented by Euglena sp. which occurred in November and Trachelomonas sp. which occurred in July.

Monthly mean myxophycean densities ranged from 94/l in May to 29,166/l in July with an annual mean density from all samples collected in 1977 of 13,998/l, 14 percent of the total phytoplankton mean (Table 3). The dominant myxophycean taxa were Oscillatoria sp. in April, May, October, and November and Aphanizomenon sp. from June through September. Aphanizomenon sp. exhibited the largest annual mean density, 8,187/l. Myxophyceae was the dominant algal class in July and September constituting 89 percent and 41 percent, respectively, of the total phytoplankton density. In contrast to this, myxophyceans represented only 0.05 percent of the phytoplankton population in May.

Protozoa, grouped here with the phytoplankton, was represented by only two taxa, Acineta sp. and Saccate protozoan, neither of which represented a significant portion of the total phytoplankton density (Table 3).

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.

Zooplankton. Zooplankters collected April through November 1977 were grouped in 61 taxa generally to the species level (Table 5). Thirty taxa were grouped under Rotifera, 17 under Copepoda, 11 under Cladocera, and 3 under Protozoa.

Monthly mean densities ranged from 55/l in November to 1,086/l in May. The mean density from all samples collected in 1977 was 401/l. Zooplankton densities at individual sampling stations ranged from 34/l at Station 8 in November to 1,474/l at Station 1 in May (Table 6).

Monthly mean rotifer densities ranged from 15/l in November to 362/l in April (Table 5). The annual mean rotifer density for all samples collected in 1977 was 96/l or 24 percent of the entire zooplankton density. The dominant rotifer taxa during 1977 were Synchaeta spp. in April, July, and November; Keratella cochlearis in May; Polyarthra spp. in June, September, and October; and Trichocerca multicrinis in August. Polyarthra spp. had the largest annual mean density, 29/l. Rotifera was the dominant zooplankton group during April and October composing 82 percent and 44 percent, respectively, of the entire zooplankton population. In contrast to this, rotifers constituted only 9 percent of the total zooplankton population in May.

Monthly mean copepod densities ranged from 25/l in November to 851/l in May (Table 5). The mean copepod density from all samples

TABLE 5

MONTHLY MEAN POPULATIONS* OF
INDIVIDUAL ZOOPLANKTON TAXA AT LOCUST POINT-1977

TAXA	April 26	May 24	June 22	July 13	August 30	Sept. 12	Oct. 26	Nov. 22	Grand Mean
ROTIFERA									
Anuraeopsis sp.	0.2								0.02
Ascomorpha sp.	0.4								0.04
Asplanchna priodonta	0.1	3.0	0.2		4.5	0.7	0.8		1.17
Brachionus angularis	0.1	0.3	17.2	7.6		0.2			3.18
B. calyciflorus	16.5	1.3	0.4	0.1					2.09
B. caudatus				0.1					0.01
B. havanaensis					1.9	10.5	0.1		1.62
B. urceolaris	14.0	0.2	0.1	0.2					1.62
Chromogaster ovalis	0.4			0.2					0.06
Filinia terminalis	14.8	1.1			0.1				1.81
Kellicottia longispina	0.7	4.0	0.6	0.1		0.1			0.69
Keratella cochlearis	73.9	44.5	2.2	0.8	1.2	0.3	22.4	1.2	17.76
K. quadrata	28.9	1.3	3.7	0.7	0.2	0.1	0.8	0.2	4.14
K. serrulata	3.5								0.39
Lecane luna	0.2								0.02
Lecane sp.	0.2								0.02
Lepadella palella	1.1								0.12
Monostyla sp.	0.2								0.02
Notholca acuminata	2.4	0.2							0.30
N. labis	17.1								1.91
N. squamula	5.0								0.57
N. spp.							1.2	1.3	0.32
Pleosoma sp.		0.1							0.02
Polyarthra spp.	86.5	28.4	38.9	4.4	4.6	38.8	35.3	0.9	29.36
Pompholyx sulcata				1.7		0.1	5.2	0.1	0.90
Synchaeta spp.	93.0	7.6	16.5	10.8		1.3	3.5	10.8	16.83
Trichocerca cylindrica				0.7					0.08
T. multicrinis		2.3	27.6	8.0	10.4	29.8	1.1		10.10
Unknown A	2.8								0.31
Unknown B	0.2								0.03
Subtotal	362.1	94.2	107.2	35.3	23.1	81.8	70.3	14.5	95.50
COPEPODA									
Calanoid Copepods									
Diaptomus ashlandii	1.8	1.4	0.1						0.40
D. minutus	1.3	0.8	0.2						0.27
D. oregonensis	0.5								0.06
D. sicilis		0.8							0.10
D. siciloides	0.3	3.1	1.0	5.1	7.7	2.3	4.3	1.4	3.11
Epischura lacustris	0.1								0.01
Eurytemora affinis		0.1							0.02
Limnocalanus macrurus	0.3								0.03
Skistodiaptomus oregonensis	0.5	8.4	2.8	0.8				2.0	1.88
Copepodids, calanoid	5.4	12.6	5.2	9.0	0.6	0.9	5.9	0.3	4.96
Nauplii, calanoid	6.8	89.3	0.6	0.9	5.6	2.4	7.8	0.6	14.72
Cyclopoid Copepods									
Cyclops bicuspidatus thomasi	1.0	24.2	2.7		2.4	5.1	1.3	7.2	5.71
C.b.t. (immature)	4.2	33.5	38.6	1.6	2.2	9.1	4.2	3.2	12.51
C. vernalis		13.5	12.4	13.7		0.4	0.1	0.3	5.04
C. vernalis (immature)		6.7	12.5	19.6					4.71
Copepodids, cyclopoid	21.5	656.7	155.0	11.3	31.4	26.4	35.8	9.2	123.03
Nauplii, cyclopoid	2.0				0.6			0.7	0.39
Subtotal	45.8	851.1	231.1	62.1	50.5	46.6	59.3	24.9	176.94
CLADOCERA									
Alona sp.	0.1					0.1			0.01
Bosmina longirostris	1.1	29.1	0.1				0.5	2.5	4.33
Ceriodaphnia sp.					0.1	0.1			0.02
Chydorus sphaericus	2.5	18.6	1.9	0.5	4.3	3.1	6.9	7.9	5.88
Daphnia galeata mendote	1.3	1.1	0.3	1.8		0.1		1.6	0.74
D. magna	0.2								0.03
D. pulex	0.1	0.9							0.13
D. retrocurva	3.9	65.6	52.9	74.8	5.6	7.2	0.5		26.03
Diaphanosoma leuchtenbergianum	0.1	3.7	0.3	1.5	4.7	4.6	0.1	0.1	1.89
Eubosmina coregoni	1.7	10.8	123.8	30.7	16.3	14.0	19.1	3.6	28.03
Leptodora kindtii			0.8	1.0	0.4	1.0	0.1		0.40
Subtotal	10.9	129.8	180.1	110.4	31.2	30.1	27.2	15.6	67.49
PROTOZOA									
Acineta sp.	0.1								0.01
Carchesium sp.			0.2						0.02
Difflugia sp.	20.3	10.6	226.1	98.3	39.5	92.3	1.8	0.2	61.41
Subtotal	20.4	10.6	226.3	98.3	39.5	92.3	1.8	0.2	61.44
TOTAL	439.1	1085.7	744.7	306.0	144.4	250.7	158.6	55.2	401.36

* Expressed as no./l 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 the dates indicated.

TABLE 6

MONTHLY MEAN ZOOPLANKTON POPULATIONS* FROM
SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1977

Date	April 26	May 24	June 22	July 13	August 30	Sept. 12	Oct. 26	Nov. 22	Grand Mean
Station									
1	510	1474	1066	533	85	315	268	63	539
3	323	879	783	265	223	230	112	42	357
6	330	1012	498	249	113	202	128	50	323
8	318	812	504	216	100	263	154	34	300
13	482	1421	875	**	136	249	176	80	489
14	468	929	585	222	156	288	119	67	354
18	528	1073	902	352	167	208	154	50	429
Grand Mean	439	1086	745	306	144	251	159	55	401

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

** Insufficient preservation.

collected in 1977 was 177/l or 44 percent of the entire zooplankton population. Cyclopoid copepodids dominated every month but July when immature Cyclops vernalis was the dominant group. Copepoda was the dominant zooplankton group in May, June, August, and November representing 78 percent, 31 percent, 35 percent, and 45 percent, respectively, of the total zooplankton population. The abrupt pulse in May was due primarily to immature cyclopoid forms although calanoid nauplii also increased from 7/l in April to 89/l in May.

Monthly mean cladoceran densities ranged from 11/l in April to 180/l in June (Table 5). The mean cladoceran density from all samples collected in 1977 was 67/l or 17 percent of the total zooplankton population. Cladoceran populations were dominated by Daphnia retrocurva in April, May, and July; Eubosmina coregoni in June, August, September, and October; and Chydorus sphaericus in November. Eubosmina coregoni had the largest annual mean density, 28/l. Cladocera was the dominant zooplankton group only in July when it constituted 36 percent of the total zooplankton density.

Monthly mean protozoan densities ranged from 0.2/l in November to 226/l in June (Table 5). The annual mean density of 61/l was 15 percent of the total zooplankton population. Difflugia sp. was always the dominant protozoa taxon. Protozoa was the dominant zooplanton group in September constituting 37% of the entire zooplankton population.

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.

Benthos

Benthic macroinvertebrates collected April through October 1977 were grouped in 37 taxa, generally to the genus or species level within 4 phyla (Table 7). Two taxa were in Coelenterata, 12 in Annelida, 17 in Arthropoda, and 6 in Mollusca.

Total populations ranged from 1,557/m^2 in June to 2,658/m^3 in August with a mean of 1,854/m^2 (Table 8). These populations were dominated by Annelids which made up 63.5 percent of the total benthos population and Arthropods which made up 32.7 percent of the total benthos population. Annelids dominated the total population in April, June, and October while Arthropods dominated in August. Immature oligochaetes were always the dominant Annelid taxa while Arthropoda was dominated by Cryptochironomus sp. in April, Leptodora kindtii in June and Tanytarsus sp. in August and October. Annelid populations ranged from 822/m^2 in June to 1,448/m^2 in April. Arthropod populations ranged from 145/m^2 in April to 1,583/m^2 in August. All raw data were keypunched and maintained on file at the offices of the Center for Lake Erie Area Research in Columbus, Ohio.

TABLE 7

MONTHLY MEAN POPULATIONS* OF INDIVIDUAL BENTHIC MACROINVERTEBRATE TAXA AT LOCUST POINT - 1977

TAXA	April	June	August	October	Grand Mean
COELENTERATA					
Hydra sp. (budding polyp)	0.0	117.2	4.5	28.0	37.4
Hydra sp. (single polyp)	0.0	93.0	2.6	28.7	31.0
Subtotal	0.0	210.1	7.0	56.7	68.4
ANNELIDA					
Hirudinea					
Helobdella elongata	0.6	1.3	0.6	0.6	0.8
H. stagnalis	3.2	1.3	0.6	0.0	1.3
Oligochaeta					
Immatures (hair setae)	0.6	0.0	0.0	1312.2	328.2
Immatures (no hair setae)	1289.3	711.8	939.1	14.0	738.5
Branchiura sowerbyi	5.7	1.3	4.5	1.9	3.3
Limnodrilus cervix	7.6	7.0	4.5	0.6	4.9
L. claperdeianus	0.6	0.0	0.0	0.0	0.2
L. claperdeianus-cervix	0.0	0.6	0.0	0.6	0.3
L. maumeensis	1.3	1.3	1.3	0.6	1.1
L. udekemianus	1.3	0.0	0.0	0.0	0.3
Ophidonais serpentina	103.8	69.4	107.6	8.9	72.4
Potamothrix moldaviensis	33.7	28.0	9.6	31.8	25.8
Subtotal	1447.8	821.9	1067.7	1371.4	1177.2
ARTHROPODA					
Cladocera					
Leptodora kindtii	10.2	442.5	64.9	11.5	132.3
Amphipoda					
Gammarus fasciatus	0.6	34.4	3.2	17.8	14.0
Hyalella azteca	0.6	0.0	0.0	0.0	0.2
Isopoda					
Asellus sp.	0.0	1.3	0.0	0.6	0.2
Diptera					
Chaoborus sp.	0.0	0.0	0.6	0.0	0.2
Chironomus sp.	14.0	7.6	53.5	26.1	25.3
Chironomus pupa	0.0	0.0	1.3	0.0	0.3
Cryptochironomus sp.	57.3	27.4	3.8	17.8	26.6
Cryptochironomus pupa	0.0	0.0	0.6	0.0	0.2
Glyptotendipes sp.	1.3	1.9	0.0	25.5	7.2
Polypedilum sp.	3.2	4.5	11.5	0.0	4.8
Procladuis sp.	34.4	0.0	38.2	24.2	24.2
Procladuis pupa	0.0	0.0	0.6	0.0	0.2
Tanytarsus sp.	22.3	1.3	1373.9	53.5	362.7
Tanytarsus pupa	0.0	0.0	31.2	0.0	7.8
Ephemeroptera					
Caenis sp.	0.6	0.0	0.0	0.6	0.3
Trichoptera					
Cheumatopsyche sp.	0.0	0.0	0.0	1.9	0.5
Subtotal	144.5	519.5	1583.4	179.5	606.7
MOLLUSCA					
Gastropoda					
Bithnia tentaculata	0.0	1.3	0.0	0.0	0.3
Physa sp.	0.0	0.0	0.0	1.3	0.3
Pelecypoda					
Amblema sp.	0.0	1.3	0.0	0.0	0.3
Ligumia sp.	0.0	0.6	0.0	0.0	0.2
Proptera sp.	0.0	1.3	0.0	0.0	0.3
Quadrula sp.	0.0	0.6	0.0	0.0	0.2
Subtotal	0.0	5.1	0.0	1.3	1.6
TOTAL	1592.3	1556.7	2658.1	1608.9	1854.0

TABLE 8

MONTHLY MEAN BENTHIC MACROINVERTEBRATE POPULATIONS*
FROM SAMPLING STATIONS AT LOCUST POINT LAKE ERIE - 1977

Date	April 27	June 22	August 16	October 3	Grand Mean
Station					
1	191	191	255	815	364
3	1910	1356	1477	83	1206
8	2623	1585	4164	611	2246
9	1865	3202	6679	4730	4119
13	127	1776	777	592	818
14	3642	1477	2610	4571	3075
15	478	1547	618	121	691
17	382	344	344	312	345
18	2540	2292	2865	3725	2855
26	2165	1795	6793	528	2820
Grand Mean	1592	1557	2658	1609	1854

* Data presented as number of organisms per m^2 and computed from 3 grabs with a Ponar dredge (A=0.052 m^2) at each station on the dates indicated.

Fish

Of the 47 species reported from the Locust Point vicinity since 1963, 27 were captured during 1977 including one new species, the shorthead redhorse (Moxostoma macrolepidotum) (Table 9). The 3 fishing methods combined yielded 16,571 fish of which 40.8 percent occurred in gill nets, 47.7 percent in shore seines, and 11.5 percent in trawls (Table 10). The combined results from all three methods of capture indicated that the dominant species in the Locust Point vicinity in order of abundance were gizzard shad (43.2%), emerald shiner (20.0%), yellow perch (17.4%), spottail shiner (8.3%), white bass (4.4%), alewife (1.8%), and freshwater drum (1.5%) (Tables 11 and 12). No other species constituted more than 1.0% of the catch by number.

Gill Nets. Gill nets set from April through October yielded 6,762 fish weighing 888.9Kg and representing 21 species (Table 13). Monthly catches ranged from 343 in May (CPE = 57) to 1,680 in June (CPE = 280).

Shore Seines. Shore seining in 1977 yielded 7,905 fish weighing 65.8Kg and representing 13 species (Table 14). Monthly catches ranged from 40 in June (CPE = 13.3) to 3,297 in July (CPE = 1,099). This large catch in July was due to young-of-the-year (YOY) gizzard shad (2,919--mean length 37.2 mm).

Trawls. Trawling in the Locust Point vicinity during 1977 yielded 1,904 fish representing 19 species (Table 15). Gizzard shad, spottail shiners, and white bass were the dominant species. Results of stomach analyses of fish collected in these trawls are presented in Tables 16 and 17.

Ichthyoplankton. Specimens collected during the 1977 field season represented 15 taxa, 12 to the species level and three listed as unidentified (Table 18). No eggs were collected in any of the samples. Gizzard shad, yellow perch, walleye and emerald shiners were the dominant species representing 51 percent, 29 percent, 11 percent, and 4 percent, respectively, of the total population. No other species represented as much as 1.5% of the total. Gizzard shad occurred from 21 May through 12 August and peaked on 2 June at 114.0 individuals per 100 m^3 of water. Yellow perch were present on the first sampling date, 20 April, but at the low concentration of 0.1/100 m^3. Perch remained through 2 June and peaked on 21 May at 46.7/100 m^3. Walleye occurred from 29 April through 2 June and peaked on 21 May at 35.0/100 m^3. Emerald shiners occurred from 13 June through 22 August and peaked at 6.7/100 m^3 on 27 July and at 6.0/100 m^3 on 25 June.

Station 3 exhibited the greatest larval density, 57.4/100 m^3, while, another control station (28) exhibited the lowest density 14.8/100 m^3 (Table 19). At 4 of the 6 stations, larvae were more abundant at the bottom (Table 20). However, the surface density at

TABLE 9

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1977

1972	1973	1974	1975	1976	1977	Scientific Name[1]	Common Name
						Amiidae	
*		*	*			Amia calva	bowfin
						Atherinidae	
		*	*	*	*	Labidesthes sicculus	brook silversides
						Catostomidae	
*				*	*	Carpiodes cyprinus	quillback carpsucker
*	*	*	*	*	*	Catostomus commersoni	common white sucker
		*				Minytrema melanops	spotted sucker
*						Moxostoma erythrurum	golden redhorse
					*	Moxostoma macrolepidotum	shorthead redhorse
*						Ictiobus cyprinellus	bigmouth buffalo fish
				*		Hypentelium nigricans	hog sucker
						Centrarchidae	
		*				Ambloplites rupestris	northern rockbass
	*	*	*			Lepomis cyanellus	green sunfish
		*	*			L. gibbosus	pumpkinseed sunfish
	*	*				L. humilis	orangespotted sunfish
		*	*			L. macrochirus	northern bluegill sunfish
	*					L. microlophus	redear sunfish
*	*	*				Micropterus dolomieui	smallmouth bass
	*	*				M. salmoides	largemouth bass
	*	*	*	*	*	Pomoxis annularis	white crappie
*	*	*	*	*	*	P. nigromaculatus	black crappie
						Clupeidae	
*	*	*	*	*	*	Alosa pseudoharengus	alewife
*	*	*	*	*	*	Dorosoma cepedianum	gizzard shad
						Cyprinidae	
*	*	*	*	*	*	Carassius auratus	goldfish
*	*					C. auratus x Cyprinus carpio	carp x goldfish hybrid
*	*	*	*	*	*	Cyprinus carpio	carp
	*	*	*	*	*	Hybopsis storeriana	silver chub
*	*	*	*	*	*	Notropis atherinoides	emerald shiner
*	*	*	*	*	*	N. hudsonius	spottail shiner
	*		*	*	*	N. spilopterus	spotfin shiner
	*		*			N. volucellus	mimic shiner
			*			Pimephales promelas	fathead minnow
						Esocidae	
						Esox lucius	northern pike

TABLE 9 (CON'T)

SPECIES FOUND IN THE LOCUST POINT AREA 1963 - 1977

1972	1973	1974	1975	1976	1977		Scientific Name[1]	Common Name
							Ictaluridae	
		*	*		*		Ictalurus melas	black bullhead
*	*	*					I. natalis	yellow bullhead
*	*	*	*	*	*		I. nebulosus	brown bullhead
*	*	*	*	*	*		I. punctatus	channel catfish
							Noturus flavus	stonecat madtom
							Lepisosteidae	
		*		*	*		Lepisosteus osseus	longnose gar
							Osmeridae	
*	*	*	*	*	*		Osmerus mordax	rainbow smelt
							Percidae	
			*		*		Etheostoma nigrum	johnny darter
*	*	*	*	*	*		Perca flavescens	yellow perch
	*	*	*	*	*		Percina caprodes	logperch darter
			*	*	*		Stizostedion canadense	sauger
*	*	*	*	*	*		S. v. vitreum	walleye
							Percichthyidae	
*	*	*	*	*	*		Morone chrysops	white bass
							Percopsidae	
	*	*	*	*	*		Percopsis omiscomaycus	troutperch
							Petromyzontidae	
		*					Petromyzon marinus	sea lamprey
							Salmonidae	
*		*					Oncorhynchus kisutch	coho salmon
							Sciaenidae	
*	*	*	*	*	*		Aplodinotus grunniens	freshwater drum
23	28	34	30	25	27			

[1] Bailey et al. (1970)

TABLE 10

NUMBER OF FISH COLLECTED AT LOCUST POINT FROM APRIL - NOVEMBER 1977 WITH EQUAL MONTHLY EFFORT[1] WITH EACH PIECE OF FISHING EQUIPMENT

METHOD OF CAPTURE	April		May		June		July		August		September		October		November		TOTAL	
	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species	No. of Fish	No. of Species
Gill Net[2]	704	15	353	14	1485	16	617	12	1680	12	768	11	1155	10	No Sample		6762	21
Shore Seine[3]	64	5	544	6	40	3	3297	7	305	5	642	11	3013	4	No Sample		7905	13
Trawl[4]	84	8	25	4	130	9	506	11	324	14	151	10	402	11	282	12	1904	19
TOTAL	852	16	922	16	1655	18	4420	16	2309	16	1561	17	4570	14	282	12	16571	27

1 These values represent the sum of the CPE results from all stations at which each piece of fishing equipment was used each month.

2 Six units of effort/month.

3 Three units of effort/month.

4 Three units of effort/month. Results from April and May were adjusted accordingly (Table 7).

TABLE 11

TOTAL ADULT FISH CATCH AT LOCUST POINT DURING 1977

SPECIES	No.	Mean Length (mm)	Weight (g) Mean	Weight (g) Total
Alewife	290.	98.7	10.7	3116.7
Black Bullhead	1.	203.0	146.0	146.0
Black Crappie	2.	119.5	56.5	113.0
Brook Silversides	4.	65.0	1.3	5.2
Brown Bullhead	15.	232.5	177.7	2665.0
Carp	129.	363.9	830.4	106294.6
Channel Catfish	141.	174.5	91.5	12901.5
Emerald Shiner	3322.	74.3	3.9	12955.8
Freshwater Drum	243.	174.4	108.7	26414.1
Gizzard Shad	7164.	127.2	27.4	195300.9
Goldfish	9.	294.6	468.1	4213.0
Johnny Darter	1.	31.0	1.0	1.0
Logperch Darter	6.	43.3	4.0	24.0
Longnose Gar	1.	810.0	1359.0	1359.0
Quillback Carpsucker	12.	287.0	738.7	8864.0
Rainbow Smelt	65.	125.2	16.1	1051.0
Sauger	14.	266.4	256.2	3587.0
Shorthead Redhorse	1.	345.0	396.0	396.0
Silver Chub	3.	174.0	45.7	137.0
Spotfin Shiner	5.	65.0	2.8	14.0
Spottail Shiner	1379.	103.7	11.4	15720.5
Troutperch	11.	100.4	10.3	113.3
Walleye	124.	214.3	184.6	22890.4
White Bass	731.	74.8	14.4	10526.4
White Crappie	3.	80.0	8.7	26.0
White Sucker	10.	332.0	491.5	4914.8
Yellow Perch	2883.	168.5	56.7	163466.1
TOTAL	16571.			597216.3

TABLE 12

MONTHLY CATCH OF INDIVIDUAL FISH SPECIES AT LOCUST POINT
WITH EQUAL EFFORT* USING GILL NETS, SHORE SEINES, AND TRAWLS - 1977

SPECIES \ MONTH	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.**	TOTAL
Alewife			3	27		10	250		290
Black Bullhead				1					1
Black Crappie					2				2
Brook Silversides		1				3			4
Brown Bullhead				1	13		1		15
Carp	13	9	15	36	38	11	2	5	129
Channel Catfish	23	12	5	78	10	9	2	2	141
Emerald Shiner	32	514	152	258	27	73	2251	15	3322
Freshwater Drum	45	42	15	59	36	37	6	3	243
Gizzard Shad	15	20	45	3134	1280	864	1673	133	7164
Goldfish	1			3	2	3			9
Johnny Darter					1				1
Logperch Darter	1		5						6
Longnose Gar		1							1
Quillback Carpsucker		1	1		4	1	3	2	12
Rainbow Smelt		1	10	5		1	48		65
Sauger	6	5	2	1					14
Shorthead Redhorse	1								1
Silver Chub	1	1	1						3
Spotfin Shiner				4		1			5
Spottail Shiner	314	153	315	115	89	178	164	51	1379
Troutperch	3	2	1		1		3	1	11
Walleye	34	2	28	13	33	5	1	8	124
White Bass	8		74	439	91	25	56	38	731
White Crappie			1			1		1	3
White Sucker	4	2	1		1	2			10
Yellow Perch	349	156	981	246	681	337	110	23	2883
Number of Species	16	16	18	16	16	17	14	12	27
TOTAL	852	922	1655	4420	2309	1561	4570	282	16571

* Six units of effort (gill net), 3 units of effort (shore seine), and 3 units of effort (trawl) per month.

** Gill nets and shore seines were not used in November due to inclement weather.

TABLE 13

SUMMARY OF GILL NET RESULTS AT LOCUST POINT DURING 1977 *

Date	Species	Number	Mean Length (mm)	Weight (g) Mean	Weight (g) Total
18 April 1977	Carp	8	322	385	3082
	Channel Catfish	4	334	380	1521
	Freshwater Drum	11	259	259	2848
	Gizzard Shad	5	342	453	2267
	Goldfish	1	266	283	283
	Logperch Darter	1	120	19	19
	Sauger	6	323	319	1913
	Shorthead Redhorse	1	345	396	396
	Silver Chub	1	178	46	46
	Spottail Shiner	294	115	14	3997
	Troutperch	1	137	28	28
	Walleye	32	314	322	10300
	White Bass	5	205	95	475
	White Sucker	4	287	392	1567
	Yellow Perch	330	173	56	18614
	subtotal	*704*			*47356*
16 May 1977	Carp	1	270	762	762
	Channel Catfish	4	320	456	1825
	Emerald Shiner	10	104	10	96
	Freshwater Drum	41	226	149	6094
	Gizzard Shad	6	318	341	2047
	Quillback Carpsucker	1	311	463	463
	Rainbow Smelt	1	167	18	18
	Sauger	5	274	244	1218
	Silver Chub	1	162	39	39
	Spottail Shiner	121	110	11	1342
	Troutperch	2	111	12	23
	Walleye	2	336	379	757
	White Sucker	2	315	404	807
	Yellow Perch	156	181	65	10119
	subtotal	*353*			*25610*
13 June 1977	Alewife	3	177	42	127
	Carp	15	349	590	8856
	Channel Catfish	1	191	200	200
	Emerald Shiner	137	109	8	1145
	Freshwater Drum	15	268	225	3368
	Gizzard Shad	41	332	438	17956
	Rainbow Smelt	2	168	23	46
	Sauger	2	235	186	372
	Silver Chub	1	182	52	52
	Spottail Shiner	288	117	14	3944
	Troutperch	1	112	8	8
	Walleye	4	358	413	1652
	White Bass	7	217	174	1216
	White Crappie	1	86	12	12
	White Sucker	1	436	896	896
	Yellow Perch	966	159	45	43543
	subtotal	*1485*			*83393*

* Total catch from nets set monthly at Stations 3, 8, 13, 26, 28, and 29 (6 units of effort/month).

TABLE 13 (cont'd.)

SUMMARY OF GILL NET RESULTS AT LOCUST POINT DURING 1977 *

Date	Species	Number	Mean Length (mm)	Weight (g) Mean	Weight (g) Total
12 July 1977	Brown Bullhead	1	195	94	94
	Carp	32	319	687	21971
	Channel Catfish	75	164	47	3547
	Emerald Shiner	1	90	4	4
	Freshwater Drum	57	168	91	5170
	Gizzard Shad	182	256	312	56692
	Goldfish	1	205	227	227
	Sauger	1	216	84	84
	Spottail Shiner	12	95	11	126
	Walleye	7	286	349	2443
	White Bass	13	175	85	1106
	Yellow Perch	235	151	57	13319
	subtotal	*617*			*107699*
9 August 1977	Brown Bullhead	1	266	240	240
	Carp	31	361	650	20162
	Channel catfish	2	199	91	182
	Freshwater Drum	24	186	108	2584
	Gizzard Shad	852	156	60	51047
	Goldfish	2	297	510	1020
	Quillback Carpsucker	2	234	188	375
	Spottail Shiner	41	109	12	510
	Walleye	14	270	321	4497
	White Bass	56	127	12	665
	White Sucker	1	188	78	78
	Yellow Perch	654	178	68	44546
	subtotal	*1680*			*125905*
13 September 1977	Alewife	7	99	10	69
	Carp	9	365	667	6000
	Channel Catfish	1	488	559	559
	Freshwater Drum	26	100	14	369
	Gizzard Shad	230	147	45	10291
	Goldfish	2	269	344	688
	Spottail Shiner	151	109	12	1832
	Walleye	4	247	283	1133
	White Bass	18	119	24	440
	White Sucker	2	400	783	1566
	Yellow Perch	318	172	64	20266
	subtotal	*768*			*43212*
20 October 1977	Alewife	250	105	12	2891
	Brown Bullhead	1	195	73	73
	Freshwater Drum	1	127	21	21
	Gizzard Shad	655	131	27	17628
	Quillback Carpsucker	1	141	35	35
	Rainbow Smelt	48	149	20	973
	Spottail Shiner	88	111	14	1194
	Trout perch	1	107	12	12
	White Bass	16	140	38	606
	Yellow Perch	94	169	65	6091
	subtotal	*1155*			*29524*
TOTAL		6762			888902

* Total catch from nets set monthly at Stations 3, 8, 13, 26, 28, and 29 (6 units of effort/month).

TABLE 14

RESULTS OF SHORE SEINING IN LAKE ERIE
AT LOCUST POINT DURING 1977

Date	Species	Number	Length (mm)		Weight (g)	
			Mean	Range	Mean	Total
18 April 1977	Carp	5	430.8	85.0 - 562.0	1853.4	9267.0
	Emerald Shiner	30	56.5	43.0 - 105.0	1.8	52.6
	Gizzard Shad	10	287.4	130.0 - 386.0	305.3	3053.0
	Spottail Shiner	18	85.7	69.0 - 132.0	8.1	145.7
	White Bass	1	132.0	132.0 - 132.0	24.0	24.0
	subtotal	*64*				*12542.3*
16 May 1977	Brook Silversides	1	72.0	72.0 - 72.0	2.2	2.2
	Carp	8	489.4	350.0 - 622.0	1903.0	15231.0
	Emerald Shiner	491	55.0	40.0 - 72.0	1.5	725.8
	Gizzard Shad	14	319.5	167.0 - 395.0	596.5	8351.0
	Longnose Gar	1	810.0	810.0 - 810.0	1359.0	1359.0
	Spottail Shiner	29	79.5	65.0 - 105.0	5.5	158.5
	subtotal	*544*				*25827.5*
13 June 1977	Emerald Shiner	10	65.9	41.0 - 75.0	2.6	26.0
	Gizzard Shad	4	132.8	29.0 - 184.0	44.5	178.0
	Spottail Shiner	26	97.6	79.0 - 125.0	10.0	260.0
	subtotal	*40*				*464.0*
12 July 1977	Alewife	27	35.5	29.0 - 40.0	1.0	27.0
	Carp	1	555.0	555.0 - 555.0	2725.0	2725.0
	Emerald Shiner	243	77.0	34.0 - 113.0	3.2	778.0
	Gizzard Shad	2919	37.2	26.0 - 79.0	0.5	1557.0
	Spotfin Shiner	4	63.8	59.0 - 71.0	2.8	11.0
	Spottail Shiner	46	38.8	32.0 - 49.0	0.9	41.0
	White Bass	57	52.7	26.0 - 159.0	3.3	188.0
	subtotal	*3297*				*5327.0*
9 August 1977	Channel Catfish	1	59.0	59.0 - 59.0	2.0	2.0
	Emerald Shiner	20	81.5	33.0 - 111.0	3.3	66.4
	Gizzard Shad	272	27.0	8.0 - 121.0	1.9	459.4
	Spottail Shiner	3	54.3	52.0 - 56.0	1.3	4.0
	White Bass	9	90.4	81.0 - 110.0	8.4	76.0
	subtotal	*305*				*607.8*

*Data presented as the sum of the catch per unit effort (2 seine hauls) results from stations 23,24,& 25.

TABLE 14 (CON'T)

RESULTS OF SHORE SEINING IN LAKE ERIE
AT LOCUST POINT DURING 1977

cont'd.

Date	Species	Number	Length (mm)		Weight (g)	
			Mean	Range	Mean	Total
13 September 1977	Alewife	3	43.0	40.0 - 45.0	1.0	3.0
	Brook Silversides	3	62.7	61.0 - 65.0	1.0	3.0
	Carp	1	610.0	610.0 - 610.0		
	Channel Catfish	1	71.0	71.0 - 71.0	3.0	3.0
	Emerald Shiner	73	69.3	24.0 - 101.0	3.1	223.0
	Gizzard Shad	544	73.9	20.0 - 155.0	5.9	3222.0
	Goldfish	1	320.0	320.0 - 320.0	640.0	640.0
	Spotfin Shiner	1	70.0	70.0 - 70.0	3.0	3.0
	Spottail Shiner	8	74.5	65.0 - 85.0	4.0	32.0
	White Bass	6	112.0	91.0 - 141.0	17.0	102.0
	White Crappie	1	65.0	65.0 - 65.0	3.0	3.0
	subtotal	*642*				*4276.0*
20 October 1977	Emerald Shiner	2241	65.1	42.0 - 102.0	4.2	9431.0
	Gizzard Shad	768	81.5	45.0 - 308.0	5.5	4215.0
	Quillback Carpsucker	1	562.0	562.0 - 562.0	3060.0	3060.0
	White Bass	3	117.0	91.0 - 165.0	28.0	84.0
	subtotal	*3013*				*16790.0*
	TOTAL	7905				65834.6

*Data presented as the sum of the catch per unit effort (2 seine hauls) results from stations 23,24, & 25.

TABLE 15

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm)		Coef. of	Weight (g)	
				Mean	Range	Cond. (K)	Mean	Total
3 April 1977	8 - 13 (0.25 units of effort)	Channel Catfish	3	152.7	138.0 - 168.0	0.859	31.3	94.0
		Freshwater Drum	6	174.7	166.0 - 187.0	1.073	57.3	344.0
		Troutperch	1	88.0	88.0 - 88.0	1.174	8.0	8.0
		Yellow Perch	3	181.3	173.0 - 190.0	1.293	77.3	232.0
		subtotal	*13*					*678.0*
	3 - 26 (0 eff.)	*						
	28 - 29 (1.00 units of effort)	Channel Catfish	5	160.6	142.0 - 198.0	0.882	38.0	190.0
		Emerald Shiner	1	55.0	55.0 - 55.0	0.601	1.0	1.0
		Freshwater Drum	8	171.9	116.0 - 210.0	1.100	61.6	493.0
		Spottail Shiner	1	118.0	118.0 - 118.0	0.974	16.0	16.0
		Walleye	1	220.0	220.0 - 220.0	1.033	110.0	110.0
		White Bass	1	165.0	165.0 - 165.0	1.336	60.0	60.0
		Yellow Perch	5	131.2	81.0 - 180.0	1.163	36.4	182.0
		subtotal	*22*					*1052.0*
		TOTAL	35					1730.0
18 May 1977	8 - 13 (0.75 units of effort)	Channel Catfish	1	140.0	140.0 - 140.0	0.875	24.0	24.0
		Emerald Shiner	1	95.0	95.0 - 95.0	0.700	6.0	6.0
		Spottail Shiner	1	78.0	78.0 - 78.0	0.843	4.0	4.0
		subtotal	*3*					*34.0*
	3 - 26 (0.50 units of effort)	Channel Catfish	1	166.0	166.0 - 166.0	0.918	42.0	42.0
		Emerald Shiner	6	60.7	50.0 - 70.0	0.657	1.5	9.0
		subtotal	*7*					*51.0*
	28 - 29 (1.00 units of effort)	Channel Catfish	4	240.8	168.0 - 340.0	0.903	161.5	646.0
		Emerald Shiner	3	87.7	57.0 - 109.0	0.873	6.3	19.0
		Freshwater Drum	1	265.0	265.0 - 265.0	1.290	240.0	240.0
		Spottail Shiner	1	115.0	115.0 - 115.0	1.184	18.0	18.0
		subtotal	*9*					*923.0*
		TOTAL	19					1008.0

* No sample collected due to inclement weather.

TABLE 15 (CON'T.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm)		Coef. of Cond. (K)	Weight (g)	
				Mean	Range		Mean	Total
23 June 1977	8 - 13 (1.00 units of effort)	Emerald Shiner	4	94.8	70.0 - 105.0	0.835	7.5	30.0
		Logperch Darter	1	28.0	28.0 - 28.0	4.555	1.0	1.0
		Rainbow Smelt	5	33.8	29.0 - 37.0	2.699	1.0	5.0
		Spottail Shiner	1	88.0	88.0 - 88.0	0.880	6.0	6.0
		Walleye	5	50.8	44.0 - 60.0	0.903	1.2	6.0
		White Bass	27	24.8	20.0 - 28.0	6.902	1.0	27.0
		Yellow Perch	3	129.3	33.0 - 194.0	1.770	48.3	145.0
		subtotal	*46*					*220.0*
	3 - 26 (1.00 units of effort)	Channel Catfish	3	197.7	156.0 - 280.0	1.025	105.3	316.0
		Emerald Shiner	1	107.0	107.0 - 107.0	0.816	10.0	10.0
		Logperch Darter	3	27.0	25.0 - 30.0	5.264	1.0	3.0
		Quillback Carpsucker	1	395.0	395.0 - 395.0	1.369	844.0	844.0
		Rainbow Smelt	2	36.0	35.0 - 37.0	2.153	1.0	2.0
		Walleye	14	50.1	41.0 - 64.0	0.975	1.2	17.0
		White Bass	11	24.2	20.0 - 29.0	7.747	1.0	11.0
		Yellow Perch	4	55.3	28.0 - 135.0	3.549	9.3	37.0
		subtotal	*39*					*1240.0*
	28 - 29 (1.00 units of effort)	Channel Catfish	1	166.0	166.0 - 166.0	0.962	44.0	44.0
		Logperch Darter	1	31.0	31.0 - 31.0	3.357	1.0	1.0
		Rainbow Smelt	1	33.0	33.0 - 33.0	2.783	1.0	1.0
		Walleye	5	55.8	50.0 - 65.0	0.778	1.4	7.0
		White Bass	29	30.1	22.0 -147.0	5.919	2.7	78.0
		Yellow Perch	8	45.4	29.0 - 149.0	3.249	6.1	49.0
		subtotal	*45*					*180.0*
		TOTAL	130					1640.0
19 July 1977	8 - 13 (1.00 units of effort)	Channel Catfish	3	233.3	189.0 - 310.0	1.032	165.7	497.0
		Emerald Shiner	6	94.3	71.0 - 107.0	0.759	6.8	41.0
		Gizzard Shad	13	54.8	34.0 - 66.0	1.275	2.2	28.0
		Goldfish	1	309.0	309.0 - 309.0	1.949	575.0	575.0
		Rainbow Smelt	3	43.7	39.0 - 49.0	1.265	1.0	3.0
		Spottail Shiner	34	44.6	37.0 - 59.0	1.178	1.0	35.0
		Walleye	3	107.3	103.0 - 111.0	0.964	12.0	36.0
		White Bass	202	47.1	20.0 - 77.0	2.079	2.0	408.0
		Yellow Perch	9	60.9	45.0 - 115.0	1.300	4.1	37.0
		subtotal	*274*					*1660.0*

TABLE 15(CON'T.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm) Mean	Length (mm) Range	Coef. of Cond. (K)	Weight (g) Mean	Weight (g) Total
19 July 1977 (cont'd.)	3 - 26 (1.00 units of effort)	Carp	2	359.5	270.0 - 449.0	1.125	622.5	1245.0
		Emerald Shiner	8	84.4	72.0 - 109.0	0.751	4.9	39.0
		Gizzard Shad	11	64.3	53.0 - 82.0	1.175	3.4	37.0
		Goldfish	1	420.0	420.0 - 420.0	1.053	780.0	780.0
		Rainbow Smelt	1	38.0	38.0 - 38.0	1.822	1.0	1.0
		Spottail Shiner	6	45.2	38.0 - 52.0	1.146	1.0	6.0
		Walleye	1	89.0	89.0 - 89.0	0.993	7.0	7.0
		White Bass	120	54.0	22.0 - 79.0	1.863	2.8	338.0
		Yellow Perch	1	185.0	185.0 -185.0	1.279	81.0	81.0
		subtotal	*151*					*2534.0*
	28 - 29 (1.00 units of effort)	Black Bullhead	1	203.0	203.0 - 203.0	1.745	146.0	146.0
		Carp	1	615.0	615.0 - 615.0	1.365	3175.0	3175.0
		Freshwater Drum	2	79.0	48.0 - 110.0	0.978	7.5	15.0
		Gizzard Shad	9	57.3	42.0 - 86.0	1.327	3.0	27.0
		Rainbow Smelt	1	32.0	32.0 - 32.0	3.052	1.0	1.0
		Spottail Shiner	17	43.3	30.0 - 58.0	1.395	1.0	17.0
		Walleye	2	95.0	92.0 - 98.0	0.928	8.0	16.0
		White Bass	47	44.0	23.0 - 198.0	2.733	4.2	196.0
		Yellow Perch	1	61.0	61.0 - 61.0	1.322	3.0	3.0
		subtotal	*81*					*3596.0*
		TOTAL	506					7790.0
23 August 1977	8 - 13 (1.00 units of effort)	Black Crappie	2	119.5	44.0 - 195.0	1.342	56.5	113.0
		Brown Bullhead	1	220.0	220.0 - 220.0	1.484	158.0	158.0
		Channel Catfish	4	82.3	58.0 - 135.0	1.034	7.8	31.0
		Freshwater Drum	2	108.5	92.0 - 125.0	1.077	15.0	30.0
		Gizzard Shad	67	130.4	107.0 - 284.0	1.199	29.8	1999.0
		Quillback Carpsucker	2	405.0	405.0 - 405.0	1.728	1753.0	3506.0
		Spottail Shiner	16	72.6	57.0 - 104.0	0.990	4.4	70.0
		Troutperch	1	89.0	89.0 - 89.0	0.993	7.0	7.0
		Walleye	13	152.5	137.0 - 170.0	0.930	33.8	439.0
		White Bass	16	72.6	33.0 - 134.0	1.527	7.6	121.0
		Yellow Perch	12	163.9	77.0 - 199.0	1.293	63.5	762.0
		subtotal	*136*					*7236.0*

TABLE 15(CON'T.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm) Mean	Length (mm) Range	Coef. of Cond.(K)	Weight (g) Mean	Weight (g) Total
23 August 1977 (cont'd.)	3 - 26 (1.00 units of effort)	Brown Bullhead	2	258.5	243.0 - 274.0	1.433	245.0	490.0
		Carp	3	429.7	374.0 - 505.0	1.114	888.3	2665.0
		Channel Catfish	1	58.0	58.0 - 58.0	1.025	2.0	2.0
		Emerald Shiner	5	48.6	43.0 - 59.0	0.927	1.0	5.0
		Freshwater Drum	3	64.7	59.0 - 75.0	1.028	3.0	9.0
		Gizzard Shad	17	117.7	96.0 - 160.0	1.259	21.9	372.0
		Johnny Darter	1	31.0	31.0 - 31.0	3.357	1.0	1.0
		Spottail Shiner	27	83.3	59.0 - 121.0	1.003	6.9	187.0
		Walleye	2	142.5	137.0 - 148.0	0.956	28.0	56.0
		White Bass	4	76.3	47.0 - 90.0	1.182	6.3	25.0
		Yellow Perch	7	145.0	81.0 - 211.0	1.282	52.9	370.0
		subtotal	*72*					*4182.0*
	28 - 29 (1.00 units of effort)	Brown Bullhead	9	232.7	179.0 - 278.0	1.377	178.9	1610.0
		Carp	4	388.8	245.0 - 447.0	1.287	860.0	3440.0
		Channel Catfish	2	254.5	152.0 - 357.0	0.900	236.0	472.0
		Emerald Shiner	2	58.0	58.0 - 58.0	0.513	1.0	2.0
		Freshwater Drum	7	73.9	36.0 - 186.0	1.237	12.1	85.0
		Gizzard Shad	72	127.6	101.0 - 166.0	1.144	24.6	1769.0
		Spottail Shiner	2	87.5	71.0 - 104.0	1.092	8.0	16.0
		Walleye	4	202.3	152.0 - 331.0	0.846	84.5	338.0
		White Bass	6	129.0	41.0 - 390.0	1.073	6.7	40.0
		Yellow Perch	8	161.8	78.0 - 197.0	1.295	62.5	500.0
		subtotal	*116*					*3272.0*
		TOTAL	324					14690.0
27 September1977	8 - 13 (1.00 units of effort)	Channel Catfish	1	390.0	390.0 - 390.0	1.177	698.0	698.0
		Freshwater Drum	1	335.0	335.0 - 335.0	1.176	442.0	442.0
		Gizzard Shad	43	141.3	111.0 - 191.0	1.103	32.7	1404.0
		Quillback Carpsucker	1	290.0	290.0 - 290.0	1.730	422.0	422.0
		Rainbow Smelt	1	63.0	63.0 - 63.0	0.400	1.0	1.0
		Spottail Shiner	11	105.1	75.0 - 122.0	0.983	12.3	135.0
		White Bass	1	146.0	146.0 - 146.0	1.414	44.0	44.0
		Yellow Perch	5	138.8	86.0 - 198.0	1.175	44.4	222.0
		subtotal	*64*					*3368.0*

TABLE 15 (CONT'D.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm)		Coef. of	Weight (g)	
				Mean	Range	Cond.(K)	Mean	Total
27 September 1977 (cont'd.)	3 - 26 (1.00 units of effort)	Spottail Shiner	5	63.2	31.0 - 75.0	1.389	2.8	14.0
		Yellow Perch	1	87.0	87.0 - 87.0	1.063	7.0	7.0
		subtotal	*6*					*21.0*
	28 - 29 (1.00 units of effort)	Carp	1	445.0	445.0 - 445.0	1.412	1244.0	1244.0
		Channel Catfish	6	80.7	62.0 - 105.0	1.059	5.8	35.0
		Freshwater Drum	10	101.1	84.0 - 117.0	1.111	11.9	119.0
		Gizzard Shad	47	140.9	115.0 - 192.0	1.137	31.0	1458.0
		Spottail Shiner	3	105.3	89.0 - 109.0	0.961	11.3	34.0
		Walleye	1	218.0	218.0 - 218.0	1.071	111.0	111.0
		Yellow Perch	13	143.7	80.0 - 187.0	1.220	46.3	602.0
		subtotal	*81*					*3603.0*
		TOTAL	151					6992.0
24 October 1977	8 - 13 (1.00 units of effort)	Emerald Shiner	5	72.8	62.0 - 94.0	0.677	2.8	14.0
		Freshwater Drum	1	123.0	123.0 - 123.0	1.021	19.0	19.0
		Gizzard Shad	166	134.0	92.0 -165.0	1.073	23.9	3975.0
		Quillback Carpsucker	1	173.0	173.0 - 173.0	1.294	67.0	67.0
		Spottail Shiner	22	101.6	80.0 - 131.0	0.961	11.0	241.0
		White Bass	23	146.9	108.0 - 247.0	1.441	52.1	1198.0
		Yellow Perch	6	174.7	142.0 -192.0	1.198	65.8	395.0
		subtotal	*224*					*5909.0*
	3 - 26 (1.00 units of effort)	Carp	1	392.0	392.0 - 392.0	1.177	709.0	709.0
		Channel Catfish	1	77.0	77.0 - 77.0	1.095	5.0	5.0
		Emerald Shiner	2	96.5	64.0 - 129.0	0.847	11.0	22.0
		Freshwater Drum	5	106.6	92.0 - 125.0	1.101	13.8	69.0
		Gizzard Shad	69	128.0	98.0 - 159.0	1.112	23.0	1584.0
		Spottail Shiner	29	95.7	66.0 - 115.0	1.019	9.6	279.0
		Troutperch	1	71.0	71.0 - 71.0	0.838	3.0	3.0
		Walleye	1	224.0	224.0 - 224.0	1.005	113.0	113.0
		White Bass	3	152.0	119.0 - 170.0	1.418	55.7	167.0
		Yellow Perch	4	184.8	158.0 - 207.0	1.252	82.0	328.0
		subtotal	*116*					*3279.0*

TABLE 15 (CON'T.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm)		Coef. of	Weight (g)	
				Mean	Range	Cond. (K)	Mean	Total
24 October 1977 (con't.)	28 - 29 (1.00 units of effort)	Carp	1	396.0	396.0 - 396.0	1.272	790.0	790.0
		Channel Catfish	1	275.0	275.0 - 275.0	1.519	316.0	316.0
		Emerald Shiner	3	104.7	62.0 - 163.0	0.747	12.3	37.0
		Gizzard Shad	15	135.8	73.0 - 170.0	1.110	29.5	442.0
		Spottail Shiner	24	108.3	61.0 - 135.0	1.022	14.0	336.0
		Troutperch	1	92.0	92.0 - 92.0	1.027	8.0	8.0
		White Bass	11	152.6	110.0 - 183.0	1.509	58.9	648.0
		Yellow Perch	6	174.7	115.0 - 195.0	1.240	71.3	428.0
		subtotal	*62*					*3005.0*
		TOTAL	402					12193.0
8 November 1977	8 - 13 (1.00 units of effort)	Carp	3	420.0	319.0 - 480.0	1.685	1354.7	4064.0
		Freshwater Drum	1	352.0	352.0 - 352.0	1.032	450.0	450.0
		Gizzard Shad	24	136.5	118.0 - 175.0	1.120	29.0	697.0
		Spottail Shiner	24	108.3	65.0 - 132.0	1.007	13.8	332.0
		Walleye	2	205.5	179.0 - 232.0	0.945	85.0	170.0
		White Bass	10	163.7	149.0 - 188.0	1.475	66.0	660.0
		White Crappie	1	89.0	89.0 - 89.0	1.560	11.0	11.0
		Yellow Perch	7	190.4	166.0 - 216.0	1.245	88.9	622.0
		subtotal	*72*					*7006.0*
	3 - 26 (1.00 units of effort)	Carp	2	301.0	240.0 - 362.0	1.589	453.5	907.0
		Channel Catfish	1	62.0	62.0 - 62.0	1.259	3.0	3.0
		Emerald Shiner	3	64.7	56.0 - 72.0	0.690	2.0	6.0
		Freshwater Drum	2	324.5	288.0 - 361.0	1.319	450.5	901.0
		Gizzard Shad	23	124.2	92.0 - 161.0	1.064	21.0	484.0
		Quillback Carpsucker	1	145.0	145.0 - 145.0	1.443	44.0	44.0
		Spottail Shiner	10	105.3	80.0 - 125.0	0.990	12.5	125.0
		Troutperch	1	75.0	75.0 - 75.0	0.948	4.0	4.0
		Walleye	5	216.8	204.0 - 225.0	0.925	94.8	474.0
		White Bass	10	157.1	142.0 - 177.0	1.490	59.6	596.0
		Yellow Perch	12	186.3	134.0 - 248.0	1.223	86.3	1035.0
		subtotal	*70*					*4579.0*

TABLE 15(CONT'D.)

RESULTS OF TRAWLING IN LAKE ERIE AT LOCUST POINT DURING 1977

Date	Transect	Species	Number	Length (mm)		Coef. of Cond. (K)	Weight (g)	
				Mean	Range		Mean	Total
8 November 1977 (cont'd.)	28 - 29 (1.00 units of effort)	Channel Catfish	1	76.0	76.0 - 76.0	0.911	4.0	4.0
		Emerald Shiner	12	71.9	55.0 - 93.0	0.693	2.8	34.0
		Gizzard Shad	86	131.1	110.0 - 170.0	1.077	24.0	2062.0
		Quillback Carpsucker	1	150.0	150.0 - 150.0	1.422	48.0	48.0
		Spottail Shiner	17	102.6	82.0 - 118.0	0.934	10.6	180.0
		Walleye	1	210.0	210.0 - 210.0	0.950	88.0	88.0
		White Bass	18	150.6	118.0 - 178.0	1.490	52.4	944.0
		Yellow Perch	4	166.3	78.0 - 225.0	1.191	73.3	293.0
		subtotal	*140*					*3653.0*
		TOTAL	282					15238.0
		GRAND TOTAL	1849					61281.0

TABLE 16

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*

APRIL- NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS I																		
				Mean	Range	Turbellaria	Oligochaeta	Cladocera	Alona sp.	Chydorus sphaericus	Daphnia sp.	D. galeata	D.g./retrocurva	D. retrocurva	Diaphanosoma sp.	Eubosmina coregoni	Leptodora kindtii	Copepoda	Calanoid	Cyclopoid	Ostracoda	Gammarus sp.	Decapoda
April	Aplodinotus grunniens	6	0	175	166-187																		
	Perca flavescens	3	0	181	173-190																		
	Subtotal	9	0										10	35		2	1				3		
May	Notropis atherinoides	1	100	95	-								43	135		5							
	N. hudsonius	1	100	78	-																		
	Subtotal	2	100									5		670		49	1				4		
June	Notropis atherinoides	4	100	95	70-105						80	2		210		62							
	N. hudsonius	1	100	88	-							1		211		0.5	2				0.4		
	Perca flavescens	2	100	178	161-194									9			4						
	Stizostedion v. vitreum	5	100	51	44-60															5			
	Subtotal	12	100								60	49		157		5	3						
July	Notropis atherinoides	6	100	94	71-107						21	50		202		1	1						
	Perca flavescens	1	100	115	-																		
	Stizostedion v. vitreum	3	100	107	103-111																		
	Subtotal	10	100											2		1	12			6			
August	Aplodinotus grunniens	2	100	109	92-125				1					9	6	1	105			11	2	0.3	
	Morone chrysops	2	100	114	94-134									1		4	1			45			
	Notropis hudsonius	3	100	101	97-104	0.3				1		1		1	0.2	1	0.4						
	Perca flavescens	5	80	176	162-199																		
	Stizostedion v. vitreum	5	80	155	137-170																		
	Subtotal	17	88																				

TABLE 16 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS, II																	
				Mean	Range	Hydracarina	Insecta (larvae)	Diptera	Chironomidae	Chironomus sp.	Cryptochironomus sp.	Procladius sp.	Rheotanytarsus sp.	Insecta (pupae)	Chironomidae	Insecta (adult)	Diptera	Chironomidae	Coleoptera	Hymenoptera	Fish	Alosa pseudoharengus	Aplodinotus grunniens
April	Aplodinotus grunniens	6	0	175	166-187																		
	Perca flavescens	3	0	181	173-190																		
	Subtotal	9	0																				
May	Notropis atherinoides	1	100	95	-																		
	N. hudsonius	1	100	78	-																		
	Subtotal	2	100																				
June	Notropis atherinoides	4	100	95	70-105																		
	N. hudsonius	1	100	88	-																		
	Perca flavescens	2	100	178	161-194															0.4			
	Stizostedion v. vitreum	5	100	51	44-60																		
	Subtotal	12	100																				
July	Notropis atherinoides	6	100	94	71-107																		
	Perca flavescens	1	100	115	-															1			
	Stizostedion v. vitreum	3	100	107	103-111																		
	Subtotal	10	100																				
August	Aplodinotus grunniens	2	100	109	92-125						1		1							1			
	Morone chrysops	2	100	114	94-134								1			0.3							
	Notropis hudsonius	3	100	101	97-104	2							0.2										0.2
	Perca flavescens	5	80	176	162-199						0.2									1	0.2		
	Stizostedion v. vitreum	5	80	155	137-170																		
	Subtotal	17	88																				

TABLE 16 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT

WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*

APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS I																		
				Mean	Range	Turbellaria	Oligochaeta	Cladocera	Alona sp.	Chydorus sphaericus	Daphnia sp.	D. galeata	D.g./retrocurva	D. retrocurva	Diaphanosoma sp.	Eubosmina coregoni	Leptodora kindtii	Copepoda	Calanoid	Cyclopoid	Ostracoda	Gammarus sp.	Decapoda
September	Aplodinotus grunniens	1	0	335	-																			
	Morone chrysops	1	100	146	-					0.4				0.2		1				7	4		
	Notropis hudsonius	5	100	108	84-122												0.3			8			
	Perca flavescens	4	50	54	8-103																		
	Subtotal	11	73																				
October	Aplodinotus grunniens	1	100	123	-																		
	Morone chrysops	5	100	169	117-247									7		37	1			2			
	Notropis atherinoides	2	100	84	74-94				36					2						118			0.2
	N. hudsonius	4	100	97	80-112													4					
	Perca flavescens	6	50	175	142-192																		
	Subtotal	18	83																				
November	Aplodinotus grunniens	1	100	352	-																		
	Morone chrysops	4	100	170	149-188											16	1	43	50	5			
	Notropis hudsonius	4	100	102	88-125		1			10						0.3							
	Perca flavescens	4	75	193	166-216					1													
	Stizostedion v. vitreum	2	100	206	179-232																		
	Subtotal	15	93																				
	TOTAL	94	90																				

TABLE 16 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*

APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS III									
				Mean	Range	Dorosoma cepedianum	Morone chrysops	Notropis sp.	N. atherinoides	Animal debris **	Plant debris **				
April	Aplodinotus grunniens	6	0	175	166-187										
	Perca flavescens	3	0	181	173-190										
	Subtotal	9	0												
May	Notropis atherinoides	1	100	95	-					X					
	N. hudsonius	1	100	78	-					X					
	Subtotal	2	100												
June	Notropis atherinoides	4	100	95	70-105					X					
	N. hudsonius	1	100	88	-					X					
	Perca flavescens	2	100	178	161-194					X					
	Stizostedion v. vitreum	5	100	51	44-60					X					
	Subtotal	12	100												
July	Notropis atherinoides	6	100	94	71-107					X					
	Perca flavescens	1	100	115	-					X					
	Stizostedion v. vitreum	3	100	107	103-111	0.3	0.3								
	Subtotal	10	100												
August	Aplodinotus grunniens	2	100	109	92-125					X					
	Morone chrysops	2	100	114	94-134	1				X					
	Notropis hudsonius	3	100	101	97-104					X	X				
	Perca flavescens	5	80	176	162-199					X	X				
	Stizostedion v. vitreum	5	80	155	137-170	1		0.2	0.2						
	Subtotal	17	88												

* Data presented as mean number of food items per fish.
** "X" indicates the presence of a food item.

TABLE 16 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS II																	
				Mean	Range	Hydracarina	Insecta (larvae)	Diptera	Chironomidae	Chironomus sp.	Cryptochironomus sp.	Procladius sp.	Rheotanytarsus sp.	Insecta (pupae)	Chironomidae	Insecta (adult)	Diptera	Chironomidae	Coleoptera	Hymenoptera	Fish	Alosa pseudoharengus	Aplodinotus grunniens
September	Aplodinotus grunniens	1	0	335	-				1														
	Morone chrysops	1	100	146	-				0.2		0.4				0.2	0.2							0.3
	N. hudsonius	5	100	108	84-122	2							1										
	Perca flavescens	4	50	54	8-103																		
	Subtotal	11	73																				
October	Aplodinotus grunniens	1	100	123	-					47	3	1								0.2			
	Morone chrysops	5	100	169	117-247																		
	Notropis atherinoides	2	100	84	74-94																		
	N. hudsonius	4	100	97	80-112		0.3			.2		0.3					0.3		0.3	1	0.2		
	Perca flavescens	6	50	175	142-192																		
	Subtotal	18	83																		2		
November	Aplodinotus grunniens	1	100	352	-																		
	Morone chrysops	4	100	170	149-188											1	0.3		1		0.3		
	Notropis hudsonius	4	100	102	88-125					0.3	0.3										1		
	Perca flavescens	4	75	193	166-216																		
	Stizostedion v. vitreum	2	100	206	179-232																		
	Subtotal	15	93																				
	TOTAL	94	90																				

TABLE 16 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 8 AND 13*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS III								
				Mean	Range	Dorosoma cepedianum	Morone chrysops	Notropis sp.	N. atherinoides	Animal debris **	Plant debris **			
September	Aplodinotus grunniens	1	0	335	-									
	Morone chrysops	1	100	146	-					X	X			
	Notropis hudsonius	5	100	108	84-122					X	X			
	Perca flavescens	4	50	54	81-103									
	Subtotal	11	73											
October	Aplodinotus grunniens	1	100	123	-									
	Morone chrysops	5	100	169	117-247	0.2			2					
	Notropis atherinoides	2	100	84	74-94					X				
	N. hudsonius	4	100	97	80-112					X	X			
	Perca flavescens	6	50	175	142-192				0.3					
	Subtotal	18	83											
November	Aplodinotus grunniens	1	100	352	-				6					
	Morone chrysops	4	100	170	149-188				4					
	Notropis hudsonius	4	100	102	88-125					X				
	Perca flavescens	4	75	193	166-216									
	Stizostedion v. vitreum	2	100	206	179-232				3					
	Subtotal	15	93											
	TOTAL	94	90											

* Data presented as mean number of food items per fish.
** "X" indicates the presence of a food item.

TABLE 17

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS 1																	
				Mean	Range	Rotifera	Oligochaeta	Cladocera	Alona sp.	Chydorus sphaericus	Daphnia galeata	D. retrocurva	Diaphanosoma sp.	Eubosmina coregoni	Ilyocryptus sp.	Latona setifera	Leptodora Kindtii	Copepoda	Calanoid	Cyclopoid	Argulus sp.	Ostracoda	Gammarus sp.
May 18	Notropis atherinoides	4	100	60	50-70	0.3				56				8				0.3					
June 23	Notropis atherinoides	1	100	107	-						3	2		2			3		1	1			
	Perca flavescens	1	100	135	-							305					3			1			
	Stizostedion v. vitreum	4	100	52	41-64						1	12		0.3			1			1			
	Subtotal	6	100																				
July 19	Morone chrysops	6	100	50	22-77						92	162		1			23		3	20	0.2		
	Notropis atherinoides	4	100	92	72-109					1	80	116		6			3	1	1	6			
	N. hudsonius	2	100	45	38-52			3			31	28		2									
	Perca flavescens	1	100	185	-						47	173	1				15						
	Stizostedion v. vitreum	1	100	89	-												1						
	Subtotal	14	100																				
August 23	Aplodinotus grunniens	3	100	65	59-75		1				0.3	38		0.3		3		1	1	69			
	Morone chrysops	4	100	76	47-90					80		71		2			90	1	1	4			
	Notropis atherinoides	2	100	51	43-59					8		9		170		0.3	1			5			
	N. hudsonius	4	100	87	59-121									27			2		0.2	35		0.3	
	Perca flavescens	5	80	155	81-211									1						24			
	Stizostedion v. vitreum	2	100	143	137-148																		
	Subtotal	20	95																				
September 27	Notropis hudsonius	4	100	71	68-75					1		0.3		5	1					24		0.3	
	Perca flavescens	1	100	87	-					2				5			3			77			
	Subtotal	5	100																				

TABLE 17 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS II																	
				Mean	Range	Hydracarina	Insecta (larvae)	Chironomidae	Chironomus sp.	Coelotanypus sp.	Cryptochironomus sp.	Polypedilum sp.	Procladius sp.	Rheotanytarsus sp.	Xenochironomus sp.	Trichoptera	Insecta (pupae)	Chironomidae	Insecta (adult)	Chironomidae	Gastropoda	Fish	Aplodinotus grunniens
May 18	Notropis atherinoides	4	100	60	50-70													1	1		1	
June 23	Notropis atherinoides	1	100	107	-																1	
	Perca flavescens	1	100	135	-																1	
	Stizostedion v. vitreum	4	100	52	41-64																	
	Subtotal	6	100																			
July 19	Morone chrysops	6	100	50	22-77																	
	Notropis atherinoides	4	100	92	72-109																	
	N. hudsonius	2	100	45	38-52																1	
	Perca flavescens	1	100	185	-																	
	Stizostedion v. vitreum	1	100	89	-																	
	Subtotal	14	100														1					
August 23	Aplodinotus grunniens	3	100	65	59-75				1	0.3		0.3	1	4								
	Morone chrysops	4	100	76	47-90																	
	Notropis atherinoides	2	100	51	43-59																	
	N. hudsonius	4	100	87	59-121	0.3		1		1		1	1	0.3	0.2						0.2	0.2
	Perca flavescens	5	80	155	81-211	0.2		1													1	
	Stizostedion v. vitreum	2	100	143	137-148																	
	Subtotal	20	95																			
September 27	Notropis hudsonius	4	100	71	68-75	2		0.3	3	0.3			0.3	2			1	1				
	Perca flavescens	1	100	87	-	2		1	1													
	Subtotal	5	100																			

TABLE 17 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS III								
				Mean	Range	Notropis atherinoides	N. hudsonius	Animal debris**	Plant debris**					
May 18	Notropis atherinoides	4	100	60	50-70			X						
June 23	Notropis atherinoides	1	100	107	-			X						
	Perca flavescens	1	100	135	-									
	Stizostedion v. vitreum	4	100	52	41-64									
	Subtotal	6	100											
July 19	Morone chrysops	6	100	50	22-77			X						
	Notropis atherinoides	4	100	92	72-109			X	X					
	N. hudsonius	2	100	45	38-52			X						
	Perca flavescens	1	100	185	-			X						
	Stizostedion v. vitreum	1	100	89	-									
	Subtotal	14	100											
August 23	Aplodinotus grunniens	3	100	65	59-75			X						
	Morone chrysops	4	100	76	47-90			X						
	Notropis atherinoides	2	100	51	43-59			X	X					
	N. hudsonius	4	100	87	59-121			X	X					
	Perca flavescens	5	80	155	81-211									
	Stizostedion v. vitreum	2	100	143	137-148	1								
	Subtotal	20	95											
September 27	Notropis hudsonius	4	100	71	68-75			X	X					
	Perca flavescens	1	100	87	-				X					
	Subtotal	5	100											

* Data presented as mean number of food items per fish.

** "X" indicates the presence of a food item.

TABLE 17 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS I																	
				Mean	Range	Rotifera	Oligochaeta	Cladocera	Alona sp.	Chydorus sphaericus	Daphnia galeata	D. retrocurva	Diaphanosoma sp.	Eubosmina coregoni	Ilyocryptus sp.	Latona setifera	Leptodora kindtii	Copepoda	Calanoid	Cyclopoid	Argulus sp.	Ostracoda	Gammarus sp.
October 24	Aplodinotus grunniens	4	100	108	92-125							9		0.3		0.3	1		15	50			4
	Morone chrysops	3	67	152	119-170					140				110			.	5					
	Notropis athernoides	1	100	64	-		1		0.3	2		1		2			0.3	0.3	1	171			
	N. hudsonius	4	100	96	66-129																		
	Perca flavescens	4	75	185	158-207																		
	Stizostedion v. vitreum	1	100	224	-																		
	Subtotal	17	88																				
November 8	Aplodinotus grunniens	2	100	320	288-351																		
	Morone chrysops	4	100	158	142-177					16				35		1	9	5	7				
	Notropis atherinoides	3	100	65	56-72		0.3			1				6			30	7	9				
	N. hudsonius	4	75	105	80-125																		
	Perca flavescens	8	75	188	134-248																		
	Stizostedion v. vitreum	4	100	215	204-225																		
	Subtotal	25	88																				
	TOTAL	91	93																				

TABLE 17 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS II																	
				Mean	Range	Hydracarina	Insecta (larvae)	Chironomidae	Chironomus sp.	Coelotanypus sp.	Cryptochironomus sp.	Polypedilum sp.	Procladius sp.	Rheotanytarsus sp.	Xenochironomus sp.	Trichoptera	Insecta (pupae)	Chironomidae	Insecta (adult)	Chironomidae	Gastropoda	Fish	Aplodinotus grunniens
October 24	Aplodinotus grunniens	4	100	108	92-125				1	1	1		0.3	0.3	0.3	0.3		0.3					
	Morone chrysops	3	67	152	119-170																		
	Notropis atherinoides	1	100	64	-																	0.3	
	N. hudsonius	4	100	96	66-129	0.3		2	4		0.3											0.3	
	Perca flavescens	4	75	185	158-207			1			1											1	
	Stizostedion v. vitreum	1	100	224	-																		
	Subtotal	17	88																			1	
November 8	Aplodinotus grunniens	2	100	320	288-351																		
	Morone chrysops	4	100	158	142-177																		
	Notropis atherinoides	3	100	65	56-72																		
	N. hudsonius	4	75	105	80-125																0.1	0.3	
	Perca flavescens	8	75	188	134-248																	1	
	Stizostedion v. vitreum	4	100	215	204-225																		
	Subtotal	25	88																				
	TOTAL	91	93																				

TABLE 17 (CON'T.)

SUMMARY OF FOOD HABITS OF FISH COLLECTED AT LOCUST POINT
WITH A 16-FT TRAWL BETWEEN STATIONS 3 AND 26*
APRIL - NOVEMBER 1977

DATE	SPECIES	No. Captured	% Containing Food	Length (mm)		FOOD ITEMS III									
				Mean	Range	Notropis atherinoides	N. hudsonius	Animal debris **	Plant debris **						
October 24	Aplodinotus grunniens	4	100	108	92-125		1	X							
	Morone chrysops	3	67	152	119-170	2									
	Notropis atherinoides	1	100	64	-										
	N. hudsonius	4	100	96	66-129			X							
	Perca flavescens	4	75	185	158-207	0.3									
	Stizostedion v. vitreum	1	100	224	-	6									
	Subtotal	17	88												
November 8	Aplodinotus grunniens	2	100	320	288-351	10									
	Morone chrysops	4	100	158	142-177	3									
	Notropis atherinoides	3	100	65	56-72										
	N. hudsonius	4	75	105	80-125			X							
	Perca flavescens	8	75	188	134-248	0.4		X							
	Stizostedion v. vitreum	4	100	215	204-225	3									
	Subtotal	25	88												
	TOTAL	91	93												

* Data presented as mean number of food items per fish.

** "X" indicates the presence of a food item.

TABLE 18

MEAN ICHTHYOPLANKTON CONCENTRATION*
AT LOCUST POINT, LAKE ERIE - 1977

SPECIES \ DATE	April 20	April 29	May 21	June 2	June 13	June 25	July 5	July 13	July 20	July 27	Aug. 12	Aug. 22	Sept. 2	MEAN
Carp	0.0	0.1	0.1	1.3	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Emerald Shiner	0.0	0.0	0.0	0.0	0.8	6.0	0.0	0.1	0.0	6.7	0.2	0.2	0.0	1.1
Freshwater Drum	0.0	0.0	0.0	2.9	0.1	1.1	0.3	1.4	0.2	0.0	0.0	0.0	0.0	0.5
Gizzard Shad	0.0	0.0	1.2	114.0	33.5	16.9	0.7	13.2	0.5	0.1	0.2	0.0	0.0	13.9
Logperch Darter	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.03
Rainbow Smelt	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.02
Sauger	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Spottail Shiner	0.0	0.0	1.4	0.2	0.0	0.1	0.4	0.0	0.0	0.2	0.04	0.0	0.0	0.2
Unidentified	0.0	0.03	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
Unidentified Crappie	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Unidentified Percid	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03
Walleye	0.0	4.3	35.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
White Bass	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02
White Sucker	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01
Yellow Perch	0.1	41.8	46.7	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
TOTAL	0.1	50.8	84.4	134.9	34.6	24.6	1.7	14.7	0.7	7.0	0.7	0.2	0.0	27.3

* Data presented as number of larvae per 100 m^3 of water and computed from 2 surface and 2 bottom tows at each of 6 sampling stations (3, 8, 13, 26, 28, 29) at Locust Point.

TABLE 19

ICHTHYOPLANKTON CONCENTRATIONS* AT SAMPLING STATIONS
AT LOCUST POINT, LAKE ERIE - 1977

SPECIES \ STATION	3	8	13	26	28	29	MEAN
April 20	0.3	**	0.0	**	**	0.0	0.1
April 29	10.1	55.7	67.8	54.5	34.4	82.2	50.8
May 21	230.4	4.9	169.7	45.9	7.4	48.4	84.4
June 2	396.6	52.1	**	59.9	31.0	**	134.9
June 13	52.8	79.1	17.3	12.3	39.2	7.0	34.6
July 5	0.0	4.1	5.6	0.4	0.0	0.0	1.7
June 25	19.3	24.6	19.9	7.4	46.6	30.1	24.6
July 13	25.7	5.4	18.8	16.0	11.2	10.8	14.7
July 20	0.7	0.7	0.9	0.7	0.3	1.0	0.7
July 27	8.6	9.4	2.9	7.1	7.1	7.2	7.0
August 12	0.8	0.0	1.0	0.5	0.5	2.3	0.7
August 22	0.6	0.0	0.0	0.6	0.0	0.0	0.2
September 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN	57.4	21.3	25.3	17.1	14.8	15.8	25.3

* Mean number per 100 m^3 of water computed from 2 surface and 2 bottom tows at each station.

** Poor weather conditions precluded sampling at this station.

TABLE 20

ICHTHYOPLANKTON CONCENTRATIONS[a] AT THE SURFACE AND BOTTOM OF SAMPLING STATIONS AT LOCUST POINT, LAKE ERIE - 1977

DATE	DEPTH[b]	STATION 3	STATION 8	STATION 13	STATION 26	STATION 28	STATION 29	MEAN
20 April	S	0.6	d	0.0	d	d	0.0	0.2
	B	0.0	d	0.0	d	d	0.0	0.0
29 April	S	7.5	34.3	46.7	31.0	25.3	32.0	29.5
	B	12.2	78.9	88.6	82.3	43.1	134.7	73.3
21 May	S	230.4	9.9	149.3	60.4	10.0	51.6	85.3
	B	c	0.0	193.0	30.3	4.5	42.9	54.1
2 June	S	731.9	57.6	d	81.8	28.5	d	225.0
	B	61.4	46.5	d	16.1	33.5	d	39.4
13 June	S	1.5	21.8	19.3	10.4	8.9	7.3	11.5
	B	112.6	132.2	15.8	14.1	65.4	6.5	57.8
25 June	S	6.9	5.3	18.7	11.1	23.2	16.9	13.7
	B	31.4	46.8	21.0	3.7	71.6	43.2	36.3
5 July	S	0.0	8.5	4.4	0.0	0.0	0.0	2.2
	B	0.0	0.0	6.9	0.6	0.0	0.0	1.3
13 July	S	51.8	7.6	28.7	12.5	20.1	8.7	21.6
	B	10.2	3.5	8.4	19.7	3.0	14.7	9.9
20 July	S	0.0	1.6	0.0	0.0	0.6	0.0	0.4
	B	1.5	0.0	1.7	1.5	0.0	1.7	1.1
27 July	S	16.6	10.8	5.0	11.1	11.1	13.7	11.4
	B	0.8	8.4	0.7	0.0	3.7	0.0	2.3
12 August	S	1.5	0.0	1.0	0.0	0.5	3.0	1.0
	B	0.0	0.0	1.0	1.0	0.5	1.5	0.7
22 August	S	1.7	0.0	0.0	1.3	0.0	0.0	0.5
	B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 September	S	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN	S	80.8	13.1	22.8	18.3	10.7	11.1	26.1
	B	19.2	26.4	28.1	14.1	18.8	20.4	21.2

a Number per 100 m^3 of water

b S=Surface; B=Bottom

c Equipment malfunction

d Poor weather conditions precluded sampling these stations.

Station 3 (80.8/100 m^3) was so much greater than the bottom density (19.2/100 m^3) that the overall mean from all stations showed the surface to have a greater density than the bottom.

All raw data were keypunched and stored at the offices of The Ohio State University's Center for Lake Erie Area Research in Columbus, Ohio. A voucher collection of all samples is also maintained at these offices.

Water Quality

The results of the monthly 1977 water quality determinations at Stations 1, 8, and 13 are presented in Tables 21-28. The results of solar radiation measurements at Stations 3, 8, 13, 14, and 28 are given in Table 29. Mean values and ranges for the monthly water quality determinations (April through November) are listed in Table 30 and a summary of solar radiation means and ranges are presented in Table 31.

Primary Productivity

Five primary productivity cruises were made to the Davis-Besse Nuclear Power Station during the 1977 field year. The measured productivity values and related results are shown in Tables 32-35.

Recommendations

All phases of sampling should continue. Additional effort was placed on computerizing data during F-41-R-9. All past fishery results were completed during F-41-R-9 along with plankton and benthos results from F-41-R-9 only. Previous results in these 2 areas plus water quality and primary productivity should also be computerized.

This was somewhat of a transitional year between pre-operational and operational phases of plant operation in that the plant started low-level operation during the late fall. This operational data including dates, times, and levels of operation should be incorporated into the data base to allow adequate measurement of the effects of plant operation.

STUDY ANALYSIS

Plankton

Phytoplankton. The Center for Lake Erie Area Research has monitored phytoplankton populations at Locust Point since 1974 (Figure 3). 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 5 and 6). The Myxophycean component of the populations accounted for the differences between the 2

TABLE 21

LAKE ERIE WATER QUALITY ANALYSES FOR APRIL 1977

Dates:
Field 26 April 1977
Laboratory 27 April 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	10.6	11.1	10.0	10.0	10.0	10.0	10.0–11.1	10.3	0.5
Dissolved Oxygen (ppm)	11.0	11.0	11.1	11.0	–	–	11.0–11.1	11.0	0.1
Conductivity (umhos/cm)	360	360	350	360	360	360	350–360	358	4
Transparency (m)	0.25		0.25		0.20		0.20–0.25	0.23	0.03
Depth (m)		2.0		4.3		3.0	2.0–4.3	3.1	1.2
Laboratory Determinations:									
Calcium (mg/l)	41.6	42.8	45.6	44.4	43.2	43.2	41.6–45.6	43.5	1.4
Magnesium (mg/l)	10.1	11.0	8.2	8.4	8.9	9.1	8.2–11.0	9.3	1.1
Sodium (mg/l)	12.4	12.2	12.7	12.7	12.4	12.4	12.2–12.7	12.5	0.2
Chloride (mg/l)	26.3	26.8	26.8	26.8	26.3	26.5	26.3–26.8	26.6	0.3
Nitrate (mg/l)	18.6	17.5	16.4	14.9	16.4	17.0	14.9–18.6	16.8	1.2
Sulfate (mg/l)	36.5	40.0	32.5	34.5	35.0	33.5	32.5–40.0	35.3	2.7
Phosphorus (mg/l)	0.10	0.09	0.08	0.12	0.12	0.09	0.08–0.12	0.10	0.02
Silica (mg/l)	0.05	0.13	0.08	0.10	0.10	0.12	0.05–0.13	0.10	0.03
Total Alkalinity (mg/l)	91	91	94	95	94	96	91–96	94	2
B.O.D. (mg/l)	3	3	3	3	4	4	3–4	3.3	0.5
Suspended Solids (mg/l)	118	108	63	80	98	101	63–118	95	20
Dissolved Solids (mg/l)	216	216	204	204	212	214	204–216	211	6
Turbidity (F.T.U.)	72	71	51	51	65	66	51–72	63	9
pH	8.3	8.3	8.6	8.2	8.6	8.3	8.2–8.6	8.4	0.2
Conductivity (umhos/cm)	340	340	335	340	340	340	335–340	339	2.0

TABLE 22

LAKE ERIE WATER QUALITY ANALYSES FOR MAY 1977

Dates:
Field 24 May 1977
Laboratory 26 May 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	19.5	15.0	20.0	15.0	20.5	15.0	15.0–20.5	17.5	2.8
Dissolved Oxygen (ppm)	11.5	11.4	11.0	9.0	11.4	9.2	9.0–11.5	10.6	1.2
Conductivity (umhos/cm)	280	280	280	280	270	270	270–280	277	5
Transparency (m)	0.55		0.70		0.60		0.55–0.70	0.62	0.08
Depth (m)		2.0		4.1		3.0	2.0–4.1	3.0	1.1
Laboratory Determinations:									
Calcium (mg/l)	42.4	41.6	40.8	40.0	42.0	41.6	40.0–42.4	41.4	0.9
Magnesium (mg/l)	9.1	9.6	10.6	10.6	9.1	9.4	9.1–10.6	9.7	0.7
Sodium (mg/l)	10.7	10.7	11.0	10.7	10.7	10.4	10.4–11.0	10.7	0.2
Chloride (mg/l)	20.0	19.3	20.3	20.0	20.3	20.0	19.3–20.3	20.0	0.4
Nitrate (mg/l)	14.0	14.9	14.9	13.5	15.9	13.5	13.5–15.9	14.5	1.0
Sulfate (mg/l)	31.5	29.5	30.5	30.0	31.5	28.0	28.0–31.5	30.2	1.3
Phosphorus (mg/l)	0.03	0.04	0.01	0.02	0.00	0.02	0.00–0.04	0.02	0.01
Silica (mg/l)	0.30	0.16	0.16	0.06	0.19	0.10	0.06–0.19	0.16	0.08
Total Alkalinity (mg/l)	98	94	100	94	97	98	94–100	97	2
B.O.D. (mg/l)	4	4	3	3	2	4	2–4	3.3	0.8
Suspended Solids (mg/l)	15	17	11	12	12	20	11–20	15	4
Dissolved Solids (mg/l)	210	206	212	202	208	202	202–210	207	4
Turbidity (F.T.U.)	17	21	6	21	12	28	6–28	18	8
pH	7.7	8.1	8.0	8.1	7.7	8.2	7.7–8.2	8.0	0.2
Conductivity (umhos/cm)	370	365	375	365	370	365	365–375	368	4

TABLE 23

LAKE ERIE WATER QUALITY ANALYSES FOR JUNE 1977

Dates:
Field 22 June 1977
Laboratory 23 June 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	21.0	20.0	21.0	20.0	21.5	-	20.0-21.5	20.7	0.7
Dissolved Oxygen (ppm)	9.6	6.8	9.6	7.2	9.0	8.5	6.8-9.6	8.5	1.2
Conductivity (umhos/cm)	250	250	260	250	250	250	250-260	252	4
Transparency (m)	0.5		0.5		0.5		0.0	0.5	-
Depth (m)		1.8		4.4		3.0	1.8-4.4	3.1	1.3
Laboratory Determinations:									
Calcium (mg/l)	40.0	40.0	39.2	38.0	38.4	38.4	38.0-40.0	39.0	0.9
Magnesium (mg/l)	9.6	9.6	9.6	10.3	9.8	9.6	9.6-10.3	9.8	0.3
Sodium (mg/l)	11.7	11.2	11.0	10.7	11.0	11.0	10.7-11.7	11.1	0.3
Chloride (mg/l)	21.8	21.8	21.0	20.3	22.5	22.5	20.3-22.5	21.7	0.9
Nitrate (mg/l)	8.4	8.4	7.7	8.0	7.7	7.7	7.7-8.4	8.0	0.3
Sulfate (mg/l)	34.5	34.0	32.0	30.5	31.5	30.5	30.5-34.5	32.2	1.7
Phosphorus (mg/l)	0.05	0.06	0.02	0.02	0.02	0.04	0.02-0.06	0.04	0.02
Silica (mg/l)	0.59	0.51	0.30	0.66	0.23	0.40	0.23-0.66	0.45	0.17
Total Alkalinity (mg/l)	96	96	95	97	97	96	95-97	96	1
B.O.D. (mg/l)	2	3	3	<1	2	2	2-3	2	0.8
Suspended Solids (mg/l)	40	30	36	60	17	67	17-67	42	19
Dissolved Solids (mg/l)	103	98	90	96	96	98	90-103	97	4.2
Turbidity (F.T.U.)	32	29	23	53	13	23	13-53	30	13
pH	8.6	8.6	8.7	8.4	8.6	8.6	8.4-8.7	8.6	0.1
Conductivity (umhos/cm)	335	330	325	310	340	340	310-340	330	11

TABLE 24

LAKE ERIE WATER QUALITY ANALYSES FOR JULY 1977

Dates:
Field 13 July 1977
Laboratory 14 July 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	24.0	24.0	22.0	22.0	23.0	23.0	22.0-24.0	23.0	0.9
Dissolved Oxygen (ppm)	7.3	3.0	7.3	4.8	7.3	4.5	3.0-7.3	5.7	1.9
Conductivity (umhos/cm)	230	230	220	220	230	230	220-230	227	5
Transparency (m)	0.25		0.40		0.30		0.25-0.40	0.32	0.08
Depth (m)		2.0		4.5		3.0	2.0-4.5	3.2	1.3
Laboratory Determinations:									
Calcium (mg/l)	36.0	35.2	33.2	33.6	34.4	34.8	33.2-36.0	34.5	1.0
Magnesium (mg/l)	8.2	8.9	9.4	9.1	9.1	9.1	8.2-9.4	9.0	0.4
Sodium (mg/l)	10.1	9.9	9.5	9.5	9.5	8.9	8.9-10.1	9.6	0.4
Chloride (mg/l)	19.3	19.3	19.8	19.5	20.0	20.0	19.3-20.0	19.7	0.3
Nitrate (mg/l)	6.9	8.0	6.9	7.7	8.8	8.4	6.9-8.8	7.8	0.8
Sulfate (mg/l)	27.0	25.0	23.5	25.0	23.0	24.5	23.0-27.0	24.7	1.4
Phosphorus (mg/l)	0.14	0.09	0.08	0.07	0.07	0.09	0.07-0.14	0.09	0.03
Silica (mg/l)	0.23	0.44	1.10	1.20	0.44	0.44	0.23-1.20	0.64	0.40
Total Alkalinity (mg/l)	90	93	90	89	92	91	89-93	91	2
B.O.D. (mg/l)	2	3	2	2	1	1	1-3	1.8	0.8
Suspended Solids (mg/l)	75	91	38	33	47	52	33-91	56	2.3
Dissolved Solids (mg/l)	174	176	194	180	186	184	174-194	182	7
Turbidity (F.T.U.)	64	65	47	53	31	45	31-65	51	13
pH	8.3	8.0	8.1	8.1	8.1	8.0	8.1-8.3	8.1	0.1
Conductivity (umhos/cm)	282	282	270	275	280	280	270-282	278	5

TABLE 25

LAKE ERIE WATER QUALITY ANALYSES FOR AUGUST 1977

Dates:
Field 30 August 1977
Laboratory 31 August 197

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	22.3	21.9	23.0	22.0	23.1	21.5	21.5-23.1	22.3	0.6
Dissolved Oxygen (ppm)	7.7	7.3	8.7	7.2	9.0	6.9	6.9-9.0	7.8	0.9
Conductivity (umhos/cm)	260	265	260	265	260	265	260-265	263	3
Transparency (m)	0.40		0.73		0.62		0.40-0.73	0.58	0.17
Depth (m)		1.5		4.0		3.0	1.5-4.0	2.8	1.3
Laboratory Determinations:									
Calcium (mg/l)	31.6	31.6	31.2	31.6	31.6	32.8	31.2-32.8	31.7	0.6
Magnesium (mg/l)	7.0	7.0	7.0	6.7	6.7	6.7	6.7-7.0	6.9	0.2
Sodium (mg/l)	8.4	8.2	8.4	8.5	8.4	8.5	8.2-8.5	8.4	0.1
Chloride (mg/l)	16.3	16.3	17.0	16.8	16.8	16.8	16.3-17.0	16.7	0.3
Nitrate (mg/l)	2.0	1.2	1.2	1.2	2.0	1.2	1.2-2.0	1.5	0.4
Sulfate (mg/l)	20.5	21.0	20.5	20.0	20.0	21.0	20.0-21.0	20.5	0.5
Phosphorus (mg/l)	0.06	0.06	0.03	0.05	0.04	0.06	0.03-0.06	0.05	0.01
Silica (mg/l)	0.17	0.17	0.10	0.11	0.11	0.12	0.10-0.17	0.13	0.03
Total Alkalinity (mg/l)	85	84	83	85	85	85	83-85	84.5	0.8
B.O.D. (mg/l)	3	3	3	3	3	4	3-4	3.2	0.4
Suspended Solids (mg/l)	18	24	11	19	7	24	7-24	17	7
Dissolved Solids (mg/l)	158	156	160	152	158	152	152-160	156	3
Turbidity (F.T.U.)	28	27	24	23	25	24	23-28	25	2
pH	8.8	8.6	8.6	8.8	8.9	8.6	8.6-8.9	8.8	0.1
Conductivity (umhos/cm)	247	249	243	247	245	251	243-251	247	3

TABLE 26

LAKE ERIE WATER QUALITY ANALYSES FOR SEPTEMBER 1977

Dates:
Field 12 September 1977
Laboratory 13 September 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	19.3	19.3	19.8	19.8	19.4	19.2	19.2–19.8	19.5	0.3
Dissolved Oxygen (ppm)	9.6	9.6	9.2	9.2	9.3	9.2	9.2–9.6	9.4	0.2
Conductivity (umhos/cm)	270	275	275	275	265	280	265–280	273	5
Transparency (m)	0.50		0.60		0.50		0.5–0.6	0.53	0.06
Depth (m)		1.6		3.8		2.7	1.6–3.8	2.7	1.1
Laboratory Determinations:									
Calcium (mg/l)	30.4	30.4	30.8	30.4	30.8	31.2	30.4–31.2	30.7	0.3
Magnesium (mg/l)	8.2	8.4	7.7	8.2	8.2	7.7	7.7–8.4	8.1	0.3
Sodium (mg/l)	8.3	8.3	8.6	8.5	8.3	8.5	8.3–8.6	8.4	0.1
Chloride (mg/l)	16.3	16.3	16.0	16.3	16.3	16.5	16.0–16.5	16.3	0.2
Nitrate (mg/l)	0.3	0.6	0.8	0.6	0.8	0.3	0.3–0.8	0.6	0.2
Sulfate (mg/l)	20.5	20.0	20.0	20.5	20.0	20.0	20.0–20.5	20.2	0.3
Phosphorus (mg/l)	0.06	0.04	0.04	0.04	0.04	0.04	0.04–0.06	0.043	0.008
Silica (mg/l)	0.30	0.28	0.21	0.28	0.26	0.36	0.21–0.36	0.28	0.05
Total Alkalinity (mg/l)	88	84	86	86	86	88	84–88	86	2
B.O.D. (mg/l)	2	3	2	3	2	4	2–4	2.7	0.8
Suspended Solids (mg/l)	17	15	5	37	23	26	5–37	21	11
Dissolved Solids (mg/l)	146	154	144	146	152	158	144–158	150	6
Turbidity (F.T.U.)	23	23	13	27	25	28	13–28	23	5
pH	8.8	8.7	8.8	8.7	8.7	8.7	8.7–8.8	8.7	0.1
Conductivity (umhos/cm)	215	215	218	222	230	230	215–230	222	7

TABLE 27

LAKE ERIE WATER QUALITY ANALYSES FOR OCTOBER 1977

Dates:
Field 25 October 1977
Laboratory 26 October 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	10.0	10.0	10.0	9.2	10.1	9.8	9.2–10.1	9.9	0.3
Dissolved Oxygen (ppm)	10.1	11.2	10.2	11.4	10.2	11.5	10.1–11.5	10.8	0.7
Conductivity (umhos/cm)	310	310	280	280	300	300	280–310	297	14
Transparency (m)	0.5		0.6		0.5		0.5–0.6	0.53	0.06
Depth (m)		1.5		4.0		3.0	1.5–4.0	2.8	1.3
Laboratory Determinations:									
Calcium (mg/l)	35.6	35.6	32.0	32.4	33.6	33.6	32.0–35.6	33.8	1.5
Magnesium (mg/l)	8.2	8.4	8.2	7.9	8.6	8.4	7.9–8.6	8.3	0.2
Sodium (mg/l)	9.2	9.2	8.0	7.6	8.9	8.9	7.6–9.2	8.6	0.7
Chloride (mg/l)	17.3	17.3	14.3	14.3	15.8	15.8	14.3–17.3	15.8	1.3
Nitrate (mg/l)	5.4	5.1	1.7	1.2	1.2	2.0	1.2–5.4	2.8	2.0
Sulfate (mg/l)	24.0	24.0	21.5	22.0	23.0	15.8	15.8–24.0	21.7	3.1
Phosphorus (mg/l)	0.09	0.09	0.04	0.05	0.05	0.03	0.03–0.09	0.06	0.03
Silica (mg/l)	0.05	0.05	0.05	0.13	0.07	0.10	0.05–0.13	0.08	0.03
Total Alkalinity (mg/l)	94	94	92	92	94	92	92–94	93	1
B.O.D. (mg/l)	4	5	3	3	3	4	3–5	4	1
Suspended Solids (mg/l)	26	51	14	18	14	13	13–51	23	15
Dissolved Solids (mg/l)	158	166	144	146	160	160	144–166	156	9
Turbidity (F.T.U.)	18	21	15	17	10	7	7–21	15	5
pH	8.2	8.1	8.1	8.3	8.2	8.1	8.1–8.3	8.2	0.1
Conductivity (umhos/cm)	341	351	336	335	358	332	332–358	342	10

TABLE 28

LAKE ERIE WATER QUALITY ANALYSES FOR NOVEMBER 1977

Dates:
Field 22 November 1977
Laboratory 23 November 1977

Parameters	Station No. 1		Station No. 8		Station No. 13		Range	Mean	Standard Deviation
	Surface	Bottom	Surface	Bottom	Surface	Bottom			
Field Measurements:									
Temperature (°C)	4.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	–
Dissolved Oxygen (ppm)	10.6	10.6	12.2	10.2	10.2	4.8	4.8–12.2	9.8	2.5
Conductivity (umhos/cm)	–	–	–	–	–	–	–	–	–
Transparency (m)	0.5		0.8		0.8		0.5–0.8	0.7	0.2
Depth (m)		1.2		3.9		3.0	1.2–3.9	2.7	1.4
Laboratory Determinations:									
Calcium (mg/l)	38.8	38.8	36.8	36.8	38.4	38.8	36.8–38.8	38.1	1.0
Magnesium (mg/l)	10.1	10.1	9.8	9.8	9.8	9.6	9.6–10.1	9.9	0.2
Sodium (mg/l)	11.2	11.2	11.2	11.2	11.2	11.2	–	11.2	0.0
Chloride (mg/l)	21.5	21.5	20.0	20.0	21.5	21.5	20.0–21.5	21.0	0.8
Nitrate (mg/l)	7.2	8.3	9.4	7.9	7.6	6.8	6.8–9.4	7.9	0.9
Sulfate (mg/l)	23.0	22.0	21.0	21.5	22.5	23.0	21.0–23.0	22.2	0.8
Phosphorus (mg/l)	0.05	0.04	0.03	0.03	0.04	0.04	0.03–0.05	0.04	0.01
Silica (mg/l)	0.46	0.52	0.61	0.59	0.64	0.64	0.46–0.64	0.58	0.07
Total Alkalinity (mg/l)	102	104	100	100	102	101	100–104	102	2
B.O.D. (mg/l)	3	4	2	2	3	2	2–4	3	1
Suspended Solids (mg/l)	21	10	13	32	14	27	10–32	20	9
Dissolved Solids (mg/l)	198	196	186	184	178	192	178–198	189	8
Turbidity (F.T.U.)	24	27	7	8	8	8	7–27	14	9
pH	7.9	7.8	8.1	8.0	8.0	8.1	7.8–8.1	8.0	0.1
Conductivity (umhos/cm)	335	340	320	320	330	330	320–340	329	8

TABLE 29

SOLAR RADIATION MEASUREMENTS AT LOCUST POINT

Station \ Time		Deck	Surface	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
12 May 1977											
3[a]	1128	2440	2250	205	19.5	2.5	0.5				
8[a]	1202	3880	3360	550	64	8.5	2.2				
13[a]	1244	5000	2000	350	65	10	2.5				
14[a]	1315	4200	3360	800	115	19.5	3.5	0.7			
18 July 1977											
3[b]	1100	5400	3500	1300	530	230	100	37	9		
8[b]	1145	5400	4000	1600	860	420	200	100	50	29	12
13[b]	1330	5500	4500	2000	870	410	180	54			
14[b]	1235	6200	4500	1700	950	440	210	120	66	25	6
28 July 1977											
3[b]	1110	5200	3500	1500	650	250	50	53	23	11	
14[b]	1220	5900	3700	1800	900	330	140	50	19	5.5	
19 August 1977											
3[b]	1056	3600	3400	550	130	27	7.9	2.9	0.8		
14[b]	1252	3100	2900	510	160	52	16	5	1.3	0.5	
28[b]	1153	6000	5700	1600	750	270	120	43	15	6.5	2.2
11 October 1977											
8[b]	1135		140	22	17	7.5	4.5	2.8	2.8		
13[b]	1106		280	45	16	5.3	1.8	0.75	0.3		

[a] Photometer readings in microamps

[b] Photometer readings in foot candles

TABLE 30

MEAN VALUES AND RANGES FOR WATER QUALITY

PARAMETERS TESTED IN 1977

Parameter	April - November 1977		Units
	Mean	Range	
1. Temperature	15.8	4.0-24.0	°C
2. Dissolved Oxygen	9.1	3.0-12.2	ppm
3. Conductivity (field)	278	220 - 360	µmhos/cm
4. Transparency	0.5	0.2-0.8	m
5. Calcium	36.8	30.4 - 45.6	mg/l
6. Magnesium	8.9	6.7-11.0	mg/l
7. Sodium	10.1	7.6-12.7	mg/l
8. Chloride	19.7	14.3-26.8	mg/l
9. Nitrate	7.5	0.3-18.6	mg/l
10. Sulfate	25.9	15.8-40.0	mg/l
11. Phosphorus	0.05	0.00-0.14	mg/l
12. Silica	0.30	0.05-1.20	mg/l
13. Total Alkalinity	93	83 - 104	mg/l
14. BOD	3.6	1 - 5	mg/l
15. Suspended Solids	36	5 - 118	mg/l
16. Dissolved Solids	168	90 - 216	mg/l
17. Turbidity	30	6 - 72	F.T.U.
18. Hydrogen-ions	8.3	7.7-8.9	pH
19. Conductivity (lab)	307	215-375	µmhos/cm

TABLE 31

SUMMARY OF JULY TO OCTOBER 1977
SOLAR RADIATION MEASUREMENTS AT LOCUST POINT

Station	Range[a]	Mean	Standard Deviation
Station 3			
Deck	5400–3600	4733	987
Surface	3500–3400	3467	58
0.5m	1500–550	1117	501
1.0	650–130	437	272
1.5	250–27	169	123
2.0	100–7.9	53	46
2.5	53–2.9	31	26
3.0	23–0.8	11	11
Station 8			
Surface	4000–140	847	1764
0.5	1600–22	811	1116
1.0	860–17	439	596
1.5	420–7.5	214	292
2.0	200–4.5	102	138
2.5	100–2.8	51	69
3.0	50–2.8	26	33
Station 13			
Surface	4500–280	2390	2984
0.5	2000–45	1023	1382
1.0	870–16	443	604
1.5	410–5.3	208	286
2.0	180–1.8	91	126
2.5	54–0.75	27	38
Station 14			
Deck	6200–3200	4700	2121
Surface	4500–2900	3700	1131
0.5	1700–510	1105	841
1.0	950–160	555	559
1.5	440–52	246	274
2.0	210–16	113	137
2.5	120–5	63	81
3.0	66–1.3	34	46
3.5	25–0.5	13	17

[a] Photometer readings in foot candles

TABLE 32

LOCUST POINT PRIMARY PRODUCTIVITY VALUES FOR 1977 FIELD SEASON
(VALUES ARE GIVEN IN mg C/m^3/hr)

Date	Depth (m)	Station 3	8	13	14	28
12 May 1977	0.5	40	49	14	46	-
	1	10	10	8	10	-
	2	-	-	4	-	-
	3	5	3	-	2	-
18 July 1977	0.5	34	27	37	42	-
	1	43	35	51	42	-
	2	18	-	7	-	-
	3	-	5	-	19	-
28 July 1977	0.5	71	-	-	79	-
	1	107	-	-	89	-
	1.5	49	-	-	47	-
	2	21	-	-	16	-
	2.5	9	-	-	8	-
19 Aug. 1977	surface	134	-	-	142	96
11 Oct. 1977	0.5	103	63	77	-	-
	1	39	45	27	-	-
	2	5	-	14	-	-
	3	-	9	-	-	-

TABLE 33

A COMPARISON OF THE MEAN OF PRIMARY PRODUCTIVITY VALUES (in mg $C/m^3/hr$) AT 0.5 AND 1-METER DEPTHS AT STATION 3 WITH THE MEAN OF 0.5 AND 1-METER DEPTHS AT STATIONS 8, 13, AND 14 FOR THE 1977 FIELD YEAR

Date	Station		
	8	13	14
12 May 1977	1.18 ± 0.16	0.44 ± 0.33	0.92 ± 0.06
18 July 1977	0.81 ± 0.21	1.14 ± 0.37	1.09 ± 0.11
28 July 1977	-	-	0.94 ± 0.04
11 Oct. 1977	1.06 ± 0.04	0.72 ± 0.05	-
Mean of three cruises	1.02 ± 0.14	0.77 ± 0.25	0.98 ± 0.07

TABLE 34

MID-DAY VALUES OF PRIMARY PRODUCTIVITY (in mg $C/m^3/hr$)
AT THE PEACH POINT NAVIGATION BUOY, SOUTH BASS ISLAND

Date	Depth (meters)										
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	5.0	5.5	7.0	9.0
13 August 1977	68	-	33	-	24	-	3.6	-	1.1	-	-
15 August 1977	190	-	140	-	42	-	14	-	2.2	-	-
16 August 1977	150	106	-	-	-	25	-	12	-	5	8

TABLE 35

PHOTOMETER READINGS OBTAINED AT LOCUST POINT
DURING THE 1977 FIELD SEASON

Date	Depth (meters)	Station 3	8	13	14
12 May 1977	surface	2250	3360	2000	3360
	0.5	205	550	350	800
	1.0	20	64	65	115
	1.5	2.5	8.5	10	20
	2.0	0.5	2	3	4
18 July 1977	surface	3500	4000	4500	4500
	0.5	1300	1600	2000	1700
	1.0	530	860	870	950
	1.5	230	420	410	440
	2.0	100	200	180	210
	2.5	37	100	54	120
	3.0	9	50	-	66
	3.5	-	29	-	25
	4.0	-	12	-	6
28 July 1977	surface	3500	-	-	3700
	0.5	1500	-	-	1800
	1.0	650	-	-	900
	1.5	250	-	-	330
	2.0	50	-	-	140
	2.5	33	-	-	50
	3.0	23	-	-	19
	3.5	11	-	-	5.5
19 August 1977	surface	3400	-	-	2900
	0.5	550	-	-	510
	1.0	130	-	-	160
	1.5	27	-	-	52
	2.0	7.9	-	-	16
	2.5	2.9	-	-	5
	3.0	0.8	-	-	1.3
	3.5	-	-	-	0.5
11 October 1977	surface	-	140	-	280
	0.5	-	22	-	45
	1.0	-	17	-	16
	1.5	-	7.5	-	5.3
	2.0	-	4.5	-	1.8
	2.5	-	2.8	-	0.8

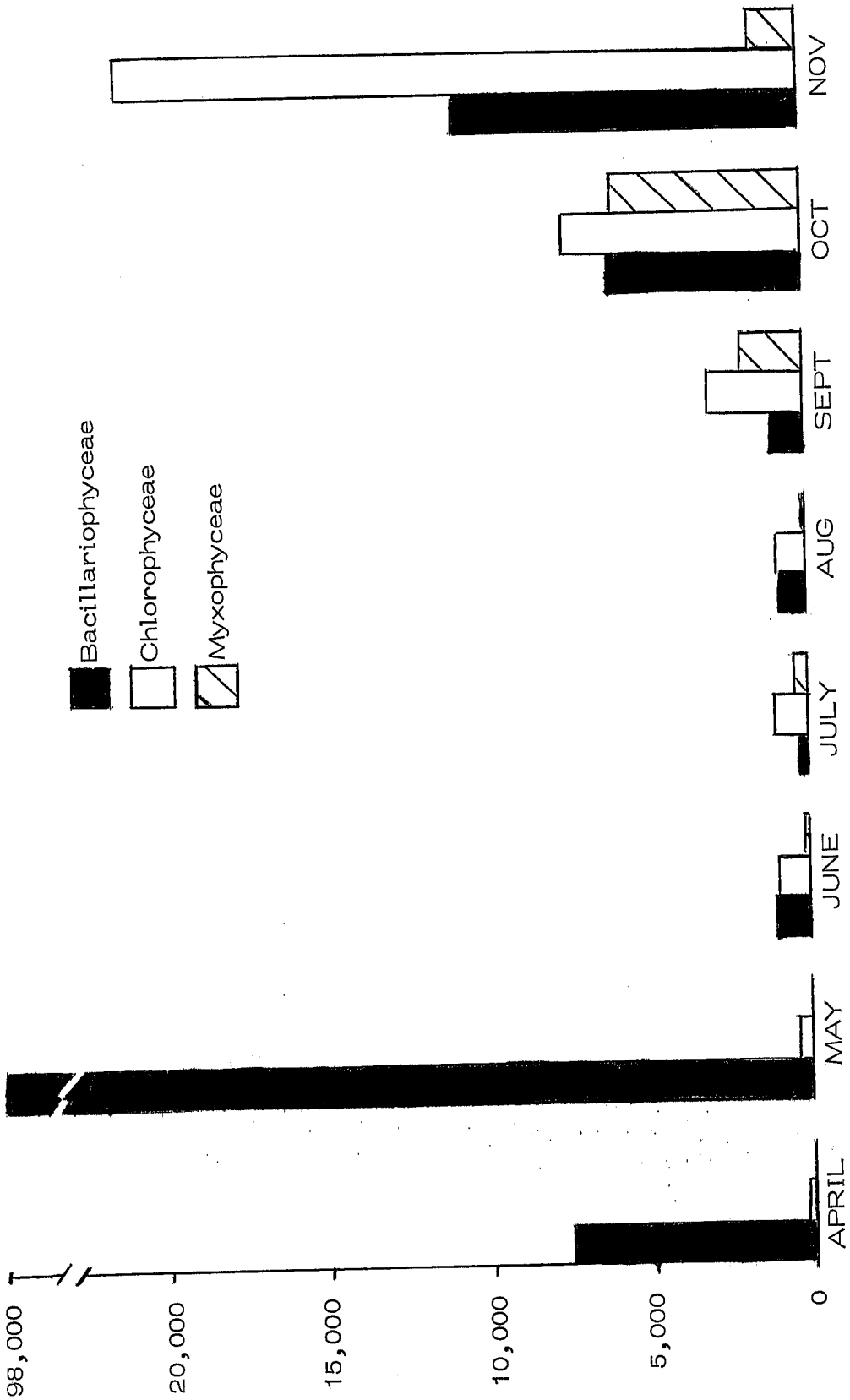


FIGURE 5. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1974.

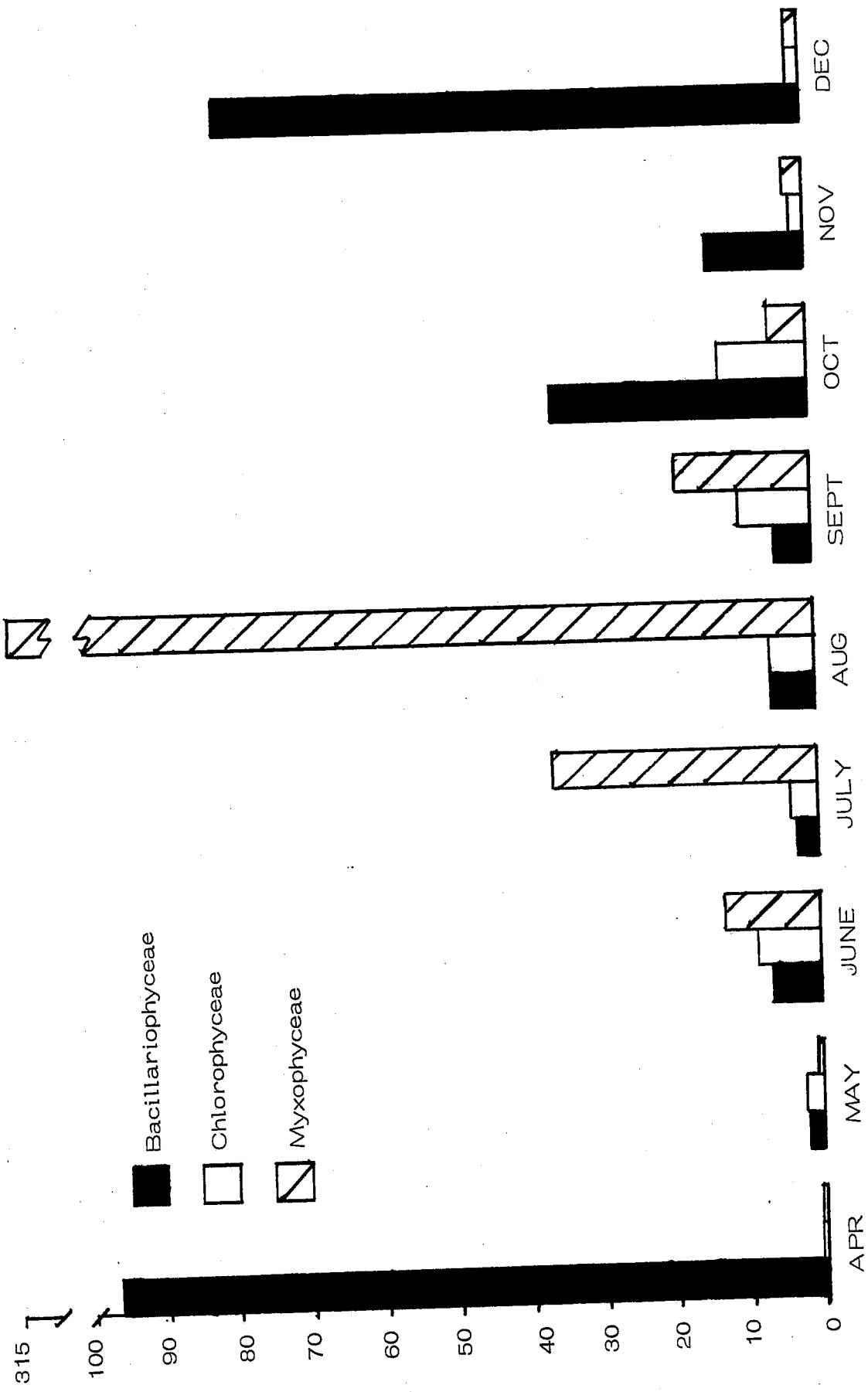


FIGURE 6. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT - 1975.

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).

Bacillariophyceae and Chlorophyceae populations in 1976 were similar in size and composition to those observed in 1974 and 1975 (Figures 5, 6, and 7). 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 begin and end 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.

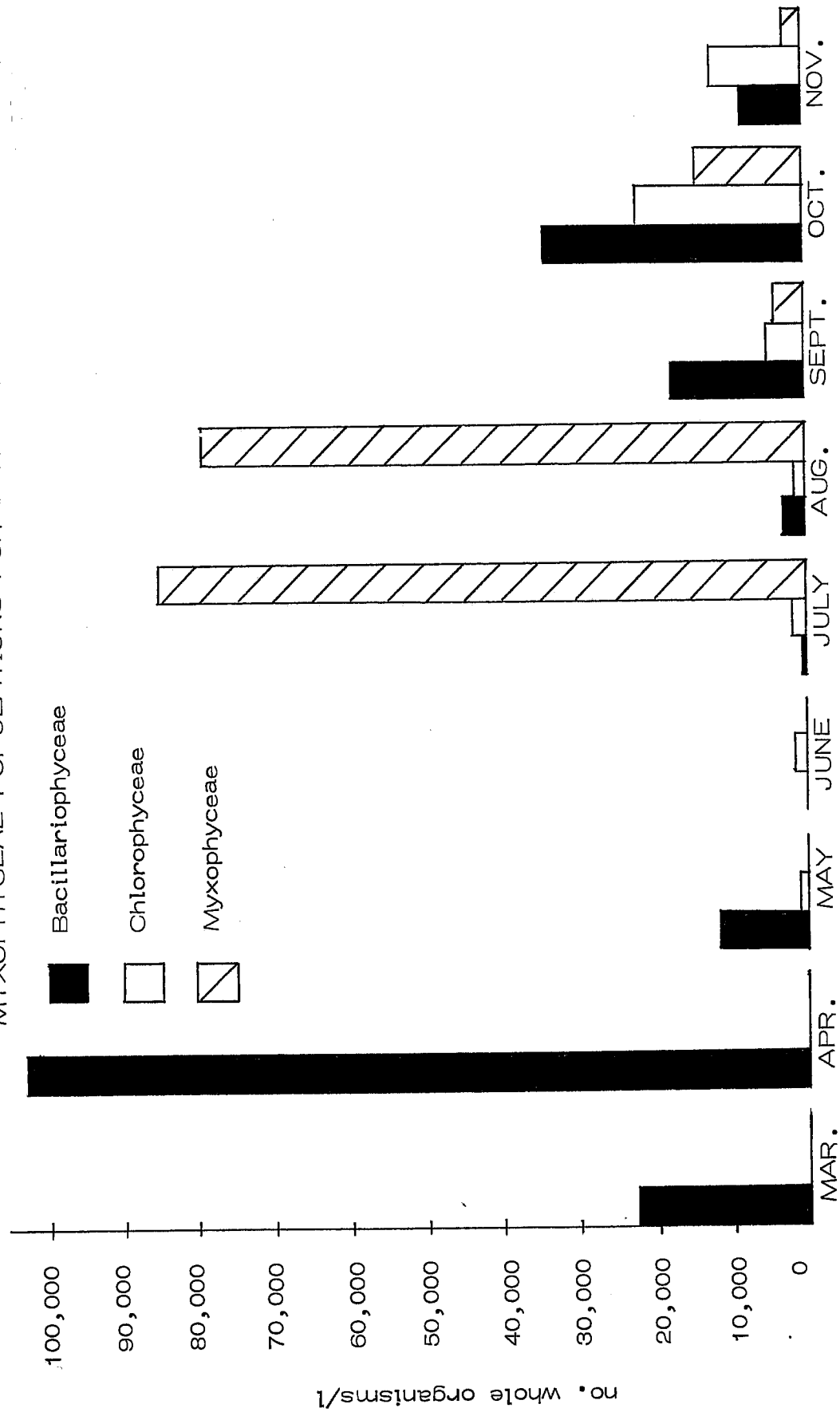
The 1976 Myxophycean population was between the extremes set forth in 1974 and 1975. A bloom of Aphanizomenon sp. occurred in July and August which corresponded well in time of occurrence with the 1975 August bloom, but, though it was slightly longer in peak duration, it was only one third the magnitude 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. 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.

In summary, it is obvious from Figures 4-7, that 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 is 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. Consequently, phytoplankton populations observed at Locust Point during 1977 should not be considered unusual for the southwest shore of Lake Erie during 1977.

Zooplankton. Zooplankton populations at Locust Point have been monitored monthly during ice-free periods since 1972. In 1977, 2 new monthly highs and 3 new monthly lows were established (Figure 8). Zooplankton densities in April and May were the highest observed during those months since sampling was initiated in 1972, while densities observed in July, August, and November were the lowest observed

FIGURE 7. MONTHLY MEAN BACILLARIOPHYCEAE, CHLOROPHYCEAE, AND MYXOPHYCEAE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1976.



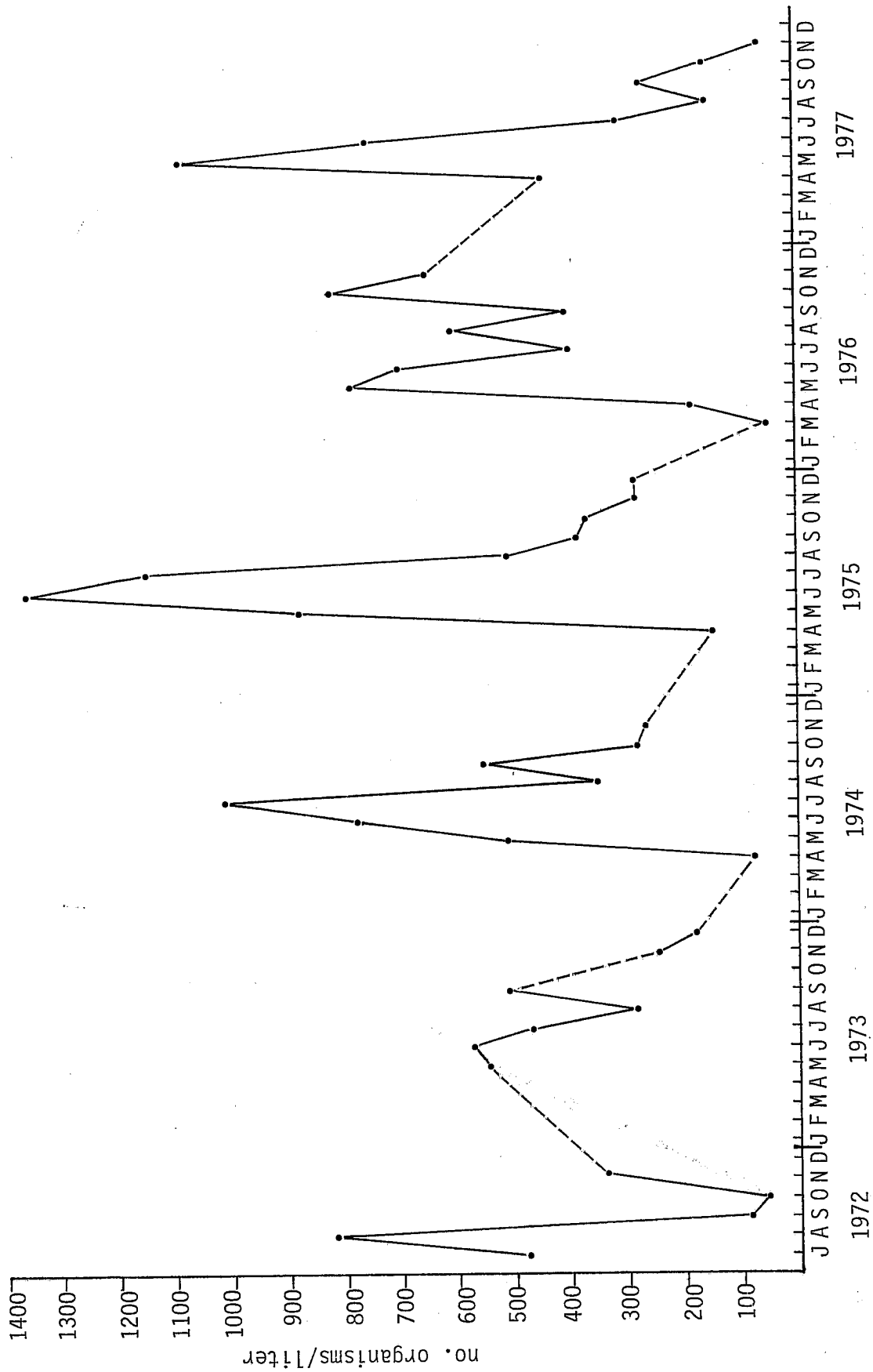


FIGURE 8. MONTHLY MEAN ZOOPLANKTON POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1977.

for those months. Results from other months fell within the ranges established from 1972-1976.

In general, densities observed at Locust Point in 1974 and 1975 were higher than those observed in 1972 and 1973. Densities in 1976 were intermediate between the 2 groupings while densities from April - June 1977 were similar to those observed in 1974 and 1975 and those from the remainder of 1977 were similar to those observed in 1972 and 1973.

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 1973-1977 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 and 1977.

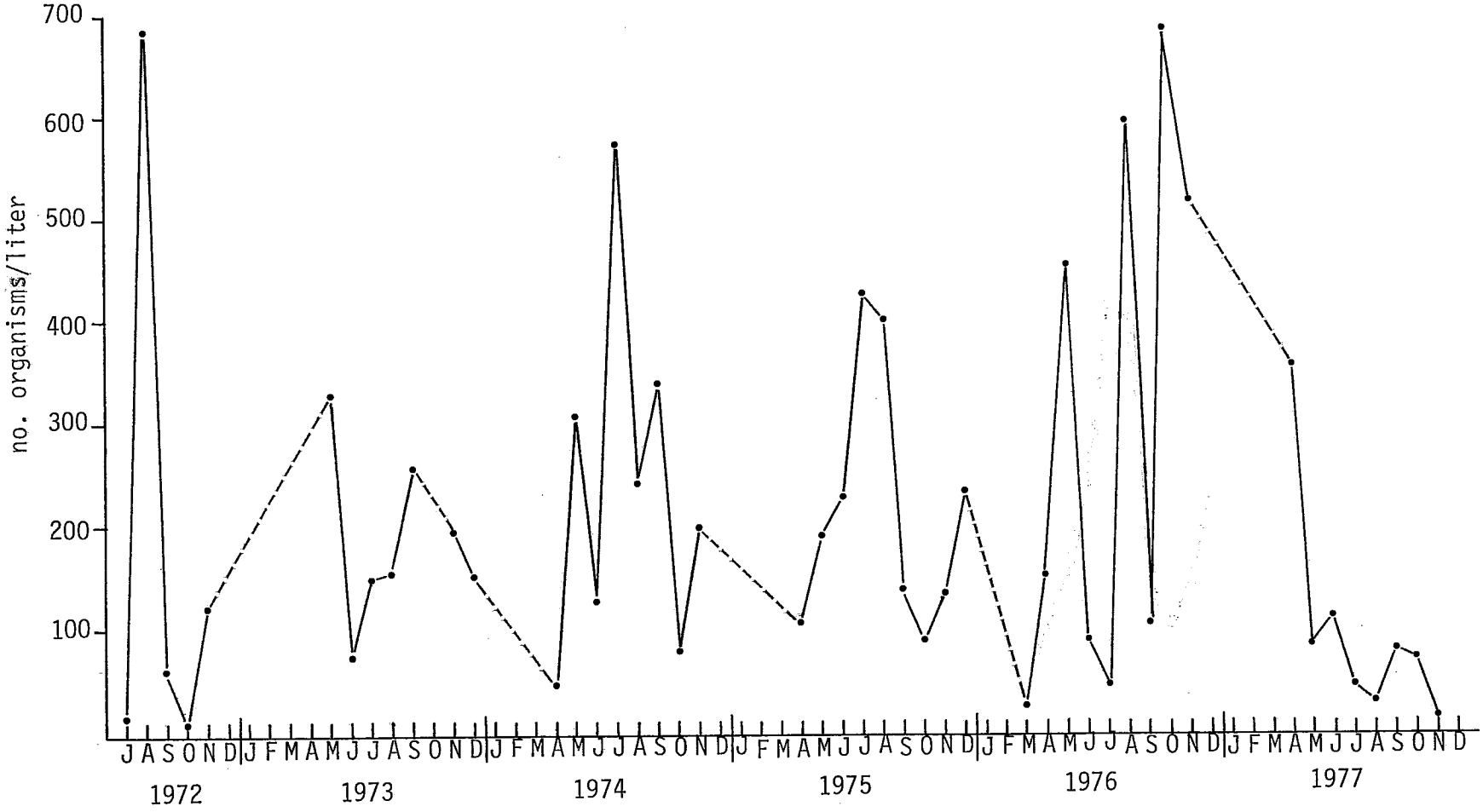
Rotifer populations in 1977 were the highest observed during the 6 years of the study in April and they were slightly lower than previous years for the remaining months (Figure 9). With the exception of the month of May, copepod populations were similar to those observed in the past (Figure 10). Each year a large copepod pulse is observed during May, June, and sometimes July. In 1977, the May pulse was approximately twice as large as previous pulses. Cladoceran populations during 1977 were very similar to previous years except that the normal fall pulse was not as prominant (Figure 11).

In summary, due to the large variability observed in previous years, zooplankton populations observed in 1977 should be considered typical for the south shore of the Western Basin of Lake Erie.

Benthos

Benthic macroinvertebrate populations collected at Locust Point during 1977 were typical for populations along the south shore of western Lake Erie and similar to those observed during preceding years (Figure 12). Species composition, mainly immature oligochaetes and chironomids, was also similar to that observed from 1972-1976 (Reutter and Herdendorf, 1977). As observed in the past, populations at Station

FIGURE 9. MONTHLY MEAN ROTIFER POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1977.



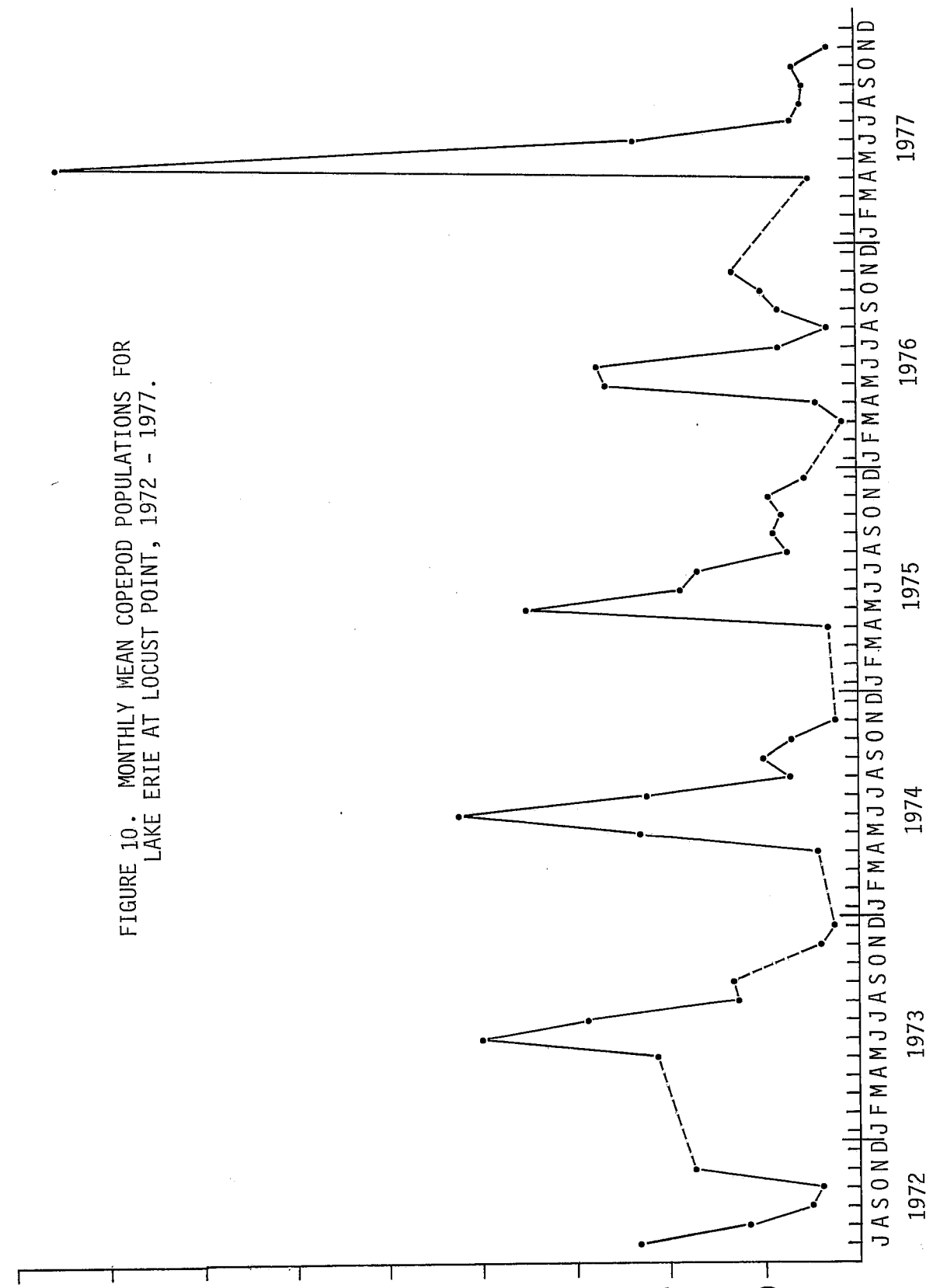


FIGURE 10. MONTHLY MEAN COPEPOD POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1977.

FIGURE 11. MONTHLY MEAN CLADOCERAN POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1977.

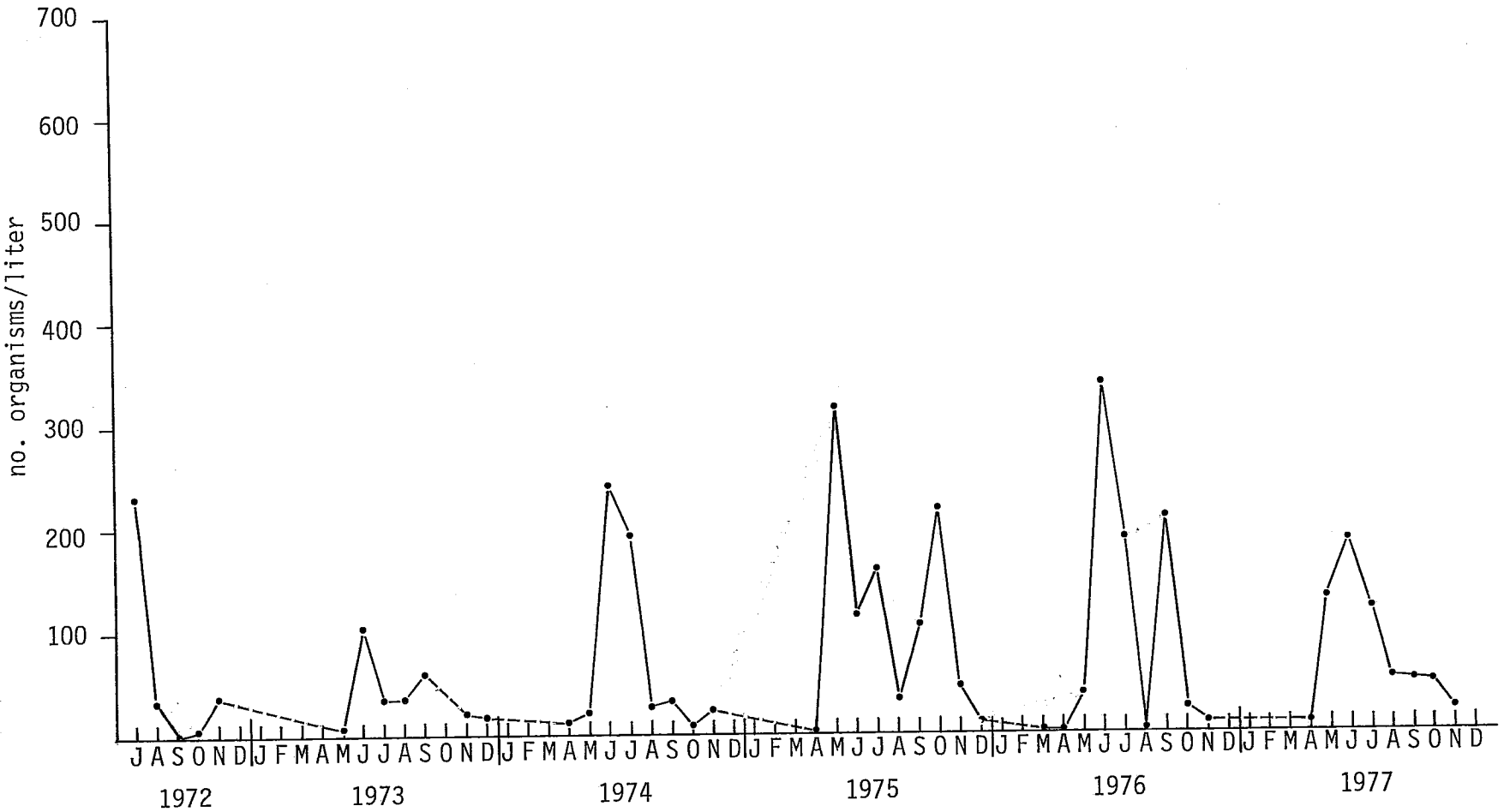
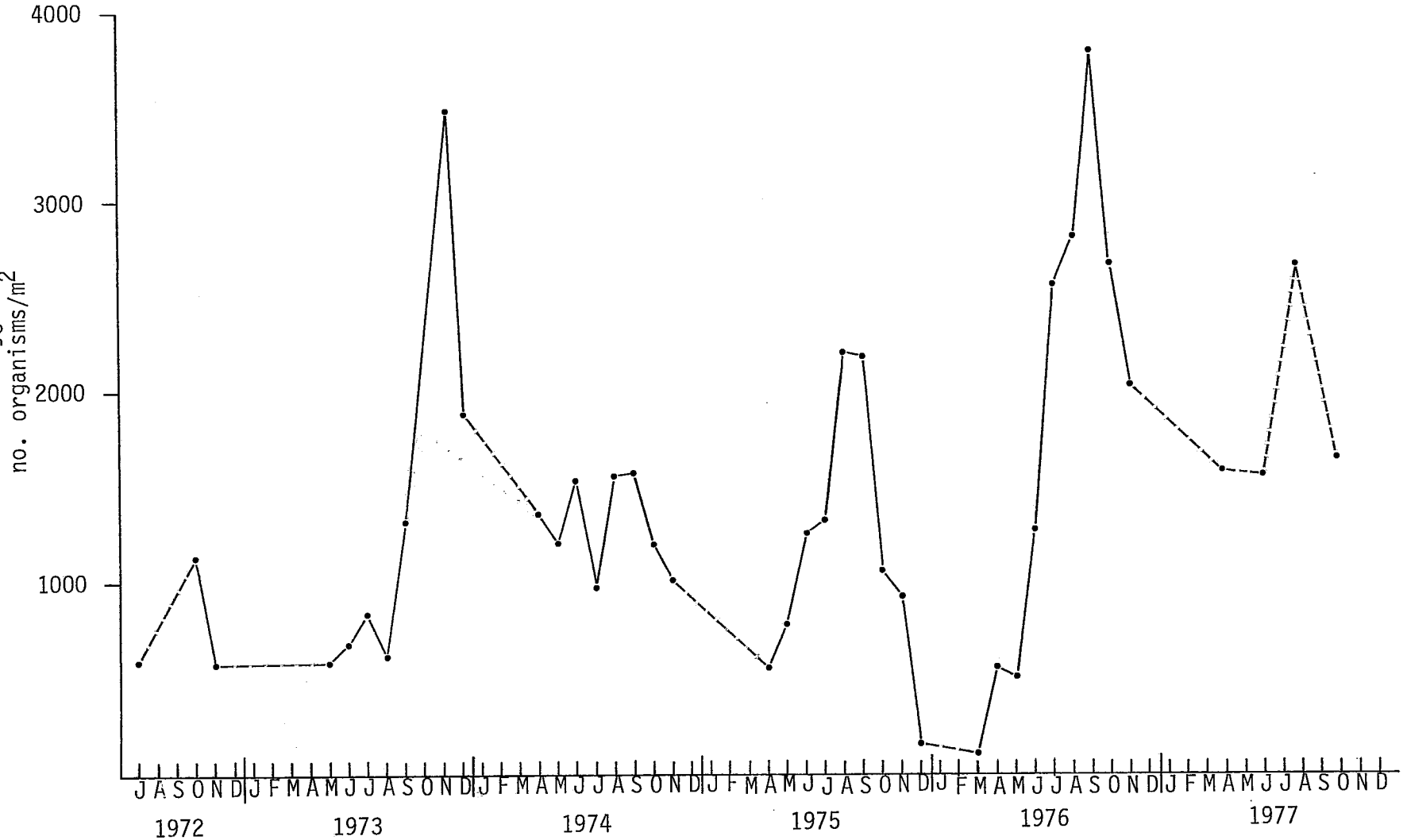


FIGURE 12 . MONTHLY MEAN BENTHIC MACROINVERTEBRATE POPULATIONS FOR LAKE ERIE AT LOCUST POINT, 1972 - 1977.



13 (plume area) appear inhibited. Personal observation indicates that this is probably due to a lack of suitable substrate at this station as it is mainly hard clay.

Due to the extreme natural variability observed between stations and dates due to shifting substrate and lack of suitable substrate for colonization, it appears unlikely that the power station will have a significant impact on benthic populations.

Fish

The Lake Erie fish community at Locust Point as observed during 1977 was quite similar to that observed in previous years. The 6 dominant species (numerically) in 1976 were alewife, gizzard shad, white bass, emerald shiner, yellow perch, and spottail shiner, respectively (Reutter and Herdendorf, 1977). Although the ranking was different in 1977, the same species constituted the top 6 numerically.

The major difference between 1977 and previous years was that fewer fish were captured in 1977. This was primarily due to a reduction in the shore seine catch. In July of 1976 over 30,000 YOY alewives and 24,000 YOY gizzard shad were collected in the shore seines following large collections in the ichthyoplankton (Reutter and Herdendorf, 1977). If this shore seining had been conducted one week earlier or later, it is quite likely that these large catches would have been missed. Results of this type are typical with schooling species, alewife and gizzard shad, and can become even more misleading as the frequency of sampling is reduced.

As in the past, a comparison of gill netting results from individual stations indicated that fish densities were generally greater closer to shore. With the exception of June, Station 3, 13, or 29 (1200 feet off shore) always yielded the greatest number of fish, and Station 8, 26, or 28 (3000 feet off shore) always yielded the fewest fish (Figure 13). In June a school of 860 alewives swam into the gill net at Station 26. Furthermore, no trend of attraction to or repulsion from the intake, Station 8, or the plume area, Station 13, was observed as the total numbers of fish captured at stations 1200 ft off shore (3, 13, 29) were similar as were the totals from Stations 26, 8, and 28 (3000 ft off shore) (Table 36). Table 36 also shows that 1.6 times as many fish were captured at nearshore stations as at offshore stations, and that there were no significant differences between the number of fish captured at the intake/discharge complex and those captured at stations on either side of the complex. Overall, there do not appear to be significant differences between direction of travel at any station or any group of stations. However, on any one date or station the differences can be significant--twice as many fish were moving southeast as northwest on 16 May.

Trawling results indicated that fish populations at the intake/discharge complex were within the range set by stations on either side (Figure 14). It also appears that densities increase in a west to east fashion, possibly due to the presence of the Toussaint

FIGURE 13

COMPARISON OF GILL NET RESULTS FROM STATIONS 3, 8, 13, 26, 28, and 29 during 1977

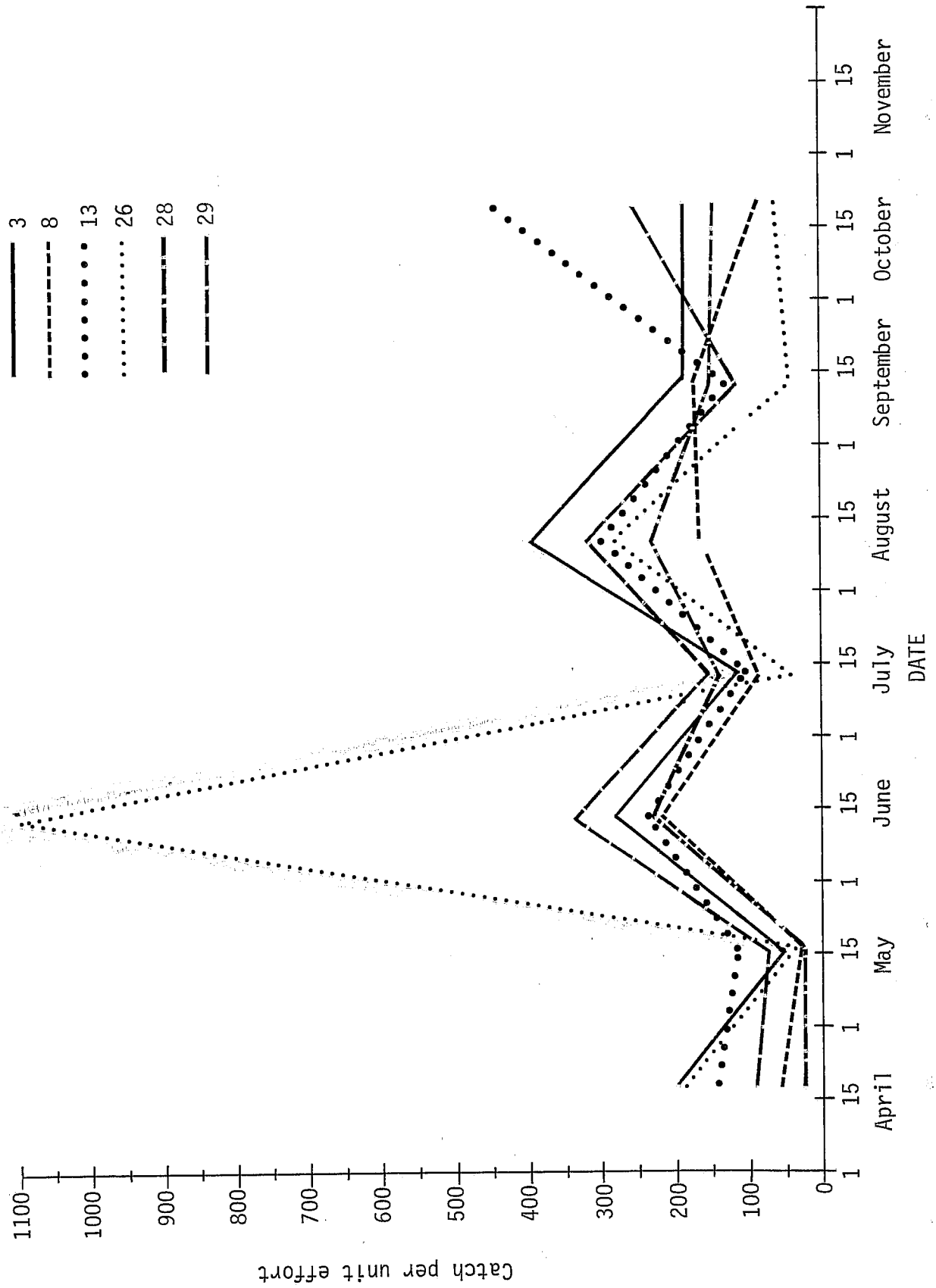


TABLE 36

SUMMARY OF GILL NET CATCH RESULTS AT LOCUST POINT DURING 1977[a]

Station and Direction[b] \ Date	April 18	May 16	June 13	July 12	Aug. 9	Sept. 13	Oct. 20	TOTAL
3								
Northwest	65	16	130	49	124	43	45	472
Southeast	73	25	100	32	85	74	22	411
Unknown	59	8	33	29	187	61	111	488
Subtotal	197	49	263	110	396	178	178	1371
13								
Northwest	67	42	131	40	91	39	76	486
Southeast	45	73	63	63	89	67	50	450
Unknown	35	5	38	0	118	16	307	519
Subtotal	147	120	232	103	298	122	433	1455
29								
Northwest	29	21	80	57	108	42	55	392
Southeast	55	53	144	58	64	44	24	442
Unknown	10	3	99	33	143	21	171	480
Subtotal	94	77	323	148	315	107	250	1314
26								
Northwest	59	5	127	14	118	21	15	359
Southeast	85	22	86	27	68	11	12	311
Unknown	47	17	25	0	107	9	32	237
Subtotal	191	44	238	41	293	41	59	907
8								
Northwest	11	12	91	31	92	44	12	293
Southeast	22	20	68	42	45	95	17	309
Unknown	19	0	56	19	21	35	64	214
Subtotal	52	32	215	92	158	174	93	816
28								
Northwest	8	11	149	54	89	46	23	380
Southeast	3	20	46	49	63	62	23	266
Unknown	12	0	19	20	68	38	96	253
Subtotal	23	31	214	123	220	146	142	899
Nearshore[c] Total								
Northwest	161	79	341	146	323	124	176	1350
Southeast	173	151	307	153	238	185	96	1303
Unknown	104	16	170	62	448	98	589	1487
Subtotal	438	246	818	361	1009	407	861	4140
Offshore Total[d]								
Northwest	78	28	367	99	299	111	50	1032
Southeast	110	62	200	118	176	168	52	886
Unknown	78	17	100	39	196	82	192	704
Subtotal	266	107	667	256	671	361	294	2622
Control West Total[e]								
Northwest	124	21	257	63	242	64	60	831
Southeast	158	47	186	59	153	85	34	722
Unknown	106	25	58	29	294	70	143	725
Subtotal	388	93	501	151	689	219	237	2278
Intake/Discharge Total[f]								
Northwest	78	54	222	71	183	83	88	779
Southeast	67	93	131	105	134	162	67	759
Unknown	54	5	94	19	139	51	371	733
Subtotal	199	152	447	195	456	296	526	2271
Control East Total[g]								
Northwest	37	32	229	111	197	88	78	772
Southeast	58	73	190	107	127	106	47	708
Unknown	22	3	118	53	211	59	267	733
Subtotal	117	108	537	271	535	253	392	2213
Grand Total								
Northwest	239	107	708	245	622	235	226	2382
Southeast	283	213	507	271	414	353	148	2189
Unknown	182	33	270	101	644	180	781	2191
TOTAL	704	353	1485	617	1680	768	1155	6762

[a] Values represent the total number of fish collected at each station on each date from a 24-hour set with a 125-ft experimental gill net consisting of five 25-ft x 6-ft contiguous panels of 1/2 in, 3/4 in, 1 in, 1-1/2 in and 2 in bar mesh.

[b] Fish which fell out of the net before their direction of travel could be ascertained were placed in the unknown category. Northwest and southeast represent fish which entered the nets traveling along the beach in those directions.

[c] Total from Stations 3, 13, and 29, all approximately 1300 ft from shore.

[d] Total from Stations 26, 8, and 28, all approximately 3000 ft from shore.

[e] Total from Stations 3 and 26, approximately 3000 ft west of the intake/discharge complex.

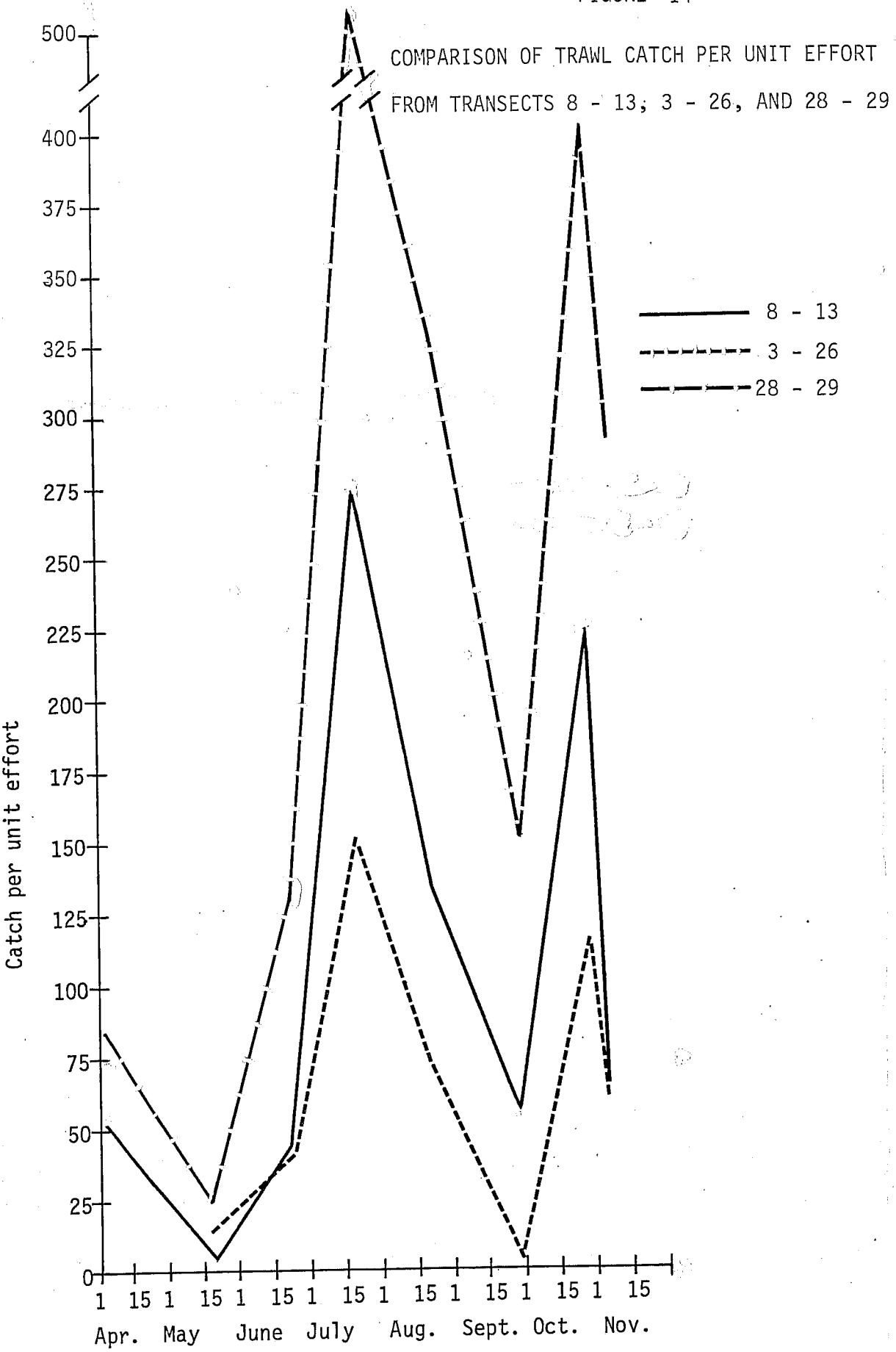
[f] Total from Stations 8 and 13 at the intake and plume area.

[g] Total from Stations 28 and 29, approximately 3000 ft east of the intake/discharge complex.

FIGURE 14

COMPARISON OF TRAWL CATCH PER UNIT EFFORT

FROM TRANSECTS 8 - 13; 3 - 26, AND 28 - 29



River just east of the station. However, this was not observed with gill net results.

A computer program usable by non-programers was developed to analyze fishery data. All results back through 1972 were keypunched and stored on magnetic tape to allow rapid and thorough analyses of operational effects.

Results of stomach analyses from fish collected in trawls at Locust Point were very similar to those of previous years. Results from the control transect and the intake/discharge transect were also very similar. In general, fish at Locust Point are opportunistic feeders, feeding primarily on zooplankters as they become available. Benthic macroinvertebrates gain in importance as the year progresses and zooplankton populations decline.

Ichthyoplankton populations have shown tremendous variations since 1974. Emerald shiners constituted 81 percent of the 1974 larvae, 1 percent of the 1975 larvae, 60 percent of the 1976 larvae, and 4 percent of the 1977 larvae. Yellow perch constituted 5 percent of the 1974 larvae, 70 percent of the 1975 larvae, 4 percent of the 1976 larvae, and 29 percent of the 1977 larvae. Gizzard shad appear to have increased significantly reaching 34 percent of the 1976 larvae and 51 percent of the 1977 larvae. It is felt that the above described variability is largely due to the fact that we are sampling schooling specimens. Consequently, when the net is drawn through a school the density appears quite high.

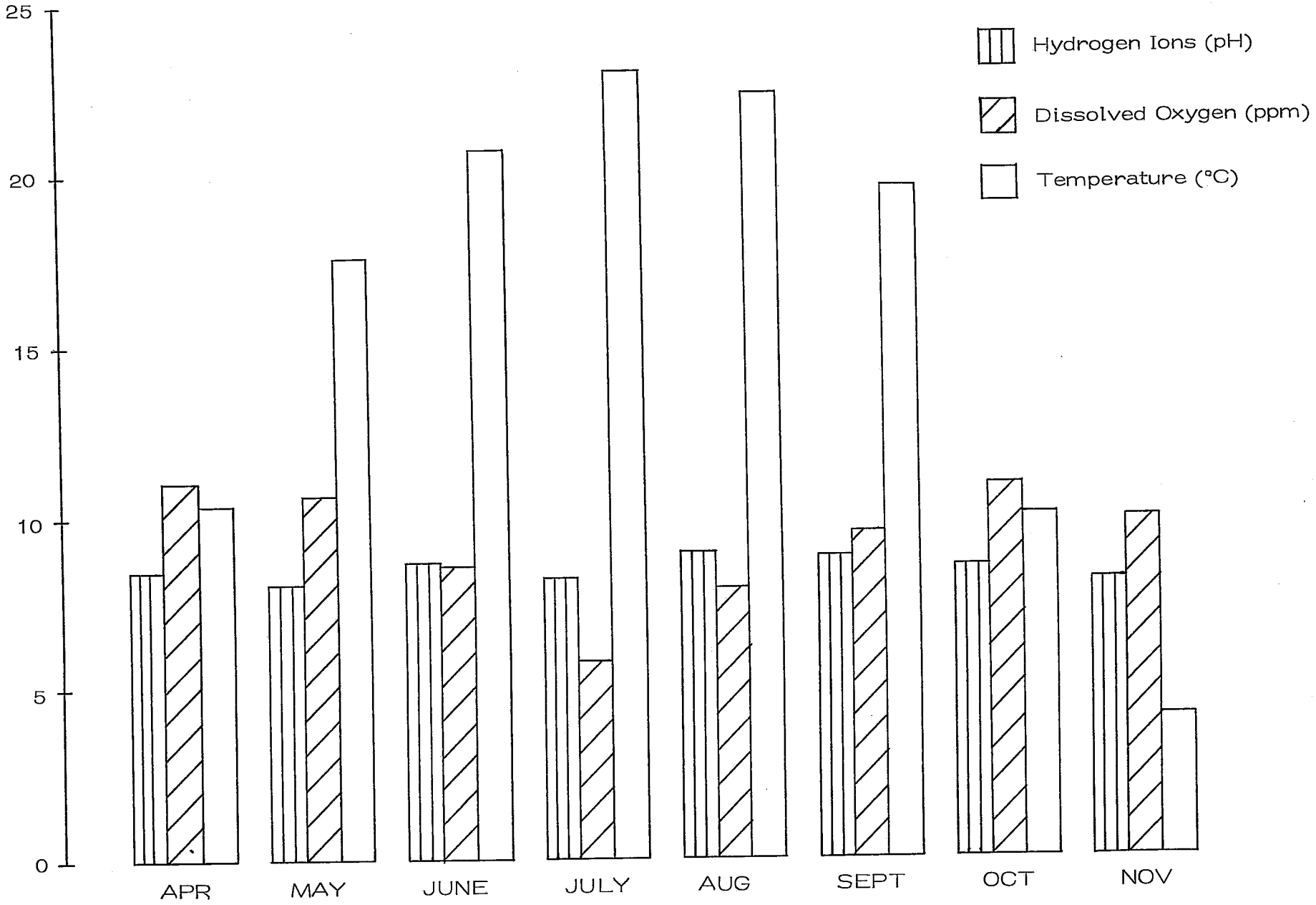
This is the first year that walleye have constituted a significant portion of the catch. However, adult populations throughout the Western Basin are increasing greatly and, consequently, greater larvae populations are to be expected (Scholl, 1978).

In 1976, control stations (3, 26, 28, and 29) were established on either side of the intake (8)/discharge (13) complex to determine if unusually large fish larvae populations were occurring due to possible spawning in the rip-rap material around these structures. This does not appear to be occurring as larvae densities in 1977, as in 1976, at Stations 8 and 13 were normally within the range set by the control stations. Furthermore, due to the great variability observed, density differences between stations were not significant at the 0.05 level. This indicates that populations occurring in the vicinity of the intake and discharge complex were not unusual for the shore of Lake Erie near Locust Point.

Water Quality

Seasonal Variations. The quality of the water in the vicinity of the Davis-Besse Nuclear Power Station during the period April through July 1977 was typical for the south shore of western Lake Erie and showed normal seasonal trends. Water temperature rose nearly 13°C during the period from April to July while the dissolved oxygen level fell 5 ppm (Figure 15). The turbulence of the early spring period and

FIGURE 15. MEAN MONTHLY HYDROGEN ION, TEMPERATURE AND DISSOLVED OXYGEN MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1977.



the corresponding high sediment load are reflected in the high turbidity and suspended solids values and low transparency observed for April (Figure 16). A 5-fold improvement in the clarity of the water took place between April and May. The biochemical oxygen demand was rather low during the entire period even at the time of high turbidity indicating that the suspended material was largely of an inorganic nature. In a like manner most dissolved substances in the water were highest in the early spring and decreased later in the season (Figures 17-19). Alkalinity and pH remained relatively constant while the major ions such as calcium and sulfate decreased significantly. Biological nutrients, such as nitrate and phosphorus, also showed notable decreases as spring algal populations utilized these materials.

The water quality in the vicinity of the Davis-Besse Nuclear Power Station during the period of July through November 1977 was typical for western Lake Erie and showed normal seasonal trends. Water temperature fell 19^{o}C during the 5-month period while the dissolved oxygen (DO) level rose 5 ppm (Figure 15). In July 1977 the DO at Station 1 (bottom) dropped to 3.0 ppm, the lowest value recorded during the pre-operational study:

Year	Dissolved Oxygen Range
1974	5.7 - 14.1 ppm
1975	7.2 - 13.6 ppm
1976	5.0 - 12.5 ppm
1977	3.0 - 12.2 ppm

The International Joint Commission recommends a minimum DO level of 6.0 ppm for Lake Erie water. The high turbulence and sediment load of the lake in early spring improved during the summer and remained relatively constant in water clarity in the fall. Biochemical oxygen demand, which is related to the suspended organic material in the water, was low and nearly constant throughout the year. Dissolved substances in the water were highest in the spring and fall samples; conductivity showed a significant decrease between April and June but remained relatively stable in the summer (Figure 19). Specific ions such as calcium, sulfate, and chloride were also highest in April and were fairly stable throughout the fall (Figure 17). The important nutrients, such as nitrate and phosphate, for primary productivity by green and blue-green algae had a peak in the spring, decreased markedly during the summer and then increased in the fall (Figure 18). A diatom bloom in April resulted in a low value for silica, whereas the green and blue-green algae utilized nitrogen in the summer and fall.

The alkalinity and pH of the water remained fairly constant throughout the year. Lake Erie is primarily a bicarbonate solution with a corresponding moderately alkaline pH of approximately 8.3. The bicarbonate in the water provides an abundant source of carbon for algae production. The pH showed a slight rise in summer (8.9 maximum) which corresponded with the bloom of the blue-green, Aphanizomenon sp.

FIGURE 16. MEAN MONTHLY TURBIDITY, SUSPENDED SOLIDS, AND TRANSPARENCY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1977

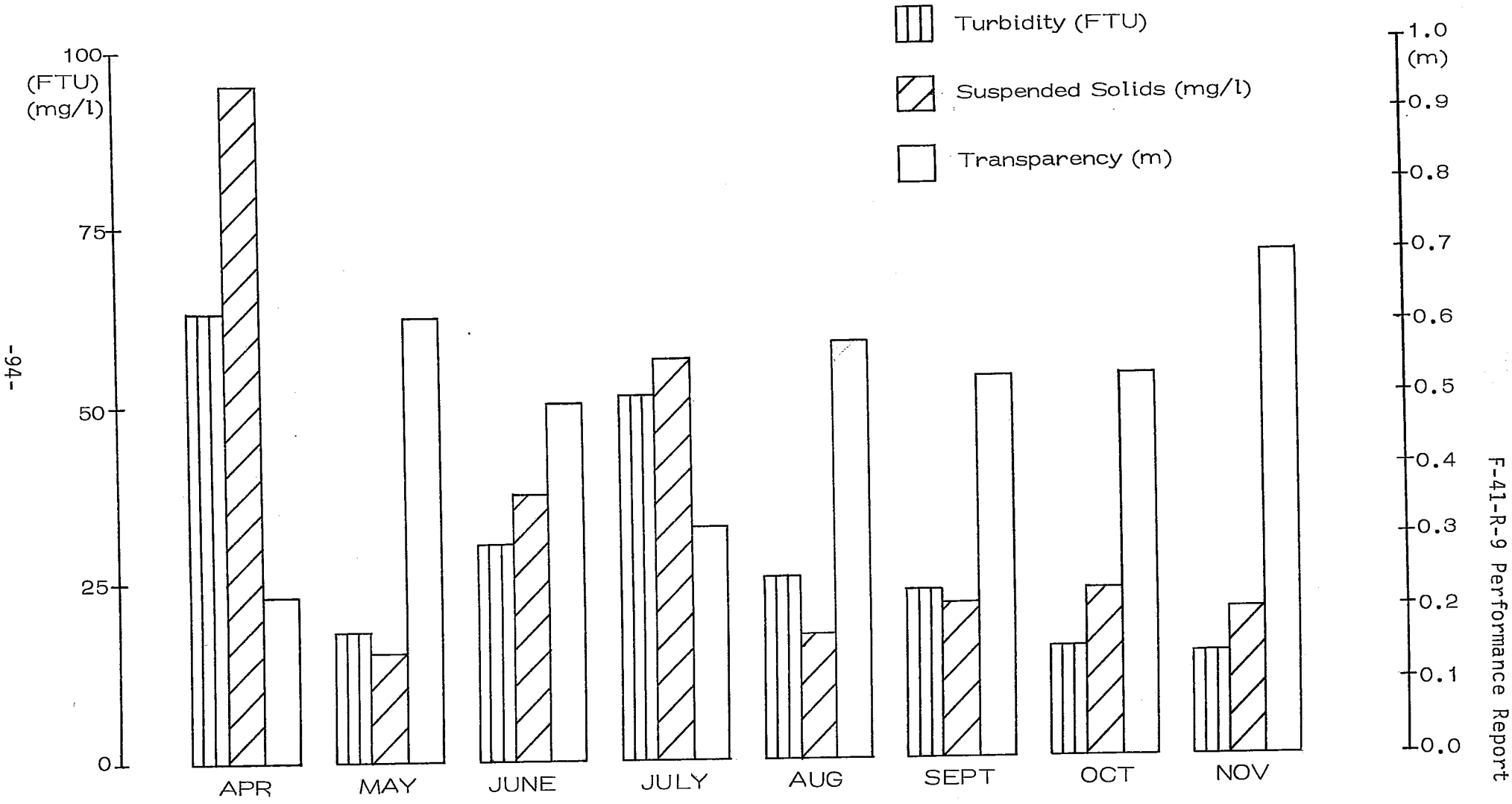


FIGURE 17. MEAN MONTHLY CALCIUM, CHLORIDE AND SULFATE CONCENTRATIONS IN LAKE ERIE AT LOCUST POINT DURING 1977

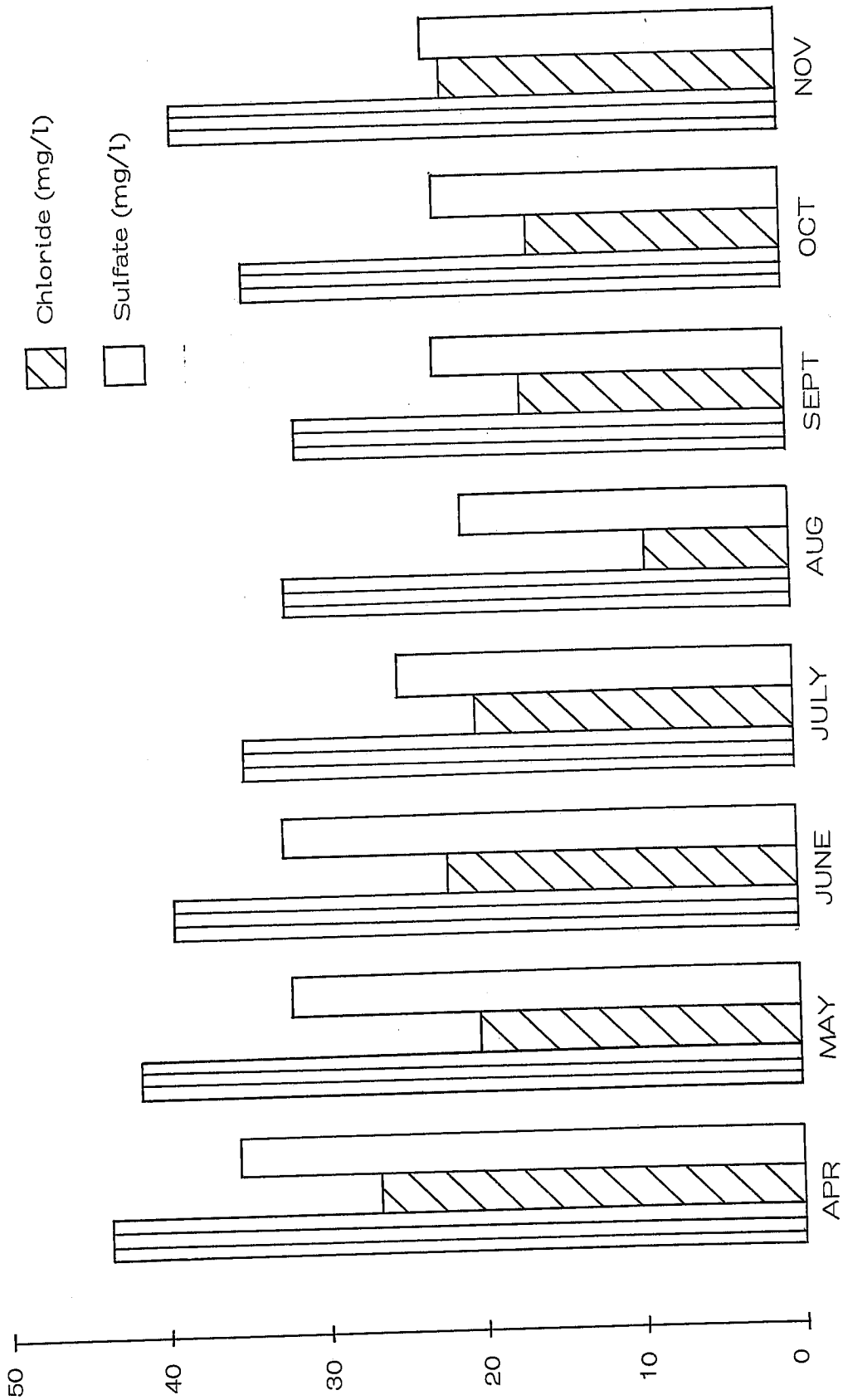


FIGURE 18. MEAN MONTHLY NITRATE, PHOSPHORUS, AND SILICA CONCENTRATIONS IN LAKE ERIE AT LOCUST POINT DURING 1977

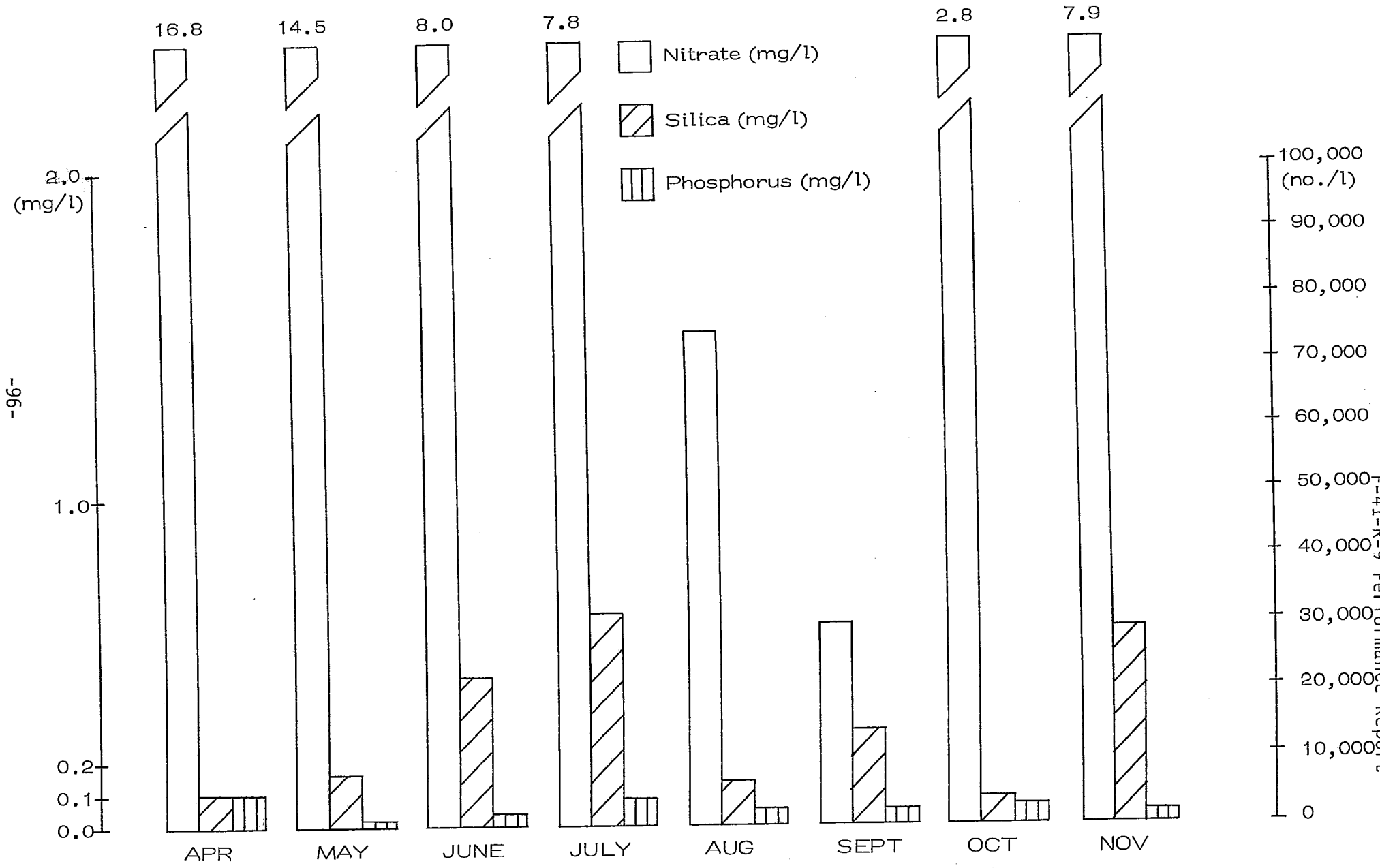
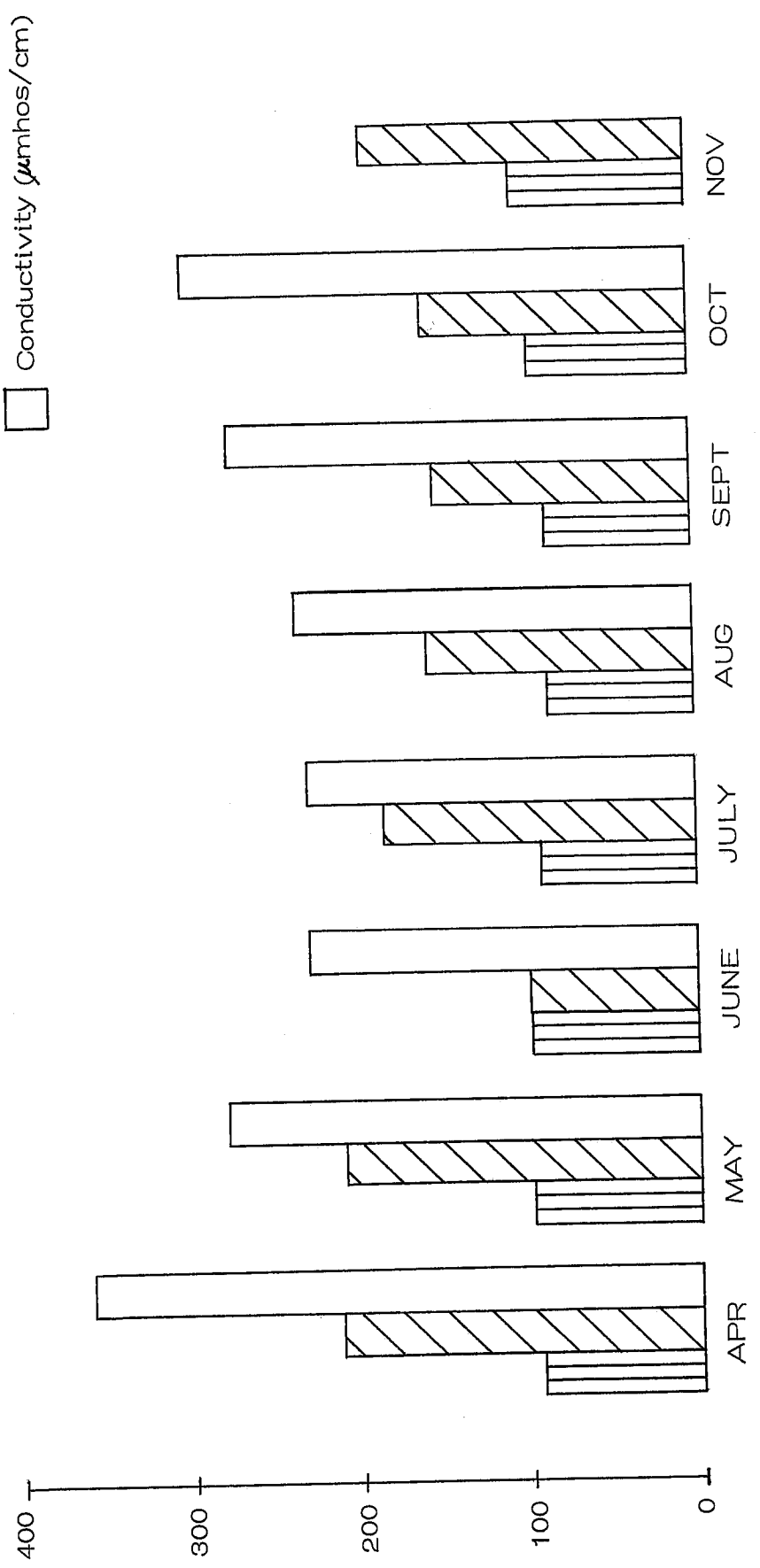


FIGURE 19. MEAN MONTHLY ALKALINITY, DISSOLVED SOLIDS AND CONDUCTIVITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT DURING 1977.



Station Variations. Stations 1, 8, and 13 are located approximately 500, 3,000, and 1,500 feet offshore respectively. Generally a slight temperature decrease was noted in an offshore direction in the spring. Slight decreases were also found for such parameters as conductivity, most of the specific ions, alkalinity, B.O.D., suspended and dissolved solids, and turbidity throughout the year. Conversely, transparency increases away from the shore. Station 8 (the farthest offshore) had the best water quality; Station 1 (nearshore) had the poorest quality for most parameters. The differential in water quality values was greatest in spring and fall which may have been related to seasonal storms. During the summer no significant difference was found between the inshore and offshore stations.

Differences between the surface and bottom water quality were slight because of the shallowness of this portion of Lake Erie. Some depression in the level of dissolved oxygen and small increases in the concentrations of dissolved and suspended solids were noted near the bottom, particularly at Station 1. In November (Table 28) the dissolved oxygen level on the bottom (4.8 ppm) was only half of the surface value (10.2 ppm). This may have resulted from oxygen-poor discharge water at that time.

Water Quality Trends. The Ohio State University, Center for Lake Erie Area Research initiated water quality studies at Locust Point in July 1972. Over the past six years most parameters have shown typical seasonal trends with only small variations from year to year. Trends for eight water quality parameters from June 1972 through November 1977 are shown on Figures 20-22. Temperature and dissolved oxygen show typical seasonal trends for each year with only minor variations from one year to the next. Dissolved oxygen appears to have undergone more depletion in 1976 and 1977 than in previous years. Hydrogen-ion concentration and alkalinity remained fairly stable over the period. Transparency, turbidity, phosphorus, and conductivity values have shown radical variations which are probably due to storms and dredging activities that have disturbed the bottom sediments. Phosphorus levels were low in 1977 compared to earlier years. In general, however, no significant deviations from the normal quality of the water in this part of western Lake Erie have been observed in the past six years.

Primary Productivity

During the August 19th cruise, only surface samples were obtained because of equipment problems. Station 28 was sampled on this occasion because of initial misidentification of bouy numbers. Rough weather precluded obtaining productivity values at Station 14 in October.

As was done in last year's report, an intercomparison of stations has been made using station 3 as a reference, and comparing the mean of productivity values at 0.5 and 1 meters. The results of this comparison are shown in Table 33. Plus or minus values for specific dates are deviations from the mean for three cruises. The 1977 season means

FIGURE 20. TRENDS IN MEAN MONTHLY TEMPERATURE, DISSOLVED OXYGEN, AND HYDROGEN ION MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1977

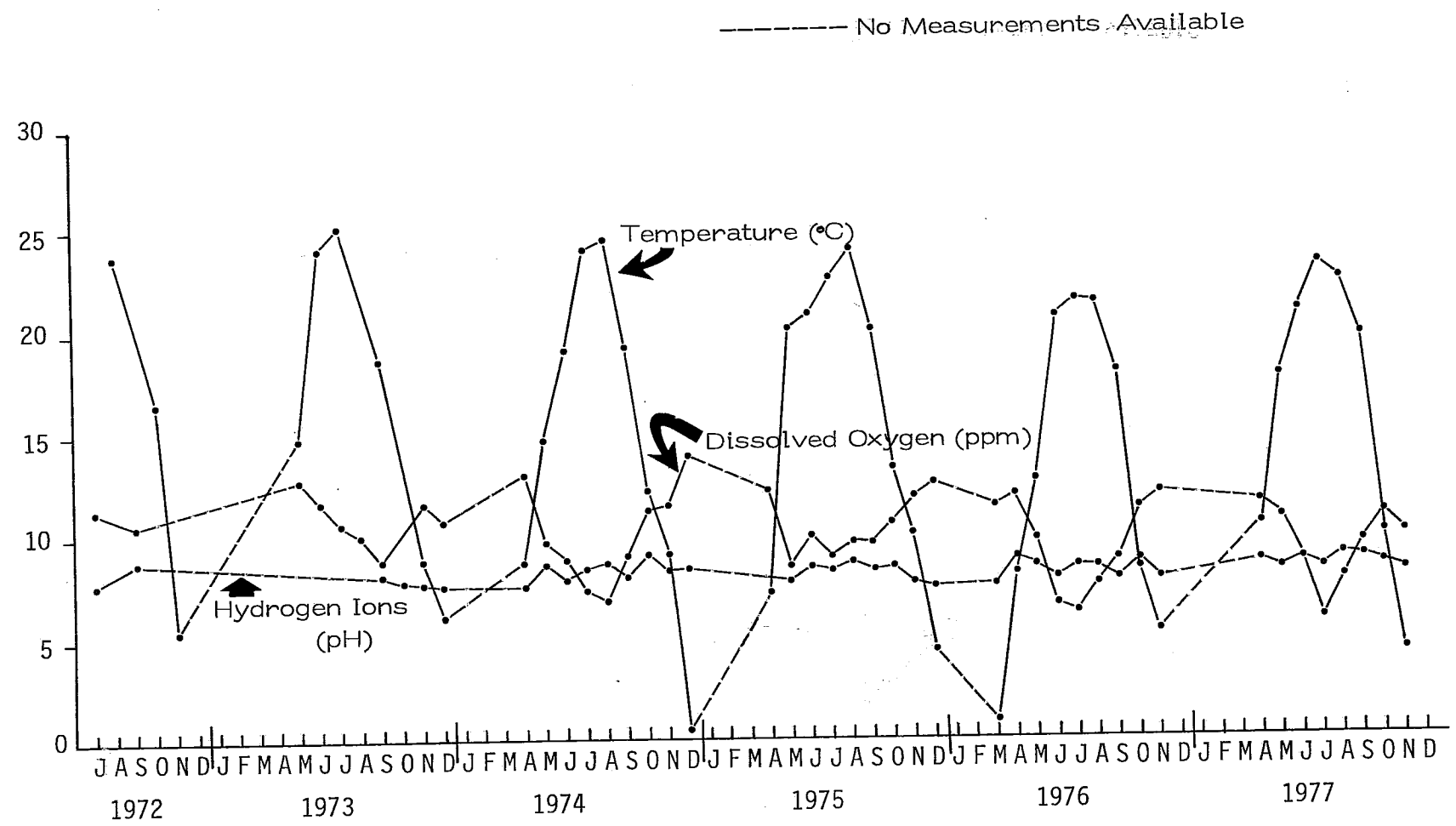


FIGURE 21. TRENDS IN MEAN MONTHLY CONDUCTIVITY, ALKALINITY AND TURBIDITY MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1977

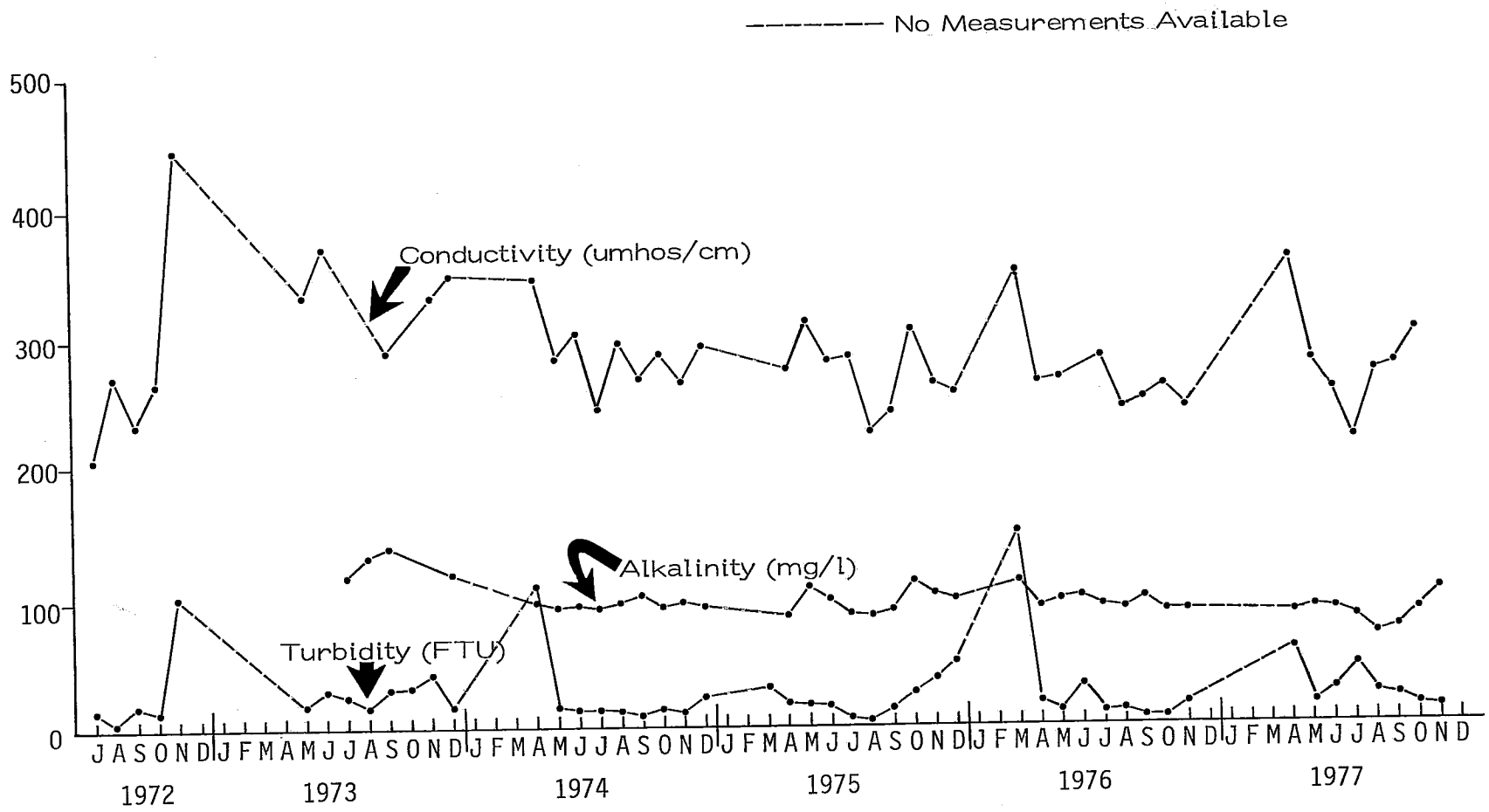
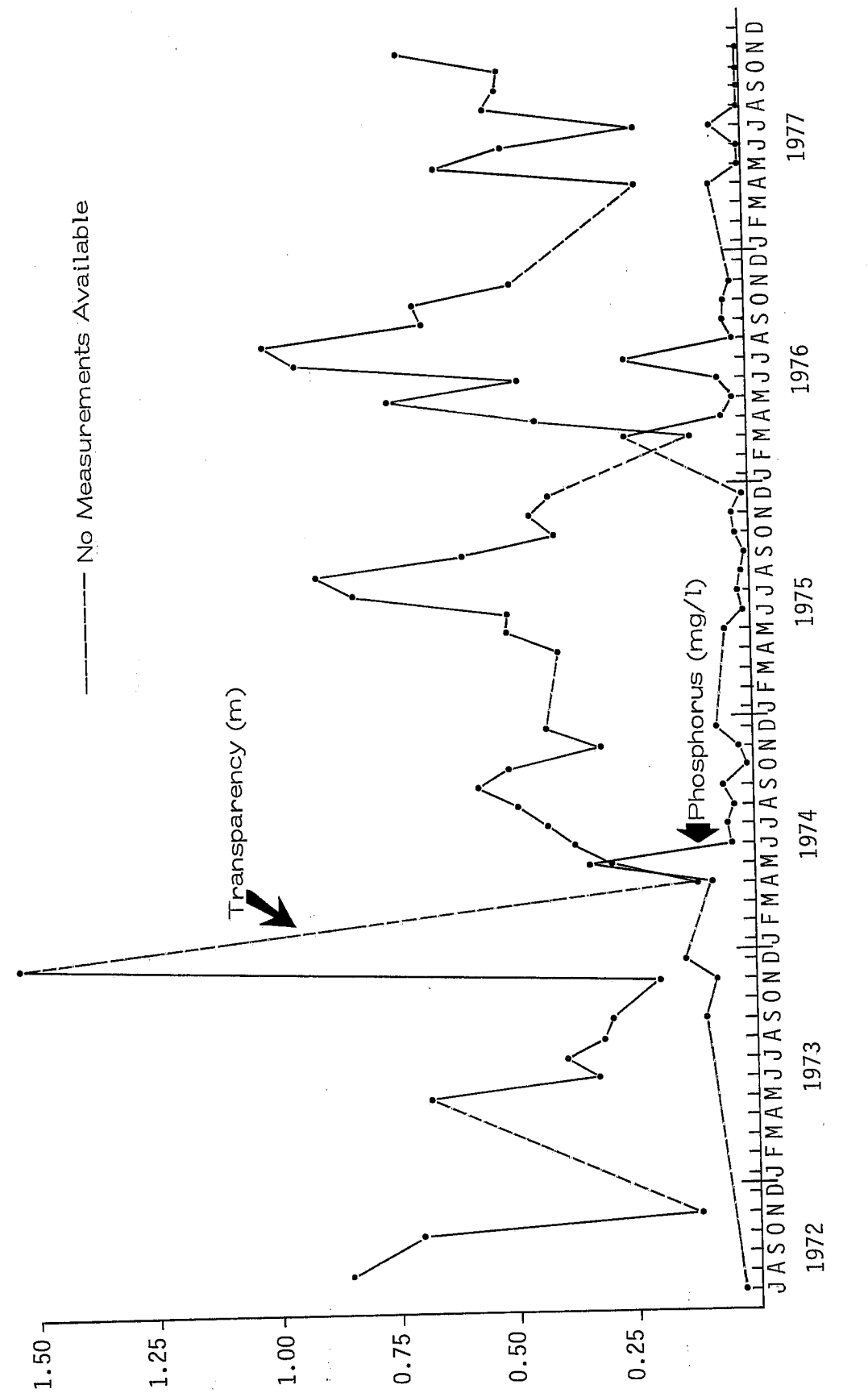


FIGURE 22. TRENDS IN MEAN MONTHLY TRANSPARENCY AND PHOSPHORUS MEASUREMENTS FOR LAKE ERIE AT LOCUST POINT FOR THE PERIOD 1972-1977



for all stations are comparable with similar values measured during the 1976 field season. This statment is based on the observation that there is overlap of the ranges determined by calculating the mean deviation from the mean. However, values for all stations are lower than they were in 1976. The mean deviations from the mean are also smaller than for 1976. Station 13 shows the greatest variability, as it did in 1976.

During two cruises, May 12th and July 18th, Stations 13 and 14 were compared. The ratio of the mean of productivity values at 0.5-meter and 1-meter depths at Station 14, compared to Station 13, was 2.5 on May 12th and 0.95 on July 18th.

During August a check was run on the day-to-day variability of primary productivity values by Dr. Walter E. Carey and students at the F. T. Stone Laboratory. The measurements were made at the navigational bouy off Peach Point at South Bass Island, and were conducted nominally between 1000 hours and 1400 hours. The results are shown in Table 34 and give insight into the daily variation of primary productivity at a fixed location such as the Locust Point sampling stations. Within a 4-day period, productivity values at a depth of 0.5 meters varied by almost a factor of three.

A draft copy of the field and radioassay procedures manual was used by several new and temporary crew members with considerable success. A final version will be produced during the next year to assure that all procedures are totally repeatable.

Since light intensity has a strong effect on primary productivity, depth profiles of light intensity were obtained with photometers when primary productivity incubations were conducted. These light intensity values are given in Table 35. Values listed for May 12th are in microamperes. Values for all other dates are given in foot-candles.

STUDY RECOMMENDATIONS

There are two major study recommendations and they are the same as the job recommendations: continue emphasis on computerization and, now that the plant is operational, add plant operating data to the data base. This will be very important during the initial years when it is likely that the plant will be on and off many times until all the "bugs are ironed out," and, if the effects of operation are to be determined, it is essential that we know the degree of operation on sampling days.

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