NIAGARA MOHAWK POWER CORPORATION

POWER AUTHORITY OF THE STATE OF NEW YORK

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NINE MILE POINT AQUATIC ECOLOGY STUDIES

LMS Project Nos. 191-21, 22, 23

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(Chapters I - VI)

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File: 191-21,22,23

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Mr. George T. Berry
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Dear Messrs Rhode and Berry:

In accordance with Niagara Mohawk Power Corporation and the Power Authority of the State of New York's authorization and the Environmental Technical Specifications for Nine Mile Point Nuclear Station Unit 1 (Docket 50-220) and the James A. FitzPatrick Nuclear Power Plant (Docket 50-330), we submit herein a report on the results of the ecological investigations conducted at Nine Mile Point during 1974.

Mr. Thomas E. Pease served as Project Manager for these investigations and Dr. Edythe Humphries as Project Biologist. The report was prepared by our Biological Sciences Section under the direction of Dr. T. Cosper. The field and laboratory studies were conducted by our Oswego Laboratory under the direction of Mr. Robert Williams.

Very truly yours,

Michael J. Skelly

Michael J. Skelly, Ph.D

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I. ABSTRACT

Ecological studies conducted by LMS in the Nine Mile Point vicinity during 1974 represent the continuing efforts of the Power Authority of the State of New York and Niagara Mohawk Power Corporation to evaluate the effects of thermal discharges from Nine Mile Point power stations on the near-field aquatic ecosystem of Lake Ontario. The lake water temperature measured in the Nine Mile Point vicinity during 1974 were significantly lower than those recorded during 1973; the annual maximum during both years occurred in late August/early September and was approximately 10°F lower in 1974. The water quality parameters monitored in the lake and in the Nine Mile Point Nuclear Station during 1974 did not fluctuate significantly from the values recorded during 1973.

The primary production rates of phytoplankton and buoy phycoperiphyton recorded in the Nine Mile Point vicinity suggested that the power plant's thermal discharges may occasionally increase production rates significantly in the thermal plume; however, increased production rates at NMPE transect may occur more frequently due to the enriched microenvironment of Mexico Bay. The seasonal fluctuations in primary productivity rates and the decrease in chlorophyll a concentrations in the discharge canal of the nuclear station suggested that metabolic changes occurred in entrained phytoplankton.

The abundance of all major microzooplankton groups was significantly greater at the NMPE transect; of the macrozooplankters, *Leptodora*, *Gammarus*, and Diptera were significantly more abundant east of the NMPP transect at the 20 ft depth contour. These patterns suggest that the plant's thermal discharge may increase the abundance of some microzooplankton (e.g., rotifers and copepods) and macrozooplankton (e.g., *Leptodora*). Viability studies on microzooplankton showed that entrainment mortality varied seasonally; the highest percent immediate mortality ocurred during winter and summer.

The effect of the thermal discharge from the Nine Mile Point Nuclear Station Unit 1 on the benthos community was not apparent during the 1974 sampling program. A preliminary survey of *Cladophora* distribution in the Nine Mile vicinity showed the alga to be most abundant at the 10 and 20 ft depth contour stations and consistently present at the NMPP 30 ft station; substrate type was the controlling factor.

Alewife and rainbow smelt were the most abundant fish species in lake samples (based on catch per effort) and in impingement collections (based on abundance and biomass) as both adults and ichthyoplankton. The timing of the spawning migration of alewives and rainbow smelt and the subsequent distribution of the ichthyoplankton were not affected by the thermal discharge from the Nine Mile Point Station. However,

the impingement rate of these species reflected the migration, and the period of peak entrainment reflected the abundance of ichthyoplankton in the near-shore zone.

Alewives, rainbow smelt, white perch, yellow perch, and smallmouth bass collected in the lake had a greater average length, growth increment between years, and weight per unit length than those from impingement collections; species composition and seasonal distribution were similar for both. Significantly more alewives were collected from the bottom waters off the James A. FitzPatrick Nuclear Station (FITZ transect) than from the other locations.

The Student's-t n-point smoothing procedure to estimate total annual impingement yielded an upper limit (at >90% confidence) of 2.5 million fish compared to 2.2 million fish estimated from an average of all impingement collections. The impingement cropping rates for both 1973 and 1974 were small compared to commercial cropping rates and natural mortality.

Viability studies indicated a greater percent survival for adult alewife, rainbow smelt, gizzard shad, and threespine stickleback which were sampled immediately following impingement rather than after passage down the sluiceway into the discharge canal. Passage of live ichthyoplankton through the condensers yielded an upper limit of 83% mortality assuming negligible net sampling mortality.

II. SUMMARY OF FINDINGS AND CONCLUSIONS

A. WATER QUALITY

Water quality parameters analyzed during 1973 and 1974 showed similar patterns, with the greatest variability by date. Algal growth and transient vertical temperature regimes were probably the major factors responsible for variations in measured values of the water quality parameters within the sampling area. Thermal gradients were observed during the summer throughout the study area; however, these gradients were transient and unstable, moving into the deeper portions of the lake as the summer months progressed. The passage of Lake Ontario water through the condenser cooling system of Nine Mile Point Nuclear Station Unit 1 appeared to have little, if any, effect on the water quality of the lake, as the difference in measured parameter values between the intake and discharge during 1973 and 1974 was minimal. Measurement of water quality in the vicinity of the Nine Mile Point sewage treatment plant and the oxidation pond show that discharges from these sources have been adequately treated to maintain the existing water quality of Lake Ontario.

B. PLANKTON

During the past two years of aquatic biology studies in the Nine Mile Point vicinity of Lake Ontario, considerable data have been amassed on the planktonic communities. In analyzing these data, the emphasis has been on the isolation of patterns in time (among years, seasons, weeks, and times of day) and space (among depth contours, depths in the water column, and geographic locations) in the vicinity of Nine Mile Point Nuclear Station Unit 1. This section will, therefore, emphasize those features most relevant to assessing the impact of Nine Mile Point Nuclear Station Unit 1 on this community. Since the macrozooplankton and ichthyoplankton studies represent baseline information for Lake Ontario, greater attention will be devoted to describing the basic characteristics of these communities.

1. Phytoplankton

The two years of study have shown the phytoplankton community in the Nine Mile Point area to be highly variable in species composition and temporal/spatial distribution. Phytoplankton community dynamics in the Nine Mile Point vicinity are generally typical of the near-shore region of Lake Ontario. The variability in the phytoplankton community appears to be primarily the effect of two environmental factors: water temperature and water circulation patterns.

Annual differences in water temperature apparently caused annual differences in the abundance and species composition of the green and blue-green algae, but near-field elevations in water temperature resulting from the plant's thermal discharge had no apparent effect on phytoplankton abundance. The spatial/temporal variability of phytoplankton in the study area was attributed to the complex water circulation patterns and frequent water mass changes in the Nine Mile Point vicinity. The dynamic nature of water circulation in the study area also suggests that residence time of phytoplankton in the discharge plume was short, probably several hours. Although measurable changes in algal abundance probably could not occur during such brief exposure to the small temperature elevation in the discharge plume, metabolic rates of phytoplankton may be altered during brief exposures to small temperature elevations; e.g., production rates were generally greater at the NMPP transect than at the NMPW control transect, but significantly so on only one of eight study dates. Other more frequent differences in production rates, and differences in the seasonal patterns of chlorophyll a concentrations among transects at a 0.05 significance level, suggested that the NMPE transect in Mexico Bay may be located in a different microenvironment from the other transects. If this is the case, stimulation of primary production in the area of the discharge plume may be an artifact of measurement in a natural transitional zone between microenvironments rather than a thermal effect.

Therefore, while thermal discharges may occasionally stimulate primary production in the immediate vicinity of the discharge, the overall effects of the power plant are negligible compared to the effects of natural environmental variables on the abundance, distribution, and production of phytoplankton in the Nine Mile Point area of Lake Ontario.

2. Microzooplankton

The microzooplankton community was apparently less affected by annual differences in water temperature than the phytoplankton, since magnitudes of peak rotifer, copepod, and cladoceran abundance were similar during 1973 and 1974. The differences observed in the seasonal abundance patterns of these taxa were related to annual differences in water temperature.

The spatial distribution of microzooplankton varied significantly among collecting dates, and as for phytoplankton, this variability may have been related to the dynamics of water circulation in the Nine Mile Point area. The mean abundance of rotifers, copepods, cladocerans, and protozoans was significantly greater at the NMPE transect than at the other three transects in the area, suggesting that the NMPE transect may be in a different microenvironment. Pattern-frequency analyses showed greater rotifer and copepod abundance and

lower cladoceran and protozoan abundance at NMPP transect than at the NMPW transect; however, only the increase in copepod abundance was significant.

In-plant sampling revealed no significant difference in the mean abundance of major microzooplankton taxa between the intake and discharge sampling locations; therefore, any mechanical destruction of microzooplankton during entrainment or sampling was undetectable. The mean difference in the percentage of dead microzooplankton, rotifers, copepods, and protozoans between the intake and discharge of Nine Mile Point Nuclear Station Unit 1 was statistically significant during both 1973 and 1974; the highest mortality occurred during winter and summer.

3. Macrozooplankton

The macrozooplankton studies conducted during 1973 and 1974 in the vicinity of Nine Mile Point represent the first effort to characterize the composition, abundance, and distribution of this community in Lake Ontario. Defined as being composed of organisms greater than 571μ, the macrozooplankton community was dominated by the cladoceran Leptodora kindtii. The amphipod Gammarus fasciatus, dipteran larvae and pupae, and hydroids were also abundant; the amphipod Pontoporeia affinis and the mysid Mysis oculata relicta were infrequently collected.

Macrozooplankters show diurnal vertical migration patterns; significantly greater numbers were collected at night and in the deeper layers of the water column throughout a daily cycle. Diurnal migration patterns were more strongly developed in some organisms than in others; for example, during the day, Gammarus fasciatus was infrequently collected in the surface layers of the water column whereas Leptodora kindtii was more homogeneously distributed. These diurnal patterns of vertical distribution are related to potential power plant impact. Because thermal discharges are buoyant (except in midwinter) and tend to be surface phenomena, they may affect Leptodora more than Gammarus. However, a bottom intake structure, such as exists at Nine Mile Point Nuclear Station Unit 1, can be expected to draw in primarily bottom water and therefore to entrain relatively more Gammarus than Leptodora.

Comparison of the abundance of Leptodora kindtii, Gammarus fasciatus, and Diptera (larvae and pupae combined) during 1973 and 1974 indicated that the seasonal patterns for Gammarus and dipteran populations were apparently unaffected by the lower water temperatures in 1974, and that the annual abundance maximum for Leptodora occurred earlier during 1973. Macrozooplankton concentrations fluctuated among collecting dates during both years, suggesting that water circulation may have also influenced macrozooplankton distribution.

During 1974, the mean abundances of three groups (Leptodora kindtii, Gammarus fasciatus, and Diptera) were significantly greater at all sampling sites east of NMPP transect than to the west. Macrozooplankton were also more abundant in shallower waters (20 ft depth contour) than in deeper waters (40 ft depth contour), but such differences were only infrequently significant. These patterns may have been related to plume entrainment of zooplankton in the vicinity of the discharge or, to the effects of thermal discharges on vertical/ diurnal distribution since seasonal increases in temperature apparently stimulated diurnal migration of benthic Gammarus populations. However, the effects of water temperature increases due to thermal discharges were probably negligible, since natural annual differences in summer water temperatures were observed to be comparatively larger (~10°F) and had no apparent effect on the magnitudes of macrozooplankton abundance in the study area.

Finally, the spatial and temporal distribution of the macrozooplankton community in the Nine Mile Point vicinity is highly dynamic. Macrozooplankton distribution is affected by thermal discharges only to the degree that warm water stimulates diurnal migration; harmful thermal effects were not detected in any of the macrozooplankton taxa examined, except possibly Leptodora kindtii. However, the generally reduced abundance of this organism toward the eastern end of the study area could have been due to natural factors associated with the Mexico Bay microecosystem.

The results of statistical analyses conducted during 1974 suggested that entrained macrozooplankton were homogeneously distributed in the intake canal at Nine Mile Point Nuclear Station Unit 1, and varied two to threefold in abundance among intake and discharge sampling locations. Although entrainment is selective to some degree for organisms found most frequently near the bottom, as opposed to those which prefer the surface or are evenly distributed throughout the water column, the mechanical stress and thermal effects of entrainment were not determined.

4. Ichthyoplankton

The ichthyoplankton community in the Nine Mile Point vicinity of Lake Ontario is characterized by relatively small numbers and few species, of which the burbot, Coregonus sp. (either the cisco or lake herring), rainbow smelt, johnny darter, mottled sculpin, white perch, and alewife were dominant. The limited numbers of ichthyoplankton collected in the study area suggest that this area is not a major spawning area for Lake Ontario fish populations.

The seasonal patterns of fish egg and larval abundance in the vicinity of Nine Mile Point Nuclear Station were consistent with documented spawning and development patterns. Three spawning and larval development periods occurred, minimizing competition among species for available

food and maximizing the probability of survival. Burbot and Coregonus sp. larvae appeared first, during early April, and during May and June the larvae of yellow perch, rainbow smelt, and white perch were observed; smelt and white perch larvae continued to be collected through early fall. The third spawning period (mid-June through August) was characterized by the dominance of alewife, johnny darter, and mottled sculpin larvae. Two distinct peaks in alewife concentrations occurred during both 1973 and 1974, possibly reflecting the spawning of separate alewife populations or dispersion of larvae by advection in the midst of an extended spawning period. There was no apparent relationship between the operation of Nine Mile Point Nuclear Station Unit 1 and this bimodal pattern.

The eggs of the walleye and the gizzard shad were identified in samples collected from the study area, but they were present in small numbers on only a few dates, and no larvae of these two species were collected.

Fish eggs were significantly more abundant in bottom collections at night than at other depths in the water column and times of day, a pattern related to the production of demersal eggs by the dominant species in the area. The occurrence of more eggs in night collections suggests that spawning may increase at night. Greater abundance of eggs at stations along the 20 ft depth contour than at stations in deeper water corresponds to the preference of adult fish for spawning in shallow waters, whereas the collection of fewer eggs at NMPE-3 mile radius in Mexico Bay was probably related to the sand-silt bottom substrate, which is not conducive to egg deposition or development.

Rainbow smelt and alewife larvae were significantly more abundant at night than during the day. During mid-June and August, rainbow smelt and alewife larvae, respectively, were more numerous at the spawning sites in shallower water, but as they matured they moved offshore.

Mean concentrations of total fish eggs, rainbow smelt larvae, and alewife larvae were statistically similar from west to east in the study area, indicating that, with the possible exception of the minimum abundance of alewife larvae collected at the NMPW-1/2 mile radius, the distribution of fish eggs and larvae in the Nine Mile Point vicinity was not influenced by the operation of Nine Mile Point Nuclear Station Unit 1. The reduced number of alewife larvae at the NMPW-1/2 mile radius stations could have reflected the effects either of entrainment or of water temperature and substrate differences at that radius.

Entrained fish larvae, like entrained macrozooplankton, were homogeneously distributed among in-plant collecting sites. Similarity of seasonal and diurnal patterns of abundance at lake and in-plant collecting locations suggested that entrainment of ichthyoplankton was non-

selective; fewer larval species were identified in in-plant samples than in lake samples probably because the number of in-plant collections was small.

During 1974, approximately 83% mortality, assuming no sampling gear mortality, resulted from plant induced factors. Assuming sampling gear mortality, however, 39% of the total ichthyoplankton collected in the discharge canal were killed due to plant induced factors.

C. BENTHOS

Thermal discharges from Nine Mile Point Nuclear Station Unit 1 did not measurably vary the effects of perturbations of the benthos community. Variations in benthic abundance and biomass occurred among stations, months and years; these variations reflected natural population fluctuations, the presence of transient species, and the responses of the benthos to shifting sediments.

Analyses of animal-sediment relationships showed that areal distribution patterns of macroinvertebrates were correlated with sediment type (Manayunkia - bedrock and rubble; Lebertia - bedrock; tubificids and Cryptochironomus - sand and silt). The dominant benthic organism, Gammarus fasciatus, was recorded from all substrate types.

Cladophora distribution and biomass were shown to be similarly related to substrate type rather than to a temperature difference among stations. Areas of increased Cladophora growth, which provided food and refuge for macroinvertebrates and nekton, were generally characterized by an increase in richness and diversity of macroinvertebrates. During the summer, the oligochaete Nais bretscheri became very abundant, utilizing partly decayed Cladophora filaments as a food source.

Sediment instability along the NMPP and FITZ transects, especially at the 20 and 30 ft contours, resulted in low benthos abundance and biomass. In contrast, periphyton abundance and biomass were greater east of the NMPP transect.

D. NEKTON

1. Abundance and Population Comparison

Comparison of impingement collection data from Nine Mile Point Nuclear Station Unit 1 with the results of fish sampling efforts conducted in Lake Ontario in the vicinity of the plant site permits the effects of plant operation to be evaluated. Because nektonic organisms were collected at lake stations from April through December, collection data from both sampling locations were comparable for most of the year, including the period of major organism activity.

In general, similar trends in total fish abundance were observed in both impingement and lake samples (lake collections based on gill net collections). Peak abundance was observed during the spring/early summer months, followed by a gradual decline through the late summer/early fall months. The fall decline was reversed in plant samples during December as a result of increased rainbow smelt and gizzard shad impingement.

Variations between lake and impingement collections during the months of peak fish abundance are in part due to the efficiency of the sampling methods employed. The gill net is often the most effective method for sampling lakes with rock-strewn substrates such as the area around Nine Mile Point. However, gill nets are a size-selective gear, and consequently, during different periods of the year, they are also species-selective. The other sampling techniques employed (trawls, beach seines), including impingement collections, also have inherent selectivity that must be considered in the comparison of data.

The dominant species observed in both impingement and lake gill net collections was the alewife, which constituted approximately 94% of the estimated 2.2 million fish impinged in 1974. Length frequency comparisons between the lake and plant samples suggest seasonal differences in population composition. During the period of peak alewife impingement (spring), yearlings composed a major portion of the samples, while lake collections were dominated by adults. Yearling alewives were not, however, a major component of the impinged population during the summer and fall months. Young-of-the-year recruitment was observed in fall impingement collections when lake fish collections were composed of yearlings and adults. Yearlings were first observed during lake sampling in July, after which they were present through the rest of the year. Length frequency graphs from lake collections (Figure VII-6) indicated no young-of-the-year alewives. The differences noted in age class composition of the two samples is due in part to gear selectivity; gill nets do not effectively catch young-of-the-year. The data also suggest the existence of seasonal distributional trends of subpopulations in the study area.

Rainbow smelt was the second most abundant species in both plant and lake collections during 1974, and in 1973 impingement samples; the species ranked fourth in lake samples in 1973. The percentage composition for both lake and in-plant collections increased between years, suggesting an increased use of the shore zone by this species. Abundance trends were similar, with the greatest percentage reported from the spring months for lake collections, and late fall/early spring for impinged rainbow smelt. Length frequency data suggest the presence of different populations in the lake and impingement collections. Impingement samples were composed predominantly of

yearling fish, with young-of-the-year fish present during fall collections.

By contrast, mature smelt (average total length around 16.0 cm) dominated the lake samples, with a few yearlings present in collections during the late spring. Young rainbow smelt are more abundant in surface to middle water layers with a preference for deeper water correlated with an increase in age. The Nine Mile Point intake is located in approximately 20 ft of water, which would be the preferred water depth for yearling fish. Most lake collections were made in deeper water with bottom nets, a combination which could account for the preponderance of more mature fish in lake samples.

White perch ranked third in Lake Ontario gill net collections and fourth in impingement collections. Most white perch taken in the lake were collected during late spring/summer; the eastern section of the study area yielded the highest concentration. Abundance of white perch in impingement collections peaked in March/April and again in September. Length frequency data for the two collections show that the composition of lake and plant samples resembled that observed for rainbow smelt; most impinged white perch were yearling specimens, with recruitment of young-of-the-year noted in September, whereas primarily older white perch were collected in the lake, with some yearlings collected in April, and young-of-the-year taken in the fall.

In lake samples during 1974, yellow perch were concentrated primarily along the two eastern transects and not in the vicinity of the plant. This in part explains the comparatively low numbers of this species impinged compared to the population abundance indicated in the study area. Length frequency data for the months when collections were comparable indicate similar age composition in lake and plant samples except during December, when young-of-the-year were noted in impingement collections and not in lake samples.

Smallmouth bass were more abundant at lake stations during the summer months, while they were impinged in greatest abundance in the winter and least during the summer months. Age composition of impinged and lake populations, as reflected in length frequency distribution, was similar; both collections were dominated by older, sexually mature fish.

Other fish populations were impinged in such small numbers at the Nine Mile Point plant that a comparison of abundance and seasonal trends between the lake and impingement collections was precluded.

2. Biomass

During the 1974 sampling program, alewives contributed 91.2% to the impinged fish biomass; the remainder was composed of rainbow smelt (3.8%) and other fish species (5.0%). The trend in biomass of impinged fish consisted of an increase during the winter, a yearly maximum during spring, and a steady decline during summer and fall. This pattern corresponds with the increased impingement of rainbow smelt during the winter, when this species constituted the greatest part of the fish biomass (>30%), and a decrease in numbers of impinged rainbow smelt in the summer as older fish moved offshore after spawning.

At Nine Mile Point, patterns of fish biomass in the lake generally follow those observed for impingement biomass. Seasonal differences in lake and impingement biomass for alewife and rainbow smelt reflect migratory habits. The biomass of the yellow perch, white perch, and smallmouth bass is consistent between impingement and lake collections. The fluctuations observed in the average weight per individual reflect the migratory and growth histories of the species.

3. Sex Ratio

a. Alewives

The ratio of male to female alewives in lake and impingement collections during 1974 was compared (Table II-1). Impingement data are presented in the Appendix and lake data in the 1974 Ecological Survey Report.

These data indicate more female alewives than males in both lake and plant sampling during 1974. These results are based upon analysis of 27,643 alewives from trawl and gill net collections in the lake and 29,343 alewives from impingement collections.

The average annual percent composition of male and female alewives in lake collections was 22.7% and 77.3%, respectively, and in impingement collections 41.9% males and 58.1% females. The 1973 lake collections at Nine Mile Point were similar, with 9.8% of the catch males and 90.2% females. Spawning populations of both anadromous and landlocked alewives have been characterized by a preponderance of males. However, male numerical dominance was observed in neither lake nor impingement collections during 1974. This suggests that alewives do not utilize the Nine Mile Point area as a spawning ground, although seasonal migrations of alewives have been noted in this area. Furthermore, because similar sex ratios were observed in both lake and impingement collections, the impingement process is apparently not sex selective for alewives.

TABLE II - 1

SEX RATIOS FOR ALEWIVES COLLECTED BY IMPINGEMENT

NINE MILE POINT - 1974

COLLECTED MONTH	MALE		FEMALE		PROBABILITY OF OBTAINING THE OBSERVED RATIO IN POPULATION WITH MALE TO FEMALE OF 1:1
	ABUNDANCE	PERCENT	ABUNDANCE	PERCENT	
APR	742	44.94	909	55.06	P < 0.001
MAY	1310	39.67	1992	60.33	P < 0.001
JUN	1061	51.68	992	48.32	0.10 < P < 0.25
JUL	2783	48.59	2945	51.41	0.025 < P < 0.05
AUG	1958	40.41	2887	59.59	P < 0.001
SEP	1262	35.01	2343	64.99	P < 0.001
OCT	1242	35.97	2211	64.03	P < 0.001
NOV	751	34.53	1424	65.47	P < 0.001
DEC	1073	47.39	1191	52.61	0.01 < P < 0.025
TOTAL	12182	41.90	16894	58.10	P < 0.001

b. Rainbow smelt

A total of 5,542 rainbow smelt collected by trawl and gill net and 3,479 smelt impinged at the Nine Mile Point plant during 1974 were utilized for plant-lake sex ratio comparisons. Sex ratio data for the impingement collections are presented in the Appendix. As indicated in Chapter VII the annual total for lake collections reflected approximately a 1:1 sex ratio, with 50.3% males and 49.7% females. However, a closer examination of monthly lake collection data indicates that the relatively large size of the April sample biased the annual ratio. In fact, the male:female sex ratio calculated for the period May through December 1974 was 1:2.04, with females predominant. Similarly, a preponderance of female rainbow smelt was indicated in impingement collections on both a monthly and an annual basis (Table II-2). More males than females are usually present in spawning areas during the early and late parts of the spawning season; the greater percentage of males observed during April, the first month of lake sampling, may reflect the end of the spawning migration. Nevertheless, the higher percentage of females in impingement collections throughout the winter and in April indicates that the Nine Mile Point area is likely not extensively used as a rainbow smelt spawning ground. The similarity between the lake and impingement sex ratio data suggests that impingement is not sex selective for rainbow smelt.

c. Others

Because other selected fish species (including yellow perch, white perch, and smallmouth bass) discussed in Chapter VII were collected in low abundance, lake and impingement collections could not be directly compared, although general trends were indicated.

More female yellow perch were observed in lake trawl and gill net collections; the sex ratio of impingement catches was also generally biased toward females. In an earlier study, 40% of yellow perch tagged and released near Nine Mile Point migrated out of the area; this makes it appear unlikely that spawning also takes place in the vicinity of Nine Mile Point.

No distinct difference in yearly abundance was observed between male and female white perch in impingement and lake collections. Earlier studies noted May-June spawning of white perch in Lake Ontario, characterized by male dominance on spawning grounds. Monthly sex ratios in Nine Mile Point lake collections show more males present than females in the area during June, so that the area may have been utilized for spawning during this period.

TABLE II-2

SEX RATIOS FOR RAINBOW SMELT COLLECTED BY IMPINGEMENT

NINE MILE POINT - 1974

COLLECTED MONTH	MALE		FEMALE		PROBABILITY OF OBTAINING THE OBSERVED RATIO IN POPULATION WITH MALE TO FEMALE OF 1:1
	ABUNDANCE	PERCENT	ABUNDANCE	PERCENT	
JAN	101	29.88	237	70.12	P < 0.001
FEB	306	48.80	321	51.20	0.75 < P < 0.90
MAR	431	40.32	638	59.68	P < 0.001
APR	374	48.38	399	51.62	0.75 < P < 0.90
MAY	95	40.95	137	59.05	0.005 < P < 0.01
JUN	9	27.27	24	72.73	0.005 < P < 0.01
JUL	0	NA	7	100.00	NA
AUG	0	NA	8	100.00	NA
SEP	4	16.67	20	83.33	0.001 < P < 0.005
OCT	11	84.62	2	15.38	0.01 < P < 0.025
NOV	8	23.53	26	76.47	0.001 < P < 0.005
DEC	56	17.45	265	82.55	P < 0.001
TOTAL	1395	40.10	2084	49.90	P < 0.001

NA = Not Applicable

Very small numbers of smallmouth bass in both lake and plant collections preclude sex ratio comparison.

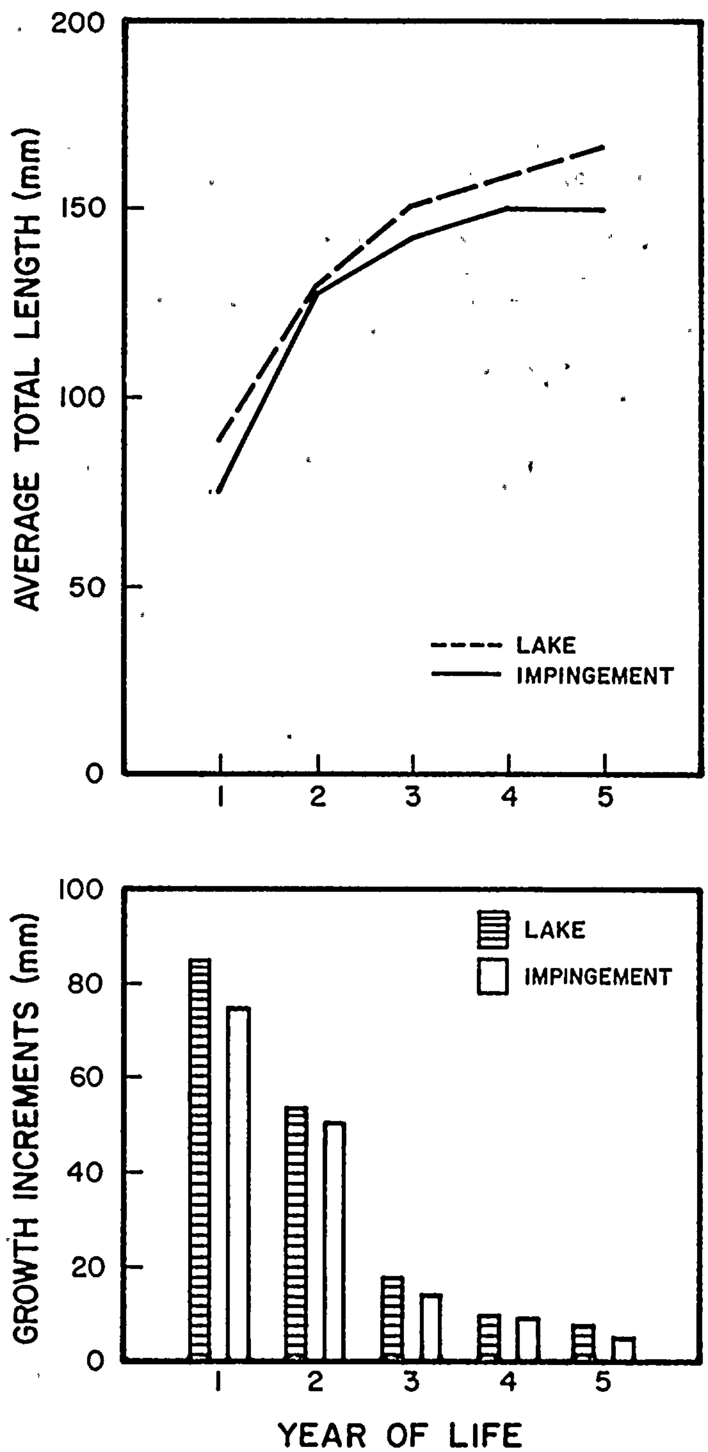
4. Growth Comparison of Lake and Impinged Alewives

Growth curves were calculated from the summation of the grand average annual increment in length by year class for male and female alewives collected from the Nine Mile Point travelling screens; these were compared with curves for the same population from lake trawl, gill net, and seine collections. The growth curve for male alewives is presented in Figure II-1 and for females in Figure II-2; average growth increments for each year class are also included in the respective figures.

The figures indicate similar trends in growth for male and female alewives in impingement samples and lake collections in the vicinity of the plant. It should be noted, however, that impinged fish of both sexes were consistently shorter than alewives collected in the lake. Impinged alewives also exhibited an overall smaller average growth increment for each year of growth compared to lake fish. The observation of smaller fish in impingement compared to lake collections could be the result of collection gear selectivity based on size; however, the use of three different gear types to sample the lake population helps to eliminate this source of bias. A second possibility is that impingement is selective for the slower growing members (retardates) of the alewife population.

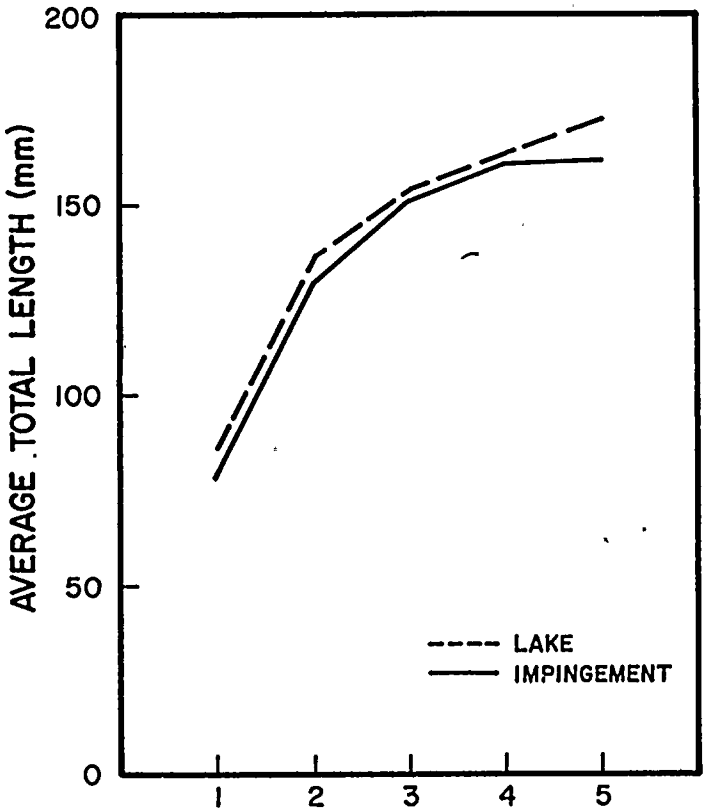
COMPARISON OF AVERAGE ANNUAL GROWTH INCREMENTS BETWEEN LAKE AND IMPINGED MALE ALEWIVES

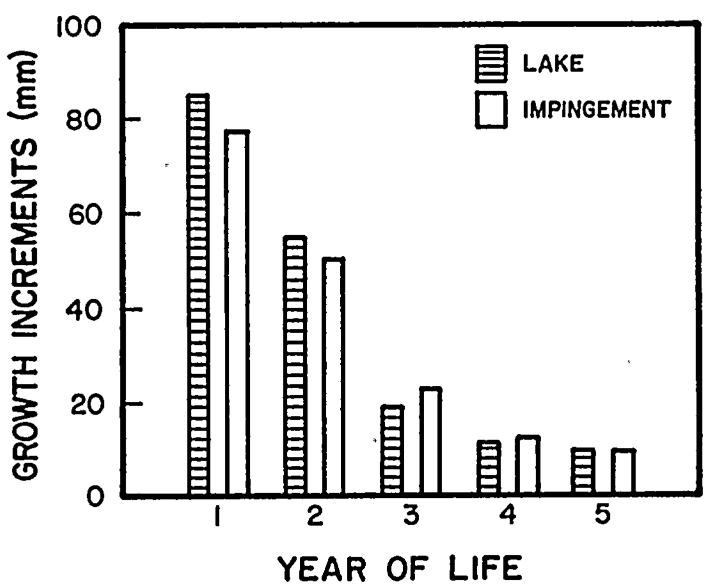
NINE MILE POINT - 1974



COMPARISON OF AVERAGE ANNUAL GROWTH INCREMENTS BETWEEN LAKE AND IMPINGED FEMALE ALEWIVES

NINE MILE POINT - 1974





III. INTRODUCTION

A. OBJECTIVES OF STUDY

Ecological studies in the Nine Mile Point vicinity during 1974 represent the continuing efforts of the Power Authority of the State of New York (PASNY) and Niagara Mohawk Power Corporation (NMPC) to evaluate the impact of existing and proposed power station operations at the site on the near-field aquatic ecosystem of Lake Ontario. Ecological studies began at the site in 1963 and have increased in scope and diversity since that time.

This annual report fulfills the utilities' commitment to assess aquatic impacts of power stations, and relevant conclusions from the previous studies are referred to as appropriate within its chapters. The studies also fulfill monitoring requirements imposed by the Nuclear Regulatory Commission (NRC) in their licenses issued to the Nine Mile Point Nuclear Station Unit 1 (Docket #50-220) and the James A. FitzPatrick Nuclear Station (Docket No. 50-333). Certain aspects of these studies have been extended beyond the NRC requirements to provide a fuller understanding of potential impacts and to fulfill requirements of a Stipulation Agreement entered into between the utilities and Ecology Action as part of the Nine Mile Point Nuclear Station Unit 2 Construction Permit Hearing in the fall of 1973.

The program is designed to provide the following information in addition to fulfilling the requirements noted above:

postoperational data relating to the aquatic ecology in the vicinity of Nine Mile Point Nuclear Station Unit 1,

preoperational data in the vicinity of the James A. FitzPatrick Nuclear Station,

analyses of the field data for both stations for use in regulatory submissions such as NPDES Permit applications and requests for alternative effluent limitations,

analyses to support recommended levels at which the monitoring of the aquatic environment should be continued in order to assure the protection of the ecosystem over the life of the stations.

B. NUCLEAR STATION DESCRIPTION

There are two nuclear electric generating stations located on the Nine Mile Point promontory on the south shore of Lake Ontario: Nine Mile Point Nuclear Station Unit 1 which has been operating since December 1969, and James A. FitzPatrick Nuclear Station which underwent testing during 1974. A third nuclear station is under construction

for this site (Nine Mile Point Nuclear Station Unit 2). Figure III-1 contains a map of the area indicating the generating stations, the intake and discharge structures, and the sampling transect locations.

The operating station, Nine Mile Point Nuclear Station Unit 1, and the proposed station, Nine Mile Point Nuclear Station Unit 2, are owned and operated by Niagara Mohawk Power Corporation. Both stations will occupy the same 900-acre site in the Town of Scriba, Oswego County, New York. Immediately adjacent to this site is the 702-acre site owned by the Power Authority of the State of New York. This is the site of the James A. FitzPatrick Nuclear Station which is presently completing testing. Operating, intake, and discharge characteristics of the Nine Mile Point and FitzPatrick nuclear stations are presented in Table III-1.

For the purpose of this study, the "vicinity" of Nine Mile Point is defined as the area within a three-mile radius of the generating station.

C. ORGANIZATION OF THE REPORT

The studies at Nine Mile Point included an analysis of virtually all aspects of the aquatic community and have involved the full-time efforts of approximately 40 aquatic biologists. Table III-2 summarizes the extent of the program and the intensity of the various sampling efforts. Data from each sampling program have been evaluated in this report and used to expand, confirm, or refute the results of the 1973 and earlier studies as to the community composition, diurnal patterns, seasonal patterns, and spatial distribution of organisms (offshore, alongshore, or in-depth). Analyses of data related to fisheries near the site are more extensive and include age, class, structure, growth rates, maturity and fecundity, as well as data on abundance and species of eggs and larvae present near the site. Where possible, direct effects of plant operation have been quantified. Specifically, the quantities of entrained and impinged organisms are provided in appropriate sections of this report.

The report chapters are organized according to broad sampling programs which encompass various aspects of the ecosystem (water body characteristics and quality, plankton, benthos, and nekton) and plant effects (entrainment and impingement). Each chapter presents the analysis of data from a specific sampling program, and is organized according to the following format:

Introduction: Defines organisms or parameters studied; summarizes pertinent results of the 1973 sampling program.

Materials and Methods: Describes field and laboratory procedures followed during 1974; details modifications from the 1973 sampling program procedures. Illustrates sampling station locations and indicates frequency of sampling efforts.

NINE MILE POINT ECOLOGICAL STUDY AREA

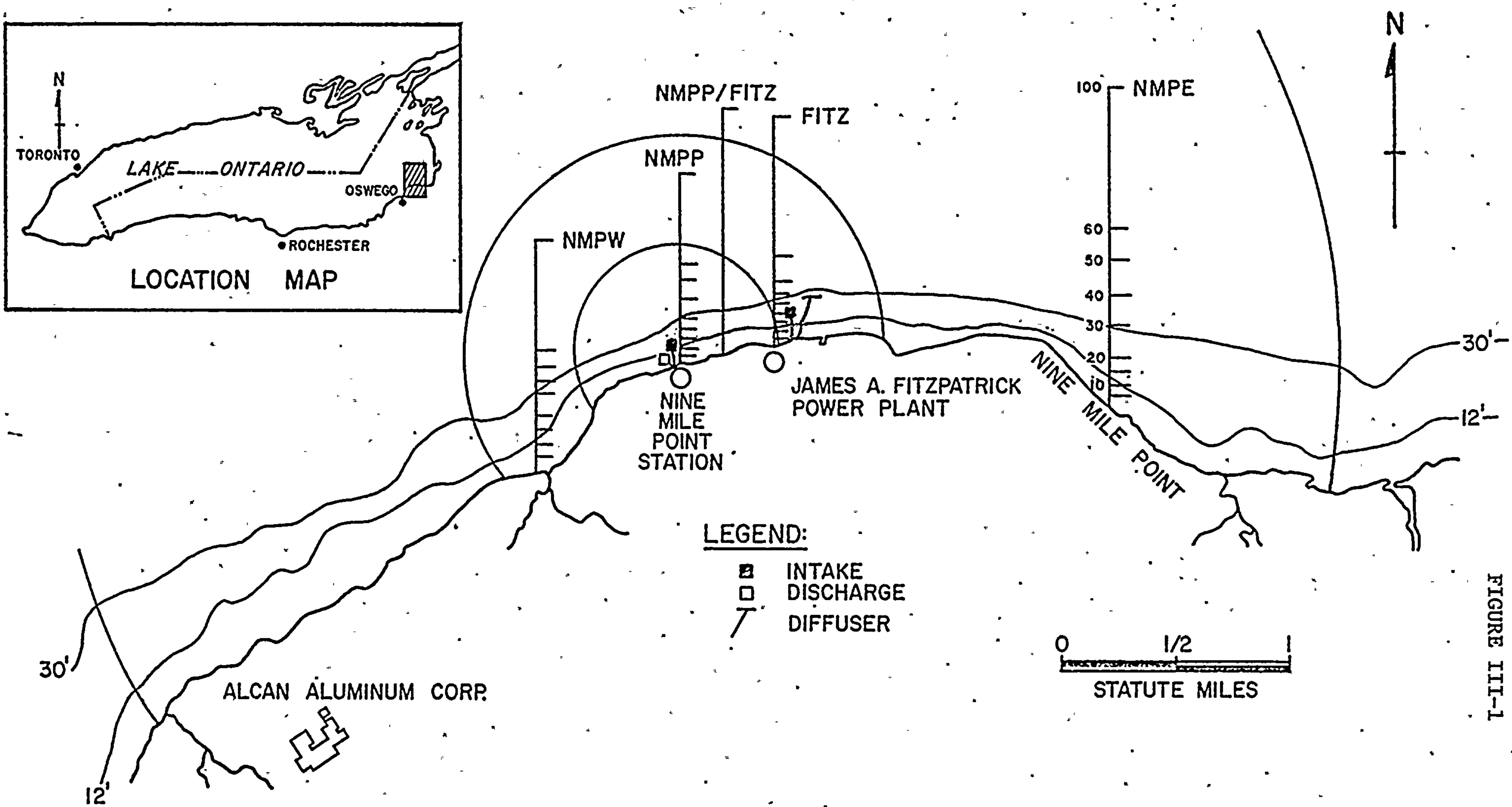


FIGURE III-1

TABLE III-1

NINE MILE POINT AND JAMES A. FITZPATRICK NUCLEAR STATIONS CHARACTERISTICS

	Nine Mile Point UNIT 1		James A. FitzPatrick	
OPERATING CHARACTERISTICS				
Generating capacity (MWe)	610		821	
Cooling water flow (GPM)				
Condenser	250000		352300	
Sevice water	18000		17900	
Heat rejection (BTU/hr)	4.0×10^9		5.7×10^9	
Cooling water temperature Rise (°F)	31.2		31.5	
STRUCTURAL CHARACTERISTICS	Intake	Discharge	Intake	Discharge
Length of main tunnel from existing shoreline	850 ft	335 ft	900 ft	1260 ft
Number of openings	6	6	4	12
Size of opening	5.5 ft high x 10.3 ft wide	3.5 ft high x 7.3 ft wide	8 ft x 17.7 ft wide	2.5 ft (inside diameter)
Other dimensions	3 ft sill 6 in roof	3 ft sill 6 in roof	3 ft sill 2 ft roof	5-6 ft above lake bed Double ports at 150 ft spacing
Velocity through openings	1.8 fps	4 fps	1.2 fps	14 fps
Tunnel velocity	8 fps	8 fps	1.4 fps (maximum)	4.7 fps
Tunnel cross-section	78 ft^2	78 ft^2	117 ft^2	117 ft^2
Water velocity at screens	0.85 fps	-	1.4 fps	-
Water depth at structure	24.5 ft (LWD)	17 ft (LWD)	24 ft (LWD)	30 ft (LWD) (aver.)
Water depth to top of structure	15.3 ft (LWD)	10.0 ft (LWD)	10 ft (LWD)	23 ft (LWD) (aver.)
Total Flow	268000 gpm (597 cfs)	26[illegible] gpm (597 cfs)	370200 gpm (825 cfs)	370200 gpm (825 cfs)

Table III-2

FREQUENCY OF SAMPLING FOR ECOLOGICAL STUDIES IN THE NINE MILE POINT AREA OF LAKE ONTARIO
1974

Study/Biotic Group	Frequency	Period°
A. Water Quality		
Monthly Water Quality (Lake)	Monthly	April-December
Bi-Monthly Biological Water Quality (Lake)	Twice monthly	April-December.
Effluent (Sewage Treatment Plant)	Monthly	January-December
Bottom Sediments (Lake)	Every other month	April-December
Dissolved Oxygen (Plant)	Weekly with impingement sampling	January-December
Thermal Stratification (Lake)	Weekly	March-December
Radiological	Three times per year	April, July, October
Carbon-14 (Lake)	Monthly	April-December
(Plant)	Twice monthly	March-December+
B. General Ecological Survey		
Phytoplankton (Lake, Windrow)	Monthly	April, September-December
	Twice monthly	May-August
Microzooplankton (Lake)	Monthly	April, September-December
	Twice monthly	May-August
Macrozooplankton and Ichthyoplankton (Lake)	Weekly	April-December
Benthos	Five times per year	April-December
Periphyton (Buoy and Bottom)	Monthly and twice monthly	May-September
	Monthly	September-November
Fish (Seines, Gill Nets)	Twice monthly	April-December
(Trawls)	Twice monthly	April-November
C Entrainment		
Phytoplankton (Plant)	Twice monthly†	March-December
Microzooplankton	Twice monthly	January-December
Macrozooplankton and Ichthyoplankton (Plant)	Twice monthly	January-December
D. Impingement (Plant)	Three times per week*	January-December

*Frequency increased during periods of high impingement

°Sampling was not conducted when prevented by inclement weather.

†monthly sample in March.

+monthly sample in February.

Results and Discussion: Presents a species inventory in taxonomic order (Pennak, 1953; see references cited for Chapter VI), and includes all figures and tables, including summaries of statistical analyses, essential to the understanding of the text.

Data are presented in either graphic or tabular form, but do not necessarily represent all the data analyzed. Unless otherwise stated, the data from the original (R-1) of the two samples (R-1 and R-2) is presented in pattern frequency analyses, tables, and figures. The taxonomic level for data interpretation varied with sampling program (e.g., nekton at species level, phytoplankton at class level). Species information was retrieved from the ranking series by date or from the original data sheets.

Data were compared within and between sampling programs wherever such comparisons were biologically meaningful; parameters monitored in the water quality program were also discussed where appropriate. Statistical tests (e.g., analysis of variance and Student-Newman-Keuls test) were conducted, using both original and replicate samples in order to increase the sensitivity of the test, and to determine levels of significance for spatial/temporal distribution patterns.

Conclusions: Presents a synopsis of the chapter findings and, where appropriate, estimates the potential effect of the Nine Mile Point and James A. FitzPatrick nuclear stations on the lake ecosystem.

Appendix: Presents tables containing supplementary data not contained in the main body of the chapter; e.g., statistical analyses, ranking of most abundant taxa, pattern frequency analyses, average abundance of taxa by transect and/or depth contour, and fisheries statistics. Original data for each sampling program by date is included in a separate four-volume report: Nine Mile Point Aquatic Ecology Studies Data Report: January-December 1974.

IV. RECEIVING WATER BODY CHARACTERISTICS AND QUALITY
NINE MILE POINT ECOLOGICAL STUDY

A. INTRODUCTION

During 1973, extensive water quality studies were conducted in the southeastern sector of Lake Ontario in the vicinity of Nine Mile Point. The objectives of these investigations were to characterize the chemical water quality of the area and to provide additional data for evaluation of the biological investigations. The water quality of Lake Ontario and large lakes in general is dependent upon the interaction of geomorphic, hydrologic, hydrodynamic, and meteorological factors in addition to factors resulting from human activity. Vertical temperature variation and algal growth, which are influenced by regular seasonal temperature variations and by irregular hydrodynamic phenomena (i.e., advection currents), were shown to be the primary localized factors affecting the water quality of the study area in 1973 (QLM, 1974).

The 1974 water quality sampling program was similar to the 1973 program. The analyses described in this chapter were designed to supplement the 1973 study and to determine those parameters that should continue to be monitored during operation of the Nine Mile Point and James A. FitzPatrick stations. Parameters monitored in the lake are compared whenever possible with those related to plant operation.

B. MATERIALS AND METHODS

Lake sampling was conducted weekly at the 50 and 100 ft depth contours for thermal profiles and monthly for monitoring of 48 parameters at the stations shown in Figure IV-1. Bimonthly lake samples were collected in conjunction with the biological sampling program and analyzed for 17 parameters (15 parameters monitored in the monthly sampling program plus chlorophyll a and carbon dioxide). In-plant parameters were monitored either weekly (temperature and dissolved oxygen in conjunction with impingement sampling program) or monthly (water quality sampling program) at Nine Mile Point Nuclear Power Station Unit 1 and monthly at Nine Mile Point sanitary sewage treatment plant (Table IV-1). All sampling locations, procedures, frequencies, and laboratory analyses were performed as described in the water quality section of the 1973 Nine Mile Point Aquatic Ecology Studies (QLM, 1974).

C. RESULTS AND DISCUSSION

1. Monthly Lake Water Chemistry

The results of the 1974 monthly lake water chemistry sampling program are summarized in Table IV-2 and Appendix IV-1. Seasonal fluctuations

WATER SAMPLING STATIONS

NINE MILE POINT, 1974

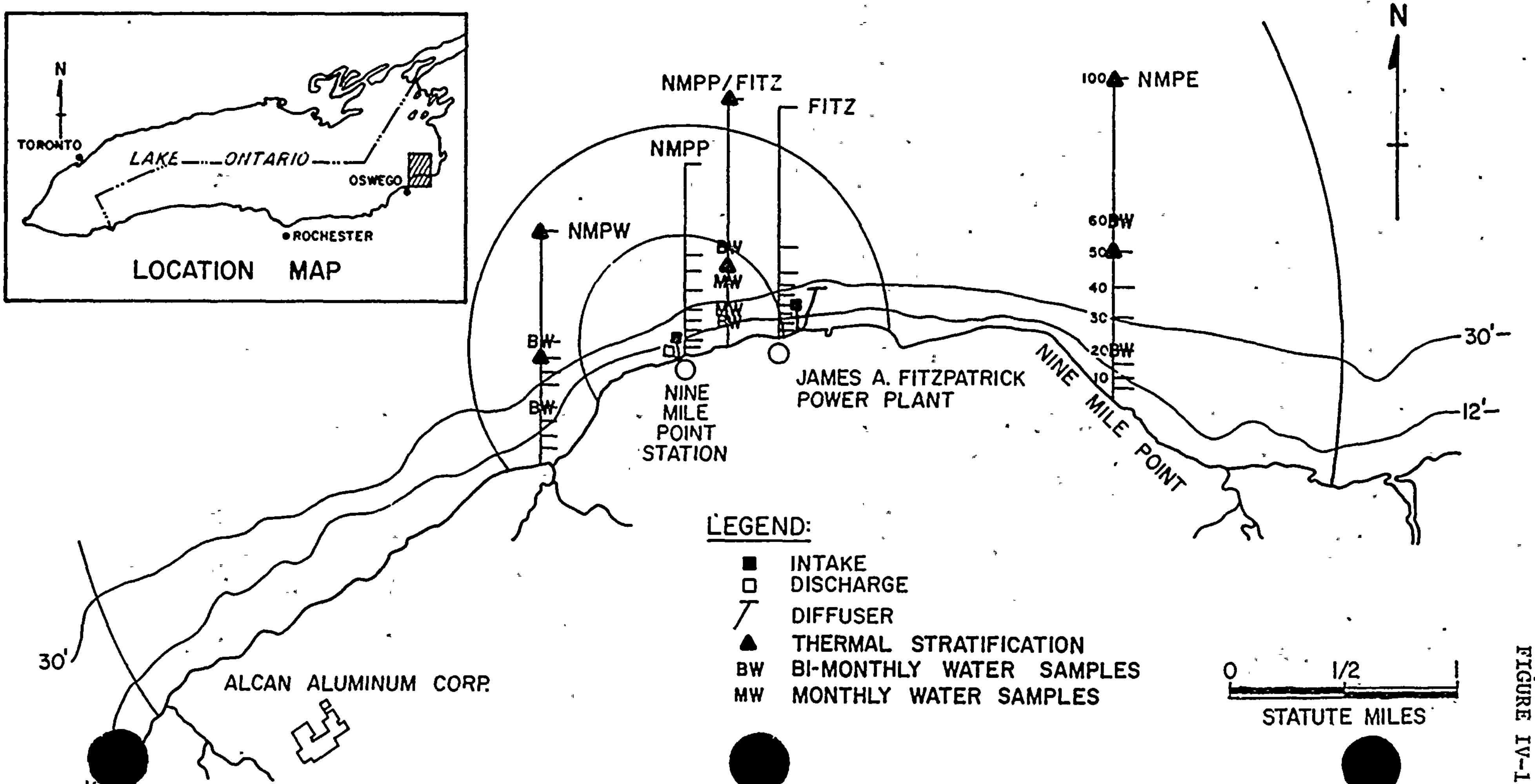


FIGURE IV-1

TABLE IV-1

WATER QUALITY SAMPLING PROGRAM
NINE MILE POINT VICINITY - 1974

	LAKE			NINE MILE POINT PLANT		
	WEEKLY	BIMONTHLY	MONTHLY	SEWAGE TREATMENT MONTHLY[2]	POWER PLANT MONTHLY	POWER PLANT WEEKLY[3]
Parameter[1]	(March-Dec)	(April-Dec)	(April-Dec)	(Jan-Dec)	(April-Dec)	(Jan-Dec)
OP		X	X		X	
TP		X	X	X	X	
TS		X	X	X	X	
TDS			X	X	X	
TSS		X	X	X	X	
TVS			X	X	X	
TBOD		X	X	X	X	
TCOD		X	X	X	X	
TTOC			X		X	
TKN		X	X	X	X	
NH_3N		X	X	X	X	
NO_3N		X	X	X	X	
PH		X	X	X	X	
ALK			X	X	X	
SPC[4]		X	X		X	
T	X[5]	X	X		X	X
TUR[4]		X	X		X	
DO[4]		X	X		X	X
CO_2		X				
Chl a		X				
COLOR			X		X	
TCOL			X	X	X	
FCOL			X	X	X	
SUR			X	X	X	
PHL			X	X	X	
CL			X	X	X	
SO_4			X	X	X	
BA			X		X	
BE			X		X	
CD			X		X	
CA			X	X	X	
CR			X	X	X	
CU			X		X	
FE			X	X	X	
PB			X		X	
MG			X		X	
MN			X		X	
HG			X		X	
NI			X		X	
K			X		X	
SI		X	X		X	
NA			X		X	
V			X		X	
ZN			X	X	X	
AG			X		X	
AL			X		X	
AS			X		X	
SE			X		X	
CN			X		X	
F			X		X	

[1] Concentration of parameter determined in the laboratory unless stated otherwise.

[2] Surface grab samples collected every 6 hours for 24 hours from discharge channel and storm drain. 24 hour composite samples collected from influent and effluent of oxidation pond.

[3] Samples collected every 6 hours for 24 hours except for 17 July, 2 October, and 25 December when they were collected hourly for 24 hours.

[4] Parameter monitored in the field.

[5] Thermal profiles.

SUMMARY OF MONTHLY
LAKE WATER CHEMISTRY*
NINE MILE POINT VICINTIY
(NMPP-1/FITZ: 25 and 45 ft depth contours)
1974

Parameter	Abbreviation[1]	No. of Samples	Maximum	Minimum	Mean	Std. Dev.
pH	(units)	36	8.8	6.9	8.0	0.5
Color	(COL)	36	35	5.	10.	7
Specific Conductance	(μmho/cm)	28	350.0	220.0	286.8	34.3
Temperature	(°F)	32	77.10	35.50	52.64	12.04
Turbidity	(Tu)	36	22.0	1.0	3.8	4.3
Alkalinity	(Alk)	36	107.0	70.0	85.6	9.2
Dissolved Oxygen	(DO)	36	12.30[2]	8.30	10.52	1.32
Biological Oxygen Demand	(TBOD)	36	5	1	3	1
Chemical Oxygen Demand	(TCOD)	36	26	0	11	7
Total Organic Carbon	(TTOC)	34	62	3	11	10
Total Solids	(TS)	36	470	195	236	54
Total Dissolved Solids	(TDS)	36	460	180	228	52
Total Volatile Solids	(TVS)	36	130	34	81	21
Total Suspended Solids	(TSS)	36	63.	1	8	11
Ammonia Nitrogen	(NH_3N)	36	0.8	0.0	0.2	0.2
Total Kjeldahl Nitrogen	(TKN)	35	1.00	0.00	0.49	0.25
Nitrate Nitrogen	(NO_3N)	36	0.46	0.02	0.15	0.10
Orthophosphate Phosphorus	(OP)	36	0.03	0.00	0.01	0.01
Total Phosphate Phosphorus	(TP)	36	0.08	0.01	0.03	0.02
Phenols	(PHL)	36	0.018	0.000	0.001	0.004
Chloride	(CL)	36	108	0	32	19
Sulfate	(SO_4)	36	53.	22	35	[illegible]
Barium	(BA)	36	0.000	0.000	0.000	[illegible]
Beryllium	(BE)	36	0.000	0.000	0.000	[illegible]
Cadmium	(CD)	36	0.000	0.000	0.000	0.000
Calcium	(CA)	36	105.000	13.100	47.840	15.821
Chromium	(CR)	36	0.590	0.000	0.040	0.106
Copper	(CU)	36	15.100[2]	0.000	1.390	3.866
Iron	(FE)	36	1.200	0.000	0.289	0.352
Lead	(PB)	36	0.750[2]	0.000	0.070	0.170
Magnesium	(MG)	36	11.900	6.180	8.014	0.968
Manganese	(MN)	32	0.040	0.000	0.004	0.010
Mercury	(HG)	36	0.024	0.000	0.001	0.004
Nickel	(NI)	36	0.256[2]	0.000	0.015	0.047
Potassium	(K)	36	66.600	40.000	54.005	7.786
Silicon	(SI)	35	1.2	0.0	0.4	0.3
Sodium	(NA)	36	216.000	9.700	37.620	46.465
Vanadium	(V)	36	0.000	0.000	0.000	0.000
Zinc	(ZN)	36	9.800[2]	0.000	0.958	2.612
Silver	(AG)	36	0.021[2]	0.000	0.002	0.005
Aluminum	(AL)	36	87.500[3]	0.000	2.831	14.546
Arsenic	(AS)	36	0.000	0.000	0.000	0.000
Selenium	(SE)	12	0.000	0.000	0.000	0.000
Cyanide	(CN)	36	0	0	0	0
Fluoride	(F)	36	0.2	0.0	0.1	0.1
Total Coliform	(TCOL cts/100ml)	36	100.	0	18	21
Fecal Coliform	(FCOL cts/100ml)	36	107	0	9	19
Surfactants	(SUR)	36	0.08	0.00	0.03	0.02

* all units in mg/l unless indicated.
1 computer code for water quality parameters.
2 8 April, sample contaminated during laboratory handling.
3 12 August.

in the parameters were determined through time series graphs which plotted concentration against time. The results of the monthly monitoring program indicated that three general trends existed: one typified by parameters which showed few seasonal fluctuations and minimal variation among stations and sample depths [i.e., total biological oxygen demand (TBOD), phenols (PHL), and total phosphate phosphorus (TP); Figure IV-2]; a second trend of seasonal fluctuations and variations among stations and sample depths [i.e., color (COL), turbidity (Tu), total chemical oxygen demand (TCOD), ammonia nitrogen (NH_3-N), total Kjeldahl nitrogen (TKN), iron (Fe), manganese (Mn), fluoride (F), surfactants (SUR)]; and a third trend, representative of the remaining 36 parameters, of distinct seasonal fluctuation with minimal variation among sample depths and stations [e.g., nitrate nitrogen (NO_3-N)]. The extremely high values recorded on 8 April for the trace metals, especially zinc (Zn) and copper (Cu), resulted in the inclusion of these metals in the third group rather than the first category as would be expected. However, these abnormally high values do not coincide with the historical data for the lake, and were confirmed as being a result of laboratory contamination. The maximum value recorded for aluminum (Al) occurred on 12 August. As the extremely high concentration occurred at only one station, predominantly at the surface, the value is probably indicative of a localized discharge.

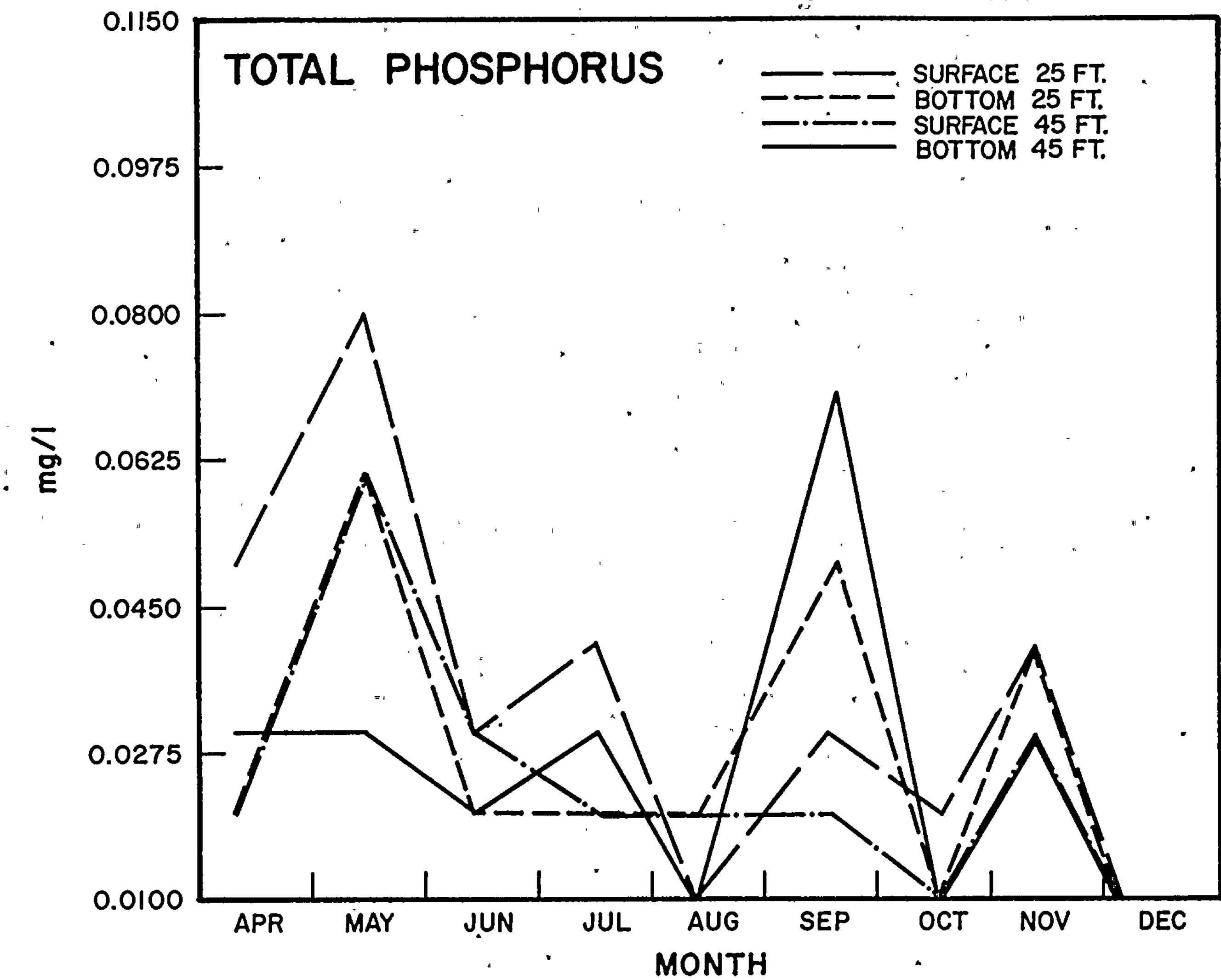
To test for possible differences among date, station, and sample depth means, an analysis of variance test was performed on the following biologically important parameters monitored monthly: total Kjeldahl nitrogen (TKN), chemical oxygen demand (COD), and nitrate (NO_3-N) (Appendix IV-2). No ANOVA was done for total phosphate phosphorus, total biological oxygen demand, and concentrations of phenols, as seasonal and sample fluctuations were minimal.

No significant difference was shown among date, station, and sample depth for TKN values. Date variation was shown for TCOD and NO_3-N; high COD values were recorded in August, July, and December, in decreasing order, and high NO_3-N values in May, December, and June. A date x station interaction for TCOD indicated that the values recorded by station varied by date but did not vary consistently throughout the year.

2. Biological Water Chemistry

The bimonthly biological water quality data are summarized in Tables IV-3 and IV-4. These values are more indicative of the seasonal trends in lake water chemistry than the monthly values due to the increased spatial (six stations instead of two) and temporal coverage. Seasonal fluctuations or trends in particular parameters fell into the three general categories described previously for the monthly water quality parameters: those indicating little seasonal fluctuation

MONTHLY WATER QUALITY
NMPP/FITZ TRANSECT
NINE MILE POINT
1974



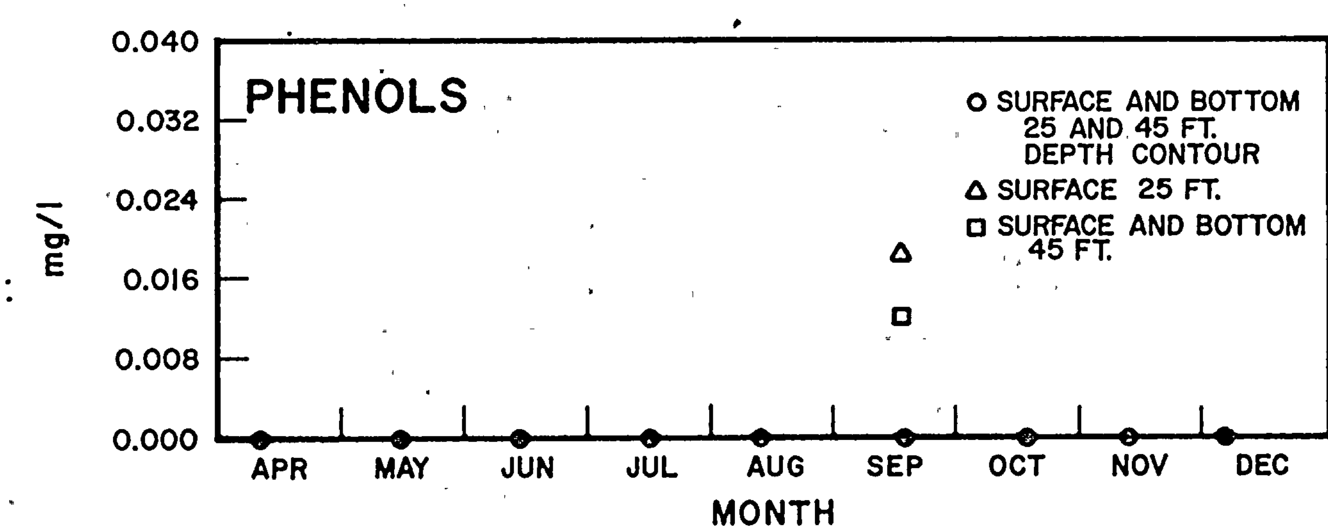


TABLE IV-3

SUMMARY OF BIMONTHLY
BIOLOGICAL WATER CHEMISTRY*
NINE MILE POINT VICINITY
(NMPP-1/FITZ, NMPE, NMPW:
20 and 60 ft depth contours)
1974

Parameter	Abbreviation[1]	No. of Samples	Maximum	Minimum	Mean	Std. Dev.
Orthophosphate Phosphorus	(OP)	203	0.10	0.00	0.01	0.01
Total Phosphate Phosphorus	(TP)	203	0.23	0.00	0.03	0.03
Total Solids	(TS)	203	450	178	236	49
Total Suspended Solids	(TSS)	203	223.	1	8	17
Chlorophyll *a*	(CHLA)	203	33.7	0.0	6.6	4.6
Biological Oxygen Demand	(TBOD)	203	6	0.0	2	1
Chemical Oxygen Demand	(TCOD)	203	50	0	12	9
Silicon	(SI)	189	2.3	0.0	0.4	0.4
Total Kjeldahl Nitrogen	(TKN)	202	1.60	0.00	0.37	0.25
Ammonia Nitrogen	(NH_3N)	203	0.5	0.0	0.1	0.1
Nitrate Nitrogen	(NO_3N)	203	0.69	0.00	0.17	0.14
pH	(units)	203	8.9	7.4	8.2	0.3
Specific Conductance	(μmhos/cm)	168	548.0	201.0	304.0	61.5
Temperature	(°F)	203	86.60	32.30	54.00	11.83
Turbidity	(Tu)	203	55.0	0.0	4.3	5.7
Carbon Dioxide	(CO_2)	203	6.3	0.0	0.5	0.8
Dissolved Oxygen	(DO)	203	14.20	7.30	10.54	1.57

* all units in mg/l unless indicated.
1 computer code for water quality parameters.

TABLE IV-4

BIMONTHLY WATER QUALITY
SPECIFIC PARAMETERS
[VALUES(mg/l) AVERAGED OVER STATIONS AND SAMPLE DEPTHS]

NINE MILE POINT VICINITY - 1974

MONTH	BOD	TP	COD	TKN	NO_3-N
APRIL	3	0.04	14	0.50	0.44
MAY	3	0.04	12	0.20	0.27
JUNE	3	0.03	11	0.42	0.16
JULY	2	0.05	16	0.39	0.19
AUGUST	2	0.04	19	0.42	0.02
SEPTEMBER	1	0.03	5	0.35	0.04
OCTOBER	2	0.02	9	0.29	0.11
NOVEMBER	2	0.01	11	0.42	0.15
DECEMBER	1	0.01	11	0.32	0.17

and minimal variation among stations and sample depths [i.e., TP, orthophosphate phosphorus (OP), total suspended solids (TSS), chlorophyll a (CHL a), TKN, carbon dioxide (CO_2), and Tu]; those indicating seasonal fluctuations and also variation among stations and sample depths [i.e., total solids (TS), TCOD, TBOD, silicon (Si), NH_3-N and specific conductance]; and those exhibiting a distinct seasonal trend with minimal variations among sample depths and stations [i.e., NO_3-N (Figure IV-3), pH, temperature, DO].

To test for possible differences in means among date, transect, depth contour, and sample depth, four-way analyses of variance were conducted on the parameters TKN, TP, COD, BOD, and NO_3-N (Appendix IV-3-IV-7), which were chosen for comparison with the monthly lake water chemistry data. Because the large volume of data made it computationally unfeasible to analyze the data as a whole, the data for each parameter were divided into two sets by dates. The first ANOVA included data collected from 2 April to 26 July 1974; data for the second ANOVA represented the period from 6 August to 5 December 1974. A Student-Newman-Keuls test was performed on the significant main effects and the significant first order interactions.

Both sets of TKN statistics (Appendix IV-3) indicated significant differences among dates with the largest values recorded in late June and October. There were significant differences among transects and sampling depths for TKN data collected during the earlier period: east and west transects were the most dissimilar (Table IV-5); and mean TKN values were significantly greater in the surface samples than the bottom samples.

Date was not a significant factor for April-July mean TP values (Appendix IV-4), but was significant during the later period, with the largest value recorded in early September. Mean TP values were significantly greater at the 20 ft than the 60 ft contour only during the early part of the sampling program. The transect x depth contour interaction was significant for the latter sampling period, and was attributed to the large TP values recorded at NMPE 20 ft station, and the similarity of the values recorded at the other stations.

Date consistently accounted for the variability of COD values throughout the year (Appendix IV-5), whereas sampling depth was shown to be significant only during the later part of the year. Neither transect nor depth contour COD values showed any significant difference throughout the sampling period.

BOD values were significantly different over time and depth contour for both sets of data (Appendix IV-6). The highest values were recorded in late May, June, October, and November at the 20 ft depth

FIGURE IV-3

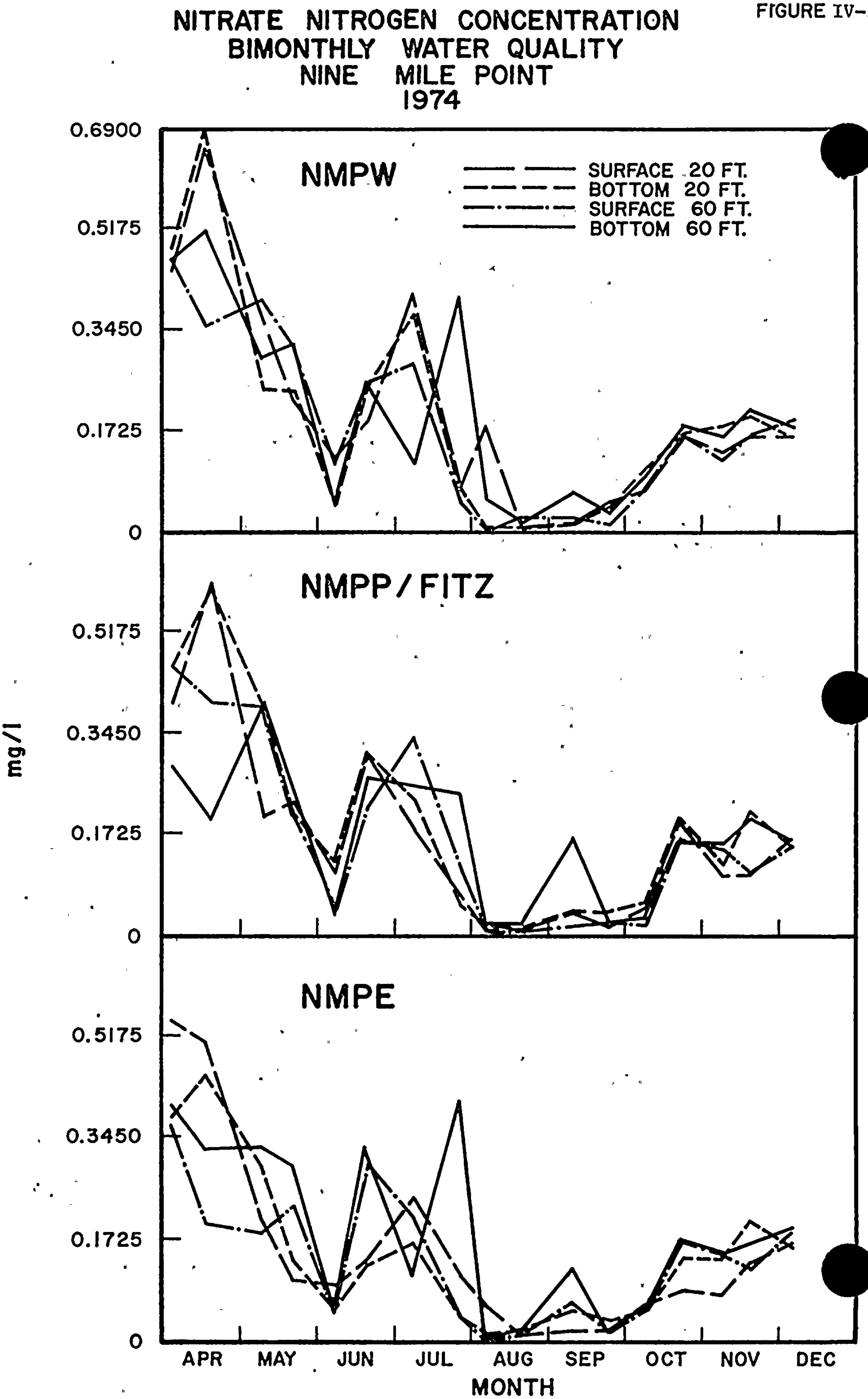

NITRATE NITROGEN CONCENTRATION
BIMONTHLY WATER QUALITY
NINE MILE POINT
1974
NMPW
SURFACE 20 FT.
BOTTOM 20 FT.
SURFACE 60 FT.
BOTTOM 60 FT.
NMPP / FITZ
NMPE
0.6900
0.5175
0.3450
0.1725
0
mg/l
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH

TABLE IV-5

BIMONTHLY WATER QUALITY
TKN
[VALUES (mg/1) AVERAGED OVER DEPTH CONTOUR AND SAMPLE DEPTH]

NINE MILE POINT VICINITY - 1974

MONTH	NMPW	NMPP/FITZ	NMPE
APRIL	0.38	0.50	0.64
MAY	0.10	0.23	0.28
JUNE	0.38	0.44	0.44
JULY	0.33	0.41	0.44
AUGUST	0.33	0.43	0.50
SEPTEMBER	0.31	0.42	0.33
OCTOBER	0.35	0.31	0.19
NOVEMBER	0.48	0.47	0.32
DECEMBER	0.24	0.39	0.33

contour. Surface sample values were significantly greater than bottom sample values during the first part of the year; however, no difference was observed during the latter part of the year.

NO_3-N values (Figure IV-3) were significantly different between dates for both sampling periods (Appendix IV-7). In general, values of NO_3-N were higher during April, November, and December than the rest of the year. This probably is correlated with the decreased algal growth and the corresponding decreased uptake of NO_3-N by algae during the colder months of the year. Both sets of data indicated significant differences among transects on all dates sampled (Table IV-6); NMPW and NMPE transects were most dissimilar, with the higher mean nitrate values recorded consistently from the west transect. The higher concentration at this transect may have resulted from its proximity to the Oswego River and the predominantly easterly flow of lake water along the southern shoreline of Lake Ontario. During the August-December sampling period, mean NO_3-N values were greater in bottom samples than surface samples, probably due to algal uptake at the surface.

The differences in significance levels between monthly and bimonthly water quality parameter values (Table IV-7) may be attributed to the smaller number of samples in the monthly collections and the frequent changes in water current patterns in the sample area. As in 1973, date differences were significant for all the parameters tested in 1974. It is hypothesized that the dynamics of seasonal temperature variation and the induced biochemical seasonal variations due to phytoplankton growth were influential in the date differences evident in most of the water quality parameters. Differences between transects were also found to be consistent from 1973 to 1974 for the parameters TKN and NO_3-N. In general, the lake water quality in the Nine Mile Point vicinity remained relatively stable from 1973 to 1974.

3. Temperature Measurements

a. Surface Temperature

Surface water temperature measured in the thermal profile program in the vicinity of Nine Mile Point during 1974 ranged from 0.6°C to 27.3°C. The mean surface water temperatures for stations at the 20 and 100 ft depth contours are plotted in Figure IV-4, and compared with a plot of the surface temperatures recorded at the NMPW 50 ft station, which is considered to be outside the influence of the Nine Mile Point thermal plume. The three temperature curves follow the same basic pattern, with little temperature variation between depth contours. This pattern was very similar to that observed in 1973 (QLM, 1974) except that no large drop in temperature occurred during June 1974.

TABLE IV-6

BIMONTHLY WATER QUALITY
NO_3-N
[VALUES (mg/1) AVERAGED OVER DEPTH CONTOUR AND SAMPLE DEPTH]

NINE MILE POINT VICINITY - 1974

MONTH	NMPW	NMPP/FITZ	NMPE
2 APRIL, 17 APRIL	0.51	0.42	0.39
9 MAY, 21 MAY	0.30	0.29	0.22
7 JUNE, 20 JUNE	0.16	0.18	0.14
8 JULY, 26 JULY	0.23	0.18	0.17
6 AUGUST, 20 AUGUST	0.04	0.01	0.02
10 SEPTEMBER, 24 SEPTEMBER	0.04	0.05	0.04
8 OCTOBER, 23 OCTOBER	0.13	0.11	0.10
8 NOVEMBER, 19 NOVEMBER	0.17	0.15	0.14
5 DECEMBER	0.18	0.17	0.18

TABLE IV-7

SUMMARY OF SIGNIFICANT DIFFERENCES
FOR SELECTED PARAMETERS
NINE MILE POINT VICINITY - 1974

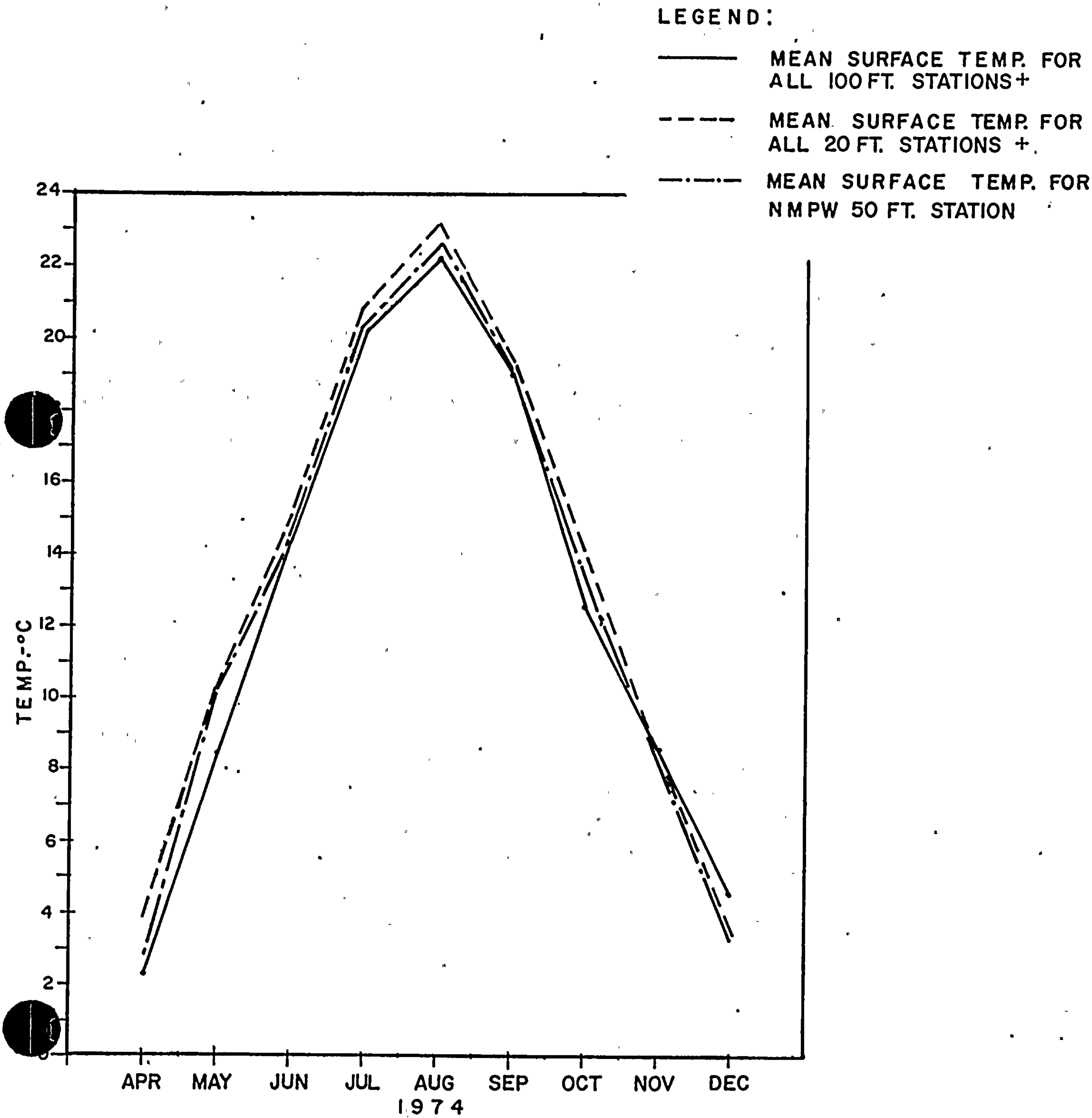
Chemical Parameter	Sample Analyses	Independent Parameter			
		Date	Transect	Contour	Depth
TKN	Monthly:April-December	---	NA	---	---
	Bimonthly:April-July	X	X	---	X
	Bimonthly:August-December	X	---	---	---
TBOD	Bimonthly:April-July	X	---	X	X
	Bimonthly:August-December	X	---	X	
TP	Bimonthly:April-July	---	---	X	---
	Bimonthly:August-December	X	X	X	---
NO_3-N	Monthly:April-December	X	NA	---	---
	Bimonthly:April-July	X	X	---	---
	Bimonthly:August-December	X	X	---	X
TCOD	Monthly:April-December	X	NA	---	---
	Bimonthly:April-July	X	---	---	---
	Bimonthly:August-December	X	---	---	---

NA not analyzed, only one transect sampled for monthly collections.
--- no significant difference.
X significant difference.

FIGURE IV-4

MEAN SURFACE TEMPERATURE

NINE MILE POINT, 1974



+ NMPW, NMPP/FITZ, NMPE transects: weekly thermal profile studies

Figure IV-5, which compares the mean monthly surface water temperatures for Lake Ontario (Yu and Brutsaert, 1968) with the mean monthly surface temperature for the three 100 ft stations in the Nine Mile Point vicinity, shows that the average surface water temperature in the vicinity of Nine Mile Point was approximately 0.7°C higher than the values recorded for the lake in 1968. In 1973, the water temperature recorded at the same station averaged 1.8°C higher than that reported by Yu and Brutsaert (1968); however, the 1973 data were derived from measurements during the months June through December only, as compared with the 1974 data, which represented March through December. Since the historical data were for the entire lake, the presence of higher average values in the Nine Mile Point vicinity was probably due to the increased natural heating of shallower, near-shore waters.

b. Thermal Profiles

During the weekly survey period (March through December 1974), 163 thermal profiles exhibited temperature gradients or stratifications equaling or exceeding 1°C per meter (LMS, 1975). Of these profiles, only 28 may be attributed to the thermal discharge of Nine Mile Point Unit 1. The potentially plant-induced temperature gradients occurred at various times of the year in the shallow waters (i.e., 20 ft depth contour) between the Nine Mile Point and FitzPatrick power plants, 13 during the late fall and late spring months of the year when isothermal conditions were present throughout the southeastern section of the lake. The other 15 gradients occurred in the shallow waters between the two plants during July, August, and September, when thermal stratification had extended out to deeper depths in the lake.

As in 1973 (QLM, 1974), the vertical temperature profiles revealed that thermal gradients existed primarily in the summertime throughout the study area (LMS, 1975). These stratifications, however, were transient and unstable and entirely dependent upon meteorological conditions for their dispersion and regeneration. Although the gradients were uniform from station to station on particular weeks of the study, such as 10 June, 29 July, 12 August, and 4 September, the temperature, as well as the depth of stratification, varied from week to week. In general, the thermal gradient pattern extended deeper into the lake as the summer months proceeded. This trend resembled that occurring during 1973 (QLM, 1974).

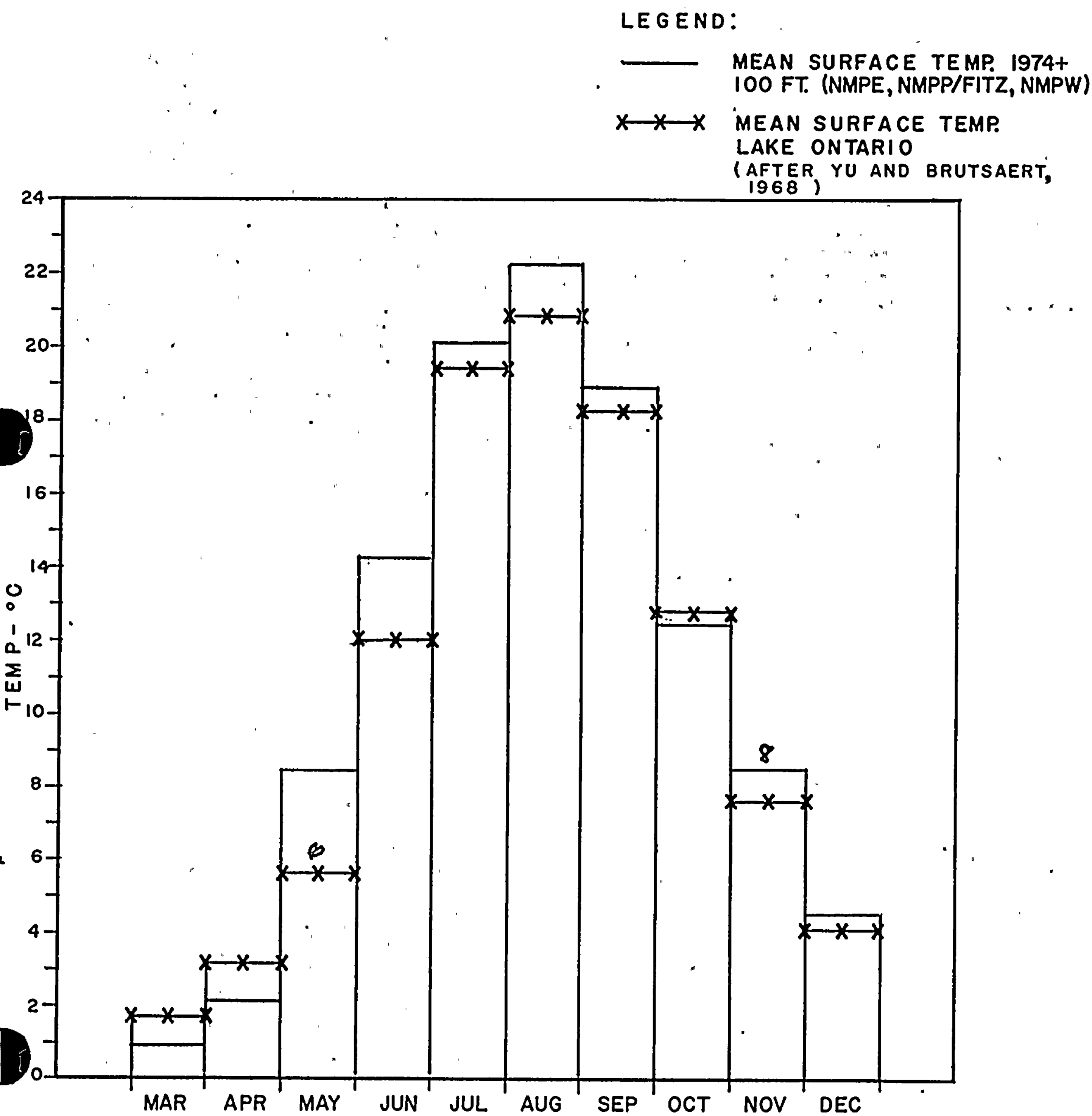
4. Plume Description

a. Discharge Zone

The discharge zone (EPA, 1974) is defined as that portion of the receiving water which falls within the isotherm of 2°C above the ambient temperature ($\Delta T = 2°C$) and includes that portion

COMPARISON OF MEAN SURFACE TEMPERATURES

NINE MILE POINT



+ weekly thermal profile program

of the plume occurring 30% or more of the time. The time is defined as consisting of a period of at least a few months, and preferably indicative of a complete annual cycle. Thermal surveys conducted a few times each month for a period of five years are adequate to delineate the discharge zone within the receiving water body segment.

b. Thermal Surveys

During the period since the Nine Mile Point Nuclear Station Unit 1 went into operation in 1969, several field surveys of the plumes resulting from the discharge of heated condenser cooling water into Lake Ontario have been conducted (Storr 1970, 1972, 1973, 1974, 1975). An examination of the data from 25 surveys, covering a period of five years, showed that the plume extent and direction were strongly dependent on wind-induced lake currents, wave action and upwelling. However, the extent of the plume was not directly related to actual wind speed; that is, high winds did not necessarily cause the longest plumes. Comparisons of the plume surveys on days of similar lake ambient temperatures indicated no definite relationship between the heat load (BTU/day) and the area of thermal influence. In addition, there was no definite trend between the heat load (BTU/day) and the plume's offshore extent, even for the same wind speed and direction. The lack of a direct relationship between these factors indicated the stochastic nature of the plumes due in part to the hydrodynamic characteristics of the lake.

c. Statistical Summary of the Plume

A cumulative frequency distribution analysis was performed on the 25 sets of data (Appendix IV-8). The surface areas within the 2°C isotherms were arranged in order of decreasing magnitude. The resulting frequency curve (Figure IV-6) illustrates that 30% of the time a surface area of greater than 160 acres is expected.

A similar analysis was performed for the estimated volumes of the plume within the 2°C rise isotherm (Figure IV-7). The volume exceeds 350 acre-ft 30% of the time; thus the calculated mean depth of the discharge zone is 2.19 ft.

Four of the 25 surveys showed a 2°C isotherm of 160 acres, and these were symmetrical about the discharge structure. A representative area of 160 acres is illustrated in Figure IV-8. This area extends approximately 1875 ft along shore on each side of the discharge structure and to a maximum of 2365 ft offshore.

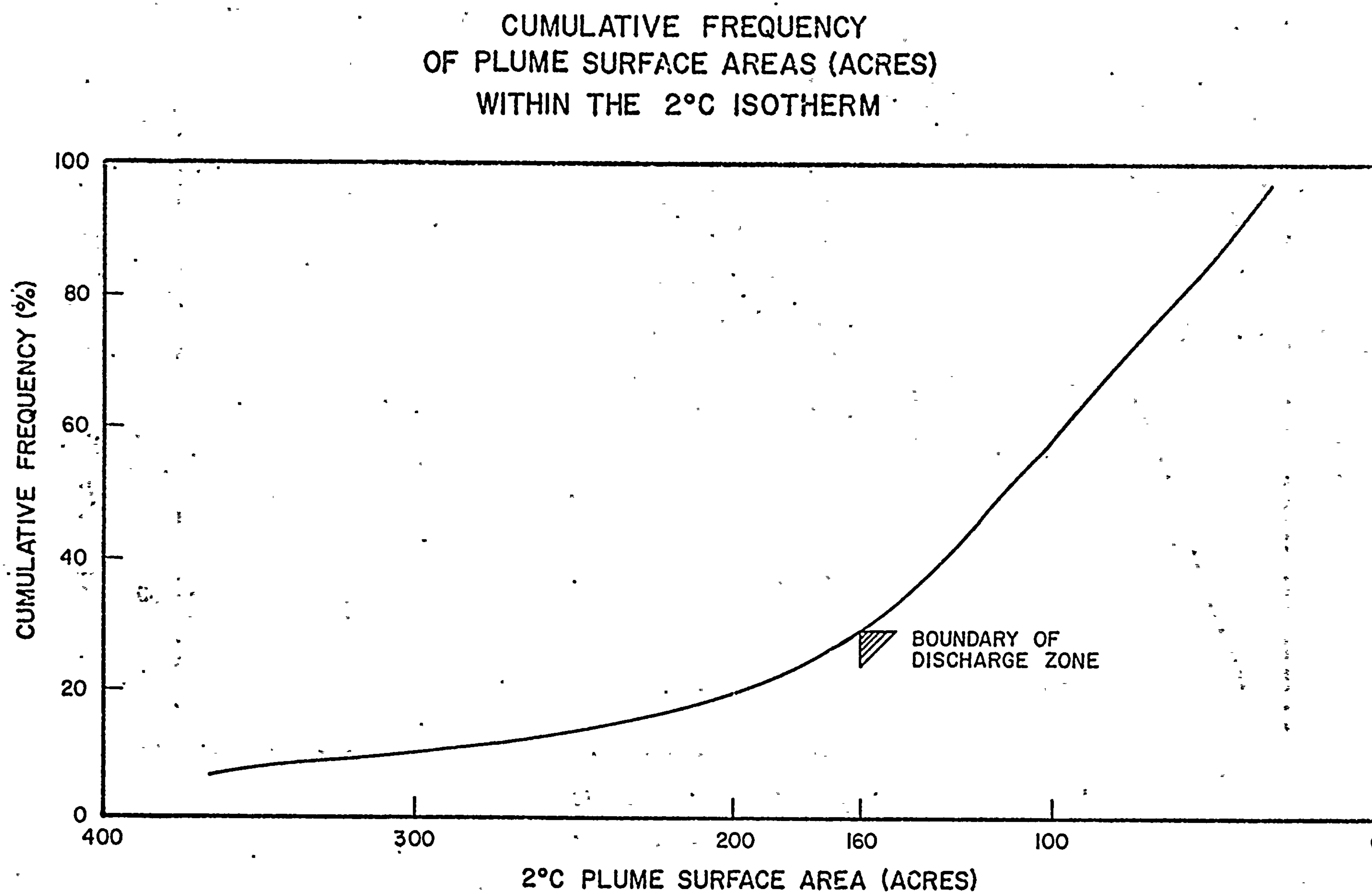

CUMULATIVE FREQUENCY
OF PLUME SURFACE AREAS (ACRES)
WITHIN THE 2°C ISOTHERM
CUMULATIVE FREQUENCY (%)
100
80
60
40
20
0
BOUNDARY OF
DISCHARGE ZONE
400
300
200
160
100
0
2°C PLUME SURFACE AREA (ACRES)

FIGURE IV-6

CUMULATIVE FREQUENCY OF PLUME VOLUMES (ACRE-FT) WITHIN THE 2°C ISOTHERM

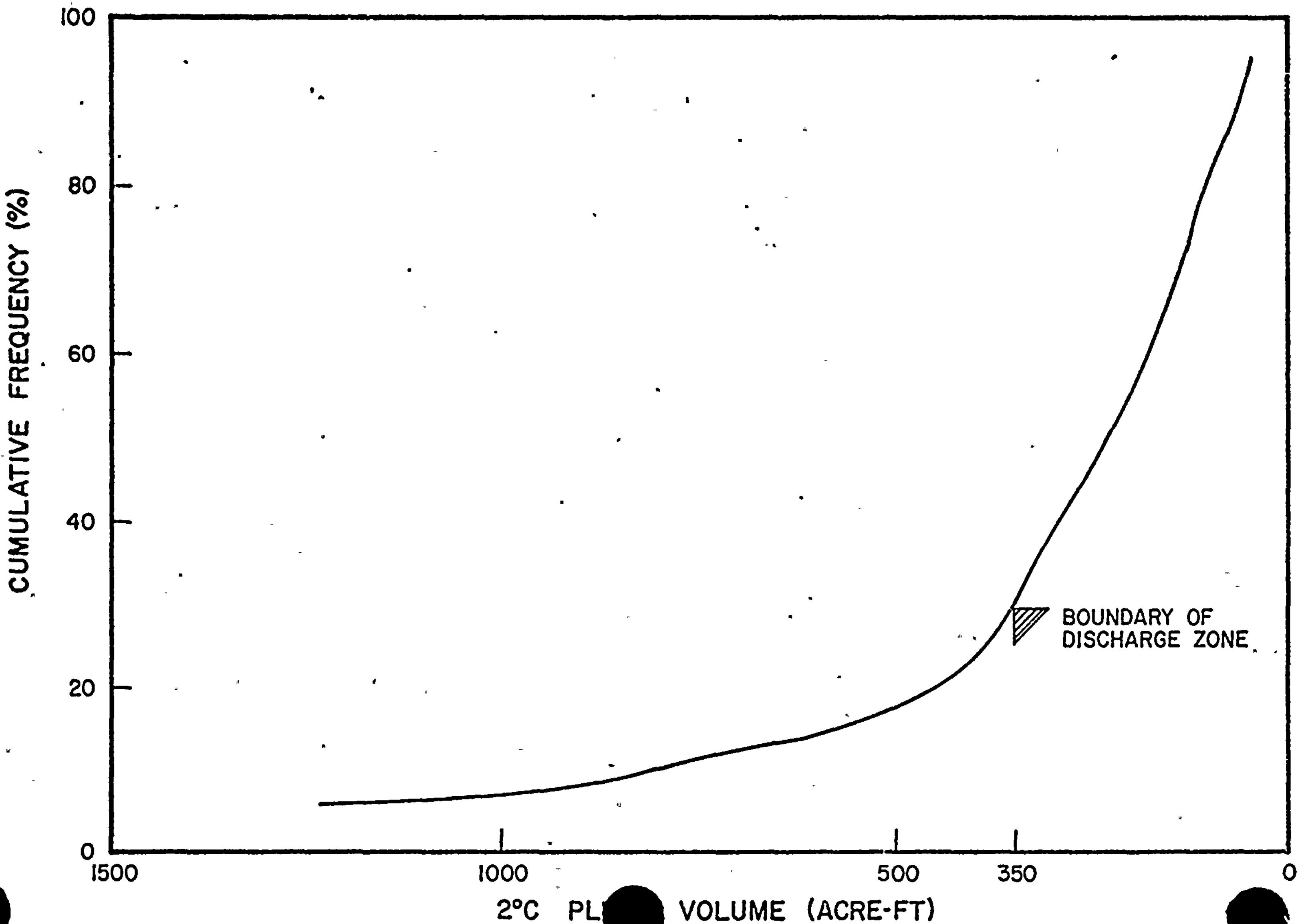


FIGURE IV-7

DISCHARGE ZONE AND ECOLOGICAL SAMPLING STATIONS AT NINE MILE POINT

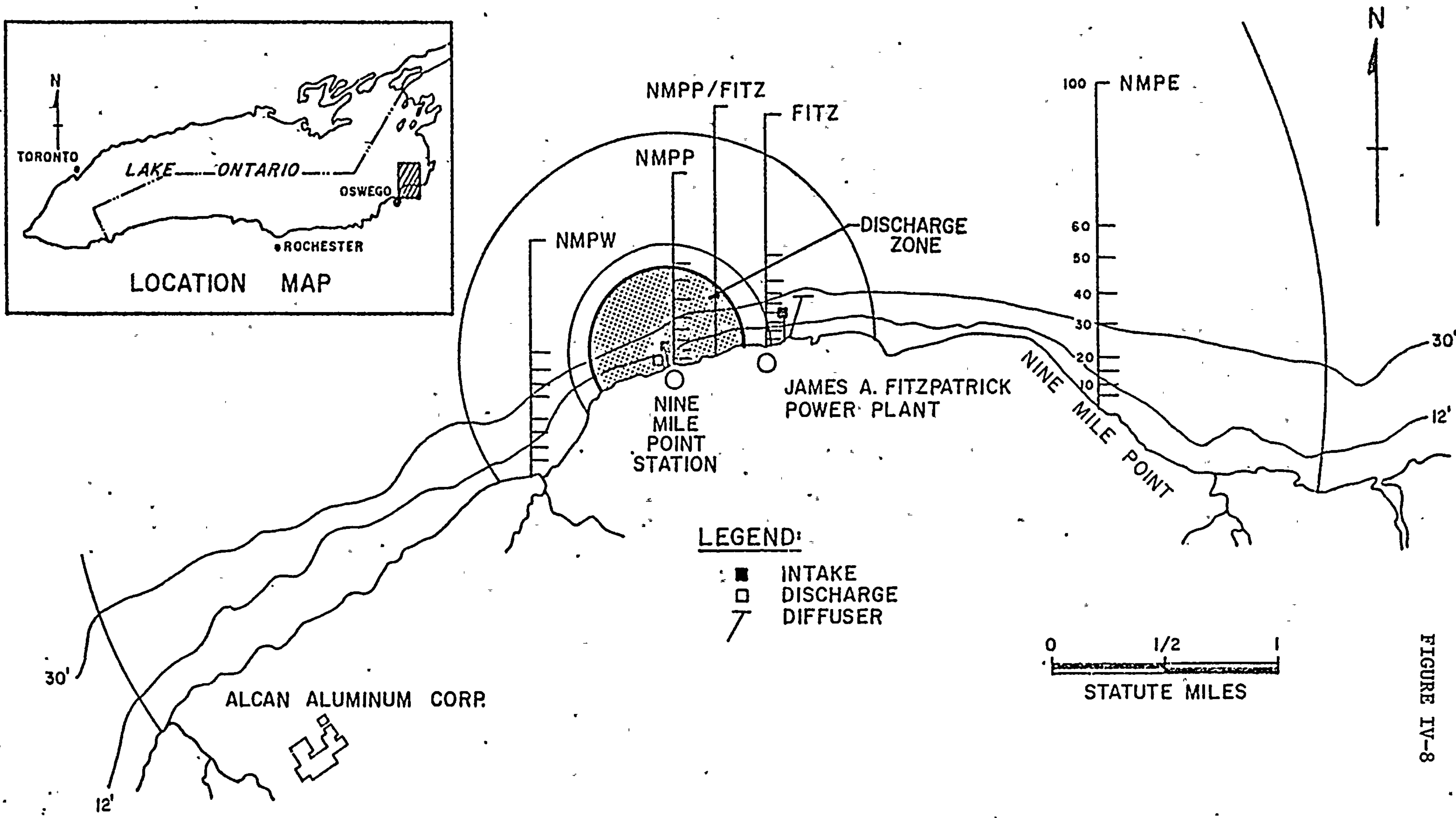


FIGURE IV-8

5. Nine Mile Point Nuclear Power Station Unit 1 Water Chemistry

The 1974 monthly plant water chemistry results are presented in Table IV-8 and Appendix IV-9 to IV-12. Comparison of the monthly mean lake parameter values with corresponding plant parameter values indicated very little difference except in the higher mean value of aluminum for the lake (See Monthly Lake Chemistry section).

Except for the expected temperature difference, the parameter concentrations at the intake and discharge (Appendix IV-9 to IV-12) were very similar. This confirmed the analysis of the 1973 data which indicated no significant difference, at the 95% confidence level, between condenser cooling intake and discharge water for all 48 parameters measured.

a. Plant Dissolved Oxygen

The dissolved oxygen (DO) concentrations in the intake forebay measured from the impingement sampling program ranged from 5.8 mg/l on 24 July to 14.2 mg/l on 13 February 1974; intake temperatures on those dates were 19.0°C and 4.0°C, respectively. The dissolved oxygen concentrations in the discharge ranged from 6.4 mg/l on 20 November to 14.4 mg/l on 13 February; respective temperatures were 24.0°C and 17.5°C. Both the intake and discharge DO concentrations generally ranged above 10 mg/l from January through June and from October through December. Only during the July-September period, when water temperatures were elevated, did the DO values drop below 10 mg/l. Even though measured DO values fluctuated with water temperature, the percent of DO saturation was generally greater than 100% in the discharge and from 90 to 110% in the intake bay.

Throughout the year, the measured oxygen loss between the intake and discharge bay was very low, averaging only 0.17 mg/l. This value is within the average range, 0.1 to 0.2 mg/l, reported from 1973 (QLM, 1974). On the three dates when measurements were recorded every hour for a 24-hour period, the average oxygen loss was 0.3 mg/l, which was identical to that reported for a similar study in 1973 (QLM, 1974).

b. Plant vs. Lake Dissolved Oxygen

The percent DO saturation was very similar at the NMPP/FITZ 20 ft station and the NMPW 20 ft station throughout the year (Figure IV-9). The percent DO saturation of the water in the Nine Mile Point plant intake and discharge bays followed a similar seasonal pattern; however, the values were generally greater in the discharge water (Table IV-9) due to its elevated temperature. The similarity of the pattern of DO saturation between the NMPW 20

TABLE IV-8

SUMMARY OF MONTHLY WATER CHEMISTRY
NINE MILE POINT NUCLEAR POWER PLANT, UNIT 1*
1974

Parameter	Abbreviation[1]	No. of Samples	Maximum	Minimum	Mean	Std. Dev.
pH	(units)	22	8.6	7.3	7.9	0.4
Color	(Cu)	22	20	5	9	5
Specific Conductance	(μmho/cm)	15	330.0	220.0	294.3	37.0
Temperature	(°F)	14	68.00	38.10	49.59	10.53
Turbidity	(Tu)	22	14.0	1.0	4.0	3.5
Alkalinity	(Alk)	22	100.0	71.0	86.7	8.1
Dissolved Oxygen	(DO)	12	13.20[2]	8.20	10.82	1.65
Biological Oxygen Demand	(TBOD)	22	5	0	3	1
Chemical Oxygen Demand	(TCOD)	22	43	1	14	10
Total Organic Carbon	(TTOC)	23	35	4	13	8
Total Solids	(TS)	22	370	181	250	47
Total Dissolved Solids	(TDS)	22	370	178	246	47
Total Volatile Solids	(TVS)	22	115	21	78	22
Total Suspended Solids	(TSS)	22	12	1	5	4
Ammonia Nitrogen	(NH_3N)	22	0.6	0.0	0.2	0.2
Total Kjeldahl Nitrogen	(TKN)	23	1.20	0.00	0.58	0.35
Nitrate Nitrogen	(NO_3N)	22	0.46[2]	0.04	0.23	0.13
Orthophosphate Phosphorus	(OP)	22	0.04	0.00	0.01	0.01
Total Phosphate Phosphorus	(TP)	22	0.08	0.00	0.03	0.02
Phenols	(PHL)	22	0.000	0.000	0.000	0.000
Chloride	(CL)	20	64	0	37	15
Sulfate	(SO_4)	22	52	21	36	7
Barium	(BA)	24	0.000	0.000	0.000	0.000
Beryllium	(BE)	24	0.024[2]	0.000	0.002	0.006
Cadmium	(CD)	24	0.015	0.000	0.001	0.003
Calcium	(CA)	24	80.400	33.100	49.700	13.280
Chromium	(CR)	24	0.240	0.000	0.032	0.063
Copper	(CU)	24	9.900[2]	0.000	1.483	3.319
Iron	(FE)	24	0.550	0.000	0.200	0.186
Lead	(PB)	24	0.680[2]	0.000	0.104	0.218
Magnesium	(MG)	24	9.590	0.480	7.320	2.150
Manganese	(MN)	20	0.070	0.000	0.008	0.017
Mercury	(HG)	26	0.005	0.000	<0.001	0.001
Nickel	(NI)	24	0.296	0.000	0.029	0.070
Potassium	(K)	24	73.000	35.400	52.158	9.057
Silicon	(SI)	25	2.1	0.0	0.6	0.5
Sodium	(NA)	24	52.00	10.200	24.090	14.000
Vanadium	(V)	24	0.000	0.000	0.000	0.000
Zinc	(ZN)	24	6.400[2]	0.000	1.048	2.281
Silver	(AG)	26	0.015	0.000	0.001	0.004
Aluminum	(AL)	26	2.550[3]	0.000	0.259	0.538
Arsenic	(AS)	24	0.000	0.000	0.000	0.000
Selenium	(SE)	7	0.008	0.000	0.002	0.004
Cyanide	(CN)	23	0.0	0.0	0.0	0.0
Fluoride	(F)	23	0.2	0.0	0.1	0.1
Total Coliform	(TCOL cts/100ml)	22	118	0	29	36
Fecal Coliform	(FCOL cts/100ml)	22	55	0	9	16
Surfactants	(SUR)	22	0.07	0.00	0.03	0.02

*Summary of plant samples: intake forebay, intake compositor, discharge aftbay, discharge compositor; all units in mg/l unless indicated.

1 Computer code for water quality parameters.
2 8 April, samples contaminated during laboratory handling.
3 12, August.

PERCENT DISSOLVED OXYGEN SATURATION

NINE MILE POINT

1974

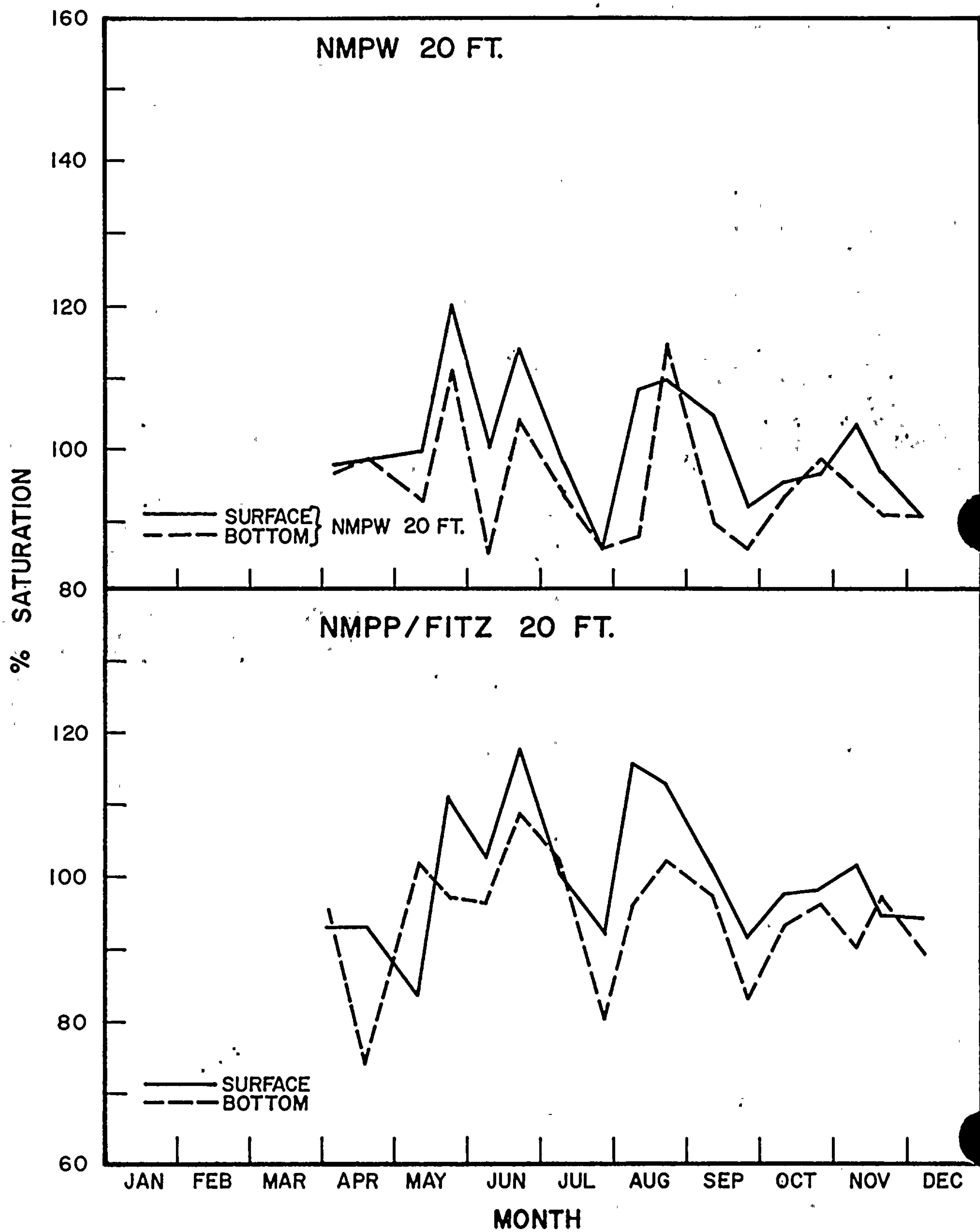


TABLE IV-9

TEMPERATURE AND DISSOLVED OXYGEN SATURATION

NINE MILE POINT NUCLEAR STATION UNIT 1 - 1974

MONTH	INTAKE BAY TEMPERATURE (°F)	INTAKE BAY DO SATURATION (%)	DISCHARGE BAY TEMPERATURE (°F)	DISCHARGE BAY DO SATURATION (%)	ΔDO (INTAKE/DISCHARGE) (mg/1)
APR	38.1	98.9	PLANT OFF-LINE		-
MAY	46.4	96.3	PLANT OFF-LINE		-
JUN	51.8	106.4	PLANT OFF-LINE		-
JUL	67.6	90.5	91.8	121.5	-0.3
AUG	68.0	94.2	89.6	124.3	-0.4
SEP	62.6	88.5	91.6	127.0	-0.4
OCT	54.5	99.8	70.2	118.1	0.2
NOV	48.2	91.8	75.2	123.7	0.3
DEC	44.6	92.3	69.8	115.4	1.0

ft station, which is outside of the defined discharge zone, and the NMPP/FITZ 20 ft station, which falls within the zone, suggests that the discharge has very little effect on DO in the lake's ecosystem.

6. Nine Mile Point Sewage Treatment Plant

The concentrations of the monitored parameters (in particular, total and fecal coliforms, chlorine residual, and pH) in the oxidation pond influent (Appendix IV-13) fluctuated monthly and seasonally. The fecal coliform (FCOL) values were high during January through August, but were negligible during the remainder of the year. Free chlorine residual concentrations were > 0.5 mg/l in June, October and November. The decrease in the coliform counts may have been attributed to the increased chlorine residual. The pH values ranged from 2.3 to 7.1 in the oxidation pond influent and effluent throughout most of the sampling period except from April through June, when values ranged from 7.5 to 8.1. The low pH values are as yet unexplained, but were consistent with the values recorded during 1973 (QLM, 1974).

The oxidation pond influent flowed at a rate of one gallon per minute (gpm) in 1974, similar to the rate in 1973, and both years were characterized by a low BOD. The majority of the parameters monitored in the sewage treatment plant in 1974 showed values similar to those measured during the four-month sampling program in 1973, except for a decrease in the coliform counts and the slight increase in TP, Ortho-PO_4, alkalinity, NO_3-N, surfactants, and chlorine residual values in 1974.

Parameters monitored from the oxidation pond influent and effluent differed considerably in value; lower values were generally recorded from the effluent. The only exceptions were total coliforms (TCOL), alkalinity, and pH. The elevation in pH and alkalinity was probably related to high algal photosynthetic production, which removed large quantities of free CO_2.

The values of all parameters monitored at the oxidation pond effluent, except for chlorine residual and phenols, fluctuated erratically both monthly and seasonally. This unexplainable fluctuation also occurred on the five 1973 sampling dates. The only difference between the 1973 and 1974 effluent data was that generally higher parameter values were recorded in 1974 than in 1973, except for the coliform counts, which were lower in 1974 than in 1973.

The values for the parameters monitored in the discharge channel of the sewage plant were considerably lower than the values of the corresponding parameters in either the oxidation pond influent or effluent. This can be attributed to the fact that the discharge channel water was diluted by surface runoff (QLM, 1974), resulting in the oxidation differential between the two areas. Parameter values in the discharge channel varied monthly, and increased values were recorded during the summer and fall months when evaporation concentrated the discharge flow into a stagnant water mass. The 1974 values and fluctuations were consistent with those measured on the five 1973 sampling dates.

The discharge channel, however, had higher values for TS, sulfate (SO_4), Fe, TP, OP, TKN, NO_3-N, BOD, COD, alkalinity, calcium (Ca), and fecal coliforms than either the lake or the storm drain water. Such higher values are frequently associated with runoff from marshy areas (Ruttner, 1963), such as the one which feeds into the discharge channel. However, the discharge channel water, even with its higher concentrations of certain chemicals, has minimal effect on the lake because it flows into the lake only a few months of the year (during spring) and is rapidly diluted.

The concentrations of the majority of the parameters monitored in the storm drain remained relatively constant throughout the year, except for fluctuations in total coliform (TCOL), Fe, and Zn. The abnormally high Zn values in the latter part of April were probably a function of high run-off. The values recorded in 1974 were consistent with those recorded from the five sampling dates in 1973. It is hypothesized that little or no effect results from water flowing from the storm drain into the lake as no significant difference was observed in the values of the parameters monitored in both areas.

Phenols, SUR, chloride (Cl), chromium (Cr), and Zn concentrations were approximately the same in the storm drain, discharge channel, and lake. Total coliform counts were similar in the storm drain and discharge channel, but higher than in the lake water.

D. CONCLUSIONS

The time series plot and the ANOVA indicated that date was the most consistent and significant statistical parameter for most of the water quality parameters monitored in the lake in 1974. Date differences were also an important factor in 1973 for all monitored parameters, except total suspended solids.

Only the values of TKN and NO_3-N were significantly different among transects; NMPW and NMPE transects were observed to be the most dissimilar based on bimonthly data. Transient vertical temperature regimes

and algal growth were again hypothesized to be the underlying factors affecting water quality variability in the study area. The bimonthly biological water quality data provided a greater resolution of variance than the monthly data, as was the case in 1973.

The water quality parameters monitored in Lake Ontario in the vicinity of Nine Mile Point Nuclear Station remained stable from 1973 to 1974 except for the high trace metal values observed in April 1974.

Thermal gradients were observed in the summer throughout the study area; however, these gradients were transient and unstable, and followed the pattern observed in 1973, i.e., they moved into the deeper portions of the lake as the summer months proceeded. Twenty-eight of the recorded 163 thermal gradients may have been partially attributed to the thermal discharges from Nine Mile Point Nuclear Station Unit 1. These gradients were observed at the 20 ft station between Nine Mile Point and FitzPatrick power plants when isothermal conditions were recorded at the other shallow water stations in the study area and when thermal stratification had moved offshore.

The passage of Lake Ontario water through the Nine Mile Point Unit 1 condenser cooling system appeared to have little, if any, effect on the water quality of the lake, as the difference in measured parameter values between the intake and discharge, during 1973 and 1974, was quite minimal.

The loss of dissolved oxygen in the water as a result of its passage through the Nine Mile Point plant condenser cooling system averaged only 0.17 mg/1 throughout the year. This low value was consistent with the value determined for 1973. It also suggests that the discharge water appeared to have little effect on the oxygen content of the lake water. Comparison of the DO saturation levels at the station within the discharge zone with those from an area predicted to be outside the effect of the thermal plume supports this conclusion of minimal effect.

The Nine Mile Point sewage treatment plant continued to provide adequate secondary treatment from 1973 through 1974, based on low BOD and Coliform levels, attributable to effective chlorination. The oxidation pond was also effective in reducing various chemical concentrations while raising the pH of the water.

The high values for thirteen of the water quality parameters (see Section 6 above), recorded from the sanitary treatment plant discharge channel water were due to local runoff. Since the flow is limited, discharging into the lake only a few months of the year (during spring), and is rapidly diluted by the lake water, only a minimal effect on the lake water quality can be expected.

The water quality of the storm drain water had little or no effect on the lake water as both sampling sites had essentially the same values for measured water quality parameters.

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APPENDIX IV-1

MONTHLY WATER QUALITY - VALUES (mg/1)
AVERAGED OVER CONTOUR DEPTH AND SAMPLE DEPTH
NMPP/FITZ (25 and 45 ft DEPTH CONTOUR) - 1974

ARAMETER	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
OP	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0	0.01
TP	0.03	0.06	0.03	0.03	0.02	0.02	0.01	0.04	0.01
TS	205	340	213	269	203	245	224	119	203
[illegible]	191	333	213	248	200	233	220	221	200
TSS	13	10	2	21	5	12	3	3	3
TVS	84	109	79	49	68	94	105	81	64
TBOD	3	3	4	4	2	2	2	2	2
TCOD	5	6	8	18	21	9	9	6	16
TTOC	5	5	13	5	6	11	10	13	29
TKN	0.33	0.31	0.53	0.73	0.57	0.29	0.55	0.55	0.55
NH_3N	0	0.2	0.1	0.4	0.2	0.3	0	0.3	0.2
NO_3N	0.18	0.33	0.21	0.10	0.07	0.03	0.10	0.12	0.23
PH	7.7	7.7	8.4	8.7	8.3	8.2	7.8	7.4	7.4
ALK	71.5	92.0	91.5	89.5	82.5	81.3	101.3	80.3	80.8
SPC	N.S.	N.S.	301	314	301	289	315	220	268
T	35.8	44.0	54.4	73.1	64.5	-	54.3	52.1	43.1
TUR	4.5	8.9	2.5	8.3	4.0	1.5	1.5	1.8	1.3
DO	12.05	11.58	11.60	8.55	8.93	9.10	10.20	11.15	11.50
COL	14	20	5	16	11	8	6	9	5
FCOL	0	16	6	41	0	11	4	1	1
TCOL	5	32	21	56	0	31	13	6	3
SUR	0.01	0.03	0.03	0.03	0.05	0.02	0.05	0.06	0.01
PHL	0	0	0	0	0	0.011	0	0	0
CL	25	65	0	30	30	31	44	35	28
SO_4	25	31	41	33	37	47	38	32	28
BA	0	0	0	0	0	0	0	0	0
BE	0	0	0	0	0	0	0	0	0
CD	0	0	0	0	0	0	0	0	0
CA	57.51	81.65	45.20	34.13	35.23	38.23	42.65	49.63	46.33
CR	0.040	0.265	0.040	0	0	0	0	0	0.005
CU	12.025	0.238	0.195	0.004	0.027	0	0	0.013	0.013
FE	0.645	0.788	0.398	0.355	0.250	0.045	0.010	0	0.108
PB	0.505	0.033	0.040	0.055	0	0	0	0	0
MG	6.933	8.450	8.100	8.455	7.573	7.325	9.370	7.670	8.250
MN	0.020	0	0	0.010	0.003	0.003	0.005	0.008	0.008
HG	0.001	0	0	0	0.007	0	0	0	0
NI	0.108	0	0	0	0	0	0.025	0	0
K	63.270	44.300	58.475	56.250	53.000	44.250	60.725	53.250	52.375
SI	0.5	0.4	0	0.5	0.3	0.1	0.2	0.1	1.0
NA	13.660	35.500	16.225	13.225	36.925	48.850	142.250	18.875	13.100
V	0	0	0	0	0	0	0	0	0
ZN	8.150	0.189	0.078	0.022	0.051	0	0.901	0.018	0.026
AG	0.015	0	0	0	0	0	0	0	0
AL	0.243	0.752	0	0.506	23.798	0.180	0	0	0
AS	0	0	0	0	0	0	0	0	0
SE	0.001	0	0	0	0	0.003	0.003	0	0.006
SN	0	0	0	0	0	0	0	0	0
[illegible]	0.1	0.1	0.2	0.8	0.1	0	0	0.1	0

N.S. no sample

APPENDIX IV-2

MONTHLY LAKE WATER CHEMISTRY
NINE MILE POINT VICINITY - 1974

I. TOTAL KJELDAHL NITROGEN (TKN)

THREE-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DATES	8	0.6760	23	1.3414	1.449 (a)
SAMPLE DEPTHS	1	0.0850	16	0.7800	1.744 (a)
STATIONS	1	0.0356	16	0.9744	0.584 (b)
DATES X DEPTHS	8	0.3289	7	0.4438	0.648 (b)
DATES X STATIONS	8	0.4990	7	0.4438	0.984 (b)
DEPTHS X STATIONS	1	0.0200	7	0.4438	0.315 (b)
TOTAL	34	2.1579			

(a) Significant at $\alpha<0.25$
(b) Not significant at $\alpha=0.25$

II. TOTAL CHEMICAL OXYGEN DEMAND (TCOD)

THREE-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DATES	8	1101.7222	24	485.9889	6.809 (a)
SAMPLE DEPTHS	1	2.2500	17	211.2500	0.181 (b)
STATIONS	1	61.3611	17	341.1389	3.058 (c)
DATES X DEPTHS	8	146.5000	8	62.5000	2.344 (d)
DATES X STATIONS	8	276.3889	8	62.5000	4.422 (e)
DEPTHS X STATIONS	1	2.2500	8	62.5000	0.288 (b)
TOTAL	35	1652.9722			

(a) Significant at $\alpha< 0.0005$
(b) Not significant at $\alpha=0.25$
(c) Significant at $\alpha<0.10$
(d) Significant at $\alpha<0.25$
(e) Significant at $\alpha<0.05$

STUDENT-NEWMAN-KEULS - DATES ($\alpha = 0.05$)

Largest: 12 Aug 15 Jul 5 Dec 17 Sep 17 Oct 13 Jun 14 May 12 Nov 10 Apr : Smallest

III. NITRATE NITROGEN (NO_3-N)

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DATES	8	2.8688	24	0.4535	18.978 (a)
SAMPLE DEPTHS	1	0.0093	17	0.2169	0.734 (b)
STATIONS	1	0.0044	17	0.3447	0.217 (b)
DATES X DEPTHS	8	0.1095	8	0.1067	1.026 (b)
DATES X STATIONS	8	0.2372	8	0.1067	2.225 (c)
DEPTHS X STATIONS	1	0.0007	8	0.1067	0.054 (b)
TOTAL	35	3.3367			

(a) Significant at $\alpha< 0.0005$
(b) Not significant at $\alpha=0.25$
(c) Significant at $\alpha<0.25$

STUDENT-NEWMAN-KEULS - DATES ($\alpha = 0.05$)

Largest: 14 May 5 Dec 13 Jun 10 Apr 12 Nov 17 Oct 15 Jul 12 Aug 17 Sep ;Smallest

APPENDIX IV-3

BIMONTHLY LAKE WATER CHEMISTRY
TOTAL KJELDAHL NITROGEN (TKN)
NINE MILE POINT VICINITY - 1974

I. PERIOD: 2 APRIL - 26 JULY

FOUR-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.3857	68	2.8128	4.663 (a)
DEPTH CONTOURS	1	0.0190	60	2.7011	0.421 (b)
SAMPLE DEPTHS	1	0.3455	60	2.6504	7.823 (d)
DATES	7	2.4786	76	3.2337	8.322 (c)
TRANSECTS X CONTOURS	2	0.0056	81	3.2906	0.069 (b)
TRANSECTS X DEPTHS	2	0.0329	60	2.7011	0.366 (b)
TRANSECTS X DATES	14	0.3413	60	2.7011	0.541 (b)
CONTOURS X DEPTHS	1	0.0045	68	2.8128	0.108 (b)
CONTOURS X DATES	7	0.2551	68	2.8128	0.881 (b)
DEPTHS X DATES	7	0.2174	68	2.8128	0.751 (b)
TRANSECTS X CONTOURS X DEPTHS	2	0.0204	76	3.2337	0.239 (b)
TOTAL	94	6.5943			

(a) Significant at $\alpha < 0.025$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.01$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 20 JUN 2 APR 8 JUL 17 APR 26 JUL 9 MAY 7 JUN 2 MAY: Smallest
STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPE NMPP/FITZ NMPW: Smallest
Sample mean is larger for surface than for bottom.

II. PERIOD: 6 AUGUST - 5 DECEMBER

FOUR-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.1089	77	2.7537	1.523 (a)
DEPTH CONTOURS	1	0.0090	68	2.4008	0.254 (b)
SAMPLE DEPTHS	1	0.0139	68	2.3496	0.403 (b)
DATES	8	2.3354	87	3.0398	8.355 (c)
TRANSECTS X CONTOURS	2	0.0007	68	2.3496	0.011 (b)
TRANSECTS X DEPTHS	2	0.1805	68	2.4008	2.557 (d)
TRANSECTS X DATES	16	0.5700	68	2.4008	1.009 (b)
CONTOURS X DEPTHS	1	0.0154	77	2.7537	0.430 (b)
CONTOURS X DATES	8	0.3749	77	2.7537	1.310 (b)
DEPTHS X DATES	8	0.1407	77	2.7537	0.492 (b)
TRANSECTS X CONTOURS X DEPTHS	2	0.0560	87	3.0398	0.802 (b)
TOTAL	106	5.7544			

(a) Significant at $\alpha < 0.25$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.10$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 23 OCT 8 NOV 6 AUG 20 AUG 24 SEP 10 SEP 19 NOV 5 DEC 8 OCT: Smallest

APPENDIX IV-4

BIMONTHLY LAKE WATER CHEMISTRY
TOTAL PHOSPHATE PHOSPHORUS (TP)
NINE MILE POINT VICINITY - 1974

I. PERIOD: 2 APRIL - 26 JULY

FOUR-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0001	68	0.0384	0.106 (a)
DEPTH CONTOURS	1	0.0025	60	0.0329	4.514 (b)
SAMPLE DEPTHS	1	0.0013	60	0.0343	2.274 (c)
DATES	7	0.0062	76	0.0400	1.682 (c)
TRANSECTS X CONTOURS	2	0.0005	60	0.0343	0.468 (a)
TRANSECTS X DEPTHS	2	0.0022	60	0.0329	1.962 (b)
TRANSECTS X DATES	14	0.0063	60	0.0329	0.820 (a)
CONTOURS X DEPTHS	1	0.0002	68	0.0384	0.297 (a)
CONTOURS X DATES	7	0.0027	68	0.0384	0.674 (a)
DEPTHS X DATES	7	0.0023	68	0.0384	0.590 (a)
TRANSECTS X CONTOURS X DEPTHS	2	0.0007	76	0.0400	0.707 (a)
TOTAL	94	0.0536			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.05$
(c) Significant at $\alpha < 0.25$

The sample mean for 20 ft contour is larger than for that of the 60 ft contour.

II. PERIOD: 6 AUGUST - 5 DECEMBER

FOUR-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0014	78	0.0452	1.219 (a)
DEPTH CONTOURS	1	0.0016	69	0.0372	3.028 (b)
SAMPLE DEPTHS	1	0.0001	69	0.0333	0.276 (a)
DATES	8	0.0180	88	0.0482	4.100 (c)
TRANSECTS X CONTOURS	2	0.0042	57	0.0284	4.171 (d)
TRANSECTS X DEPTHS	2	0.0004	57	0.0284	0.398 (a)
TRANSECTS X DATES	16	0.0120	57	0.0284	1.490 (e)
CONTOURS X DEPTHS	2	0.0006	57	0.0284	0.596 (a)
CONTOURS X DATES	8	0.0043	57	0.0284	1.068 (a)
DEPTHS X DATES	8	0.0040	57	0.0284	0.993 (a)
TRANSECTS X CONTOURS X DEPTHS	2	0.0005	88	0.0482	0.462 (a)
TOTAL	107	0.0750			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.10$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.025$
(e) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 10 SEP 6 AUG 20 AUG 24 SEP 23 OCT 19 NOV 8 OCT 5 DEC 8 NOV: Smallest

At $\alpha = 0.10$, more at 20 ft contour than at 60 ft contour.

STUDENT-NEWMAN-KEULS TEST - TRANSECT X DEPTH CONTOUR INTERACTION:
Largest: NMPE-20 ft NMPW-20 ft NMPP/FITZ-60 ft NMPW-60 ft NMPP/FITZ-20 ft NMPE-60 ft: Smallest

APPENDIX IV-5

BIMONTHLY LAKE WATER CHEMISTRY
TOTAL CHEMICAL OXYGEN DEMAND (TCOD)
NINE MILE POINT VICINITY - 1974

I. PERIOD: 2 APRIL - 26 JULY

FOUR-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	1.5454	68	50.8409	1.033 (a)
DEPTH CONTOURS	1	0.3191	60	62.2719	0.307 (a)
SAMPLE DEPTHS	1	0.0046	60	53.2503	0.005 (a)
DATES	7	46.5269	76	73.8710	6.833 (b)
TRANSECTS X CONTOURS	2	4.9967	60	53.2503	2.815 (e)
TRANSECTS X DEPTHS	2	0.5395	60	62.2719	0.260 (a)
TRANSECTS X DATES	14	6.1829	60	62.2719	0.426 (a)
CONTOURS X DEPTHS	1	0.0681	68	50.8409	0.091 (a)
CONTOURS X DATES	7	17.9874	68	50.8409	3.437 (c)
DEPTHS X DATES	7	13.4360	68	50.8409	2.567 (d)
TOTAL	94	127.7205			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.0005$
(c) Significant at $\alpha < 0.005$
(d) Significant at $\alpha < 0.025$
(e) Significant at $\alpha < 0.10$

STUDENT NEWMAN KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 26 JUL 17 APR 9 MAY 7 JUN 8 JUL 20 JUN 21 MAY 2 APR: Smallest

II. PERIOD: 6 AUGUST - 5 DECEMBER

FOUR-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	3.9471	69	69.6940	1.954 (a)
DEPTH CONTOURS	1	0.1765	60	68.2569	0.155 (b)
SAMPLE DEPTHS	1	3.2691	60	66.0655	2.969 (c)
DATES	8	71.8518	81	78.4790	9.270 (d)
TRANSECTS X CONTOURS	2	1.0738	49	49.0667	0.536 (b)
TRANSECTS X DEPTHS	2	2.3845	49	49.0667	1.191 (b)
TRANSECTS X DATES	16	17.1690	49	49.0667	1.072 (b)
CONTOURS X DEPTHS	1	10.2437	49	49.0667	10.230 (e)
CONTOURS X DATES	8	7.8727	49	49.0667	0.983 (b)
DEPTHS X DATES	8	4.3706	49	49.0667	0.546 (b)
TOTAL	107	171.4225			

(a) Significant at $\alpha < 0.25$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.10$
(d) Significant at $\alpha < 0.0005$
(e) Significant at $\alpha < 0.0025$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 6 AUG 5 DEC 19 NOV 8 NOV 8 OCT 23 OCT 20 AUG 10 SEP 24 SEP: Smallest
More at surface than at bottom (at $\alpha = 0.10$)

APPENDIX IV-6

BIMONTHLY LAKE WATER CHEMISTRY
TOTAL BIOLOGICAL OXYGEN DEMAND (BOD)
NINE MILE POINT VICINITY - 1974

I. PERIOD: 2 APRIL - 26 JULY

FOUR-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0267	68	1.5988	0.569 (a)
DEPTH CONTOURS	1	0.1780	60	1.5887	6.722 (b)
SAMPLE DEPTHS	1	0.2115	60	1.8724	6.777 (b)
DATES	7	3.0544	78	2.8381	11.992 (c)
TRANSECTS X CONTOURS	2	0.0283	78	2.8381	0.389 (a)
TRANSECTS X DEPTHS	2	0.0187	78	2.8381	0.257 (a)
TRANSECTS X DATES	14	0.4981	60	1.5887	1.344 (d)
CONTOURS X DEPTHS	1	0.0002	78	2.8381	0.007 (a)
CONTOURS X DATES	7	0.5028	68	1.5988	3.055 (e)
DEPTHS X DATES	7	0.7968	68	1.5988	4.841 (c)
TOTAL	94	6.3109			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.025$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$
(e) Significant at $\alpha < 0.01$

STUDENT NEWMAN KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 21 MAY 20 JUN 17 APR 9 MAY 8 JUL 2 APR 26 JUL 7 JUN: Smallest

The sample mean for 20 ft contour is greater than that for the 60 ft.
The sample mean for surface is greater than that for bottom depth.

II. PERIOD: 6 AUGUST - 5 DECEMBER

FOUR-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0654	78	6.3921	0.399 (a)
DEPTH CONTOURS	1	0.3469	69	5.5541	4.310 (b)
SAMPLE DEPTHS	1	0.0093	69	5.6258	0.114 (a)
DATES	8	5.0124	90	7.3109	7.713 (c)
TRANSECTS X CONTOURS	2	0.1625	58	4.8975	0.962 (a)
TRANSECTS X DEPTHS	2	0.0653	58	4.8975	0.387 (a)
TRANSECTS X DATES	16	1.2669	58	4.8975	0.938 (a)
CONTOURS X DEPTHS	1	0.0053	58	4.8975	0.063 (a)
CONTOURS X DATES	8	0.4888	58	4.8975	0.724 (a)
DEPTHS X DATES	8	0.6577	58	4.8975	0.974 (a)
TOTAL	107	12.9780			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.05$
(c) Significant at $\alpha < 0.0005$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 23 OCT 19 NOV 20 AUG 8 NOV 6 AUG 5 DEC 10 SEP 24 SEP 8 OCT: Smallest

The sample mean for 20 ft contour is greater than for 60 ft contour.

APPENDIX IV-7

BIMONTHLY LAKE WATER CHEMISTRY
NITRATE-NITROGEN (NO_3-N)
NINE MILE POINT VICINITY - 1974

I. PERIOD: 2 APRIL - 26 JULY

FOUR-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0093	68	0.0419	7.523 (a)
DEPTH CONTOURS	1	0.0001	60	0.0660	0.056 (b)
SAMPLE DEPTHS	1	0.0002	60	0.0448	0.317 (b)
DATES	7	0.1616	78	0.0811	22.199 (c)
TRANSECTS X CONTOURS	2	0.0008	78	0.0811	0.380 (b)
TRANSECTS X DEPTHS	2	0.0004	78	0.0811	0.199 (b)
TRANSECTS X DATES	14	0.0066	60	0.0660	0.431 (b)
CONTOURS X DEPTHS	1	0.0005	78	0.0811	0.489 (b)
CONTOURS X DATES	7	0.0307	68	0.0419	7.106 (c)
DEPTHS X DATES	7	0.0098	68	0.0419	2.279 (d)
TOTAL	94	0.2542			

(a) Significant at $\alpha < 0.0025$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.05$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 17 APR 2 APR 9 MAY 20 JUN 8 JUL 21 MAY 26 JUL 7 JUN: Smallest

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$)
Largest: NMPW NMPP/FITZ NMPE: Smallest

II. PERIOD: 6 AUGUST - 5 DECEMBER

FOUR-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	2	0.0010	78	0.0083	4.785 (a)
DEPTH CONTOURS	1	0.0000	60	0.0080	0.306 (b)
SAMPLE DEPTHS	1	0.0012	69	0.0083	9.892 (c)
DATES	8	0.0672	90	0.0123	61.446 (d)
TRANSECTS X CONTOURS	2	0.0002	90	0.0123	0.867 (b)
TRANSECTS X DEPTHS	2	0.0001	90	0.0123	0.507 (b)
TRANSECTS X DATES	16	0.0024	69	0.0080	1.281 (e)
CONTOURS X DEPTHS	1	0.0002	90	0.0123	1.514 (e)
CONTOURS X DATES	8	0.0020	78	0.0083	2.356 (f)
DEPTHS X DATES	8	0.0024	78	0.0083	2.845 (a)
TOTAL	107	0.0823			

(a) Significant at $\alpha < 0.025$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0025$
(d) Significant at $\alpha < 0.0005$
(e) Significant at $\alpha < 0.25$
(f) Significant at $\alpha < 0.05$

STUDENT-NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)
Largest: 5 DEC 19 NOV 23 OCT 8 NOV 8 OCT 10 SEP 6 AUG 24 SEP 20 AUG: Smallest

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$)
Largest: NMPW NMPP/FITZ NMPE: Smallest
The sample mean for bottom is larger than that for surface.

APPENDIX IV-8

THREE-DIMENSIONAL THERMAL SURVEYS
SURFACE AREA AND VOLUME OF WATER
ENCLOSED WITHIN 2°C ABOVE AMBIENT ISOTHERMS

NINE MILE POINT - 1970-1974

SURVEY DATES	SURFACE AREA (ACRES)	VOLUME (ACRE-FT)	MEAN DEPTH (FT)	WIND SPEED (mph)	WIND DIRECTION
8 AUG 74	369.50	1229.00	3.33	8-12	W/NW
5 SEP 74	72.00	235.20	3.27	5	E/SE
15 OCT 74	51.70	54.00	1.04	8-10	NW
27 JUN 73	75.97	116.16	1.57	15-20	S
3 AUG 73	142.65	394.09	2.76	10-12	NW
5 SEP 73	220.05	340.51	1.55	10-15	S
12 OCT 73	178.02	487.09	2.74	3- 5	S
21 JUL 72	109.28	167.85	1.54	20	W
2 AUG 72	125.06	368.51	2.94	5-10	S/SE
16 AUG 72	117.25	301.43	2.57	5- 8	S/SE
31 AUG 72	52.80	89.67	1.70	9	SW
20 OCT 72	137.86	195.19	1.42	10	NW
29 JUN 71	72.89	103.27	1.42	15-20	W/SW
13 JUL 71	43.44	83.52	1.92	10-15	S/SW
23 JUL 71	365.12	744.34	2.04	6- 8	S/SW
30 JUL 71	161.38	219.75	1.36	0- 5	E
16 AUG 71	84.08	198.01	2.36	5-10	N
25 AUG 71	106.34	324.86	3.05	0-10	S/SW
3 NOV 71	46.37	141.42	3.06	5-15	NW
16 NOV 71	267.61	1005.25	3.76	5-10	NW
22 JUL 70	136.25	314.74**	2.31*	NA	W
14 AUG 70	310.65	776.63**	2.50*	NA	NA
16 AUG 70	80.90	131.87**	1.63*	NA	NA
23 SEP 70	183.21	338.94**	1.85*	NA	NA
21 OCT 70	33.95	95.06**	2.82*	NA	NA

NA - Data not available
 * - Estimated from the depth temperature profiles
** - Obtained by multiplying surface area by mean depth.

APPENDIX IV-9

MONTHLY WATER QUALITY - VALUES (mg/1)*

NINE MILE POINT NUCLEAR STATION - UNIT 1

INTAKE FOREBAY

PARAMETER	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
OP	0.01	0.02	0	0.03	0.01	0.01	0.01	0.01	0.01
TP	0.02	0.05	0	0.07	0.03	0.04	0.01	0.08	0.01
TS	210	340	240	282	229	254	211	229	219
TDS	200	330	240	277	223	246	204	226	216
TSS	11	12	3	5	6	8	7	3	3
TVS	90	90	75	59	51	107	101	81	61
TBOD	4	3	5	5	4	2	4	4	2
TCOD	1	1	13	19	27	18	28	13	22
TTOC	7	19	8	6	14	10	8	14	15
TKN	0.40	0.60	1.20	1.20	0.80	0.50	0.90	0.95	0.50
NH_3N	0	0.3	0	0.1	0.1	0.1	0	0.1	0.3
NO_3N	0.30	0.39	0.30	0.11	0.08	0.04	0.11	0.16	0.35
PH	7.8	7.8	8.5	8.5	8.3	8.2	8.1	7.5	7.7
ALK	71.0	92.0	90.0	91.0	81.0	80.0	100.0	82.0	88.0
SPC	N.S.	N.S.	295.0	325.0	310.0	301.0	280.0	220.0	290.0
T	38.10	46.40	51.80	67.60	68.00	62.60	54.50	48.20	44.60
TUR[illegible]	5.0	14.0	3.0	4.0	3.0	2.0	2.0	3.0	2.0
DO	13.20	11.40	11.70	8.20	8.50	8.50	10.60	10.60	11.20
COL	10	20	5	15	10	10	10	5	5
FCOL	0	42	0	10	0	12	5	1	0
TC[illegible]	0	35	109	118	0	17	19	4	0
[illegible]	0.01	0.02	0.05	0.03	0.06	0.01	0.04	0.07	0.03
P[illegible]	0	0	0	0	0	0	0	0	0
CL	25	61	0	30	30	33	31	35	29
SO_4	21	31	41	35	37	46	36	32	29
BA	0	0	0	0	0	0	0	0	0
BE	0.024	0	0	0	0	0	0	0	0
CD	0.008	0	0	0	0	0	0	0	0
CA	56.020	46.700	49.000	35.900	39.500	33.100	39.700	52.000	40.000
CR	0.050	0.240	0.080	0	0	0.010	0	0	0
CU	9.900	0.110	0.210	0.011	0	0	0	0.010	0.010
FE	0.370	0.450	0.420	0.049	0	0.60	0	0	0.040
PB	0.620	0	0.050	0.073	0	0	0	0	0
MG	7.020	0.480	7.900	8.210	7.400	7.170	7.170	7.870	8.250
MN	0.012	0	0	0	0	0.070	0.020	0	0
HG	0	0	0	0	0	0	0.005	0	0
NI	0.123	0	0	0	0	0	0.003	0	0
K	60.300	45.400	56.300	57.000	50.000	45.000	51.000	73.000	48.000
SI	0.7	0.7	0.2	0.5	0.4	0.8	0	0.2	0.8
NA	10.230	15.000	15.500	15.800	29.000	51.000	43.000	18.000	12.400
V	0	0	0	0	0	0	0	0	0
ZN	6.400	0.060	0.071	0.026	0.067	0	0.124	0.012	0.142
AG	0.015	0	0.003	0	0	0	0	0	0
AL	0.163	0.437	0	0.052	2.550	0.340	0	0	0
AS	0	0	0	0	0	0	0	0	0
SE	0.007	0	0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CN	0	0	0	0	0	0	0	0	0
F	0.1	0.1	0.1	0	0.1	0	0	0	0

N.S. = No sample
N.A. Not analyzed
* values recorded in mg/l except for temperature (°F), pH (units), color (units), specific conductance (µmho/cm), coliform (counts/100 ml)

APPENDIX IV-10

MONTHLY WATER QUALITY - VALUES (mg/1)*
AVERAGE OVER CONTOUR DEPTH AND SAMPLE DEPTH

NINE MILE POINT NUCLEAR STATION - UNIT 1 - 1974

DISCHARGE AFTBAY

PARAMETER	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
OP	0.01	0.02	0	0.02	0.01	0.01	0	0	0.01
TP	0.02	0.07	0.02	0.06	0.02	0.03	0.01	0.03	0.01
TS	195	330	210	239	214	246	234	214	213
TDS	185	320	210	234	210	239	233	211	209
TSS	11	12	1	5	4	7	1	3	4
TVS	50	115	90	52	63	94	96	63	62
TBOD	3	3	3	4	4	2	3	1	1
TCOD	10	11	6	24	11	9	17	18	7
TTOC	4	12	20	5.0	7.7	10	5	13	23
TKN	0.30	0.20	0.70	0.20	1.10	0.30	0.60	1.10	0.50
NH_3N	0.1	0.3	0.2	0.2	0.2	0.1	0	0.1	0.1
NO_3N	0.33	0.39	0.25	0.08	0.17	0.06	0.12	0.15	0.26
PH	7.6	7.6	7.8	8.6	8.3	8:4	7.9	8.0	7.5
ALK	71.0	90.0	92.0	90	86	82	102	86	78
SPC	N.S.	N.S.	300.0	340	320	315	292	220	278
T	38.10+	46.40+	51.80+	91.76	89.60	91.58	70.16	75.20	69.80
TUR	5.0	14.0	3.0	3.0	3.0	2.0	1.0	2	2.0
DO	12.80	11.70	11.50	8.50	8.90	8.90	10.40	10.30	[illegible]0
COL	10	15	5	10	10	10	5	5	[illegible]
FCOL	3	45	55	0	1	7	1	0	[illegible]
TCOL	32	15	94	46	3	19	13	5	4
SUR	0.02	0.02	0.03	0.02	0.06	0.01	0.02	0.04	0.01
PHL	0	0	0	0	0	0	0	0	0
CL	25	64	29	32	30	33	34	32	29
SO_4	25	35	41	27	36	44	37	33	27
BA	0	0	0	0	0	0	0	0	0
BE	0	0	0	0	0	0	0	0	0
CD	0	0	0	0	0	0	0	0	0
CA	56.660	75.300	50.300	35.700	46.400	35.000	39.900	59.000	40.000
CR	0.070	0	0	0.010	0	0.030	0	0	0.020
CU	8.500	0.120	0.190	0.023	0.121	0	0	0	0.010
FE	0.410	0.550	0.340	0.107	0.220	0.260	0.020	0	0.180
PB	0.680	0	0.030	0	0	0	0	0	0
MG	6.810	8.100	0.780	8.000	8.440	7.370	9.520	8.040	7.800
MN	0.044	0	0	0	0	0.020	0.010	0	0
HG	0	0	0	0.002	0	0	0	0	0
NI	0	0	0	0	0	0	0	0	0
K	68.400	43.300	55.300	47.000	44.000	45.000	53.000	51.000	44.000
SI	0.8	0.4	0.1	0.4	0.2	0.6	0	0	2.1
NA	14.230	32.000	16.900	12.600	53.200	48.000	42.000	18.000	12.400
V	0	0	0	0	0	0	0	0	0
ZN	6.400	0.049	0.089	0.0230	0.042	0	0.084	0	0.059
AG	0	0	0	0	0	0	0	0	0
AL	0.700	0.437	0	0.23	0.950	0.140	0	0	0
AS	0	0	0	0	0	0	0	0	0
SE	—	0	0	0	N.A.	N.A.	N.A.	N.A.	N.A.
CN	0	0	0	0	0	0	0	0	0
F	0.1	0.2	0.2	0.1	0.2	0	0	0	0

N.A. not analyzed
N.S. no sample
* values recorded in mg/l except for temperature (°F), pH (units), color (units), specific conductance (μmho/cm), coliform (counts/100 ml).
\+ plant off-line

APPENDIX IV-11

MONTHLY WATER QUALITY - VALUES (mg/l)*

NINE MILE POINT NUCLEAR STATION - UNIT 1

INTAKE COMPOSITOR

PARAMETER	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
OP	0.02	0.01	0.0	0.03	0.02	0	0.01	0.01	0.03
TP	0.03	0.05	0.01	0.04	0.03	0.01	0.01	0.03	0.03
TS	250	370	250	268	219	255	194	224	234
TDS	250	370	250	265	217	251	191	220	231
TSS	1	4	2	3	2	4	3	4.	3
TVS	85	90	85	59	87	97	91	79	93
TBOD	2	1	2	2.	6	2	2	2	4
TCOD	1	2	2	10.	51	6	15	11	4
TTOC	5	8	14	5.1	15.7	9	13	13	35.
TKN	0.20	0	0.50	0.20	N.S.	/0.15	0.30	1.00	0.80
NH_3N	0	0.5	0	0	0.2	0.1	0	0.2	0
NO_3N	0.46	0.21	0.26	0.15	0.04	0.22	0.17	0.16	0.30
PH	7.7	7.8	7.8	7.9	8.2	7.8	7.7	7.8	7.6
ALK	88.0	93.0	89.0	87	84	80	104	84	90
SPC	N.S.	N.S.	330.0	3.50	288	320	302	220	250
T	38.1	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
TUR	1.0	6.0	3.0	4	2	2	3	1	3
[illegible]	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
[illegible]	5	20	5	15	10.	10	.5	.5	5
F[illegible]	8	13	1	0	16	14	0	0	25
TCOL	44	28	18	12	23	28	0	0	35
SUR	0.02	0.02	0.03	0.03	0.05	0.03	0.07	0.05	0.03
PHL	0	0	0	0	0	0	0	0	0
CL	36	58	35	31	31	36	35	34	41
SO_4	30	33	43	31	38.	51	42	33	46
BA	0	0	0	0	0	0	0	0	0
BE	0.15	0	0	0	0	0	0	0	0
CD	0	0	0	0	0	0	0.003	0	0
CA	69.440	80.400	50.300	36.100	39.800	35.400	39.100	50.600	43.600
CR	0.010	0.200	0.010	0.040	0	0	0	0.030	0.
CU	9.800	0.070	0.240	0	N.S.	0	0	0	0.010
FE	0.520	0.320	0.200	0.307	0	0.130	0.420	0.140	0
PB	0.570	0	0.060	0	0	0	0.	0	0.
MG	8.250	7.700	8.100	8.050	7.860	7.440	9.140	7.500	8.570
MN	0	0	0	0	0.010	0.020	0.090	0	0.010
HG	0	0	0	0	N.S.	0	0	0	0
NI	0.123	0	0	0.023	0.070	0	0.130	0.040	0
K	68.400	39.800	53.200	55.000	46.400	45.000	57.000	53.000	53.000
SI	0.8	0.5	0.2	0.5	----	0.6	1.5	0	2.1
NA	15.510	25.000	18.400	12.600	53.000	52.400	43.500	19.500	16.600
V	0	0	0	0	0	0	0	0	0.
ZN	5.900	0.032	0.084	0	0	0	0.078	0.016	0.048
AG	0	0	0	0	N.S.	0	0	0	0
AL	0.131	0.545	0	0.071	0.380	0.470	0.	0	0
AS	0	0	0	0	0	0	0	0	0
SE	0	0.008	0	0	N.A.	N.A.	N.A.	N.A.	N.A.
CN	0	0	0	0	0	0	0	0	0
F	0.1	0.2	0.1	0.1	0.1	0.	0	0	0

N.A. not analyzed
N.S. no sample
* values recorded in mg/l except for temperature (°F), pH (units), color (units), specific conductance (μmho/cm), coliform (counts/100 ml).

APPENDIX IV-12

MONTHLY WATER QUALITY - VALUES (mg/1)*

NINE MILE POINT NUCLEAR STATION - UNIT 1

DISCHARGE COMPOSITOR

PARAMETER	APRIL	MAY°	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
OP	0.02	NOT ANALYZED	NO SAMPLE	0.02	0.02	0	0.01	0.02	0.04
TP	0.02			0.02	0.03	0.01	0.02	0.07	0.04
TS	240			181	237	262	249	229	277
TDS	240			178	234	259	247	223	274
TVS	65			21	77	106	78	55	82
TSS	2			3	3	3	2	6	3
TBOD	0			3	4	2	3	3	4
TCOD	18			5	43	17	14	12	15
TTOC	11			N.A.	6	7	16	13	34
TKN	0			N.A.	1.10	0.25	0.30	0.80	0.70
NH_3N	0			0.6	0.4	0.1	0	0.4	0
NO_3N	0.46			0.04	0.08	0.12	0.17	0.22	0.33
PH	8.0			8.3	8.0	8.1	7.7	7.3	7.7
ALK	96.0			86.0	85.0	82.0	100.0	74.0	87.0
SPC	N.S.			330	320	321	322.	220	250
T	38.1			N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
TUR	2.0			4.0	3.0	1.0	1.0	3.0	3.0
DO	N.S.			N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
COL	10			15	10	5	5	5	[illegible]
FCOL	0			2	0	6	1	0	[illegible]
TCOL	0			17	0	28	4	0	[illegible]
SUR	0.02			0.03	0.06	0	0.02	0.04	0.03
PHL	0			0	0	0	0	0	0
CL	36			59	36	36	37	37	41
SO_4	30			52	41	43	38	34	45
BA	0			0	0	0	0	0	0
BE	0			0	0	0	0	0	0
CD	0.015			0	0	0	0	0	0.003
CA	71.780			34.650	48.200	34.400	41.600	56.700	47.600
CR	0.050			0	0	0	0	0	0.020
CU	6.300			0.061	0	0	0	0	0.020
FE	0.350			0.141	0	0.060	0	0.160	0.180
PB	0.410			0	0	0	0	0	0
MG	8.420			9.590	8.380	7.330	8.570	7.520	8.300
MN	.049			0	0	0	0.020	0.016	0.020
HG	0.002			0	0	0	0	0	0
NI	0.296			0	0	0.	0.120	0	0
K	54.000			35.400	49.000	50.000	58.000	46.000	48.000
SI	N.A.			N.A.	0.4	0.6	0.2	0	1.1
NA	14.340			12.100	52.000	50.000	46.000	29.000	13.800
V	0.000			0	0	0	0	0	0
ZN	5.400			0	0.042	0	0.076	0.30	0.039
AG	0.012			0	0	0	0	0	0
AL	0.385			0	1.000	0	0	0	0
AS	0.000			0	0	0	0	0	0
SE	0			N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CN	0			0	0	0	0	0	0
F	0.1			0.2	0.1	0	0	0	0

* Values recorded in mg/l except for temperature (°F), pH (units), color (units), specific conductance (µmho/cm), coliform (counts/100 ml).

° May sample lost (bottle broken).

NA= Not analyzed

NS= Not sample

\+ Plant off-line.

APPENDIX IV-13

WATER QUALITY PARAMETERS**

NINE MILE POINT SEWAGE TREATMENT PLANT

1974

PARAMETER	30 - 31 JANUARY				25 - 26 FEBRUARY				25 - 26 MARCH			
	INF.[1]	EFF.[2]	STORM DRAIN	DISCHARGE CH.[3]	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.
PH	5.9	0.9	7.8	7.0	5.6	6.8	7.3	6.9	6.4	6.9	7.3	6.8
ALK	4	44	92	53	4	51	99	112	23	57	103	88
BOD	7	9	2	4	8	8	2	8	13	14	3	6
COD	270	270	15	17	105	75	15	45	19	85	29	19
TS	640	510	280	121	560	510	225	390	610	2850	283	171
TDS	550	480	268	117	520	490	209	205	570	850	235	158
TVS	220	170	68	46	145	120	46	118	155	1750	54	50
TSS	90	35	13	5	45	16	16	188	40	2000	48	13
NH_3N	15.0	8.8	0.1	0.01	13.3	12.7	0.3	0.2	18.8	13.9	0.2	0.3
TKN	13.40	10.40	0.60	0.70	12.40	13.00	0.70	1.60	22.00	17.90	0.65	1.30
NO_3N	16.51	12.87	0.47	0.04	22.60	15.82	0.40	0.78	12.16	16.48	0.39	0.64
OP	6.67	4.64	0.04	0.01	6.12	6.12	0.02	0.16	6.07	3.77	0.05	0.22
TP	7.79	5.00	0.07	0.17	6.12	6.27	0.04	0.23	7.10	4.97	0.10	0.26
PHL	0.000	0.000	0.000	0.016	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000
CL	119	77	42	3	139	102	33	7	254	90	44	6
*CL(R)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SO_4	106.70	83.20	43.60	22.20	147.40	124.20	32.70	35.40	208.70	128.60	38.30	30.95
SO_3	1.0	1.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CA	66.448	65.090	50.929	25.620	---	---	---	---	---	---	---	---
CR	0.050	0.050	0.010	0.010	0.020	0.040	0.020	0.030	---	---	---	---
FE	1.790	0.910	0.670	0.150	3.380	0.410	0.660	2.680	0.790	2.780	1.040	0.600
ZN	0.169	0.120	0.013	0.005	0.234	0.149	0.006	0.049	0.194	0.409	0.010	0.130
TCOL	N.A.	210	170	55	225	533	766	58	N.A.	190	63	14
FCOL	2710	51	10	2	37	270	143	0	8580	500	7	1
SUR	0.16	0.11	0.02	0.02	0.13	0.08	<0.01	0.05	0.35	0.19	0.03	0.07

PARAMETER	24 - 25 APRIL				28 - 27 MAY				26 - 27 JUNE			
	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.
PH	7.8	8.1	7.7	7.2	7.5	7.0	7.7	7.5	7.8	7.6	8.0	7.6
ALK	346	237	123	97	299	150	125	168	270	260	108	233
BOD	1	720	3	3	4	16	3	12	1	13	2	10
COD	165	155	16	38	110	130	15	39	55	55	2	14
TS	530	530	363	169	420	470	300	278	430	420	248	375
TDS	520	500	358	168	400	430	280	268	410	410	248	355
TVS	125	130	79	75	115	160	69	70	85	105	60	91
TSS	10	35	8	4	18	40	20	11	24	9	3	18
NH_3N	95.2	107.0	0.2	0.3	72.0	37.4	0.2	2.5	40.5	35.3	0.1	9.1
TKN	80.45	52.85	0.55	0.60	49.30	30.60	0.70	4.70	49.60	40.70	0.56	11.90
NO_3N	12.62	21.34	0.38	0.17	0.44	8.14	0.41	0.80	0.12	0.04	0.43	0.17
OP	7.70	6.14	0.01	0.03	6.67	5.84	0.02	0.50	7.75	8.00	0.02	1.42
TP	8.46	6.82	0.06	0.06	6.86	6.00	0.05	0.57	11.76	8.96	0.07	2.32
PHL	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.004	0.000	0.000	0.000	0.000
CL	100	86	78	7	77	74	47	16	77	77	37	37
*CL(R)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.6	0.0	0.0	0.0
SO_4	89.10	68.60	44.20	15.40	102.90	77.80	35.70	21.13	98.40	94.90	35.70	34.00
SO_3	0.0	0.0	0.0	0.0	1.2	1.2	0.9	1.1	1.0	1.0	1.0	0.8
CA	91.520	83.200	93.280	58.110	73.500	79.140	71.480	81.890	68.800	69.300	48.600	102.350
CR	0.000	0.000	0.021	0.010	0.000	0.000	0.000	0.000	0.000	0.040	0.012	0.040
FE	0.477	0.471	1.946	1.930	0.068	1.000	0.487	0.300	0.333	0.366	0.269	0.960
ZN	0.170	0.255	13.680	6.806	0.224	0.265	0.106	0.056	0.078	0.000	0.005	0.000
TCOL	5	10	206	88	0	40	373	69	4	226	378	118
FCOL	0	0	25	32	0	14	7	46	0	328	73	113
SUR	0.10	0.07	0.02	0.03	0.16	0.12	0.02	0.04	0.10	0.12	0.05	0.09

* Free Chlorine Residual

** Values recorded in mg/l except for: temperature (°F), pH (units), color (units), specific conductance (µmho/cm), coliform (counts/100 ml).

N.A. Not analyzed

1. Oxidation pond influent.
2. Oxidation pond effluent.
3. Discharge Channel - mean for four samples
4. Storm drain - located approximately 150 ft east of discharge channel; mean of four samples.

APPENDIX IV-13 (Continued)

WATER QUALITY PARAMETERS

NINE MILE POINT SEWAGE TREATMENT PLANT

1974

	30-31 JULY				26-27 AUGUST				30 SEPTEMBER - 1 OCTOBER			
	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.
PH	2.3	13.9	9.7	9.4	6.7	7.1	7.6	7.3	4.3	7.0	7.8	7.3
ALK	20	138	93	90	16	102	85	241	0	62	80	210
BOD	7	5	3	7	3	24	2	12	N.A.	15	2	27
COD	224	123	15	43	80	48	19	115	130	28	13	138
TS	458	312	212	184	702	512	251	568	608	511	266	7719
TDS	442	303	209	155	684	507	242	384	590	505	236	506
TVS	155	83	65	73	281	140	74	147	214	197	113	1168
TSS	16	10	13	29	18	5	10	184	18	6	30	7213
NH_3N	1.4	8.2	0.2	0.5	0.0	2.1	0.1	1.3	7.0	3.6	0.1	1.1
TKN	3.50	10.40	0.60	1.30	0.40	2.55	1.21	3.00	8.65	5.00	0.50	5.70
NO_3N	31.50	3.75	0.29	0.11	51.53	9.18	0.03	0.06	47.34	14.47	0.05	0.76
OP	8.95	6.10	0.01	0.04	14.21	5.88	0.01	1.02	8.55	7.65	0.03	0.26
TP	9.82	6.10	0.03	0.12	16.48	7.00	0.06	1.88	14.05	12.79	0.06	1.72
PHL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CL	81	61	30	3	97	96	44	41	90	84	43	47
*CL(R)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SO_4	216	138	47	23	150	163	53	57	82	108	33	94
SO_3	2.0	2.0	1.3	1.0	2.0	0.0	0.0	0.0	1.5	0.5	1.3	1.5
CA	72.500	66.200	46.500	35.100	94.500	86.400	47.030	83.300	60.800	64.600	37.200	83.600
CR	0.020	0.000	0.000	0.000	0.000	0.000	0.070	0.020	0.050	0.000	0.000	0.020
FE	0.110	0.190	0.116	0.330	0.424	0.338	0.172	0.340	0.350	0.070	0.430	9.690
ZN	0.117	0.035	0.068	0.017	0.490	0.201	0.064	0.023	0.680	0.293	0.007	0.094
TCOL	0	335	280	441	0	0	380	146	0	59	183	68
FCOL	0	176	88	424	N.A.	N.A.	12	40	0	90	62	43
SUR	0.12	0.11	0.02	0.07	0.18	0.09	0.03	0.06	0.08	0.09	0.02	0.08

	29-30 OCTOBER				21-22 NOVEMBER				30-31 DECEMBER			
	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.	INF.	EFF.	STORM DRAIN	DISCHARGE CH.
PH	4.2	6.5	7.7	7.1	6.4	6.7	7.8	7.1	4.3	6.4	7.8	7.3
ALK	12	42	109	215	9	27	98	84	0	19	110	98
BOD	8	37	2	19	6	5	1	5	0	6	2	11
COD	93	176	27	70	14	14	14	24	124	88	14	27
TS	600	523	246	757	787	526	227	178	717	521	291	262
TDS	583	515	230	467	774	519	214	163	681	505	283	158
TVS	214	192	66	207	359	228	88	107	181	208	79	67
TSS	17	8	16	289	13	7	14	15	36	16	8	104
NH_3N	4.3	3.5	0.0	1.1	0.0	1.6	0.1	<0.1	1.2	3.3	0.1	0.1
TKN	7.50	5.50	0.60	3.40	1.45	3.15	0.50	0.40	4.40	5.30	0.21	0.40
NO_3N	25.70	17.80	0.12	4.41	49.53	24.92	0.35	0.10	36.95	25.50	0.39	0.05
OP	5.75	6.70	0.01	1.22	5.50	4.05	0.01	0.01	5.51	4.95	0.03	0.07
TP	8.30	8.92	0.04	2.26	8.90	9.20	0.02	0.15	5.90	5.50	0.03	0.13
PHL	0.007	0.031	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CL	76	74	31	41	90	75	33	6	110	83	58	6
*CL(R)	0.6	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
SO_4	136	119	34	57	72	55	28	24	56	65	46	23
SO_3	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	13.0	2.0	1.0	1.0
CA	58.200	60.000	44.000	83.800	94.200	64.200	46.700	38.500	91.300	75.600	60.700	40.600
CR	0.000	0.050	0.010	0.010	0.040	0.030	0.020	0.010	0.000	0.050	0.010	0.000
FE	0.040	0.030	0.020	0.580	0.180	0.070	0.110	0.190	0.380	0.150	0.080	0.080
ZN	0.447	0.357	0.086	0.131	0.290	0.217	0.006	0.200	0.368	0.324	0.000	0.000
TCOL	53	60	16	6	0	0	79	112	0	0	334	270
FCOL	0	24	3	3	0	0	36	70	0	0	48	2
SUR	0.97	0.15	0.03	0.13	0.47	0.12	0.06	0.06	0.19	0.10	0.01	0.02

* FREE CHLORINE RESIDUAL

V. PLANKTON

A. PHYTOPLANKTON

1. Introduction

A brief review of the published background information on the plankton communities (i.e., phytoplankton, microzooplankton, macrozooplankton, and ichthyoplankton) in Lake Ontario and in the Nine Mile Point vicinity was presented in the 1973 Nine Mile Point Aquatic Ecology Studies (QLM, 1974), and consequently this report will refer to past work only as part of comparison with the 1974 study results.

The phytoplankton community is selected for study because: 1) phytoplankton provide the major portion of primary production in lake ecosystems, and changes in the abundance and species composition of phytoplankton communities can, through trophic interaction, affect other aquatic communities; 2) since the phytoplankton biota respond rapidly to environmental changes, alterations in phytoplankton community composition and abundance are an indication of a change in the water quality of the environment.

Phytoplankton are microscopic floating plants in the form of single cells, clumps, and filaments that live suspended in the water column; their distribution is influenced primarily by water movements because they are non-motile. This community was included in the ecological study to assess the postoperational effects of Nine Mile Point Nuclear Station Unit 1 on the lake ecosystem. The study will also form the basis for the delineation of preoperational environmental conditions for the James A. FitzPatrick Nuclear Station.

The 1973 phytoplankton study conducted in the Nine Mile Point vicinity (QLM, 1974) established that:

> The seasonal succession pattern of phytoplankton in the Nine Mile Point vicinity (i.e., diatoms: green algae: blue-green algae) was typical of that reported for other areas of Lake Ontario and was dependent primarily on seasonal changes in water temperature. The ranges of phytoplankton abundance and biomass were, likewise, similar to the ranges recorded in other areas of the lake.
>
> During 1973, maximum phytoplankton concentrations occurred during July and August. Some species of algae showed concentrations at bloom proportions during certain periods of the 1973 study; however, these blooms were limited in duration to less than the time between collecting dates (2-4 weeks). Zygonema, Glenodinium, Euglena, and Microcystis (=Polycystis) were reported in bloom proportions during the summer maximum.

Along-shore and offshore patterns of phytoplankton abundance varied with collecting date, although there was evidence of a general trend toward decreasing abundance with increasing distance from shore; this trend was statistically significant at the FITZ transect.

2. MATERIALS AND METHODS

a. Field Collection

(i) Whole Water Samples*

Samples were collected 0.5 meters (m) below the surface of the water with a 4.1 liter (l) capacity PVC Van Dorn water sampler. The sampling locations (Figure VA-1) were the same as those for the 1973 program (QLM, 1974). Samples were collected once a month during April and from September through December and twice per month from May through August 1974 on the dates listed in Table VA-1.

One liter of each sample to be analyzed for phytoplankton identification and enumeration was preserved with either Lugol's solution or Weber's solution, a merthiolate-based preservative (APHA, 1971). The latter preservative was used for all samples collected after 28 June. A second liter from each sample was retained in a black plastic bag on ice for transport to the laboratory and subsequent chlorophyll a analyses.

(ii) Windrow Samples

Windrow phytoplankton samples were collected between NMPE and NMPW transects approximately 2 kilometers (km) from the shoreline. Windrows were located by aircraft overflight on the following dates: 26 April, 17 May, 15 July, 8 August. On dates when no windrows were sited, three random samples from each of six locations were collected within the designated area (Table VA-1).

Windrows (i.e., foam lines or windstreaks) were approached downwind and sampled with a centrifugal pump (10 liter/min. capacity) fitted with a 1.9 cm diameter hose and an intake funnel 20.3 cm in diameter. The funnel was positioned in the foamline or in the middle of the windstreak at a depth of 1 ft and a 20-liter surface sample was collected while

* Net phytoplankton (>20μ) collections were discontinued in 1974 and replaced by whole water collections in order to sample the entire size spectrum of phytoplankton.

PLANKTON SAMPLING STATIONS

NINE MILE POINT, 1974

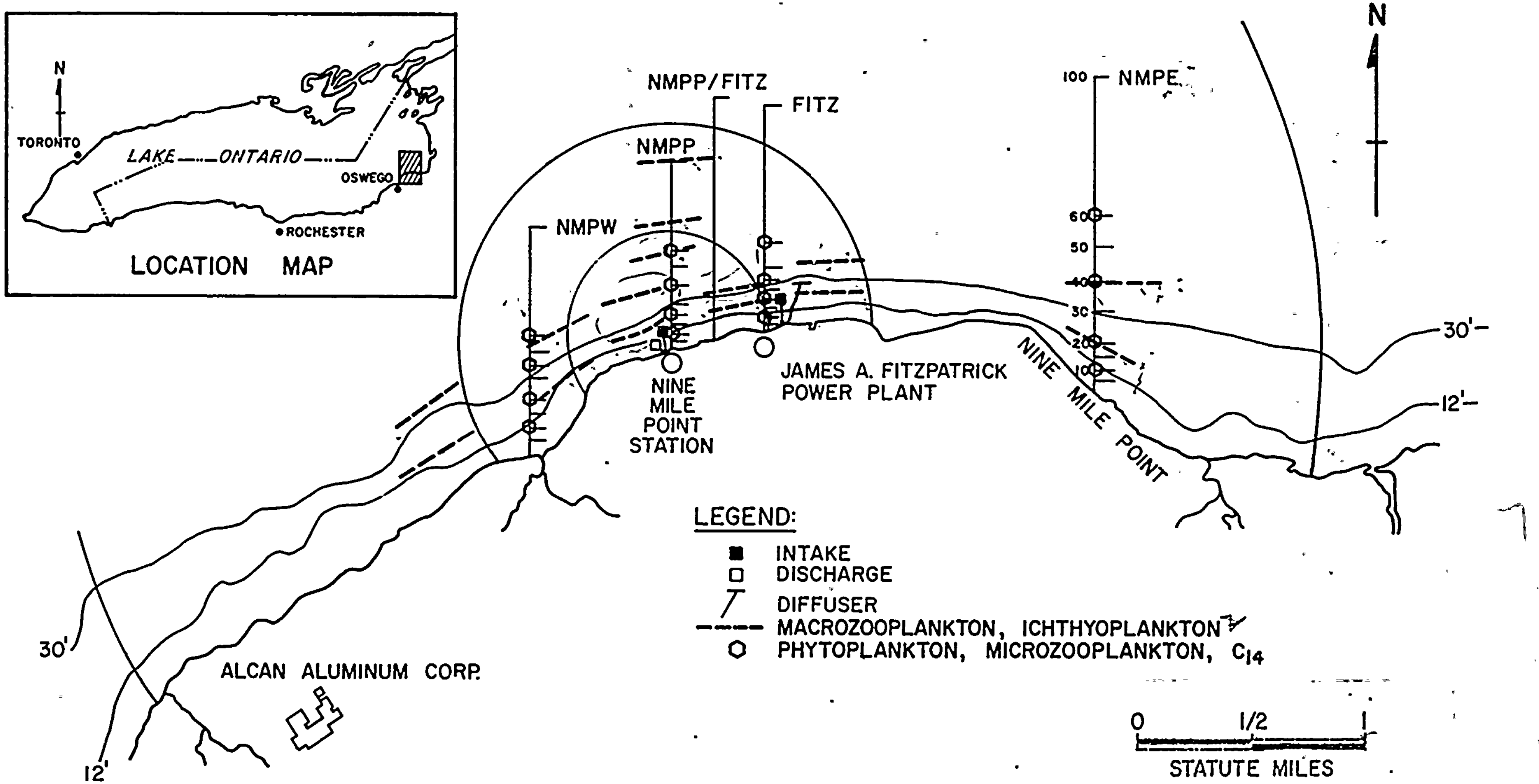

TABLE VA-1

PHYTOPLANKTON AND MICROZOOPLANKTON SAMPLING PROGRAM

NINE MILE POINT VICINITY - 1974

DATE	PLANKTON	WINDROW PHYTOPLANKTON	PRIMARY[1] PRODUCTION
26 APR	X	X[a]	
2 MAY			X
11 MAY	X		
17 MAY		X[a]	
22 MAY	X		X
31 MAY		X	
6 JUN	X	X	
28 JUN	X	X	X
15 JUL	X	X[a]	
29 JUL	X	X	X
8 AUG	X	X[a]	
22 AUG	X	X	X
27 SEP	X	X	X
24 OCT	X	X	X
27 NOV	X	X	
3 DEC			X
12 DEC	X		

1 The November sample was not collected due to inclement weather conditions

a Windrows sampled on these dates. Random samples were collected on the other dates designated as the windrow sampling program.

the boat moved forward at idle speed. A second 20-liter sample was collected in a similar manner midway between two foamlines or at the edges of the windstreak. A third 20-liter sample was collected by raising the collecting hose vertically from a depth of 5 m (15 ft) at a constant rate of 30.5 cm/sec while the boat was positioned over the foamline or the windstream. A 1-liter subsample was withdrawn from each sample and preserved.

(iii) Primary Production and Chlorophyll *a* Samples

Samples for estimation of primary production by the ^{14}C-uptake method were collected for the first time by QLM in the Nine Mile Point vicinity: samples were taken at the phytoplankton stations on the dates listed in Table VA-1. At each station, two light bottles and one dark bottle (125 ml capacity) were filled with surface water obtained with a Van Dorn water sampler and inoculated with 1 ml of $Na_2{}^{14}CO_3$ solution (activity: 1 μCi/ml). The light and dark bottles were then attached to Plexiglas plates designed to hold the bottles horizontal to the surface and suspended from an anchored buoy at each of their respective locations at a depth of 1 m. The light and dark bottles were incubated *in situ* for four hours, during which time a Whitney-Montedoro LMD-8A Solar Illuminance Meter and a Secchi disc were used to measure light transmittance at 1-m intervals through the water column. After incubation, the samples were fixed with two drops of mercuric chloride solution (40 mg/l), placed in dark boxes, and returned to the laboratory (Vollenweider, 1974).

In addition, a 1-liter surface water sample was collected at each sampling site and transported to the laboratory on ice for total inorganic carbon and chlorophyll *a* determination.

b. Laboratory Analysis

(i) Identification and Enumeration

The preserved whole water and windrow phytoplankton samples were concentrated by allowing the phytoplankton to settle for seven days in acid-cleaned 1-liter separatory funnels. Two 0.1-ml subsamples of the concentrate were analyzed separately in a Palmer-Maloney nannoplankton counting chamber at 200 magnifications. Phytoplankton in each of three strips, each 10 mm wide and the length of a Whipple grid, were enumerated and identified to the lowest possible taxonomic level.

Phytoplankton abundance was calculated using the following equation:

$$X = \frac{(\bar{A}/\bar{B})(C)}{D}$$

where: $\underline{X}$ = phytoplankton abundance (algal cells/ml*).
$\bar{A}$ = average number of cells counted in three strips.
$\bar{B}$ = average volume of three strips analyzed (ml).
C = volume of sample concentrate (ml).
D = volume of sample collected (ml).

(ii) Chlorophyll *a*

Water samples to be analyzed for chlorophyll *a* concentration were filtered through 1.2μm pore size glass fiber filters using the Millipore® filtration apparatus. The method described by Golterman (1971) was used during 1974, as during 1973, to determine chlorophyll *a* concentrations.

(iii) Primary Production

The ^{14}C labeled samples were analyzed according to the Millipore® filtration-liquid scintillation technique similar to that described by Vollenweider (1974) and summarized as follows:

Aliquots of 50 or 100 ml (100 ml utilized after 7 August) from each incubation bottle were filtered through a single or double 0.45μ pore Millipore® filter (single filter utilized after 22 May) to remove the labeled phytoplankton. Then, the filters containing the phytoplankton were dissolved in a dioxanne-base POP-POPOP scintillator fluor and radioactivity was subsequently determined with a Teledyne Model SL-30 Intertechnique liquid scintillation counter. After correction for background radiation, ^{14}C-uptake/unit volume/unit time was calculated according to the following expression:

$$mgC/m^3/hr = \frac{C}{B} \times A \times K_{1,\ 2}$$

where: A = mg $^{12}C/m^3$ (total inorganic carbon).
B = ^{14}C available (μCi added).
C = ^{14}C assimilated (μCi-background x 1.06).
K_1 = aliquot correction factor (2.48; 1.24 after 7 August.
K_2 = time correction factor (0.25).

* Individual cells of Aphanizomenon, and Oscillatoria could not be distinguished and abundances of these genera were expressed as filaments/ml.

Primary production (generally considered to approximate net production using the ^{14}C-uptake method) was calculated by subracting ^{14}C-uptake in the dark bottle from the mean of ^{14}C-uptake in the light bottles.

Total inorganic carbon was determined by titration according to the method described by Golterman (1971).

3. Results and Discussion

a. Phytoplankton Community Composition

The species of phytoplankton collected during 1974 in the vicinity of Nine Mile Point are grouped at the class level acording to the classification scheme of Prescott (1962). The seven classes recorded were the Chlorophyceae (green algae), Euglenophyceae (euglenoids), Chrysophyceae (golden-brown algae), Bacillariophyceae (diatoms), Dinophyceae (dinoflagellates), Myxophyceae (blue-green algae), and the Cryptophyceae (cryptomonads). The algae identified within these classes are listed in Table VA-2; nuisance algae[1] and algae found in windrow collections are noted as indicated.

Green algae composed the majority of genera identified. Of the 42 genera of this class identified, 41 were recorded from the fixed lake stations and 31 of these were also identified from the windrow collections; 13 were nuisance genera. Of the 20 genera of diatoms identified, 18 were identified from both the fixed lake stations and in the windrows samples and 8 were potential nuisance genera. Fourteen genera of blue-green algae were identified; all were recorded from the fixed lake stations whereas only nine of these were identified from the windrow collections. Four genera of the blue-green algae identified were potential nuisance forms. Ten genera were identified among the other classes of phytoplankton, of which seven were potential nuisance genera and one, a euglenoid, was unique to windrow collections. Of these other classes, only the cryptophytes and dinoflagellates were relatively abundant.

Of the 32 genera of potential nuisance algae[2] recorded during

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[1] Nuisance algae as define here should not be confused with bloom-forming or pollution-tolerant algae. Nuisance algae are plants associated with tastes and odors in drinking water, and are not evident until bloom concentrations of these algae are present.

[2] Potential nuisance genera include those genera frequently occurring in bloom proportions; i.e., greater than 1,000 cells/ml (Whipple et al., 1948).

TABLE VA-2

SPECIES INVENTORY AND FREQUENCY OF OCCURRENCE OF THE PHYTOPLANKTON IN THE VICINITY OF NINE MILE POINT 1974

	26 APR	11 MAY	22 MAY	6 JUN	28 JUN	15 JUL	29 JUL	8 AUG	22 AUG	27 SEP	24 OCT	27 NOV	12 DEC
Class Chlorophyceae													
N*Actinastrum hantzschii			X	X	X								
**Ankistrodesmus convolutus													
*A. falcatus	X	X	X	X	X	X	X	X	X	X	X	X	X
Botryococcus sudeticus	X					X	X						
Carteria spp.		X	X	X		X		X	X				
*Characium sp.													
C. ornithocephalum						X							
N*Chlamydomonas sp.	X	X	X	X	X	X	X	X	X	X	X	X	
*Chodatella ciliata			X			X	X	X	X	X	X	X	X
C. longiseta										X			
C. quadriseta		X	X		X	X		X	X	X			
C. subsalsa								X					
N*Closterium spp.			X	X		X							X
*C. aciculare				X	X	X	X	X	X	X	X	X	X
C. venus				X									
Coelastrum cambricum					X			X		X			
*C. microporum		X	X	X	X	X	X	X	X	X	X	X	X
N*Cosmarium spp.	X	X			X	X	X	X	X	X	X	X	X
*Crucigenia sp.		X	X		X			X					
*C. quadrata			X				X						
*C. tetrapedia								X					
**Cylindrocapsa sp.													
N Dictyosphaerium ehrenbergianum						X		X		X		X	
*D. pulchellum		X	X	X		X	X	X	X	X	X		
*Echinosphaerella limnetica							X		X				
Elakatothrix gelatinosa				X		X	X	X				X	X
Errerella bornhemiensis						X	X		X	X			
N*Eudorina elegans	X		X	X		X	X	X	X	X	X	X	X
Franceia droescheri		X		X			X	X	X	X	X	X	
F. ovalis							X			X			
N*Gloeocystis spp.									X				
G. ampla			X										
G. gagas			X			X		X	X				
G. vesiculosa		X				X	X	X	X	X	X	X	
*Golenkinia paucispina							X			X			
G. radiata	X			X		X	X	X	X	X	X		
Kirchneriella lunaris								X					
*K. obesa							X						
K. subsolitaria							X						
*Micractinium pusillum	X	X	X	X	X	X	X	X	X	X	X		
*Mougeotia spp.	X	X	X	X	X	X	X	X	X	X	X	X	X
*Nephrocytium agardhianum								X					
N. limneticum						X	X	X					
N. lunatum						X							
*Oedogonium spp.		X		X	X	X		X	X	X	X	X	X
*Oocystis sp.			X	X									
*O. borgei	X			X	X	X	X	X	X	X	X	X	X
O. parva			X			X	X	X	X	X	X	X	X
O. pusilla						X	X	X	X	X			
N*Pandorina morum			X			X	X	X	X	X	X		X
N*Pediastrum boryanum	X	X	X	X			X			X			
*P. duplex		X		X	X	X	X	X	X	X	X	X	

TABLE VA-2 (Continued)

	26 APR	11 MAY	22 MAY	6 JUN	28 JUN	15 JUL	29 JUL	8 AUG	22 AUG	27 SEP	24 OCT	27 NOV	12 DEC
Class Chlorophyceae (Continued)													
*P. simplex						X	X	X	X	X	X	X	
*P. tetras			X			X	X	X	X	X	X	X	X
*Phacotus lenticularis				X	X	X	X	X	X	X	X	X	X
Polyedriopsis spinulosa								X					
Quadrigula chodatii		X	X	X			X	X					
Q. lacustris						X	X			X			X
N*Scenedesmus sp.						X			X		X		
		X	X		X	X	X	X	X	X	X	X	X
S. abundans	X		X	X	X	X	X	X	X	X	X		
*S. acuminatus					X		X	X	X	X	X	X	
*S. bijuga	X	X	X	X	X	X	X	X	X	X	X	X	X
**S. brasiliensis													
*S. denticulatus						X	X	X	X	X	X	X	X
*S. dimorphus	X		X	X	X	X	X	X	X	X	X	X	X
S. longus							X	X	X				
*S. obliquus			X		X		X	X	X	X			X
S. opoliensis				X	X	X	X	X	X	X	X	X	X
*S. quadricauda	X	X	X	X	X	X	X	X	X	X	X	X	X
*Schroederia judayi									X				
*S. setigera			X		X	X	X	X	X	X	X		
Selenastrum minutum													X
*Sphaerocystis schroeteri							X	X	X				
N Spirogyra spp.		X											
N*Staurastrum spp.		X				X	X	X	X	X	X	X	
S. gracile			X					X	X	X	X	X	X
Tetraedron caudatum			X		X		X	X	X				
*T. minimum			X			X	X	X	X	X	X	X	X
*T. muticum					X		X	X	X	X			
T. pentaedricum			X										
*T. regulare					X		X			X			
*Tetraspora lacustris	X	X			X	X	X						
T. lamellosa						X							
*Tetrastrum sp.													
T. elegans							X						
*T. staurogeniaforme		X				X	X	X	X		X		X
Treubaria setigerum		X	X						X		X		
T. triappendiculata							X	X	X	X	X		
N Ulothrix spp.										X	X		
U. subconstricta			X										
Unidentified colony							X			X		X	
*Unidentified single cell			X	X	X	X	X	X	X	X	X	X	X
Unidentified germling								X	X				
Class Euglenophyceae													
N*Euglena spp.				X		X		X	X				
Lepocinclis spp.				X									
**Trachelomonas spp.													
Class Chrysophyceae													
N*Dinobryon sociale var. americanum		X	X	X	X	X	X						
N**Synura uvella													

TABLE VA-2 (Continued)

	26 APR	11 MAY	22 MAY	6 JUN	28 JUN	15 JUL	29 JUL	8 AUG	22 AUG	27 SEP	24 OCT	27 NOV	12 DEC
Class Bacillariophyceae													
Amphiprora sp.	X												
N*Asterionella formosa	X	X	X	X	X	X	X	X			X	X	X
**Cocconeis spp.													
*Coscinodiscus subtilis						X	X	X	X	X	X	X	
N*Cyclotella spp.	X	X				X		X	X	X	X	X	
**C. meneghiniana													
**Cymatopleura elliptica													
Cymbella spp.	X			X								X	
N*Diatoma tenue var. elongatum	X	X	X	X	X	X	X	X		X	X	X	X
*D. vulgare	X												
*Eunotia curvata		X	X	X		X							X
N*Fragilaria capucina													
F. crotonensis	X	X	X	X	X	X	X	X			X	X	X
Gomphonema spp.							X				X		
**G. olivaceium													
*Gyrosigma spp.		X				X	X						X
N*Melosira spp.	X	X		X									X
*M. binderana	X	X	X	X	X		X	X		X	X	X	X
*M. granulata			X			X		X		X			
*M. islandica		X	X	X	X	X		X					
M. varians	X	X	X		X								
*Navicula spp.	X	X	X	X	X	X		X			X		
*N. tripunctata			X	X		X				X		X	X
*Nitzschia spp.	X			X	X	X				X	X		X
*N. acicularis													
*N. holsatica		X		X	X					X			X
*N. sigmoidea		X											
*Rhoicosphenia curvata	X					X		X				X	
N*Stephanodiscus spp.			X	X	X	X	X	X	X	X	X	X	X
*S. astrea	X	X	X	X		X							
*S. hantzschii var. pusilla	X		X		X	X	X	X	X	X		X	
*S. niagarae											X		
S. tenuis								X					
*Surirella spp.	X											X	
**S. ovata													
N*Synedra spp.	X	X	X	X	X	X						X	X
**S. ulna													
N*Tabellaria fenestrata	X		X	X	X	X	X			X		X	X
Class Dinophyceae													
N Ceratium hirundinella								X	X	X	X	X	
N*Glenodinium spp.	X	X		X	X	X	X	X	X	X	X	X	
Gymnodinium spp.		X		X									
*G. helveticum		X		X				X					
N*Peridinium spp.	X			X									
*P. aciculiferum	X	X	X	X		X	X	X	X	X	X		
*P. cinctum		X		X		X	X	X	X	X	X	X	
P. inconspicuum						X		X	X				
Class Myxophyceae													
N*Anabaena sp.		X	X	X			X	X					
A. flos-aquae				X		X		X					
A. macrospora				X		X							
A. spiroides													
N Aphanizomenon flos-aquae					X	X	X	X	X	X			X
Aphanocapsa spp.								X	X				
A. pulchra										X			X

TABLE VI-2. (Continued).

Class Myxophyceae (Continued)	26 APR	11 MAY	22 MAY	6 JUN	28 JUN	15 JUL	29 JUL	8 AUG	22 AUG	27 SEP	24 OCT.	27 NOV	12 DEC.
*Aphanothece spp.		X				X							
*Chroococcus spp.						X	X				X		
C. dispersus	X				X	X	X	X	X	X		X	
*C. limneticus			X										
C. minutus						X	X	X					
*C. turgidus													
N*Coelosphaerium kuetzingianum		X						X					
C. naegelianum	X												
*Dactylococcopsis spp.													
D. smithi						X							
*Gloeocapsa spp.							X						
N Gomphosphaeria lacustris							X	X			X		
*Lyngbya limnetica	X	X	X	X	X	X	X	X	X	X	X	X	
Merismopedia tenuissima							X						
N*Oscillatoria sp.		X					X	X					
O. limnetica	X		X	X	X	X	X	X	X	X	X		
Phormidium sp.						X	X	X			X	X	
*Polycystis aeruginosa	X							X					
P. incerta						X							
*Unidentified single cell													
Class Cryptophyceae													
N*Cryptomonas erosa	X	X	X										
Katablepharis ovalis							X	X	X	X		X	
*Unidentified Cryptophyte	X		X	X					X		X		

KEY
* identified in windrow collections (windrow species collection dates not indicated)
** unique to windrow collections
N potential nuisance algal genus (Mackenthun, 1969)

the 1974 study (Table VA-2), only one, the diatom Melosira binderana, reached potentially troublesome levels of abundance (1000 algal cells/ml; Whipple et al., 1948) in early May through early June (Appendix V-1a, b). Of the blue-green algae, only Aphanizomenon may have reached bloom proportions (on 8 August, 1974); however, this alga was three times less abundant during 1974 than during the previous year. Other blue-green nuisance genera, such as Anabaena and Oscillatoria, were not abundant during 1974; none of the green algal nuisance genera approached bloom proportions (Appendix V-1a-V-1i).

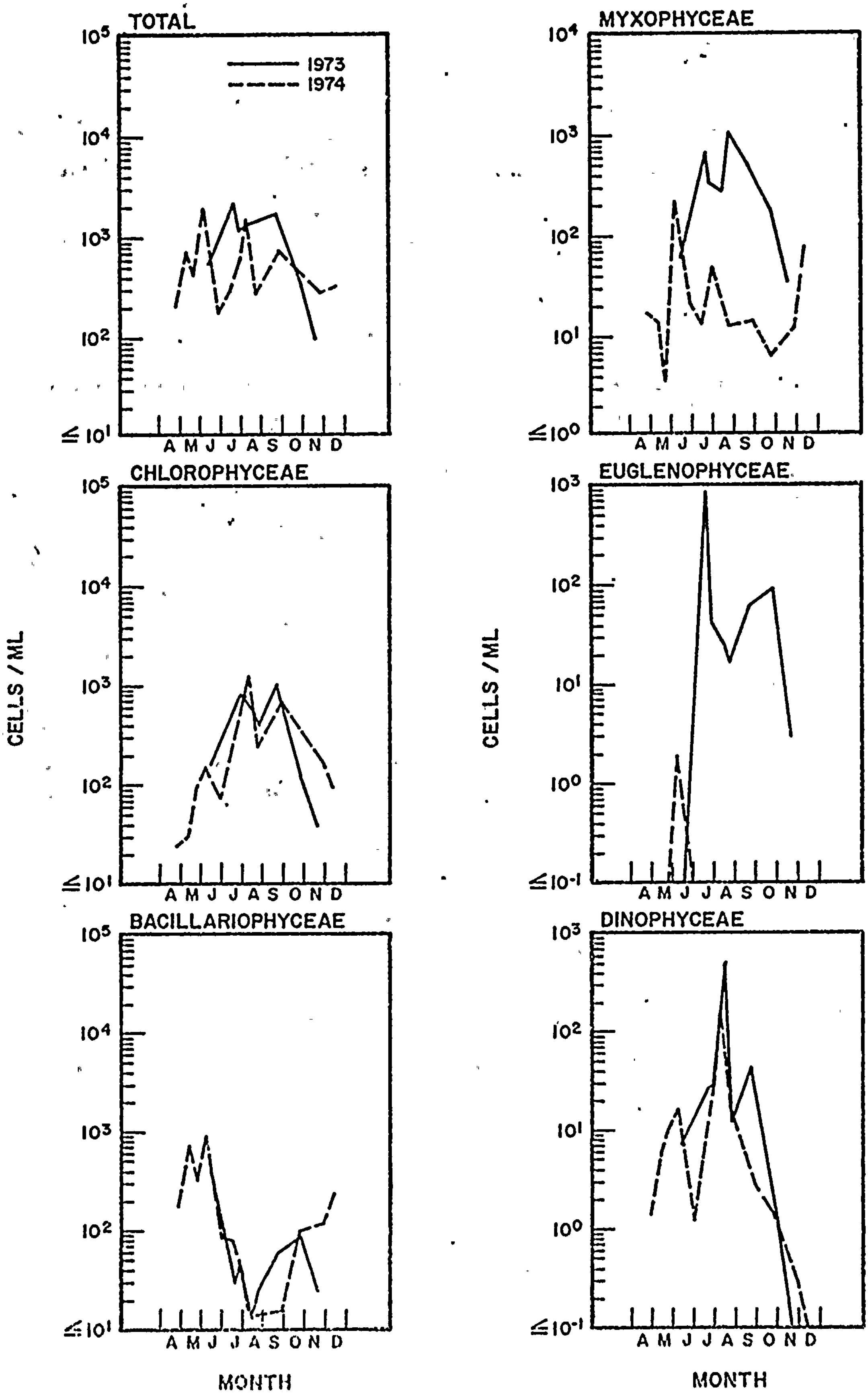
b. Seasonal Patterns

(i) Abundance

The seasonal patterns of mean total phytoplankton, green algae, diatom, dinoflagellate, euglenoid, and blue-green algae concentrations during 1973 and 1974 are illustrated in Figure VA-2. As shown in this figure, there were substantial differences in the seasonal patterns of total phytoplankton abundance between the two years, reflecting primarily annual differences in the seasonal patterns of green and blue-green algae as influenced by annual differences in water temperature.

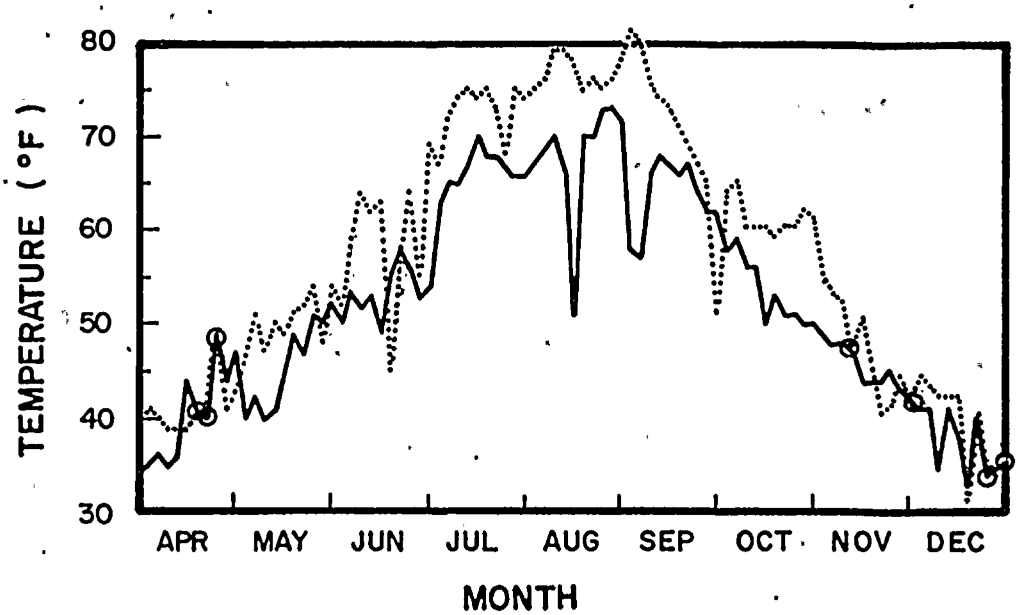
Diatoms and green algae were typically the most abundant phytoplankters recorded from the Nine Mile Point vicinity. Blue-green algae, while present in substantial numbers, formed a relatively small component of the phytoplankton community compared to diatoms and green algae. Thus, the seasonal pattern for phytoplankton for 1974 was diatom dominance (early May/early June) followed by green algal dominance (early August/late September) and subsequently by diatom dominance (December). While this pattern is similar to those reported in the literature for Lake Ontario (Munawar and Nauwerck, 1971; Vollenweider et al., 1974), it is different from the pattern recorded in the Nine Mile Point vicinity during 1973, when a blue-green algal dominance followed the period of green algal dominance. This difference in the seasonal phytoplankton pattern was probably related to the difference in the seasonal cycle of water temperature between the two years (Figure VA-3). Specifically, the warmer summer water temperatures in 1973 could have favored the development of blue-green algae because the temperature optimum for these algae as a class tends to be higher than that for diatoms and green algae (Patrick, 1969).

WHOLE WATER PHYTOPLANKTON* COMPARISONS IN THE VICINITY OF NINE MILE POINT 1973 – 1974



* Mean of all stations

SEASONAL VARIATION IN WATER TEMPERATURE *
NINE MILE POINT
1973–1974



* FROM PLANT GENERATION DATA; "LAKE TEMPERATURE" AT 1200 HRS., OR HOUR CLOSEST TO 1200.

o SAME TEMPERATURE 1973, 1974
······· 1973
—— 1974

Some differences in phytoplankton species composition and concentration between 1973 and 1974 are hypothesized to be correlated with upwelling occurrences, as observed during studies in the near-shore waters of Lake Michigan (Schelske, Stoermer, and Feldt, 1971).

A review of the ranking series of the top five algal species by depth contour (Appendix V-1a to V-1i) indicates the following: individuals of the taxon Bacillariophyceae (in particular, Melosira binderana) dominated the phytoplankton from April through mid-June, with individuals of the taxon Cryptophyceae of secondary importance in early June; individuals of the taxon Chlorophyceae were dominant in the phytoplankton from mid-June through November; however, within this period there was a shift in the dominant species, which were Scenedesmus quadricauda through mid-July, Coelastrum microporum and Sphaerocystis schroeteri through July, Eudorina elegans through mid-August, and Mougeotia spp. through November. Individuals of the taxon Bacillariophyceae, in particular Diatoma tenue var. elongatum, were dominant in December.

The dominant species per collecting date during 1974 were different from those of 1973 (QLM, 1974) possibly due to the lower water temperatures in 1974, and species-specific temperature optima.

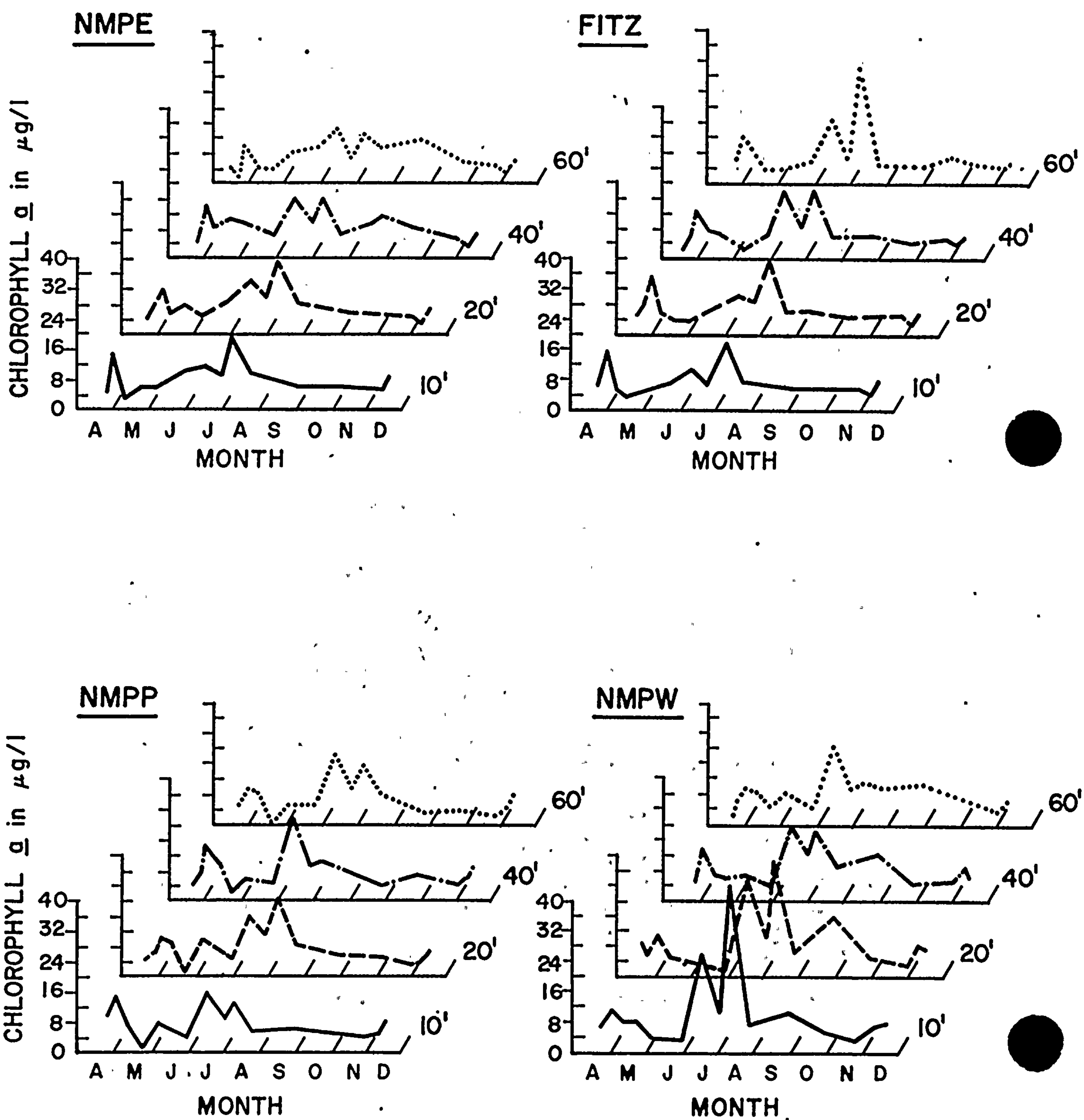
(ii) Chlorophyll a

The values for chlorophyll a concentrations in the Nine Mile Point vicinity during 1974 have been graphed by transect and depth contour (Figure VA-4). In general, values at each collecting location fluctuated among sampling dates, but seasonal maxima occurred during July and August at all stations. Seasonal patterns and magnitudes of chlorophyll a concentrations during 1973 (QLM, 1974) and 1974 were similar. However, no correlation was observed during these two years between the seasonal patterns of phytoplankton abundance and those of chlorophyll a concentrations. For example, the maximum in phytoplankton abundance recorded on 6 June was not matched by a maximum in chlorophyll a concentrations.

The lack of significant correlation between these two factors, also reported by Munawar et al. (1974), is probably attributable to the variability of chlorophyll a within an algal cell according to both season and algal species. For example, on the date of peak abundance, 6 June, when the diatom Melosira binderana was the most abundant phytoplankter, less chlorophyll a was measured than on 8 August, a date when total phytoplankton abundance was lower and Eudorina elgans, a green alga, was dominant. In addition, chlorophyll a also influenced

FIGURE VA-4

CHLOROPHYLL a DISTRIBUTION
(REPLICATES AVERAGED)
NINE MILE POINT
1974



by the amount of detritus and chlorophyll in the water mass and the inefficiency of present methods of extracting chlorophyll *a* from mucoid-coated blue-green algae and chitinuous walled green algae.

(iii) Primary Production

The seasonal patterns of primary production rates* at stations in the Nine Mile Point vicinity during 1974 were variable depending on transect location (Figure VA-5): a bimodal pattern occurred at the NMPE transect; trimodal patterns were observed at the NMPP transect, and both patterns were observed at NMPW and FITZ transects. A September maximum was common to all transects except NMPE, which showed a June maximum for the 20 through 60 ft depth contours. The range of mean primary production values recorded in 1974 in the Nine Mile Point vicinity, 2-21 mgC/m^3/hr, was less than that reported as the mean range for inshore waters of Lake Ontario during 1970 (Vollenweider et al, 1974), suggesting that the Nine Mile Point vicinity of the lake may be less productive on the average than other inshore locations. However, it should be noted that Vollenweider et al. (1974) determined productivity based on a vertical water sample which was incubated at different depths, whereas QLM determined productivity on a subsurface water sample (0.5 m) incubated at one depth (0.5 m).

(iv) Dissolved Nutrients

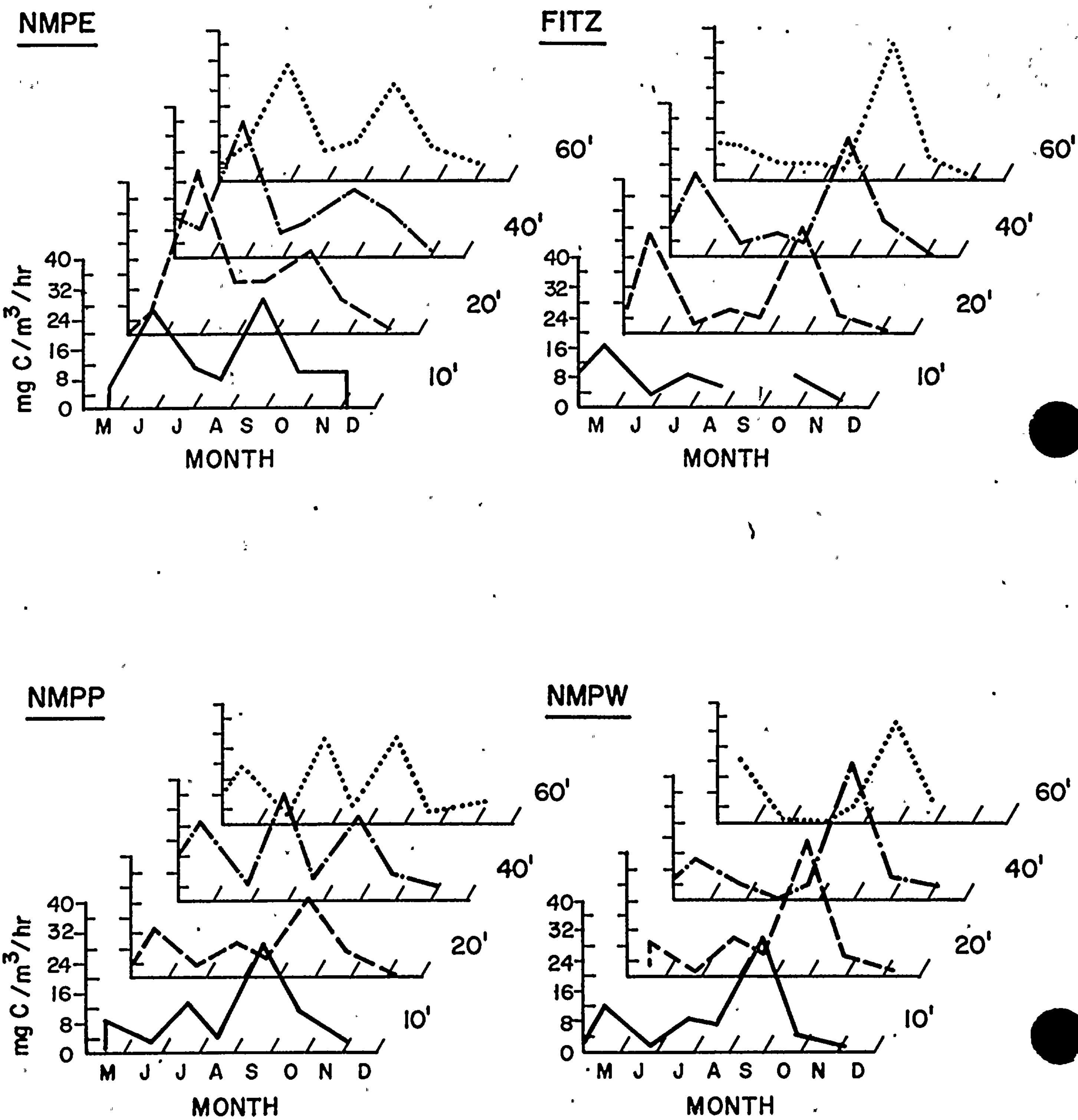
Comparisons of seasonal trends in biotic parameters (phytoplankton abundance, chlorophyll *a*, and primary production) with seasonal patterns in dissolved nutrient concentrations (i.e., nitrate and orthophosphate; Figure VA-6) indicate a possible correlation during spring and early summer months. Nitrate concentrations in the Nine Mile Point vicinity during 1974 show the highest values recorded in early spring, with a secondary peak during early July, and the lowest values recorded during August/September. Phosphate concentrations in 1974 followed a similar pattern. It is significant to note that decreases in both nutrients occurred within approximately

* Dark assimilation rates during 1974 were frequently greater than 10% of light assimilation rates, a common occurrence in eutrophic waters. Primary production rates may, therefore, be underestimates and should be regarded as approximations (See Conover and Francis, 1973).

FIGURE VA-5

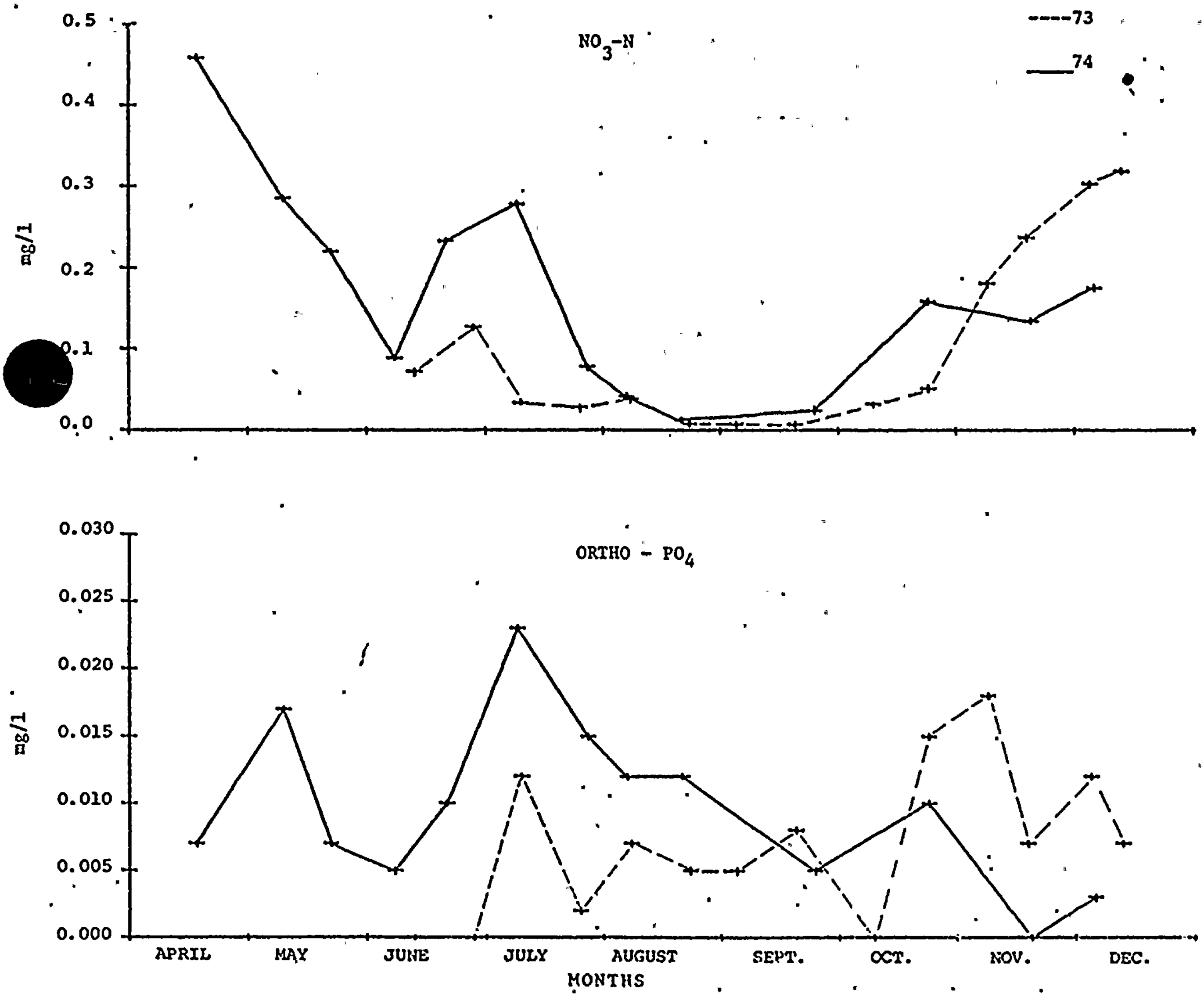
PRIMARY PRODUCTIVITY

NINE MILE POINT
1974



MEAN NITRATE AND PHOSPHATE CONCENTRATIONS*

NINE MILE POINT, 1974



* Values are mean station concentrations per sampling date from the bimonthly Lake water quality sampling program (Chapter IV).

the same periods during both years. The simultaneous decrease in algal nutrients reflects increased assimilation by growing phytoplankton populations. There appears to be little lag between nutrient assimilation and increased algal growth. Low nutrient concentrations were found in early June, the time of high diatom and cryptomonad densities, and again when the green algal population reached its peak during August. In general, however, the seasonal patterns in phytoplankton biotic parameters are not predictable based only on dissolved nutrient concentrations. Moreover, an apparent influx of nutrients during the late June/July period suggests that the Nine Mile Point vicinity is not typical of the lake as a whole in terms of nutrient cycles (Shiomi and Chawla, 1970; Gachter, Vollenweider, and Glooschenko, 1974), and provides evidence for the occurrence of upwellings in this area.

c. Interstation Patterns

Differences in phytoplankton abundance (i.e., total phytoplankton, diatoms, green algae, and blue-green algae) and primary production among stations were examined statistically (Appendix V-2 to V-6) in order to determine significant distribution patterns. The results of the statistical analyses on phytoplankton abundance are summarized in Table VA-3. During 1974 there were significant differences in mean total phytoplankton abundance among collecting dates annually within seasons and reflecting the fluctuations in concentrations among dates and the seasonal pattern discussed previously. There were no significant differences in mean abundance among transects either within seasons or yearly, indicating that there was no consistent east/west distribution pattern. There were, however, significant differences in mean total phytoplankton concentrations (Appendix V-2) among depth contours during the spring and summer; the depth patterns differed between these seasons and varied significantly with collecting date during the summer (Figures VA-7 through VA-10). This latter finding indicates that some other factor or factors, such as water circulation patterns, grazing pressure from consumers, or dissolved nutrient concentrations, controlled the distribution of phytoplankton offshore. There was no apparent correlation between water temperature distribution patterns in the Nine Mile Point vicinity and phytoplankton distribution patterns.

Table VA-4 summarizes the results of three-way ANOVAs for the three dominant phytoplankton classes (Appendix V-3 to V-5) in the Nine Mile Point vicinity during 1973 and 1974. The results of these analyses confirm the occurrence of significant annual differences in mean green and blue-green algal concentrations

TABLE VA-3*

SUMMARY OF RESULTS OF STATISTICAL ANALYSES
FOR TOTAL PHYTOPLANKTON ABUNDANCE
(SIGNIFICANT EFFECTS ONLY)

NINE MILE POINT VICINITY - 1974

a) Three-way ANOVA (all dates)

dates: significant difference at $\alpha < 0.0005$.

b) Three-way ANOVA (April, May, June dates)

dates: significant difference at $\alpha < 0.0005$.
depth contours: significant difference at $\alpha < 0.025$
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS:
Largest: 40 ft 20 ft 10 ft 60 ft: Smallest

c) Three-way ANOVA (July, August, September dates)

dates: significant difference at $\alpha < 0.0005$.
depth contours: significant difference at $\alpha < 0.05$.
date X depth contour: significant difference at $\alpha < 0.025$.
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS:
Largest: 20 ft 10 ft 60 ft 40 ft: Smallest

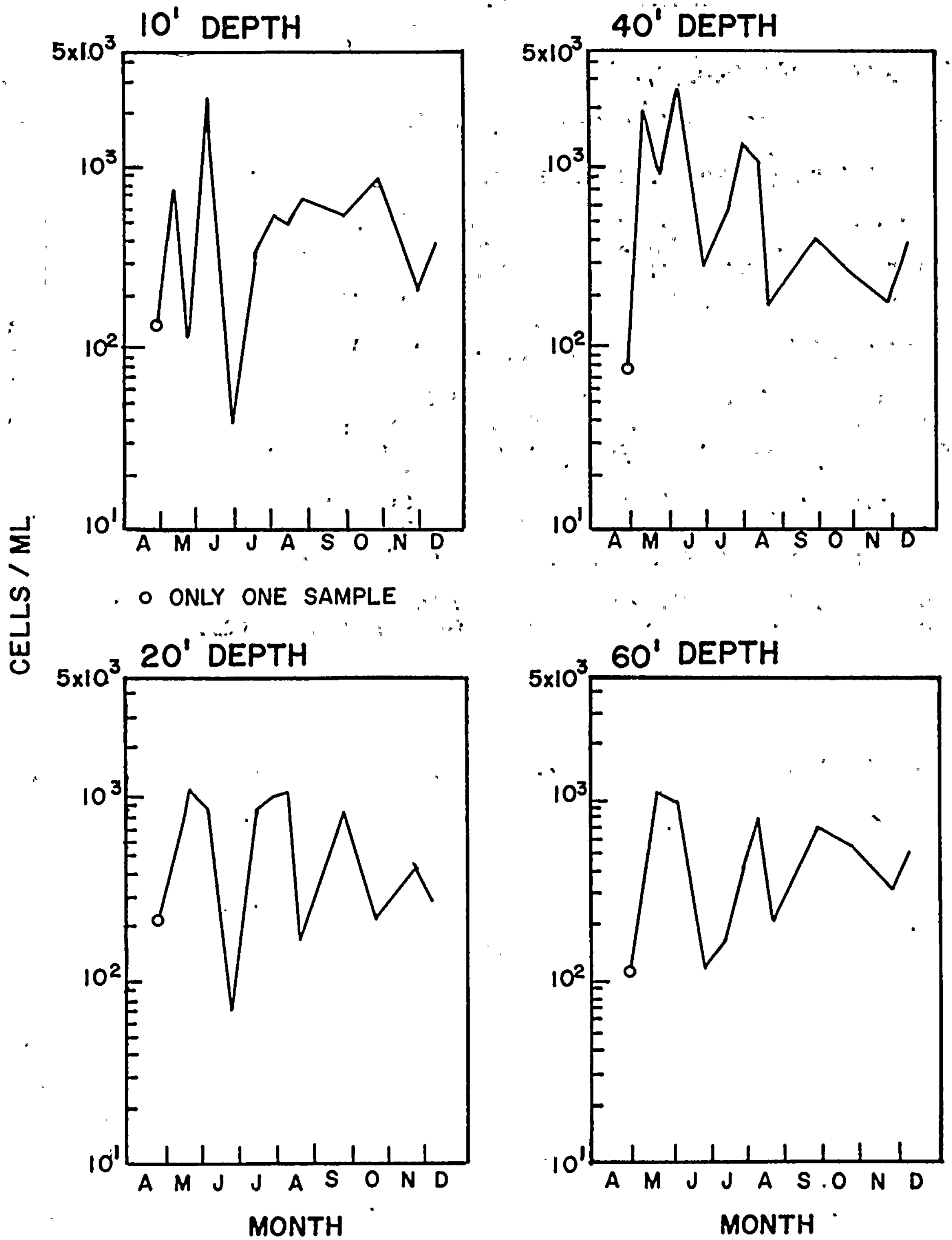
d) Three-way ANOVA (October, November, December dates)

dates: significant difference at $\alpha < 0.005$.
date X depth contour: significant difference at $\alpha < 0.025$.

* All results are compiled in Appendix V-2.

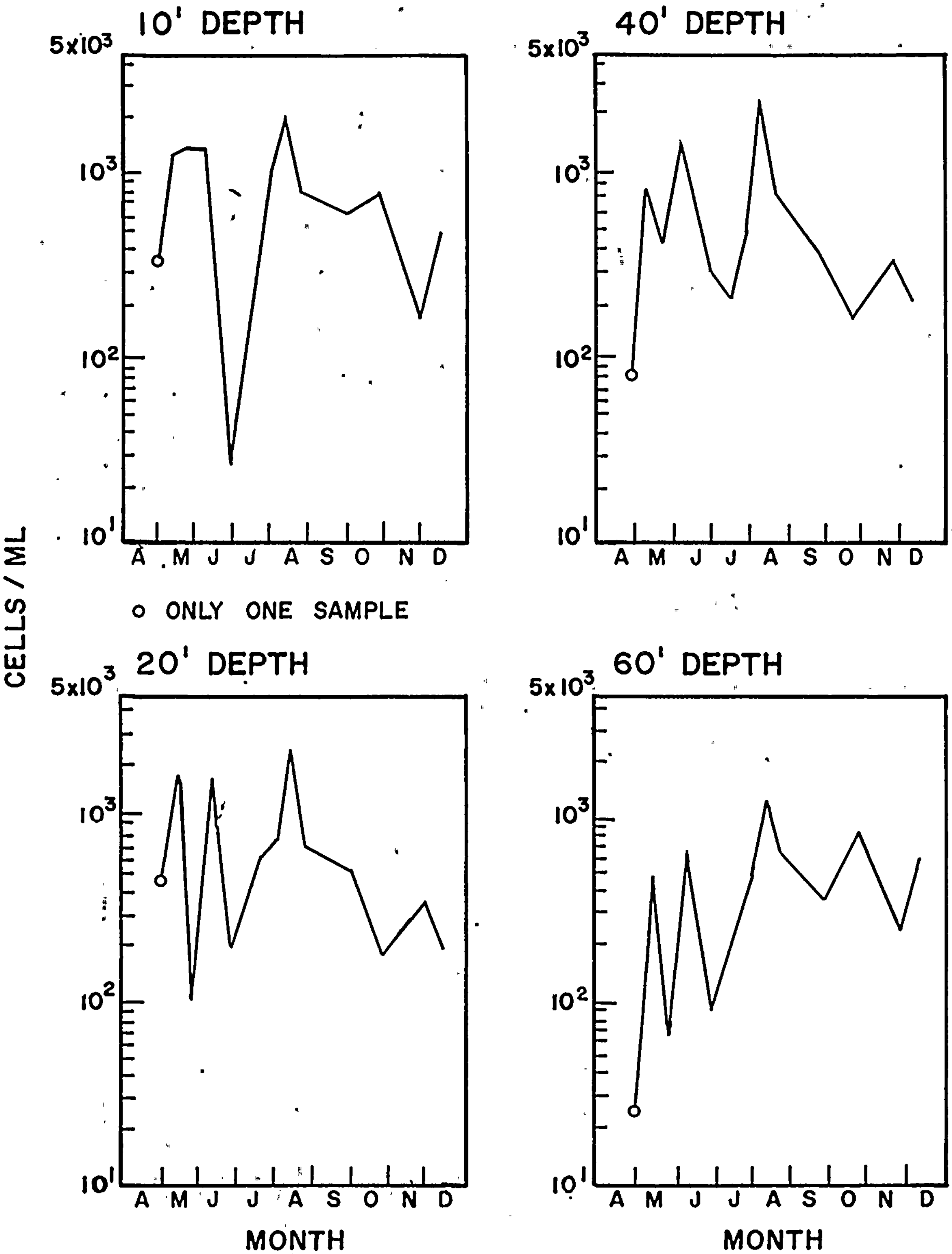
FIGURE VA-7

WHOLE WATER TOTAL PHYTOPLANKTON ABUNDANCE *
NMPP' TRANSECT
NINE MILE POINT VICINITY
1974



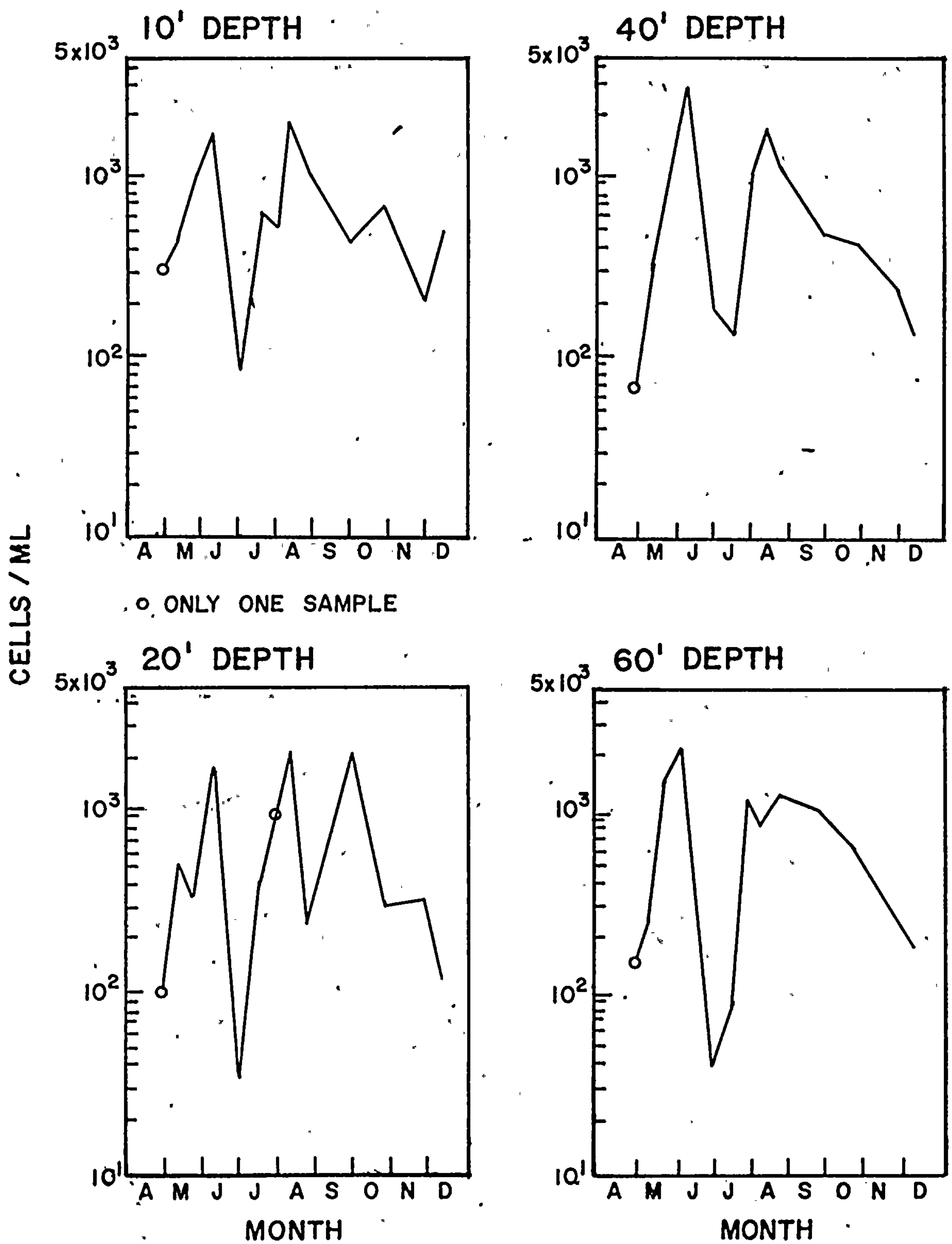
* AVERAGE OF ORIGINAL AND REPLICATE SAMPLES

WHOLE WATER TOTAL PHYTOPLANKTON ABUNDANCE *
FITZ TRANSECT
NINE MILE POINT VICINITY
1974



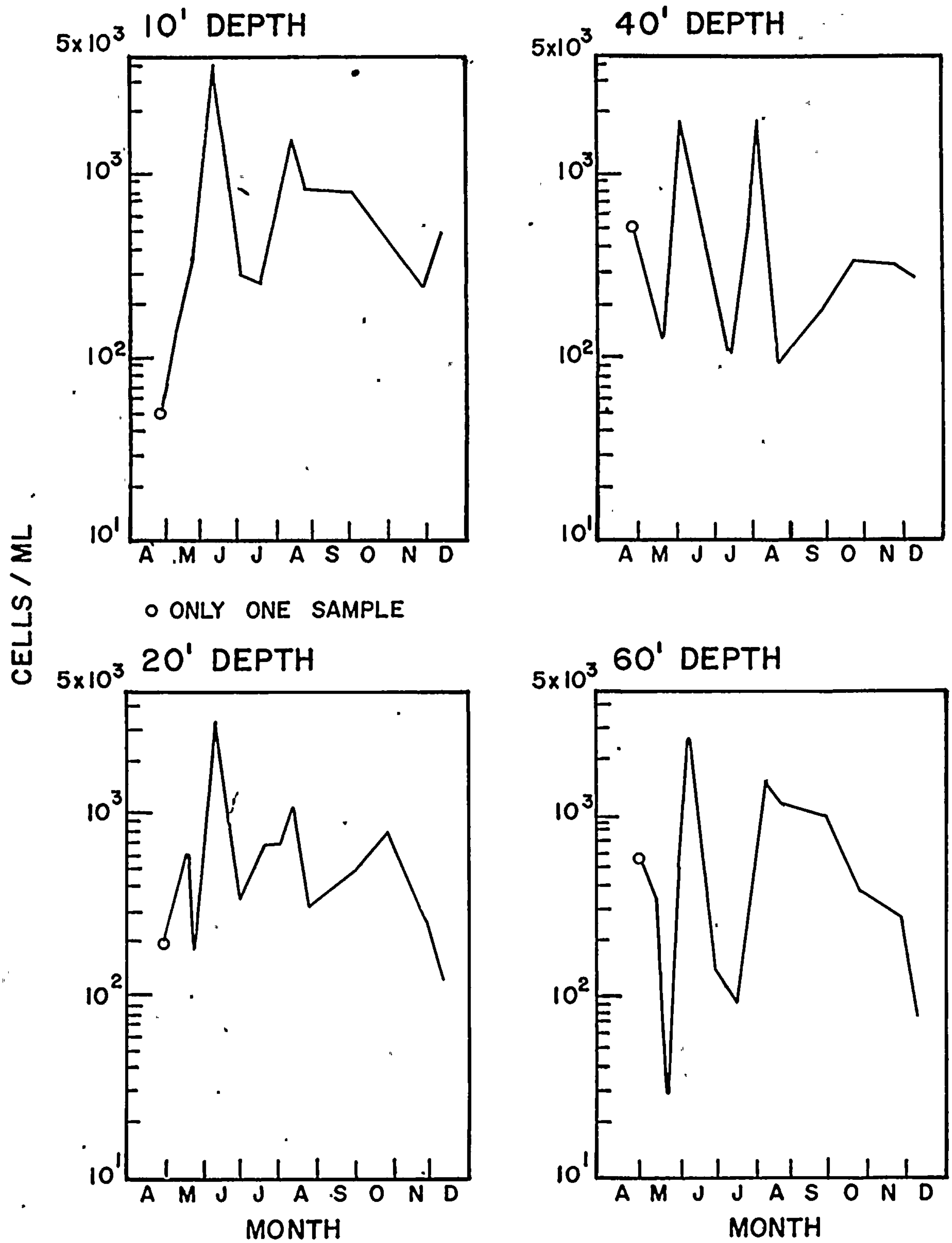
* AVERAGE OF ORIGINAL AND REPLICATE SAMPLES

WHOLE WATER TOTAL PHYTOPLANKTON ABUNDANCE *
NMPW TRANSECT
NINE MILE POINT VICINITY
1974



* AVERAGE OF ORIGINAL AND REPLICATE SAMPLES

WHOLE WATER TOTAL PHYTOPLANKTON ABUNDANCE *
NMPE TRANSECT
NINE MILE POINT VICINITY
1974



* AVERAGE OF ORIGINAL AND REPLICATE SAMPLES

TABLE V A-4

SUMMARY OF RESULTS OF STATISTICAL ANALYSES FOR MAJOR PHYTOPLANKTON CLASSES °

NINE MILE POINT VICINITY - 1973*- 1974

	DIATOMS						GREEN ALGAE						BLUE-GREEN ALGAE					
ANOVA FACTOR	JUN	JUL	AUG	SEP	OCT	NOV	JUN	JUL	AUG	SEP	OCT	NOV	JUN	JUL	AUG	SEP	OCT	NOV
Years (1973, 1974)				✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
Transects		✓	✓				✓								✓			
Depth Contours	✓	✓						✓		✓		✓						
Transect X Depth Contour											✓							
Transect X Year							✓						✓					
Depth Contour X Year		✓			✓													

RESULTS OF STUDENT-NEWMAN-KEULS TESTS for significant differences among transects and depth contours. Where significant differences among the years occurred, the year with the larger mean is noted above.	DIATOMS	GREEN ALGAE	BLUE-GREEN ALGAE
	Transects, JUL lg: P F E W: sm Transects, AUG lg: W F E P: sm Depth Contours, JUN lg: 40 20 60 10: sm Depth Contours, JUL lg: 20 40 10 60: sm	Transects, JUN lg: E W F P: sm Depth Contours, JUL lg: 20 10 40 60: sm Depth Contours, SEP lg: 20 10 60 40: sm Depth Contours, NOV lg: 20 60 40 10: sm	Transects, AUG lg: W F E P: sm

KEY:
✓=significant difference at $\alpha < 0.10$
lg=largest mean
sm=smallest mean
P=NMPP
F=FITZ
E=NMPE
W=NMPW

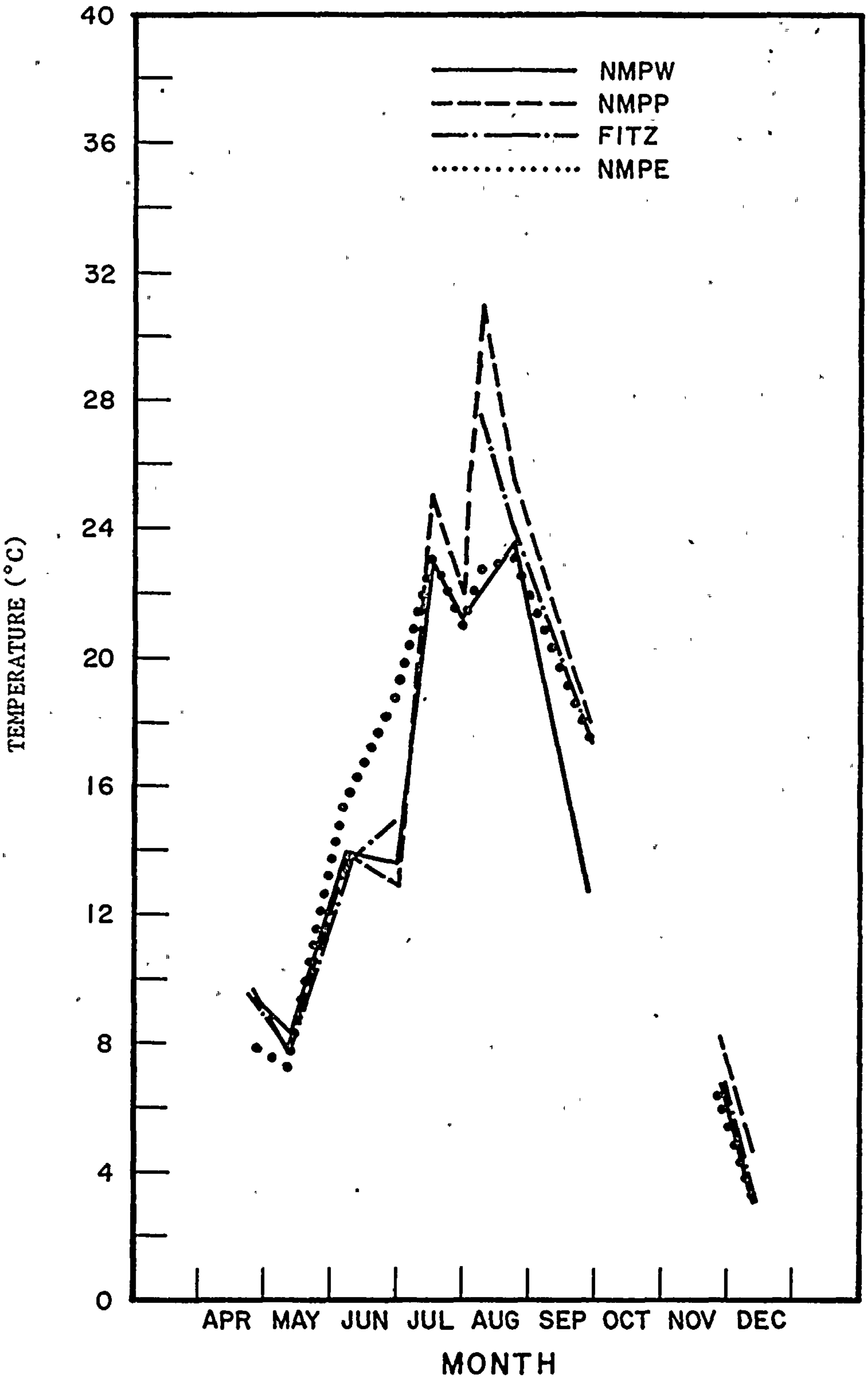
° All results are compiled in Appendix V-3 to V-5.
* (QLM, 1974)

as previously discussed in (Section b(i)) and illustrated (Figure VA-2). In addition, significant differences in mean concentrations of each of the three classes among transects were isolated during the late spring or early summer months; however, these patterns varied with each month (Table VA-4). Interpretation of these patterns in relation to water temperature values recorded at the time of phytoplankton collection is difficult. For example, during August the east/west distribution pattern of diatoms and blue-green algae were the same and may have been related to the significant difference in water temperature at NMPP transect compared to the other three transects (Figure VA-11 and Appendix V-6) (e.g., minimum algal abundance and maximum temperature recorded at the NMPP transect). However, as the optimum temperature for growth and reproduction for diatoms and blue-green algae is different (Canale and Vogel, 1974), it is hypothesized that the transect pattern is related primarily to water circulation patterns (e.g., upwelling).

Significant differences were documented in the mean abundances of diatoms and green algae among depth contours (Table VA-4). The distribution patterns varied among months for diatoms and green algae and between years for diatoms; however, there appeared to be a general trend toward decreasing abundance with increasing depth contour for both diatoms and green algae. The monthly and yearly variability inherent in this trend is possibly correlated with temporal variations in water circulation patterns, grazing pressure from consumers, dissolved nutrient availability, and/or (surface) water temperature, which was greater on the average in shallow waters than in deeper waters.

The results of the statistical analyses for primary production (Appendix V-7) are summarized in Table VA-5. There were significant differences in primary production among transects on five of the eight collecting dates; however, no significant differences were documented among depth contours. On the five dates for which productivity was significantly different among transects, the value reported at the NMPP transect was greater than that reported at the NMPW transect, but significantly greater only on 29 July 1974. On the other four dates, the source of significant difference was found to lie either between NMPE and FITZ transects or between NMPE and the other transects combined. The results suggest that the higher production rate recorded from the NMPE transect may be unique compared to that at the other transects in the Nine Mile Point vicinity and may reflect the occurrence of a separate microenvironment in Mexico Bay.

SEASONAL PATTERNS OF TEMPERATURE*
AT THE 20' DEPTH CONTOUR
NINE MILE POINT
1974



* Surface temperature from phytoplankton sampling program

TABLE VA-5

ESTIMATED MEAN PRODUCTIVITY
BY DATE AND SNK RANKING TESTS
FOR DIFFERENCES IN TRANSECTS

NINE MILE POINT VICINITY - 1974

DATE	ESTIMATED MEAN PRODUCTIVITY ($mgC/m^3/hr$)	RANK	SNK RANKING TEST RESULTS FOR TRANSECTS ($\alpha = 0.05$)*
2 MAY	3.088	7	NSD
22 MAY	9.329	2	Largest:FITZ NMPP NMPW NMPE:Smallest
28 JUN	6.741	3	Largest:NMPE FITZ NMPP NMPW:Smallest
29 JUL	6.230	4	Largest:NMPP NMPE FITZ NMPW:Smallest
22 AUG	3.311	6	Largest:NMPE NMPW NMPP FITZ:Smallest
27 SEP	20.884	1	NSD
24 OCT	4.330	5	NSD
3 DEC	2.014	8	Largest:NMPE NMPP NMPW FITZ:Smallest

* Two-way ANOVAS are presented in Appendix V-7.

NSD = No significant differences in production among transects

TABLE VA-6

COMPARISON OF WINDROW PHYTOPLANKTON ABUNDANCE
IN SURFACE WATERS IN AND BETWEEN FOAMLINES

NINE MILE POINT VICINITY - 1974

	Frequency of Occurrence of > Abundance In Foamlines	Frequency of Occurrence of > Abundance Between Foamlines	Total Occurrences
Total Phytoplankton	5	7	12
Green Algae	7	5	12
Euglenoids	2	2	4
Golden-brown Algae	1	3	4
Diatoms	7	5	12
Dinoflagellates	2	10	12
Blue-green Algae	3	8	11
Cryptomonads	1	5	6

d. Windrow Phytoplankton

Comparisons of the abundance of the seven phytoplankton classes in and between foamlines (Table VA-6) indicate that dinoplagellates, blue-green algae, and cryptomonads were generally more abundant between the foamlines than in the foamlines. Green algae and diatoms showed a minor tendency toward the reverse trend. Paired t-tests showed that there were no significant differences in total phytoplankton concentrations between surface samples collected in foamlines and between foamlines (11 d.f.; T_{calc} = 1.669; T_{crit} = 2.201) or between vertical collections in the foamlines and surface collections in the foamlines (11 d.f.; T_{calc} = 0.462; T_{crit} = 2.201) at $\alpha = 0.05$.

These results, particularly the observation of greater blue-green algal concentrations between rather than within the foamlines as reported by Fogg (1965), were unexpected. They suggest either that the principle underlying foamline aggregation (Langmuir circulations) does not necessarily apply to shallow waters such as those adjacent to Nine Mile Point, or that the sampling procedure was inadequate for the clear delineation of surface windrow aggregations.

4. Conclusions

A mean increase in green algal abundance and a decrease in blue-green algal abundance was observed between 1974 and 1973. A difference in seasonal patterns was also recorded and attributed to the cooler lake water temperatures during 1974. The cooler temperature was probably also influential in the reduction of green algal genera and the difference in dominant phytoplankton species between the two years. Melosira binderana potential nuisance diatom species was recorded in concentrations as high as 1,950 cells/ml in 1974.

Seasonal patterns of chlorophyll a concentrations were similar during 1973 and 1974, with the periods of maximum values occurring during the summer. Fluctuations in concentrations between collecting dates were hypothesized to be correlated with upwellings, which were indicated by the high values of dissolved algal nutrients (i.e., NO_3-N and Ortho-PO_4) during June 1974 in the Nine Mile Point vicinity (See also Chapter V-B). Similar fluctuations in primary production rates and phytoplankton abundance among dates were observed during 1974.

Significant differences in mean total phytoplankton abundance among depth contours were recorded by season in 1974, the distribution pattern varied between seasons, indicating that the factors influencing phytoplankton distribution varied with collecting date. There was no apparent correlation between water temperature and phytoplankton

concentrations by depth contour. Statistical analyses also showed that the spatial distribution patterns of diatoms, green algae, and blue-green algae also varied among collecting dates. The similarity between distribution patterns of algal classes having different temperature optima, nutrient requirements, and susceptibility to grazing suggested that water circulation was the controlling factor in their spatial distribution.

Primary production rates among stations in the Nine Mile Point vicinity were significantly different only among transects. The distribution patterns isolated suggested that thermal discharges from Nine Mile Point Nuclear Station may occasionally significantly enhance production rates in the near-field area of the station, but that significant differences in production rates between the three west transects (NMPW, NMPP, and FITZ) and the east transect (NMPE) in Mexico Bay may occur more frequently due to the enriched microenvironment of Mexico Bay.

The results of the windrow phytoplankton study showed greater concentrations of dinoflagellates, blue-green algae, and cryptomonads between foamlines than in foamlines. Concentrations of total phytoplankton were not significantly different in and between foamlines.

B. ZOOPLANKTON

1. Microzooplankton

a. Introduction

The zooplankton community was included in the study of the postoperational environmental effects of Nine Mile Point Nuclear Station and preoperational conditions at James A. Fitzpatrick Nuclear Station because of the important position of these organisms in the trophic structure of Lake Ontario. Changes in their abundance or composition could result, through trophic interaction, in alterations of other lake communities such as fish or phytoplankton. Microzooplankton are defined for the purposes of this study as zooplankton ranging in size from 76 - 571 μ.

The microzooplankton studies conducted in the Nine Mile Point area during 1973 (QLM, 1974) established that:

Copepods, cladocerans, and rotifers were the most abundant microzooplankters found in samples collected with a 76 μ net at 16 locations near Nine Mile Point.

Seasonally, microzooplankton was most abundant during the early summer and fall; abundance was slightly depressed during the warmest summer months. More than 2×10^6 organisms/m^3 were found during periods of greatest abundance.

The seasonal patterns of abundance were related primarily to seasonal changes in temperature and food availability.

Changes in rotifer standing stocks seemed to be the most reliable indicator of environmental changes.

Microzooplankton standing stock was greater in the near vicinity of Nine Mile Point Nuclear Generating Station (NMPP and FITZ transects) than at locations further west and east.

b. Methods and Materials

(i) Field Collection

Microzooplankton samples were collected at the same transects, depth contours, and dates as phytoplankton samples (See Section V.A.2).

Samples were collected with double 12 cm diameter Wisconsin type plankton nets equipped with 76 μ mesh netting. Vertical tows were conducted from the bottom to the surface and the volume sampled was calculated by multiplying the depth of water by the mouth area of the net. The plankters were anesthetized with in 0.06% Neosynephrine[R] prior to preservation in buffered 5% formalin.

(ii) Laboratory Analysis

Adult copepods, as well as rotifers, protozoans, and cladocerans, were identified to the lowest possible taxonomic level; copepod nauplii and copepodites were not identifed to the species level.

The microzooplankton were counted according to the following procedure:

- The volume of the preserved sample was measured in a graduated cylinder.

- A 1-ml aliquot of the homogeneously mixed sample was withdrawn and placed in a Sedgewick-Rafter counting chamber (EPA, 1973).

- All organisms in each of two 1-ml aliquots were counted at 100 magnifications in either 10 or 20 strips of the chamber, depending upon organism concentration. Each strip was defined by the width of a Whipple grid and the length of the chamber.

- The number of organisms/m^3 was calculated according to the following formula:

$$X = \frac{(A/E)\ (B)}{D}$$

Where: X = Number of organisms/m^3
A = Total organisms counted
E = Total volume counted (ml)
B = Volume of preserved sample
D = Volume of lake water sampled (m^3)

(iii) Replicate Samples

Replicate microzooplankton samples were collected during 1974 (and 1973) to increase the precision of abundance estimates and the sensitivity of statistical analyses. Original samples were used to provide data illustrating seasonal and interstation patterns of abundance in accordance with the general procedure for data presentation for this report. However, both original and replicate data were used in all statistical analyses. A paired t-test showed that the mean of the replicates was significantly larger than that of the originals ($t = 2.562$; 201 d.f.) at the 99% significance level. Since the replicate sample was consistently larger than the original sample, the difference was attributed to laboratory procedure.

c. Results and Discussion

This section of the report on the microzooplankton study includes a brief presentation of the 1974 data. The major portion of the text deals with comparisons of community composition between years, and abundance among transects, depth contours, and years. Emphasis will be placed on detection and interpretation of trends and patterns to evaluate the postoperational impact of Nine Mile Point Nuclear Station Unit 1 and preoperational conditions for James A. FitzPatrick Nuclear Station.

(i) Community Composition

The microzooplankters identified in samples collected from the Nine Mile Point vicinity during 1974 are listed in Table VB-1. Differences between the 1973 and 1974 species lists reflected primarily identification to lower taxonomic levels during 1974 rather than changes in community composition between the two years. All microzooplankters recorded during

TABLE VB-1

MICROZOOPLANKTON SPECIES INVENTORY

NINE MILE POINT - 1974

- PROTOZOA
  - Lobosa
    - Testacealobosa
      - Difflugiidae
        - *Difflugia* sp.
  - Suctoria
    - Tentaculiferida
      - Acinetidae
        - *Thecacineta* sp.
        - *Tokophrya* sp.
      - Dendrosomidae
        - *Staurophyra elegans*
      - Podophryidae
        - *Paracineta* sp.
  - Ciliata
    - Spirotrichida
      - Tintinnidae
        - *Codonella cratera*
    - Peritrichida
      - Epistylidae
        - *Epistylis* sp.
      - Vaginocolidae
      - Vorticellidae
        - *Vorticella* spp.
    - Holotrichida
      - Gymnostomina*

- ROTIFERA
  - Monogononta
    - Ploima
      - Brachionidae
        - *Brachionus* sp.
        - *B. calyciflorus*
        - *B. quadridentata*
        - *B. urceolaris*
        - *Euchlanis* sp.
        - *Kellicottia longispina*
        - *Keratella* sp.
        - *K. cochlearis*
        - *K. quadrata*
        - *Notholca* sp.
        - *N. acuminata*
        - *Lepadella* sp.
      - Lecanidae
        - *Lecane* sp.
      - Notommatidae
        - *Cephaledella* sp.
      - Trichocercidae
        - *Trichocera* sp.
        - *T. cylindrica*
        - *T. multicrinus*
        - *T. porcellus*
      - Gastropidae
        - *Chromogaster ovalis*
      - Asplanchnidae
        - *Asplanchna* sp.
      - Synchaetidae
        - *Ploesoma* sp.
        - *P. hudsoni*
        - *P. lenticulare*
        - *P. truncatum*
        - *Polyarthra* sp.
        - *P. euryptera*
        - *Synchaeta pectinata*
        - *S. stylatata*
        - *S. tremula*
    - Flosculariaceae
      - Testudinellidae
        - *Filinia longiseta*
      - Conochilidae
        - *Conochilus* sp.
        - *C. unicornis*
    - Conothecaceae
      - *Collotheca mutabilis*

* Suborder

TABLE VB-1
(Continued)

ARTHROPODA
- Crustacea
  - Cladocera
    - Bosminidae
      - _Bosmina_ spp.
    - Chydoridae
      - _Chydorus sphaericus_
    - Daphnidae
      - _Ceriodaphnia lacustris_
      - _Daphnia_ spp.
      - _D. galeata mendotae_
      - _D. longiremus_
      - _D. retrocurva_
    - Holopedidae
      - _Holopedium gibberum_
    - Sididae
      - _Diaphanosoma leuchtenbergianum_
- Copepoda**
  - Calanoida
    - Diaptomidae
      - _Diaptomus_ spp.
      - _D. minutus_
    - Centropagidae
      - _Limnocalanus macrurus_
    - Temoridae
      - _Eurytemora affinis_
  - Cyclopoida
    - Cyclopidae
      - _Diacyclops bicuspidatus thomasi_
      - _Mesocyclops edax_
      - _Tropocyclops prasinus mexicanus_
    - Harpacticoida

** Subclass

1973 were also sampled during 1974, with the exception of the protozoan Strombidium and the cladoceran Leptodora kindtii. These organisms were collected only infrequently by the Wisconsin type plankton net during 1973 and not at all during 1974 due to their rarity in the microzooplankton community.

The species of microzooplankton recorded during 1974 have also been identified by other researchers (See QLM, 1974 for a review of previous Lake Ontario zooplankton studies). However, because some microzooplankters collected in the Nine Mile Point vicinity were identified only to class or family and because specific identification of cladocerans is difficult, it is not yet possible to determine whether community composition in the lake waters adjacent to Nine Mile Point is different from the community composition for the lake as a whole.

As was observed during 1973, rotifers generally composed the largest fraction of the total microzooplankton community (range: 6 - 97%), followed in relative abundance by copepods (range: 0 - 74%), cladocerans (range: 0 - 63%) and protozoans (0 - 52%), respectively (Appendix V-8). Rotifers and protozoans were the numerically dominant microzooplankters during spring, whereas cladocerans and copepods formed an increasing percentage of the community through the summer and were dominant during late summer/early fall.

Keratella, Polyarthra, and Synchaeta were the most abundant rotifer genera; Tropocyclops prasinus mexicanus, cyclopoid copepodites (juvenile), and nauplii were the most abundant copepods. The most abundant cladoceran genus recorded was Bosmina; the family Vorticellidae constituted the majority of the protozoans (Appendix V-9).

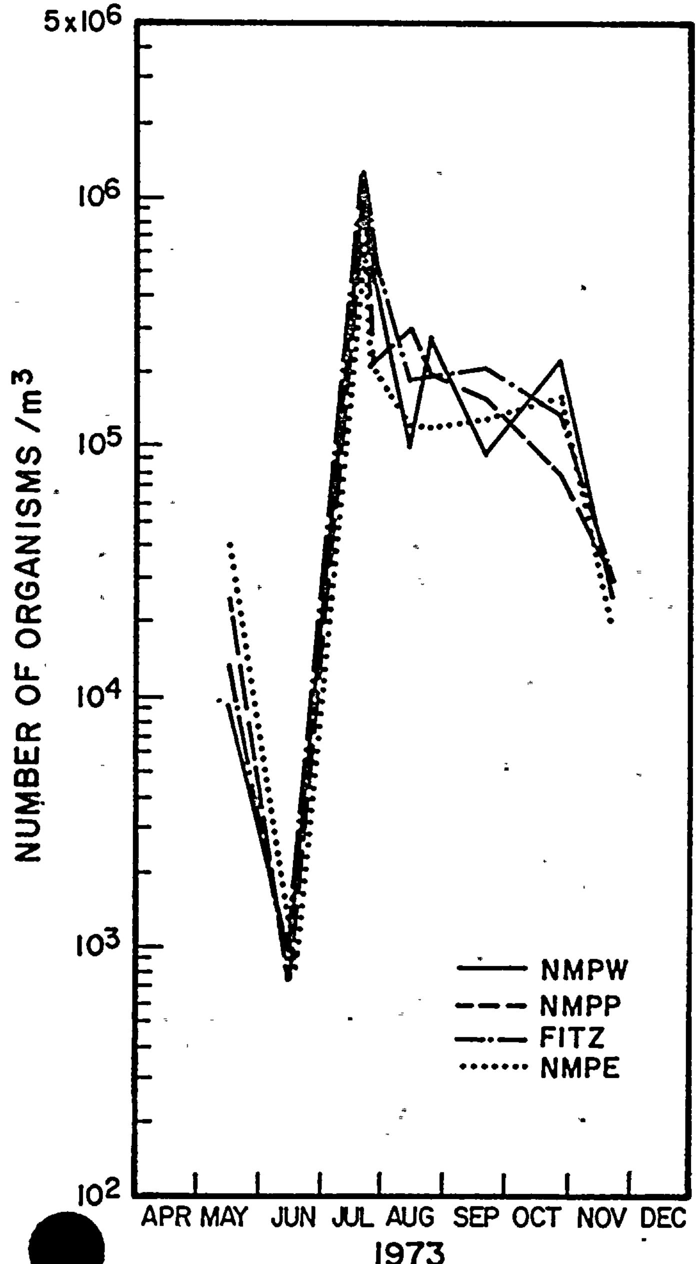
(ii) Seasonal Patterns of Abundance

Seasonal patterns of the mean abundance (over depth contours) of rotifers, cladocerans copepods, and protozoans at each transect in the Nine Mile Point area on each collecting date during 1973* and 1974 are illustrated in Figures VB-1 through VB-4.

There were substantial differences in the seasonal patterns of rotifer abundance between 1973 and 1974 (Figure VB-1). Seasonal maxima of comparable magnitudes occurred during

* Only 1974 protozoan data are presented since only ciliate protozoan genera (i.e., Epistylis, Vorticella, Codonella, and Strombidium) were identified and enumerated during the 1973 survey.

ROTIFER ABUNDANCE
NINE MILE POINT, 1973-1974



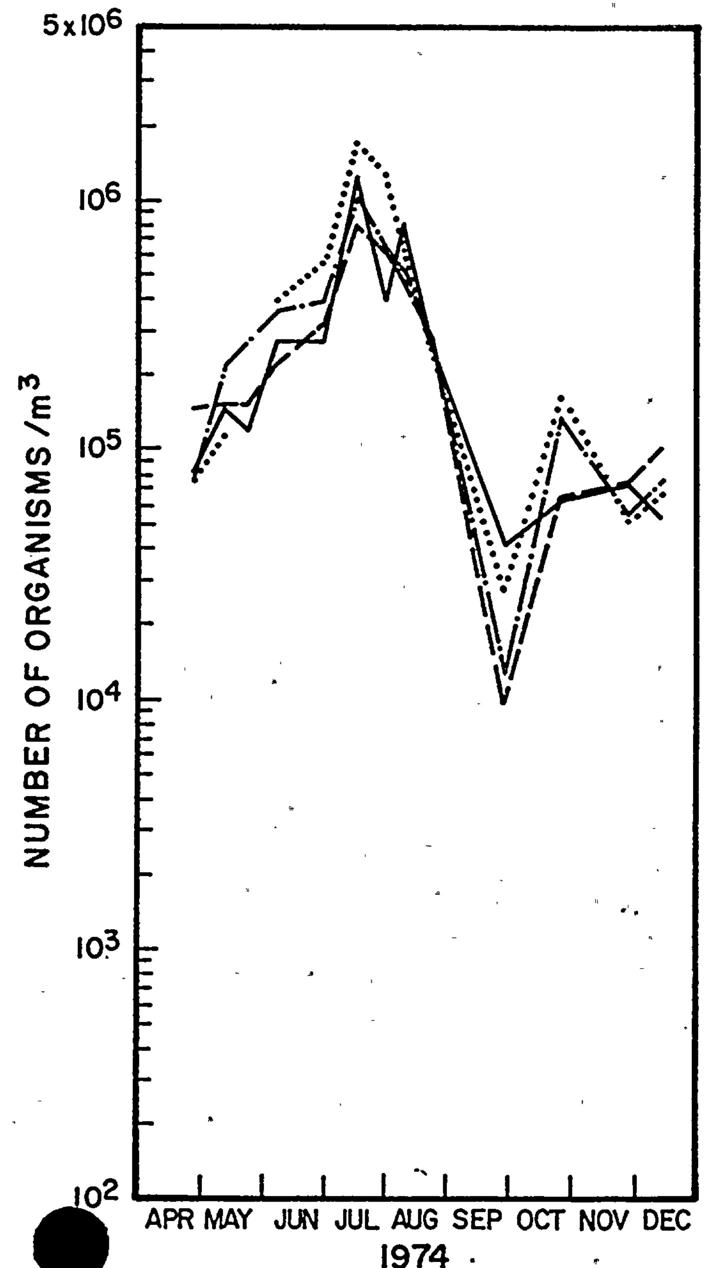


FIGURE VB-1

COPEPOD ABUNDANCE
NINE MILE POINT, 1973-1974

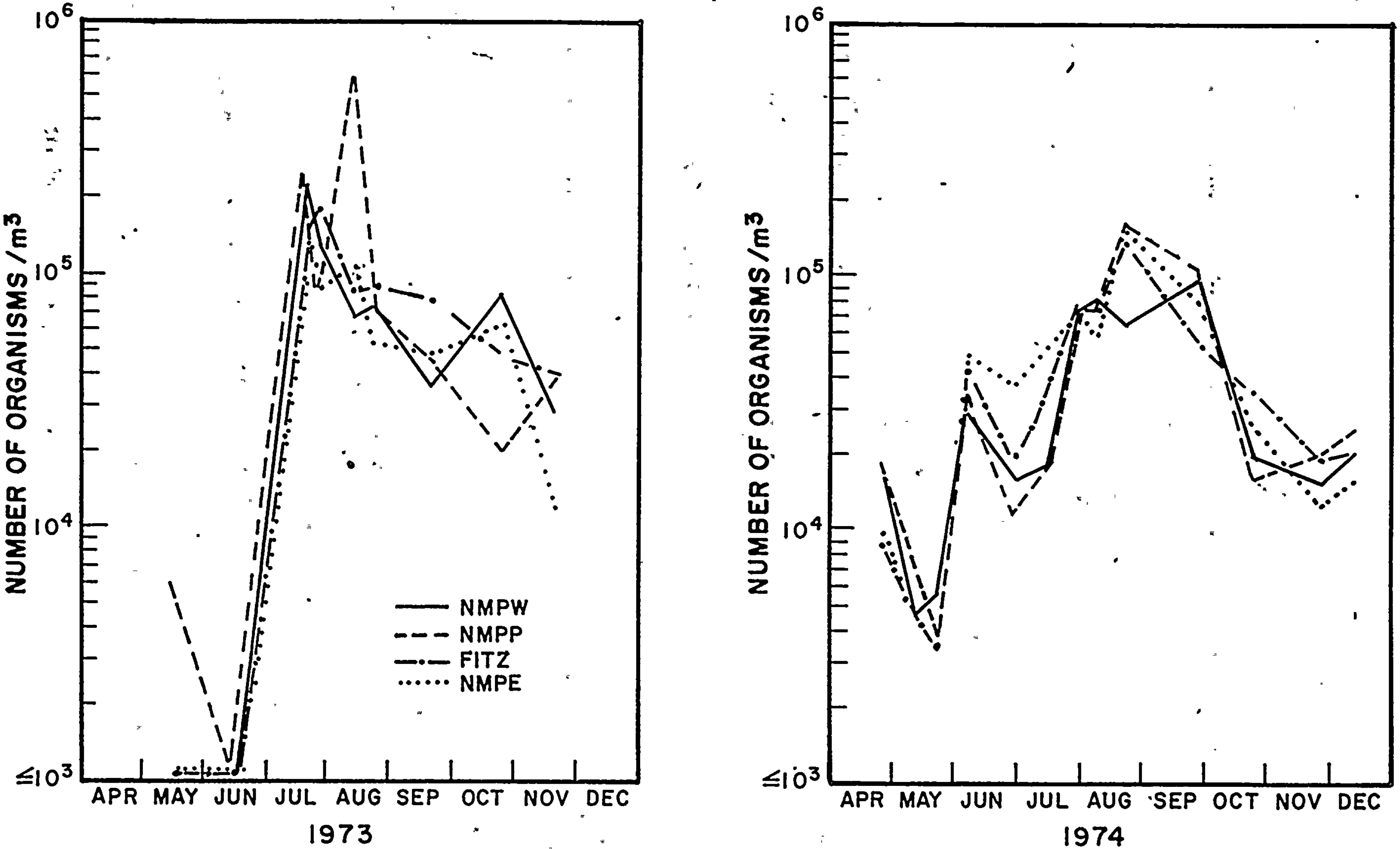


FIGURE VB-2

CLADOCERAN ABUNDANCE
NINE MILE POINT, 1973-1974

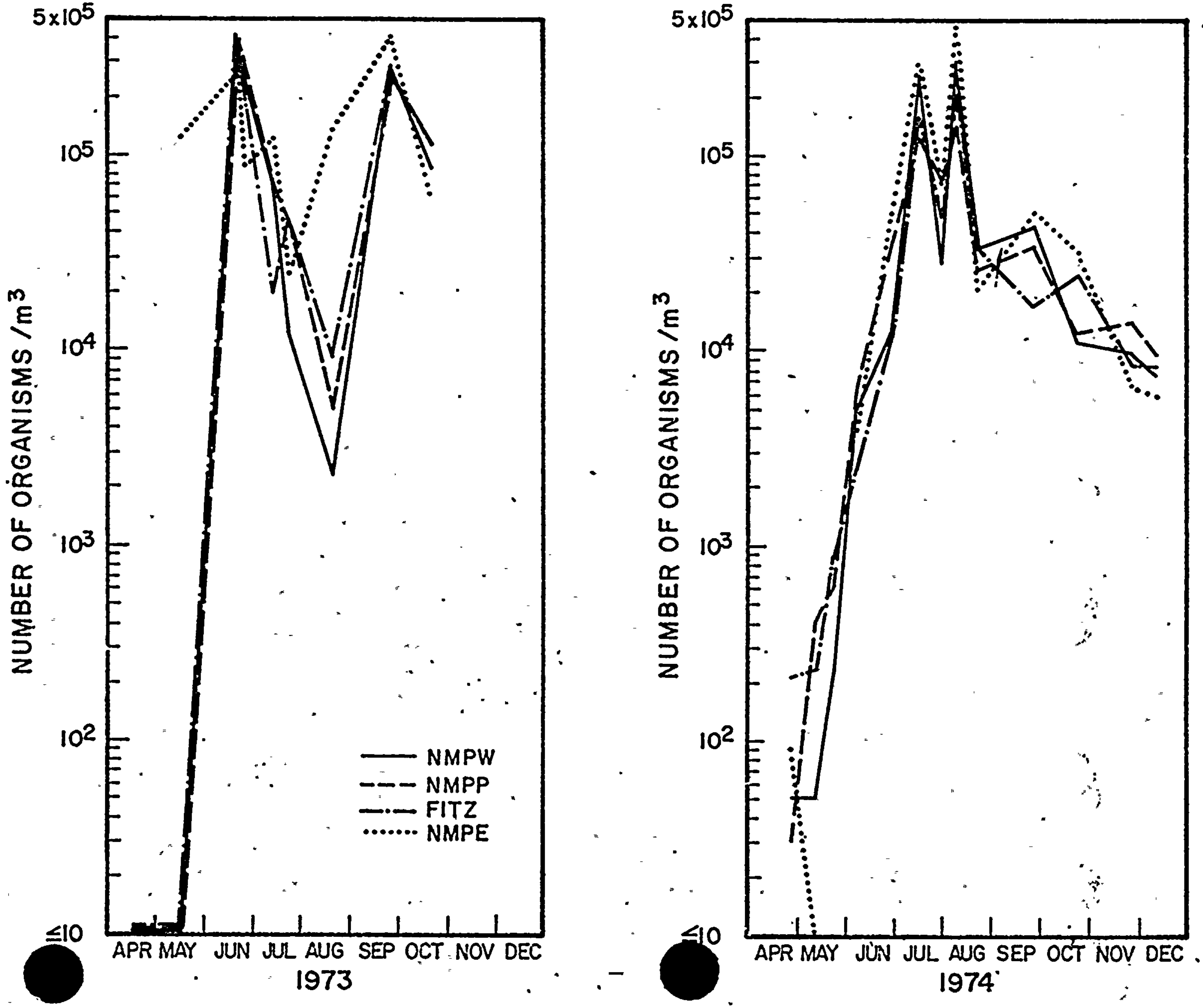
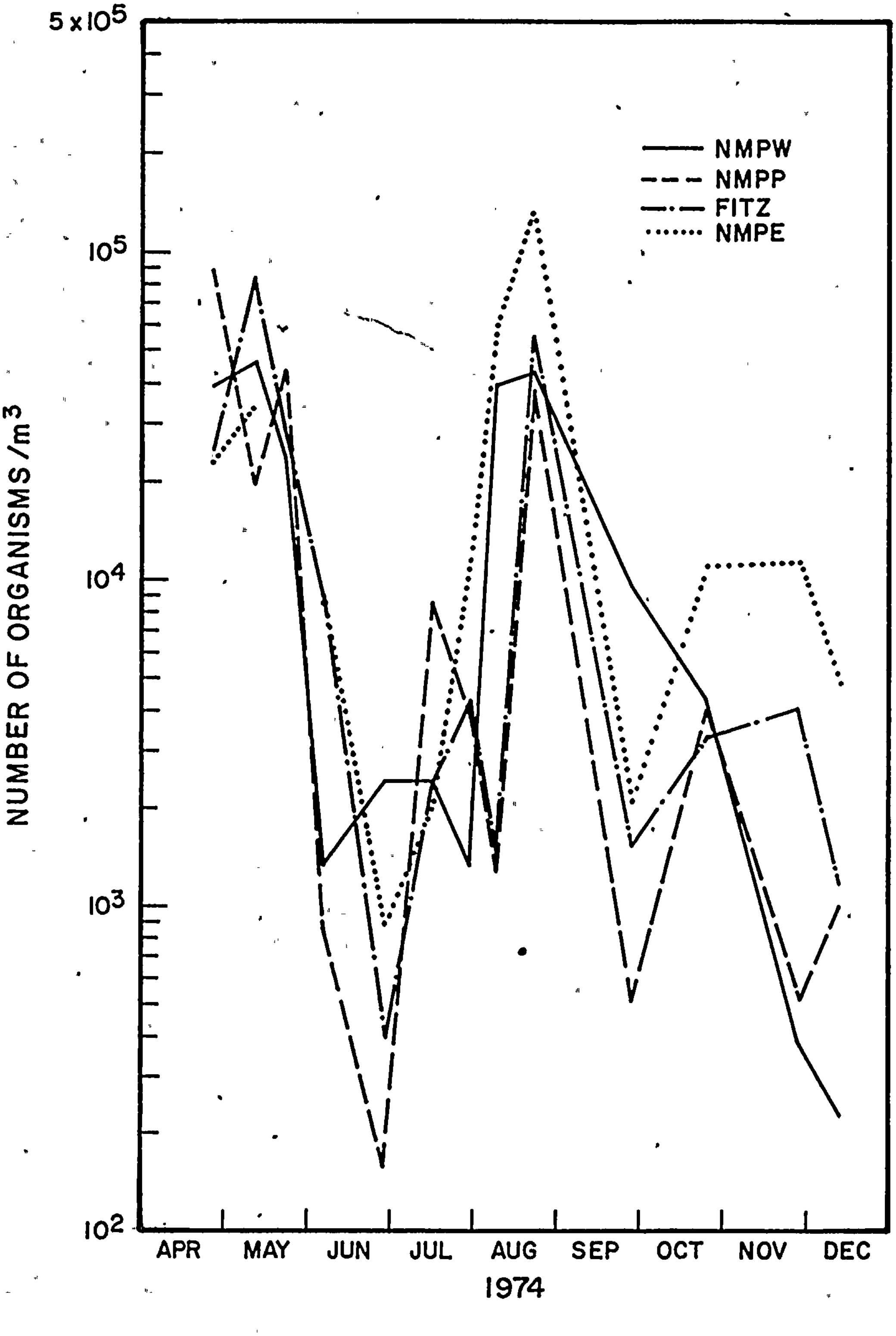


FIGURE VB-3

PROTOZOAN ABUNDANCE NINE MILE POINT, 1974



On the average, rotifers were more abundant during 1974 than during 1973.

There were also substantial differences in the seasonal patterns of cladoceran and copepod abundance between 1973 and 1974 (Figures VB-3 and VB-2, respectively). Maximum numbers of cladocerans and copepods occurred during the summer and were, as with rotifer numbers, comparable between the two years; most differences in seasonal patterns were again noted during the spring and fall months.

Protozoan concentrations fluctuated more than concentrations of other microzooplankton during 1974 (Figure VB-4); maximum concentrations were found during August, April, and May. Even greater variations in protozoan numbers were recorded at Nine Mile Point Nuclear Station intake (Figure VIII-9), and the trend of abundance with time at the intake was different from that in the lake. The combined intake and lake data suggest that the annual minimum in protozoan abundance occurred during the winter and that the annual maximum occurred during the summer; a more detailed interpretation was not possible given the temporal variability of the data.

In general, seasonal changes in microzooplankton concentrations were related to seasonal changes in water temperature and food availability (QLM, 1974). However, on a shorter time scale, it is apparent from the variability in temporal distribution that other factors (e.g., water circulation patterns) alter microzooplankton concentrations.

The low levels of microzooplankton abundance during the spring months of 1973 were most likely related to a massive upwelling of cold water in the Nine Mile Point vicinity (QLM, 1974), and some changes in microzooplankton abundance among collection dates during 1974 may also have reflected an upwelling of water masses. For example, the increase in protozoan abundance during August 1974 (Figure VB-4) may have been related to a mid-August influx of cold water (Figure VA-3). An expanded program of sampling and analysis would be necessary to examine the relationship between fluctuations in microzooplankton populations in the Nine Mile Point vicinity and upwelling events. If upwelling events in the Nine Mile Point vicinity were documented, the effect of the thermal discharge in this area would be considerably diluted among transient microzooplankton populations.

(iii) Patterns of Abundance among Transects and Depth Contours

As during 1973, two methods were used to examine interstation patterns of abundance: pattern-frequency analysis and analysis of variance coupled with Student-Newman-Keuls tests. Since the predominant currents in the Nine Mile Point area are from the west, pattern-frequency analyses were based on a west-to-east sequence of abundance values for each collecting date, i.e., the assumption was made that the west transect (NMPW) was the control transect.

The results of these analyses and statistical tests on rotifers, copepods, cladocerans, and protozoans are compiled in Appendix V-10 to V-11 and summarized, with the results of 1973 analyses, in Table VB-2.

Based on pattern-frequency analyses, rotifer, copepod, and cladoceran distribution among transects were similar between 1973 and 1974. Patterns isolated by statistical analyses (S-N-K tests), however, were different between these two years, and with one exception, different from those based on pattern-frequency analyses (Table VB-2). More important, both pattern-frequency analyses and statistical analyses showed that the inter-transect distribution patterns of all microzooplankton groups analyzed varied considerably among dates (Appendix V-10 and V-11). The significant date x transect (and date x depth contour) interaction for all four microzooplankton groups analyzed statistically during 1974 indicates that some other variable, possibly water circulation, was a controlling factor for microzooplankton distribution.

The hypothesis is based on a study (Patalas, 1969 documenting the influence of advection (upwelling) on the local distribution of microzooplankton in Lake Ontario during 1967, and also on the temperature as recorded hourly during the present study (Plant Generation Data, 1974). The variations in temperature, summarized in Figure VA-3, were frequent and changes of many degrees within a few hours were common. Additional evidence supporting the occurrence of upwellings was provided by hydrographic studies conducted during 1969 by Stone and Webster Engineering Corporation (1970); these studies showed that current velocity and direction, measured continuously at fixed towers off the James A. FitzPatrick site, could vary substantially within a day.

Since pattern-frequency analyses were based on distribution patterns assuming a west-to-east longshore current, and statistical analyses were based only on a matrix of abundance values,

TABLE VB-2

MICROZOOPLANKTON DISTRIBUTION PATTERNS

NINE MILE POINT VICINITY, 1973 - 1974

ORGANISM/ANALYSIS	PATTERNS, 1973+	PATTERNS, 1974
Rotifers		
Pattern-Frequency	⊗ NMPW ⊕ NMPP ⊕ FITZ ⊖ NMPE	⊗ NMPW ⊕ NMPP ⊕ FITZ ⊖ NMPE
S-N-K Test (Transect)	L: FITZ NMPP NMPW NMPE : S	L: NMPE FITZ NMPP NMPW : S
S-N-K Test (depth contour)	L: 20' 10' 60' 40' : S	L: 10' 20' 40' 60' : S
Copepods		
Pattern-frequency	⊗ NMPW ⊕ NMPP ⊕ FITZ ⊖ NMPE	⊗ NMPW ⊕ NMPP ⊖ FITZ ⊖ NMPE
S-N-K Test (Transect)	NSD	L: NMPE NMPP FITZ NMPW
S-N-K Test (depth contour)	NSD	L: 10' 20' 40' 60' : S
Cladocerans		
Pattern-frequency	⊗ NMPW ⊖ NMPP (±) FITZ ⊖ NMPE	⊗ NMPW ⊖ NMPP ⊖ FITZ (±) NMPE
S-N-K Test (Transect)	NSD	L: NMPE NMPW FITZ NMPP : S
S-N-K Test (depth contour)	NSD	L: 10' 20' 40' 60' : S
Protozoans		
Pattern-frequency	NA	⊗ NMPW ⊖ NMPP ⊕ FITZ ⊕ NMPE
S-N-K Test (Transect)	NA	L: NMPE FITZ NMPP NMPW : S
S-N-K Test (depth contour)	NA	L: 10' 20' 40' 60' : S

S-N-K = Student-Newman-Keuls
NSD = No significant difference
NA = Data not analyzed
L = Largest
S = Smallest
+ (QLM, 1974)

the microzooplankton distribution patterns developed through pattern-frequency analysis may be more representative than the patterns isolated through Student-Newman-Keuls tests. The pattern-frequency analyses indicated that rotifers and copepods were usually more abundant in the vicinity of Nine Mile Point Unit 1 (NMPP and FITZ transects) than to the west or east, that cladoceran abundances decreased from NMPW to FITZ transect, and that protozoans were less abundant in the near vicinity of the power plant (NMPP transect) than to the east or west.

For all groups, except copepods, statistical analyses showed a significant increase in mean abundance between NMPP and NMPE transect, suggesting that the increase at the NMPE transect may have resulted from the presence of a different microenvironment. The significant decrease in the mean number of copepods at NMPW transect compared to the other transects in the study area suggests the possibility of thermal impact since water temperatures at the 20 ft depth contour were generally higher east of NMPW transect (Figure VA-11).

The mean west-to-east distribution pattern of cladoceran abundance, based on pattern frequency analysis, was the opposite of the pattern reported by Fenlon, McNaught, and Schroeder (1971) in Lake Ontario for the cladocerans Bosmina and Daphnia. Furthermore, the decrease reported by these authors in the abundance of the copepod Diacyclops between preoperational/postoperational years does not seem consistent with the occurrence during 1973 (QLM, 1974)and 1974 of generally greater copepod abundance including the genus Diacyclops) in the vicinity of Nine Mile Point Unit 1 (NMPP and FITZ transects) than to the west (NMPW transect). It is suggested that, considering the variability of microzooplankton distribution in the near-shore zone, the limited duration and small sample sizes in the study of Fenlon et al. (1971) may have influenced their results.

Microzooplankton abundance generally decreased with depth contour during both 1973 (QLM, 1974) and 1974 and was consistent among microzooplankton groups during 1974 (Appendix V-12). The occurrence of significant date x depth contour interactions (Appendix V-11) indicates that the depth contour distribution patterns varied among collecting dates. However, since other studies have also documented greater zooplankton abundance near-shore than offshore (Patalas, 1969; Watson and Carpenter, 1974), it is probable that variations in this pattern are neither as great nor as frequent as variations in distribution patterns among transects.

d. Conclusions

There were no apparent changes in the microzooplankton community composition between 1973 and 1974, indicating that the microzooplankton community structure was stable in the Nine Mile Point vicinity during these two years. Differences in species composition between 1973 and 1974 were a function of identification to lower taxonomic levels. During both years, rotifers, copepods, and cladocerans were the most abundant microzooplankton groups.

The seasonal patterns of rotifer, copepod, and cladoceran abundance differed between 1973 and 1974, but maximum levels of abundance were similar between the two years. Due to the differences in seasonal patterns, total microzooplankton abundance was, on the average, greater during 1974 than during 1973. It was hypothesized that the differences in seasonal patterns between years were related to localized variations in water mass (i.e., upwellings).

Temporal variability in spatial distribution, reflecting the temporal changes in water circulation patterns, was found for all major microzooplankton taxa through both pattern-frequency and statistical analyses. Pattern-frequency analyses showed that copepod and rotifer abundance most frequently increased between NMPW and NMPP transect, whereas cladoceran abundance frequently decreased between these two transects. A ranking of mean abundance of rotifers and cladocerans by transect, however, showed no significant difference between these two transects. Protozoan abundance was variable both within and between collecting dates. All groups were significantly more abundant at NMPE transect, but the significance in abundance between transects varied by group. Significant decreases in the mean concentration of the four dominant taxa with increasing depth contour were noted.

The available information suggests that natural environmental factors, e.g., upwellings, have the primary effect on microzooplankton distribution. It is possible, based on the present data base, that thermal discharges from Nine Mile Point and FitzPatrick Nuclear Stations may result in an increase in abundance of rotifers and copepods and a decrease in cladoceran abundance in the vicinity of the plants. These changes, however, are expected to be negligible in terms of the lake ecosystem as evidenced by the natural variability in the microzooplankton community distribution.

2. Macrozooplankton

a. Introduction

Macrozooplankton were defined in the study as zooplankton >571μ.

Macrozooplankton studies conducted in the vicinity of Nine Mile Point Nuclear Station Unit 1 during 1973 (QLM, 1974) established that:

Cladocerans (other than Leptodora), Leptodora kindtii, copepods, and amphipods were the most abundant macrozooplankters during 1973. Other macrozooplankters, including Mysis relicta, dipteran larvae and pupae, hydroids, hydracarinids, and isopods occurred sporadically and in small numbers. Total macrozooplankton abundance ranged between approximately 10 and 5 x 10^5 organisms/$1000m^3$.

The four dominant macrozooplankters were significantly more abundant in surface waters at night than during the day. Significant diurnal differences were found throughout the water column for amphipods, whereas copepod and cladoceran diurnal migration was observed within the upper water column, i.e., above mid-depth.

Seasonally, there were two maxima in macrozooplankton abundance: the first during the summer and the second during the fall. The late summer/early fall depression in abundance was partially masked by the seasonal maximum in Leptodora abundance. The seasonal trends in abundance were attributed primarily to fluctuations in water temperature and food availability.

Although significant differences in the abundance of cladocerans and amphipods between some stations were documented, these differences assumed no consistent pattern.

b. Materials and Methods

(i) Field Collection

With the Nine Mile Point Nuclear Station as a central point, three concentric arcs of 1/2, 1, and 3 mile radii were superimposed on the lake to designate the sampling locations.

As during 1973, samples were collected at the 20 and 40 ft depth contours both east and west of the plant within each arc, and directly north of the plant at 60, 80, and 100 ft depth contours (Figure VA-1).

At each location, five-minute horizontal tows were conducted at the surface, mid-depth, and bottom with a 1-m diameter Henson-type plankton net of #0 mesh netting (571μ). These nets were constructed according to the specifications described previously (QLM, 1974). The volume of water sampled was

measured with a TSK pigmy-pattern flow meter positioned approximately one-third of the distance across the diameter of the net mouth. The following equation was used to calculate the volume of water sampled by the net:

$$V = C \times N \times MA \qquad \text{(VB-1)}$$

where: V = Volume of water sampled (m^3)
C = Calibration factor (m/revolution) as read from the flow meter calibration certificate
N = Number of revolutions as read from the flow meter
MA = Mouth area of the net (m^2)

Tows were conducted parallel to shore from east to west, following the depth contour at each sampling location, at a constant engine speed, for an average distance of 0.32 km. The problem encountered during the 1973 sampling season concerning the nets' rising in the water column was alleviated in the 1974 sampling season be redesign of the net towing bridle. Samples were preserved in 5-8% buffered formalin.

Macrozooplankton-ichthyoplankton samples were collected weekly during daylight hours from 3 April to 13 December and during nighttime hours from 19 June to 11 September (Table VB-3).

(ii) Laboratory Analysis

All samples were poured into a cod-end bucket with a 571μ screen, washed with tap water to remove the formalin solution, and resuspended in 70% ethanol. After all fish eggs and larvae had been removed, the sample volume was then measured in a graduated cylinder. If the concentration of organisms was low, the entire sample was counted for total macrozooplankton abundance; otherwise, a subsample was analyzed. Macrozooplankton were identified to the species level for specific taxa, all other taxa were identified to the generic level. If five 10-ml aliquots (subsampled with a Tipet[R]) were analyzed in a petri dish having a total area of 39-squares, the following equation was used to determine the total abundance of a taxon in a sample:

$$X = \frac{(\bar{A})(B)}{V} \qquad \text{(VB-2a)}$$

where: X = total number of macrozooplankters of a particular taxon in the sample (ml)
$\bar{A}$ = average number of organisms per 10 ml
B = total sample volume (ml)
V = volume of subsample (10ml)

TABLE VB-3

MACROZOOPLANKTON AND ICHTHYOPLANKTON SAMPLING PROGRAM

NINE MILE POINT - 1974

3 APR (D)	19 JUN (D/N)	28-29 AUG (D/N)
12 APR (D)	26-27 JUN (D/N)	5- 6 SEP (D/N)
17 APR (D)	2 JUL (D)	11-12 SEP (D/N)
25 APR (D)	10 JUL (D)	19 SEP (D)
2 MAY (D)	12-13 JUL (D/N)	27 SEP (D)
10 MAY (D)	17-18 JUL (D/N)	4 OCT (D)
14 MAY (D)	24-25 JUL (N/D)	9,11 OCT (D)
22 MAY (D)	31 JUL-1 AUG (D/N)	17 OCT (D)
30 MAY (D)	7- 8 AUG (D/N)	24 OCT (D)
5 JUN (D)	14-16 AUG (N/D/N)	30 OCT (D)
12 JUN (D)	21 AUG (D/N)	8 NOV (D)
		19 NOV (D)
		23,24 NOV (D)
		13 DEC (D)

D = DAY
N = NIGHT

If taxa occurred in concentrations of 75 organisms per square, individuals were counted in 10 random squares (25.6%) of five petri dishes and this total was extrapolated to that of a 10-ml subsample. The following equation was used to calculate the total abundance of a taxon:

$$X = (0.39\bar{A})\,(B) \qquad \text{(VB-2b)}$$

where: X = Total number of macrozooplankters of a particular taxon in the sample (ml)
$0.39\bar{A}$ = Average number of organisms/ml in petri dish
B = Total sample volume (ml)

The total number of each taxon in the sample was converted to total number/1000m^3 by using the expression:

$$N = 1000\,\frac{X}{V} \qquad \text{(VB-3)}$$

where: N = Number of organisms/1000m^3
X = Number of organisms/ml (Equation (VB-2a), (VB-2b), or from direct count)
V = Volume of water sampled (Equation (VB-1)).

All fish larvae were counted and identified to species. Sixty randomly selected individuals of each larval species were measured to the nearest 0.1 mm with a calibrated ocular micrometer and identified to life stage (yolk-sac, post yolk-sac, juvenile). All fish eggs were counted and the first 100 eggs in each sample were identified to species for the first time in 1974. The abundance of fish larvae and eggs was calculated using equation (VB-3).

c. Results and Discussion

(i) Community Composition

The macrozooplankton identified during 1974 are listed in Table VB-4. *Leptodora kindtii* was the numerically dominant organism among the macrozooplankters enumerated during the 1974 study, and was followed, in decreasing order of relative abundance, by *Gammarus fasciatus*, Hydroida, and Diptera (larvae and pupae combined). The remaining macrozooplankton taxa identified represented only a small fraction of the total macrozooplankton enumerated. For example, *Pontoporeia affinis* and *Mysis oculata relicta* were infrequently collected and each composed less than 1% of the total macrozooplankton enumerated on dates when they did occur. *Leptodora kindtii*,

TABLE VB-4

MACROZOOPLANKTON SPECIES INVENTORY

NINE MILE POINT VICINITY - 1974

- COELENTERATA
  - Hydrozoa
    - *Cordylophora caspia* (=*C. lacustris*)
    - *Hydra americana*
- NEMATODA
- PLATYHELMINTHES
  - Turbellaria
- ANNELIDA
  - Polychaeta
    - Sabellidae
      - *Manayunkia speciosa*
  - Oligochaeta
- MOLLUSCA
  - Gastropoda
  - Pelecypoda
- ARTHROPODA
  - Arachnoidea
    - Hydracarina (Acarina)
      - Hygrobatidae
        - *Hygrobates* sp. A
        - *Hygrobates* sp. C
      - Limnesiidae
        - *Limnesia*
      - Unionicolidae
        - *Unionicola* sp. A
        - *Unionicola* sp. B
        - *Huitfeldtia rectipes*
      - Lebertiidae
        - *Lebertia*
      - Pionidae
        - *Piona*
        - *Forelia*
      - Zerconidae (Free Living Terrestial Forms)
  - Crustacea
    - Branchipoda
      - Cladocera
        - *Leptodora kindtii*
    - Branchiura
      - *Argulus* sp.

TABLE VB-4 (Continued)

Malacostraca
    Amphipoda
        Gammaridae
            Gammarus fasciatus
        Haustoridae
            Pontoporeia affinis
    Mysidacea
        Mysidae
            Mysis oculata relicta
Octracoda
    Podocopa
INSECTA
    Neuroptera
            Climacia areolaris
    Hemiptera
    Trichoptera
    Odonata
    Ephemeroptera
    Coleoptera
    Diptera
        Chaoboridae
            Chaoborus albipes
        Simuliidae
        Chironomidae
            Chironomus
            Cricotopus
            Cryptochironomus
            Pseudochironomus
            Endochironomus
            Demicryptochironomus
            Parachironomus
            Rheotanytarsus
            Tanytarsus
            Dicrotendipes
            Paratendipes
            Glyptotendipes
            Orthocladius
            Psectrocladius
            Procladius
            Polypedilum
            Micropsectra
            Phaenopsectra
            Paracladopelma
            Potthastia

Gammarus fasciatus, and Diptera were selected for analysis of patterns in spatial and temporal distribution because: 1) these organisms are most abundant during the summer; 2) they constitute a considerable portion of the diet of fish in the Nine Mile Point vicinity (Chapter VII); and 3) these organisms are hypothesized to reflect the effect of the Nine Mile Point Nuclear Station thermal discharge on the entire macrozooplankton community.

(ii) Seasonal Patterns of Abundance

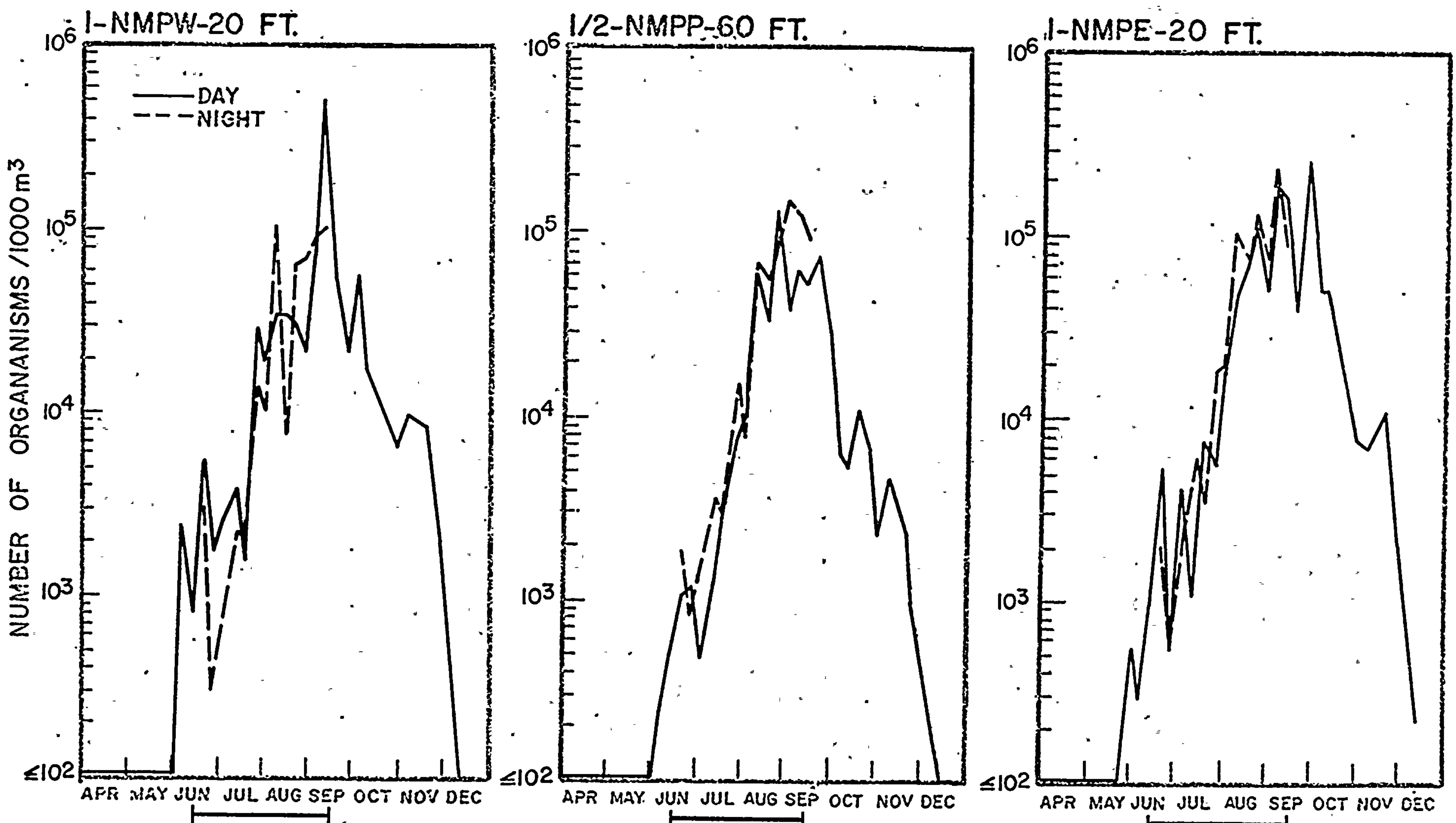
- Leptodora kindtii

Leptodora first occurred in macrozooplankton samples collected during the day on 22 May 1974 and, thereafter, increased in numbers to an annual maximum during September (Figure VB-5). Leptodora concentrations then decreased through the fall months and during early December were collected in approximately the same concentrations as in late May concentrations. The seasonal pattern of Leptodora abundance during 1974 was similar to the 1973 pattern (QLM, 1974) except for the greater temporal variability and for the occurrence of the annual maximum approximately two weeks earlier during 1973. During both years, the first appearance of Leptodora was noted during late May when water temperatures were approximately 50°F. The warmer lake water temperatures of 1973 compared to those of 1974 (Figure VA-3) may have stimulated population the growth of Leptodora resulted in the earlier occurrence of the 1973 annual maximum of abundance. Similarly, the warmer water temperatures during the fall of 1973 may have been influential in maintaining Leptodora concentrations at slightly higher levels during 1973 than during 1974. The fluctuation in the abundance of this species of cladoceran among collecting dates during both 1973 and 1974 may have been related to upwelling which occurred frequently during both years.

- Gammarus fasciatus

Gammarus first occurred in early April daylight collections during 1974 (Figure VB-6); seasonal trends in abundance were not evident due to large fluctuations in concentration among sampling dates. Similar fluctuations in Gammarus abundance, which precluded determination of seasonal trends, occurred during 1973 (QLM, 1974). Thus, comparisons of trends or magnitudes of abundance between the two years were not conducted.

ABUNDANCE OF LEPTODORA KINDTII*
NINE MILE POINT, 1974

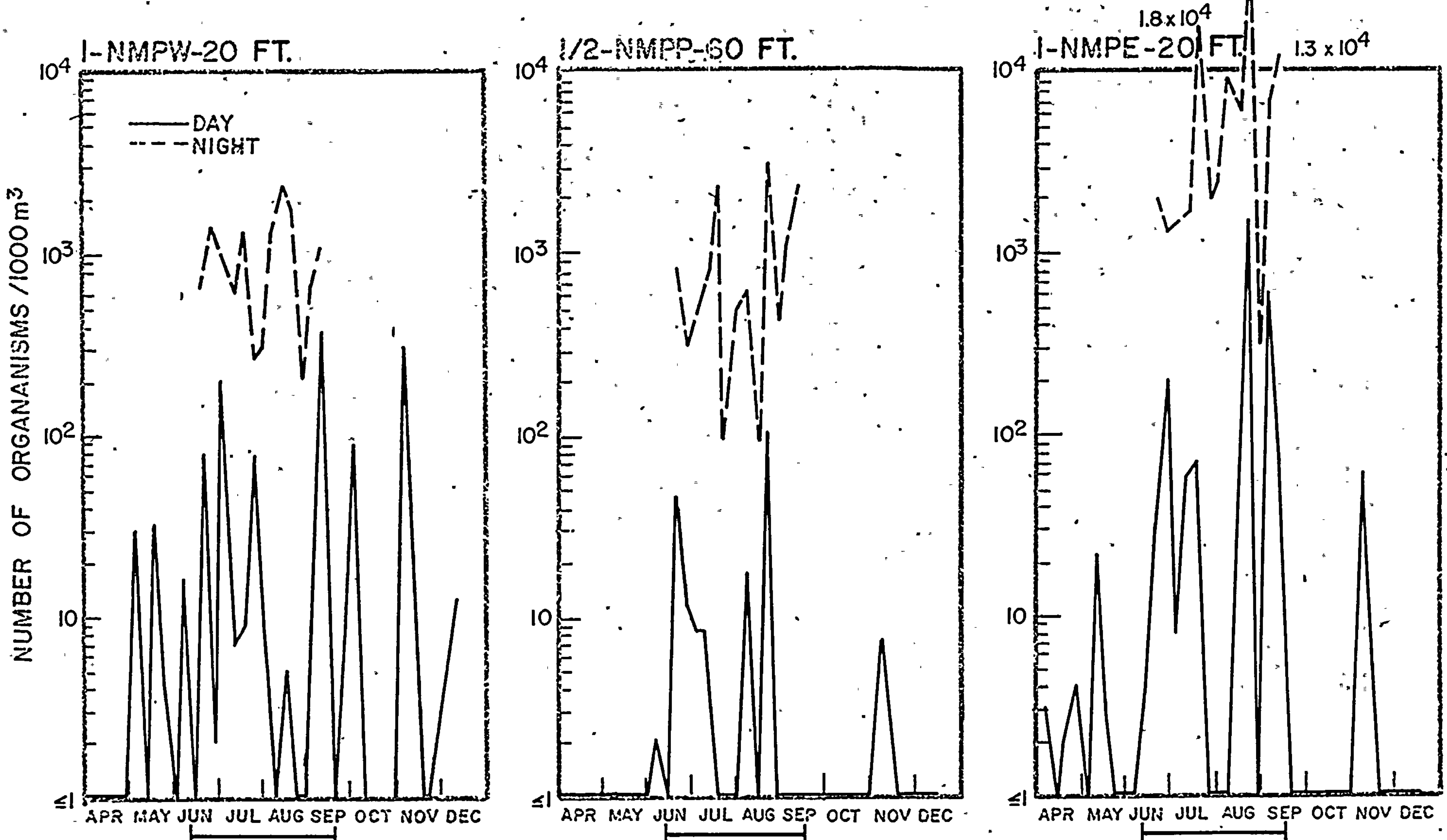


* Mean of surface, mid-depth, and bottom abundance.

|——| Period of night collections.

FIGURE VB-5

ABUNDANCE OF GAMMARUS FASCIATUS*
NINE MILE POINT, 1974



* Mean of surface, mid-depth, and bottom abundance.
|——| Period of night collections.

FIGURE VB-6

The factors causing the temporal variability of Gammarus abundance are unknown, but it is possible that advection events could have modified the vertical/diurnal distribution patterns of this amphipod, resulting in the observed, apparently erratic population fluctuations. Other factors, such as patchiness and avoidance of the plankton nets (Clutter and Anraku, 1968), could also have influenced Gammarus abundance estimates.

Gammarus was consistently observed in the night collections and in greater abundance than in the day collections for the same period; thus, data obtained from night collections conducted over the course of a year should provide a better estimate of seasonal patterns than the nine-month day collections.

- Diptera

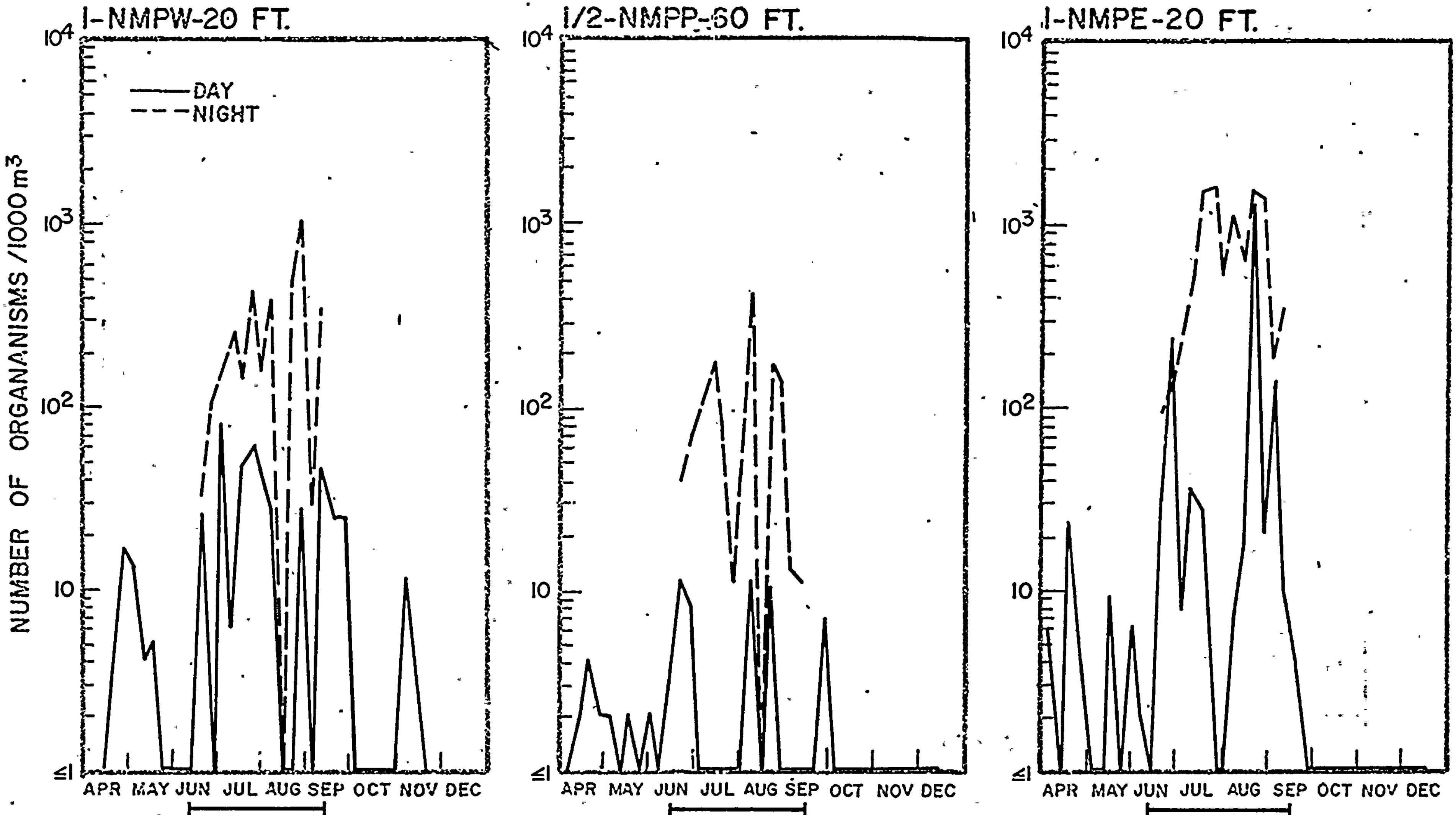
Dipteran larvae and pupae were collected in the first sample of the 1974 macrozooplankton program, with their concentrations generally increasing during mid-June to a maximum during July and August (Figure VB-7). Dipteran abundance decreased rapidly after the summer maximum and only a few were recorded during the fall months. Although dipteran concentrations fluctuated considerably among collecting dates during both 1973 (QLM, 1974) and 1974, the seasonal patterns of abundance were detectable and similar for both years.

(iii) Patterns of Abundance among Depths, Stations, and Times of Day

Four-way analyses of variance (ANOVA) were conducted to determine whether there were significant differences in abundance of Leptodora kindtii (Appendix V-13), Gammarus fasciatus (Appendix V-14), and Diptera (Appendix V-15) among dates, stations, sample depths, and times of day based on data collected from mid-June through mid-September, the period when samples were collected during both day and night. Significant differences in abundance among the main effects were identified using the Student-Newman-Keuls test.

The results of these analyses, which are summarized in Table VB-5, indicated that there were significant differences in the abundance of each of the three macrozooplankters among all main effects. For each of the macrozooplankters, the differences in abundance among collecting dates reflected the erratic fluctuations among dates and to a lesser extent, the seasonal patterns discussed previously. Each of the

ABUNDANCE OF DIPTERA*
NINE MILE POINT, 1974



* Mean of surface, mid-depth, and bottom abundance.
|——| Period of night collections.

FIGURE VB-7

TABLE VB-5

SUMMARY OF STATISTICAL ANALYSIS RESULTS:
SELECTED TAXA AND SELECTED FACTORS*

NINE MILE POINT VICINITY - 1974

TAXON	FACTOR	SIGNIFICANCE	RESULTS: STUDENT-NEWMAN-KEULS TEST LARGEST → SMALLEST
Leptodora kindtii	STA	Significant $\alpha < 0.001$	.5E 1E 1W .5W 3W 1W .5E .5W P P 3W 1E 3E 3E P 20 20 20 20 20 40 40 40 60 100 40 40 20 40 80 ($\alpha = 0.05$)
	DEP	Significant $\alpha < 0.0005$	B M S ($\alpha = 0.05$)
	DAT	Significant $\alpha < 0.0005$	Not conducted; represents seasonal pattern
	D/N	Significant $\alpha < 0.0005$	N D ($\alpha = 0.05$)
Gammarus fasciatus	STA	Significant $\alpha < 0.0005$	3E 1E .5E 1E 3E .5E .5W 3W P .5W 3W 1W 1W P P 20 20 20 40 40 40 20 20 60 40 40 40 20 80 100 ($\alpha = 0.05$)
	DEP	Significant $\alpha < 0.0005$	B M S ($\alpha = 0.05$)
	DAT	Significant $\alpha < 0.0005$	Not conducted; represents seasonal pattern
	D/N	Significant $\alpha < 0.0005$	N D ($\alpha = 0.05$)
Diptera	STA	Significant $\alpha < 0.0005$	3E 1E .5E .5W 3E 3W 1W 1E .5E 3W 1W .5W P P P 20 20 20 20 40 20 20 40 40 40 40 40 60 80 100 ($\alpha = 0.05$)
	DEP	Significant $\alpha < 0.0005$	M B S ($\alpha = 0.05$)
	DAT	Significant $\alpha < 0.0005$	Not conducted; represents seasonal pattern
	D/N	Significant $\alpha < 0.0005$	N D ($\alpha = 0.05$)

STA = Stations [Transect and depth contour (ft)]
DEP = Sample depths
DAT = Dates
D/N = Day/Night

.5E = 1/2-NMPE
1E = 1-NMPE
3E = 3-NMPE

.5W = 1/2-NMPW
1W = 1-NMPW
3W = 3-NMPW

P = NMPP

B = Bottom
M = Mid-depth
S = Surface

*All results are compiled in Appendix V-13 through V-15.

three macrozooplankters were also shown to be more abundant in night collections than in day samples and in the sub-surface layers of the water column than at the surface, which was due to diurnal migration. Photoperiod (day/night) vertical distribution (surface/mid-depth/bottom) patterns varied significantly with date, station, and each other (Appendix V-10 through V-14).

The differences in abundance of each of the three macrozooplankters among stations irrespective of sample depth, were also significant. The mean distribution patterns based on the Student-Newman-Keuls test are presented in a schematic format, in which each station is ranked according to mean abundance from the station with the smallest mean concentration, denoted by "1," to the station with the greatest mean concentration, denoted by "15" (Figure VB-8).

- Leptodora kindtii

The abundance of Leptodora generally decreased as the depth contour increased; however, this difference in mean abundance between depth contours was significant only at the 1-NMPE location. These cladocerans were generally more abundant to the west than to the east of the Nine Mile Point Nuclear Station; however, maximum concentrations occurred at the 20 ft depth contour of 1/2-NMPE and 1-NMPE. Mean abundance at these two stations was significantly greater than at the stations ranked 1 through 4.

- Gammarus fasciatus

The mean abundance of Gammarus also decreased as depth contour increased at all locations except 1-NMPW, which may reflect the influence of an upwelling. The differences in abundance between the 20 and 40 ft depth contours were statistically significant only at the three east transects (i.e., 1/2-NMPE, 1-NMPE, and 3-NMPE). This amphipod was generally more abundant to the east than to the west of the Nine Mile Point Nuclear Station, with mean concentrations at the 20 ft depth contour of all three east transects significantly greater than mean concentrations at all other stations.

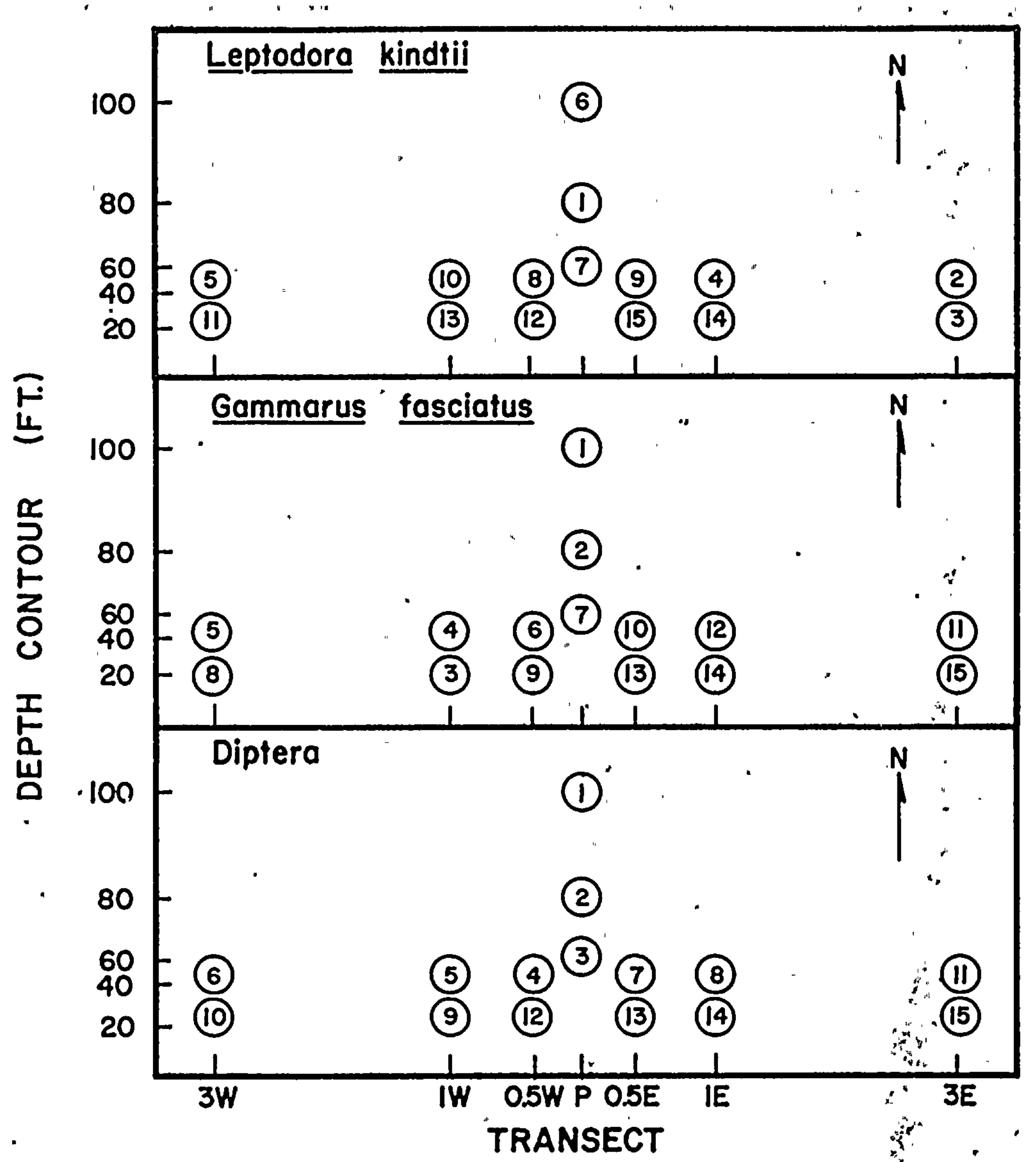
- Diptera

Mean concentrations of dipteran also decreased as depth contour increased at all locations. This depth distribution was statistically significant at 1/2-NMPW, 1-NMPE, and 3-NMPE location. Dipterans, like Gammarus, were generally collected

SCHEMATIC REPRESENTATION OF THE MEAN DISTRIBUTION PATTERNS OF SELECTED MACROZOOPLANKTERS*

NINE MILE POINT VICINITY, 1974

(LEAST : 1 THROUGH 15 : GREATEST)



* Based on the results of STUDENT-NEWMAN-KEULS tests

W = NMPW; P = NMPP; E = NMPE

in greater abundance east of Nine Mile Point Nuclear Station than west, and although the differences in mean abundance between adjacent stations were not significant, significant differences were observed among some stations. For example, mean dipteran concentrations were significantly greater at the 3-NMPE-20 ft station than at the three west locations on the 20 ft depth contour.

The west-to-east patterns of abundance for all taxa were complex and varied significantly among dates (Appendix V-13 through V-15). This could have been related either to water temperature distribution patterns, food availability, water current patterns, bottom substrate characteristics, or to the effects of entrainment at Nine Mile Point Nuclear Station Unit 1. It is not possible based on the present data to determine the separate or synergistic effects of these factors on the distribution of these members of the macrozooplankton community based on the present sampling program.

(iv) Interrelationships among Benthic and Planktonic Invertebrates

As noted in the previous annual report (QLM, 1974), a number of invertebrate taxa are common to both benthos and plankton collections. Since Gammarus fasciatus was relatively abundant in both benthic and planktonic samples, the seasonal patterns of its abundance in the two collections were compared to provide an indication of the overall occurrence of this species in the lake ecosystem. Comparisons of absolute abundance values were not possible because planktonic and benthic abundance were reported in different units.

Gammarus concentrations increased from April through August in both bottom plankton (QLM, 1975) and benthos collections (Table VI-26). Gammarus abundance decreased rapidly in the bottom plankton collections for the remainder of the year, whereas in the benthic collections, they decreased in abundance during October and then increased to their maximum observed concentrations during December. The difference in the seasonal pattern of abundance of this epibenthic species probably reflected a relationship between water temperature and diurnal migration. Specifically, it appears that the warm water in summer induced diurnal migration of the Gammarus population, whereas the cooling of the water during the fall appeared to limit their distribution to the bottom substrates and Cladophora beds.

Planktonic Gammarus tended to be more abundant to the east than to the west of Nine Mile Point Nuclear Station, but benthic Gammarus appeared to be evenly distributed from west to east in the Nine Mile Point vicinity.

Although the reason for the difference between the west/east distribution pattern for the planktonic and benthic populations of this species is not clear, it is hypothesized that water circulation patterns and/or the localized effects of the thermal plume may have resulted in the apparent concentration of planktonic Gammarus to the east of the Nine Mile Point Nuclear Station.

d. Conclusions

Leptodora kindtii was the most abundant macrozooplankter of those enumerated during the 1974 study. This organism was followed, in decreasing order of relative abundance, by Gammarus fasciatus, Hydroida, and Diptera. Pontoporeia affinis and Mysis oculata relicta were infrequently collected in the macrozooplankton samples.

The seasonal patterns of abundance for Leptodora kindtii, Gammarus fasciatus, and Diptera were similar during 1973 and 1974. No differences in Gammarus and dipteran concentrations were apparent between the two years; however, Leptodora concentrations were greater during 1973 than during 1974 and reached the annual maximum earlier in 1973 due apparently to the higher water temperatures during that year. Fluctuations in abundance among collecting dates, particularly common among Gammarus populations, were hypothesized to be correlated with upwellings.

The three macrozooplankton taxa (Leptodora, Gammarus, and Diptera) were significantly more abundant at night than during the day and in the deeper layers of the water column than at the surface in both day and night collections. A significant photoperiod x sample depth interaction indicated that the abundance of these organisms throughout the water column was a function of diel periodicity, such that a greater portion of the organisms were recorded from the night surface sample than the day surface sample; this is indicative of diurnal migration.

Concentrations of these organisms tended to decrease as depth contour increased. This depth contour distribution pattern was more pronounced for Gammarus and Diptera than for Leptodora during 1974.

The west to east patterns of distribution were complex and varied significantly among dates for the three taxa examined. There was however, a significant increase in abundance of Gammarus and a trend toward an increase in abundance of Diptera from west to east in the Nine Mile Point vicinity, and the opposite trend for Leptodora. Leptodora, however, was most abundant at the 20 ft depth contour at the two east locations within a mile of Nine Mile Point Nuclear Station. This pattern suggests that the thermal discharge from Nine Mile Point Nuclear Station Unit 1 may cause increases in the abundance of some macrozooplankters; however, other factors such as food availability, current distribution patterns, and bottom substrate characteristics could separately or together result in the observed west/east patterns.

Comparisons of the seasonal patterns of planktonic and benthic Gammarus populations revealed an inverse seasonal relationship which suggested that warm water during summer induced diurnal migration of this epibenthic population. Water circulation patterns and/or local thermal effects were hypothesized to be the primary factor influencing the spatial distribution of planktonic Gammarus populations, in particular, the greater abundance of this macrozooplankter to the east of Nine Mile Point Nuclear Station.

3. Ichthyoplankton and Fish Eggs

a. Introduction

Ichthyoplankton studies conducted in the vicinity of the Nine Mile Point Nuclear Station during 1973 established that:

Of the 18 species of fish larvae identified, alewives were the most abundant larvae. The johnny darter, carp, mottled sculpin, and white perch were the next most numerous larval species.

Fish larvae were collected from May through December, and were most abundant from June through September.

Alewife larvae in the yolk-sac stage were present from June through early August; however, the alewife length frequencies were multimodal, indicating the occurrence of several spawning periods in the Nine Mile Point area.

The abundance of alewife larvae and total fish larvae was significantly greater in the night collections at all depth contours.

The distribution of alewife and total fish larvae among stations in the Nine Mile Point area varied considerably over time, with differences in abundance between stations as large as 1000 larvae/1000m^3 on a collecting date; however, the differences in abundance over all stations and collecting dates were not significant at $\alpha = 0.05$.

b. Materials and Methods

The sampling program and laboratory methods for the analysis of ichthyoplankton and fish eggs during 1974 were reported in Section V.B.2.b.

c. Results and Discussion

(i) Community Composition

A species inventory of fish eggs and ichthyoplankton collected during 1974 is presented in Table VB-6; a total of 17 species, representing ten families, were identified. The 1974 species inventory contains three additional species of fish larvae not observed in a similar sampling program conducted at the same locations in 1973 (QLM, 1974); however, the 1973 ichthyoplankton species inventory reported six species not collected in 1974. Concentrations of four of the six species collected in 1973 and not in 1974 (spottail shiner, emerald shiner, log perch, threespine stickleback) ranged from 4 to 12 larvae per 1000 m^3. In 1974, larvae of the smallmouth bass were collected on one date only (12-13 July) at a concentration of 6 larvae per 1000 m^3; the trout-perch, collected on two dates, had an average concentration of 6 larvae per 1000 m^3. The other larvae collected in 1974 were present in greater abundance over a more extended period of time.

In general, the apparent difference in species composition between the two years was probably the result of the presence in the study area of small numbers of individuals and species, so that the weekly sampling did not necessarily yield a complete representative collection. Moreover, Williams et al. (1975), discussing the data contained in this report, indicated that the area encompassed by the larval survey does not contain desirable spawning sites and areas for larval development, because of the predominantly bedrock/rubble substrate intermittent with shifting sandy patches, the lack of extensive *Cladophora* beds, and the buffeting of the near-shore zone by waves caused by the dominant north and west winds.

TABLE VB-6

SPECIES INVENTORY
ICHTHYOPLANKTON SURVEY

NINE MILE POINT - 1974

FAMILY	COMMON NAME	SCIENTIFIC NAME
Centrarchidae	Pumpkinseed	Lepomis gibbosus
	Smallmouth bass*	Micropterus dolomieui
Clupeidae	Alewife	Alosa pseudoharengus
	Gizzard shad+	Dorosoma cepedianum
Cottidae	Mottled sculpin	Cottus bairdi
Cyprinidae	Carp	Cyprinus carpio
	Common shiner	Notropis cornutus
	Goldfish	Carassius auratus
	UID shiner	Notropis sp.
Gadidae	Burbot	Lota lota
Osmeridae	Rainbow smelt	Osmerus mordax
Percichthyidae	White perch	Morone americana
Percidae	Johnny darter	Etheostoma nigrum
	Yellow perch	Perca flavescens
	Walleye+	Stizostedion vitreum
Percopsidae	Trout-perch*	Perocopsis omiscomaycus
Salmonidae	Cisco/Lake herring*	Coregonus sp.

* Larval species not reported from 1973 sampling program.
\+ Identified from eggs.

(ii) Seasonal Patterns

Spawning time and development of eggs and larvae are dependent on the interrelationship of abiotic and biotic factors. Among the abiotic factors, water temperature is of primary importance to spawning, whereas food availability is a major biotic factor. The differences in environmental requirements of each species generally minimize developmental competition for food and space while maximizing the chances of survival for each population (Ruttner, 1963).

Fish eggs were collected in the vicinity of Nine Mile Point from 12 April through 11 September 1974 (Table VB-7); in 1973, fish eggs were collected from 1 May, the date of the initiation of the 1973 sampling program, through 12 September. During the earliest period of egg abundance (25 April through 23 May), collections consisted primarily of rainbow smelt eggs. Eggs of the white perch were collected only during the last weeks of May and the first week of June. The eggs of three species, the walleye, gizzard shad, and common shiner were collected in very low concentrations. The combination of the low egg abundance of these three species in the macrozooplankton collection and the high egg mortality during development would make the collection of these larvae unlikely with the present sampling program frequency.

Alewife eggs were dominant in samples collected from 19 June through 21 August (Table VB-7). Peak concentrations of these eggs occurred during the middle of July, following very closely the estimated period of alewife spawning predicted by coefficient of maturity measurements (Figure VII-2). Alewife egg abundance declined rapidly after the middle of July.

Table VB-8 presents the occurrence of larval fish species in the Nine Mile Point vicinity by sampling date. In order to indicate relative proportions of each species within the total populations sampled, the table is keyed to denote species whose representation in the total ichthyoplankton population per date was less than 10%, and other species that composed 10% or more of the total fish larvae collected per date.

The first field sampling efforts, which commenced on 3 April, yielded larvae of the burbot and herring (Coregonus sp.). Both species are oligothermal and prefer cold water, which accounts for their appearance in the early spring samples when the lake water temperature ranged from 0.5 to 4.5°C (32.9 - 40.1°F) (Figure VA-2). The burbot reportedly migrates to shallow water under the winter ice to spawn (Scott and Crossman, 1973).

TABLE VB-7

AVERAGE FISH EGG ABUNDANCE*

NINE MILE POINT - 1974

FISH SPECIES

Sampling Date	Rainbow Smelt	White Perch	Alewife	Walleye	Gizzard Shad	Common Shiner	UID eggs
12 APR 74							3
25 APR 74	7						24
2 MAY 74	3						1
10 MAY 74	11						1
22-23 MAY 74	22	6					1
5 JUN 74		42					
12 JUN 74							16
19-20 JUN 74			23	1	1		8
26-27 JUN 74			369			1	9
2 JUL 74			349				6
10 JUL 74			73				3
12-13 JUL 74			3985		1		38
17 JUL 74			2148		1		48
24-25 JUL 74			105				14
31 JUL/1 AUG 74			29				1
7- 8 AUG 74			7				1
14-15 AUG 74			1				
21 AUG 74			1				
11 SEP							1

UID eggs = Unidentified eggs
* (no eggs/1000 m^3)

TABLE VB-8

FISH LARVAE SPECIES OCCURRENCE

NINE MILE POINT - 1974

DATE	ALEWIFE	BURBOT	CARP	COMMON SHINER	COREGONUS SP.	GOLDFISH	JOHNNY DARTER	MOTTLED SCULPIN	NOTROPIS SP.	PUMPKINSEED	RAINBOW SMELT	SMALLMOUTH BASS	TROUT PERCH	WHITE PERCH	YELLOW PERCH
3 APR		*			*										
12 APR		*			*										
17 APR		*			*										
25 APR		*													
2 MAY		*													
10 MAY											*				*
14 MAY											*				*
22-23 MAY											*			*	
30 MAY											*				
5 JUN											*			X	X
12 JUN											*			*	X
19 JUN†			X				X	*			*			X	
26-27 JUN†	*			X		X	*	*	X	X	X			X	
2 JUL	*		X				X	X		X	X			X	
10 JUL	*						X							X	
12-13 JUL	X		X				*	X			X	X	X	X	
17-18 JUL†	*		*	X			*	X			X		X	X	X
24-25 JUL†	*		X				X				X				
31 JUL-1 AUG†	*		X				X	X		X	X			X	
7- 8 AUG†	*						X	X			X			X	
14-16 AUG†	*		X				X	X			X			X	
21-22 AUG†	*		X				*	X			X			X	
28-29 AUG†	*						X				X			X	
5- 6 SEP†	*						*	X			*			X	
11-12 SEP†	X						*	X			X				
19 SEP	*														
27 SEP															
4- 5 OCT															
9,11 OCT															
17 OCT															
24 OCT															
30 OCT															
8 NOV															
19 NOV															
23 NOV															
13 DEC															

† Day and night collections combined

X Indicates presence at < 10% of total larvae for that date

* Indicates presence at ≥ 10% of total larvae for that date

Larvae hatch from eggs during late winter/early spring and emigrate from the shore zone as they mature and as the shallow waters warm. Upon maturation, coregonid larvae follow an offshore migration pattern similar to that of burbot larvae; however, the adults spawn in the fall and the eggs gradually develop through the winter months (Braum, 1966; Scott and Crossman, 1973). The early spring hatching of both of these species in the shallow waters coincides with the start of the spring spawning run of the rainbow smelt; when viewed in conjunction with the results of stomach content analysis of adult smelt, this suggest that both species are preferred food items for smelt at that time (Scott and Crossman, 1973).

A second group of fish larvae consisting of rainbow smelt, yellow perch, and white perch dominated the mid-spring larval collections (Table VB-8). Water temperature during this period (10 May-20 June) ranged from 5.0° to 10.9°C (41-51.6°F) (Figure VA-3). Larvae of the rainbow smelt and white perch were collected throughout the period from mid-spring through early fall, although abundance levels declined during the summer months. Yellow perch larvae were collected primarily during the mid-spring period.

Rainbow smelt and yellow perch larvae were first collected on approximately the same date during 1973 and 1974; however the duration of time over which they were collected varied between years. Water temperatures when larval presence was noted in 1973 averaged approximately 5°C (9.0°F) warmer than during 1974; however, during the early spring spawning period, water temperatures between years were comparable. White perch were not collected in 1973 until 14 June (QLM, 1974). It should be noted, however, that the observations between years especially for white perch and yellow perch are based on low abundance values.

The third larval group collected in the Nine Mile Point vicinity included late spring/early summer spawning species, dominated by the alewife and, to a lesser degree, by the benthic johnny darter (Table VB-8). Landlocked populations of alewife migrate inshore to spawn, beginning in April (Graham, 1956; Scott and Crossman, 1973). Water temperature reported for Chesapeake Bay alewife migrations ranged from 13.0 to 22.0°C (Mansueti and Hardy, 1967); and Nordon (1967) found developing alewife eggs and larvae in Lake Michigan when the water temperature ranged from 17.5 to 21.1°C. In Lake Ontario, the larvae remain in the spawning area throughout the summer months. Alewife larvae were collected at an earlier date during 1973

(14 June) than during 1974 (26 June), and it is hypothesized that the warmer water temperatures recorded during 1973 (Figure VA-3) resulted in the earlier spawning period, and subsequently in earlier larval development. The johnny darter and mottled sculpin, which were also dominant in the summer collections, exhibited similar trends in abundance between 1973 (QLM, 1974) and 1974, i.e., they were present throughout the summer months.

Fish larvae were collected further into the fall in 1973 (QLM, 1974) compared to 1974. The more extended use of the shore zone by larvae in 1973 compared to 1974 was influenced by the warmer water temperatures throughout the year in 1973 and the more gradual fall cooling. This does not imply, however, that larvae will remain in the near-shore zone later in to the fall under the influence of the thermal plume, since off-shore migration is a consequence of completion of larval development.

(iii) Diel and Distributional Patterns Evaluated by Analysis of Variance

Feeding and spawning migration patterns of adult pelagic fish have been shown to be related both directly and indirectly to light intensity (Spencer, 1939; Carlander and Cleary, 1949; Scott and Crossman, 1973). The distribution patterns associated with changes in light intensity have also been observed for ichthyoplankton populations (Braum, 1966; QLM, 1973). Substrate type and water depth preference for spawning of adults, and the protective behavior of adults are additional factors contributing to distributional patterns of individual species of ichthyoplankton.

Statistical analyses conducted on the 1973 ichthyoplankton collections to determine diel and interstation differences for total and alewife larval abundances in the vicinity of Nine Mile Point (QLM, 1974) showed the following:

Significantly greater numbers of larvae per volume of water sampled were collected in night tows compared to corresponding day tows at all stations tested, and

no significant differences were noted among stations along the same depth contour; however, a high level of variability was observed between the shallower (20 ft) and the deeper (40 ft) stations at the same radius.

During 1974, total fish egg abundance and alewife and rainbow smelt larval concentrations were tested for significant differences among stations, sample depths, and dates using a three-way analysis of variance (ANOVA) (Appendix VB-16). During the period of 19 June through 11 September, when night samples were collected in conjunction with day samples, diel egg and larval abundance were tested using a four-way ANOVA (Appendix VB-17).

(a) Eggs

Fish egg abundance was significantly greater in both the bottom samples and in the night collections, with the peak observed during the middle of July (Appendix VB-17). The reproductive cycle of the alewife, as determined during 1974 (Figure VII-2), suggested a good correlation between the calculated time of spawning and observed egg abundance in the vicinity of Nine Mile Point. Water temperature during the time of peak egg abundance ranged from 18° to 21°C (64.4-69.8°F) (Figure VA-3). The species of ichthyoplankton which dominated the larval collections (i.e., alewife, rainbow smelt, mottled sculpin, and johnny darter) were also represented in the egg collections. The greatest concentrations of eggs in the bottom samples were attributed to the demersal or attached type of eggs common to these species (Scott and Crossman, 1973).

By location, the abundance of eggs was generally greatest at the shallow 20 ft stations and decreased with depth contour. The small number of eggs collected at the 20 and 40 ft depth contours of the NMPE-3 location undoubtedly reflected the higher percentage lof sand and silt in this area compared to the other sampling locations (Section VI-A.3.a.). A fine grained substrate would not be favorable for the attached eggs of the johnny darter, and silt deposition caused by the shifting currents would subject the demersal eggs of the alewife and rainbow smelt to anoxia.

(b) Rainbow Smelt

Adult rainbow smelt migrate in the spring from open water to spawn in the shore zone (Wells, 1968; Scott and Crossman, 1973); spawning occurred during April 1974 in the Nine Mile Point vicinity (Figure VII-5). During the summer, the developing larvae are distributed throughout the near-shore zone by water circulation patterns and the young gradually migrate from the near-shore areas to the deeper water. Rainbow smelt larvae were in greatest abundance in mid-June with peak concentrations continuing through mid-July (Appendix VB-17). There-

after, larval abundance gradually declined through the summer months.

A comparison of rainbow smelt larval abundance between day and night collections revealed that significantly more larvae were sampled in night tows (Appendix VB-17). Scott and Crossman (1973) report that rainbow smelt are negatively phototactic, and their greater night abundance substantiates this fact. The difference observed between day and night abundance was more pronounced in late spring, suggesting that diel patterns became progressively more established as the larvae matured.

During the 10 May through 2 July period (day samples collected only), mid-depth tows yielded a significantly greater abundance ($\alpha = 0.05$) of rainbow smelt larvae in comparison to surface and bottom tows. However, during the period of day-night samples (19 June through 11 September), no significant ($\alpha \leq 0.05$) depth preference was observed, although there was a significant ($\alpha = 0.10$) sample depth x photoperiod interaction.

In general, the 20 ft depth contour stations showed the greatest abundance of rainbow smelt larvae during June, with the average larval abundance decreasing with depth contour. During July there was a tendency for an increased larval abundance at the 40 ft depth contour and the corresponding collection of more mature larvae at that depth.

(c) Alewife

Alewife larvae were present in peak abundance in the Nine Mile Point vicinity during early August, after which their numbers declined rapidly; this abrupt reduction is hypothesized to correspond to the emigration of the larvae from the shore zone. In general, the greatest concentration of alewife larvae was recorded from the shallower near-shore stations (e.g., 20 ft contour). As the larvae matured, a movement to deeper water was observed. The 20 and 40 ft stations of the 1/2-NMPW radius exhibited the lowest abundance of alewife larvae, a distribution feature related to the low abundance of adult alewives west of the Nine Mile Point Nuclear Station (Table VII-5 and Appendix VII-5) and the dominant west to east longshore current.

A significantly greater number ($\alpha = 0.0005$) of alewife larvae per 1000 m^3 were collected in night samples than from the

corresponding day samples. This suggests a more active larval population during night hours and may, in turn, be related to the nightly vertical migration of planktonic organisms (Section VA.3, V.B.1c, and VB.2c) which are utilized by the alewife larvae as food. Surface tows yielded greater concentrations of alewife larvae than mid-depth or bottom tows. Other fish larvae populations did not exist in great enough concentrations or over a sufficiently extended period of time to permit statistically meaningful evaluations to be conducted.

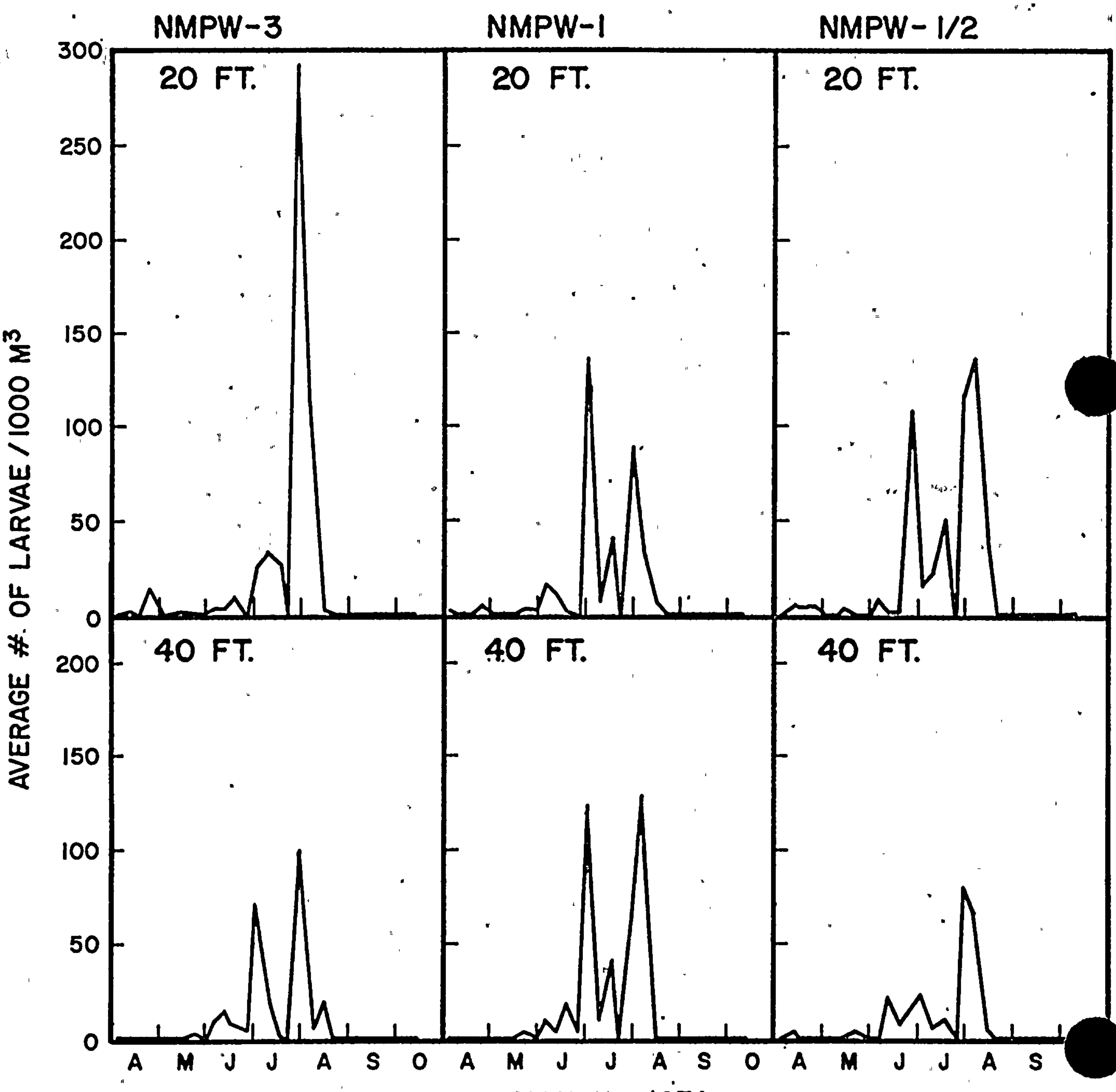
(iv) Distributional Patterns by Station

The average abundance for total larvae collected at each station is graphically presented in Figures VB-9 through VB-13. Values for night collections are presented separately from those of day collections since nighttime collections were conducted only during periods of peak larval abundance.

Larval concentration in April, reflecting the presence of burbot and Coregonus sp., was the lowest recorded during 1974, with larvae observed primarily at the 20 and 40 ft stations. Abundance during May and early June was low, and highest values for this period were recorded at the stations east of Nine Mile Point Nuclear Station, especially at the NMPE-1/2 mile station.

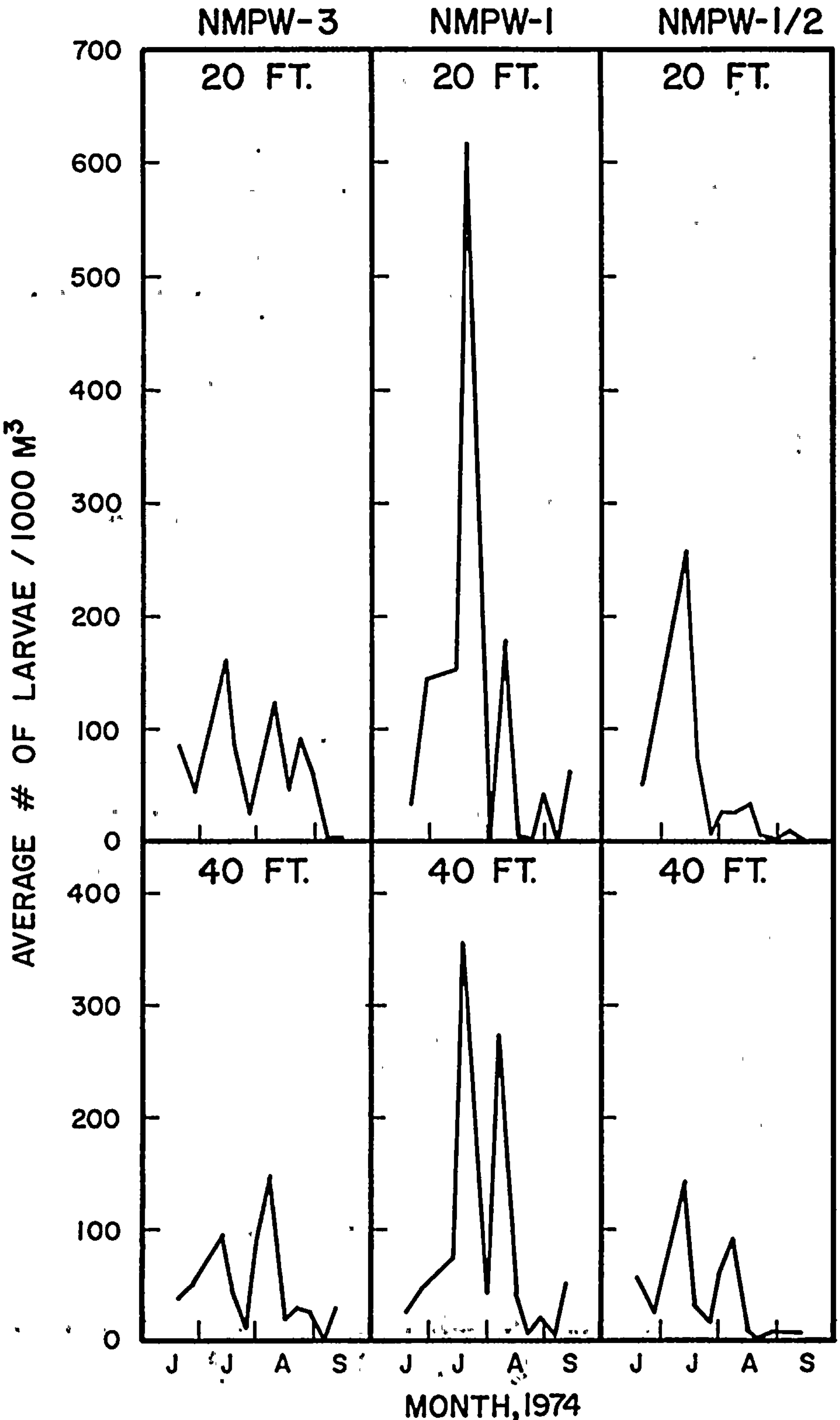
Two distinct peaks in yearly abundance were observed in the study area and were attributed to the large numbers of alewife larvae; one peak occurred during mid-July and the second in the beginning of August. Samples collected during late July yielded very few larvae over all stations sampled. A decrease in larval abundance during this period was noted for both day and night collections. This same pattern in abundance (i.e., two periods of peak abundance separated by a period of low abundance) was also observed during 1973 at approximately the same time (QLM, 1974). The two periods of greater abundance were possibly the result of two separate spawning groups within the population or for those individuals which had spawned earlier. The length frequency analyses (Chapter VB.3.c5) suggested that two groups of larvae, one from adults spawning during early spring and one from the peak spawning period during mid-July, were present in the Nine Mile Point vicinity. An additional explanation for the larval abundance pattern in the vicinity of Nine Mile Point is the fluctuation in water temperature (Figure VA-3); and in particular the cooler waters during the second half of July in both 1973 and 1974. These abrupt temperature changes may be correlated with upwellings which would cause

ABUNDANCE OF TOTAL LARVAE PER STATION
WEST TRANSECT - DAY SAMPLES*
NINE MILE POINT, 1974



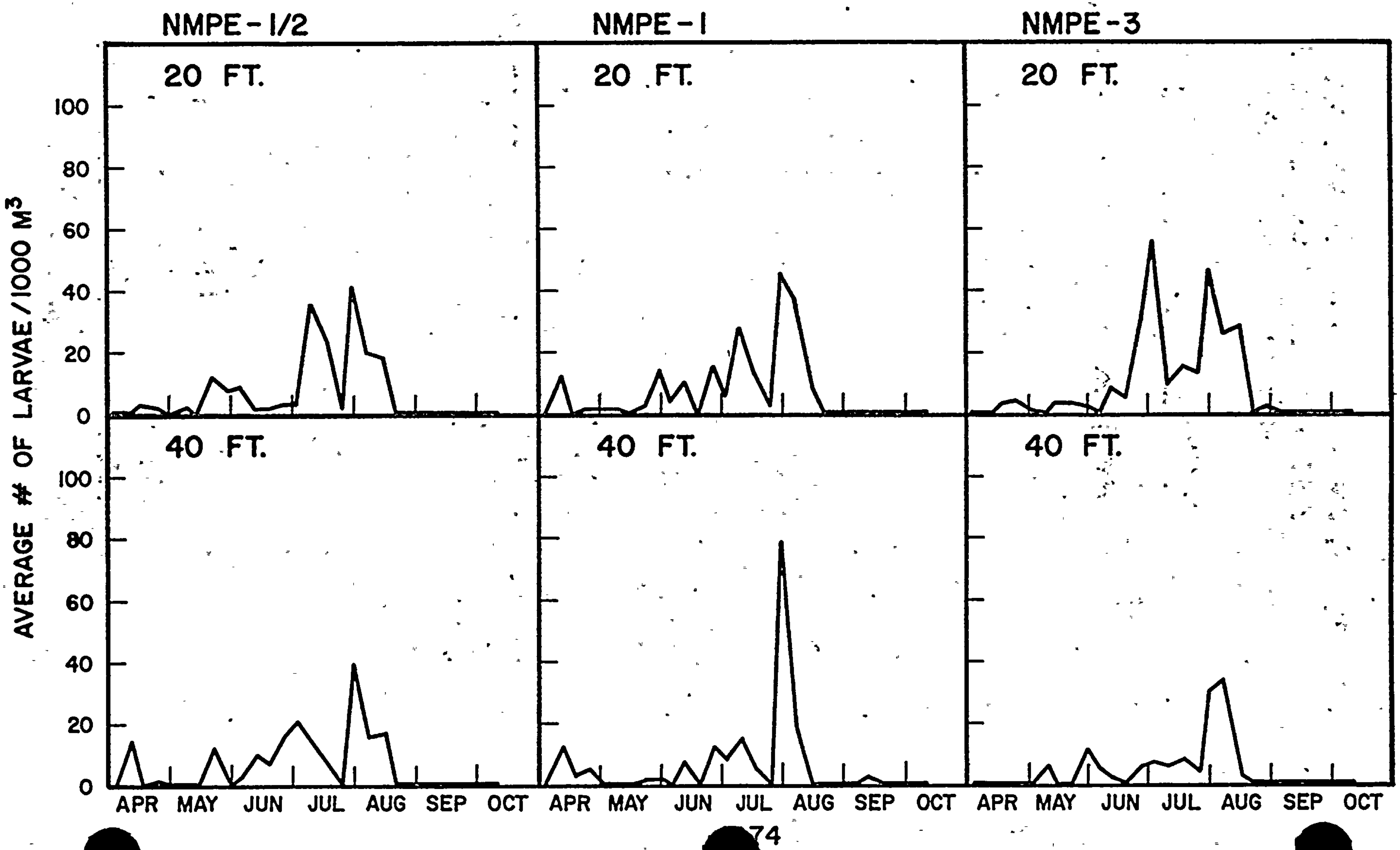
*Mean of surface, mid, and bottom.

ABUNDANCE OF TOTAL LARVAE PER STATION
WEST TRANSECT-NIGHT SAMPLES*
NINE MILE POINT, 1974



*Mean of surface, mid, and bottom.

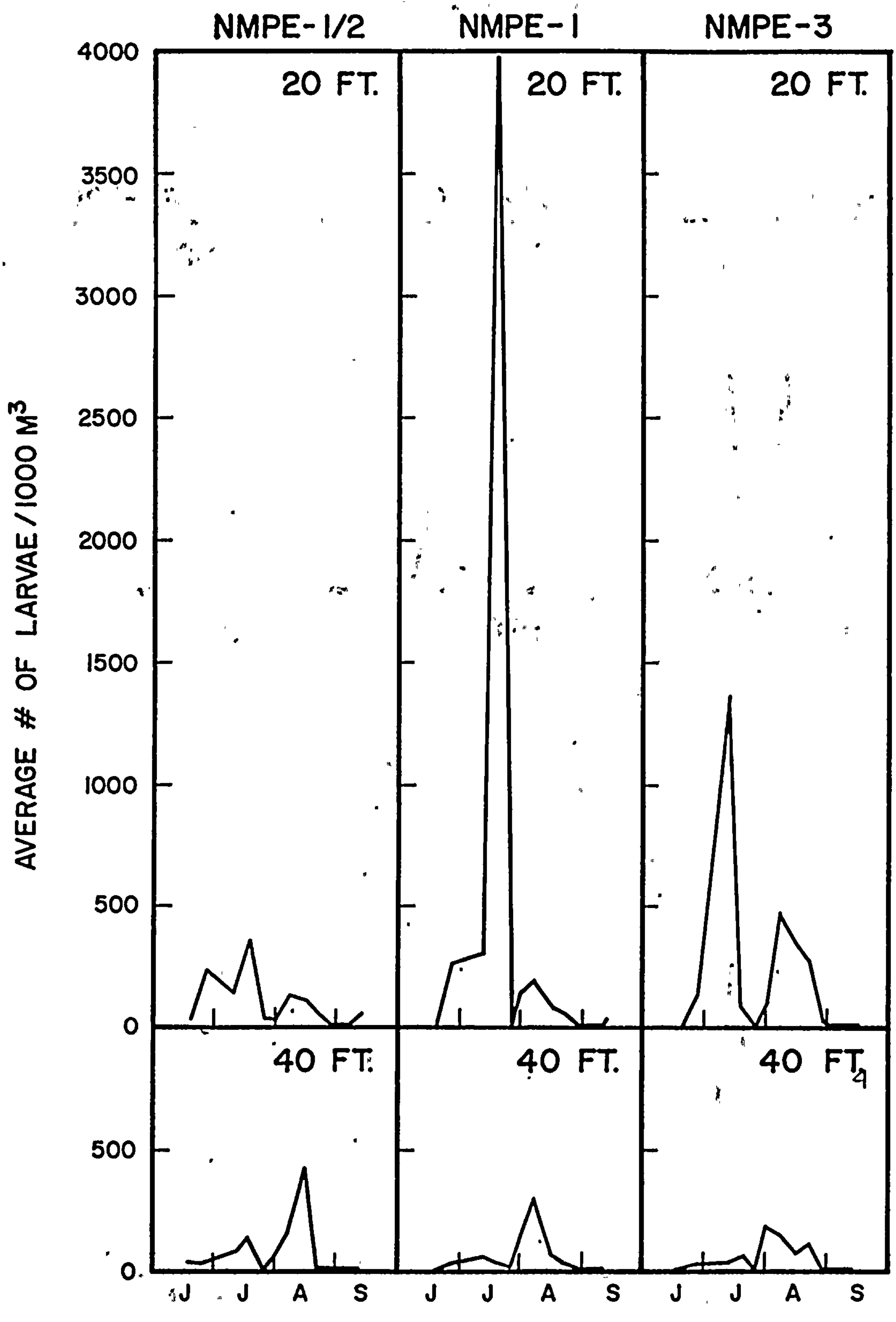
ABUNDANCE OF TOTAL LARVAE PER STATION
EAST TRANSECT - DAY SAMPLES*
NINE MILE POINT, 1974



*Mean of surface, mid, and bottom

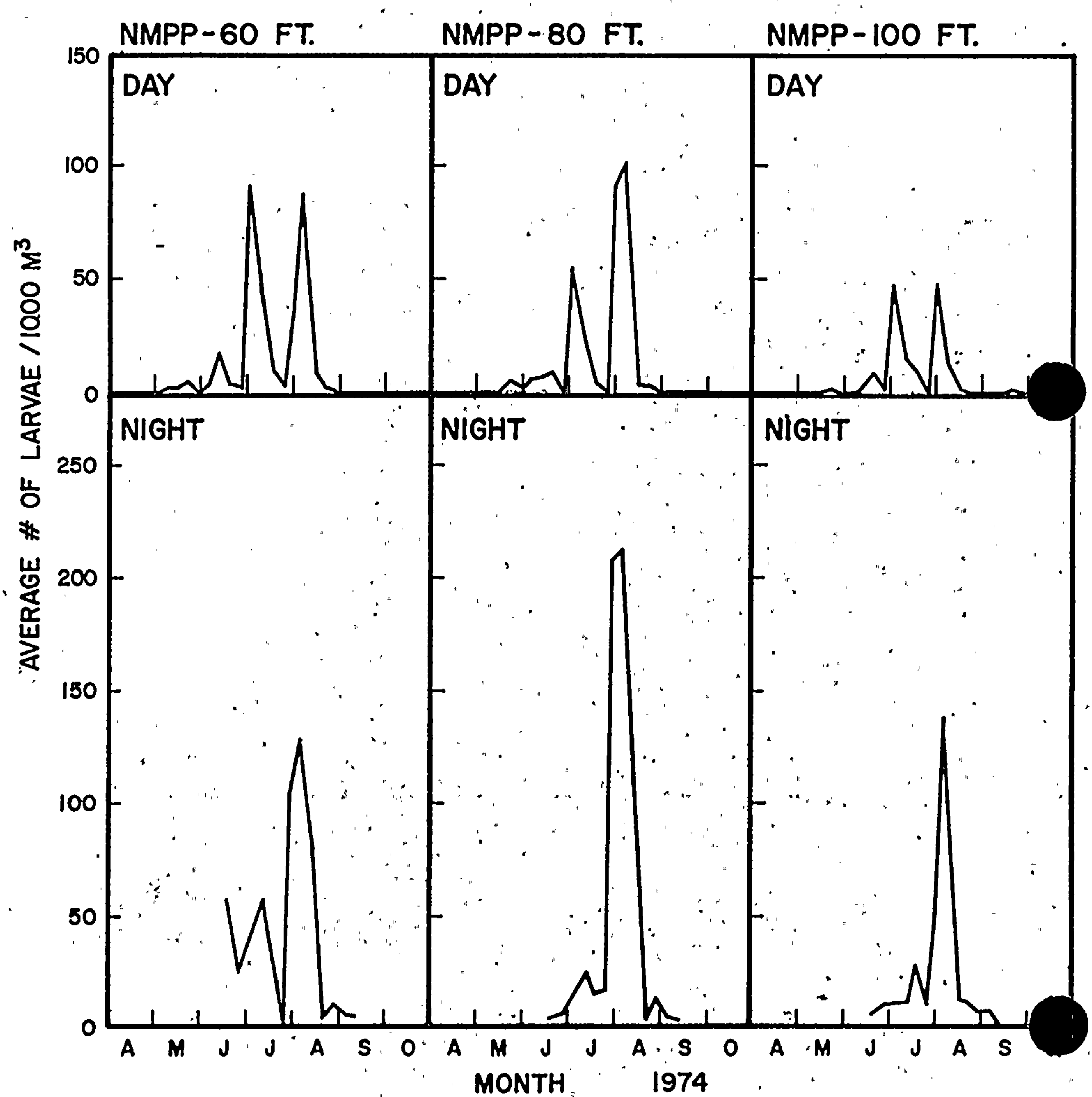
FIGURE VB-11

ABUNDANCE OF TOTAL LARVAE PER STATION
EAST TRANSECT–NIGHT SAMPLES*
NINE MILE POINT, 1974



*Mean of surface, mid, and bottom

ABUNDANCE OF TOTAL LARVAE PER STATION
PLANT TRANSECT SAMPLES*
NINE MILE POINT, 1974



* Mean of surface, mid, and bottom

lower larval abundance near shore as a consequence of mortality related to the temperature differential or passive movement of larvae offshore.

In general, the mid-July abundance peak was more pronounced in the night samples and the August peak more pronounced in daytime samples, except at the deeper stations along the plant transect where the August peak was of approximately the same magnitude for both day and night collections.

Larvae were not collected in the samples in the Nine Mile Point vicinity beyond the middle of September. Their absence was probably the result of their emigration as young-of-the-year from the near-shore area to the open water zone or to the avoidance of the sampling gear by the more mature larvae.

(v) Length Frequency

Measurements of fish larvae length and analyses of patterns of temporal distribution are useful in assessing growth rate characteristics and population development. Four species of fish larvae (rainbow smelt, mottled sculpin, johnny darter, and alewife) were collected from the lake stations in sufficient quantity over an extended period of time to permit evaluation of larval growth and development. The number of larvae enumerated for each length interval (mm) by collection date is presented in Tables VB-9 through VB-12 for the four species.

Rainbow smelt larvae were first collected in the vicinity of Nine Mile Point on 10 May, and were continuously present in the samples through the middle of July (Table VB-9). Larvae are approximately 5 mm long at hatching (Scott and Crossman, 1973), and the continued collection of larvae in this size range through the middle of June suggests that adults of the rainbow smelt spawn over a prolonged period in the study area. The recruitment of a few hatching size larvae in collections as late as 7 August is further evidence of the extended nature of rainbow smelt spawning. Larvae were observed to grow at a fairly rapid rate; the weighted mean total length of the larvae collected increased from 5.6 mm on 10 May to 16.7 mm on 17 July.

The total number of mottled sculpin larvae collected was small, concentrated mostly in the period between 19 June, the first date that they were collected, and 17 July. During this period of greatest larval concentration, the average length of the larvae collected doubled (Table VB-10), with

TABLE V[illegible]-9

LENGTH FREQUENCY DISTRIBUTION BY DATE
FOR RAINBOW SMELT LARVAE

NINE MILE POINT - 1974

LENGTH (mm)	10 MAY	15 MAY	22 MAY	30 MAY	5 JUN	12 JUN	19 JUN	26 JUN	2 JUL	10 JUL	17 JUL	24 JUL	31 JUL	7 AUG	14 JUL	21 JUL	28 AUG	5- 6 SEP	11-12 SEP	19 SEP	27 SEP
1.1- 2.0																					
2.1- 3.0							1							1							
3.1- 4.0				1	1	2	1														
4.1- 5.0	3		12	7	6	1	4	1													
5.1- 6.0	4	2	21	11	11	3	5							1							
6.1- 7.0		2		8	12	10	19				1										
7.1- 8.0			1		5	26	20	2			1										
8.1- 9.0					1	12	14	9			3										
9.1-10.0				1	1	5	17	7			8			1							
10.1-11.0							8	6			2			1							
11.1-12.0							10	8			1			1		2					
12.1-13.0							5	7			1			1							
13.1-14.0							4	6		1						1					
14.1-15.0							4	5		6	2			1		2					
15.1-16.0								3		1	3			2		1					
16.1-17.0						1		2	1	5	4										
17.1-18.0							1	1		5	5			2							
18.1-19.0										3	5			2							
19.1-20.0									1	4	3					1					
20.1-21.0										3	3		NO LARVAE		NO LARVAE (ONLY JUVENILES)		NO LARVAE		NO LARVAE	NO LARVAE	NO LARVAE
21.1-22.0										4	2			1		1					
22.1-23.0										1		1		3		1					
23.1-24.0											2										
24.1-25.0											2			1							
25.1-26.0												1									
26.1-27.0										1	1			2							
27.1-28.0														2							
28.1-29.0											1					1		1			
29.1-30.0														1							
30.1-31.0																					
31.1-32.0																					
32.1-33.0											1										
33.1-34.0																					
34.1-35.0																					
TOTAL LARVAE	7	4	34	28	37	60	113	57	2	34	51	2	-	23	-	10	-	1	-	-	-
[illegible]EANS	5.6	6.5	5.7	6.1	6.6	8.1	9.3	12.[illegible]	[illegible]5	18.6	16.7	24.5	-	18.8	-	17.8	-	30.0	[illegible]	-	-

TABLE VB-10

LENGTH FREQUENCY DISTRIBUTION BY DATE
FOR MOTTLED SCULPIN LARVAE

NINE MILE POINT - 1974

LENGTH (mm)	19 JUN	26 JUN	2 JUL	10-12 JUL	17 JUL	24 JUL	31 JUL	7 AUG	14 AUG	21 AUG	28 AUG	5-6 SEP	11-12 SEP	19 SEP	27 SEP
1.1- 2.0															
2.1- 3.0															
3.1- 4.0							1								
4.1- 5.0															
5.1- 6.0		2		1											
6.1- 7.0	15	7		1											
7.1- 8.0	48	22	1	1			1			1					
8.1- 9.0	83	70		1											
9.1-10.0	14	54	1	4					2						
10.1-11.0		6		7	1										
11.1-12.0		1		4	9				1						
12.1-13.0				1	5								1		
13.1-14.0				3	1								1		
14.1-15.0		1		3	5		1								
15.1-16.0				1	8										
16.1-17.0				1	1										
17.1-18.0					7										
18.1-19.0				1	16										
19.1-20.0					7										
20.1-21.0						NO LARVAE		NO LARVAE			NO LARVAE	NO LARVAE		NO LARVAE	NO LARVAE
21.1-22.0															
22.1-23.0					1										
23.1-24.0															
24.1-25.0															
25.1-26.0															
26.1-27.0															
27.1-28.0															
28.1-29.0															
29.1-30.0													1		
30.1-31.0															
31.1-32.0															
32.1-33.0															
33.1-34.0															
34.1-35.0															
TOTAL LARVAE	160	163	2	29	61	0	3	0	3	1	0	0	3	0	0
MEANS	8.6	9.2	9.0	12.0	16.6	–	9.0	–	10.7	8.0	–	–	19.0	–	–

TABLE VB-11

LENGTH FREQUENCY DISTRIBUTION BY DATE
FOR JOHNNY DARTER LARVAE

NINE MILE POINT - 1974

LENGTH (mm)	19 JUN	26 JUN	2 JUL	10-12 JUL	17 JUL	24 JUL	31 JUL	7 AUG	14 AUG	21 AUG	28 AUG	5-6 SEP	11-12 SEP	19 SEP	27 SEP
1.1- 2.0															
2.1- 3.0		3		15											
3.1- 4.0	1	9		63	2										
4.1- 5.0	1	93		111	68	3									
5.1- 6.0	6	233	3	415	138	4									
6.1- 7.0		36	1	72	35	2	1								
7.1- 8.0		3		5	16		1								
8.1- 9.0				3	6										
9.1-10.0				6	10	1									
10.1-11.0				2	17					1					
11.1-12.0				2	8					3					
12.1-13.0					8					3	1				
13.1-14.0					2			1		2					
14.1-15.0					6			1		2			2		
15.1-16.0					4			3					2		
16.1-17.0					3	1		2		2			5		
17.1-18.0					10			5		2			6		
18.1-19.0					4			1		3			8		
19.1-20.0					8			2		5			14		
20.1-21.0					1					2		NO LARVAE	7	NO LARVAE	NO LARVAE
21.1-22.0													6		
22.1-23.0					2				1	4			10		
23.1-24.0										1			6		
24.1-25.0													2		
25.1-26.0										1			4		
26.1-27.0								1							
27.1-28.0													1		
28.1-29.0					1								1		
29.1-30.0													1		
30.1-31.0															
31.1-32.0															
32.1-33.0															
33.1-34.0															
34.1-35.0															
TOTAL LARVAE	8	377	4	696	349	11	2	16	1	31	1	0	75	0	0
MEANS	5.6	5.8	6.3	5.8	8.1	7.3	7.5	17.9	23.0	17.9	13.0	-	21.1	-	-

TABLE VB-12

LENGTH FREQUENCY DISTRIBUTION BY DATE
FOR ALEWIFE LARVAE

NINE MILE POINT - 1974

LENGTH (mm)	26 JUN	17 JUL	24-25 JUL	31JUL-1AUG	7- 8 AUG	14-16 AUG	21-22 AUG	28-29 AUG	5- 6 SEP	11-12 SEP	19-27 SEP
0.1- 1.0	8	2									
1.1- 2.0	6	27	2								
2.1- 3.0	10	47	19	39	1						
3.1- 4.0	26	100	170	73	10						
4.1- 5.0	21	79	79	241	44	2					
5.1- 6.0	8	24	22	359	138	14					
6.1- 7.0		11	9	252	164	46					
7.1- 8.0		9	5	175	168	31	5				
8.1- 9.0		28	3	136	279	54	8				
9.1-10.0		19	4	126	318	81	14	1	1		
10.1-11.0		10		46	173	70	23	2			
11.1-12.0		8	8	69	288	48	56	2			
12.1-13.0		6	2	44	186	31	28	6			
13.1-14.0		4	3	10	82	20	7	5			
14.1-15.0		1	4	22	77	28	12	14	1		
15.1-16.0		7	2	11	45	29	10	13			
16.1-17.0		3	3	15	56	34	13	15			
17.1-18.0		2		5	38	20	14	19	2		
18.1-19.0		1		6	21	28	27	28	1		
19.1-20.0			2	6	15	24	22	13	1		NO LARVAE
20.1-21.0			1		6	10	11	10	2	1	
21.1-22.0			1		3	2	1	6			
22.1-23.0			1		7	1	5	9	4		
23.1-24.0					2	1	4	3	1		
24.1-25.0					3			5	2		
25.1-26.0					2			6	1		
26.1-27.0					2	1	1	3		2	
27.1-28.0					1	1		1		1	
28.1-29.0							1				
29.1-30.0					1						
30.1-31.0						2					
31.1-32.0											
32.1-33.0											
33.1-34.0											
34.1-35.0											
TOTAL LARVAE	79	388	340	1635	2130	578	262	161	16	4	-
MEANS	3.9	5.9	5.4	7.7	10.8	12.5	15.0	18.8	20.9	25.8	-

the mean length reaching 16.6 mm. Absence of larvae in large numbers in the plankton collections beyond the middle of July could be the result of the larval and juvenile fish assuming their normal benthic preference and thus avoiding the sampling nets.

Larvae of the johnny darter were present in the larval collections from 19 June through 12 September, with the weighted mean length increasing from 5.6 to 21.1 mm during that time (Table VB-11). Larvae in the 2.0 to 5.0 mm range were present through 24 July, possibly indicating either an extended spawning period or successive spawnings by separate populations. Based on larval collections and the recorded development rate of johnny darter eggs (Scott and Crossman, 1973), initial spawning probably occurred in the Nine Mile Point vicinity during the first week of June. Maximum length attained during their first summer, as indicated by the length frequency of collected larvae, was 30 mm, or approximately one-half the length of the mature johnny darter.

Alewives, the dominant fish larvae in the Nine Mile Point vicinity, were collected from 26 June, when their mean total length was 3.9 mm, to 12 September, when the weighted mean length had reached 25.8 mm (Table VB-12). Larvae in the "just hatched" category (3.5 mm: Mansueti and Hardy, 1967) were collected from 26 June throughout July, suggesting a long spawning season. Bimodal appearance of the weighted mean length distribution on any given sampling date after mid-July indicates successive spawning periods or separate groups of spawners in the study area. Development of the egg to the larval stage would have taken approximately one week at the water temperatures recorded in the study area (Figure VA-3) (Scott and Crossman, 1973), indicating that spawning activity was initiated in mid-June. Since length is measured for all larvae or a representative sub-sample during the identification process, the fact that larvae in the 2.0 to 5.0 mm size range reached peak abundance in mid/late July indicates that peak spawning took place during the first two weeks of July; this observation corresponds to the coefficient of maturity data for alewives (Figure VII-2).

d. Conclusions

The ichthyoplankton community in the vicinity of the Nine Mile Point Nuclear Station is characterized by few species and, with the exception of the larval alewife, low overall abundance. Infrequently other species dominated the ichthyoplankton collections, both spatially and temporally. In 1974 a total of fifteen

species were identified from collections conducted over eight months from April through December. The low concentrations of most larval species indicate that the Nine Mile Point area is not a major spawning area for the majority of the Lake Ontario fish population.

Seasonal patterns of egg and fish larvae abundance indicated two periods of spawning activity in the vicinity of Nine Mile Point. The first period was dominated by populations whose larvae are present in early spring, primarily the rainbow smelt, and also the burbot and Coregonus sp. Most abundant during the second period were those larvae which had been spawned during the summer, a group including most fish species in the Nine Mile Point area, and dominated by the alewife.

Distributional patterns resulting from environmental conditions and physiological responses by the organisms revealed that significantly more eggs and larvae were collected at night than during the day. The stations located at the 20 ft depth contours were all similar in their representation of larval populations; however, the similarity in fish larvae concentrations between the shallower 20 ft and deeper 40 ft depth contour stations varied with time. The change in depth distribution patterns (distance from shore) reflected the emigration of the larval populations from the shore zone as they matured and developed.

Four populations, the rainbow smelt, mottled sculpin, johnny darter, and alewife, were collected in large enough concentrations and over a sufficiently, long period of time to permit evaluation of their growth (through length frequency analysis) while resident in the Nine Mile Point vicinity. All four populations exhibited rapid growth and development following the spring/early summer spawning period. Data collected suggest that the rainbow smelt spawns during late April while adults of the other three species initiate spawning during early June. The spawning of all four species took place over several weeks; alewife spawning may have been interrupted by upwellings or reflected the influx of two separate sub-populations.

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APPENDIX V-1a

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
APRIL 1974

DATE: 26 APRIL

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10 FT	W	Bacillariophyceae	Stephanodiscus spp.	0.111
	F	Myxophyceae	Coelosphaerium naegelianum	0.093
	F	Bacillariophyceae	Stephanodiscus spp.	0.078
	W	Bacillariophyceae	Melosira binderana	0.060
	F	Bacillariophyceae	Asterionella formosa	0.047
20 FT	F	Bacillariophyceae	Melosira binderana	0.176
	P	Bacillariophyceae	Melosira binderana	0.129
	E	Bacillariophyceae	Melosira binderana	0.097
	F	Bacillariophyceae	Asterionella formosa	0.069
	F	Bacillariophyceae	Fragilaria crotonensis	0.055
40 FT	E	Bacillariophyceae	Melosira binderana	0.207
	E	Bacillariophyceae	Asterionella formosa	0.083
	E	Bacillariophyceae	Cyclotella spp.	0.064
	E	Bacillariophyceae	Melosira islandica	0.049
	P	Bacillariophyceae	Melosira binderana	0.045
60 FT	E	Bacillariophyceae	Melosira binderana	0.272
	W	Bacillariophyceae	Melosira binderana	0.077
	E	Myxophyceae	Polycystis aeruginosa	0.077
	E	Bacillariophyceae	Asterionella formosa	0.060
	P	Bacillariophyceae	Melosira binderana	0.056

KEY

TRANSECTS*:
- W - NMPW
- F - FITZ
- P - NMPP
- E - NMPE

**x 10^3 cells/ml

APPENDIX V-1b

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
MAY 1974

Date: 11 May 1974

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10 FT	F	Bacillariophyceae	Melosira binderana	1.018
	P	Bacillariophyceae	Melosira binderana	0.241
	W	Bacillariophyceae	Melosira binderana	0.138
	E	Bacillariophyceae	Melosira binderana	0.105
	F	Bacillariophyceae	Asterionella formosa	0.078
20 FT	F	Bacillariophyceae	Melosira binderana	1.326
	P	Bacillariophyceae	Melosira binderana	0.871
	E	Bacillariophyceae	Melosira binderana	0.612
	W	Bacillariophyceae	Melosira binderana	0.430
	P	Bacillariophyceae	Asterionella formosa	0.102
40 FT	P	Bacillariophyceae	Melosira binderana	1.954
	F	Bacillariophyceae	Melosira binderana	0.370
	P	Bacillariophyceae	Asterionella formosa	0.173
	F	Bacillariophyceae	Stephanodiscus hantzschii	0.127
	W	Bacillariophyceae	Melosira binderana	0.097
60 FT	F	Bacillariophyceae	Melosira binderana	0.481
	P	Bacillariophyceae	Melosira binderana	0.265
	E	Bacillariophyceae	Melosira binderana	0.256
	W	Bacillariophyceae	Melosira binderana	0.126
	F	Bacillariophyceae	Fragilaria crotonensis	0.094

KEY

TRANSECTS*:
W - NMPW
F - FITZ
P - NMPP
E - NMPE

** x 10^3 cells/ml

APPENDIX V-1b
(Continued)

DATE: 22 MAY

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10 FT	W	Bacillariophyceae	Melosira binderana	0.767
	E	Bacillariophyceae	Melosira binderana	0.337
	W	Bacillariophyceae	Stephanodiscus spp.	0.094
	F	Bacillariophyceae	Melosira binderana	0.085
	P	Bacillariophyceae	Melosira binderana	0.045
20 FT	E	Bacillariophyceae	Melosira binderana	0.139
	E	Chlorophyceae	Scenedesmus two cells	0.071
	F	Bacillariophyceae	Melosira binderana	0.062
	P	Bacillariophyceae	Melosira binderana	0.054
	W	Bacillariophyceae	Melosira binderana	0.043
40 FT	F	Bacillariophyceae	Melosira binderana	0.538
	P	Bacillariophyceae	Melosira binderana	0.308
	W	Bacillariophyceae	Melosira binderana	0.247
	W	Chlorophyceae	Unidentified single cell	0.115
	F	Bacillariophyceae	Stephanodiscus spp.	0.058
60 FT	P	Bacillariophyceae	Melosira binderana	1.359
	W	Bacillariophyceae	Melosira binderana	0.186
	P	Bacillariophyceae	Stephanodiscus spp.	0.122
	P	Chlorophyceae	Scenedesmus two cells	0.104
	P	Bacillariophyceae	Fragilaria crotonensis	0.064

KEY

TRANSECTS*:

W - NMPW

F - FITZ

P - NMPP

E - NMPE

**x 10^3 cells/ml

APPENDIX V-1c

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
JUNE 1974

DATE: 6 JUNE

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10 FT	P	Cryptophyceae	Unidentified cryptophyte	2.470
	E	Cryptophyceae	Unidentified cryptophyte	1.837
	E	Bacillariophyceae	*Melosira binderana*	1.551
	W	Cryptophyceae	Unidentified cryptophyte	0.903
	P	Bacillariophyceae	*Melosira binderana*	0.843
20 FT	E	Cryptophyceae	Unidentified cryptophyte	1.350
	E	Bacillariophyceae	*Melosira binderana*	1.076
	W	Bacillariophyceae	*Melosira binderana*	0.862
	W	Cryptophyceae	Unidentified cryptophyte	0.547
	F	Bacillariophyceae	*Melosira binderana*	0.458
40 FT	W	Bacillariophyceae	*Melosira binderana*	1.944
	P	Bacillariophyceae	*Melosira binderana*	1.539
	P	Cryptophyceae	Unidentified cryptophyte	1.333
	E	Bacillariophyceae	*Melosira binderana*	0.815
	W	Cryptophyceae	Unidentified cryptophyte	0.745
60 FT	E	Bacillariophyceae	*Melosira binderana*	1.591
	W	Bacillariophyceae	*Melosira binderana*	1.080
	P	Bacillariophyceae	*Melosira binderana*	0.604
	W	Cryptophyceae	Unidentified cryptophyte	0.242
	W	Myxophyceae	*Polycystis incerta*	0.173

KEY

TRANSECTS*:

W – NMPW
F – FITZ
P – NMPP
E – NMPE

**x 10^3 cells/ml

APPENDIX V-1c
(Continued)

DATE: 28 JUNE

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10FT	E	Chlorophyceae	*Scenedesmus* two cells	0.103
	E	Myxophyceae	*Lyngbya limnetica*	0.046
	E	Bacillariophyceae	*Melosira binderana*	0.033
	P	Chlorophyceae	*Mougeotia* spp.	0.025
	E	Chlorophyceae	*Ankistrodesmus falcatus*	0.024
20FT	E	Bacillariophyceae	*Melosira binderana*	0.137
	E	Chlorophyceae	*Scenedesmus quandricauda*	0.068
	E	Chlorophyceae	*Mougeotia* spp.	0.065
	F	Bacillariophyceae	*Melosira binderana*	0.065
	F	Chlorophyceae	*Scenedesmus quandricauda*	0.034
40FT	F	Bacillariophyceae	*Melosira binderana*	0.106
	W	Bacillariophyceae	*Melosira binderana*	0.095
	P	Bacillariophyceae	*Melosira binderana*	0.093
	E	Bacillariophyceae	*Melosira binderana*	0.068
	P	Chlorophyceae	*Pediastrum duplex*	0.067
60FT	E	Chlorophyceae	Mougeotia spp.	0.041
	P	Myxophyceae	*Chroccoccus dispersus*	0.027
	F	Chlorophyceae	*Mougeotia* spp.	0.016
	P	Chlorophyceae	*Scenedesmus* two cells	0.015
	E	Chlorophyceae	*Scenedesmus quadricauda*	0.015

KEY
TRANSECTS*:
W – NMPW
F – FITZ
P – NMPP
E – NMPE
** x 10^3 cells/ml

APPENDIX V-1d

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
JULY 1974

DATE: 15 JULY

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10 FT	W	Chlorophyceae	Scenedesmus bijuga	0.216
	W	Chlorophyceae	Scenedesmus quadricauda	0.082
	P	Chlorophyceae	Pediastrum duplex	0.076
	W	Bacillariophyceae	Coscinodiscus subtilis	0.069
	W	Chlorophyceae	Coelastrum microporum	0.060
20 FT	P	Bacillariophyceae	Melosira binderana	0.224
	F	Bacillariophyceae	Stephanodiscus spp.	0.112
	P	Chlorophyceae	Gloeocystis vesiculosa	0.111
	P	Chlorophyceae	Scenedesmus bijuga	0.093
	E	Bacillariophyceae	Stephanodiscus spp.	0.093
40 FT	E	Chlorophyceae	Botryococcus sudeticus	0.062
	P	Chlorophyceae	Ankistrodesmus falcatus	0.059
	P	Chlorophyceae	Coelastrum microporum	0.051
	P	Chlorophyceae	Pediastrum duplex	0.041
	P	Chlorophyceae	Scenedesmus bijuga	0.041
60 FT	F	Chlorophyceae	Scenedesmus bijuga	0.098
	F	Chlorophyceae	Scenedesmus quadricauda	0.049
	E	Myxophyceae	Anabaena spiroides	0.041
	P	Chlorophyceae	Scenedesmus quadricauda	0.040
	P	Chlorophycaee	Unidentified single cell	0.035

KEY
TRANSECTS*:
W - NMPW
F - FITZ
P - NMPP
E - NMPE
**x 10^3 cells/ml

APPENDIX V-1d
(Continued)

DATE: 29 JULY

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10 FT	W	Chlorophyceae	*Pediastrum duplex*	0.151
	W	Chlorophyceae	*Sphaerocystis schroeteri*	0.145
	F	Chlorophyceae	*Sphaerocystis schroeteri*	0.126
	E	Chlorophyceae	*Coelastrum microporum*	0.112
	W	Chlorophyceae	*Coelastrum microporum*	0.076
20 FT	F	Chlorophyceae	*Sphaerocystis schroeteri*	0.266
No sample	P	Chorophyceae	*Sphaerocystis schroeteri*	0.247
at West	E	Chlorophyceae	*Micractinium pusillum*	0.136
transect	P	Chlorophyceae	*Chlamydomonas* sp.	0.118
	F	Bacillariophyceae	*Fragilaria capucina*	0.111
40 FT	P	Chlorophyceae	*Coelastrum microporum*	0.379
	W	Chlorophyceae	*Chlamydomonas* sp.	0.238
	P	Myxophyceae	*Polycystis incerta*	0.206
	E	Chlorophyceae	*Sphaerocystis schroeteri*	0.195
	P	Chlorophyceae	*Micractinium pusillum*	0.188
60 FT	W	Chlorophyceae	*Gloeocystis vesiculosa*	0.320
	W	Chlorophyceae	*Coelastrum microporum*	0.262
	P	Chlorophyceae	*Coelastrum microporum*	0.196
	W	Chlorophyceae	Unidentified single cell	0.187
	E	Chlorophyceae	Unidentified single cell	0.167

KEY

TRANSECTS*:

W — NMPW

F — FITZ

P — NMPP

E — NMPE

**x 10^3 cells/ml

APPENDIX V-1e

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
AUGUST 1974

DATE: 8 AUGUST

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10FT	W	Chlorophyceae	Pandorina morum	0.658
	F	Chlorophyceae	Pandorina morum	0.445
	F	Chlorophyceae	Eudorina elegans	0.435
	W	Dinophyceae	Glenodinium spp.	0.330
	E	Cryptophyceae	Katablepharis ovalis	0.328
20FT	E	Cryptophyceae	Katablepharis ovalis	0.478
	W	Chlorophyceae	Eudorina elegans	0.449
	P	Chlorophyceae	Eudorina elegans	0.416
	W	Chlorophyceae	Unidentified single cell	0.319
	F	Chlorophyceae	Pandorina morum	0.305
40FT	W	Cryptophyceae	Katablepharis ovalis	0.630
	E	Chlorophyceae	Eudorina elegans	0.626
	F	Chlorophyceae	Eudorina elegans	0.602
	W	Chlorophyceae	Pediastrum duplex	0.450
	F	Chlorophyceae	Pandorina morum	0.373
60FT	E	Chlorophyceae	Gloeocystis vesiculosa	0.419
	P	Chlorophyceae	Eudorina elegans	0.401
	E	Chlorophyceae	Unidentified single cell	0.346
	E	Chlorophyceae	Eudorina elegans	0.329
	E	Chlorophyceae	Coelastrum microporum	0.180

KEY

TRANSECTS*:
W - NMPW
F - FITZ
P - NMPP
E - NMPE

**x 10^3 cells/ml

APPENDIX V-1e
(Continued)

DATE: 22 AUGUST

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10FT	P	Chlorophyceae	*Mougeotia* spp.	0.232
	P	Chlorophyceae	*Pediastrum duplex*	0.187
	E	Chlorophyceae	*Mougeotia* spp.	0.158
	P	Chlorophyceae	*Gloeocystis vesiculosa*	0.145
	E	Chlorophyceae	*Pediastrum duplex*	0.110
20FT	P	Chlorophyceae	*Eudorina elegans*	0.114
	F	Chlorophyceae	*Coelastrum cambricum*	0.065
	E	Chlorophyceae	*Coelastrum microporum*	0.055
	P	Chlorophyceae	*Dictyosphaerium pulchellum*	0.041
	F	Chlorophyceae	*Coelastrum microporum*	0.035
[illegible]0FT	W	Chlorophyceae	*Micractinium pusillum*	0.044
	P	Chlorophyceae	*Eudorina elegans*	0.037
	E	Chlorophyceae	*Eudorina elegans*	0.033
	W	Chlorophyceae	*Eudorina elegans*	0.024
	W	Chlorophyceae	*Mougeotia* spp.	0.021
60FT	E	Chlorophyceae	Unidentified single cell	0.232
	E	Bacillariophyceae	*Fragilaria capucina*	0.152
	E	Chlorophyceae	*Mougeotia* spp.	0.099
	E	Chlorophyceae	*Scenedesmus quadricauda*	0.084
	E	Chlorophyceae	*Coelastrum microporum*	0.071

KEY

TRANSECTS*:
W – NMPW
F – FITZ
P – NMPP
E – NMPE

**x 10^3 cells/ml

APPENDIX V-1f

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
SEPTEMBER 1974

DATE: 27 SEPTEMBER

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10 FT	E	Chlorophyceae	*Mougeotia* spp.	0.491
	W	Chlorophyceae	*Mougeotia* spp.	0.229
	F	Chlorophyceae	*Coelastrum microporum*	0.225
	F	Chlorophyceae	*Mougeotia* spp.	0.222
	P	Chlorophyceae	*Mougeotia* spp.	0.214
20 FT	W	Chlorophyceae	*Mougeotia* spp.	0.825
	W	Chlorophyceae	*Coelastrum microporum*	0.565
	P	Chlorophyceae	*Mougeotia* spp.	0.344
	F	Chlorophyceae	*Mougeotia* spp.	0.243
	E	Chlorophyceae	*Mougeotia* spp.	0.222
40 FT	F	Chlorophyceae	*Mougeotia* spp.	0.282
	W	Chlorophyceae	*Coelastrum microporum*	0.281
	W	Chlorophyceae	*Mougeotia* spp.	0.166
	P	Chlorophyceae	*Mougeotia* spp.	0.135
	W	Chlorophyceae	*Gloeocystis vesiculosa*	0.069
60 FT	W	Chlorophyceae	*Mougeotia* spp.	0.570
	E	Chlorophyceae	*Mougeotia* spp.	0.323
	E	Myxophyceae	*Aphanocapsa pulchra*	0.283
	W	Chlorophyceae	*Coelastrum microporum*	0.214
	F	Chlorophyceae	*Mougeotia* spp.	0.199

KEY

TRANSECTS*:
W – NMPW
F – FITZ
P – NMPP
E – NMPE

** x 10^3 cells/ml

APPENDIX V-1g

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
OCTOBER 1974

DATE: 24 OCTOBER

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10 FT	P	Chlorophyceae	Mougeotia spp.	0.424
	W	Chlorophyceae	Mougeotia spp.	0.323
	P	Bacillariophyceae	Fragilaria capucina	0.295
	F	Chlorophyceae	Mougeotia spp.	0.225
	F	Bacillariophyceae	Fragilaria capucina	0.153
20 FT	E	Chlorophyceae	Mougeotia spp.	0.452
	F	Chlorophyceae	Mougeotia spp.	0.238
	E	Bacillariophyceae	Fragilaria capucina	0.150
	P	Chlorophyceae	Mougeotia spp.	0.087
	E	Chlorophyceae	Unidentified single cell	0.069
40 FT	W	Chlorophyceae	Mougeotia spp.	0.277
	P	Chlorophyceae	Mougeotia spp.	0.180
	E	Chlorophyceae	Mougeotia spp.	0.141
	W	Chlorophyceae	Coelastrum microporum	0.126
	P	Chlorophyceae	Coelastrum microporum	0.077
60 FT	F	Chlorophyceae	Mougeotia spp.	0.440
	W	Chlorophyceae	Mougeotia spp.	0.338
	P	Chlorophyceae	Mougeotia spp.	0.226
	F	Chlorophyceae	Coelastrum microporum	0.074
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.060

KEY

TRANSECTS*:

W - NMPW

F - FITZ

P - NMPP

E - NMPE

** x 10^3 cells/ml

APPENDIX V-1h

RANKING OF MOST ABUNDANT SPECIES
OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY
NOVEMBER 1974

DATE: 27 NOVEMBER

DEPTH	TRANSECT*	GROUP	SPECIES	ABUNDANCE**
10FT	P	Chlorophyceae	Mougeotia spp.	0.149
	W	Chlorophyceae	Mougeotia spp.	0.135
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.118
	F	Chlorophyceae	Mougeotia spp.	0.081
	P	Bacillariophyceae	Diatoma tenue var. elongatum	0.068
20FT	W	Chlorophyceae	Mougeotia spp.	0.142
	F	Chlorophyceae	Mougeotia spp.	0.136
	E	Chlorophyceae	Mougeotia spp.	0.131
	P	Chlorophyceae	Mougeotia spp.	0.121
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.077
40FT	F	Chlorophyceae	Mougeotia spp.	0.182
	F	Cryptophyceae	Katablepharis ovalis	0.134
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.121
	E	Bacillariophyceae	Diatoma tenue var. elongatum	0.115
	E	Chlorophyceae	Mougeotia spp.	0.082
60FT	F	Chlorophyceae	Mougeotia spp.	0.158
	E	Chlorophyceae	Mougeotia spp.	0.154
	W	Chlorophyceae	Mougeotia spp.	0.143
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.140
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.092

KEY

TRANSECTS*:

W – NMPW
F – FITZ
P – NMPP
E – NMPE

**x 10^3 cells/ml

APPENDIX V-1i

RANKING OF MOST ABUNDANT SPECIES OF WHOLE WATER PHYTOPLANKTON BY DEPTH CONTOUR

NINE MILE POINT VICINITY DECEMBER 1974

DATE: 12 DECEMBER

DEPTH	TRANSECT *	GROUP	SPECIES	ABUNDANCE**
10 FT	E	Bacillariophyceae	Diatoma tenue var. elongatum	0.411
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.185
	P	Bacillariophyceae	Diatoma tenue var. elongatum	0.183
	P	Chlorophyceae	Mougeotia spp.	0.093
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.093
20 FT	P	Bacillariophyceae	Diatoma tenue var. elongatum	0.242
	P	Chlorophyceae	Mougeotia spp.	0.122
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.099
	E	Bacillariophyceae	Diatoma tenue var. elongatum	0.055
	E	Bacillariophyceae	Fragilaria crotonensis	0.055
40 FT	P	Bacillariophyceae	Diatoma tenue var. elongatum	0.270
	P	Chlorophyceae	Mougeotia spp.	0.148
	E	Bacillariophyceae	Diatoma tenue var. elongatum	0.137
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.103
	W	Bacillariophyceae	Diatoma tenue var. elongatum	0.079
60 FT	P	Bacillariophyceae	Diatoma tenue var. elongatum	0.297
	F	Bacillariophyceae	Diatoma tenue var. elongatum	0.238
	P	Chlorophyceae	Mougeotia spp.	0.161
	F	Chlorophyceae	Mougeotia spp.	0.149
	E	Bacillariophyceae	Diatoma tenue var. elongatum	0.063

KEY

TRANSECTS*:

W -- NMPW

F - FITZ

P - NMPP

E - NMPE

** x 10^3 cells/ml

APPENDIX V-2

WHOLE WATER TOTAL PHYTOPLANKTON (ABUNDANCE)

NINE MILE POINT - 1974

I. PERIOD: ALL DATES

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.150189	380	57.328914	0.332 (a)
DEPTH CONTOURS	3	0.875116	380	57.328914	1.934 (b)
DATES	12	44.141287	371	56.109994	24.322 (c)
DEPTHS X TRANSECTS	9	1.218920	371	56.109994	0.896 (a)
TOTAL	398	102.507360			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.25$, but not at $\alpha = 0.10$
(c) Significant at $\alpha < 0.0005$

Student-Newman-Keuls - Months (at $\alpha = 0.05$)
largest: 6 JUN 8 AUG 29 JUL 27 SEP 11 MAY 24 OCT 22 AUG 22 MAY 15 JUL 27 NOV 12 DEC 26 APR 28 JUN:Smallest

II. PERIOD: SPRING - 26 APR, 11 MAY, 22 MAY, 6 JUN, 28 JUN

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	MS	DF (ERR)	MS (ERR)	F
TRANSECTS	3	0.0509	121	0.1949	0.261 (a)
DEPTH CONTOURS	3	0.5286	121	0.1514	3.491 (b)
DATES	4	7.0574	124	0.1898	37.193 (c)
DEPTHS X TRANSECTS	9	0.2189	100	0.1444	1.516 (d)
DATES X TRANSECTS	12	0.5982	100	0.1444	4.144 (c)
DATES X DEPTHS	12	0.1596	100	0.1444	1.105 (a)
TOTAL	143	55.4671			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.025$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$

Student-Newman-Keuls - Dates ($\alpha = 0.05$) largest: 6 JUN 11 MAY 22 MAY 26 APR 28 JUN: smallest

Student-Newman-Keuls - Depth Contours ($\alpha = 0.05$) largest: 40 ft 20 ft 10 ft 60 ft: smallest

APPENDIX V-2
(Continued)

TOTAL PHYTOPLANKTON

III. PERIOD: SUMMER - 15 JUL, 29 JUL, 8 AUG, 22 AUG, 27 SEP

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	MS	DF (ERR)	MS (ERR)	F
TRANSECTS	3	0.0566	136	0.1277	0.443 (a)
DEPTH CONTOURS	3	0.3951	136	0.1415	2.793 (b)
DATES	4	2.5567	139	0.1421	17.990 (c)
DEPTHS X TRANSECTS	9	0.1250	115	0.1270	0.984 (a)
DATES X TRANSECTS	12	0.1368	115	0.1270	1.077 (a)
DATES X DEPTHS	12	0.2928	115	0.1270	2.306 (d)
TOTAL	158	32.4011			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.05$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.025$

Student-Newman-Keuls - Dates ($\alpha = 0.05$) largest: 8 AUG 29 JUL 27 SEP 22 AUG 15 JUL: smallest

Student-Newman-Keuls - Depth Contours ($\alpha = 0.10$) (test at $\alpha = 0.05$ has no resolution)
largest: 20 ft 10 ft 60 ft 40 ft : smallest

IV. PERIOD: FALL - 24 OCT, 27 NOV, 12 DEC

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	MS	DF (ERR)	MS (ERR)	F
TRANSECTS	3	0.0799	81	0.0848	0.943 (a)
DEPTH CONTOURS	3	0.1614	81	0.0943	1.710 (b)
DATES	2	0.5702	78	0.0911	6.256 (c)
DEPTHS X TRANSECTS	9	0.1190	66	0.0797	1.493 (b)
DATES X TRANSECTS	6	0.0897	66	0.0797	1.125 (a)
DATES X DEPTHS	6	0.2188	66	0.0797	2.746 (d)
DATES X DEPTHS X TRANSECTS	18	0.0798	48	0.0796	1.002 (a)
TOTAL	95	10.0447			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.25$
(c) Significant at $\alpha < 0.005$
(d) Significant at $\alpha < 0.025$

Student-Newman-Keuls - Dates ($\alpha = 0.5$) largest: 24 OCT 27 NOV 12 DEC: smallest

APPENDIX V-3

ABUNDANCE OF MYXOPHYCEAE
IN WHOLE WATER PHYTOPLANKTON

NINE MILE POINT - 1974

I. JUNE

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	2.0342	69	37.1727	1.259 (a)
DEPTH CONTOURS	3	1.0485	69	32.7832	0.736 (a)
YEARS	1	4.3689	63	35.8952	7.668 (b)
TRANSECT X DEPTH	9	2.0811	63	35.8952	0.406 (a)
TRANSECT X YEAR	3	5.1931	69	32.7832	3.643 (c)
DEPTH X YEAR	3	0.8035	69	37.1727	0.497 (a)
TRANSECT X DEPTH X YEAR	9	6.1125	48	23.7861	1.371 (d)
TOTAL	79	45.4278			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.01$
(c) Significant at $\alpha < 0.025$
(d) Significant at $\alpha < 0.25$

Greater estimated abundance for 1974 than for 1973.

II. JULY

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	1.0076	84	40.7681	0.692 (a)
DEPTH CONTOURS	3	1.3806	84	40.3107	0.959 (a)
YEARS	1	53.3691	78	37.7288	110.335 (b)
TRANSECT X DEPTH	9	3.1290	78	37.7288	0.719 (a)
TRANSECT X YEAR	3	0.5471	84	40.3107	0.380 (a)
DEPTH X YEAR	3	0.0897	84	40.7681	0.062 (a)
TRANSECT X DEPTH X YEAR	9	2.3863	63	34.6959	0.481 (a)
TOTAL	94	93.6345			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.0005$

Greater estimated abundance for 1973 than for 1974.

III. AUGUST

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	6.8716	85	58.3626	3.336 (a)
DEPTH CONTOURS	3	1.0192	85	55.3805	0.521 (b)
YEARS	1	29.9364	79	56.5660	41.809 (c)
TRANSECT X DEPTH	9	2.4048	79	56.5660	0.373 (b)
TRANSECT X YEAR	3	3.5903	85	55.3805	1.837 (d)
TRANSECT X DEPTH	3	0.6081	85	58.3626	0.295 (b)
TRANSECT X DEPTH X YEAR	9	3.4841	64	48.8834	0.507 (b)
TOTAL	95	96.7980			

(a) Significant at $\alpha < 0.025$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPW FITZ NMPE NMPP: Smallest

Greater estimated abundance for 1973 than for 1974.

APPENDIX V-3
(Continued)

MYXOPHYCEAE

IV. SEPTEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	1.1932	37	11.6833	1.260 (a)
DEPTH CONTOURS	3	0.3278	37	12.6234	0.320 (a)
YEARS	1	32.3883	31	11.4762	87.488 (b)
TRANSECT X DEPTH	9	1.2241	31	11.4762	0.367 (a)
TRANSECT X YEAR	3	0.0769	37	12.6234	0.075 (a)
DEPTH X YEAR	3	1.0170	37	11.6833	1.074 (a)
TRANSECT X DEPTH X YEAR	9	3.6786	16	6.7037	0.976 (a)
TOTAL	47	46.6097			

(a) Not significant at α = 0.25
(b) Significant at α < 0.0005

Greater estimated abundance for 1973 than for 1974.

V. OCTOBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.4790	37	7.1462	0.827 (a)
DEPTH CONTOURS	3	0.6768	37	7.5038	1.112 (a)
YEARS	1	20.9779	31	6.9764	93.216 (b)
TRANSECT X YEAR	9	1.2086	31	6.9764	0.597 (a)
TRANSECT X YEAR	3	0.6813	37	7.5038	1.120 (a)
DEPTH X YEAR	3	1.0388	37	7.1462	1.793 (c)
TRANSECT X DEPTH X YEAR	9	2.0835	16	3.1728	1.167 (a)
TOTAL	47	30.3187			

(a) Not significant at α = 0.25
(b) Significant at α < 0.0005
(c) Significant at α < 0.25

Greater estimated abundance for 1973 than for 1974.

VI. NOVEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.8841	35	7.8144	1.320 (a)
DEPTH CONTOURS	3	0.8243	35	7.3728	1.304 (a)
YEARS	1	0.2415	29	5.8961	1.188 (a)
TRANSECT X DEPTH	9	2.5798	29	5.8961	1.410 (b)
TRANSECT X YEAR	3	1.1030	35	7.3728	1.745 (b)
[illegible] X YEAR	3	0.6615	35	7.8144	0.988 (a)
[illegible]	45	10.3757			

(a) Not significant at α = 0.25
(b) Significant at α < 0.25

APPENDIX V-4

ABUNDANCE OF BACILLARIOPHYCEAE
IN WHOLE WATER PHYTOPLANKTON

NINE MILE POINT-1974

I. JUNE

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.6609	69	38.3154	0.397 (a)
DEPTH CONTOURS	3	3.9692	69	38.5639	2.367 (b)
YEARS	1	1.0034	63	37.5428	1.684 (c)
TRANSECTS X DEPTHS	9	1.1117	63	37.5428	0.207 (a)
TRANSECTS X YEARS	3	0.0907	69	38.5639	0.054 (a)
DEPTHS X YEARS	3	0.3392	69	38.3154	0.204 (a)
TRANSECTS X DEPTHS X YEARS	9	0.4646	48	36.6483	0.068 (a)
TOTAL	79	44.2880			

(a) Not significant α = 0.25
(b) Significant at α < 0.10
(c) Significant at α < 0.25

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α = 0.10) Largest: 40 ft 20 ft 60 ft 10 ft: Smallest

II. JULY

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	1.6210	84	18.2590	2.486 (a)
DEPTH CONTOURS	3	7.6449	84	23.3720	9.195 (b)
YEARS	1	0.1462	78	20.7631	0.549 (c)
TRANSECTS X DEPTHS	9	3.0293	78	20.7631	1.264 (c)
TRANSECTS X YEARS	3	0.4204	84	23.3720	0.504 (c)
DEPTHS X YEARS	3	5.5334	84	18.2590	8.485 (b)
TRANSECTS X DEPTHS X YEARS	9	1.7854	63	13.0934	0.955 (c)
TOTAL	94	33.3962			

(a) Significant at α < 0.10
(b) Significant at α < 0.0005
(c) Not significant at α = 0.25

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α = 0.10) Largest: NMPP FITZ NMPE NMPW: Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α 0.05) Largest: 20 ft 40 ft 10 ft 60 ft: Smallest

III. AUGUST

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS	F
TRANSECTS	3	4.2183	85	41.6818	2.867 (a)
DEPTH CONTOURS	3	2.5775	85	40.8851	1.786 (b)
YEARS	1	0.9818	79	39.1170	1.983 (b)
TRANSECTS X DEPTHS	9	3.0775	79	39.1170	0.691 (c)
TRANSECTS X YEARS	3	1.3095	85	40.8851	0.907 (c)
DEPTHS X YEARS	3	0.5128	85	41.6818	0.349 (c)
TRANSECTS X DEPTHS X YEARS	9	2.6304	64	34.6643	0.540 (c)
TOTAL	95	49.9721			

(a) Significant at α = 0.05
(b) Significant at α < 0.25
(c) Not Significant at α = 0.25

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α = 0.05) Largest: NMPW FITZ NMPE NMPP: Smallest

APPENDIX V-4
(Continued)

BACILLARIOPHYCEAE

IV. SEPTEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS	F
TRANSECTS	3	0.9171	37	13.2847	0.851 (a)
DEPTH CONTOURS	3	1.0765	37	13.5401	0.981 (a)
YEARS	1	2.7176	31	12.4784	0.751 (b)
TRANSECTS X DEPTHS	9	1.4436	31	12.4784	0.398 (a)
TRANSECTS X YEARS	3	0.3819	37	13.5401	0.348 (a)
DEPTHS X YEARS	3	0.6373	37	13.2847	0.592 (a)
TRANSECTS X DEPTHS X YEARS	9	6.4768	16	4.9823	2.311 (c)
TOTAL	47	18.6333			

(a) Not significant α = 0.25
(b) Significant at α < 0.025
(c) Significant at α < 0.10

Greater estimated abundance for 1973 than for 1974.

V. OCTOBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS	F
TRANSECTS	3	0.9484	37	9.7371	1.201 (a)
DEPTH CONTOURS	3	1.7669	37	11.9767	1.820 (b)
YEARS	1	0.0404	31	10.4580	0.120 (a)
TRANSECTS X DEPTHS	9	1.7615	31	10.4580	0.580 (a)
TRANSECTS X YEARS	3	0.2428	37	11.9767	0.250 (a)
DEPTHS X YEARS	3	2.4825	37	9.7371	3.144 (c)
TRANSECTS X DEPTHS X YEARS	9	3.3726	16	4.3601	1.375 (a)
TOTAL	47	14.9753			

(a) Not significant at α = 0.25
(b) Significant at α < 0.25
(c) Significant at α < 0.05

VI. NOVEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS	F
TRANSECTS	3	0.1080	35	2.7703	0.428 (a)
DEPTH CONTOURS	3	0.1084	35	3.1550	0.401 (a)
YEARS	1	3.8271	29	2.5938	42.790 (b)
TRANSECTS X DEPTHS	9	0.6505	29	2.5938	0.808 (a)
TRANSECTS X YEARS	3	0.0893	35	3.1550	0.330 (a)
DEPTHS X YEARS	3	0.4734	35	2.7708	1.993 (c)
TOTAL	45	7.5634			

(a) Not significant at α = 0.25
(b) Significant at α < 0.0005
(c) Significant at α < 0.25

Greater estimated abundance for 1974 than for 1973.

APPENDIX V-5

ABUNDANCE OF CHLOROPHYCEAE
IN WHOLE WATER PHYTOPLANKTON

NINE MILE POINT 1974

I. JUNE

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	2.8240	69	25.8040	2.517 (a)
DEPTH CONTOURS	3	1.3733	69	23.9914	1.317 (b)
YEARS	1	1.3997	63	22.1116	3.988 (a)
TRANSECTS X DEPTHS	9	4.0767	63	22.1116	1.291 (b)
TRANSECTS X YEARS	3	2.1969	69	23.9914	2.106 (c)
DEPTHS X YEARS	3	0.3842	69	25.8040	0.342 (b)
TRANSECTS X DEPTHS X YEARS	9	3.9692	48	15.5612	1.360 (c)
TOTAL	79	31.7852			

(a) Significant at $\alpha < 0.10$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS - TRANSECTS
Largest: NMPE NMPW FITZ NMPP: Smallest

Greater abundance in 1974 than in 1973 (at α=0.10)

II. JULY

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.3698	84	9.8197	1.055 (a)
DEPTH CONTOURS	3	0.8333	84	9.3923	2.484 (b)
YEARS	1	1.8631	78	9.3613	15.524 (c)
TRANSECTS X DEPTHS	9	0.6142	78	9.3613	0.569 (a)
TRANSECTS X YEARS	3	0.5832	84	9.3923	1.739 (d)
DEPTHS X YEARS	3	0.1558	84	9.8197	0.444 (a)
TRANSECTS X DEPTHS X YEARS	9	0.8704	63	7.7696	0.784 (a)
TOTAL	94	13.0306			

(a) Not significant at α=0.25
(b) Significant at $\alpha < 0.10$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS - DEPTHS (α=0.10)
Largest: 20 ft 10 ft 40 ft 60 ft : Smallest

Greater estimated abundance for 1973 than for 1974

ABUNDANCE OF CHLOROPHYCEAE

III. AUGUST

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.1099	85	18.3443	0.170 (a)
DEPTH CONTOURS	3	0.6452	85	18.1228	1.009 (a)
YEARS	1	0.0260	79	17.8036	0.115 (a)
TRANSECTS X DEPTHS	9	0.8795	79	17.8036	0.434 (a)
TRANSECTS X YEARS	3	0.5602	85	18.1228	0.876 (a)
DEPTHS X YEARS	3	0.3388	85	18.3443	0.523 (a)
TRANSECTS X DEPTHS X YEARS	9	0.8366	64	16.0680	0.370 (a)
TOTAL	95	19.4641			

(a) Not significant at α=0.025

IV. SEPTEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.1865	36	2.4921	0.898 (a)
DEPTH CONTOURS	3	0.5577	36	2.4636	2.716 (b)
YEARS	1	0.1289	30	1.9771	1.955 (c)
TRANSECTS X DEPTHS	9	0.8343	30	1.9771	1.407 (c)
TRANSECTS X YEARS	3	0.3478	36	2.4636	1.694 (c)
DEPTHS X YEARS	3	0.3194	36	2.4921	1.538 (c)
TOTAL	46	3.6202			

(a) Not Significant at α=0.25
(b) Significant at α <0.10
(c) Significant at α <0.25

STUDENT-NEWMAN-KEULS TEST DEPTHS (α=0.10)
Largest: 20 ft 10 ft 60 ft 40 ft : Smallest

V. OCTOBER

THREE-WAY ANAYLISIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.1110	37	3.5360	0.387 (a)
DEPTH CONTOURS	3	0.5413	37	3.6366	1.836 (b)
YEARS	1	2.3220	31	2.3081	31.186 (c)
TRANSECTS X DEPTHS	9	1.3736	31	2.3081	2.050 (d)
TRANSECTS X YEARS	3	0.0451	37	3.6366	0.153 (a)
DEPTHS X YEARS	3	0.1457	37	3.5360	0.508 (a)
TRANSECTS X DEPTHS X YEARS	9	0.6511	16	1.4632	0.795 (a)
TOTAL	47	6.6560			

(a) Not significant at α=0.25
(b) Significant at α <0.25
(c) Significant at α <0.0005
(d) Significant at α <0.10

Greater estimated abundance in 1974 then in 1973

APPENDIX V-5 (Continued)

ABUNDANCE OF CHLOROPHYCEAE

VI. NOVEMBER

THREE-WAY ANALYSIS OF VARIANCE
(Log transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.0218	35	1.4234	0.179 (a)
DEPTH CONTOURS	3	0.5197	35	1.5219	3.984 (b)
YEARS	1	2.2464	29	1.4075	52.466 (c)
TRANSECTS X DEPTHS	9	0.1380	29	1.4075	0.316 (a)
TRANSECTS X YEARS	3	0.0236	35	1.5219	0.181 (a)
DEPTHS X YEARS	3	0.1221	35	1.4234	1.000 (a)
TOTAL	45	4.8632			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < .025$
(c) Significant at $\alpha < 0.0005$

STUDENT-NEWMAN-KEULS - DEPTHS ($\alpha = 0.05$)
Largest: 20ft 60ft 40ft 10ft: Smallest

Greater estimated abundance in 1974 than in 1973.

APPENDIX V-6

TEMPERATURES*

NINE MILE POINT - 1974

THREE-WAY ANALYSIS OF VARIANCE

SOURCE	DF	SS	DF(ERR)	SS(ERR)	F
TRANSECTS	3	19.9488	81	189.6087	2.841 (a)
DEPTH CONTOURS	3	7.1131	81	85.1544	2.255 (b)
DATES	6	4624.1846	90	198.8525	348.815 (c)
TRANSECTS X DEPTHS	9	14.6887	54	46.5332	1.894 (b)
TRANSECTS X DATES	18	128.3868	54	46.5332	8.277 (c)
DATES X DEPTHS	18	23.9324	54	46.5332	1.542 (d)
TOTAL	111	4864.7878			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.05$
(c) Significant at $\alpha < 0.10$
(d) Significant at $\alpha < 0.25$

STUDENT - NEWMAN-KEULS TEST - DATES ($\alpha = 0.05$)

Largest: 22 Aug 27 Sep 28 Jun 6 Jun 26 Apr 11 May 12 Dec: Smallest
° C 24.2 17.4 15.2 14.4 8.3 7.9 3.5

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPP NMPE FITZ NMPW: Smallest
° C 13.6 13.1 12.9 12.4

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.10$)

Largest; 10 ft 60 ft 20 ft 40 ft: Smallest
° C 13.4 12.9 12.9 12.7

STUDENT-NEWMAN-KEULS TEST - TRANSECT X DATE INTERACTION (each at $\alpha = 0.05$)

(a) 27 Apr: Largest: NMPP FITZ NMPW NMPE: Smallest
° C 9.1 8.8 8.8 6.6

(b) 11 May: Largest: NMPW NMPP FITZ NMPE: Smallest (No significant difference)
° C 8.7 7.9 7.8 7.2

(c) 6 Jun: Largest: NMPE NMPP NMPW FITZ: Smallest (No significant difference)
° C 15.5 14.5 13.8 13.8

(d) 23 Jun: Largest: NMPE FITZ NMPP NMPW: Smallest
° C 18.1 14.9 13.8 13.8

(e) 22 Aug: Largest: NMPP FITZ NMPW NMPE: Smallest
° C 25.7 23.9 23.7 23.4

(f) 27 Sep: Largest: NMPP NMPE FITZ NMPW: Smallest
° C 19.4 17.8 17.7 14.5

(g) 12 Dec: Largest: NMPP NMPW FITZ NMPE: Smallest
° C 4.6 3.4 3.2 2.8

* Values from phytoplankton sampling program.

APPENDIX V-7

PRIMARY PRODUCTIVITY (^{14}C METHOD)

NINE MILE POINT - 1974

I. DATE: 2 MAY

SOURCE	DF	SS	MS	F
TRANSECT X BOTTLES	3	34.2838	11.4279	0.908 (a)
DEPTHS X BOTTLES	3	12.7826	4.2609	0.339 (a)
RESIDUAL	15	188.7019	12.5801	
TOTAL	28	585.4355		

(a) Not Significant at $\alpha = 0.25$

II. DATE: 22 MAY

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS X BOTTLES	3	110.4438	24	185.0945	4.774 (a)*
DEPTHS X BOTTLES	3	22.1473	24	185.0945	0.957 (b)
TRANSECTS X DEPTHS X BOTTLES	9	122.2448	15	62.8496	3.242 (c)*
TOTAL	46	2493.4138			

(a) Significant at $\alpha < 0.01$
(b) Not Significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.025$

STUDENT-NEWMAN-KEULS: Largest: FITZ NMPP NMPW NMPE: Smallest

III. DATE: 28 JUNE

SOURCE	DF	SS	MS	F
TRANSECTS X BOTTLES	3	1112.6993	370.8998	100.270 (a)*
DEPTHS X BOTTLES	3	9.0139	3.0046	0.812 (b)
RESIDUALS	23	85.0769	3.6990	
TOTAL	45	4701.6688		

(a) Significant at $\alpha < 0.0005$
(b) Not Significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS: Largest: NMPE FITZ NMPP NMPW: Smallest

IV. DATE: 29 JULY

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS X BOTTLES	3	205.5834	25	173.3306	9.884 (a)*
DEPTHS X BOTTLES	3	4.1227	25	173.3306	0.198 (b)
TRANSECTS X DEPTHS X BOTTLES	9	163.1344	16	10.1963	28.443 (a)*
TOTAL	47	2512.5484			

(a) Significant at $\alpha < 0.0005$
(b) Not Significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS: Largest; NMPP NMPE FITZ NMPW: Smallest

APPENDIX V- 7 (Continued)

PRIMARY RRODUCTIVITY (^{14}C METHOD)

V. DATE: 22 AUGUST

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS X BOTTLES	3	42.7931	25	26.9391	13.238 (a)*
DEPTHS X BOTTLES	3	4.5955	25	26.9391	1.422 (b)
TRANSECTS X DEPTHS X BOTTLES	9	11.8978	16	15.0413	1.406 (b)
TOTAL	47	580.0516			

(a) Significant at $\alpha < 0.0005$
(b) Not Significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS: NMPE NMPW NMPP FITZ: Smallest

VI. DATE: 27 SEPTEMBER

SOURCE	DF	SS	MS	F
TRANSECTS X BOTTLES	3	133.0906	44.3635	1.120 (a)
DEPTHS X BOTTLES	3	27.2549	9.0850	0.229 (a)
RESIDUAL	29	1148.6784	39.6096	-
TOTAL	42	6498.7051		

(a) Not Significant at $\alpha = 0.25$

VII. DATE: 24 OCTOBER

SOURCE	DF	SS	MS	F
TRANSECTS X BOTTLES	3	12.5669	4.1890	2.216 (a)
DEPTHS X BOTTLES	3	7.1065	2.3688	1.253 (b)
RESIDUAL	24	45.3772	1.8907	-
TOTAL	46	612.7558		

(a) Significant at $\alpha < 0.25$
(b) Not Significant at $\alpha = 0.25$

VIII. DATE: 3 DECEMBER

SOURCE	DF	SS	MS	F
TRANSECTS X BOTTLES	3	11.3826	3.7942	3.166 (a)
DEPTHS X BOTTLES	3	8.8673	2.9558	2.467 (b)
RESIDUALS	23	27.5617	1.1983	-
TOTAL	45	161.3056		

(a) Significant at $\alpha < 0.05$
(b) Significant at $\alpha < 0.10$

STUDENT-NEWMAN-KEULS: Largest: NMPE NMPP NMPW FITZ: Smallest

APPENDIX V- 8a

CLADOCERANS
PERCENT COMPOSITION OF TOTAL MICROZOOPLANKTON

NINE MILE POINT - 1974

	NMPW				NMPP				FITZ				NMPE			
DATE	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft
26 APR	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.2	0.0	0.8	0.0	0.2	0.0	0.1	0.0
11 MAY	0.0	0.0	0.0	0.1	0.3	0.2	0.3	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0
22 MAY	0.0	0.3	0.6	0.0	0.7	0.0	0.0	0.0	0.5	0.0	NO SAMPLES					
6 JUN	1.7	2.0	0.8	1.4	3.8	1.1	3.1	0.8	0.8	0.1	1.3	0.3	0.8	1.5	0.2	0.8
28 JUN	4.4	4.3	3.1	5.1	15.4	5.6	2.5	4.6	2.2	5.1	3.5	1.6	16.5	2.9	4.2	2.9
15 JUL	22.3	18.5	19.5	7.6	11.5	15.1	14.4	13.9	15.7	10.8	11.2	14.9	13.9	24.4	9.1	12.8
29 JUL	6.6	4.7	6.3	5.8	4.9	4.8	6.5	6.0	3.8	5.9	11.8	8.8	9.7	1.9	3.7	13.6
8 AUG	29.4	20.1	22.3	26.3	17.7	21.8	23.4	20.4	26.5	34.8	25.9	40.1	25.1	24.6	62.7	42.0
22 AUG	11.3	5.1	9.6	0.7	4.6	3.5	6.4	6.2	11.9	4.2	3.1	9.1	2.1	3.8	4.7	8.0
27 SEP	28.9	23.6	23.4	19.2	25.0	24.6	19.8	26.9	16.1	16.8	22.1	25.9	31.3	35.7	36.2	25.0
24 OCT	18.7	6.6	10.1	8.9	7.5	10.1	19.3	13.5	18.0	8.2	12.9	17.0	12.4	16.4	11.8	13.7
27 NOV	11.1	8.6	8.4	11.2	15.6	14.2	7.7	10.3	10.2	8.0	10.6	8.6	2.0	6.4	15.5	13.7
12 DEC	9.2	3.2	10.9	16.2	9.1	11.1	3.8	0.3	11.5	6.8	6.3	5.6	4.6	4.7	13.3	4.7

PROTOZOANS
PERCENT COMPOSITION OF TOTAL MICROZOOPLANKTON

NINE MILE POINT - 1974

DATE	NMPW				NMPP				FITZ				NMPE			
	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft
26 APR	52.2	27.1	5.9	5.2	38.8	42.5	0.0	23.8	33.3	29.1	4.6	0.7	31.3	10.9	24.1	1.3
11 MAY	18.0	35.2	24.3	18.9	9.6	13.0	14.7	3.6	22.3	26.5	29.3	33.1	15.9	3.8	34.9	22.5
22 MAY	25.4	0.5	0.6	29.6	22.2	30.1	14.7	12.2	9.5	9.5	NO SAMPLES					
6 JUN	0.0	1.0	0.7	0.2	0.9	0.0	0.0	0.0	0.5	3.9	2.0	0.3	0.0	7.5	0.3	0.0
28 JUN	0.9	0.6	1.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5	0.0	0.3	0.1	0.0	0.0
15 JUL	0.0	0.1	0.8	0.0	3.5	0.5	0.0	0.0	0.5	0.2	0.0	0.1	0.1	0.0	0.0	0.1
29 JUL	0.0	0.8	0.2	0.0	0.2	0.9	0.9	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.4	5.1
8 AUG	0.0	0.0	0.0	25.2	0.0	0.0	0.3	0.4	0.3	0.0	0.4	0.0	22.8	0.1	2.5	0.0
22 AUG	4.9	22.2	6.6	7.9	0.5	9.7	10.6	9.2	6.7	9.0	20.4	10.0	13.9	33.4	35.0	15.2
27 SEP	2.2	9.4	3.9	3.0	0.0	0.3	0.0	2.5	0.0	6.2	1.1	1.2	1.0	2.4	1.3	0.2
24 OCT	0.5	2.8	15.4	2.6	0.0	3.8	1.2	11.0	1.6	0.0	1.4	4.3	12.4	0.0	0.6	5.3
27 NOV	0.7	0.0	0.0	0.7	0.0	0.0	2.0	0.8	5.1	6.2	0.0	5.2	34.7	5.6	2.1	0.0
12 DEC	0.0	0.0	0.6	0.6	00.0	0.9	1.4	1.0	0.0	1.7	0.5	2.6	7.7	7.5	0.0	1.2

APPENDIX V-8 c

ROTIFERS
PERCENT COMPOSITION OF TOTAL MICROZOOPLANKTON

NINE MILE POINT - 1974

Date	NMPW				NMPP				FITZ				NMPE			
	10'	20'	40'	60'	10'	20'	40'	60'	10'	20'	40'	60'	10'	20'	40'	60'
26 Apr	43.4	60.8	73.7	76.0	55.8	51.4	82.7	66.8	62.1	63.7	83.5	76.3	60.8	81.7	68.1	73.6
11 May	79.4	62.0	74.3	77.4	84.3	82.3	82.9	93.4	75.6	71.7	69.7	65.2	83.4	93.9	62.2	72.9
22 May	72.8	93.4	89.7	69.6	75.6	67.7	84.6	81.1	90.0	87.8	NO SAMPLES					
6 Jun	87.8	89.2	89.9	86.5	84.9	85.8	79.8	89.0	85.9	89.0	83.8	88.4	89.7	78.0	91.2	91.0
28 Jun	89.0	91.6	92.8	86.0	82.5	90.9	93.3	90.6	92.3	91.1	91.8	96.5	75.2	91.4	93.5	94.7
15 Jul	76.6	80.6	78.2	90.4	83.7	81.4	83.8	84.7	81.3	85.9	84.2	82.7	83.3	72.5	89.3	84.4
29 Jul	76.7	83.7	79.7	84.9	85.7	84.4	81.6	83.3	84.4	85.4	72.0	76.4	79.3	95.8	93.0	70.0
8 Aug	63.9	72.2	72.5	41.5	67.1	70.6	66.8	69.1	67.5	60.4	63.6	44.6	48.7	69.8	31.0	50.7
22 Aug	70.9	57.8	67.3	56.8	67.2	54.9	50.9	50.2	60.4	55.7	48.1	48.0	46.8	47.0	44.2	50.1
27 Sep	26.7	28.0	17.0	20.3	6.7	6.7	5.9	7.8	14.3	17.7	16.1	12.7	30.7	14.7	10.5	8.9
24 Oct	58.2	74.5	47.3	71.3	75.0	68.1	62.5	62.2	49.2	78.8	66.1	59.2	72.7	75.1	71.2	65.9
27 Nov	74.8	71.1	80.1	70.1	66.7	67.2	70.4	71.5	62.2	70.4	65.6	63.3	51.5	72.0	66.5	67.7
12 Dec	69.7	68.0	61.2	62.1	76.1	66.7	77.3	76.7	72.5	68.4	69.1	76.2	70.8	74.5	67.5	79.8

APPENDIX V-8d

COPEPODS
PERCENT COMPOSITION OF TOTAL MICROZOOPLANKTON

NINE MILE POINT - 1974

DATE	NMPW				NMPP				FITZ				NMPE			
	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft
26 APR	4.4	12.1	20.4	18.6	5.4	6.1	17.3	9.3	4.4	7.1	11.1	23.0	7.7	7.4	7.7	25.2
11 MAY	2.6	2.8	1.5	3.6	5.8	4.5	2.0	3.0	2.1	1.7	0.9	1.4	0.6	2.4	2.9	4.7
22 MAY	1.7	5.8	9.1	0.9	1.5	2.3	0.7	6.8	0.0	2.6	NO SAMPLES					
6 JUN	10.4	7.8	8.6	11.9	10.4	13.1	17.2	10.2	12.7	7.1	13.0	10.9	9.6	13.0	8.3	10.2
28 JUN	5.7	3.5	2.8	8.8	2.1	3.5	4.1	4.7	5.6	3.8	4.2	2.0	8.1	5.6	2.3	2.4
15 JUL	1.1	0.8	1.5	1.9	1.3	3.1	1.8	1.5	2.6	3.0	4.6	2.2	2.8	3.1	1.7	2.7
29 JUL	16.6	10.8	13.8	9.2	9.2	9.9	11.1	10.7	10.4	8.7	16.2	14.8	11.0	2.3	2.9	11.3
8 AUG	6.6	7.7	5.3	7.0	15.1	7.7	9.5	10.1	5.7	4.8	10.1	15.3	3.4	5.5	3.8	7.3
22 AUG	12.9	14.9	16.6	34.6	27.7	31.9	32.1	34.4	21.1	31.2	28.4	32.8	37.2	15.7	16.0	26.6
27 SEP	42.2	39.0	55.7	57.5	68.3	68.3	74.3	62.8	69.6	59.3	60.7	60.2	37.0	47.1	52.0	65.8
24 OCT	22.5	16.0	27.1	17.2	17.5	18.1	17.0	13.3	31.1	13.0	19.5	19.4	2.6	8.5	16.4	15.1
27 NOV	13.3	20.4	11.5	18.0	17.7	18.6	19.9	17.5	22.4	15.3	23.8	22.9	11.9	16.0	16.0	18.5
12 DEC	21.1	28.8	27.3	21.0	14.7	21.3	17.5	21.9	16.0	23.2	24.1	15.6	16.9	13.2	19.2	14.2

RANKING OF MOST ABUNDANT MICROZOOPLANKTON TAXA*
(MEAN ABUNDANCE OVER DEPTH CONTOURS)

NINE MILE POINT - 1974

DATE	NMPW	NMPP	FITZ	NMPE
26 APR	Vorticellidae Synchaeta tremula Nothulca acuminata Copepod nauplii	Vorticellidae Synchaeta tremula Nothulca acuminata Polyarthra sp.	Synchaeta tremula Vorticellidae Nothulca acuminata Polyarthra sp.	Synchaeta tremula Vorticellidae Polyarthra sp. Nothulca acuminata
11 MAY	Polyarthra sp. Vorticellidae Synchaeta tremula Keratella quadrata	Polyarthra sp. Synchaeta tremula Vorticellidae Keratella quadrata	Polyarthra sp. Vorticellidae Synchaeta tremula Keratella cochlearis	Polyarthra sp. Vorticellidae Nothulca sp. Keratella quadrata
22 MAY FITZ sampled at 10ft and 20ft only	Polyarthra sp. Keratella cochlearis Keratella quadrata Vorticellidae	Polyarthra sp. Keratella cochlearis Voticellidae Synchaeta tremula	Polyarthra sp. Synchaeta tremula Keratella cochlearis Brachionus calyciflorus	No sample
6 JUN	Synchaeta tremula Keratella cochlearis Polyarthra sp. Keratella quadrata	Synchaeta tremula Keratella cochlearis Polyarthra sp. Keratella quadrata	Synchaeta tremula Polyarthra sp. Keratella cochlearis Keratella quadrata	Synchaeta tremula Keratella cochlearis Polyarthra sp. Keratella quadrata
28 JUN	Kellicottia longispina Keratella cochlearis Polyarthra sp. Synchaeta stylata	Kellicottia longispina Keratella cochlearis Synchaeta stylata Polyarthra sp.	Keratella cochlearis Kellicottia longispina Polyarthra sp. Synchaeta stylata	Keratella cochlearis Polyarthra sp. Synchaeta stylata Kellicottia longispina
15 JUL	Keratella cochlearis Polyarthra sp. Bosmina spp. Ploesoma lenticulare	Keratella cochlearis Polyarthra sp. Bosmina spp. Ploesoma lenticulare	Keratella cochlearis Polyarthra sp. Bosmina spp. Asplanchna sp.	Keratella cochlearis Polyarthra sp. Bosmina spp. Asplanchna sp.
29 JUL	Keratella cochlearis Polyarthra sp. Synchaeta stylata Ploesoma lenticulare	Keratella cochlearis Polyarthra sp. Ploesoma lenticulare Synchaeta stylata	Keratella cochlearis Polyarthra sp. Ploesoma lenticulare Synchaeta stylata	Polyarthra sp. Keratella cochlearis Ploesoma lenticulare Synchaeta stylata
8 AUG	Ploesoma lenticulare Bosmina spp. Keratella cochlearis Polyarthra sp.	Ploesoma lenticulare Bosmina spp. Keratella cochlearis Conochilus sp.	Bosmina spp. Ploesoma lenticulare Keratella cochlearis Polyarthra sp.	Bosmina spp. Ploesoma lenticulare Keratella cochlearis Polyarthra sp.
22 AUG	Polyarthra sp. Keratella cochlearis Nauplii Bosmina spp.	Nauplii Cyclopod-Juvenile Keratella cochlearis Polyarthra sp.	Keratella cochlearis Cyclopod-Juvenile Polyarthra sp. Nauplii	Vorticellidae Keratella cochlearis Cyclopod-Juvenile Polyarthra sp.
27 SEP	Tropocyclops prasinus Bosmina spp. Cyclopod-Juvenile Keratella cochlearis	Tropocyclops prasinus Cyclopod-Juvenile Bosmina spp. Nauplii	Tropocyclops prasinus Cyclopod-Juvenile Bosmina spp. Polyarthra sp.	Tropocyclops prasinus Bosmina spp. Cyclopod-Juvenile Daphnia retrocurva
24 OCT	Polyarthra sp. Keratella cochlearis Synchaeta stylata Bosmina spp.	Polyarthra sp. Keratella cochlearis Synchaeta stylata Bosmina spp.	Polyarthra sp. Keratella cochlearis Synchaeta stylata Bosmina spp.	Polyarthra sp. Synchaeta styleta Keratella cochlearis Bosmina spp.
27 NOV	Keratella cochlearis Bosmina spp. Polyarthra sp. Synchaeta pectinata	Keratella cochlearis Bosmina spp. Synchaeta pectinata Cyclopod-Juvenile	Keratella cochlearis Synchaeta pectinata Bosmina spp. Cyclopod-Juvenile	Keratella cochlearis Vorticellidae Synchaeta pectinata Bosmina spp.
12 DEC	Keratella cochlearis Cyclopod-Juvenile Synchaeta tremula Nauplii	Keratella cochlearis Polyarthra sp. Cyclopod-Juvenile Synchaeta tremula	Keratella cochlearis Polyarthra sp. Synchaeta tremula Cyclopod-Juvenile	Keratella cochlearis Polyarthra sp. Synchaeta tremula Cyclopod-Juvenile

* original sample
Juvenile = Copepodites

APPENDIX V-10a

CLADOCERANS
RESULTS OF PATTERN-FREQUENCY ANALYSIS°

NINE MILE POINT - 1974

PATTERNS				NUMBER OF OCCURRENCES				
NMPW	NMPP	FITZ	NMPE	10ft	20ft	40ft	60ft	Total
X	+	-	-	2	2	2	0	6
X	+	+	-	0	1	3	3	7
X	+	+	+	0	1	0	0	1
X	-	-	-	0	0	1	0	1
X	-	+	+	2	2	0	1	5
X	-	-	+	1	3	4	3	11
X	-	+	-	2	0	1	3	6
X	+	-	+	3	1	0	1	5
SPECIAL CASE PATTERNS+								
X	S	+	-	1	0	1	0	2
X	+	-	S	1	1	0	0	2
X	-	-	S	0	0	0	1	1
X	S	S	S	0	1	0	0	1

+Special case = Values at adjacent stations the same (S)

°The magnitude of each element in a sequence is compared with the magnitude of the preceding element and given a plus sign if it is greater than the preceding element and a minus sign if it is smaller than the preceding element. The pattern was determined by each depth contour on every date on which the full complement of samples were collected.

APPENDIX V-10b

PROTOZOANS
RESULTS OF PATTERN-FREQUENCY ANALYSES

NINE MILE POINT - 1974

PATTERNS				NUMBER OF OCCURRENCES				
NMPW	NMPP	FITZ	NMPE	10ft	20ft	40ft	60ft	Total
X	+	-	-	3	2	1	0	6
X	+	+	-	1	0	1	1	3
X	+	+	+	0	0	0	0	0
X	-	-	-	0	0	0	1	1
X	-	+	+	3	1	2	0	6
X	-	-	+	0	1	0	0	1
X	-	+	-	1	2	4	3	10
X	+	-	+	0	2	3	3	8
SPECIAL CASE PATTERNS								
X	-	-	S	0	0	0	1	1
X	+	-	S	0	1	0	0	1
X	-	S	+	2	1	0	0	3
X	S	+	+	0	1	0	1	2
X	S	+	+	1	0	0	0	1
X	-	S	S	0	0	1	0	1
X	S	S	+	1	1	0	1	3
X	S	S	S	0	0	0	1	1

Special case = values at adjacent stations the same (S)

ROTIFERS
RESULTS OF PATTERN-FREQUENCY ANALYSES

NINE MILE POINT - 1974

PATTERNS				NUMBER OF OCCURRENCES				
NMPW	NMPP	FITZ	NMPE	10 ft	20 ft	40 ft	60 ft	Total
X	+	-	-	2	2	2	3	9
X	+	+	-	3	3	1	1	8
X	+	+	+	0	1	2	0	3
X	-	-	-	0	0	1	0	1
X	-	+	+	3	3	0	3	9
X	-	-	+	2	0	1	1	4
X	-	+	-	1	1	3	2	7
X	+	-	+	1	2	2	2	7

APPENDIX V-10d

COPEPODS
RESULTS OF PATTERN-FREQUENCY ANALYSES

NINE MILE POINT - 1974

PATTERNS				NUMBER OF OCCURRENCES				
NMPW	NMPP	FITZ	NMPE	10 ft	20 ft	40 ft	60 ft	Total
X	+	-	-	2	4	3	1	10
X	+	+	-	0	2	4	1	7
X	+	+	+	0	1	0	0	1
X	-	-	-	1	1	0	2	4
X	-	+	+	3	1	0	3	7
X	-	-	+	0	0	0	1	1
X	-	+	-	2	0	1	2	5
X	+	-	+	4	3	4	2	13

APPENDIX V-11

ABUNDANCE OF MICROZOOPLANKTON

NINE MILE POINT - 1974

I. ROTIFERS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.2438	333	11.8181	2.290 (b)
DEPTH CONTOURS	3	5.8963	333	10.0104	65.383 (a)
DATES	11	71.6107	357	13.9846	166.189 (a)
TRANSECTS X DEPTHS	9	0.1251	291	7.5867	0.533 (c)
TRANSECTS X DATES	33	4.1063	291	7.5867	4.773 (a)
DEPTHS X DATES	33	2.2916	291	7.5967	2.664 (a)
TRANSECTS X DEPTHS X DATES	99	4.2217	192	3.3650	2.433 (a)
TOTAL	383	91.8605			

(a) Significant at α < 0.0005
(b) Significant at α < 0.10
(c) Not significant at α = 0.25

ENT-NEWMAN-KEULS TEST - TRANSECTS (α = 0.10) Largest: NMPE FITZ NMPP NMPW: Smallest
ENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α = 0.05) Largest: 10 ft 20 ft 40 ft 60 ft: Smallest

II. COPEPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.2052	333	7.5626	3.012 (b)
DEPTH CONTOURS	3	1.4222	333	7.6197	20.718 (a)
DATES	11	25.1580	357	9.5618	85.391 (a)
TRANSECTS X DEPTHS	9	0.1768	291	5.2669	1.085 (c)
TRANSECTS X DATES	33	2.1189	291	5.2669	3.548 (a)
DEPTHS X DATES	33	2.1760	291	5.2669	3.643 (a)
TRANSECTS X DEPTHS X DATES	99	2.9512	192	2.3157	2.472 (a)
TOTAL	383	36.5240			

(a) Significant at α < 0.0005
(b) Significant at α < 0.05
(c) Not significant at α = 0.05

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α = 0.05) Largest: NMPE NMPP FITZ NMPW: Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTHS (α = 0.05) Largest: 10 ft 20 ft 40 ft 60 ft: Smallest

APPENDIX V-11 (continued)

ABUNDANCE OF MICROZOOPLANKTON

NINE MILE POINT - 1974

III. CLADOCERANS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.5975	333	10.1375	6.542 (a)
DEPTH CONTOURS	3	1.3353	333	9.7220	15.246 (a)
DATES	11	70.8503	357	12.4952	184.024 (a)
TRANSECTS X DEPTHS	9	0.1544	291	7.0555	0.708 (b)
TRANSECTS X DATES	33	2.9276	291	7.0555	3.659 (a)
DEPTHS X DATES	33	2.5121	291	7.0555	3.140 (a)
TRANSECTS X DEPTHS X DATES	99	3.9062	192	3.1493	2.406 (a)
TOTAL	383	85.4327			

(a) Significant at $\alpha < 0.0005$
(b) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPE NMPW FITZ NMPP: Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$) Largest: 10 ft 20 ft 40 ft 60 ft: Smallest

IV. PROTOZOANS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	0.4171	333	19.5245	2.371 (b)
DEPTH CONTOURS	3	0.6517	333	19.2416	3.759 (c)
DATES	11	24.5143	357	22.0518	36.079 (a)
TRANSECTS X DEPTHS	9	0.2586	291	16.1971	0.516 (e)
TRANSECTS X DATES	33	3.0688	291	16.1971	1.671 (c)
DEPTHS X DATES	33	2.7859	291	16.1971	1.517 (d)
TRANSECTS X DEPTHS X DATES	99	5.2082	192	10.9889	0.919 (e)
TOTAL	383	47.8935			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.10$
(c) Significant at $\alpha < 0.025$
(d) Significant at $\alpha < 0.05$
(e) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.10$) Largest: NMPE FITZ NMPP NMPW: Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$) Largest: 10 ft 20 ft 40 ft 60 ft: Smallest

APPENDIX V-12

MICROZOOPLANKTON
AVERAGE ABUNDANCE BY CONTOUR DEPTH
($No./m^3 x10^4$)

NINE MILE POINT - 1974

DATE	ROTIFIERS				COPEPODS				CLADOCERANS				PROTOZOANS			
	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft	10 ft	20 ft	40 ft	60 ft
26 APR	12.178	12.250	8.049	5.809	1.187	1.607	1.354	1.278	0.012	0.000	0.020	0.008	8.765	6.303	1.275	0.999
11 MAY	17.295	14.961	17.741	12.831	0.615	0.528	0.418	0.513	0.012	0.012	0.025	0.021	3.842	4.290	6.265	3.782
22 MAY	27.604[1]	17.061[1]	11.345[2]	4.081[2]	0.359[1]	0.687[1]	0.402[2]	0.252[2]	0.142[1]	0.014[1]	0.023[2]	0.000[2]	6.484[1]	2.909[1]	1.427[2]	0.954[2]
6 JUN	46.461	37.086	24.691	18.499	5.643	4.203	3.301	2.230	0.816	0.440	0.344	0.173	0.150	1.573	0.247	0.023
28 JUN	61.881	47.031	27.831	19.595	4.059	2.453	1.037	0.720	7.108	1.961	0.979	0.616	0.196	0.068	0.127	0.000
15 JUL	140.810	131.355	118.845	85.388	3.981	3.394	3.274	2.073	26.268	29.748	17.600	12.175	0.972	0.190	0.199	0.040
29 JUL	89.100	131.348	45.888	27.255	12.679	8.789	4.654	4.095	6.727	5.311	3.348	3.731	0.467	0.392	0.215	0.961
8 AUG	76.965	72.085	61.028	33.288	8.444	6.503	6.899	6.719	32.595	26.845	42.085	21.383	5.017	0.052	1.125	4.022
22 AUG	42.035	34.393	19.125	14.250	18.350	14.954	9.125	9.132	4.851	2.625	2.115	1.988	5.316	13.081	5.845	3.050
27 SEP	2.449	2.754	2.447	1.558	6.451	7.967	12.226	7.038	3.180	4.133	4.869	2.674	0.086	0.743	0.374	0.197
24 OCT	7.710	13.983	11.822	9.709	1.314	2.432	3.370	2.526	1.569	1.991	2.365	2.130	1.416	0.207	0.449	0.810
27 NOV	8.516	7.363	5.188	5.042	2.138	1.850	1.305	1.422	1.372	1.007	0.733	0.815	1.164	0.301	0.067	0.120
12 DEC	10.959	7.231	5.989	5.606	2.495	2.390	1.792	1.406	1.242	0.759	0.658	0.537	0.367	0.139	0.065	0.110

[1] No sample at NMPE

[2] No sample at FITZ, NMPE

APPENDIX V-13

ABUNDANCE OF MACROZOOPLANKTON

NINE MILE POINT - 1974

LEPTODORA KINDTII

FOUR-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
STATIONS	14	6.1841	758	124.4061	2.691 (a)
SAMPLE DEPTHS	2	8.3068	650	105.6751	25.547 (b)
DATES	8	361.2480	740	139.4472	239.6279 (b)
PHOTOPERIODS (DAY/NIGHT)	1	3.5015	628	102.0106	21.556 (b)
STATIONS X DEPTHS	28	3.2164	604	82.7666	0.838 (c)
STATIONS X DATES	112	35.7379	604	82.7666	2.329 (b)
STATIONS X PHOTOPERIODS	14	2.6852	604	82.7666	1.400 (d)
DEPTHS X DATES	16	12.0380	604	82.7666	5.491 (b)
DEPTHS X PHOTOPERIODS	2	7.6541	604	82.7666	27.928 (b)
DATES X PHOTOPERIODS	8	8.9047	604	82.7666	8.123 (b)
STATIONS X DEPTHS X DATES	224	24.8257	224	31.1382	0.797 (c)
STATIONS X DEPTHS X PHOTOPERIODS	28	2.5148	224	31.1382	0.646 (c)
STATIONS X DATES X PHOTOPERIODS	112	18.4127	224	31.1382	1.183 (d)
DEPTHS X DATES X PHOTOPERIODS	16	5.8752	224	31.1382	2.642 (a)
TOTAL	809	532.2432			

(a) Significant at α< 0.001
(b) Significant at α< 0.0005
(c) Not significant at α< 0.25
(d) Significant at α< 0.25

STUDENT-NEWMAN-KEULS- STATIONS *(α = 0.05)

Largest:	0.5E	1E	1W	0.5W	3W	1W	0.5E	0.5W	P	P	3W	1E	3E	3E	P	: Smallest
	20ft	20ft	20ft	20ft	20ft	40ft	40ft	40ft	60ft	100ft	40ft	40ft	20ft	40ft	80ft	

STUDENT-NEWMAN-KEULS - Sample depths (α=0.05)
Largest: Bottom Mid-depth Surface: Smallest

Greater estimated abundance at night than during the day

*0.5E = 1/2 NMPE . 0.5W = 1/2 NM P = NMPP
1E = 1 NMPE 1W = 1 NMPW

ABUNDANCE OF MACROZOOPLANKTON

NINE MILE POINT - 1974

GAMMARUS FASCIATUS

FOUR-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
STATIONS	14	68854.4670	758	300267.9039	12.416 (a)
SAMPLE DEPTHS	2	38004.9461	650	222073.6285	55.619 (a)
DATES	8	55744.5235	740	282867.2697	18.229 (a)
PHOTOPERIODS (DAY/NIGHT)	1	215299.9271	628	294738.4535	458.740 (a)
STATIONS X DEPTHS	28	14140.8521	604	171286.2590	1.781 (b)
STATIONS X DATES	112	59124.8977	604	171286.2590	1.862 (a)
STATIONS X PHOTOPERIODS	14	55715.8951	604	171286.2590	14.034 (a)
DEPTHS X DATES	16	10683.1655	604	171286.2590	2.355 (c)
DEPTHS X PHOTOPERIODS	2	25963.3519	604	171286.2590	45.777 (a)
DATES X PHOTOPERIODS	8	41772.9475	604	171286.2590	18.413 (a)
STATIONS X DEPTHS X DATES	224	43486.4464	224	41801.3771	1.040 (d)
STATIONS X DEPTHS X PHOTOPERIODS	28	10874.7443	224	41801.3771	2.081 (c)
STATIONS X DATES X PHOTOPERIODS	112	63534.1928	224	41801.3771	3.040 (a)
DEPTHS X DATES X PHOTOPERIODS	16	11589.4984	224	41801.3771	3.882 (a)
TOTAL	809	756591.2324			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.01$
(c) Significant at $\alpha < 0.0025$
(d) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS - STATIONS *($\alpha = 0.05$)

Largest: 3E 20ft, 1E 20ft, 0.5E 20ft, 1E 40ft, 3E 40ft, 0.5E 40ft, 0.5W 20ft, 3W 20ft, P 60ft, 0.5W 40ft, 3W 40ft, 1W 40ft, 1W 20ft, P 80ft, P 100ft : Smallest

STUDENT-NEWMAN-KEULS-SAMPLE DEPTHS ($\alpha = 0.05$)

Largest: Bottom Mid-depth Surface: Smallest

Greater estimated abundance at night than during the day.

APPENDIX V-15

ABUNDANCE OF MACROZOOPLANKTON

NINE MILE POINT - 1974

INSECTA-DIPTERA

FOUR-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
STATIONS	14	10095.5012	758	44422.4095	12.305 (a)
SAMPLE DEPTHS	2	1267.3496	650	31502.3966	13.075 (a)
DATES	8	5582.4808	740	47410.5213	10.892 (a)
PHOTOPERIODS (DAY/NIGHT)	1	28772.1990	628	41919.5516	431.0385 (a)
STATIONS X DEPTHS	28	1334.6771	604	29092.6250	0.990 (b)
STATIONS X DATES	112	9748.8448	604	29092.6250	1.807 (a)
STATIONS X PHOTOPERIODS	14	4642.2626	604	29092.6250	6.884 (a)
DEPTHS X DATES	16	729.7410	604	29092.6250	0.947 (b)
DEPTHS X PHOTOPERIODS	2	345.3535	604	29092.6250	3.585 (c)
DATES X PHOTOPERIODS	8	7839.3105	604	29092.6250	20.344 (a)
STATIONS X DEPTHS X DATES	224	7170.7575	224	7916.7988	0.906 (b)
STATIONS X DEPTHS X PHOTOPERIODS	28	949.9541	224	7916.7988	0.960 (b)
STATIONS X DATES X PHOTOPERIODS	112	12225.3196	224	7916.7988	3.088 (a)
DEPTHS X DATES X PHOTOPERIODS	16	829.7950	224	7916.7988	1.467 (d)
TOTAL	809	99450.3452			

(a) Significant at $\alpha < 0.0005$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.05$
(d) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS-STATIONS* ($\alpha = 0.05$)

Largest:	3E 20ft	1E 20ft	.5E 20ft	.5W 20ft	3E 40ft	3W 20ft	1W 20ft	1E 40ft	.5E 40ft	3W 40ft	1W 40ft	.5W 40ft	P 60ft	P 80ft	P 100ft	: Smallest

...DENT-NEWMAN-KEULS-DEPTHS ($\alpha = 0.05$)
...gest: Mid-depth Bottom Surface: Smallest

APPENDIX V-16

ABUNDANCE OF FISH EGGS AND SPECIFIC ICHTHYOPLANKTON IN DAY COLLECTIONS

NINE MILE POINT - 1974

I. FISH EGGS

THREE-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	13.3647	658	291.9631	2.151 (a)
Sample Depths	2	2.5302	478	187.3656	3.227 (b)
Dates *	15	121.7536	660	301.9918	17.738 (c)
Stations X Depths	28	12.8786	420	151.5807	1.274 (d)
Stations X Dates	210	127.5043	420	151.5807	1.682 (c)
Depths X Dates	30	22.9068	420	151.5807	2.116 (c)
Total	719	452.5184			

(a) Significant at $\alpha < 0.01$ but not at $\alpha = 0.005$
(b) Significant at $\alpha < 0.05$ but not at $\alpha = 0.025$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$ but not at $\alpha = 0.10$

Student-Newman-Keuls Test -Sample Depths ($\alpha = 0.05$) Largest: Bottom Surface Mid-depth: Smallest
Student-Newman-Keuls Test - Stations ($\alpha = 0.05$) Largest: 1-NMPW 20 ft........ .5-NMPP-60 ft.: Smallest
* 25 April through 8 August

II. ALEWIFE LARVAE

THREE-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	6.8872	322	105.1334	1.507 (a)
Sample Depths	2	3.2581	238	69.9615	5.541 (b)
Dates *	7	85.5322	308	97.0741	39.766 (c)
Stations X Depths	28	8.9880	196	51.6868	1.217 (a)
Stations X Dates	98	44.4586	196	51.6868	1.721 (d)
Depths X Dates	14	9.2867	196	51.6868	2.515 (b)
Total	359	210.0977			

(a) Significant at $\alpha < 0.25$ but not at $\alpha = 0.10$
(b) Significant at $\alpha < 0.005$ but not at $\alpha = 0.0025$
(c) Significicnat at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.001$ but not at $\alpha = 0.0005$

Student-Newman-Keuls Test - Sample Depth ($\alpha = 0.05$) Largest: Surface Mid-depth Bottom: Smallest

* 26 June through 15 August

III. RAINBOW SMELT LARVAE

THREE-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	2.4457	364	52.2872	1.217 (a)
Sample Depths	2	1.5005	268	36.6300	5.488 (b)
Dates	8	14.5837	352	52.5419	12.210 (c)
Stations X Depths	28	3.6492	224	29.0769	1.004 (a)
Stations X Dates	112	19.5611	224	29.0769	1.346 (d)
Depths X Dates	16	3.9039	224	29.0769	1.880 (e)
Total	404	74.7211			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.005$ but not at $\alpha < 0.0025$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.05$ but not at $\alpha = 0.025$
(e) Significant at $\alpha < 0.025$ but not at $\alpha < 0.01$

Student-Newman-Keuls Test - Sample Depth ($\alpha = 0.05$) Largest: Mid-depth Bottom Surface: Smallest
* 10 May through 2 July

APPENDIX V -17

ABUNDANCE OF FISH EGGS AND SPECIFIC ICHTHYOPLANKTON IN COMPARABLE DAY/NIGHT COLLECTIONS

NINE MILE POINT - 1974

I FISH EGGS

FOUR-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	35.2120	500	309.9032	4.058 (a)
Sample Depths	2	11.0203	428	247.5510	9.527 (a)
Dates	5	259.9231	473	382.8449	64.226 (a)
Photoperiods (day/night)	1	122.9001	409.	319.6451	157.256 (a)
Stations X Depths	28	11.1749	388	229.3494	0.675 (b)
Stations X Dates	70	62.9445	388	229.3494	1.521 (c)
Stations X Photoperiods	14	6.4344	388	229.3494	0.778 (b)
Depths X Dates	10	6.8582	388	229.3494	1.160 (b)
Depths X Photoperiods	2	0.1685	388	229.3494	0.143 (b)
Dates X Photoperiods	5	83.6928	388.	229.3494	28.3173(a)
Stations X Depths X Dates	140	60.7522	140	68.8306	0.833 (b)
Stations X Depths X Photoperiods	28	17.1392	140	68.8306	1.245 (d)
Stations X Dates X Photoperiods	70	67.9514	140	68.8306	1.975 (a)
Depths X Dates X Photoperiods	10	14.6760	140	68.8306	2.985 (e)
Total	539	829.6782			

(a) Significant at α < 0.0005
(b) Not significant at α = 0.25
(c) Significnat at α < 0.01
(d) Significant at α < 0.25
(e) Significant at α < 0.0025

Student-Newman-Keuls Test - Stations (α = 0.05)
Largest: 1W 20ft .5E 20ft .5W 20ft 1E 20ft 3W 20ft 3W 40ft 1W 40ft .5E 40ft P 60ft 1E 40ft .5W 40ft 3E 40ft 3E 20ft P 100ft P 80ft :Smallest

Student-Newman-Keuls Test - Sample Depths (α = 0.05) Largest: Bottom Mid-depth Surface: Smallest

Student-Newman-Keuls Test - Dates (α = 0.05) Largest: 17 Jul 12 Jul 24 Jul 1 Aug 19 Jun 7 Aug: Smallest

Greater estimated abundance at night than during the day.

II ALEWIFE LARVAE

FOUR-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	7.4488	758	187.8149	2.147 (a)
Sample Depths	2	1.7568	650	153.0986	3.729 (b)
Dates	8	258.1267	740	211.6755	112.799 (c)
Photoperiods (day/night)	1	48.1534	628	180.1524	167.860 (c)
Stations X Depths	28	4.5466	604	142.6298	0.688 (d)
Stations X Dates	112	33.8001	604	142.6298	1.278 (e)
Stations X Photoperiods	14	6.8384	604	142.6298	2.068 (b)
Depths X Dates	16	5.2418	604	142.6298	1.387 (f)
Depths X Photoperiods	2	0.6804	604	142.6298	1.441 (f)
Dates X Photoperiods	8	30.0038	604	142.6298	15.882 (c)
Stations X Depths X Dates	224	46.5100	224	45.7248	1.017 (d)
Stations X Depths X Photoperiods	28	4.7999	224	45.7248	0.840 (d)
Stations X Dates X Photoperiods	112	38.9290	224	45.7248	1.703 (g)
Depths X Dates X Photoperiods	16	6.6661	224	45.7248	2.041 (b)
Total	809	539.2269			

(a) Significant at α < 0.01
(b) Significant at α < 0.025
(c) Significant at α < 0.0005
(d) Not Significant at α = 0.25
(e) Significant at α < 0.05
(f) Significant at α < 0.25
(g) Significant at α < 0.001

Student-Newman-Keuls Test - Stations* (α = 0.10)
Largest: 3W 20ft 3E 20ft 1W 40ft 0.5E 20ft 1E 40ft 3E 40ft P 80ft 1E 20ft 1W 20ft P 60ft 3W 40ft 0.5E 40ft P 100ft 0.5W 20ft 0.5W 40ft: Smallest

Student-Newman-Keuls Test - Sample Depth (α = 0.05) Largest: Surface Mid-depth Bottom: Smallest

Student-Newman-Keuls Test - Dates (α = 0.05)
Largest: 1 Aug 7 Aug 17 Jul 12 Jul 24 Jul 28 Aug 21 Aug 5 Sep 11 Sep: Smallest

Greater estimated abundance at night than during the day.

III RAINBOW SMELT LARVAE

FOUR-WAY ANALYSIS OF VARIANCE
log transformed

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
Stations	14	2.5397	844	71.8513	2.131 (a)
Sample Depths	2	0.1688	724	58.4220	1.046 (b)
Dates	9	28.2121	829	74.5582	34.854 (c)
Photoperiods (day/night)	1	9.5323	701	64.2139	104.061 (c)
Stations X Depths	28	2.5574	676	52.9504	1.166 (b)
Stations X Dates	126	12.3515	676	52.9504	1.251 (d)
Stations X Photoperiods	14	3.9920	676	52.9504	3.640 (c)
Depths X Dates	18	2.4495	676	52.9504	1.737 (d)
Depths X Photoperiods	2	0.4647	676	52.9504	2.966 (e)
Dates X Photoperiods	9	6.8068	676	52.9504	9.656 (c)
Stations X Depths X Dates	252	20.6470	252	17.8730	1.155 (e)
Stations X Depths X Photoperiods	28	1.9065	252	17.8730	0.960 (b)
Stations X Dates X Photoperiods	126	10.6604	252	17.8730	1.193 (f)
Depths X Dates X Photoperiods	18	1.8635	252	17.8730	1.460 (f)
Total	899	122.0253			

(a) Significant at $\alpha < 0.01$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.05$
(e) Significant at $\alpha < 0.10$
(f) Significant at $\alpha < 0.25$

Student-Newman-Keuls Test - Stations ($\alpha = 0.05$)
Largest: 1E 20ft 0.5E 40ft 3W 20ft 0.5E 20ft 1W 20ft 0.5W 20ft 3E 20ft 0.5W 40ft 1E 40ft 3W 40ft 1W 40ft P 100ft P 60ft 3E 40ft P 80ft :Smallest

Student-Newman-Keuls Test - Dates ($\alpha = 0.05$)
Largest: 19 Jun 17 Jul 12 Jul 7 Aug 2 Aug 28 Aug 24 Jul 5 Sep 11 Sep 1 Aug: Smallest

Greater estimated abundance at night than during the day.

* Stations:
3W - 3 mile radius, West transect
3E - 3 mile radius, East transect
1W - 1 mile radius, West transect
1E - 1 mile radius, East transect
0.5W - 0.5 mile radius, West transect
0.5E - 0.5 mile radius, East transect
P - Nine Mile Point Plant transect

VI. BENTHOS

A. NATURAL HABITATS

1. Introduction

The benthic community, because of its importance in the trophic structure of an ecosystem, and the sedentary/sessile existence of the benthic population, was sampled as part of a study to assess the postoperational effects of Nine Mile Point Nuclear Station Unit 1 on the near-shore lake ecosystem and to describe the benthic community prior to operation of the James A. FitzPatrick Nuclear Station. The seasonal and distributional patterns of abundance, biomass, and community composition were analyzed with particular reference to variations in the following environmental parameters: sediment composition, water temperature, depth contour, and the presence of Cladophora beds. It is hypothesized that the thermal discharge does not directly affect the bottom community except possibly at the 10, 20, and 30 ft depths along NMPP transect. It is during this period that the warm water discharge, which is normally buoyant, either mixes with the cold lake water or, if the plume water is more dense, sinks below the surface and spreads along the bottom.

A preliminary investigation of the spatial distribution of macrofauna with depth in 1972 stated that the number of organisms decreased with depth and that none were found in significant numbers at depths greater than 15 ft (QLM, 1973). An expanded sampling program in 1973, which included areas other than Cladophora beds and monitored seasonal changes, established the following:

Benthic diversity and abundance increased from west to east transects; this increase was associated with the greater proportion of fine grain sand/silt fraction of the sediment.

With the exception of the distribution of macroinvertebrates associated with total Cladophora, macroinvertebrates were not significantly distributed by depth contour.

An increase in total macroinvertebrates (QLM, 1974) and Cladophora growth in the vicinity of the thermal plume (20 ft NMPP transect) was observed only during the month of June.

2. Materials and Methods

a. Sampling Locations

In 1974, benthic collections were made at the same transects and depths as in 1973 (Figure VI-1) (QLM, 1974). Collections by month, transect and depth contour are indicated in Table VI-1.

BENTHOS SAMPLING STATIONS

NINE MILE POINT, 1974

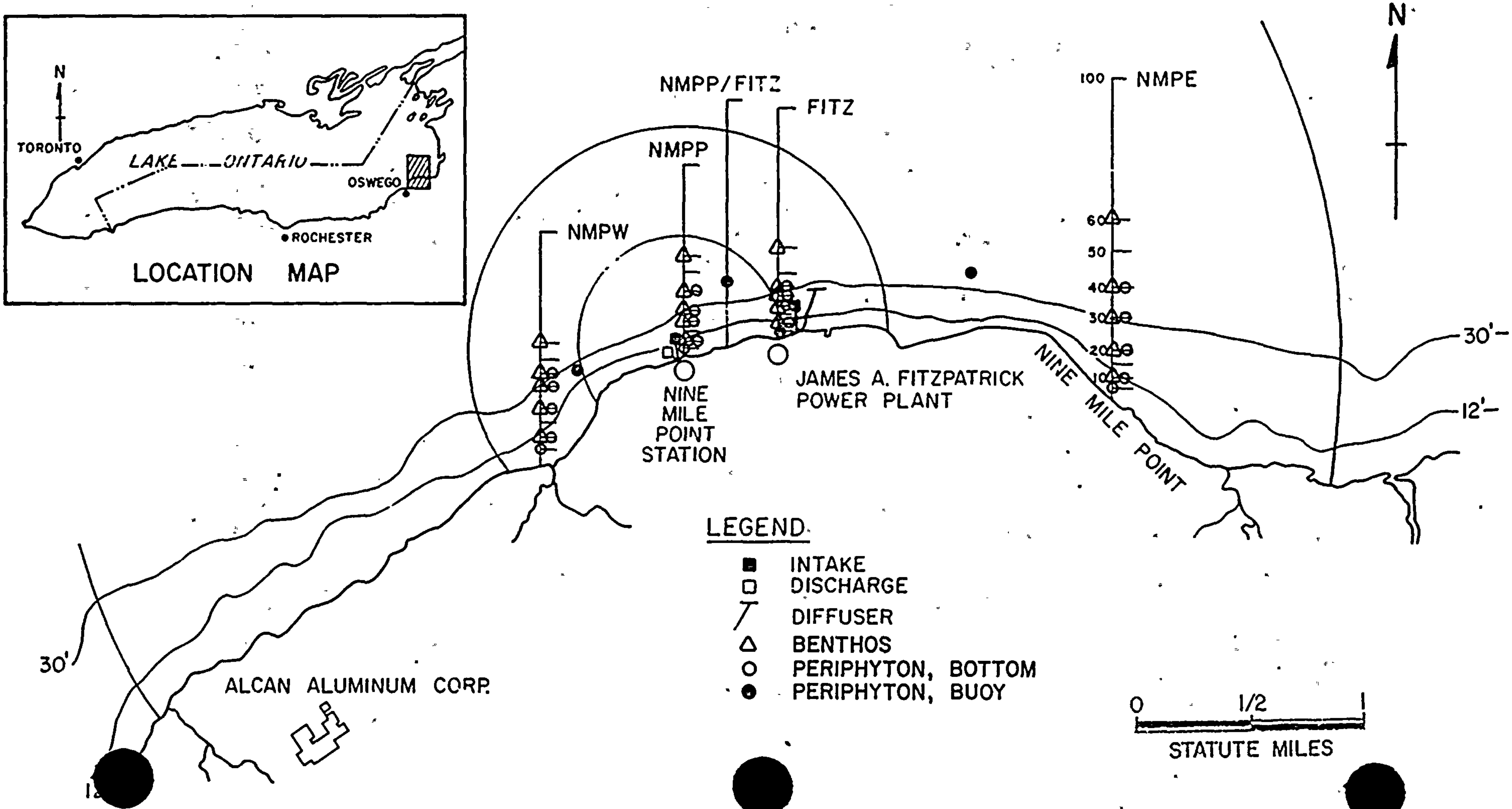

FIGURE VI-1

TABLE VI-1

BENTHOS SAMPLING PROGRAM

NINE MILE POINT - 1974

Transect/Depth Contour	MONTHS				
	April 24,26,27,29	June 12,14	Aug 13,15	Oct 24,29	Dec 7,12,13
NMPE 10'C	no sample	X	no sample	no sample	no sample
10'NC	X	X	X	X	X
20'	X	X	XΔ	X	X
30'	X	X	X	X	X
40'	X	X	X	X	X
60'	X	X	X	X	X
FITZ 10'C	X	X	no sample	no sample	no sample
10'NC	no sample	X	X	X	X
20'	X	X	X	X	X
30'	X	X	X	X	X
40'	X	X	X	X	X
60'	X	X	X	X	X
NMPP 10'C	no sample	X	no sample	no sample	no sample
10'NC	X	no sample	X	X	X
20'	X	X	X	X	X
30'	X	X	X	X	X
40'	X	X	X	X	X
60'	X	X	X	X	X
NMPW 10'C	X	X	no sample	no sample	no sample
10'NC	no sample	no sample	X	X	X
20'	X	X	X	X	X
30'	X	X	X	X	X
40'	X	X	X	X	X
60'	X	X	X	X	X

X = Two samples were collected per station.
C = *Cladophora* sample (i.e., *Cladophora* present)
NC = non-*Cladophora* sample
Δ = nematode sample lost

b. Sampling Procedures

Two collections were made at each station using a benthos pump and a 0.5 m diameter ring following the procedure used in 1973 (QLM, 1974). A Cladophora station was identified by the presence of a mat of algae, approximately 1" thick, growing throughout the 0.5 m sampling ring.

c. Sampling Frequency

Benthic samples were collected once a month in April, June, August, October, and December, 1974.

d. Laboratory Analysis

Upon collection, samples were chilled and returned to the laboratory, where each benthic sample was rinsed with tap water in a #40 (420 μm) USGS Standard Sieve prior to preservation and staining with a solution of 70% ethanol and Phloxine-B (Mason and Yevich, 1967). The Phloxine-B, which stains the tissues of the organism red within 48 hours, facilitates the observation and subsequent removal of the organisms from the substrate. Forceps and a zoom dissecting microscope were utilized to remove specimens from the sediment. These were then sorted by taxon (generally Order), counted, and preserved in 70% ethanol. Large samples, primarily those containing Cladophora, were subsampled using one of the following methods:

1. Very large samples were evenly spread in a 21.1 liter Plexiglas box measuring 88.3 cm X 30.5 cm X 7.6 cm and constructed so that the sample could be divided into eight aliquots. One of these aliquots was randomly chosen as a subsample, from which the total abundance of the sample was determined by extrapolation.

2. In the case of smaller collections, a smaller Plexiglas box (measuring 30.1 cm X 25.0 cm X 7.6 cm) was used to divide the sample into fourths, from which one or two aliquots were selected as a subsample for determination of total abundance.

Identification and biomass procedures were the same as those used in 1973 (QLM, 1974), with the following exception: for determination of wet weight biomass of Turbellaria, Oligochaeta, Hydracarina, Ostracoda, and Diptera. The weight of dipterans and oligochaetes was based on weights of subjective size categories (Tables VI-2A, VI-2B). The biomass value for turbellarians, ostracods, and Hydracarina was determined by multiplying the number of organisms in each group, irrespective of size, by the

average weight per organism of that group as determined from the biomass of a large sample. Gastropods and pelecypods were weighed in toto.

e. Statistical Analysis

Replicate samples (R-1 and R-2) were used in all statistical analyses in order to increase the sensitivity of the tests. Substrate composition was not a factor in the analysis of variance between years as the sediment was analyzed only once in 1973.

3. Results and Discussion

a. Sediment Characteristics of Benthic Sampling Sites

Visual observations of the bottom sediment within the sampling ring at each station for each sampling date in 1974 are presented in Tables VI-3 to VI-7. Although the deepest station was at the 60 ft (approximately 18 m) depth contour, because of overall lake topography, this can be classified as representing the near-shore sediment patterns.

Sutton, Lewis, and Woodrow (1970) made several observations during the summers of 1968 and 1969 on the near-shore (0-33 m) sediment along the southern shore of Lake Ontario between Rochester and Stony Point. Several of their conclusions are as follows:

(1) There is generally a west-to-east transport of sediment.

(2) Sites of sediment accumulation occur in near-shore shallow areas where the shoreline is irregular and where there are local deviations from the above transport pattern.

(3) In general, the coarser sands, boulders, pebbles, and cobbles lie in the beach or near-shore area, and finer sediments are found lakeward.

(4) Several small patches of sand occur offshore between Oswego and Mexico Bay, and it is hypothesized that these originate from the Oswego River.

Visual observations made in the Nine Mile Point vicinity during the 1974 sampling period corroborate some of the earlier observations of Sutton et al. (1970). The two western transects, NMPW and NMPP, were dominated by more bedrock and rubble than sand and silt, whereas the FITZ and NMPE transects had bedrock and rubble near shore with sand and silt prevalent beyond the 20 ft depth contour. The presence of a finer grained sediment to

TABLE VI-2A

LABORATORY PROCEDURE FOR BIOMASS DETERMINATIONS

SIZE CLASSES AND AVERAGE WEIGHTS FOR DIPTERA

NINE MILE POINT - 1974

CLASS	SIZE RANGE (mm)	AVG BIOMASS 10^{-4}g
1	0.0 -2.49	3.54
2	2.50-4.99	3.88
3	5.00-7.49	8.42
4	7.50-9.99	20.79
5	10.00-12.49	31.64
6	12.50-14.99	54.62

TABLE VI-2B

LABORATORY PROCEDURE FOR BIOMASS DETERMINATIONS

SIZE CLASSES AND AVERAGE WEIGHTS FOR OLIGOCHAETA

NINE MILE POINT - 1974

CLASS	AVG BIOMASS 10^{-4}g
"Small" (Naidids, *Manayunkia*, *Stylodrilus*)	3.22
"Large" (Tubificids, *Stylodrilus*)	9.8

TABLE VI-3

BENTHIC STATION SUBSTRATE COMPOSITION
and
RANKING OF MOST ABUNDANT TAXA PER MONTH AND TRANSECT

10 FT. DEPTH CONTOUR

NINE MILE POINT - 1974

MONTH	NMPW		NMPP		FITZ		NMPE	
	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa
APRIL	40% Rubble 40% Bedrock 20% Sand	*Gammarus Cricotopus Ostracoda	100% Rubble	Nematode Rheotanytarsus Cricotopus	100% Bedrock	*Gammarus Cricotopus Diptera pupae	80% Bedrock 20% Rubble	Goniobasis Stichochironomus Gammarus
JUNE	75% Bedrock 20% Rubble 5% Sand & Silt	*Gammarus Cricotopus Ostracoda	100% Bedrock & Rubble	*Nais Gammarus Ostracoda	100% Bedrock	Ostracoda Lebertia Alaimus	100% Bedrock	Gammarus Ostracoda Polypedilum
AUGUST	95% Bedrock & Rubble 5% Sand & Silt	Gammarus Rheotanytarsus Bithynia	80% Bedrock 20% Sand & Silt	Gammarus Cryptochironomus Diptera pupae	95% Bedrock & Rubble 5% Sand & Silt	Gammarus Goniobasis Sphaerium	100% Sand & Silt	Gammarus Cryptochironomus Paracladopelma
OCTOBER	100% Bedrock & Rubble	Gammarus Physa Lebertia	80% Bedrock 20% Silt	Gammarus Lebertia Amnicola Ferissia Goniobasis Physa	100% Bedrock & Boulders	Gammarus Pontoporeia Planariidae	100% Sand & Silt	Gammarus Pisidium Tubificidae IWOC
DECEMBER	95% Bedrock & Rubble 5% Sand & Silt	Gammarus Lebertia Eukiefferiella	80% Bedrock 20% Sand & Silt	Gammarus Eukiefferiella Cricotopus	100% Bedrock & Rubble	Gammarus Eukiefferiella Rheotanytarsus	90% Bedrock 10% Sand & Silt	Gammarus Physa Nemertea Planariidae Goniobasis

* Cladaphora sample at 10 ft. contour

IWOC = Immature, without chaetae

Gammarus = G. fasciatus
Nais = N. bretscheri
Amnicola = A. limosa
Ferissia = F. tarda
Goniobasis = G. livescens
Physa = P. integra
Pontoporeia = P. affinis

TABLE VI-4

BENTHIC STATION SUBSTRATE COMPOSITION
and
RANKING OF MOST ABUNDANT TAXA PER MONTH AND TRANSECT

20 FT DEPTH CONTOUR

NINE MILE POINT - 1974

MONTH	NMPW Substrate	NMPW Taxa	NMPP Substrate	NMPP Taxa	FITZ Substrate	FITZ Taxa	NMPE Substrate	NMPE Taxa
APRIL	99% Bedrock 1% Silt	Manayunkia Gammarus Amnicola	95% Bedrock 5% Rubble	Manayunkia Gammarus Lebertia	50% Bedrock 50% Rubble	Gammarus Manayunkia Lebertia	95% Bedrock 5% Rubble & Sand	Gammarus Amnicola Lebertia
JUNE	75% Bedrock 20% Rubble 5% Sand & Silt	Ostracoda Manayunkia Gammarus	100% Bedrock & Rubble	Manayunkia Gammarus Ostracoda	95% Bedrock % Silt	Ostracoda Gammarus Tanytarsini	100% Bedrock & Rubble	Ostracoda Gammarus Amnicola
AUGUST	95% Bedrock & Rubble 5% Sand & Silt	Manayunkia Gammarus Micropsectra	80% Bedrock 20% Sand & Silt	Tanytarsini Diptera pupae Gammarus	95% Bedrock & 5% Sand & Silt	Ostracoda Manayunkia Gammarus	50% Rubble 50% Sand & Silt	Gammarus Sphaerium Manayunkia
OCTOBER	100% Bedrock & Rubble	Manayunkia Amnicola Gammarus	80% Bedrock 20% Silt	Gammarus Lebertia Hygrobates I	100% Bedrock	Gammarus Tubificidae IWOC Planariidae Pisidium	90% Rock & Small Boulders 10% Sand & Gravel	Gammarus Sphaerium Amnicola
DECEMBER	95% Bedrock & Rubble 5% Sand & Silt	Manayunkia Gammarus Lebertia	80% Bedrock 20% Sand & Silt	Gammarus Limnodrilus	95% Bedrock 5% Sand & Silt	Gammarus Nemertea Lebertia	90% Rubble & Rock 10% Sand & Silt	Gammarus Amnicola Dorylaimus

IWOC - immature, without chaetae

Manayunkia = *M. speciosa*
Gammarus = *G. fasciatus*
Amnicola = *A. limosa*
Hygrobates I = *Hygrobates* sp. I
Hygrobates III = *Hygrobates* sp. III
Limnodrilus = *L. hoffmeisteri*

TABLE VI-5

BENTHIC STATION SUBSTRATE COMPOSITION
and
RANKING OF MOST ABUNDANT TAXA PER MONTH AND TRANSECT

30 FT DEPTH CONTOUR

NINE MILE POINT - 1974

MONTH	NMPW Substrate	NMPW Taxa	NMPP Substrate	NMPP Taxa	FITZ Substrate	FITZ Taxa	NMPE Substrate	NMPE Taxa
APRIL	70% Bedrock 25% Rubble	Hygrobates I Ostracoda Manayunkia	50% Bedrock 50% Rubble	Gammarus Manayunkia Lebertia	100% Sand & Silt	Cryptochironomus Tubificidae IWOC Pisidium	100% Sand & Silt	Valvata Pisidium Amnicola
JUNE	90% Bedrock & Rubble 10% Sand & Silt	Gammarus Ostracoda Planariidae	100% Bedrock & Rubble	Ostracoda Forelia Tubificidae IWOC	75% Bedrock & Rubble 25% Sand & Silt	Gammarus Ostracoda Hydracarina Forelia	100% Sand & Silt	Ostracoda Sphaerium Valvata
AUGUST	95% Bedrock & Rubble 5% Sand & Silt	Manayunkia Gammarus Hygrobates I	80% Bedrock 20% Sand & Silt	Manayunkia Tanytarsini Physa	70% Rubble 30% Sand & Silt	Gammarus Tubificidae Ostracoda	100% Sand & Silt	Pisidium Gammarus Tubificidae IWOC
OCTOBER	100% Bedrock	Hygrobates I Hygrobates III Gammarus	80% Bedrock 20% Silt	Gammarus Lebertia Hygrobates III	100% Sand & Silt	Tubificidae IWOC Sphaerium Pisidium	100% Sand & Silt	Valvata Sphaerium Amnicola
DECEMBER	50% Sand & Silt 50% Bedrock	Gammarus Amnicola Hygrobates III	100% Bedrock	Gammarus Lebertia Planariidae	100% Sand & Silt	Pontoporeia Tubificidae IWOC Gammarus	100% Sand & Silt	Sphaerium Gammarus Crptochironomus

IWOC = Immature, without chaetae

Manayunkia = M. speciosa
Gammarus = G. fasciatus
Hygrobates I = Hygrobates sp. I
Hygrobates III = Hygrobates sp. III
Amnicola = A. limosa
Valvata = V. perdepressa

TABLE VI-6

BENTHIC STATION SUBSTRATE COMPOSITION
and
RANKING OF MOST ABUNDANT TAXA PER MONTH AND TRANSECT

40 FT DEPTH CONTOUR

NINE MILE POINT - 1974

MONTH	NMPW		NMPP		FITZ		NMPE	
	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa
APRIL	80% Rubble 15% Bedrock 5% Silt	Hygrobates I Hygrobates III Lebertia	90% Bedrock 10% Rubble	Gammarus Planariidae Lebertia	100% Sand & Silt	Tubificidae IWOC Dorylaimus Gammarus	100% Sand & Silt	Valvata Amnicola Pisidium
JUNE	80% Bedrock & Rubble 20% Sand & Silt	Forelia Gammarus Ostracoda	100% Bedrock & Rubble	Ostracoda Forelia Manayunkia	100% Sand & Silt	Ostracoda Tubificidae IWOC Pontoporeia	100% Sand & Silt	Ostracoda Valvata Pontoporeia
AUGUST	95% Bedrock & Rubble 5% Sand & Silt	Manayunkia Gammarus Ostracoda	90% Bedrock 10% Silt	Tanytarsini Diptera pupae Hygrobates I	100% Sand & Silt	Tubificidae IWOC Gammarus Valvata Ostracoda Pisidium	100% Sand & Silt	Sphaerium Ostracoda Valvata
OCTOBER	100% Bedrock	Gammarus Hygrobates III Hygrobates I	80% Bedrock 20% Silt	Hygrobates III Gammarus Lebertia	100% Sand & Silt	Tubificidae IWOC Cryptochironomus Valvata	100% Sand & Silt	Gammarus Valvata Pisidium
DECEMBER	100% Bedrock	Gammarus Manayunkia Hygrobates III	100% Bedrock	Gammarus Ostracoda Lebertia	100% Sand & Silt	Tubificidae IWOC Potamothrix Pontoporeia	100% Sand & Silt	Sphaerium Gammarus Ostracoda

IWOC = Immature, without chaetae

Gammarus = G. fasciatus
Manayunkia = M. speciosa
Ponteporeia = P. affinis
Valvata = V. perdepressa
Potamothrix = P. moldaviensis
Amnicola = A. limosa

TABLE VI-7

BENTHIC STATION SUBSTRATE COMPOSITION
and
RANKING OF MOST ABUNDANT TAXA PER MONTH AND TRANSECT

60 FT DEPTH CONTOUR

NINE MILE POINT - 1974

MONTH	NMPW		NMPP		FITZ		NMPE	
	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa	Substrate	Taxa
APRIL	95% Bedrock 5% Silt	Hygrobates I Hygrobates III Tubificidae IWOC UID Dipteran	49% Bedrock 49% Rubble 2% Silt	Hygrobates I Hygrobates III Gammarus Physa Ostracoda Amnicola Eukiefferiella	100% Sand & Silt	Tubificidae IWOC Gyraulus Dorylaimus	100% Sand & Silt	Pisidium Valvata Ostracoda
JUNE	100% Sand & Silt	Ostracoda Tubificidae IWOC Limnodrilus	100% Bedrock & Rubble	Forelia Ostracoda Hygrobates I	100% Sand & Silt	Pontoporeia Ostracoda Tubificidae IWOC	100% Sand & Silt	Ostracoda Pontoporeia Valvata
AUGUST	95% Bedrock & Rubble 5% Sand & Silt	Ostracoda Forelia Chironomus	85% Bedrock 15% Silt	Ostracoda Chironomus Tubificidae IWOC	100% Sand & Silt	Ostracoda Dorylaimus Pontoporeia	100% Sand & Silt	Valvata Sphaerium Pontoporeia
OCTOBER	100% Sand & Silt	Tubificidae IWOC Potamothrix Ostracoda	80% Bedrock 20% Silt	Ostracoda Tubificidae IWOC Gammarus	100% Sand & Silt	Chironomus Ostracoda Valvata	100% Sand & Silt	Valvata Pisidium Gammarus
DECEMBER	100% Sand & Silt	Tubificidae IWOC Chironomus Sphaerium	95% Bedrock 5% Sand & Silt	Planariidae Gammarus Oecetis	100% Sand & Silt	Tubificidae IWOC Dorylaimus Cryptochironomus	100% Sand & Silt	Sphaerium Valvata Pisidium

IWOC = Immature without chaetae

Limnodrilus = L. hoffmeisteri
Potamothrix = P. moldaviensis
Gammarus = G. fasciatus
Physa = P. integra
Amnicola = A. limosa
Gyralus = G. parvus
Pontoporeia = P. affinis
Valvata = V. perdepressa

the east probably corresponds to the dominance of patchy sand deposits in Mexico Bay. The irregularity of the shoreline at Nine Mile Point could possibly be the cause of minor sand and silt deposition at that point and eastward. In general, finer grained sediments are more dominant farther offshore (60 ft depth contour).

In addition to the characterization of sediment type, chemical analyses were performed on the sand-silt sediment type and its supernatant collected on 19-20 September 1974 (Table VI-8).

Moisture content measurements indicated finer grained sediments at 20 and 40 ft depths at NMPP and at the 20 ft depth at FITZ. Copper and chromium concentrations were relatively uniform between stations and depths; lead and mercury concentrations were more variable. Based primarly on investigations, the sediments off the Nine Mile Point Nuclear Station are higher in heavy metal concentrations. However, with the inherent variability in sediment characteristics, additional data is necessary prior to further interpretation. Mercury concentrations exceeded the criteria for acceptability of dredged spoil disposal to the nation's waters (0.1 mg/100 g) (QLM, 1974) in four of the eight samples. The high concentration values recorded for mercury were verified in the laboratory and followed the same concentration pattern for the remaining heavy metals.

The organic content of the sediment, characterized by COD (chemical oxygen demand), TKN (total Kjeldahl nitrogen), and TP (total phosphorus), was higher in 1974 than in 1973. The highest values (TKN approximately 193 mg/100 g dry weight; COD approximately 5200 mg/100 g dry weight) were recorded at the 20 ft depth contour at NMPP and FITZ transects. High values for TKN (>100 mg/100 g dry weight) were also recorded at NMPE 20 ft and NMPP 40 ft stations, although the corresponding values of COD were <5000 mg/100 g dry weight. Values for these parameters exceeded the maximum limits for acceptability of dredged spoil. Total phosphorus (TP) concentrations were high at 20 and 40 ft depths at NMPP, and corresponded with the high values of TKN and COD recorded for these stations. The lowest values for TKN and COD (TKN approximately 30 mg/100 g dry weight and COD approximately 210 mg/100 g dry weight) were recorded at the NMPW 20 ft and NMPE 40 ft stations.

The COD and TP concentrations for the supernatant waters within the sample containers were considerably higher than for surrounding lake waters, indicating an appreciable amount of leaching into the supernatant during sample handling and transport.

TABLE [illegible]-8

WATER QUALITY SEDIM[illegible]CHARACTERISTICS

19 - 20 September

NINE MILE POINT - 1974

PARAMETER	20 ft. depth contour				40 ft. depth contour			
	NMPW	NMPP	FITZ	NMPE	NMPW	NMPP	FITZ	NMPE
COD*	217	5247	5447	3056	1176	4419	546	233
Total Phosphorus*	7.89	210.73	26.45	32.18	27.16	114.31	39.16	72.79
Total Kjeldahl Nitrogen*	30.74	197.85	198.50	116.15	44.20	173.34	12.99	30.52
Moisture content %	22.65	64.62	63.10	40.94	28.16	62.33	19.24	22.40
Total Solids %	77.35	35.38	36.90	59.06	71.84	37.67	80.76	77.60
Total Volatile Solids %	0.93	1.68	1.96	0.92	0.89	1.78	0.15	0.88
Cu*	<0.005	<0.005	0.190	0.931	0.109	0.372	<0.005	<0.005
Hg*	0.005	0.133	0.121	0.061	0.049	0.239	0.171	0
Pb*	<0.03	2.954	2.832	1.964	0.863	1.725	0.211	<0.030
Cr*	1.655	3.618	2.398	2.260	1.121	3.164	0.662	0.554
Supernatant COD (mg/1)	25.74	47.33	369	40	385	124.85	177	47
Supernatant TP (mg/1)	0.50	1.09	0.98	2.44	0.61	1.59	2.74	0.73

* mg/100g dry weight

b. Animal-Sediment Relationships

The macroinvertebrates collected from the Nine Mile Point vicinity during 1974 are listed systematically in Table VI-9. Seven phyla and a minimum of 82 genera were represented. Coelenterates (Hydra sp. and Cordylophora caspia) and nemerteans were collected in 1973 but recorded for the first time in the benthic samples in 1974. The invertebrates were identified in 1974 to the same taxonomic level as that reported in 1973 except for the nematodes, which were now identified at the generic level. The difference in the species inventory between 1973 and 1974 for the tubificids, naidids, pulmonates, prosobranchs, pelecypods, Hydracarina, decapods, dipterans, and Trichoptera is discussed in the General Systematic Survey section of the benthos.

Tables VI-3 to VI-7 present the observed sediment characteristics of replicate one (R-1) and a ranking by abundance of the dominant organisms at each transect for the 10, 20, 30, 40, and 60 ft depth contours, respectively.

The ranking of gammarids, the dipterans Cricotopus, Rheotanytarsus, Polypedilum, and Stictochironomus, and naidids at the 10 ft contour (Table VI-3) for April and June reflect heavier Cladophora growth on the rubble and bedrock during these months. For those months when Cladophora growth was reduced, the amphipod Gammarus fasciatus, several genera of dipterans (particularly Cryptochironomus, Rheotanytarsus, and Eukiefferiella), and the water mite Lebertia were dominant at the stations characterized by bedrock and rubble. In August and October NMPE transect was characterized as 100% sand and silt. In October at this transect the pelecypod Pisidium and immature tubificid oligochaetes were found to be second in dominance to Gammarus.

At the 20 ft contour (Table VI-4) Gammarus and the polychaete Manayunkia were ranked first in abundance at more stations than any other organism. Manayunkia dominance was evident at NMPW transect which was characterized by a bedrock and rubble substrate for all sampling dates. This freshwater polychaete was reported occasionally from the other transects from April through August when the sediments were observed to be predominantly rubble and bedrock. Gammarus was found at all locations, regardless of sediment type. The pelecypod Sphaerium sp., the pulmonate Amnicola limosa, and the oligochaete Limnodrilus hoffmeisteri were found at those stations which had a higher proportion of sand and silt at the 20 ft depth contour (e.g., NMPE and NMPP).

TABLE VI-9

MACROINVERTEBRATE SPECIES INVENTORY

NINE MILE POINT - 1974

COELENTERATA
- Hydrozoa
  - *Hydra* sp.
  - *Cordylophora caspia (lacustris)*

NEMERTEA
- UID

NEMATODA[1]
- UID
- *Alaimus* sp.
- *Anonchus* sp.
- *Butlerius* sp.
- *Dorylaimus* sp.
- Bastianiidae
  - Genus A
  - Genus B
  - Genus C

PLATYHELMINTHES
- Turbellaria
  - Tricladida
    - Planariidae
      - *Dugesia* sp. √

ANNELIDA
- Polychaeta
  - Sabellidae
    - *Manayunkia speciosa* √
- Oligochaeta
  - Prosopora
    - Lumbriculidae
      - *Stylodrilus heringianus* √
  - Plesiopora
    - Tubificidae
      - IWOC - immature without chaetae
      - IWC - immature with chaetae
      - *Aulodrilus americanus*
      - *A. limnobuis* √
      - *A. piqueti* √
      - *A. pluriseta* √
      - *Ilyodrilus templetoni* √
      - *Limnodrilus claparedianus* √
      - *L. hoffmeisteri* √
      - *L. profundicola* √
      - *L. spiralis*
      - *L. udekemianus* √
      - *Peloscolex ferox* √
      - *P. freyi* √
      - *P. multisetosus multisetosus* √
      - *P. multisetosus longidentus*
      - *Potamothrix moldaviensis* √
      - *P. vejdovskyi* √
      - *Tubifex tubifex* √
    - Enchytraeidae
      - UID
    - Naididae
      - *Arcteonais lomondi* √
      - *Nais barbata*
      - *N. bretscheri*
      - *N. elinquis*
      - *N. simplex*
      - *Ophidonais serpentina* √
      - *Paranais simplex*
      - *Piquetiella michiganensis* √
      - *Specaria josinae* √
      - *Stylaria fossularis*
      - *S. lacustris*
      - *Uncinais uncinata* √
      - *Vejdovskyella* sp.
      - *V. comata*

[1]Only genera are listed; taxonomy is under revision.
UID = Unidentified taxa.
√ = Occurrence in 1973 and 1974 benthic samples

TABLE VI-9 (continued)

- MOLLUSCA
  - Gastropoda
  - Prosobranchia[2]
    - Valvatidae
      - *Valvata perdepressa*
      - *V. tricarinata*
    - Bulimidae
      - *Amnicola integra* ✓
      - *A. limosa* ✓
      - *A. lustrica* ✓
      - *Bithynia tentaculata*
    - Pleuroceridae
      - *Goniobasis livescens* ✓
      - *Pleurocera acuta*
  - Pulmonata[2]
    - Physidae
      - *Physa* spp. (immatures)
      - *P. integra* ✓
      - *P. sayii* ✓
    - Lymnaeidae
      - *Lymnaea catascopium* ✓
    - Planorbidae
      - *Gyraulus parvus* ✓
      - *Helisoma anceps* ✓
      - *H. trivolvis* ✓
    - Ancylidae
      - *Ferissia tarda*
  - Pelecypoda
    - Schizodonta
      - Unionidae
        - *Elliptio* sp.
    - Heterodonta
      - Sphaeridae
        - *Pisidium* spp. ✓
        - *Sphaerium* spp. ✓
- ARTHROPODA
  - Arachnoidea
    - Hydracarina
      - Hygrobatidae
        - *Hygrobates* spp. ✓
      - Limnesiidae
        - *Limnesia* sp.
      - Unionicaledae
        - *Huitfeldtia rectipes*
        - *Neumania* sp.
        - *Unionicola* sp. ✓
      - Lebertiidae
        - *Lebertia* sp. ✓
      - Torrenticollidae
      - Pionidae
        - *Forelia* sp. ✓
        - *Piona* sp. ✓
  - Crustacea
  - Ostracoda[2]
    - Podocopa
      - UID genera
  - Malacostraca[2]
    - Isopoda
      - Asellidae
        - *Asellus* sp. ✓
    - Amphipoda
      - Haustoridae
        - *Pontoporeia affinis* ✓
      - Gammaridae
        - *Gammarus fasciatus* ✓
    - Decapoda
      - Astacidae
      - Cambarinae[3]
        - *Cambarus robustus*
        - *Orconectes propinquus* ✓
  - Insecta
    - Diptera
    - UID[1] pupae
      - Chironomidae
      - Chironomini[4]
        - *Chironomus* sp. ✓
        - *Cryptochironomus* sp. ✓
        - *Cryptocladopelma* sp.
        - *Dicrotendipes* sp. ✓
        - *Glyptotendipes* sp.
        - *Microtendipes* sp. ✓

[2] Subclass
[3] Subfamily
[4] Tribe
✓ 1973 and 1974.

TABLE VI-9 (continued)

Parachironomus sp.
Paracladopelma sp.✓
Paralauterborniella sp.
Paratendipes sp.✓
Phaenopsectra sp.✓
Pseudochironomus sp.✓
Polypedilum sp.✓
Stictochironomus sp.✓
Xenohironomus sp.✓
Tanytarsini
Cladotanytarsus sp.
Micropsectra sp.[5]✓
Paratanytarsus sp.
Rheotanytarsus sp.
Tanytarsus sp.[5]
Tanypodinae[3]
Anatopynis sp.
Procladius sp.✓
Orthocladiinae[3]
Cardiocladius sp.
Cricotopus spp.✓
Heterotrissocladius sp.✓
Orthocladius sp.
Trissocladius sp.
Diamesinae[3]
Potthastia sp.
Ceratopogonidae
UID
Empididae
UID
Stratiomyidae
UID
Ephemeroptera
Heptageniidae
Stenonema sp.✓
Trichoptera
UID pupa
Hydroptilidae
Agraylea sp.
Leptoceridae
Athripsodes sp.✓
Oecetis sp.✓

5 Genera identification tentative.
✓ 1973 and 1974

The substrate composition at the 30 ft depth contour (Table VI-5) was more variable than at the other depth contours. Substrates at the western stations (NMPW and NMPP), which appeared to be composed of coarse grained material, were dominated by Gammarus and two genera of Hydracarina, Hygrobates and Lebertia. The eastern stations (FITZ and NMPE) were characterized as 100% sand and silt, which was reflected in the high ranking of pelecypods and gastropods. Gammarus was among the three most abundant species in 12 of the 20 collections and was found on all substrate types. Ostracods were also found on all substrates at this depth contour.

The 40 ft contour (Table VI-6) at the western transects was predominantly bedrock and rubble, although the sand and silt component of the sediment was greater at this contour than at the shallower contours. Gammarus, ostracods, Hygrobates, and Lebertia were the dominant taxa at these stations. The eastern transects (FITZ and NMPE) were characterized as 100% sand and silt for all collections, with the molluscs Valvata perdepressa, Pisidium, and Sphaerium, immature tubificids, ostracods, and Gammarus the most abundant organisms.

A 100% sand and silt sediment type characterized the NMPW transect in June, October, and December and the FITZ and NMPW transects for all collections at the 60 ft contour (Table VI-7). Immature tubificids, the molluscs Valvata perdepressa, Pisidium and Sphaerium, and ostracods were dominant as they were at the 100% sand and silt stations at the 40 ft depth contour. For those collections at NMPW and NMPP which were characterized by a bedrock or bedrock and rubble with <5% silt substrate type, ostracods, Hygrobates, and the dipteran Chironomus were dominant. A specific substrate preference for Cladophora is hypothesized for the nematode Alaimus, the oligochaete Nais bretscheri, and the dipterans Cricotopus and Polypedilum. The nemerteans and the water mite Lebertia appear to prefer a bedrock substrate, and Manayunkia a bedrock and rubble substrate. The nematode Dorylaimus, immature tubificid oligochaetes and Potamothrix moldaviensis, and the molluscs Valvata perdepressa, Gyraulus parvus, Pisidium, and Sphaerium, and the dipteran Cryptochironomus were predominant at sand and silt substrates. The ostracods and the amphipod Gammarus were shown to be more eurytopic than any of the above organisms, with depth more of a limiting factor than substrate composition.

c. Replicate Samples Collected From Different Substrates

Two samples (R-1, R-2) were collected from each station; however, the samples collected did not necessarily represent identical substrate types, e.g., NMPE 10 ft non-Cladophora, NMPE 20 ft and FITZ 30 ft on 15 August 1974.

The differences in species composition and abundance between replicates of different substrate types (Table VI-10) emphasize the importance of sediment type to benthic communities.

NMPE 10 ft non-Cladophora - The substrate for replicate one (R-1) was characterized by visual observation as 100% sand and silt and was void of Cladophora. The associated community was low in total abundance (586 organisms/m^2) and diversity (10 taxa recorded). The amphipod Gammarus (43.5%) and the dipteran Cryptochironomus (26.1%) were the dominant organisms in this sample, and were frequently associated with a sand and silt sediment type throughout this study.

Replicate two (R-2) sediment was visually characterized as 60% rubble and 40% sand and silt, with filaments of Cladophora sparsely distributed over the total sample area. Abundance (14,438 organisms/m^2) and diversity (19 taxa) for this sample was greater than that of R-1. Gammarus composed 95% of the total abundance of R-2. Dipterans, in particular Polypedilum, and Pseudochironomus, ostracods, the nematode Alaimus, and the polychaete Manayunkia, were more abundant in this sample than in R-1. Alaimus was observed to be prevalent in Cladophora communities in the Nine Mile Point vicinity (particularly FITZ and NMPW in June), and Manayunkia was prevalent in bedrock rubble sediment type.

NMPE 20 ft - Replicate one (R-1) was visually characterized as 50% rubble, and 50% sand and silt, with very sparse Cladophora growth (0.18 g/m^2). Both abundance (11,039 organisms/m^2) and diversity (26 taxa) were high compared to other NMPE stations in August. Gammarus was the major taxon reported from this collection, composing 70.1% of the total abundance. Other species occurring in significant abundance were the pelecypod Sphaerium (8.6%), which is usually associated with a sand and silt sediment type, Manayunkia (6.1%), and Polypedilum (4.2%).

The characterization of R-2 sediment was similar to that of R-1 (75% rubble, 25% sand and silt); however, this sample area had greater Cladophora growth (9.73 g/m^2). Thirty-one taxa were identified from R-2, but the total abundance, although not sparse (3,052 organisms/m^2), was much less than that of R-1. The major species recorded from this sample were Gammarus, the pelecypod Pisidium, turbellarians, the gastropod Amnicola limosa, and the Hydracarina Lebertia. These species were also reported from R-1 but in lower abundance, except for Gammarus, whose abundance remained relatively high. Although the total abundance of R-1 and R-2 were different by a factor of 3.6, the diversity of the two samples was comparable and reflected the similar sediment type and composition of these two replicates. Shallow-water

TABLE VI-10

ABUNDANCE (no. organisms/m^2) of MAJOR TAXA FROM SELECTED STATIONS

15-AUGUST 1974

NINE MILE POINT - 1974

STATION	NMPE 10'NC		NMPE 20'		FITZ 30'	
Replicate	R-1	R-2	R-1	R-2	R-1	R-2
Substrate	100% sand, silt	60% rubble 40% sand, silt	50% rubble 50% sand & silt	75% rubble 25% sand & silt	70% rubble 30% sand, silt	100% sand, silt
Cladophora	not present	17.2g/m^2	0.18g/m^2	9.73g/m^2	not present	not present
ORGANISM						
Turbellaria	0	5	0	153	46	0
Oligochaeta	0	10	30	25	188	0
Polychaeta	0	51	673	36	0	0
Gastropoda	0	0	127	290	5	5
Pelecypoda	5	41	1148	393	56	10
Diptera	280	530	815	192	106	0
Trichoptera	5	5	5	5	0	0
Ostracoda	21	112	413	41	82	0
Isopoda	0	0	0	10	0	0
Amphipoda	255	13602	7742	1591	229	46
Decapoda	0	0	0	5	0	0
Hydracarina	15	41	86	158	179	25
Nematoda	5	41	N.A.	153	5	15
Total	586	14,438	11,039	3,052	896	101

R-1 = replicate 1
R-2 = replicate 2
N.A. = sample lost

heterogeneous substrates offer numerous niches for exploitation, both by organisms preferring or requiring silty areas and also by those requiring a coarser substrate.

FITZ 30 ft - The sediment composition described for these replicates are as dissimilar as those described for the NMPE 10 ft non-*Cladophora* station. Replicate one (R-1) was visually described as 70% rubble and 30% sand and silt, whereas R-2 was characterized as 100% sand and silt. There was no *Cladophora* at either sampling site.

Replicate one, with 21 taxa, was the more diverse of the two replicates at this station and was similar to the rubble and sand and silt replicate at the NMPE 10 ft station. Total abundance was low (896 organisms/m^2), and reflected the sparse *Gammarus* population. The dominant taxa in this replicate were water mites, ostracods, the dipteran *Cryptochironomus*, and immature oligochaetes.

The sand and silt sediment of R-2 supported a very sparse community in both number of taxa and organisms collected. *Gammarus* was the dominant organism (46% of the total abundance); however, its abundance was low. No other organism made a significant quantitative contribution to the sample.

Observations on the sediment type at this station throughout the sampling program indicated that the August collection may have represented a transitional stage from the predominantly bedrock and rubble composition noted at this station in June to the 100% sand and silt composition indicated in October and December. The community abundance at the FITZ 30 ft station was the least of all contours of this transect for all dates; in addition, the abundance at the 30 ft contour ranked last for the year at all transects. This state of flux in the sediments may inhibit the establishment of any permanent community which would be dependent upon a more stable substrate.

d. *Cladophora* Associations

Cladophora is an attached, filamentous, green alga which has, in recent years, undergone extensive growth in several of the Great Lakes. Primary considerations for optimum growth are a stable substrate for holdfast attachment, water movement, 18°C water temperature, and a nutrient source (Neil and Owen, 1964; Bellis and McLarty, 1967). Although this alga was observed throughout the sampling program in the Nine Mile Point vicinity, the two-cycle pattern that characterizes its growth in the Great

Lakes (Herbst, 1969) was not evident from the data available from the benthic sampling program. Maximum standing crop of Cladophora in the Nine Mile Point vicinity was recorded in June and particularly at the 10 ft depth contours for all transects (Table VI-11). Bottom water temperatures recorded at the 20 ft depth contours during the first three weeks of June averaged 13°C (Table VI-12). Minimum values for Cladophora biomass were recorded in October, when average bottom water temperature was 13.4°C; at this time, greatest Cladophora biomass occurred at the NMPP 20 and NMPP 30 ft stations. The presence of great Cladophora biomass at these stations was attributed to substrate type and not to a temperature difference between stations. According to Bellis and McLarty (1967) and Storr and Sweeney (1971), growth of Cladophora is dependent on photoperiod and water temperature, with optimum growth at 18.3°C. The bottom temperatures recorded at Nine Mile Point during periods of both maximum and minimum biomass for Cladophora were near the lower end of the temperature range for growth (12°-25°C) reported by Storr and Sweeney (1971).

The distribution of Cladophora among transects indicated that NMPP and NMPW contributed the greatest Cladophora biomass for the year (Table VI-11), and distribution by depth indicated increased growth in the littoral areas. This is partially explained by the retention within the wave zone of primarily larger rocks, which afford the alga a more stable attachment base. This substrate preference was further supported by the observation that Cladophora growth extended to the 30 and 40 ft depths at those transects where the bottom sediment was primarily of a bedrock and/or rubble composition (e.g., NMPP and NMPW). A second factor limiting depth distribution is the degree of light penetration. Neil and Owen (1964) found Cladophora restricted to a maximum depth of 8 ft in the turbid waters of Lake Erie, whereas in the clearer waters south of Prince Edward County in Lake Ontario distribution extended to 45 ft. Cladophora was restricted primarily to the 10 and 20 ft depth contours at NMPE and FITZ, the transects in the Nine Mile Point vicinity where sand and silt were more prevalent.

Benthic organisms associated with Cladophora beds at the 10 ft depth contour in April and June are presented in Table VI-13. The April community was composed primarily of the amphipod Gammarus fasciatus and larvae of the dipteran Cricotopus. Barton and Hynes (1975) reported that Gammarus fasciatus was the dominant species in Cladophora beds and occurred in numbers greater than 10,000 organisms/m^2. Bocsor and Judd (1972) and QLM (1973) reported

TABLE VI-11

BIOMASS (g/m^2) of CLADOPHORA*
Nine Mile Point - 1974

Station		Months														
		April			June			August			October			December		
Transect-Depth (ft).		R-1	R-2	Av.	R-1	R-2	Av.	R-1	R-2	Av.	R-1	R-2	Av.	R-1	R-2	Av.
NMPE	10 C	NS	NS	NS	10.81	14.74	12.78	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10 NC	0.00	1.74	0.87	0.00	0.00	0.00	0.00	17.20	8.60	0.00	0.00	0.00	10.40	7.06	8.73
	20	3.55	8.24	5.90	7.98	1.40	4.69	0.18	9.73	4.96	0.00	0.00	0.00	3.62	34.50	19.06
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.30	0.11	0.16	0.14
	40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.02	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FITZ	10 C	46.87	133.73	90.30	53.50	42.34	47.92	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10 NC	NS	NS	NS	4.23	4.83	4.53	8.42	0.00	4.21	0.46	0.01	0.24	13.44	16.62	15.03
	20	10.37	35.62	23.00	1.43	2.85	2.14	0.00	0.00	0.00	0.00	0.00	0.00	6.38	0.00	3.19
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NMPP	10 C	NS	NS	NS	32.71	39.33	36.02	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10 NC	6.65	3.57	5.11	NS	NS	NS	2.81	0.97	1.89	0.12	0.00	0.06	1.35	0.98	1.17
	20	41.02	11.94	26.48	9.40	6.37	7.89	2.85	2.38	2.62	2.12	7.40	4.76	0.04	4.66	2.35
	30	1.30	3.72	2.51	0.00	1.87	0.94	22.89	1.78	12.34	6.20	0.27	3.24	0.77	1.27	1.02
	40	0.82	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NMPW	10 C	21.64	55.61	38.63	71.40	469.25	270.33	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10 NC	NS	NS	NS	NS	NS	NS	0.36	0.55	0.46	1.23	2.05	1.64	10.55	7.80	9.18
	20	31.62	15.56	23.59	8.72	50.70	29.71	0.00	26.67	13.34	0.00	0.00	0.00	0.00	0.51	0.26
	30	0.83	0.00	0.42	0.00	0.00	0.00	0.00	6.32	3.16	0.00	0.00	0.00	11.47	0.24	5.86
	40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
MONTHLY AVERAGE		10.86			18.95			2.58			0.51			3.30		

* Cladophora sp. collected with macroinvertebrate sample
C = Cladophora sample
NC = Non-Cladophora sample
NS = No sample
Av = Average of Replicate 1 (R-1) and Replicate 2 (R-2)

TABLE VI-12

BOTTOM LAKE WATER TEMPERATURE (°C) VALUES AT SELECTED STATIONS

NINE MILE POINT - 1974

DATE	NMPW 20 ft (7m)	NMPW 40 ft (14m)	NMPP/FITZ 20 ft (7m)	NMPP/FITZ 40 ft (14m)	NMPE 20 ft (7m)	NMPE 40 ft (14m)
1 April	1.2	1.1	0.9	0.9 (13)	0.8	0.8 (13m)
10-11 April	2.0	2.2	1.9	2.2	1.9	2.3 (12m)
17 April	7.1	5.7	6.8 (6m)	4.7	5.9	4.6
22 April	6.7	4.9	5.6	3.4	4.3	4.2 (13m)
27 April	N.A.	N.A.	6.1	5.6	5.6	5.2
3 June	13.4 (6m)	10.7 (13m)	11.6 (6m)	10.1	12.3	10.4 (13m)
10 June	16.1	12.6 (13m)	15.1	14.1	11.0	10.1 (13m)
17 June	13.3	13.2	13.0	12.9 (13m)	12.2	12.1 (13m)
25 June	8.8	5.2	14.0	13.0	14.0	12.1
6 August	22.5	22.0	22.3	22.0	22.5	21.8
12 August	20.5	19.9	20.6	19.3	17.7	7.3
16 August	N.A.	N.A.	19.6	10.6	22.8	12.7
26 August	22.7	22.7	22.7	22.7 (13m)	22.8	22.6
1 October	16.2	16.2	15.8	16.0	15.2	16.0
8 October	13.9	13.9	14.3	14.1 (12m)	13.6	14.3 (13m)
25 October	10.4	10.3	10.8	10.7	10.4	10.5
5 December	3.9	4.8	5.2	4.1	5.2	5.8
11 December	1.3	1.6	3.2	3.5	1.8	2.2

[1] Temperature values recorded in conjunction with vertical temperature profile program.

N.A. Not available.

TABLE VI-13 (continued)

TAXON	MONTH: APRIL[3] #/m²	TOTAL	g/m²	JUNE #/m²	TOTAL	g/m²
Trichoptera - ARTHROPODA		0	0.00		57	0.28
<u>Agraylea</u> sp.	0			33		
<u>Athripsodes</u> sp.	0			24		
Diptera - ARTHROPODA		805	0.75		505	0.55
Pupae - UID	138			66		
Larvae - UID	11			12		
fam. Chironomidae	655			426		
<u>Chironomus</u> sp.	3			3		
<u>Cryptochironomus</u> sp.	0			1		
<u>Glyptotendipes</u> sp.	10			0		
<u>Microtendipes</u> sp.	103			8		
<u>Dicrotendipes</u> sp.	9			9		
<u>Pseudochironomus</u> sp.	0			1		
<u>Polypedilum</u> sp.	0			34		
<u>Stictochironomus</u> sp.	0			2		
<u>Cladotanytarsus</u> sp.	5			12		
<u>Rheotanytarsus</u> sp.	207			8		
<u>Tanytarsus</u> sp.	0			1		
<u>Paratanytarsus</u> sp.	31			0		
<u>Cardiocladius</u> sp.	0			9		
<u>Cricotopus</u> sp.	276			287		
<u>Eukiefferiella</u> sp.	0			5		
<u>Orthocladius</u> sp.	3			0		
<u>Procladius</u> sp.	0			18		
<u>Psectracladius</u> sp.	5			15		
<u>Micropsectra</u> sp.	3			13		
fam. Ceratopogonidae	0			1		
fam. Empididae	1			0		
Gastropoda - MOLLUSCA		48	1.53		150	3.59
<u>Amnicola limosa</u>	3			39		
<u>Bithynia tentaculata</u>	5			6		
<u>Goniobasis livescens</u>	32			57		
<u>Physa integra</u>	4			41		
<u>Physa sayi</u>	0			1		
<u>Lymnaea catascopium</u>	4			0		
<u>Gyraulus parvus</u>	0			3		
<u>Ferrissia tarda</u>	0			3		
Pelecypoda - MOLLUSCA		10	0.07		18	0.10
<u>Pisidium</u> sp.	9			15		
<u>Sphaerium</u> sp.	1			3		
FISH EGGS		0	0.00		253	0.11
TOTAL		1,815	5		26,945	14.19

TABLE VI-13 (continued)

[1] Abundance and biomass values based on the average of replicates 1 and 2.

[2] No Cladophora benthic sample was collected in August, October, or December, 1974.

[3] No Cladophora benthic sample was collected at stations NMPE 10'C and NMPP 10'C

N.A. - data not available.

UID - unidentified species.

IWOC - immature form without chaeta.

TABLE VI-14

COMMUNITY STRUCTURE
AVERAGE ABUNDANCE (NO. ORGANISMS/M^2) OF MACROINVERTEBRATES
AND FISH EGGS[1] COLLECTED AT THE 10 FT DEPTH CLADOPHORA
AND NON-CLADOPHORA STATIONS

NINE MILE POINT (TRANSECTS: NMPE & FITZ)

JUNE 1974

TAXON	Cladophora Stations #/m^2	Non-Cladophora Stations #/m^2
Nematoda	134	42
Polychaeta	82	5
Oligochaeta	71	32
Hydracarina	90	59
Ostracoda	455	255
Amphipoda	601	103
Diptera	561	174
Gastropoda	61	36
Pelecypoda	6	4
Fish Eggs	142	211
Others	73	3
AVERAGE	207	84

1 Abundance based on average of replicates 1 and 2; no samples were taken at the NMPP 10 NC and NMPW 10 NC stations.

TABLE IV-15

COMMUNITY STRUCTURE

AVERAGE ABUNDANCE (no. organisms/m^2), BIOMASS (g/m^2) AND PERCENT COMPOSITION OF MACROINVERTEBRATES BY TAXON AND MONTH*

NINE MILE POINT - 1974

Taxon	APRIL				JUNE				AUGUST				OCTOBER				DECEMBER			
	Abundance		Biomass		Abundance		Biomass		Abundance		Biomass		Abundance		Biomass		Abundance		Biomass	
	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%
Amphipoda	202	14.48	0.97	27.02	742	6.65	0.90	8.70	1539	34.22	1.26	17.17	857	33.09	0.97	17.57	3506	83.32	7.10	83.53
																	230			1.65
Annelida+	426	30.54	0.22	6.13	7609	68.21	2.91	28.14	1088	24.19	0.55	7.49	556	21.47	0.52	9.42	230	5.47	0.14	1.65
Oligochaeta	136	9.75			7422	66.53			311	6.91			513	19.81			183	4.35		
Polychaeta	290	20.79			187	1.65			777	17.27			44	1.70			47	1.12		
Ostracoda	64	4.59	0.10	2.79	1749	15.68	2.61	25.24	338	7.51	0.51	6.95	177	6.83	0.27	4.89	29	0.69	0.04	0.47
Diptera	147	10.54	0.23	6.41	227	2.03	0.34	3.29	464	10.32	0.42	5.72	170	6.56	0.36	6.52	95	2.26	0.12	1.41
Gastropoda	210	15.05	1.49	41.50	234	2.10	2.21	21.37	381	8.47	3.42	46.59	352	13.59	2.55	46.20	119	2.83	0.69	8.12
Pelecypoda	120	8.60	0.30	8.36	199	1.78	0.51	4.93	458	10.18	0.89	12.13	266	10.27	0.57	10.33	86	2.04	0.20	2.35
Hydracarina	58	4.16	0.13	3.62	156	1.40	0.10	0.97	110	2.45	0.15	2.04	151	5.83	0.21	3.80	72	1.71	0.10	1.18
Others°	168	12.04	0.15	4.18	240	2.15	0.76	7.35	120	2.67	0.14	1.91	61	2.36	0.07	1.27	71	1.69	0.11	1.29
Average Per Month	174		0.45		1395		1.31		562		0.92		324		0.69		526		1.06	

* Values based on average of replicates 1 and 2 unless stated otherwise.
+ The biomass for annelids was determined at the phylum level.
° Nematods (NMPE 20 ft NC R-2; August), platyhelminthes, isopods, decapods, trichopterans, nemerteans, ephemeropterans, hydroids.

the NMPP 10 ft NC station. Gastropods (*Valvata perdepressa* and *Amnicola limosa*) composed approximately 15% of the April benthic community; this percentage particularly reflected their abundance at the 30 through 60 ft depths at NMPE transect. *Gammarus fasciatus* and the *Cladophora*-associated dipterans *Cricotopus* and *Rheotanytarsus*, were also abundant. Biomass determinations indicated the dominance of gastropods (41.5%) and amphipods (27.0%).

June: Annelids dominated the benthic community in abundance (68%) and biomass (28%) with the oligochaetes contributing 66.5% of the annelid population. As noted previously, the *Nais bretscheri* population associated with *Cladophora* accounted for the major portion of the annelid abundance and biomass. Other *Cladophora* inhabitants, ostracods and *Gammarus*, were also abundant. The biomass rankings in June reflected the large ostracod population and the increase in gastropod abundance from April to June. The 1973 June benthic community was dominated by amphipods, ostracods, and *Cladophora*-associated dipterans (*Phaenopsectra*, *Tanytarsus*, and *Cricotopus*) in both abundance and biomass (QLM, 1974). The major difference between 1973 and 1974 was the presence of the naidid population living attached to *Cladophora* filaments in 1974.

August: *Gammarus fasciatus* ranked first in abundance in 1974 (32% of total abundance) as it had in 1973 (52.6% of total abundance) (QLM, 1974). The 1974 community was also characterized by a dominance of annelids (24% of total abundance), in particular the polychaete *Manayunkia* at NMPW 20, 30, and 40 ft depth contours. The numbers of gastropods peaked in August, reflecting increased abundance at the NMPE sublittoral stations similar to the situation reported in 1973 (QLM, 1974). Benthic biomass percent composition was dominated by the gastropod community (46.6% of the total biomass), followed by the amphipods (17.2% of the total biomass). The gastropods had also been the greatest contributors to benthic biomass in 1973, followed by the pelecypods and dipterans.

October: Amphipods, in particular *Gammarus fasciatus* at NMPW 10 ft station, and oligochaetes, especially immature forms at FITZ 30 through 60 ft stations, were the major contributors to the benthic community in 1974. The 1973 benthic community, however, was dominated by amphipods at all transects, and by gastropods at NMPE (in particular *Amnicola limosa*) and NMPW transects (*A. limosa*, *Goniobasis livescens*, and *Physa integra*). Benthic biomass values were greatest for gastropods and amphipods in 1974, similar to 1973 (QLM, 1974). The gastropods ranked third in percent composition of the total benthos in 1974.

December: In December the amphipod community, specifically Gammarus fasciatus, reached its peak in monthly abundance and biomass, representing 83% and 84%, respectively, of the total benthos for that collection. A similar early winter increase in amphipod abundance has also been reported by LMS (1975) for Gammarus daiberi/tigrinis in the vicinity of Haverstraw Bay in the Hudson River. Bottom water temperatures recorded in the vicinity of the thermal plume (i.e., NMPP 10, 20, 30 ft) on 11 December 1974 were 1.4 to 1.9°C higher than those recorded at the 20 ft depths at the NMPE and NMPW transects (Table VI-12). Storr (1972) predicted a greater abundance of Gammarus during the latter part of the year resulting from an increase in reproduction of individuals as a consequence of the thermal discharge. However, the abundance of Gammarus at the stations in the vicinity of the thermal discharge ranked fourth, ninth, and seventh, respectively. Thus the observation of an increased Gammarus abundance for the month of December may represent a natural population oscillation.

The majority of the remaining taxa (except oligochaetes and Hydracarina) recorded their lowest quantitative and gravimetric values in December. Gastropod abundance and biomass in December were the lowest recorded for the year.

These data point out the importance of amphipods, followed in dominance by gastropods, in the yearly benthic abundance and biomass distribution patterns in the Nine Mile Point vicinity. The dominance (i.e., high values for abundance and biomass) of oligochaetes and ostracods is dependent on the suitability of the substrate and the presence of Cladophora (e.g., June). For the three months comparable between the 1973 and 1974 sampling program, the major source of variation lies with the Nais bretcheri population at NMPP 10 ft Cladophora station.

f. Percent Composition of Macroinvertebrates by Transect: 1974 (Table VI-16)

April: The lowest gravimetric determinations (10.2% of total biomass) and quantitative values (5.8% of total abundance) for the year's sampling program were obtained from benthos collected in April. The NMPE transect was the major contributor (Appendix VI-2) in both abundance (2,046 organisms/m^2) and biomass (6.2 g/m^2) during this period as a result of the great abundance of gastropods, pelecypods, and oligochaetes (Tables VI-17, VI-18, and VI-19A and B), and gastropod biomass, predominantly at the 30 through 60 ft depth contours. The NMPW transect community was the sparsest, contributing only 7.2% of the abundance and 13.5% of the biomass for the total benthos collected at all transects.

TABLE VI-16

AVERAGE ABUNDANCE (no. organisms/m^2)+
BIOMASS (g/m^2) AND PERCENT COMPOSITION OF MACROINVERTEBRATES BY TRANSECT AND MONTH

NINE MILE POINT - 1974

	APRIL				JUNE				AUGUST				OCTOBER				DECEMBER				AVERAGE PER TRANSECT			
	Abundance		Biomass		Abundance		Biomass		Abundance		Biomass		Abundance		Biomass		Abundance		Biomass		Abundance		Biomass	
TRANSECT	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%	#/m^2	%	g/m^2	%
NMPE	2046	37.21	6.15	42.83	5278	11.23	10.64	24.90	7155*	39.90	11.45*	38.84	2937	28.32	9.62	43.61	4707	27.94	11.32	33.30	4459	22.82	987	34.68
FITZ	1182	21.50	3.73	25.97	2355	5.01	4.01	9.38	2594	14.44	6.78	23.00	1992	19.21	4.14	18.77	6530	38.79	11.25	33.10	2908	14.88	591	20.74
NMPP	1872	34.05	2.54	17.69	33171	70.60	16.29	38.12	2339	13.30	3.56	12.08	831	8.01	1.17	5.30	3426	20.35	8.06	23.71	8338	42.67	633	22.22
NMPW	398	7.24	1.94	13.51	6182	13.16	11.79	27.59	5811	32.36	7.69	26.09	4609	44.45	7.13	32.32	2175	12.92	3.36	9.89	3835	19.63	638	22.39
AVERAGE PER MONTH	1374	5.80	3.59	10.15	11026	46.54	10.38	29.36	4490	18.95	7.37	20.84	2592	10.94	5.52	8.50	4209	17.77	8.50	24.04				

AVERAGE YEARLY ABUNDANCE: 4861 org/m^2

AVERAGE YEARLY BIOMASS: 7.14 g/m^2

+ replicate 1.
* NMPE 20 ft NC R-1 Nematoda sample lost.

June: The maximum values for benthic abundance and biomass for 1974 were recorded in June; NMPP and NMPW transects also showed yearly peaks in community abundance and biomass for this month (Table VI-16). NMPP was ranked first in annual abundance and third in annual biomass. The benthic abundance values for NMPP transect reflected the population size of the *Cladophora*-associated oligochaete *Nais bretscheri* which composed 88% of that collection. A secondary contribution to the June peak in benthos was attributed to prosobranchs and ostracods, particularly at the sublittoral NMPE stations. A depth x transect interaction was significant ($\alpha < 0.005$) for total benthos, amphipods (Appendix VI-3A), and for oligochaetes in June (Appendix VI-2). The NMPW transect showed its greatest yearly biomass (11.8 g/m^2) during this month.

August: The abundance and biomass values recorded for NMPP transect in August were significantly lower than those for June (Table VI-16). This reduction was attributed to the eradication of the *Cladophora*-associated naidid population. NMPE transect reached its maximum yearly abundance during August; this was attributed to the yearly abundance maximum of pelecypods and prosobranchs, in particular *Valvata perdepressa* and *Amnicola limosa*, which were most prevalent at the 30 through 60 ft depth contours. The maximum biomass for this period was also recorded at NMPE transect. Abundance of macroinvertebrates at NMPW and FITZ transects decreased from June levels; however, the biomass at FITZ increased, attributed primarily to increased populations of *V. perdepressa* and the pulmonate *Goniobasis livescens*.

October: The NMPE transect had the greatest biomass for this period, continuing the trend established in April and August. The gastropod population was the greatest biomass contributor. The peak benthic abundance for this month was recorded at the NMPW transect, where it was indicative of the increased Hydracarina population, in particular *Hygrobates* at the 20 and 30 ft depth contours, and the *Gammarus* population, which remained stable at this transect while declining at the other transects. In general, biomass and abundance decreased from August levels.

December: The greatest biomass of macroinvertebrates for this period was recorded from both FITZ and NMPE transects; the highest abundance was observed from the FITZ transect. Amphipods constituted 83% of the macroinvertebrates in December, with *Gammarus* the dominant organism at all transects similar to conditions previously reported for total macroinvertebrates. Immature oligochaetes, the second most abundant organism in December, were

TABLE VI-17

AVERAGE ABUNDANCE (no. organisms/m^2) OF GASTROPODA (MOLLUSCA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL		JUNE		AUGUST		OCTOBER		DECEMBER		% OF TOTAL GASTROPODA			
	UID #/m^2		UID #/m^2		UID #/m^2		UID #/m^2		UID #/m^2		0.04			
	4		2		2		10		1		AVERAGE PER TRANSECT			
											PROSOBRANCHIA		PULMONATA	
TRANSECT	Pros. #/m^2	Pul.	Pros. #/m^2	Pul.	Pros. #/m^2	Pul.	Pros. #/m^2	Pul.	Pros. #/m^2	Pul.	#/m^2	%	#/m^2	%
NMPE	694	12	684	9	912	35	896	48	256	16	688	67.98	23	2.27
FITZ	31	36	33	3	198	20	145	2	59	7	91	8.99	13	1.28
NMPP	7	10	33	6	54	90	6	8	17	7	24	2.37	24	2.37
NMPW	32	3	63	44	143	65	190	73	96	16	105	10.38	40	3.95
AVERAGE PER MONTH #/m^2	191	15	218	15	327	52	309	33	107	11				
% of total gastropods	14.73	1.16	16.81	1.16	25.21	4.01	23.82	2.54	8.25	0.85				

AVERAGE YEARLY UNIDENTIFIED GASTROPODA ABUNDANCE: 4/m^2
AVERAGE YEARLY PROSOBRANCHIA ABUNDANCE: 230/m^2
AVERAGE YEARLY PULMONATA ABUNDANCE: 25/m^2

UID - Unidentified gastropods Pros. - Prosobranchia Pul. - Pulmonata

+ replicate 1

TABLE VI-18

AVERAGE ABUNDANCE (no. organisms/m^2) OF PELECYPODA (MOLLUSCA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL	JUNE	AUGUST	OCTOBER	DECEMBER	AVERAGE PER TRANSECT	
TRANSECT	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	%
NMPE	442	553	1653	649	299	713	80.29
FITZ	35	46	143	195	19	86	9.68
NMPP	2	12	23	3	0	8	0.90
NMPW	0	147	14	219	27	81	9.12
AVERAGE PER MONTH #/m^2	120	199	458	267	86		
%	10.62	17.61	40.53	23.63	7.61		

AVERAGE YEARLY ABUNDANCE: 225/m^2

+ replicate 1

TABLE VI-19A

AVERAGE ABUNDANCE (no. organisms/m^2) OF OLIGOCHAETA (ANNELIDA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL	JUNE	AUGUST	OCTOBER	DECEMBER	AVERAGE PER TRANSECT	
TRANSECT	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	%
NMPE	253	428	658	267	78	341	4.60
FITZ	243	335	308	312	358	314	4.23
NMPP	44	30037	263	25	2	6074	81.88
NMPW	5	1690	13	1443	294	689	9.29
AVERAGE PER MONTH #/m^2	136	7421	311	512	183		
%	1.59	86.66	3.63	5.98	2.14		
AVERAGE YEARLY ABUNDANCE: 1825/m^2							

\+ replicate 1

TABLE VI-19B

AVERAGE ABUNDANCE (no. organisms/m^2) BY DEPTH OF FIVE MOST ABUNDANT SPECIES OF OLIGOCHAETA+

NINE MILE POINT - 1974

	Stylodrilus heringianus		Limnodrilus hoffmeisteri		Nais bretscheri		Potamothrix moldaviensis		Potamothrix vejdovskyi	
DEPTH (FT.)	#/m^2	%	#/m^2	%	#/m^2	%	#/m^2	%	#/m^2	%
10 C+NC	0[1]	0.00	1[1]	0.84	6813[1]	99.95	0[1]	0.00	0[1]	0.00
20	3	4.48	3	2.52	4	0.05	1	0.01	1	1.30
30	0	0.00	11	9.24	1	<0.01	13	8.28	6	7.79
40	1	1.49	7	5.88	0	0.00	22	14.01	10	12.99
60	63	94.03	97	81.51	0	0.00	120	76.43	60	77.92
AVERAGE PER SPECIES #/m^2	13		24		1470		30		15	

1. No sample was collected:
   NMPE 10'C - April, August, October, December
   FITZ 10'C - August, October, December
   FITZ 10'NC - April
   NMPW 10'C - August, October, December
   NMPW 10'C - August, October, December
   NMPP 10'C - April, August, October, December
   NMPP 10'NC - June

\+ replicate 1

dominant at FITZ and NMPW transects, respectively, and undoubtedly contributed to the differential in total abundance between FITZ and NMPE.

g. June-October 1973 vs. 1974: Abundance and Biomass Comparisons

Comparisons of abundance and biomass by transect were conducted on the data collected in 1973 and 1974, both for total macroinvertebrates and for the six most dominant taxa (Polychaeta, Oligochaeta, Gastropoda, Ostracoda, Amphipoda, and Diptera) (Appendix VI-3). Only the sampling months common to both years (June, August, and October) could be compared. The analyses were performed to identify the consistencies in abundance and biomass of specific taxa between years in order to identify the most stable population for use in assessing the postoperational effect of the FitzPatrick plant. Abundance comparisons of the six dominant taxa were facilitated by the application of a three-way analysis of variance (Appendix VI-3).

June: The greatest abundance of total macroinvertebrates (Table VI-20) was recorded during June in both 1973 and 1974. The increase in abundance in 1974 was primarily a function of the increase in benthos at NMPP and NMPW transects, which more than offset the decrease at FITZ transect. The greatest biomass of total macroinvertebrates was recorded in June 1973. The significant decline in biomass for June in 1974 was attributed primarily to the drop in biomass at the FITZ transect between the two years. The high biomass value recorded in 1973 was related to the biomass values for dipterans and the gastropod Physa integra at the FITZ 10 ft Cladophora station.

A significant difference in taxon abundance between 1973 and 1974 (Appendix VI-3A) was evident only for amphipods ($\alpha < 0.01$). The year x transect and year x depth contour interactions were significant for amphipods ($\alpha < 0.025$ for both parameters) and for dipterans ($\alpha < 0.005$). The remaining taxa analyzed were not significantly different. These interactions are explained by the abundant Cladophora community present in 1973 at FITZ, NMPP, and NMPE transects. Gammarus abundance was significantly greater in 1973 at these three transects and at the 10 ft stations.

Dipteran abundance and biomass at FITZ was greater in 1973 than in 1974. The 1973 dipteran community was composed essentially of three genera: Phaenopsectra, Tanytarsus, and Cricotopus, whereas only the latter genus was prevalent in 1974. At NMPP

TABLE VI-20

AVERAGE ABUNDANCE (no. organisms/m^2)
AND BIOMASS (g/m^2) OF MACROINVERTEBRATES
BY TRANSECT AND MONTH FOR 1973 AND 1974 +

NINE MILE POINT - 1974

TRANSECT	JUNE				AUGUST				OCTOBER			
	ABUNDANCE		BIOMASS		ABUNDANCE		BIOMASS		ABUNDANCE		BIOMASS	
	1973 #/m^2	1974 #/m^2	1973 g/m^2	1974 g/m^2	1973 #/m^2	1974 #/m^2	1973 g/m^2	1974 g/m^2	1973 #/m^2	1974 #/m^2	1973 g/m^2	1974 g/m^2
NMPE	9695	5278	18.30	10.64	11165	7165*	18.00	11.45*	5670	2937	14.13	9.62
FITZ	13736	2355	23.12	4.01	6477	2594	14.11	6.78	4099	1992	12.07	4.14
NMPP	7013	33171	13.87	16.29	2002	2389	6.10	3.56	1534	831	4.19	1.17
NMPW	1244	6182	4.45	11.79	2987	5811	3.83	7.69	4378	4609	15.30	7.13
AVERAGE PER MONTH	7604	11026	14.43	10.38	5798	4490	10.86	7.37	3920	2592	11.42	5.52

* NMPE 20 ft NC R-1 Nematoda sample lost
\+ replicate 1, 1974

transect, the 1973 community was composed of Phaenopsectra, Tanytarsus, and Chironomus. Cricotopus replaced these genera at NMPP in 1974, with a corresponding decline in dipteran biomass.

At NMPE transect, the 1973 dipteran community associated with Cladophora was composed primarily of Tanytarsus and Cricotopus sp. In 1974, the dipteran abundance declined, and the dominant genera were Polypedilum and Cricotopus, with Tanytarsus contributing minimally to the dipteran community. The biomass values substantiate the changes in abundance between the two years. These distributional changes may be, in part, explained by the timing of emergence of the various species of dipterans. A late spring (i.e., June) emergence pattern for Tanytarsus, Chironomus, and Polypedilum has been reported in the literature (Miller, 1941; Mundie, 1957; Hamilton, 1965; Albu, 1971), and may account for the disparate abundances noted between 1973 and 1974. Species of Cricotopus, which were prevalent during 1973 and 1974, have been described as summer-autumn emergers (Mundie, 1957; Hamilton, 1965; Albu, 1971), and would thus account for their presence in larval form at this season. In addition, particular macroinvertebrates (i.e., Cricotopus) have been previously indicated as inhabitants of Cladophora beds (Mundie, 1957; Bocsor and Judd, 1972), and thus their distribution is dependent on algal growth.

August: The abundance and biomass of total macroinvertebrates was greater in 1973 than in 1974 primarily due to high values recorded at the eastern transects. At FITZ transect, abundance decreased approximately 40% with a concomitant decrease in biomass of approximately 47%; at NMPE transect the abundance and biomass reductions were approximately 62% and 69%, respectively. These differences may be ascribed to the high abundance of the gastropods Valvata perdepressa (identified as V. sincera in 1973) and Amnicola limosa at the NMPE transect and Goniobasis livescens at the FITZ transect in 1973. The major factor contributing to the difference in abundance of these organisms between years at these transects was probably the instability of the sediments in this area, as was observed during 1974.

A significant difference in abundance between years was indicated for polychaetes ($\alpha < 0.0025$), oligochaetes ($\alpha < 0.0005$), and gastropods ($\alpha < 0.025$) (Appendix VI-4B). Polychaete and oligochaete abundances were greater in 1974 than 1973. The increase in oligochaete abundance was attributed to a larger population of immature individuals at all transects. Of the mature oligochaetes recorded in 1974, Limnodrilus hoffmeisteri and Potamothrix spp. were most abundant. The high value recorded for gastropod abundance in

1973 was primarily a result of the large population of Amnicola limosa and Valvata sincera (= V. perdepressa in 1974) at NMPE transect. The August 1974 gastropod abundance was significantly less than that recorded during 1973; however, NMPE transect remained dominant. No significant difference in abundance between years for August was indicated for amphipods, although biomass in 1973 was approximately double that of 1974. There was no difference in ostracod abundance by years (Appendix VI-4A).

The transect x year interaction for August was significant for polychaetes ($\alpha < 0.0005$) and for dipterans ($\alpha < 0.05$) (Appendix VI-4A and B). Manayunkia speciosa was recorded in less abundance in August 1973 than in 1974, with the majority of the organisms collected in 1973 from NMPP transect 30 ft depth and FITZ transect 20 ft depth. Polychaete abundance in 1974 was more consistent between replicates, and was dominated by NMPW (NMPW: 20, 30, and 40 ft) and NMPP (NMPP: 20 and 30 ft) transects.

The significance of the transect x year interaction for dipterans is partially explained by the increase in abundance (> 400%) at NMPW transect between 1973 and 1974. In 1973, Chironomus was the dominant genus, whereas in 1974, Rheotanytarsus was dominant with few individuals of Chironomus recorded. Dipterans were most abundant at NMPE transect in both 1973 and 1974, although greater numbers were indicated in 1973. The generic composition of the dipteran community at this transect also changed between 1973 and 1974; Pseudochironomus and Tanytarsus were the dominant forms in 1973, but were absent in 1974 and replaced by Cryptochironomus as the most abundant genus. Reduced numbers of dipterans recorded at NMPP in 1974 compared to 1973 reflected the decrease in the Chironomus population. The FITZ transect retained the same species composition and abundance from 1973 to 1974. These differences in dipteran distribution and species composition of the community may be a function of the emergence patterns of particular species, the clumped distribution pattern typical for benthic organisms, especially dipterans, and the variability of sediment characteristics.

Contour x year interactions were significant for oligochaetes ($\alpha < 0.01$), polychaetes ($\alpha < 0.025$) (Appendix VI-4B), and ostracods ($\alpha < 0.05$) (Appendix VI-4A). In August 1973, oligochaetes were recorded in greatest total numbers from the 20 and 60 ft depth contours, in decreasing order. However, the frequency of occurrence by depth at all transects showed their dominance at the 60 and 40 ft depth contours, respectively. Abundance was greater in 1974 at all contours, with the 60 and 40 ft contours, respectively, contributing the most and the 20 ft contour the least. The 20 ft contour ranked first in relative abundance for both years.

The majority of the ostracods in 1973 were found at the 20 and 30 ft depth contours, whereas in 1974 they were more abundant at the 30 through 60 ft depth contours.

October: A significant decrease in abundance and biomass of total macroinvertebrates between August and October was observed at NMPE and FITZ transects in 1974, similar to that reported in 1973 (QLM, 1974). These decreases were evident in the populations of immature oligochaetes, ostracods, Gammarus, and the dipterans Polypedilum and Cladotanytarsus at NMPE transect, and by Gammarus and ostracod populations at FITZ transect. Macroinvertebrates decreased approximately 20% in abundance at the NMPW transect between August and October, 1974. The decrease was attributed to the decrease in abundance of the dipterans and polychaetes.

The majority of the community in October was composed of immature oligochaetes (60 ft depth contour) and Gammarus (10 ft depth contour). The October biomass value at NMPW transect in 1974 was similar to the August value, reflecting the community structure and the developmental stage of the individuals. The biomass value in 1973 for NMPP and FITZ transects was due in part to the presence of crayfish as well as to increased amphipod abundance at these transects.

A significant difference in abundance in October between years was indicated only for gastropods ($\alpha < 0.05$) (Appendix VI-5B). The decrease in the gastropod abundance was a consequence of a 90% reduction in the number of pulmonates, in particular Goniobasis livescens and Physa integra, and a 85% reduction in the number of prosobranchs. Similarly, gastropod biomass values in October 1974 were reduced approximately 50% from those of 1973.

The year x transect interaction was significant for oligochaetes ($\alpha < 0.05$), ostracods ($\alpha < 0.025$), and dipterans ($\alpha < 0.025$) (Appendix VI-5A and B). The oligochaete abundance was dominated by a large population of immature forms and mature Potamothrix moldaviensis at the NMPW 60 ft station in 1974. The NMPE and FITZ transects had a greater abundance of immature forms in 1973 (QLM, 1974) than in 1974 (Table VI-19A). The abundance of oligochaetes at NMPP transect was negligible in both years with few individuals recorded at the 30 and 60 ft depths, respectively, for 1973 and 1974 (Table VI-19B).

Ostracod abundance year x transect interactions reflected changes in transect abundance rankings: NMPE transect was ranked first in abundance in 1973, but last in 1974, whereas for those two years FITZ moved from third (R-1) to first place (R-2).

In 1974, ostracods were reported at NMPP transect in depths from 20 to 60 ft with a 95% increase in abundance at the 60 ft depth from that recorded in 1973. Biomass values followed a similar ranking pattern.

Variation in dipteran abundance by transect between years was best demonstrated by examination of the NMPW and NMPE transect data as NMPP and FITZ transects remained relatively stable. The NMPW transect dipteran community was dominated by Chironomus in October for both years; however, Tanytarsus sp. was most abundant in numbers and biomass in 1973. The NMPE transect dipteran population also had greater numbers and biomass in 1973, with Pseudochironomus the dominant genus in one of the samples at the 10 ft non-Cladophora station and Chironomus dominant in both samples taken at the 60 ft station. The 1974 NMPE transect community was characterized by a dominance of Cryptochironomus, particularly at the 30 ft depth.

Transect x depth contour interactions in October were significant for polychaetes ($\alpha < 0.01$), gastropods ($\alpha < 0.0005$), ostracods ($\alpha < 0.01$), amphipods ($\alpha < 0.0005$), dipterans ($\alpha < 0.0005$), and oligochaetes ($\alpha < 0.0005$) (Appendix VI-5). The October Manayunkia populations for both 1973 and 1974 were rather sparse. Distribution by depth and transect, however, was observed to shift, so that whereas the greatest abundance was found at the NMPE 10 ft and NMPW 30 ft stations in 1973, the NMPW 20 ft station had greatest abundance in 1974.

The depth contour x transect interaction for gastropods in 1973 was influenced by the dominance of prosobranchs and particularly species of the families Valvatidae and Bulimidae at NMPE 30 and 40 ft stations. The 1974 distribution of gastropods was characterized by the dominance of the prosobranchs Amnicola limosa and Valvata perdepressa (identified as V. sincera in 1973) at the NMPE 60 ft station. In 1973, only 8.3% of the A. limosa population at the NMPE transect was collected at the 60 ft depth contour. A similar trend was observed for V. perdepressa. Prosobranchs and pulmonates were reported at a greater frequency of occurrence at the 10 ft depths of the two eastern transects in 1973 whereas in 1974 the 20 ft depths dominated.

Ostracods were most numerous at the 30 and 40 ft depth contours of NMPE transect and the 60 ft depth contour of NMPW transect in 1973. However, in 1974, these organisms were most numerous at the 60 ft depth contour of NMPW and FITZ transects. Amphipods (i.e., Gammarus fasciatus) were quite abundant at all transects at the 10 ft non-Cladophora and 30 ft depths in 1973. In 1974, however, the majority of the amphipods were recorded from the

NMPW and FITZ 10 ft stations. The variation of dipterans and oligochaetes by depth contour and transect was noted above.

The evaluation of differences in abundance and species composition over time must be approached with caution because of the nature of the sampling program. Variability in sample location between collection dates and between replicates, timing of the sampling dates between years, and the paucity of sediment analysis, bottom temperatures, and water quality parameter data both within and between years result in difficulty in interpreting the differences observed between 1973 and 1974. The tendency for west-to-east longshore currents (Landsberg et al., 1970), the apparent state of flux of the sediment in the Nine Mile Point vicinity, and the cooler water temperature in 1974 compared to 1973 (Figure VA-3) represent the catalyst for interstation, intrastation, and interdepth benthic variation between 1973 and 1974.

h. General Systematic Survey

(1) Order Tricladida (Class Turbellaria, Phylum Platyhelmenthes)

Triclad abundance in 1974 was much reduced from the levels recorded in the 1973 Nine Mile Point benthos collections (95% of 1973 abundance during months sampled in both years). The seasonal distribution remained similar, with a peak in June and a low in August for both years. In 1974 (Table VI-21) a second peak of a magnitude similar to the first occurred in December (no corresponding sample was taken in 1973). A spatial shift in relative abundance was observed between the two years: NMPW, a minor contributor (8%) to the 1973 triclad population, increased in relative abundance to compose 35.5% of the 1974 triclad population. The proportion contributed by NMPE and FITZ decreased, while NMPP remained unchanged with respect to its relative contribution.

Distribution by depth was observed to be variable. The substrate preferences of triclads in Lake Ontario and its watersheds are reported by Mettrick et al. (1970) to be stone, sand, and gravel; areas of silting are not favorable for these organisms. These authors also stated that sediment grain size distribution may be a more effective indicator of triclad distribution than water temperature, as had been reported previously. Analyses of the 1974 benthic samples indicated that a greater triclad abundance was associated with a bedrock and rubble substrate type (e.g., NMPW, NMPP [Tables VI-3-7]), whereas a lower abundance was recorded from areas of higher sand and/or silt composition (e.g., NMPE, FITZ transects).

TABLE VI-21

AVERAGE ABUNDANCE (no. organisms/m^2) OF TRICLADIDA (TURBELLARIA) +
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL	JUNE	AUGUST	OCTOBER	DECEMBER	AVERAGE PER TRANSECT.	
TRANSECT.	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	#/m^2	%
NMPE	14	7	0	6	31.	11	17.74
FITZ	3	1	15	11	14	9	14.52
NMPP	26	41	9	1	21	20	32.26
NMPW	5	46	6	23	28	22	35.48
AVERAGE PER MONTH #/m^2	12	22	8	10	24		
%	15.79	28.95	10.53	13.16	31.58		
AVERAGE YEARLY ABUNDANCE: 15/m^2							

+ replicate 1

(2) Phylum Nematoda

Nematode distribution in 1974 was correlated with the abundance fluctuations of two of the four identified genera (Dorylaimus and Alaimus).

Monthly abundance (Table VI-22) was greatest in April, when an average of 136 nematodes were collected. Dorylaimus was the most abundant genus (54% of the April population) and it occurred at the 20 to 60 ft depth at all transects. A decrease in abundance of nematodes was noted in June, and the population was composed primarily of Dorylaimus at the 40 to 60 ft depth contours at all transects and Alaimus at the Cladophora 10 ft depth contour at FITZ and NMPW transects. Alaimus population numbers declined in August, and this genus was replaced in total abundance by Dorylaimus (87.2% of the August nematode population), which reached its peak abundance at this time. In October and December, total nematode abundance decreased from August levels with the population remaining primarily monogeneric.

Substrate preferences for sand and silt were indicated for Dorylaimus (Tables VI-6 and VI-7). Alaimus was primarily found associated with Cladophora communities at the 10 ft depth contours (Tables VI-3 and VI-4). The data collected in 1973 (QLM, 1974) indicated similar substrate preferences.

(3) Class Polychaeta (Phylum Annelida)

The sabellid Manayunkia speciosa was the only polychaete collected during the 1973 and 1974 sampling program in the Nine Mile Point vicinity of Lake Ontario. It is a domiculous species (Pennak, 1953; Pettibone, 1953) living in tubes constructed from mucus secretions, mud, or detritus.

The abundance of Manayunkia in 1974 (Table VI-23A) reached its peak in August (57% of its total abundance), dropping off sharply in October and December. The peak was achieved one sampling period, or two months, earlier than in 1973 (QLM, 1974). The 20 and 40 ft depth contours at the NMPW transect exerted the greatest influence on the August 1974 peak.

Interstation comparisons for 1974 indicate that NMPW and NMPP transects contributed most significantly to the Manayunkia population (63.6% and 30.7%, repectively). The NMPE transect population, which was the major component of the Manayunkia abundance in 1973 (53.9% of the population) diminished to

TABLE VI-22

AVERAGE ABUNDANCE (no. organisms/m^2) OF NEMATODA+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

TRANSECT.	APRIL #/m^2	JUNE #/m^2	AUGUST #/m^2	OCTOBER #/m^2	DECEMBER #/m^2	AVERAGE PER TRANSECT. #/m^2	AVERAGE PER TRANSECT. %
NMPE	128	140	248[1]	108	12	133	41.96
FITZ	179	91	150	44	117	115	36.28
NMPP	223	6	7	0	0	47	14.83
NMPW	13	63	15	18	0	22	6.94
AVERAGE PER MONTH #/m^2	136	79	105	4	32		
%	33.92	19.70	27.68	10.72	7.98		

AVERAGE YEARLY ABUNDANCE: 80/m^2

1 20' non-*Cladophora* sample lost

+ replicate 1

TABLE VI-23A

AVERAGE ABUNDANCE (no. organisms/m^2) OF POLYCHAETA (ANNELIDA) +
BY MONTH AND TRANSECT
NINE MILE POINT - 1974

TRANSECT.	APRIL #/m^2	JUNE #/m^2	AUGUST #/m^2	OCTOBER #/m^2	DECEMBER #/m^2	AVERAGE PER TRANSECT. #/m^2	AVERAGE PER TRANSECT. %
NMPE	13	72	136	5	0	46	4.22
FITZ	30	8	29	2	12	16	1.47
NMPP	1075	310	269	5	10	334	30.67
NMPW	42	349	2675	162	165	693	63.64
AVERAGE PER MONTH #/m^2	290	187	777	44	47		
%	21.56	13.90	57.77	3.27	3.49		
AVERAGE YEARLY ABUNDANCE: 267/m^2							

+ replicate 1

TABLE VI-23B

AVERAGE ABUNDANCE (no. organisms/m^2) OF POLYCHAETA +
BY MONTH AND DEPTH
NINE MILE POINT - 1974

DEPTH. (Ft.)	APRIL #/m^2	JUNE #/m^2	AUGUST #/m^2	OCTOBER #/m^2	DECEMBER #/m^2	AVERAGE PER DEPTH. #/m^2	AVERAGE PER DEPTH. %
10 C	0[1]	5	no sample	no sample	no sample	3	0.22
10 NC	3[2]	11[3]	5	0	0	3	0.22
20	1418	950	1783	193	153	899	65.76
30	21	16	941	13	13	201	14.70
40	9	55	1155	5	69	259	18.95
60	0	0	3	8	0	2	0.15
AVERAGE PER MONTH #/m^2	290	187	777	44	47		
AVERAGE YEARLY ABUNDANCE: 267/m^2							

[illegible] = *Cladophora* sample
[illegible] = non - *Cladophora* sample
1 = No sample was collected at NMPE and NMPP Transects
2 = No sample was collected at NMPW and FITZ Transects
3 = No sample was collected at NMPW and NMPP Transects
+ replicate 1

4.2% of the 1974 total. NMPP showed the reverse trend (6.3% in 1973 and 30.7% in 1974). The apparent depth preference of Manayunkia (Table VI-23B) was similar to that reported in 1973 (QLM, 1974), with the greatest abundance (65.8%) occurring at the 20 ft depth contour at each transect (Appendix VI-1).

(4) Class Oligochaeta (Phylum Annelida)

Thirty-three species of oligochaetes, representing four families, were identified from benthic samples collected in the vicinity of Nine Mile Point in 1974. Tubificid oligochaetes have been recognized as a useful indicator of aquatic organic pollution (Hiltunen, 1969; Howmiller and Beeton, 1970; Goodnight, 1973), whereas the lumbriculid Stylodrilus heringianus is usually classified as a more saprophobic species (Hiltunen, 1964; Howmiller and Beeton, 1970).

Oligochaete abundance for the sampling period was greatest at NMPP transect (Table VI-19A). This was, however, probably influenced by the ephemeral population of Nais bretscheri which was associated with Cladophora during June. The abundance of N. bretscheri in this collection composed 79% of the total oligochaete abundance for the entire sampling period. NMPW transect ranked second in total oligochaete abundance with a contribution of 9.3%. Immature forms contributed to the abundance of oligochaetes at all transects and accounted for 13% of the total oligochaete population, thereby making species comparisons between 1973 and 1974 difficult. Bimonthly totals for oligochaetes indicated fluctuations in abundance with a major peak in June, a secondary peak in October and the lowest value in April.

Distribution over water depth (Table VI-19B) for the five most abundant species of oligochaetes (S. heringianus, Limnodrilus hoffmeisteri, N. bretscheri, Potamothrix moldaviensis, and P. vejdovskyi) indicated that abundance increased with depth for three of the four tubificids and the lumbriculid S. heringianus. Similar distributional patterns were reported by Johnson and Matheson (1968), Thut (1969), and QLM (1974).

It has been stated that L. hoffmeisteri, P. vejdovskyi and P. moldaviensis prefer sediment of a fine grain composition (Kinney, 1972) and this finding was observed in the Nine Mile Point vicinity (Tables VI-6 and VI-7). Kinney (1972) characterized the Nine Mile Point benthic community as mesotrophic, resulting from the nature of its enriched, but unpolluted sediments. This would account for the high abundance

of P. vejdovskyi and P. moldaviensis, which are tolerant of some nutrient enrichment, but not of a heavily polluted environment (Kinney, 1972). It also explains the low abundance of S. heringianus, which is intolerant of pollution (Hiltunen, 1964; Howmiller and Beeton, 1970; Kinney, 1972), and the fact that L. hoffmeisteri, which reaches maximum abundance only in highly enriched sediments (Hiltunen 1969; Kinney, 1972), is only moderately abundant in the Nine Mile Point vicinity.

The abundance of the naidid, N. bretscheri (unreported in 1973), reached a peak level in June, which was particularly evident from the Cladophora sample. Naidids have been characterized as a littoral family, often associated with aquatic vegetation (Howmiller and Beeton, 1970). Judd (1975), in his investigation of Cladophora communities, noted that the family Naididae were the most abundant organism associated with Cladophora during the summer. Thus their relatively low abundance at the other stations may be more directly related to the absence of Cladophora rather than to any other limiting factor.

(5) Class Gastropoda (Phylum Mollusca)

The abundance of gastropods in 1974 (Table VI-17) gradually increased from April through August, followed by a slight reduction in October (a pattern similar to that observed in 1973), and a sharp reduction in December. Of the gastropods collected, 89.7% were prosobranchs, which possess one gill for respiration, and 9.9% were pulmonates, which lack gills but are secondarily adapted for aquatic respiration (Barnes, 1967). The remaining gastropods were unidentified due to their poor condition.

Prosobranchs collected at NMPE transect contributed a major portion (68%) of the total gastropods collected in 1974, attributable to the populations of Valvata perdepressa and Amnicola limosa at the 30 to 60 ft depths. Samples collected at NMPP transect contributed the least (2.4%) to the prosobranch abundance. However, this was the only transect at which pulmonates, particularly Physa integra, showed a greater absolute abundance than prosobranchs.

Pulmonate abundance reached a maximum in August similar to the observation for total gastropods; this was particularly apparent at the NMPP and NMPW transects. The absolute seasonal abundance of pulmonates varied spatially; the FITZ transect had the greatest abundance in April, attibutable primarily

to *Gyraulus* spp. *Physa integra* composed the abundance in June and October (at NMPW), August (at NMPP) and December (at NMPW and NMPE).

(6) Class Pelecypoda (Phylum Mollusca)

Two genera of the family Sphaeriidae (*Sphaerium* and *Pisidium*) composed more than 99% of the pelecypods collected. Fifty-one individuals of the family Unionidae, all of which were collected from the NMPE transect in October, accounted for the remaining 0.3% of the pelecypods. Total pelecypod abundance (Table VI-18) and biomass gradually increased to a peak in August (40.5% of the total abundance), after which a drastic reduction occurred in both relative and absolute numbers through December (7.6% and 86 organisms/m^2, respectively).

The majority of the sphaeriids collected during the sampling program were obtained from the 40 and 60 ft depth contours at NMPE transect. The distribution and abundance of sphaeriids in 1974 was similar to that reported in 1973. Sphaeriids were most abundant at the NMPE transect throughout the year, with peak abundance occurring in August.

(7) Order Hydracarina (Class Arachnoidea, Phylum Arthropoda)

Temporal and spatial distributions of Hydracarina in the vicinity of the Nine Mile Point plant are based on genus abundance patterns. The developmental sequence of water mites typically consists of four stages: egg -> larva -> nymph -> adult (imago). Nymphal stages were encountered at most sampling stations in the vicinity of Nine Mile Point plant from June through October with the peak occurring in October.

A comparison of the relative abundance of water mites between 1973 and 1974 indicated a shift in the period of peak water mite abundance, from August in 1973 to June in 1974. NMPW transect contributed the greatest percentage of Hydracarina for both years (44% in 1973; 46.1% in 1974). The abundance at FITZ transect was relatively low for both years; however, the proportion of total abundance at NMPE transect dropped from 20% in 1973 to 9.2% of the Hydracarina population in 1974.

NMPW and NMPP transects (Table VI-24) were observed to dominate water mite abundance throughout the 1974 program. NMPP was the dominant transect in June and August with a peak abundance of 382 individuals/m^2 in June. *Forelia* sp. dominated in June and August, with individuals of the genus *Hygrobates*

TABLE VI-24.

AVERAGE ABUNDANCE (no. organisms/m²) OF HYDRACARINA (ARTHROPODA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL	JUNE	AUGUST	OCTOBER	DECEMBER	AVERAGE PER TRANSECT	
TRANSECT	#/m²	#/m²	#/m²	#/m²	#/m²	#/m²	%
NMPE	33	68	35	38	26	41	9.17
FITZ	29	87	71	11	34	48	10.74
NMPP	81	382	181	84	31	152	34.00
NMPW	90	119	151	473	198	206	46.09
AVERAGE PER MONTH #/m²	58	156	110	151	72		
%	10.60	28.52	20.11	27.61	13.16		
AVERAGE YEARLY ABUNDANCE: 110/m²							

+ replicate 1

TABLE VI-25

AVERAGE ABUNDANCE (no. organisms/m²) OF OSTROCODA (ARTHROPODA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL	JUNE	AUGUST	OCTOBER	DECEMBER	AVERAGE PER TRANSECT	
TRANSECT	#/m²	#/m²	#/m²	#/m²	#/m²	#/m²	%
NMPE	159	2572	560	106	76	767	38.68
FITZ	21	927	263	250	9	318	16.04
NMPP	29	849	429	146	17	294	14.83
NMPW	49	2646	101	207	16	604	30.46
AVERAGE PER MONTH #/m²	64	1749	338	117	29		
%	2.79	76.14	14.71	5.09	1.26		
AVERAGE YEARLY ABUNDANCE: 497/m²							

+ replicate 1

TABLE VI-26

AVERAGE ABUNDANCE (no. organisms/m²) OF AMPHIPODA (ARTHROPODA)+
BY SPECIES, MONTH AND TRANSECT

NINE MILE POINT - 1974

	APRIL		JUNE		AUGUST		OCTOBER		DECEMBER		AVERAGE PER TRANSECT: GAMMARUS		AVERAGE PER TRANSECT: PONTOPOREIA	
	GAMM.	PON.	GAMM.	PON.	GAMM.	PON.	GAMM.	PON.	GAMM.	PON.				
TRANSECT	#/m²		#/m²		#/m²		#/m²		#/m²		#/m²	%	#/m²	%
NMPE	143	29	305	298	2036	222	522	165	3734	48	5668	22.68	685	2.74
NMPP	280	15	214	290	1052	141	593	63	5712	36	6578	26.32	503	2.01
FITZ	250	0	1353	8	476	9	548	0	3206	2	5833	23.32	19	0.08
NMPW	88	1	396	180	2218	2	1500	38	1281	3	5483	21.94	224	0.90
AVERAGE PER MONTH #/m²	190	11	539	203	1445	93	791	67	3483	22				
% total [illegible]ods	2.8	0.2	7.9	3.0	21.1	1.4	11.6	1.0	50.9	0.3				

[illegible]GE YEARLY GAMMARUS FASCIATUS ABUNDANCE: 1275/m²
[illegible]GE YEARLY *PONTOPOREIA AFFINIS* ABUNDANCE: 82/m²

+ replicate 1
GAMM. - *Gammarus*
PON. - *Pontoporeia affinis*

composed 97% of the Hydracarina population at NMPW transect for the October and December sampling dates.

Three major genera in 1974 were *Lebertia*, *Forelia*, and *Hygrobates*. Although *Lebertia* sp. was collected from all depths, it was most abundant at 20 and 30 ft depths. *Forelia* sp. and *Hygrobates* spp. were recorded in greatest numbers from the 30 and 60 ft depth contours, substantiating the findings of QLM in 1973 (QLM, 1974).

(8) Order Ostracoda (Class Crustacea, Phylum Arthropoda)

A similar seasonal distribution of ostracods (Table VI-25) was reported in 1974 as in 1973. The abundance at all transects increased from relatively low population levels in April (2.8% of total yearly ostracod abundance) to a maximum abundance in June, followed by a sharp decline through December. Natural mortality and migration are hypothesized as the causes of this sharp decline in both 1973 (QLM, 1974) and 1974.

Spatial distribution of ostracods showed minor alterations in relative transect abundance over the two-year study. NMPE was found to contribute 39% of the ostracod population for both years. The abundance at NMPW transect showed an increase from 13% in 1973 to 30.5% of the total ostracod population in 1974, a result primarily of a large June population. There was a marked decrease in abundance at NMPP transect in 1974 (32% to 14.8% of the population), whereas the abundance at FITZ transect was unchanged between 1973 and 1974 (approximately 15%).

The distribution of ostracods over depth followed the pattern of benthic organisms in general, i.e., an increased abundance with depth, with the 60 ft depth contour contributing approximately 34.7% of the ostracod population.

(9) Order Amphipoda (Class Crustacea, Phylum Arthropoda)

Two species of amphipods were identified from Nine Mile Point benthic collections in 1973 and 1974: *Gammarus fasciatus* (Family Gammaridae) and *Pontoporeia affinis* (Family Haustoriidae). *G. fasciatus* is generally considered a littoral species, although it has been recorded from depths up to 33 m (108 ft) in Lake Ontario (Hiltunen, 1964).

The abundance of *G. fasciatus* in the vicinity of Nine Mile Point in 1974 was characterized by a minor peak in August

followed by a major peak in December (Table VI-26). In 1973 the peak abundance occurred in June with a declining population reported through October. Although no transect was dominated by Gammarus fasciatus on a seasonal basis, the littoral habit of this species was evident in that more than 80% of the individuals were collected from the 10 and 20 ft depth contours.

The hypothesis that the presence of Cladophora contributed to the abundance of Gammarus in June 1973 (QLM, 1974) was verified in the 1974 study (Table VI-14). During the period of greatest biomass of Cladophora, i.e., June 1974, more Gammarus was recorded from the Cladophora stations at NMPP, NMPW, and FITZ transects than from the corresponding depth non-Cladophora samples. The abundance of Gammarus was the second lowest for this month.

The total abundance of Pontoporeia affinis in 1974 increased from April to June and then declined from August through December (Table VI-26), thus following the seasonal trend observed in 1973 (QLM, 1974). The abundance of Pontoporeia affinis for the survey period was dependent on the populations at the 40 and 60 ft depth contours of the FITZ and NMPE transects. It was not encountered in samples from either NMPP transect in August and October, or NMPW transect in June.

Individuals of P. affinis showed a distinct distribution over depth within the study area, such that more than 90% occurred at the 40 and 60 ft depths. This was previously reported in 1973 (QLM, 1974). Pontoporeia affinis has been collected at various depths from the Great Lakes (Hiltunen, 1964; Thut, 1969; Kinney, 1972); thus it is assumed that a more critical limiting factor in the distribution of P. affinis is the degree of organic enrichment (Hiltunen, 1964; Kinney, 1972).

(10) Order Decapoda (Class Crustacea, Phylum Arthropoda)

Studies of benthic macroinvertebrates in the Great Lakes have been characterized by a dearth of information concerning the abundance, distribution, and habits of crayfish. This lack of information from Lake Ontario is probably related to the nature of benthic sampling programs which are primarily designed to sample sessile or sedentary macroinvertebrates and not nocturnally active crayfish. Benthic samples are not normally collected during the night, so the data presently available are insufficient for quantitative analysis of the seasonal and spatial distribution of decapods. Only 30 crayfish were collected in benthic samples in 1974; the ten individuals collected during June were identified as Orconectes

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propinquus, the most abundant species reported from the Nine Mile Point vicinity in 1973 by QLM (1974). The remaining 20 individuals were collected during August at the NMPP 60 ft station. Because these were immature they could not be identified.

(11) Order Diptera (Class Insecta, Phylum Arthropoda)

The dipteran population in the vicinity of Nine Mile Point plant in 1974 exceeded that reported in 1973 and was composed primarily of individuals (larvae and pupae) of the family Tendipedidae (= Chironomidae). Members of this family undergo holometabolous metamorphosis (egg -> larva -> pupa -> adult transition) in which the immature stages (larvae and pupae) are both aquatic and free-living. The most abundant taxa were the Tanytarsini tribe and Cricotopus sp.

The dipteran population increased in abundance to a maximum in August (42% of total population) [Table VI-27A], with NMPE transect displaying the greatest abundance. The August samples also had the greatest dipteran biomass and diversity (23 taxa identified). The October dipteran population declined by more than 50%, probably due to pupal emergence at the shallower stations. However, Chironomus sp. larvae at NMPW and FITZ 60 ft stations were found to be quite numerous. During December, total dipteran populations declined to a minimum; however, the appearance of Cricotopus sp. at the NMPP 10 ft non-Cladophora station resulted in a major abundance increase for that station. The remaining stations displayed low levels of dipteran abundance, with Cryptochironomus the dominant genus at the 30 to 60 ft stations. The presence of Cladophora at the 10 ft depth contour at FITZ and NMPW transects in April and June had a positive direct effect on the dipteran population at these stations. The abundance of dipterans at the 60 ft depth contour (Table VI-27B) increased from April levels to a peak in October, particularly at NMPW and FITZ transects. This same trend was observed for individuals of Chironomus sp. and members of the Tanytarsini tribe.

Substrate preferences of Cricotopus are for a littoral bedrock substrate colonized by Cladophora (Mundie, 1957; Boscor and Judd, 1972). Cladophora stations accounted for 36% and 40% of the dipteran abundance in April and June, respectively (Tables VI-13 and VI-14). Chironomus sp., Cryptochironomus sp., and members of the Tanytarsini tribe, which occurred at depths exceeding 30 ft, were found in sand and silt sediments (Tables VI-6 and VI-7).

TABLE VI-27-A

AVERAGE ABUNDANCE (no. organisms/m^2) OF DIPTERA (ARTHROPODA)+
BY MONTH AND TRANSECT

NINE MILE POINT - 1974

TRANSECT	APRIL #/m^2	JUNE #/m^2	AUGUST #/m^2	OCTOBER #/m^2	DECEMBER #/m^2	AVERAGE PER TRANSECT #/m^2	AVERAGE PER TRANSECT %
NMPE	110	140	659	118	109	223	25.31
FITZ	281	306	226	364	114	260	29.51
NMPP	125	125	572	5	108	187	21.23
NMPW	71	339	400	195	48	211	23.95
AVERAGE PER MONTH #/m^2	147	227	464	170	95		
%	13.33	20.58	42.07	15.14	8.61		
AVERAGE YEARLY ABUNDANCE: 221/m^2							

+ replicate 1

TABLE VI-27-B

AVERAGE ABUNDANCE (no. organisms/m^2) OF DIPTERA (ARTHROPODA)+
BY MONTH AND DEPTH

NINE MILE POINT - 1974

DEPTH(Ft.)	APRIL #/m^2	JUNE #/m^2	AUGUST #/m^2	OCTOBER #/m^2	DECEMBER #/m^2	AVERAGE PER DEPTH #/m^2	AVERAGE PER DEPTH %
10 C	530[1]	480	no sample	no sample	no sample	497	32.83
10 NC	230[2]	132[3]	395	17	226	205	13.54
20	62	144	557	3	5	154	10.17
30	78	81	432	78	61	146	9.64
40	117	128	470	58	13	157	10.36
60	96	348	466	696	170	355	23.45
AVERAGE PER MONTH #/m^2	147	227	464	170	95		
AVERAGE YEARLY ABUNDANCE: 221/m^2							

C = *Cladophora* sample + replicate 1
C = non - *Cladophora* sample
1 = No sample was collected at NMPE and NMPP Transects
2 = No sample was collected at NMPW and FITZ Transects
3 = No sample was collected at NMPW and NMPP Transects

TABLE VI-28

ABUNDANCE (no. eggs/m^2) OF FISH EGGS IN BENTHIC COLLECTIONS BY DATE AND STATION

NINE MILE POINT - 1974

DATE	NMPW 10'NC	NMPW 10'C	NMPW 20'	NMPP 10'NC	NMPP 10'C	NMPP 20'	NMPP 60'	FITZ 10'NC	FITZ 10'C	FITZ 20'	FITZ 30'	FITZ 40'	NMPE 10'NC	NMPE 10'C	NMPE 60'
24-29 APR	N.S.	0	15	97	N.S.	41	0	N.S.	0	0	0	0	0	N.S.	5
12-14 JUN	N.S.	638	36	N.S.	0	92	581	576	245	362	46	5	82	77	0

+ = replicate 1

N.S. = no sample.

(12) Fish Eggs

Fish eggs were recorded only in late April and mid-June benthic samples; both these dates preceded the July peak in egg abundance reported from the macrozooplankton samples (Table VB-7). No attempt was made to identify the species of eggs; however, tentative species identifications are hypothesized based on the seasonal trends in the abundance of ichythyoplankton in the Nine Mile Point vicinity and the published literature.

In the benthic sampling, fish eggs were collected in the greatest abundance in April at the NMPP 10 ft non-Cladophora station, whereas in the ichythyoplankton sample taken during the same period, the greatest abundance was recorded from the one-mile NMPE bottom 20 ft station. The eggs were probably those of either the yellow perch or the rainbow smelt, both of which spawn in the spring in shallow water. The eggs of the rainbow smelt were recorded from late April through late May in ichthyoplankton samples (Table VB-7). The larvae of these species have been reported in the early May (10 May) ichythyoplankton samples (Table VB-8)in a concentration of >10% of the total larvae collected on that date.

Ninety-four percent of the fish eggs sampled with the benthos were collected in mid-June, with their greatest abundance reported from the FITZ transect (Table VI-28). The depth contour distribution of the eggs varied according to transect: 86% of the fish eggs collected at NMPP were collected at the 60 ft depth, whereas eggs collected at the other transects were limited to the 10 and 20 ft depth contours (e.g., 96% of the total fish eggs were collected at the FITZ 10 - 40 ft stations). On the same date, i.e., 12-14 June, 52 to 70% more eggs were collected in the non-Cladophora samples than in the Cladophora samples. The fish eggs collected in the ichthyoplankton samples for the period 12-19 June were most abundant at the 20 ft one-mile NMPW station. Based on spawning habits and occurrence of alewife eggs in the macrozooplankton collection, it is hypothesized that the eggs collected in shallow water were primarily those of alewives.

(13) Others

Those organisms classified as coelenterates, nemerteans, hirudineans, ephemeropterans, trichopterans, and isopods were encountered at such low levels of abundance that their distributional patterns could not be described.

4. Conclusions

No obvious effects of the thermal discharge from the Nine Mile Point Nuclear Station Unit 1 were apparent during the 1974 benthic program. The changes in abundance and biomass of macroinvertebrates observed between stations, transects, and years appeared to be more a function of animal-sediment relationships and quantitative changes intrinsic to a given population than the response to a thermal effluent.

The abundance of macroinvertebrates in the area of the discharge plume (NMPP 20 to 30 ft) was variable, but generally low. Intertransect comparisons along the 20 and 30 ft contours indicated that NMPP and FITZ transects always ranked low in abundance and biomass, indicative of the changing sediments at these stations.

Visual characterization of the sediment type in the Nine Mile Point vicinity over five months indicated an unstable substrate with shifting sediments at all depths but particularly at the 20 and 30 ft depth contours. Sand-and-silt was the dominant sediment type at NMPE and FITZ transects and at the 60 ft depth contour at all transects, whereas bedrock and rubble were most prevalent at NMPW and NMPP transects. Population fluctuations were minimal at NMPE transect and were attributed to a stable substrate.

Animal-substrate relationships were studied more extensively than during the 1973 benthic program (QLM, 1974). Conclusions similar to those of the 1973 study were provided by:

- observations of the general distributional patterns of various organisms (e.g., _Manayunkia_ was most abundant on a bedrock and rubble substrate, _Lebertia_ on a bedrock substrate, and molluscs, tubificids, the nematode _Dorylaimus_, and the dipteran _Cryptochironomus_ on sand and silt substrate).

- comparisons of replicate station samples collected from dissimilar substrates (e.g., the dipteran _Cryptochironomus_ was associated with the sand and silt substrate, whereas the dipterans _Polypedilum_ and _Pseudochironomus_ were abundant in the 60% rubble and 40% sand and silt _Cladophora_ substrate).

- occurrence of _Gammarus_ and ostracods from all substrate types.

The Nine Mile Point benthic community in 1974 was characterized by a diverse fauna (110 taxa identified compared to 81 in 1973), which was dominated by the epibenthic amphipod _Gammarus fasciatus_, particularly from August through December.

Seasonally the abundance of macroinvertebrates was as follows: the polychaete Manayunkia and the gastropods Valvata perdepressa and Amnicola limosa were dominant in April, the oligochaetes (in particular Nais bretscheri) and the ostracods in June, the amphipod Gammarus fasciatus and the polychaete Manayunkia in August, Gammarus fasciatus and oligochaetes in October, and Gammarus fasciatus in December.

The three comparable sampling months for 1973 and 1974 were June, August, and October; of these, the greatest abundance of total macroinvertebrates was recorded in June in both years. Of all groups, only ostracods indicated no significant difference in abundance among the three sampling months common to both 1973 and 1974. The year x transect interaction revealed a significant difference in the abundance of various taxa; however, no particular transect was consistently dominant.

The minor differences in abundance and biomass of macroinvertebrates between 1973 and 1974 were considered to represent population fluctuations resulting from effects of substrate variability on the quantity and quality of niches available for colonization, as well as on natural population cycles, except for the occurrence of Nais bretscheri which is a transitory species.

The maximum seasonal abundance and biomass of benthic macroinvertebrates reported during June undoubtedly reflected the naidid abundance at the NMPP Cladophora station. In April and June, Cladophora beds in the littoral zone supported a richer and more diverse community of macrobenthic organisms than non-Cladophora areas.

The nematode Alaimus, the oligochaete Nais bretscheri, and the dipterans Cricotopus and Polypedilum were most abundant in Cladophora samples. Transect distribution of macroinvertebrates indicated that the greatest average yearly abundance occurred at NMPP transect; however, this average was not representative of the transect monthly abundance rankings, but rather reflected the high naidid population recorded in June. NMPE transect ranked second in average yearly abundance but first in average monthly abundance when the abundance values of the top two transects were ranked. Biomass values were greatest at NMPE transect, reflecting the large mollusc community which inhabited the sand and silt sediments characteristic of this transect throughout the year.

The maximum standing crop of Cladophora in the Nine Mile Point vicinity was recorded in the June benthos sample (18.95 g/m^2 monthly average). Cladophora was most abundant at the 10 and 20 ft benthos stations; however, it was also recorded consistently at the NMPP 30 ft station. Cladophora distribution and standing crop was shown to be related to substrate type rather than to a temperature difference among stations.

B. ARTIFICIAL SUBSTRATES - PERIPHYTON

1. Introduction

The organisms that rapidly colonize immersed artificial and natural substrates are significant sources of primary and secondary production in aquatic ecosystems. These organisms (periphyton), as an assemblage, provide a tool for identifying and evaluating certain water quality changes within aquatic systems. Applications include identification of sewage and domestic waste influx, and monitoring the effects of biological sewage treatment (e.g., trickling filters and clarifiers) and, recently, heated discharges from power plants (QLM, 1974).

The 1973 periphyton study in the vicinity of Nine Mile Point (QLM, 1974) revealed the following:

The ratios of animal to plant periphyton increased from near-shore to offshore waters on the bottom substrates and from shallow to deeper depths on the buoy substrates both after two weeks of exposure.

At all depths sampled, the animal:plant ratios decreased as exposure time increased.

Dominant flora included *Navicula* spp. and *Lyngbya diguetti*; dominant fauna included species of protozoans.

Cladophora, although abundant on natural substrates, was only a minor constituent of the periphyton community on the artificial substrates.

Net production rate ranged from 0.05 to 3.59 mg ash-free dry weight/dm^2/day.

Net production appeared to be retarded on the shallow water bottom substrates on NMPP transect (two-week exposure); overall, net production tended to increase from west to east.

Water temperature and light intensity seemed to be of primary importance in determining periphyton growth.

2. Materials and Methods

a. Field Collection

(i) Bottom periphyton

Periphyton samples were collected at the 5, 10, 20, 30, and 40 ft depth contours of the four transects established in 1973 (NMPW, NMPP, FITZ, and NMPE) (Figure VI-1).

The artificial substrates were doubled Plexiglas plates (5.08 cm x 15.24 cm), exposed for two and four-week periods between 20 May and 5 September, and for four-week periods only between 5 September and 23 November, 1974.

On each collection date, scuba divers collected the exposed substrates and replaced them with cleaned plates. Collection dates and exposure periods are listed in Table VI-29.

(ii) Buoy Periphyton

Three buoy systems, anchored at the 40 ft depth contours of the stations established in 1973 (QLM, 1974), were used for periphyton collections. Artificial substrates (Plexiglas plates) were located at depths of 2, 7, 12, and 17 ft on each buoy system (Figure VI-2).

Between 17 May and 6 September, exposed substrates were collected at two-week intervals and replaced with cleaned plates. Between 3 June and 24 November, overlapping the period of two-week collections, additional substrates were collected and replaced at intervals of about four weeks (Table VI-29).

b. Laboratory Analysis

Bottom and buoy periphyton Plexiglas substrates were analyzed in the same manner: each substrate was divided into specific areas from which all growth was scraped with a single-edge razor blade for species identification and determination, biomass and chlorophyll a (Figure VI-2).

(i) Identification

Material from two areas on the plate was scraped into a 16-dram (dr) vial containing 5% buffered formalin; suspended scrapings were agitated with a magnetic stirrer to break up algal films. Two 0.1-ml aliquots were analyzed in a Palmer-Maloney nannoplankton counting cell (0.1-ml capacity) and the resulting values converted to number of organisms per square decimeter (dm^2), using the procedure and equation established in 1973 (QLM, 1974) for glass slides. Organisms in each aliquot were identified to the lowest taxonomic level possible (Table VI-30).

Diatoms were enumerated as live (with cellular content) centrates and live pennates. In addition, a separate count of the number of empty diatom frustules was made for each sample. Diatoms were prepared for species identification following a modification of the procedure outlined by Weber (1973), i.e., frustules were cleaned in concentrated nitric acid.

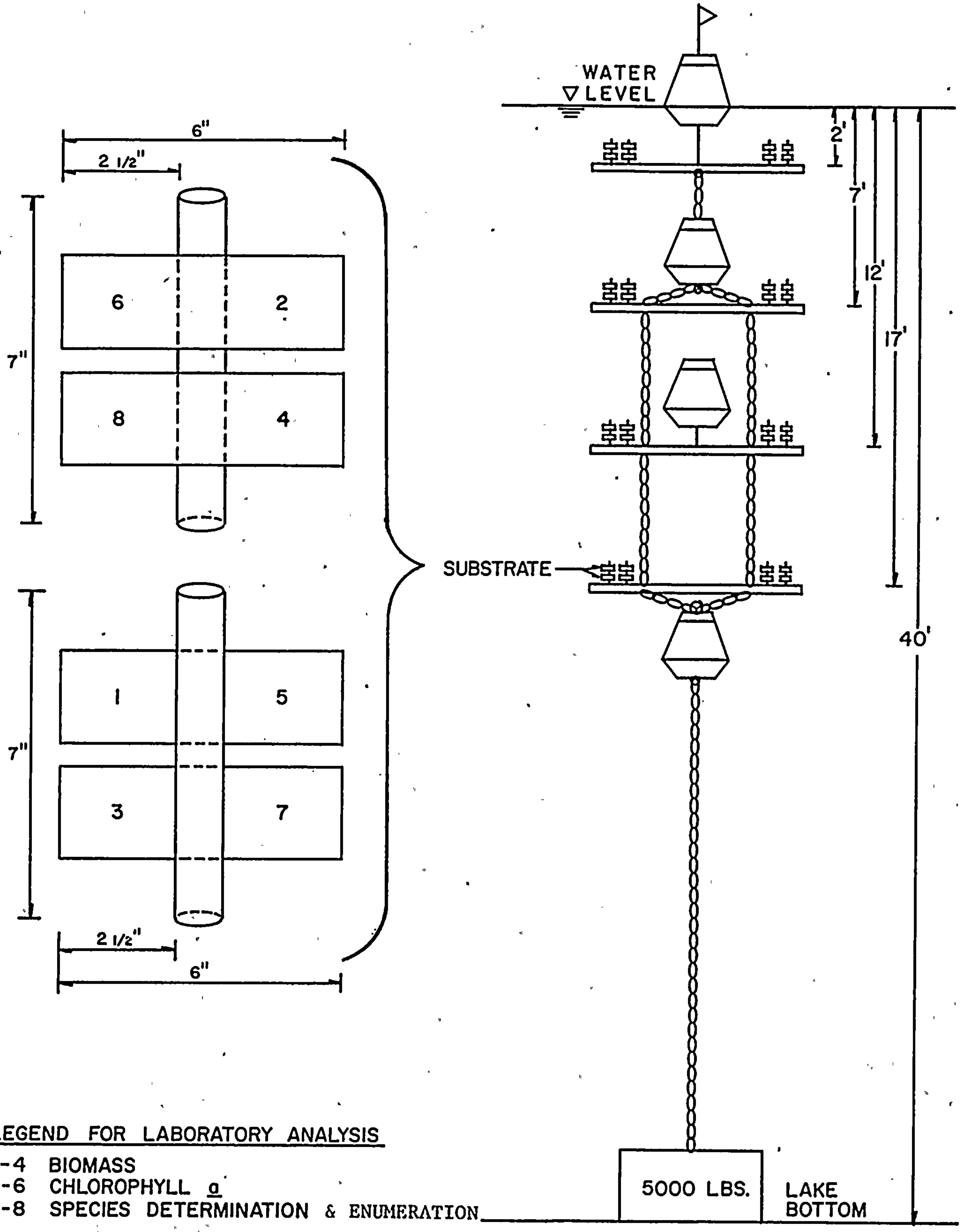
TABLE VI-29

PERIPHYTON SAMPLING PROGRAM

NINE MILE POINT - 1974

DATE SAMPLE RETRIEVED		SUBSTRATE NUMBERS	EXPOSURE PERIOD	
BOTTOM STATIONS	BUOY STATIONS		2 wk.	4 wk.
20 MAY	17 MAY	1, 2	1, 2	
4 - 5 JUN	3 JUN	3, 4, 5, 6	5, 6	3, 4
18 JUN	17 JUN	7, 8	7, 8	
1 - 2 JUL	30 JUN	9, 10, 11, 12	11, 12	9, 10
18, 22 JUL	17 JUL	13, 14	13, 14	
1 AUG	2 AUG	15, 16, 17, 18	17, 18	15, 16
16 AUG	15 AUG	19, 20	19, 20	
5 SEP	6 SEP	21, 22, 23, 24	23, 24	21, 22
1 OCT	5 OCT	25, 26		25, 26
30 OCT	31 OCT	27, 28		27, 28
23 NOV	24 NOV	29, 30		29, 30

BUOY PERIPHYTON SAMPLING APPARATUS
NINE MILE POINT
1974



LEGEND FOR LABORATORY ANALYSIS

1-4 BIOMASS
5-6 CHLOROPHYLL *a*
7-8 SPECIES DETERMINATION & ENUMERATION

TABLE VI-30

SPECIES INVENTORY OF PERIPHYTON

NINE MILE POINT - 1974

Plant Kingdom

Class Chlorophyceae

N Actinastrum gracilimum
A. Hantzschii
Ankistrodesmus convolutus
A. falcatus
Botryococcus sudeticus
Characium sp.
C. ornithocephalum
N Chlamydomonas sp.
Chodatella ciliata
C. quadriseta
C. subsalsa
Cladophora sp.
N Closterium sp.
C. aciculare
C. moniliferum
C. venus
Coelastrum cambricum
C. microporum
N Cosmarium spp.
C. crenatum
C. nitidulum
Crucigenia quadrata
C. tetrapedia
Cylindrocapsa sp.
N Dictyosphaerium pulchellum
Echinosphaerella limnetica
Elakatothrix gelatinosa
N Eudorina elegans
Franceia droescheri
F. ovalis
N Gloeocystis spp.
G. gigas
G. planctonica
G. vesiculosa
Golenkinia paucispina
G. radiata
Kirchneriella lunaris
K. subsolitaria
Micractinium pusillum
Mougeotia spp.
Oedogonium spp.
Oocystis sp.
O. borgei
O. parva
O. solitaria
N Pandorina morum
N Pediastrum boryanum
P. duplex
P. integrum
P. simplex
P. tetras
Phacotus lenticularis
Quadrigula chodatii
N Scenedesmus sp.
S. abundans
S. acuminatus
S. acutiformis
S. bijuga
S. brasiliensis
S. denticulatus
S. dimorphus
S. incrassatulus
S. obliquus
S. opoliensis
S. quadricauda
Scenedesmus sp. (2 cells)
Schroederia judayi
S. setigera
Selenastrum minutum
Sorastrum spinulosum
Sphaerocystis schroeteri
N Spirogyra spp.
N Staurastrum spp.
S. cingulum
S. gracile
Stigeoclonium tenue
Tetraedron caudatum
T. minimum
T. muticum
T. pentaedricum
T. regulare
T. trigonom
Tetrastrum sp.
T. elegans
T. staurogeniaforme
Treubaria setigerum
T. triappendiculata
N Ulothrix spp.
U. tenuissima
U. zonata
Westella linearis
Unidentified colony

TABLE VI-30
(Continued)

Unidentified filament
Unidentified single cell

Class Euglenophyceae

N *Euglena* spp.
Lepocinclis spp.

Class Chrysophyceae

N *Dinobryon sociale* var. *americanum*
Ophiocytium sp.
Stipitococcus sp.

Class Bacillariophyceae

Achnanthes lanceolata
A. linearis
A. microcephala
Amphora ovalis var. *pediculus*
N *Asterionella formosa*
Cocconeis amphisbaena
C. diminuta
C. pediculus
C. placentula
Coscinodiscus Rothii
N *Cyclotella* spp.
C. atomus
C. bodanica
C. comta
C. glomerata
C. meneghiniana
C. ocellata
C. pseudostelligera
C. stelligera
Cymatopluera elliptica
C. solea
Cymbella affinis
C. prostrata
C. tumida
C. ventricosa
N *Diatoma* sp.
D. tenue var. *elongatum*
D. tenue var. *minor*
D. vulgare
Diploneis sp.
Eunotia curvata
Epithemia sorex
N *Fragilaria capucina*
F. construens
F. crotonensis
F. pinnata
F. vaucheriae
F. virescens
Gomphonema angustatum
G. olivaceum
G. parvulum
Gyrosigma acuminatum
G. attenuatum
G. scalproides
N *Melosira binderana*
M. granulata
M. islandica
M. italica
Mendion circulare
Navicula spp.
N. anglica
N. bacillum
N. canalis
N. capitata
N. cryptocephala
N. elginensis
N. exigua var. *capitata*
N. graciloides
N. gregaria
N. minima
N. rhynchocephala
N. salinarum var. *intermedia*
N. scutelloides
N. tripunctata
N. virdula
Nitzschia spp.
N. acicularis
N. dissipata
N. fonticola
N. gracilis
N. linearis
N. palea
Rhoicosphenia curvata
N *Stephanodiscus* spp.
S. astraea
S. astraea var. *minutula*
S. Hantzschii
S. niagarae
S. tenuis
Surirella angustata
S. ovata
S. ovalis

TABLE VI-30
(Continued)

N *Synedra acus*
S. acus var. radians
S. fasciculata
S. pulchella
S. rumpens
S. ulna
N *Tabellaria fenestrata*

Class Dinophyceae

N *Ceratium hirundinella*
N *Glenodinium* spp.
N *Peridinum* sp.
P. aciculiferum
P. cinctum

Class Myxophyceae

N *Anabaena* sp.
A. affinis
A. flos-aquae
A. spiroides
N *Aphanizomenon flos-aquae*
Aphanocapsa sp.
A. pulchra
Aphanothece spp.
Chaemisiphon incrustans
Chroococcus sp.
C. dispersus
C. limneticus
C. minutus
C. turgidus
N *Coelosphaerium Kuetzingianum*
Gloeocapsa spp.
N *Gomphosphaeria lacustris*
Lyngbya aerugineo-caerulea
L. birgei
L. diguetii
L. limnetica
Merisimopedia sp.
M. glauca
M. tenuissima
N *Oscillatoria* sp.
O. limnetica
O. subbrevis
Phormidium sp.
Polycystis aeruginosa
P. incerta

Spirulina subsalsa
Unidentified colony
Unidentified filament
Unidentified single cell

Class Cryptophyceae

Unidentified cryptophyte

Animal Kingdom

Phylum Protozoa

Class Ciliata

Codonella cratera
Epistylidae
Epistylis spp.
Vaginicolidae
Vorticellidae
Unidentified ciliate
Unidentified gymnostomina

Class Suctoria

Paracineta sp.
Thecacineta sp.
Tokophrya sp.

Phylum Rotifera

Class Monogononta

Brachionus urceolaris
Cephalodella sp.
Lecane sp.
Lepadella sp.
Unidentified rotifer

N= potential nuisance algal genera (Mackenthun, 1969)

Diatoms were examined at 1500 magnifications and the first 100-150 individuals were identified to species. These diatom species counts were expressed as percentages of total pennate and total centrate diatoms and converted into representative counts of live species based on the live pennate and centrate counts obtained in the Plamer-Maloney cell.

(ii) Biomass

Periphyton was scraped from four sections of the Plexiglas plates (Figure VI-2) into pre-weighed aluminum dishes. The procedure for determining biomass (mg ash-free dry weight/dm^2) was the same as that followed in 1973 (QLM, 1974). The amount of biomass accumulation per unit time exposure period was designated as the net production rate (APHA, 1971).

(iii) Chlorophyll a

The trichromatic method (APHA, 1971) was used for determination of chlorophyll a concentrations (uncorrected for phaeopigments).

3. Results and Discussion

a. Community Composition

The organisms identified in bottom and buoy periphyton collections during 1974 are listed in Table VI-30. The algal classes represented were the same as those composing the phytoplankton community (Chapter V-A); protozoans and rotifers composed the animal portion of the periphyton community. As during 1973, Cladophora was only infrequently found on bottom substrates and rarely on buoy substrates, and in both collections was limited to the shallower depths of water.

Since green algae, diatoms, blue-green algae, and protozoans were generally the numerically dominant periphyton groups, trends and patterns in the spatial and temporal distribution of these organisms will be described in the following section.

b. Abundance

(i) Green Algae

In bottom samples collected every two weeks (biweekly) (Appendix VI-6), green algae showed a trend of increasing abundance as the season progressed from the spring through the summer. At the 5 ft depth contour, mean abundance continued to increase to the end of the sampling period, but farther offshore (10-40

ft), numbers tended to fluctuate during late summer. Monthly bottom samples (Appendix VI-7) averaged by depth generally showed a bimodal seasonal pattern of green algal abundance with maxima during summer and fall. The fall peak was the more pronounced of the two at the 5 and 10 ft depth contours, whereas the spring peak was greater farther offshore.

Green algal abundances averaged by transect for biweekly and monthly exposure periods (Appendix VI-6 and VI-7) showed seasonal variations similar to those described above. Concentrations tended to be slightly greater at the FITZ and NMPE transects than at NMPW and NMPP, and the timing of peaks varied with transect. Major representative genera included Scenedesmus, Mougeotia, Ankistrodesmus and Stigeoclonium.

The bimodal seasonal patterns of green algal abundance observed in bottom periphyton collections appeared to occur only at the 12 and 17 ft depths in monthly buoy periphyton collections (Appendix VI-8). A unimodal seasonal pattern of mean green algal numbers, with the peak during early September, was found at the 2 and 7 ft depths. Green algal maxima in biweekly buoy collections were noted for all depths during early September and during July and August for the 2 and 7 ft depths, respectively. Statistical analyses on two-week exposure data (Appendix VI-9A) showed that green algae were on the average significantly more abundant at the 7 ft sample depth than at the 17 ft sample depth, and at the NMPE buoy station compared to the NMPW buoy station. A statistically significant date x depth interaction indicated that the sample depth distribution of green algae varied with date.

The major representative green algal genera in buoy collections were similar to those in bottom collections (Mougeotia, Pediastrum, Scenedesmus, and Stigeoclonium).

Generally, then, a bimodal seasonal pattern of green algal abundance was common to all periphyton collections from depths greater than 10 ft. Periphytic green algal growth was generally greater to the east in the study area than to the west, and in shallow waters compared to deeper waters. However, abundance varied among locations and particularly among depths over time.

(ii) Diatoms

For diatoms, as for green algae, a bimodal seasonal pattern of abundance appeared typical for bottom collections; maxima occurred during summer and fall (Appendix VI-10 and VI-11),

but the timing of peaks varied with depth contour and transect. Diatom abundance tended to decrease as depth increased; however, distribution appeared to vary among transects. Major representative diatom genera in bottom collections were *Cyclotella*, *Coscinodiscus*, and *Diatoma*.

Diatoms were generally most abundant at all depths in monthly buoy collections during late summer (Appendix VI-12), with highest values occurring typically in either August or September (actual maxima were observed in October and June for 2 and 17 ft monthly collections, respectively). Biweekly collections tended to confirm the existence of late summer peaks in abundance and, like monthly collections, indicated that diatom abundance decreased as sample depth increased. Statistical analyses performed on two-week exposure data (Appendix VI-9A) showed that mean diatom abundance was significantly greater at the NMPP/FITZ and NMPE buoy station than at the NMPW buoy station and at shallow water sample depths (2 and 7 ft) than at greater depths in the water column (12 and 17 ft). Like green algae, diatoms exhibited a significant difference in depth distribution by collection date.

Diatoma tenue var. *elongatum*, *Gomphonema parvulum*, *Navicula* spp., and *Nitzschia* sp. were the most abundant diatoms in buoy periphyton samples; only the first species was also identified in phytoplankton samples.

Overall, periphytic diatoms seemed to be more variable in temporal and spatial distribution than green algae. However, the tendency toward decreasing abundance with increasing depth generally appeared consistent for all collection methods and exposure periods.

(iii) Blue-green algae

The spatial and temporal distribution of this algal class was also variable, but like the two other dominant classes in bottom collections, blue-green algae tended to decrease in concentration as depth increased (Appendix VI-13 and VI-14). In monthly collections averaged by depths (Appendix VI-14), a late summer maximum in abundance was typical, but seasonal patterns based on data averaged by transect were variable. Mean abundance at the NMPW transect seemed to be particularly variable over time, whereas a maximum value was recorded in either August or September at the other three transects. In biweekly bottom collections (Appendix VI-13), blue-green algae tended to increase from the spring through the summer, but this trend was not steady. Mean blue-green algal abundance

varied among transects for both biweekly and monthly collections. Lyngbya and Anabaena were the dominant blue-green algal genera identified in bottom collections.

Seasonal patterns of blue-green algal abundance varied with sample depth in monthly buoy collections, but maximum numbers were generally observed during the late summer/early fall (Appendix VI-15). The biweekly buoy collections tended to confirm the occurrence of a late summer maximum in blue-green algal numbers. As noted for bottom collections, abundance generally decreased with increasing depth in the water column. Statistical analyses on two-week exposure periods (Appendix VI-9B) indicated no significant differences in mean blue-green algal abundances among buoy locations, but did show differences for sample depths: these algae were significantly more abundant at 2 ft than at 7 and 12 ft or 17 ft. Aphanothece, Chroococcus, and Lyngbya diguetti were the numerically dominant blue-green algae in buoy collections; the latter species was unique to the observed periphyton community.

Thus, seasonal patterns of abundance for blue-green algae appeared to be more variable among depths and locations (both buoy and bottom collections) than those of the phycoperiphytic diatoms and green algae; maximum concentrations were observed during the late summer/early fall. Blue-green algal numbers, like those of diatoms and green algae, generally decreased as depth of collection increased.

(iv) Protozoans

In monthly bottom collections, these organsims, which constituted the majority of the zooperiphyton standing stock, were found in peak abundance within the period July through October, depending on transect location and depth of collection (Appendix VI-17). A bimodal seasonal pattern with summer and fall peaks was suggested by the available data, but temporal variability was high. Biweekly collections tended to confirm the occurrence of a summer maximum (Appendix VI-16). Protozoans appeared to be most abundant at depth contours greater than 5 ft in monthly collections and between 5 and 30 ft in biweekly collections. East-to-west distribution among bottom periphyton stations seemed to vary temporally.

The seasonal patterns of protozoan abundance in monthly and biweekly buoy collections (Appendix VI-18) were similar to those described for bottom periphyton collections. Protozoans were observed to be generally more abundant at sample

depths greater than 2 ft for both two-week and four-week exposure periods. Statistical analyses on two-week exposure periods (Appendix VI-9B) indicated that differences among sample depths were not significant; however, they did show significant differences among dates and a date x depth interaction. There were no significant differences in mean protozoan abundance among buoy locations.

The Vorticellidae dominated bottom collections, whereas the stalked ciliates (Suctoria), Paracineta in particular, dominated buoy collections. Like the dominant phycoperiphyton, protozoans manifested seasonal maxima during summer and fall. Both temporal and spatial distribution were generally variable.

(v) Faunal-floral Relationships

Figure VI-3, depicting the relative abundance of specific groups in the buoy periphyton collections, indicates that zooperiphyton (fauna, primarily protozoans) generally composed a small numerical fraction of the periphyton community. Greater relative faunal abundance tended generally to occur during late spring/summer and in deeper waters; as exposure time increased, however, the faunal component of the periphyton community decreased in relative abundance (Figure VI-3).

The trend toward greater relative abundance of zooperiphyton in deeper waters was probably related to the amount of available light, as had been noted during 1973. Only a small fraction of the light striking the surface of the water penetrates depths below 5 ft (Appendix VI-19 and VI-20), and consequently the light-independent zooperiphyton apparently grows more rapidly than the light-dependent phycoperiphyton. As exposure time of the substrate increased, however, algal standing stocks continued to increase, reducing the relative abundance of the fauna in the community.

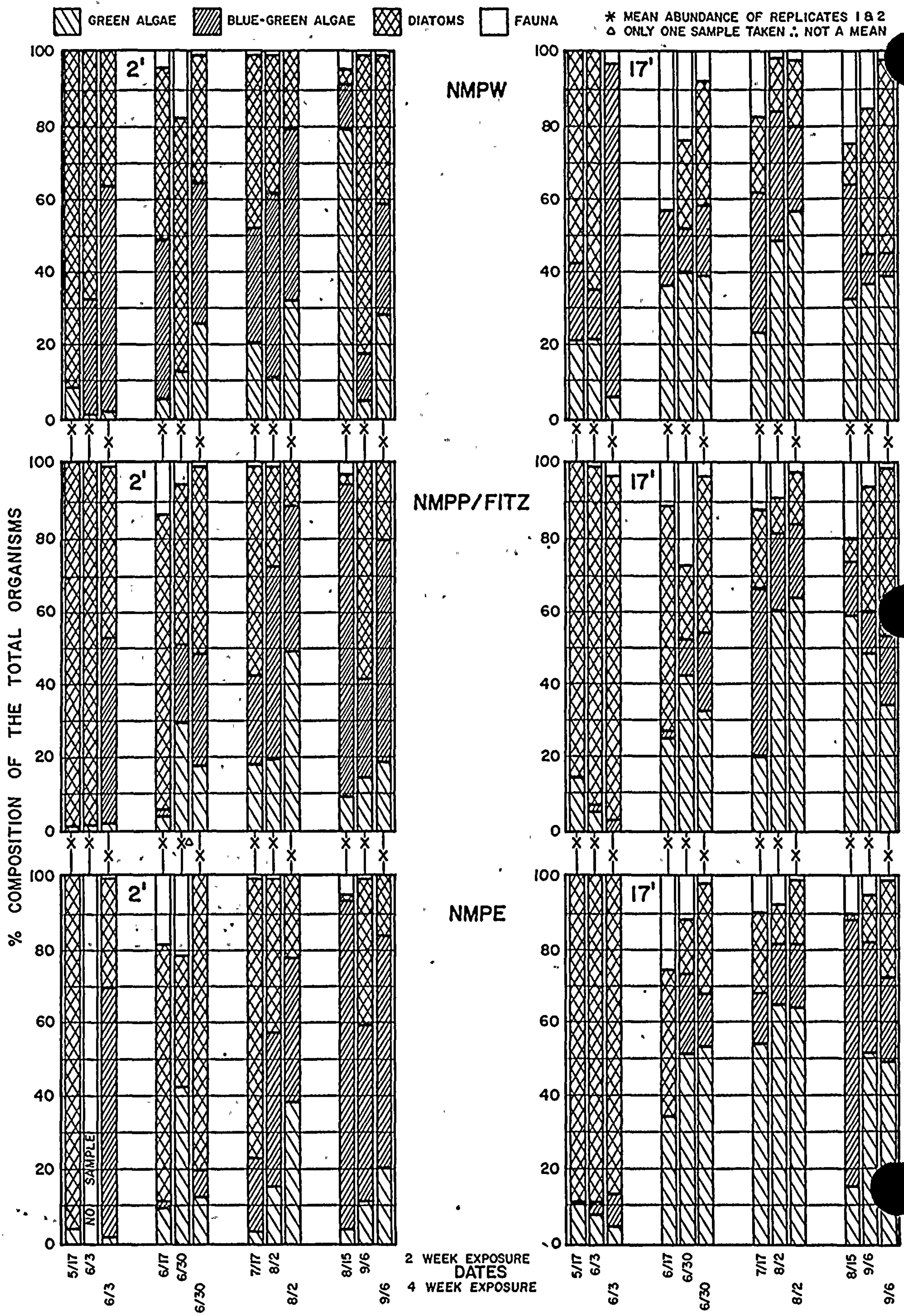
The pattern of algal succession was similar for both the phycoperiphyton (Figure VI-3) and the phytoplankton (Chapter V-A) communities and typical of conditions in temperate water bodies. The presence of a relatively large blue-green algal component is consistent with recent reports of increasing eutrophication of Lake Ontario, particularly in the near-shore waters (e.g., Stoermer et al, 1975).

c. Biomass

(i) Ash-free dry weight

This parameter is an indicator of particulate organic matter and includes but does not differentiate between living and

RELATIVE ABUNDANCE* OF MAJOR PERIPHYTON GROUPS IN SELECTED BUOY COLLECTIONS NINE MILE POINT 1974



and non-living plant and animal particles. In monthly bottom periphyton collections, summer maxima in ash-free dry weight were found at all depths (Appendix VI-21). The exact period during which these maxima, which were more pronounced at the near-shore stations, occurred varied with depth contour such that it occurred earlier at the deeper stations. Changes in ash-free dry weight over time in biweekly collections (Appendix VI-21) tended to confirm seasonal and depth patterns observed in the monthly collections; ash-free dry weight generally decreased as collection depth increased.

Similar spatial and temporal distribution patterns for ash-free dry weight biomass were observed in buoy collections (Appendix VI-22) although buoy biomass values were greater in magnitude. The increase in biomass at the buoy stations may be attributed to the greater light penetration at the buoy suspension depths (Appendix VI-19) than at comparable bottom depths (Appendix VI-20); percent light transmission is a function primarily of turbidity.

In general, the ash-free dry weight distribution patterns were similar to the distribution of periphyton abundance. The absence of bimodal seasonal distribution patterns in the ash-free dry weight data may have been related to the seasonal variations in the weight of the zooperiphyton or the accumulation of non-living organic matter.

(ii) Chlorophyll a

This biomass parameter is a measure of active and inactive plant pigments and, as such, an indicator of phycoperiphyton standing stock. The patterns of chlorophyll a distribution in relation to depth and date of collection paralleled those described for ash-free dry weight in both bottom and buoy collections (Appendix VI-23 and VI-24). A bimodal seasonal pattern was, however, apparent at the 5 and 10 ft depths in monthly bottom collections, suggesting a greater degree of correlation between chlorophyll a concentrations and algal abundance than between ash-free dry weight and algal abundance.

d. Production Rates

Production as calculated in these studies (ash-free dry weight/dm^2/day) is an estimate of net community production, since changes in plant and animal standing stock are combined; this estimate includes losses related to respiration, grazing pressure, and mortality, and additions due to sedimentation.

In bottom collections, production was typically greatest in the summer months and decreased in the spring and fall. In the two-week samples, production was generally higher at NMPE, FITZ, and NMPP than at NMPW in the late summer, but varied among transects in the late spring/early summer. A similar trend in distribution among transects was observed for monthly collections.

The seasonal patterns of production rates at the buoy collecting sites were similar to those described for the bottom periphyton. A three-way ANOVA on production rates from two and four-week exposures revealed significant differences among dates and sample depths (Beckwith and Keppel, 1975); production was greater at the 2 ft depth than at the remaining depths. Overall, production rates in both two-week and four-week buoy collections were greatest at NMPE station and least at NMPW station, paralleling the general west-to-east increase in phycoperiphyton abundance. However, station differences were only significant (> 0.05) for two-week exposure collections; production rates at NMPW was significantly lower than NMPP/FITZ and NMPE.

4. Conclusions

a. Abundance, biomass, and production decreased as depth increased; in the summer, protozoan abundance increased as depth increased.

b. Green algae and diatoms were more abundant at NMPE transect than at NMPW transect; blue-green algae and protozoans were more homogeneously distributed. Production rates also tended to be greater toward the eastern end of the study area.

c. As the periphyton community matured, the relative abundance of the algal component increased; the protozoan component decreased with increasing exposure time.

d. The distribution of periphyton organisms with depth and season appeared to be related primarily to variations in light intensity and water temperature, similar to observations reported in 1973.

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APPENDIX VI-1

ABUNDANCE OF POLYCHAETES (*Manayunkia speciosa*)
NINE MILE POINT VICINITY - 1974

A. APRIL, 1974

TWO-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DEPTH	3	2911.1948	25	3982.0571	6.092 (a)
TRANSECT	3	489.3090	25	3982.0571	1.024 (b)
DEPTH X TRANSECT	9	605.6917	16	3376.3654	0.319 (b)
TOTAL	31	7382.5609			

(a) Significant at $\alpha < 0.005$ but not at $\alpha = 0.0025$
(b) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$)
Largest: 20' 30' 40' 60' : Smallest

B. JUNE, 1974

TWO-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DEPTH	4	4612.1152	32	3537.6684	10.430 (a)
TRANSECT	3	482.1768	32	3537.6684	1.454 (b)
DEPTH X TRANSECT	12	2373.0570	20	1164.6114	3.396 (c)
TOTAL	39	8631.9604			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.25$ but not at $\alpha = 0.10$
(c) Significant at $\alpha < 0.01$ but not at $\alpha = 0.005$

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$)
Largest: 20' 30' 10'C 40' 60' : Smallest

C. AUGUST, OCTOBER, DECEMBER, 1974

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
MONTHS	2	2189.8635	98	9988.0423	10.743 (a)
DEPTHS	4	3296.2259	104	10774.7039	7.954 (a)
TRANSECTS	3	2682.5019	102	10944.8377	8.333 (a)
MONTH X DEPTH	8	1881.1028	84	6055.7029	3.262 (b)
MONTH X TRANSECT	6	2051.2366	84	6055.7029	4.742 (a)
DEPTH X TRANSECT	12	2837.8982	84	6055.7029	3.280 (c)
MONTH X DEPTH X TRANSECT	24	1878.0490	60	4177.6539	1.124 (d)
TOTAL	119	20994.5316			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.005$ but not at $\alpha = 0.0025$
(c) Significant at $\alpha < 0.001$ but not at $\alpha = 0.0005$
(d) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$)
Largest: 20' 30' 40' 60' 10'NC: Smallest

APPENDIX VI-2

ABUNDANCE OF MACROINVERTEBRATES
NINE MILE POINT VICINITY - 1974

A. TOTAL BENTHOS - APRIL, 1974

TWO-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DEPTH (20' - 60')	3	1.2799	25	4.7956	2.224 (a)
TRANSECT	3	3.1834	25	4.7956	5.532 (b)
DEPTH X TRANSECT	9	2.3459	16	2.4497	1.702 (a)
TOTAL	31	9.2590			

(a) Significant at $\alpha < 0.25$ but not at $\alpha = 0.10$
(b) Significant at $\alpha < 0.0005$ but not at $\alpha = 0.0025$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$)
Largest: NMPE FITZ NMPP NMPW: Smallest

B. TOTAL BENTHOS - JUNE, 1974

TWO-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DEPTH (10'C, 20'-60')	4	1.8149	32	9.9174	1.464 (a)
TRANSECT	3	0.6600	32	9.9174	0.710 (b)
DEPTH X TRANSECT	12	8.9681	20	0.9493	15.745 (c)
TOTAL	39	12.3923			

(a) Significant at $\alpha < 0.25$ but not at $\alpha = 0.10$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$

C. OLIGOCHAETES - JUNE, 1974

TWO-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
DEPTH (10'C, 20'-60')	4	7.2427	32	54.1259	1.070 (a)
TRANSECT	3	0.0735	32	54.1259	0.014 (a)
DEPTH X TRANSECT	12	47.9661	20	6.1598	12.978 (b)
TOTAL	39	61.4421			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.0005$

APPENDIX VI-3A

ABUNDANCE OF MACROINVERTEBRATES (ARTHROPODS)
NINE MILE POINT VICINITY - JUNE-1973-1974

I. AMPHIPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	2.6448	37	10.6553	3.061 (a)
DEPTH	3	6.8483	37	10.4355	8.094 (b)
YEARS	1	1.1203	31	4.4226	7.853 (c)
TRANSECT X DEPTH	9	7.2394	25	2.1895	9.185 (b)
TRANSECT X YEAR	3	1.2265	25	2.1895	4.668 (d)
DEPTH X YEAR	3	1.0066	25	2.1895	3.831 (d)
TOTAL	47	22.2755			

(a) Significant at $\alpha<0.05$
(b) Significant at $\alpha<0.0005$
(c) Significant at $\alpha<0.01$
(d) Significant at $\alpha<0.025$

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α=0.05) Largest: 10'C 60' 40' 30' : Smallest
STUDENT-NEWMAN-KEULS TEST FOR TRANSECTS (α =0.10) Largest: FITZ NMPE NMPP NMPW : Smallest

II. DIPTERANS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	2.7246	37	13.7431	2.445 (a)
DEPTH	3	8.3537	37	14.3596	7.175 (b)
YEARS	1	0.6321	31	17.1016	1.146 (c)
TRANSECT X DEPTH	9	4.0584	25	2.8844	3.908 (d)
TRANSECT X YEAR	3	6.8004	25	2.8844	19.647 (e)
DEPTH X YEAR	3	7.4169	25	2.8844	21.428 (e)
TOTAL	47	32.8703			

(a) Significant at $\alpha<0.10$
(b) Significant at $\alpha<0.001$
(c) Not significant at α=0.25
(d) Significant at $\alpha<0.005$
(e) Significant at $\alpha<0.0005$

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α=0.05) Largest: 10'C 40' 30' 60' : Smallest

III. OSTRACODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	4.8730	37	10.5641	5.689 (a)
DEPTH	3	4.3697	37	12.0874	4.459 (b)
YEARS	1	0.0461	31	8.1081	0.176 (c)
TRANSECT X DEPTH	9	4.4900	25	5.5633	2.242 (d)
TRANSECT X YEAR	3	0.5108	25	5.5633	0.765 (c)
DEPTH X YEAR	3	2.0341	25	5.5633	3.047 (e)
TOTAL	47	21.8870			

(a) Significant at $\alpha<$ 0.005
(b) Significant at $\alpha<$ 0.01
(c) Not significant at α =0.25
(d) Significant at $\alpha<0.10$
(e) Significant at α =0.05

STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α=0.05) Largest: 60' 40' 30' 10'C : Smallest
STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α=0.05) Largest: NMPE FITZ NMPP NMPW : Smallest

APPENDIX VI-3B

ABUNDANCE OF MACROINVERTEBRATES (MOLLUSCA-ANNELIDA)
NINE MILE POINT VICINITY - JUNE-1973-1974

I. GASTROPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	15.8441	37	34.4812	5.667 (a)
DEPTHS	3	2.2829	37	33.8604	0.832 (b)
YEARS	1	0.0398	31	21.0416	0.059 (b)
TRANSECT X DEPTH	9	16.2740	25	14.7519	3.064 (c)
TRANSECT X YEAR	3	3.4552	25	14.7519	1.952 (d)
DEPTH X YEAR	3	2.8344	25	14.7519	1.601 (d)
TOTAL	47	55.4824			

(a) Significant at $\alpha < 0.005$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.025$
(d) Significant at $\alpha < 0.25$

STUDENT-NEWMAN-KEULS -TRANSECTS ($\alpha = 0.05$) Largest: NMPE FITZ NMPP NMPW : Smallest

II. POLYCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	74.9693	37	968.1252	0.955 (a)
DEPTHS	3	110.0559	37	904.1035	1.501 (b)
YEARS	1	22.9663	31	674.7201	1.055 (a)
TRANSECT X DEPTH	9	334.9459	25	527.6169	1.763 (b)
TRANSECT X YEAR	3	105.5625	25	527.6169	1.667 (b)
DEPTH X YEAR	3	41.5408	25	527.6169	0.656 (a)
TOTAL	47	1217.6574			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.25$

III. OLIGOCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	5.3108	37	70.4127	0.930 (a)
DEPTH	3	5.2643	37	68.8593	0.943 (a)
YEARS	1	0.0630	31	28.3939	0.069 (a)
TRANSECT X DEPTH	9	46.4061	25	18.0659	7.135 (b)
TRANSECT X YEAR	3	5.9407	25	18.0659	2.740 (c)
DEPTH X YEAR	3	4.3873	25	18.0659	2.024 (d)
TOTAL	47	85.4381			

(a) Not significant at $\alpha = 0.25$
(b) Significant at $\alpha < 0.0005$
(c) Significant at $\alpha < 0.10$
(d) Significant at $\alpha < 0.25$

APPENDIS VI-4A

ABUNDANCE OF MACROINVERTEBRATES (ARTHROPODS)
NINE MILE POINT VICINITY - AUGUST-1973-1974

I. AMPHIPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	4.6425	67	29.3457	3.533 (a)
DEPTHS	4	8.0038	68	28.1083	4.841 (b)
YEARS	1	0.9847	59	20.6719	2.810 (c)
TRANSECT X DEPTH	12	9.0700	52	18.6421	2.108 (d)
TRANSECT X YEAR	3	1.6336	52	18.6421	1.519 (e)
DEPTH X YEAR	4	0.3962	52	18.6421	0.276 (f)
TOTAL	79	43.3729			

(a) Significant at α<0.025
(b) Significant at α<0.0025
(c) Significant at α<0.10
(d) Significant at α<0.05
(e) Significant at α<0.25
(f) Not significant at α=0.25
(g) Significant at α<0.0005

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α=0.05) Largest: NMPE FITZ NMPP NMPW : Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α=0.05) Largest: 10'NC 20' 30' 40' 60' : Smallest

II. DIPTERANS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	10.4167	67	28.8909	8.052 (a)
DEPTH	4	3.7460	68	27.3383	2.329 (b)
YEARS	1	0.8352	59	24.1899	2.037 (c)
TRANSECT X DEPTH	12	6.6499	52	18.7395	1.538 (c)
TRANSECT X YEAR	3	3.5015	52	18.7395	3.239 (d)
DEPTH X YEAR	4	1.9489	52	18.7395	1.352 (e)
TOTAL	79	45.8377			

(a) Significant at α<0.0005
(b) Significant at α<0.10
(c) Significant at α<0.25
(d) Significant at α<0.05
(e) Not significant at α=0.25

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α=0.05) Largest: NMPE NMPP FITZ NMPW : Smallest

III. OSTRACODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	10.0241	67	40.8954	5.474 (a)
DEPTS	4	16.9168	68	43.4106	6.625 (b)
YEARS	1	0.3080	59	24.1012	0.754 (c)
TRANSECT X DEPTH	12	20.6493	52	18.9062	4.733 (b)
TRANSECT X YEAR	3	1.3399	52	18.9062	1.228 (d)
DEPTH X YEAR	4	3.8551	52	18.9062	2.651 (e)
TOTAL	79	71.9994			

(a) Significant at α<0.0025
(b) Significant at α<0.0005
(c) Not significant at α=0.25
(d) Not significant at α=0.25
(e) Significant at α<0.05

STUDENT-NEWMAN-KEULS TEST - TRANSECTS (α=0.05) Largest: NMPE FITZ NMPP NMPW
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS (α=0.05) Largest: 60' 40' 20' 30' 10'NC

APPENDIX VI-4B

ABUNDANCE OF MACROINVERTEBRATES (MOLLUSCA-ANNELIDA)
NINE MILE POINT VICINITY-AUGUST - 1973 - 1974

I. POLYCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS(ERR)	F
TRANSECTS	3	2012.5914	67	10254.8285	4.383 (a)
DEPTHS	4	3306.7647	68	9398.5854	5.981 (b)
YEARS	1	1935.2110	59	9593.2168	11.902 (c)
TRANSECT X DEPTH	12	2237.3504	52	5585.4963	1.736 (d)
TRANSECT X YEAR	3	2431.9818	52	5585.4963	7.547 (b)
DEPTH X YEAR	4	1575.7387	52	5585.4963	3.667 (e)
TOTAL	79	19085.1344			

(a) Significant at $\alpha < 0.01$
(b) Significant at $\alpha < 0.0005$
(c) Significant at $\alpha < 0.0025$
(d) Significant at $\alpha < 0.10$
(e) Significant at $\alpha < 0.025$

STUDENT-NEWMAN-KEULS TEST-TRANSECTS (α=0.05) Largest: NMPW NMPP NMPE FITZ : Smallest
STUDENT-NEWMAN-KEULS TEST-DEPTH CONTOURS (α=0.05) Largest: 20' 30' 40' 10'NC 60' : Smallest

II. OLIGOCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	730.5952	67	5266.7058	3.09[illegible]
DEPTHS	4	1587.4172	68	5771.9114	4.675 (b)
YEARS	1	2133.4896	59	4263.1948	29.526 (c)
TRANSECT X DEPTH	12	1932.7038	52	2910.0148	2.878 (d)
TRANSECT X YEAR	3	423.9872	52	2910.0148	2.525 (e)
DEPTH X YEAR	4	929.1928	52	2910.0148	4.151 (f)
TOTAL	79	10647.4006			

(a) Significant at $\alpha < 0.05$
(b) Significant at $\alpha < 0.0025$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.005$
(e) Significant at $\alpha < 0.10$
(f) Significant at $\alpha < 0.01$

STUDENT-NEWMAN-KEULS TEST-TRANSECTS (α =0.05) Largest: NMPE FITZ NMPP NMPW : Smallest
STUDENT-NEWMAN-KEULS TEST-DEPTH CONTOURS (α =0.05) Largest: 60' 40' 30' 20' 10'NC: Smallest

III. GASTROPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF(ERR)	SS (ERR)	F
TRANSECTS	3	8.2204	67	51.2540	3.582 (a)
DEPTHS	4	1.4296	68	50.2569	0.484 (b)
YEARS	1	3.1339	59	28.3933	6.512 (a)
TRANSECTS X DEPTHS	12	24.5562	52	24.0052	4.433 (c)
TRANSECT X YEAR	3	2.6926	52	24.0052	1.944 (d)
DEPTH X YEAR	4	1.6955	52	24.0052	0.918 (b)
TOTAL	79	65.7379			

(a) Significant at $\alpha < 0.025$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.0005$
(d) Significant at $\alpha < 0.25$

APPENDIX VI-5A

ABUNDANCE OF MACROINVERTEBRATES (ARTHROPODS)
NINE MILE POINT VICINITY - OCTOBER - 1973 - 1974

I. AMPHIPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	4.9711	67	42.5097	2.612 (a)
DEPTHS	4	9.4253	68	46.1212	3.474 (b)
YEARS	1	0.6769	59	27.0059	1.479 (c)
TRANSECTS X DEPTH	12	19.5744	52	22.4762	3.774 (d)
TRANSECT X YEAR	3	0.4591	52	22.4762	0.354 (e)
DEPTH X YEAR	4	4.0706	52	22.4762	2.354 (a)
TOTAL	79	61.6536			

(a) Significant at $\alpha < 0.10$
(b) Significant at $\alpha < 0.025$
(c) Significant at $\alpha < 0.25$
(d) Significant at $\alpha < 0.0005$
(e) Not significant at $\alpha = 0.25$

STUDENT-NEWMAN-KEULS TEST-DEPTH CONTOURS ($\alpha = 0.05$) Largest: 10'NC 20' 30' 60' 40' : Smallest

II. OSTRACODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	17.7240	67	30.7806	12.860 (a)
DEPTHS	4	51.4912	68	28.1340	31.114 (a)
YEARS	1	0.1459	59	22.1004	0.389 (b)
TRANSECTS X DEPTH	12	9.9696	52	16.8750	2.560 (c)
TRANSECT X YEAR	3	3.9360	52	16.8750	4.043 (d)
DEPTH X YEAR	4	1.2894	52	16.8750	0.993 (b)
TOTAL	79	101.4312			

(a) Significant at $\alpha < 0.0005$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.01$
(d) Significant at $\alpha < 0.025$

STUDENT-NEWMAN-KEULS TEST-TRANSECTS ($\alpha = 0.05$) Largest: NMPE NMPW FITZ NMPP : Smallest
STUDENT-NEWMAN-KEULS TEST-DEPTH CONTOURS ($\alpha = 0.05$) Largest: 60' 40' 30' 20' 10'NC : Smallest

III. DIPTERANS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	21.3270	67	43.5278	10.943 (a)
DEPTHS	4	20.8670	68	44.8473	7.910 (a)
YEARS	1	0.4141	59	24.4566	0.999 (b)
TRANSECTS X DEPTH	12	23.8123	52	16.2939	6.333 (a)
TRANSECT X YEAR	3	3.4216	52	16.2939	3.640 (c)
DEPTH X YEAR	4	4.7411	52	16.2939	3.783 (d)
TOTAL	79	90.8800			

(a) Significant at $\alpha < 0.0005$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.025$
(d) Significant at $\alpha < 0.01$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPE FITZ NMPW NMPP : Smallest
STUDENT-NEWMAN-KEULS TEST - DEPTH CONTOURS ($\alpha = 0.05$) Largest: 60' 10'NC 30' 40' 20' : Smallest

APPENDIX VI-5B

ABUNDANCE OF MACROINVERTEBRATES (MOLLUSCA-ANNELIDA)
NINE MILE POINT VICINITY - OCTOBER 1973 - 1974

I. GASTROPODS

THREE-WAY ANALYSIS OF VARIANCE
(Log Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	15.4775	67	42.6049	8.113 (a)
DEPTHS	4	5.1008	68	48.2366	1.798 (b)
YEARS	1	2.0143	59	27.1286	4.381 (c)
TRANSECTS X DEPTH	12	22.6090	52	18.4949	5.297 (a)
TRANSECT X YEAR	3	1.5010	52	18.4949	1.407 (b)
DEPTH X YEAR	4	7.1327	52	18.4949	5.014 (d)
TOTAL	79	72.3301			

(a) Significant at $\alpha < 0.0005$
(b) Significant at $\alpha < 0.25$
(c) Significant at $\alpha < 0.05$
(d) Significant at $\alpha < 0.0025$

STUDENT-NEWMAN-KEULS TEST - TRANSECTS ($\alpha = 0.05$) Largest: NMPE NMPW FITZ NMPP :Smallest

II. POLYCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	294.5527	67	3789.5275	1.714 (a)
DEPTHS	4	330.7359	68	4039.8569	1.392 (a)
YEARS	1	110.3579	59	2714.9193	2.398 (a)
TRANSECTS X DEPTH	12	1439.3431	52	2235.7789	2.790 (b)
TRANSECT X YEAR	3	114.4055	52	2235.7789	0.887 (c)
DEPTH X YEAR	4	364.7349	52	2235.7789	2.121 (d)
TOTAL	79	4889.9090			

(a) Significant at $\alpha < 0.25$
(b) Significant at $\alpha < 0.01$
(c) Not significant at $\alpha = 0.25$
(d) Significant at $\alpha < 0.10$

III. OLIGOCHAETES

THREE-WAY ANALYSIS OF VARIANCE
(Square Root Transformed)

SOURCE	DF	SS	DF (ERR)	SS (ERR)	F
TRANSECTS	3	3683.0741	67	9956.4526	8.262 (a)
DEPTHS	4	8426.9751	68	9914.5073	14.449 (a)
YEARS	1	18.6217	59	4328.7683	0.254 (b)
TRANSECTS X DEPTH	12	6172.2215	52	3197.7486	8.364 (a)
TRANSECT X YEAR	3	586.4825	52	3197.7486	3.179 (c)
DEPTH X YEAR	4	544.5372	52	3197.7486	2.214 (d)
TOTAL	79	22629.6607			

(a) Significant at $\alpha < 0.0005$
(b) Not significant at $\alpha = 0.25$
(c) Significant at $\alpha < 0.05$
(d) Significant at $\alpha < 0.10$

APPENDIX VI-6

AVERAGE ABUNDANCE* (cells/dm^2) OF CHLOROPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(TWO WEEK EXPOSURE)

NINE MILE POINT - 1974

DATE	DEPTH 5 ft	10 ft	20 ft	30 ft	40 ft
20 MAY	3.822 E5 (3)	1.517 E3 (4)	1.528 E2 (3)	3.791 E4 (3)	1.561 E3 (3)
4 JUN	2.847 E5 (4)	1.084 E5 (4)	2.066 E4 (4)	1.996 E3 (4)	5.261 E2 (3)
18 JUN	1.214 E3 (1)	1.325 E5 (5)	1.469 E6 (4)	6.304 E3 (4)	3.942 E3 (4)
1 JUL	4.306 E5 (4)	1.753 E5 (4)	1.988 E5 (4)	8.386 E4 (4)	2.118 E4 (4)
22 JUL	7.231 E5 (3)	2.388 E5 (4)	1.664 E5 (4)	1.111 E5 (3)	2.051 E5 (4)
1 AUG	2.527 E6 (4)	1.799 E5 (3)	4.322 E4 (4)	1.748 E4 (4)	1.533 E4 (4)
16 AUG	2.925 E6 (4)	4.959 E5 (4)	8.700 E4 (3)	6.292 E4 (4)	2.516 E4 (4)
5 SEP	3.039 E6 (3)	3.782 E5 (4)	4.111 E4 (4)	2.360 E4 (4)	4.918 E4 (4)

DATE	TRANSECT NMPW	NMPP	FITZ	NMPE
20 MAY	2.396 E4 (5)	8.370 E3 (5)	2.081 E3 (1)	2.215 E5 (5)
4 JUN	1.873 E5 (5)	3.129 E3 (5)	1.375 E5 (4)	3.248 E4 (5)
18 JUN	1.102 E4 (4)	1.439 E6 (4)	9.745 E3 (4)	1.219 E5 (5)
1 JUL	2.750 E5 (5)	1.315 E5 (5)	1.415 E5 (5)	1.797 E5 (5)
22 JUL	1.711 E5 (4)	1.831 E5 (5)	1.881 E5 (5)	6.008 E5 (4)
1 AUG	4.220 E4 (5)	6.169 E4 (5)	5.906 E5 (4)	1.614 E6 (5)
16 AUG	1.076 E5 (5)	1.261 E6 (4)	3.132 E5 (5)	1.429 E6 (5)
5 SEP	2.123 E5 (4)	5.186 E5 (4)	3.255 E5 (5)	1.203 E6 (5)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-7

AVERAGE ABUNDANCE* (cells/dm^2) OF CHLOROPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(FOUR WEEK EXPOSURE)

NINE MILE POINT - 1974

	DEPTH				
DATE	5 ft	10 ft	20 ft	30 ft	40 ft
4 JUN	6.015 E5 (4)	4.951 E5 (4)	1.532 E5 (4)	1.208 E4 (4)	9.700 E3 (3)
1 JUL	1.040 E4 (1)	8.660 E5 (4)	9.636 E5 (4)	3.546 E5 (4)	2.116 E5 (4)
1 AUG	5.431 E6 (3)	8.305 E5 (3)	4.259 E4 (4)	2.161 E4 (3)	8.597 E4 (4)
5 SEP	7.068 E6 (4)	9.541 E5 (4)	2.955 E5 (3)	8.310 E4 (4)	5.883 E4 (4)
1 OCT	4.873 E6 (4)	3.194 E5 (3)	2.553 E5 (3)	2.013 E4 (4)	8.023 E4 (4)
30 OCT	1.372 E7 (4)	2.892 E6 (4)	7.557 E5 (3)	7.812 E4 (4)	1.809 E4 (5)
23 NOV	1.656 E5 (3)	1.813 E4 (4)	9.731 E4 (3)	2.878 E4 (2)	1.770 E4 (2)

	TRANSECT			
DATE	NMPW	NMPP	FITZ	NMPE
4 JUN	5.125 E5 (4)	3.660 E4 (5)	3.312 E5 (4)	2.013 E5 (5)
1 JUL	1.043 E6 (4)	4.234 E5 (4)	1.918 E5 (4)	5.922 E5 (5)
1 AUG	1.480 E5 (4)	81126 E5 (5)	1.109 E6 (4)	2.568 E6 (4)
5 SEP	6.214 E5 (5)	3.721 E6 (4)	1.245 E6 (5)	1.863 E6 (5)
1 OCT	4.215 E5 (5)	8.422 E4 (3)	1.318 E6 (5)	2.533 E6 (5)
30 OCT	5.462 E6 (5)	8.145 E5 (4)	5.941 E6 (5)	1.763 E6 (5)
23 NOV	1.251 E5 (4)	1.549 E4 (3)	3.573 E4 (5)	8.000 E4 (3)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-8

AVERAGE ABUNDANCE* (cells/dm^2) OF CHLOROPHYCEAE IN BUOY PERIPHYTON SAMPLES (40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks

DATE	SAMPLE DEPTH 2 ft	7 ft	12 ft	17 ft
17 MAY	2.483 E2 (3)	6.077 E1 (3)	1.858 E2 (3)	2.569 E2 (3)
3 JUN	1.214 E4 (2)	1.291 E4 (3)	4.600 E3 (3)	1.106 E4 (3)
17 JUN	1.592 E5 (3)	3.773 E5 (3)	1.663 E5 (3)	3.025 E4 (3)
30 JUN	4.174 E5 (3)	1.438 E5 (3)	1.061 E5 (3)	2.891 E4 (3)
17 JUL	2.183 E7 (3)	5.848 E6 (3)	3.650 E5 (3)	2.757 E5 (3)
2 AUG	4.909 E6 (3)	2.445 E6 (3)	3.553 E5 (3)	2.968 E5 (3)
15 AUG	1.122 E5 (3)	1.108 E6 (3)	3.587 E5 (3)	2.567 E5 (3)
6 SEP	5.272 E6 (3)	7.316 E6 (3)	2.117 E6 (3)	5.517 E5 (3)

4 weeks

DATE	SAMPLE DEPTH 2 ft	7 ft	12 ft	17 ft
3 JUN	6.441 E5 (3)	2.554 E5 (3)	4.446 E4 (3)	1.324 E3 (3)
30 JUN	7.888 E6 (3)	1.672 E7 (3)	2.762 E6 (3)	2.384 E6 (3)
2 AUG	5.134 E7 (3)	1.100 E7 (3)	4.298 E6 (3)	8.145 E5 (3)
6 SEP	1.943 E7 (3)	2.170 E7 (3)	1.283 E7 (3)	2.066 E6 (3)
5 OCT	1.298 E7 (3)	1.244 E7 (3)	2.024 E6 (3)	7.092 E5 (3)
31 OCT	7.412 E5 (3)	4.848 E6 (3)	9.277 E6 (3)	1.288 E6 (3)
24 NOV	3.866 E4 (3)	4.531 E5 (3)	1.636 E6 (3)	5.038 E5 (3)

* (   ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-9A

ABUNDANCE OF SPECIFIC BUOY PERIPHYTON TAXA (TWO-WEEK EXPOSURE)

NINE MILE POINT VICINITY - 1974

I. CHLOROPHYCEAE

THREE WAY ANOVA
(Log transformed)

SOURCE	DF	SS	DF(ERR)	SS(ERR)	F	
STATIONS	2	3.3029	118	63.2385	3.081	(a)
SAMPLE DEPTHS	3	11.1948	123	89.6401	5.120	(b)
DATES	5	452.1838	127	92.9935	123.508	(c)
STATIONS X DEPTHS	6	3.4651	102	52.9549	1.112	(d)
STATIONS X DATES	10	6.8185	102	52.9549	1.313	(e)
DEPTHS X DATES	15	33.2201	102	52.9549	4.266	(c)
STATIONS X DEPTHS X DATES	30	10.0325	72	42.9224	0.561	(d)
TOTAL	143	563.1401				

(a) Significant at $\alpha < 0.05$
(b) Significant at $\alpha < 0.0025$
(c) Significant at $\alpha < 0.0005$
(d) Not significant at $\alpha = 0.25$
(e) Significant at $\alpha < 0.25$

Student-Newman-Keuls Test - Dates ($\alpha = 0.05$) Largest: 6 SEP 17 JUL
Largest: 6 SEP 17 JUL 2 AUG 15 AUG 3 JUN 17 MAY: Smallest
Student-Newman-Keuls Test - Stations ($\alpha = 0.05$) Largest: NMPE NMPP NMPW: Smallest
Student-Newman-Keuls Test - Sample Depths ($\alpha = 0.05$) Largest: 7 ft 2 ft 12 ft 17 ft: Smallest

II. BACILLARIOPHYCEAE

THREE WAY ANOVA
(Log transformed)

SOURCE	DF	SS	DF(ERR)	SS(ERR)	F	
STATIONS	2	3.2919	118	54.3957	3.571	(a)
SAMPLE DEPTHS	3	36.6099	123	101.9323	14.725	(b)
DATES	5	181.0310	127	103.3957	44.472	(b)
STATIONS X DEPTHS	6	2.2013	102	48.5297	0.771	(c)
STATIONS X DATES	10	3.6647	102	48.5297	0.770	(c)
DEPTHS X DATES	15	51.2013	102	48.5297	7.174	(b)
STATIONS X DEPTHS X DATES	30	10.8580	72	37.6717	0.692	(c)
TOTAL	143	326.5297				

(a) Significant at $\alpha < 0.05$
(b) Significant at $\alpha < 0.0005$
(c) Not significant at $\alpha = 0.25$

Student-Newman-Keuls Test - Dates ($\alpha = 0.05$)
Largest: 6 SEP 17 JUL 2 AUG 17 JUN 15 AUG 17 MAY: Smallest
Student-Newman-Keuls Test - Stations ($\alpha = 0.05$) Largest: NMPE NMPP NMPW: Smallest
Student-Newman-Keuls Test - Sample Depths ($\alpha = 0.05$) Largest: 2 ft 7 ft 12 ft 17 ft: Smallest

NMPP = NMPP/FITZ

APPENDIX VI-9B

ABUNDANCE OF SPECIFIC BUOY PERIPHYTON TAXA (TWO-WEEK EXPOSURE)

NINE MILE POINT VICINITY - 1976

III. MYXOPHYCEAE

THREE WAY ANOVA
(Log transformed)

SOURCE	DF	SS	DF(ERR)	SS(ERR)	F	
STATIONS	2	2.6602	118	94.0488	1.669	(a)
SAMPLE DEPTHS	3	41.1039	123	144.4077	11.671	(b)
DATES	5	764.8381	127	152.4054	127.469	(b)
STATIONS X DEPTHS	6	2.4783	102	81.0875	0.520	(c)
STATIONS X DATES	10	10.4830	102	81.0875	1.319	(a)
DEPTHS X DATES	15	60.8349	102	81.0875	5.102	(b)
STATIONS X DEPTHS X DATES	30	37.1422	72	43.9453	2.028	(d)
TOTAL	143	963.4858				

(a) Significant at α < 0.25
(b) Significant at α < 0.0005
(c) Not significant at α = 0.25
(d) Significant at α < 0.01

Student-Newman-Keuls Test - Dates (α = 0.05)
Largest: 6 SEP 17 JUL 2 AUG 15 AUG 17 JUN 17 MAY: Smallest
Student-Newman-Keuls Test - Depths (α = 0.05) Largest: 2 ft 7 ft 12 ft 17 ft: Smallest

IV. PROTOZOA

THREE WAY ANOVA
(Log transformed)

SOURCE	DF	SS	DF(ERR)	SS(ERR)	F	
STATIONS	2	2.6565	118	210.0724	0.746	(a)
SAMPLE DEPTHS	3	12.9607	123	260.3762	2.041	(b)
DATES	5	361.8966	127	245.2927	37.474	(c)
STATIONS X DEPTHS	6	20.3924	102	184.3711	1.880	(d)
STATIONS X DATES	10	5.3089	102	184.3711	0.294	(a)
DEPTHS X DATES	15	55.6127	102	184.3711	2.051	(e)
STATIONS X DEPTHS X DATES	30	68.0893	72	116.2818	1.405	(b)
TOTAL	143	643.1988				

(a) Not significant at α = 0.25
(b) Significant at α < 0.25
(c) Significant at α < 0.0005
(d) Significant at α < 0.10
(e) Significant at α < 0.025

Student-Newman-Keuls Test - Dates (α = 0.05)
Largest: 15 AUG 17 JUN 6 SEP 2 AUG 17 JUL 17 MAY: Smallest

APPENDIX VI-10

AVERAGE ABUNDANCE* (cells/dm^2) OF BACILLARIOPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(TWO WEEK EXPOSURE)

NINE MILE POINT - 1974

DATE	DEPTH 5 ft	10 ft	20 ft	30 ft	40 ft
20 MAY	8.388 E4 (3)	3.429 E4 (4)	1.745 E4 (3)	1.184 E4 (3)	1.144 E4 (3)
4 JUN	2.393 E5 (4)	1.396 E5 (4)	9.802 E4 (4)	3.225 E3 (4)	3.147 E3 (3)
18 JUN	1.845 E4 (1)	2.464 E4 (4)	5.876 E5 (4)	5.778 E3 (4)	1.949 E3 (4)
1 JUL	1.181 E5 (4)	4.488 E4 (4)	7.955 E4 (4)	2.403 E4 (4)	7.967 E3 (4)
22 JUL	2.619 E5 (3)	5.551 E5 (4)	2.848 E5 (4)	7.543 E4 (3)	9.019 E4 (4)
1 AUG	1.994 E5 (4)	4.858 E4 (3)	4.670 E4 (3)	3.796 E3 (4)	7.925 E3 (4)
16 AUG	8.703 E5 (4)	5.112 E5 (4)	3.851 E4 (3)	5.970 E3 (4)	8.351 E3 (4)
5 SEP	1.361 E6 (3)	3.667 E5 (4)	6.028 E4 (4)	3.829 E3 (4)	2.436 E3 (4)

DATE	TRANSECT NMPW	NMPP	FITZ	NMPE
20 MAY	3.109 E4 (5)	2.426 E4 (5)	1.769 E4 (1)	4.330 E4 (5)
4 JUN	2.306 E5 (5)	1.915 E4 (5)	7.947 E4 (5)	7.280 E4 (5)
18 JUN	4.366 E3 (4)	5.595 E5 (4)	7.046 E3 (4)	4.296 E4 (5)
1 JUL	1.105 E5 (5)	4.025 E4 (5)	4.048 E4 (5)	2.836 E4 (5)
22 JUL	2.834 E5 (4)	1.830 E5 (5)	3.875 E5 (5)	1.865 E5 (4)
1 AUG	2.661 E4 (5)	8.966 E3 (5)	1.379 E5 (4)	8.954 E4 (5)
16 AUG	2.849 E4 (5)	4.089 E5 (4)	9.748 E4 (5)	6.879 E5 (5)
5 SEP	2.433 E5 (4)	4.168 E5 (5)	4.805 E5 (5)	7.135 E4 (5)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-11

AVERAGE ABUNDANCE* (cells/dm^2) OF BACILLARIOPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(FOUR WEEK EXPOSURE)

NINE MILE POINT - 1974

DATE	DEPTH 5 ft	10 ft	20 ft	30 ft	40 ft
4 JUN	4.395 E5 (4)	7.932 E5 (4)	9.345 E5 (4)	3.816 E4 (4)	2.684 E4 (3)
1 JUL	7.775 E2 (1)	2.638 E5 (4)	1.207 E6 (4)	2.188 E5 (4)	1.479 E5 (4)
1 AUG	1.819 E6 (3)	1.837 E6 (3)	4.249 E5 (4)	6.408 E3 (3)	3.114 E4 (4)
5 SEP	4.243 E6 (4)	1.580 E6 (4)	3.759 E5 (3)	7.323 E3 (4)	3.402 E3 (4)
1 OCT	7.424 E6 (4)	3.264 E6 (3)	7.380 E5 (3)	1.116 E4 (4)	1.594 E4 (4)
30 OCT	8.587 E6 (4)	3.274 E6 (4)	1.018 E6 (3)	5.304 E4 (4)	1.080 E4 (4)
23 NOV	3.469 E4 (3)	9.406 E3 (4)	5.427 E4 (4)	6.531 E3 (2)	1.097 E4 (2)

DATE	TRANSECT NMPW	NMPP	FITZ	NMPE
4 JUN	5.612 E5 (5)	1.888 E5 (5)	3.068 E5 (4)	7.769 E5 (5)
1 JUL	9.910 E5 (4)	2.432 E5 (4)	1.158 E5 (4)	3.904 E5 (5)
1 AUG	4.181 E5 (4)	1.080 E5 (5)	1.053 E6 (4)	1.597 E6 (4)
5 SEP	8.044 E5 (5)	2.333 E6 (4)	1.295 E6 (5)	9.261 E5 (5)
1 OCT	1.776 E6 (5)	2.922 E5 (3)	6.057 E6 (5)	3.543 E5 (5)
30 OCT	4.586 E6 (5)	2.390 E6 (4)	4.835 E6 (5)	5.386 E5 (5)
23 NOV	6.704 E4 (4)	1.832 E4 (3)	3.807 E3 (5)	1.721 E4 (3)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-12

AVERAGE ABUNDANCE* (cells/dm^2) OF BACILLARIOPHYCEAE
IN BUOY PERIPHYTON SAMPLES
(40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks — SAMPLE DEPTH

DATE	2 ft	7 ft	12 ft	17 ft
17 MAY	7.967 E3 (3)	5.688 E3 (3)	2.914 E3 (3)	1.415 E3 (3)
3 JUN	1.011 E6 (2)	1.999 E5 (3)	5.432 E4 (3)	1.235 E5 (3)
17 JUN	1.714 E6 (3)	5.433 E5 (3)	2.391 E5 (3)	4.271 E4 (3)
30 JUN	6.335 E5 (3)	1.104 E5 (3)	9.257 E4 (3)	1.453 E4 (3)
17 JUL	8.722 E7 (3)	4.320 E6 (3)	2.722 E5 (3)	1.874 E5 (3)
2 AUG	1.192 E7 (3)	5.467 E5 (3)	8.620 E4 (3)	5.025 E4 (3)
15 AUG	2.093 E4 (3)	2.336 E5 (3)	5.803 E4 (3)	2.471 E4 (3)
6 SEP	2.323 E7 (3)	6.969 E6 (3)	5.747 E6 (3)	2.797 E5 (3)

4 weeks — SAMPLE DEPTH

DATE	2 ft	7 ft	12 ft	17 ft
3 JUN	1.444 E7 (3)	4.540 E6 (3)	1.490 E6 (3)	2.977 E4 (3)
30 JUN	1.914 E7 (3)	1.258 E7 (3)	1.673 E6 (3)	2.305 E6 (3)
2 AUG	2.337 E7 (3)	1.916 E7 (3)	9.620 E6 (3)	2.174 E5 (3)
6 SEP	1.974 E7 (3)	1.307 E7 (3)	3.003 E7 (3)	1.835 E6 (3)
5 OCT	8.013 E7 (3)	4.479 E6 (3)	5.210 E6 (3)	3.731 E5 (3)
31 OCT	5.300 E6 (3)	3.637 E6 (3)	2.719 E6 (3)	1.070 E6 (3)
24 NOV	1.015 E6 (3)	6.433 E5 (3)	7.640 E5 (3)	2.901 E5 (3)

* (   ) = number of samples on which average is based.
E5 = 10^5 , etc.

APPENDIX VI-13

AVERAGE ABUNDANCE* (cells/dm^2) OF MYXOPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(TWO WEEK EXPOSURE)

NINE MILE POINT - 1974

DATE	DEPTH 5 ft	10 ft	20 ft	30 ft	40 ft
20 MAY	3.530 E3 (3)	0.000 E0 (4)	0.000 E0 (3)	3.220 E2 (3)	0.000 E0 (3)
4 JUN	3.943 E4 (4)	7.351 E3 (4)	1.210 E3 (4)	0.000 E0 (4)	6.167 E2 (3)
18 JUN	0.000 E0 (1)	2.066 E3 (4)	9.892 E4 (4)	2.003 E3 (4)	9.962 E2 (4)
1 JUL	1.171 E5 (4)	4.533 E4 (4)	6.563 E4 (4)	4.900 E4 (4)	2.341 E4 (4)
22 JUL	1.046 E6 (3)	2.072 E5 (4)	1.595 E5 (4)	1.802 E5 (3)	1.636 E5 (4)
1 AUG	9.102 E5 (4)	3.581 E4 (3)	5.488 E4 (4)	3.407 E4 (4)	2.887 E4 (4)
16 AUG	3.267 E6 (4)	3.879 E5 (4)	2.121 E4 (3)	1.324 E4 (4)	1.839 E4 (4)
5 SEP	4.160 E6 (3)	1.265 E6 (4)	1.514 E5 (4)	1.600 E4 (4)	1.236 E5 (4)

DATE	TRANSECT NMPW	NMPP	FITZ	NMPE
20 MAY	0.000 E0 (5)	0.000 E0 (5)	0.000 E0 (1)	2.311 E3 (5)
4 JUN	3.414 E4 (5)	0.000 E0 (5)	4.059 E3 (4)	1.387 E3 (5)
18 JUN	1.693 E3 (4)	9.733 E4 (4)	1.683 E3 (4)	2.619 E3 (5)
1 JUL	1.034 E5 (5)	3.976 E4 (5)	6.469 E4 (5)	3.260 E4 (5)
22 JUL	8.720 E4 (4)	1.811 E5 (5)	3.254 E5 (5)	7.294 E5 (4)
1 AUG	2.895 E4 (5)	1.711 E4 (5)	2.251 E5 (4)	6.174 E5 (5)
16 AUG	3.596 E4 (5)	1.784 E6 (4)	2.623 E5 (5)	1.236 E6 (5)
5 SEP	4.870 E5 (4)	2.120 E6 (5)	9.234 E5 (5)	3.084 E5 (5)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-14

AVERAGE ABUNDANCE* (cells/dm^2) OF MYXOPHYCEAE
IN BOTTOM PERIPHYTON SAMPLES
(FOUR WEEK EXPOSURE)

	DEPTH				
DATE	5 ft	10 ft	20 ft	30 ft	40 ft
4 JUN	5.384 E5 (4)	3.102 E5 (4)	9.557 E3 (4)	4.393 E2 (4)	1.331 E3 (3)
1 JUL	2.242 E3 (1)	4.162 E5 (4)	4.816 E5 (4)	2.050 E5 (4)	1.737 E5 (4)
1 AUG	4.797 E6 (3)	2.989 E6 (3)	1.286 E5 (4)	3.306 E4 (3)	9.119 E4 (4)
5 SEP	1.230 E7 (4)	5.589 E6 (4)	8.077 E5 (3)	1.537 E5 (4)	2.264 E5 (4)
1 OCT	6.200 E6 (4)	5.507 E5 (3)	6.800 E4 (3)	1.363 E4 (4)	2.555 E4 (4)
30 OCT	7.882 E6 (4)	1.755 E6 (4)	2.600 E5 (3)	3.521 E4 (4)	1.396 E4 (4)
23 NOV	6.384 E4 (3)	1.217 E4 (4)	1.262 E4 (4)	6.371 E3 (2)	5.111 E4 (2)

	TRANSECT			
DATE	NMPW	NMPP	FITZ	NMPE
4 JUN	4.440 E5 (5)	3.451 E3 (5)	2.769 E5 (4)	1.864 E4 (5)
1 JUL	5.329 E5 (4)	1.892 E5 (4)	9.298 E4 (4)	3.696 E5 (5)
1 AUG	2.081 E5 (4)	2.201 E5 (5)	2.169 E6 (4)	3.439 E6 (4)
5 SEP	1.950 E6 (5)	1.215 E7 (4)	2.245 E6 (5)	1.100 E6 (5)
1 OCT	5.819 E5 (5)	2.453 E5 (3)	4.128 E6 (5)	5.054 E5 (5)
30 OCT	3.479 E6 (5)	5.925 E5 (4)	3.359 E6 (5)	5.931 E5 (5)
23 NOV	3.561 E4 (4)	3.770 E4 (3)	9.838 E3 (5)	4.031 E4 (3)

* ( ) = number of samples on which average is based.
E5 = 10^5, etc.

AVERAGE ABUNDANCE* (cells/dm^2) OF MYXOPHYCEAE IN BUOY PERIPHYTON SAMPLES (40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks

DATE	SAMPLE DEPTH 2 ft	7 ft	12 ft	17 ft
17 MAY	0.000 E0 (3)	0.000 E0 (3)	3.717 E1 (3)	5.573 E1 (3)
3 JUN	9.200 E4 (2)	1.898 E5 (3)	1.428 E4 (3)	3.631 E3 (3)
17 JUN	7.526 E5 (3)	8.523 E2 (3)	5.310 E3 (3)	3.833 E2 (3)
30 JUN	1.016 E5 (3)	2.660 E4 (3)	2.342 E4 (3)	4.549 E3 (3)
17 JUL	3.582 E7 (3)	6.517 E6 (3)	3.331 E5 (3)	3.031 E5 (3)
2 AUG	1.638 E7 (3)	3.429 E6 (3)	1.328 E5 (3)	9.447 E4 (3)
15 AUG	8.927 E5 (3)	6.684 E5 (3)	6.090 E5 (3)	3.597 E5 (3)
6 SEP	1.198 E7 (3)	9.227 E6 (3)	3.476 E6 (3)	2.471 E5 (3)

4 weeks

DATE	SAMPLE DEPTH 2 ft	7 ft	12 ft	17 ft
3 JUN	1.984 E7 (3)	9.407 E5 (3)	3.930 E4 (3)	1.404 E3 (3)
30 JUN	1.252 E7 (3)	5.302 E6 (3)	6.314 E5 (3)	1.251 E6 (3)
2 AUG	5.617 E7 (3)	2.684 E7 (3)	1.683 E7 (3)	2.528 E5 (3)
6 SEP	5.648 E7 (3)	3.130 E7 (3)	2.551 E7 (3)	8.348 E5 (3)
5 OCT	3.101 E7 (3)	9.652 E6 (3)	5.697 E6 (3)	1.275 E6 (3)
31 OCT	1.205 E6 (3)	3.821 E5 (3)	4.334 E5 (3)	1.702 E5 (3)
24 NOV	8.526 E5 (3)	8.412 E5 (3)	6.713 E4 (3)	1.800 E4 (3)

* (   ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-16

AVERAGE ABUNDANCE* (cells/dm^2) OF PROTOZOA
IN BOTTOM PERIPHYTON SAMPLES
(TWO WEEK EXPOSURE)

	DEPTH				
DATE	5 ft	10 ft	20 ft	30 ft	40 ft
20 MAY	3.389 E3 (3)	1.486 E2 (4)	5.450 E2 (3)	1.610 E2 (3)	3.387 E2 (3)
4 JUN	6.548 E3 (4)	2.871 E3 (4)	4.334 E3 (4)	3.888 E2 (4)	4.660 E2 (3)
18 JUN	0.000 E0 (1)	2.187 E3 (4)	1.058 E4 (4)	3.035 E2 (4)	2.983 E3 (4)
1 JUL	3.246 E3 (4)	2.922 E2 (4)	1.539 E4 (4)	2.534 E3 (4)	2.436 E3 (4)
22 JUL	6.384 E4 (3)	1.092 E5 (4)	2.165 E4 (4)	5.735 E3 (3)	4.335 E3 (4)
1 AUG	1.096 E4 (4)	1.019 E4 (3)	3.167 E4 (4)	1.985 E3 (4)	7.634 E3 (4)
16 AUG	5.540 E3 (4)	1.856 E6 (4)	2.961 E3 (3)	8.719 E2 (4)	1.970 E3 (4)
5 SEP	4.105 E3 (3)	9.519 E4 (4)	2.032 E4 (4)	3.624 E3 (4)	2.323 E2 (4)

	TRANSECT			
DATE	NMPW	NMPP	FITZ	NMPE
20 MAY	8.670 E1 (5)	3.667 E2 (5)	0.000 E0 (1)	2.326 E3 (5)
4 JUN	5.284 E3 (5)	1.162 E3 (5)	4.482 E3 (4)	1.561 E3 (5)
18 JUN	7.525 E2 (4)	3.796 E3 (4)	3.744 E3 (4)	8.384 E3 (5)
1 JUL	2.853 E4 (5)	9.686 E3 (5)	1.007 E3 (5)	3.038 E3 (5)
22 JUL	5.938 E4 (4)	5.050 E4 (5)	2.083 E4 (5)	3.880 E4 (4)
1 AUG	1.725 E4 (5)	6.358 E3 (5)	1.129 E4 (4)	1.527 E4 (5)
16 AUG	8.436 E2 (5)	7.947 E3 (4)	4.955 E3 (5)	1.117 E4 (5)
5 SEP	8.854 E4 (4)	8.553 E3 (5)	2.290 E4 (5)	1.320 E3 (5)

* (   ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-17

AVERAGE ABUNDANCE* (cells/dm^2) OF PROTOZOA
IN BOTTOM PERIPHYTON SAMPLES
(4 week exposure)

NINE MILE POINT - 1974

DATE	DEPTH 5 ft	10 ft	20 ft	30 ft	40 ft
4 JUN	9.034 E3 (4)	1.802 E4 (4)	3.978 E4 (4)	3.711 E3 (4)	1.952 E4 (3)
1 JUL	4.521 E2 (1)	4.935 E4 (4)	4.050 E4 (4)	1.720 E4 (4)	3.092 E4 (4)
1 AUG	4.037 E3 (3)	9.048 E3 (3)	1.281 E4 (4)	2.230 E2 (3)	2.104 E4 (4)
5 SEP	1.947 E4 (4)	2.801 E4 (4)	4.003 E4 (3)	1.349 E4 (4)	2.836 E3 (4)
1 OCT	1.830 E4 (4)	5.978 E3 (3)	2.677 E4 (3)	2.304 E4 (4)	1.556 E4 (4)
30 OCT	1.664 E4 (4)	5.537 E4 (4)	3.241 E4 (3)	1.582 E4 (4)	1.362 E4 (4)
23 NOV	1.416 E2 (3)	3.373 E2 (4)	3.033 E3 (4)	0.000 E0 (2)	7.295 E3 (2)

DATE	TRANSECT NMPW	NMPP	FITZ	NMPE
4 JUN	8.468 E3 (5)	1.835 E4 (5)	1.692 E4 (4)	2.779 E4 (5)
1 JUL	3.235 E4 (4)	3.323 E4 (4)	4.696 E4 (4)	2.043 E4 (5)
1 AUG	2.618 E3 (4)	3.645 E3 (5)	9.208 E3 (4)	2.745 E4 (4)
5 SEP	5.663 E4 (5)	1.025 E4 (4)	9.756 E3 (5)	4.694 E2 (5)
1 OCT	1.268 E4 (5)	3.760 E4 (3)	2.095 E4 (5)	8.996 E3 (5)
30 OCT	1.900 E4 (5)	3.807 E4 (4)	2.955 E4 (5)	2.161 E4 (5)
23 NOV	2.661 E3 (4)	5.777 E3 (3)	1.040 E2 (5)	0.000 E0 (3)

* (   ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-18

AVERAGE ABUNDANCE* (cells/dm^2) OF PROTOZOA
IN BUOY PERIPHYTON SAMPLES
(40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks DATE	SAMPLE DEPTH 2 ft			7 ft			12 ft			17 ft		
17 MAY	0.000	E0	(3)	0.000	E0	(3)	0.000	E0	(3)	0.000	E0	(3)
3 JUN	0.000	E0	(2)	1.001	E3	(3)	5.863	E2	(3)	4.250	E2	(3)
17 JUN	2.370	E5	(3)	6.977	E4	(3)	1.908	E4	(3)	2.261	E4	(3)
30 JUN	1.947	E5	(3)	3.753	E4	(3)	9.096	E4	(3)	1.477	E4	(3)
17 JUL	6.078	E4	(3)	1.683	E4	(3)	2.783	E4	(3)	1.209	E5	(3)
2 AUG	7.649	E4	(3)	3.234	E4	(3)	5.255	E4	(3)	3.695	E4	(3)
15 AUG	3.127	E4	(3)	1.490	E5	(3)	1.165	E5	(3)	1.153	E5	(3)
6 SEP	1.437	E4	(3)	2.198	E4	(3)	8.594	E4	(3)	8.021	E4	(3)

4 weeks DATE	SAMPLE DEPTH 2 ft			7 ft			12 ft			17 ft		
3 JUN	6.589	E3	(3)	6.085	E4	(3)	4.896	E4	(3)	4.807	E2	(3)
30 JUN	4.658	E4	(3)	3.706	E4	(3)	5.492	E4	(3)	3.224	E5	(3)
2 AUG	0.000	E0	(3)	4.583	E3	(3)	1.299	E4	(3)	1.036	E4	(3)
6 SEP	1.561	E4	(3)	5.223	E3	(3)	1.643	E4	(3)	2.562	E4	(3)
5 OCT	1.548	E4	(3)	3.045	E4	(3)	5.033	E4	(3)	4.580	E4	(3)
31 OCT	2.077	E4	(3)	7.478	E4	(3)	5.957	E4	(3)	1.707	E4	(3)
24 NOV	2.437	E4	(3)	4.445	E4	(3)	4.014	E4	(3)	2.856	E4	(3)

* (   ) = number of samples on which average is based.
E5 = 10^5, etc.

APPENDIX VI-19

AVERAGE LIGHT INTENSITY (% TRANSMITTANCE) PER MONTH*
BUOY PERIPHYTON STATIONS - 40 FT DEPTH CONTOUR

NINE MILE POINT - 1974

DATE	SAMPLE DEPTH (ft)	PERCENT TRANSMITTANCE
MAY	2	46.25
	7	9.13
	12	2.88
	17	1.18
JUN	2	65.83
	7	7.17
	12	3.50
	17	1.50
JUL	2	27.83
	7	2.97
	12	0.83
	17	0.86
AUG	NO DATA	
SEP	2	34.00
	7	8.27
	12	3.10
	17	1.47
OCT	2	13.00
	7	5.87
	12	2.05
	17	0.68
NOV	2	21.67
	7	8.67
	12	4.33
	17	2.33

* Monthly average of values recorded at three buoy periphyton stations

APPENDIX VI-20

LIGHT INTENSITY (% TRANSMITTANCE) BY DATE AND STATION
BOTTOM PERIPHYTON

NINE MILE POINT - 1974

TRANSECT - depth contour (ft)

	NMPW					NMPP					FITZ					NMPE				
DATE	5	10	20	30	40	5	10	20	30	40	5	10	20	30	40	5	10	20	30	40
18 JUN	-	2.10	0.81	0.11	0.02	-	3.90	2.60	0.21	0.04	6.60	3.80	1.20	0.20	0.07	18.00	2.50	1.70	0.34	0.15
2 JUL	5.80	2.10	0.62	0.05	0.02	14.00	4.80	0.74	0.09	0.04	7.00	4.60	0.42	0.10	0.02	19.00	2.60	0.80	0.12	0.06
18 JUL	-	-	-	-	-	-	-	-	-	-	7.00	4.00	0.50	0.10	0.08	18.00	-	0.80	-	<0.01
22 JUL	-	1.60	0.90	0.10	0.03	18.00	7.00	2.10	0.28	0.12	-	-	-	-	-	-	-	-	-	-
1 AUG	0.07	0.22	0.16	0.05	0.04	0.52	0.05	0.02	0.02	0.04	1.25	0.40	0.09	0.06	0.03	1.40	1.10	0.22	0.03	0.02
5 SEP	100.00	100.00	25.00	1.56	0.20	25.00	12.50	3.44	1.56	0.39	12.50	25.00	1.36	1.36	1.36	18.75	12.50	12.50	1.56	0.59
1 OCT	4.40	1.20	0.10	0.05	0.01	2.60	0.08	0.80	0.05	0.02	4.00	2.00	0.10	0.03	0.01	8.00	1.90	0.28	0.30	0.05
23 NOV	7.40	4.40	<0.01	<0.01	-	10.20	4.20	0.60	-	0.18	10.00	4.20	0.58	0.20	0.06	80.00	2.60	0.08	1.00	-

- No sample

AVERAGE BIOMASS* (mg/dm^2) OF
BOTTOM PERIPHYTON SAMPLES

NINE MILE POINT - 1974

2 weeks

DATE	DEPTH 5 ft		10 ft		20 ft		30 ft		40 ft	
20 MAY	1.22	(3)	1.83	(4)	1.01	(3)	1.47	(3)	0.63	(3)
4 JUN	1.77	(4)	1.43	(4)	1.12	(4)	0.82	(4)	1.09	(3)
18 JUN	0.89	(1)	1.22	(4)	1.46	(4)	0.66	(4)	0.94	(4)
1 JUL	2.37	(4)	2.87	(4)	3.08	(4)	1.85	(4)	1.28	(4)
18, 22 JUL	7.20	(3)	10.42	(4)	10.68	(4)	6.62	(3)	13.19	(4)
1 AUG	5.48	(4)	2.78	(3)	2.46	(4)	2.27	(4)	2.06	(4)
16 AUG	13.93	(4)	3.19	(4)	0.59	(3)	0.44	(4)	0.80	(4)
5 SEP	12.29	(3)	5.55	(4)	2.18	(4)	1.16	(4)	2.66	(4)

4 weeks

DATE	DEPTH 5 ft		10 ft		20 ft		30 ft		40 ft	
4 JUN	14.10	(4)	6.55	(4)	4.69	(4)	2.25	(4)	3.05	(3)
1 JUL	7.48	(1)	7.78	(4)	9.87	(4)	5.52	(4)	3.80	(4)
1 AUG	32.26	(3)	11.94	(3)	6.40	(4)	4.63	(3)	5.71	(4)
5 SEP	30.40	(4)	13.42	(4)	7.50	(3)	3.09	(4)	3.65	(4)
1, 4 OCT	13.02	(4)	6.56	(3)	3.87	(3)	2.76	(4)	2.36	(4)
30 OCT	17.29	(4)	5.85	(4)	3.64	(3)	2.04	(4)	1.89	(4)
23 NOV	1.03	(3)	0.81	(4)	0.64	(4)	0.77	(2)	0.87	(2)

* (   ) = number of samples on which average is based.

APPENDIX VI-22

AVERAGE BIOMASS* (mg/dm^2) OF
BUOY PERIPHYTON SAMPLES
(40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks

DATE	SAMPLE DEPTH 2 ft		7 ft		12 ft		17 ft	
17 MAY	0.46	(3)	0.61	(3)	0.48	(3)	0.57	(3)
3 JUN	3.61	(2)	1.56	(3)	0.79	(3)	1.38	(3)
17 JUN	8.27	(3)	4.59	(3)	2.22	(3)	1.50	(3)
30 JUN	6.63	(3)	4.65	(3)	3.44	(3)	2.97	(3)
16 JUL	114.32	(3)	17.55	(3)	15.05	(3)	14.22	(3)
2 AUG	31.92	(3)	11.79	(3)	9.07	(3)	7.15	(3)
15 AUG	6.62	(3)	12.90	(3)	7.79	(3)	6.21	(3)
6 SEP	26.82	(3)	20.31	(3)	17.11	(3)	11.89	(3)

4 weeks

DATE	SAMPLE DEPTH 2 ft		7 ft		12 ft		17 ft	
3 JUN	22.59	(3)	10.18	(3)	4.08	(3)	4.94	(3)
30 JUN	34.19	(3)	19.27	(3)	14.20	(3)	8.34	(3)
2 AUG	238.69	(3)	120.81	(3)	57.18	(3)	39.53	(3)
6 SEP	87.45	(3)	82.43	(3)	100.39	(3)	52.28	(3)
5 OCT	50.30	(3)	19.25	(3)	35.85	(3)	62.78	(3)
31 OCT	6.53	(3)	5.33	(3)	7.66	(3)	5.47	(3)
24 NOV	2.98	(3)	4.45	(3)	5.59	(3)	3.12	(3)

* (   ) = number of samples on which average is based.

AVERAGE CHLOROPHYLL *a**
IN BOTTOM PERIPHYTON SAMPLES

NINE MILE POINT - 1974

2 weeks

DATE	DEPTH 5 ft		10 ft		20 ft		30 ft		40 ft	
20 MAY	0.60	(3)	0.27	(4)	0.02	(3)	0.01	(3)	0.01	(3)
4 JUN	0.37	(4)	0.55	(4)	0.22	(4)	0.01	(4)	0.15	(3)
18 JUN	0.28	(1)	0.16	(4)	0.65	(4)	0.05	(4)	0.02	(4)
1 JUL	0.65	(4)	0.42	(4)	0.68	(4)	0.40	(4)	0.19	(4)
18 JUL	3.57	(3)	2.55	(4)	1.73	(4)	1.16	(3)	1.93	(4)
1 AUG	2.76	(4)	0.60	(3)	0.32	(4)	0.12	(4)	0.18	(4)
16 AUG	5.07	(4)	1.74	(4)	0.17	(3)	0.16	(4)	0.17	(4)
5 SEP	5.09	(3)	1.83	(4)	0.31	(4)	0.11	(4)	0.08	(4)

4 weeks

DATE	DEPTH 5 ft		10 ft		20 ft		30 ft		40 ft	
4 JUN	2.82	(4)	3.54	(4)	1.36	(4)	0.39	(4)	0.53	(3)
1 JUL	1.65	(1)	2.37	(4)	3.54	(4)	2.09	(4)	0.90	(4)
1 AUG	20.86	(3)	7.08	(3)	1.15	(4)	0.48	(3)	0.43	(4)
5 SEP	9.74	(4)	4.67	(4)	2.02	(3)	0.16	(4)	0.23	(4)
1 OCT	5.93	(4)	3.37	(3)	0.21	(3)	0.04	(4)	0.11	(4)
30 OCT	14.84	(4)	5.58	(4)	2.67	(3)	0.43	(4)	0.22	(4)
23 NOV	0.00	(3)	0.14	(4)	0.02	(4)	0.00	(2)	0.34	(2)

* (   ) = number of samples on which average is based.

APPENDIX VI-24

AVERAGE CHLOROPHYLL a*
IN BUOY PERIPHYTON SAMPLES
(40 ft DEPTH CONTOUR)

NINE MILE POINT - 1974

2 weeks

DATE	DEPTH 2 ft		7 ft		12 ft		17 ft	
17 MAY	0.00	(3)	0.00	(3)	0.00	(3)	0.00	(3)
3 JUN	1.72	(2)	2.57	(3)	0.02	(3)	0.08	(3)
17 JUN	0.99	(3)	2.00	(3)	1.05	(3)	0.08	(3)
30 JUN	0.62	(3)	0.88	(3)	0.61	(3)	0.46	(3)
16 JUL	55.55	(3)	10.05	(3)	3.16	(3)	3.30	(3)
2 AUG	15.72	(3)	2.21	(3)	1.59	(3)	1.55	(3)
15 AUG	1.15	(3)	3.96	(3)	1.17	(3)	0.66	(3)
6 SEP	10.83	(3)	9.77	(3)	5.62	(3)	1.31	(3)

4 weeks

DATE	DEPTH 2 ft		7 ft		12 ft		17 ft	
3 JUN	16.71	(3)	3.29	(3)	1.05	(3)	0.65	(3)
30 JUN	18.95	(3)	15.43	(3)	9.97	(3)	6.08	(3)
2 AUG	100.76	(3)	49.19	(2)	13.62	(3)	3.47	(3)
6 SEP	46.75	(3)	15.06	(3)	21.06	(3)	7.91	(3)
5 OCT	45.10	(3)	16.77	(3)	10.83	(3)	2.60	(3)
31 OCT	3.73	(3)	4.34	(3)	7.42	(3)	2.28	(3)
24 NOV	0.13	(3)	1.67	(3)	2.20	(3)	1.46	(3)

* ( ) = number of samples on which average is based.