Ecological Studies Of The Susquehanna River In The Vicinity Of The Susquehanna Steam Electric Station

1981 Annual Report

Theodore V. Jacobsen, Project Director and Editor

For
Pennsylvania Power and Light Company

ICHTHYOLOGICAL ASSOCIATES, INC.
April 1982

ECOLOGICAL STUDIES OF THE SUSQUEHANNA RIVER IN THE VICINITY OF THE SUSQUEHANNA STEAM ELECTRIC STATION

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INTRODUCTION

The Susquehanna Steam Electric Station (Susquehanna SES) consists of two boiling water reactors, each with an electrical generating capacity of 1,050 megawatts. It is located on a 435-ha site in Salem Township, Luzerne County, 8 km northeast of Berwick, Pennsylvania. Commercial operation of Unit 1 is scheduled to begin in 1983 and Unit 2 in 1984. Under terms of an agreement finalized in January 1978, 90% of the Susquehanna SES is owned by the Pennsylvania Power and Light Company (PP&L) and 10% by the Allegheny Electric Cooperative, Inc.

Ecological studies have been conducted near the Susquehanna SES by Ichthyological Associates, Inc. (IA) since 1971. The Susquehanna River, from which the Susquehanna SES will withdraw cooling water, has been investigated since the beginning of the studies, whereas terrestrial investigations of the site were conducted from 1972 through 1974 and from 1977 through 1981. The overall objective of these studies has been to establish an ecological baseline of existing conditions in the river and on the site prior to operation of the Susquehanna SES. Data from studies prior to 1981 have been presented in annual progress reports from 1971 through 1980 (see page 365).

Throughout 1981, both aquatic and terrestrial studies were continued. Various physicochemical characteristics of the river were measured, and its algal, macroinvertebrate, and fish populations were monitored. Terrestrial investigations of the site dealt with studies of flora, vegetation, and birds. Descriptions of sampling procedures, detailed

data tabulations, and interpretation of the results are presented in this annual progress report for 1981.

Most of the aquatic studies were conducted within 2 km of the intake structure and discharge diffuser of the Susquehanna SES. The slope of the riverbed in this stretch is 0.3 m/km and the average width is 300 m. Depth is relatively shallow in most areas (less than 2 m), but some pools may exceed 5 m even during low river flow. During periods of low flow, which normally occur in late summer and early autumn, abandoned eel walls help maintain pools, some of which are several kilometers long. In times of high flow, the river level commonly increases 3 m or more, and its flow characteristics resemble an open channel. Upriver from the site, the "Wyoming Region" of the northern anthracite coalfield lies beneath or adjacent to the river. Acid mine drainages from this area, which enter from abandoned strip and shaft mines, degrade the water quality at the site (Gale et al. 1976).

Terrestrial studies were done on either the site or on adjacent PP&L properties. Elevations ranged from 150 m above mean sea level on the river floodplain to a maximum of 372 m on Council Cup Ridge, 3 km southeast of the site. This area is located within the Ridge and Valley Section of the Appalachian Valley Province (Fenneman 1938).

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PHYSICOCHEMICAL ANALYSES

by

Walter J. Soya and Theodore V. Jacobsen

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ABSTRACT

Physicochemical data were collected upriver from the Susquehanna SES intake (SSES), downriver from the discharge diffuser (Bell Bend), and at the Susquehanna SES Biological Laboratory throughout 1981. River temperature ranged from 0.0 to 29.9 C, level from 148.18 to 152.69 m above msl, and flow from 39.7 to 2,869 m^3/s. New maxima were recorded for Secchi disc depth, dissolved oxygen, total alkalinity, and pH; and minima for turbidity, dissolved oxygen, percent oxygen saturation, and total iron. Annual mean data were similar at SSES and Bell Bend, but values of some parameters were higher at SSES a significantly greater number of times. Correlations ($r>0.90$) were found for specific conductance, sulfate, and filtrable residue to flow; total iron and nonfiltrable residue to turbidity; and total residue to fixed total residue.

Drainages from abandoned coal mines continued to degrade water quality at the Susquehanna SES in 1981, but not as severe as in previous years. The percentage of total iron concentrations exceeding 1.5 mg/l (the Pennsylvania Department of Environmental Resources limit for the river) was the lowest found at either sampling site. Statistical analyses of the physicochemical data from 1973 through 1981 showed significantly improved water quality. Much of this trend resulted from the termination of pumping mine water into the river and improved water quality of four major upriver drainages since 1972.

INTRODUCTION

This report presents physicochemical data collected from the Susquehanna River near the Susquehanna SES in 1981. The objective since 1971 has been to establish a baseline of water quality data for evaluation of possible effects from the operation of the Susquehanna SES on the river. Similar data are in annual reports from 1971 through 1980 (Ichthyological Associates 1972, 1973, 1974; Smith and Soya 1976; Jacobsen and Soya 1976, 1977; Soya and Jacobsen 1978, 1979, 1980, and 1981).

PROCEDURES

Physicochemical data were collected from the river at the Susquehanna SES Biological Laboratory and the SSES and Bell Bend sampling sites (Fig. A-1). The laboratory is on the west bank, 465 m upriver from the center of the Susquehanna SES intake structure. The SSES site is 190 m upriver from the intake structure and Bell Bend is 740 m downriver from the Susquehanna SES discharge diffuser; both are about 40 m from the west bank. The SSES and Bell Bend sampling sites are 1.14 km apart.

River temperature and level were monitored (Table A-1) at the laboratory. Temperature and depth of the river were recorded continuously on 7-day graphs. Sensors for both recorders were located on the river bottom within 30 m of the bank. Temperature (C) was read directly from the graph, whereas depth (ft) was converted to river level (m) above mean

sea level (msl). River level data were used to calculate flow (m^3/s) past the laboratory (Table A-1). Daily means of temperature and level recordings were determined by averaging hourly values from 0100 through 2400 h. Daily minimum and maximum values and their respective hours of occurrence were tabulated. When either a minimum or maximum value remained constant for several hours in a day, only the first hour of occurrence was noted.

Physicochemical data were collected at the SSES and Bell Bend sites twice per week from April through September, and usually once per week from January through March and October through December. Collection of data at both sites was hindered by river ice in January and February. Ice cover prevented sampling at either site in January, but on the 29th, collections were made through holes augered in the ice near the west shore adjacent to the Bell Bend site and about 275 m upriver from the SSES site. The ice began to break up on 11 February, and on the 12th, while the river was choked with large ice floes, samples were collected along the west shore at both sites.

The order of which site was first or second to be sampled or analyzed was randomly determined. All samples were collected between 1200 and 1400 h. A grab sample and dissolved oxygen sample of surface water were taken while drifting over each site in a boat; air and surface water temperature, Secchi disc depth, and prevailing weather conditions were recorded (Table A-1). Secchi disc depth was not recorded on 29 January. River level and flow at collection time were also tabulated with the SSES data.

Samples were immediately transported to the laboratory and analyzed for dissolved oxygen, pH, total alkalinity, specific conductance, sulfate, residues (total, fixed total, and nonfiltrable), and turbidity (Table A-1). Each laboratory analysis was performed at least twice and the mean was reported. All calculations were maintained in bound notebooks. Aliquots of each grab sample were fixed for total and dissolved iron analyses (Table A-1) which were performed by personnel at the Pennsylvania Power and Light (PP&L) Water Laboratory, Hazleton, Pennsylvania. All analyses were conducted within the holding time interval recommended by the U. S. Environmental Protection Agency (EPA 1979).

Physicochemical data collected in 1981 were analyzed using various statistical techniques. The nonparametric Wilcoxon signed rank test (Siegel 1956) was used to compare data collected at SSES and Bell Bend to determine if there were significant differences between the sites. Linear regressions, with log transformations when appropriate, were applied to selected parameters at SSES to determine relationships between them. Data collected at the laboratory and SSES were compared to those obtained in previous years. Nonparametric statistics were used to determine if: 1) year-to-year changes had occurred in each parameter, and 2) a trend among years was present. Friedman's two-way analysis of variance test (S) was used in the first determination and Page's distribution-free test (L) for ordered alternatives in the second (Hollander and Wolfe 1973). The tests were based on monthly mean values from 1973 through 1981, but only years with 12 monthly means were used. The 5% probability level was

used to determine significance in the Wilcoxon, Friedman, and Page test.

Personnel from the PP&L Water Laboratory collected surface water samples from the river once each month at the Susquehanna SES Biological Laboratory (Fig. A-1). Water temperature and dissolved oxygen were measured in the field; all other analyses were made at the PP&L Laboratory according to *Standard Methods* (APHA 1975) or *Methods for Chemical Analysis of Water and Wastes* (EPA 1979).

RESULTS AND DISCUSSION

The Susquehanna River was influenced by drought conditions from June 1980 through early February 1981 (U.S. Department of the Interior 1981). During this eight-month period, river flow past the Susquehanna SES Biological Laboratory averaged only 78 m^3/s. In December 1980, winter temperatures combined with low flow completely froze over the river at the Susquehanna SES site. This ice cover remained from 18 December through 11 February 1981 when extended rainfall washed away the ice and relieved the drought conditions.

Throughout 1981, the river temperature ranged from 0.0 C, recorded on numerous days in January, February, and December, to 29.9 C, on 12 July (Table A-2). The lowest daily mean temperature, also 0.0 C, occurred on all days in January and several days in February and December, whereas the highest, 28.1 C, occurred on 10 and 12 July. The daily mean temperature varied least in January (Standard Error = 0.00) and most in May (SE = 0.54). The monthly mean temperature was lowest, 0.0 C, in January and highest, 25.0 C, in July.

The daily mean temperature (Table A-2) was less than 1.0 C for 67 days (18.4% of the year), from 1.0 to 10.0 C for 91 days (24.9%), from 10.1 to 20.0 C for 91 days (24.9%), and greater than 20.0 C for 116 days (31.8%). These temperature ranges are similar to those recorded in previous years (Soya and Jacobsen 1980, 1981). Since 1974, the daily mean river temperature has been less than 1.0 C for 18.8% of the days, from 1.0 to 10.0 C for 28.9%, from 10.1 to 20.0 C for 24.6%, and greater than 20.0 C for 27.8%.

In 1981, daily water temperature fluctuations of C or greater occurred in each month except January when the temperature remained at 0.0 C for the entire month. These fluctuations were found in 88.9% of the days when the daily mean temperature was greater than 10.0 C and 27.6% of the days when the daily mean temperature was 10.0 C or less. The maximum fluctuation, 4.3 C, occurred on 1 August.

The minimum river level, 148.18 m above msl, occurred from 2 through 6 September (Table A-3). The maximum river level, 152.69 m above msl, was recorded on 24 and 25 February. The daily mean level varied least in January (SE = 0.009) and most in February (SE = 0.277). The monthly mean level was lowest, 148.34 m above msl, in August and highest, 150.63 m above msl, in February.

River flow ranged from 39.7 m^3/s to 2,869 m^3/s (calculated from the minimum and maximum river levels). The daily mean flow was least, 40 m^3/s, from 3 through 5 September and greatest, 2,768 m^3/s, on 22 February (Table A-4). The daily mean flow varied least in January (SE = 2.0) and most in

February (SE = 180.2). The monthly mean flow was lowest, 67 m^3/s, in August and highest, 1,263 m^3/s, in February.

Acid mine water enters the river at several abandoned coal mine drainages from the confluence with the Lackawanna River to Nanticoke, Pennsylvania (Jacobsen and Soya 1977). Sewage effluents (raw, primary, and secondary) also flow into the river from several upriver towns and cities. These mine drainages and sewage effluents continued to degrade water quality at the Susquehanna SES site in 1981. However, significant improvement has been documented since 1976 (Soya and Jacobsen 1981).

Physicochemical data collected upriver from the intake structure (SSES) and downriver from the discharge diffuser (Bell Bend) were similar throughout 1981 (Tables A-5 through A-16). Annual means were identical at both sites for 7 of 15 parameters (Table A-17). The means of the other parameters at Bell Bend varied less than $\pm$6.7% of those at SSES.

Even though there was little difference in the annual means between the SSES and Bell Bend sites, significant patterns occurred in the data. Statistical analysis (Wilcoxon) showed that turbidity ($P<0.001$), sulfate ($P<0.001$), total iron ($P<0.01$), dissolved iron ($P<0.001$), percent dissolved iron ($P<0.05$), and fixed total residue ($P<0.01$) were higher at SSES a significantly greater number of times (Table A-18). It is probable that most of these patterns were caused by the oxidation and neutralization of mine water components in the river between the two sites (Barnes and Romberger 1968). Because SSES and Bell Bend are only 1.14 km apart, these patterns did not substantially affect the annual means at both sites.

In 1973, greater differences occurred in annual means between SSES and the Nescopeck sampling site, approximately 9 km downriver (Ichthyological Associates 1974).

Wilcoxon analysis of the physicochemical data collected during the concurrent sampling period at SSES and Bell Bend from 1978 through 1981 shows similar results (Table A-19). Turbidity ($P<0.001$), sulfate ($P<0.001$), total iron ($P<0.001$), dissolved iron ($P<0.001$), and fixed total residue ($P<0.05$) were higher at SSES a significantly greater number of times; Secchi disc depth ($P<0.01$), dissolved oxygen ($P<0.01$), total alkalinity ($P<0.05$), total residue ($P<0.001$), and filtrable residue ($P<0.01$) were higher at Bell Bend a significantly greater number of times. Water quality in reference to acid mine drainages, was therefore better at Bell Bend that at SSES.

Most data collected in 1981 were within ranges established since sampling began at the SSES and Bell Bend sites in 1972-73 and 1978, respectively. However, new maxima occurred at SSES for Secchi disc depth (235 cm on 16 December), total alkalinity (87 mg/l on 11 September), and pH (9.0 on 1 April) (Table A-20). New minima were established for turbidity (3.3 NTU on 16 December), dissolved oxygen and percent oxygen saturation (5.20 mg/l and 60%, respectively, on 1 September), and total iron (0.96 mg/l on 29 December). At Bell Bend, there were new minima for turbidity (3.1 NTU on 16 December) and dissolved oxygen and percent oxygen saturation (5.00 mg/l and 58%, respectively, on 1 September); new maxima for Secchi disc depth (225 cm on 16 December), dissolved oxygen (14.50 mg/l on 1 April), total

alkalinity (88 mg/l on 11 September), and pH (8.9 on 1 April). Overall, these new maxima and minima are indicative of improved water quality.

Total iron concentrations exceeded the 1.5 mg/l limit of the Pennsylvania Department of Environmental Resources (PDER 1971) in 49 of 73 samples (67.1%) at SSES and 46 of 73 samples (63.0%) at Bell Bend. These percentages were the lowest found at either site since sampling began; the percentages have usually decreased each year. For the period 1978 through 1981, there were more total iron samples greater than 1.5 mg/l at SSES (80.1%) than at Bell Bend (73.7%); the number has been greater at SSES each year. These data indicate that there has been a gradual decline in the concentration of total iron. They also tend to support the Wilcoxon analysis of higher total iron concentrations at SSES a greater number of times.

Statistical analysis of the physicochemical data collected at the laboratory and SSES from 1973 through 1981 revealed significant water quality trends during this period. Using the Friedman analysis of variance test, significant year-to-year differences were found for river temperature ($S = 25.076$, $DF = 7$, $P<0.001$), level ($S = 26.597$, $DF = 7$, $P<0.001$), flow ($S = 23.563$, $DF = 7$, $P<0.001$), turbidity ($S = 36.578$, $DF = 8$, $P<0.001$), total alkalinity ($S = 32.375$, $DF = 7$, $P<0.001$), pH ($S = 51.739$, $DF = 8$, $P<0.001$), total iron ($S = 30.650$, $DF = 8$, $P<0.001$), and dissolved iron ($S = 40.361$, $DF = 8$, $P<0.001$). Page's test showed that a significant increasing trend occurred in this period for river temperature ($L = 2105$, $P<0.01$), total alkalinity ($L = 2215$, $P<0.001$), pH ($L = 3203$, $P<0.001$), and

dissolved iron ($L = 2963$, $P<0.01$). A significant decreasing trend was found for river level ($L = 2159.5$, $P<0.001$), flow ($L = 2148$, $P<0.001$), turbidity ($L = 3137.5$, $P<0.001$), and total iron ($L = 3070.5$, $P<0.001$). In addition, significant year-to-year changes were found for dissolved oxygen ($S = 19.989$, $DF = 8$, $P<0.05$), sulfate ($S = 16.011$, $DF = 8$, $P<0.05$), specific conductance ($S = 15.783$, $DF = 8$, $P<0.05$), total residue ($S = 16.694$, $DF = 7$, $P<0.05$), and filtrable residue ($S = 15.090$, $DF = 7$, $P<0.05$), but there was no trend. A decreasing trend was found for nonfiltrable residue ($L = 2944.5$, $P<0.001$) even though significant year-to-year changes were not found. Most of these trends can be seen in monthly mean plots of parameters associated with acid mine drainage (Figs. A-2 and A-3).

Similar significant trends in improved water quality have been observed yearly at SSES since 1976 (Soya and Jacobsen 1981). In each year, an increasing trend was found for pH and a decreasing trend for total iron and turbidity. An increasing trend was recorded for total alkalinity in each year except 1976 and for dissolved oxygen in each year except 1981. These trends have been associated with the termination of pumping coal mine water into the river at several locations upriver from the Susquehanna SES site in 1972 as a result of flooding from Tropical Storm Agnes (Soya and Jacobsen 1978). In addition, and perhaps even more important, the quality of mine water which flows into the river from four major seeps and boreholes also improved since 1972 (Table A-21). Unpublished data collected by PDER shows that overall, pH and alkalinity increased and acidity, sulfate, and total iron decreased

during the past nine years at the Old Forge borehole, the Duryea outfall, the South Wilkes-Barre outfall, and the Buttonwood tunnel. However, these mine drainages are still major sources of pollutants to the river.

With the use of regression analysis, several relationships ($r>0.90$) were found in the physicochemical data at SSES in 1981 (Table A-22). Specific conductance, sulfate, and filtrable residue (dissolved solids) were inversely related to river flow. Gale et al. (1976) found similar correlations at SSES in 1973-74. The correlation of specific conductance and filtrable residue to flow occurs when the concentration of dissolved solids is related principally to the volume of water available for dilution (Hem 1970, Knapton 1978). The relationship of sulfate to flow and the subsequent direct relationship of sulfate to specific conductance indicates that a continual supply of sulfate is being discharged into the river from acid mine drainages.

There were also direct relationships ($r>0.90$) at SSES between turbidity, total iron, and nonfiltrable residue (Table A-22). Their interactions are attributed to flocculent ferric hydroxide which forms when dissolved (ferrous) iron is oxidized in the river. These colloidal particles, which give the river a rust color, eventually precipitate to the substrate. This precipitation is affected by river flow; low flow and concomitant low velocity allow the suspended particles to settle out of the water column, whereas high flow and velocity keep the particles in suspension and resuspend precipitated particles (Gale et al. 1976).

A total of 47 water quality parameters was analyzed each month from samples collected at the Susquehanna SES Biological Laboratory by personnel from the PP&L Water Laboratory (Table A-23). The concentrations of sulfate, iron, aluminum, and manganese show that acid mine drainage pollution persists at the site. Total iron concentrations in only 2 of 12 samples exceeded the PDER limit of 1.5 mg/l; total manganese concentrations did not exceed the PDER limit of 1.0 mg/l in any month. Major cation and anion composition was similar to that found in previous years (Soya and Jacobsen 1981). Calcium was the dominant cation ($\bar{x}$ = 30.0 mg/l and 1.50 me/l); bicarbonate was the dominant anion ($\bar{x}$ = 69.2 mg/l and 1.14 me/l). Phenolphthalien alkalinity (1 mg/l) and carbonate (1.2 mg/l and 0.04 me/l) were found in the 6 April sample. Comparison of PP&L water analyses since 1968 showed that new minimum values were established for turbidity (3.3 NTU) on 14 December and nitrate nitrogen (0.07 mg/l) on 3 August.

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Table A-1

Physicochemical parameters and methods of analyses, 1981.

Parameter	Method	Reference
River level	Seven-day continuous recordings from an ACCO Bristol, Model No. G500-15 bubbler-type water level gauge	ACCO (1971)
River flow	River flow = 231.4857 + 321.2703 (river level -149) + 106.6087 (river level $-149)^2$	Hewlett Packard (1972)
River temperature	Seven-day continuous recordings from a calibrated, Leeds and Northrup Speedomax Thermistor-type, Model R temperature recorder	APHA (1975)
	Calibrated, mercury thermometer	APHA (1975)
Air temperature	Calibrated, mercury thermometer	APHA (1975)
Dissolved oxygen	Azide modification of Winkler	APHA (1975)
pH	Glass electrode	APHA (1975)
Total alkalinity	Potentiometric titration	APHA (1975)
Specific conductance	Self-contained conductivity meter	APHA (1975)
Sulfate	Turbidimetric	APHA (1975)
Total iron	Atomic absorption spectrophotometric determination of extractable iron	APHA (1975)
Dissolved iron	Atomic absorption spectrophotometric determination of dissolved iron	APHA (1975)
Total residue	Evaporation, dried at 105 C	APHA (1975)
Fixed total residue	Ignition of total residue at 550 C	APHA (1975)
Nonfiltrable residue	Residue retained on a glass fiber filter, dried at 105 C	APHA (1975)
Filtrable residue	Calculation; total residues minus nonfiltrable residue	--
Turbidity	Nephelometric	APHA (1975)
Secchi disc depth	Limit of visibility	Welch (1948)

Table A-2

Daily minimum, maximum, and mean temperature (C) of the Susquehanna River at the Susquehanna SES Biological Laboratory, 1981.

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JAN					
1	0.0	0100	0.0	0100	0.0
2	0.0	0100	0.0	0100	0.0
3	0.0	0100	0.0	0100	0.0
4	0.0	0100	0.0	0100	0.0
5	0.0	0100	0.0	0100	0.0
6	0.0	0100	0.0	0100	0.0
7	0.0	0100	0.0	0100	0.0
8	0.0	0100	0.0	0100	0.0
9	0.0	0100	0.0	0100	0.0
10	0.0	0100	0.0	0100	0.0
11	0.0	0100	0.0	0100	0.0
12	0.0	0100	0.0	0100	0.0
13	0.0	0100	0.0	0100	0.0
14	0.0	0100	0.0	0100	0.0
15	0.0	0100	0.0	0100	0.0
16	0.0	0100	0.0	0100	0.0
17	0.0	0100	0.0	0100	0.0
18	0.0	0100	0.0	0100	0.0
19	0.0	0100	0.0	0100	0.0
20	0.0	0100	0.0	0100	0.0
21	0.0	0100	0.0	0100	0.0
22	0.0	0100	0.0	0100	0.0
23	0.0	0100	0.0	0100	0.0
24	0.0	0100	0.0	0100	0.0
25	0.0	0100	0.0	0100	0.0
26	0.0	0100	0.0	0100	0.0
27	0.0	0100	0.0	0100	0.0
28	0.0	0100	0.0	0100	0.0
29	0.0	0100	0.0	0100	0.0
30	0.0	0100	0.0	0100	0.0
31	0.0	0100	0.0	0100	0.0
MEAN					0.0
SE					0.00

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
FEB					
1	0.0	0100	0.0	0100	0.0
2	0.0	0100	0.0	0100	0.0
3	0.0	0100	0.0	0100	0.0
4	0.0	0100	0.0	0100	0.0
5	0.0	0100	0.0	0100	0.0
6	0.0	0100	0.0	0100	0.0
7	0.0	0100	0.0	0100	0.0
8	0.0	0100	0.0	0100	0.0
9	0.0	0100	0.0	0100	0.0
10	0.0	0100	0.1	0900	0.1
11	0.1	0100	0.2	2200	0.1
12	0.1	0100	0.1	0100	0.1
13	0.0	0100	0.0	0100	0.0
14	0.0	0100	0.1	1600	0.0
15	0.0	0300	0.3	1800	0.2
16	0.2	0700	1.1	2400	0.6
17	1.1	0100	1.4	2400	1.2
18	1.4	0100	2.0	1300	1.8
19	1.9	0500	2.1	0100	2.0
20	1.7	0800	2.0	0100	1.8
21	1.9	1400	2.2	2400	2.0
22	2.2	0100	3.3	2400	2.8
23	3.3	0100	4.4	2400	3.8
24	4.4	0100	5.0	1700	4.7
25	4.8	0300	4.9	0100	4.8
26	4.2	2400	4.8	0100	4.6
27	3.7	0900	4.2	0100	3.9
28	3.6	0900	3.9	0100	3.6
MEAN					1.4
SE					0.33

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
MAR					
1	3.7	0100	3.8	1400	3.7
2	3.7	2400	3.9	1200	3.8
3	3.0	0900	3.6	0100	3.1
4	2.7	0700	3.0	0100	2.8
5	2.5	2300	2.7	0100	2.7
6	2.0	0800	2.4	0100	2.2
7	2.1	0100	2.2	1300	2.2
8	2.1	0400	2.2	0100	2.2
9	2.2	0100	2.9	1400	2.6
10	2.9	0100	3.2	1400	3.1
11	3.1	0500	3.2	0100	3.1
12	3.1	0100	3.8	1400	3.5
13	3.8	0100	4.8	1800	4.3
14	4.2	2200	4.8	0100	4.6
15	3.8	0600	4.5	1500	4.0
16	3.9	2400	4.6	1500	4.2
17	2.5	2400	3.8	0100	3.3
18	2.0	0700	3.0	1400	2.4
19	1.9	2300	2.4	1500	2.1
20	1.4	0800	1.9	0100	1.7
21	1.7	0800	2.2	1500	1.9
22	1.9	0400	2.6	1600	2.3
23	2.4	0700	4.1	1500	3.3
24	3.8	0500	5.0	1400	4.5
25	4.6	0700	5.3	1500	5.0
26	4.7	0500	6.2	1400	5.5
27	5.9	0800	6.2	1400	6.0
28	5.7	0700	7.3	1400	6.6
29	6.8	0300	8.3	1400	7.6
30	8.3	0100	8.9	1800	8.6
31	8.9	0100	10.6	1400	9.8
MEAN					4.0
SE					0.36

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
APR					
1	10.0	0700	10.9	1500	10.5
2	10.8	0100	11.8	1500	11.3
3	11.0	0800	12.0	1400	11.6
4	12.0	0100	13.0	1600	12.5
5	13.0	0100	13.2	1400	13.1
6	11.5	2400	13.0	0100	12.3
7	10.8	0800	11.8	1400	11.3
8	11.0	0600	12.2	1500	11.7
9	11.9	2400	12.2	1600	12.1
10	11.5	0700	12.6	1400	12.1
11	12.1	0200	12.9	1600	12.5
12	12.2	2400	12.8	0100	12.7
13	11.8	2200	12.2	0100	11.9
14	10.4	2400	11.7	0100	10.8
15	9.8	0800	10.2	0100	10.0
16	9.6	0600	10.3	1500	10.0
17	10.1	0100	10.2	1200	10.2
18	10.2	0100	11.8	1500	11.1
19	11.3	0600	12.1	1500	11.8
20	11.2	2400	12.0	1500	11.8
21	10.8	2400	11.4	1500	11.1
22	10.4	0600	11.3	1600	10.9
23	11.1	0100	11.1	0100	11.1
24	10.9	0800	11.5	1400	11.2
25	10.0	2100	11.2	0100	10.2
26	9.7	0600	9.9	0100	9.8
27	9.9	0100	10.9	1600	10.4
28	10.9	0100	11.5	2100	11.1
29	11.3	0700	12.1	1800	11.7
30	12.1	0100	12.8	1700	12.4
MEAN					11.4
SE					0.16

Table A-2 (cont.)

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
MAY					
1	12.2	0700	12.8	0100	12.7
2	12.4	2400	12.8	0100	12.7
3	12.1	0400	12.9	1700	12.5
4	12.9	0100	14.1	2000	13.4
5	14.1	0100	15.2	1800	14.7
6	15.0	2400	15.8	1300	15.4
7	14.1	0800	15.1	1500	14.7
8	14.1	0500	15.6	1700	14.8
9	14.7	0700	16.0	1500	15.4
10	15.0	0700	16.6	1600	15.8
11	16.3	0100	17.1	1400	16.8
12	15.9	2400	16.9	0100	16.7
13	15.1	0800	15.9	1500	15.6
14	15.4	0800	16.9	1900	16.2
15	16.8	0100	17.0	1300	16.9
16	15.8	2400	16.9	0100	16.5
17	15.1	0700	16.1	1600	15.7
18	15.0	0700	15.9	0100	15.3
19	14.7	1100	15.1	0100	14.9
20	14.2	0700	15.2	1600	14.8
21	15.1	0100	16.7	1600	15.9
22	16.1	0600	17.9	1600	17.1
23	17.2	0400	19.0	1700	18.1
24	18.0	0700	19.8	1600	19.0
25	19.0	0500	21.2	1700	20.2
26	20.2	0600	21.6	1800	21.0
27	20.9	0600	22.2	1500	21.6
28	21.5	0700	22.1	1700	21.8
29	21.1	0800	22.3	1500	21.7
30	21.6	0700	23.5	1500	22.5
31	22.7	0700	23.9	1600	23.1
MEAN					16.9
SE					0.54

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JUN					
1	22.1	0700	23.9	1400	23.0
2	21.2	2300	22.8	0100	21.9
3	20.1	2400	21.1	0100	20.5
4	20.0	0300	21.1	1600	20.6
5	20.8	0300	22.3	1800	21.5
6	21.8	0700	23.0	1900	22.4
7	22.0	0800	23.1	1700	22.6
8	21.8	0600	23.8	1500	22.8
9	22.6	0800	24.1	1500	23.2
10	22.0	2400	22.9	0100	22.4
11	21.3	0600	23.0	1500	22.3
12	21.7	0600	24.1	1500	22.9
13	22.7	0700	24.9	1500	23.8
14	23.1	2200	24.0	0100	23.4
15	22.3	0800	23.7	1700	23.0
16	23.1	0400	25.3	1900	24.3
17	25.1	0200	26.0	1500	25.4
18	24.7	2400	25.4	1500	25.0
19	24.1	0700	25.0	1400	24.6
20	24.0	2400	24.6	0100	24.3
21	23.5	0700	24.2	1300	23.9
22	23.4	0800	24.2	1800	23.8
23	22.3	2400	23.2	0100	22.9
24	22.0	0700	22.9	1400	22.5
25	22.3	2400	23.1	1500	22.7
26	21.1	2400	22.2	0100	21.8
27	20.1	0700	21.7	1600	21.0
28	20.3	0700	22.7	1700	21.6
29	21.2	0600	23.1	1700	22.3
30	22.2	0600	24.1	1600	23.2
MEAN					22.9
SE					0.22

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JUL					
1	23.2	0600	24.8	1500	23.9
2	23.2	0700	23.9	0100	23.6
3	23.0	0700	24.0	1700	23.5
4	23.1	0600	23.7	1700	23.3
5	23.0	0700	23.6	1700	23.2
6	22.7	0700	24.7	1500	23.6
7	23.8	0400	26.3	1500	25.1
8	25.3	0500	27.7	1700	26.6
9	26.4	0600	28.5	1700	27.6
10	27.2	0600	29.2	1500	28.1
11	26.8	0600	29.1	1700	27.9
12	26.9	0700	29.9	1500	28.1
13	26.9	0700	28.9	1600	27.7
14	25.0	2400	28.6	1500	26.9
15	24.8	0700	27.8	1600	25.9
16	23.9	0600	27.1	1500	25.5
17	23.9	0500	27.8	1800	25.7
18	24.0	0700	28.0	1700	26.0
19	24.8	0600	28.3	1700	26.6
20	25.8	0800	27.0	1700	26.2
21	25.2	0700	26.5	1300	25.8
22	23.9	2400	25.8	1600	24.9
23	22.9	0600	26.2	1500	24.3
24	22.8	0600	25.0	1300	23.8
25	22.9	0700	23.9	1700	23.4
26	22.9	0800	23.3	1700	23.1
27	22.9	0500	25.1	1600	23.7
28	22.8	0700	23.2	1300	23.0
29	21.7	2400	24.1	1300	23.1
30	20.3	0700	24.4	1700	22.4
31	20.9	0600	25.1	1800	23.0
MEAN					25.0
SE					0.32

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
AUG					
1	22.0	0700	26.3	1600	23.9
2	23.6	0700	26.9	1600	25.0
3	23.9	0700	26.4	1600	25.0
4	24.1	0600	26.9	1700	25.2
5	24.1	0600	26.4	1500	25.2
6	23.2	0700	25.9	1700	24.5
7	23.0	0700	26.0	1500	24.5
8	24.2	0800	24.9	0100	24.5
9	24.1	0100	26.8	1600	25.2
10	24.1	0700	27.7	1600	25.6
11	25.0	0800	27.7	1500	26.0
12	25.1	0800	27.0	1600	25.9
13	24.3	0800	26.6	1600	25.3
14	24.0	0700	26.2	1600	25.1
15	24.4	0700	25.9	1200	25.2
16	23.7	2400	26.7	1500	25.1
17	22.0	2400	25.2	1500	23.4
18	21.1	0700	25.2	1600	23.0
19	21.2	0700	25.1	1600	23.0
20	21.3	0700	24.8	1700	22.8
21	20.9	0700	24.9	1800	22.9
22	22.0	0800	23.8	1700	22.8
23	21.3	0800	24.9	1800	23.0
24	21.8	0700	23.3	1700	22.5
25	21.2	0500	23.9	1800	22.3
26	21.1	0700	24.6	1900	22.8
27	21.1	0700	25.0	1800	23.2
28	22.4	0900	25.0	1700	23.7
29	22.9	0800	25.0	1500	23.8
30	22.3	0800	24.2	1800	23.2
31	22.1	0800	23.5	1700	22.9
MEAN					24.1
SE					0.21

Table A-2 (cont.)

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
SEP					
1	21.7	0800	22.9	1900	22.4
2	21.2	2400	22.3	0100	21.9
3	21.0	0700	22.8	1700	21.8
4	20.8	0800	22.0	1400	21.5
5	20.5	0700	21.7	1700	21.1
6	20.8	0700	23.2	1700	21.9
7	21.2	0700	23.0	1700	22.0
8	21.1	2400	21.9	1600	21.6
9	20.0	0700	22.6	1500	21.0
10	19.2	0800	21.5	1500	20.3
11	19.7	0700	21.1	1400	20.4
12	20.2	0400	21.9	1500	21.0
13	20.9	0700	22.7	1500	21.7
14	21.4	0700	23.2	1500	22.3
15	21.5	2400	22.3	1700	22.0
16	20.6	2400	21.7	1500	21.2
17	19.8	2400	21.0	1600	20.4
18	19.4	0900	20.9	1600	20.0
19	18.8	2400	20.3	1500	19.4
20	18.0	2400	19.7	1500	18.7
21	17.0	0800	18.7	1300	17.8
22	17.0	2400	18.1	1500	17.5
23	15.3	2400	17.0	0100	16.4
24	14.9	0700	17.4	1500	15.9
25	14.8	0800	17.5	1500	16.0
26	15.5	0400	16.4	1600	15.9
27	15.8	0800	16.8	1500	16.4
28	16.1	2400	17.1	1600	16.6
29	14.7	2400	15.9	0100	15.2
30	14.0	0800	15.0	1500	14.4
MEAN					19.5
SE					0.47

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
OCT					
1	14.0	0700	14.4	1500	14.1
2	13.2	2300	14.0	0100	13.7
3	12.4	2400	13.2	0100	12.9
4	11.9	0700	13.0	1400	12.4
5	12.3	0100	13.2	1500	12.8
6	13.1	0100	13.2	1600	13.1
7	12.7	7400	13.2	1300	13.0
8	1.9	2400	12.6	0100	12.2
9	11.3	0800	11.8	0100	11.6
10	11.1	0700	11.6	1500	11.3
11	11.0	0800	11.2	0100	11.1
12	10.8	0800	11.4	1500	11.1
13	10.9	0700	11.5	1500	11.2
14	10.9	0700	11.8	1500	11.3
15	11.0	0400	11.8	1600	11.4
16	11.2	2400	12.0	1400	11.6
17	10.9	0700	11.8	1400	11.3
18	11.0	0400	11.1	0100	11.0
19	10.0	2400	11.0	0100	10.5
20	9.2	0800	10.2	1400	9.8
21	9.3	0700	10.9	1400	10.1
22	10.1	0300	11.1	1500	10.6
23	11.1	0100	11.3	1500	11.2
24	10.2	2400	11.3	1300	10.8
25	9.7	0700	10.1	0100	9.9
26	9.8	0700	10.0	1300	9.9
27	10.0	0100	10.9	2200	10.4
28	10.9	0100	11.8	1500	11.3
29	10.7	1100	11.3	0100	10.9
30	10.3	2400	10.8	0100	10.6
31	10.0	0600	10.2	0100	10.0
MEAN					11.4
SE					0.20

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
NOV					
1	9.9	0100	10.0	1400	9.9
2	9.9	0700	10.1	1300	10.0
3	9.8	0700	10.0	1300	9.9
4	9.7	0700	9.9	0100	9.8
5	9.7	0800	10.0	1500	9.9
6	9.8	2300	10.1	1400	10.0
7	8.6	2400	9.8	0100	9.2
8	8.1	0700	8.5	0100	8.2
9	7.5	2400	8.1	0100	8.0
10	7.1	1700	7.5	0100	7.3
11	6.8	2300	7.1	1300	7.0
12	6.2	2300	6.8	0100	6.6
13	5.9	0700	6.2	0100	6.0
14	5.8	0200	6.1	1300	5.9
15	6.0	0100	6.2	1300	6.1
16	6.2	0100	6.8	1400	6.6
17	6.8	0100	6.9	1100	6.9
18	6.9	0100	7.0	2400	6.9
19	7.0	0100	7.3	2300	7.1
20	7.3	0100	7.8	1500	7.6
21	7.0	2300	7.8	0100	7.3
22	6.3	2400	6.9	0100	6.7
23	5.4	2400	6.3	0100	5.9
24	4.9	2300	5.3	0100	5.1
25	4.1	2200	4.9	0100	4.5
26	3.8	0700	4.0	0100	3.9
27	3.9	0100	4.2	1500	4.1
28	4.2	0100	4.5	1300	4.4
29	4.1	2400	4.5	0100	4.3
30	3.8	2300	4.1	0100	4.0
MEAN					7.0
SE					0.36

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
DEC					
1	3.1	1800	3.8	0100	3.4
2	3.1	0100	3.2	1300	3.2
3	3.2	0100	3.8	1200	3.5
4	3.4	0300	3.6	1500	3.5
5	3.5	0100	3.8	1600	3.6
6	3.1	2400	3.7	0100	3.4
7	2.9	0800	3.1	0100	3.0
8	2.9	0100	3.1	1400	3.0
9	2.4	2400	3.1	0100	2.9
10	1.2	2200	2.4	0100	1.8
11	0.9	0800	1.2	0100	1.0
12	0.8	2100	0.9	0100	0.9
13	0.8	0100	0.9	1400	0.8
14	0.3	2100	0.8	0100	0.8
15	0.3	0100	0.3	0100	0.3
16	0.3	0100	0.9	1500	0.7
17	0.9	0100	1.0	0100	0.9
18	0.8	2400	0.9	1000	0.9
19	0.0	2000	0.8	0100	0.4
20	0.0	0100	C	0100	0.0
21	0.0	0100	0.0	0100	0.0
22	0.0	0100	0.0	0100	0.0
23	0.0	0100	0.4	1300	0.2
24	0.1	2300	0.7	1200	0.5
25	0.1	0100	0.1	0100	0.1
26	0.0	0900	0.1	0100	0.0
27	0.0	0100	0.1	1700	0.0
28	0.1	0100	0.6	2400	0.3
29	0.6	0100	1.0	1600	0.9
30	0.8	0500	1.0	1400	0.9
31	0.8	0500	0.9	0100	0.8
MEAN					1.3
SE					0.24

Table A-3

Daily minimum, maximum, and mean level (m above msl) of the Susquehanna River at the Susquehanna SES Biological Laboratory, 1981.

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JAN					
1	148.67	0100	148.67	0100	148.67
2	148.58	1600	148.67	0100	148.62
3	148.55	1900	148.64	0100	148.60
4	148.52	0900	148.61	2300	148.55
5	148.55	1700	148.61	0100	148.58
6	148.52	1600	148.61	0100	148.56
7	148.52	1600	148.61	2400	148.57
8	148.49	1700	148.61	0100	148.54
9	148.49	0900	148.52	0100	148.50
10	148.49	0100	148.52	2300	148.49
11	148.49	1400	148.52	0100	148.50
12	148.49	1000	148.55	2100	148.52
13	148.52	1300	148.55	0100	148.53
14	148.49	2000	148.55	0100	148.52
15	148.52	0100	148.55	0600	148.53
16	148.52	0100	148.55	1700	148.52
17	148.49	2100	148.52	0100	148.51
18	148.49	0100	148.52	0300	148.51
19	148.52	0100	148.55	1400	148.53
20	148.49	2000	148.55	0100	148.53
21	148.49	0100	148.52	1300	148.51
22	148.49	0100	148.55	1000	148.52
23	148.49	0100	148.52	1200	148.49
24	148.49	0100	148.49	0100	148.49
25	148.46	0700	148.52	2400	148.48
26	148.52	0100	148.52	0100	148.52
27	148.49	1900	148.52	0100	148.51
28	148.49	0100	148.52	1200	148.49
29	148.43	2200	148.49	0100	148.47
30	148.39	1700	148.46	0100	148.44
31	148.39	1400	148.46	0100	148.42
MEAN					148.52
SE					0.009

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
FEB					
1	148.43	0100	148.55	2400	148.47
2	148.55	0100	148.94	2300	148.71
3	148.97	0100	149.13	1900	149.07
4	148.94	1900	149.13	0100	149.01
5	148.79	1400	148.91	0100	148.83
6	148.82	0100	148.97	2400	148.86
7	148.97	0100	149.10	2100	149.04
8	149.04	1900	149.10	0100	149.07
9	148.94	1700	149.00	0100	148.97
10	148.88	0700	148.94	0100	148.91
11	148.94	0100	150.65	2400	149.49
12	152.02	0100	152.39	1000	152.24
13	151.84	2300	152.24	0100	152.04
14	151.44	2300	151.81	0100	151.60
15	151.14	2100	151.44	0100	151.24
16	150.99	2200	151.14	0100	151.04
17	150.92	1900	150.99	0100	150.97
18	150.92	0100	151.23	2400	151.05
19	151.23	0100	151.66	2300	151.47
20	151.69	0100	152.05	2400	151.81
21	152.08	0100	152.57	2400	152.37
22	152.51	2300	152.63	0400	152.60
23	152.14	2200	152.51	0100	152.33
24	152.11	0200	152.69	2200	152.36
25	152.14	2400	152.69	0100	152.50
26	151.47	2400	152.08	0100	151.76
27	150.99	2400	151.47	2400	151.23
28	150.59	2200	150.99	0100	150.75
MEAN					150.63
SE					0.277

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
MAR					
1	150.41	2400	150.59	0100	150.35
2	150.25	2400	150.41	0100	150.33
3	150.13	2200	150.25	0100	150.20
4	149.92	2400	150.10	0100	150.03
5	149.74	2400	149.92	0100	149.84
6	149.64	1900	149.74	0100	149.69
7	149.55	1800	149.64	0100	149.59
8	149.46	1900	149.52	0100	149.49
9	149.43	1000	149.46	0100	149.45
10	149.40	0400	149.43	0100	149.41
11	149.37	0400	149.40	0100	149.38
12	149.34	0100	149.34	0100	149.34
13	149.31	0400	149.34	0100	149.32
14	149.28	0700	149.31	0100	149.28
15	149.25	0100	149.25	0100	149.25
16	149.25	0100	149.25	0100	149.25
17	149.22	0100	149.22	0100	149.22
18	149.16	1900	149.19	0100	149.18
19	149.10	1900	149.16	0100	149.12
20	149.04	0900	149.10	0100	149.05
21	148.97	1600	149.04	0100	149.00
22	148.94	1300	148.97	0100	148.96
23	148.94	0100	148.94	0100	148.94
24	148.94	0100	148.94	0100	148.94
25	148.91	0100	148.91	0100	148.91
26	148.91	0100	148.91	0100	148.91
27	148.79	0900	148.91	0100	148.83
28	148.79	0100	148.79	0100	148.79
29	148.79	0100	148.79	0100	148.79
30	148.79	0100	148.85	1800	148.82
31	148.88	0100	148.88	0100	148.88
MEAN					149.31
SE					0.081

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
APR					
1	148.88	0100	148.91	2200	148.90
2	148.94	0100	149.07	2200	149.00
3	149.07	0100	149.10	0400	149.09
4	149.10	0100	149.13	1200	149.11
5	149.13	0100	149.19	0900	149.15
6	149.13	1300	149.19	0100	149.15
7	149.10	0700	149.13	0100	149.11
8	149.07	0400	149.10	0100	149.07
9	149.07	0100	149.07	0100	149.07
10	149.00	1900	149.07	0100	149.04
11	148.97	0700	149.00	0100	149.00
12	149.00	0100	149.00	0100	149.00
13	149.04	0100	149.04	0100	149.04
14	149.04	0100	149.13	1900	149.08
15	149.13	0100	149.22	2400	149.15
16	149.22	0100	149.25	0600	149.24
17	149.25	0100	149.25	0100	149.25
18	149.22	1300	149.25	0100	149.23
19	149.22	0100	149.22	0100	149.22
20	149.22	0100	149.25	0900	149.24
21	149.19	1300	149.22	0100	149.20
22	149.10	1700	149.19	0100	149.13
23	149.04	0900	149.10	0100	149.04
24	149.04	0100	149.16	2200	149.08
25	149.16	0100	149.37	2400	149.25
26	149.37	0100	149.52	2000	149.46
27	149.49	1900	149.52	0100	149.51
28	149.40	2000	149.49	0100	149.44
29	149.40	0100	149.52	2400	149.42
30	149.55	0100	150.28	2400	149.88
MEAN					149.18
SE					0.036

Table A-3 (cont.)

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
MAY					
1	150.32	0100	150.62	1100	150.53
2	150.04	2200	150.44	0100	150.21
3	149.86	2000	150.01	0100	149.93
4	149.64	2400	149.83	0100	149.76
5	149.46	2400	149.64	0100	149.56
6	149.34	2200	149.46	0100	149.40
7	149.25	1900	149.34	0100	149.29
8	149.13	1800	149.22	0100	149.17
9	149.04	2300	149.13	0100	149.08
10	149.04	0100	149.04	0100	149.04
11	149.04	0100	149.04	0100	149.04
12	149.07	0100	149.43	2300	149.23
13	149.46	0100	149.55	1800	149.52
14	149.55	0100	149.74	1600	149.67
15	149.58	1400	149.71	0100	149.64
16	149.71	0100	150.04	2400	149.83
17	150.07	0100	150.22	2300	150.13
18	150.01	2400	150.22	0100	150.14
19	149.77	2300	150.01	0100	149.89
20	149.55	2200	149.77	0100	149.64
21	149.37	2200	149.52	0100	149.45
22	149.22	2200	149.37	0100	149.28
23	149.13	1800	149.22	0100	149.16
24	149.04	1900	149.10	0100	149.07
25	148.97	1900	149.04	0100	149.00
26	148.88	2000	148.97	0100	148.92
27	148.82	2400	148.88	0100	148.86
28	148.79	1300	148.82	0100	148.81
29	148.76	1200	148.79	0100	148.78
30	148.73	0100	148.73	0100	148.73
31	148.73	0100	148.73	0100	148.73
MEAN					149.40
SE					0.087

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JUN					
1	148.73	0100	148.73	0100	148.73
2	148.73	0100	148.85	2400	148.76
3	148.85	0100	148.94	1400	148.92
4	148.94	0100	148.94	0100	148.94
5	148.91	1800	148.97	0100	148.95
6	148.88	0100	148.91	1800	148.89
7	148.82	2000	148.91	0100	148.87
8	148.76	1300	148.82	0100	148.78
9	148.76	0100	148.76	0100	148.76
10	148.73	0100	148.73	0100	148.73
11	148.64	2100	148.73	0100	148.68
12	148.64	0100	148.67	1900	148.65
13	148.67	0100	148.67	0100	148.67
14	148.67	0100	148.70	0300	148.70
15	148.70	0100	148.85	2400	148.78
16	148.85	0100	149.25	2400	148.97
17	149.31	0100	149.77	0900	149.64
18	149.16	2400	149.58	0100	149.34
19	149.07	2400	149.16	0100	149.13
20	149.00	2400	149.07	0100	149.04
21	148.97	0600	149.04	2100	148.99
22	148.97	1100	149.04	0100	149.00
23	149.04	0100	149.40	2300	149.22
24	149.28	2100	149.40	0100	149.34
25	149.10	2300	149.28	0100	149.18
26	148.97	2100	149.10	0100	149.03
27	148.88	1800	148.97	0100	148.91
28	148.82	0700	148.85	0100	148.84
29	148.88	0100	148.88	0100	148.88
30	148.82	1700	148.88	0100	148.85
MEAN					148.94
SE					0.042

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
JUL					
1	148.70	1900	148.79	0100	148.75
2	148.67	0100	148.67	0100	148.67
3	148.64	0400	148.67	0100	148.64
4	148.61	0100	148.67	2200	148.63
5	148.61	1600	148.67	0100	148.64
6	148.61	0100	148.70	2400	148.64
7	148.64	1900	148.70	0100	148.67
8	148.67	0100	148.76	0900	148.74
9	148.61	2000	148.70	0100	148.65
10	148.55	2300	148.61	0100	148.58
11	148.49	2400	148.55	0100	148.53
12	148.46	1300	148.49	0100	148.47
13	148.43	0100	148.43	0100	148.43
14	148.43	0100	148.43	0100	148.43
15	148.36	1300	148.39	0100	148.38
16	148.33	2300	148.36	0100	148.36
17	148.30	1300	148.33	0100	148.32
18	148.27	0700	148.30	0100	148.28
19	148.27	0100	148.27	0100	148.27
20	148.27	0100	148.39	2300	148.32
21	148.39	0100	148.43	1900	148.40
22	148.43	0100	148.46	1200	148.44
23	148.43	0100	148.43	0100	148.43
24	148.36	1300	148.43	0100	148.38
25	148.36	0100	148.39	1600	148.37
26	148.39	0100	148.43	0700	148.42
27	148.43	0100	148.43	0100	148.43
28	148.39	1800	148.43	0100	148.42
29	148.39	0100	148.39	0100	148.39
30	148.33	1500	148.39	0100	148.36
31	148.33	0100	148.33	0100	148.33
MEAN					148.46
SE					0.025

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
AUG					
1	148.33	0100	148.39	1800	148.36
2	148.43	0100	148.43	0100	148.43
3	148.36	1600	148.43	0100	148.39
4	148.33	1400	148.36	0100	148.35
5	148.33	0100	148.39	1300	148.36
6	148.33	0600	148.36	0100	148.36
7	148.33	0100	148.52	2400	148.41
8	148.46	2100	148.52	0100	148.49
9	148.39	2300	148.46	0100	148.43
10	148.39	0100	148.49	2400	148.40
11	148.49	0100	148.52	0500	148.51
12	148.43	2200	148.52	0100	148.47
13	148.36	1200	148.43	0100	148.38
14	148.36	0100	148.36	0100	148.36
15	148.36	0100	148.36	0100	148.36
16	148.36	0100	148.36	0100	148.36
17	148.39	0100	148.39	0100	148.39
18	148.39	0100	148.39	0100	148.39
19	148.36	2100	148.39	0100	148.39
20	148.33	1200	148.36	0100	148.35
21	148.30	0900	148.33	0100	148.32
22	148.27	1900	148.30	0100	148.29
23	148.27	0100	148.27	0100	148.27
24	148.27	0100	148.27	0100	148.27
25	148.27	0100	148.27	0100	148.27
26	148.21	2200	148.27	0100	148.24
27	148.21	0100	148.21	0100	148.21
28	148.21	0100	148.21	0100	148.21
29	148.21	0100	148.21	0100	148.21
30	148.21	0100	148.21	0100	148.21
31	148.21	0100	148.21	0100	148.21
MEAN					148.34
SE					0.015

Table A-3 (cont.)

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
SEP					
1	148.21	0100	148.21	0100	148.21
2	148.18	0700	148.21	0100	148.19
3	148.18	0100	148.18	0100	148.18
4	148.18	0100	148.18	0100	148.18
5	148.18	0100	148.18	0100	148.18
6	148.18	0100	148.21	0300	148.21
7	148.21	0100	148.27	2100	148.23
8	148.30	0100	148.36	2300	148.32
9	148.36	0100	148.52	2100	148.43
10	148.52	0100	148.55	2300	148.54
11	148.55	0100	148.67	1000	148.64
12	148.64	2100	148.67	0100	148.67
13	148.58	1700	148.64	0100	148.61
14	148.52	2300	148.58	0100	148.55
15	148.46	2400	148.52	0100	148.50
16	148.43	1300	148.46	0100	148.44
17	148.36	1600	148.43	0100	148.39
18	148.33	1400	148.36	0100	148.36
19	148.39	0100	148.43	0700	148.42
20	148.43	0100	148.43	0100	148.43
21	148.43	0100	148.43	0100	148.43
22	148.39	0700	148.43	0100	148.40
23	148.36	1900	148.39	0100	148.39
24	148.36	0100	148.36	0100	148.36
25	148.36	0100	148.36	0100	148.36
26	148.39	0100	148.97	2400	148.64
27	149.00	0100	149.13	1400	149.09
28	148.94	2400	149.10	0100	149.02
29	148.82	2200	148.94	0100	148.89
30	148.79	0400	148.82	0100	148.79
MEAN					148.47
SE					0.044

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
OCT					
1	148.79	0100	148.82	1500	148.81
2	148.82	0100	148.82	0100	148.82
3	148.76	1400	148.82	0100	148.79
4	148.76	0100	148.82	2400	148.77
5	148.82	0100	148.91	2100	148.87
6	148.91	0100	148.97	1900	148.94
7	149.00	0100	149.00	0100	149.00
8	148.94	0800	148.97	0100	148.96
9	148.97	0100	149.25	2300	149.07
10	149.25	0100	149.43	1800	149.38
11	--	--	--	--	-- [a]
12	--	--	--	--	--
13	149.10	2300	149.25	0100	149.17
14	149.00	2400	149.10	0100	149.06
15	148.91	2200	149.00	0100	148.96
16	148.82	2400	148.91	0100	148.87
17	148.76	2200	148.82	0100	148.79
18	148.76	0100	148.76	0100	148.76
19	148.76	0100	148.76	0100	148.76
20	148.70	1900	148.73	0100	148.72
21	148.67	1000	148.70	0100	148.68
22	148.67	0100	148.67	0100	148.67
23	148.67	0100	148.67	0100	148.67
24	148.64	1600	148.70	0100	148.67
25	148.64	0100	148.64	0100	148.64
26	148.67	0100	148.79	2300	148.71
27	148.79	0100	148.91	2400	148.86
28	148.91	0100	149.58	2400	149.07
29	149.77	0100	152.11	2100	151.43
30	151.35	2400	152.11	0100	151.73
31	150.74	2400	151.35	0100	151.04
MEAN					149.13
SE					0.150

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
NOV					
1	150.28	2400	150.71	0100	150.48
2	150.01	2100	150.25	0100	150.11
3	149.77	2300	149.98	0100	149.87
4	149.55	2400	149.77	0100	149.66
5	149.43	1400	149.55	0100	149.47
6	149.31	2400	149.43	0100	149.38
7	149.28	0900	149.31	0100	149.30
8	149.28	0100	149.34	2000	149.30
9	149.37	0100	149.40	1500	149.39
10	149.37	1300	149.40	0100	149.39
11	149.31	1800	149.37	0100	149.34
12	149.22	2100	149.31	0100	149.26
13	149.13	1800	149.22	0100	149.17
14	149.07	1800	149.13	0100	149.09
15	149.04	0100	149.04	0100	149.04
16	149.04	0100	149.22	2400	149.10
17	149.22	0100	150.22	2400	149.72
18	150.07	2400	150.32	0500	150.23
19	149.74	2300	150.04	0100	149.87
20	149.64	2200	149.74	0100	149.68
21	149.64	0100	149.77	2400	149.67
22	149.80	0100	149.95	1000	149.89
23	149.71	1900	149.83	0100	149.75
24	149.55	2400	149.71	0100	149.63
25	149.43	2200	149.55	0100	149.50
26	149.34	2200	149.43	0100	149.39
27	149.25	1500	149.34	0100	149.28
28	149.19	1800	149.25	0100	149.21
29	149.16	0100	149.16	0100	149.16
30	149.16	0100	149.16	0100	149.16
MEAN					149.52
SE					0.066

DATE	MINIMUM	(TIME)	MAXIMUM	(TIME)	MEAN
DEC					
1	149.16	0100	149.16	0100	149.16
2	149.19	0100	149.19	0100	149.19
3	149.19	0100	149.19	0100	149.19
4	149.19	0100	149.28	1900	149.24
5	149.28	0100	149.31	1300	149.29
6	149.28	1100	149.31	0100	149.30
7	149.22	1600	149.28	0100	149.24
8	149.19	0100	149.19	0100	149.19
9	149.19	0100	149.19	0100	149.19
10	149.19	0100	149.22	0300	149.21
11	149.16	2100	149.22	0100	149.19
12	149.04	2400	149.13	0100	149.10
13	149.04	0100	149.04	0100	149.04
14	149.04	0100	149.04	0100	149.04
15	149.04	0100	149.04	0100	149.04
16	149.00	0400	149.04	0100	149.03
17	148.94	2100	148.97	0100	148.97
18	148.94	0100	148.94	0100	148.94
19	148.88	1000	148.91	0100	148.89
20	148.79	1300	148.85	0100	148.82
21	148.70	1500	148.82	0100	148.75
22	148.64	1000	148.76	0100	148.69
23	148.70	0200	148.85	2400	148.74
24	148.85	0100	149.68	2400	149.14
25	149.77	0100	150.01	1500	149.84
26	149.77	2300	149.98	0100	149.89
27	149.58	2300	149.77	0100	149.68
28	149.43	2200	149.58	0100	149.50
29	149.34	2400	149.40	0100	149.38
30	149.28	2300	149.34	0100	149.32
31	149.19	2300	149.28	0100	149.24
MEAN					149.17
SE					0.051

[a] Recorder malfunction

Table A-4

Daily mean flow (m^3/s) of the Susquehanna River at the Susquehanna SES Biological Laboratory, 1981.

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	137	92	862	200	969	153	156	70	45	174	940	284
2	124	146	847	231	779	161	137	82	41	177	722	295
3	120	253	772	262	620	206	131	75	40	167	593	295
4	108	235	673	268	536	214	128	67	40	163	486	313
5	116	179	575	281	444	214	128	70	40	192	407	335
6	111	189	504	281	377	198	130	69	44	212	370	336
7	112	245	458	266	335	191	138	80	48	233	337	315
8	106	253	415	254	288	165	154	95	63	218	339	295
9	96	221	397	253	258	161	133	83	83	255	372	295
10	95	203	379	244	243	153	115	78	107	369	371	305
11	98	413	367	230	243	140	104	100	131	--	353	297
12	102	2390	353	233	311	131	91	90	136	--	323	263
13	104	2193	343	243	426	137	82	74	122	290	288	243
14	102	1791	331	257	496	144	82	70	108	250	260	243
15	104	1484	318	283	461	165	73	70	98	220	243	243
16	102	1331	318	315	570	222	70	70	85	192	263	241
17	100	1276	306	318	730	478	62	76	75	170	518	221
18	100	1337	293	312	737	351	55	76	69	161	787	214
19	104	1675	272	306	599	276	54	75	81	161	593	199
20	104	1983	247	314	483	246	61	68	82	150	500	177
21	99	2527	233	301	396	229	77	63	82	140	494	158
22	101	2768	218	275	331	233	86	58	77	137	604	143
23	96	2479	214	246	287	306	82	54	75	137	534	155
24	95	2515	214	257	254	353	74	54	70	137	477	279
25	94	2665	204	320	233	294	72	54	70	129	418	576
26	101	1929	204	402	206	241	81	49	131	148	371	599
27	100	1480	180	424	190	204	82	45	261	188	328	497
28	96	1118	169	393	173	182	80	45	239	255	305	419
29	91		169	305	165	195	76	45	197	1644	284	369
30	84		177	598	153	186	69	45	170	1905	284	347
31	81		195		153		65	45		1333		314
MEAN	103	1263	361	298	402	218	94	67	97	341	439	299
SE	2.0	180.2	35.4	14.3	37.7	14.1	5.5	2.7	10.4	84.3	30.6	19.4

Table A-5

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, January 1981.

	SSES	BELL BEND
DATE	29 JAN	29 JAN
TIME	1312	1252
RIVER LEVEL (M ABOVE MSL)	148.49	
DISCHARGE (M^3/S)	96	
TEMPERATURE (C)		
AIR	1.0	1.0
WATER	0.0	0.0
WEATHER	OVERCAST	OVERCAST
TURBIDITY (NTU)	5.3	5.8
OXYGEN		
DISSOLVED (MG/L)	11.20	11.40
PERCENT SATURATION	77	78
TOTAL ALKALINITY (MG/L)	82	82
PH	7.3	7.3
SPECIFIC CONDUCTANCE		
AT 25 C (μMHOS/CM)	400	400
SULFATE (MG/L)	72	70
IRON (MG/L)		
TOTAL	1.75	1.76
DISSOLVED	1.44	1.43
PERCENT DISSOLVED	82	81
RESIDUE (MG/L)		
TOTAL	238	237
FIXED TOTAL	197	178
NONFILTRABLE	1	2
FILTRABLE	237	235

Table A-6

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, February 1981.

SSES

DATE	12 FEB	18 FEB	26 FEB		
TIME	1230	1311	1310		
RIVER LEVEL(M ABOVE MSL)	152.33	151.05	151.72		
DISCHARGE(M^3/S)	2485	1339	1895		
TEMPERATURE(C)					
AIR	-1.0	9.5	5.0		
WATER	0.0	2.5	5.0		
WEATHER	SUNNY	P.CLOUDY	OVERCAST		
				MEAN	SE
SECCHI DISC(CM)	5	31	19	18	6.5
TURBIDITY(NTU)	170	23	34	76	40.9
OXYGEN					
DISSOLVED(MG/L)	12.50	12.75	11.80	12.35	0.246
PERCENT SATURATION	88	94	93	92	1.6
TOTAL ALKALINITY(MG/L)	21	28	22	24	1.9
PH	7.1	7.2	7.1	7.1	0.03
SPECIFIC CONDUCTANCE					
AT 25 C(µMHOS/CM)	115	145	120	127	8.0
SULFATE(MG/L)	16	25	14	18	2.9
IRON(MG/L)					
TOTAL	18.70	2.48	3.45	8.21	4.549
DISSOLVED	0.34	0.36	0.40	0.37	0.015
PERCENT DISSOLVED	2	15	12	10	3.4
RESIDUE(MG/L)					
TOTAL	660	136	162	319	147.7
FIXED TOTAL	581	113	122	272	133.8
NONFILTRABLE	532	47	63	214	137.8
FILTRABLE	128	89	99	105	10.1

BELL BEND

DATE	12 FEB	18 FEB	26 FEB		
TIME	1248	1257	1300		
TEMPERATURE(C)					
AIR	-1.0	9.5	5.0		
WATER	0.0	2.5	5.0		
WEATHER	SUNNY	P.CLOUDY	OVERCAST		
				MEAN	SE
SECCHI DISC(CM)	5	31	19	18	6.5
TURBIDITY(NTU)	170	23	34	76	40.9
OXYGEN					
DISSOLVED(MG/L)	12.55	12.80	11.80	12.38	0.261
PERCENT SATURATION	89	95	93	92	1.5
TOTAL ALKALINITY(MG/L)	22	28	22	24	1.7
PH	7.1	7.1	7.1	7.1	0.00
SPECIFIC CONDUCTANCE					
AT 25 C(µMHOS/CM)	115	140	120	125	6.6
SULFATE(MG/L)	16	25	14	18	2.9
IRON(MG/L)					
TOTAL	17.10	2.49	3.40	7.66	4.093
DISSOLVED	0.44	0.35	0.40	0.40	0.023
PERCENT DISSOLVED	3	14	12	10	2.9
RESIDUE(MG/L)					
TOTAL	590	140	158	296	127.4
FIXED TOTAL	509	114	112	245	114.3
NONFILTRABLE	459	48	65	191	116.3
FILTRABLE	131	92	93	105	11.1

Table A-7

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, March 1981.

SSES

DATE	4 MAR	13 MAR	18 MAR	24 MAR		
TIME	1317	1236	1314	1312		
RIVER LEVEL(M ABOVE MSL)	150.05	149.31	149.19	148.95		
DISCHARGE(M^3/S)	684	343	297	215		
TEMPERATURE(C)						
AIR	5.5	9.5	1.0	9.0		
WATER	3.0	4.5	3.0	5.0		
WEATHER	P.CLOUDY	P.CLOUDY	SUNNY	P.CLOUDY		
					MEAN	SE
SECCHI DISC(CM)	92	130	115	100	109	7.5
TURBIDITY(NTU)	6.2	4.8	5.3	6.0	5.6	0.3
OXYGEN						
DISSOLVED(MG/L)	12.40	12.10	12.75	13.00	12.56	0.176
PERCENT SATURATION	92	92	93	102	95	2.2
TOTAL ALKALINITY(MG/L)	37	50	53	58	50	4.0
PH	7.2	7.2	7.4	7.4	7.3	0.05
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	182	230	245	268	231	16.3
SULFATE(MG/L)	30	44	48	58	45	5.2
IRON(MG/L)						
TOTAL	1.27	1.30	1.41	1.63	1.40	0.073
DISSOLVED	0.66	0.87	0.94	1.13	0.90	0.087
PERCENT DISSOLVED	52	67	67	69	64	3.5
RESIDUE(MG/L)						
TOTAL	144	156	156	192	162	9.3
FIXED TOTAL	116	115	106	151	122	8.9
NONFILTRABLE	9	4	3	4	5	1.2
FILTRABLE	135	152	153	188	157	10.0

BELL BEND

DATE	4 MAR	13 MAR	18 MAR	24 MAR		
TIME	1325	1246	1324	1322		
TEMPERATURE(C)						
AIR	5.5	9.5	1.0	9.0		
WATER	3.0	4.5	3.0	5.0		
WEATHER	P.CLOUDY	P.CLOUDY	SUNNY	P.CLOUDY		
					MEAN	SE
SECCHI DISC(CM)	92	130	112	100	109	7.4
TURBIDITY(NTU)	5.9	4.7	5.4	6.2	5.6	0.3
OXYGEN						
DISSOLVED(MG/L)	12.45	12.10	12.80	13.00	12.59	0.177
PERCENT SATURATION	92	92	93	102	95	2.2
TOTAL ALKALINITY(MG/L)	37	50	53	57	49	3.9
PH	7.1	7.2	7.4	7.5	7.3	0.08
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	182	230	245	268	231	16.3
SULFATE(MG/L)	28	42	46	54	43	4.9
IRON(MG/L)						
TOTAL	1.27	1.30	1.37	1.66	1.40	0.080
DISSOLVED	0.56	0.86	0.95	1.18	0.89	0.115
PERCENT DISSOLVED	44	66	69	71	63	5.6
RESIDUE(MG/L)						
TOTAL	136	161	154	192	161	10.4
FIXED TOTAL	112	110	104	146	118	8.5
NONFILTRABLE	9	4	3	4	5	1.2
FILTRABLE	127	157	151	188	156	11.2

Table A-8

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, April 1981.

SSES

DATE	1 APR	7 APR	10 APR	14 APR	17 APR	21 APR	24 APR	28 APR		
TIME	1330	1340	1206	1319	1225	1335	1324	1240		
RIVER LEVEL(M ABOVE MSL)	148.89	149.10	149.04	149.10	149.28	149.22	149.07	149.44		
DISCHARGE(M^3/S)	197	265	244	265	331	308	254	392		
TEMPERATURE(C)										
AIR	16.0	13.5	18.0	10.5	13.0	7.5	14.0	12.0		
WATER	11.5	12.0	13.0	11.5	10.5	12.0	12.0	11.5		
WEATHER	OVERCAST	SUNNY	SUNNY	OVERCAST	OVERCAST	SUNNY	OVERCAST	HVY.RAIN		
									MEAN	SE
SECCHI DISC(CM)	60	75	90	100	100	115	105	110	94	6.2
TURBIDITY(NTU)	8.6	7.0	6.3	6.4	5.7	6.0	5.7	4.6	6.3	0.4
OXYGEN										
DISSOLVED(MG/L)	14.70	11.60	10.90	10.30	11.10	11.70	11.70	11.00	11.63	0.444
PERCENT SATURATION	133	109	104	94	99	110	106	101	107	3.9
TOTAL ALKALINITY(MG/L)	62	50	50	49	46	44	43	42	48	2.1
PH	9.0	7.9	7.6	7.4	7.5	7.6	7.5	7.4	7.7	0.18
SPECIFIC CONDUCTANCE										
AT 25 C(μMHOS/CM)	279	225	222	230	205	210	220	197	224	8.3
SULFATE(MG/L)	47	40	40	42	39	40	44	35	41	1.2
IRON(MG/L)										
TOTAL	1.65	1.43	1.41	1.43	1.18	1.26	1.46	1.24	1.38	0.050
DISSOLVED	0.66	0.58	0.63	0.66	0.60	0.57	0.86	0.60	0.65	0.031
PERCENT DISSOLVED	40	41	45	46	51	45	59	48	47	2.0
RESIDUE(MG/L)										
TOTAL	206	152	151	136	128	141	168	144	153	8.1
FIXED TOTAL	140	106	108	114	100	101	119	98	111	4.6
NONFILTRABLE	14	13	12	6	9	8	6	7	9	1.1
FILTRABLE	192	139	139	130	119	133	162	137	144	7.6

BELL BEND

DATE	1 APR	7 APR	10 APR	14 APR	17 APR	21 APR	24 APR	28 APR		
TIME	1342	1330	1213	1312	1217	1328	1315	1247		
TEMPERATURE(C)										
AIR	16.0	13.5	18.0	10.5	13.0	8.5	14.0	12.0		
WATER	11.5	12.0	13.0	11.5	10.5	12.0	12.0	11.5		
WEATHER	OVERCAST	SUNNY	SUNNY	OVERCAST	OVERCAST	SUNNY	OVERCAST	HVY.RAIN		
									MEAN	SE
SECCHI DISC(CM)	60	75	89	100	100	105	108	118	94	6.3
TURBIDITY(NTU)	8.4	6.5	6.4	6.4	5.2	5.9	6.0	4.6	6.2	0.4
OXYGEN										
DISSOLVED(MG/L)	14.50	11.60	11.00	10.20	11.10	11.80	11.70	11.15	11.63	0.422
PERCENT SATURATION	132	109	105	93	99	110	106	102	107	3.8
TOTAL ALKALINITY(MG/L)	62	50	50	49	45	44	44	42	48	2.1
PH	8.9	7.9	7.6	7.5	7.6	7.6	7.5	7.4	7.8	0.16
SPECIFIC CONDUCTANCE										
AT 25 C(μMHOS/CM)	280	225	220	228	205	203	220	194	222	8.8
SULFATE(MG/L)	47	39	40	42	38	39	43	34	40	1.3
IRON(MG/L)										
TOTAL	1.64	1.41	1.40	1.39	1.30	1.22	1.40	1.11	1.36	0.052
DISSOLVED	0.62	0.57	0.62	0.64	0.58	0.55	0.86	0.59	0.63	0.033
PERCENT DISSOLVED	38	40	44	46	45	45	61	53	47	2.4
RESIDUE(MG/L)										
TOTAL	196	166	154	136	128	148	174	145	156	7.3
FIXED TOTAL	143	107	112	104	100	97	114	102	110	4.9
NONFILTRABLE	17	14	9	7	10	8	6	7	10	1.3
FILTRABLE	179	152	145	129	118	140	168	138	146	6.6

Table A-9

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, May 1981.

SSES

DATE	1 MAY	5 MAY	8 MAY	12 MAY	15 MAY	19 MAY	22 MAY	26 MAY	29 MAY		
TIME	1203	1322	1218	1252	1240	1245	1215	1330	1205		
RIVER LEVEL (M ABOVE MSL)	150.62	149.56	149.16	149.25	149.59	149.89	149.28	148.92	148.76		
DISCHARGE (M^3/S)	1034	444	286	319	457	603	331	206	162		
TEMPERATURE (C)											
AIR	14.0	19.5	14.5	13.5	21.0	18.0	27.0	25.0	23.5		
WATER	12.5	14.5	14.5	16.5	17.0	14.0	17.0	21.0	21.0		
WEATHER	P.CLOUDY	SUNNY	SUNNY	OVERCAST	OVERCAST	P.CLOUDY	SUNNY	OVERCAST	P.CLOUDY		
										MEAN	SE
SECCHI DISC (CM)	50	69	94	64	88	36	75	60	55	66	5.8
TURBIDITY (NTU)	23	6.4	5.2	11	7.3	28	11	12	12	13	2.4
OXYGEN											
DISSOLVED (MG/L)	9.20	9.90	10.60	9.00	9.70	8.60	9.90	10.40	7.90	9.47	0.276
PERCENT SATURATION	85	96	104	91	99	83	102	116	87	96	3.4
TOTAL ALKALINITY (MG/L)	34	33	41	45	45	34	37	47	50	41	2.0
PH	7.2	7.2	7.4	7.2	7.4	7.2	7.2	8.0	7.4	7.4	0.08
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	155	172	200	222	187	158	189	235	253	197	10.8
SULFATE (MG/L)	26	32	45	46	30	30	38	48	54	39	3.1
IRON (MG/L)											
TOTAL	2.39	1.35	1.37	1.71	1.24	2.76	1.88	1.82	2.14	1.85	0.161
DISSOLVED	0.24	0.52	0.73	0.52	0.42	0.41	0.72	0.17	0.53	0.47	0.060
PERCENT DISSOLVED	10	39	53	30	34	15	38	9	25	28	4.7
RESIDUE (MG/L)											
TOTAL	153	125	153	150	138	152	152	184	196	156	6.9
FIXED TOTAL	102	99	111	108	101	124	104	108	130	110	3.4
NONFILTRABLE	48	14	7	12	15	41	17	16	16	21	4.4
FILTRABLE	105	111	146	138	123	111	135	168	180	135	8.2

BELL BEND

DATE	1 MAY	5 MAY	8 MAY	12 MAY	15 MAY	19 MAY	22 MAY	26 MAY	29 MAY		
TIME	1208	1315	1225	1259	1248	1235	1225	1340	1215		
TEMPERATURE (C)											
AIR	14.0	19.5	15.0	13.5	21.0	18.5	27.0	25.0	23.5		
WATER	12.5	14.5	14.5	16.5	17.0	14.0	17.0	21.0	21.0		
WEATHER	P.CLOUDY	SUNNY	SUNNY	OVERCAST	OVERCAST	P.CLOUDY	SUNNY	OVERCAST	P.CLOUDY		
										MEAN	SE
SECCHI DISC (CM)	50	68	100	68	88	40	77	60	55	67	6.0
TURBIDITY (NTU)	19	6.5	5.0	10	7.3	29	12	12	13	13	2.3
OXYGEN											
DISSOLVED (MG/L)	9.20	9.85	10.60	9.00	9.75	8.60	10.05	10.60	7.95	9.51	0.284
PERCENT SATURATION	85	96	104	91	100	83	104	118	88	97	3.5
TOTAL ALKALINITY (MG/L)	34	34	40	45	45	34	38	46	50	41	1.9
PH	7.2	7.2	7.2	7.3	7.5	7.2	7.2	8.1	7.3	7.4	0.09
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	155	169	205	220	189	158	189	235	260	198	11.3
SULFATE (MG/L)	25	32	44	45	30	30	38	48	56	39	3.2
IRON (MG/L)											
TOTAL	2.19	1.38	1.39	1.60	1.20	2.84	1.89	1.80	2.22	1.83	0.164
DISSOLVED	0.22	0.49	0.71	0.52	0.38	0.41	0.70	0.22	0.52	0.46	0.056
PERCENT DISSOLVED	10	36	51	32	32	14	37	12	23	27	4.3
RESIDUE (MG/L)											
TOTAL	151	126	158	168	135	158	153	182	188	158	6.3
FIXED TOTAL	101	96	112	114	98	128	106	114	136	112	4.3
NONFILTRABLE	44	13	10	12	15	44	19	14	18	21	4.2
FILTRABLE	107	113	148	156	120	114	134	168	170	137	7.8

Table A-10

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, June 1981.

SSES

DATE	2 JUN	5 JUN	9 JUN	12 JUN	16 JUN	19 JUN	23 JUN	26 JUN	30 JUN		
TIME	1323	1229	1302	1215	1200	1235	1328	1252	1252		
RIVER LEVEL (M ABOVE MSL)	148.76	148.95	148.76	148.64	148.92	149.16	149.25	149.04	148.86		
DISCHARGE (M^3/S)	162	215	162	130	206	286	319	244	188		
TEMPERATURE (C)											
AIR	16.5	22.0	23.0	26.5	29.5	28.5	20.0	17.5	29.5		
WATER	21.0	21.0	22.0	22.5	24.0	24.5	23.0	21.5	23.5		
WEATHER	OVERCAST	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY		
										MEAN	SE
SECCHI DISC (CM)	42	42	41	50	42	22	38	43	47	41	2.5
TURBIDITY (NTU)	15	20	15	13	17	56	21	21	12	21	4.3
OXYGEN											
DISSOLVED (MG/L)	8.90	8.00	9.85	9.70	7.80	6.10	8.35	8.00	10.40	8.57	0.41
PERCENT SATURATION	100	89	110	111	92	73	96	90	122	98	4.6
TOTAL ALKALINITY (MG/L)	55	56	57	54	54	46	53	47	54	53	1.2
PH	7.4	7.5	7.9	7.6	7.5	7.3	7.6	7.4	8.0	7.6	0.07
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	282	260	278	283	270	220	230	222	255	256	8.1
SULFATE (MG/L)	62	48	53	58	52	43	52	42	46	51	2.1
IRON (MG/L)											
TOTAL	2.09	2.46	1.90	2.12	2.30	4.08	2.38	2.18	1.69	2.36	0.218
DISSOLVED	0.22	0.29	0.25	0.39	0.46	0.45	0.39	0.50	0.39	0.37	0.031
PERCENT DISSOLVED	11	12	13	18	20	11	16	23	23	16	1.5
RESIDUE (MG/L)											
TOTAL	207	198	204	218	200	216	185	179	184	199	4.4
FIXED TOTAL	139	146	151	146	146	156	134	131	136	143	2.6
NONFILTRABLE	18	30	19	20	24	62	32	28	19	28	4.4
FILTRABLE	189	168	185	198	176	154	153	151	165	171	5.4

BELL BEND

DATE	2 JUN	5 JUN	9 JUN	12 JUN	16 JUN	19 JUN	23 JUN	26 JUN	30 JUN		
TIME	1331	1237	1255	1222	1210	1244	1321	1244	1305		
TEMPERATURE (C)											
AIR	16.5	22.0	23.0	26.5	28.0	28.5	20.0	17.5	29.5		
WATER	21.0	21.0	22.0	22.5	24.0	24.5	23.0	21.5	23.5		
WEATHER	OVERCAST	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY		
										MEAN	SE
SECCHI DISC (CM)	42	41	45	50	45	25	36	45	45	42	2.3
TURBIDITY (NTU)	15	18	14	12	14	54	21	20	12	20	4.2
OXYGEN											
DISSOLVED (MG/L)	9.10	8.25	9.85	9.90	8.00	6.15	8.50	8.00	10.60	8.71	0.422
PERCENT SATURATION	102	92	110	114	94	73	98	90	124	100	4.8
TOTAL ALKALINITY (MG/L)	55	55	58	55	54	47	52	49	55	53	1.1
PH	7.4	7.5	7.9	7.8	7.4	7.3	7.6	7.4	7.9	7.6	0.07
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	285	260	282	288	270	220	230	222	253	257	8.6
SULFATE (MG/L)	60	48	53	63	54	42	42	42	46	50	2.5
IRON (MG/L)											
TOTAL	2.16	2.41	1.82	2.02	2.33	3.92	2.29	2.08	1.72	2.31	0.205
DISSOLVED	0.20	0.28	0.23	0.39	0.43	0.45	0.34	0.48	0.53	0.37	0.036
PERCENT DISSOLVED	9	12	13	19	18	11	15	23	31	17	2.2
RESIDUE (MG/L)											
TOTAL	198	208	207	208	208	224	189	182	189	201	4.1
FIXED TOTAL	134	144	142	150	154	156	132	126	142	142	3.2
NONFILTRABLE	21	28	19	20	23	56	30	27	20	27	3.6
FILTRABLE	177	180	188	188	185	168	159	155	169	174	3.9

Table A-11

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, July 1981.

SSES

DATE	2 JUL	7 JUL	10 JUL	14 JUL	17 JUL	21 JUL	24 JUL	28 JUL	31 JUL		
TIME	1308	1258	1257	1348	1205	1353	1323	1324	1320		
RIVER LEVEL (M ABOVE MSL)	148.67	148.67	148.58	148.43	148.34	148.40	148.37	148.40	148.34		
DISCHARGE (M^3/S)	138	138	116	83	66	77	71	77	66		
TEMPERATURE (C)											
AIR	24.0	30.0	30.5	22.5	24.0	21.5	26.5	21.5	28.0		
WATER	23.0	25.0	27.5	27.0	26.0	26.0	24.5	23.5	24.0		
WEATHER	OVERCAST	SUNNY	P.CLOUDY	SUNNY	SUNNY	HVY.RAIN	P.CLOUDY	OVERCAST	SUNNY		
										MEAN	SE
SECCHI DISC (CM)	55	48	40	56	45	60	44	48	45	49	2.1
TURBIDITY (NTU)	12	11	11	7.4	8.8	7.0	11	8.5	11	9.7	0.6
OXYGEN											
DISSOLVED (MG/L)	8.45	10.05	9.80	10.10	11.05	7.30	9.70	8.05	11.50	9.56	0.436
PERCENT SATURATION	98	120	123	124	135	88	116	94	137	115	5.6
TOTAL ALKALINITY (MG/L)	61	63	71	63	67	63	53	66	69	64	1.7
PH	7.7	7.6	8.2	7.9	8.0	7.4	7.2	7.3	8.1	7.7	0.11
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	280	285	317	347	380	285	348	355	390	332	13.2
SULFATE (MG/L)	57	58	60	80	88	98	79	74	88	76	4.7
IRON (MG/L)											
TOTAL	1.71	1.53	1.57	1.27	1.73	1.19	1.74	1.95	1.98	1.63	0.086
DISSOLVED	0.42	0.19	0.14	0.12	0.17	0.15	0.36	0.22	0.18	0.22	0.033
PERCENT DISSOLVED	25	12	9	9	10	13	21	11	9	13	1.8
RESIDUE (MG/L)											
TOTAL	208	214	206	248	264	282	260	242	290	246	9.9
FIXED TOTAL	155	142	146	190	200	199	180	176	214	178	8.1
NONFILTRABLE	14	14	16	13	16	10	14	15	16	14	0.6
FILTRABLE	194	200	190	235	248	272	246	227	274	232	10.1

BELL BEND

DATE	2 JUL	7 JUL	10 JUL	14 JUL	17 JUL	21 JUL	24 JUL	28 JUL	31 JUL		
TIME	1316	1250	1247	1356	1210	1359	1316	1332	1329		
TEMPERATURE (C)											
AIR	24.0	30.0	30.5	22.5	24.0	21.5	26.5	21.5	28.0		
WATER	23.0	25.0	27.5	27.0	26.0	26.0	24.0	23.5	24.0		
WEATHER	OVERCAST	SUNNY	P.CLOUDY	SUNNY	SUNNY	HVY.RAIN	P.CLOUDY	OVERCAST	SUNNY		
										MEAN	SE
SECCHI DISC (CM)	52	48	43	59	45	55	46	50	45	49	1.7
TURBIDITY (NTU)	12	11	10	7.2	7.8	7.2	10	8.5	11	9.4	0.6
OXYGEN											
DISSOLVED (MG/L)	8.50	10.00	9.80	9.30	11.05	6.90	9.75	8.00	10.50	9.31	0.411
PERCENT SATURATION	99	119	123	114	135	83	117	94	125	112	5.3
TOTAL ALKALINITY (MG/L)	60	62	71	65	67	63	54	66	70	64	1.7
PH	7.6	7.7	8.3	7.8	8.1	7.4	7.2	7.2	7.6	7.7	0.12
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	275	292	320	347	377	290	343	348	392	332	12.7
SULFATE (MG/L)	54	56	57	80	87	99	80	74	87	75	5.1
IRON (MG/L)											
TOTAL	1.62	1.74	1.45	1.24	1.43	1.38	1.94	2.03	2.04	1.65	0.095
DISSOLVED	0.37	0.20	0.11	0.11	0.15	0.16	0.40	0.20	0.17	0.21	0.033
PERCENT DISSOLVED	23	11	8	9	10	12	21	10	8	12	1.8
RESIDUE (MG/L)											
TOTAL	214	234	210	258	268	273	250	245	296	250	8.8
FIXED TOTAL	154	145	147	192	208	224	172	177	207	181	9.1
NONFILTRABLE	14	15	16	13	14	11	13	17	16	14	0.6
FILTRABLE	200	219	194	245	254	262	237	228	280	235	9.0

Table A-12

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, August 1981.

SSES

DATE	4 AUG	7 AUG	11 AUG	14 AUG	18 AUG	21 AUG	25 AUG	28 AUG		
TIME	1321	1321	1311	1228	1323	1317	1250	1205		
RIVER LEVEL (M ABOVE MSL)	148.34	148.43	148.52	148.37	148.40	148.31	148.28	148.22		
DISCHARGE (M^3/S)	66	83	102	71	77	60	55	45		
TEMPERATURE (C)										
AIR	27.0	27.0	29.5	28.0	22.5	25.5	21.0	26.0		
WATER	25.5	25.0	26.5	25.0	23.5	24.5	23.0	23.5		
WEATHER	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	SUNNY	SUNNY	P.CLOUDY	OVERCAST		
									MEAN	SE
SECCHI DISC (CM)	38	39	30	32	32	35	34	32	34	1.1
TURBIDITY (NTU)	15	12	16	15	16	16	14	15	15	0.5
OXYGEN										
DISSOLVED (MG/L)	9.50	9.10	9.90	9.00	10.20	8.60	6.95	7.70	8.87	0.366
PERCENT SATURATION	115	108	122	108	119	103	81	90	106	4.7
TOTAL ALKALINITY (MG/L)	74	63	62	60	56	58	58	52	60	2.2
PH	7.8	7.4	8.0	7.6	7.8	7.4	7.3	7.1	7.6	0.10
SPECIFIC CONDUCTANCE										
AT 25 C (μMHOS/CM)	370	382	350	343	368	380	415	428	[illegible]	9.8
SULFATE (MG/L)	76	87	74	77	74	86	104	110	[illegible]	4.7
IRON (MG/L)										
TOTAL	1.97	2.16	2.52	2.45	2.74	2.77	2.68	2.76	2.51	0.100
DISSOLVED	0.13	0.19	0.25	0.22	0.28	0.35	0.27	0.30	0.25	0.023
PERCENT DISSOLVED	7	9	10	9	10	13	10	11	10	0.6
RESIDUE (MG/L)										
TOTAL	290	284	254	[illegible]	242	264	300	317	274	9.2
FIXED TOTAL	195	195	168	[illegible]	186	188	218	237	195	7.6
NONFILTRABLE	19	21	24	21	24	22	18	20	21	0.7
FILTRABLE	271	263	230	223	218	242	282	297	253	9.7

BELL BEND

DATE	4 AUG	7 AUG	11 AUG	14 AUG	18 AUG	21 AUG	25 AUG	28 AUG		
TIME	1311	1314	1320	1223	1331	1310	1240	1214		
TEMPERATURE (C)										
AIR	27.0	27.0	29.5	28.0	22.5	25.5	21.0	26.0		
WATER	25.5	25.0	26.5	25.0	23.5	24.5	23.0	23.5		
WEATHER	P.CLOUDY	P.CLOUDY	P.CLOUDY	P.CLOUDY	SUNNY	SUNNY	P.CLOUDY	OVERCAST		
									MEAN	SE
SECCHI DISC (CM)	38	40	30	32	31	35	32	37	34	1.2
TURBIDITY (NTU)	13	11	15	14	14	14	14	14	14	0.4
OXYGEN										
DISSOLVED (MG/L)	8.80	9.00	9.85	8.60	10.30	8.60	6.60	7.35	8.64	0.402
PERCENT SATURATION	106	107	121	103	121	103	76	86	103	5.2
TOTAL ALKALINITY (MG/L)	74	63	62	62	58	58	57	53	61	2.1
PH	7.8	7.4	7.8	7.6	7.9	7.4	7.4	7.3	7.6	0.08
SPECIFIC CONDUCTANCE										
AT 25 C (μMHOS/CM)	374	375	355	348	365	382	415	430	381	9.5
SULFATE (MG/L)	76	86	74	75	74	82	102	108	85	4.5
IRON (MG/L)										
TOTAL	1.80	1.96	2.46	2.37	2.55	2.41	2.63	2.53	2.34	0.099
DISSOLVED	0.12	0.17	0.26	0.23	0.29	0.34	0.25	0.27	0.24	0.023
PERCENT DISSOLVED	7	9	11	10	11	14	10	11	10	0.7
RESIDUE (MG/L)										
TOTAL	280	314	256	246	246	271	301	326	280	10.3
FIXED TOTAL	187	192	178	170	174	176	208	238	190	7.6
NONFILTRABLE	18	18	24	20	21	20	19	17	20	0.7
FILTRABLE	262	296	232	226	225	251	282	309	260	10.9

Table A-13

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, September 1981.

SSES

DATE	1 SEP	4 SEP	8 SEP	11 SEP	15 SEP	18 SEP	22 SEP	25 SEP	29 SEP		
TIME	1250	1220	1245	1235	1335	1220	1328	1239	1330		
RIVER LEVEL (M ABOVE MSL)	148.22	148.19	148.34	148.67	148.52	148.37	148.40	148.37	148.89		
DISCHARGE (M^3/S)	45	41	66	138	102	71	77	71	196		
TEMPERATURE (C)											
AIR	22.0	23.0	22.5	26.5	20.0	21.0	19.0	23.0	13.5		
WATER	23.0	22.0	22.0	20.5	22.0	20.0	18.0	16.0	15.5		
WEATHER	HVY.RAIN	OVERCAST	LT.RAIN	P.CLOUDY	OVERCAST	OVERCAST	LT.RAIN	SUNNY	OVERCAST		
										MEAN	SE
SECCHI DISC (CM)	38	41	40	34	50	50	58	60	68	49	3.6
TURBIDITY (NTU)	14	14	12	14	8.4	7.7	8.1	8.5	8.2	11	0.9
OXYGEN											
DISSOLVED (MG/L)	5.20	5.70	7.30	9.50	8.10	7.60	8.40	9.05	9.20	7.78	0.479
PERCENT SATURATION	60	65	82	105	92	83	88	92	92	84	4.5
TOTAL ALKALINITY (MG/L)	56	62	69	87	78	72	73	78	70	72	2.9
PH	7.0	7.0	7.1	7.6	7.6	7.4	7.3	7.3	7.8	7.3	0.09
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	463	491	485	412	350	384	370	395	275	403	22.0
SULFATE (MG/L)	120	120	110	56	57	72	66	76	34	79	9.7
IRON (MG/L)											
TOTAL	2.69	2.61	2.56	2.70	1.77	1.91	2.03	1.96	1.61	2.20	0.137
DISSOLVED	0.39	0.49	0.46	0.20	0.38	0.49	0.74	0.37	0.43	0.44	0.045
PERCENT DISSOLVED	14	19	18	7	21	26	36	19	27	21	2.6
RESIDUE (MG/L)											
TOTAL	344	345	342	290	243	244	270	252	174	278	18.4
FIXED TOTAL	254	260	248	204	171	178	196	170	114	199	15.2
NONFILTRABLE	14	13	16	25	14	12	8	9	14	14	1.5
FILTRABLE	330	332	326	265	229	232	262	243	160	264	18.1

BELL BEND

DATE	1 SEP	4 SEP	8 SEP	11 SEP	15 SEP	18 SEP	22 SEP	25 SEP	29 SEP		
TIME	1305	1210	1230	1245	1343	1210	1336	1232	1320		
TEMPERATURE (C)											
AIR	22.0	23.0	22.5	26.5	20.0	21.0	19.0	23.0	11.0		
WATER	23.0	22.0	22.0	20.5	22.0	20.0	18.0	15.5	15.5		
WEATHER	HVY.RAIN	OVERCAST	LT.RAIN	P.CLOUDY	OVERCAST	OVERCAST	LT.RAIN	SUNNY	OVERCAST		
										MEAN	SE
SECCHI DISC (CM)	38	41	39	31	50	48	60	62	68	49	4.0
TURBIDITY (NTU)	13	14	12	12	7.8	7.7	7.8	8.2	7.7	10	0.8
OXYGEN											
DISSOLVED (MG/L)	5.00	5.45	7.40	9.50	8.10	7.25	8.40	8.90	9.60	7.73	0.519
PERCENT SATURATION	58	62	84	105	92	79	88	89	96	84	4.8
TOTAL ALKALINITY (MG/L)	56	61	70	88	76	72	76	78	68	72	3.0
PH	7.0	6.9	7.1	7.5	7.6	7.4	7.3	7.3	7.8	7.3	0.09
SPECIFIC CONDUCTANCE											
AT 25 C (μMHOS/CM)	458	480	489	418	351	383	372	400	270	402	21.9
SULFATE (MG/L)	118	120	111	54	57	72	67	72	33	78	9.8
IRON (MG/L)											
TOTAL	2.57	2.61	2.51	2.11	1.85	1.99	2.05	1.94	1.53	2.13	0.116
DISSOLVED	0.41	0.44	0.44	0.19	0.37	0.46	0.61	0.40	0.38	0.41	0.035
PERCENT DISSOLVED	16	17	18	9	20	23	30	21	25	20	1.9
RESIDUE (MG/L)											
TOTAL	329	336	352	276	229	252	280	260	175	277	17.8
FIXED TOTAL	248	262	250	196	166	170	192	184	114	198	15.2
NONFILTRABLE	14	14	14	18	15	12	9	10	14	13	0.9
FILTRABLE	315	322	338	258	214	240	271	250	161	263	17.8

Table A-14

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, October 1981.

SSES						
DATE	6 OCT	14 OCT	21 OCT	28 OCT		
TIME	1300	1313	1318	1322		
RIVER LEVEL(M ABOVE MSL)	148.95	149.07	148.67	149.13		
DISCHARGE (M^3/S)	215	254	138	275		
TEMPERATURE(C)						
AIR	17.0	15.0	17.5	14.5		
WATER	13.5	11.5	10.0	11.5		
WEATHER	OVERCAST	SUNNY	SUNNY	P.CLOUDY		
					MEAN	SE
SECCHI DISC(CM)	80	87	140	49	89	16.9
TURBIDITY(NTU)	7.0	6.2	5.3	11	7.4	1.1
OXYGEN						
DISSOLVED(MG/L)	9.70	10.50	10.90	9.50	10.15	0.296
PERCENT SATURATION	92	97	98	87	94	2.3
TOTAL ALKALINITY(MG/L)	68	56	68	65	64	2.5
PH	7.6	7.6	7.6	7.5	7.6	0.02
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	278	225	297	270	268	13.6
SULFATE(MG/L)	35	29	52	38	39	4.4
IRON(MG/L)						
TOTAL	1.43	1.32	1.45	2.22	1.61	0.185
DISSOLVED	0.56	0.53	0.95	0.60	0.66	0.087
PERCENT DISSOLVED	39	40	66	27	43	7.3
RESIDUE(MG/L)						
TOTAL	174	148	191	176	172	8.0
FIXED TOTAL	116	108	146	144	129	8.7
NONFILTRABLE	10	10	3	19	11	2.9
FILTRABLE	164	138	188	157	162	9.2

BELL BEND						
DATE	6 OCT	14 OCT	21 OCT	28 OCT		
TIME	1309	1323	1325	1332		
TEMPERATURE(C)						
AIR	17.0	15.0	17.5	14.5		
WATER	13.5	11.5	10.0	11.5		
WEATHER	OVERCAST	SUNNY	SUNNY	P.CLOUDY		
					MEAN	SE
SECCHI DISC(CM)	82	90	140	49	90	16.8
TURBIDITY(NTU)	7.4	6.2	5.2	11	7.5	1.1
OXYGEN						
DISSOLVED(MG/L)	9.70	10.50	10.90	9.60	10.18	0.281
PERCENT SATURATION	92	97	98	88	94	2.1
TOTAL ALKALINITY(MG/L)	70	56	70	66	66	3.0
PH	7.6	7.7	7.6	7.6	7.6	0.02
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	278	220	297	272	267	14.7
SULFATE(MG/L)	35	28	50	37	38	4.1
IRON(MG/L)						
TOTAL	1.47	1.38	1.48	2.37	1.68	0.208
DISSOLVED	0.56	0.52	0.93	0.66	0.67	0.083
PERCENT DISSOLVED	38	38	63	28	42	6.7
RESIDUE(MG/L)						
TOTAL	169	144	194	174	170	9.2
FIXED TOTAL	114	100	138	128	120	7.4
NONFILTRABLE	13	12	4	22	13	3.3
FILTRABLE	156	132	190	152	158	10.8

Table A-15

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, November 1981.

	SSES					
DATE	4 NOV	11 NOV	18 NOV	25 NOV		
TIME	1328	1307	1330	1340		
RIVER LEVEL(M ABOVE MSL)	149.65	149.34	150.26	149.50		
DISCHARGE(M^3/S)	485	355	805	417		
TEMPERATURE(C)						
AIR	14.5	9.0	11.0	3.5		
WATER	10.0	7.0	6.5	4.0		
WEATHER	SUNNY	P.CLOUDY	OVERCAST	SUNNY		
					MEAN	SE
SECCHI DISC(CM)	33	110	20	70	58	18.1
TURBIDITY(NTU)	17	5.9	34	11	17	5.5
OXYGEN						
DISSOLVED(MG/L)	10.20	11.30	11.00	12.00	11.13	0.333
PERCENT SATURATION	91	93	88	92	91	1.0
TOTAL ALKALINITY(MG/L)	49	61	46	46	51	3.2
PH	7.4	7.6	7.5	7.4	7.5	0.04
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	203	240	199	209	213	8.3
SULFATE(MG/L)	27	31	24	30	28	1.4
IRON(MG/L)						
TOTAL	1.67	0.99	3.27	1.21	1.79	0.461
DISSOLVED	0.39	0.54	0.39	0.52	0.46	0.036
PERCENT DISSOLVED	23	55	12	43	33	8.7
RESIDUE(MG/L)						
TOTAL	148	148	180	124	150	10.3
FIXED TOTAL	97	108	147	98	113	10.5
NONFILTRABLE	23	6	53	8	23	9.7
FILTRABLE	125	142	127	116	128	4.8

	BELL BEND					
DATE	4 NOV	11 NOV	18 NOV	25 NOV		
TIME	1320	1316	1315	1330		
TEMPERATURE(C)						
AIR	14.5	9.0	11.0	3.5		
WATER	10.0	7.0	6.5	4.0		
WEATHER	SUNNY	P.CLOUDY	OVERCAST	SUNNY		
					MEAN	SE
SECCHI DISC(CM)	33	110	20	70	58	18.1
TURBIDITY(NTU)	17	5.6	32	11	16	5.1
OXYGEN						
DISSOLVED(MG/L)	10.20	11.40	11.05	12.05	11.18	0.345
PERCENT SATURATION	91	94	88	92	91	1.1
TOTAL ALKALINITY(MG/L)	49	62	46	46	51	3.4
PH	7.4	7.7	7.5	7.4	7.5	0.06
SPECIFIC CONDUCTANCE						
AT 25 C(μMHOS/CM)	205	240	201	207	213	8.1
SULFATE(MG/L)	26	30	24	29	27	1.2
IRON(MG/L)						
TOTAL	1.67	0.96	3.06	1.20	1.72	0.420
DISSOLVED	0.38	0.53	0.36	0.49	0.44	0.037
PERCENT DISSOLVED	23	55	12	41	33	8.5
RESIDUE(MG/L)						
TOTAL	146	146	175	125	148	9.2
FIXED TOTAL	94	108	136	96	109	8.7
NONFILTRABLE	23	6	51	7	22	9.4
FILTRABLE	123	140	124	118	126	4.3

Table A-16

Physicochemical data collected at SSES and Bell Bend on the Susquehanna River, December 1981.

SSES							
DATE	2 DEC	9 DEC	16 DEC	22 DEC	29 DEC		
TIME	1358	1329	1325	1335	1228		
RIVER LEVEL(M ABOVE MSL)	149.19	149.19	149.01	148.64	149.37		
DISCHARGE(M^3/S)	297	297	234	130	367		
TEMPERATURE(C)							
AIR	4.5	1.0	0.5	1.5	5.5		
WATER	3.0	2.5	0.5	0.0	1.0		
WEATHER	FOG	OVERCAST	P.CLOUDY	OVERCAST	OVERCAST		
						MEAN	SE
SECCHI DISC(CM)	140	180	235	210	103	174	21.6
TURBIDITY(NTU)	5.6	3.9	3.3	4.6	6.4	4.8	0.5
OXYGEN							
DISSOLVED(MG/L)	12.50	12.90	13.70	13.90	13.60	13.32	0.242
PERCENT SATURATION	92	94	95	95	96	94	0.6
TOTAL ALKALINITY(MG/L)	57	52	56	62	40	53	3.4
PH	7.5	7.3	7.6	7.5	7.4	7.5	0.05
SPECIFIC CONDUCTANCE							
AT 25 C(μMHOS/CM)	255	233	260	305	198	250	16.0
SULFATE(MG/L)	42	36	39	32	30	36	2.0
IRON(MG/L)							
TOTAL	1.03	1.02	1.05	1.55	0.96	1.12	0.099
DISSOLVED	0.72	0.74	0.84	1.24	0.58	0.82	0.102
PERCENT DISSOLVED	70	73	80	80	60	73	3.4
RESIDUE(MG/L)							
TOTAL	154	132	156	170	112	145	9.3
FIXED TOTAL	134	107	98	123	84	109	8.1
NONFILTRABLE	4	3	2	2	5	3	0.5
FILTRABLE	150	129	154	168	107	142	9.7

BELL BEND							
DATE	2 DEC	9 DEC	16 DEC	22 DEC	29 DEC		
TIME	1350	1320	1313	1346	1335		
TEMPERATURE(C)							
AIR	4.5	1.0	0.5	1.5	5.5		
WATER	3.0	2.5	0.5	0.0	1.0		
WEATHER	FOG	OVERCAST	P.CLOUDY	OVERCAST	OVERCAST		
						MEAN	SE
SECCHI DISC(CM)	140	192	225	210	105	174	20.6
TURBIDITY(NTU)	5.3	3.9	3.1	4.3	6.4	4.6	0.5
OXYGEN							
DISSOLVED(MG/L)	12.50	12.90	13.70	13.90	13.60	13.32	0.242
PERCENT SATURATION	92	94	95	95	96	94	0.6
TOTAL ALKALINITY(MG/L)	57	52	56	62	40	53	3.4
PH	7.5	7.3	7.6	7.6	7.4	7.5	0.05
SPECIFIC CONDUCTANCE							
AT 25 C(μMHOS/CM)	250	231	260	305	200	249	15.8
SULFATE(MG/L)	40	34	38	30	29	34	2.0
IRON(MG/L)							
TOTAL	1.01	0.95	1.05	1.50	0.98	1.10	0.093
DISSOLVED	0.70	0.64	0.85	1.18	0.55	0.78	0.101
PERCENT DISSOLVED	69	67	81	79	56	70	4.1
RESIDUE(MG/L)							
TOTAL	152	128	157	169	108	143	10.0
FIXED TOTAL	112	108	104	110	76	102	6.1
NONFILTRABLE	4	3	2	2	5	3	0.5
FILTRABLE	148	125	155	167	103	140	10.4

Table A-17

Summary of physicochemical data collected at SSES and Bell Bend on the Susquehanna River, 1981.

PARAMETER	SSES				BELL BEND			
	MINIMUM	MAXIMUM	MEAN	SE	MINIMUM	MAXIMUM	MEAN	SE
SECCHI DISC(CM)	5	235	65	13.4	5	225	65	13.4
TURBIDITY(NTU)	3.3	170	16	5.6	3.1	170	16	5.6
OXYGEN								
DISSOLVED(MG/L)	5.20	14.70	10.55	0.505	5.00	14.50	10.55	0.517
PERCENT SATURATION	60	137	96	2.9	58	135	96	2.7
TOTAL ALKALINITY(MG/L)	21	87	55	4.3	22	88	55	4.4
PH	7.0	9.0	7.5	0.05	6.9	8.9	7.5	0.05
SPECIFIC CONDUCTANCE								
AT 25 C(μMHOS/CM)	115	491	273	25.2	115	489	273	25.3
SULFATE(MG/L)	14	120	51	6.4	14	120	50	6.3
IRON								
TOTAL(MG/L)	0.96	18.70	2.32	0.549	0.95	17.10	2.24	0.504
DISSOLVED(MG/L)	0.12	1.44	0.59	0.099	0.11	1.43	0.58	0.098
PERCENT DISSOLVED	2	82	37	7.3	3	81	36	7.1
RESIDUE(MG/L)								
TOTAL	112	660	208	17.5	108	590	206	16.7
FIXED TOTAL	84	581	156	14.9	76	509	150	13.4
NONFILTRABLE	1	532	30	16.9	2	459	28	14.9
FILTRABLE	89	332	177	15.7	92	338	178	16.0

Table A-18

Results of Wilcoxon signed rank test comparing concurrent physicochemical data at SSES and Bell Bend on the Susquehanna River, 1981.

Parameter	No. of Samples With Unequal Values	No. of Sample Values Greater at SSES	No. of Sample Values Greater at Bell Bend	Z Score
Water temperature	2	2	0	1.41 NS
Secchi disc (cm)	37	15	22	1.71 NS
Turbidity (NTU)	49	38	11	4.25 ***
Oxygen				
Dissolved (mg/l)	46	18	28	0.09 NS
Percent saturation	38	16	22	0.34 NS
Total alkalinity (mg/l)	34	12	22	1.95 NS
pH	31	14	17	0.24 NS
Specific conductance				
at 25 C (μmhos/cm)	47	22	25	0.07 NS
Sulfate (mg/l)	48	41	7	4.45 ***
Iron (mg/l)				
Total	68	43	25	2.67 **
Dissolved	66	51	15	3.77 ***
Percent dissolved	54	36	18	2.18 *
Residue (mg/l)				
Total	70	29	41	1.02 NS
Fixed total	69	42	27	2.73 **
Nonfiltrable	47	22	25	0.45 NS
Filtrable	70	29	41	1.30 NS

N.S. = Not Significant
* = $P<0.05$
** = $P<0.01$
*** = $P<0.001$

Table A-19

Results of Wilcoxon signed rank test comparing concurrent physicochemical data at SSES and Bell Bend on the Susquehanna River, 1978-81.

Parameter	No. of Samples With Unequal Values	No. of Sample Values Greater at SSES	No. of Sample Values Greater at Bell Bend	Z Score
Water temperature	11	8	3	1.55 NS
Secchi disc (cm)	170	61	109	2.96 **
Turbidity (NTU)	198	144	54	6.32 ***
Oxygen				
Dissolved (mg/l)	219	86	133	2.62 **
Percent saturation	183	76	107	1.41 NS
Total Alkalinity (mg/l)	150	65	85	2.12 *
pH	120	57	63	1.14 NS
Specific conductance at 25 C (μmhos/cm)	198	105	93	1.15 NS
Sulfate (mg/l)	184	133	51	5.87 ***
Iron (mg/l)				
Total	288	197	91	6.70 ***
Dissolved	268	188	80	5.86 ***
Percent dissolved	228	125	103	0.85 NS
Residue (mg/l)				
Total	273	102	171	4.51 ***
Fixed total	277	152	125	2.42 *
Nonfiltrable	208	111	97	0.91 NS
Filtrable	264	105	159	3.21 **

N.S. = Not Significant
* = $P<0.05$
** = $P<0.01$
*** = $P<0.001$

Table A-20

Summary of physicochemical data collected at SSES (1973-81) and Bell Bend (1978-81) on the Susquehanna River.

	SSES				BELL BEND			
PARAMETER	MINIMUM	MAXIMUM	MEAN	SE	MINIMUM	MAXIMUM	MEAN	SE
SECCHI DISC (CM)	2	235	69	3.1	4	225	72	5.4
TURBIDITY (NTU)	3.3	1600	30	2.9	3.1	450	18	2.7
OXYGEN								
DISSOLVED (MG/L)	5.20	14.95	10.86	0.162	5.00	14.50	10.86	0.249
PERCENT SATURATION	60	177	98	1.0	58	157	98	1.3
TOTAL ALKALINITY (MG/L)	12	87	43	1.8	16	88	53	1.8
PH	6.4	9.0	7.3	0.03	6.6	8.9	7.4	0.03
SPECIFIC CONDUCTANCE AT 25 C (μMHOS/CM)	76	575	268	8.8	74	525	282	13.6
SULFATE (MG/L)	8	224	60	2.6	9	158	59	4.3
IRON								
TOTAL (MG/L)	0.96	52.80	2.79	0.131	0.83	22.50	2.33	0.174
DISSOLVED (MG/L)	0.01	5.88	0.54	0.044	0.01	2.23	0.64	0.060
PERCENT DISSOLVED	0	98	25	1.9	0	92	34	3.1
RESIDUE (MG/L)								
TOTAL	100	1490	187	8.3	107	710	216	8.8
FIXED TOTAL	72	1380	141	6.4	74	670	159	6.6
NONFILTRABLE	1	1090	37	4.5	1	649	28	5.4
FILTRABLE	61	346	81	9.6	55	346	183	9.0

Table A-21

Summary of water chemistry data collected from four major acid mine drainages upriver from the Susquehanna SES, 1972-80. Data were provided by the Pennsylvania Department of Environmental Resources, Wilkes-Barre, Pennsylvania.

Year	pH	Alkalinity (mg/l)	Acidity (mg/l) (at pH 8)	Sulfate (mg/l)	Total Iron (mg/l)
			OLD FORGE BOREHOLE		
1972	5.5	--	136	1010	74
1973	5.2	35	300	1500	175
1974	5.6	63	191	968	59
1975	5.6	47	44	739	44
1976	5.0	44	59	664	42
1977	6.2	94	84	671	36
1978	6.0	78	37	965	30
1979	6.1	69	31	645	33
1980	6.1	82	17	660	37
			DURYEA OUTFALL		
1972	5.8	--	110	970	70
1973	5.5	35	315	1450	160
1974	5.8	87	53	904	47
1975	5.7	51	70	749	44
1976	6.1	51	46	582	40
1977	6.5	77	71	572	34
1978	5.9	70	44	571	38
1979	6.1	68	31	605	32
1980	6.1	82	23	630	39
			SOUTH WILKES-BARRE OUTFALL		
1972	4.9	--	700	2420	257
1973	4.0	10	705	2410	330
1974	4.9	20	586	2440	267
1975	4.9	40	384	1789	178
1976	5.8	47	181	1121	123
1977	6.1	59	228	1420	127
1978	5.9	54	4[illegible]2	1629	152
1979	6.0	56	285	1350	128
1980	5.9	67	251	1321	148
			BUTTONWOOD TUNNEL		
1972	5.5	--	350	1850	168
1973	5.0	35	440	1840	220
1974	5.4	41	265	1571	147
1975	5.7	51	311	1523	142
1976	5.6	54	191	1210	102
1977	5.9	64	204	1221	73
1978	5.9	67	133	1090	79
1979	5.9	73	170	971	80
1980	6.1	86	156	1118	94

Table A-22

Regression equations of selected physicochemical parameters at SSES on the Susquehanna River, 1981.

Variable		Regression Equation	Corelation Coefficient (r)
Dependent	Independent		
Log flow	Log filtrable residue	$\log Q = 6.912 - 0.332 \log C_{fr}$	0.921
Log flow	Log sulfate	$\log Q = 6.4611 - 0.488 \log C_s$	0.941
Log flow	Log conductance	$\log Q = 7.402 - 0.3457 \log K$	0.958
Conductance	Filtrable residue	$K = 0.3052 + 0.6584\ C_{fr}$	0.953
Conductance	Sulfate	$K = -17.7026 + 0.2579\ C_s$	0.903
Sulfate	Filtrable residue	$C_s = 59.4276 + 2.2965\ C_{fr}$	0.949
Turbidity	Total iron	$C_t = 0.7107 + 0.0994\ C_{tfe}$	0.975
Turbidity	Nonfiltrable residue	$C_t = -17.9825 + 2.9593\ C_{nfr}$	0.972
Nonfiltrable residue	Total iron	$C_{nfr} = 1.3307 + 0.0329\ C_{tfe}$	0.983
Total residue	Fixed total residue	$C_{tr} = -17.2681 + 0.8154\ C_{ftr}$	0.979

Table A-23

Physicochemical data collected from the Susquehanna River at the Susquehanna SES Biological Laboratory by the Pennsylvania Power and Light Company, Hazleton, Pennsylvania, 1981.

SAMPLE NUMBER	211	212	213	214	215	216	217	218	219	220	221	222
DATE	20 JAN	17 FEB	3 MAR	6 APR	26 MAY	15 JUN	14 JUL	3 AUG	21 SEP	19 OCT	10 NOV	14 DEC
TIME	1357	1354	1445	1440	1440	1349	1352	1306	1449	920	1406	1412
RIVER TEMPERATURE(F)	30.2	33.8	35.6	50.0	57.0	69.8	80.5	74.3	52.6	46.4	41.0	28.4
COLOR(PT-CO UNITS)	40.5	25.7	24.3	23.0	12.2	13.5	16.2	29.7	18.9	25.7	17.6	14.9
TURBIDITY(FTU)	4.0	21.0	4.5	7.6	7.0	17.0	5.5	8.0	6.4	4.6	7.1	3.3
PH AT 25 C	7.2	7.3	7.4	8.3	7.5	7.5	8.2	7.7	7.7	7.6	7.7	7.6
SPECIFIC CONDUCTANCE(µMHOS)	405	150	180	245	235	285	350	375	370	270	240	255
ANALYSIS (MG/L)												
SUSPENDED MATTER	3.1	42.9	9.9	14.0	11.8	20.2	3.3	10.9	8.5	7.2	9.3	2.9
AMMONIA NITROGEN	0.19	0.17	0.16	0.12	0.09	0.11	0.11	0.24	0.20	0.24	0.57	0.29
NITRATE NITROGEN	1.84	1.38	1.29	0.68	0.60	0.73	0.26	0.07	0.82	0.85	1.09	0.89
M. O. ALKALINITY	75	23	36	50	42	55	65	73	75	69	65	55
HARDNESS	151.3	49.9	63.9	89.0	81.1	104.0	133.7	136.5	137.4	105.5	92.3	90.0
TOTAL DISSOLVED SOLIDS	245.2	90.0	100.8	135.2	143.0	182.0	234.0	234.4	226.0	158.0	139.0	141.0
LOSS ON IGNITION	76.8	35.4	33.0	49.4	52.0	64.6	69.6	70.8	70.4	53.2	47.6	37.8
SILICON DIOXIDE	1.56	3.60	4.30	0.03	0.64	1.18	0.97	0.54	2.09	1.66	4.78	2.69
CALCIUM	44.2	15.0	19.3	26.7	24.0	29.9	38.0	36.8	39.3	31.8	28.2	26.6
MAGNESIUM	9.9	3.0	3.8	5.4	5.6	7.1	9.4	10.8	9.5	6.3	5.3	5.7
SODIUM	17.6	6.1	5.8	9.2	9.0	11.1	13.3	17.2	15.8	9.0	8.1	9.1
POTASSIUM	2.0	1.7	1.1	1.2	1.4	1.6	1.9	2.2	2.4	1.6	1.6	1.2
BICARBONATE	91.5	28.1	43.9	58.6	51.2	67.1	79.3	89.1	91.5	84.2	79.3	67.1
SULFATE	70.0	20.0	24.0	33.1	36.6	45.0	69.0	67.5	62.5	37.8	26.8	31.0
CHLORIDE	25.5	9.7	9.7	15.2	13.4	17.0	18.8	23.1	21.8	14.0	12.7	15.8
NITRATE	8.16	6.09	5.71	3.01	2.64	3.23	1.13	0.31	3.61	3.77	4.84	3.96
PHOSPHATE	0.22	0.40	0.21	0.25	0.21	0.17	0.10	0.17	0.06	0.19	0.17	0.04
TOTAL MINERAL SOLIDS	270.6	93.7	117.8	153.8	144.7	183.4	231.9	247.6	248.6	190.3	171.8	163.2
DISSOLVED OXYGEN	12.4	12.0	13.5	12.5	9.8	9.0	11.2	12.6	11.1	10.4	12.0	+15
ANALYSIS (ME/L)												
POSITIVE IONS												
CALCIUM	2.21	0.75	0.96	1.33	1.20	1.49	1.90	1.84	1.96	1.59	1.41	1.33
MAGNESIUM	0.81	0.25	0.31	0.44	0.46	0.58	0.77	0.89	0.78	0.52	0.44	0.47
SODIUM	0.77	0.27	0.25	0.40	0.39	0.48	0.58	0.75	0.69	0.39	0.35	0.40
POTASSIUM	0.05	0.04	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.04	0.04	0.03
TOTAL	3.84	1.30	1.56	2.21	2.09	2.60	3.30	3.53	3.49	2.54	2.24	2.22
NEGATIVE IONS												
BICARBONATE	1.50	0.46	0.72	0.96	0.84	1.10	1.30	1.46	1.50	1.38	1.30	1.10
SULFATE	1.46	0.42	0.50	0.69	0.76	0.94	1.44	1.41	1.30	0.79	0.56	0.65
CHLORIDE	0.72	0.27	0.27	0.43	0.38	0.48	0.53	0.65	0.61	0.39	0.36	0.45
NITRATE	0.13	0.10	0.09	0.05	0.04	0.05	0.02	0.00	0.06	0.06	0.08	0.06
PHOSPHATE	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.00
TOTAL	3.81	1.26	1.59	2.13	2.03	2.57	3.29	3.53	3.48	2.63	2.30	2.26
TRACE METAL ANALYSIS (MG/L)												
IRON, TOTAL	1.79	1.47	1.08	1.44	1.22	1.84	0.85	1.16	1.50	1.29	1.18	0.94
IRON, DISSOLVED	0.57	0.24	0.39	0.07	0.12	0.06	<0.05	<0.05	0.23	0.56	0.27	0.61
ALUMINUM, TOTAL	0.1	0.5	0.2	0.2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.3	<0.3
ALUMINUM, DISSOLVED	0.0	0.0	0.0	0.0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
MANGANESE, TOTAL	0.46	0.18	0.14	0.16	0.20	0.30	0.27	0.34	0.31	0.20	0.11	0.18
MANGANESE, DISSOLVED	0.46	0.11	0.12	0.08	0.18	0.18	0.14	0.09	0.26	0.18	0.09	0.17
COPPER, TOTAL	0.05	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
COPPER, DISSOLVED	0.01	0.00	0.00	0.00	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZINC, TOTAL	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.02	0.03
ZINC, DISSOLVED	0.02	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01
NICKEL, TOTAL	0.02	0.02	0.02	0.01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03
NICKEL, DISSOLVED	0.01	0.00	0.02	0.01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

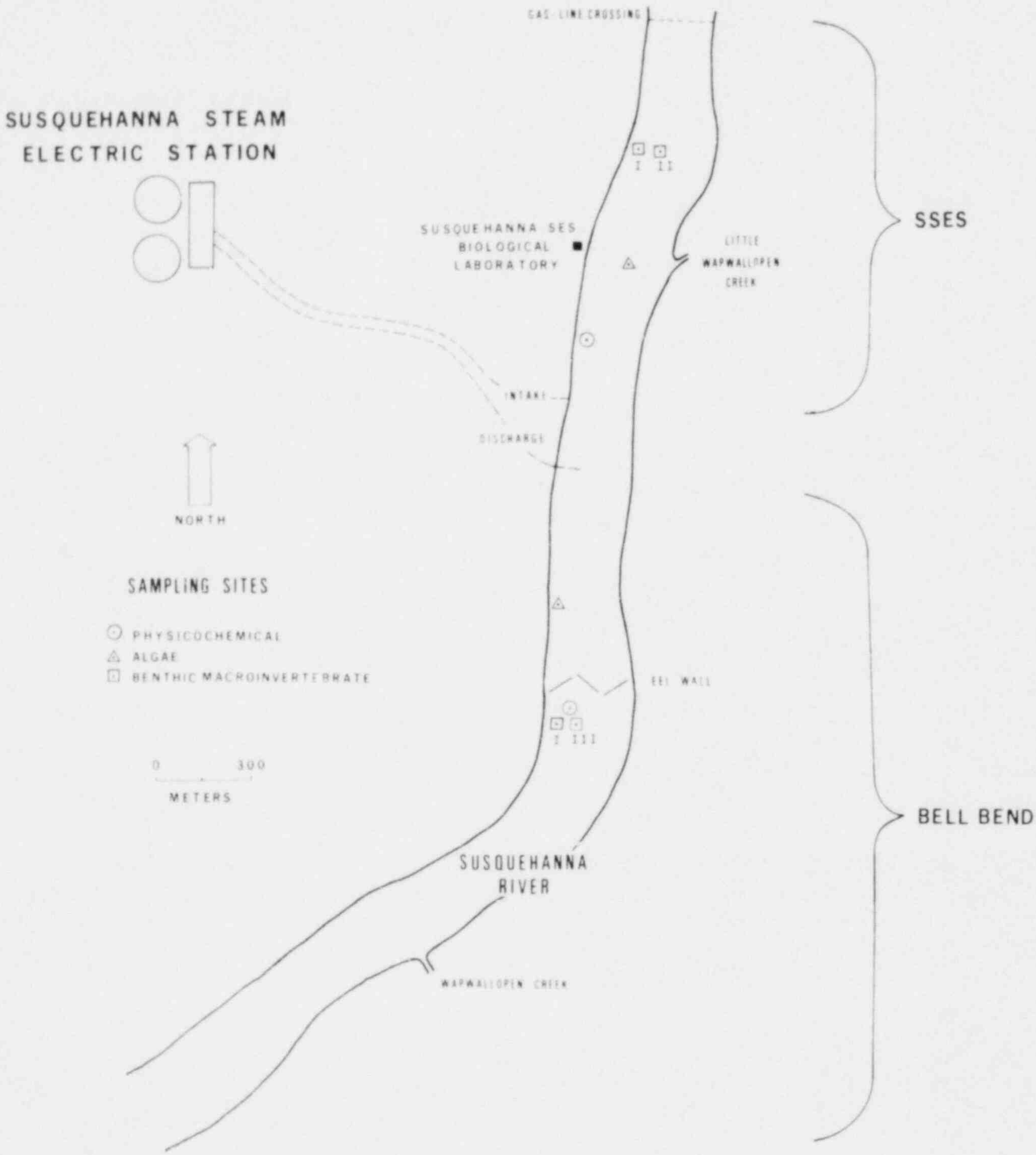

Fig. A-1

Physicochemical, algae, and benthic macroinvertebrate sampling sites at SSES and Bell Bend on the Susquehanna River, 1981.

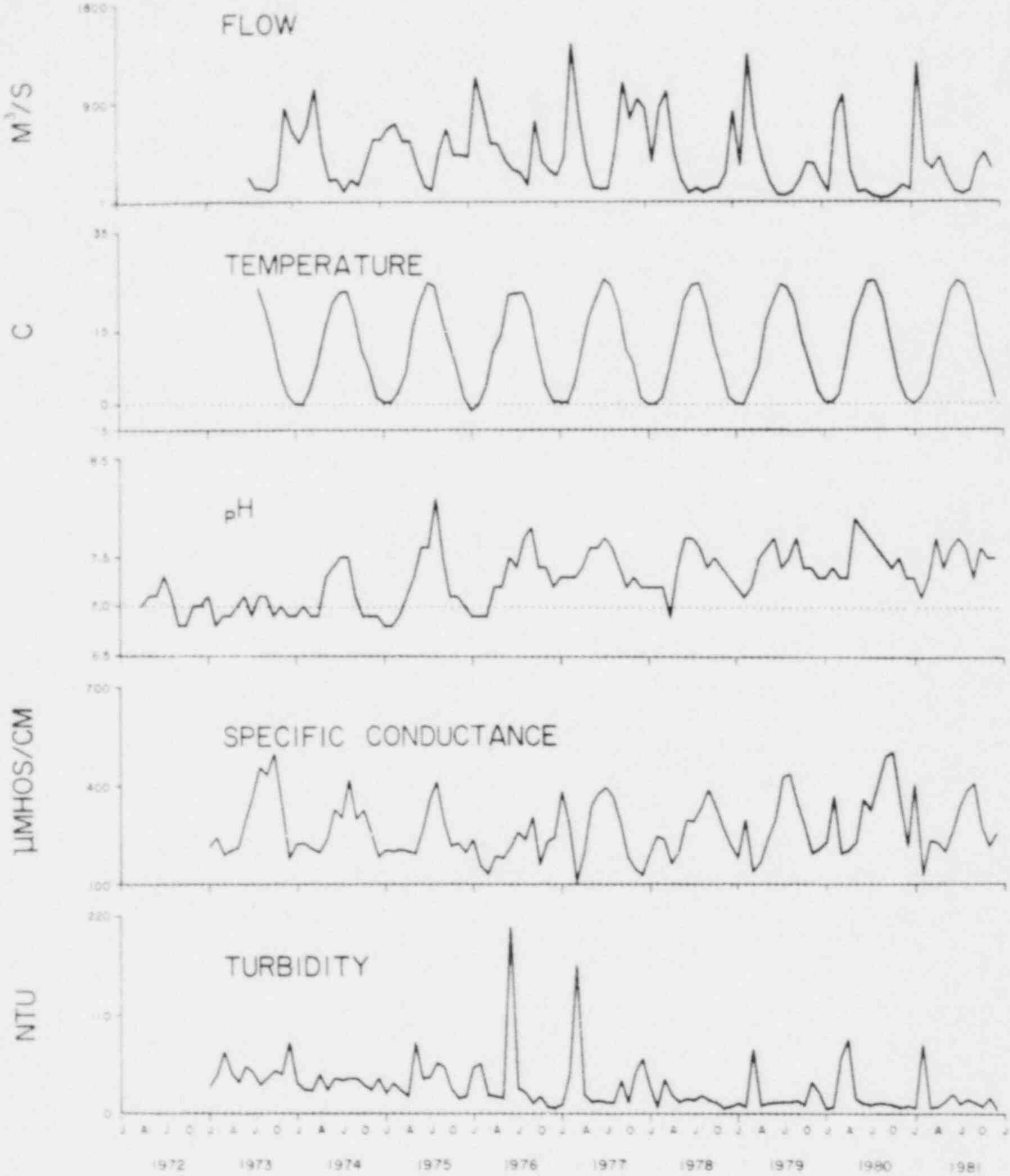

Fig. A-2

Monthly mean flow, temperature, pH, specific conductance, and turbidity of the Susquehanna River from 1972 through 1981. Flow and temperature were monitored at the Susquehanna SES Biological Laboratory; pH, specific conductance, and turbidity were monitored at SSES. Temperature is shown in reference to the freezing point (0 C) and pH to neutrality (7.0).

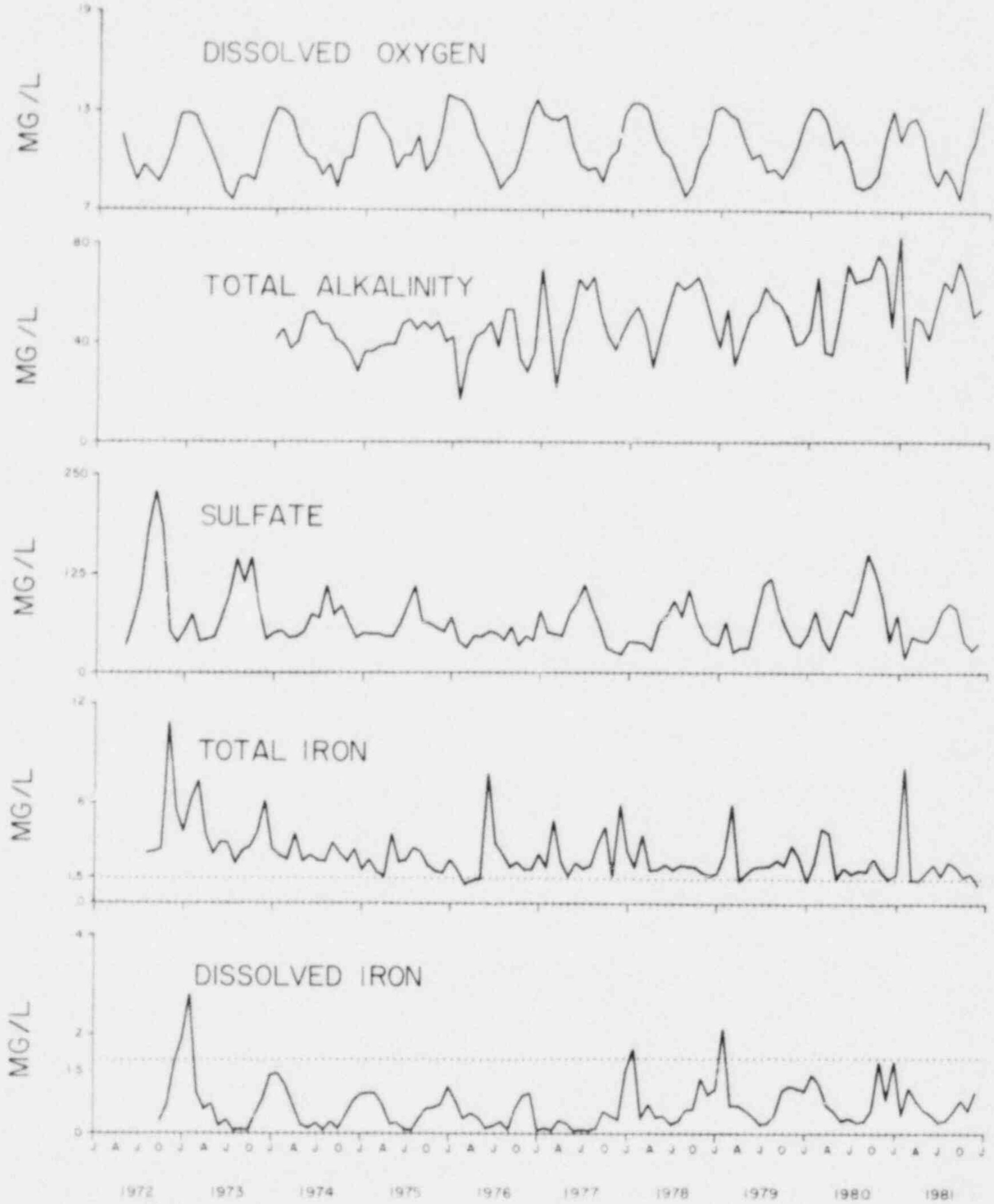

Fig. A-3

Monthly mean concentrations of dissolved oxygen, total alkalinity, sulfate, total iron, and dissolved iron at SSES on the Susquehanna River from 1972 through 1981. Total and dissolved iron are shown in reference to the 1.5 mg/l limit established for the river by the Pennsylvania Department of Environmental Resources.

ALGAE

by

Andrew J. Gurzynski and William F. Gale

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ABSTRACT

Samples of algae (periphyton and phytoplankton) were collected upriver from the Susquehanna SES intake structure (SSES) and downriver from the discharge diffuser (Bell Bend) throughout 1981, as they have been since February 1977. Overall, the mean periphyton density at SSES and Bell Bend in 1981 (2,300 units/mm^2) decreased from the 2,700 units/mm^2 found in 1980. Periphyton density at SSES and Bell Bend in 1981 averaged 1,600 and 2,900 units/mm^2, respectively. Density peaked at both sites in October. Green algae composed 62.8% of the periphyton collected; diatoms composed 36.7%. The upward trend in phytoplankton density continued in 1981 and the mean standing crop at SSES and Bell Bend increased markedly to 25,700 units/ml. Density was highest in June when there was an average of 65,300 units/ml. Diatoms composed 53.9% of the phytoplankton collected; green algae composed 42.0%.

INTRODUCTION

Because algal density in periphyton samples from Susquehanna River stones varied widely in 1973 (Ichthyological Associates 1974), artificial substrates were used to reduce sample variability. Artificial substrates provided a more homogeneous surface for algae to colonize than did river stones. Of five substrates tested in 1974, frosted (sandblasted) acrylic was the most desirable (Gale and Gurzynski 1976).

The basic objective in 1981, as it has been since February 1977, was to describe seasonal changes in the periphyton and phytoplankton communities at two sites near the Susquehanna SES (Fig. A-1). One site (SSES) was 463 m upriver from the Susquehanna SES intake structure and 135 m from the west bank; the other (Bell Bend) was 397 m downriver from the discharge diffuser and 30 m from the west bank.

PROCEDURES

Periphyton

Sandblasted plates of clear acrylic (22 x 30 cm) were held to an acrylic holder (Fig. B-1) on the river substrate by brass pins. The holder lacked projections that would catch drifting detritus. Plates faced upstream at 5^{o} from horizontal to minimize resistance to the current. Holders for the plates were put near the main channel where minimum and maximum water depths ranged in 1981 from 1.9 m to 6.4 m, respectively. The concrete-filled holder, which was too bulky for a scuba diver to manipulate in the current, was lowered to the river substrate on a submersible raft (Gale and Thompson 1974). The holder was held in place by steel stakes driven into the substrate. The stakes and the upriver edge of the holder were covered with small stones to prevent detrital fouling.

In 1981, two plates were sampled at two-month intervals at each site. Three replicate samples were taken from each plate. Slots where plates were removed were filled with clean plates to be sampled later. The schedule for

plate removal was a continuation of a plan established in 1977 by random selection. Ice floes and high river levels resulted in a three week delay in collecting the "February" samples. The February samples were collected on 6 March. Normally, plates had been submerged for 12 months before being sampled. One plate sampled in December (collection numbers AJG-81-097, -098, -099) had been submerged for only eight months. This was a substitute plate used to replace a lost plate in April.

A scuba diver sampled the plates with bar-clamp samplers (Gale 1975). The samplers included a collecting cup which delimited a circular sampling area (415 mm^2) and prevented loss of algal cells while the plate was retrieved from the river and processed in the laboratory.

The sampling area was cleaned by scraping and vibration (Gale 1975) with an ultrasonic dental cleaning probe that loosened almost all cells within a few minutes. Vibration lasted 10 minutes, however, to reduce the chances of missing any cells. Dislodged cells were carried to a collecting jar by water sprayed inside the collecting cup through the cleaning probe. As a result, these cells were not subjected to further vibration. Vibration may have destroyed some cells, but Gale (1975) reported that more cells per unit area were obtained by scraping and vibration than by scraping and brushing. Samples were preserved with formalin and, after settling 10 days, were concentrated to 50 ml by siphoning. One half of the concentrate was sent to Dr. Rex L. Lowe, Department of Biology, Bowling Green State University, Bowling Green, Ohio, for identification and enumeration of algae. The other half of the

concentrate was placed in our reference collection to be retained for at least 12 months.

Phytoplankton

A 1-liter phytoplankton sample was collected near the river surface at each periphyton sampling site on the same days that periphyton samples were collected. After the samples were preserved and allowed to settle for 10 days, the algae in them was concentrated in a manner similar to that employed with periphyton samples. The main difference was that phytoplankton samples, because of their greater initial volume, were siphoned three times instead of once.

Algal cells in periphyton and phytoplankton samples that contained chloroplasts were enumerated in terms of units (Gale and Lowe 1971). In most instances, at least 1,500 units were enumerated and identified in each sample (about 500 per each of 3 subsamples). Extremely low algal densities in some subsamples made it impractical to count 500 units. Counts were made with a microscope (430X) using a 'almer counting cell. Higher magnification, including electron microscopy, was used for some identifications. Algae were identified to genus and the more abundant forms to species using keys by Hustedt (1930) and Prescott (1962).

RESULTS AND DISCUSSION

Periphyton

In 1981, a total of 49 genera of algae was collected in 36 samples from acrylic plates above the intake; 51 genera were found in 36 samples taken below the discharge. Forty-four of the genera were found at both sites. None of the 12 genera that occurred at only one site were abundant and when combined, they composed less than 1% of the total units counted. These data are summarized in Tables B-1 and B-2; raw data are in Tables B-3 through B-14.

At SSES and Bell Bend, 26 species of algae were identified that composed 5% or more of the total units counted, during at least one sampling period (Table B-15). Green algae (Chlorophyta) composed 62.8% of the periphyton at the two sites. Proportionately, green algae was much more abundant in 1981 than it was from 1977-80 (Fig. B-2). The mean standing crop of green algae increased from 800 units/mm^2 in 1980 to 1,400 units/mm^2 in 1981. Much of the increase was due to a sudden increase in the density of *Oocystis parva*, a species that usually occurs in lakes (Prescott 1962). From 1977-80, *O. parva* composed less than 1% of the total standing crop; in 1981, it was abundant at both sites (Tables B-16 and B-17) and composed 54.8% of the total. To assure that Dr. Lowe had not made a mistake in his identification, two samples were sent to Dr. George Schumacher, Department of Biology, State University of New York, Binghamton, New York, to obtain a second opinion. Dr. Schumacher confirmed Dr. Lowe's identification.

The mean standing crop of diatoms (Bacillariophyta) in 1980 (1,900 units/mm^2) decreased to only 800 units/mm^2 in 1981. Much of the decrease was due to a sharp decline in the abundance of *Cyclotella* (primarily *C. meneghiniana* and *C. pseudostelligera*) and *Nitzschia* (several species) (Tables B-16 and B-17). Diatoms were relatively more abundant at Bell Bend (39.4% of the total) than at SSES (31.9% of the total). Overall, diatoms composed 36.7% of the total periphyton at the two sites. In 1980, diatoms composed 68.0% of the total algae collected (Gurzynski and Gale 1981).

Most of the algae found were "clean water" forms and only 4 of the 26 abundant species in the samples were among the 10 species listed by Palmer (1969) most tolerant of heavy organic pollution. These were *Nitzschia palea*, *Scenedesmus quadricauda*, *Synedra ulna*, and *Ankistrodesmus falcatus*. Most of the 20 species of abundant diatoms (Table B-15) were rated as "alkaliphilous" by Lowe (1974); the others were rated "indifferent."

Periphyton was more abundant at Bell Bend in 1981 than it was at SSES. There was an average of 1,600 units/mm^2 on acrylic plates at SSES and 2,900 units/mm^2 at Bell Bend. The largest difference in standing crop at the two sites occurred in April and August, when the density at Bell Bend averaged 5.7-fold greater than at SSES (Fig. B-2). The high standing crop at Bell Bend in April was brought about by an unusual abundance of centric diatoms (*Stephanodiscus invisitatus*) that had settled to the substrate from the water column. Centric diatoms were p rticularly abundant in phytoplankton

samples at both sites in April. Settling was much more pronounced at Bell Bend than at SSES. This was probably a result of the slower water current at Bell Bend.

Overall, the mean density at SSES and Bell Bend in 1981 (2,300 units/ mm^2) decreased from the 2,700 units/mm^2 found in 1980 (Fig. B-2). In 1981, algae was most abundant at SSES and Bell Bend in October, when river levels were low (Fig. B-3) and the water warm. Algae was least abundant in the February sample.

Phytoplankton

Phytoplankton in samples collected at SSES was nearly identical to that in samples taken at Bell Bend (Fig. B-4). There was a total of 47 genera of algae in 6 samples at SSES and 48 genera in 6 samples from Bell Bend (Tables B-18 and B-19). Forty genera were found at both sites.

Fourteen species of phytoplankton composed 5% or more of the total units counted in samples from the two sampling sites during one or more sampling periods (Table B-20). Diatoms composed 53.9% of the phytoplankton collected; green algae composed 42.0%. In 1981, the upward trend in phytoplankton abundance continued and the mean standing crop at both sites increased markedly to 25,700 units/ml. In 1980, it had been 12,600 units/ml. Much of the increase was due to higher densities of diatoms and green algae in April and June (Fig. B-4). Most of the increase was due to a much greater abundance of *Stephanodiscus invisitatus* which increased over 7.4-fold at the

two sites. Three genera of green algae (*Scenedesmus* sp., *Dictyosphaerium* sp., and *Chlamydomonas* sp.) and one bluegreen alga (*Microcystis* sp.) also increased substantially in abundance.

Most of the phytoplankton found were "clean water" forms and only one of the abundant species (*Scenedesmus quadricauda*) was among the 10 species listed by Palmer (1969) most tolerant of heavy organic pollution.

None of the species of abundant diatoms were rated as "acidophilous" by Lowe (1974). Some were rated "indifferent," but most were"alkaliphilous" (Table B-20). Phytoplankton density was very low in winter, but increased over 275-fold by June, when there was an average of 65,300 units/ml at the two sites (Fig. B-4). The density dropped sharply by October when there was an average of 3,100 units/ml at both sites. The density dropped to very low levels in December (100 units/ml), as it usually does in winter.

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Table B-1

Mean density (units/mm^2) of periphytic algae on two (Feb-Dec) acrylic plates at SSES on the Susquehanna River, 1981. Three replicates were taken per plate.

TAXON	6 MAR	15 APR	15 JUN	14 AUG	15 OCT	14 DEC	% TOTAL
CHLOROPHYTA							
ACTINASTRUM	0.0	0.0	1.7	0.3	0.0	0.0	<0.1
ANKISTRODESMUS	0.0	0.9	19.5	22.5	7.4	1.5	0.5
CHLAMYDOMONAS	0.1	0.3	8.9	0.9	0.0	0.0	0.1
CHODATELLA	0.0	0.0	1.7	0.0	0.0	0.0	<0.1
CLOSTERIUM	0.1	0.0	0.0	0.0	2.1	0.3	<0.1
COELASTRUM	0.0	0.0	2.2	9.7	0.0	0.0	0.1
COSMARIUM	0.0	0.0	0.6	1.1	1.1	1.0	<0.1
CRUCIGENIA	0.0	0.0	0.0	0.3	0.0	0.0	<0.1
DICTYOSPHAERIUM	0.0	0.3	5.6	36.2	1.1	0.0	0.4
FRANCEIA	0.0	0.0	5.0	0.6	0.0	0.0	0.1
KIRCHNERIELLA	0.0	0.0	0.6	11.3	2.1	1.8	0.2
MICRACTINIUM	0.0	0.0	1.1	0.0	0.0	0.0	<0.1
OOCYSTIS	0.0	0.0	1611.4	619.3	2829.7	962.4	62.5
PEDIASTRUM	0.0	0.0	1.1	2.7	0.0	0.9	<0.1
SCENEDESMUS	0.0	0.6	86.0	66.8	29.6	6.4	2.0
SELENASTRUM	0.0	0.0	1.1	0.0	0.0	0.0	<0.1
TETRAEDRON	0.0	0.0	2.2	1.5	0.0	0.0	<0.1
TETRASTRUM	0.0	0.0	14.5	1.7	1.1	0.0	0.2
ULOTHRIX	0.0	0.3	0.0	0.0	0.0	0.0	<0.1
UNIDENTIFIED CHLOROPHYTA	0.1	2.2	66.4	36.9	4.2	17.8	1.3
BACILLARIOPHYTA							
ACHNANTHES	0.0	0.3	1.1	0.3	0.0	0.3	<0.1
AMPHORA	0.0	1.9	0.6	0.0	1.1	3.1	0.1
ASTERIONELLA	0.0	1.2	0.0	0.0	0.0	0.0	<0.1
COCCONEIS	0.2	0.0	1.7	0.9	5.3	4.0	0.1
CYCLOTELLA	0.1	6.5	57.0	40.7	47.6	8.7	1.7
CYMBELLA	0.1	9.9	5.6	0.0	9.5	16.6	0.4
DIATOMA	0.1	11.1	0.6	0.3	4.2	4.2	0.2
EUNOTIA	0.0	0.0	0.0	0.0	1.1	0.3	<0.1
FRAGILARIA	0.5	4.0	0.0	0.0	0.0	20.8	0.3
FRUSTULIA	0.0	0.0	0.0	0.0	1.1	3.2	<0.1
GOMPHONEMA	0.0	14.8	3.9	0.6	3.2	18.4	0.4
GYROSIGMA	0.0	0.0	0.0	0.0	0.0	0.3	<0.1
MELOSIRA	0.2	4.6	0.0	1.2	125.7	20.9	1.6
MERIDION	0.1	1.2	1.1	0.0	0.0	0.7	<0.1
NAVICULA	0.3	45.3	22.3	4.0	758.7	400.4	12.8
NITZSCHIA	1.0	94.4	24.0	3.7	160.6	652.5	9.7
PINNULARIA	0.1	0.0	0.0	0.0	0.0	0.3	<0.1
RHOICOSPHENIA	0.0	0.0	0.0	0.0	1.1	0.4	<0.1
STEPHANODISCUS	0.0	188.1	126.2	26.8	0.0	0.0	3.5
SURIRELLA	0.0	0.0	0.0	0.0	0.0	1.7	<0.1
SYNEDRA	0.1	4.9	5.0	0.3	25.4	56.4	1.0
CYANOPHYTA							
CHROOCOCCUS	0.0	0.0	0.0	0.3	0.0	0.0	<0.1
COELOSPHAERIUM	0.0	0.0	0.0	1.7	0.0	0.0	<0.1
MERISMOPEDIA	0.0	0.0	0.0	4.1	0.0	0.0	<0.1
MICROCYSTIS	0.0	0.0	17.3	21.1	0.0	0.0	0.4
OSCILLATORIA	0.0	0.0	0.6	0.0	2.1	0.0	<0.1
SCHIZOTHRIX	0.1	0.3	0.0	0.0	0.0	0.0	<0.1
EUGLENOPHYTA							
TRACHELOMONAS	0.0	0.0	0.0	0.3	0.0	0.4	<0.1
PYRRHOPHYTA							
PERIDINIUM	0.0	0.0	0.0	0.3	0.0	0.0	<0.1
RHODOPHYTA							
RHODOCHORTON	0.0	0.0	0.0	0.0	1.1	0.0	<0.1

Table B-2

Mean density (units/mm^2) of periphytic algae on two (Feb-Dec) acrylic plates at Bell Bend on the Susquehanna River, 1981. Three replicates were taken per plate.

TAXON	6 MAR	16 APR	15 JUN	14 AUG	15 OCT	14 DEC	% TOTAL
CHLOROPHYTA							
ACTINASTRUM	0.0	0.0	2.8	0.7	0.0	0.0	<0.1
ANKISTRODESMUS	0.0	1.3	46.5	79.8	7.4	1.2	0.8
CHLAMYDOMONAS	0.0	0.0	8.0	2.1	0.0	0.6	0.1
CHODATELLA	0.0	0.0	1.1	1.5	0.0	0.0	<0.1
CLOSTERIUM	0.0	0.0	0.0	0.0	0.0	1.1	<0.1
COELASTRUM	0.1	0.7	1.1	110.7	0.0	0.0	0.6
CRUCIGENIA	0.0	0.0	0.0	5.7	0.0	0.6	<0.1
DICTYOSPHAERIUM	0.0	0.0	7.4	183.4	1.1	0.0	1.1
FRANCEIA	0.0	0.0	7.8	0.0	0.0	0.0	<0.1
GOLENKINIA	0.0	0.6	0.0	0.0	0.0	0.0	<0.1
KIRCHNERIELLA	0.0	0.0	2.8	34.0	2.1	0.6	0.2
MICRACTINIUM	0.0	0.0	0.6	0.0	0.0	0.0	<0.1
MOUGEOTIA	0.0	0.0	0.6	0.0	0.0	0.0	<0.1
OOCYSTIS	0.0	0.0	1529.8	1970.3	3534.5	1771.8	50.6
PEDIASTRUM	0.0	0.0	1.1	37.5	1.1	0.0	0.2
SCENEDESMUS	0.1	3.2	218.3	535.4	30.6	14.0	4.6
SELENASTRUM	0.0	0.0	0.6	0.0	0.0	0.0	<0.1
STAURASTRUM	0.0	0.0	0.0	2.5	0.0	0.0	<0.1
TETRAEDRON	0.0	0.0	5.6	3.6	0.0	0.0	0.1
TETRASTRUM	0.0	0.4	31.3	5.1	0.0	0.0	0.2
UNIDENTIFIED CHLOROPHYTA	0.0	5.8	74.4	135.7	13.7	34.3	1.5
BACILLARIOPHYTA							
ACHNANTHES	0.1	1.8	1.1	0.0	0.0	1.7	<0.1
AMPHORA	0.0	25.9	0.0	0.7	1.1	1.9	0.2
ASTERIONELLA	0.1	0.0	0.0	0.0	0.0	1.3	<0.1
COCCONEIS	0.1	2.6	5.0	12.0	13.7	9.0	0.2
CYCLOTELLA	0.0	79.9	218.8	632.2	118.3	18.2	6.1
CYMATOPLEURA	0.0	0.0	0.0	0.0	1.1	0.0	<0.1
CYMBELLA	0.1	49.0	16.9	6.8	9.5	20.5	0.6
DIATOMA	0.1	29.3	0.6	0.0	29.6	32.3	0.5
FRAGILARIA	0.0	26.3	6.1	0.7	0.0	18.2	0.3
FRUSTULIA	0.0	0.0	0.0	0.0	0.0	0.7	<0.1
GOMPHONEMA	0.2	95.6	13.4	4.2	7.4	35.6	0.9
GYROSIGMA	0.0	0.0	0.6	0.0	2.1	0.7	<0.1
MELOSIRA	0.1	4.3	3.9	16.1	94.0	25.8	0.8
MERIDION	0.1	6.1	1.3	0.0	14.8	5.6	0.2
NAVICULA	0.7	67.2	36.7	34.8	355.0	229.5	4.2
NITZSCHIA	1.7	213.1	38.0	19.1	134.2	428.2	4.8
PINNULARIA	0.0	0.0	0.0	1.1	1.1	0.0	<0.1
RHOICOSPHENIA	0.0	1.5	0.0	1.1	0.0	2.6	<0.1
STEPHANODISCUS	0.0	2627.5	499.6	385.9	0.0	0.0	20.2
SURIRELLA	0.0	1.0	0.6	0.7	0.0	0.0	<0.1
SYNEDRA	0.0	18.3	1.1	2.1	2.1	18.4	0.2
CYANOPHYTA							
CHROOCOCCUS	0.0	0.0	0.6	3.2	1.1	0.0	<0.1
COELOSPHAERIUM	0.0	0.0	0.0	1.1	0.0	0.0	<0.1
MERISMOPEDIA	0.0	0.0	0.0	10.7	0.0	0.0	0.1
MICROCYSTIS	0.0	0.0	19.4	32.4	0.0	0.0	0.3
OSCILLATORIA	0.0	0.4	0.0	0.0	0.0	0.5	<0.1
CHRYSOPHYTA							
DINOBRYON	0.0	1.1	0.0	0.0	0.0	0.0	<0.1
EUGLENOPHYTA							
TRACHELOMONAS	0.0	0.0	0.0	0.0	0.0	0.5	<0.1
PYRRHOPHYTA							
GLENODINIUM	0.0	0.0	0.0	1.1	0.0	0.0	<0.1
PERIDINIUM	0.0	0.0	0.0	0.7	0.0	0.0	<0.1
CRYPTOPHYTA							
CRYPTOMONAS	0.0	0.0	0.0	0.0	0.0	0.5	<0.1

Table B-3

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 6 March 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-011	AJG-81-012	AJG-81-013	AJG-81-014	AJG-81-015	AJG-81-016	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
CHLAMYDOMONAS	0.0	0.0	0.0	0.4	0.0	0.0	0.1	2.3
CLOSTERIUM	0.0	0.0	0.4	0.0	0.0	0.0	0.1	2.3
UNIDENTIFIED CHLOROPHYTA	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.3
BACILLARIOPHYTA								
COCCONEIS	0.8	0.4	0.0	0.0	0.0	0.0	0.2	6.8
CYCLOTELLA	0.0	0.0	0.0	0.0	0.8	0.0	0.1	4.5
CYMBELLA	0.0	0.0	0.0	0.4	0.4	0.0	0.1	4.5
DIATOMA	0.4	0.0	0.0	0.0	0.0	0.0	0.1	2.3
FRAGILARIA	2.8	0.0	0.0	0.0	0.0	0.0	0.5	15.9
MELOSIRA	1.2	0.0	0.0	0.0	0.0	0.0	0.2	6.8
MERIDION	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.3
NAVICULA	0.8	0.0	0.8	0.0	0.0	0.0	0.3	9.1
NITZSCHIA	1.6	0.8	0.4	1.2	1.6	0.4	1.0	34.1
PINNULARIA	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.3
SYNEDRA	0.0	0.0	0.4	0.0	0.0	0.0	0.1	2.3
CYANOPHYTA								
SCHIZOTHRIX	0.0	0.0	0.4	0.0	0.0	0.0	0.1	2.3
TOTAL	7.6	1.2	2.4	2.0	2.8	1.6	2.9	

Table B-4

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 6 March 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-003	AJG-81-004	AJG-81-005	AJG-81-006	AJG-81-007	AJG-81-008	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
COELASTRUM	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.0
SCENEDESMUS	0.0	0.0	0.0	0.4	0.0	0.4	0.1	3.9
BACILLARIOPHYTA								
ACHNANTHES	0.0	0.0	0.0	0.0	0.4	0.0	0.1	2.0
ASTERIONELLA	0.0	0.4	0.0	0.0	0.0	0.0	0.1	2.0
COCCONEIS	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.0
CYMBELLA	0.0	0.0	0.4	0.0	0.0	0.0	0.1	2.0
DIATOMA	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.0
GOMPHONEMA	0.0	0.0	0.0	1.2	0.0	0.0	0.2	5.9
MELOSIRA	0.0	0.0	0.0	0.0	0.0	0.4	0.1	2.0
MERIDION	0.0	0.0	0.0	0.4	0.0	0.4	0.1	3.9
NAVICULA	0.8	0.8	0.4	1.6	0.8	0.0	0.7	21.6
NITZSCHIA	0.4	1.2	1.2	3.2	1.2	3.2	1.7	51.0
TOTAL	1.2	2.4	2.0	6.8	2.4	5.6	3.4	

Table B-5

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 15 April 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-019	AJG-81-020	AJG-81-021	AJG-81-022	AJG-81-023	AJG-81-024	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	0.0	3.7	1.9	0.0	0.0	0.0	0.9	0.2
CHLAMYDOMONAS	0.0	0.0	0.0	1.9	0.0	0.0	0.3	0.1
DICTYOSPHAERIUM	0.0	0.0	0.0	1.9	0.0	0.0	0.3	0.1
SCENEDESMUS	0.0	1.9	0.0	1.9	0.0	0.0	0.6	0.2
ULOTHRIX	0.0	1.9	0.0	0.0	0.0	0.0	0.3	0.1
UNIDENTIFIED CHLOROPHYTA	1.9	1.9	1.9	0.0	3.7	3.7	2.2	0.5
BACILLARIOPHYTA								
ACHNANTHES	1.9	0.0	0.0	0.0	0.0	0.0	0.3	0.1
AMPHORA	0.0	1.9	9.3	0.0	0.0	0.0	1.9	0.5
ASTERIONELLA	0.0	7.4	0.0	0.0	0.0	0.0	1.2	0.3
CYCLOTELLA	5.6	11.1	5.6	5.6	5.6	5.6	6.5	1.6
CYMBELLA	13.0	14.8	16.7	1.9	3.7	9.3	9.9	2.5
DIATOMA	3.7	29.6	11.1	9.3	11.1	1.9	11.1	2.8
FRAGILARIA	14.8	0.0	7.4	0.0	1.9	0.0	4.0	1.0
GOMPHONEMA	22.2	22.2	20.4	1.9	18.5	3.7	14.8	3.8
MELOSIRA	9.3	0.0	0.0	3.7	14.8	0.0	4.6	1.2
MERIDION	0.0	1.9	0.0	0.0	0.0	5.6	1.2	0.3
NAVICULA	62.9	61.1	79.6	13.0	38.9	16.7	45.3	11.5
NITZSCHIA	107.3	99.9	138.8	62.9	81.4	75.9	94.4	24.0
STEPHANODISCUS	155.4	320.1	194.3	131.4	144.3	183.2	188.1	47.8
SYNEDRA	9.3	5.6	9.3	0.0	3.7	1.9	4.9	1.3
CYANOPHYTA								
SCHIZOTHRIX	0.0	0.0	0.0	0.0	0.0	1.9	0.3	0.1
TOTAL	407.0	584.6	495.8	235.0	327.5	309.0	393.1	

Table B-6

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 16 April 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-027	AJG-81-028	AJG-81-029	AJG-81-030	AJG-81-031	AJG-81-032	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	4.5	0.0	0.0	0.0	0.0	3.4	1.3	<0.1
COELASTRUM	4.5	0.0	0.0	0.0	0.0	0.0	0.7	<0.1
GOLENKINIA	0.0	0.0	0.0	0.0	0.0	3.4	0.6	<0.1
SCENEDESMUS	0.0	13.4	0.0	2.4	0.0	3.4	3.2	0.1
TETRASTRUM	0.0	0.0	0.0	2.4	0.0	0.0	0.4	<0.1
UNIDENTIFIED CHLOROPHYTA	0.0	0.0	0.0	4.8	[illegible]	16.8	5.8	0.2
BACILLARIOPHYTA								
ACHNANTHES	0.0	0.0	0.0	7.2	[illegible]	3.4	1.8	0.1
AMPHORA	35.7	35.7	50.7	[illegible]	[illegible]	6.7	25.9	0.8
COCCONEIS	0.0	13.4	0.0	[illegible]	0.0	0.0	2.6	0.1
CYCLOTELLA	84.7	102.6	139.5	[illegible]	[illegible]	67.0	79.9	2.5
CYMBELLA	40.1	71.4	63.4	[illegible]	[illegible]	50.3	49.0	1.5
DIATOMA	13.4	26.8	63.4	[illegible]	[illegible]	33.5	29.3	0.9
FRAGILARIA	0.0	26.8	0.0	16.9	13.4	100.5	26.3	0.8
GOMPHONEMA	75.8	102.6	133.1	67.5	80.4	113.9	95.6	2.9
MELOSIRA	8.9	0.0	0.0	16.9	0.0	0.0	4.3	0.1
MERIDION	4.5	8.9	12.7	7.2	0.0	3.4	6.1	0.2
NAVICULA	53.5	66.9	107.8	57.8	0.0	117.3	67.2	2.1
NITZSCHIA	173.9	187.3	259.9	212.1	251.3	194.3	213.1	6.5
RHOICOSPHENIA	0.0	8.9	0.0	0.0	0.0	0.0	1.5	<0.1
STEPHANODISCUS	2845.5	3206.7	4621.9	1118.2	1852.6	2120.6	[illegible]	80.5
SURIRELLA	0.0	0.0	0.0	2.4	3.4	0.0	1.0	0.0
SYNEDRA	22.3	13.4	25.4	12.1	13.4	23.5	18.[illegible]	0.6
CYANOPHYTA								
OSCILLATORIA	0.0	0.0	0.0	2.4	0.0	0.0	0.4	<0.1
CHRYSOPHYTA								
DINOBYRON	0.0	0.0	6.3	0.0	0.0	0.0	1.1	<0.1
TOTAL	3367.3	3884.7	5484.1	1629.2	2351.7	2860.9	3262.8	

Table B-7

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 15 June 1981. Replicates are indicated by collection number.

ACRYLIC PLATE		1			2			
COLLECTION NO.	AJG-81-035	AJC-81-036	AJG-81-037	AJG-81-038	AJG-81-039	AJG-81-040	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ACTINASTRUM	0.0	0.0	0.0	3.4	3.4	3.4	1.7	0.1
ANKISTRODESMUS	3.4	30.2	26.8	26.8	16.8	13.4	19.5	0.9
CHLAMYDOMONAS	30.2	6.7	0.0	3.4	6.7	6.7	8.9	0.4
CHODATELLA	0.0	10.1	0.0	0.0	0.0	0.0	1.7	0.1
COELASTRUM	3.4	0.0	6.7	3.4	0.0	0.0	2.2	0.1
COSMARIUM	0.0	0.0	3.4	0.0	0.0	0.0	0.6	<0.1
DICTYOSPHAERIUM	0.0	16.8	0.0	6.7	10.1	0.0	5.6	0.3
FRANCEIA	6.7	0.0	10.1	10.1	0.0	3.4	5.0	0.2
KIRCHNERIELLA	0.0	0.0	3.4	0.0	0.0	0.0	0.6	<0.1
MICRACTINIUM	3.4	0.0	3.4	0.0	0.0	0.0	1.1	0.1
OOCYSTIS	1433.8	1510.9	1658.3	1825.8	1654.9	1584.6	1611.4	76.9
PEDIASTRUM	0.0	0.0	6.7	0.0	0.0	0.0	1.1	0.1
SCENEDESMUS	93.8	103.9	46.9	73.7	113.9	83.8	86.0	4.1
SELENASTRUM	0.0	0.0	0.0	0.0	6.7	0.0	1.1	0.1
TETRAEDRON	0.0	3.4	0.0	10.1	0.0	0.0	2.2	0.1
TETRASTRUM	16.8	23.5	26.8	6.7	6.7	6.7	14.5	0.7
UNIDENTIFIED CHLOROPHYTA	80.4	67.0	70.4	50.3	67.0	63.7	66.4	3.2
BACILLARIOPHYTA								
ACHNANTHES	0.0	3.4	0.0	0.0	3.4	0.0	1.1	0.1
AMPHORA	3.4	0.0	0.0	0.0	0.0	0.0	0.6	<0.1
COCCONEIS	0.0	3.4	0.0	0.0	3.4	3.4	1.7	0.1
CYCLOTELLA	33.5	100.5	40.2	63.7	50.3	53.6	57.0	2.7
CYMBELLA	3.4	16.8	0.0	3.4	10.1	0.0	5.6	0.3
DIATOMA	0.0	3.4	0.0	0.0	0.0	0.0	0.6	<0.1
GOMPHONEMA	6.7	3.4	0.0	6.7	6.7	0.0	3.9	0.2
MERIDION	3.4	0.0	0.0	0.0	3.4	0.0	1.1	0.1
NAVICULA	10.1	40.2	23.5	16.8	16.8	26.8	22.3	1.1
NITZSCHIA	20.1	26.8	46.9	10.1	13.4	26.8	24.0	1.1
STEPHANODISCUS	80.4	211.1	90.5	147.4	113.9	113.9	126.2	6.0
SYNEDRA	6.7	10.1	3.4	0.0	6.7	3.4	5.0	0.2
CYANOPHYTA								
MICROCYSTIS	13.4	40.2	23.5	10.1	10.1	6.7	17.3	0.8
OSCILLATORIA	0.0	0.0	0.0	0.0	3.4	0.0	0.6	<0.1
TOTAL	1852.6	2231.1	2090.4	2278.0	2127.3	2000.0	2096.4	

Table B-8

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 15 June 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-043	AJG-81-044	AJG-81-045	AJG-81-046	AJG-81-047	AJG-81-048	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ACTINASTRUM	6.7	0.0	3.4	0.0	0.0	6.7	2.8	0.1
ANKISTRODESMUS	70.4	58.0	87.1	13.4	30.2	20.1	46.5	1.7
CHLAMYDOMONAS	3.4	4.5	10.1	13.4	13.4	3.4	8.0	0.3
CHODATELLA	0.0	0.0	0.0	0.0	3.4	3.4	1.1	<0.1
COELASTRUM	0.0	0.0	6.7	0.0	0.0	0.0	1.1	<0.1
DICTYOSPHAERIUM	10.1	4.5	26.8	3.4	0.0	0.0	7.4	0.3
FRANCEIA	6.7	13.4	0.0	13.4	3.4	10.1	7.8	0.3
KIRCHNERIELLA	3.4	0.0	0.0	3.4	3.4	6.7	2.8	0.1
MICRACTINIUM	3.4	0.0	0.0	0.0	0.0	0.0	0.6	<0.1
MOUGEOTIA	0.0	0.0	0.0	3.4	0.0	0.0	0.6	<0.1
OOCYSTIS	790.6	2288.0	693.5	2458.9	1912.9	1035.2	1529.8	54.6
PEDIASTRUM	3.4	0.0	0.0	0.0	0.0	3.4	1.1	<0.1
SCENEDESMUS	348.4	227.5	432.2	120.6	100.5	80.4	218.3	7.8
SELENASTRUM	3.4	0.0	0.0	0.0	0.0	0.0	0.6	<0.1
TETRAEDRON	20.1	0.0	3.4	0.0	3.4	6.7	5.6	0.2
TETRASTRUM	46.9	13.4	33.5	13.4	53.6	26.8	31.3	1.1
UNIDENTIFIED CHLOROPHYTA	117.3	44.6	110.6	50.3	83.8	40.2	74.4	2.7
BACILLARIOPHYTA								
ACHNANTHES	6.7	0.0	0.0	0.0	0.0	0.0	1.1	<0.1
COCCONEIS	6.7	0.0	16.8	0.0	3.4	3.4	5.0	0.2
CYCLOTELLA	304.9	240.8	445.6	117.3	103.9	100.5	218.8	7.8
CYMBELLA	10.1	31.2	36.9	3.4	10.1	10.1	16.9	0.6
DIATOMA	3.4	0.0	0.0	0.0	0.0	0.0	0.6	<0.1
FRAGILARIA	0.0	0.0	10.1	0.0	0.0	26.8	6.1	0.2
GOMPHONEMA	13.4	13.4	36.9	6.7	6.7	3.4	13.4	0.5
GYROSIGMA	3.4	0.0	0.0	0.0	0.0	0.0	0.6	<0.1
MELOSIRA	3.4	0.0	13.4	6.7	0.0	0.0	3.9	0.1
MERIDION	0.0	4.5	0.0	3.4	0.0	0.0	1.3	<0.1
NAVICULA	60.3	22.3	77.1	16.8	6.7	36.9	36.7	1.3
NITZSCHIA	60.3	40.1	67.0	23.5	30.2	6.7	38.0	1.4
STEPHANODISCUS	710.2	548.6	1021.8	268.0	217.8	231.2	499.6	17.8
SURIRELLA	0.0	0.0	3.4	0.0	0.0	0.0	0.6	<0.1
SYNEDRA	3.4	0.0	0.0	0.0	0.0	3.4	1.1	<0.1
CYANOPHYTA								
CHROOCOCCUS	0.0	0.0	3.4	0.0	0.0	0.0	0.6	<0.1
MICROCYSTIS	23.5	8.9	16.8	30.2	26.8	10.1	19.4	0.7
TOTAL	2643.2	3563.5	3155.7	3169.1	2613.0	1675.0	2803.1	

Table B-9

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 14 August 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-059	AJG-81-060	AJG-81-061	AJG-81-062	AJG-81-063	AJG-81-064	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ACTINASTRUM	0.0	0.0	0.0	1.9	0.0	0.0	0.3	<0.1
ANKISTRODESMUS	38.9	16.7	18.5	14.8	22.3	24.1	22.5	2.5
CHLAMYDOMONAS	1.9	0.0	1.9	1.9	0.0	0.0	0.9	0.1
COELASTRUM	16.7	7.4	11.1	14.8	4.5	3.7	9.7	1.1
COSMARIUM	0.0	0.0	0.0	0.0	4.5	1.9	1.1	0.1
CRUCIGENIA	1.9	0.0	0.0	0.0	0.0	0.0	0.3	<0.1
DICTYOSPHAERIUM	42.6	37.0	20.4	40.7	35.7	40.7	36.2	3.9
FRANCEIA	1.9	0.0	0.0	0.0	0.0	1.9	0.6	0.1
KIRCHNERIELLA	5.6	11.1	5.6	13.0	17.8	14.8	11.3	1.2
OOCYSTIS	109.2	79.6	105.5	109.2	3251.3	61.1	619.3	67.4
PEDIASTRUM	0.0	1.9	0.0	3.7	8.9	1.9	2.7	0.3
SCENEDESMUS	98.1	75.9	77.7	44.4	49.1	55.5	66.8	7.3
TETRAEDRON	3.7	1.9	1.9	1.9	0.0	0.0	1.5	0.2
TETRASTRUM	1.9	1.9	0.0	1.9	4.5	0.0	1.7	0.2
UNIDENTIFIED CHLOROPHYTA	37.0	29.6	35.2	48.1	40.1	31.5	36.9	4.0
BACILLARIOPHYTA								
ACHNANTHES	0.0	1.9	0.0	0.0	0.0	0.0	0.3	<0.1
COCCONEIS	1.9	1.9	0.0	1.9	0.0	0.0	0.9	0.1
CYCLOTELLA	50.0	38.9	62.9	24.1	31.2	37.0	40.7	4.4
DIATOMA	0.0	0.0	0.0	1.9	0.0	0.0	0.3	<0.1
GOMPHONEMA	0.0	0.0	3.7	0.0	0.0	0.0	0.6	0.1
MELOSIRA	7.4	0.0	0.0	0.0	0.0	0.0	1.2	0.1
NAVICULA	3.7	7.4	5.6	1.9	0.0	5.6	4.0	0.4
NITZSCHIA	5.6	5.6	1.9	1.9	0.0	7.4	3.7	0.4
STEPHANODISCUS	31.5	24.1	40.7	18.5	22.3	24.1	26.8	2.9
SYNEDRA	0.0	0.0	1.9	0.0	0.0	0.0	0.3	<0.1
CYANOPHYTA								
CHROOCOCCUS	0.0	0.0	0.0	0.0	0.0	1.9	0.3	<0.1
COELOSPHAERIUM	0.0	0.0	1.9	1.9	4.5	1.9	1.7	0.2
MERISMOPEDIA	9.3	1.9	0.0	3.7	4.5	5.6	4.1	0.5
MICROCYSTIS	20.4	14.8	13.0	22.2	49.1	7.4	21.1	2.3
EUGLENOPHYTA								
TRACHELOMONAS	1.9	0.0	0.0	0.0	0.0	0.0	0.3	<0.1
PYRRHOPHYTA								
PERIDINIUM	0.0	0.0	0.0	0.0	0.0	1.9	0.3	<0.1
TOTAL	490.3	358.9	408.9	373.7	3550.2	329.3	918.5	

Table B-10

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 14 August 1981. Replicates are indicated by col...ion number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-051	AJG-81-052	AJG-81-053	AJG-81-054	AJG-81-055	AJG-81-056	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ACTINASTRUM	0.0	0.0	4.5	0.0	0.0	0.0	0.7	<0.1
ANKISTRODESMUS	209.2	114.1	44.6	57.1	40.1	13.4	79.8	1.9
CHLAMYDOMONAS	0.0	0.0	0.0	12.7	0.0	0.0	2.1	<0.1
CHODATELLA	0.0	0.0	4.5	0.0	0.0	4.5	1.5	<0.1
COELASTRUM	374.1	126.8	26.8	69.7	40.1	26.8	110.7	2.6
CRUCIGENIA	0.0	0.0	0.0	25.4	4.5	4.5	5.7	0.1
DICTYOSPHAERIUM	374.1	183.9	249.8	145.8	93.7	53.5	183.4	4.3
KIRCHNERIELLA	38.0	69.7	13.4	38.0	31.2	13.4	34.0	0.8
OOCYSTIS	1940.0	1274.3	1601.1	2555.0	1534.2	2916.8	1970.3	46.1
PEDIASTRUM	44.4	82.4	8.9	44.4	17.8	26.8	37.5	0.9
SCENEDESMUS	982.7	843.2	428.2	418.4	370.2	169.5	535.4	12.5
STAURASTRUM	0.0	0.0	8.9	6.3	0.0	0.0	2.5	0.1
TETRAEDRON	6.3	6.3	4.5	0.0	0.0	4.5	3.6	0.1
TETRASTRUM	6.3	0.0	8.9	6.3	4.5	4.5	5.1	0.1
UNIDENTIFIED CHLOROPHYTA	215.6	190.2	71.4	158.5	129.3	49.1	135.7	3.2
BACILLARIOPHYTA								
AMPHORA	0.0	0.0	0.0	0.0	0.0	4.5	0.7	<0.1
COCCONEIS	0.0	25.4	13.4	6.3	22.3	4.5	12.0	0.3
CYCLOTELLA	887.6	1071.5	602.1	589.6	446.0	196.2	632.2	14.8
CYMBELLA	12.7	6.3	0.0	12.7	8.9	0.0	6.8	0.2
FRAGILARIA	0.0	0.0	0.0	0.0	0.0	4.5	0.7	<0.1
GOMPHONEMA	12.7	12.7	0.0	0.0	0.0	0.0	4.2	0.1
MELOSIRA	25.4	0.0	44.6	0.0	13.4	13.4	16.1	0.4
NAVICULA	38.0	63.4	44.6	31.7	31.2	0.0	34.8	0.8
NITZSCHIA	6.3	31.7	22.3	31.7	17.8	4.5	19.1	0.4
PINNULARIA	0.0	6.3	0.0	0.0	0.0	0.0	1.1	<0.1
RHOICOSPHENIA	0.0	0.0	0.0	6.3	0.0	0.0	1.1	<0.1
STEPHANODISCUS	551.6	646.7	365.7	367.7	263.1	120.4	385.9	9.0
SURIRELLA	0.0	0.0	4.5	0.0	0.0	0.0	0.7	<0.1
SYNEDRA	0.0	6.3	0.0	6.3	0.0	0.0	2.1	<0.1
CYANOPHYTA								
CHROOCOCCUS	0.0	0.0	0.0	19.0	0.0	0.0	3.2	0.1
COELOSPHAERIUM	6.3	0.0	0.0	0.0	0.0	0.0	1.1	<0.1
MERISMOPEDIA	19.0	31.7	8.9	0.0	4.5	0.0	10.7	0.2
MICROCYSTIS	44.4	76.1	13.4	38.0	13.4	8.9	32.4	0.8
PYRRHOPHYTA								
GLENODINIUM	6.3	0.0	0.0	0.0	0.0	0.0	1.1	<0.1
PERIDINIUM	0.0	0.0	4.5	0.0	0.0	0.0	0.7	<0.1
TOTAL	5801.1	4869.1	3599.2	4647.2	3086.3	3643.8	4274.2	

Table B-11

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 15 October 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-067	AJG-81-068	AJG-81-069	AJG-81-070	AJG-81-071	AJG-81-072	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	6.3	6.3	12.7	0.0	12.7	6.3	7.4	0.2
CLOSTERIUM	0.0	0.0	6.3	0.0	6.3	0.0	2.1	0.1
COSMARIUM	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
DICTYOSPHAERIUM	0.0	6.3	0.0	0.0	0.0	0.0	1.1	< 0.1
KIRCHNERIELLA	6.3	0.0	0.0	0.0	6.3	0.0	2.1	0.1
OOCYSTIS	323.3	3601.1	3930.8	3493.3	2986.1	2643.8	2829.7	70.3
SCENEDESMUS	63.4	12.7	12.7	31.7	44.4	12.7	29.6	0.7
TETRASTRUM	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
UNIDENTIFIED CHLOROPHYTA	6.3	6.3	6.3	6.3	0.0	0.0	4.2	0.1
BACILLARIOPHYTA								
AMPHORA	0.0	0.0	0.0	0.0	0.0	6.3	1.1	< 0.1
COCCONEIS	6.3	12.7	0.0	0.0	0.0	12.7	5.3	0.1
CYCLOTELLA	133.1	38.0	19.0	25.4	38.0	31.7	47.6	1.2
CYMBELLA	6.3	38.0	6.3	0.0	6.3	0.0	9.5	0.2
DIATOMA	6.3	6.3	0.0	6.3	0.0	6.3	4.2	0.1
EUNOTIA	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
FRUSTULIA	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
GOMPHONEMA	0.0	0.0	0.0	12.7	6.3	0.0	3.2	0.1
MELOSIRA	158.5	0.0	133.1	228.2	145.8	88.8	125.7	3.1
NAVICULA	957.3	779.8	412.1	1046.1	773.5	583.3	758.7	18.8
NITZSCHIA	158.5	145.8	152.2	209.2	171.2	126.8	160.6	4.0
RHOICOSPHENIA	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
SYNEDRA	38.0	38.0	50.7	12.7	6.3	6.3	25.4	0.6
CYANOPHYTA								
OSCILLATORIA	0.0	0.0	0.0	6.3	6.3	0.0	2.1	0.1
RHODOPHYTA								
RHODOCHORTON	0.0	0.0	0.0	0.0	0.0	6.3	1.1	< 0.1
TOTAL	1902.0	4691.6	4742.3	5078.3	4209.8	3531.4	4025.7	

Table B-12

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 15 October 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-075	AJG-81-076	AJG-81-077	AJG-81-078	AJG-81-079	AJG-81-080	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	0.0	12.7	6.3	0.0	25.4	0.0	7.4	0.2
DICTYOSPHAERIUM	6.3	0.0	0.0	0.0	0.0	0.0	1.1	< 0.1
KIRCHNERIELLA	0.0	0.0	0.0	0.0	12.7	0.0	2.1	< 0.1
OOCYSTIS	3512.4	3100.3	4444.3	3112.9	3696.2	3341.2	3534.5	80.8
PEDIASTRUM	0.0	0.0	0.0	0.0	0.0	6.3	1.1	< 0.1
SCENEDESMUS	19.0	38.0	19.0	25.4	31.7	50.7	30.6	0.7
UNIDENTIFIED CHLOROPHYTA	0.0	25.4	0.0	6.3	19.0	31.7	13.7	0.3
BACILLARIOPHYTA								
AMPHORA	0.0	0.0	0.0	0.0	6.3	0.0	1.1	< 0.1
COCCONEIS	12.7	19.0	12.7	12.7	0.0	25.4	13.7	0.3
CYCLOTELLA	101.4	253.6	19.0	82.4	114.1	139.5	118.3	2.7
CYMATOPLEURA	0.0	6.3	0.0	0.0	0.0	0.0	1.1	< 0.1
CYMBELLA	12.7	19.0	12.7	6.3	0.0	6.3	9.5	0.2
DIATOMA	50.7	44.4	31.7	6.3	25.4	19.0	29.6	0.7
GOMPHONEMA	0.0	31.7	6.3	0.0	0.0	6.3	7.4	0.2
GYROSIGMA	0.0	0.0	6.3	0.0	0.0	6.3	2.1	< 0.1
MELOSIRA	76.1	82.4	63.4	76.1	69.7	196.5	94.0	2.1
MERIDION	0.0	0.0	88.8	0.0	0.0	0.0	14.8	0.3
NAVICULA	367.7	500.9	190.2	393.1	367.7	310.7	355.0	8.1
NITZSCHIA	114.1	228.2	88.8	120.5	139.5	114.1	134.2	3.1
PINNULARIA	0.0	6.3	0.0	0.0	0.0	0.0	1.1	< 0.1
SYNEDRA	0.0	12.7	0.0	0.0	0.0	0.0	2.1	< 0.1
CYANOPHYTA								
CHROOCOCCUS	0.0	0.0	0.0	0.0	6.3	0.0	1.1	< 0.1
TOTAL	4273.2	4380.9	4989.6	3842.0	4514.1	4254.1	4375.4	

Table B-13

Density (units/mm^2) of periphytic algae on acrylic plates 1 and 2 submerged for 12 and 8 months, respectively, at SSES on the Susquehanna River, 14 December 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-094	AJG-81-095	AJG-81-096	AJG-81-097	AJG-81-098	AJG-81-099	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	0.0	0.0	2.2	6.7	0.0	0.0	1.5	0.1
CLOSTERIUM	0.0	1.9	0.0	0.0	0.0	0.0	0.3	< 0.1
COSMARIUM	0.0	0.0	0.0	0.0	3.4	2.8	1.0	< 0.1
KIRCHNERIELLA	3.4	1.9	2.2	3.4	0.0	0.0	1.8	0.1
OOCYSTIS	1266.3	568.4	481.6	1497.5	1011.7	949.2	962.4	43.6
PEDIASTRUM	3.4	1.9	0.0	0.0	0.0	0.0	0.9	< 0.1
SCENEDESMUS	3.4	3.9	12.9	3.4	6.7	8.4	6.4	0.3
UNIDENTIFIED CHLOROPHYTA	16.8	29.1	10.8	16.8	16.8	16.8	17.8	0.8
BACILLARIOPHYTA								
ACHNANTHES	0.0	1.9	0.0	0.0	0.0	0.0	0.3	< 0.1
AMPHORA	0.0	1.9	0.0	0.0	0.0	16.8	3.1	0.1
COCCONEIS	6.7	3.9	4.3	3.4	0.0	5.6	4.0	0.2
CYCLOTELLA	6.7	9.7	8.6	6.7	6.7	14.0	8.7	0.4
CYMBELLA	20.1	23.3	23.7	10.1	16.8	5.6	16.6	0.8
DIATOMA	16.8	3.9	4.3	0.0	0.0	0.0	4.2	0.2
EUNOTIA	0.0	1.9	0.0	0.0	0.0	0.0	0.3	< 0.1
FRAGILARIA	3.4	27.2	40.9	3.4	50.3	0.0	20.8	0.9
FRUSTULIA	0.0	0.0	19.4	0.0	0.0	0.0	3.2	0.1
GOMPHONEMA	10.1	23.3	21.5	20.1	26.8	8.4	18.4	0.8
GYROSIGMA	0.0	1.9	0.0	0.0	0.0	0.0	0.3	< 0.1
MELOSIRA	23.5	31.0	19.4	6.7	33.5	11.2	20.9	0.9
MERIDION	0.0	0.0	4.3	0.0	0.0	0.0	0.7	< 0.1
NAVICULA	358.5	382.2	468.7	351.8	552.8	288.4	400.4	18.2
NITZSCHIA	649.9	655.7	726.7	653.3	700.2	529.2	652.5	29.6
PINNULARIA	0.0	1.9	0.0	0.0	0.0	0.0	0.3	< 0.1
RHOICOSPHENIA	0.0	0.0	2.2	0.0	0.0	0.0	0.4	< 0.1
SURIRELLA	0.0	0.0	0.0	3.4	6.7	0.0	1.7	0.1
SYNEDRA	23.5	87.3	103.2	50.3	43.6	30.8	56.4	2.6
EUGLENOPHYTA								
TRACHELOMONAS	0.0	0.0	2.2	0.0	0.0	0.0	0.4	< 0.1
TOTAL	2412.0	1864.3	1958.7	2636.5	2475.7	1887.2	2205.6	

Table B-14

Density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 14 December 1981. Replicates are indicated by collection number.

ACRYLIC PLATE	1			2				
COLLECTION NO.	AJG-81-086	AJG-81-087	AJC-81-088	AJG-81-089	AJG-81-090	AJG-81-091	MEAN	% TOTAL
TAXON								
CHLOROPHYTA								
ANKISTRODESMUS	2.8	4.3	0.0	0.0	0.0	0.0	1.2	<0.1
CHLAMYDOMONAS	0.0	0.0	0.0	0.0	0.0	3.4	0.6	<0.1
CLOSTERIUM	0.0	0.0	0.0	6.7	0.0	0.0	1.1	<0.1
CRUCIGENIA	0.0	0.0	0.0	0.0	0.0	3.4	0.6	<0.1
KIRCHNERIELLA	0.0	0.0	0.0	0.0	3.4	0.0	0.6	<0.1
OOCYSTIS	1318.8	2459.6	1646.4	1762.1	2174.2	1269.7	1771.8	66.2
SCENEDESMUS	16.8	25.8	11.2	10.1	3.4	16.8	14.0	0.5
UNIDENTIFIED CHLOROPHYTA	25.2	30.1	53.2	30.2	20.1	46.9	34.3	1.3
BACILLARIOPHYTA								
ACHNANTHES	0.0	0.0	0.0	6.7	3.4	0.0	1.7	0.1
AMPHORA	2.8	0.0	8.4	0.0	0.0	0.0	1.9	0.1
ASTERIONELLA	0.0	4.3	0.0	0.0	0.0	3.4	1.3	<0.1
COCCONEIS	11.2	17.2	5.6	3.4	3.4	13.4	9.0	0.3
CYCLOTELLA	19.6	38.7	14.0	13.4	10.1	13.4	18.2	0.7
CYMBELLA	28.0	8.6	19.6	16.8	6.7	43.6	20.5	0.8
DIATOMA	36.4	68.8	25.2	6.7	13.4	43.6	32.3	1.2
FRAGILARIA	30.8	0.0	11.2	36.9	16.8	13.4	18.2	0.7
FRUSTULIA	0.0	4.3	0.0	0.0	0.0	0.0	0.7	<0.1
GOMPHONEMA	56.0	21.5	42.0	26.8	26.8	40.2	35.6	1.3
GYROSIGMA	0.0	4.3	0.0	0.0	0.0	0.0	0.7	<0.1
MELOSIRA	33.6	21.5	22.4	26.8	30.2	20.1	25.8	1.0
MERIDION	11.2	0.0	5.6	16.8	0.0	0.0	5.6	0.2
NAVICULA	207.2	227.9	184.8	237.9	164.2	355.1	229.5	8.6
NITZSCHIA	403.2	391.3	378.0	442.2	361.8	593.0	428.2	16.0
RHOICOSPHENIA	0.0	8.6	0.0	3.4	0.0	3.4	2.6	0.1
SYNEDRA	25.2	30.1	8.4	6.7	6.7	33.5	18.4	0.7
CYANOPHYTA								
OSCILLATORIA	2.8	0.0	0.0	0.0	0.0	0.0	0.5	<0.1
EUGLENOPHYTA								
TRACHELOMONAS	2.8	0.0	0.0	0.0	0.0	0.0	0.5	<0.1
CRYPTOPHYTA								
CRYPTOMONAS	2.8	0.0	0.0	0.0	0.0	0.0	0.5	<0.1
TOTAL	2237.2	3366.9	2436.0	2653.2	2844.2	2515.9	2675.5	

Table B-15

Species of periphytic algae composing at least 5% of the total units counted in samples at SSES and Bell Bend on the Susquehanna River, 1981. Numbers following diatoms indicate the species affinity for pH as rated by Lowe (1974): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent to pH, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Ankistrodesmus falcatus		Aug	
Chlamydomonas sp.		Feb	
Coelastrum sphaericum			Aug
Dictyosphaerium pulchellum		Aug	Aug
Oocystis parva		Jun, Aug, Oct, Dec	Jun, Aug, Oct, Dec
Scenedesmus quadricauda		Aug	Feb, Jun, Aug
BACILLARIOPHYTA			
Achnanthes lanceolata	(1)		Feb
Asterionella formosa	(1)		Feb
Cocconeis pediculus	(1)	Feb	Feb
Cyclotella meneghiniana	(1)	Feb, Aug	Aug
C. pseudostelligera	(1,3)		Jun
Cymbella minuta[a]	(1,3)	Feb	Feb
Diatoma tenue	(4)	Feb	
D. vulgare	(1)		Feb
Fragilaria sp.		Feb	
Melosira granulata	(1)	Feb	
M. varians	(1)	Oct	Feb
Meridion circulare	(1)		Feb
Navicula sp.			Feb
N. cryptocephala	(1)	Feb	
N. cryptocephala var. *veneta*	(1)	Dec	Dec
N. salinarum var. *intermedia*	(4)	Oct, Dec	Feb, Oct, Dec
Navicula tripunctata	(1)	Feb	
Nitzschia sp.			Feb
N. acicularis	(1)	Apr	
N. dissipata	(1)	Feb, Apr, Oct, Dec	Feb, Apr, Dec
N. palea	(1,3)	Dec	Dec
Stephanodiscus invisitatus	(4)	Apr, Jun, Aug	Apr, Jun, Aug
Synedra ulna	(1)	Feb	
CYANOPHYTA			
Schizothrix calcicola		Feb	

[a]Referred to as *Cymbella ventricosa* on page 76 in Gale and Gurzynski (1976); reclassified as *Cymbella minuta* by Patrick and Reimer (1975).

Table B-16

Density (units/mm^2) of periphytic algae that averaged at least 1% of the total for one or more years at SSES and Bell Bend on the Susquehanna River, 1977-81.

Taxon	SSES					Bell Bend				
	1977	1978	1979	1980	1981	1977	1978	1979	1980	1981
CHLOROPHYTA										
Actinastrum	15.7	1.1	1.3	2.0	0.3	29.8	1.3	1.3	9.2	0.6
Ankistrodesmus	20.0	21.8	16.8	42.1	8.6	73.1	27.5	19.1	90.5	22.7
Cerasterias	30.8	0.0	0.0	0.1	0.0	37.7	0.1	0.1	0.9	0.0
Chlamydomonas	18.9	44.1	5.8	2.5	1.7	14.3	17.5	8.1	6.1	1.8
Coelastrum	3.0	0.5	4.1	9.4	2.0	10.3	2.6	3.6	52.1	18.8
Dictyosphaerium	10.4	2.4	16.6	9.5	7.2	13.4	3.7	47.7	67.4	32.0
Kirchneriella	5.2	4.2	45.5	[illegible]1.0	2.6	14.4	2.5	116.2	96.2	6.6
Oocystis	0.6	0.1	0.1	0.6	1003.8	3.2	0.5	0.0	0.6	1467.7
Pediastrum	2.5	2.2	4.3	4.9	0.8	10.6	4.2	12.1	17.3	6.6
Scenedesmus	62.9	44.2	135.4	198.3	31.6	299.4	66.3	284.7	781.1	133.6
Unidentified	23.3	17.6	50.3	51.5	21.3	52.5	16.4	52.1	169.7	44.0
BACILLARIOPHYTA										
Cocconeis	0.7	11.8	2.9	5.6	2.0	8.3	14.1	4.3	28.9	7.1
Cyclotella	52.4	91.5	275.4	239.7	26.8	363.3	212.4	344.9	1040.1	177.9
Cymbella	1.3	22.0	4.9	31.8	6.9	23.0	13.8	7.3	36.2	17.1
Diatoma	<0.1	24.2	3.1	9.5	3.4	1.5	14.0	6.6	29.8	15.3
Fragilaria	0.7	38.2	1.2	11.5	4.2	10.2	6.0	0.4	21.9	8.6
Gomphonema	2.1	13.5	4.8	25.6	6.8	13.8	16.2	3.3	53.6	26.1
Melosira	4.0	74.9	22.5	26.4	25.4	17.1	79.6	30.2	95.2	24.0
Navicula	16.6	369.9	83.3	161.2	205.2	132.2	199.5	41.8	206.1	120.7
Nitzschia	17.2	275.0	130.5	439.8	156.0	93.5	212.3	87.1	373.6	139.1
Stephanodiscus	49.0	110.1	44.9	143.4	56.9	177.3	247.2	66.6	611.7	585.5
Surirella	0.1	0.3	0.4	6.1	0.3	1.6	0.8	0.7	42.8	0.4
Synedra	4.8	37.1	6.2	14.8	15.4	40.5	24.9	7.4	21.4	7.0
Thalassiosira	10.6	0.0	10.4	0.0	0.0	47.9	0.0	15.1	0.0	0.0
CYANOPHYTA										
Oscillatoria	0.2	4.7	0.2	0.9	0.4	1.3	12.8	0.4	4.2	0.1
Schizothrix	31.7	9.2	15.1	4.0	0.1	122.8	13.6	33.6	5.0	0.0

Table B-17

Relative abundance (% total) of periphytic algae that averaged at least 1% of the total for one or more years at SSES and Bell Bend on the Susquehanna River, 1977-81.

Taxon	SSES 1977	SSES 1978	SSES 1979	SSES 1980	SSES 1981	Bell Bend 1977	Bell Bend 1978	Bell Bend 1979	Bell Bend 1980	Bell Bend 1981
CHLOROPHYTA										
Actinastrum	3.6	0.1	0.1	0.1	<0.1	1.8	0.1	0.1	0.2	<0.1
Ankistrodesmus	4.6	1.8	1.9	2.8	0.5	4.4	2.2	1.5	2.3	0.8
Cerasterias	7.1	0.0	0.0	<0.1	0.0	2.2	<0.1	<0.1	<0.1	0.0
Chlamydomonas	4.4	3.6	0.6	0.2	0.1	0.9	1.4	0.6	0.2	0.1
Coelastrum	0.7	<0.1	0.5	0.6	0.1	0.6	0.2	0.3	1.3	0.6
Dictyosphaerium	2.4	0.2	1.8	0.6	0.4	0.8	0.3	3.8	1.7	1.1
Kirchneriella	1.2	0.3	5.0	2.0	0.2	0.9	0.2	9.3	2.4	0.2
Oocystis	0.1	<0.1	<0.1	<0.1	62.5	0.2	<0.1	0.0	<0.1	50.6
Pediastrum	0.6	0.2	0.5	0.3	<0.1	0.6	0.3	1.0	0.4	0.2
Scenedesmus	14.5	3.6	15.0	13.1	2.0	17.9	5.4	22.9	19.8	4.6
Unidentified	5.4	1.4	5.6	3.4	1.3	3.1	1.3	4.2	4.3	1.5
BACILLARIOPHYTA										
Cocconeis	0.2	1.0	0.3	0.4	0.1	0.5	1.1	0.3	0.7	0.2
Cyclotella	12.1	7.4	30.4	15.9	1.7	21.7	17.2	27.7	26.4	6.1
Cymbella	0.3	1.8	0.5	2.1	0.4	1.4	1.1	0.6	0.9	0.6
Diatoma	<0.1	2.0	0.3	0.6	0.2	0.1	1.1	0.5	0.8	0.5
Fragilaria	0.2	3.1	0.1	0.8	0.3	0.6	0.5	<0.1	0.6	0.3
Gomphonema	0.5	1.1	0.5	1.7	0.4	0.8	1.3	0.3	1.4	0.9
Melosira	0.9	6.1	2.5	2.3	1.6	1.0	6.4	2.4	2.4	0.8
Navicula	3.8	29.9	9.2	10.7	12.8	7.9	16.2	3.4	5.2	4.2
Nitzschia	4.0	22.3	14.4	29.1	9.7	5.6	17.2	7.0	9.5	4.8
Stephanodiscus	11.3	8.9	5.0	9.5	3.5	10.6	20.0	5.4	15.5	20.2
Surirella	<0.1	<0.1	<0.1	0.4	<0.1	0.1	0.1	0.1	1.1	<0.1
Synedra	1.1	3.0	0.7	1.0	1.0	2.4	2.0	0.6	0.5	0.2
Thalassiosira	2.4	0.0	1.1	0.0	0.0	2.9	0.0	1.2	0.0	0.0
CYANOPHYTA										
Oscillatoria	<0.1	0.4	<0.1	0.1	<0.1	0.1	1.0	<0.1	0.1	<0.1
Schizothrix	7.3	0.7	1.7	0.3	<0.1	7.3	1.1	2.7	0.1	0.0

Table B-18

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at SSES on the Susquehanna River, 1981.

TAXON	6 MAR AJG-81-009	15 APR AJG-81-017	15 JUN AJG-81-033	14 AUG AJG-81-057	15 OCT AJG-81-065	14 DEC AJG-81-092	MEAN	% TOTAL
CHLOROPHYTA								
ACTINASTRUM	0	0	333	0	0	0	55.6	0.2
ANKISTRODESMUS	2	0	3000	2267	58	0	887.8	3.4
CERASTERIAS	0	0	0	67	0	0	11.1	<0.1
CHLAMYDOMONAS	2	150	4917	133	6	0	867.8	3.3
CHODATELLA	0	0	1083	0	0	0	180.6	0.7
COELASTRUM	0	0	417	2467	0	0	480.6	1.8
COSMARIUM	0	0	0	0	3	0	0.5	<0.1
CRUCIGENIA	0	0	500	133	0	0	105.6	0.4
DICTYOSPHAERIUM	0	0	1167	7000	3	0	1361.6	5.2
FRANCEIA	0	0	0	133	0	0	22.2	0.1
KIRCHNERIELLA	0	0	1417	4533	0	0	991.7	3.8
MICRACTINIUM	0	0	83	67	3	0	25.5	0.1
OOCYSTIS	0	0	417	267	78	0	126.9	0.5
PEDIASTRUM	0	0	0	533	0	0	88.9	0.3
SCENEDESMUS	5	0	13000	8000	142	0	3524.4	13.4
SELENASTRUM	0	0	83	67	0	0	25.0	0.1
STAURASTRUM	0	0	0	67	0	0	11.1	<0.1
TETRAEDRON	2	0	917	333	0	0	208.6	0.8
TETRASTRUM	0	0	1833	467	0	0	383.3	1.5
UNIDENTIFIED CHLOROPHYTA	6	0	9917	6000	28	5	2659.2	10.1
BACILLARIOPHYTA								
ACHNANTHES	5	0	0	67	0	0	11.9	<0.1
AMPHORA	0	0	0	0	0	1	0.1	<0.1
ASTERIONELLA	0	250	0	0	6	1	42.8	0.2
COCCONEIS	3	0	0	0	47	1	8.6	<0.1
CYCLOTELLA	114	700	7333	8733	197	1	2846.5	10.8
CYMBELLA	6	550	0	0	11	4	95.2	0.4
DIATOMA	5	100	0	0	36	2	23.8	0.1
EPITHEMIA	2	0	0	0	0	0	0.3	<0.1
FRAGILARIA	60	100	0	0	6	0	27.6	0.1
GOMPHONEMA	6	0	0	67	19	17	18.3	0.1
MELOSIRA	5	750	0	0	319	0	179.0	0.7
MERIDION	11	100	0	0	3	1	19.1	0.1
NAVICULA	20	150	250	67	242	23	125.3	0.5
NITZSCHIA	34	3600	250	200	153	55	715.3	2.7
PINNULARIA	0	0	0	0	0	1	0.1	<0.1
RHOICOSPHENIA	2	50	0	0	0	0	8.6	<0.1
SKELETONEMA	0	0	0	267	0	0	44.4	0.2
STEPHANODISCUS	31	34950	17250	2267	122	1	9103.3	34.5
SYNEDRA	3	0	0	0	8	1	2.1	<0.1
THALASSIOSIRA	0	0	0	0	478	0	79.6	0.3
CYANOPHYTA								
CHROOCOCCUS	0	0	0	200	3	0	33.8	0.1
COELOSPHAERIUM	0	0	0	67	0	0	11.1	<0.1
MERISMOPEDIA	0	0	0	800	0	0	133.3	0.5
MICROCYSTIS	0	0	4250	600	0	0	808.3	3.1
OSCILLATORIA	0	0	0	67	0	0	11.1	<0.1
SCHIZOTHRIX	2	0	0	0	0	0	0.3	<0.1
CHRYSOPHYTA								
SYNURA	0	0	0	0	3	0	0.5	<0.1
PYRRHOPHYTA								
GLENODINIUM	0	0	0	67	0	0	11.1	<0.1
TOTAL	321	41450	68416	46000	1972	115	26379.2	

Table B-19

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at Bell Bend on the Susquehanna River, 1981.

TAXON	6 MAR AJG-81-001	16 APR AJG-81-025	15 JUN AJG-81-041	14 AUG AJG-81-049	15 OCT AJG-81-073	14 DEC AJG-81-084	MEAN	% TOTAL
CHLOROPHYTA								
ACTINASTRUM	0	0	167	67	0	0	38.9	0.2
ANKISTRODESMUS	6	50	1917	1800	75	1	641.4	2.6
CERASTERIAS	0	0	0	67	0	0	11.1	< 0.1
CHLAMYDOMONAS	0	100	3250	133	6	0	581.5	2.3
CHODATELLA	0	0	833	0	0	0	138.9	0.6
CLOSTERIOPSIS	2	0	0	0	0	0	0.3	< 0.1
CLOSTERIUM	2	0	0	0	0	0	0.3	< 0.1
COELASTRUM	0	0	500	3133	3	0	606.0	2.4
COSMARIUM	0	0	0	67	0	0	11.1	< 0.1
CRUCIGENIA	0	0	250	67	3	0	53.2	0.2
DICTYOSPHAERIUM	0	0	917	7267	0	0	1363.9	5.5
ELAKATOTHRIX	0	0	0	133	0	0	22.2	0.1
FRANCEIA	0	0	0	200	0	0	33.3	0.1
KIRCHNERIELLA	0	0	500	3067	6	0	595.4	2.4
MICRACTINIUM	0	0	0	0	3	0	0.5	< 0.1
OOCYSTIS	0	0	333	600	114	0	174.5	0.7
PEDIASTRUM	0	0	83	333	0	0	69.4	0.3
SCENEDESMUS	3	50	10417	6200	164	0	2805.6	11.2
SCHROEDERIA	0	0	0	0	0	1	0.1	< 0.1
SELENASTRUM	0	0	167	67	0	0	38.9	0.2
TETRAEDRON	0	0	417	200	3	0	103.2	0.4
TETRASTRUM	0	0	1333	200	3	0	256.0	1.0
UNIDENTIFIED CHLOROPHYTA	3	100	7000	4867	33	1	2000.6	8.0
BACILLARIOPHYTA								
ACHNANTHES	3	0	0	0	3	0	1.0	< 0.1
AMPHORA	6	0	0	0	3	1	1.6	< 0.1
ASTERIONELLA	14	0	0	0	0	1	2.5	< 0.1
COCCONEIS	2	0	0	0	11	1	2.3	< 0.1
CYCLOTELLA	168	650	7917	11133	194	0	3343.7	13.4
CYMBELLA	3	550	83	0	11	1	108.1	0.4
DIATOMA	22	50	0	0	42	3	19.4	0.1
EPITHEMIA	2	0	0	0	0	0	0.3	< 0.1
FRAGILARIA	2	0	0	0	8	0	1.6	< 0.1
GOMPHONEIS	0	0	83	0	0	0	13.9	0.1
GOMPHONEMA	14	100	0	0	14	11	23.1	0.1
MELOSIRA	29	450	0	0	542	2	170.5	0.7
MERIDION	8	0	0	0	0	0	1.3	< 0.1
NAVICULA	32	100	250	133	183	12	118.5	0.5
NITZSCHIA	42	4900	333	467	119	50	985.2	3.9
RHOICOSPHENIA	2	0	0	0	0	0	0.3	< 0.1
STEPHANODISCUS	43	33200	20000	2933	108	0	9380.8	37.5
SYNEDRA	8	250	333	67	17	0	112.4	0.4
THALASSIOSIRA	0	0	0	0	461	0	76.9	0.3
CYANOPHYTA								
APHANOTHECE	0	0	0	0	3	0	0.5	< 0.1
CHROOCOCCUS	0	0	0	0	6	0	0.9	< 0.1
MERISMOPEDIA	0	0	83	733	0	0	136.1	0.5
MICROCYSTIS	0	0	4917	933	3	0	975.5	3.9
CHRYSOPHYTA								
DINOBYRON	5	0	0	0	0	1	0.9	< 0.1
SYNURA	0	0	0	0	3	0	0.5	< 0.1
EUGLENOPHYTA								
EUGLENA	2	0	0	0	0	0	0.3	< 0.1
TOTAL	418	40550	62083	44867	2142	85	25024.1	

Table B-20

Species of phytoplankton composing at least 5% of the total units counted in samples at SSES and Bell Bend on the Susquehanna River, 1981. Numbers following diatoms indicate the species affinity for pH as rated by Lowe (1974): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent to pH, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Coelastrum sphaericum			Aug
Dictyosphaerium pulchellum		Aug	Aug
Kirchneriella lunaris		Aug	
Oocystis parva			Oct
Scenedesmus quadricauda		Jun, Aug, Oct	Jun, Aug, Oct
BACILLARIOPHYTA			
Cyclotella atomus	(4)	Feb	Feb
C. meneghiniana	(1)	Feb, Aug, Oct	Feb, Aug, Oct
C. pseudostelligera	(1,3)	Feb, Jun	Feb, Jun
Melosira granulata	(1)	Oct	Oct
Navicula salinarum var. *intermedia*	(4)	Oct	Oct
Nitzschia acicularis	(1)	Apr	Apr
N. dissipata	(1)	Feb, Oct, Dec	Feb, Dec
Stephanodiscus invisitatus	(4)	Feb, Apr, Jun, Oct	Feb, Apr, Jun
Thalassiosira pseudonana	(3)	Oct	Oct

Table B-21

Density (units/ml) of phytoplankton t'at averaged at least 1% of the total for one or more years at SSES and Bell Bend on the Susquehanna River, 1977-81.

Taxon	SSES					Bell Bend				
	1977	1978	1979	1980	1981	1977	1978	1979	1980	1981
CHLOROPHYTA										
Actinastrum	490.4	95.2	194.4	56.4	55.6	458.3	29.8	208.0	91.9	38.9
Ankistrodesmus	107.8	501.0	292.6	928.4	887.8	104.0	285.2	345.9	996.1	641.4
Chlamydomonas	226.0	1565.6	1524.6	199.6	867.8	288.1	1102.6	1478.9	173.3	581.5
Chlorella	0.0	0.0	0.0	283.3	0.0	0.0	0.0	0.0	280.0	0.0
Chodatella	109.1	41.7	37.0	0.0	180.6	271.8	77.4	10.1	0.0	138.9
Coelastrum	47.6	31.4	22.2	164.6	480.6	91.3	30.2	26.8	180.5	606.0
Dictyosphaerium	184.9	390.3	491.2	628.6	1361.6	160.7	583.4	525.6	795.8	1363.9
Kirchneriella	117.1	167.1	1336.4	1283.1	991.7	74.3	108.9	1246.1	1088.1	595.4
Micractinium	105.2	38.8	97.2	29.5	25.5	67.5	52.1	156.6	20.0	0.5
Scenedesmus	462.5	575.5	782.2	2259.5	3524.4	400.5	648.9	695.3	2289.4	2805.6
Tetrastrum	21.8	58.1	25.5	42.0	383.3	4.0	64.0	37.3	61.0	256.0
Unidentified	211.1	496.6	737.8	1441.3	2659.2	162.5	518.6	787.9	1707.5	2000.6
BACILLARIOPHYTA										
Cyclotella	865.6	2490.6	1688.3	2267.5	2846.5	1211.4	2271.2	1752.0	2423.2	3343.7
Fragilaria	134.1	9.5	2.7	5.8	27.6	155.1	5.8	2.3	6.7	1.6
Melosira	28.9	247.9	99.1	99.1	179.0	140.5	495.0	78.0	171.3	170.5
Navicula	30.9	154.0	29.6	50.0	125.3	46.1	170.9	52.4	72.3	118.5
Nitzschia	100.6	926.0	124.9	241.2	715.3	[illegible]07.2	1004.9	116.3	143.2	985.2
Stephanodiscus	4389.5	3889.1	829.4	1087.6	9103.3	4820.5	3724.9	742.7	1393.3	9380.8
Synedra	20.9	179.3	36.9	32.2	2.1	75.8	185.3	91.8	24.8	112.4
CYANOPHYTA										
Chroococcus	139.2	0.9	88.0	363.5	33.8	17.9	23.8	10.1	552.5	0.9
Merismopedia	9.9	47.6	256.0	277.8	133.3	15.9	87.8	138.9	257.3	136.1
Microcystis	0.0	11.9	63.5	100.0	808.3	0.0	4.5	23.9	166.7	975.5

Table B-22

Relative abundance (% total) of phytoplankton that averaged at least 1% of the total for one or more years at SSES and Bell Bend on the Susquehanna River, 1977-81.

Taxon	SSES					Bell Bend				
	1977	1978	1979	1980	1981	1977	1978	1979	1980	1981
CHLOROPHYTA										
Actinastrum	6.1	0.8	2.2	0.5	0.2	5.1	0.3	2.4	0.7	0.2
Ankistrodesmus	1.3	4.0	3.2	7.7	3.4	1.2	2.4	3.9	7.6	2.3
Chlamydomonas	2.8	12.6	16.9	1.7	3.3	3.2	9.3	16.8	1.3	2.3
Chlorella	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	2.1	0.0
Chodatella	1.4	0.3	0.4	0.0	0.7	3.0	0.7	0.1	0.0	0.6
Coelastrum	0.6	0.3	0.3	1.4	1.8	1.0	0.3	0.3	1.4	2.4
Dictyosphaerium	2.3	3.1	5.4	5.2	5.2	1.8	4.9	6.0	6.1	5.5
Kirchneriella	1.5	1.3	14.8	10.6	3.8	0.8	0.9	14.1	8.3	2.4
Micractinium	1.3	0.3	1.1	0.2	0.1	0.8	0.4	1.8	0.2	<0.1
Scenedesmus	5.8	4.6	8.7	18.7	13.4	4.5	5.5	7.9	17.4	11.2
Tetrastrum	0.3	0.5	0.3	0.4	1.5	<0.1	0.5	0.4	0.5	1.0
Unidentified	2.6	4.0	8.2	11.9	10.1	1.8	4.4	8.9	13.0	8.0
BACILLARIOPHYTA										
Cyclotella	10.8	20.0	18.7	18.7	10.8	13.5	19.1	19.9	18.4	13.4
Fragilaria	1.7	0.1	<0.1	0.1	0.1	1.7	0.1	<0.1	0.1	<0.1
Melosira	0.4	2.0	1.1	0.8	0.7	1.6	4.2	0.9	1.3	0.7
Navicula	0.4	1.2	0.3	0.4	0.5	0.5	1.4	0.6	0.6	0.5
Nitzschia	1.3	7.4	1.4	2.0	2.7	1.2	8.5	1.3	1.1	3.9
Stephanodiscus	54.7	31.3	9.2	9.0	34.5	53.7	31.3	8.4	10.6	37.5
Synedra	0.3	1.4	0.4	0.3	<0.1	0.8	1.6	1.0	0.2	0.5
CYANOPHYTA										
Chroococcus	1.7	<0.1	1.0	3.0	0.1	0.2	0.2	0.1	4.2	<0.1
Merismopedia	0.1	0.4	2.8	2.3	0.5	0.2	0.7	1.6	2.0	0.5
Microcystis	0.0	0.1	0.7	0.8	3.1	0.0	0.1	0.3	1.3	3.9

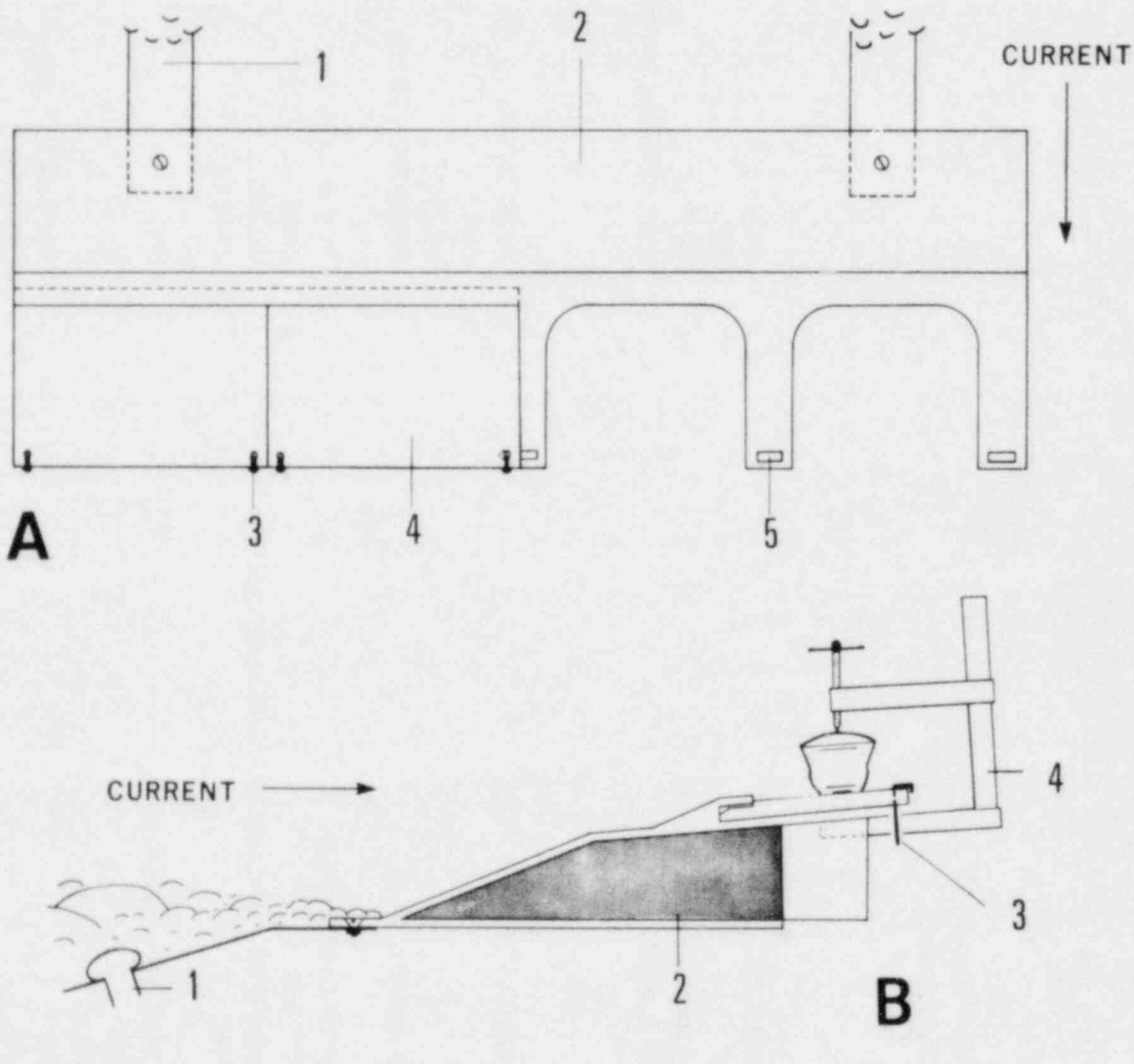

Fig. B-1

Detritus-free apparatus for periphytic algae studies. A. Acrylic holder with two plates removed (top view): 1) metal retaining strap; 2) deflecting shield, acrylic; 3) brass pin; 4) acrylic plate; 5) pin retaining slot. B. Acrylic holder (end view) with sampler in place: 1) steel stake (buried); 2) concrete ballast; 3) brass pin; 4) bar-clamp sampler.

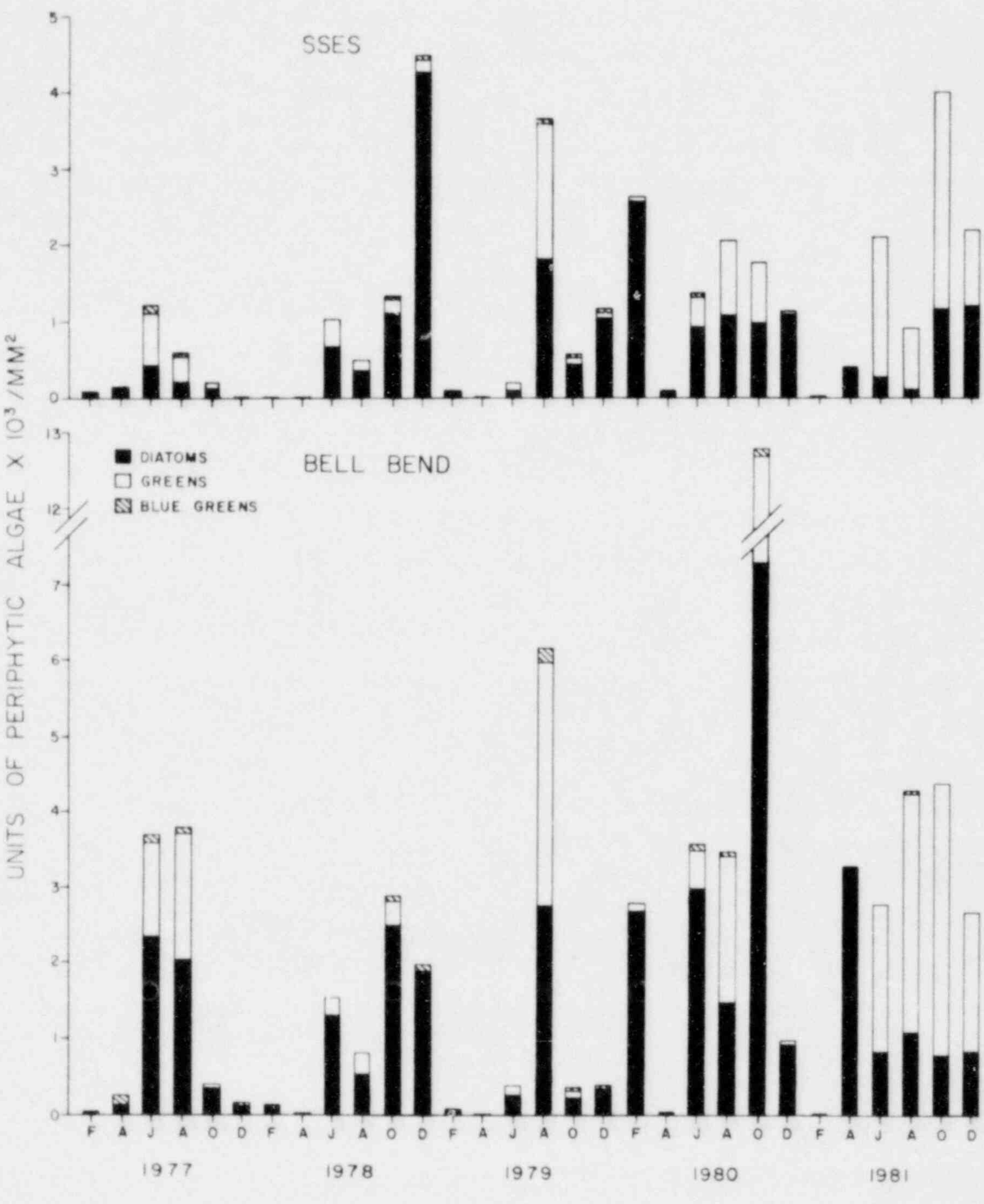

Fig. B-2

Standing crop of periphytic algae (units/mm^2) on cumulative acrylic plates at SSES and Bell Bend on the Susquehanna River, 1977-81.

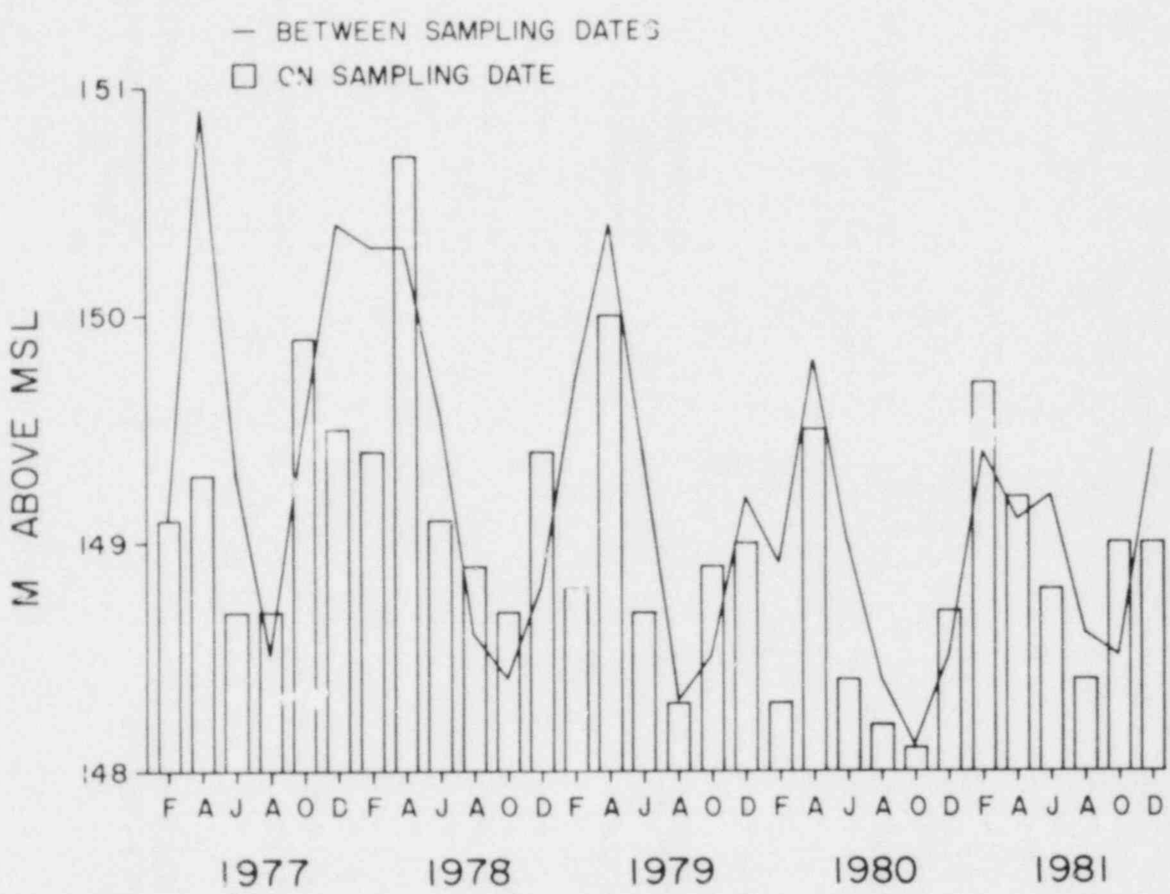

Fig. B-3

River level (meters above mean sea level) at SSES, 1977-81. The mean river level between sampling dates is based upon daily values.

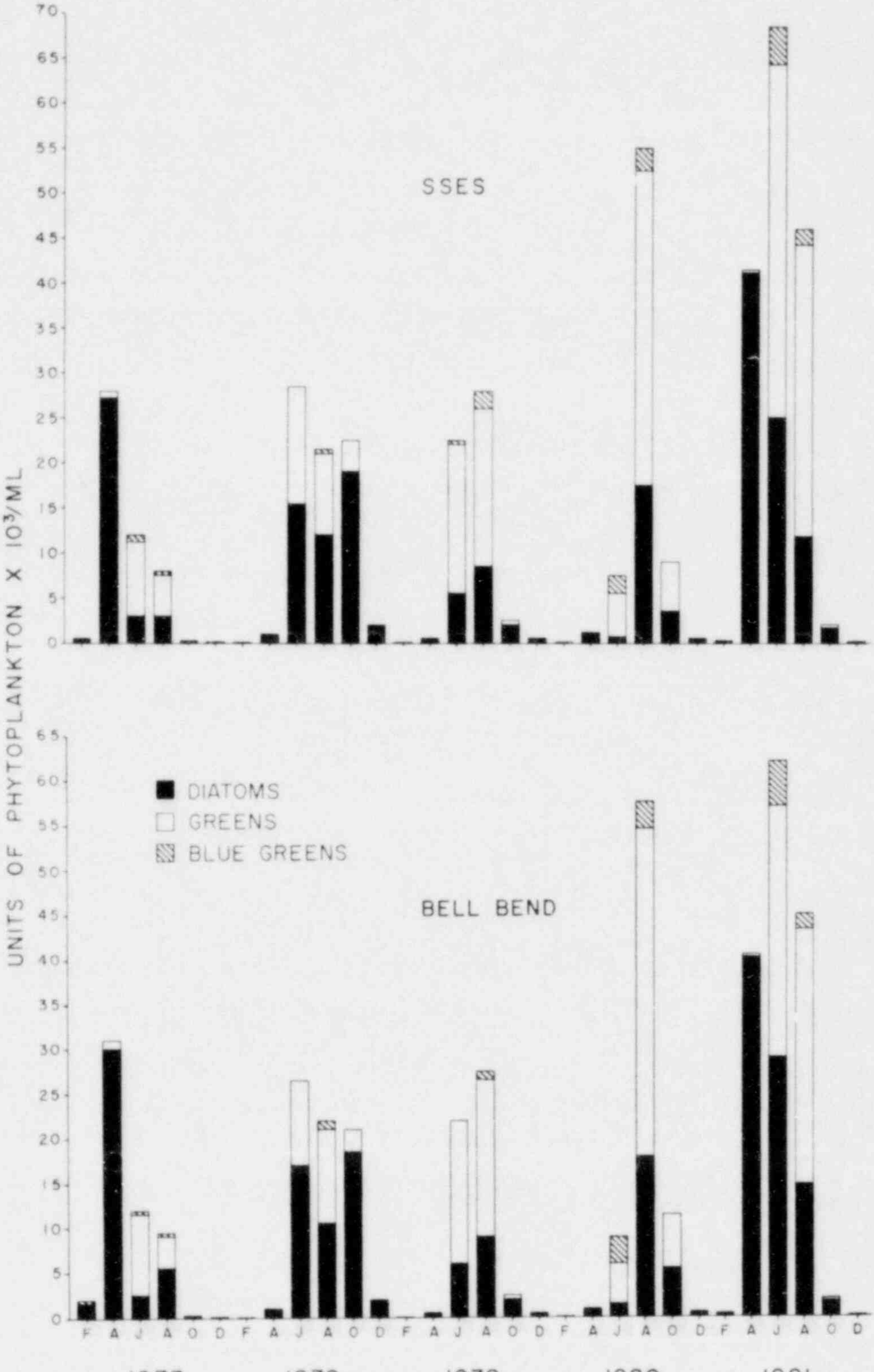

Fig. B-4

Standing crop of phytoplankton (units/ml) from bimonthly samples taken at SSES and Bell Bend on the Susquehanna River, 1977-81.

BENTHIC MACROINVERTEBRATES

by

William G. Deutsch, Linda S. Imes, and William F. Gale

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ABSTRACT

To establish a baseline of preoperational conditions in the Susquehanna River, the benthic macroinvertebrate community was sampled at two stations (four sites) in April, June, and October 1981. The overall mean standing crop of macroinvertebrates in 1981 (24,400 organisms/m^2) was 27% less than in 1980 (33,600 org/m^2), and was similar to that found in 1979 (24,800 org/m^2). This reversed the trend of increasing standing crops from 1977-80. The 1981 mean standing crop at SSES (33,000 org/m^2), upriver from the intake structure, was more than twice that at Bell Bend (15,900 org/m^2), downriver from the discharge diffuser. Oligochaetes (Naididae, Tubificidae), trichopterans (Hydropsychidae), and dipterans (Chironomidae) composed from 58 to 82% of the standing crop. Total mean biomass in 1981 (23.6 kg/ha) was similar to that in 1980 (22.1 kg/ha) and 1979 (23.2 kg/ha). Biomass at SSES (32.1 kg/ha) was twice that at Bell Bend (15.1 kg/ha) in 1981.

INTRODUCTION

Benthic macroinvertebrate populations are relatively sessile and many are highly specific in habitat selection. As a result, they are important indicators of environmental quality (Paine and Gaufin 1956). The density and taxonomic composition of the community often reflect changes in the environment (Deutsch 1981). The benthic community near

the Susquehanna SES has been monitored since 1972 to establish a baseline of preoperational conditions in the Susquehanna River. Macroinvertebrate biomass has been determined since 1975.

PROCEDURES

Benthic macroinvertebrates were collected at two stations (four sites) near the Susquehanna SES (Fig. A-1). Two sites (SSES I and II) were upriver from the intake structure, and two (Bell Bend I and III) were downriver from the discharge diffuser. Sites were the same as those sampled in 1978-80 (Table C-1).

Three samples were collected by a scuba diver at each site on 13-15 April, 15-18 June, and 12-14 October 1981 using a dome suction sampler (Gale and Thompson 1975). After the sampler was lowered from a boat to the river substrate, the diver moved it upriver or laterally to the first undisturbed area where an adequate seal between the sampler band and the substrate could be established. The diver then vacuumed the substrate inside the sampler (0.163 m^2) for five minutes with a screened intake hose leading to the sampler's bilge pump. Sediments (silt, sand, fine gravel) and organisms were pumped into a nylon net (216-μ mesh). The diver carefully vacuumed larger stones and then discarded them. The samples were returned to the boat by the diver for transport to the laboratory.

One replicate from each site was used for biomass estimates. It was washed and sieved through a number 20 sieve (840-μ mesh). The biomass

sample was refrigerated (or kept in ice water) until the organisms were sorted, removed, and identified. Processing was completed within 12 hours of collection. By chilling the sample, it was possible to avoid the use of preservatives which have been found to distort organism weight (Howmiller 1972, Wiederholm and Eriksson 1977). Before molluscs were weighed, their shells were decalcified in 1% HCl. After being sorted, organisms were placed in aluminum foil containers and dried in a Precision Scientific Thelco Model 17 oven at 100 C for at least 12 hours. After drying, the containers and their contents were cooled to room temperature in a glass dessicator. Organism dry weights were determined using a Mettler H10W balance.

The other two replicates were used for density estimates. Soon after collection, they were washed, sieved (250-μ mesh), and preserved (10% buffered formalin) for storage. Later, the residue was placed in white pans for sorting. Readily visible specimens (except chironomids and naidids) were removed from the residue, identified, and counted.

Estimates of the number of chironomids, naidids, and small organisms left in the sample were obtained by counting those organisms in a subsample of the total residue. Chironomids and naidids were counted from 1/23 of the residue; other organisms were counted from 1/4 of the residue. Both the 1/23 and 1/4 subsample were a composite of three randomly selected portions of the total residue. Subsamples were examined using a dissecting microscope (10-70X). The number of organisms found in the subsample was multiplied by the appropriate conversion factor (23 or 4) and then added to the total number of organisms sorted from pans. Some chironomids had to be mounted on microscope slides and examined with a compound microscope (100-470X) for identification.

The number of organisms per square meter was determined by multiplying the number of organisms per sample by 6.135. Invertebrates were identified (usually to genus or species) with the keys of Ross (1944), Allen and Edmunds (1962a-b, 1963a-b, 1965), Hilsenhoff (1970), Harman and Berg (1971), McCafferty (1974), Beck (1976), Brown (1976), Edmunds et al. (1976), Resh (1976), Surdick and Kim (1976), Wiggins (1977), Brown and White (1978), Lewis (1978), Mackay (1978), Merritt and Cummins (1978), Pennak (1978), Schuster and Etnier (1978), Morihara and McCafferty (1979), and Simpson and Bode (1980).

Samples were classified according to similarity in macroinvertebrate abundance and taxonomic composition using BASIC computer programs and a Hewlett-Packard 9830-A computer. Chance and Deutsch (1980) evaluated four similarity indexes and found the index of Bray and Curtis (1957) to be the best for analysis of Susquehanna River macroinvertebrate samples. The Bray-Curtis index:

$$1 - \frac{\sum_{j=1}^{n} |X1_j - X2_j|}{\sum_{j=1}^{n} (X1_j + X2_j)}$$

was used to calculate a between-sample similarity matrix, where $X1_j$ and $X2_j$ represent the abundance of taxon j in samples 1 and 2, respectively, and n represents the total number of taxa. The similarity matrix was then subjected to a cluster analysis by the group-average sorting technique (Clifford and Stephenson 1975).

RESULTS AND DISCUSSION

Standing Crop

The mean standing crop of macroinvertebrates at both stations combined in 1981 (24,400 organisms/m^2) was 27% less than in 1980 (33,600 org/m^2), and was similar to that found in 1979 (24,800 org/m^2) (Fig. C-1). The 1981 mean standing crop of macroinvertebrates at SSES (33,000 org/m^2) was again greater than at Bell Bend (15,900 org/m^2), as it was from 1978-80. The relative abundance of oligochaetes (Naididae, Tubificidae) and dipterans (Chironomidae) in 1981 (51% of the total) was less than in 1980 (75%). The relative abundance of Trichoptera (Hydropsychidae) (25%), however, was much higher than in 1980 (11%). The hydropsychid, *Cheumatopsyche* spp., composed almost 20% of the total organisms collected. Three chironomids (*Rheotanytarsus* spp., *Thienemannimyia* gr., and *Polypedilum* spp.) composed 22% of the total organisms. In general, seasonal changes in macroinvertebrate density were similar to patterns observed from 1976 through 1980. Data are summarized in Table C-2; raw data appear in Tables C-3 through C-14.

April

The overall mean density of macroinvertebrates was lowest in April (18,400 org/m^2) as it has been since 1977. However, there has been an increase in the number of macroinvertebrates collected in April from 1977 through 1981 (Figs. C-2 and C-3). Macroinvertebrates were 41% more abundant at SSES (21,500 org/m^2) than at Bell Bend (15,300 org/m^2). At

SSES, chironomids (10,000 org/m^2) and naidids (6,600 org/m^2) composed 77% of the total organisms; hydropsychids (1,500 org/m^2) composed 7%. At Bell Bend, chironomids (9,000 org/m^2) and tubificids (2,100 org/m^2) composed 73% of the total organisms; nematodes (1,500 org/m^2) and naidids (1,100 org/m^2) composed 17% of the total.

June

The overall mean standing crop (both stations combined) in June 1981 (24,100 org/m^2) was 31% greater than that found in April. It increased by 67% at SSES (36,100 org/m^2), but decreased by 20% at Bell Bend (12,200 org/m^2). At SSES, chironomids (14,700 org/m^2) composed 41% of the total number of organisms. Hydropsychids (11,900 org/m^2) and the mayfly, *Caenis* sp., (4,200 org/m^2) composed 45% of the total. At Bell Bend, *Caenis* sp. (2,700 org/m^2) and chironomids (2,600 org/m^2) composed 43% of the total organisms; hydropsychids (2,100 org/m^2) and tubificids (1,500 org/m^2) made up 30% of the total. The total number of organisms collected in June 1981 was nearly half that found in June 1980 (45,200 org/m^2). This accounted for most of the overall decrease in the 1981 standing crop of macroinvertebrates.

October

Macroinvertebrate density was highest in October at both stations (30,800 org/m^2), as it was in 1978 and 1979. In 1980, however, densities were much greater in June than in October. In October 1981, there was

an average of 41,400 org/m^2 at SSES and 20,100 org/m^2 at Bell Bend. At SSES, hydropsychids (14,000 org/m^2) composed 34% of the total organisms. Chironomids (9,600 org/m^2), oligochaetes (6,300 org/m^2), and heptageniid mayflies (2,500 org/m^2) composed 44% of the total. At Bell Bend, chironomids (3,800 org/m^2) composed 19% of the total organisms. Heptageniids (3,300 org/m^2), sphaeriid clams (2,800 org/m^2), and tubificids (2,600 org/m^2) composed 43% of the total.

Population Trends

The mean standing crop of macroinvertebrates at both SSES and Bell Bend in 1981 was less than in 1980. This reversed a trend of steadily increasing standing crops at both stations since 1977 (Fig. C-1). The greatest decline in numbers, relative to 1980, occurred at SSES (down 29%), primarily due to fewer naidids in April, and fewer chironomids (*Rheotanytarsus* spp., *Thienemannimyia* gr., *Cricotopus* spp.) in June and October (Fig. C-2). Also, density of the hydropsychid, *Hydropsyche phalerata*, which had been increasing at SSES since 1977 (Deutsch 1978, Sabin et al. 1979, Sabin-Zelenak et al. 1980, Deutsch et al. 1981), declined by 42% from 1980 to 1981 ($\bar{x}$ = 900 org/m^2). The lower standing crop at Bell Bend (down 23%) was mainly due to fewer chironomids (*Rheotanytarsus* spp., *Thienemannimyia* gr., *Tanytarsus* sp.) in June and October (Fig. C-3). In addition, the 1981 density of oligochaetes at Bell Bend was 34% less than in 1980.

Not all organisms declined in number in 1981. Populations of the hydropsychid, *Cheumatopsyche* spp., increased 2.5-fold at SSES ($\bar{x}$ = 8,000 org/m^2), and more than 5-fold at Bell Bend ($\bar{x}$ = 1,200 org/m^2). Also, density of sphaeriid clams increased by 41% at Bell Bend ($\bar{x}$ = 1,200 org/m^2) and 57% at SSES ($\bar{x}$ = 1,400 org/m^2). Sphaeriid density has been increasing at both stations since 1977 (Deutsch 1978, Sabin et al. 1979, Sabin-Zelenak et al. 1980, Deutsch et al. 1981); *Pisidium casertanum* and *Sphaerium transversum* are the two most common species.

Station Similarity

Cluster analysis indicated seasonal, station, and site differences in taxonomic composition and abundance of organisms in 1981 (Fig. C-4). All samples were grouped by sampling period before they were grouped by station or site. This indicated that seasonal changes were more important in distinguishing macroinvertebrate communities than station or site differences. As in 1980, the cluster analysis generally segregated SSES samples from those at Bell Bend, suggesting that macroinvertebrate communities at the two stations were distinct.

Of the three sampling periods, the October samples were the most distinctly grouped by station and site. April samples were grouped by station, but some of the SSES samples were mixed by site. June samples were mixed by station and site, and were the least similar to other samples. The June samples were probably segregated from those of April and October because of taxonomic composition, rather than overall abundance of organisms.

For example, the mayfly, *Caenis* sp., composed 14% of total organisms collected at SSES and Bell Bend in June, but only 1% in both April and October.

Taxonomic Treatment

A list of macroinvertebrates collected in dome samples from 1975 through 1981 is presented in Table C-15. Seventeen taxa were added to the 1981 list. Many of these organisms had been previously collected at other stations on the Susquehanna River, or with other sampling gear (Deutsch 1976, 1977), but were collected with a dome sampler at SSES or Bell Bend for the first time in 1981. Some organisms had been previously collected with a dome sampler at SSES or Bell Bend, but were more specifically identified in 1981.

The following specialists made or verified identifications: Mr. Donald G. Huggins, State Biological Survey of Kansas (odonates); Dr. William P. McCafferty, Purdue University at Lafayette (mayflies); Dr. Selwyn S. Roback, Academy of Natural Sciences of Philadelphia (chironomids); Dr. David S. White, University of Michigan at Ann Arbor (molluscs).

Names of two heptageniid mayflies were changed (Table C-15) in accordance with Bednarik and McCafferty (1979):

1. *Stenonema nepotellum* now is *S. mediopunctatum*
2. *Stenonema rubrum* now is *S. modestum*

Biomass

The total mean biomass (dry weight) at SSES and Bell Bend in 1981 (23.6 kg/ha) was similar to that measured in 1980 (22.1 kg/ha) and 1979 (23.2 kg/ha) (Fig. C-1). In 1981, biomass was more than twice as great at SSES (32.1 kg/ha) as at Bell Bend (15.1 kg/ha) (Tables C-16 and C-17). At SSES, trichopterans (17.1 kg/ha) composed 53% of the total dry weight. Molluscs (4.4 kg/ha), ephemeropterans (4.3 kg/ha), and oligochaetes (3.2 kg/ha) made up 37% of the total. At Bell Bend, ephemeropterans (4.9 kg/ha) composed 32% of the biomass, and trichopterans (3.0 kg/ha), molluscs (2.9 kg/ha), and oligochaetes (2.4 kg/ha) made up an additional 55% of the total.

In spite of fluctuations in organism density from 1979 through 1981, biomass has remained relatively stable at both stations (Fig. C-1). Organisms which declined in number in 1981 (naidids, chironomids) were small and composed relatively little of the biomass. Some organisms which became more numerous in 1981 (*Cheumatopsyche* spp.) were relatively large and composed a greater percent of the biomass.

April

At SSES, trichopterans (16.3 kg/ha) composed 68% of the total biomass (24.1 kg/ha); dipterans (2.8 kg/ha) and oligochaetes (2.0 kg/ha) made up 20% of the total. At Bell Bend, oligochaetes (4.0 kg/ha) composed 35% of the total biomass (11.6 kg/ha), and trichopterans (3.6 kg/ha) and dipterans (1.6 kg/ha) made up an additional 45% of the total.

June

At SSES, trichopterans (10.3 kg/ha) formed 38% of the total biomass (26.8 kg/ha). Ephemeropterans (5.7 kg/ha), oligochaetes (5.2 kg/ha), and molluscs (4.2 kg/ha) composed 56% of the total. At Bell Bend, ephemeropterans (7.2 kg/ha) made up 64% of the total biomass (11.4 kg/ha); trichopterans (2.4 kg/ha) and oligochaetes (0.9 kg/ha) composed an additional 29% of the total.

October

Maximum biomass ($\bar{x}$ = 33.8 kg/ha) occurred at all sites in October. At SSES, trichopterans (24.8 kg/ha) composed 55% of the total dry weight (45.4 kg/ha). Molluscs (8.3 kg/ha) and ephemeropterans (6.1 kg/ha) made up 32% of the total. More than half of the molluscan biomass at SSES I (13.3 kg/ha) was composed of a large specimen of the snail, *Goniobasis virginica*. It was the first time the species had been collected in the study area. At Bell Bend, molluscs (7.8 kg/ha) composed 35% of the total biomass (22.2 kg/ha), and ephemeropterans (6.3 kg/ha) and trichopterans (3.2 kg/ha) composed 43% of the total.

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Table C-1

Description and location of benthic macroinvertebrate sampling sites on the Susquehanna River, 1981.

Station	SSES		BELL BEND	
Site	I	II	I	III
Depth[a]	0.6	1.0	1.3	1.3
Substrate Type[b]	gravel-pebble	pebble-cobble	gravel-pebble with bouiders	gravel-pebble
Location	817 m upriver from the center of the intake structure; 32 m from the west bank	817 m upriver from the center of the intake structure; 103 m from the west bank	791 m downriver from the center of the discharge diffuser; 37 m from the west bank	791 m downriver from the center of the discharge diffuser; 66 m from the west bank

[a]Site depth (m) when river surface elevation is 148.6 m above mean sea level at the Susquehanna SES Biological Laboratory.

[b]Based on predominant particle size (Cummins 1962).

Table C-2

Mean standing crop (org/m^2) and percent total of benthic macroinvertebrates in six dome samples at each site on the Susquehanna River, 1981.

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
HYDRA SP.	0	0	0.0	10	4	<0.1
ALLOEOCOELA	39	27	<0.1	50	28	0.2
TRICLADIDA	587	133	1.1	120	158	0.9
PROSTOMA SP.	24	4	<0.1	28	46	0.2
NEMATODA	717	240	1.5	777	1885	8.4
NAIDIDAE	4584	2328	10.5	530	503	3.3
SLAVINA APPENDICULATA	24	0	<0.1	0	0	0.0
TUBIFICIDAE	2381	627	4.6	2441	1603	12.7
PELOSCOLEX SP.	5	0	<0.1	80	10	0.3
LUMBRICULIDAE	324	63	0.6	141	264	1.3
HIRUDINEA	0	0	0.0	10	0	<0.1
ERPOBDELLIDAE	1	0	<0.1	0	0	0.0
ASELLUS SP.	2	0	<0.1	0	0	0.0
ASTACIDAE	0	1	<0.1	2	1	<0.1
ISOTOMURUS PALUSTRIS	0	0	0.0	0	5	<0.1
PLECOPTERA	4	4	<0.1	0	0	0.0
STROPHOPTERYX FASCIATA	1	0	<0.1	0	0	0.0
PERLIDAE	83	21	0.2	4	4	<0.1
ACRONEURIA SPP.	1	0	<0.1	0	0	0.0
NEOPERLA SP.	3	0	<0.1	4	1	<0.1
PHASGANOPHORA SP.	5	4	<0.1	0	1	<0.1
EPHEMEROPTERA	4	1	<0.1	4	4	<0.1
EPHORON SP.	7	1	<0.1	1	0	<0.1
POTAMANTHUS SPP.	434	251	1.0	95	244	1.1
CAENIS SP.	2214	929	4.8	1108	854	6.2
TRICORYTHODES SP.	2	0	<0.1	1	1	<0.1
EPHEMERELLIDAE	49	19	0.1	15	0	<0.1
DRUNELLA SPP.	12	0	<0.1	5	1	<0.1
DRUNELLA WALKERI	10	5	<0.1	0	0	0.0
EPHEMERELLA SPP.	5	0	<0.1	0	0	0.0
EPHEMERELLA INVARIA	1	0	<0.1	0	0	0.0
EPHEMERELLA NEEDHAMI	4	2	<0.1	0	0	0.0
EURYLOPHELLA LUTULENTA	0	0	0.0	1	0	<0.1
SERRATELLA SPP.	6	4	<0.1	1	1	<0.1
SERRATELLA DEFICIENS	6	3	<0.1	0	1	<0.1
LEPTOPHLEBIIDAE	0	1	<0.1	1	0	<0.1
BAETIDAE	29	1	<0.1	1	5	<0.1
PSEUDOCLOEON SP.	1	1	<0.1	0	0	0.0
ISONYCHIA SP.	40	32	0.1	2	14	<0.1
HEPTAGENIIDAE	679	422	1.7	1143	641	5.6
HEPTAGENIA SPP.	27	11	<0.1	91	82	0.5
RHITHROGENA SP.	1	6	<0.1	0	3	<0.1
STENACRON SPP.	0	0	0.0	4	0	<0.1
STENACRON INTERPUNCTATUM	3	21	<0.1	144	32	0.6
STENONEMA SPP.	39	99	0.2	55	22	0.2
STENONEMA FUSCUM	2	2	<0.1	0	1	<0.1
STENONEMA ITHACA	74	15	0.1	0	12	<0.1
STENONEMA PULCHELLUM	492	350	1.3	187	358	1.7
STENONEMA TERMINATUM	167	96	0.4	147	197	1.1
STYLOGOMPHUS ALBISTYLUS	1	0	<0.1	0	0	0.0
COENAGRIONIDAE	13	3	<0.1	0	0	0.0
ARGIA SP.	5	1	<0.1	0	0	0.0
SIALIS SP.	2	7	<0.1	25	26	0.2
CORYDALUS SP.	0	0	0.0	1	0	<0.1
TRICHOPTERA	0	0	0.0	4	0	<0.1
TRICHOPTERA (PUPAE)	3	6	<0.1	2	1	<0.1
POLYCENTROPODIDAE	10	4	<0.1	28	21	0.2
NEURECLIPSIS SP.	176	79	0.4	44	22	0.2
POLYCENTROPUS SP.	31	4	<0.1	7	12	<0.1
HYDROPSYCHIDAE	0	1	<0.1	0	0	0.0
CHEUMATOPSYCHE SPP.	11516	4482	24.2	1086	1328	7.6
HYDROPSYCHE SPP.	420	45	0.7	0	46	0.1
HYDROPSYCHE PHALERATA	1155	546	2.6	37	139	0.6
MACRONEMA SPP.	5	15	<0.1	1	0	<0.1
SYMPHITOPSYCHE SPP.	19	8	<0.1	1	0	<0.1
SYMPHITOPSYCHE BIFIDA GR.	17	7	<0.1	0	4	<0.1
SYMPHITOPSYCHE MOROSA	32	11	<0.1	0	0	0.0
HYDROPTILIDAE (PUPAE)	4	0	<0.1	0	0	0.0
AGRAYLEA SP.	4	0	<0.1	0	0	0.0
HYDROPTILA SPP.	182	10	0.3	0	8	<0.1
LEPTOCERIDAE	165	246	0.6	152	116	0.8
CERACLEA SPP.	12	14	<0.1	9	0	<0.1
CERACLEA ALAGMA	1	0	<0.1	0	0	0.0
CERACLEA FLAVA	0	3	<0.1	0	0	0.0
CERACLEA MACULATA	4	0	<0.1	4	0	<0.1
CERACLEA SP#1	2	2	<0.1	0	0	0.0
CERACLEA TARSIPUNCTATA	7	4	<0.1	3	9	<0.1
MYSTACIDES SPP.	5	0	<0.1	8	0	<0.1
NECTOPSYCHE SP.	22	28	<0.1	142	345	1.5

Table C-2 (cont.)

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
OECETIS SPP.	182	138	0.5	173	89	0.8
OECETIS AVARA	46	31	0.1	9	19	<0.1
OECETIS CINERASCENS	180	59	0.4	117	46	0.5
OECETIS INCONSPICUA	8	0	<0.1	141	32	0.5
COLEOPTERA (PUPAE)	0	0	0.0	1	0	<0.1
BEROSUS SP.	1	5	<0.1	0	1	<0.1
PSEPHENUS SP.	1	0	<0.1	0	0	0.0
ELMIDAE (ADULTS)	30	10	<0.1	4	4	<0.1
DUBIRAPHIA SP.	18	8	<0.1	24	14	0.1
OPTIOSERVUS SP.	44	20	<0.1	9	2	<0.1
STENELMIS SP.	284	147	0.7	51	212	0.8
DIPTERA (PUPAE)	4	0	<0.1	0	0	0.0
TIPULIDAE	0	13	<0.1	0	0	0.0
ANTOCHA SP.	5	0	<0.1	0	0	0.0
SIMULIIDAE	34	17	<0.1	4	0	<0.1
ATHERIX SP.	1	0	<0.1	0	0	0.0
EMPIDIDAE	535	128	1.0	14	17	<0.1
CERATOPOGONIDAE	13	0	<0.1	43	22	0.2
CHIRONOMIDAE	72	96	0.3	24	24	0.1
CHIRONOMIDAE (PUPAE)	702	461	1.8	313	138	1.4
TANYPODINAE	24	0	<0.1	47	0	0.1
ABLABESMYIA SPP.	0	0	0.0	24	0	<0.1
ABLABESMYIA MALLOCHI	48	48	0.1	339	72	1.3
LABRUNDINIA SP.	0	0	0.0	47	0	0.1
NILOTANYPUS SP.	47	0	<0.1	0	0	0.0
PROCLADIUS SP.	24	0	<0.1	0	0	0.0
THIENEMANNIMYIA GR.	2884	1155	6.1	1327	1420	8.7
CHIRONOMINAE	0	0	0.0	72	0	0.2
CRYPTOCHIRONOMUS SPP.	24	0	<0.1	0	24	<0.1
CRYPTOCHIRONOMUS FULVUS GR.	29	1	<0.1	221	122	1.1
DICROTENDIPES NEOMODESTUS	265	168	0.7	217	24	0.8
ENDOCHIRONOMUS SPP.	0	1	<0.1	0	0	0.0
GLYPTOTENDIPES SP.	268	53	0.5	47	24	0.2
MICROTENDIPES SP.	50	217	0.4	123	121	0.8
PARACHIRONOMUS SPP.	25	0	<0.1	0	0	0.0
PHAENOPSECTRA SP.	75	24	0.1	119	74	0.6
POLYPEDILUM SPP.	0	0	0.0	47	0	0.1
POLYPEDILUM CONVICTUM	1713	1224	4.4	263	95	1.1
POLYPEDILUM NR. SCALAENUM	49	1	<0.1	193	72	0.8
RHEOTANYTARSUS SPP.	6892	2892	14.8	437	504	3.0
TANYTARSUS SPP.	97	72	0.3	1035	551	5.0
TRIBELOS FUSICORNIS	24	0	<0.1	0	2	<0.1
ZAVRELIA GR.	95	190	0.4	600	503	3.5
SYMPOTTHASTIA SP.	0	24	<0.1	48	47	0.3
ORTHOCLADIINAE	24	0	<0.1	0	24	<0.1
CORYNONEURA SP.	24	24	<0.1	72	24	0.3
CORYNONEURA CELERIPES	0	0	0.0	0	25	<0.1
CRICOTOPUS SPP.	725	601	2.0	1	96	0.3
CRICOTOPUS BICINCTUS	248	122	0.6	95	72	0.5
EUKIEFFERIELLA SPP.	1	0	<0.1	0	0	0.0
EUKIEFFERIELLA BAVARICA GR.	47	120	0.3	48	0	0.2
EUKIEFFERIELLA DISCOLORIPES GR.	169	49	0.3	0	0	0.0
NANOCLADIUS SPP.	120	72	0.3	263	144	1.3
ORTHOCLADIUS SP.	191	72	0.4	0	0	0.0
RHEOCRICOTOPUS SPP.	1	0	<0.1	0	0	0.0
SYNORTHOCLADIUS SP.	191	24	0.3	24	72	0.3
THIENEMANNIELLA SPP.	25	0	<0.1	0	0	0.0
UNIDENTIFIED TERRESTRIAL	13	0	<0.1	0	0	0.0
PHYSA SP.	2	0	<0.1	16	0	<0.1
LYMNAEA SP.	4	1	<0.1	2	4	<0.1
PLANORBIDAE	0	0	0.0	1	0	<0.1
GYRAULUS SP.	1	1	<0.1	5	4	<0.1
HELISOMA SP.	7	1	<0.1	4	1	<0.1
FERRISSIA SP.	164	53	0.3	44	25	0.2
GONIOBASIS VIRGINICA	1	0	<0.1	0	0	0.0
PISIDIUM SP.	996	300	2.0	553	1288	5.8
SPHAERIUM SPP.	1011	447	2.2	278	333	1.9
UNIONIDAE	0	0	0.0	0	1	<0.1

Table C-3

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES I on the Susquehanna River, 13 April 1981. Replicates are indicated by collection number.

TAXON	LSI-81-002	LSI-81-003	MEAN	PERCENT TOTAL
ALLOEOCOELA	12.3	85.9	49.1	0.2
TRICLADIDA	6.1	30.7	18.4	0.1
PROSTOMA SP.	24.5	24.5	24.5	0.1
NEMATODA	135.0	171.8	153.4	0.5
NAIDIDAE	17570.5	1871.2	9720.8	34.5
TUBIFICIDAE	601.2	717.8	659.5	2.3
PELOSCOLEX SP.	0.0	6.1	3.1	<0.1
LUMBRICULIDAE	214.7	325.2	269.9	1.0
STROPHOPTERYX FASCIATA	0.0	6.1	3.1	<0.1
PHASGANOPHORA SP.	6.1	6.1	6.1	<0.1
POTAMANTHUS SPP.	171.8	214.7	193.3	0.7
CAENIS SP.	300.6	233.1	266.9	0.9
EPHEMERELLIDAE	190.2	24.5	107.4	0.4
DRUNELLA SPP.	0.0	73.6	36.8	0.1
DRUNELLA WALKERI	61.3	0.0	30.7	0.1
EPHEMERELLA SPP.	0.0	24.5	12.3	<0.1
EPHEMERELLA INVARIA	6.1	0.0	3.1	<0.1
EPHEMERELLA NEEDHAMI	24.5	0.0	12.3	<0.1
SERRATELLA SPP.	36.8	0.0	18.4	0.1
SERRATELLA DEFICIENS	24.5	0.0	12.3	<0.1
HEPTAGENIIDAE	61.3	36.8	49.1	0.2
STENACRON INTERPUNCTATUM	0.0	18.4	9.2	<0.1
STENONEMA SPP.	6.1	24.5	15.3	0.1
STENONEMA FUSCUM	0.0	6.1	3.1	<0.1
STENONEMA ITHACA	24.5	36.8	30.7	0.1
STENONEMA PULCHELLUM	36.8	98.2	67.5	0.2
STENONEMA TERMINATUM	30.7	6.1	18.4	0.1
COENAGRIONIDAE	18.4	6.1	12.3	<0.1
NEURECLIPSIS SP.	6.1	0.0	3.1	<0.1
CHEUMATOPSYCHE SPP.	2312.9	1024.5	1668.7	5.9
HYDROPSYCHE PHALERATA	429.4	135.0	282.2	1.0
MACRONEMA SPP.	6.1	0.0	3.1	<0.1
SYMPHITOPSYCHE SPP.	0.0	6.1	3.1	<0.1
SYMPHITOPSYCHE BIFIDA GR.	36.8	42.9	39.9	0.1
SYMPHITOPSYCHE MOROSA	6.1	12.3	9.2	<0.1
AGRAYLEA SP.	0.0	24.5	12.3	<0.1
HYDROPTILA SPP.	24.5	0.0	12.3	<0.1
LEPTOCERIDAE	79.8	24.5	52.1	0.2
CERACLEA SPP.	24.5	0.0	12.3	<0.1
CERACLEA SP#1	6.1	6.1	6.1	<0.1
NECTOPSYCHE SP.	55.2	24.5	39.9	0.1
OECETIS SPP.	539.9	165.6	352.8	1.3
OECETIS AVARA	24.5	0.0	12.3	<0.1
OECETIS CINERASCENS	135.0	92.0	113.5	0.4
ELMIDAE (ADULTS)	18.4	6.1	12.3	<0.1
DUBIRAPHIA SP.	6.1	0.0	3.1	<0.1
OPTIOSERVUS SP.	98.2	30.7	64.4	0.2
STENELMIS SP.	374.2	380.4	377.3	1.3
DIPTERA (PUPAE)	0.0	24.5	12.3	<0.1
ANTOCHA SP.	6.1	0.0	3.1	<0.1
EMPIDIDAE	723.9	165.6	444.8	1.6
CERATOPOGONIDAE	0.0	24.5	12.3	<0.1
CHIRONOMIDAE (PUPAE)	1325.2	337.4	831.3	2.9
TANYPODINAE	141.1	0.0	70.6	0.3
ABLABESMYIA MALLOCHI	288.3	0.0	144.2	0.5
NILOTANYPUS SP.	141.1	0.0	70.6	0.3
THIENEMANNIMYIA GR.	1607.4	1006.1	1306.7	4.6
CRYPTOCHIRONOMUS SPP.	0.0	141.1	70.6	0.3
CRYPTOCHIRONOMUS FULVUS GR.	141.1	0.0	70.6	0.3
DICROTENDIPES NEOMODESTUS	723.9	429.4	576.7	2.0
GLYPTOTENDIPES SP.	435.6	300.6	368.1	1.3
MICROTENDIPES SP.	0.0	6.1	3.1	<0.1
PHAENOPSECTRA SP.	141.1	159.5	150.3	0.5
POLYPEDILUM CONVICTUM	2908.0	1006.1	1957.1	6.9
RHEOTANYTARSUS SPP.	2883.4	1435.6	2159.5	7.7
TANYTARSUS SPP.	288.3	153.4	220.9	0.8
ZAVRELIA GR.	429.4	141.1	285.3	1.0
ORTHOCLADIINAE	0.0	141.1	70.6	0.3
CRICOTOPUS SPP.	2312.9	576.7	1444.8	5.1
CRICOTOPUS BICINCTUS	429.4	625.8	527.6	1.9
EUKIEFFERIELLA SPP.	6.1	0.0	3.1	<0.1
EUKIEFFERIELLA BAVARICA GR.	141.1	0.0	70.6	0.3
EUKIEFFERIELLA DISCOLORIPES GR.	429.4	141.1	285.3	1.0
NANOCLADIUS SPP.	288.3	429.4	358.9	1.3
ORTHOCLADIUS SP.	141.1	576.7	358.9	1.3
RHEOCRICOTOPUS SPP.	6.1	0.0	3.1	<0.1
SYNORTHOCLADIUS SP.	717.8	429.4	573.6	2.0
PHYSA SP.	0.0	6.1	3.1	<0.1
LYMNAEA SP.	12.3	0.0	6.1	<0.1
PISIDIUM SP.	1085.9	165.6	625.8	2.2
SPHAERIUM SPP.	423.3	55.2	239.3	0.8
TOTAL	41923.8	14502.2	28210.3	

Table C-4

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES II on the Susquehanna River, 14 April 1981. Replicates are indicated by collection number.

TAXON	LSI-81-005	LSI-81-006	MEAN	PERCENT TOTAL
ALLOEOCOELA	6.1	0.0	3.1	<0.1
TRICLADIDA	6.1	6.1	6.1	<0.1
PROSTOMA SP.	24.5	0.0	12.3	0.1
NEMATODA	171.8	196.3	184.0	1.2
NAIDIDAE	4607.4	2165.6	3386.5	22.8
TUBIFICIDAE	809.8	263.8	536.8	3.6
LUMBRICULIDAE	49.1	67.5	58.3	0.4
POTAMANTHUS SPP.	67.5	73.6	70.6	0.5
CAENIS SP.	110.4	42.9	76.7	0.5
EPHEMERELLIDAE	55.2	24.5	39.9	0.3
DRUNELLA WALKERI	24.5	6.1	15.3	0.1
EPHEMERELLA NEEDHAMI	12.3	0.0	6.1	<0.1
SERRATELLA SPP.	0.0	24.5	12.3	0.1
SERRATELLA DEFICIENS	18.4	0.0	9.2	0.1
ISONYCHIA SP.	6.1	6.1	6.1	<0.1
HEPTAGENIIDAE	30.7	30.7	30.7	0.2
STENACRON INTERPUNCTATUM	0.0	6.1	3.1	<0.1
STENONEMA SPP.	12.3	0.0	6.1	<0.1
STENONEMA ITHACA	6.1	12.3	9.2	0.1
STENONEMA PULCHELLUM	18.4	12.3	15.3	0.1
STENONEMA TERMINATUM	12.3	42.9	27.6	0.2
COENAGRIONIDAE	0.0	6.1	3.1	<0.1
NEURECLIPSIS SP.	0.0	6.1	3.1	<0.1
CHEUMATOPSYCHE SPP.	779.1	816.0	797.5	5.4
HYDROPSYCHE PHALERATA	171.8	159.5	165.6	1.1
MACRONEMA SPP.	18.4	12.3	15.3	0.1
SYMPHITOPSYCHE BIFIDA GR.	12.3	12.3	12.3	0.1
SYMPHITOPSYCHE MOROSA	6.1	12.3	9.2	0.1
HYDROPTILA SPP.	30.7	0.0	15.3	0.1
LEPTOCERIDAE	55.2	0.0	27.6	0.2
CERACLEA SPP.	0.0	6.1	3.1	<0.1
CERACLEA SP#1	6.1	0.0	3.1	<0.1
NECTOPSYCHE SP.	55.2	55.2	55.2	0.4
OECETIS SPP.	496.9	159.5	328.2	2.2
OECETIS AVARA	18.4	0.0	9.2	0.1
OECETIS CINERASCENS	12.3	0.0	6.1	<0.1
BEROSUS SP.	0.0	6.1	3.1	<0.1
ELMIDAE (ADULTS)	6.1	0.0	3.1	<0.1
DUBIRAPHIA SP.	24.5	24.5	24.5	0.2
OPTIOSERVUS SP.	24.5	24.5	24.5	0.2
STENELMIS SP.	165.6	73.6	119.6	0.8
TIPULIDAE	0.0	79.8	39.9	0.3
EMPIDIDAE	159.5	135.0	147.2	1.0
CHIRONOMIDAE (PUPAE)	447.9	576.7	512.3	3.4
THIENEMANNIMYIA GR.	871.2	288.3	579.8	3.9
DICROTENDIPES NEOMODESTUS	576.7	141.1	358.9	2.4
GLYPTOTENDIPES SP.	12.3	288.3	150.3	1.0
POLYPEDILUM CONVICTUM	2877.3	1294.5	2085.9	14.0
RHEOTANYTARSUS SPP.	1441.7	1006.1	1223.9	8.2
TANYTARSUS SPP.	429.4	0.0	214.7	1.4
ZAVRELIA GR.	141.1	429.4	285.3	1.9
SYMPOTTHASTIA SP.	141.1	0.0	70.6	0.5
CRICOTOPUS SPP.	2018.4	1447.9	1733.1	11.7
CRICOTOPUS BICINCTUS	294.5	141.1	217.8	1.5
EUKIEFFERIELLA BAVARICA GR.	429.4	0.0	214.7	1.4
EUKIEFFERIELLA DISCOLORIPES GR.	0.0	12.3	6.1	<0.1
NANOCLADIUS SPP.	288.3	0.0	144.2	1.0
ORTHOCLADIUS SP.	288.3	0.0	144.2	1.0
SYNORTHOCLADIUS SP.	141.1	0.0	70.6	0.5
LYMNAEA SP.	6.1	0.0	3.1	<0.1
FERRISSIA SP.	6.1	0.0	3.1	<0.1
PISIDIUM SP.	306.7	92.0	199.4	1.3
SPHAERIUM SPP.	576.7	73.6	325.2	2.2
TOTAL	19385.7	10361.5	14873.1	

Table C-5

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend I on the Susquehanna River, 14 April 1981. Replicates are indicated by collection number.

TAXON	LSI-81-008	LSI-81-009	MEAN	PERCENT TOTAL
ALLOEOCOELA	98.2	36.8	67.5	0.4
PROSTOMA SP.	6.1	6.1	6.1	<0.1
NEMATODA	1177.9	1730.1	1454.0	8.0
NAIDIDAE	871.2	717.8	794.5	4.4
TUBIFICIDAE	2957.1	2190.2	2573.6	14.2
PELOSCOLEX SP.	61.3	36.8	49.1	0.3
LUMBRICULIDAE	269.9	190.2	230.1	1.3
EPHEMEROPTERA	24.5	0.0	12.3	0.1
POTAMANTHUS SPP.	171.8	92.0	131.9	0.7
CAENIS SP.	42.9	18.4	30.7	0.2
EPHEMERELLIDAE	6.1	85.9	46.0	0.3
DRUNELLA SPP.	24.5	6.1	15.3	0.1
EURYLOPHELLA LUTULENTA	0.0	6.1	3.1	<0.1
SERRATELLA SPP.	0.0	6.1	3.1	<0.1
ISONYCHIA SP.	0.0	12.3	6.1	<0.1
HEPTAGENIIDAE	92.0	18.4	55.2	0.3
HEPTAGENIA SPP.	6.1	0.0	3.1	<0.1
STENACRON INTERPUNCTATUM	49.1	55.2	52.1	0.3
STENONEMA PULCHELLUM	30.7	24.5	27.6	0.2
STENONEMA TERMINATUM	55.2	12.3	33.7	0.2
TRICHOPTERA	24.5	0.0	12.3	0.1
NEURECLIPSIS SP.	6.1	0.0	3.1	<0.1
CHEUMATOPSYCHE SPP.	239.3	92.0	165.6	0.9
HYDROPSYCHE PHALERATA	24.5	6.1	15.3	0.1
SYMPHITOPSYCHE SPP.	6.1	0.0	3.1	<0.1
LEPTOCERIDAE	55.2	24.5	39.9	0.2
MYSTACIDES SPP.	24.5	0.0	12.3	0.1
NECTOPSYCHE SP.	104.3	79.8	92.0	0.5
OECETIS SPP.	282.2	177.9	230.1	1.3
OECETIS CINERASCENS	42.9	55.2	49.1	0.3
COLEOPTERA (PUPAE)	0.0	6.1	3.1	<0.1
OPTIOSERVUS SP.	55.2	0.0	27.6	0.2
STENELMIS SP.	110.4	12.3	61.3	0.3
EMPIDIDAE	0.0	6.1	3.1	<0.1
CERATOPOGONIDAE	73.6	55.2	64.4	0.4
CHIRONOMIDAE	0.0	141.1	70.6	0.4
CHIRONOMIDAE (PUPAE)	288.3	582.8	435.6	2.4
TANYPODINAE	141.1	141.1	141.1	0.8
ABLABESMYIA SPP.	0.0	141.1	70.6	0.4
ABLABESMYIA MALLOCHI	582.8	1006.1	794.5	4.4
THIENEMANNIMYIA GR.	871.2	1294.5	1082.8	6.0
CHIRONOMINAE	429.4	0.0	214.7	1.2
CRYPTOCHIRONOMUS FULVUS GR.	30.7	1153.4	592.0	3.3
DICROTENDIPES NEOMODESTUS	717.8	429.4	573.6	3.2
GLYPTOTENDIPES SP.	141.1	141.1	141.1	0.8
PHAENOPSECTRA SP.	429.4	141.1	285.3	1.6
POLYPEDILUM SPP.	0.0	141.1	70.6	0.4
POLYPEDILUM CONVICTUM	717.8	141.1	429.4	2.4
POLYPEDILUM NR. SCALAENUM	435.6	288.3	352.0	2.0
RHEOTANYTARSUS SPP.	1024.5	717.8	871.2	4.8
TANYTARSUS SPP.	3036.8	2883.4	2960.1	16.3
ZAVRELIA GR.	1018.4	1723.9	1371.2	7.6
SYMPOTTHASTIA SP.	0.0	288.3	144.2	0.8
CRICOTOPUS SPP.	6.1	0.0	3.1	<0.1
CRICOTOPUS BICINCTUS	141.1	429.4	285.3	1.6
EUKIEFFERIELLA BAVARICA GR.	0.0	288.3	144.2	0.8
NANOCLADIUS SPP.	717.8	429.4	573.6	3.2
SYNORTHOCLADIUS SP.	141.1	0.0	70.6	0.4
PHYSA SP.	6.1	0.0	3.1	<0.1
PISIDIUM SP.	92.0	30.7	61.3	0.3
SPHAERIUM SPP.	36.8	6.1	21.5	0.1
TOTAL	17999.2	18299.8	18149.0	

Table C-6

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend III on the Susquehanna River, 15 April 1981. Replicates are indicated by collection number.

TAXON	LSI-81-011	LSI-81-012	MEAN	PERCENT TOTAL
ALLOEOCOELA	18.4	24.5	21.5	0.2
NEMATODA	785.3	2196.3	1490.8	12.0
NAIDIDAE	717.8	2012.3	1365.0	11.0
TUBIFICIDAE	1441.7	1785.3	1613.5	13.0
PELOSCOLEX SP.	6.1	6.1	6.1	<0.1
LUMBRICULIDAE	723.9	527.6	625.8	5.0
ISOTOMURUS PALUSTRIS	24.5	0.0	12.3	0.1
EPHEMEROPTERA	24.5	0.0	12.3	0.1
POTAMANTHUS SPP.	12.3	92.0	52.1	0.4
CAENIS SP.	79.8	104.3	92.0	0.7
DRUNELLA SPP.	6.1	0.0	3.1	<0.1
SERRATELLA SPP.	0.0	6.1	3.1	<0.1
SERRATELLA DEFICIENS	6.1	0.0	3.1	<0.1
HEPTAGENIIDAE	55.2	55.2	55.2	0.4
HEPTAGENIA SPP.	0.0	12.3	6.1	<0.1
STENACRON INTERPUNCTATUM	24.5	18.4	21.5	0.2
STENONEMA SPP.	0.0	6.1	3.1	<0.1
STENONEMA ITHACA	0.0	6.1	3.1	<0.1
STENONEMA PULCHELLUM	24.5	0.0	12.3	0.1
STENONEMA TERMINATUM	12.3	55.2	33.7	0.3
NEURECLIPSIS SP.	0.0	18.4	9.2	0.1
POLYCENTROPUS SP.	6.1	0.0	3.1	<0.1
CHEUMATOPSYCHE SPP.	135.0	110.4	122.7	1.0
HYDROPSYCHE SPP.	0.0	6.1	3.1	<0.1
HYDROPSYCHE PHALERATA	42.9	42.9	42.9	0.3
SYMPHITOPSYCHE BIFIDA GR.	0.0	24.5	12.3	0.1
NECTOPSYCHE SP.	0.0	79.8	39.9	0.3
OECETIS SPP.	153.4	165.6	159.5	1.3
OECETIS AVARA	0.0	6.1	3.1	<0.1
OECETIS CINERASCENS	24.5	85.9	55.2	0.4
ELMIDAE (ADULTS)	0.0	24.5	12.3	0.1
STENELMIS SP.	6.1	18.4	12.3	0.1
EMPIDIDAE	24.5	24.5	24.5	0.2
CERATOPOGONIDAE	24.5	0.0	12.3	0.1
CHIRONOMIDAE	0.0	141.1	70.6	0.6
CHIRONOMIDAE (PUPAE)	12.3	527.6	269.9	2.2
ABLABESMYIA MALLOCHI	141.1	141.1	141.1	1.1
THIENEMANNIMYIA GR.	717.8	582.8	650.3	5.2
CRYPTOCHIRONOMUS FULVUS GR.	6.1	288.3	147.2	1.2
DICROTENDIPES NEOMODESTUS	141.1	0.0	70.6	0.6
GLYPTOTENDIPES SP.	0.0	141.1	70.6	0.6
PHAENOPSECTRA SP.	12.3	429.4	220.9	1.8
POLYPEDILUM CONVICTUM	141.1	141.1	141.1	1.1
RHEOTANYTARSUS SPP.	723.9	1294.5	1009.2	8.1
TANYTARSUS SPP.	1435.6	1589.0	1512.3	12.2
TRIBELOS FUSICORNIS	12.3	0.0	6.1	<0.1
ZAVRELIA GR.	717.8	576.7	647.2	5.2
SYMPOTTHASTIA SP.	141.1	141.1	141.1	1.1
ORTHOCLADIINAE	141.1	0.0	70.6	0.6
CORYNONEURA SP.	0.0	141.1	70.6	0.6
CRICOTOPUS SPP.	288.3	288.3	288.3	2.3
CRICOTOPUS BICINCTUS	288.3	141.1	214.7	1.7
NANOCLADIUS SPP.	576.7	288.3	432.5	3.5
SYNORTHOCLADIUS SP.	288.3	141.1	214.7	1.7
GYRAULUS SP.	24.5	0.0	12.3	0.1
PISIDIUM SP.	24.5	55.2	39.9	0.3
SPHAERIUM SPP.	30.7	42.9	36.8	0.3
UNIONIDAE	0.0	6.1	3.1	<0.1
TOTAL	10245.0	14612.9	12428.6	

Table C-7

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES I on the Susquehanna River, 15 June 1981. Replicates are indicated by collection number.

TAXON	LSI-81-014	LSI-81-015	MEAN	PERCENT TOTAL
TRICLADIDA	6.1	55.2	30.7	0.1
NEMATODA	79.8	190.2	135.0	0.2
NAIDIDAE	871.2	73.6	472.4	0.9
SLAVINA APPENDICULATA	141.1	0.0	70.6	0.1
TUBIFICIDAE	1582.8	1447.9	1515.3	2.8
PELOSCOLEX SP.	0.0	24.5	12.3	<0.1
LUMBRICULIDAE	337.4	404.9	371.2	0.7
ASELLUS SP.	6.1	6.1	6.1	<0.1
ACRONEURIA SPP.	6.1	0.0	3.1	<0.1
NEOPERLA SP.	6.1	12.3	9.2	<0.1
EPHEMEROPTERA	24.5	0.0	12.3	<0.1
EPHORON SP.	18.4	24.5	21.5	<0.1
POTAMANTHUS SPP.	110.4	147.2	128.8	0.2
CAENIS SP.	5681.0	5987.7	5834.4	10.8
SERRATELLA DEFICIENS	0.0	12.3	6.1	<0.1
BAETIDAE	42.9	55.2	49.1	0.1
ISONYCHIA SP.	6.1	153.4	79.8	0.1
HEPTAGENIIDAE	1239.3	1306.7	1273.0	2.4
HEPTAGENIA SPP.	122.7	36.8	79.8	0.1
RHITHROGENA SP.	0.0	6.1	3.1	<0.1
STENONEMA SPP.	18.4	0.0	9.2	<0.1
STENONEMA ITHACA	18.4	55.2	36.8	0.1
STENONEMA PULCHELLUM	208.6	251.5	230.1	0.4
SIALIS SP.	6.1	6.1	6.1	<0.1
TRICHOPTERA (PUPAE)	6.1	12.3	9.2	<0.1
POLYCENTROPODIDAE	6.1	0.0	3.1	<0.1
NEURECLIPSIS SP.	18.4	12.3	15.3	<0.1
CHEUMATOPSYCHE SPP.	15134.9	18552.1	16843.5	31.2
HYDROPSYCHE SPP.	1411.0	975.5	1193.3	2.2
HYDROPSYCHE PHALERATA	1190.2	3460.1	2325.2	4.3
MACRONEMA SPP.	6.1	0.0	3.1	<0.1
SYMPHITOPSYCHE SPP.	12.3	79.8	46.0	0.1
SYMPHITOPSYCHE MOROSA	49.1	73.6	61.3	0.1
LEPTOCERIDAE	141.1	24.5	82.8	0.2
CERACLEA SPP.	24.5	0.0	12.3	<0.1
CERACLEA ALAGMA	6.1	0.0	3.1	<0.1
CERACLEA MACULATA	24.5	0.0	12.3	<0.1
CERACLEA TARSIPUNCTATA	0.0	18.4	9.2	<0.1
OECETIS SPP.	12.3	18.4	15.3	<0.1
OECETIS CINERASCENS	6.1	6.1	6.1	<0.1
OECETIS INCONSPICUA	24.5	0.0	12.3	<0.1
PSEPHENUS SP.	0.0	6.1	3.1	<0.1
DUBIRAPHIA SP.	0.0	24.5	12.3	<0.1
STENELMIS SP.	55.2	190.2	122.7	0.2
SIMULIIDAE	79.8	61.3	70.6	0.1
CHIRONOMIDAE	0.0	141.1	70.6	0.1
CHIRONOMIDAE (PUPAE)	1362.0	1184.0	1273.0	2.4
NILOTANYPUS SP.	0.0	141.1	70.6	0.1
THIENEMANNIMYIA GR.	1165.6	1736.2	1450.9	2.7
CRYPTOCHIRONOMUS FULVUS GR.	30.7	0.0	15.3	<0.1
GLYPTOTENDIPES SP.	141.1	147.2	144.2	0.3
MICROTENDIPES SP.	0.0	12.3	6.1	<0.1
PHAENOPSECTRA SP.	141.1	0.0	70.6	0.1
POLYPEDILUM CONVICTUM	877.3	1441.7	1159.5	2.1
POLYPEDILUM NR. SCALAENUM	0.0	6.1	3.1	<0.1
RHEOTANYTARSUS SPP.	13116.5	18871.1	15993.8	29.6
TRIBELOS FUSICORNIS	0.0	141.1	70.6	0.1
CORYNONEURA SP.	141.1	0.0	70.6	0.1
CRICOTOPUS BICINCTUS	0.0	141.1	70.6	0.1
EUKIEFFERIELLA DISCOLORIPES GR.	0.0	294.5	147.2	0.3
THIENEMANNIELLA SPP.	0.0	147.2	73.6	0.1
LYMNAEA SP.	0.0	12.3	6.1	<0.1
FERRISSIA SP.	6.1	0.0	3.1	<0.1
PISIDIUM SP.	687.1	723.9	705.5	1.3
SPHAERIUM SPP.	1263.8	1558.3	1411.0	2.6
TOTAL	47673.4	60470.9	54071.3	

Table C-8

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES II on the Susquehanna River, 18 June 1981. Replicates are indicated by collection number.

TAXON	LSI-81-017	LSI-81-018	MEAN	PERCENT TOTAL
TRICLADIDA	6.1	36.8	21.5	0.1
NEMATODA	128.8	184.0	156.4	0.9
NAIDIDAE	288.3	717.8	503.1	2.8
TUBIFICIDAE	349.7	1165.6	757.7	4.2
LUMBRICULIDAE	18.4	67.5	42.9	0.2
ASTACIDAE	0.0	6.1	3.1	<0.1
EPHEMEROPTERA	6.1	0.0	3.1	<0.1
EPHORON SP.	0.0	6.1	3.1	<0.1
POTAMANTHUS SPP.	36.8	18.4	27.6	0.2
CAENIS SP.	1773.0	3325.2	2549.1	14.1
EPHEMERELLIDAE	12.3	0.0	6.1	<0.1
LEPTOPHLEBIIDAE	0.0	6.1	3.1	<0.1
ISONYCHIA SP.	30.7	116.6	73.6	0.4
HEPTAGENIIDAE	288.3	705.5	496.9	2.7
HEPTAGENIA SPP.	30.7	36.8	33.7	0.2
RHITHROGENA SP.	12.3	24.5	18.4	0.1
STENACRON INTERPUNCTATUM	6.1	24.5	15.3	0.1
STENONEMA ITHACA	0.0	12.3	6.1	<0.1
STENONEMA PULCHELLUM	98.2	159.5	128.8	0.7
COENAGRIONIDAE	6.1	0.0	3.1	<0.1
SIALIS SP.	18.4	24.5	21.5	0.1
TRICHOPTERA (PUPAE)	6.1	30.7	18.4	0.1
POLYCENTROPUS SP.	0.0	6.1	3.1	<0.1
HYDROPSYCHIDAE	6.1	0.0	3.1	<0.1
CHEUMATOPSYCHE SPP.	1546.0	3429.4	2487.7	13.8
HYDROPSYCHE SPP.	0.0	245.4	122.7	0.7
HYDROPSYCHE PHALERATA	325.2	914.1	619.6	3.4
MACRONEMA SPP.	0.0	6.1	3.1	<0.1
SYMPHITOPSYCHE SPP.	0.0	42.9	21.5	0.1
SYMPHITOPSYCHE MOROSA	0.0	24.5	12.3	0.1
LEPTOCERIDAE	135.0	214.7	174.8	1.0
CERACLEA SPP.	24.5	55.2	39.9	0.2
CERACLEA FLAVA	18.4	0.0	9.2	0.1
CERACLEA TARSIPUNCTATA	0.0	24.5	12.3	0.1
OECETIS SPP.	6.1	67.5	36.8	0.2
ELMIDAE (ADULTS)	0.0	24.5	12.3	0.1
OPTIOSERVUS SP.	0.0	24.5	12.3	0.1
STENELMIS SP.	98.2	128.8	113.5	0.6
CHIRONOMIDAE (PUPAE)	[illegible].8	883.4	800.6	4.4
THIENEMANNIMYIA GR.	441.7	865.0	653.4	3.6
CRYPTOCHIRONOMUS FULVUS GR.	0.0	6.1	3.1	<0.1
ENDOCHIRONOMUS SPP.	0.0	6.1	3.1	<0.1
GLYPTOTENDIPES SP.	0.0	18.4	9.2	0.1
MICROTENDIPES SP.	141.1	441.7	291.4	1.6
PHAENOPSECTRA SP.	0.0	141.1	70.6	0.4
POLYPEDILUM CONVICTUM	6.1	1153.4	579.8	3.2
POLYPEDILUM NR. SCALAENUM	6.1	0.0	3.1	<0.1
RHEOTANYTARSUS SPP.	2932.5	9092.0	6012.3	33.2
ZAVRELIA GR.	141.1	141.1	141.1	0.8
CORYNONEURA SP.	141.1	0.0	70.6	0.4
EUKIEFFERIELLA DISCOLORIPES GR.	0.0	141.1	70.6	0.4
NANOCLADIUS SPP.	0.0	141.1	70.6	0.4
PISIDIUM SP.	282.2	128.8	205.5	1.1
SPHAERIUM SPP.	251.5	803.7	527.6	2.9
TOTAL	10337.2	25839.4	18088.1	

Table C-9

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend I on the Susquehanna River, 16 June 1981. Replicates are indicated by collection number.

TAXON	LSI-81-020	LSI-81-021	MEAN	PERCENT TOTAL
HYDRA SP.	6.1	55.2	30.7	0.2
ALLOEOCOELA	12.3	6.1	9.2	0.1
TRICLADIDA	12.3	0.0	6.1	<0.1
PROSTOMA SP.	55.2	0.0	27.6	0.2
NEMATODA	171.8	141.1	156.4	1.1
NAIDIDAE	435.6	723.9	579.8	4.1
TUBIFICIDAE	1601.2	3000.0	2300.6	16.4
PELOSCOLEX SP.	6.1	165.6	85.9	0.6
LUMBRICULIDAE	73.6	233.1	153.4	1.1
HIRUDINEA	0.0	61.3	30.7	0.2
ASTACIDAE	12.3	0.0	6.1	<0.1
NEOPERLA SP.	18.4	6.1	12.3	0.1
EPHORON SP.	0.0	6.1	3.1	<0.1
POTAMANTHUS SPP.	61.3	55.2	58.3	0.4
CAENIS SP.	2981.6	3055.2	3018.4	21.5
LEPTOPHLEBIIDAE	6.1	0.0	3.1	<0.1
HEPTAGENIIDAE	1042.9	852.8	947.9	6.7
HEPTAGENIA SPP.	85.9	454.0	269.9	1.9
STENACRON SPP.	0.0	24.5	12.3	0.1
STENACRON INTERPUNCTATUM	0.0	6.1	3.1	<0.1
STENONEMA SPP.	6.1	24.5	15.3	0.1
STENONEMA PULCHELLUM	171.8	171.8	171.8	1.2
SIALIS SP.	73.6	49.1	61.3	0.4
TRICHOPTERA (PUPAE)	12.3	0.0	6.1	<0.1
POLYCENTROPODIDAE	6.1	0.0	3.1	<0.1
NEURECLIPSIS SP.	12.3	6.1	9.2	0.1
CHEUMATOPSYCHE SPP.	1766.9	1631.9	1699.4	12.1
HYDROPSYCHE PHALERATA	73.6	18.4	46.0	0.3
LEPTOCERIDAE	214.7	55.2	135.0	1.0
CERACLEA MACULATA	24.5	0.0	12.3	0.1
CERACLEA TARSIPUNCTATA	0.0	18.4	9.2	0.1
OECETIS SPP.	79.8	98.2	89.0	0.6
OECETIS CINERASCENS	6.1	0.0	3.1	<0.1
OECETIS INCONSPICUA	6.1	6.1	6.1	<0.1
DUBIRAPHIA SP.	0.0	36.8	18.4	0.1
STENELMIS SP.	6.1	12.3	9.2	0.1
SIMULIIDAE	0.0	24.5	12.3	0.1
CERATOPOGONIDAE	55.2	73.6	64.4	0.5
CHIRONOMIDAE (PUPAE)	429.4	576.7	503.1	3.6
ABLABESMYIA MALLOCHI	159.5	288.3	223.9	1.6
LABRUNDINIA SP.	141.1	141.1	141.1	1.0
THIENEMANNIMYIA GR.	589.0	1294.5	941.7	6.7
CRYPTOCHIRONOMUS FULVUS GR.	141.1	0.0	70.6	0.5
DICROTENDIPES NEOMODESTUS	0.0	6.1	3.1	<0.1
MICROTENDIPES SP.	6.1	589.0	297.5	2.1
POLYPEDILUM SPP.	141.1	0.0	70.6	0.5
POLYPEDILUM NR. SCALAENUM	0.0	294.5	147.2	1.0
RHEOTANYTARSUS SPP.	0.0	288.3	144.2	1.0
TANYTARSUS SPP.	0.0	141.1	70.6	0.5
ZAVRELIA GR.	141.1	141.1	141.1	1.0
CORYNONEURA SP.	0.0	429.4	214.7	1.5
NANOCLADIUS SPP.	141.1	288.3	214.7	1.5
PHYSA SP.	0.0	6.1	3.1	<0.1
LYMNAEA SP.	6.1	6.1	6.1	<0.1
PLANORBIDAE	6.1	0.0	3.1	<0.1
FERRISSIA SP.	30.7	6.1	18.4	0.1
PISIDIUM SP.	220.9	411.0	316.0	2.2
SPHAERIUM SPP.	687.1	171.8	429.4	3.1
TOTAL	11938.1	16152.2	14044.9	

Table C-10

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend III on the Susquehanna River, 17 June 1981. Replicates are indicated by collection number.

TAXON	LSI-81-023	LSI-81-024	MEAN	PERCENT TOTAL
HYDRA SP.	24.5	0.0	12.3	0.1
NEMATODA	337.4	30.7	184.0	1.8
NAIDIDAE	288.3	0.0	144.2	1.4
TUBIFICIDAE	760.7	251.5	506.1	4.9
PELOSCOLEX SP.	24.5	0.0	12.3	0.1
LUMBRICULIDAE	116.6	92.0	104.3	1.0
ASTACIDAE	6.1	0.0	3.1	<0.1
NEOPERLA SP.	6.1	0.0	3.1	<0.1
POTAMANTHUS SPP.	67.5	18.4	42.9	0.4
CAENIS SP.	3368.1	1196.3	2282.2	22.0
BAETIDAE	30.7	0.0	15.3	0.1
ISONYCHIA SP.	30.7	6.1	18.4	0.2
HEPTAGENIIDAE	877.3	239.3	558.3	5.4
HEPTAGENIA SPP.	337.4	141.1	239.3	2.3
RHITHROGENA SP.	12.3	6.1	9.2	0.1
STENACRON INTERPUNCTATUM	30.7	0.0	15.3	0.1
STENONEMA SPP.	12.3	6.1	9.2	0.1
STENONEMA ITHACA	6.1	12.3	9.2	0.1
STENONEMA PULCHELLUM	239.3	171.8	205.5	2.0
SIALIS SP.	98.2	30.7	64.4	0.6
TRICHOPTERA (PUPAE)	6.1	0.0	3.1	<0.1
NEURECLIPSIS SP.	12.3	12.3	12.3	0.1
CHEUMATOPSYCHE SPP.	2460.1	1773.0	2116.6	20.4
HYDROPSYCHE SPP.	110.4	159.5	135.0	1.3
HYDROPSYCHE PHALERATA	190.2	392.6	291.4	2.8
LEPTOCERIDAE	239.3	0.0	119.6	1.2
CERACLEA TARSIPUNCTATA	55.2	0.0	27.6	0.3
OECETIS SPP.	61.3	36.8	49.1	0.5
OECETIS INCONSPICUA	135.0	0.0	67.5	0.7
OPTIOSERVUS SP.	6.1	0.0	3.1	<0.1
STENELMIS SP.	61.3	61.3	61.3	0.6
CERATOPOGONIDAE	6.1	24.5	15.3	0.1
CHIRONOMIDAE (PUPAE)	141.1	147.2	144.2	1.4
ABLABESMYIA MALLOCHI	6.1	0.0	3.1	<0.1
THIENEMANNIMYIA GR.	717.8	141.1	429.4	4.1
CRYPTOCHIRONOMUS FULVUS GR.	6.1	0.0	3.1	<0.1
MICROTENDIPES SP.	147.2	147.2	147.2	1.4
POLYPEDILUM CONVICTUM	288.3	0.0	144.2	1.4
RHEOTANYTARSUS SPP.	576.7	429.4	503.1	4.9
TANYTARSUS SPP.	0.0	141.1	70.6	0.7
ZAVRELIA GR.	865.0	288.3	576.7	5.6
CORYNONEURA CELERIPES	147.2	0.0	73.6	0.7
LYMNAEA SP.	24.5	0.0	12.3	0.1
FERRISSIA SP.	67.5	0.0	33.7	0.3
PISIDIUM SP.	834.4	73.6	454.0	4.4
SPHAERIUM SPP.	705.5	128.8	417.2	4.0
TOTAL	14545.2	6159.3	10352.5	

Table C-11

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES I on the Susquehanna River, 12 October 1981. Replicates are indicated by collection number.

TAXON	LSI-81-026	LSI-81-027	MEAN	PERCENT TOTAL
ALLOEOCOELA	55.2	79.8	67.5	0.1
TRICLADIDA	2331.3	1092.0	1711.7	3.1
PROSTOMA SP.	79.8	12.3	46.0	0.1
NEMATODA	3190.2	533.7	1862.0	3.4
NAIDIDAE	6251.5	865.0	3558.3	6.5
TUBIFICIDAE	6386.5	3552.1	4969.3	9.1
LUMBRICULIDAE	263.8	398.8	331.3	0.6
ERPOBDELLIDAE	0.0	6.1	3.1	<0.1
PLECOPTERA	24.5	0.0	12.3	<0.1
PERLIDAE	288.3	208.6	248.5	0.5
PHASGANOPHORA SP.	6.1	12.3	9.2	<0.1
POTAMANTHUS SPP.	1147.2	809.8	978.5	1.8
CAENIS SP.	699.4	380.4	539.9	1.0
TRICORYTHODES SP.	12.3	0.0	6.1	<0.1
EPHEMERELLIDAE	0.0	79.8	39.9	0.1
EPHEMERELLA SPP.	0.0	6.1	3.1	<0.1
BAETIDAE	55.2	18.4	36.8	0.1
PSEUDOCLOEON SP.	6.1	0.0	3.1	<0.1
ISONYCHIA SP.	67.5	12.3	39.9	0.1
HEPTAGENIIDAE	1067.5	362.0	714.7	1.3
STENONEMA SPP.	159.5	24.5	92.0	0.2
STENONEMA FUSCUM	0.0	6.1	3.1	<0.1
STENONEMA ITHACA	190.2	116.6	153.4	0.3
STENONEMA PULCHELLUM	1392.6	963.2	1177.9	2.2
STENONEMA TERMINATUM	454.0	509.2	481.6	0.9
STYLOGOMPHUS ALBISTYLUS	0.0	6.1	3.1	<0.1
COENAGRIONIDAE	55.2	0.0	27.6	0.1
ARGIA SP.	6.1	24.5	15.3	<0.1
POLYCENTROPODIDAE	55.2	0.0	27.6	0.1
NEURECLIPSIS SP.	607.4	411.0	509.2	0.9
POLYCENTROPUS SP.	30.7	153.4	92.0	0.2
CHEUMATOPSYCHE SPP.	18319.0	13754.6	16036.8	29.3
HYDROPSYCHE SPP.	79.8	55.2	67.5	0.1
HYDROPSYCHE PHALERATA	877.3	840.5	858.9	1.6
MACRONEMA SPP.	12.3	6.1	9.2	<0.1
SYMPHITOPSYCHE SPP.	0.0	18.4	9.2	<0.1
SYMPHITOPSYCHE BIFIDA GR.	24.5	0.0	12.3	<0.1
SYMPHITOPSYCHE MOROSA	24.5	24.5	24.5	<0.1
HYDROPTILIDAE (PUPAE)	24.5	0.0	12.3	<0.1
HYDROPTILA SPP.	687.1	380.4	533.7	1.0
LEPTOCERIDAE	319.0	398.8	358.9	0.7
CERACLEA SPP.	24.5	0.0	12.3	<0.1
CERACLEA TARSIPUNCTATA	24.5	0.0	12.3	<0.1
MYSTACIDES SPP.	30.7	0.0	15.3	<0.1
NECTOPSYCHE SP.	0.0	55.2	27.6	0.1
OECETIS SPP.	135.0	220.9	177.9	0.3
OECETIS AVARA	61.3	190.2	125.8	0.2
OECETIS CINERASCENS	466.3	374.2	420.2	0.8
OECETIS INCONSPICUA	0.0	24.5	12.3	<0.1
BEROSUS SP.	6.1	0.0	3.1	<0.1
ELMIDAE (ADULTS)	67.5	85.9	76.7	0.1
DUBIRAPHIA SP.	0.0	79.8	39.9	0.1
OPTIOSERVUS SP.	61.3	73.6	67.5	0.1
STENELMIS SP.	300.6	404.9	352.8	0.6
ANTOCHA SP.	0.0	24.5	12.3	<0.1
SIMULIIDAE	61.3	0.0	30.7	0.1
ATHERIX SP.	6.1	0.0	3.1	<0.1
EMPIDIDAE	1355.8	963.2	1159.5	2.1
CERATOPOGONIDAE	30.7	24.5	27.6	0.1
CHIRONOMIDAE	288.3	0.0	144.2	0.3
CHIRONOMIDAE (PUPAE)	6.1	0.0	3.1	<0.1
PROCLADIUS SP.	141.1	0.0	70.6	0.1
THIENEMANNIMYIA GR.	6613.5	5177.9	5895.7	10.8
DICROTENDIPES NEOMODESTUS	294.5	141.1	217.8	0.4
GLYPTOTENDIPES SP.	6.1	576.7	291.4	0.5
MICROTENDIPES SP.	141.1	141.1	141.1	0.3
PARACHIRONOMUS SPP.	147.2	0.0	73.6	0.1
PHAENOPSECTRA SP.	6.1	0.0	3.1	<0.1
POLYPEDILUM CONVICTUM	3325.2	717.8	2021.5	3.7
POLYPEDILUM NR. SCALAENUM	288.3	0.0	144.2	0.3
RHEOTANYTARSUS SPP.	3748.5	1294.5	2521.5	4.6
TANYTARSUS SPP.	141.1	0.0	70.6	0.1
CRICOTOPUS SPP.	1319.0	141.1	730.1	1.3
CRICOTOPUS BICINCTUS	6.1	288.3	147.2	0.3
EUKIEFFERIELLA BAVARICA GR.	0.0	141.1	70.6	0.1
EUKIEFFERIELLA DISCOLORIPES GR.	6.1	141.1	73.6	0.1
ORTHOCLADIUS SP.	288.3	141.1	214.7	0.4
UNIDENTIFIED TERRESTRIAL	0.0	79.8	39.9	0.1
PHYSA SP.	6.1	0.0	3.1	<0.1
GYRAULUS SP.	0.0	6.1	3.1	<0.1
HELISOMA SP.	42.9	0.0	21.5	<0.1
FERRISSIA SP.	503.1	472.4	487.7	0.9
GONIOBASIS VIRGINICA	6.1	0.0	3.1	<0.1
PISIDIUM SP.	1932.5	1380.4	1656.4	3.0
SPHAERIUM SPP.	1546.0	1220.9	1383.4	2.5
TOT.	68684.2	40703.6	54692.3	

Table C-12

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at SSES II on the Susquehanna River, 14 October 1981. Replicates are indicated by collection number.

TAXON	LSI-81-029	LSI-81-030	MEAN	PERCENT TOTAL
ALLOEOCOELA	141.1	12.3	76.7	0.3
TRICLADIDA	496.9	245.4	371.2	1.3
NEMATODA	705.5	55.2	380.4	1.4
NAIDIDAE	5901.8	288.3	3095.1	11.0
TUBIFICIDAE	773.0	398.8	585.9	2.1
LUMBRICULIDAE	104.3	73.6	89.0	0.3
PLECOPTERA	24.5	0.0	12.3	<0.1
PERLIDAE	61.3	67.5	64.4	0.2
PHASGANOPHORA SP.	18.4	6.1	12.3	<0.1
POTAMANTHUS SPP.	840.5	466.3	653.4	2.3
CAENIS SP.	276.1	49.1	162.6	0.6
EPHEMERELLIDAE	0.0	24.5	12.3	<0.1
BAETIDAE	0.0	6.1	3.1	<0.1
PSEUDOCLOEON SP.	6.1	0.0	3.1	<0.1
ISONYCHIA SP.	24.5	6.1	15.3	0.1
HEPTAGENIIDAE	1233.1	245.4	739.3	2.6
STENACRON INTERPUNCTATUM	79.8	12.3	46.0	0.2
STENONEMA SPP.	582.8	0.0	291.4	1.0
STENONEMA FUSCUM	12.3	0.0	6.1	<0.1
STENONEMA ITHACA	12.3	49.1	30.7	0.1
STENONEMA PULCHELLUM	1018.4	791.4	904.9	3.2
STENONEMA TERMINATUM	282.2	239.3	260.7	0.9
COENAGRIONIDAE	0.0	6.1	3.1	<0.1
ARGIA SP.	6.1	0.0	3.1	<0.1
POLYCENTROPODIDAE	0.0	24.5	12.3	<0.1
NEURECLIPSIS SP.	227.0	239.3	233.1	0.8
POLYCENTROPUS SP.	12.3	6.1	9.2	<0.1
CHEUMATOPSYCHE SPP.	10294.4	10024.5	10159.4	36.2
HYDROPSYCHE SPP.	24.5	0.0	12.3	<0.1
HYDROPSYCHE PHALERATA	705.5	1000.0	852.8	3.0
MACRONEMA SPP.	18.4	36.8	27.6	0.1
SYMPHITOPSYCHE SPP.	6.1	0.0	3.1	<0.1
SYMPHITOPSYCHE BIFIDA GR.	6.1	12.3	9.2	<0.1
SYMPHITOPSYCHE MOROSA	24.5	0.0	12.3	<0.1
HYDROPTILA SPP.	6.1	24.5	15.3	0.1
LEPTOCERIDAE	723.9	349.7	536.8	1.9
CERACLEA SP#1	0.0	6.1	3.1	<0.1
NECTOPSYCHE SP.	0.0	55.2	27.6	0.1
OECETIS SPP.	61.3	36.8	49.1	0.2
OECETIS AVARA	61.3	104.3	82.8	0.3
OECETIS CINERASCENS	196.3	147.2	171.8	0.6
BEROSUS SP.	0.0	24.5	12.3	<0.1
ELMIDAE (ADULTS)	0.0	30.7	15.3	0.1
OPTIOSERVUS SP.	24.5	24.5	24.5	0.1
STENELMIS SP.	306.7	110.4	208.6	0.7
SIMULIIDAE	104.3	0.0	52.1	0.2
EMPIDIDAE	306.7	165.6	236.2	0.8
CHIRONOMIDAE	576.7	0.0	288.3	1.0
CHIRONOMIDAE (PUPAE)	141.1	0.0	70.6	0.3
ABLABESMYIA MALLOCHI	288.3	0.0	144.2	0.5
THIENEMANNIMYIA GR.	3312.9	1153.4	2233.1	8.0
DICROTENDIPES NEOMODESTUS	288.3	0.0	144.2	0.5
MICROTENDIPES SP.	429.4	288.3	358.9	1.3
POLYPEDILUM CONVICTUM	1582.8	429.4	1006.1	3.6
RHEOTANYTARSUS SPP.	2159.5	717.8	1438.6	5.1
ZAVRELIA GR.	288.3	0.0	144.2	0.5
CRICOTOPUS SPP.	141.1	0.0	70.6	0.3
CRICOTOPUS BICINCTUS	6.1	288.3	147.2	0.5
EUKIEFFERIELLA BAVARICA GR.	288.3	0.0	144.2	0.5
EUKIEFFERIELLA DISCOLORIPES GR.	141.1	0.0	70.6	0.3
ORTHOCLADIUS SP.	0.0	141.1	70.6	0.3
GYRAULUS SP.	0.0	6.1	3.1	<0.1
HELISOMA SP.	6.1	0.0	3.1	<0.1
FERRISSIA SP.	104.3	208.6	156.4	0.6
PISIDIUM SP.	582.8	404.9	493.9	1.8
SPHAERIUM SPP.	435.6	539.9	487.7	1.7
TOTAL	36482.7	19642.8	28062.1	

Table C-13

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend I on the Susquehanna River, 13 October 1981. Replicates are indicated by collection number.

TAXON	LSI-81-032	LSI-81-033	MEAN	PERCENT TOTAL
ALLOEOCOELA	104.3	42.9	73.6	0.4
TRICLADIDA	257.7	447.9	352.8	2.1
PROSTOMA SP.	73.6	24.5	49.1	0.3
NEMATODA	1079.8	362.0	720.9	4.3
NAIDIDAE	141.1	288.3	214.7	1.3
TUBIFICIDAE	2742.3	2153.4	244[illegible].9	14.7
PELOSCOLEX SP.	122.7	85.9	104.3	0.6
LUMBRICULIDAE	18.4	61.3	39.9	0.2
PERLIDAE	24.5	0.0	12.3	0.1
POTAMANTHUS SPP.	110.4	79.8	95.1	0.6
CAENIS SP.	233.1	319.0	276.1	1.7
TRICORYTHODES SP.	0.0	6.1	3.1	<0.1
BAETIDAE	0.0	6.1	3.1	<0.1
HEPTAGENIIDAE	2392.6	2460.1	2426.4	14.5
STENACRON INTERPUNCTATUM	447.9	306.7	377.3	2.3
STENONEMA SPP.	116.6	184.0	150.3	0.9
STENONEMA PULCHELLUM	466.3	257.7	362.0	2.2
STENONEMA TERMINATUM	349.7	466.3	408.0	2.4
SIALIS SP.	24.5	0.0	12.3	0.1
CORYDALUS SP.	0.0	6.1	3.1	<0.1
POLYCENTROPODIDAE	0.0	159.5	79.8	0.5
NEURECLIPSIS SP.	122.7	116.6	119.6	0.7
POLYCENTROPUS SP.	6.1	36.8	21.5	0.1
CHEUMATOPSYCHE SPP.	1067.5	1717.8	1392.6	8.3
HYDROPSYCHE PHALERATA	36.8	61.3	49.1	0.3
MACRONEMA SPP.	0.0	6.1	3.1	<0.1
LEPTOCERIDAE	564.4	0.0	282.2	1.7
CERACLEA SPP.	0.0	55.2	27.6	0.2
MYSTACIDES SPP.	24.5	0.0	12.3	0.1
NECTOPSYCHE SP.	24.5	644.2	334.4	2.0
OECETIS SPP.	104.3	294.5	199.4	1.2
OECETIS AVARA	30.7	24.5	27.6	0.2
OECETIS CINERASCENS	380.4	214.7	297.5	1.8
OECETIS INCONSPICUA	61.3	773.0	417.2	2.5
ELMIDAE (ADULTS)	0.0	24.5	12.3	0.1
DUBIRAPHIA SP.	79.8	24.5	52.1	0.3
STENELMIS SP.	85.9	79.8	82.8	0.5
EMPIDIDAE	24.5	55.2	39.9	0.2
THIENEMANNIMYIA GR.	1306.7	2607.4	1957.1	11.7
DICROTENDIPES NEOMODESTUS	0.0	147.2	73.6	0.4
MICROTENDIPES SP.	0.0	141.1	70.6	0.4
PHAENOPSECTRA SP.	141.1	0.0	70.6	0.4
POLYPEDILUM CONVICTUM	288.3	429.4	358.9	2.2
POLYPEDILUM NR. SCALAENUM	141.1	0.0	70.6	0.4
RHEOTANYTARSUS SPP.	300.6	288.3	294.5	1.8
TANYTARSUS SPP.	6.1	141.1	73.6	0.4
ZAVRELIA GR.	288.3	288.3	288.3	1.7
PHYSA SP.	61.3	24.5	42.9	0.3
GYRAULUS SP.	30.7	0.0	15.3	0.1
HELISOMA SP.	0.0	24.5	12.3	0.1
FERRISSIA SP.	36.8	190.2	113.5	0.7
PISIDIUM SP.	1355.8	1208.6	1282.2	7.7
SPHAERIUM SPP.	503.1	263.8	383.4	2.3
TOTAL	15778.0	17600.2	16688.7	

Table C-14

Standing crop (org/m^2) and percent total of benthic macroinvertebrates collected with a dome sampler at Bell Bend III on the Susquehanna River, 13 October 1981. Replicates are indicated by collection number.

TAXON	LSI-81-035	LSI-81-036	MEAN	PERCENT TOTAL
ALLOEOCOELA	55.2	67.5	61.3	0.3
TRICLADIDA	576.7	374.2	475.5	2.0
PROSTOMA SP.	190.2	85.9	138.0	0.6
NEMATODA	4214.7	3748.5	3981.6	16.9
TUBIFICIDAE	2104.3	3276.1	2690.2	11.4
PELOSCOLEX SP.	24.5	0.0	12.3	0.1
LUMBRICULIDAE	42.9	79.8	61.3	0.3
ISOTOMURUS PALUSTRIS	0.0	6.1	3.1	<0.1
PERLIDAE	0.0	24.5	12.3	0.1
PHASGANOPHORA SP.	6.1	0.0	3.1	<0.1
POTAMANTHUS SPP.	674.8	601.2	638.0	2.7
CAENIS SP.	98.2	276.1	187.1	0.8
TRICORYTHODES SP.	0.0	6.1	3.1	<0.1
ISONYCHIA SP.	24.5	24.5	24.5	0.1
HEPTAGENIIDAE	1092.0	1527.6	1309.8	5.6
STENACRON INTERPUNCTATUM	61.3	55.2	58.3	0.2
STENONEMA SPP.	0.0	110.4	55.2	0.2
STENONEMA FUSCUM	6.1	0.0	3.1	<0.1
STENONEMA ITHACA	12.3	36.8	24.5	0.1
STENONEMA PULCHELLUM	1098.2	613.5	855.8	3.6
STENONEMA TERMINATUM	441.7	674.8	558.3	2.4
SIALIS SP.	18.4	6.1	12.3	0.1
POLYCENTROPODIDAE	24.5	104.3	64.4	0.3
NEURECLIPSIS SP.	49.1	42.9	46.0	0.2
POLYCENTROPUS SP.	61.3	6.1	33.7	0.1
CHEUMATOPSYCHE SPP.	1135.0	2355.8	1745.4	7.4
HYDROPSYCHE PHALERATA	49.1	116.6	82.8	0.4
HYDROPTILA SPP.	24.5	24.5	24.5	0.1
LEPTOCERIDAE	454.0	0.0	227.0	1.0
NECTOPSYCHE SP.	61.3	1926.4	993.9	4.2
OECETIS SPP.	36.8	79.8	58.3	0.2
OECETIS AVARA	55.2	55.2	55.2	0.2
OECETIS CINERASCENS	61.3	104.3	82.8	0.4
OECETIS INCONSPICUA	0.0	55.2	27.6	0.1
BEROSUS SP.	0.0	6.1	3.1	<0.1
DUBIRAPHIA SP.	6.1	79.8	42.9	0.2
OPTIOSERVUS SP.	0.0	6.1	3.1	<0.1
STENELMIS SP.	650.3	472.4	561.3	2.4
EMPIDIDAE	0.0	55.2	27.6	0.1
CERATOPOGONIDAE	55.2	24.5	39.9	0.2
ABLABESMYIA MALLOCHI	0.0	141.1	70.6	0.3
THIENEMANNIMYIA GR.	1006.1	5355.8	3181.0	13.5
CRYPTOCHIRONOMUS SPP.	0.0	141.1	70.6	0.3
CRYPTOCHIRONOMUS FULVUS GR.	0.0	429.4	214.7	0.9
MICROTENDIPES SP.	0.0	429.4	214.7	0.9
POLYPEDILUM NR. SCALAENUM	288.3	141.1	214.7	0.9
TANYTARSUS SPP.	141.1	0.0	70.6	0.3
ZAVRELIA GR.	429.4	141.1	285.3	1.2
HELISOMA SP.	0.0	6.1	3.1	<0.1
FERRISSIA SP.	18.4	61.3	39.9	0.2
PISIDIUM SP.	3969.3	2773.0	3371.2	14.3
SPHAERIUM SPP.	871.2	220.9	546.0	2.3
TOTAL	20189.2	26949.4	23568.8	

Table C-15

Benthic macroinvertebrates collected in dome samples at SSES and Bell Bend on the Susquehanna River, 1975-81. An * denotes macroinvertebrates collected or identified for the first time in dome samples in 1981.

	SSES	Bell Bend
Coelenterata		
Hydroida		
Hydridae		
Hydra sp.	X	X
Platyhelminthes		
Turbellaria		
Alloeocoela	X	X
Tricladida	X	X
Nemertinea		
Tetrastemmatidae		
Prostoma sp.	X	X
Nematoda	X	X
Entoprocta		
Urnatella gracilis	X	X
Annelida		
Oligochaeta		
Naididae	X	X
Slavina appendiculata	X*	
Tubificidae	X	X
Peloscolex sp.	X*	X*
Lumbriculidae	X	X*
Hirudinea	X	X*
Erpobdellidae	X*	
Arthropoda		
Crustacea		
Isopoda		
Asellus sp.	X	X
Amphipoda		
Gammarus sp.	X	X
Decapoda		
Astacidae	X	X
Insecta		
Collembola		
Isotomidae		
Isotomurus palustris	X	X
Plecoptera		
Taeniopterygidae		
Strophopteryx fasciata	X	
Taeniopteryx sp.	X	X
Leuctridae		
Leuctra sp.	X	
Perlidae		
Acroneuria abnormis	X	
A. lycorias	X	
Acroneuria spp.	X	X
Neoperla clymene	X	X
Neoperla sp.	X	X
Phasganophora capitata	X	
Phasganophora sp.	X	X
Perlesta sp.	X	
Ephemeroptera		
Ephemeridae		
Ephemera sp.		X
Hexagenia limbata	X	
Hexagenia sp.	X	X
Polymitarcidae		
Ephoron sp.	X	X
Potamanthidae		
Potamanthus spp.	X	X
Caenidae		
Caenis sp.	X	X
Tricorythidae		
Tricorythodes sp.	X*	X
Ephemerellidae		
Drunella cornutella	X	
D. walkeri	X	
Drunella spp.	X	X*
Ephemerella dorothea	X	X
E. invaria	X	X
E. needhami	X*	
E. septentrionalis	X	
Ephemerella spp.	X	X
Eurylophella bicolor	X	X
E. funeralis		X
E. lutulenta		X*
Serratella deficiens	X	X
S. sordida	X	
Serratella spp.	X	X
Leptophlebiidae		
Paraleptophlebia adoptiva		X
Ephemeroptera (cont.)		
Baetidae		
Baetis macdunnoughi		X
Baetis sp.	X	X
Heterocloeon curiosum	X	
Pseudocloeon carolina	X	
Pseudocloeon sp.	X	X
Siphlonuridae		
Isonychia sp.	X	X
Heptageniidae		
Epeorus sp.	X	X
Heptagenia spp.	X	X
Rhithrogena sp.	X	X
Stenacron interpunctatum	X	X
Stenacron spp.	X	X
Stenonema fuscum	X	X
S. ithaca	X	X
S. mediopunctatum	X	X
S. modestum	X	X
S. pulchellum	X	X
S. terminatum	X	X
Stenonema spp.	X	X
Odonata		
Anisoptera		
Gomphidae		
Stylogomphus albistylus	X*	
Zygoptera		
Coenagrionidae		
Argia sp.	X*	
Megaloptera		
Sialidae		
Sialis sp.	X	X
Corydalidae		
Chauliodes sp.	X	
Corydalus cornutus	X	
Corydalus sp.	X	X*
Trichoptera		
Glossosomatidae		
Glossosoma sp.	X	
Protoptila sp.	X	
Philopotamidae		
Chimarra obscura	X	X
Chimarra sp.	X	
Polycentropodidae		
Neureclipsis sp.	X	X
Polycentropus sp.	X	X
Hydropsychidae		
Cheumatopsyche spp.	X	X
Hydropsyche hageni	X	
H. phalerata	X	X
H. valanis	X	
Hydropsyche spp.	X	X
Macronema carolina	X	
M. zebratum	X	X
Macronema spp.	X	X
Symphitopsyche bifida gr.	X	X
S. morosa	X	X
Symphitopsyche spp.	X	X
Hydroptilidae		
Agraylea sp.	X	
Hydroptila sp.	X	X*
Ithytrichia sp.	X	
Phryganeidae		
Ptilostomis sp.	X	
Leptoceridae		
Ceraclea alagma	X*	X
C. ancylus	X	
C. flava	X*	X
C. maculata	X	X
C. mentiea		X
C. neffi	X	X
C. nepha	X	X
C. tarsipunctata	X	X
Ceraclea sp. #1	X	X
Ceraclea spp.	X	X
Mystacides spp.	X	X
Nectopsyche sp.	X	X
Oecetis avara	X	X
O. cinerascens	X	X
O. inconspicua	X	X*
O. nocturna		X
Oecetis spp.	X	X

Table C-15 (cont.)

	SSES	Bell Bend
Trichoptera (cont.)		
Lepidostomatidae		
Lepidostoma sp.	X	
Lepidoptera	X	X
Noctuidae	X	
Coleoptera		
Gyrinidae	X	
Dineutes sp.		X
Hydrophilidae	X	
Berosus sp.	X	X
Psephenidae		
Psephenus herricki	X	
Psephenus sp.	X	
Elmidae		
Dubiraphia vittata	X	X
Dubiraphia sp.	X	X
Macronychus sp.	X	
Optioservus sp.	X	X
Stenelmis bicarinata	X	X
S. mera	X	
Stenelmis spp.	X	X
Diptera		
Tipulidae	X	X
Antocha saxicola	X	X
Antocha sp.	X	X
Psychodidae		X
Simuliidae	X	X
Tabanidae		X
Athericidae		
Atherix sp.	X*	
Empididae	X	X
Ceratopogonidae	X	X
Chironomidae		
Tanypodinae		
Ablabesmyia mallochi	X	X
A. ornata	X	X
A. peleensis	X	
A. rhamphe	X	X
Ablabesmyia spp.	X	X
Labrundinia sp.		X*
Macropelopia sp.	X	X
Procladius sp.	X*	X
Psectrotanypus sp.	X	
Nilotanypus sp.	X	X
Thienemannimyia gr.	X	X
Chironominae		
Chironomus decorus gr.		X
Chironomus spp.	X	X
Cryptochironomus blarina	X	X
C. fulvus gr.	X	X
Cryptochironomus spp.	X	X
Demicryptochironomus sp.		X
Dicrotendipes neomodestus	X	X
Dicrotendipes spp.	X	X
Endochironomus spp.	X	X
Glyptotendipes sp.	X	X
Harnischia gr.		X
Micropsectra sp.	X	X
Microtendipes sp.	X	X
Nilothauma sp.		X
Phaenopsectra sp.	X*	X*
Parachironomus abortivus	X	X
P. carinatus	X	X
P. frequens	X	X
Parachironomus spp.	X	X
Polypedilum convictum	X	X
P. fallax gr.	X	X
P. nr. *scalaenum*	X	X
Polypedilum spp.	X	X
Rheotanytarsus distinctissimus gr.	X	X
R. exiguus gr.	X	X
Rheotanytarsus spp.	X	X
Stenochironomus sp.	X	
Stictochironomus sp.		X
Tanytarsus coffmani	X	X
Tanytarsus spp.	X	X
Tribelos fuscicornis	X*	X
T. jucundus	X	X
Zavrelia gr.	X	X
Chironomidae (cont.)		
Diamesinae		
Diamesa sp.	X	X
Pseudodiamesa sp.	X	
Sympotthastia sp.	X	X*
Orthocladiinae		
Brillia sp.	X	
Cardiocladius sp.	X	
Corynoneura celeripes		X*
C. taris	X	X
Corynoneura spp.	X	X
Cricotopus bicinctus	X	X
Cricotopus spp.	X	X
Eukiefferiella bavarica gr.	X	X
E. discoloripes gr.	X	X
Eukiefferiella spp.	X	X
Heterotrissocladius gr.	X	X
Nanocladius spp.	X	X
Orthocladius sp.	X	X
Parametriocnemus sp.	X	X
Rheocricotopus spp.	X	X
Synorthocladius sp.	X	X
Thienemanniella spp.	X	X
Mollusca		
Gastropoda		
Physidae		
Physa sp.	X	X
Lymnaeidae		
Lymnaea sp.	X	X
Planorbidae		
Gyraulus sp.	X*	X*
Helisoma sp.	X*	X*
Ancylidae		
Ferrissia sp.	X	X
Pleuroceridae		
Goniobasis virginica	X*	
Pelecypoda		
Sphaeriidae		
Pisidium casertanum	X*	X*
Pisidium sp.	X	X
Sphaerium transversum	X*	X*
Sphaerium spp.	X	X
Unionidae		X*

Table C-16

Dry weight of benthic macroinvertebrates (mg/m^2) collected with a dome sampler at SSES I and II on the Susquehanna River in April, June, and October 1981.

SITE	SSES I			PERCENT	SSES II			PERCENT
MONTH	APR	JUN	OCT	TOTAL	APR	JUN	OCT	TOTAL
TAXON								
OLIGOCHAETA	294.5	325.2	380.4	9.0	110.4	717.8	92.0	11.2
PLECOPTERA	0.0	6.1	0.0	<0.1	0.0	<0.1	61.3	0.7
EPHEMEROPTERA	135.0	650.3	705.5	13.5	55.2	490.8	521.5	13.0
TRICHOPTERA	1668.7	1539.9	2681.0	53.2	1589.0	515.3	2276.1	53.4
COLEOPTERA	85.9	18.4	92.0	1.8	36.8	36.8	110.4	2.2
DIPTERA	288.3	135.0	177.9	5.4	263.8	61.3	122.7	5.5
MOLLUSCA	55.2	349.7	1331.3	15.7	73.6	484.7	337.4	10.9
OTHER	6.1	<0.1	153.4	1.4	159.5	36.8	42.9	2.9
TOTAL	2533.7	3024.5	5521.5		2288.3	2343.6	3564.4	

Table C-17

Dry weight of benthic macroinvertebrates (mg/m^2) collected with a dome sampler at Bell Bend I and III on the Susquehanna River in April, June, and October 1981.

SITE	BB I			PERCENT	BB III			PERCENT
MONTH	APR	JUN	OCT	TOTAL	APR	JUN	OCT	TOTAL
TAXON								
OLIGOCHAETA	282.2	18.4	184.0	17.2	527.6	165.6	269.9	15.5
CRUSTACEA	0.0	0.0	0.0	<0.1	0.0	18.4	0.0	0.3
PLECOPTERA	<0.1	0.0	0.0	<0.1	0.0	<0.1	0.0	<0.1
EPHEMEROPTERA	55.2	589.0	447.9	38.8	159.5	858.9	[illegible]16.0	29.5
TRICHOPTERA	417.2	55.2	92.0	20.0	300.6	417.2	539.9	20.2
COLEOPTERA	30.7	<0.1	6.1	1.3	12.3	6.1	24.5	0.7
DIPTERA	177.9	24.5	67.5	9.6	147.2	36.8	92.0	4.4
MOLLUSCA	30.7	18.4	128.8	6.3	104.3	36.8	1423.3	25.1
OTHER	30.7	6.1	153.4	6.8	42.9	18.4	202.5	4.2
TOTAL	1024.5	711.7	1079.8		1294.5	1558.3	3368.1	

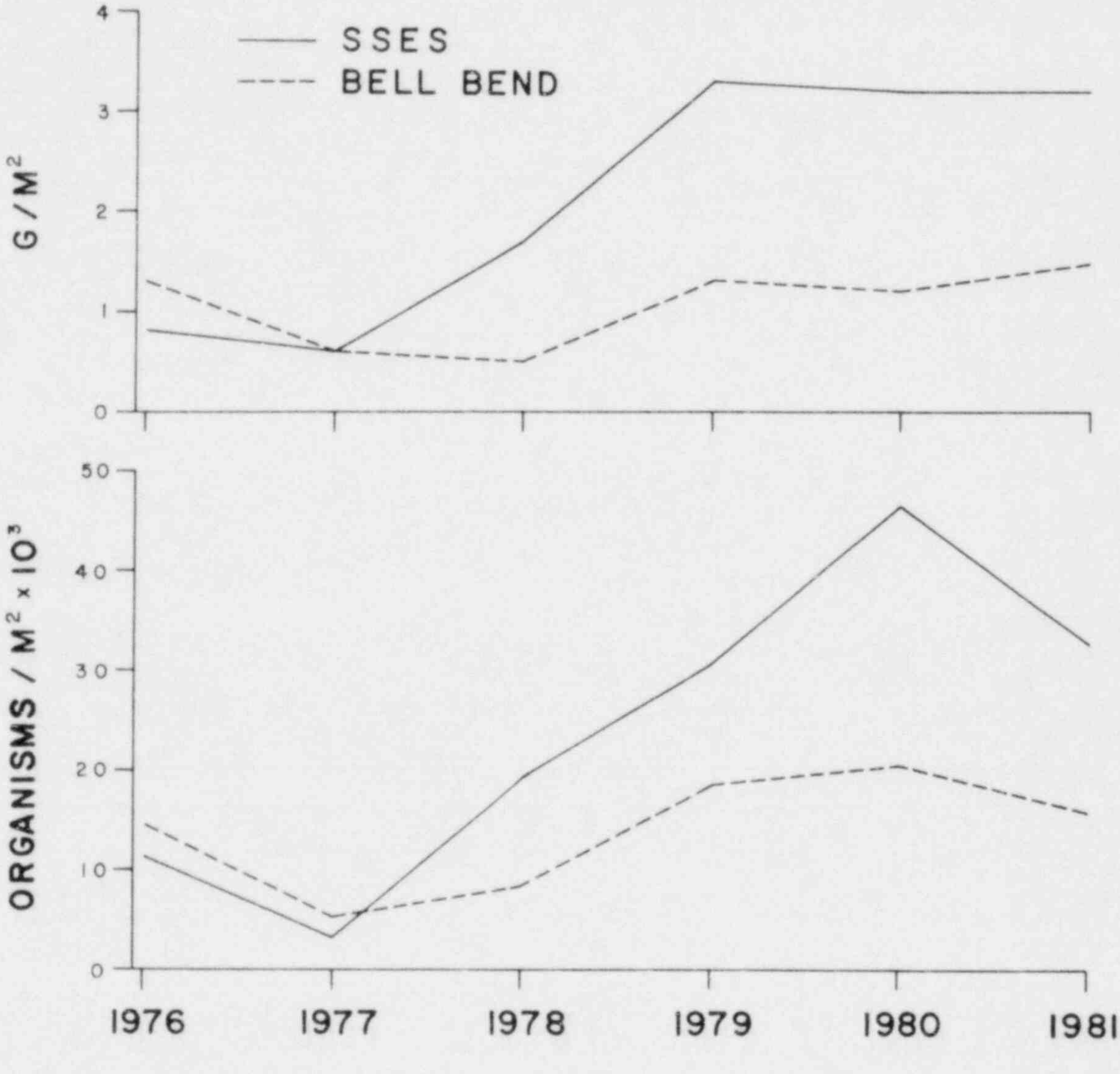

Fig. C-1

Annual mean biomass (g/m^2) and density (org/m^2) of benthic macroinvertebrates at SSES and Bell Bend on the Susquehanna River, 1976-81.

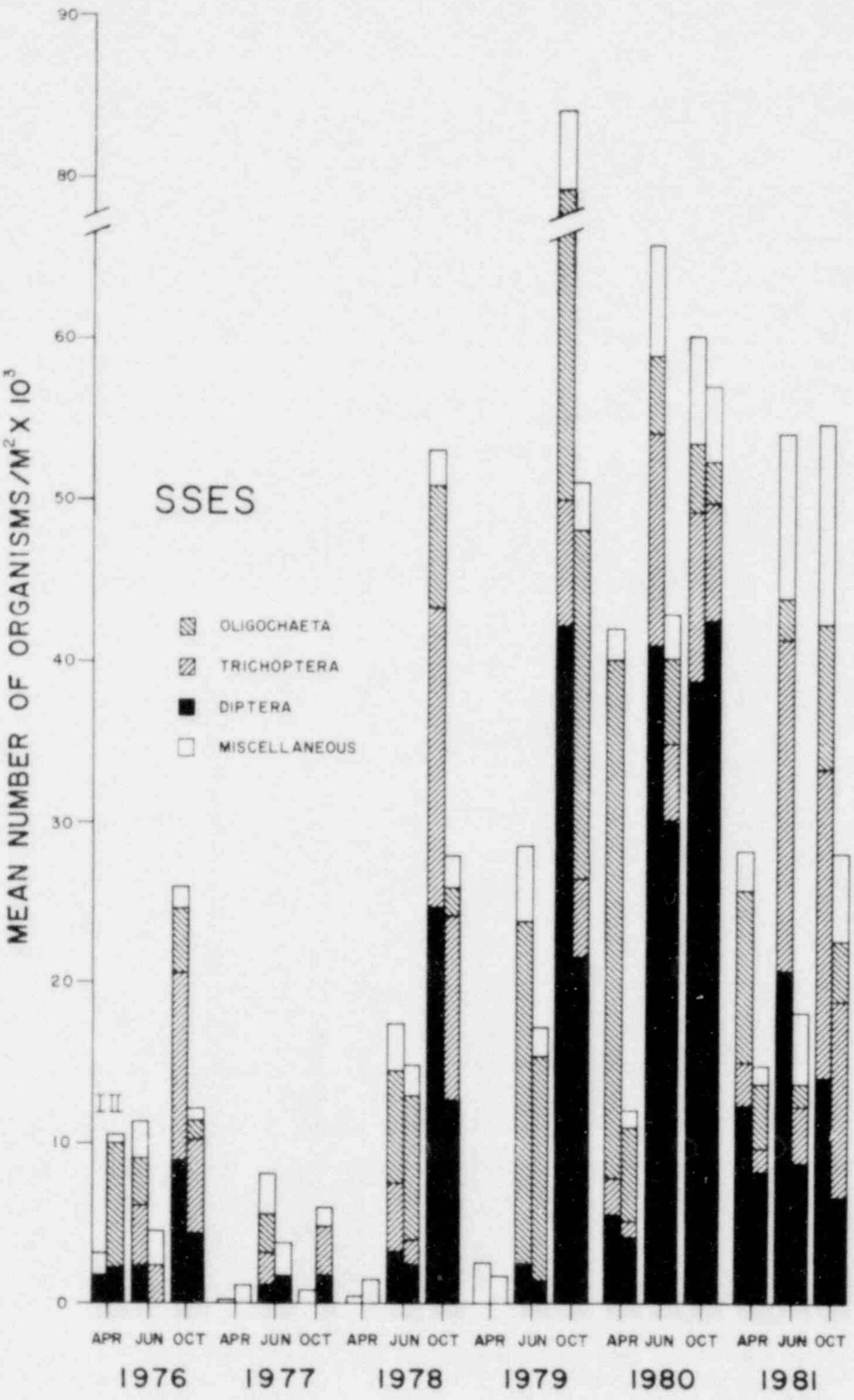

Fig. C-2

Mean standing crop (org/m^2) of benthic macroinvertebrates in replicate dome samples (2/sampling period) at SSES I and II on the Susquehanna River, 1976-81.

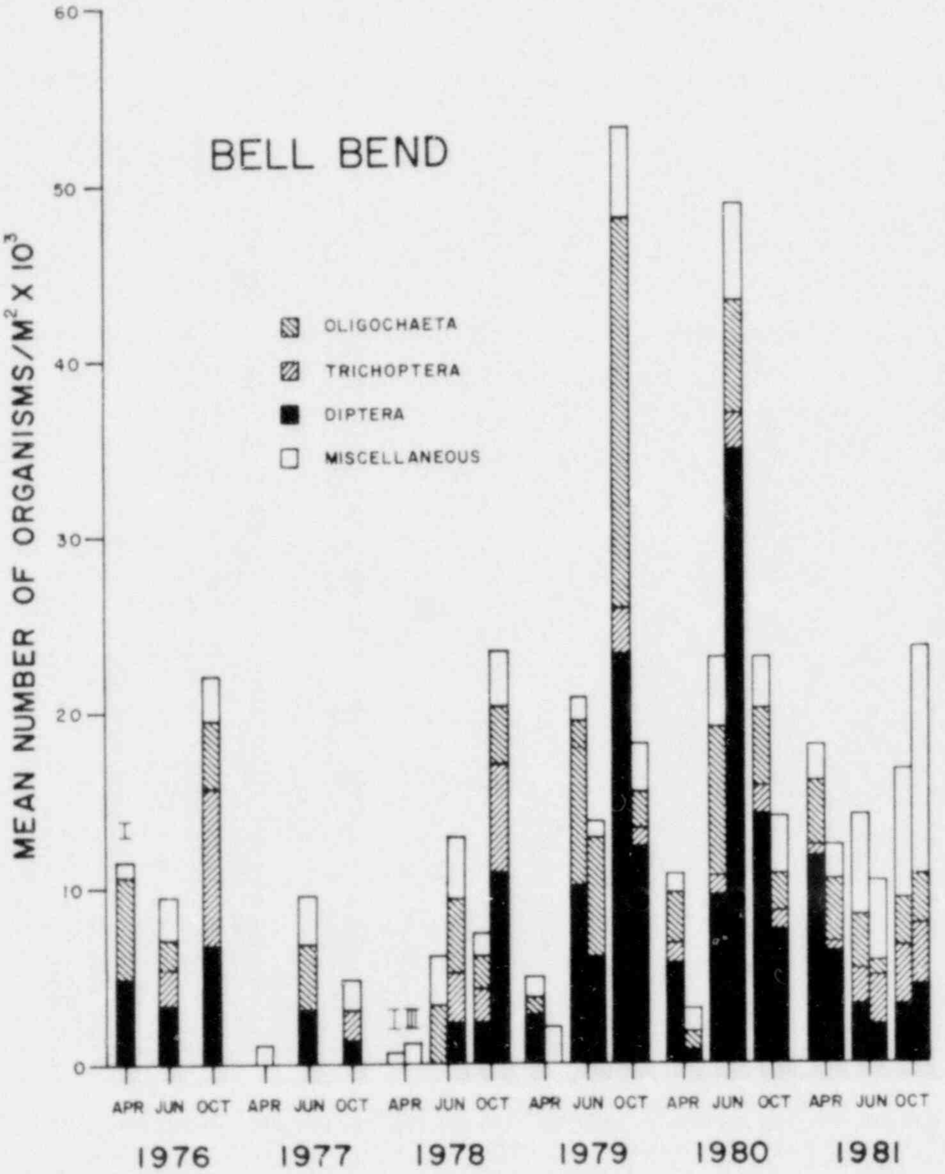

Fig. C-3

Mean standing crop (org/m^2) of benthic macroinvertebrates in replicate dome samples (2/sampling period) at Bell Bend I (1976-81) and III (1978-81) on the Susquehanna River.

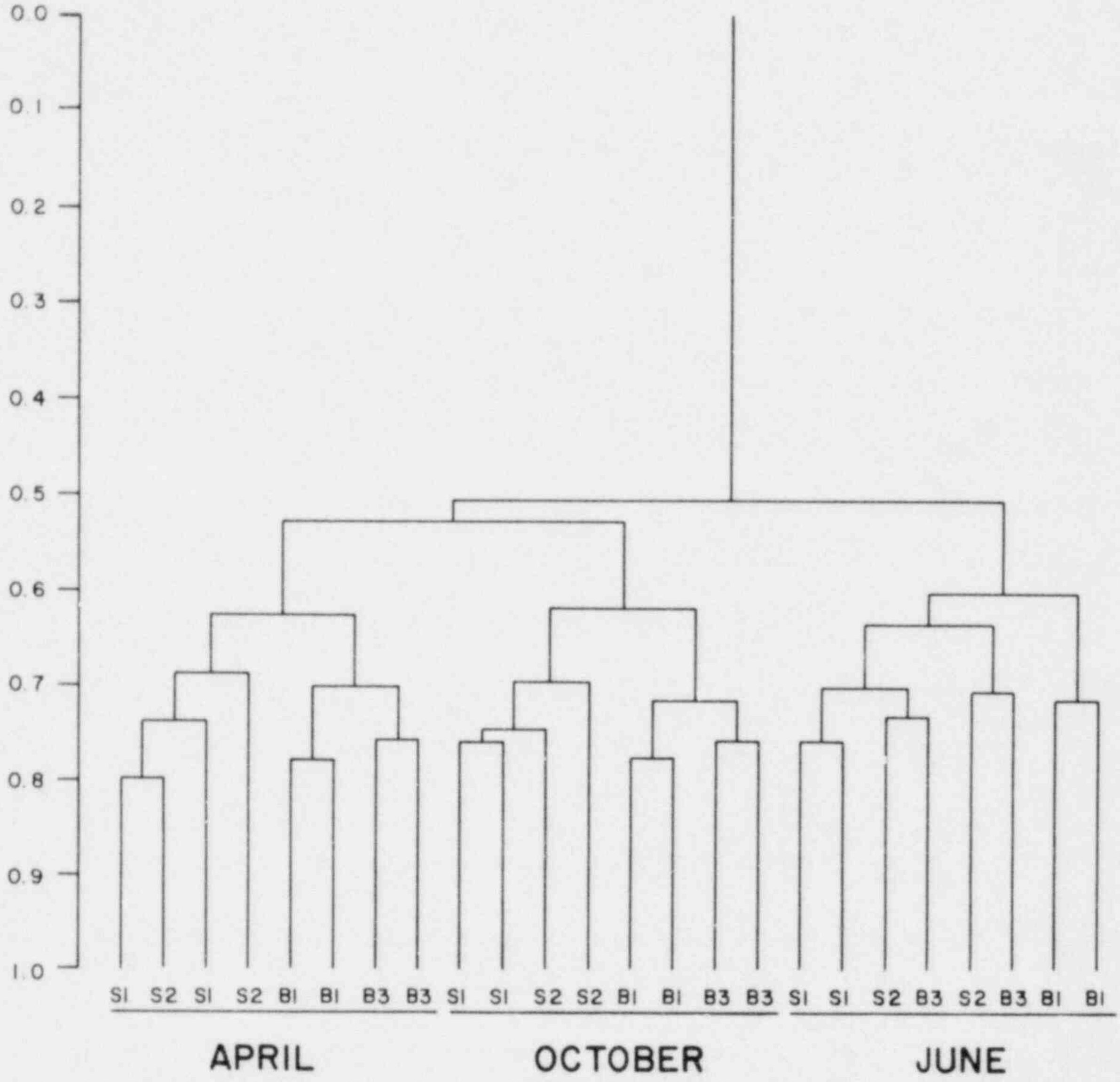

Fig. C-4

Dendrogram of the cluster analysis of Bray-Curtis similarity matrices for 1981 benthic macroinvertebrate data at SSES I (S1) and II (S2) and at Bell Bend I (B1) and III (B3). The scale ranges from complete similarity (1.0) to complete dissimilarity (0.0).

LARVAL FISHES

by

Harold W. Mohr, Jr., Gerard L. Buynak, and Theodore V. Jacobsen

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ABSTRACT

In 1981, the relative abundance and density of larval fish was monitored at SSES and Bell Bend near the Susquehanna SES. A total of 2,011 larvae (about 87% prolarvae) of at least 19 species was collected from 29 April through 26 August. Over 93% of the total number captured at SSES was composed of carp, spottail shiner, spotfin shiner, quillback, tessellated darter, and banded darter. At Bell Bend, these same six species composed over 89% of the total. Maximum densities at SSES and Bell Bend occurred on 27 May when 34.4 and 26.7 fish/10 m^3 were collected, respectively. No significant differences were found in the combined catch at SSES as compared to Bell Bend. Significantly more larvae ($P<0.001$), however, were taken at night than during the day. In addition, significantly more ($P<0.05$) larvae were taken near the surface of the river as compared to the bottom.

INTRODUCTION

Seasonal fluctuations in the relative abundance and density of drifting larval fish near the Susquehanna SES intake structure have been monitored since 1974 (Buynak and Mohr 1976, 1977, 1978a; Gale and Mohr 1978; Mohr et al. 1979, 1980, 1981). In 1981, monitoring was conducted upriver and downriver from the station's intake-discharge complex to establish a baseline of preoperational conditions at these two sites. This was the fourth consecutive year that these two sites were monitored simultaneously.

PROCEDURES

Larval fish were sampled at SSES and Bell Bend pumping sites (Fig. D-1). The site at SSES was located 190 m upriver from the Susquehanna SES intake structure. The Bell Bend site was 920 m downriver from the discharge diffuser. Both sites were within 50 m of the west bank. Depth was 4.9 m at SSES and 4.1 m at Bell Bend on 14 May 1981 when the surface elevation of the river at the Susquehanna SES Biological Laboratory was 149.7 m above mean sea level.

Samples were collected simultaneously at both sites with similarly equipped pontoon boats on 29 April; 5, 13, 19, and 27 May; 3, 9, 16, and 23 June; 1, 15, and 28 July; and 12 and 26 August 1981. At each site, river water was pumped through a 216-μ mesh net with a high-capacity, gasoline-powered trash pump (Gale and Mohr 1978). Three replicate surface and bottom samples (5 min each) were taken at 0900 and 2100 h. Surface replicates were taken before bottom replicates. Night sampling at SSES on 16 June was delayed due to pump failure and was not begun until 2230 h with the equipment from Bell Bend.

The volume sampled in each replicate was determined by multiplying pumping duration (5 min) by pumping rate. The pumping rate was checked on each sampling date with a hand-held tachometer (Stewart-Warner, Model 757-W). The pumping rate of each pump was tested monthly by timing the filling of a 1,280-liter trough. Tachometer readings taken during these tests were compared with those taken on each sampling date to assure that

each pump was functioning at near maximum capacity. Sample volumes at SSES were 11.0 m^3 from 29 April through 23 June; from 1 July through 26 August, they were 10.4 m^3. Sample volumes at Bell Bend varied between 11.0 m^3 and 12.0 m^3 throughout the sampling period.

Each sample was preserved in the field with 10% formalin containing rose bengal stain, and transported to the laboratory where larvae were sorted. Identifications and life stages (prolarva or postlarva) of all larvae were determined using a dissecting microscope (10-70X). Prolarvae were defined as fish with yolk and postlarvae were those without yolk (Hubbs 1943). Once scalation began, fish were considered juveniles and not reported. Catfishes were considered juveniles when morphometrics, meristics, and pigmentation patterns resembled those of adults.

Where necessary, identifications were made by comparing larvae to our reference series of 31 species of laboratory-reared specimens and with developmental information given in Buynak and Mohr (1978b-d, 1979a-f, 1980a-d). We also used keys and descriptions in Fish (1932), Norden (1961), Mansueti (1964), Mansueti and Hardy (1967), May and Gasaway (1967), Siefert (1969), Taber (1969), Meyer (1970), Gerlach (1973), Lippson and Moran (1974), Hogue et al. (1976), Fuiman and Loos (1977), Snyder et al. (1977), Taubert (1977), Fuiman and Loos (1978), Hardy (1978), Jones et al. (1978), Fuiman (1979), Perry (1979), Cooper (1980), and Lathrop (1981). In a few instances, positive identifications to species could not be made, either because of damaged specimens or a lack of adequate keys. These fish were identified to the lowest taxon possible. Severely damaged fish which could

not be identified were tabulated as fragments. Names and order of listing (Table D-1) conform to Bailey et al. (1970). All specimens were stored in 10% formalin.

Data were processed with a Hewlett-Packard 9830-A computer and stored on permanent magnetic disc files. A thermal printout of these data was checked for accuracy before final raw data and density tables were printed with an impact printer. Data collected on 16 June were not included in the analysis of variance test because of the pump failure at SSES. It was anticipated that the 1½-hour delay in sample collection at SSES made the data incomparable with those from Bell Bend because of diurnal changes in the migration patterns of the larvae. Densities of larvae collected on all other dates were analyzed using a four-way analysis of variance (Hewlett-Packard 1974). The factors tested were sites, dates, day-night surface-bottom, and their first order interactions. Because replicate means were positively correlated with their variances, data were given a log (X+1) transformation prior to analyses. Upon completion of the analysis of variance, Bartlett's test for homogeneity of variance was applied. The nonsignificant results in Bartlett's test indicated that variances were suitably homogeneous for significance testing. The 5% probability level was used to determine significance in each test.

RESULTS AND DISCUSSION

A total of 2,011 larvae of at least 19 species was collected from 29 April through 26 August at SSES (1,077) and Bell Bend (934) sampling sites (Tables D-1 through D-15). Blacknose dace and yellow perch were collected only at Bell Bend, whereas margined madtom, bluegill, and crappie spp. were collected only at SSES (Tables D-16 and D-17). About 87% of all larvae collected were prolarvae.

The phenological occurrence of larval fishes at SSES and Bell Bend is presented in Tables D-16 and D-17. On 29 April, prolarval white sucker, yellow perch, and walleye were collected. Yellow perch was captured at Bell Bend and white sucker was taken only at SSES; no yellow perch were taken at either site after this date. By 5 May, white sucker, tessellated darter, and walleye were collected at both sites, and spottail shiner and shield darter were taken only at Bell Bend. No walleye were taken at either site after 5 May. White sucker was captured at one or both sites through 3 June. Tessellated darter was captured through 16 June at both sites and on 23 June at SSES and on 1 July at Bell Bend. On 13 May, prolarvae quillback were taken at both sites and collected at SSES through 16 June and Bell Bend through 23 June. Also, spottail shiner were collected at both sites on this date and through 9 June at SSES and 23 June at Bell Bend (except 16 June). Shorthead redhorse were collected at both sites on 19 May and found at one or both sites through 9 June.

Over 93% of the total number at SSES was composed of carp, spottail shiner, spotfin shiner, quillback, tessellated darter, and banded darter

(Table D-16). At Bell Bend, these same six species composed over 89% of the total (Table D-17). Overall, quillback was most abundant; it composed 40.7% and 33.1% of the total at SSES and Bell Bend, respectively. Tessellated darter was second in abundance (28.9 and 33.4%) followed by spotfin shiner (9.0 and 6.6%), banded darter (7.4 and 7.1%), carp (3.9 and 5.1%), and spottail shiner (3.3 and 4.2%).

A total of 150 larvae was captured during the day at SSES (Tables D-2 through D-15). Totals of 66 and 84 fish were taken near the surface and bottom, respectively. Quillback was most abundant in surface samples (65.0%) with 0.9 fish/10 m^3 (Table D-18). Carp was second in abundance (18.2%), averaging 0.3 fish/10 m^3. In bottom samples (Table D-19), quillback was again most abundant (30.9%, 0.6 fish/10 m^3) followed by spotfin shiner (13.2%, 0.2 fish/10 m^3), tessellated darter (13.1%, 0.2 fish/10 m^3), and banded darter (13.0%, 0.2 fish/10 m^3).

A total of 927 larvae was captured at night at SSES (Tables D-2 through D-15). Totals of 755 and 172 fish were captured near the surface and bottom, respectively. Quillback dominated surface samples (47.4%) and averaged 7.7 fish/10 m^3 (Table D-20). Tessellated darter was second in abundance (27.9%) with a mean of 4.6 fish/10 m^3. Spotfin shiner composed 9.5% of the total and averaged 1.6 fish/10 m^3. Bottom samples (Table D-21) were composed mainly of tessellated darter (49.0%, 1.8 fish/10 m^3) and spottail shiner (13.3%, 0.5 fish/10 m^3).

A total of 218 larvae was captured during the day at Bell Bend (Tables D-2 through D-15). Totals of 67 and 151 fish were captured near the surface

and bottom, respectively. Quillback dominated surface samples (61.8%), averaging 0.9 fish/10 m^3 (Table D-22). Carp was second in abundance (22.1%) with only 0.3 fish/10 m^3. Abundance was more evenly distributed in bottom samples (Table D-23) with tessellated darter (29.0%, 0.9 fish/10 m^3), quillback (16.8%, 0.5 fish/10 m^3), spottail shiner (15.3%, 0.5 fish/10 m^3), and spotfin shiner (14.4%, 0.5 fish/10 m^3) most prevalent.

A total of 716 larvae was captured at night at Bell Bend (Tables D-2 through D-15). Totals of 475 and 241 fish were taken near the surface and bottom, respectively. Quillback was most abundant (50.0%) in surface samples and averaged 5.1 fish/10 m^3 (Table D-24). Tessellated darter was second in abundance at 29.0% with 3.0 fish/10 m^3. Tessellated darter dominated bottom samples (53.5%) averaging 2.7 fish/10 m^3 followed by channel catfish (15.3%, 0.8 fish/10 m^3) and spotfin shiner (8.3%, 0.4 fish/10 m^3) (Table D-25).

Fishes in three families composed over 94% of the total number of larvae captured at both sites (Tables D-16 and D-17). Suckers were the most abundant at SSES (43.1%) followed by perches (36.9%) and minnows (16.2%). At Bell Bend, perches were the most abundant (42.4%) followed by suckers (35.7%) and minnows (16.1%). Overall, 93.8% of the sucker larvae were quillback followed by shorthead redhorse (4.0%) and white sucker (2.1%). Perches were composed of mostly tessellated darter (78.5%) and banded darter (18.5%). Minnows were dominated by spotfin shiner (49.2%) followed in abundance by carp (27.5%) and spottail shiner (22.6%).

Fishes from these same three families have composed over 94% of the total catch (Fig. D-2) each year since 1974 (Buynak and Mohr 1976, 1977, 1978a; Gale and Mohr 1978; Mohr et al. 1979, 1980, 1981). In 1974 and 1975, minnows were first in order of abundance, followed by suckers and perches. From 1976 through 1978, suckers were most abundant followed by minnows and perches. In 1979 and 1980, suckers were again most abundant; however, perches were second and minnows third in order of abundance. In 1981, equal numbers of suckers and perches were captured and each composed almost 40% of the total catch; minnows were next in order of abundance.

Sunfishes and catfishes composed 5% or less of the total number of larvae at both sites. As in prior years, most of the sunfishes and catfishes were captured in June and July as postlarvae. Catches of these two families were similar at both sites and most were captured in bottom samples at night.

Fluctuations in larval fish densities were similar at SSES and Bell Bend throughout the 1981 sampling season (Tables D-16 and D-17; Fig. D-3). At both sites, the greatest increase occurred from 19 through 27 May when maximum densities were found. During this time, density at SSES increased from 6.0 to 34.4 fish/10 m^3 while at Bell Bend, it increased from 4.1 to 26.7 fish/10 m^3. These peak densities were attributed to marked increases in prolarval quillback and, to a lesser extent, in spottail shiner, tessellated darter, and banded darter. On 3 June, the densities at each site decreased substantially, mainly from decreases in quillback prolarvae.

After 3 June, densities were greater at SSES during four of the remaining eight sampling dates.

Highly significant differences ($P<0.001$) were found in the densities of drifting larvae relative to sampling dates (Table D-26). Fluctuations in larval fish abundance throughout the sampling season directly influenced these differences (Fig. D-3).

No significant differences were found in the combined catch per unit effort at SSES as compared to Bell Bend (Table D-26). It averaged 5.8 fish/10 m^3 at SSES and 5.0 fish/10 m^3 at Bell Bend (Tables D-16 and D-17). In addition, no significant differences occurred in the catch per unit effort between SSES and Bell Bend for any of the eight major species of larval fish. This was the first year since simultaneous sampling began that significant site differences were not found in both the combined catch per unit effort and the catch per unit effort of the major fishes. Overall, the combined catch at both sites in 1981 decreased from that observed in 1980 (Mohr et al. 1981), but it was similar to that observed in 1978 and 1979 (Mohr et al. 1979, 1980). The decrease at SSES occurred mainly because fewer carp and quillback were captured, while at Bell Bend, less carp, quillback, and tessellated darter were taken.

Significantly more larvae ($P<0.001$) were taken at night than during the day (Table D-26). Similar results were obtained in 1977 at SSES (Buynak and Mohr 1978a) and in 1978, 1979, and 1980 at SSES and Bell Bend (Mohr et al. 1979, 1980, 1981). In 1981, mean density at night (10.0 fish/10 m^3) was over 6-fold greater than during the day (1.6 fish/10 m^3) at SSES

(Tables D-18 through D-21). At Bell Bend (Tables D-22 through D-25), mean density at night (7.6 fish/10 m^3) was over 3-fold greater than during the day (2.3 fish/10 m^3). Significantly more carp, spotfin shiner, quillback, white sucker, shorthead redhorse, tessellated darter, and banded darter were captured at night.

No significant day-night differences were found for spottail shiner, but a significant interaction was found for sites versus day-night effects. Over 3-fold more spottail shiner were collected at SSES at night (0.29 fish/10 m^3) than during the day (0.09 fish/10 m^3) (Tables D-18 through D-21). At Bell Bend, however, day-night differences were not as large and more were captured in the day (0.26 fish/10 m^3) than at night (0.16 fish/10 m^3) (Tables D-22 through D-25).

Significantly more larvae ($P<0.05$) were taken near the surface (7.3 fish/10 m^3) as compared to the bottom (3.5 fish/10 m^3) in the combined catches at SSES and Bell Bend (Table D-26). This difference was not found in 1979 and 1980 (Mohr et al. 1980, 1981), but it occurred in 1978 (Mohr et al. 1979) when about 2-fold more larvae were taken near the surface. In 1981, significantly more ($P<0.001$) carp and quillback were captured near the surface while more spottail shiner were taken near the bottom. No significant surface-bottom differences were found for spotfin shiner, white sucker, shorthead redhorse, tessellated darter, and banded darter. Significantly more larvae of either carp, quillback, white sucker, or a combination of these species were captured near the surface from 1978 through 1980 while more spottail shiner and tessellated darter were captured

near the bottom in 1979 and 1980 (Mohr et al. 1980, 1981). Annual variability probably occurred because maximum diel surface-bottom differences for each species may not have always been detected in the 2100-h sample. Diel studies by Gale and Mohr (1978) found the greatest differences between surface and bottom catches to occur at 2400 h for most of these species.

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Table D-1

Larval fishes collected in pump samples at SSES (1974-81) and Bell Bend (1978-81) on the Susquehanna River. An * denotes fishes taken in 1981.

Cyprinidae - Minnows and Carps
- *Cyprinus carpio* - carp*
- *Nocomis micropogon* - river chub
- *Notropis amoenus* - comely shiner
- *N. hudsonius* - spottail shiner*
- *N. spilopterus* - spotfin shiner*
- *Pimephales notatus* - bluntnose minnow
- *Rhinichthys atratulus* - blacknose dace*
- Unidentified Cyprinidae - minnow spp.*

Catostomidae - Suckers
- *Carpiodes cyprinus* - quillback*
- *Catostomus commersoni* - white sucker*
- *Hypentelium nigricans* - northern hog sucker
- *Moxostoma macrolepidotum* - shorthead redhorse*
- Unidentified Catostomidae - sucker spp.

Ictaluridae - Freshwater Catfishes
- *Ictalurus catus* - white catfish*
- *I. natalis* - yellow bullhead
- *I. punctatus* - channel catfish*
- *Noturus insignis* - margined madtom*
- Unidentified Ictaluridae - catfish spp.*

Centrarchidae - Sunfishes
- *Ambloplites rupestris* - rock bass*
- *Lepomis auritus* - redbreast sunfish
- *L. gibbosus* - pumpkinseed*
- *L. macrochirus* - bluegill*
- *Lepomis* spp. - sunfish spp.*
- *Micropterus dolomieui* - smallmouth bass
- *Pomoxis* spp. - crappie spp.*

Percidae - Perches
- *Etheostoma olmstedi* - tessellated darter*
- *E. zonale* - banded darter*
- *Perca flavescens* - yellow perch*
- *Percina peltata* - shield darter*
- *Stizostedion vitreum* - walleye*
- Unidentified Percidae - perch spp.

Table D-2

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 29 April 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2100-2133						0900-0933						2052-2125					
M^3/REPLICATE	11.0						11.0						11.0						11.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024
SPECIES																								
WHITE SUCKER PROLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YELLOW PERCH PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
WALLEYE PROLARVA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
TOTAL	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0

Table D-3

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 5 May 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2101-2133						0900-0932						2100-2133					
M^3/REPLICATE	11.0						11.0						11.0						11.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	025	026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048
SPECIES																								
SPOTTAIL SHINER PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
WHITE SUCKER PROLARVA	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
TESSELLATED DARTER PROLARVA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
SHIELD DARTER PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
WALLEYE PROLARVA	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
TOTAL	0	0	0	0	1	2	1	1	1	0	0	0	0	0	0	1	4	1	1	1	1	0	0	0

Table D-4

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 13 May 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2100-2132						0900-0933						2100-2132					
M^3/REPLICATE	11.0						11.0						11.0						11.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	049	050	051	052	053	054	055	056	057	058	059	060	061	062	063	064	065	066	067	068	069	070	071	072
SPECIES																								
SPOTTAIL SHINER																								
PROLARVA	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
QUILLBACK																								
PROLARVA	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0
WHITE SUCKER																								
PROLARVA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POSTLARVA	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
TESSELLATED DARTER																								
PROLARVA	0	1	0	2	0	0	11	5	4	3	2	0	1	0	1	0	0	0	4	1	5	0	2	3
POSTLARVA	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
FISH (FRAGMENTS)	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	1	0	2	1	0	14	6	7	4	2	1	2	0	2	0	0	0	4	3	9	0	2	4

Table D-5

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 19 May 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2100-2133						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.0						11.0						11.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	073	074	075	076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095	096
SPECIES																								
SPOTTAIL SHINER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
QUILLBACK																								
PROLARVA	5	5	14	0	1	0	11	9	6	0	0	0	6	8	6	0	1	0	9	6	1	0	0	0
WHITE SUCKER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
SHORTHEAD REDHORSE																								
PROLARVA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
TESSELLATED DARTER																								
PROLARVA	0	1	0	0	0	0	5	6	4	3	2	0	0	0	0	0	0	0	4	1	2	2	2	1
POSTLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FISH (FRAGMENTS)	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
TOTAL	5	6	14	2	1	2	18	15	10	3	2	1	6	8	6	1	2	0	13	7	3	3	4	1

Table D-6

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 27 May 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2100-2133						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.0						11.0						11.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	097	098	099	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
SPECIES																								
CARP																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
SPOTTAIL SHINER																								
PROLARVA	0	0	0	0	0	2	0	2	0	2	5	4	0	0	0	2	2	1	0	1	0	2	0	3
POSTLARVA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
QUILLBACK																								
PROLARVA	5	4	7	2	8	6	67	83	98	3	4	2	2	9	2	4	5	5	69	61	37	0	2	0
POSTLARVA	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
WHITE SUCKER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0
SHORTHEAD REDHORSE																								
PROLARVA	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0
TESSELLATED DARTER																								
PROLARVA	0	0	0	1	0	1	24	28	21	12	11	5	0	0	0	1	1	1	21	21	14	20	20	14
BANDED DARTER																								
PROLARVA	0	0	0	0	3	2	14	14	3	0	0	0	0	0	0	0	0	0	8	5	6	0	0	0
POSTLARVA	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	1	1	0
SHIELD DARTER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
POSTLARVA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FISH (FRAGMENTS)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	4	7	5	11	12	105	128	125	19	21	12	2	9	2	7	10	7	99	88	63	24	24	17

Table D-7

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 3 June 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2100-2132						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.0						11.3						11.3					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144
SPECIES																								
CARP																								
PROLARVA	4	5	3	4	1	2	7	6	5	0	0	0	3	2	8	5	6	4	4	4	4	4	0	1
SPOTTAIL SHINER																								
PROLARVA	0	0	1	0	0	5	0	1	0	3	3	2	0	0	0	5	3	5	1	0	0	3	0	3
SPOTFIN SHINER																								
PROLARVA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MINNOW SPP.																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
QUILLBACK																								
PROLARVA	0	2	0	3	1	3	13	17	14	0	0	2	1	1	2	1	3	1	4	5	7	0	0	0
POSTLARVA	0	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	2	0	0	1	0	0	0
WHITE SUCKER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SHORTHEAD REDHORSE																								
PROLARVA	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POSTLARVA	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRAPPIE SPP																								
POSTLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TESSELLATED DARTER																								
PROLARVA	2	0	1	1	2	1	10	20	10	15	5	5	0	0	0	19	5	4	7	5	4	13	8	6
POSTLARVA	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	5	0	0	0	0	1	0	1
BANDED DARTER																								
PROLARVA	0	0	0	0	1	0	14	5	6	1	1	0	0	0	0	0	0	1	4	1	1	0	0	0
POSTLARVA	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	2
SHIELD DARTER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	3
FISH (FRAGMENTS)	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
TOTAL	7	7	5	10	6	11	48	50	39	22	12	9	5	3	10	31	23	20	20	15	17	22	11	17

Table D-8

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 9 June 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0933						2100-2141						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.0						11.3						11.3					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168
SPECIES																								
CARP																								
PROLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
SPOTTAIL SHINER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	1	0	0	0	0	0	0	0
SPOTFIN SHINER																								
PROLARVA	0	0	0	0	1	2	0	2	0	0	0	0	0	0	1	4	2	0	2	1	3	0	0	1
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
QUILLBACK																								
PROLARVA	1	0	0	1	0	0	2	3	1	0	0	1	0	3	0	0	1	0	4	6	3	0	0	1
POSTLARVA	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0
SHORTHEAD REDHORSE																								
POSTLARVA	0	0	0	0	0	0	2	3	1	2	1	0	1	1	0	0	0	1	1	0	7	0	1	0
TESSELLATED DARTER																								
PROLARVA	0	0	0	2	0	0	12	12	10	4	2	3	0	0	0	1	0	3	7	11	20	10	9	5
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	2	0	2	0	0	1	1
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	1	0	2	6	0	0	0
POSTLARVA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
SHIELD DARTER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	1
FISH (FRAGMENTS)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TOTAL	1	0	0	4	2	2	17	23	14	7	6	7	1	5	2	8	4	9	14	24	41	14	12	10

Table D-9

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 16 June 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2225-2308						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.3						11.3						11.3					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
SPECIES																								
CARP																								
PROLARVA	0	0	0	0	0	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
SPOTFIN SHINER																								
PROLARVA	1	0	1	0	1	1	8	4	2	0	1	2	0	0	0	2	2	2	0	3	1	0	0	0
POSTLARVA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
QUILLBACK																								
PROLARVA	0	0	0	0	0	0	9	9	8	0	0	0	0	0	0	0	0	1	3	2	5	0	0	0
POSTLARVA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCK BASS																								
POSTLARVA	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
BLUEGILL																								
POSTLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CRAPPIE SPP.																								
POSTLARVA	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TESSELLATED DARTER																								
PROLARVA	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	2	4	2	0	1	0
POSTLARVA	0	0	0	0	0	1	8	8	7	0	1	2	0	0	0	0	0	2	0	0	0	1	3	2
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	1	0	0	0
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	0
TOTAL	1	0	1	1	1	2	25	25	22	2	4	6	0	1	0	3	2	6	6	11	10	3	4	2

Table D-10

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 23 June 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2101-2132						0900-0932						2100-2132					
M^3/REPLICATE	11.0						11.0						11.3						11.3					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216
SPECIES																								
SPOTTAIL SHINER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
SPOTFIN SHINER																								
PROLARVA	0	0	0	1	1	1	13	23	13	1	2	1	0	0	0	1	2	1	1	0	1	0	0	0
BLACKNOSE DACE																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
QUILLBACK																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0
WHITE CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CHANNEL CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	8	3
CATFISH SPP.																								
PROLARVA	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PUMPKINSEED																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
TESSELLATED DARTER																								
PROLARVA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	0
TOTAL	0	0	0	2	1	1	13	24	13	1	4	2	1	0	0	2	2	2	4	2	2	5	11	3

Table D-11

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 1 July 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2100-2132						0900-0935						2100-2132					
M^3/REPLICATE	10.4						10.4						12.0						12.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
SPECIES																								
SPOTFIN SHINER																								
PROLARVA	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	2	1	0	1	0	0	0	0
WHITE CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	1	1	2	6	3	0	0	0	0	0	0	1	1	1	7	1	6
MARGINED MADTOM																								
POSTLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TESSELLATED DARTER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
BANDED DARTER																								
PROLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
FISH (FRAGMENTS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
TOTAL	0	0	0	0	0	1	0	1	1	3	8	3	0	1	0	1	3	1	1	2	1	9	2	6

Table D-12

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 15 July 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0904-0936						2100-2135						0900-0932						2100-2132					
M^3/REPLICATE	10.4						10.4						12.0						12.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264
SPECIES																								
SPOTFIN SHINER																								
PROLARVA	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	1	2	13
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	3	2	2
ROCK BASS																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
PUMPKINSEED																								
POSTLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFISH SPP.																								
POSTLARVA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BANDED DARTER																								
POSTLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	2	0
TOTAL	1	0	0	0	0	0	1	1	2	1	1	4	0	0	1	0	0	0	2	0	1	4	6	15

Table D-13

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 28 July 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2100-2132						0900-0932						2100-2132					
M^3/REPLICATE	10.4						10.4						12.0						12.0					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288
SPECIES																								
SPOTFIN SHINER																								
PROLARVA	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	1	1	0	0
POSTLARVA	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHANNEL CATFISH																								
POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
PUMPKINSEED																								
PROLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BLUEGILL																								
POSTLARVA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	1	2	0	3	0	0	0	0	0	0	0	0	0	3	1	1	1	0

Table D-14

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 12 August 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2103-2135						0900-0932						2100-2132					
M^3/REPLICATE	10.4						10.4						11.6						11.6					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312
SPECIES																								
SPOTFIN SHINER PROLARVA	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	2	0	0
CHANNEL CATFISH POSTLARVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0
FISH (FRAGMENTS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	1	3	0	0

Table D-15

Number of larval fish captured with a pump sampler at SSES and Bell Bend on the Susquehanna River, 26 August 1981.

SITE	SSES												BELL BEND											
SAMPLING PERIOD	DAY						NIGHT						DAY						NIGHT					
SAMPLING TIME	0900-0932						2100-2133						0900-0932						2100-2131					
M^3/REPLICATE	10.4						10.4						11.6						11.6					
LOCATION	SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM			SURFACE			BOTTOM		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
COLLECTION NO. HWM-81-	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336
SPECIES																								
SPOTFIN SHINER PROLARVA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table D-16

Mean density of larval fish/10 m^3 captured at SSES on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	2.80	0.08	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.23	3.9
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.15	0.08	1.14	1.14	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	3.2
POSTLARVA	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.1
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.08	0.38	1.56	4.24	0.08	0.24	0.16	0.16	0.08	0.50	8.5
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.08	0.24	0.00	0.00	0.03	0.5
QUILLBACK																
PROLARVA	0.00	0.00	0.15	3.86	21.89	4.17	0.68	1.92	0.00	0.00	0.00	0.00	0.00	0.00	2.33	40.0
POSTLARVA	0.00	0.00	0.00	0.00	0.08	0.30	0.15	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.7
WHITE SUCKER																
PROLARVA	0.08	0.15	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.4
POSTLARVA	0.00	0.00	0.15	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.3
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.08	0.23	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.6
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.23	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.1
WHITE CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.01	0.2
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.32	0.00	0.00	0.00	0.10	1.7
MARGINED MADTOM																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.01	0.1
CATFISH SPP.																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.1
ROCK BASS																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.3
PUMPKINSEED																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.01	0.1
BLUEGILL																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.08	0.00	0.00	0.01	0.2
SUNFISH SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.01	0.1
CRAPPIE SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.2
TESSELLATED DARTER																
PROLARVA	0.00	0.08	2.12	1.59	7.80	5.45	3.41	0.29	0.08	0.00	0.00	0.00	0.00	0.00	1.49	25.5
POSTLARVA	0.00	0.00	0.08	0.08	0.00	0.23	0.30	1.99	0.08	0.00	0.00	0.00	0.00	0.00	0.20	3.4
BANDED DARTER																
PROLARVA	0.00	0.00	0.00	0.08	2.73	2.12	0.30	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.38	6.5
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.15	0.08	0.00	0.15	0.00	0.08	0.00	0.00	0.00	0.05	0.9
SHIELD DARTER																
POSTLARVA	0.00	0.00	0.00	0.00	0.08	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.2
WALLEYE																
PROLARVA	0.08	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.4
FISH (FRAGMENTS)	0.00	0.00	0.15	0.23	0.08	0.15	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.8
TOTAL	0.15	0.45	2.88	5.98	34.39	17.12	6.29	6.65	4.62	1.36	0.88	0.56	0.16	0.08	5.83	

Table D-17

Mean density of larval fish/10 m^3 captured at Bell Bend on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.08	3.32	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.25	5.1
SPOTTAIL SHINER																
PROLARVA	0.00	0.08	0.08	0.08	0.83	1.47	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	4.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.1
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.07	1.03	0.74	0.44	0.42	1.18	0.28	0.29	0.07	0.32	6.5
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.1
BLACKNOSE DACE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.1
MINNOW SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.1
QUILLBACK																
PROLARVA	0.00	0.00	0.23	2.80	14.85	1.84	1.33	0.81	0.22	0.00	0.00	0.00	0.00	0.00	1.58	31.8
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.22	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.3
WHITE SUCKER																
PROLARVA	0.00	0.15	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	0.2
POSTLARVA	0.00	0.00	0.30	0.08	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.9
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.2
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.3
WHITE CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.1
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	1.18	0.49	0.07	0.22	0.00	0.22	4.5
ROCK BASS																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.07	0.00	0.00	0.00	0.01	0.2
PUMPKINSEED																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.1
TESSELLATED DARTER																
PROLARVA	0.00	0.08	1.29	0.91	8.56	5.24	4.87	0.66	0.00	0.00	0.00	0.00	0.00	0.00	1.54	31.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.52	0.44	0.59	0.00	0.07	0.00	0.00	0.00	0.00	0.12	2.3
BANDED DARTER																
PROLARVA	0.00	0.00	0.08	0.00	1.44	0.52	0.66	0.29	0.15	0.07	0.00	0.00	0.00	0.00	0.23	4.6
POSTLARVA	0.00	0.00	0.00	0.00	0.23	0.44	0.22	0.29	0.22	0.07	0.28	0.00	0.00	0.00	0.13	2.5
YELLOW PERCH																
PROLARVA	0.08	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	0.1
SHIELD DARTER																
PROLARVA	0.00	0.08	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.2
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.44	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	1.1
WALLEYE																
PROLARVA	0.08	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.5
FISH (FRAGMENTS)	0.00	0.00	0.00	0.15	0.00	0.15	0.07	0.00	0.00	0.07	0.00	0.00	0.07	0.00	0.04	0.7
TOTAL	0.15	0.68	1.97	4.09	26.67	14.31	10.62	3.54	2.51	1.87	2.01	0.42	0.57	0.07	4.96	

Table D-18

Mean density of larval fish/10 m^3 captured near the surface during the day at SSES on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	3.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	18.2
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.5
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.04	3.0
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.02	1.6
QUILLBACK																
PROLARVA	0.00	0.00	0.00	7.27	4.85	0.61	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	65.0
SHORTHEAD REDHORSE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.5
SUNFISH SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.02	1.6
TESSELLATED DARTER																
PROLARVA	0.00	0.00	0.30	0.30	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	7.6
TOTAL	0.00	0.00	0.30	7.58	4.85	5.76	0.30	0.61	0.00	0.00	0.32	0.32	0.00	0.00	1.43	

Table D-19

Mean density of larval fish/10 m^3 captured near the bottom during the day at SSES on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	8.3
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.61	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	8.3
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.91	0.61	0.91	0.32	0.00	0.00	0.00	0.00	0.22	12.0
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.2
QUILLBACK																
PROLARVA	0.00	0.00	0.00	0.30	4.85	2.12	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	29.7
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.2
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.2
CATFISH SPP.																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.02	1.2
TESSELLATED DARTER																
PROLARVA	0.00	0.00	0.61	0.00	0.61	1.21	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	11.5
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.2
BANDED DARTER																
PROLARVA	0.00	0.00	0.00	0.00	1.52	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	7.1
POSTLARVA	0.00	0.00	0.00	0.00	0.61	0.61	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	5.9
SHIELD DARTER																
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.2
WALLEYE																
PROLARVA	0.30	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	4.8
FISH (FRAGMENTS)	0.00	0.00	0.30	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	4.8
TOTAL	0.30	0.91	0.91	1.52	8.48	8.18	2.42	1.21	1.21	0.32	0.00	0.00	0.00	0.00	1.82	

Table D-20

Mean density of larval fish/10 m^3 captured near the surface at night at SSES on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	5.45	0.30	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.45	2.8
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.61	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.4
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.61	4.13	14.85	0.00	0.96	0.32	0.32	0.32	1.54	9.4
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.02	0.1
QUILLBACK																
PROLARVA	0.00	0.00	0.61	7.88	75.15	13.33	1.82	7.67	0.00	0.00	0.00	0.00	0.00	0.00	7.60	46.6
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.91	0.30	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.8
WHITE SUCKER																
PROLARVA	0.00	0.61	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.4
POSTLARVA	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.00	0.30	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.4
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.61	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.1
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.05	0.3
ROCK BASS																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.4
PUMPKINSEED																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.02	0.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.02	0.1
CRAPPIE SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1
TESSELLATED DARTER																
PROLARVA	0.00	0.30	6.06	4.55	22.12	12.12	10.30	0.59	0.30	0.00	0.00	0.00	0.00	0.00	4.02	24.7
POSTLARVA	0.00	0.00	0.30	0.30	0.00	0.00	0.00	6.78	0.00	0.00	0.00	0.00	0.00	0.00	0.53	3.2
BANDED DARTER																
PROLARVA	0.00	0.00	0.00	0.30	9.39	7.58	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	8.1
FISH (FRAGMENTS)	0.00	0.00	0.30	0.00	0.30	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.5
TOTAL	0.00	0.91	8.18	13.03	108.48	41.51	16.36	21.24	15.15	0.64	1.28	0.96	0.32	0.32	16.31	

Table D-21

Mean density of larval fish/10 m^3 captured near the bottom at night at SSES on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.1
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.61	0.30	3.33	2.42	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	13.3
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	1.21	0.00	0.00	0.32	0.32	0.00	0.20	5.2
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.32	0.00	0.00	0.05	1.2
QUILLBACK																
PROLARVA	0.00	0.00	0.00	0.00	2.73	0.61	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	6.9
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.6
WHITE SUCKER																
PROLARVA	0.30	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	0.02	0.6
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.6
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.2
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.7
WHITE CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.05	1.2
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.53	1.28	0.00	0.00	0.00	0.34	9.2
MARGINED MADTOM																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.02	0.6
BLUEGILL																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.32	0.00	0.00	0.04	1.2
CRAPPIE SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.6
TESSELLATED DARTER																
PROLARVA	0.00	0.00	1.52	1.52	8.48	7.58	2.73	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.60	42.7
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.91	1.21	0.88	0.30	0.00	0.00	0.00	0.00	0.00	0.24	6.3
BANDED DARTER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.7
POSTLARVA	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.61	0.00	0.32	0.00	0.00	0.00	0.11	2.9
SHIELD DARTER																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.6
FISH (FRAGMENTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.6
TOTAL	0.30	0.00	2.12	1.82	15.76	13.03	6.06	3.54	2.12	4.49	1.92	0.96	0.32	0.00	3.75	

Table D-22

Mean density of larval fish/10 m^3 captured near the surface during the day at Bell Bend on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	3.83	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.32	22.1
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	1.5
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.04	2.9
QUILLBACK																
PROLARVA	0.00	0.00	0.30	6.06	3.94	1.18	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	61.8
SHORTHEAD REDHORSE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	2.9
ROCK BASS																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.02	1.4
PUMPKINSEED																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.02	1.5
TESSELLATED DARTER																
PROLARVA	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	3.0
FISH (FRAGMENTS)	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	2.9
TOTAL	0.00	0.00	1.21	6.06	3.94	5.31	2.36	0.29	0.29	0.28	0.28	0.00	0.00	0.00	1.43	

Table D-23

Mean density of larval fish/10 m^3 captured near the bottom during the day at Bell Bend on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	4.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	9.9
SPOTTAIL SHINER																
PROLARVA	0.00	0.30	0.00	0.00	1.52	3.83	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	15.3
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.29	1.77	1.77	1.18	1.11	0.00	0.00	0.00	0.00	0.44	13.7
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.7
BLACKNOSE DACE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.02	0.7
QUILLBACK																
PROLARVA	0.00	0.00	0.00	0.30	4.24	1.47	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.47	14.8
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.59	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	2.0
WHITE SUCKER																
PROLARVA	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.7
SHORTHEAD REDHORSE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.7
TESSELLATED DARTER																
PROLARVA	0.00	0.00	0.00	0.00	0.91	8.26	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	23.1
POSTLARVA	0.00	0.00	0.00	0.00	0.00	1.47	0.59	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.19	5.9
BANDED DARTER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.29	0.28	0.00	0.00	0.00	0.00	0.08	2.6
POSTLARVA	0.00	0.00	0.00	0.00	0.30	0.88	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.13	4.0
SHIELD DARTER																
PROLARVA	0.00	0.30	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.4
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.7
WALLEYE																
PROLARVA	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	2.0
FISH (FRAGMENTS)	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.06	2.0
TOTAL	0.00	1.82	0.00	0.91	7.27	21.83	6.19	3.24	1.77	1.39	0.00	0.00	0.29	0.00	3.19	

Table D-24

Mean density of larval fish/10 m^3 captured near the surface at night at Bell Bend on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.30	3.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	2.7
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.30	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.4
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.02	0.2
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	1.77	1.18	0.59	0.28	0.28	0.83	0.57	0.00	0.39	3.9
QUILLBACK																
PROLARVA	0.00	0.00	0.61	4.85	50.61	4.72	3.83	2.95	0.88	0.00	0.00	0.00	0.00	0.00	4.89	48.1
POSTLARVA	0.00	0.00	0.00	0.00	1.21	0.29	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	1.9
WHITE SUCKER																
PROLARVA	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.2
POSTLARVA	0.00	0.00	0.91	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	1.1
SHORTHEAD REDHORSE																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.7
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.83	0.00	0.00	0.57	0.00	0.12	1.2
ROCK BASS																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.2
PUMPKINSEED																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.02	0.2
TESSELLATED DARTER																
PROLARVA	0.00	0.30	3.03	2.12	16.97	4.72	11.21	2.36	0.00	0.00	0.00	0.00	0.00	0.00	2.91	28.6
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.4
BANDED DARTER																
PROLARVA	0.00	0.00	0.30	0.00	5.76	1.77	2.36	1.18	0.29	0.00	0.00	0.00	0.00	0.00	0.83	8.2
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.04	0.4
YELLOW PERCH																
PROLARVA	0.30	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	0.02	0.2
WALLEYE																
PROLARVA	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.4
TOTAL	0.61	0.91	4.85	6.97	75.76	15.34	23.30	7.96	2.36	1.11	0.83	1.11	1.15	0.00	10.16	

Table D-25

Mean density of larval fish/10 m^3 captured near the bottom at night at Bell Bend on the Susquehanna River, 1981.

SPECIES	29 APR	5 MAY	13 MAY	19 MAY	27 MAY	3 JUN	9 JUN	16 JUN	23 JUN	1 JUL	15 JUL	28 JUL	12 AUG	26 AUG	MEAN	% TOTAL
CARP																
PROLARVA	0.00	0.00	0.00	0.00	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	2.1
SPOTTAIL SHINER																
PROLARVA	0.00	0.00	0.00	0.30	1.52	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	5.1
SPOTFIN SHINER																
PROLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	4.44	0.28	0.57	0.29	0.42	8.3
MINNOW SPP.																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.4
QUILLBACK																
PROLARVA	0.00	0.00	0.00	0.00	0.61	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.3
WHITE SUCKER																
POSTLARVA	0.00	0.00	0.30	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1.3
SHORTHEAD REDHORSE																
PROLARVA	0.00	0.00	0.00	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.9
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.4
WHITE CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.02	0.4
CHANNEL CATFISH																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.42	3.89	1.94	0.28	0.29	0.00	0.77	15.3
TESSELLATED DARTER																
PROLARVA	0.00	0.00	1.52	1.52	16.36	7.96	7.08	0.29	0.00	0.00	0.00	0.00	0.00	0.00	2.48	49.0
POSTLARVA	0.00	0.00	0.00	0.00	0.00	0.59	0.59	1.77	0.00	0.28	0.00	0.00	0.00	0.00	0.23	4.5
BANDED DARTER																
POSTLARVA	0.00	0.00	0.00	0.00	0.61	0.88	0.88	0.59	0.88	0.28	0.56	0.00	0.00	0.00	0.33	6.6
SHIELD DARTER																
POSTLARVA	0.00	0.00	0.00	0.00	0.00	1.47	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	3.7
FISH (FRAGMENTS)	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.04	0.8
TOTAL	0.00	0.00	1.82	2.42	19.70	14.75	10.62	2.65	5.60	4.72	6.94	0.56	0.86	0.29	5.07	

Table D-26

Results (F values) of eight analysis of variance tests comparing larval fish densities among replicates, dates (1), sites (2), times (3), and depths (4) on the Susquehanna River, 1981 (N.S. = not significant, * = P<0.05, ** = P<0.01, and *** = P<0.001).

Species		Main Effects					Interaction Effects						Bartlett's
		Replicates	1	2	3	4	1 X 2	1 X 3	2 X 3	1 X 4	2 X 4	3 X 4	Test
	DF	(2, 206)	(12, 206)	(1, 206)	(1, 206)	(1, 206)	(12, 206)	(12, 206)	(1, 206)	(12, 206)	(1, 206)	(1, 206)	
Combined		0.55	162.96***	1.44	320.40***	4.66*	2.47**	15.67***	2.26	10.74***	9.81**	53.45***	N.S.
Carp		1.77	182.84***	2.47	3.94*	23.82***	1.67	5.44***	0.30	15.76***	4.36*	13.31***	N.S.
Spottail shiner		0.12	20.10***	0.32	2.30	35.01***	0.34	1.77	9.59**	10.60***	0.35	0.04	N.S.
Spotfin shiner		0.26	16.74***	0.05	17.88***	0.10	6.71***	7.06***	2.55	1.28	5.49*	24.49***	N.S.
Quillback		2.41	164.88***	1.40	26.79***	203.09***	2.88**	7.80***	3.13	41.02***	1.00	120.65***	N.S.
White sucker		1.35	2.59**	0.25	10.55**	0.63	0.63	2.09*	0.00	1.29	0.23	1.65	N.S.
Shorthead redhorse		0.64	10.99***	1.40	11.15**	1.82	1.00	4.47***	2.52	2.98***	0.23	0.86	N.S.
Tessellated darter		2.90	135.25***	0.00	437.92***	0.42	1.38	64.84***	2.35	5.83***	17.19***	37.14***	N.S.
Banded darter		0.93	25.25***	0.01	47.52***	2.40	1.66	8.22***	0.36	2.70**	0.85	36.23***	N.S.

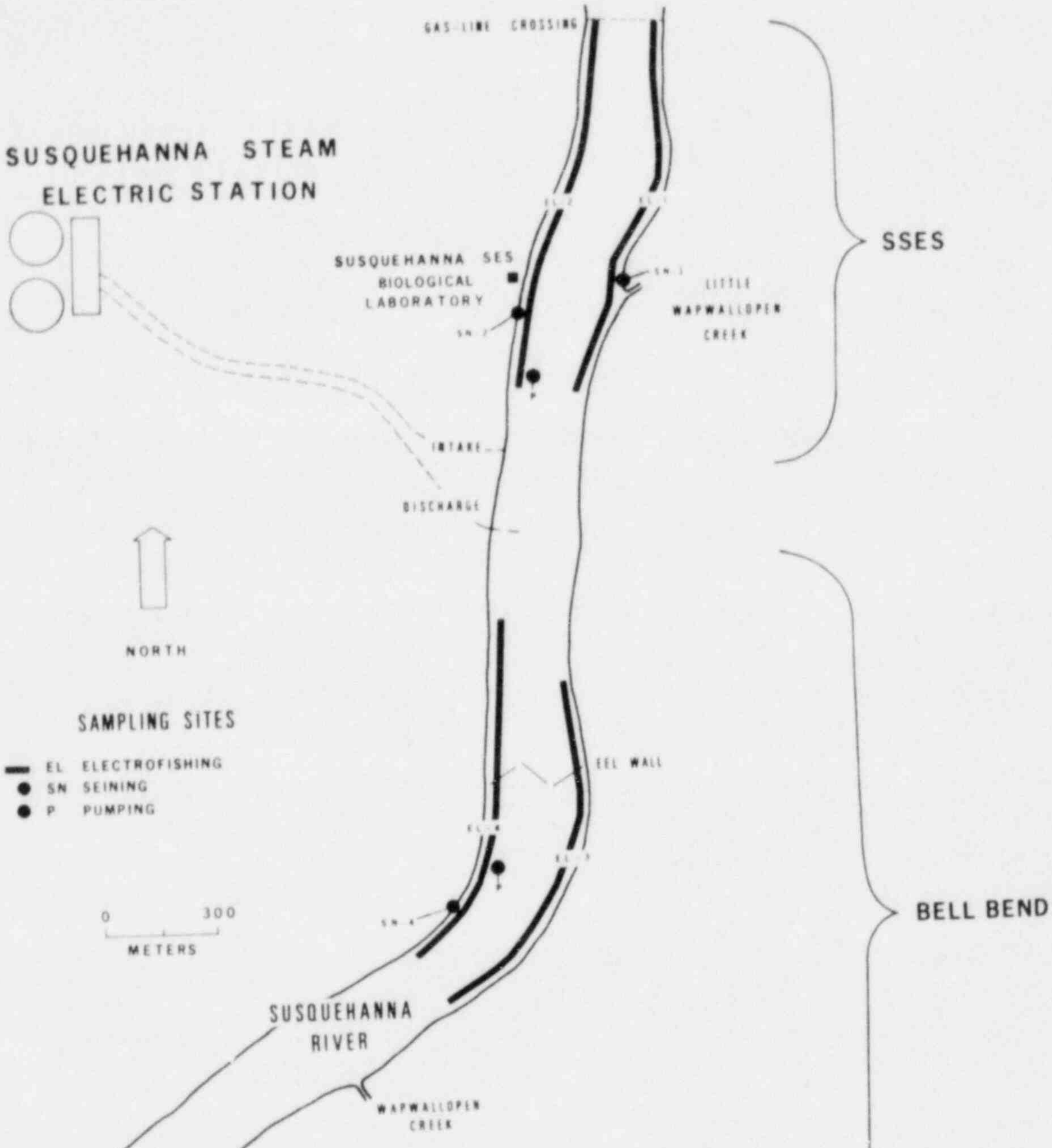

Fig. D-1

Sampling sites for pumping (P), electrofishing (EL), and seining (SN) at SSES and Bell Bend on the Susquehanna River, 1981.

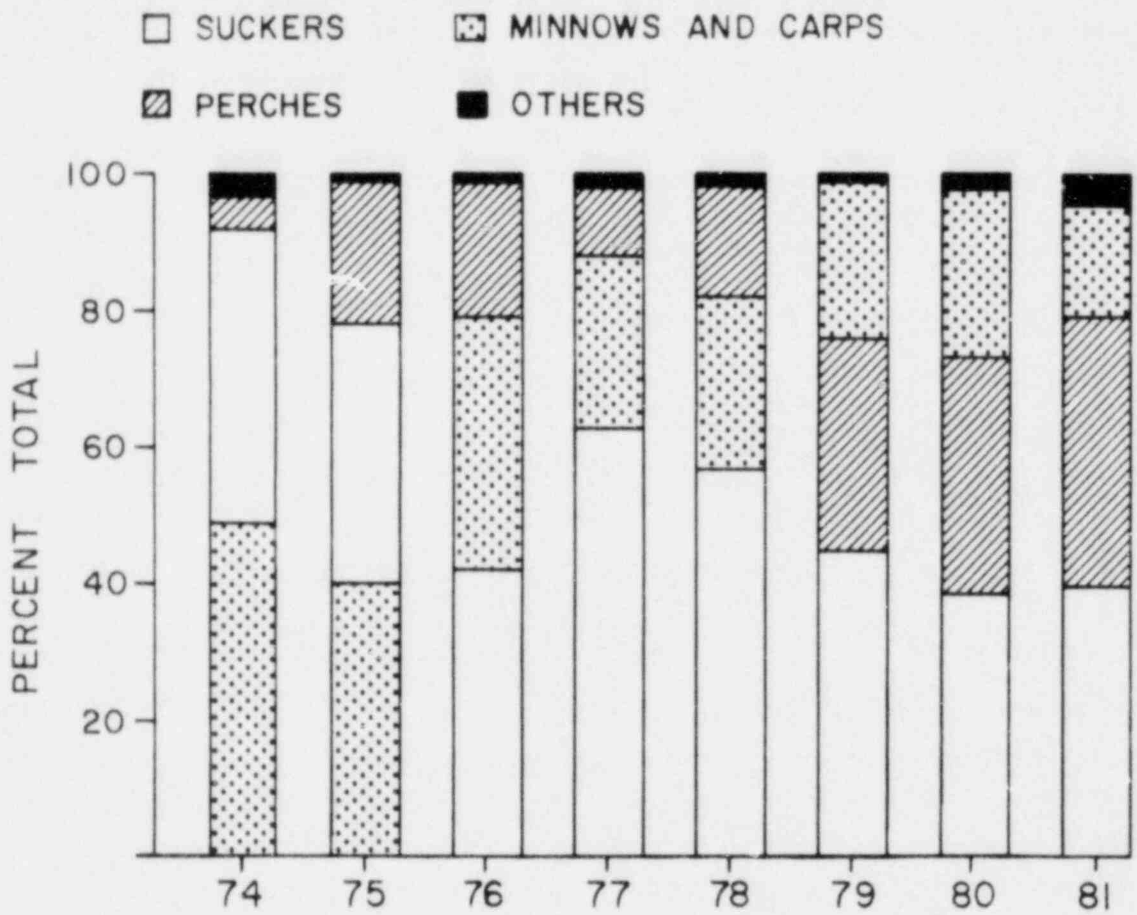

Fig. D-2

Percent total of dominant families of larval fish collected from 1974 through 1981. Data from 1974 are a summation of fixed-net (drift), push-net, and pump samples; 1975-81 are from pump samples.

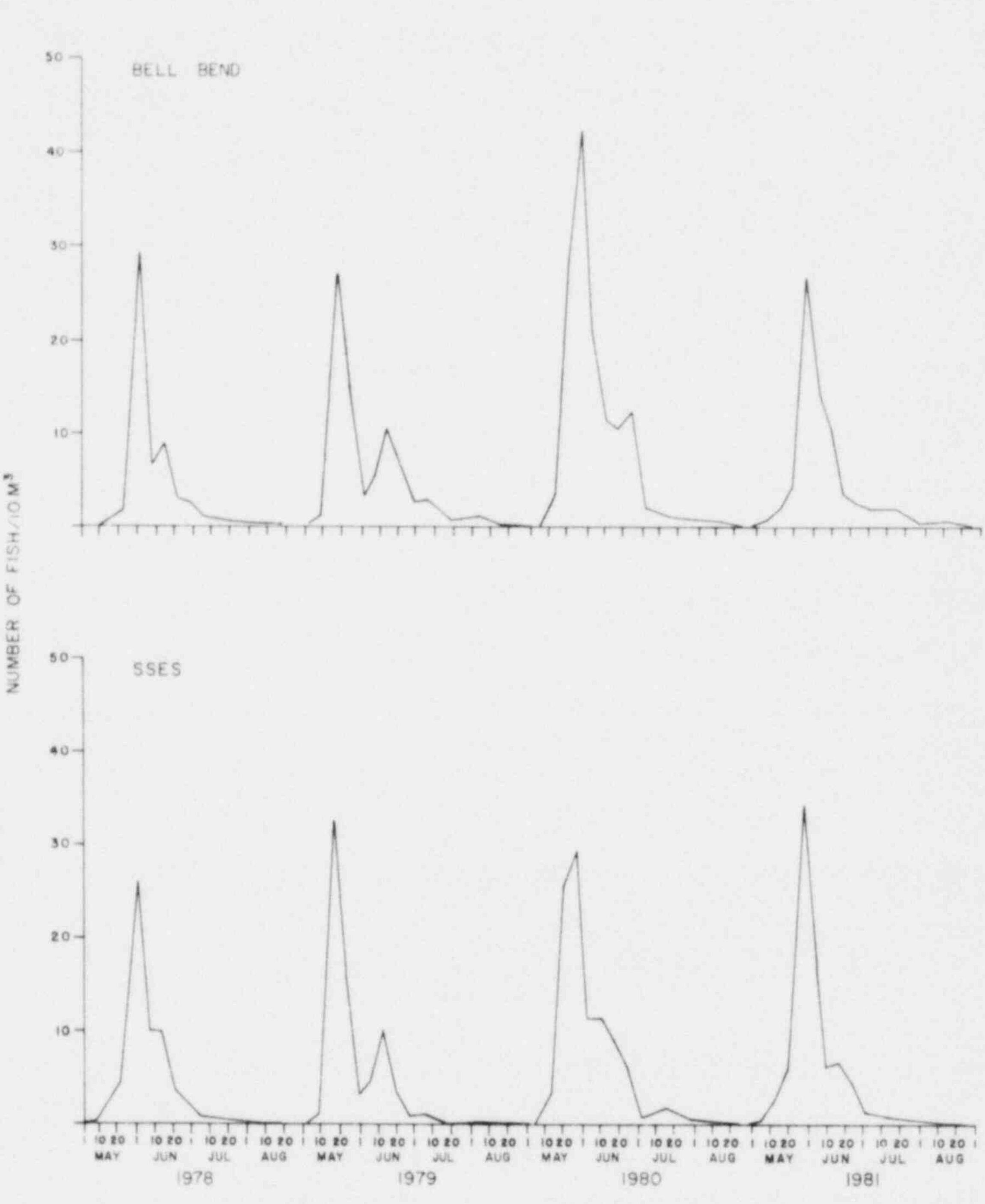

Fig. D-3

Mean density of larval fish captured at SSES and Bell bend on the Susquehanna River, 1978-81.

FISHES

by

Gerard L. Buynak, Andrew J. Gurzynski, Harold W. Mohr, Jr.,

and Theodore V. Jacobsen

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ABSTRACT

Fish were sampled at two stations (SSES and Bell Bend) with an electrofisher and seine. A total of 5,548 specimens of at least 27 fishes was observed while electrofishing and 7,694 specimens of 25 fishes was captured by seine. White sucker, shorthead redhorse, and walleye composed over 58% of the total number observed while electrofishing. Over 92% of the seine catch was composed of spotfin shiner, bluntnose minnow, and bluegill. Occurrence of the more abundant fishes was similar at both stations. No significant differences were found in either the total number of fishes or their species composition at the electrofishing sites. At the seining sites, a significant difference was found in the total number of fishes captured, but no difference was found in the species composition at the four sites. Significantly more specimens per unit effort were observed while electrofishing at the west bank site compared to the east bank site at SSES, and at night compared to the day. No significant differences in the catch per unit effort were obtained while seining at SSES and Bell Bend. The relative abundance of walleye and the number observed per unit effort, which has increased annually since 1976-77, decreased slightly in 1981. Juvenile American shad were captured for the first time at SSES and Bell Bend on 11 September, when five juveniles were taken during the day electrofishing runs.

INTRODUCTION

Seasonal fluctuations in species composition and relative abundance of fishes near the Susquehanna SES have been monitored since 1971 (Ichthyological Associates 1972, 1973, 1974; Buynak and Gurzynski 1976a-b, 1977a-d, 1978; Buynak et al. 1978a-b, 1979, 1980a-b, 1981). Beginning in 1976, emphasis was placed on a comparison of fisheries data collected at two sampling stations, SSES and Bell Bend. Comparative sampling at both stations continued in 1981. These data will be used to establish a baseline of preoperational conditions.

PROCEDURES

Fish populations were sampled with an electrofisher and seine at two stations, one located upriver from the Susquehanna SES intake (SSES) and a second located downriver from the discharge diffuser (Bell Bend). Electrofishing samples were taken using a pulsed direct-current electrofisher similar to that described by Novotny and Priegel (1974). The electrofisher used consisted of a 4-KW generator and a variable voltage pulsator in a 6-m flat-bottomed boat powered by an outboard motor. Seine samples were collected with a 7.6-m bag seine with 0.64-cm mesh.

Each station was electrofished at two 1,000-m sites, one near each river bank (Table E-1; Fig. D-1). Samples were taken once per month at each site from March through December during ice-free periods when the river level at the Susquehanna SES Biological Laboratory was between 148.5 and 150.3 m above

mean sea level (msl). Sites were sampled once during the day and once at night by slowly driving the electrofisher downriver parallel to the current from 1 to 50 m from the river bank. Each 1,000-m run was considered one unit of effort. Day sampling began about 3 hours after sunrise and night sampling about 1 hour after sunset. Most specimens of stunned fishes (excluding cyprinids, except carp, river chub, and fallfish) larger than about 10 cm were identified and enumerated by two observers on the bow of the boat. The few specimens that surfaced behind the observers were identified and enumerated by the boat operator. Data were recorded on a cassette tape recorder (Craig No. 8108). Fish which could not be positively identified in the water were captured, identified, and released; those that escaped were recorded as unidentified.

Seine samples were collected at two sites at each station, one site on each river bank (Table E-1; Fig. D-1). Sites were selected in areas free of underwater obstructions to increase sampling efficiency. Samples were collected once per month at each site from April through October during ice-free periods when river level at the laboratory was less than 149.4 m above msl. Seining was conducted at night beginning about 1 hour after sunset. Using the same starting point, two replicate hauls were made at each site. For both hauls, one seine brail was held on the river bank and the other was taken into the river to a depth of about 1.3 m or, if not limited by depth, to a distance of about 6 m. The brail on the river bank was held stationary while the other was pulled slowly upriver and then to shore.

Fish were removed from the net and preserved in 10% formalin. The catch from both hauls was combined and considered one unit of effort. In the laboratory, all specimens were identified, separated by species, and enumerated. All specimens were stored in 40% isopropyl alcohol.

Identification of the fish observed in the electrofishing runs and those collected in the seine samples were based on characteristics given in keys by Pflieger (1968), Eddy (1969), and Scott and Crossman (1973). Names of fishes and the order of listing conform to Bailey et al. (1970).

Data were processed with a Hewlett-Packard 9830-A computer and stored on permanent magnetic disc files. A thermal printout of these data was checked for accuracy before final data tables were printed with an impact printer. A three-way analysis of variance (Hewlett-Packard 1974) was used to determine differences in the number of fish captured between months, stations, and time periods for the electrofishing data. Seining data were analyzed with a two-way analysis of variance (Hewlett-Packard 1974) to determine differences in the number of fish captured between months and stations. For both the seining and electrofishing data, *a priori* treatment contrasts tested site differences between east and west banks of the river, east banks at SSES and Bell Bend, and west banks at SSES and Bell Bend. Preliminary log (X+1) transformations were performed on the data prior to analysis of variance. Also, two significance tests (Hendrickson 1978) were used to determine if varying patterns of species occurrence were present in both the electrofishing and seining data. The first, the mathematical

equivalent of Cochran's Q-statistic, tested whether sites differed in the number of species present. Because sites might have similar number of species, but different species composition, a second test called an M-statistic, was used to compute the number of species in common at each site. Both the Q- and M-statistics have an approximately chi-squared distribution. The 5% probability level was used to determine significance in all tests except analysis of variance, where some skewness in the residuals prompted a more conservative 1% level.

RESULTS AND DISCUSSION

Electrofishing

A total of 5,548 specimens of at least 27 fishes was observed using the electrofisher at SSES and Bell Bend (Tables E-2 through E-12). Of the 26 fishes recorded at SSES (Table E-13), five composed 75.4% of the total. Walleye was the most abundant (21.9%) followed by smallmouth bass (21.0%), white sucker (15.4%), shorthead redhorse (10.4%), and rock bass (6.7%). At Bell Bend, 24 fishes were observed (Table E-14). Smallmouth bass was the most abundant (25.3%) followed by walleye (19.8%), white sucker (12.9%), rock bass (10.4%), and shorthead redhorse (5.4%). These five fishes composed 73.9% of the total catch at Bell Bend.

Occurrence of the more abundant fishes was similar at both stations throughout the ten months sampled. At SSES (Table E-13), the number of fishes observed each month was highest in September (18) and lowest in December (4).

White sucker and walleye were observed in all months sampled. The number of fishes observed each month at Bell Bend (Table E-14) was highest in September (19) and lowest in March, November, and December (10). Chain pickerel, white sucker, shorthead redhorse, smallmouth bass, and walleye were observed in all months sampled.

As in 1980 (Buynak et al. 1981), no significant differences were found at the four sites sampled (Tables E-3 through E-12) in either the total number of fishes observed (Q = 2.84; DF = 3) or in the species composition (M = 3.38; DF = 3). The number of fishes observed at the sites ranged from 20 to 24. White sucker, smallmouth bass, and walleye composed 58.3, 58.2, 56.1, and 60.4% of the total number observed at EL-1, EL-2, EL-3, and EL-4, respectively.

At SSES, the number of specimens observed per unit effort was significantly greater ($P<0.01$) at the west bank site (EL-2) as compared to the east bank site (EL-1). More specimens were observed at the west bank site in seven of ten months sampled. Numbers ranged from a low of 12.0 specimens observed per unit effort in December to a high of 134.5 in May with a monthly mean of 76.0 specimens per unit effort. At the east bank site, numbers ranged from 18.5 in March to 89.5 in April with a mean of 54.9 specimens per unit effort.

No significant difference was found when the east (EL-3) and west (EL-4) bank sites at Bell Bend were compared even though more fish were captured at Bell Bend east in eight of ten months sampled. The number of specimens

observed per unit effort ranged from a low of 28.0 in December to a high of 142.0 in September with a monthly mean of 79.1. At Bell Bend west, numbers ranged from 12.0 in December to 140.5 in September with a monthly mean of 67.6 specimens per unit effort.

Similar to 1980 (Buynak et al. 1981), no significant difference was found in the number of specimens observed per unit effort between SSES and Bell Bend (Tables E-13 and E-14). The number of specimens observed per unit effort was greater at SSES from March through June, but from July through December, it was larger at Bell Bend. The number of specimens observed per unit effort at SSES ranged from a low of 19.8 in December to a high of 101.5 in May. A monthly mean of 65.4 specimens per unit effort was observed at SSES for the ten-month sampling period. At Bell Bend, the number ranged from 20.0 in December to 141.3 in September with a monthly mean of 73.3 specimens per unit effort.

No significant difference was found in the number of specimens observed per unit effort on the east bank (EL-1 and EL-3) of the river (Tables E-3 through E-12) as compared to the west bank (EL-2 and EL-4). Numbers were larger on the west bank in six of ten months sampled ranging from a low of 12.0 in December to a high of 123.8 in September with a monthly mean of 71.8 specimens per unit effort. On the east bank, the numbers ranged from 27.8 in December to 110.3 in September with a monthly mean of 67.0 specimens per unit effort.

No significant difference was found in the number of specimens observed per unit effort between the west bank sites (EL-2 and EL-4) at SSES and Bell Bend, however a significant difference (P<0.01) was observed between the east

bank sites (EL-1 and EL-3). Monthly mean number of fish observed per unit effort at the west bank sites was greatest at SSES west in five of the ten months sampled. Numbers there ranged from a low of 12.0 specimens per unit effort in December to 134.5 in May with a monthly mean of 76.0 specimens per unit effort. At Bell Bend west, the number of specimens observed ranged from 12.0 in December to 140.5 in September with a mean of 67.6 specimens per unit effort. At the east bank sites, numbers were greater at Bell Bend east in all months sampled except April. Number of specimens observed per unit effort at Bell Bend east ranged from a low of 28.0 in December to 142.0 in September with a monthly mean of 79.1 specimens per unit effort. Numbers at SSES east ranged from 18.5 in March to 89.5 in April with a monthly mean of 54.9 specimens per unit effort.

The number of specimens observed per unit effort at SSES and Bell Bend was significantly greater ($P<0.001$) at night than during the day. More specimens were observed at night in all ten months sampled. The number of specimens observed per unit effort ranged from a low of 34.5 in December to a high of 158.3 in September with a monthly mean of 96.9 specimens per unit effort. During the day, the numbers ranged from 5.3 in December to 75.8 in September with a monthly mean of 41.9 specimens per unit effort.

In 1981, as was found in 1976-80, four families of fishes composed at least 83% of the electrofishing catch at both SSES and Bell Bend (Fig. E-1). The four families in order of abundance at SSES were suckers, sunfishes, perches, and minnows. At Bell Bend, sunfishes were the most abundant followed by suckers, perches, and minnows. Prior to 1981, an annual increasing trend

in the percent composition of perches and minnows was documented at SSES and Bell Bend (Buynak et al. 1981). Perches had increased each year at both stations since 1977 while the percent composition of minnows increased at SSES since 1977 and at Bell Bend since 1978. In 1981, however, the percent composition of these two families decreased at both stations. Compared to 1980, the percent composition of suckers also decreased while sunfishes increased at both stations.

The number of fish observed per unit effort increased at both SSES and Bell Bend in 1981 (Fig. E-1). At SSES, the number of suckers, sunfishes, and perches observed per unit effort increased while minnows decreased. Similar patterns were observed for sunfishes and minnows at Bell Bend. Numbers of suckers and perches, however, decreased at this station. Increases in suckers and perches observed at SSES resulted from larger numbers of white sucker, northern hog sucker, yellow perch, and walleye. The decrease observed at Bell Bend was attributed to a decline in the number of all perches and suckers except white sucker. The number of sunfishes at both stations has fluctuated since 1976, but reached maximum levels in 1981. These large increases occurred mainly because of the greater number of smallmouth bass observed. In addition, the number of most other sunfish species observed showed increases at one or both stations in 1981 compared to 1980 (Buynak et al. 1981).

Each year from 1976 through 1980, walleye, an important game fish, increased in relative abundance and number observed per unit effort. During

this five-year period, relative abundance increased from an average of 6.0% at SSES and Bell Bend in 1976-77 to 29.3% in 1980 (Buynak et al. 1981). The number observed per unit effort increased from an average of 2.5 walleye in 1976-77 to 16.9 in 1980. In 1981, however, relative abundance of walleye decreased to 20.8% and the number observed per unit effort declined to 14.4. From 1978 through 1980 (Buynak et al. 1979, 1980b, 1981), more than 50% of the walleye observed were young, whereas in 1981, young composed only 37% of the total number observed. These young walleye, which entered the electrofishing catch each autumn, composed 83% of the 787 walleye recorded from October through December in 1980 (Buynak et al. 1981), but only 65% of the 665 walleye recorded from September through December 1981 (Fig. E-2). These data indicate that although another relatively large year class of walleye was produced in 1981, it was probably smaller than the 1980 year class. In addition, more older walleye were present in 1981 than in 1980. The estimated number of legal walleye (381 mm) observed, however, did not increase. In 1980 (Buynak et al. 1981), about 6% (54 fish) of the walleye observed were legal size while in 1981, 4% (51 fish) were legal.

Age and growth studies of the walleye in the Susquehanna River (Buynak et al. 1980a), show that faster-growing survivors of the 1981 year class will enter the sport fishery in 1984. The 1978 through 1981 year classes should provide the basis for an improved walleye sport fishery over the next several years. Although the 1978 year class began to enter the sport fishery in 1981, the majority of its survivors should enter the fishery in 1982.

From 6 May through 1 June 1981, 1,486 adult American shad were transported from the Connecticut River to the Susquehanna River at Tunkhannock, Pennsylvania by National Environmental Services, Inc. (NES). Of the fish transported, 1,165 survived and were transplanted in the Susquehanna River (Nack 1981). Spawning success was confirmed on 28 August, when 12 juvenile American shad were seined by NES at Wilkes-Barre. On 11 September, five juvenile American shad were captured by Ichthyological Associates, Inc. during the day electrofishing runs at SSES and Bell Bend. One additional Clupeid was observed, but avoided capture. Total length (TL) of these five shad ranged from 131 to 135 mm ($\bar{x}$ = 132.1 mm) and weight ranged from 22 to 25 g ($\bar{x}$ = 22.9 g). On 23 September, two juvenile American shad (141 and 147 mm TL, 24 and 30 g) were captured and three other Clupeids were observed while electrofishing along the west bank of the river near the Susquehanna SES Biological Laboratory. No other American shad were captured or observed during routine monitoring at SSES or Bell Bend after 23 September.

Seining

A total of 7,694 specimens of 25 fishes was captured by seine at SSES and Bell Bend (Tables E-2 and E-15 through E-21). Of the 21 fishes captured at SSES (Table E-22), four composed 93.7% of the total catch. Spotfin shiner was the most abundant (74.8%) followed by bluegill (8.5%), spottail shiner (5.9%), and bluntnose minnow (4.6%). At Bell Bend, 16 fishes were captured

(Table E-23). Again, spotfin shiner was the most abundant (70.6%) fish captured; it was followed in abundance by bluegill (13.6%), bluntnose minnow (10.8%), and spottail shiner (1.9%). These four fishes composed 96.9% of the total catch at Bell Bend.

Occurrence of the more abundant fishes was similar at both stations throughout the seven months sampled. The number of fishes captured each month at SSES (Table E-22) was highest in June (15) and lowest in September (4). Spotfin shiner and rock bass were captured in all months sampled; spottail shiner and bluntnose minnow were captured in six of seven months. At Bell Bend (Table E-23), the number of fishes captured each month was highest in July (12) and lowest in May (4). Spotfin shiner, bluntnose minnow, and rock bass were the only fishes captured in all months sampled at Bell Bend; spottail shiner and tessellated darter were captured in six of seven months sampled.

At the four sites (Tables E-15 through E-21), a significant ($P<0.05$) difference was found in the total number of fishes captured ($Q = 9.52$; $DF = 3$). No difference, however, was found in the species composition ($M = 5.68$; $DF = 3$). These results were similar to those found in 1980 (Buynak et al. 1981). In 1981, the number of fishes captured ranged from 10 at SSES west to 19 at SSES east. Seven species (stoneroller, golden shiner, common shiner, swallowtail shiner, longnose dace, quillback, and white crappie) were captured only at SSES east. Blacknose dace and mottled sculpin were captured only at SSES west and redbreast sunfish and walleye only at Bell Bend east. Spottail

shiner, spotfin shiner, bluntnose minnow, and bluegill composed 93.5, 94.8, 92.3, and 98.4% of the total catch at SN-1, SN-2, SN-3, and SN-4, respectively.

No significant difference was found in the number of specimens captured per unit effort at SSES compared to Bell Bend (Tables E-22 and E-23). The catch per unit effort was greatest at SSES from April through June and at Bell Bend from July through October. The catch per unit effort at SSES ranged from a low of 24.0 specimens in July to a high of 502.5 in June. A monthly mean of 202.7 specimens per unit effort was captured at SSES for the seven-month sampling period. At Bell Bend, the numbers ranged from 31.0 in May to 1,727.0 in October with a monthly mean of 346.9 specimens per unit effort.

At SSES, no significant difference was found in the number of specimens captured per unit effort at the east bank site (SN-1) as compared to the west bank site (SN-2) of the river (Tables E-15 through E-21). The catch per unit effort was larger on the east bank in all months sampled except May. It ranged from a low of 41.0 specimens in July to a high of 993.0 in June. On the west bank, the catch per unit effort ranged from 7.0 specimens in July to 139.0 in August. Of the 21 species captured at SSES, the mean monthly catch per unit effort was greater at the west bank site for only blacknose dace and mottled sculpin. Over 5-fold as many fish and six more minnow species were captured at the east bank site as compared to the west bank site. The larger number of fish and species captured at the east bank site was probably caused by the influence of Little Wapwallopen Creek which flows into the river about 15 m downriver.

At Bell Bend, no significant difference was found in the number of specimens captured per unit effort at the east bank site (SN-3) as compared to the west bank site (SN-4) of the river (Tables E-15 through E-21). The catch per unit effort was larger on the east bank from June through August, and for the seven-month sampling period, it ranged from a low of 1.0 specimens per unit effort in May to 435.0 in August with a mean of 168.0 specimens per unit effort. At the west bank site, numbers ranged from 9.0 in July to 3,047.0 in October with a mean of 525.7 specimens per unit effort.

The number of specimens captured per unit effort did not differ significantly between the east bank (SN-1 and SN-3) and the west bank (SN-2 and SN-4) of the river (Tables E-15 through E-21). The catch per unit effort was greater on the east bank in four of seven months where it ranged from a low of 59.0 specimens in July to a high of 539.0 in June. On the west bank, the catch per unit effort ranged from 8.0 in July to 1,592.0 in October. The large catch in October at the west bank was composed mainly of spotfin shiner and bluntnose minnow. These fish had moved into the flooded terrestrial vegetation along the shoreline following a rise in river level.

No significant difference was found in the number of specimens captured per unit effort at the east bank site (SN-1) at SSES as compared to the east bank site (SN-3) at Bell Bend (Tables E-15 through E-21). The largest number of specimens captured per unit effort occurred at SSES east from April through June and at Bell Bend east from July through October. The mean monthly catch per unit effort, however, was over 2-fold greater at the SSES east bank site. Comparison of the mean monthly catches of minnows and

sunfishes at the two sites revealed an important difference. At SSES east, over 4-fold more minnows were captured than at Bell Bend east. Sunfishes were, however, more abundant at Bell Bend east where over 3-fold more were taken than at SSES east.

Even though nearly 8-fold more fish were captured at Bell Bend west, no significant difference was found in the number of specimens captured per unit effort at the west bank site (SN-2) at SSES as compared to the west bank site (SN-4) at Bell Bend (Tables E-15 through E-21). The largest number of specimens captured per unit effort occurred at Bell Bend west in five of seven months and averaged 525.7 specimens per unit effort. At SSES west, the catch per unit effort averaged only 66.6 specimens per unit effort for the seven months. The mean monthly catch per unit effort was greater at the west bank site at SSES for only 4 (blacknose dace, rock bass, black crappie, and mottled sculpin) of the 15 species captured at these two sites. The lack of significance between the west bank sites resulted mainly because of the 22-fold difference in the October catches at these sites when large numbers of minnows were captured at the Bell Bend west site following a rise in river level.

In 1981, as was found from 1978 through 1980, four families of fishes composed over 99.8% of the seining catch at both SSES and Bell Bend (Fig. E-3). The four families, in order of abundance at SSES, were minnows, sunfishes, suckers, and perches. At Bell Bend, minnows were the most abundant followed by sunfishes, perches, and suckers. When data from SSES and Bell Bend were combined and compared with collections from the three previous years,

an increasing trend is evident in the annual catch per unit effort. The increased catch per unit effort in 1981 occurred primarily because of the large catches of minnows and sunfishes, mainly spotfin shiner and bluegill.

When monthly data collected at SSES and Bell Bend were combined (Fig. E-4), large differences occurred in the catch per unit effort of the four major families in each year from 1978 through 1981. In 1981, the monthly catch per unit effort was the highest recorded in four of the seven months sampled each year since 1978. This occurred primarily because of the greater catches of minnows and sunfishes. As was found in prior years, the catch in April and May was dominated by minnows. From 1978 through 1980, the largest monthly catch was taken in June when suckers and perches increased substantially. The June 1981 catch was composed primarily of minnows rather than suckers and perches which declined overall. The relatively small number of suckers taken on 8 June was due to their nonvulnerability to seining rather than the production of a poor year class. On 6 June, large numbers of quillback, white sucker, and shorthead redhorse were captured along the shoreline with a fine-meshed dipnet. On this date, the largest specimens were white sucker that ranged in total length from 17.8-25.5 mm. Shorthead redhorse larvae ranged from 14.3-17.2 mm and quillback ranged from 8.2-14.9 mm. White sucker of similar size were reported by Buynak and Mohr (1978) to have a maximum body depth of 3.0-4.8 mm. These sized suckers could have easily escaped capture by passing through the 6.4-mm mesh seine on 8 June. In July, the total catch per unit effort

decreased as it has from 1978 through 1980. The catch began to increase again in August as young minnows and sunfishes became vulnerable to seining. The higher catch resulted from increases in the number of spotfin shiner and, in particular, increases in bluegill. Although the catch per unit effort decreased in September, bluegill still made up a large portion of the catch. The catch per unit effort in October, the largest ever recorded, resulted from the capture of large numbers of young spotfin shiner that moved into the flooded terrestrial vegetation along the shoreline following a rise in river level.

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Table E-1

Descriptions of electrofishing (EL) and seining (SN) sites at SSES and Bell Bend on the Susquehanna River, 1981.

Site	Location
	SSES
EL-1	East bank from gas-line crossing to 213 m upriver from a point opposite the center of the Susquehanna SES intake structure
EL-2	West bank from gas-line crossing to 213 m upriver from the center of the Susquehanna SES intake structure
SN-1	East bank 540 m upriver from a point opposite the center of the Susquehanna SES intake structure (15 m upriver from the mouth of Little Wapwallopen Creek)
SN-2	West bank 350 m upriver from the center of the Susquehanna SES intake structure (75 m downriver from the boat dock at the Susquehanna SES Biological Laboratory)
	BELL BEND
EL-3	East bank from 230 m downriver from a point opposite the Susquehanna SES discharge diffuser to 200 m upriver from the mouth of Wapwallopen Creek
EL-4	West bank from 165 m downriver from the Susquehanna SES discharge diffuser to 175 m upriver from the mouth of the small stream opposite the mouth of Wapwallopen Creek
SN-3	East bank 2,235 m downriver from a point opposite the Susquehanna SES discharge diffuser (at the launching ramp of the Berwick Boat Club)
SN-4	West bank 1,175 m downriver from the Susquehanna SES discharge diffuser (300 m upriver from the mouth of the small stream opposite Wapwallopen Creek)

Table E-2

Fishes found at SSES and Bell Bend on the Susquehanna River, 1971-81.
An * denotes fishes taken in 1981.

Anguillidae - Freshwater Eels
Anguilla rostrata - American eel*

Clupeidae - Herrings
Alosa sapidissima - American shad*
Unidentified Clupeidae - herring spp.*

Salmonidae - Trouts
Coregonus artedii - cisco
Salmo gairdneri - rainbow trout*
S. trutta - brown trout*

Esocidae - Pikes
Esox lucius - northern pike
E. masquinongy - muskellunge*
E. niger - chain pickerel*
E. lucius x E. masquinongy - tiger muskellunge
Esox spp. - pike spp.*

Cyprinidae - Minnows and Carps
Campostoma anomalum - stoneroller*
Cyprinus carpio - carp*
Exoglossum maxillingua - cutlips minnow
Nocomis micropogon - river chub*
Notemigonus crysoleucas - golden shiner*
Notropis amoenus - comely shiner*
N. cornutus - common shiner*
N. hudsonius - spottail shiner*
N. procne - swallowtail shiner*
N. rubellus - rosyface shiner
N. spilopterus - spotfin shiner*
Notropis spp. - shiner spp.
Pimephales notatus - bluntnose minnow*
Rhinichthys atratulus - blacknose dace*
R. cataractae - longnose dace*
Semotilus atromaculatus - creek chub
S. corporalis - fallfish*

Catostomidae - Suckers
Carpiodes cyprinus - quillback*
Catostomus commersoni - white sucker*
Hypentelium nigricans - northern hog sucker*
Moxostoma macrolepidotum - shorthead redhorse*
Unidentified Catostomidae - sucker spp.

Ictaluridae - Freshwater Catfishes
Ictalurus catus - white catfish*
I. natalis - yellow bullhead*
I. nebulosus - brown bullhead*
I. punctatus - channel catfish*
Unidentified Ictaluridae - catfish spp.

Cyprinodontidae - Banded Killifishes
Fundulus diaphanus - banded killifish

Centrarchidae - Sunfishes
Ambloplites rupestris - rock bass*
Lepomis auritus - redbreast sunfish*
L. cyanellus - green sunfish
L. gibbosus - pumpkinseed*
L. macrochirus - bluegill*
Lepomis spp. - sunfish spp.*
Micropterus dolomieui - smallmouth bass*
M. salmoides - largemouth bass*
Pomoxis annularis - white crappie*
P. nigromaculatus - black crappie*
Pomoxis spp. - crappie spp.*

Percidae - Perches
Etheostoma olmstedi - tessellated darter*
E. zonale - banded darter
Perca flavescens - yellow perch*
Percina peltata - shield darter
Stizostedion vitreum - walleye*

Cottidae - Sculpins
Cottus bairdi - mottled sculpin*

Table E-3

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 12 March 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-004	GLB-81-007	GLB-81-003	GLB-81-008	GLB-81-001	GLB-81-006	GLB-81-002	GLB-81-005
TIME	1027-1046	2002-2021	1007-1022	2029-2046	0906-0924	1931-1953	0931-0952	1908-1925
SPECIES								
BROWN TROUT	0	1	0	0	1	2	0	0
MUSKELLUNGE	0	1	2	0	0	0	1	2
CHAIN PICKEREL	0	0	0	0	2	0	2	0
CARP	0	2	0	8	0	0	0	0
FALLFISH	0	0	0	11	0	17	0	3
WHITE SUCKER	8	5	10	37	0	18	0	3
NORTHERN HOG SUCKER	0	2	1	4	0	2	0	2
SHORTHEAD REDHORSE	1	1	1	6	0	3	0	1
WHITE CATFISH	0	0	1	1	0	0	0	0
BROWN BULLHEAD	2	0	0	0	0	0	0	0
CHANNEL CATFISH	0	1	3	0	0	0	0	0
ROCK BASS	0	0	0	7	0	8	0	0
SMALLMOUTH BASS	0	0	1	0	0	0	1	1
SUNFISH SPP.	0	0	0	0	0	1	0	0
BLACK CRAPPIE	1	0	0	0	0	0	0	0
WALLEYE	0	8	1	8	0	11	0	5
FISH (UNIDENTIFIED)	0	4	1	6	5	5	0	6
TOTAL	12	25	21	88	8	67	4	23

Table E-4

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 1 April 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-010	GLB-81-016	GLB-81-009	GLB-81-015	GLB-81-011	GLB-81-014	GLB-81-012	GLB-81-013
TIME	0903-0921	2100-2121	0840-0858	2037-2055	0934-0956	1947-2011	1004-1022	1918-1938
SPECIES								
BROWN TROUT	1	0	0	0	0	0	0	0
MUSKELLUNGE	1	1	1	1	2	1	2	2
CHAIN PICKEREL	0	0	2	0	0	0	2	0
PIKE SPP.	0	0	0	0	0	0	1	0
CARP	3	9	0	6	8	10	2	3
FALLFISH	1	0	1	0	1	1	0	2
QUILLBACK	23	2	1	4	0	2	0	4
WHITE SUCKER	10	31	11	22	5	22	7	12
NORTHERN HOG SUCKER	1	2	0	1	0	0	0	1
SHORTHEAD REDHORSE	5	10	0	5	8	10	2	7
BROWN BULLHEAD	0	1	0	0	0	0	0	0
CHANNEL CATFISH	0	0	0	1	0	0	0	0
ROCK BASS	0	7	0	9	1	7	0	6
PUMPKINSEED	0	0	1	0	0	0	0	0
SMALLMOUTH BASS	4	5	12	4	6	2	4	9
SUNFISH SPP.	0	0	5	0	0	0	0	0
YELLOW PERCH	0	1	1	0	0	0	0	0
WALLEYE	4	35	26	16	0	17	8	41
FISH (UNIDENTIFIED)	8	14	4	9	2	13	2	17
TOTAL	61	118	65	78	33	85	30	104

Table E-5

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 7 May 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-023	GLB-81-026	GLB-81-024	GLB-81-025	CLB-81-021	GLB-81-028	GLB-81-022	GLB-81-027
TIME	1028-1049	2117-2137	1058-1114	2055-2112	0919-0942	2208-2236	0949-1013	2141-2203
SPECIES								
RAINBOW TROUT	0	1	1	0	0	0	0	0
MUSKELLUNGE	0	2	0	4	1	1	3	1
CHAIN PICKEREL	0	0	0	0	2	4	2	0
PIKE SPP.	0	0	0	0	1	0	0	0
CARP	0	6	4	1	1	1	0	0
RIVER CHUB	0	1	2	0	0	0	0	1
FALLFISH	0	0	0	4	2	11	1	4
QUILLBACK	0	7	3	5	0	3	0	10
WHITE SUCKER	5	27	3	16	6	8	10	14
NORTHERN HOG SUCKER	1	1	4	3	0	0	2	0
SHORTHEAD REDHORSE	0	14	76	23	1	4	0	6
BROWN BULLHEAD	0	1	0	5	0	3	1	0
ROCK BASS	1	6	1	17	3	39	4	22
PUMPKINSEED	0	0	0	0	3	0	0	1
SMALLMOUTH BASS	1	9	8	15	6	30	6	21
LARGEMOUTH BASS	0	0	0	1	0	0	0	0
CRAPPIE SPP.	0	0	0	1	0	0	0	0
YELLOW PERCH	0	0	0	0	1	1	0	0
WALLEYE	2	44	11	50	5	33	1	33
FISH (UNIDENTIFIED)	2	6	1	10	3	15	1	12
TOTAL	12	125	114	155	35	153	31	125

Table E-6

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 8 June 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-033	GLB-81-037	GLB-81-034	CLB-81-038	CLB-81-035	GLB-81-040	CLB-81-036	CLB-81-039
TIME	0838-0900	2125-2146	0908-0922	2151-2207	0928-0946	2235-2256	0952-1008	2211-2228
SPECIES								
AMERICAN EEL	0	0	0	0	0	0	0	1
BROWN TROUT	1	0	0	0	0	0	0	0
MUSKELLUNGE	0	0	0	0	0	0	0	2
CHAIN PICKEREL	0	0	0	0	0	0	2	3
PIKE SPP.	0	0	0	0	0	0	1	1
CARP	3	1	5	[illegible]	7	3	0	1
RIVER CHUB	0	0	1	[illegible]	1	0	1	0
FALLFISH	1	1	12	0	0	0	0	1
QUILLBACK	3	8	0	1	0	3	0	2
WHITE SUCKER	3	2	11	5	11	4	1	5
NORTHERN HOG SUCKER	1	3	14	1	0	0	1	0
SHORTHEAD REDHORSE	10	3	11	5	6	3	3	0
YELLOW BULLHEAD	0	0	0	1	0	0	0	0
BROWN BULLHEAD	0	1	1	0	1	0	0	0
CHANNEL CATFISH	1	0	0	2	0	1	1	0
ROCK BASS	0	8	6	21	7	16	3	17
PUMPKINSEED	0	0	2	1	2	0	1	0
BLUEGILL	1	0	4	2	0	0	3	0
SMALLMOUTH BASS	11	18	31	37	7	69	17	26
SUNFISH SPP.	0	0	2	0	0	0	0	1
YELLOW PERCH	0	0	1	0	1	1	0	0
WALLEYE	1	19	9	14	3	12	2	25
FISH (UNIDENTIFIED)	5	11	2	15	2	19	6	13
TOTAL	41	75	112	105	48	131	42	98

Table E-7

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 8 July 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-048	GLB-81-050	GLB-81-047	GLB-81-049	GLB-81-046	GLB-81-051	GLB-81-045	GLB-81-052
TIME	0940-0956	2148-2206	0920-0937	2125-2143	0853-0911	2215-2240	0830-0847	2246-2305
SPECIES								
CHAIN PICKEREL	1	0	1	1	0	0	2	1
PIKE SPP.	0	0	0	0	0	1	1	0
CARP	1	4	2	3	2	5	0	0
FALLFISH	0	0	0	0	0	0	1	0
QUILLBACK	1	8	0	5	1	26	1	8
WHITE SUCKER	4	10	11	21	8	20	5	11
NORTHERN HOG SUCKER	0	1	18	1	0	0	2	0
SHORTHEAD REDHORSE	3	2	0	2	7	10	5	2
BROWN BULLHEAD	0	0	0	0	0	0	0	1
CHANNEL CATFISH	0	1	0	3	0	0	1	1
ROCK BASS	0	0	1	11	3	8	4	8
REDBREAST SUNFISH	0	0	0	0	1	0	0	0
PUMPKINSEED	3	2	0	0	1	0	3	0
BLUEGILL	1	2	1	1	0	5	1	0
SMALLMOUTH BASS	6	17	13	70	8	48	7	30
SUNFISH SPP.	0	0	0	0	0	1	0	0
WALLEYE	1	5	1	3	1	8	1	2
FISH (UNIDENTIFIED)	2	7	4	5	6	16	10	17
TOTAL	23	59	52	126	38	148	44	81

Table E-8

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 3 August 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-058	GLB-81-063	GLB-81-057	GLB-81-064	GLB-81-060	GLB-81-062	GLB-81-059	GLB-81-061
TIME	0923-0948	2205-2220	0900-0917	2230-2245	1018-1033	2130-2150	0952-1009	2105-2124
SPECIES								
CHAIN PICKEREL	0	0	0	1	1	0	2	2
CARP	1	0	0	2	1	2	0	1
QUILLBACK	3	5	1	9	4	18	0	14
WHITE SUCKER	1	4	1	5	0	6	5	10
NORTHERN HOG SUCKER	2	1	0	1	2	1	0	0
SHORTHEAD REDHORSE	8	19	26	2	8	5	6	2
CHANNEL CATFISH	0	0	0	1	0	3	0	1
ROCK BASS	0	0	0	4	0	3	2	10
PUMPKINSEED	0	0	1	0	0	0	2	0
BLUEGILL	0	0	0	0	1	1	1	0
SMALLMOUTH BASS	24	19	39	7	21	16	41	23
SUNFISH SPP.	0	0	0	0	0	0	1	0
YELLOW PERCH	0	0	0	1	0	0	0	0
WALLEYE	1	3	1	4	0	10	0	4
FISH (UNIDENTIFIED)	9	3	6	9	10	10	6	13
TOTAL	49	54	75	46	48	75	66	80

Table E-9

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 11 September 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-074	GLB-81-079	GLB-81-073	GLB-81-080	GLB-81-076	GLB-81-078	GLB-81-075	GLB-81-077
TIME	0904-0928	2157-2216	0841-0858	2222-2239	1000-1022	2110-2135	0934-0952	2033-2102
SPECIES								
AMERICAN SHAD	0	0	2	0	2	0	1	0
HERRING SPP.	1	0	0	0	0	0	0	0
MUSKELLUNGE	1	0	0	0	0	1	0	2
CHAIN PICKEREL	3	1	0	0	0	2	0	1
CARP	1	1	3	1	1	2	2	4
RIVER CHUB	0	0	0	0	0	0	2	0
FALLFISH	0	0	2	2	0	0	0	0
QUILLBACK	2	3	0	0	1	2	0	1
WHITE SUCKER	4	3	11	11	10	18	2	10
NORTHERN HOG SUCKER	5	1	6	5	1	0	0	0
SHORTHEAD REDHORSE	5	12	6	3	6	8	9	5
BROWN BULLHEAD	0	1	0	0	0	0	0	0
CHANNEL CATFISH	1	3	0	2	1	0	0	0
ROCK BASS	0	9	1	24	3	30	8	41
REDBREAST SUNFISH	1	0	1	0	4	1	2	3
PUMPKINSEED	2	1	2	2	0	1	4	3
BLUEGILL	0	2	1	0	1	1	2	1
SMALLMOUTH BASS	19	29	27	35	24	79	45	57
LARGEMOUTH BASS	0	0	0	0	0	1	0	0
SUNFISH SPP.	0	0	0	1	8	1	1	1
WHITE CRAPPIE	0	0	0	1	1	1	0	0
YELLOW PERCH	0	0	0	0	1	0	0	0
WALLEYE	4	29	8	41	7	38	2	50
FISH (UNIDENTIFIED)	6	7	11	5	9	18	7	15
TOTAL	55	102	81	133	80	204	87	194

Table E-10

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 14 October 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-088	GLB-81-089	GLB-81-087	GLB-81-090	GLB-81-085	GLB-81-092	GLB-81-086	GLB-81-091
TIME	1024-1042	1932-1950	1004-1019	1955-2010	0914-0931	2037-2100	0937-0953	2012-2032
SPECIES								
MUSKELLUNGE	0	0	0	0	1	2	0	3
CHAIN PICKEREL	1	0	2	0	2	2	2	3
CARP	0	5	0	0	2	9	0	5
FALLFISH	0	1	0	2	0	2	0	1
QUILLBACK	0	0	0	0	0	3	0	2
WHITE SUCKER	3	3	8	8	22	32	5	7
NORTHERN HOG SUCKER	1	0	2	1	2	0	1	0
SHORTHEAD REDHORSE	0	4	0	1	4	13	0	8
CHANNEL CATFISH	0	2	0	3	0	2	0	0
ROCK BASS	2	15	3	9	0	22	0	15
REDBREAST SUNFISH	0	0	0	0	0	1	0	0
PUMPKINSEED	0	1	0	0	0	0	0	0
BLUEGILL	1	0	0	0	0	0	0	1
SMALLMOUTH BASS	11	19	20	25	21	39	26	23
LARGEMOUTH BASS	0	0	0	0	0	0	1	0
SUNFISH SPP.	0	0	0	0	0	2	0	0
WHITE CRAPPIE	0	0	0	0	0	1	0	0
BLACK CRAPPIE	0	1	0	0	0	1	0	0
YELLOW PERCH	2	0	1	0	0	2	0	0
WALLEYE	8	51	14	59	5	58	12	92
FISH (UNIDENTIFIED)	3	4	5	5	3	9	2	3
TOTAL	32	106	55	113	62	200	49	163

Table E-11

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 5 November 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-094	GLB-81-099	GLB-81-093	GLB-81-100	GLB-81-096	GLB-81-097	GLB-81-095	GLB-81-098
TIME	0922-0935	1909-1930	0902-0914	1932-1948	1005-1025	1815-1835	0938-0958	1842-1900
SPECIES								
MUSKELLUNGE	1	0	1	0	0	0	2	2
CHAIN PICKEREL	2	0	1	1	3	4	2	4
PIKE SPP.	0	0	0	0	0	0	0	1
CARP	0	0	0	0	0	7	0	4
FALLFISH	1	0	0	0	0	1	0	2
WHITE SUCKER	3	13	8	18	7	26	4	8
NORTHERN HOG SUCKER	0	0	0	1	0	0	0	0
SHORTHEAD REDHORSE	0	7	0	2	0	5	0	1
CHANNEL CATFISH	0	2	0	0	0	0	0	0
ROCK BASS	0	11	1	1	2	9	2	2
REDBREAST SUNFISH	0	1	0	0	0	0	0	0
BLUEGILL	0	0	1	0	0	0	1	1
SMALLMOUTH BASS	2	5	3	3	4	3	12	5
SUNFISH SPP.	0	2	0	0	0	0	0	2
BLACK CRAPPIE	0	1	0	0	0	0	0	0
WALLEYE	1	35	6	23	2	27	9	35
FISH (UNIDENTIFIED)	0	6	2	4	2	8	3	4
TOTAL	10	83	23	53	20	90	35	71

Table E-12

Number of fish observed at SSES and Bell Bend electrofishing sites on the Susquehanna River, 10 December 1981.

STATION	SSES				BELL BEND			
SITE	EL-1		EL-2		EL-3		EL-4	
COLLECTION NO.	GLB-81-115	GLB-81-119	GLB-81-116	GLB-81-120	GLB-81-118	GLB-81-122	GLB-81-117	GLB-81-121
TIME	0849-0904	1808-1827	0910-0920	1835-1851	0944-1003	1925-1948	0923-0939	1857-1918
SPECIES								
BROWN TROUT	0	0	0	0	1	0	0	0
MUSKELLUNGE	0	0	0	0	0	1	0	0
CHAIN PICKEREL	0	1	0	0	1	3	1	0
PIKE SPP.	0	0	0	0	1	0	0	0
FALLFISH	0	0	0	0	1	0	0	0
WHITE SUCKER	5	29	1	11	2	22	1	12
SHORTHEAD REDHORSE	0	0	0	0	0	1	0	0
PUMPKINSEED	0	0	0	0	0	0	1	0
BLUEGILL	0	1	0	0	0	0	0	0
SMALLMOUTH BASS	0	0	0	0	3	2	1	0
YELLOW PERCH	0	0	0	0	0	1	0	0
WALLEYE	0	17	0	10	0	15	1	6
FISH (UNIDENTIFIED)	0	2	0	2	0	2	1	0
TOTAL	5	50	1	23	9	47	6	18

Table E-13

Number of fish observed per unit effort in electrofishing runs at SSES on the Susquehanna River, March through December 1981.

SPECIES	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	% TOTAL
AMERICAN SHAD	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.05	0.08
HERRING SPP.	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.03	0.04
RAINBOW TROUT	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.08
BROWN TROUT	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.08	0.11
MUSKELLUNGE	0.8	1.0	1.5	0.0	0.0	0.0	0.3	0.0	0.5	0.0	0.40	0.61
CHAIN PICKEREL	0.0	0.5	0.0	0.0	0.8	0.3	1.0	0.8	1.0	0.3	0.45	0.69
CARP	2.5	4.5	2.8	2.3	2.5	0.8	1.5	1.3	0.0	0.0	1.80	2.75
RIVER CHUB	0.0	0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.15
FALLFISH	2.8	0.5	1.0	3.5	0.0	0.0	1.0	0.8	0.3	0.0	0.98	1.49
QUILLBACK	0.0	7.5	3.8	3.0	3.5	4.5	1.3	0.0	0.0	0.0	2.35	3.59
WHITE SUCKER	15.0	18.5	12.8	5.3	11.5	2.8	7.3	5.5	10.5	11.5	10.05	15.37
NORTHERN HOG SUCKER	1.8	1.0	2.3	4.8	5.0	1.0	4.3	1.0	0.3	0.0	2.13	3.25
SHORTHEAD REDHORSE	2.3	5.0	28.3	7.3	1.8	13.8	6.5	1.3	2.3	0.0	6.83	10.44
WHITE CATFISH	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.08
YELLOW BULLHEAD	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.04
BROWN BULLHEAD	0.5	0.3	1.5	0.5	0.0	0.0	0.3	0.0	0.0	0.0	0.30	0.46
CHANNEL CATFISH	1.0	0.3	0.0	0.8	1.0	0.3	1.5	1.3	0.5	0.0	0.65	0.99
ROCK BASS	1.8	4.0	6.3	8.8	3.0	1.0	8.5	7.3	3.3	0.0	4.38	6.69
REDBREAST SUNFISH	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.3	0.0	0.08	0.11
PUMPKINSEED	0.0	0.3	0.0	0.8	1.3	0.3	1.8	0.3	0.0	0.0	0.45	0.69
BLUEGILL	0.0	0.0	0.0	1.8	1.3	0.0	0.8	0.3	0.3	0.3	0.45	0.69
SMALLMOUTH BASS	0.3	6.3	8.3	24.3	26.5	22.3	27.5	18.8	3.3	0.0	13.73	20.99
LARGEMOUTH BASS	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.04
SUNFISH SPP.	0.0	1.3	0.0	0.5	0.0	0.0	0.3	0.0	0.5	0.0	0.25	0.38
WHITE CRAPPIE	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.03	0.04
BLACK CRAPPIE	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.08	0.11
CRAPPIE SPP.	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.04
YELLOW PERCH	0.0	0.5	0.0	0.3	0.0	0.3	0.0	0.8	0.0	0.0	0.18	0.27
WALLEYE	4.3	20.3	26.8	10.8	2.5	2.3	20.5	33.0	16.3	6.8	14.33	21.90
FISH (UNIDENTIFIED)	2.8	8.8	4.8	8.3	4.5	6.8	7.3	4.3	3.0	1.0	5.13	7.84
TOTAL	36.5	80.5	101.5	83.3	65.0	56.0	92.8	76.5	42.3	19.8	65.40	

Table E-14

Number of fish observed per unit effort in electrofishing runs at Bell Bend on the Susquehanna River, March through December 1981.

SPECIES	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	% TOTAL
AMERICAN EEL	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.03
AMERICAN SHAD	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.08	0.10
BROWN TROUT	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.10	0.14
MUSKELLUNGE	0.8	1.8	1.5	0.5	0.0	0.0	0.8	1.5	1.0	0.3	0.80	1.09
CHAIN PICKEREL	1.0	0.5	2.0	1.3	0.8	1.3	0.8	2.3	3.3	1.3	1.43	1.94
PIKE SPP.	0.0	0.3	0.3	0.5	0.5	0.0	0.0	0.0	0.3	0.3	0.20	0.27
CARP	0.0	5.8	0.5	2.8	1.8	1.0	2.3	4.0	2.8	0.0	2.08	2.83
RIVER CHUB	0.0	0.0	0.3	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.13	0.17
FALLFISH	5.0	1.0	4.5	0.3	0.3	0.0	0.0	0.8	0.8	0.3	1.28	1.74
QUILLBACK	0.0	1.5	3.3	1.3	9.0	9.0	1.0	1.3	0.0	0.0	2.63	3.58
WHITE SUCKER	5.3	11.5	9.5	5.3	11.0	5.3	10.0	16.5	11.3	9.3	9.48	12.93
NORTHERN HOG SUCKER	1.0	0.3	0.5	0.3	0.5	0.8	0.3	0.8	0.0	0.0	0.43	0.58
SHORTHEAD REDHORSE	1.0	6.8	2.8	3.0	6.0	5.3	7.0	6.3	1.5	0.3	3.98	5.42
BROWN BULLHEAD	0.0	0.0	1.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.15	0.20
CHANNEL CATFISH	0.0	0.0	0.0	0.5	0.5	1.0	0.3	0.5	0.0	0.0	0.28	0.38
ROCK BASS	2.0	3.5	17.0	10.8	5.8	3.8	20.5	9.3	3.8	0.0	7.63	10.40
REDBREAST SUNFISH	0.0	0.0	0.0	0.0	0.3	0.0	2.5	0.3	0.0	0.0	0.30	0.41
PUMPKINSEED	0.0	0.0	1.0	0.8	1.0	0.5	2.0	0.0	0.0	0.3	0.55	0.75
BLUEGILL	0.0	0.0	0.0	0.8	1.5	0.8	1.3	0.3	0.5	0.0	0.50	0.68
SMALLMOUTH BASS	0.5	5.3	15.8	29.8	23.3	25.3	51.3	27.3	6.0	1.5	18.58	25.34
LARGEMOUTH BASS	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.05	0.07
SUNFISH SPP.	0.3	0.0	0.0	0.3	0.3	0.3	2.8	0.5	0.5	0.0	0.48	0.65
WHITE CRAPPIE	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.0	0.08	0.10
BLACK CRAPPIE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.03	0.03
YELLOW PERCH	0.0	0.0	0.5	0.5	0.0	0.0	0.3	0.5	0.0	0.3	0.20	0.27
WALLEYE	4.0	16.5	18.0	10.5	3.0	3.5	24.3	41.8	18.3	5.5	14.53	19.82
FISH (UNIDENTIFIED)	4.0	8.5	7.8	10.0	12.3	9.8	12.3	4.3	4.3	0.8	7.38	10.06
TOTAL	25.5	63.0	86.0	79.8	77.8	67.3	141.3	118.5	54.0	20.0	73.30	

Table E-15

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 2 April 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-017	GLB-81-018	GLB-81-019	GLB-81-020
TIME	1915-1925	1928-1934	1941-1949	1956-2002
SPECIES				
COMELY SHINER	8	1	1	3
SPOTTAIL SHINER	8	2	6	2
SWALLOWTAIL SHINER	2	0	0	0
SPOTFIN SHINER	621	17	14	39
BLUNTNOSE MINNOW	25	1	0	10
FALLFISH	3	0	0	1
WHITE SUCKER	1	0	1	0
ROCK BASS	1	2	2	0
BLUEGILL	1	0	0	0
TESSELLATED DARTER	11	3	0	12
TOTAL	681	26	24	67

Table E-16

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 26 May 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-032	GLB-81-031	GLB-81-029	GLB-81-030
TIME	2132-2142	2119-2126	1853-1859	2105-2112
SPECIES				
SPOTTAIL SHINER	0	3	0	0
SPOTFIN SHINER	128	123	1	57
BLUNTNOSE MINNOW	1	4	0	2
WHITE SUCKER	1	0	0	1
ROCK BASS	2	3	0	1
TOTAL	132	133	1	61

Table E-17

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 23 June 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-041	GLB-81-042	GLB-81-044	GLB-81-043
TIME	2150-2202	2205-2211	2230-2242	2217-2225
SPECIES				
STONEROLLER	5	0	0	0
GOLDEN SHINER	1	0	0	0
COMELY SHINER	0	1	1	0
COMMON SHINER	1	0	0	0
SPOTTAIL SHINER	99	2	10	2
SPOTFIN SHINER	783	5	62	6
BLUNTNOSE MINNOW	14	1	2	3
BLACKNOSE DACE	0	1	0	0
LONGNOSE DACE	1	0	0	0
FALLFISH	10	0	0	0
QUILLBACK	1	0	0	0
WHITE SUCKER	68	0	0	0
ROCK BASS	6	1	4	0
REDBREAST SUNFISH	0	0	1	0
SMALLMOUTH BASS	0	0	2	0
BLACK CRAPPIE	1	0	0	0
TESSELLATED DARTER	3	1	3	0
TOTAL	993	12	85	11

Table E-18

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 22 July 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-056	GLB-81-055	GLB-81-053	GLB-81-054
TIME	2145-2153	2137-2142	2110-2120	2125-2130
SPECIES				
STONEROLLER	1	0	0	0
COMELY SHINER	0	0	1	0
COMMON SHINER	1	0	0	0
SPOTTAIL SHINER	2	2	3	3
SPOTFIN SHINER	31	4	0	2
BLUNTNOSE MINNOW	0	0	4	1
ROCK BASS	1	0	3	1
PUMPKINSEED	0	0	2	0
BLUEGILL	3	1	51	0
SMALLMOUTH BASS	0	0	0	1
LARGEMOUTH BASS	1	0	3	0
BLACK CRAPPIE	0	0	6	0
TESSELLATED DARTER	1	0	3	1
WALLEYE	0	0	1	0
TOTAL	41	7	77	9

Table E-19

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 17 August 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-068	GLB-81-067	GLB-81-065	GLB-81-066
TIME	2140-2150	2127-2135	2052-2104	2111-2118
SPECIES				
CHAIN PICKEREL	0	0	0	1
COMELY SHINER	1	0	0	0
COMMON SHINER	1	0	0	0
SPOTTAIL SHINER	42	4	0	14
SPOTFIN SHINER	89	62	0	31
BLUNTNCSE MINNOW	33	12	7	144
ROCK BASS	3	2	7	5
PUMPKINSEED	2	0	21	11
BLUEGILL	106	57	399	40
BLACK CRAPPIE	2	0	0	0
TESSELLATED DARTER	7	1	1	6
MOTTLED SCULPIN	0	1	0	0
TOTAL	286	139	435	252

Table E-20

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 1 September 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-069	GLB-81-070	GLB-81-071	GLB-81-072
TIME	2007-2015	2017-2023	2030-2039	2043-2104
SPECIES				
CHAIN PICKEREL	0	0	1	0
SPOTTAIL SHINER	0	0	0	7
SPOTFIN SHINER	35	9	6	134
BLUNTNOSE MINNOW	5	0	1	52
ROCK BASS	1	0	2	4
PUMPKINSEED	0	0	10	2
BLUEGILL	22	3	125	33
LARGEMOUTH BASS	0	0	1	0
TESSELLATED DARTER	0	0	1	1
TOTAL	63	12	147	233

Table E-21

Number of fish captured at SSES and Bell Bend seining sites on the Susquehanna River, 5 October 1981.

STATION	SSES		BELL BEND	
SITE	SN-1	SN-2	SN-3	SN-4
COLLECTION NO.	GLB-81-081	GLB-81-082	GLB-81-083	GLB-81-084
TIME	1950-2000	2003-2010	2020-2031	2035-2048
SPECIES				
COMELY SHINER	1	0	3	7
SPOTTAIL SHINER	0	3	5	41
SPOTFIN SHINER	106	109	369	2709
BLUNTNOSE MINNOW	21	13	11	285
ROCK BASS	3	6	9	2
PUMPKINSEED	0	0	1	0
BLUEGILL	42	5	9	2
WHITE CRAPPIE	1	0	0	0
BLACK CRAPPIE	1	1	0	0
TESSELLATED DARTER	1	0	0	1
TOTAL	176	137	407	3047

Table E-22

Number of fish captured per unit effort in seining hauls at SSES on the Susquehanna River, April through October 1981.

SPECIES	APR	MAY	JUN	JUL	AUG	SEP	OCT	MEAN	% TOTAL
STONEROLLER	0.0	0.0	2.5	0.5	0.0	0.0	0.0	0.43	0.21
GOLDEN SHINER	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.07	0.04
COMELY SHINER	4.5	0.0	0.5	0.0	0.5	0.0	0.5	0.86	0.42
COMMON SHINER	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.21	0.11
SPOTTAIL SHINER	5.0	1.5	50.5	2.0	23.0	0.0	1.5	11.93	5.88
SWALLOWTAIL SHINER	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.14	0.07
SPOTFIN SHINER	319.0	125.5	394.0	17.5	75.5	22.0	107.5	151.57	74.77
BLUNTNOSE MINNOW	13.0	2.5	7.5	0.0	22.5	2.5	17.0	9.29	4.58
BLACKNOSE DACE	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.07	0.04
LONGNOSE DACE	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.07	0.04
FALLFISH	1.5	0.0	5.0	0.0	0.0	0.0	0.0	0.93	0.46
QUILLBACK	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.07	0.04
WHITE SUCKER	0.5	0.5	34.0	0.0	0.0	0.0	0.0	5.00	2.47
ROCK BASS	1.5	2.5	3.5	0.5	2.5	0.5	4.5	2.21	1.09
PUMPKINSEED	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.14	0.07
BLUEGILL	0.5	0.0	0.0	2.0	81.5	12.5	23.5	17.14	8.46
LARGEMOUTH BASS	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.07	0.04
WHITE CRAPPIE	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.07	0.04
BLACK CRAPPIE	0.0	0.0	0.5	0.0	1.0	0.0	1.0	0.36	0.18
TESSELLATED DARTER	7.0	0.0	2.0	0.5	4.0	0.0	0.5	2.00	0.99
MOTTLED SCULPIN	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.07	0.04
TOTAL	353.5	132.5	502.5	24.0	212.5	37.5	156.5	202.71	

Table E-23

Number of fish captured per unit effort in seining hauls at Bell Bend on the Susquehanna River, April through October 1981.

SPECIES	APR	MAY	JUN	JUL	AUG	SEP	OCT	MEAN	% TOTAL
CHAIN PICKEREL	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.14	0.04
COMELY SHINER	2.0	0.0	0.5	0.5	0.0	0.0	5.0	1.14	0.33
SPOTTAIL SHINER	4.0	0.0	6.0	3.0	7.0	3.5	23.0	6.64	1.92
SPOTFIN SHINER	26.5	29.0	34.0	1.0	15.5	70.0	1539.0	245.00	70.63
BLUNTNOSE MINNOW	5.0	1.0	2.5	2.5	75.5	26.5	148.0	37.29	10.75
FALLFISH	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.02
WHITE SUCKER	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.14	0.04
ROCK BASS	1.0	0.5	2.0	2.0	6.0	3.0	5.5	2.86	0.82
REDBREAST SUNFISH	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.07	0.02
PUMPKINSEED	0.0	0.0	0.0	1.0	16.0	6.0	0.5	3.36	0.97
BLUEGILL	0.0	0.0	0.0	25.5	219.5	79.0	5.5	47.07	13.57
SMALLMOUTH BASS	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.21	0.06
LARGEMOUTH BASS	0.0	0.0	0.0	1.5	0.0	0.5	0.0	0.29	0.08
BLACK CRAPPIE	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.43	0.12
TESSELLATED DARTER	6.0	0.0	1.5	2.0	3.5	1.0	0.5	2.07	0.60
WALLEYE	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.07	0.02
TOTAL	45.5	31.0	48.0	43.0	343.5	190.0	1727.0	346.86	

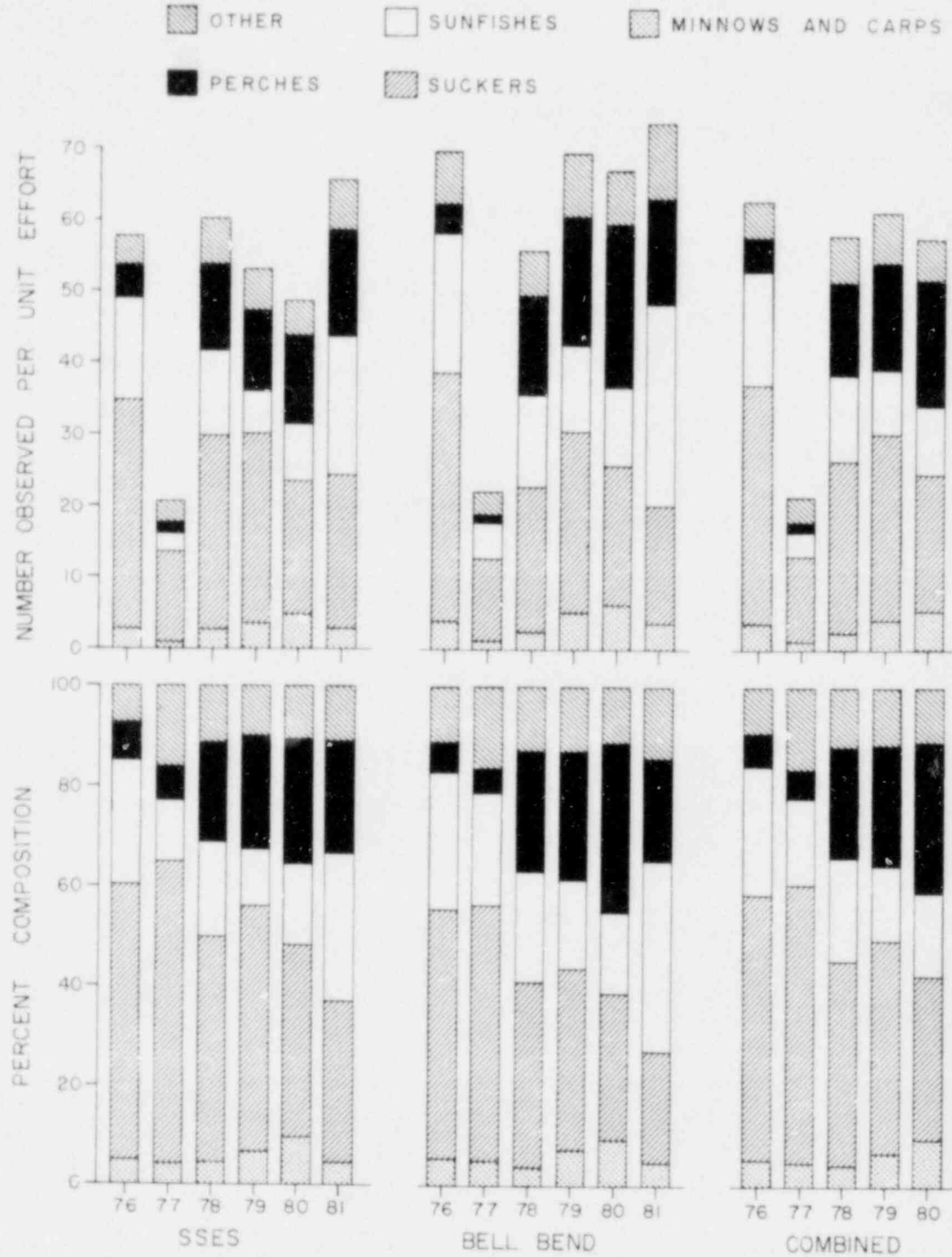

Fig. E-1

Number per unit effort and percent composition of fish observed in electrofishing runs at SSES, Bell Bend, and both stations combined, 1976-81.

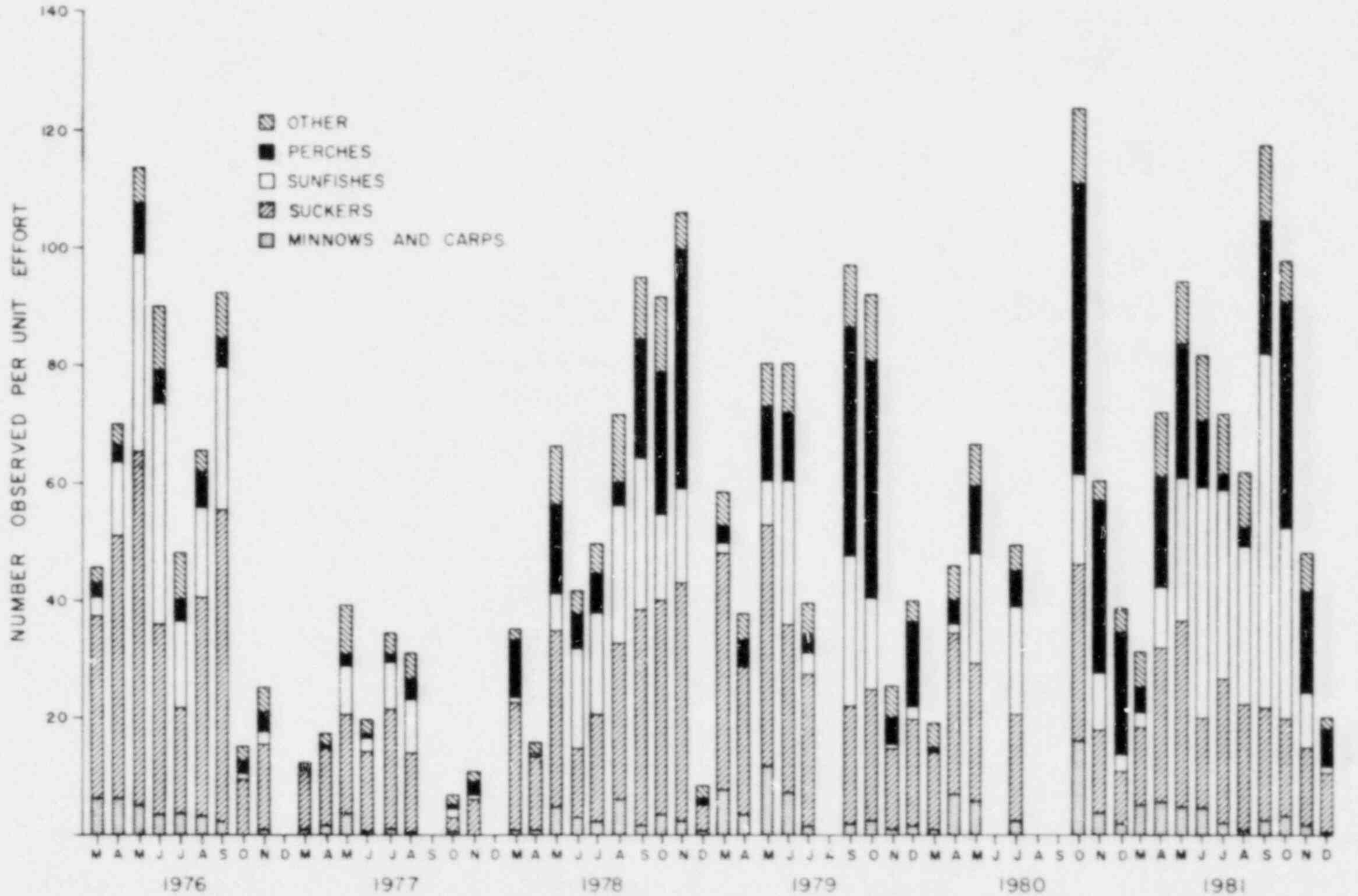

Fig. E-2

Number of fish observed per unit effort in monthly electrofishing runs at SSES and Bell Bend combined from March through December 1976-81. A blank indicates samples were not taken.

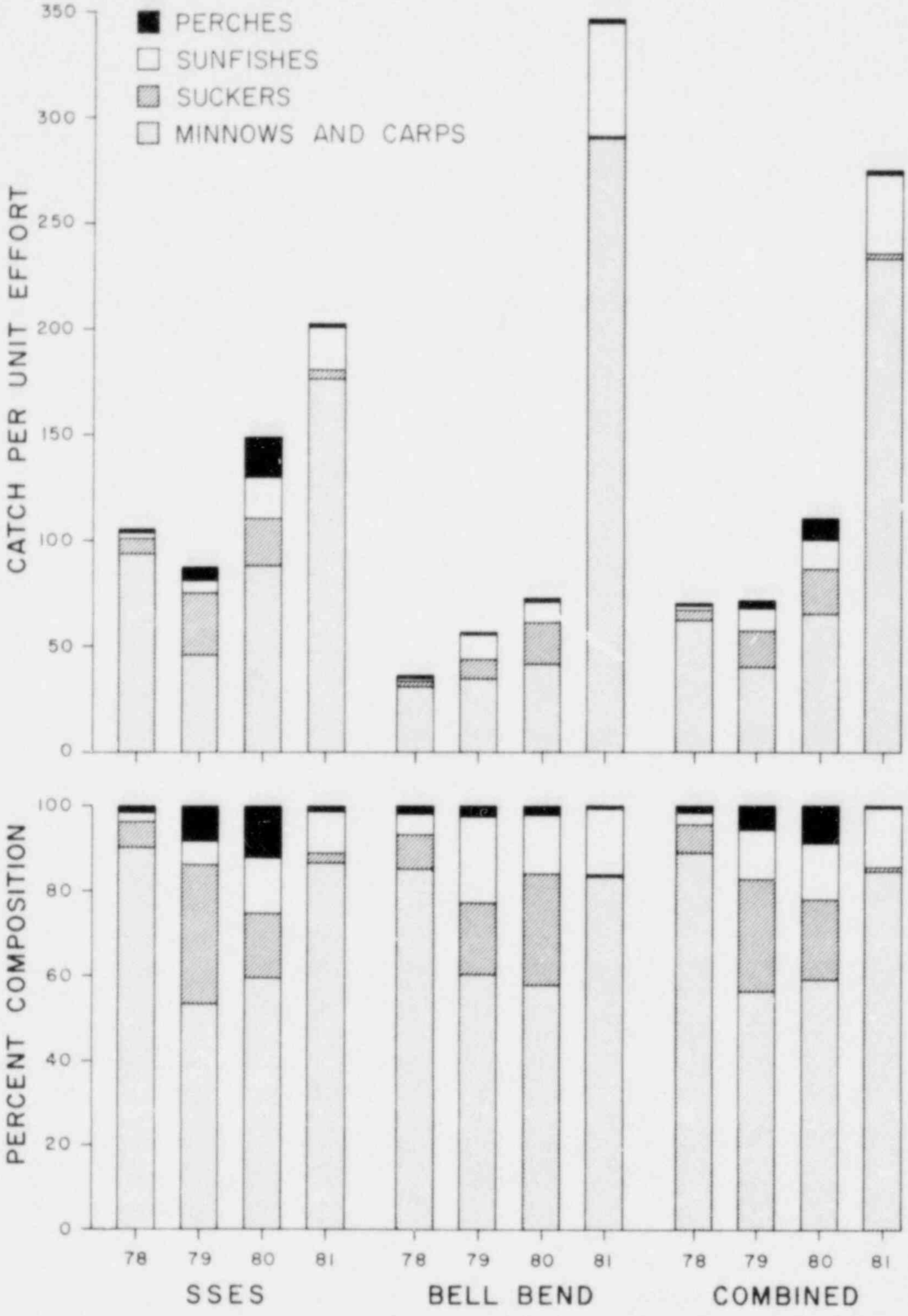

Fig. E-3

Catch per unit effort and percent composition of the four major families of fishes captured in seine hauls at SSES, Bell Bend, and both stations combined, 1978-81.

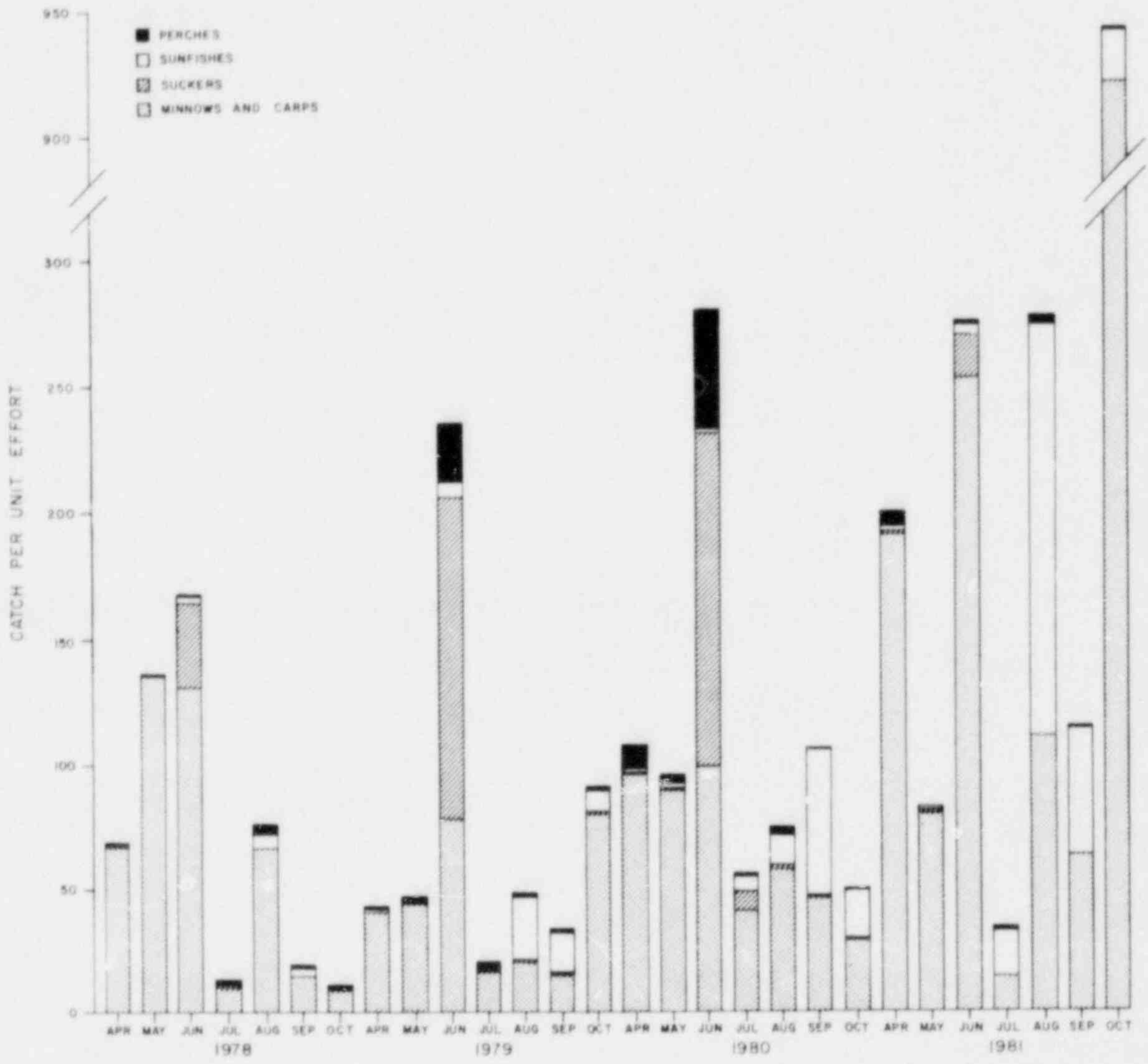

Fig. E-4

Catch per unit effort of the four major families of fishes captured in monthly seine hauls at SSES and Bell Bend combined from April through December 1978-81.

FLORA AND VEGETATION

by

James D. Montgomery

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ABSTRACT

From 1972 through 1974 and 1977 through 1981, 675 species of vascular plants have been observed on the Susquehanna SES site. In 1981, 414 plant taxa were found on nine salt drift transects. Thirty-two plant parasitic diseases were observed on 52 host species. Disease frequency ranged from rare to abundant, and disease effect ranged from almost none for powdery mildews to minor necrosis for most other diseases.

Three upland forest plots, one river-bottom hardwood forest, and two abandoned fields were quantitatively sampled. These data were compared with information collected from 1977 through 1980. In the upland forest plots, 30 significant changes were observed in 1981. Of these changes, 17 were reported previously, and the largest number, 16, was in the Council Cup Forest. There were nine changes in the Gould Island Forest, of which five were reported previously. There were 28 significant changes in the two abandoned fields. In both fields, the changes were successional, but those in Transmission Corridor Field indicate an earlier stage of succession or slower succession in this field.

Defoliation by gypsy moth was estimated for the four forest plots. Defoliation was most severe on oaks (*Quercus* spp.) in the upland forest plots. The Council Cup Forest was most severely affected, but there was some defoliation in all upland forest plots. No defoliation was found in the Gould Island Forest.

INTRODUCTION

Terrestrial ecological studies were conducted on the Susquehanna SES site from 1972 through 1974 (Ichthyological Associates 1973, 1974; Burton 1976) and from 1977 through 1981 (Montgomery 1978, 1979, 1980, 1981). The flora and vegetation studies from January 1977 through 1981 were initiated to gather baseline information to compare with information to be collected during operation of the Susquehanna SES.

The purpose of the flora and vegetation studies in 1981 was to continue programs that can be used to monitor changes, if any, during the Susquehanna SES operation. Systematic information was collected on the phenology of flowering plants and ferns and parasitic plant diseases (flora), and quantitative information was obtained for selected plant communities (vegetation).

PROCEDURES

Flora

Floristic studies were conducted from March through October 1981. As from 1977 through 1980 (Montgomery 1978, 1979, 1980, 1981), observations were made on both sides of the Susquehanna River throughout the Susquehanna SES site (Fig. F-1). In addition to general observations, transects for systematic observations were established. These transects were selected for observing possible effects of moisture and salt drift from the Susquehanna SES cooling towers during future operation, and are referred to as salt drift

transects. These transects were located in several plant communities at varying distances and directions from the Susquehanna SES (Table F-1; Fig. F-1). On each salt drift transect, the following data were recorded: all plant taxa in flower (shedding spores for ferns), all parasitic plant diseases observed according to host species, and frequency and relative effect of the disease on the host. A coding system was established for frequency and relative effect as follows:

Disease Frequency Code

1 = Rare -- one or two plants only (estimated at less than 5% of population affected

2 = Uncommon -- a few plants, either scattered or clumped (estimated at less than 10% of population affected)

3 = Scattered -- several plants at different localities (estimated at 10-25% of population affected)

4 = Common -- many plants affected (estimated at 25-50% of population)

5 = Abundant -- more than half affected (estimated at 50-100% of population).

Disease Effect Code

0 = No effect

1 = Local necrosis in small areas only

2 = More important necrosis in larger area

3 = Important necrosis and minor defoliation or twig death

4 = Important necrosis and more important defoliation or twig death

5 = Major necrosis and defoliation or host death

This coding system was used for the first time in 1981.

Each transect was surveyed once a month, usually in the latter half, from March through October. Identifications of vascular plants were made using Fernald (1950), Gleason and Cronquist (1963), Peterson and McKenny (1968); Wherry (1961) and Mickel (1979) for ferns; and Hitchcock (1950) for grasses. Nomenclature follows Gleason and Cronquist (1963), except for ferns and fern allies, for which Mickel (1979) is used. Parasitic plant diseases were identified using U.S. Department of Agriculture (1960), Hepting (1971), Westcott (1971), and Pennsylvania Department of Environmental Resources (1975). Scientific names are used because of the confusion of some common names of plants. Common and scientific names are given in Tables F-2 and F-3. Species not previously observed on the site were collected and added to the reference herbarium.

Vegetation

Quantitative vegetation studies were conducted in three upland forests: Council Cup Forest, Township Road 419 (TR419) Forest, and Quarry Hillside Forest; a river-bottom hardwood forest on Gould Island; and two abandoned fields: Switchyard Field and Transmission Corridor Field (Fig. F-1).

Three upland forest plots were sampled in July. Council Cup Forest was located east of the Council Cup Overlook, in Conyngham and Hollenback Townships, Luzerne County, 3 km southeast of the Susquehanna SES. The study plot was nearly level to gently east-facing slope, at an elevation of approximately 335 m above mean sea level. TR419 Forest was located on

a steep south-facing hillside above a dirt road (Township Road 419), just north of the Susquehanna SES fence, in Salem Township, Luzerne County. Elevation ranged from 200 to 250 m. Quarry Hillside Forest was located on a steep south-facing hillside east of an abandoned quarry above PA. Route 239, in Conyngham Township, Luzerne County. Elevation ranged from 225 to 250 m. The Council Cup and TR419 Forests have been sampled annually since 1977; the Quarry Hillside Forest has been sampled annually since 1978.

The river-bottom hardwood forest on Gould Island, sampled annually since July 1979, was sampled again in July 1981. The forest is located along the western edge of Gould Island adjacent to the Susquehanna River. Only the mature forest was sampled. The study plot was nearly level, at an elevation of approximately 150 m.

The forests were surveyed into transects parallel with the long direction of the plot. Points were located along these transects at distances depending on the plot size: 50-m intervals in Council Cup Forest, 75-m intervals in TR419 Forest, 30-m intervals in Quarry Hillside Forest, and 40-m intervals in Gould Island Forest. At each point, a 10 x 10-m quadrat was permanently marked for sampling trees and saplings (Cain and Castro 1959). Trees were defined as 10-cm diameter breast height (dbh) or greater, saplings as 1.0-9.5-cm dbh, and seedlings less than 1.0-cm dbh. All trees and saplings in the 10 x 10-m quadrat were identified, counted, and the dbh measured to the nearest cm with a diameter tape. Two 1 x 1-m quadrats were established in diagonally opposite corners of the 10 x 10-m quadrat for sampling tree seedlings, shrubs, herbs, and ground cover (litter, moss, rock, and bare

soil). Plants were identified and an estimate was made of the percent cover in the quadrat for each species, but stems were counted only for tree seedlings. Stems of shrubs and herbs were not counted because many species are colonial, and stem number was judged not to be useful. The following were calculated for trees, saplings, and tree seedlings (Cain and Castro 1959):

$$\text{Frequency} = \frac{\text{number of plots in which a species occurs}}{\text{total number of plots}}$$

$$\text{Relative Frequency} = \frac{\text{frequency of a species}}{\text{total frequency of all species}} \times 100$$

$$\text{Density} = \frac{\text{number of stems of a species}}{\text{hectare}}$$

$$\text{Relative Density} = \frac{\text{density of a species}}{\text{total density of all species}} \times 100$$

$$\text{Dominance (trees and samplings)} = \frac{\text{basal area of a species}}{\text{hectare}}, \text{ where basal area} = \pi \left(\frac{\text{dbh}}{2}\right)^2$$

$$\text{Dominance (tree seedlings)} = \frac{\text{cover value of a species}}{\text{area sampled in } m^2}$$

$$\text{Relative Dominance} = \frac{\text{dominance for a species}}{\text{total dominance for all species}} \times 100$$

Importance Value = relative frequency + relative density + relative dominance (maximum value = 300)

The following were calculated from the quadrat data for shrubs, herbs, and ground cover:

Frequency and Relative Frequency = same as above

$$\text{Dominance} = \frac{\text{cover value for a species}}{\text{area sampled in m}^2}$$

$$\text{Relative Dominance} = \frac{\text{dominance for a species}}{\text{total dominance for all species}} \times 100$$

$$\text{Importance Value} = \text{relative frequency} + \text{relative dominance}$$

Comparisons of 1981 data with that collected from 1977 through 1980 were made using a repeated measures analysis of variance with a test for linear trends (Sokal and Rohlf 1969). Quadrat by quadrat tests were made using number of stems per quadrat for each tree, sapling, and seedling species, and percent cover per quadrat for shrub and herb species and ground cover. Tree seedlings were not counted in 1977 and 1 x 1-m quadrats were not sampled in TR419 Forest in 1977; therefore, these comparisons could not be made. Log (X+1) transformations for stem numbers and arcsine transformations for percent cover values were made as recommended by Sokal and Rohlf (1969) and Goodall (1970).

Defoliation by gypsy moth (*Lymantria dispar*) was observed in the upland forest plots in the late spring and early summer of 1981. While conducting the quadrat surveys in July, quantitative estimates of this damage were made in the four forest plots by visually judging the percentage of defoliation for each tree and sapling in the 10 x 10-m quadrats. These estimates were made at the time of maximum defoliation, when gypsy moth larvae were beginning to pupate. Data were tabulated for each species in each plot.

Two abandoned fields, Switchyard Field and Transmission Corridor Field, were sampled in September and October 1981 (Fig. F-1). Both of these fields were sampled in 1979 and Switchyard Field also in 1978. Neither were done in 1980.

Switchyard Field was located adjacent to the Luzerne Electric Division, UGI substation, east of PA. Route 239, 2.8 km east of the Susquehanna SES in Conyngham Township, Luzerne County. Elevation was approximately 210 m above mean sea level. The field sloped gently northward and was relatively dry.

Transmission Corridor Field was located immediately east of the transmission lines in the transmission corridor south of the Susquehanna SES and north of U.S. Route 11. Elevation was approximately 195 m. The field was level and dry.

The line intercept method was used for sampling (Cain and Castro 1959, Smith 1966). A baseline was established near and parallel to one edge of each field and marked into 10-m intervals. Lines were run perpendicular to the baseline at these intervals. Beginning at the baseline, these lines were divided into 10-m transects with permanent numbered stakes. There were five transects per line in both Transmission Corridor Field and Switchyard Field. Fifty-five transects were established in Switchyard Field, but six were disturbed during construction of the switchyard and not sampled. Fifty transects were sampled in Transmission Corridor Field. The first 5 m of each transect was sampled by stretching a metric tape between the stakes marking the ends of the transect. The length of cover for each taxon along the tape

was recorded to the nearest cm. Tree seedlings, shrubs, and herbs were sampled together, but the data for each were treated separately. Species area curves were drawn after sampling to check on the adequacy of the area sampled (Mueller-Dombois and Ellenberg 1974). The following were calculated for all taxa:

$$\text{Frequency} = \frac{\text{number of transects on which a species occurs}}{\text{total number of transects}}$$

$$\text{Relative Frequency} = \frac{\text{frequency of a species}}{\text{total frequency of all species}} \times 100$$

$$\text{Percent Coverage} = \frac{\text{coverage of a species on all transects}}{\text{total length of transects}}$$

$$\text{Relative Dominance} = \frac{\text{percent coverage of a species}}{\text{total percent coverage of all species}} \times 100$$

$$\text{Importance Value} = \text{relative frequency} + \text{relative dominance}$$

Comparisons of 1981 data with that collected in 1978 and 1979 were made as with forest data. Percent cover values for species with importance value greater than 5.0 in any sampling year were tested for significance of changes and trends. Species which had importance value of 5.0 or less were not tested since they occurred in too few transects and had cover values too low to make comparisons useful.

RESULTS AND DISCUSSION

Flora

From 1972 through 1974 and 1977 through 1981, 675 species of vascular plants have been observed on the Susquehanna SES site. This total included 128 woody plants (Table F-2) and 547 herbaceous plants (Table F-3). Fourteen species were observed for the first time on the site in 1981. None of the plants observed on the site has been proposed as threatened or endangered by the U.S. Department of the Interior (1975, 1976). No plants are presently listed in either category for Pennsylvania (U.S. Department of the Interior 1979). *Festuca rubra*, found for the first time on the Susquehanna SES site in 1980 (Montgomery 1981), was listed in *Rare and Endangered Vascular Plant Species in Pennsylvania* (Wiegman 1979); this species was not observed in 1981. No other species listed by Wiegman (1979) has been found on the site.

There were 414 plant taxa observed in flower or shedding spores on the salt drift transects, 392 on forest transects (Table F-4), and 175 on field transects (Table F-5). Of the forest transects, QSH (abbreviations are given in Table F-1) had the greatest number of taxa (207), followed by TR438 (178), TR419 (149), CC (143), RF (115), and GIF (113). The greatest number of species was observed in August on all transects except CC, where the maximum number occurred in May. The total number of taxa observed, 392, was eight more than that found in 1979 and 1980 (Montgomery 1980, 1981), but the species were not all the same.

Comparison of 1981 transect phenology data with 1978 through 1980 data indicated that 137 taxa (34.9%) occurred on the same transects in 1981 as in 1980, including 88 taxa (29.8%) which occurred on the same transects for two or more years; 160 taxa (40.8%) occurred on one additional transect or one less transect in 1981 than 1980; and 95 taxa (24.2%) were more variable in occurrence. Some variability was caused by the short flowering period of spring forest plants. These plants may or may not be observed in flower on a given transect in each year. Of the abandoned field transects, TCF had the greatest number of taxa observed (103), followed by SwF (100) and NF (85). The peak of flowering occurred in August when 80 taxa were observed on the transects.

Comparison of 1981 field transect data with 1977 through 1980 data indicated that 94 taxa (53.7%) occurred on the same transects in 1981 as in 1980, including 70 taxa (30.3%) which occurred on the same transects for three or more years (at least 1979-1981); 68 taxa (38.9%) occurred on one additional or one less transect in 1981 than in 1980; and 13 taxa (7.4%) were more variable in occurrence.

Thirty-two plant parasitic diseases were observed on 52 host species (Table F-6). Five of the plant diseases were observed for the first time in 1981. As in 1979 and 1980 (Montgomery 1980, 1981), leaf spots were the most frequent diseases encountered, accounting for 16 of the 32 diseases (50%) on 16 host species (31%). Powdery mildews occurred on 20 species (38%). Rust diseases occurred on 18 species (35%). The largest number of diseases (23) was observed on QSH.

There has been some annual variation in occurrence and location of parasitic diseases from 1978 through 1981, but many diseases have been observed on the same transects in most years. Leaf spots and powdery mildews occurred with about the same frequency in 1981 as in 1980; powdery mildews were more frequent in 1979. Disease frequency ranged from rare (1) to abundant (5) for all kinds of diseases and no pattern was evident. Disease effect ranged from almost none (0) for powdery mildews, to minor necrosis (1) for most other diseases. Only one disease, chestnut blight, caused death of plants (5); no other disease effect was more serious than necrosis.

Vegetation

Betula lenta was the most important (highest importance value) tree in the Council Cup Forest (Table F-7). Associates included two oaks *(Quercus velutina* and *Q. alba)* and two pines *(Pinus strobus* and *P. virginiana)*. Total density was 595 trees/ha. *Acer rubrum* and *Betula lenta* were the most important saplings, with three oaks *(Q. borealis*, *Q. velutina*, and *Q. prinus)* as associates (Table F-8). Total density was 1,760 saplings/ha. *Acer rubrum* was the most important seedling, followed in importance by *Prunus serotina*, *Quercus velutina*, *Q. borealis*, and *Q. prinus* (Table F-9). Total density was 29,250 seedlings/ha. *Vaccinium vacillans* was the most important shrub (Table F-10). *Lycopodium flabelliforme* was the most important herb, with *Aralia nudicaulis*, *Maianthemum canadense*, and *Dennstaedtia punctilobula* as the most important associates; 20 taxa were

encountered. Litter was the predominant ground cover.

The only significant change found in trees in the Council Cup Forest was for *Quercus velutina* (Table F-11); this change was first noted in 1978 (Montgomery 1979). Tree density decreased slightly from 610 trees/ha in 1980 to 595 trees/ha in 1981. The number of saplings of *Betula lenta*, *Quercus borealis*, *Q. prinus*, *Betula populifolia*, and *Carya glabra* all exhibited significant decreases from 1977 through 1981 (Table F-12). *Acer rubrum*, *Carya tomentosa*, and *Fraxinus americana* also exhibited significant changes in number of stems, but there was no trend. Changes in *Carya* spp. were noted and discussed in 1979 (Montgomery 1980). Significant changes in *Acer rubrum*, *Quercus borealis*, *Betula populifolia*, and *Fraxinus americana* were noted in 1980 (Montgomery 1981). The decreases in *Betula lenta* and *Quercus prinus* were significant for the first time in 1981, although a decline in numbers of stems for both species has occurred since 1977. These decreases are correlated with a decrease in total sapling density from 2,345/ha in 1978, 2,210/ha in 1979, and 2,015/ha in 1980 to 1,760/ha in 1981. *Quercus velutina* changed significantly in number of seedlings from 1977 through 1981 (Table F-13). A significant decrease for this species was noted in 1980 (Montgomery 1981). There were no other significant changes in seedlings. Seedling density increased slightly from 29,000/ha in 1979, but decreased from 32,000/ha in 1980. *Vaccinium vacillans* and *Rhus radicans* changed significantly among shrubs from 1977 through 1981 (Table F-14); both changes were first noted in 1978 (Montgomery 1979). *Maianthemum canadense* and *Veronica officinalis* increased significantly among herbs from 1977 through

1981 (Table F-14). *Lycopodium flabelliforme* also showed significant change, without trend. The change in *Maianthemum canadense* was found also in 1980. The other changes were observed for the first time in 1981.

In the TR419 Forest, *Quercus velutina* was the most important tree, with *Pinus virginiana* and *Cornus florida* as associates (Table F-15). Total density was 546 trees/ha. *Cornus florida* was the most important sapling, with *Quercus velutina*, *Acer rubrum*, and *Carya tomentosa* as associates (Table F-16). Total density was 1,158 saplings/ha. *Cornus florida* was the most important seedling, with *Fraxinus americana*, *Prunus serotina*, and *Acer rubrum* as associates (Table F-17). Total density was 70,833 seedlings/ha. *Rubus allegheniensis* was the most important shrub, with *Parthenocissus quinquefolia*, *Lindera benzoin*, and *Vaccinium vacillans* as associates (Table F-18). *Dennstaedtia punctilobula* was the most important herb, with *Carex swannii* the most important associate; 43 taxa were encountered. Litter was the most important ground cover.

Quercus velutina changed significantly from 1977 through 1981, but no trend was evident (Table F-19). This was the first significant tree change observed for the TR419 Forest. Tree density has decreased continuously from 617/ha in 1978 (Montgomery 1979), 562/ha in 1979 (Montgomery 1980), and 554/ha in 1980 (Montgomery 1981) to 546/ha in 1981. There were no significant changes in saplings (Table F-20). Sapling density increased slightly from 1,121/ha in 1980 to 1,158/ha. *Sassafras albidum* increased significantly from 1978 through 1981 (Table F-21); this was the only significant change in seedlings. Seedling density decreased from

87,499/ha in 1980 to 70,833/ha in 1981. There were no significant changes in shrubs (Table F-22). Among herbs, *Carex* spp. increased significantly from 1978 through 1981; this change was observed for the first time in 1981.

In the Quarry Hillside Forest, *Quercus velutina* was the most important tree (Table F-23), with *Q. prinus*, *Fraxinus americana*, and *Q. borealis* as the most important associates. Total density was 647 trees/ha. *Cornus florida* was the most important sapling (Table F-24), with *Quercus borealis*, *Fraxinus americana*, and *Acer rubrum* as associates. Total density was 1,433 saplings/ha. *Acer rubrum* was the most important seedling (Table F-25), with *Fraxinus americana*, *Cornus florida*, and *Quercus borealis* as associates. Total density was 55,666 seedlings/ha. *Parthenocissus quinquefolia* was the most important shrub (Table F-26), with *Lindera benzoin* as the most important associate. *Aster divaricatus* was the most important herb, with *Dryopteris marginalis*, *Deschampsia flexuosa*, and *Eupatorium rugosum* as associates. Thirty-five taxa were encountered. Litter was the most important ground cover.

Quercus velutina decreased significantly from 1978 through 1981 (Table F-27); there were no other significant changes among tree species. Tree density decreased slightly from 653/ha in 1980 to 647/ha in 1981. *Quercus velutina* also decreased significantly among saplings from 1978 through 1981 (Table F-28). Sapling density decreased from 1,540/ha in 1980 to 1,433/ha in 1981. *Prunus avium* increased significantly, *Quercus borealis* decreased significantly, and *Fraxinus americana* changed significantly, but without trend from 1978 through 1981 (Table F-29). The increase in *Prunus avium* was first found in 1981, others were noted in previous years (Montgomery 1981).

Seedling density decreased from 66,000/ha in 1980 to 55,666/ha in 1981. There were no significant changes among shrubs (Table F-30). *Eupatorium rugosum* and *Veronica serpyllifolia* increased significantly among herbs (Table F-30). The change in *Eupatorium rugosum* was observed in 1980 (Montgomery 1981); the change in *Veronica officinalis* was first found in 1981. Rock decreased significantly and litter changed without trend in ground cover; these changes were first reported in 1979 (Montgomery 1980).

Acer saccharinum was the most important tree in the Gould Island Forest (Table F-31), with *Celtis occidentalis*, *Ulmus americana*, and *Tilia americana* as associates. Total density was 274 trees/ha. *Fraxinus pennsylvanica* was the most important sapling (Table F-32), with *Ulmus americana* and *F. americana* as associates. Total density was 163 saplings/ha. *Ulmus americana* was the most important tree seedling (Table F-33), with *Celtis occidentalis* and *Fraxinus americana* as associates. Total density was 10,000 seedlings/ha. *Parthenocissus quinquefolia* was the most important shrub (Table F-34); *Rhus radicans* was the most important associate (both of these are woody vines). *Matteuccia struthiopteris* was the most important herb, with *Viola papilionacea*, *Polygonum cilinode*, and *Alliaria officinalis* as the most important associates. Thirty-three herb taxa were encountered. Litter was the most important ground cover.

There were no significant changes in tree species from 1979 through 1981 (Table F-35). Density decreased somewhat from 300/ha in 1979 and 305/ha in 1980 to 274/ha in 1981. Among saplings, *Fraxinus pennsylvanica* increased significantly from 1979 through 1981 (Table F-36). This species was not separated

from *F. americana* in 1979 and 1980. There was a corresponding decrease in *F. americana* for number of stems and importance value from 1980 to 1981, but these were below statistical significance. Sapling density has changed very little from 168/ha in 1979 and 158/ha in 1980 to 163/ha in 1981. There were no significant changes in seedlings from 1979 through 1981 (Table F-37). Seedling density increased from 7,632/ha in 1980 to 10,000/ha in 1981. Density in both years was much lower than the 23,947/ha reported in 1979 (Montgomery 1980). This change was correlated with density of seedlings of *Acer saccharium* from 17,632/ha in 1979 to 263/ha in 1980 and 1981. There were no significant changes in shrubs. Among herbs, *Eupatorium rugosum* increased significantly from 1979 through 1981, and *Polygonum cilinode, Alliaria officinalis, Pilea pumila*, and grass changed significantly with no trend evident (Table F-38). Changes in all taxa except *Polygonum cilinode* and grass were reported in 1980 (Montgomery 1981). Litter and moss increased and bare soil decreased significantly from 1979 through 1981. These changes were noted and discussed in 1980 (Montgomery 1981), and are correlated with lack of flooding of the transect in spring 1980 and in 1981, which allowed litter to accumulate.

As noted in 1979 (Montgomery 1980) and 1980 (Montgomery 1981), the total number of significant changes in the forest plots was small. Of the 28 changes observed in the upland forest plots in 1981, 17 were observed previously. As in previous years, the largest number of significant changes, 16, was in the Council Cup Forest. There were 9 changes in Quarry Hillside Forest, 5 more than in 1980, and changes occurred in all classes of

vegetation sampled except shrubs. The decreases in trees and saplings in the Council Cup and Quarry Hillside Forests were correlated with heavy gypsy moth damage in these plots (see below).

There were nine changes in the Gould Island Forest; five of these were reported in 1980. Five of the nine changes were in herbs and three in ground cover.

Among the important tree and sapling species, oaks (*Quercus* spp.) were most seriously defoliated by gypsy moth on all upland forest plots (Table F-39). There was no defoliation in the Gould Island Forest. *Amelanchier arborea* and *Carya* spp. were also seriously defoliated, especially in the Council Cup Forest. Among the important trees and saplings in the forest plots, *Cornus florida*, *Acer rubrum*, and *Fraxinus americana* were the least affected. The relative affects on species in the forest plots agree closely with affects on trees by gypsy moth in Pennsylvania (Nichols 1980). Defoliation was most severe in the Council Cup Forest (Table F-39), and least severe in the TR419 Forest. Defoliation such as occurred in 1981 in the Council Cup Forest will usually not kill hardwood species (Nichols 1980), and most trees, including oaks, were observed to leaf out again in mid-July. Defoliation for more than two years will kill many oaks, and defoliation for more than one year will kill conifers. The data collected in 1981 will allow monitoring of tree mortality in the forest plots in subsequent years.

In Switchyard Field, *Cornus florida* was the most important tree seedling (Table F-40). *Cornus racemosa* was the most important shrub. *Solidago rugosa*

was the most important herb, with *S. canadensis*, grass, and *Potentilla simplex* as important associates; 65 taxa were encountered in the field, of which 46 were herbs.

In Switchyard Field, 19 changes were significant among species tested (Table F-41). Twelve changes were significant increases, four were decreases, and three showed no trend. All changes in tree seedlings and all except one without trend in shrubs were increases. An increase in tree seedlings and shrubs is a normal successional pattern (Smith 1966). *Solidago* spp. continued to dominate (as measured by % cover) this field and the herb changes showed no pattern of change.

In Transmission Corridor Field, *Acer rubrum* was the most important tree seedling (Table F-42). *Rubus flagellaris* was the most important shrub. Grass was the most important herb taxon (Table F-42), with *Solidago juncea*, *Fragaria virginiana*, and *S. nemoralis* as important associates; 67 taxa were encountered, of which 48 were herbs.

There were nine significant changes in Transmission Corridor Field (Table F-43). There were no changes in tree seedlings, and three changes, all decreases, in shrubs. Among herbs, *Solidago nemoralis*, *S. canadensis*, and *Aster pilosus* increased, and *Fragaria virginiana*, *Rumex acetosella*, and *Linaria vulgaris* decreased. The increasing species are tall perennial herbs typical of this stage in succession; while the decreasing species are low or groundcover perennials more typical of early succession. These changes, and the lower dominance of tree seedlings in Transmission Corridor Field, indicate a somewhat earlier stage in succession or slower succession for this field.

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Table F-1

Location of salt drift transects at the Susquehanna SES, 1981.

Transect (Abbreviation)	Direction from Susquehanna SES	Distance (km) from Susquehanna SES	Habitat Type	Transect Length (km)	Location of Transect
River Forest (RF)	E-NE	1.5-2.0	River bottom hardwood forest	1.2	Adjacent to the Susquehanna River, north from Susquehanna SES Biological Laboratory to southern tip of Gould Island
Gould Island Forest (GIF)	NE	2.2-2.7	River bottom hardwood forest	1.0	Marked trail along western shore of Gould Island
TR 419 (TR419)	N	0.5-1.2	Upland hardwood-pine forest	1.5	Along Township Road 419, from U.S. 11 to T.R. 438
TR 438 (TR438)	W-SW	0.4-1.9	Upland forest, open field, marsh	2.3	Along Township Road 438, from T.R. 419 to the entrance of abandoned race track
Quarry-Spring House Trail (QSH)	ENE	2.2-3.2	Upland hardwood-pine forest	2.3	Trail from PA. 239 (quarry trail) to the transmission line along ridge top to the transmission line down the slope of Little Wapwallopen Valley to a trail past an abandoned spring house, ending on PA. 239
Council Cup (CC)	ESE	2.8-3.3	Upland hardwood-pine forest	1.4	Council Cup Nature Trail and Overlook
North Field (NF)	NE	1.8-2.0	Abandoned field	0.4	Field north of Susquehanna SES Biological Laboratory
Switchyard Field (SwF)	E	2.7-3.0	Abandoned field	0.3	Field north of the switching station east of PA. 239
Transmission Corridor Field (TCF)	S	1.3-2.3	Abandoned field	1.0	Field in the transmission corridor south of Susquehanna SES

Table F-2

Species of woody plants observed on the Susquehanna SES site, 1972-74 and 1977-81. Taxa are arranged alphabetically within phyla. An * indicates taxa observed for the first time in 1981.

PINOPHYTA
- Cupressaceae
  - *Juniperus virginiana* - red cedar
  - *Thuja occidentalis* - arbor vitae
- Pinaceae
  - *Picea glauca* - white spruce
  - *P. rubens* - red spruce
  - *Pinus rigida* - pitch pine
  - *P. strobus* - white pine
  - *P. sylvestris* - scotch pine
  - *P. virginiana* - Virginia pine
  - *Tsuga canadensis* - eastern hemlock

MAGNOLIOPHYTA-DICOTYLEDONEAE
- Aceraceae
  - *Acer negundo* - box-elder*
  - *A. nigrum* - black maple
  - *A. pensylvanicum* - striped maple
  - *A. platanoides* - Norway maple
  - *A. rubrum* - red maple
  - *A. saccharinum* - silver maple
  - *A. saccharum* - sugar maple
  - *A. spicatum* - mountain maple
- Anacardiaceae
  - *Rhus copallina* - winged sumac
  - *R. glabra* - smooth sumac
  - *R. radicans* - poison ivy
  - *R. typhina* - staghorn sumac
  - *R. vernix* - poison sumac
- Aquifoliaceae
  - *Ilex verticellata* - winterberry
- Berberidaceae
  - *Berberis thunbergii* - Japanese barberry
- Betulaceae
  - *Alnus rugosa* - speckled alder
  - *Betula lenta* - sweet birch
  - *B. lutea* - yellow birch
  - *B. nigra* - river birch
  - *B. papyrifera* - paper birch
  - *B. populifolia* - gray birch
  - *Carpinus caroliniana* - American hornbeam
  - *Corylus americana* - hazel-nut
  - *Ostrya virginiana* - hop-hornbeam
- Bignoniaceae
  - *Catalpa bignonioides* - catalpa
- Caprifoliaceae
  - *Diervilla lonicera* - bush-honeysuckle
  - *Lonicera tatarica* - tartarian honeysuckle
  - *Sambucus canadensis* - common elder
  - *S. pubens* - red-berried elder
  - *Viburnum acerifolium* - maple-leaf viburnum
  - *V. dentatum* - arrowwood
- Celastraceae
  - *Celastrus scandens* - bittersweet
- Cornaceae
  - *Cornus alternifolia* - alternate-leaf dogwood
  - *C. amomum* - silky dogwood
  - *C. florida* - flowering dogwood
  - *C. racemosa* - gray dogwood
  - *C. rugosa* - round-leaf dogwood
  - *Nyssa sylvatica* - black gum
- Elaeagnaceae
  - *Elaeagnus commutata* - silverberry
- Ericaceae
  - *Gaylussacia baccata* - black huckleberry
  - *Kalmia angustifolia* - sheep laurel
  - *K. latifolia* - mountain laurel
  - *Rhododendron maximum* - rhododendron
  - *R. nudiflorum* - pinxter-flower
  - *Vaccinium corymbosum* - high-bush blueberry
  - *V. stamineum* - deerberry
  - *V. vacillans* - low-bush blueberry
- Fagaceae
  - *Castanea dentata* - American chestnut
  - *Fagus grandifolia* - American beech
  - *Quercus alba* - white oak
  - *Q. bicolor* - swamp white oak
  - *Q. borealis* - red oak
  - *Q. ilicifolia* - scrub oak
  - *Q. palustris* - pin oak
  - *Q. prinus* - chestnut oak
  - *Q. velutina* - black oak
- Hamamelidaceae
  - *Hamamelis virginiana* - witch hazel
- Juglandaceae
  - *Carya cordiformis* - bitternut hickory
  - *C. glabra* - pignut hickory
  - *C. ovata* - shagbark hickory
  - *C. tomentosa* - mockernut hickory
  - *Juglans cinerea* - butternut
  - *J. nigra* - black walnut
- Lauraceae
  - *Lindera benzoin* - spicebush
  - *Sassafras albidum* - sassafras
- Leguminosae
  - *Gleditsia triacanthos* - honey locust
  - *Robinia pseudoacacia* - black locust
  - *Wisteria floribunda* - wisteria
- Magnoliaceae
  - *Liriodendron tulipifera* - tulip-tree
- Moraceae
  - *Morus rubra* - red mulberry
- Myricaceae
  - *Myrica asplenifolia* - sweet fern
- Oleaceae
  - *Forsythia* sp. - forsythia
  - *Fraxinus americana* - white ash
  - *F. pennsylvanica* - red ash
  - *Ligustrum vulgare* - common privet
  - *Syringa vulgaris* - lilac
- Platanaceae
  - *Platanus occidentalis* - sycamore
- Rhamnaceae
  - *Ceanothus americanus* - New Jersey tea
- Rosaceae
  - *Amelanchier arborea* - shad-bush
  - *Aronia melanocarpa* - chokeberry
  - *Crataegus pruinosa* - hawthorne
  - *Crataegus* sp. - hawthorne
  - *Physocarpus opulifolius* - ninebark
  - *Prunus avium* - sweet cherry
  - *P. pensylvanica* - pin cherry
  - *P. serotina* - black cherry
  - *P. virginiana* - choke cherry

Table F-2 (cont.)

Rosaceae (cont.)
Pyrus communis - pear
P. malus - apple
Pyrus sp. - crabapple
Rosa multiflora - multiflora rose
R. palustris - swamp rose
R. virginiana - wild rose
Rubus allegheniensis - blackberry
R. flagellaris - dewberry
R. hispidus - dewberry
R. occidentalis - black raspberry
Spiraea latifolia - meadow-sweet
S. tomentosa - steeplebush

Rubiaceae
Cephalanthus occidentalis - buttonbush

Rutaceae
Zanthoxylum americanum - prickly ash

Salicaceae
Populus grandidentata - big-toothed aspen
P. tremuloides - quaking aspen
Salix humilis - prairie willow
S. nigra - black willow
S. sericea - silky willow
Salix sp. - willow

Saxifragaceae
Hydrangea arborescens - hydrangea
Ribes americanum - wild black currant

Staphyleaceae
Staphylea trifolia - bladder-nut

Tiliaceae
Tilia americana - basswood

Ulmaceae
Celtis occidentalis - hackberry
Ulmus americana - American elm
U. rubra - slippery elm

Vitaceae
Parthenocissus quinquefolia - Virginia creeper
Vitis aestivalis - summer grape
V. labrusca - fox grape
V. riparia - riverbank grape

MAGNOLIOPHYTA-MONOCOTYLEDONEAE
Liliaceae
Smilax rotundifolia - greenbrier

Table F-3

Species of herbaceous plants observed on the Susquehanna SES site, 1972-74 and 1977-81. Taxa are arranged alphabetically within phyla. An * indicates taxa observed for the first time in 1981.

EQUISETOPHYTA
- Equisetaceae
  - *Equisetum arvense* - field horsetail
  - *E. sylvaticum* - woodland horsetail

LYCOPODIOPHYTA
- Isoetaceae
  - *Isoetes engelmannii* - Englemann's quillwort
- Lycopodiaceae
  - *Lycopodium clavatum* - staghorn clubmoss
  - *L. flabelliforme* - ground pine
  - *L. inundatum* - bog clubmoss
  - *L. lucidulum* - shining clubmoss
  - *L. obscurum* - tree clubmoss
  - *L. tristachyum* - ground cedar
- Selaginellaceae
  - *Selaginella apoda* - meadow spike-moss

POLYPODIOPHYTA
- Ophioglossaceae
  - *Botrychium dissectum* - grape fern
  - *B. lanceolatum* - lanceolate
  - *B. matricariifolium* - daisy-leaf grape fern
  - *B. virginianum* - rattlesnake fern
- Osmundaceae
  - *Osmunda cinnamomea* - cinnamon fern
  - *O. claytoniana* - interrupted fern
- Polypodiaceae
  - *Adiantum pedatum* - maidenhair fern
  - *Asplenium platyneuron* - ebony spleenwort
  - *Athyrium filix-femina* - lady fern
  - *A. thelypterioides* - silvery spleenwort
  - *Cystopteris fragilis* - fragile fern
  - *C. protrusa* - lowland fragile fern
  - *Dennstaedtia punctilobula* - hay-scented fern
  - *Dryopteris cristata* - crested wood fern
  - *D. intermedia* - evergreen wood fern
  - *D. marginalis* - marginal wood fern
  - *D. spinulosa* - spinulose wood fern
  - *Dryopteris X boottii* - Boott's wood fern
  - *Dryopteris X triploidea* - hybrid wood fern
  - *Dryopteris X uliginosa* - hybrid wood fern*
  - *Gymnocarpium dryopteris* - oak fern
  - *Matteuccia struthiopteris* - ostrich fern
  - *Onoclea sensibilis* - sensitive fern
  - *Polypodium virginianum* - common polypody
  - *Polystichum acrostichoides* - Christmas fern
  - *Pteridium aquilinum* - bracken
  - *Thelypteris noveboracensis* - New York fern
  - *T. palustris* - marsh fern
  - *Woodsia ilvensis* - rusty woodsia
  - *W. obtusa* - blunt-lobed woodsia

MAGNOLIOPHYTA-DICOTYLEDONEAE
- Acanthaceae
  - *Justicia americana* - water-willow
- Aizoaceae
  - *Mollugo verticillata* - carpet-weed
- Apocynaceae
  - *Apocynum androsaemifolium* - dogbane
  - *A. cannabinum* - Indian hemp
  - *Vinca minor* - periwinkle
- Araliaceae
  - *Aralia nudicaulis* - wild sarsaparilla
  - *Panax trifolium* - dwarf ginseng
- Asclepiadaceae
  - *Asclepias amplexicaulis* - blunt-leaved milkweed
  - *A. incarnata* - swamp milkweed
  - *A. quadrifolia* - four-leaved milkweed
  - *A. syriaca* - common milkweed
  - *A. tuberosa* - butterfly-weed
- Asteraceae
  - *Achillea millefolium* - yarrow
  - *Ambrosia artemisiifolia* - ragweed
  - *A. trifida* - giant ragweed
  - *Anaphalis margaritacea* - pearly everlasting
  - *Antennaria neglecta* - pussytoes
  - *A. plantaginifolia* - pussytoes
  - *Anthemis cotula* - mayweed
  - *Arctium minus* - burdock
  - *Aster acuminatus* - whorled wood aster
  - *A. cordifolius* - heart-leaved aster
  - *A. divaricatus* - white wood ester
  - *A. dumosus* - aster
  - *A. laevis* - smooth aster
  - *A. lateriflorus* - calico aster
  - *A. novae-angliae* - New England aster
  - *A. patens* - late purple aster
  - *A. paternus* - aster
  - *A. pilosus* - aster
  - *A. prenanthoides* - aster *
  - *A. puniceus* - purple-stemmed aster
  - *A. simplex* - aster
  - *A. umbellatus* - flat-topped white aster
  - *A. undulatus* - aster
  - *Bidens cernua* - beggar-ticks
  - *B. frondosa* - beggar-ticks
  - *B. tripartita* - beggar-ticks
  - *Cacalia suaveolens* - Indian-plantain
  - *Centaurea maculosa* - spotted knapweed
  - *Chrysanthemum leucanthemum* - ox-eye daisy
  - *Cichorium intybus* - chicory
  - *Cirsium arvense* - Canada thistle
  - *C. pumilum* - pasture thistle
  - *C. vulgare* - bull thistle
  - *Conyza canadensis* - horseweed
  - *Erechtites hieracifolia* - fireweed
  - *Erigeron annus* - daisy fleabane
  - *E. philadelphicus* - dairy fleabane *
  - *Eupatorium fistulosum* - Joe-Pye-weed
  - *E. maculatum* - spotted Joe-Pye-weed
  - *E. perfoliatum* - boneset
  - *E. rugosum* - white snakeroot
  - *Galinsoga ciliata* - galinsoga
  - *Gnaphalium obtusifolium* - cudweed
  - *Helenium autumnale* - sneezeweed
  - *Helianthus decapetalus* - thin-leaf sunflower
  - *H. divaricatus* - woodland sunflower
  - *H. tuberosus* - Jerusalem artichoke
  - *Heliopsis helianthoides* - ox-eye
  - *Hieracium aurantiacum* - king-devil
  - *H. paniculatum* - hawkweed
  - *H. pilosella* - mouse-ear hawkweed
  - *H. pratense* - hawkweed
  - *H. venosum* - rattlesnake-weed
  - *Krigia virginica* - dwarf dandelion
  - *Lactuca canadensis* - wild lettuce
  - *Matricaria matricarioides* - pineapple-weed
  - *Prenanthes alba* - tall white lettuce
  - *Rudbeckia hirta* - black-eyed susan
  - *R. laciniata* - coneflower
  - *Senecio aureus* - golden ragwort
  - *S. obovatus* - roundleaf ragwort
  - *Solidago arguta* - sharp-leaved goldenrod
  - *S. bicolor* - silverrod
  - *S. caesia* - blue-stemmed goldenrod
  - *S. canadensis* - Canada goldenrod
  - *S. flexicaulis* - zigzag goldenrod
  - *S. gigantea* - late goldenrod
  - *S. graminifolia* - flat-topped goldenrod
  - *S. juncea* - early goldenrod
  - *S. nemoralis* - little gray goldenrod
  - *S. rugosa* - rough goldenrod
  - *Taraxacum officinale* - dandelion
  - *Tragopogon dubius* - goat's beard
  - *Tussilago farfara* - coltsfoot
  - *Vernonia noveboracensis* - ironweed
  - *Xanthium strumarium* - cocklebur

Table F-3 (cont.)

Balsaminaceae
- *Impatiens biflora* - jewelweed
- *I. pallida* - pale jewelweed

Berberidaceae
- *Caulophyllum thalictroides* - blue cohosh
- *Podophyllum peltatum* - may apple

Boraginaceae
- *Hackelia virginiana* - beggar's lice
- *Mertensia virginica* - Virginia bluebells
- *Myosotis laxa* - forget-me-not
- *M. scorpioides* - forget-me-not
- *M. verna* - forget-me-not

Callitrichaceae
- *Callitriche heterophylla* - water starwort

Campanulaceae
- *Campanula aparinoides* - marsh bellflower
- *Triodanis perfoliata* - Venus' looking-glass

Cannabinaceae
- *Cannabis sativa* - marijuana

Caprifoliaceae
- *Lonicera japonica* - Japanese honeysuckle

Caryophyllaceae
- *Arenaria serpyllifolia* - sandwort
- *Cerastium arvense* - field chickweed
- *C. vulgatum* - mouse-ear chickweed
- *Dianthus armeria* - deptford pink
- *Lychnis alba* - white campion
- *Paronychia canadensis* - whitlow-wort
- *Saponaria officinalis* - bouncing bet
- *Silene stellata* - starry campion
- *Stellaria aquatica* - chickweed
- *S. graminea* - common stitchwort
- *S. longifolia* - chickweed
- *S. media* - common chickweed

Ceratophyllaceae
- *Ceratophyllum demersum* - hornwort

Chenopodiaceae
- *Chenopodium album* - lamb's quarters
- *C. ambrosioides* - Mexican tea

Cistaceae
- *Helianthemum canadense* - frostweed

Convolvulaceae
- *Convolvulus sepium* - hedge bindweed
- *Cuscuta gronovii* - dodder

Crassulaceae
- *Penthorum sedoides* - ditch stonecrop
- *Sedum telephium* - orpine

Cruciferae
- *Alliaria officinalis* - garlic mustard
- *Arabidopsis thaliana* - mouse-ear cress
- *Arabis glabra* - rock cress
- *A. laevigata* - rock cress
- *A. lyrata* - rock cress
- *A. shortii* - rock cress

Cruciferae (cont.)
- *Barbarea vulgaris* - wintercress
- *Brassica campestris* - field mustard
- *B. kaber* - charlock
- *B. nigra* - black mustard
- *Capsella bursa-pastoris* - shepherd's purse
- *Cardamine bulbosa* - bitter cress
- *C. parviflora* - bitter cress
- *C. pensylvanica* - bitter cress
- *C. pratensis* - cuckoo-flower
- *Dentaria diphylla* - pepperwort
- *D. laciniata* - cut-leaf toothwort
- *Erysimum cheiranthoides* - wormseed mustard
- *Hesperis matronalis* - dame's rocket
- *Lepidium campestre* - field cress
- *L. virginicum* - pepper-grass
- *Nasturtium officinale* - water-cress
- *Rorippa sylvestris* - yellow cress
- *Sisymbrium altissimum* - tumble mustard
- *S. officinale* - hedge-mustard
- *Thlaspi arvense* - field pennycress

Cucurbitaceae
- *Echinocystis lobata* - wild cucumber
- *Sicyos angulatus* - bur-cucumber

Ericaceae
- *Chimaphila maculata* - spotted wintergreen
- *Epigaea repens* - trailing arbutus
- *Gaultheria procumbens* - wintergreen
- *Monotropa uniflora* - Indian pipe
- *Pyrola elliptica* - shinleaf

Euphorbiaceae
- *Acalypha rhomboidea* - three-seeded mercury
- *Euphorbia maculata* - spurge
- *E. preslii* - spurge

Fumariaceae
- *Corydalis flavula* - corydalis
- *Dicentra cucullaria* - Dutchman's breeches

Gentianaceae
- *Gentiana andrewsii* - bottle gentian

Geraniaceae
- *Geranium carolinianum* - Carolina cranesbill
- *G. maculatum* - wild geranium

Hydrophyllaceae
- *Hydrophyllum virginianum* - waterleaf

Hypericaceae
- *Hypericum gentianoides* - St. John's wort
- *H. mutilum* - St. John's wort
- *H. perforatum* - common St. John's wort
- *H. punctatum* - spotted St. John's wort
- *H. pyramidatum* - great St. John's wort
- *Triadenum virginicum* - marsh St. John's wort

Labiatae
- *Collinsonia canadensis* - horse-balm
- *Cunila origanoides* - dittany
- *Galeopsis tetrahit* - hemp-nettle
- *Glecoma hederacea* - gill-over-the-ground
- *Hedeoma pulegioides* - American pennyroyal
- *Lamium amplexicaule* - dead nettle
- *Leonurus cardiaca* - motherwort
- *Lycopus americanus* - water horehound
- *L. virginicus* - water horehound

Table F-3 (cont.)

Labiatae (cont.)
Monarda clinopodia - wild bergamot
M. fistulosa - wild bergamot
Nepeta cataria - catnip
Prunella vulgaris - self-heal
Pycnanthemum incanum - mountain-mint
P. virginianum - mountain-mint
Satureja vulgaris - wild basil
Scutellaria galericulata - skullcap
S. lateriflora - skullcap
Stachys hispida - rough hedge-nettle
Teucrium canadense - woodsage
Trichostema dichotomum - blue curls

Leguminosae
Amphicarpa bracteata - hog peanut
Apios americana - groundnut
Baptisia tinctoria - wild indigo
Cassia nictitans - wild sensitive plant
Coronilla varia - crown vetch
Desmodium canescens - tick-trefoil
D. dillenii - tick-trefoil
D. glutinosum - tick-trefoil
D. lineatum - tick-trefoil
D. nudiflorum - tick-trefoil
D. paniculatum - tick-trefoil
Lathyrus latifolius - everlasting pea
Lespedeza hirta - bush-clover
L. intermedia - bush-clover
L. virginica - bush-clover
Lotus corniculatus - bird's-foot trefoil
Medicago lupulina - black medick
Melilotus alba - white sweet clover
M. officinalis - yellow sweet clover
Trifolium agrarium - hop-clover
T. arvense - rabbit-foot clover
T. hybridum - alsike clover
T. pratense - red clover
T. repens - white clover
Vicia cracca - cow vetch

Lentibulariaceae
Utricularia vulgaris - bladderwort

Limnanthaceae
Floerkia proserpinacoides - false mermaid

Linaceae
Linum virginianum - wild flax

Lobeliaceae
Lobelia cardinalis - cardinal-flower
L. inflata - Indian-tobacco
L. siphilitica - great lobelia
L. spicata - lobelia

Lythraceae
Lythrum salicaria - purple loosestrife

Malvaceae
Abutilon theophrasti - velvet-leaf
Malva neglecta - cheeses

Onogracea
Circaea quadrisulcata - enchanter's nightshade
Epilobium coloratum - willow-herb
Gaura biennis - biennial gaura
Ludwigia alternifolia - seed-box
Oenothera biennis - evening-primrose
O. perennis - sundrops

Orobanchaceae
Orobanche uniflora - cancer-root

Oxalidaceae
Oxalis dillenii - yellow wood sorrel
O. stricta - yellow wood sorrel
O. violacea - violet wood sorrel

Papaveraceae
Chelidonium majus - celandine
Sanguinaria canadensis - bloodroot

Phytolaccaceae
Phytolacca americana - pokeweed

Plantaginaceae
Plantago aristata - buckhorn
P. lanceolata - English plantain
P. major - common plantain

Polemoniaceae
Phlox subulata - moss-pink
Polemonium reptans - Jacob's ladder

Polygalaceae
Polygala paucifolia - fringed polygala
P. sanguinea - cross-leaved milkwort
P. verticillata - whorled milkwort

Polygonaceae
Polygonum arifolium - halberd-leaved tearthumb
P. caespitosum - long-bristled smartweed
P. cilinode - bindweed
P. convolvulus - black bindweed
P. cuspidatum - Mexican bamboo
P. hydropiperoides - mild water pepper
P. natans - water smartweed
P. pensylvanicum - smartweed
P. persicaria - smartweed
P. punctatum - smartweed
P. sagittatum - arrow-leaved tearthumb
P. scandens - false buckwheat
P. virginianum - Virginia knotweed
Rumex acetosella - sheep sorrel
R. crispus - curly dock
R. obtusifolius - bitter dock
R. patientia - patience dock

Portulacaceae
Claytonia virginica - spring beauty

Primulaceae
Lysimachia ciliata - fringed loosestrife
L. quadrifolia - whorled loosestrife
L. terrestris - yellow loosestrife
L. vulgaris - garden loosestrife
Trientalis borealis - starflower

Ranunculaceae
Anemone canadensis - Canada anemone
A. quinquefolia - wood anemone
A. virginiana - thimbleweed
Anemonella thalictroides - rue anemone
Aquilegia canadensis - columbine
Cimicifuga racemosa - bugbane
Clematis virginiana - virgin's bower
Coptis trifolia - goldthread
Hepatica americana - hepatica
Ranunculus abortivus - kidneyleaf buttercup
R. acris - common buttercup

Table F-3 (cont.)

Ranunculaceae (cont.)
- *Ranunculus bulbosus* - buttercup
- *R. pensylvanicus* - buttercup
- *R. recurvatus* - buttercup
- *R. repens* - creeping buttercup
- *R. septentrionalis* - buttercup
- *Thalictrum dioicum* - early meadow rue
- *T. polygamum* - tall meadow rue

Rosaceae
- *Agrimonia gryposepala* - agrimony
- *Fragaria virginiana* - wild strawberry
- *Geum canadense* - avens
- *G. laciniatum* - avens
- *Gillenia trifoliata* - bowman's root
- *Potentilla canadensis* - dwarf cinquefoil
- *P. norvegica* - rough cinquefoil
- *P. recta* - rough-fruited cinquefoil
- *P. simplex* - cinquefoil

Rubiaceae
- *Galium aparine* - cleavers
- *G. asprellum* - bedstraw
- *G. boreale* - bedstraw
- *G. circaezans* - bedstraw
- *G. mollugo* - cleavers
- *G. palustre*- bedstraw
- *G. trifidum* - bedstraw
- *G. triflorum* - bedstraw
- *Houstonia caerulea* - bluets
- *Mitchella repens* - partridge-berry

Santalaceae
- *Comandra umbellata* - bastard toad-flax

Saxigragaceae
- *Chrysosplenum americanum* - golden saxifrage
- *Mitella diphylla* - miterwort
- *Saxifraga virginiensis* - early saxifrage

Scrophylariaceae
- *Aureolaria virginica* - downy false foxglove
- *Chelone glabra* - turtle-head
- *Gerardia tenuifolia* - slender gerardia
- *Linaria vulgaris* - butter-and-eggs
- *Lindernia dubia* - false pumpernel
- *Melampyrum lineare* - cow-wheat
- *Mimulus ringens* - monkey-flower
- *Pedicularis canadensis* - lousewort
- *Penstemon digitalis* - beard-tongue*
- *P. hirsutis* - hairy beard-tongue
- *Scrophylaria lanceolata* - figwort
- *Verbascum blattaria* - moth mullein
- *V. thapsus* - common mullein
- *Veronica americana* - American brooklime
- *V. arvensis* - speedwell
- *V. officinalis* - common speedwell
- *V. peregrina* - speedwell*
- *V. serpyllifolia* - speedwell
- *Veronicastrum virginicum* - culver's root

Solanaceae
- *Physalis heterophylla* - ground cherry
- *Solanum carolinense* - horse-nettle
- *S. dulcamara* - nightshade
- *S. nigrum* - black nightshade

Umbelliferae
- *Cicuta bulbifera* - water hemlock
- *C. maculata* - water hemlock
- *Cryptotaenia canadensis* - honewort
- *Daucus carota* - Queen Anne's lace
- *Osmorhiza claytoni* - sweet cicely
- *O. longistylis* - sweet cicely

Umbelliferae (cont.)
- *Pastinaca sativa* - wild parsnip
- *Sanicula marilandica* - black snakeroot
- *Zisea aptera* - golden alexanders
- *Z. aurea* - golden alexanders

Urticaceae
- *Boehmeria cylindrica* - false nettle
- *Parietaria pensylvanica* - pellitory
- *Pilea pumila* - clearweed
- *Urtica dioica* - stinging nettle

Valerianaceae*
- *Valerianella locusta* - corn-salad *

Verbenaceae
- *Verbena hastata* - blue vervain
- *V. urticifolia* - white vervain

Violaceae
- *Viola blanda* - sweet white violet
- *V. conspersa* - American dog-violet
- *V. cucullata* - blue marsh violet
- *V. eriocarpa* - smooth yellow violet
- *V. fimbriatula* - northern downy violet
- *V. palmata* - wood-violet
- *V. papilionacea* - common blue violet
- *V. pubescens* - downy yellow violet
- *V. sororia* - woolly blue violet
- *V. striata* - pale violet

MAGNOLIOPHYTA-MONOCOTYLEDONEAE

Alismaceae
- *Alisma subcordatum* - water-plantain
- *Sagittaria latifolia* - arrow-head

Amaryllidaceae
- *Hypoxis hirsuta* - stargrass

Araceae
- *Acorus calamus* - sweet flag
- *Arisaema dracontium* - green dragon
- *A. triphyllum* - jack-in-the-pulpit
- *Symplocarpus foetidus* - skunk cabbage

Commelinaceae
- *Commelina communis* - day-flower

Cyperaceae
- *Bulbostylis capillaris* - sedge
- *Carex annectens* - sedge
- *C. bromoides* - sedge
- *C. comosa* - sedge
- *C. crinita* - sedge
- *C. debilis* - sedge
- *C. intumescens* - sedge
- *C. lacustris* - sedge
- *C. laevivaginata* - sedge
- *C. laxiflora* - sedge
- *C. lurida* - sedge
- *C. muhlenbergii* - sedge
- *C. pensylvanica* - sedge
- *C. rosea* - sedge
- *C. scoparia* - sedge
- *C. stipata* - sedge
- *C. striata* - sedge
- *C. swannii* - sedge
- *C. tribuloides* - sedge
- *C. vulpinoidea* - sedge
- *Carex* sp. (unidentified) - sedge
- *Cyperus esculentus* - yellow nut-grass
- *C. filiculmis* - galingale
- *C. strigosus* - galingale

Table F-3 (cont.)

Cyperaceae (cont.)
Eleocharis acicularis - spike-rush
E. obtusa - spike-rush
E. tenuis - spike-rush
Scirpus americanus - three-square
S. atrovirens - bulrush
S. cyperinus - wool grass
S. validus - great bulrush

Dioscoreaceae
Dioscorea villosa - wild yam

Gramineae
Agropyron repens - quack grass
Agrostis hyemalis - bentgrass
A. perennans - autumn bent
A. stolonifera - bentgrass
Alopecurus aequalis - foxtail
Andropogon gerardi - big bluestem
A. scoparius - little bluestem
A. virginicus - broom sedge
Anthoxanthum odoratum - sweet vernal grass
Aristida dichotoma - three-awn
Bromus inermis - smooth brome
B. japonicus - Japanese chess
B. latiglumis - bromegrass
B. mollis - soft chess
B. tectorum - downy chess
Cinna arundinacea - stout woodreed
Dactylis glomerata - orchard grass
Danthonia spicata - poverty oatgrass
Deschampsia flexuosa - hairgrass
Digitaria ischaemum - crabgrass
D. sanguinalis - crabgrass
Echinochloa muricata - barnyard grass
Elymus canadensis - wild rye
E. riparius - wild rye
E. villosus - wild rye
E. virginicus - wild rye
Eragrostis capillaris - lovegrass
E. cilianensis - lovegrass
E. frankii - lovegrass
E. hypnoides - lovegrass
E. pilosa - lovegrass
E. spectabilis - purple lovegrass
Festuca elatior - meadow fescue
F. obtusa - nodding fescue
F. rubra - red fescue
Glyceria canadensis - rattlesnake mannagrass
G. striata - fowl mannagrass
Holcus lanatus - velvet grass
Hysterix patula - bottlebrush
Leersia oryzoides - rice cutgrass
L. virginica - white grass
Lolium perenne - perennial ryegrass
Muhlenbergia frondosa - wirestem muhly
M. schreberi - nimblewill
M. sobolifera - muhly
Panicum boscii - panic-grass
P. capillare - witch grass
P. clandestinum - panic-grass
P. commutatum - panic-grass
P. depauperatum - panic-grass
P. dichotomiflorum - panic-grass
P. dichotomum - panic-grass
P. lanuginosum - panic-grass
P. nitidum - panic-grass
P. virgatum - switchgrass
Phalaris arundinacea - reed canary grass
Phleum pratense - timothy
Poa annua - speargrass
P. compressa - Canada bluegrass
P. palustris - fowl bluegrass
P. pratensis - Kentucky bluegrass
P. trivialis - bluegrass
Setaria faberii - nodding foxtail
S. glauca - foxtail grass
S. italica - foxtail millet

Gramineae (cont.)
Sorghastrum nutans - Indian grass
Sphenopholis intermedia - wedgegrass
Triodia flava - purpletop

Hydrocharitaceae
Anacharis canadensis - water-weed

Iridaceae
Iris versicolor - blue flag
Sisyrinchium angustifolium - blue-eyed grass

Juncaceae
Juncus acuminatus - rush
J. effusus - rush
J. tenuis - path rush
Luzula campestris - wood rush

Lemnaceae
Lemna minor - duckweed
Wolffia punctata - water meal

Liliaceae
Allium canadense - wild garlic
A. vineale - field garlic
Asparagus officinalis - asparagus
Erythronium albidum - white trout-lily
E. americanum - trout-lily
Hemerocallus fulva - day-lily
Lilium canadense - Canada lily
L. superbum - turk's-cap
Maianthemum canadense - wild lily-of-the-valley
Medeola virginiana - Indian cucumber
Ornithogalum umbellatum - star of Bethlehem
Polygonatum biflorum - Soloman's seal
P. pubescens - Soloman's seal
Smilacina racemosa - false Soloman's seal
Trillium cernuum - nodding trillium
T. erectum - purple trillium
Uvularia perfoliata - perfoliate bellwort
U. sessilifolia - sessile-leaved bellwort
Veratrum veride - false hellebore

Najadaceae
Potamogeton spirillus - pondweed

Orchidaceae
Cypripedium acaule - pink lady's slipper
Epipactis helleborine - helleborine
Goodyera pubescens - rattlesnake plantain
Habenaria lacera - ragged fringed orchid
Spiranthes cernua - ladies' tresses
S. gracilis - ladies' tresses

Sparganiaceae
Sparganium eurycarpum - bur-reed

Typhaceae
Typha angustifolia - narrow-leaf cat-tail
T. latifolia - cat-tail

Table F-4

Months when plants were observed in flower or shedding spores on forest salt drift transects on the Susquehanna SES site, 1981. Names, abbreviations, and locations of transects are given in Table F-1.

Species	RF	GIP	TR419	TR438	QSH	CC
Acalypha virginica	0	0	Aug, Sep	Aug	Jul, Aug	0
Acer nigrum	0	Apr	0	0	0	0
A. saccharinum	Mar	Mar	0	0	Mar	0
Achillea millefolium	0	0	Jun-Aug	Jun-Sep	Jun-Sep	Jun-Aug
Agrimonia gryposepala	Aug	0	0	0	Jul	Jul, Aug
Agrostis perennans	Aug	0	0	0	0	Aug
A. stolonifera	0	Jun	Jun, Jul	Jul	Jun	0
Alliaria officinalis	May-Aug	May, Jun	0	0	0	0
Alnus rugosa	0	0	0	Mar	Mar	0
Ambrosia artemisiifolia	0	0	Aug, Sep	Aug, Sep	Aug, Sep	Aug, Sep
Amelanchier arborea	0	0	0	Apr	0	0
Amphicarpa bracteata	0	0	Aug	Aug	Aug	Aug
Anaphalis margaritacea	0	0	0	0	Aug	0
Andropogon gerardi	Aug	Aug, Sep	0	0	0	0
A. scoparius	0	0	0	0	Aug	Sep
Anemone quinquefolia	0	0	0	May	0	0
Anemonella thalictroides	0	0	0	0	Apr, May	0
Antennaria neglecta	0	0	May	May	Apr, May	0
A. plantaginifolia	0	0	May	May	Apr, May	0
Anthemis cotula	0	0	Jul, Aug	Jun	0	0
Anthoxanthum odoratum	0	0		May	May, Jun	May, Jun
Apocynum androsaemifolium	0	0	0	0	Jun	0
A. cannabinum	0	0	Jun, Jul	Jul	0	0
Aquilegia canadensis	0	0	0	0	0	Apr, May
Arabidopsis thaliana	0	0	May	Apr, May	Apr, May	0
Arabis glabra	0	0	0	0	May	0
A. laevigata	0	0	0	0	May	May
A. lyrata	May	0	0	0	0	Apr-Jun
A. shortii	May	0	0	0	0	0
Aralia nudicaulis	0	0	0	0	0	May
Arctium minus	Jul	0	Aug	0	0	Aug
Arenaria serpyllifolia	0	0	0	May, Jun	0	0
Arisaema triphyllum	May	May	Apr, May	0	0	0
Aronia melanocarpa	0	0	0	May	0	0
Asclepias incarnata	0	Jun, Jul	0	0	0	0
A. syriaca	0	0	Jun, Jul	Jun	0	0
A. tuberosa	0	0	Jul	0	0	0
Asplenium platyneuron	Aug	0	Jun, Aug	0	Jun-Aug	Jun-Aug
Aster cordifolius	Sep, Oct	Sep	Sep, Oct	0	Sep, Oct	0
A. divaricatus	Aug-Oct	Aug	0	0	Aug-Oct	Aug, Sep
A. laevis	0	0	0	0	0	Sep, Oct
A. lateriflorus	Sep	Sep	Aug-Oct	Sep	Jul-Oct	Sep
A. novae-angliae	0	0	0	0	Aug-Oct	0
A. patens	0	0	0	0	Aug, Sep	0
A. paternus	0	0	0	0	Jul	0
A. pilosus	Oct	0	Sep, Oct	Sep, Oct	Aug-Oct	Sep, Oct
A. prenanthoides	Aug	0	0	0	0	0
A. puniceus	0	0	0	Aug, Sep	0	0
A. simplex	Sep	0	Sep, Oct	Sep, Oct	Sep	0
A. umbellatus	0	Aug	0	0	0	0
A. undulatus	0	0	0	0	0	Sep, Oct
Athyrium filix-femina	0	Jun, Jul	Jun, Jul	Jul	Jun, Jul	0
Aureolaria virginica	0	0	0	0	Jul	Jul
Baptisia tinctoria	0	0	0	0	Jun, Jul	0
Barbarea vulgaris	May	May	Apr, May	Apr, May	Apr, May	May
Berberis thunbergii	0	0	0	0	Apr	0
Betula lenta	0	0	May	May	Apr, May	May
B. populifolia	0	0	0	May	Apr	0
Bidens frondosa	Aug	0	Aug, Sep	0	0	0
Boehmeria cylindrica	Jul, Aug	Jul, Aug	0	0	0	0
Botrychium dissectum	0	0	0	0	Sep	0
Brassica campestris	0	0	0	May-Jul, Sep	0	0
B. kaber	0	0	May-Aug	0	0	0
B. nigra	Aug	0	0	0	0	0
Bromus inermis	0	0	Jun	Jun	0	0
B. japonicus	0	0	0	Jun	0	0
B. latiglumis	0	Aug	0	0	Aug	0
Cardamine parviflora	0	0	0	0	0	May, Jun
Carex cephalophora	0	0	0	0	Apr	0
Carex sp.	May	May	May	0	Apr, May	May

Table F-4 (cont.)

Species	RF	GIF	TR419	TR438	QSH	CC
Carpinus caroliniana	0	0	0	0	Apr	0
Carya cordiformis	May	0	0	0	0	0
C. glabra	0	0	0	0	0	May
C. tomentosa	0	0	May	0	0	0
Cassia nictitans	0	0	0	Aug, Sep	0	0
Catalpa bignonioides	Jun	Jun	Jun	0	0	0
Caulophyllum thalictroides	0	Apr, May	0	0	0	0
Ceanothus americanus	0	0	0	0	Jun	Jun, Jul
Celtis occidentalis	0	Apr	0	0	0	0
Centaurea maculosa	0	0	0	Aug	Jul	0
Cerastium arvense	0	0	0	Sep	0	Apr, May
C. vulgatum	0	0	May	May, Aug	May	May
Chelidonium majus	May	May, Aug	May-Aug	0	0	0
Chenopodium album	0	0	0	Aug	0	0
C. ambrosioides	0	0	0	0	0	Jul
Chimaphila maculata	0	0	0	0	0	Jul
Chrysanthemum leucanthemum	0	0	Jun-Aug	Jun-Oct	May-Aug	Jul
Cicuta maculata	0	0	0	Jul	0	0
Cimicifuga racemosa	0	0	0	0	Aug	0
Cinna arundinacea	0	Aug	0	0	Aug	0
Circaea quadrisulcata	Jun, Jul	Jun, Jul	Jul	0	Jun, Jul	Jun-Aug
Cirsium pumilum	0	0	0	0	Aug	0
C. vulgare	Aug-Oct	0	0	Sep	0	0
Claytonia virginica	Apr	Apr, May	0	0	0	0
Clematis virginiana	0	Aug	0	0	Jul	0
Collinsonia canadensis	Aug	0	0	Aug	0	0
Comandra umbellata	0	0	0	0	May	May
Commelina communis	Aug	Aug	Jun-Aug	Jul, Aug	Jun-Sep	0
Convolvulus sepium	0	0	Jul	Aug	0	0
Conyza canadensis	0	0	Aug	Aug	Aug	Aug
Cornus amomum	0	0	0	Jun	0	0
C. florida	0	0	May	May	May	May
C. racemosa	0	0	0	Jun	0	0
Coronilla varia	0	0	Jun-Oct	Jun-Oct	Jun	0
Corylus americana	0	0	Mar	Mar	0	0
Crataegus sp.	0	0	May	0	May	May
Cryptotaenia canadensis	0	0	Jun, Jul	0	0	0
Cunila origanoides	0	0	0	0	Aug, Sep	Aug
Cyperus strigosus	0	0	0	Aug	Jul, Aug	0
Cyperpedium acaule	0	0	0	0	0	May
Cystopteris fragilis	0	0	0	0	Jun	0
C. protrusa	0	Jun	0	0	0	0
Dactylis glomerata	Jun, Jul	0	Jun, Jul	Jul	May	0
Danthonia spicata	0	0	Jun	0	Jun	Jun
Daucus carota	Jul, Aug	Jul	Jul, Aug	Jun-Oct	Jul, Aug	Jul-Oct
Dennstaedtia punctilobula	0	0	Jul	Jul	Jun-Aug	Jun, Jul
Dentaria laciniata	Apr	Apr	0	0	0	0
Deschampsia flexuosa	0	0	0	0	Jun	Jun
Desmodium cillenii	Aug	0	Aug	Aug	Aug	0
D. nudiflorum	0	0	Jul	0	Jul	Jul, Aug
D. paniculatum	0	0	0	0	Aug	Aug
Dianthus armeria	0	0	Jun	Jun-Aug	Jun-Aug	Jun
Dicentra cucullaria	Apr	Apr	0	0	0	0
Digitaria sanguinalis	0	0	Aug	Aug, Sep	Aug	0
Dioscorea villosa	Jun	0	0	0	0	0
Dryopteris intermedia	0	0	Jun	0	0	0
D. marginalis	0	0	Jun, Jul	0	Jun, Aug	Jun, Jul
D. spinulosa	0	0	Jun	0	0	0
Echinochloa muricata	Aug	0	Aug	Aug	0	0
Echinocystis lobata	Aug	0	0	0	0	0
Elymus canadensis	0	0	0	0	Aug	0
E. riparius	Jun	0	0	0	0	0
E. villosus	Jul	Jul	0	0	0	0
E. virginicus	Jul	Jul	0	0	Jul	0
Epigaea repens	0	0	0	0	Apr	Apr
Epilobium coloratum	Aug	Aug	0	Aug	Aug	0
Equisetum arvense	0	0	0	Apr, May	0	0
Eragrostis capillaris	0	0	0	0	Aug	0
E. cilianensis	0	0	0	Sep	0	0
E. frankii	0	Jul	0	0	0	0

Table F-4 (cont.)

Species	RF	GIF	TR419	TR438	QSH	CC
Eragrostis hypnoides	0	Jul	0	0	0	0
E. pilosa	0	0	0	Sep	0	0
E. spectabilis	0	0	0	Aug	Jul, Aug	0
Erechtites hieracifolia	Sep	Aug	Sep	Sep	Aug	Sep
Erigeron annuus	Jun-Aug	Jun-Sep	Jun-Aug	May-Aug	May-Aug	Jun-Aug
Erysimum cheiranthoides	Jun	Jun-Aug	Jun, Jul	Jun, Aug	0	0
Erythronium albidum	Apr	0	0	0	0	0
E. americanum	Apr	Apr	0	0	0	0
Eupatorium fistulosum	0	0	0	Aug, Sep	0	0
E. maculatum	Aug	Aug	0	Sep	0	0
E. perfoliatum	Aug	0	0	Aug, Sep	Aug	0
E. rugosum	Jul-Oct	Jul-Oct	Aug-Oct	Sep	Jul-Sep	Sep, Oct
Euphorbia maculata	0	0	0	Aug	0	0
E. preslii	0	0	Aug	Sep	Aug	0
Festuca obtusa	0	Jun	0	0	0	0
Floerkia proserpinacoides	May	May	0	0	0	0
Fragaria virginiana	0	0	May	Apr, May	Apr, May	May
Galinsoga ciliata	0	0	Jun-Sep	Sep, Oct	Jul, Aug, Oct	Aug
Galium aparine	May	May	May, Jul	May	May	May
G. asprellum	0	Jul	0	0	0	0
G. circaezans	0	0	Aug	0	Aug	Aug
G. palustre	0	Jun	0	0	0	0
G. triflorum	Aug	0	0	0	0	0
Gaultheria procumbens	0	0	0	0	0	Jul
Gaura biennis	Aug	Aug	0	0	0	0
Gaylussacia baccata	0	0	May	0	May	May
Geranium maculatum	0	0	0	0	May	May
Gerardia tenuifolia	0	0	0	0	Aug	0
Geum canadense	Jun, Jul	Jun-Aug	Jun, Jul	0	Jun-Aug	Jun, Jul
Glechoma hederacea	May	May	0	0	0	0
Gnaphalium obtusifolium	0	0	0	Aug	Aug, Sep	0
Goodyera pubescens	0	0	0	0	Jul	Aug
Hackelia virginiana	Aug	Jul, Aug	0	0	0	0
Hedeoma pulegioides	0	0	Aug	0	0	0
Helenium autumnale	Aug	Aug-Oct	Aug	0	0	0
Helianthus decapetalus	0	Jul-Sep	0	0	0	0
H. divaricatus	0	0	0	0	Jul, Aug	Jul, Aug
H. tuberosus	0	Sep	0	0	0	0
Heliopsis helianthoides	Aug	0	0	0	0	0
Hemerocallis fulva	0	0	Jun, Jul	Jun, Jul	Jun	0
Hepatica americana	0	0	0	0	0	Apr
Hesperis matronalis	May, Jun	May, Jun	May	May	0	0
Hieracium paniculatum	0	0	Aug	0	Aug	0
H. pilosella	0	0	0	May	May	0
H. pratense	0	0	Jun	May, Jun	May, Jun	May, Sep
H. venosum	0	0	Jun	0	May	Aug
Houstonia caerulea	0	0	0	0	Apr, May	Apr, May
Hypericum gentianoides	0	0	0	0	Jul	0
H. perforatum	Jul	Aug	Jun-Aug	Jun, Jul	Jun, Jul	Jun, Jul
H. punctatum	Jul	Jul	Jun, Jul	Jul	Jul	0
Hypoxis hirsuta	0	0	0	0	0	May, Aug
Hystrix patula	0	0	0	0	0	Jun, Jul
Ilex verticillata	0	0	0	Jun	0	0
Impatiens biflora	Jun-Aug	Jun-Aug	Jun-Sep	Jul-Sep	0	0
I. pallida	Jun-Sep	Jul, Aug	Aug	0	Aug	0
Juglans nigra	0	May	May	0	0	0
Juncus tenuis	0	0	Jun	Jun	Jun	Jun
Kalmia latifolia	0	0	0	0	0	Jun
Krigia virginica	0	0	0	0	May, Jun	0
Lactuca canadensis	Aug	0	Aug	Aug	Jun	Jul, Aug
Lamium amplexicaule	0	0	May	0	0	0
Leersia virginica	Jul-Sep	Jul, Aug	Jul, Aug	0	Jul, Aug	0
Leonurus cardiaca	0	0	Jun, Jul	0	0	0
Lepidium campestre	0	0	May	May	May	0
Lespedeza hirta	0	0	0	0	Aug	0
L. intermedia	0	0	0	0	0	Aug
L. virginica	0	0	0	0	Aug	0
Lilium canadense	0	Jun	0	0	0	0
L. superbum	Jul	Jul	0	0	0	0
Linaria vulgaris	0	Aug	Jul-Sep	Jun, Aug	Jun-Oct	0
Lindera benzoin	Apr	Apr	Apr	Apr	Apr	0

Table F-4 (cont.)

Species	RF	GIF	TR419	TR438	QSH	CC
Liriodendron tulipifera	0	0	0	0	May	0
Lobelia cardinalis	0	Aug	0	0	0	0
L. inflata	0	0	0	Aug	Jul, Aug	Jul-Sep
Lolium perenne	0	0	0	Jun	0	0
Lotus corniculata	0	0	Jun, Jul	Jun	0	Aug
Luzula campestris	0	0	0	0	0	May
Lychnis alba	0	0	0	May, Jun	Jul	May
Lycopodium flabelliforme	0	0	0	Sep, Oct	0	Sep, Oct
L. obscurum	0	0	0	Oct	0	0
Lycopus americanus	0	0	0	Aug	0	0
L. virginicus	0	0	0	0	Jul, Aug	0
Lysimachia ciliata	Jul, Aug	Jul	0	0	0	0
L. quadrifolia	0	0	Jun	0	Jun	0
L. vulgaris	0	Jul	0	0	0	0
Lythrum salicaria	0	Aug	0	0	0	0
Maianthemum canadense	0	0	0	May	0	May
Matteuccia struthiopteris	0	Mar	0	0	0	0
Medicago lupulina	0	0	Jul	Jun	0	0
Melampyrum lineare	0	0	0	0	Jul	Jul, Aug
Melilotus alba	0	0	0	Jun-Aug	Jun-Aug	Aug
M. officinalis	0	0	Jun, Jul	Jun, Jul	0	0
Mertensia virginica	Apr, May	Apr, May	0	0	0	0
Mimulus ringens	0	Jul	0	Aug	0	0
Mollugo verticillata	0	Jun	0	0	0	0
Muhlenbergia frondosa	Aug	Aug	Aug	0	Aug	0
M. schreberi	0	0	0	Aug	0	0
M. sylvatica	0	0	0	0	Aug	0
Myosotis scorpioides	Jun	0	0	0	0	0
Myrica asplenifolia	0	0	0	0	Apr	0
Oenothera biennis	Aug	Jul, Aug	Aug	Aug, Sep	Aug	0
Onoclea sensibilis	0	0	0	Mar	0	0
Osmunda cinnamomea	0	0	0	May	0	0
Oxalis violacea	0	0	0	0	May	0
Oxalis sp.	Jun-Aug	Jun-Aug	May-Aug	May-Aug	May-Aug	Aug
Panicum capillare	0	0	0	Aug	Aug	0
P. clandestinum	Jun	Jun	0	0	Jun	0
P. dichotomiflorum	0	0	0	0	Aug	Aug
P. lanuginosum	0	0	0	0	Jun	0
P. virgatum	0	0	Aug	0	0	0
Panicum sp.	0	0	Jun	May, Jun	0	0
Penstemon digitalis	0	0	0	Jun	0	0
P. hirsutus	0	0	0	0	May-Jul	0
Phalaris arundinacea	Jun	0	Jun	Jun	0	0
Phleum pratense	0	0	Jun, Jul	Jun, Jul	Jun	Jul
Phlox subulata	0	0	0	0	0	Apr, May
Phytolacca americana	Jul-Sep	Jul	Jul, Aug	Jul, Aug	Jul, Aug	Jul
Pilea pumila	Aug	Aug	0	Aug	Aug	0
Plantago lanceolata	0	0	Jul, Aug	May, Jul, Aug	May, Aug	Jul
P. major	0	0	0	0	Aug	Aug
Poa annua	0	0	0	0	May	May
P. compressa	0	0	Jun	Jun	May, Jun	May, Jun
P. palustris	0	Jun	0	0	0	0
P. pratensis	May	May	May, Jun	May, Jun	May	May
Podophyllum peltatum	May	May	May	May	May	0
Polemonium reptans	0	May	0	0	0	0
Polygala paucifolia	0	0	0	0	0	May
P. sanguinea	0	0	0	0	Jul-Sep	0
P. verticillata	0	0	0	Aug	Jul, Aug	0
Polygonatum biflorum	0	0	0	0	May	May
Polygonum cilinode	Jun, Jul	Jun. Jul	0	0	0	0
P. convolvulus	0	0	Aug	0	0	0
P. cuspidatum	Aug	Aug	0	0	0	0
P. pensylvanicum	Aug, Sep	0	Aug	Aug, Sep	Jul, Aug	Sep
P. persicaria	Jul	0	Jun-Oct	Aug, Oct	Jun-Sep	Jul, Aug
P. punctatum	Aug-Oct	Sep	0	0	0	0
P. sagittatum	Sep	0	0	Aug, Sep	Aug	0
P. scandens	Aug, Sep	Aug	0	Aug	Aug	Aug
P. virginianum	Jul, Aug	Jul, Aug	Aug	0	Jul, Aug	Jul, Aug
Polypodium virginianum	0	0	0	0	0	Aug
Polystichum acrostichoides	0	0	Jun	Jun	0	0

Table F-4 (cont.)

Species	RF	GIF	TR419	TR438	QSH	CC
Potentilla norvegica	Aug	Jul, Aug	0	Jun, Aug	Jun-Aug	0
P. recta	0	0	Jun	Jun, Aug, Sep	Jun	0
P. simplex	0	0	May	May	Apr, May	May
Prenanthes alba	0	0	0	0	Aug	Sep
Prunella vulgaris	Aug	0	Aug	Jul, Aug	Jul-Oct	0
Prunus avium	0	0	0	0	Apr	0
P. pensylvanica	0	0	0	May	Apr	Apr
P. serotina	0	0	0	0	May	0
P. virginiana	0	0	0	May	0	May
Pycnanthemum incanum	0	0	0	0	Jul, Aug	Jul, Aug
Pyrola elliptica	0	0	0	0	0	Jun
Pyrus communis	0	0	0	0	Apr	0
P. malus	0	May	0	May	Apr	May
Quercus alba	0	0	May	May	0	May
Q. bicolor	0	0	0	May	0	0
Q. palustris	0	0	0	May	0	0
Q. prinus	0	0	0	0	0	May
Q. velutina	0	0	May	0	0	May
Ranunculus abortivus	May	May	Apr, May	May	Apr, May	0
R. acris	0	0	0	May-Jul	May, Jun	0
R. recurvatus	0	0	0	0	May	0
Rhododendron nudiflorum	0	0	0	May	0	May
Rhus glabra	0	0	0	0	Jun	0
R. radicans	0	Jun	0	0	0	0
R. typhina	0	0	0	Jun	0	0
Ribes rotundifolia	0	0	0	0	May	0
Rorippa sylvestris	0	Jun	0	0	0	0
Rosa virginiana	0	0	0	Jun	Jun, Jul	0
Rubus allegheniensis	0	0	0	May	May	May
R. flagellaris	0	0	May	May, Jun	May	May
R. hispidus	0	0	0	Jun	0	0
R. occidentalis	0	0	May	May	May	May
Rudbeckia hirta	0	Jul	Jun-Aug	Jun-Oct	Jun-Aug	0
R. laciniata	Aug	0	0	0	0	0
Rumex acetosella	0	0	May	May, Jun	May, Jun	May
R. crispus	Jun	0	0	0	Jun	0
R. obtusifolius	Jun	May, Jun	0	0	0	0
Sambucus canadensis	0	0	0	Jun, Jul	Jun	0
S. pubens	0	0	0	0	0	Apr
Saponaria officinalis	0	0	0	Jul-Sep	Jul, Aug	0
Sassafras albidum	0	0	Apr, May	Apr, May	0	0
Satureja vulgaris	0	0	Jul	0	Jun	Jul-Oct
Saxifraga virginiensis	0	0	Apr, May	0	Apr, May	Apr, May
Scrophularia lanceolata	Jul, Aug	Jul	Jun	Jun	May, Jun	Jun
Senecio obovatus	0	0	0	0	0	May
Setaria faberii	0	0	Aug	0	0	0
S. glauca	Aug	0	Aug	Aug	Jul, Aug	Aug
Sicyos angulatus	Aug	Aug	0	0	0	0
Silene stellata	0	0	0	0	Jul, Aug	Jul
Sisyrinchium angustifolium	0	0	0	0	May	0
Smilacina racemosa	0	0	May	May	0	May
Solanum carolinense	0	Jun-Aug	0	Jun, Aug, Sep	Jun, Jul	0
S. dulcamara	0	Jul	Jun-Aug	Aug	0	0
S. nigrum	Aug	0	0	Jul	Aug	0
Solidago arguta	0	0	0	0	0	Jul-Sep
S. bicolor	0	0	Sep	0	Aug-Oct	Sep
S. caesia	0	0	Sep, Oct	0	Aug-Oct	Sep, Oct
S. canadensis	Oct	Aug, Sep	Aug, Sep	Aug-Oct	Aug	0
S. flexicaulis	Aug-Oct	Sep	0	0	0	0
S. gigantea	Jul, Aug	Jul-Sep	Aug	Aug, Sep	Jul, Aug	0
S. graminifolia	Aug	0	Aug, Sep	Aug, Sep	Jul-Sep	Aug
S. juncea	0	0	Jul, Aug	Jul, Aug	Jun-Aug	Aug
S. nemoralis	0	0	0	Aug-Oct	Aug-Oct	Sep
S. rugosa	Sep	Sep	Sep, Oct	Aug-Oct	Aug-Oct	Aug-Oct
Sphenopholis intermedia	Jun	0	0	0	May	0
Spiraea latifolia	0	Jun	0	Jul	0	0
S. tomentosa	0	0	0	0	0	Jul
Spiranthes vernalis	0	0	Sep	0	0	0
Staphylea trifolia	May	0	0	0	0	0

Table F-4 (cont.)

Species	RF	GIF	TR419	TR438	QSH	CC
Stellaria media	0	0	May	May	0	0
Symplocarpus foetidus	0	0	0	Mar	0	0
Taraxacum officinale	Apr, May	0	Apr-Jul, Sep	Apr-Jun, Aug, Sep	Apr, May	Apr, May, Aug
Teucrium canadense	Jul	Jul, Aug	Jul, Aug	Jul	Jul	0
Thalictrum polygamum	Jul	Jul	0	Jul	0	0
Thelypteris noveboracensis	0	0	0	0	Jul	0
Trifolium agrarium	0	0	Jun	Jun-Aug	Jun	Jun, Jul
T. arvense	0	0	0	Jul, Aug	0	0
T. hybridum	0	0	0	Jun, Aug, Sep	0	0
T. pratense	0	0	Jul, Aug, Oct	Jun-Oct	0	Jun, Aug, Oct
T. repens	0	0	Jun, Jul	May-Aug	May, Jun	Jun, Jul
Trillium erectum	Apr	Apr	0	0	0	0
Tri.danum perfoliata	0	0	Jun	Jun	Jun	Jun
Triodia flava	0	0	Aug	Aug	Aug	0
Tussilago farfara	0	0	Mar	May	0	0
Urtica dioica	Aug	Aug, Sep	Sep	0	Jul	0
Uvularia perfoliata	0	0	0	0	May	May
Vaccinium corymbosum	0	0	0	May	0	0
V. stamineum	0	0	May	0	May	May
V. vacillans	0	0	May	0	May	May
Verbascum thapsis	Aug	0	Jul	Jul	Jun-Aug	Jul
Verbena hastata	Jul, Aug	Jul, Aug	0	Jul	Jul	0
V. urticifolia	Jul, Aug	Jun, Jul	Jul, Aug	Aug	Jul, Aug	Jul
Vernonia noveboracensis	0	0	0	Aug	0	0
Veronica arvensis	0	0	0	May	0	May
V. officinalis	0	0		0	May	May, Jun
V. serpyllifolia	0	May	May	0	May	0
Viburnum acerifolium	0	0	0	0	May	May
V. dentatum	0	0	0	0	0	May
Vicia cracca	0	0	0	Jun	0	0
Vinca minor	0	0	Apr, May	0	0	0
Viola blanda	0	0	0	May	0	Apr
V. eriocarpa	0	0	0	0	May	0
V. fimbriatula	0	0	0	May	Apr, May	0
V. palmata	0	0	0	0	0	May
V. papilionacea	Apr, May	Apr, May	Apr, May	Apr, May	Apr, May	Apr, May
V. pubescens	Apr, May	May	0	0	0	0
V. sororia	0	May	Apr, May	0	0	0
V. striata	May	0	0	0	0	0
Vitis aestivalis	0	0	Jun	0	0	0
Woodsia obtusa	0	0	0	0	Jun	0
Zizea aurea	May	May	0	0	0	0

Table F-5

Months when plants were observed in flower or shedding spores on abandoned field salt drift transects on the Susquehanna SES site, 1981. Names, abbreviations, and locations of transects are given in Table F-1.

Species	NF	SwF	TCF
Achillea millefolium	Jul	Jun-Aug	Jun-Sep
Agropyron repens	0	0	Jun
Agrostis perennans	Aug	Aug	0
A. stolonifera	Jul	Jun-Aug	Jun, Jul
Alliaria officinalis	May	0	0
Alnus rugosa	0	Mar	0
Ambrosia artemisiifolia	Aug	Aug	Aug, Sep
Amphicarpa bracteata	Aug	0	0
Anaphalis margaritacea	0	Aug	0
Andropogon gerardi	Jul, Aug	0	0
A. scoparius	Aug	0	Aug, Sep
A. virginicus	0	0	Sep
Antennaria neglecta	0	May	May
Anthoxanthum odoratum	0	May, Jun	May, Jun
Apocynum cannabinum	Jun, Jul	0	Jun, Jul
Arabidopsis thaliana	0	May	0
Aronia melanocarpa	0	0	May
Asclepias tuberosa	0	0	Jun, Jul
Asplenium platyneuron	0	0	Jun, Jul
Aster cordifolius	0	Sep	0
A. dumosus	0	Oct	0
A. lateriflorus	Sep	Sep	0
A. novae-angliae	Sep	Sep, Oct	0
A. pilosus	Sep, Oct	Sep, Oct	Sep, Oct
A. simplex	Sep, Oct	Aug, Sep	Aug-Oct
A. umbellatus	0	Aug, Sep	0
Athyrium filix-femina	0	Jul	0
Barbarea vulgaris	May	Apr, May	Apr, May
Berberis thunbergii	0	May	0
Betula populifolia	0	Apr	0
Boehmeria cylindrica	Jul, Aug	0	0
Botrychium dissectum	0	Sep	Sep, Oct
Bromus japonicus	0	0	Jun
Carex sp.	May	0	May
Centaurea maculosa	0	Aug	0
Cerastium vulgatum	0	May	May
Chenopodium album	0	0	Aug
Chrysanthemum leucanthemum	Jun, Jul	Jun-Aug	Jun-Aug
Cicuta maculata	0	Jul	0
Cirsium arvense	Jul	0	0
C. pumilum	0	0	Jul-Sep
C. vulgare	Aug	Aug	0
Convolvulus sepium	Aug	Aug	Jun-Aug
Conyza canadensis	0	0	Sep
Cornus amomum	Jun	Jun, Sep	Jun
C. florida	0	May	May
Cyperus strigosus	0	0	Aug
Dactylis glomerata	0	0	May
Danthonia spicata	0	0	Jun
Daucus carota	Jul, Aug	Jul-Oct	Jul-Sep
Desmodium dillenii	Jul, Aug	Jul, Aug	Aug
D. paniculatum	0	0	Aug
Dianthus armeria	Jun	Jun-Aug	Jun-Aug
Digitaria sanguinalis	0	Aug	Jul-Sep
Echinochloa muricata	0	Aug	Jul, Aug
Elaeagnus commutata	0	May	0
Epilobium coloratum	Aug	0	0
Eragrostis cilianensis	0	0	Jul
E. spectabilis	0	0	Jul-Sep
Erigeron annuus	Jun, Jul	Jun-Aug	Jun-Aug
Eupatorium fistulosum	Aug	Jul, Aug	0
E. maculatum	Jul-Sep	Aug	0
E. perfoliatum	Aug, Sep	Aug	0
E. rugosum	Sep	0	0
Festuca obtusa	Jun	0	0
Floerkia proserpinacoides	May	0	0
Fragaria virginiana	May	Apr, May	Apr, May

Table F-5 (cont.)

Species	NF	SwF	TCF
Galium palustre	Jun, Jul	0	0
Gaura biennis	Jul, Aug	0	0
Gentiana andrewsii	0	Sep	0
Gerardia tenuifolia	Aug	0	0
Geum canadense	Jun	0	0
Gnaphalium obtusifolium	0	Aug	Aug, Sep
Habenaria lacera	0	0	Jun
Helenium autumnale	Aug, Sep	0	0
Helianthus decapetalus	Jul, Aug	Jul, Aug	0
Hesperis matronalis	May, Jun	0	0
Hieracium pratense	0	0	May, Jun, Aug
Houstonia caerulea	0	Apr, May	0
Hypericum perforatum	Jun	Jun-Aug	Jun, Jul
H. punctatum	Jun, Jul	Jul, Aug	Jul
H. pyramidatum	Jul	0	0
Hypoxis hirsuta	0	May	0
Impatiens biflora	Aug	0	0
Juncus tenuis	Jun	0	Jun
Krigia virginica	0	0	May
Leersia virginica	Sep	0	0
Lepidium campestre	0	May	0
Linaria vulgaris	0	Aug	Jul-Sep
Lobelia inflata	Aug	Jul, Aug	Aug
L. siphilitica	Aug, Sep	Aug	0
L. spicata	0	Jun	0
Lolium perenne	0	0	Jun
Lonicera tatarica	0	0	May
Luzula campestris	0	May	0
Lychnis alba	0	0	Jul
Lycopodium flabelliforme	0	0	Sep, Oct
L. obscurum	0	0	Sep
L. tristachyum	0	0	Aug
Lycopus americanus	Jul, Aug	0	Aug
Lysimachia ciliata	Jul	0	0
L. quadrifolia	0	0	Jun
L. vulgaris	Jul	0	0
Melilotus alba	0	0	Jul, Aug
M. officinalis	0	Jun-Aug	0
Mollugo verticillata	0	Aug	0
Monarda fistulosa	Jul	0	0
Muhlenbergia frondosa	Aug	0	0
Oenothera biennis	Jun-Sep	Jul, Aug	Jul-Sep
O. perennis	Jun	Jun, Jul	0
Onoclea sensibilis	0	Mar	0
Oxalis sp.	Jun-Aug	Jun-Sep	May-Sep
Panicum capillare	0	Aug	Aug
P. clandestinum	Jun	0	0
P. depauperatum	0	0	Jun
P. lanuginosum	0	Jun	Jun
P. virgatum	Jul, Aug	0	Jul
Phleum pratense	0	Jun, Jul	Jun, Jul
Phytolacca americana	0	Jul	0
Plantago lanceolata	0	May-Aug	May, Jun, Aug
Poa compressa	0	0	Jun
P. pratensis	May, Jun	May, Jun	May, Jun
Polygala verticillata	0	Aug	Jul, Aug
Polygonum cilinode	Jun	0	0
P. pensylvanicum	Aug	Aug	Jul-Sep
P. sagittatum	Aug, Sep	0	0
P. virginianum	Aug	0	0
Potentilla norvegica	Jul, Aug	Jun-Aug	Jul
P. recta	Jun	0	Jun
P. simplex	May	May	May
Prunella vulgaris	Jul, Aug	Jun-Aug	Jul, Aug
Prunus serotina	0	May	May
Pycnanthemum virginianum	0	Jul	0
Pyrus malus	0	Apr, May	0

Table F-5 (cont.)

Species	NF	SwF	TCF
Ranunculus acris	0	Jun	0
Rhus typhina	0	0	Jun
Rosa virginiana	0	0	Jun
Rubus flagellaris	0	May	May
Rudbeckia hirta	Jun, Jul	Jun-Aug	Jun-Sep
Rumex acetosella	0	May, Jun	May, Jun
Sassafras albidum	0	0	May
Setaria faberii	Aug	Jul, Aug	Jul, Aug
Sisyrinchium angustifolium	Jun	0	0
Solanum carolinense	Jul	Jun	Jul, Aug
Solidago canadensis	Aug-Oct	Aug-Oct	Sep
S. gigantea	Jul-Oct	Aug	0
S. graminifolia	Aug, Sep	Jul-Sep	Aug-Oct
S. juncea	Jul, Aug	Jul, Aug	Jun-Sep
S. nemoralis	0	Aug, Sep	Aug-Oct
S. rugosa	Sep, Oct	Sep, Oct	Sep
Spiraea latifolia	Jun-Aug	Jul	Jun-Aug
S. tomentosa	Jul, Aug	Jul	0
Spiranthes gracilis	0	0	Aug
Stellaria aquatica	Jun	0	0
S. longifolia	0	Jun, Jul	0
Syringa vulgaris	0	0	May
Taraxacum officinale	Apr, May	Apr-Jun, Aug	Apr, May
Teucrium canadense	Jul	Jul	0
Thalictrum polygamum	Jul	0	0
Trichostema dichotomum	0	0	Aug
Trifolium agrarium	Jun	Jun-Aug	Jun, Jul
T. arvense	0	Aug	Aug
T. hybridum	0	Jun-Aug	Jun-Aug
T. pratense	0	Jun-Sep	Jun-Sep
T. repens	0	Jun, Aug	May, Jun
Triodanus perfoliata	0	0	Jun
Triodia flava	0	Aug	Aug
Vaccinium vacillans	0	0	May
Valerianella locusta	0	May	0
Verbascum thapsis	0	0	Jul, Aug
Verbena hastata	Jul, Aug	0	0
Veronica arvensis	0	May	0
V. officinalis	0	0	May
V. serpyllifolia	0	May	0
Viola papilionacea	May	Apr, May	Apr

Table F-6

Parasitic plant diseases observed on salt drift transects on the Susquehanna SES site, 1981. Names, abbreviations, and locations of transects are given in Table F-1. An * denotes diseases observed for the first time in 1981.

Host Species	Disease	Transect	Disease Frequency[a]	Disease Effect[a]
Acer nigrum	*Phyllosticta minima* leaf spot	GIF	2	1
A. rubrum	*P. minima* leaf spot	TR419, TR438, QSH, CC, SwF, TCF	3-5	1
A. rubrum	*Rhytisma acerinum** tar spot	TCF	5	1
A. saccharinum	*Phyllosticta minima* leaf spot	RF, GIF, QSH, NF	2-4	1
A. saccharinum	*Rhytisma acerinum** tar spot	RF	4	1
Ambrosia artemisiifolia	*Erysiphe cichoracearum* powdery mildew	TR419, TR438, CC, TCF	2-4	0
Aster cordifolius	*Coleosporium asterum* pine needle rust	QSH	2-4	1
A. divaricatus	*Rhytisma* sp.* tar spot	TR419	1	1
A. lateriflorus	*Coleosporium asterum* pine needle rust	QSH	2	1
A. novae-angliae	*C. asterum* pine needle rust	QSH	3	1
A. novae-angliae	*Erysiphe cichoracearum* powdery mildew	SwF	2	0
A. puniceus	*E. cichoracearum* powdery mildew	TR438	2	0
A. simplex	*Coleosporium asterum* pine needle rust	TR419, QSH	2-4	1
A. simplex	*Erysiphe cichoracearum* powdery mildew	TR438	2	1
Betula lenta	*Nectria galligena* nectria canker	CC	4	2
B. nigra	*Gloeosporium betularum* leaf spot	NF, SwF	2-3	1
Carya cordiformis	*Gnomonia caryi* leaf spot	RF, NF	1-3	1
Castanea dentata	*Endothia parasitica* chestnut blight	CC	3	5
Catalpa bignonioides	*Phyllosticta catalpae* leaf spot	GIF, TR419	1-2	1
Cornus amomum	*Septoria cornicola* leaf spot	TR438, NF, SwF, TCF	2-4	1
C. florida	*Elsinoe corni** leaf spot	QSH, CC, SwF	2-3	1-2
Erechtites hieraciifolia	*Erysiphe cichoracearum* powdery mildew	CC	2	0
Eupatorium fistulosum	*E. cichoracearum* powdery mildew	TR438	3	0
E. rugosum	*E. cichoracearum* powdery mildew	GIF, SwF	1	0-1
Fragaria virginiana	*Cylindrosporium* sp. leaf spot	TR438, CC, NF, TCF	2-4	1

Table F-6 (cont.)

Host Species	Disease	Transect	Disease Frequency[a]	Disease Effect[a]
Fraxinus americana	*Gloeosporium aridum* anthracnose	TR438, QSH, CC	2-4	1-2
Helenium autumnale	*Erysiphe cichoracearum* powdery mildew	RF, GIF	5	0
Impatiens sp.	*Puccinia recondita* rust	RF, GIF, TR419	1-3	1
Kalmia latifolia	*Phyllosticta kalmicola** leaf rust	CC	2	1
Lysimachia ciliaris	*Phyllosticta* sp. leaf spot	NF	3	1
Panicum lanuginosum	*Balansia strangulans* black ring	QSH	2	1
Parthenocissus quinquefolia	*Guignardia bidwellii* leaf spot	GIF, TR419, TR438, QSH, TCF	2-4	1
Platanus occidentalis	*Gnomonia platani* anthracnose	RF	3	2
Podophyllum peltatum	*Puccinia podophylli* rust	RF, GIF, TR419, QSH	2-5	1
Polygonum virginianum	*Erysiphe polygoni* powdery mildew	TR419	2	0
Populus tremuloides	*Venturia tremulae* leaf spot, dieback	TR419, QSH	2	2
Prunus virginiana	*Coccomyces lutescens* leaf spot	CC	3	1
Quercus velutina	*Microsphaera alni* powdery mildew	CC	1	0
Rubus allegheniensis	*Gymnoconia peckiana* rust	QSH	1	1
R. flagellaris	*G. peckiana* rust	TR438, QSH, TCF	1-2	1
R. occidentalis	*G. peckiana* rust	QSH	2	1
Salix sericea	*Melampsora bigelowii* rust	TR438	2	1
Sassafras albidum	*Actinopelte dryina* leaf spot	TR419	2-4	1
Solidago arguta	*Erysiphe cichoracearum* powdery mildew	CC	3-4	0
S. caesia	*Coleosporium asterum* pine needle rust	TR419, QSH, CC	2-4	1
S. caesia	*Erysiphe cichoracearum* powdery mildew	QSH, CC	1-4	0-1
S. canadensis	*Coleosporium asterum* pine needle rust	GIF, TR438, NF	2-4	1
S. canadensis	*Erysiphe cichoracearum* powdery mildew	RF, TR438, QSH, CC, SwF, TCF	2-4	0
S. flexicaulis	*Coleosporium asterum* pine needle rust	RF	4	1
S. flexicaulis	*Erysiphe cichoracearum* powdery mildew	RF	3	0

Table F-6 (cont.)

Host Species	Disease	Transect	Disease Frequency[a]	Disease Effect[a]
S. gigantea	*Coleosporium asterum* pine needle rust	RF, NF	2-4	1
S. gigantea	*Erysiphe cichoracearum* powdery mildew	RF, GIF, SwF	2-4	0
S. graminifolia	*Coleosporium delicatulum* pine needle rust	QSH, NF, SwF, TCF	1-4	1
S. graminifolia	*Placosphaera haydeni* tar spot	RF, TR419, QSH, CC, NF, SwF, TCF	2-3	1
S. juncea	*Coleosporium asterum* pine needle rust	TCF	3-5	1
S. rugosa	*C. asterum* pine needle rust	RF, TR419, TR438, QSH, SwF, TCF	2-4	1
S. rugosa	*Erysiphe cichoracearum* powdery mildew	QSH, CC, SwF	2-3	0
Trifolium pratense	*E. polygoni* powdery mildew	TR438, CC, SwF	1-3	0
Verbena urticifolia	*E. cichoracearum* powdery mildew	RF, GIF, QSH	2-5	0
Vernonia noveboracensis	*E. cichoracearum* powdery mildew	TR438	2	0
Vitis aestivalis	*Phyllosticta viticola* leaf spot	TR419	3	1
V. aestivalis	-- powdery mildew (unidentified)*	TR419	2	1
V. labrusca	*Phyllosticta viticola* leaf spot	TR419	4	1

[a]Frequency and effect codes are given on page 215.

Table F-7

Vegetation analysis for trees in the Council Cup Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
BETULA LENTA	SWEET BIRCH	0.70	24.1	200	33.6	54223	31.2	89.0
QUERCUS VELUTINA	BLACK OAK	0.40	13.8	90	15.1	23028	13.3	42.2
QUERCUS ALBA	WHITE OAK	0.20	6.9	25	4.2	29558	17.0	28.1
PINUS STROBUS	WHITE PINE	0.25	8.6	40	6.7	18465	10.6	26.0
PINUS VIRGINIANA	VIRGINIA PINE	0.15	5.2	50	8.4	18072	10.4	24.0
ACER RUBRUM	RED MAPLE	0.30	10.3	50	8.4	5667	3.3	22.0
QUERCUS BOREALIS	RED OAK	0.30	10.3	45	7.6	6660	3.8	21.7
QUERCUS PRINUS	CHESTNUT OAK	0.25	8.6	45	7.6	8973	5.2	21.3
CORNUS FLORIDA	FLOWERING DOGWOOD	0.05	1.7	10	1.7	2706	1.6	5.0
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0.05	1.7	10	1.7	1838	1.1	4.5
TSUGA CANADENSIS	EASTERN HEMLOCK	0.05	1.7	10	1.7	1041	0.6	4.0
PYRUS MALUS	APPLE	0.05	1.7	5	0.8	1272	0.7	3.3
CARYA GLABRA	PIGNUT HICKORY	0.05	1.7	5	0.8	1135	0.7	3.2
SASSAFRAS ALBIDUM	SASSAFRAS	0.05	1.7	5	0.8	664	0.4	2.9
PRUNUS PENSYLVANICA	PIN CHERRY	0.05	1.7	5	0.8	393	0.2	2.8
TOTAL		-	100.0	595	100.0	173685	100.0	300.0

Table F-8

Vegetation analysis for saplings in the Council Cup Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
ACER RUBRUM	RED MAPLE	0.90	17.0	485	27.6	6926	21.4	66.0
BETULA LENTA	SWEET BIRCH	0.70	13.2	410	23.3	8356	25.8	62.3
QUERCUS BOREALIS	RED OAK	0.60	11.3	180	10.2	3954	12.2	33.8
QUERCUS VELUTINA	BLACK OAK	0.55	10.4	140	8.0	3943	12.2	30.5
QUERCUS PRINUS	CHESTNUT OAK	0.40	7.5	160	9.1	2961	9.2	25.8
PINUS STROBUS	WHITE PINE	0.45	8.5	105	6.0	1382	4.3	18.7
BETULA POPULIFOLIA	GRAY BIRCH	0.20	3.8	55	3.1	1700	5.3	12.2
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.25	4.7	35	2.0	601	1.9	8.6
CARYA GLABRA	PIGNUT HICKORY	0.20	3.8	25	1.4	742	2.3	7.5
CORNUS FLORIDA	FLOWERING DOGWOOD	0.20	3.8	40	2.3	452	1.4	7.[illegible]
FRAXINUS AMERICANA	WHITE ASH	0.20	3.8	20	1.1	27	0.1	5.0
QUERCUS ALBA	WHITE OAK	0.15	2.8	20	1.1	82	0.3	4.2
TSUGA CANADENSIS	EASTERN HEMLOCK	0.05	0.9	30	1.7	424	1.3	4.0
PRUNUS SEROTINA	BLACK CHERRY	0.10	1.9	15	0.9	137	0.4	3.2
AMELANCHIER ARBOREA	SHAD-BUSH	0.10	1.9	15	0.9	134	0.4	3.2
SASSAFRAS ALBIDUM	SASSAFRAS	0.10	1.9	10	0.6	51	0.2	2.6
PRUNUS PENSYLVANICA	PIN CHERRY	0.05	0.9	5	0.3	251	0.8	2.0
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0.05	0.9	5	0.3	192	0.6	1.8
CASTANEA DENTATA	AMERICAN CHESTNUT	0.05	0.9	5	0.3	16	0.0	1.3
TOTAL		-	100.0	1760	100.0	32332	100.0	300.0

Table F-9

Vegetation analysis for tree seedlings in the Council Cup Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
ACER RUBRUM	RED MAPLE	0.55	32.8	13000	44.4	1.43	22.9	100.2
PRUNUS SEROTINA	BLACK CHERRY	0.28	16.4	6250	21.4	1.58	25.3	63.1
QUERCUS VELUTINA	BLACK OAK	0.15	9.0	1500	5.1	0.68	10.8	24.9
QUERCUS BOREALIS	RED OAK	0.18	10.4	1250	4.3	0.38	6.0	20.7
QUERCUS PRINUS	CHESTNUT OAK	0.10	6.0	2000	6.8	0.33	5.2	18.0
SASSAFRAS ALBIDUM	SASSAFRAS	0.13	7.5	1000	3.4	0.40	6.4	17.3
FRAXINUS AMERICANA	WHITE ASH	0.05	3.0	750	2.6	0.30	4.8	10.4
AMELANCHIER ARBOREA	SHAD-BUSH	0.03	1.5	1250	4.3	0.23	3.6	9.4
CASTANEA DENTATA	AMERICAN CHESTNUT	0.03	1.5	250	0.9	0.30	4.8	7.2
QUERCUS ALBA	WHITE OAK	0.03	1.5	250	0.9	0.15	2.4	4.8
POPULUS TREMULOIDES	QUAKING ASPEN	0.03	1.5	250	0.9	0.15	2.4	4.8
CARYA GLABRA	PIGNUT HICKORY	0.03	1.5	250	0.9	0.13	2.0	4.4
BETULA LENTA	SWEET BIRCH	0.03	1.5	500	1.7	0.05	0.8	4.0
PRUNUS AVIUM	SWEET CHERRY	0.03	1.5	250	0.9	0.05	0.8	3.2
CRATAEGUS SP.	HAWTHORNE	0.03	1.5	250	0.9	0.03	0.4	2.7
PINUS STROBUS	WHITE PINE	0.03	1.5	250	0.9	0.03	0.4	2.7
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.03	1.5	0	0.0	0.05	0.8	2.3
TOTAL		-	100.0	29250	100.0	6.23	100.0	300.0

Table F-10

Vegetation analysis for shrubs, herbs, and ground cover in the Council Cup Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
SHRUBS						
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	0.45	37.5	6.38	39.3	76.8
KALMIA LATIFOLIA	MOUNTAIN LAUREL	0.20	16.7	4.23	26.0	42.7
RHODODENDRON NUDIFLORUM	PINXTER-FLOWER	0.13	10.4	1.90	11.7	22.1
RHUS RADICANS	POISON IVY	0.15	12.5	1.15	7.1	19.6
VACCINIUM STAMINEUM	DEERBERRY	0.10	8.3	1.28	7.9	16.2
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.08	6.3	0.18	1.1	7.3
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.05	4.2	0.33	2.0	6.2
VIBURNUM ACERIFOLIUM	MAPLE-LEAF VIBURNUM	0.03	2.1	0.40	2.5	4.5
KALMIA ANGUSTIFOLIA	SHEEP LAUREL	0.03	2.1	0.40	2.5	4.5
HERBS						
LYCOPODIUM FLABELLIFORME	GROUND PINE	0.30	20.7	4.13	29.4	50.0
ARALIA NUDICAULIS	WILD SARSAPARILLA	0.23	15.5	3.00	21.4	36.9
MAIANTHEMUM CANADENSE	WILD LILY-OF-THE-VALLEY	0.13	8.6	2.13	15.1	23.7
DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	0.10	6.9	2.30	16.4	23.3
LYSIMACHIA QUADRIFOLIA	WHORLED LOOSESTRIFE	0.13	8.6	0.43	3.0	11.6
VERONICA OFFICINALIS	COMMON SPEEDWELL	0.10	6.9	0.45	3.2	10.1
POLYGALA PAUCIFOLIA	FRINGED POLYGALA	0.08	5.2	0.35	2.5	7.7
DESCHAMPSIA FLEXUOSA	HAIRGRASS	0.05	3.4	0.55	3.9	7.4
CAREX SWANNII	SEDGE	0.05	3.4	0.08	0.5	4.0
CHIMAPHILIA MACULATA	SPOTTED WINTERGREEN	0.05	3.4	0.05	0.4	3.8
MELAMPYRUM LINEARE	COW-WHEAT	0.03	1.7	0.13	0.9	2.6
MITCHELLA REPENS	PARTRIDGE-BERRY	0.03	1.7	0.13	0.9	2.6
GALIUM CIRCAEZANS	BEDSTRAW	0.03	1.7	0.05	0.4	2.1
ASTER DIVARICATUS	WHITE WOOD ASTER	0.03	1.7	0.05	0.4	2.1
CAREX SP.	SEDGE	0.03	1.7	0.05	0.4	2.1
MEDEOLA VIRGINIANA	INDIAN CUCUMBER	0.03	1.7	0.05	0.4	2.1
PRENANTHES ALBA	TALL WHITE LETTUCE	0.03	1.7	0.05	0.4	2.1
PYROLA ELLIPTICA	SHINLEAF	0.03	1.7	0.05	0.4	2.1
GAULTHERIA PROCUMBENS	WINTERGREEN	0.03	1.7	0.03	0.2	1.9
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.03	1.7	0.03	0.2	1.9
GROUND COVER						
LITTER	-	1.00	65.6	98.23	98.5	164.0
MOSS	-	0.30	19.7	0.65	0.7	20.3
ROCK	-	0.23	14.8	0.88	0.9	15.6

ble F-11

mparison of trees (number of stems) in the Council Cup Forest, 1977-81.

PECIES	COMMON NAME	NUMBER OF STEMS 1977	1978	1979	1980	1981	F	TREND
ETULA LENTA	SWEET BIRCH	45	41	40	45	40	0.66	
UERCUS VELUTINA	BLACK OAK	11	21	19	17	18	2.77*	
CER RUBRUM	RED MAPLE	8	7	8	7	10	1.51	
INUS VIRGINIANA	VIRGINIA PINE	8	11	10	9	10	1.50	
UERCUS BOREALIS	RED OAK	9	6	5	5	9	0.73	
UERCUS PRINUS	CHESTNUT OAK	13	13	13	13	9	0.84	
INUS STROBUS	WHITE PINE	10	10	9	9	8	1.14	
UERCUS ALBA	WHITE OAK	3	5	5	5	5	2.11	
ORNUS FLORIDA	FLOWERING DOGWOOD	3	2	3	3	2	1.00	
SUGA CANADENSIS	EASTERN HEMLOCK	1	1	1	1	2	1.00	
OPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	3	3	2	3	2	0.77	
RUNUS PENSYLVANICA	PIN CHERRY	0	0	0	1	1	1.00	
ARYA GLABRA	PIGNUT HICKORY	1	1	1	1	1	0.00	
YRUS MALUS	APPLE	1	1	1	1	1	0.00	
ASSAFRAS ALBIDUM	SASSAFRAS	[illegible]	1	1	1	1	0.00	
ETULA POPULIFOLIA	GRAY BIRCH	0	1	1	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

able F-12

omparison of saplings (number of stems) in the Council Cup Forest, 1977-81.

PECIES	COMMON NAME	NUMBER OF STEMS 1977	1978	1979	1980	1981	F	TREND
CER RUBRUM	RED MAPLE	133	114	98	100	97	2.50*	
ETULA LENTA	SWEET BIRCH	131	131	118	104	82	3.36*	-
UERCUS BOREALIS	RED OAK	57	38	47	33	36	2.56*	-
UERCUS PRINUS	CHESTNUT OAK	55	45	47	37	32	3.27*	-
UERCUS VELUTINA	BLACK OAK	36	38	35	25	28	0.93	
INUS STROBUS	WHITE PINE	24	22	22	24	21	0.58	
ETULA POPULIFOLIA	GRAY BIRCH	27	16	16	18	11	3.84**	-
ORNUS FLORIDA	FLOWERING DOGWOOD	10	10	9	8	8	0.78	
ARYA TOMENTOSA	MOCKERNUT HICKORY	0	12	6	6	7	5.76**	
SUGA CANADENSIS	EASTERN HEMLOCK	4	4	4	6	6	1.00	
ARYA GLABRA	PIGNUT HICKORY	15	6	7	6	5	4.16**	-
RAXINUS AMERICANA	WHITE ASH	3	0	0	3	4	2.96*	
UERCUS ALBA	WHITE OAK	20	11	15	16	4	1.96	
MELANCHIER ARBOREA	SHAD-BUSH	3	4	3	3	3	1.00	
RUNUS SEROTINA	BLACK CHERRY	9	7	2	4	3	2.16	
ASSAFRAS ALBIDUM	SASSAFRAS	6	4	6	6	2	1.22	
OPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0	1	1	1	1	1.00	
ASTANEA DENTATA	AMERICAN CHESTNUT	2	4	3	2	1	0.82	
RUNUS PENSYLVANICA	PIN CHERRY	3	2	2	1	1	1.00	
INUS VIRGINIANA	VIRGINIA PINE	3	0	1	0	0	1.64	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-13

Comparison of tree seedlings (number of stems) in the Council Cup Forest, 1978-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1978	1979	1980	1981	F	TREND
ACER RUBRUM	RED MAPLE	37	50	52	52	1.46	
PRUNUS SEROTINA	BLACK CHERRY	24	25	32	25	0.42	
QUERCUS PRINUS	CHESTNUT OAK	8	5	9	8	0.76	
QUERCUS VELUTINA	BLACK OAK	8	7	1	6	3.40*	
AMELANCHIER ARBOREA	SHAD-BUSH	0	0	6	5	1.00	
QUERCUS BOREALIS	RED OAK	6	4	7	5	0.43	
SASSAFRAS ALBIDUM	SASSAFRAS	4	2	4	4	0.49	
FRAXINUS AMERICANA	WHITE ASH	2	2	2	3	1.00	
BETULA LENTA	SWEET BIRCH	5	6	5	2	1.90	
PRUNUS AVIUM	SWEET CHERRY	0	0	0	1	1.00	
POPULUS TREMULOIDES	QUAKING ASPEN	3	9	1	1	1.53	
QUERCUS ALBA	WHITE OAK	0	1	2	1	1.00	
CASTANEA DENTATA	AMERICAN CHESTNUT	3	3	3	1	1.96	
CRATAEGUS SP.	HAWTHORNE	1	0	0	1	1.00	
CARYA GLABRA	PIGNUT HICKORY	1	1	1	1	0.00	
PINUS STROBUS	WHITE PINE	1	0	1	1	1.00	
PINUS VIRGINIANA	VIRGINIA PINE	0	0	1	0	1.00	
CARYA TOMENTOSA	MOCKERNUT HICKORY	0	1	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-14

Comparison of shrubs, herbs, and ground cover (% cover) in the Council Cup Forest, 1977-81.

SPECIES	COMMON NAME	% COVER 1977	1978	1979	1980	1981	F	TREND
SHRUBS								
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	8.15	10.28	9.93	9.63	6.38	4.68**	
KALMIA LATIFOLIA	MOUNTAIN LAUREL	3.33	4.28	3.30	4.93	4.23	1.97	
RHODODENDRON NUDIFLORUM	PINXTER-FLOWER	1.33	2.00	2.40	2.65	1.90	1.95	
VACCINIUM STAMINEUM	DEERBERRY	0.00	0.00	0.00	0.00	1.28	1.77	
RHUS RADICANS	POISON IVY	0.38	1.08	1.10	1.20	1.15	4.48**	+
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.13	0.45	0.25	0.58	0.33	1.63	
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.03	0.18	0.10	0.15	0.18	1.54	
HERBS								
LYCOPODIUM FLABELLIFORME	GROUND PINE	4.58	6.75	6.08	6.38	4.13	3.58*	
ARALIA NUDICAULIS	WILD SARSAPARILLA	2.80	3.90	3.65	2.40	3.00	1.85	
DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	1.28	2.48	3.18	2.15	2.30	1.74	
MAIANTHEMUM CANADENSE	WILD LILY-OF-THE-VALLEY	0.25	0.50	1.05	1.43	2.13	3.43*	+
VERONICA OFFICINALIS	COMMON SPEEDWELL	0.00	0.00	0.05	0.15	0.45	2.97*	+
LYSIMACHIA QUADRIFOLIA	WHORLED LOOSESTRIFE	0.08	0.53	0.33	0.38	0.43	2.45	
POLYGALA PAUCIFOLIA	FRINGED POLYGALA	0.18	0.55	0.43	0.35	0.35	0.71	
GROUND COVER								
LITTER	-	97.80	97.35	97.75	97.48	98.23	0.82	
ROCK	-	0.88	1.18	1.18	1.38	0.88	2.64*	
MOSS	-	0.55	0.63	0.53	0.58	0.65	1.30	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-15

Vegetation analysis for trees in the TR419 Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
QUERCUS VELUTINA	BLACK OAK	0.54	17.1	108	19.8	68651	32.3	69.3
PINUS VIRGINIANA	VIRGINIA PINE	0.33	10.5	92	16.8	43337	20.4	47.7
CORNUS FLORIDA	FLOWERING DOGWOOD	0.54	17.1	96	17.6	11385	5.4	40.0
PINUS STROBUS	WHITE PINE	0.21	6.6	50	9.2	15256	7.2	22.9
PRUNUS SEROTINA	BLACK CHERRY	0.25	7.9	42	7.6	14595	6.9	22.4
QUERCUS PRINUS	CHESTNUT OAK	0.29	9.2	38	6.9	11257	5.3	21.4
ACER RUBRUM	RED MAPLE	0.21	6.6	33	6.1	12252	5.8	18.5
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.17	5.3	21	3.8	4539	2.1	11.2
FRAXINUS AMERICANA	WHITE ASH	0.17	5.3	17	3.1	5956	2.8	11.1
QUERCUS ALBA	WHITE OAK	0.08	2.6	8	1.5	9687	4.6	8.7
PRUNUS AVIUM	SWEET CHERRY	0.08	2.6	8	1.5	4297	2.0	6.2
TSUGA CANADENSIS	EASTERN HEMLOCK	0.04	1.3	8	1.5	3943	1.9	4.7
LIRIODENDRON TULIPIFERA	TULIP-TREE	0.04	1.3	4	0.8	2752	1.3	3.4
QUERCUS BOREALIS	RED OAK	0.04	1.3	4	0.8	2212	1.0	3.1
SASSAFRAS ALBIDUM	SASSAFRAS	0.04	1.3	4	0.8	736	0.3	2.4
BETULA POPULIFOLIA	GRAY BIRCH	0.04	1.3	4	0.8	736	0.3	2.4
PYRUS MALUS	APPLE	0.04	1.3	4	0.8	553	0.3	2.3
CARYA GLABRA	PIGNUT HICKORY	0.04	1.3	4	0.8	327	0.2	2.2
TOTAL		-	100.0	546	100.0	212466	100.0	300.0

Table F-16

Vegetation analysis for saplings in the TR419 Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
CORNUS FLORIDA	FLOWERING DOGWOOD	0.83	26.3	550	47.5	15012	56.0	129.8
QUERCUS VELUTINA	BLACK OAK	0.38	11.8	213	18.3	3593	13.4	43.6
ACER RUBRUM	RED MAPLE	0.54	17.1	104	9.0	2009	7.5	33.6
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.38	11.8	104	9.0	2929	10.9	31.8
CRATAEGUS SP.	HAWTHORNE	0.21	6.6	33	2.9	327	1.2	10.7
CARYA GLABRA	PIGNUT HICKORY	0.13	3.9	33	2.9	992	3.7	10.5
BETULA POPULIFOLIA	GRAY BIRCH	0.17	5.3	29	2.5	625	2.3	10.1
PRUNUS SEROTINA	BLACK CHERRY	0.13	3.9	21	1.8	481	1.8	7.5
QUERCUS BOREALIS	RED OAK	0.13	3.9	13	1.1	108	0.4	5.4
QUERCUS PRINUS	CHESTNUT OAK	0.08	2.6	17	1.4	88	0.3	4.4
AMELANCHIER ARBOREA	SHAD-BUSH	0.04	1.3	13	1.1	252	0.9	3.3
SASSAFRAS ALBIDUM	SASSAFRAS	0.04	1.3	17	1.4	49	0.2	2.9
PINUS VIRGINIANA	VIRGINIA PINE	0.04	1.3	4	0.4	209	0.8	2.5
PINUS STROBUS	WHITE PINE	0.04	1.3	4	0.4	82	0.3	2.0
FAGUS GRANDIFOLIA	AMERICAN BEECH	0.04	1.3	4	0.4	29	0.1	1.8
TOTAL		-	100.0	1158	100.0	26786	100.0	300.0

Table F-17

Vegetation analysis for tree seedlings in the TR419 Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
CORNUS FLORIDA	FLOWERING DOGWOOD	0.48	17.0	13542	19.1	4.19	27.2	63.3
FRAXINUS AMERICANA	WHITE ASH	0.48	17.0	18542	26.2	2.15	13.9	57.1
PRUNUS SEROTINA	BLACK CHERRY	0.44	15.6	11875	16.8	1.23	8.0	40.3
ACER RUBRUM	RED MAPLE	0.40	14.1	8542	12.1	1.58	10.3	36.4
SASSAFRAS ALBIDUM	SASSAFRAS	0.40	14.1	9375	13.2	1.19	7.7	35.0
QUERCUS VELUTINA	BLACK OAK	0.19	6.7	1875	2.6	0.98	6.4	15.7
QUERCUS PRINUS	CHESTNUT OAK	0.06	2.2	1250	1.8	1.52	9.9	13.9
BETULA LENTA	SWEET BIRCH	0.02	0.7	1042	1.5	1.46	9.5	11.7
PRUNUS AVIUM	SWEET CHERRY	0.13	4.4	1875	2.6	0.17	1.1	8.2
CRATAEGUS SP.	HAWTHORNE	0.04	1.5	833	1.2	0.46	3.0	5.6
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0.06	2.2	417	0.6	0.15	0.9	3.8
CELTIS OCCIDENTALIS	HACKBERRY	0.02	0.7	833	1.2	0.17	1.1	3.0
AMELANCHIER ARBOREA	SHAD-BUSH	0.04	1.5	208	0.3	0.04	0.3	2.0
PYRUS MALUS	APPLE	0.02	0.7	208	0.3	0.08	0.5	1.6
QUERCUS BOREALIS	RED OAK	0.02	0.7	208	0.3	0.04	0.3	1.3
CARYA GLABRA	PIGNUT HICKORY	0.02	0.7	208	0.3	0.02	0.1	1.2
TOTAL			100.0	70833	100.0	15.42	100.0	300.0

Table F-18

Vegetation analysis for shrubs, herbs, and ground cover in the TR419 Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
SHRUBS						
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.31	20.0	5.60	34.0	54.0
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.40	25.3	2.67	16.2	41.5
LINDERA BENZOIN	SPICEBUSH	0.15	9.3	3.04	18.4	27.8
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	0.21	13.3	1.56	9.5	22.8
VITIS AESTIVALIS	SUMMER GRAPE	0.25	16.0	0.48	2.9	18.9
VACCINIUM STAMINEUM	DEERBERRY	0.04	2.7	1.77	10.7	13.4
RHUS RADICANS	POISON IVY	0.10	6.7	0.75	4.5	11.2
VIBURNUM ACERIFOLIUM	MAPLE-LEAF VIBURNUM	0.06	4.0	0.50	3.0	7.0
RUBUS OCCIDENTALIS	BLACK RASBERRY	0.04	2.7	0.13	0.8	3.4
HERBS						
DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	0.10	4.6	3.38	28.2	32.8
CAREX SWANNII	SEDGE	0.27	12.0	1.35	11.3	23.3
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	0.06	2.8	1.02	8.5	11.3
SOLIDAGO CAESIA	BLUE-STEMMED GOLDENROD	0.15	6.5	0.35	3.0	9.4
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.08	3.7	0.54	4.5	8.2
GEUM CANADENSE	AVENS	0.08	3.7	0.46	3.8	7.5
CAREX SP.	SEDGE	0.10	4.6	0.25	2.1	6.7
POLYGONUM VIRGINIANUM	VIRGINIA KNOTWEED	0.08	3.7	0.31	2.6	6.3
POLYSTICHUM ACROSTICHOIDES	CHRISTMAS FERN	0.04	1.9	0.42	3.5	5.3
PANICUM SPP.	PANIC-GRASS	0.08	3.7	0.19	1.6	5.3
DESMODIUM NUDIFLORUM	TICK-TREFOIL	0.08	3.7	0.13	1.0	4.7
CAREX PENSYLVANICA	SEDGE	0.04	1.9	0.33	2.8	4.6
ALLIARIA OFFICINALIS	GARLIC MUSTARD	0.02	0.9	0.44	3.7	4.6
SOLIDAGO RUGOSA	ROUGH GOLDENROD	0.06	2.8	0.21	1.7	4.5
UVULARIA SESSILIFOLIA	SESSILE-LEAVED BELLWORT	0.06	2.8	0.21	1.7	4.5
ASTER DIVARICATUS	WHITE WOOD ASTER	0.06	2.8	0.19	1.6	4.3
CIRCAEA QUADRISULCATA	ENCHANTER NIGHTSHADE	0.06	2.8	0.17	1.4	4.2
UVULARIA PERFOLIATA	PERFOLIATE BELLWORT	0.06	2.8	0.17	1.4	4.2
POLYGONUM PERSICARIA	SMARTWEED	0.04	1.9	0.23	1.9	3.8
DANTHONIA SPICATA	POVERTY OATGRASS	0.06	2.8	0.10	0.9	3.6
DRYOPTERIS SPINULOSA	SPINULOSE WOOD FERN	0.04	1.9	0.17	1.4	3.2
CUNILA ORIGANOIDES	DITTANY	0.04	1.9	0.13	1.0	2.9
ASPLENIUM PLATYNEURON	EBONY SPLEENWORT	0.04	1.9	0.10	0.9	2.7
CAREX LAXIFLORA	SEDGE	0.04	1.9	0.10	0.9	2.7
VERONICA SERPYLLIFOLIA	SPEEDWELL	0.04	1.9	0.08	0.7	2.5
MAIANTHEMUM CANADENSE	WILD LILY-OF-THE-VALLEY	0.04	1.9	0.08	0.7	2.5
LYSIMACHIA QUADRIFOLIA	WHORLED LOOSESTRIFE	0.02	0.9	0.17	1.4	2.3
CHIMAPHILIA MACULATA	SPOTTED WINTERGREEN	0.04	1.9	0.04	0.3	2.2
GALIUM APARINE	CLEAVERS	0.02	0.9	0.08	0.7	1.6
RUMEX ACETOSELLA	SHEEP SORREL	0.02	0.9	0.06	0.5	1.4
FRAGARIA VIRGINIANA	WILD STRAWBERRY	0.02	0.9	0.06	0.5	1.4
POLYGONUM SCANDENS	FALSE BUCKWHEAT	0.02	0.9	0.06	0.5	1.4
IMPATIENS BIFLORA	JEWELWEED	0.02	0.9	0.06	0.5	1.4
ATHYRIUM FILIX-FEMINA	LADY FERN	0.02	0.9	0.04	0.3	1.3
OXALIS STRICTA	YELLOW WOOD SORREL	0.02	0.9	0.04	0.3	1.3
GRASS(UNIDENTIFIED)	-	0.02	0.9	0.04	0.3	1.3
POTENTILLA SIMPLEX	CINQUEFOIL	0.02	0.9	0.04	0.3	1.3
ARISAEMA TRIPHYLLUM	JACK-IN-THE-PULPIT	0.02	0.9	0.04	0.3	1.3
JUNCUS TENUIS	PATH RUSH	0.02	0.9	0.04	0.3	1.3
LYCOPODIUM FLABELLIFORME	GROUND PINE	0.02	0.9	0.02	0.2	1.1
SMILACINA RACEMOSA	FALSE SOLOMAN'S SEAL	0.02	0.9	0.02	0.2	1.1
CONVOLVULUS SEPIUM	HEDGE BINDWEED	0.02	0.9	0.02	0.2	1.1
GALIUM CIRCAEZANS	BEDSTRAW	0.02	0.9	0.02	0.2	1.1
GROUND COVER						
LITTER	-	1.00	56.5	94.38	95.5	152.0
MOSS	-	0.35	20.0	2.13	2.2	22.2
ROCK	-	0.25	14.1	0.83	0.8	15.0
BARE SOIL	-	0.17	9.4	1.48	1.5	10.9

Table F-19

Comparison of trees (number of stems) in the TR419 Forest, 1977-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1977	1978	1979	1980	1981	F	TREND
QUERCUS VELUTINA	BLACK OAK	27	31	29	27	26	2.48*	
CORNUS FLORIDA	FLOWERING DOGWOOD	18	23	19	20	23	1.15	
PINUS VIRGINIANA	VIRGINIA PINE	28	25	24	22	22	2.10	
PINUS STROBUS	WHITE PINE	13	15	13	11	12	0.81	
PRUNUS SEROTINA	BLACK CHERRY	8	9	8	9	10	0.56	
QUERCUS PRINUS	CHESTNUT OAK	10	9	8	11	9	0.45	
ACER RUBRUM	RED MAPLE	12	12	11	9	8	2.17	
CARYA TOMENTOSA	MOCKERNUT HICKORY	6	6	6	5	5	0.68	
FRAXINUS AMERICANA	WHITE ASH	3	4	4	4	4	1.00	
PRUNUS AVIUM	SWEET CHERRY	2	2	2	2	2	0.00	
TSUGA CANADENSIS	EASTERN HEMLOCK	2	2	2	2	2	0.00	
QUERCUS ALBA	WHITE OAK	2	2	2	2	2	0.00	
QUERCUS BOREALIS	RED OAK	0	0	0	0	1	1.00	
PYRUS MALUS	APPLE	3	2	2	2	1	1.23	
LIRIODENDRON TULIPIFERA	TULIP-TREE	1	1	1	1	1	0.00	
CARYA GLABRA	PIGNUT HICKORY	1	1	1	1	1	0.00	
SASSAFRAS ALBIDUM	SASSAFRAS	1	1	1	1	1	0.00	
BETULA POPULIFOLIA	GRAY BIRCH	2	2	2	3	1	1.23	
CRATAEGUS SP.	HAWTHORNE	0	1	0	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-20

Comparison of saplings (number of stems) in the TR419 Forest, 1977-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1977	1978	1979	1980	1981	F	TREND
CORNUS FLORIDA	FLOWERING DOGWOOD	136	128	137	127	132	0.06	
QUERCUS VELUTINA	BLACK OAK	50	47	48	42	51	0.67	
CARYA TOMENTOSA	MOCKERNUT HICKORY	19	20	22	23	25	1.29	
ACER RUBRUM	RED MAPLE	16	25	25	18	25	1.91	
CARYA GLABRA	PIGNUT HICKORY	9	9	9	7	8	0.94	
CRATAEGUS SP.	HAWTHORNE	6	10	8	8	8	1.49	
BETULA POPULIFOLIA	GRAY BIRCH	11	16	9	9	7	0.45	
PRUNUS SEROTINA	BLACK CHERRY	8	5	3	8	5	1.60	
QUERCUS PRINUS	CHESTNUT OAK	6	5	8	6	4	1.39	
SASSAFRAS ALBIDUM	SASSAFRAS	1	0	5	4	4	1.29	
AMELANCHIER ARBOREA	SHAD-BUSH	4	5	4	4	3	0.48	
QUERCUS BOREALIS	RED OAK	2	2	4	3	3	1.34	
PINUS STROBUS	WHITE PINE	1	2	2	1	1	1.00	
PINUS VIRGINIANA	VIRGINIA PINE	7	4	3	1	1	1.46	
FAGUS GRANDIFOLIA	AMERICAN BEECH	2	2	1	1	1	0.74	
ULMUS AMERICANA	AMERICAN ELM	0	0	0	1	0	1.00	
FRAXINUS AMERICANA	WHITE ASH	1	5	3	2	0	2.00	
QUERCUS ALBA	WHITE OAK	5	5	2	4	0	1.69	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-21

Comparison of tree seedlings (number of stems) in the TR419 Forest, 1978-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1978	1979	1980	1981	F	TREND
FRAXINUS AMERICANA	WHITE ASH	157	122	136	89	0.99	
CORNUS FLORIDA	FLOWERING DOGWOOD	78	60	103	6[illegible]	2.06	
PRUNUS SEROTINA	BLACK CHERRY	66	73	57	57	0.86	
SASSAFRAS ALBIDUM	SASSAFRAS	29	43	40	45	5.30**	+
ACER RUBRUM	RED MAPLE	45	48	32	41	0.86	
QUERCUS VELUTINA	BLACK OAK	6	6	8	9	0.94	
PRUNUS AVIUM	SWEET CHERRY	15	35	25	9	0.48	
QUERCUS PRINUS	CHESTNUT OAK	4	3	4	6	1.48	
BETULA LENTA	SWEET BIRCH	11	11	7	5	1.00	
CELTIS OCCIDENTALIS	HACKBERRY	0	2	0	4	1.00	
CRATAEGUS SP.	HAWTHORNE	2	1	2	4	0.56	
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0	0	0	2	2.09	
QUERCUS BOREALIS	RED OAK	0	0	1	1	0.66	
PYRUS MALUS	APPLE	0	1	1	1	1.00	
CARYA GLABRA	PIGNUT HICKORY	0	0	1	1	1.00	
AMELANCHIER ARBOREA	SHAD-BUSH	6	2	1	1	2.41	
POPULUS TREMULOIDES	QUAKING ASPEN	0	2	0	0	1.00	
PINUS VIRGINIANA	VIRGINIA PINE	1	1	0	0	1.00	
BETULA POPULIFOLIA	GRAY BIRCH	4	2	1	0	1.12	
CARYA TOMENTOSA	MOCKERNUT HICKORY	1	1	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-22

Comparison of shrubs, herbs, and ground cover (% cover) in the TR419 Forest, 1978-81.

SPECIES	COMMON NAME	% COVER 1978	1979	1980	1981	F	TREND
SHRUBS							
RUBUS ALLEGHENIENSIS	BLACKBERRY	3.06	4.13	5.63	5.60	1.70	
LINDERA BENZOIN	SPICEBUSH	1.17	2.65	3.19	3.04	2.16	
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	2.27	2.65	2.10	2.67	1.34	
VACCINIUM STAMINEUM	DEERBERRY	1.90	1.96	2.19	1.77	0.98	
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	2.83	2.31	2.06	1.56	0.05	
RHUS RADICANS	POISON IVY	0.94	1.42	0.92	0.75	0.58	
VIBURNUM ACERIFOLIUM	MAPLE-LEAF VIBURNUM	0.58	0.71	0.75	0.50	1.11	
VITIS AESTIVALIS	SUMMER GRAPE	0.71	0.96	0.40	0.48	2.02	
RUBUS OCCIDENTALIS	BLACK RASBERRY	0.00	0.17	0.21	0.13	1.79	
HERBS							
DENNSTAEDTIA PUNCTILOBULA	HAY-SCENTED FERN	3.60	3.67	5.27	3.38	1.92	
CAREX SWANNII	SEDGE	0.92	1.73	1.79	1.35	2.54	
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	0.44	1.08	1.40	1.02	0.79	
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.02	0.27	0.44	0.54	1.75	
GEUM CANADENSE	AVENS	0.44	0.60	0.42	0.46	1.33	
SOLIDAGO CAESIA	BLUE-STEMMED GOLDENROD	0.33	0.35	0.46	0.35	0.34	
CAREX PENSYLVANICA	SEDGE	0.02	0.19	0.19	0.33	0.66	
POLYGONUM VIRGINIANUM	VIRGINIA KNOTWEED	0.27	0.46	0.25	0.31	0.74	
CAREX SP.	SEDGE	0.00	0.00	0.25	0.25	3.27*	+
UVULARIA SESSILIFOLIA	SESSILE-LEAVED BELLWORT	0.35	0.38	0.17	0.21	1.12	
SOLIDAGO RUGOSA	ROUGH GOLDENROD	0.25	0.60	0.40	0.21	1.58	
ASTER DIVARICATUS	WHITE WOOD ASTER	0.40	0.44	0.29	0.19	2.04	
PANICUM SPP.	PANIC-GRASS	0.33	0.27	0.27	0.19	0.27	
CIRCAEA QUADRISULCATA	ENCHANTER NIGHTSHADE	0.63	0.44	0.29	0.17	0.13	
UVULARIA PERFOLIATA	PERFOLIATE BELLWORT	0.13	0.17	0.44	0.17	1.32	
DESMODIUM NUDIFLORUM	TICK-TREFOIL	0.08	0.25	0.19	0.13	1.86	
DANTHONIA SPICATA	POVERTY OATGRASS	0.60	0.71	0.35	0.10	0.23	
MAIANTHEMUM CANADENSE	WILD LILY-OF-THE-VALLEY	0.13	0.15	0.10	0.08	1.00	
GALIUM APARINE	CLEAVERS	0.40	0.71	0.25	0.08	1.34	
POTENTILLA SIMPLEX	CINQUEFOIL	1.19	0.85	0.15	0.04	2.33	
GROUND COVER							
LITTER	-	91.96	93.96	93.31	94.38	1.45	
MOSS	-	2.65	1.90	1.65	2.13	0.27	
BARE SOIL	-	2.21	1.25	2.08	1.48	1.65	
ROCK	-	1.40	1.29	1.21	0.83	1.53	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-23

Vegetation analysis for trees in the Quarry Hillside Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
QUERCUS VELUTINA	BLACK OAK	0.40	12.2	133	20.6	53941	27.7	60.5
QUERCUS PRINUS	CHESTNUT OAK	0.47	14.3	80	12.4	23588	12.1	38.8
FRAXINUS AMERICANA	WHITE ASH	0.47	14.3	80	12.4	18373	9.4	36.1
QUERCUS BOREALIS	RED OAK	0.47	14.3	80	12.4	16645	8.5	35.2
ACER RUBRUM	RED MAPLE	0.33	10.2	87	13.4	16074	8.2	31.9
TILIA AMERICANA	BASSWOOD	0.13	4.1	40	6.2	24290	12.5	22.7
ULMUS AMERICANA	AMERICAN ELM	0.13	4.1	27	4.1	11551	5.9	14.1
PINUS VIRGINIANA	VIRGINIA PINE	0.13	4.1	27	4.1	10142	5.2	13.4
CORNUS FLORIDA	FLOWERING DOGWOOD	0.13	4.1	20	3.1	2021	1.0	8.2
SASSAFRAS ALBIDUM	SASSAFRAS	0.13	4.1	13	2.1	2644	1.4	7.5
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.07	2.0	7	1.0	4403	2.3	5.3
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	0.07	2.0	13	2.1	2204	1.1	5.2
BETULA LENTA	SWEET BIRCH	0.07	2.0	13	2.1	1932	1.0	5.1
PRUNUS SEROTINA	BLACK CHERRY	0.07	2.0	7	1.0	2770	1.4	4.5
CELTIS OCCIDENTALIS	HACKBERRY	0.07	2.0	7	1.0	1890	1.0	4.0
CARYA OVATA	SHAGBARK HICKORY	0.07	2.0	7	1.0	1890	1.0	4.0
JUGLANS NIGRA	BLACK WALNUT	0.07	2.0	7	1.0	634	0.3	3.4
TOTAL		-	100.0	647	100.0	194986	100.0	300.0

Table F-24

Vegetation analysis for saplings in the Quarry Hillside Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
CORNUS FLORIDA	FLOWERING DOGWOOD	0.73	18.3	593	41.4	10439	32.0	91.7
QUERCUS BOREALIS	RED OAK	0.47	11.7	220	15.3	5335	16.3	43.4
FRAXINUS AMERICANA	WHITE ASH	0.60	15.0	167	11.6	5409	16.6	43.2
ACER RUBRUM	RED MAPLE	0.47	11.7	153	10.7	4246	13.0	35.4
QUERCUS PRINUS	CHESTNUT OAK	0.40	10.0	87	6.0	3236	9.9	26.0
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.20	5.0	33	2.3	749	2.3	9.6
QUERCUS VELUTINA	BLACK OAK	0.20	5.0	20	1.4	565	1.7	8.1
SASSAFRAS ALBIDUM	SASSAFRAS	0.13	3.3	20	1.4	890	2.7	7.5
ULMUS AMERICANA	AMERICAN ELM	0.13	3.3	20	1.4	529	1.6	6.3
TILIA AMERICANA	BASSWOOD	0.13	3.3	27	1.9	319	1.0	6.2
PRUNUS VIRGINIANA	CHOKE CHERRY	0.13	3.3	27	1.9	319	1.0	6.2
PINUS VIRGINIANA	VIRGINIA PINE	0.13	3.3	13	0.9	319	1.0	5.2
AMELANCHIER ARBOREA	SHAD-BUSH	0.07	1.7	20	1.4	31	0.1	3.2
CELTIS OCCIDENTALIS	HACKBERRY	0.07	1.7	13	0.9	105	0.3	2.9
CARYA GLABRA	PIGNUT HICKORY	0.07	1.7	13	0.9	94	0.3	2.9
PRUNUS AVIUM	SWEET CHERRY	0.07	1.7	7	0.5	47	0.1	2.3
TOTAL		-	100.0	1433	100.0	32634	100.0	300.0

Table F-25

Vegetation analysis for tree seedlings in the Quarry Hillside Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
ACER RUBRUM	RED MAPLE	0.47	26.9	21333	38.3	0.83	13.8	79.1
FRAXINUS AMERICANA	WHITE ASH	0.20	11.5	10667	19.2	0.80	13.3	44.0
CORNUS FLORIDA	FLOWERING DOGWOOD	0.17	9.6	7667	13.8	1.03	17.1	40.5
QUERCUS BOREALIS	RED OAK	0.13	7.7	1000	1.8	0.63	10.5	20.0
ULMUS AMERICANA	AMERICAN ELM	0.07	3.8	3000	5.4	0.53	8.8	18.1
PRUNUS SEROTINA	BLACK CHERRY	0.13	7.7	2333	4.2	0.30	5.0	16.9
TILIA AMERICANA	BASSWOOD	0.10	5.8	3667	6.6	0.23	3.9	16.2
SASSAFRAS ALBIDUM	SASSAFRAS	0.10	5.8	1667	3.0	0.40	6.6	15.4
AMELANCHIER ARBOREA	SHAD-BUSH	0.10	5.8	1667	3.0	0.37	6.1	14.8
PRUNUS AVIUM	SWEET CHERRY	0.10	5.8	1667	3.0	0.20	3.3	12.1
QUERCUS VELUTINA	BLACK OAK	0.03	1.9	0	0.0	0.40	6.6	8.6
PINUS VIRGINIANA	VIRGINIA PINE	0.03	1.9	333	0.6	0.13	2.2	4.7
QUERCUS PRINUS	CHESTNUT OAK	0.03	1.9	333	0.6	0.07	1.1	3.6
PINUS STROBUS	WHITE PINE	0.03	1.9	333	0.6	0.03	0.6	3.1
CARYA TOMENTOSA	MOCKERNUT HICKORY	0.03	1.9	0	0.0	0.07	1.1	3.0
TOTAL		-	100.0	55666	100.0	6.03	100.0	300.0

Table F-26

Vegetation analysis for shrubs, herbs, and ground cover in the Quarry Hillside Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
SHRUBS						
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.27	32.0	5.60	38.8	70.8
LINDERA BENZOIN	SPICEBUSH	0.10	12.0	5.07	35.1	47.1
HAMAMELIS VIRGINIANA	WITCH HAZEL	0.07	8.0	1.73	12.0	20.0
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	0.10	12.0	1.10	7.6	19.6
VITIS AESTIVALIS	SUMMER GRAPE	0.13	16.0	0.30	2.1	18.1
RHUS RADICANS	POISON IVY	0.07	8.0	0.13	0.9	8.9
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.03	4.0	0.27	1.8	5.8
CELASTRUS SCANDENS	BITTERSWEET	0.03	4.0	0.13	0.9	4.9
VIBURNUM ACERIFOLIUM	MAPLE-LEAF VIBURNUM	0.03	4.0	0.10	0.7	4.7
HERBS						
ASTER DIVARICATUS	WHITE WOOD ASTER	0.37	10.9	7.30	30.0	40.9
DRYOPTERIS MARGINALIS	MARGINAL WOOD FERN	0.30	8.9	3.27	13.4	22.4
DESCHAMPSIA FLEXUOSA	HAIRGRASS	0.17	5.0	2.83	11.7	16.6
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	0.23	6.9	2.17	8.9	15.8
SOLIDAGO CAESIA	BLUE-STEMMED GOLDENROD	0.27	7.9	0.93	3.8	11.8
CAREX SP.	SEDGE	0.20	5.9	0.77	3.2	9.1
DANTHONIA SPICATA	POVERTY OATGRASS	0.10	3.0	1.03	4.3	7.2
GEUM CANADENSE	AVENS	0.07	2.0	0.80	3.3	5.3
ARALIA NUDICAULIS	WILD SARSAPARILLA	0.07	2.0	0.60	2.5	4.4
POLYGONUM VIRGINIANUM	VIRGINIA KNOTWEED	0.07	2.0	0.57	2.3	4.3
VERONICA SERPYLLIFOLIA	SPEEDWELL	0.10	3.0	0.23	1.0	3.9
CAREX PENSYLVANICA	SEDGE	0.10	3.0	0.23	1.0	3.9
PARIETARIA PENSYLVANICA	PELLITORY	0.10	3.0	0.23	1.0	3.9
SOLIDAGO JUNCEA	EARLY GOLDENROD	0.07	2.0	0.43	1.8	3.8
ASPLENIUM PLATYNEURON	EBONY SPLEENWORT	0.10	3.0	0.17	0.7	3.7
POLYSTICHUM ACROSTICHOIDES	CHRISTMAS FERN	0.07	2.0	0.40	1.6	3.6
POA COMPRESSA	CANADA BLUEGRASS	0.10	3.0	0.13	0.5	3.5
CAREX SWANNII	SEDGE	0.07	2.0	0.33	1.4	3.4
POLYGONUM SCANDENS	FALSE BUCKWHEAT	0.07	2.0	0.27	1.1	3.1
SMILACINA RACEMOSA	FALSE SOLOMAN'S SEAL	0.07	2.0	0.23	1.0	2.9
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.07	2.0	0.17	0.7	2.7
POTENTILLA SIMPLEX	CINQUEFOIL	0.07	2.0	0.17	0.7	2.7
GALIUM APARINE	CLEAVERS	0.07	2.0	0.17	0.7	2.7
UVULARIA SESSILIFOLIA	SESSILE-LEAVED BELLWORT	0.07	2.0	0.13	0.5	2.5
PANICUM SPP.	PANIC-GRASS	0.07	2.0	0.10	0.4	2.4
GRASS (UNIDENTIFIED)	-	0.07	2.0	0.07	0.3	2.3
CHENOPODIUM ALBUM	LAMB'S QUARTERS	0.03	1.0	0.13	0.5	1.5
CAREX ROSEA	SEDGE	0.03	1.0	0.10	0.4	1.4
HIERACIUM PRATENSE	HAWKWEED	0.03	1.0	0.07	0.3	1.3
CAREX LAXIFLORA	SEDGE	0.03	1.0	0.07	0.3	1.3
ANEMONELLA THALICTROIDES	RUE ANEMONE	0.03	1.0	0.07	0.3	1.3
OXALIS DILLENII	YELLOW WOOD SORREL	0.03	1.0	0.03	0.1	1.1
WOODSIA OBTUSA	BLUNT-LOBED WOODSIA	0.03	1.0	0.03	0.1	1.1
CONVOLVULUS SEPIUM	HEDGE BINDWEED	0.03	1.0	0.03	0.1	1.1
SOLIDAGO BICOLOR	SILVERROD	0.03	1.0	0.03	0.1	1.1
GROUND COVER						
LITTER	-	1.00	33.7	82.80	83.1	116.8
ROCK	-	1.00	33.7	13.00	13.1	46.8
MOSS	-	0.57	19.1	2.13	2.1	21.2
BARE SOIL	-	0.40	13.5	1.67	1.7	15.2

Table F-27

Comparison of trees (number of stems) in the Quarry Hillside Forest, 1978-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1978	1979	1980	1981	F	TREND
QUERCUS VELUTINA	BLACK OAK	25	24	24	20	3.04*	-
ACER RUBRUM	RED MAPLE	11	10	11	13	1.00	
FRAXINUS AMERICANA	WHITE ASH	15	12	13	12	1.63	
QUERCUS BOREALIS	RED OAK	8	7	8	12	2.33	
QUERCUS PRINUS	CHESTNUT OAK	12	12	11	12	1.00	
TILIA AMERICANA	.ASSWOOD	5	5	6	6	0.70	
ULMUS AMERICANA	AMERICAN ELM	3	4	4	4	1.00	
PINUS VIRGINIANA	VIRGINIA PINE	5	5	5	4	1.00	
CORNUS FLORIDA	FLOWERING DOGWOOD	4	3	4	3	0.75	
SASSAFRAS ALBIDUM	SASSAFRAS	1	2	2	2	1.00	
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	2	1	2	2	1.00	
BETULA LENTA	SWEET BIRCH	2	2	2	2	0.00	
CARYA TOMENTOSA	MOCKERNUT HICKORY	1	1	1	1	0.00	
JUGLANS NIGRA	BLACK WALNUT	0	1	1	1	1.00	
PRUNUS SEROTINA	BLACK CHERRY	1	1	1	1	0.00	
CELTIS OCCIDENTALIS	HACKBERRY	1	1	1	1	0.00	
CARYA OVATA	SHAGBARK HICKORY	1	1	1	1	0.00	
CARYA GLABRA	PIGNUT HICKORY	0	1	1	0	1.00	
PRUNUS AVIUM	SWEET CHERRY	1	0	0	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-28

Comparison of saplings (number of stems) in the Quarry Hillside Fores*, 1978-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1978	1979	1980	1981	F	TREND
CORNUS FLORIDA	FLOWERING DOGWOOD	106	105	101	89	0.75	
QUERCUS BOREALIS	RED OAK	27	29	29	33	1.17	
FRAXINUS AMERICANA	WHITE ASH	27	25	20	25	1.24	
ACER RUBRUM	RED MAPLE	30	29	27	23	0.41	
QUERCUS PRINUS	CHESTNUT OAK	15	16	17	13	1.70	
CARYA TOMENTOSA	MOCKERNUT HICKORY	8	6	6	5	1.14	
PRUNUS VIRGINIANA	CHOKE CHERRY	2	4	1	4	0.90	
TILIA AMERICANA	BASSWOOD	3	3	5	4	1.63	
SASSAFRAS ALBIDUM	SASSAFRAS	3	3	3	3	0.00	
AMELANCHIER ARBOREA	SHAD-BUSH	2	4	3	3	0.77	
QUERCUS VELUTINA	BLACK OAK	12	10	8	3	2.96*	-
ULMUS AMERICANA	AMERICAN ELM	4	4	2	3	1.64	
CELTIS OCCIDENTALIS	HACKBERRY	3	0	1	2	1.49	
PINUS VIRGINIANA	VIRGINIA PINE	4	2	2	2	0.74	
CARYA GLABRA	PIGNUT HICKORY	0	1	1	2	1.00	
PRUNUS [illegible]IUM	SWEET CHERRY	0	3	2	1	1.09	
JUGLANS NIGRA	BLACK WALNUT	0	1	1	0	1.00	
PRUNUS SEROTINA	BLACK CHERRY	2	1	1	0	0.79	
POPULUS GRANDIDENTATA	BIG-TOOTHED ASPEN	1	1	1	0	1.00	
CARYA OVATA	SHAGBARK HICKORY	1	0	0	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-29

Comparison of tree seedlings (number of stems) in the Quarry Hillside Forest, 1978-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1978	1979	1980	1981	F	TREND
ACER RUBRUM	RED MAPLE	24	41	46	64	2.24	
FRAXINUS AMERICANA	WHITE ASH	111	61	86	32	5.01**	
CORNUS FLORIDA	FLOWERING DOGWOOD	30	8	21	23	0.60	
TILIA AMERICANA	BASSWOOD	4	2	10	11	0.50	
ULMUS AMERICANA	AMERICAN ELM	7	6	9	9	0.55	
PRUNUS SEROTINA	BLACK CHERRY	11	15	11	7	2.72	
PRUNUS AVIUM	SWEET CHERRY	0	0	0	5	3.03*	+
SASSAFRAS ALBIDUM	SASSAFRAS	14	7	4	5	0.76	
AMELANCHIER ARBOREA	SHAD-BUSH	3	6	4	5	1.53	
QUERCUS BOREALIS	RED OAK	8	3	3	3	3.13*	-
QUERCUS PRINUS	CHESTNUT OAK	3	4	2	1	1.75	
PINUS VIRGINIANA	VIRGINIA PINE	1	1	1	1	0.00	
PINUS STROBUS	WHITE PINE	1	1	1	1	0.00	
CRATAEGUS SP.	HAWTHORNE	1	0	0	0	1.00	
CELTIS OCCIDENTALIS	HACKBERRY	1	0	0	0	1.00	
PRUNUS VIRGINIANA	CHOKE CHERRY	6	1	0	0	2.37	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-30

Comparison of shrubs, herbs, and ground cover (% cover) in the Quarry Hillside Forest, 1978-81.

SPECIES	COMMON NAME	% COVER 1978	1979	1980	1981	F	TREND
SHRUBS							
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	6.27	5.80	4.53	5.60	0.39	
LINDERA BENZOIN	SPICEBUSH	2.43	2.97	4.53	5.07	1.11	
HAMAMELIS VIRGINIANA	WITCH HAZEL	2.03	3.33	0.03	1.73	0.37	
VACCINIUM VACILLANS	LOW-BUSH BLUEBERRY	1.67	1.53	1.60	1.10	0.37	
VITIS AESTIVALIS	SUMMER GRAPE	0.27	0.43	0.47	0.30	0.40	
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.17	0.23	0.20	0.27	0.48	
VIBURNUM ACERIFOLIUM	MAPLE-LEAF VIBURNUM	0.07	0.00	0.20	0.10	1.46	
HERBS							
ASTER DIVARICATUS	WHITE WOOD ASTER	7.50	8.80	9.80	7.30	1.27	
DRYOPTERIS MARGINALIS	MARGINAL WOOD FERN	3.63	3.00	3.47	3.27	0.76	
DESCHAMPSIA FLEXUOSA	HAIRGRASS	4.33	4.57	6.30	2.83	1.47	
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	0.77	0.80	2.10	2.17	2.98*	+
DANTHONIA SPICATA	POVERTY OATGRASS	0.20	0.27	0.00	1.03	1.05	
SOLIDAGO CAESIA	BLUE-STEMMED GOLDENROD	0.90	0.83	0.90	0.93	1.01	
CAREX SP.	SEDGE	0.73	0.67	0.83	0.77	0.13	
CAREX SWANNII	SEDGE	1.80	1.17	0.73	0.33	1.75	
CAREX PENSYLVANICA	SEDGE	0.47	0.47	0.30	0.23	0.11	
PARIETARIA PENSYLVANICA	PELLITORY	0.00	0.23	0.40	0.23	1.64	
VERONICA SERPYLLIFOLIA	SPEEDWELL	0.00	0.00	0.00	0.23	3.37*	+
ASPLENIUM PLATYNEURON	EBONY SPLEENWORT	0.13	0.20	0.10	0.17	0.67	
UVULARIA SESSILIFOLIA	SESSILE-LEAVED BELLWORT	0.27	0.30	0.53	0.13	1.54	
POA COMPRESSA	CANADA BLUEGRASS	0.33	0.53	0.83	0.13	1.26	
PANICUM SPP.	PANIC-GRASS	0.10	0.20	0.07	0.10	0.71	
CAREX ROSEA	SEDGE	0.60	1.40	1.30	0.10	2.06	
GROUND COVER							
LITTER	-	75.97	80.17	76.23	82.80	2.91*	
ROCK	-	19.33	14.10	16.87	13.00	5.00**	-
MOSS	-	1.33	1.23	1.50	2.13	2.77	
BARE SOIL	-	5.20	3.90	4.50	1.67	2.40	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-31

Vegetation analysis for trees in the Gould Island Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
ACER SACCHARINUM	SILVER MAPLE	0.47	30.0	95	34.6	181952	56.7	121.3
CELTIS OCCIDENTALIS	HACKBERRY	0.37	23.3	53	19.2	75604	23.5	66.1
ULMUS AMERICANA	AMERICAN ELM	0.21	13.3	26	9.6	11177	3.5	26.4
TILIA AMERICANA	BASSWOOD	0.05	3.3	37	13.5	17911	5.6	22.4
FRAXINUS AMERICANA	WHITE ASH	0.11	6.7	11	3.8	10719	3.3	13.9
BETULA LENTA	SWEET BIRCH	0.11	6.7	16	5.8	3481	1.1	13.5
LIRIODENDRON TULIPIFERA	TULIP-TREE	0.05	3.3	5	1.9	10752	3.3	8.6
CARYA CORDIFORMIS	BITTERNUT HICKORY	0.05	3.3	11	3.8	4406	1.4	8.6
FRAXINUS PENNSYLVANICA	RED ASH	0.05	3.3	11	3.8	1000	0.3	7.5
JUGLANS CINEREA	BUTTERNUT	0.05	3.3	5	1.9	3476	1.1	6.3
PRUNUS SEROTINA	BLACK CHERRY	0.05	3.3	5	1.9	699	0.2	5.5
TOTAL			100.0	274	100.0	321172	100.0	300.0

Table F-32

Vegetation analysis for saplings in the Gould Island Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (BA/HA)	RELATIVE DOMINANCE	IMPORTANCE VALUE
FRAXINUS PENNSYLVANICA	RED ASH	0.21	28.6	68	41.9	1695	40.0	110.5
ULMUS AMERICANA	AMERICAN ELM	0.26	35.7	47	29.0	1773	41.8	106.6
FRAXINUS AMERICANA	WHITE ASH	0.11	14.3	32	19.4	529	12.5	46.1
CARYA CORDIFORMIS	BITTERNUT HICKORY	0.05	7.1	5	3.2	203	4.8	15.1
CATALPA BIGNONIOIDES	CATALPA	0.05	7.1	5	3.2	37	0.9	11.2
LIRIODENDRON TULIPIFERA	TULIP-TREE	0.05	7.1	5	3.2	4	0.1	10.5
TOTAL		-	100.0	163	100.0	4241	100.0	300.0

Table F-33

Vegetation analysis for tree seedlings in the Gould Island Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DENSITY (NO./HA)	RELATIVE DENSITY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
ULMUS AMERICANA	AMERICAN ELM	0.29	33.3	4211	42.1	0.42	20.3	95.7
CELTIS OCCIDENTALIS	HACKBERRY	0.24	27.3	2895	28.9	0.42	20.3	76.5
FRAXINUS AMERICANA	WHITE ASH	0.18	21.2	1842	18.4	0.58	27.8	67.5
CARYA CORDIFORMIS	BITTERNUT HICKORY	0.08	9.1	526	5.3	0.39	19.0	33.3
TILIA AMERICANA	BASSWOOD	0.03	3.0	0	0.0	0.16	7.6	10.6
QUERCUS BOREALIS	RED OAK	0.03	3.0	263	2.6	0.08	3.8	9.5
ACER SACCHARINUM	SILVER MAPLE	0.03	3.0	263	2.6	0.03	1.3	6.9
TOTAL		-	100.0	10000	100.0	2.08	100.0	300.0

Table F-34

Vegetation analysis for shrubs, herbs, and ground cover in the Gould Island Forest, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
SHRUBS						
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.76	55.8	13.08	78.6	134.4
RHUS RADICANS	POISON IVY	0.29	21.2	1.89	11.4	32.5
LINDERA BENZOIN	SPICEBUSH	0.13	9.6	0.68	4.1	13.7
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.13	9.6	0.50	3.0	12.6
LIGUSTRUM VULGARE	COMMON PRIVET	0.05	3.8	0.47	2.8	6.7
HERBS						
MATTEUCCIA STRUTHIOPTERIS	OSTRICH FERN	0.63	9.6	46.05	41.9	51.5
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.79	12.0	12.08	11.0	23.0
POLYGONUM CILINODE	BINDWEED	0.53	8.0	13.03	11.8	19.9
ALLIARIA OFFICINALIS	GARLIC MUSTARD	0.74	11.2	6.13	5.6	16.8
POLYGONUM VIRGINIANUM	VIRGINIA KNOTWEED	0.50	7.6	6.82	6.2	13.8
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	0.53	8.0	4.58	4.2	12.2
GEUM CANADENSE	AVENS	0.42	6.4	3.24	2.9	9.4
HESPERIS MATRONALIS	DAME'S ROCKET	0.37	5.6	2.47	2.2	7.9
IMPATIENS BIFLORA	JEWELWEED	0.32	4.8	3.16	2.9	7.7
TEUCRIUM CANADENSE	WOOD-SAGE	0.26	4.0	2.47	2.2	6.3
LEERSIA VIRGINICA	WHITE GRASS	0.26	4.0	1.76	1.6	5.6
CIRCAEA QUADRISULCATA	ENCHANTER NIGHTSHADE	0.18	2.8	1.74	1.6	4.4
ARISAEMA TRIPHYLLUM	JACK-IN-THE-PULPIT	0.11	1.6	1.00	0.9	2.5
ELYMUS RIPARIUS	WILD RYE	0.13	2.0	0.42	0.4	2.4
POLYGONUM CUSPIDATUM	MEXICAN BAMBOO	0.08	1.2	1.29	1.2	2.4
BOEHMERIA CYLINDRICA	FALSE NETTLE	0.05	0.8	1.71	1.6	2.4
PILEA PUMILA	CLEARWEED	0.13	2.0	0.26	0.2	2.2
PODOPHYLLUM PELTATUM	MAY APPLE	0.05	0.8	0.26	0.2	1.0
URTICA DIOICA	STINGING NETTLE	0.05	0.8	0.18	0.2	1.0
OXALIS DILLENII	YELLOW WOOD SORREL	0.05	0.8	0.16	0.1	0.9
EPIPACTIS HELLEBORINE	HELLEBORINE	0.05	0.8	0.11	0.1	0.9
SOLIDAGO FLEXICAULIS	ZIGZAG GOLDENROD	0.03	0.4	0.21	0.2	0.6
HELIANTHUS TUBEROSUS	JERUSALEM ARTICHOKE	0.03	0.4	0.13	0.1	0.5
CINNA ARUNDINACEA	STOUT WOODREED	0.03	0.4	0.13	0.1	0.5
LYCOPUS VIRGINICUS	WATER HOREHOUND	0.03	0.4	0.13	0.1	0.5
GRASS (UNIDENTIFIED)		0.03	0.4	0.11	0.1	0.5
LYSIMACHIA CILIATA	FRINGED LOOSESTRIFE	0.03	0.4	0.11	0.1	0.5
POLYGONUM PERSICARIA	SMARTWEED	0.03	0.4	0.08	0.1	0.5
GLECOMA HEDERACEA	GILL-OVER-THE-GROUND	0.03	0.4	0.08	0.1	0.5
CAREX SP.	SEDGE	0.03	0.4	0.05	0.0	0.4
EQUISETUM ARVENSE	FIELD HORSETAIL	0.03	0.4	0.05	0.0	0.4
SOLIDAGO RUGOSA	ROUGH GOLDENROD	0.03	0.4	0.03	0.0	0.4
ASTER DIVARICATUS	WHITE WOOD ASTER	0.03	0.4	0.03	0.0	0.4
GROUND COVER						
LITTER	-	1.00	43.7	77.13	77.6	121.3
BARE SOIL	-	0.82	35.6	20.34	20.5	56.1
MOSS	-	0.47	20.7	1.89	1.9	22.6

Table F-35

Comparison of trees (number of stems) in the Gould Island Forest, 1979-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1979	1980	1981	F	TREND
ACER SACCHARINUM	SILVER MAPLE	17	18	18	1.00	
CELTIS OCCIDENTALIS	HACKBERRY	11	11	10	1.00	
TILIA AMERICANA	BASSWOOD	7	7	7	0.00	
ULMUS AMERICANA	AMERICAN ELM	8	8	5	0.71	
BETULA LENTA	SWEET BIRCH	3	3	3	0.00	
FRAXINUS PENNSYLVANICA	RED ASH	0	0	2	1.00	
CARYA CORDIFORMIS	BITTERNUT HICKORY	0	2	2	1.00	
FRAXINUS AMERICANA	WHITE ASH	7	4	2	1.42	
LIRIODENDRON TULIPIFERA	TULIP-TREE	1	1	1	0.00	
PRUNUS SEROTINA	BLACK CHERRY	1	1	1	0.00	
JUGLANS CINEREA	BUTTERNUT	1	1	1	0.00	
CATALPA BIGNONIOIDES	CATALPA	0	1	0	1.00	
ROBINIA PSEUDOACACIA	BLACK LOCUST	1	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-36

Comparison of saplings (number of stems) in the Gould Island Forest, 1979-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1979	1980	1981	F	TREND
FRAXINUS PENNSYLVANICA	RED ASH	0	0	13	3.86*	+
ULMUS AMERICANA	AMERICAN ELM	10	8	9	1.38	
FRAXINUS AMERICANA	WHITE ASH	17	18	6	3.16	
LIRIODENDRON TULIPIFERA	TULIP-TREE	0	0	1	1.00	
CATALPA BIGNONIOIDES	CATALPA	3	1	1	1.00	
CARYA CORDIFORMIS	BITTERNUT HICKORY	1	1	1	0.00	
TILIA AMERICANA	BASSWOOD	0	1	0	1.00	
PRUNUS SEROTINA	BLACK CHERRY	1	1	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-37

Comparison of tree seedlings (number of stems) in the Gould Island Forest, 1979-81.

SPECIES	COMMON NAME	NUMBER OF STEMS 1979	1980	1981	F	TREND
ULMUS AMERICANA	AMERICAN ELM	7	12	16	2.65	
CELTIS OCCIDENTALIS	HACKBERRY	7	6	11	1.43	
FRAXINUS AMERICANA	WHITE ASH	6	5	7	0.38	
CARYA CORDIFORMIS	BITTERNUT HICKORY	3	0	2	2.52	
ACER SACCHARINUM	SILVER MAPLE	67	1	1	2.59	
QUERCUS BOREALIS	RED OAK	0	0	1	1.00	
BETULA NIGRA	RIVER BIRCH	0	3	0	2.00	
ACER NIGRUM	BLACK MAPLE	1	2	0	1.00	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-38

Comparison of shrubs, herbs, and ground cover (% cover) in the Gould Island Forest, 1979-81.

SPECIES	COMMON NAME	% COVER 1979	1980	1981	F	TREND
SHRUBS						
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	9.66	13.21	13.08	2.98	
RHUS RADICANS	POISON IVY	1.39	1.84	1.89	1.45	
LINDERA BENZOIN	SPICEBUSH	0.71	0.58	0.68	1.80	
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.32	1.29	0.50	0.60	
LIGUSTRUM VULGARE	COMMON PRIVET	0.53	0.63	0.47	0.42	
HERBS						
MATTEUCCIA STRUTHIOPTERIS	OSTRICH FERN	45.21	46.79	46.05	0.13	
POLYGONUM CILINODE	BINDWEED	10.05	8.11	13.03	3.98*	
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	13.79	14.34	12.08	0.51	
POLYGONUM VIRGINIANUM	VIRGINIA KNOTWEED	9.11	7.45	6.82	1.66	
ALLIARIA OFFICINALIS	GARLIC MUSTARD	4.18	14.00	6.13	7.65**	
EUPATORIUM RUGOSUM	WHITE SNAKEROOT	1.76	3.00	4.58	9.88**	+
GEUM CANADENSE	AVENS	4.45	3.24	3.24	2.34	
IMPATIENS BIFLORA	JEWELWEED	5.42	6.16	3.16	2.43	
TEUCRIUM CANADENSE	WOOD-SAGE	2.34	1.74	2.47	1.62	
HESPERIS MATRONALIS	DAME'S ROCKET	2.66	1.42	2.47	2.09	
LEERSIA VIRGINICA	WHITE GRASS	1.50	1.95	1.76	0.82	
CIRCAEA QUADRISULCATA	ENCHANTER NIGHTSHADE	0.24	0.66	1.74	2.60	
POLYGONUM CUSPIDATUM	MEXICAN BAMBOO	0.42	1.11	1.29	2.15	
ARISAEMA TRIPHYLLUM	JACK-IN-THE-PULPIT	2.03	1.84	1.00	1.58	
ELYMUS RIPARIUS	WILD RYE	0.42	0.79	0.42	1.62	
PILEA PUMILA	CLEARWEED	0.08	0.87	0.26	11.19**	
URTICA DIOICA	STINGING NETTLE	0.68	0.11	0.18	2.55	
OXALIS DILLENII	YELLOW WOOD SORREL	0.11	0.11	0.16	0.89	
GRASS(UNIDENTIFIED)	-	0.29	0.00	0.11	3.48*	
CAREX SP.	SEDGE	0.34	0.16	0.05	1.58	
GROUND COVER						
LITTER	-	21.21	74.21	77.13	160.17**	+
BARE SOIL	-	76.74	23.18	20.34	184.19**	-
MOSS	-	0.29	1.37	1.89	14.40**	+

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-39

Estimated damage (% defoliation) by gypsy moth to trees and saplings in the Council Cup, TR419, and Quarry Hillside Forests, 1981.

Species	Council Cup		TR419		Quarry Hillside		Total	
	No.	% Def.	No.	% Def.	No.	% Def.	No.	% Def.[a]
Quercus alba	9	88.9	2	35.0	0	0	11	79.1
Amelanchier arborea	3	100.0	3	13.3	3	100.0	9	71.1
Quercus prinus	40	94.0	12	39.2	25	68.0	77	77.0
Quercus velutina	46	74.8	77	17.3	20	74.5	143	43.8
Quercus borealis	43	49.8	2	10.0	45	38.4	90	43.2
Carya glabra	6	51.7	9	16.7	2	25.0	17	30.0
Carya tomentosa	7	54.3	30	21.0	6	41.7	43	29.3
Prunus virginiana	0	0.0	0	0.0	4	25.0	4	25.0
Tilia americana	0	0.0	0	0.0	10	21.0	10	21.0
Sassafras albidum	3	76.7	5	0.0	5	6.0	13	20.0
Betula lenta	122	14.2	0	0.0	2	85.0	124	15.3
Pinus strobus	29	16.6	13	10.0	0	0.0	42	14.5
Betula populifolia	11	16.4	8	0.0	0	0.0	19	9.5
Ulmus americana	0	0.0	0	0.0	6	6.7	6	6.7
Acer rubrum	103	5.0	33	3.0	36	8.1	172	5.2
Tsuga canadensis	8	6.2	2	0.0	0	0.0	10	5.0
Crataegus sp.	0	0.0	8	2.5	0	0.0	8	2.5
Fraxinus americana	4	0.0	4	2.5	37	1.1	45	0.9
Prunus serotina	3	3.3	14	0.0	1	0.0	18	0.6
Cornus florida	9	1.1	155	0.1	92	0.0	256	0.0
Pinus virginiana	10	0.0	23	0.0	6	0.0	39	0.0
Other spp.[b]	11	25.5	5	0.0	8	5.0	24	13.3
Total	467	31.3[a]	405	7.4[a]	308	20.9[a]	1180	

[a]Weighted mean.

[b]Species with less than three individuals per plot.

Table F-40

Vegetation analysis for tree seedlings, shrubs, and herbs in Switchyard Field, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
TREE SEEDLINGS						
CORNUS FLORIDA	FLOWERING DOGWOOD	0.49	45.3	6.93	51.8	97.1
BETULA POPULIFOLIA	GRAY BIRCH	0.14	13.2	3.92	29.3	42.5
FRAXINUS AMERICANA	WHITE ASH	0.22	20.8	1.04	7.7	28.5
ACER RUBRUM	RED MAPLE	0.14	13.2	1.05	7.9	21.1
PRUNUS SEROTINA	BLACK CHERRY	0.04	3.8	0.08	0.6	4.4
FRAXINUS PENNSYLVANICA	RED ASH	0.02	1.9	0.26	1.9	3.8
SASSAFRAS ALBIDUM	SASSAFRAS	0.02	1.9	0.09	0.7	2.6
SHRUBS						
CORNUS RACEMOSA	GRAY DOGWOOD	0.63	37.8	8.51	58.0	95.8
RHUS RADICANS	POISON IVY	0.31	18.3	1.41	9.6	27.9
RUBUS FLAGELLARIS	DEWBERRY	0.24	14.6	1.33	9.1	23.7
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.20	12.2	1.04	7.1	19.3
CORNUS AMOMUM	SILKY DOGWOOD	0.08	4.9	1.40	9.6	14.4
ILEX VERTICELLATA	WINTERBERRY	0.04	2.4	0.35	2.4	4.8
VIBURNUM DENTATUM	ARROWWOOD	0.04	2.4	0.31	2.1	4.6
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.04	2.4	0.04	0.3	2.7
ROSA MULTIFLORA	MULTIFLORA ROSE	0.02	1.2	0.17	1.1	2.4
VACCINIUM CORYMBOSUM	HIGH-BUSH BLUEBERRY	0.02	1.2	0.06	0.4	1.6
SALIX HUMILIS	PRAIRIE WILLOW	0.02	1.2	0.03	0.2	1.4
VITIS LABRUSCA	FOX-GRAPE	0.02	1.2	0.01	0.1	1.3
HERBS						
SOLIDAGO RUGOSA	ROUGH GOLDENROD	1.00	8.8	34.75	24.3	33.2
SOLIDAGO CANADENSIS	CANADA GOLDENROD	0.96	8.5	30.24	21.2	29.7
GRASS(UNIDENTIFIED)	-	1.00	8.8	26.90	18.8	27.7
POTENTILLA SIMPLEX	CINQUEFOIL	0.82	7.2	14.25	10.0	17.2
RUMEX ACETOSELLA	SHEEP SORREL	0.88	7.8	9.71	6.8	14.6
SOLIDAGO GRAMINIFOLIA	FLAT-TOPPED GOLDENROD	0.69	6.1	5.25	3.7	9.8
FRAGARIA VIRGINIANA	WILD STRAWBERRY	0.39	3.4	4.18	2.9	6.4
SOLIDAGO JUNCEA	EARLY GOLDENROD	0.43	3.8	3.22	2.3	6.0
ASTER PILOSUS	HEATH ASTER	0.47	4.2	2.19	1.5	5.7
HIERACIUM PRATENSE	HAWKWEED	0.53	4.7	1.11	0.8	5.5
TRIFOLIUM SP.	CLOVER	0.45	4.0	0.74	0.5	4.5
VERONICA OFFICINALIS	COMMON SPEEDWELL	0.43	3.8	0.94	0.7	4.5
SOLIDAGO GIGANTEA	LATE GOLDENROD	0.33	2.9	1.65	1.2	4.0
CAREX SP.	SEDGE	0.31	2.7	0.88	0.6	3.3
DAUCUS CAROTA	QUEEN ANNE'S LACE	0.31	2.7	0.53	0.4	3.1
ONOCLEA SENSIBILIS	SENSITIVE FERN	0.16	1.4	1.74	1.2	2.7
BOTRYCHIUM DISSECTUM	GRAPE FERN	0.27	2.3	0.22	0.2	2.5
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.24	2.2	0.21	0.1	2.3
ASTER LATERIFLORUS	CALICO ASTER	0.18	1.6	0.49	0.3	2.0
OXALIS STRICTA	YELLOW WOOD SORREL	0.18	1.6	0.16	0.1	1.7
TRIODIA FLAVA	PURPLETOP	0.12	1.1	0.60	0.4	1.5
TARAXACUM OFFICINALE	DANDELION	0.12	1.1	0.17	0.1	1.2
PHLEUM PRATENSE	TIMOTHY	0.06	0.5	0.88	0.6	1.2
SOLIDAGO NEMORALIS	LITTLE GREY GOLDENROD	0.10	0.9	0.19	0.1	1.0
APOCYNUM CANNABINUM	INDIAN HEMP	0.08	0.7	0.17	0.1	0.8
TRIFOLIUM PRATENSE	RED CLOVER	0.08	0.7	0.11	0.1	0.8
PLANTAGO LANCEOLATA	ENGLISH PLANTAIN	0.08	0.7	0.10	0.1	0.8
LYCOPODIUM FLABELLIFORME	GROUND PINE	0.06	0.5	0.13	0.1	0.6
DESMODIUM DILLENII	TICK-TREFOIL	0.04	0.4	0.37	0.3	0.6
CERASTIUM ARVENSE	FIELD CHICKWEED	0.06	0.5	0.06	0.0	0.6
GEUM CANADENSE	AVENS	0.06	0.5	0.06	0.0	0.6
HYPERICUM PUNCTATUM	SPOTTED ST. JOHN'S WORT	0.06	0.5	0.06	0.0	0.6
CHRYSANTHEMUM LEUCANTHEMUM	OX-EYE DAISY	0.04	0.4	0.07	0.1	0.4
HYPERICUM PERFORATUM	COMMON ST. JOHN'S WORT	0.04	0.4	0.04	0.0	0.4
LOBELIA SPICATA	LOBELIA	0.04	0.4	0.03	0.0	0.4
ASTER UMBELLATUS	FLAT-TOPPED WHITE ASTER	0.02	0.2	0.11	0.1	0.3
LACTUCA CANADENSIS	WILD LETTUCE	0.02	0.2	0.07	0.0	0.2
OENOTHERA PERENNIS	SUNDROPS	0.02	0.2	0.03	0.0	0.2
RUDBECKIA HIRTA	BLACK-EYED SUSAN	0.02	0.2	0.02	0.0	0.2
LOBELIA INFLATA	INDIAN-TOBACCO	0.02	0.2	0.02	0.0	0.2
ACHILLEA MILLEFOLIUM	YARROW	0.02	0.2	0.02	0.0	0.2
CONVOLVULUS SEPIUM	HEDGE BINDWEED	0.02	0.2	0.02	0.0	0.2
ASTER SIMPLEX	ASTER	0.02	0.2	0.01	0.0	0.2
GALIUM APARINE	CLEAVERS	0.02	0.2	0.01	0.0	0.2
SOLANUM CAROLINENSE	HORSE-NETTLE	0.02	0.2	0.01	0.0	0.2
PANICUM SPP.	PANIC-GRASS	0.02	0.2	0.01	0.0	0.2

Table F-41

Comparison of tree seedlings, shrubs, and herbs (% cover) in Switchyard Field, 1978-79 and 1981.

		% COVER				
SPECIES	COMMON NAME	1978	1979	1981	F	TREND
TREE SEEDLINGS						
CORNUS FLORIDA	FLOWERING DOGWOOD	1.96	4.40	6.93	22.20**	+
BETULA POPULIFOLIA	GRAY BIRCH	1.15	1.79	3.92	10.80**	+
ACER RUBRUM	RED MAPLE	0.31	0.22	1.05	6.60**	+
FRAXINUS AMERICANA	WHITE ASH	0.69	0.51	1.04	1.31	
SASSAFRAS ALBIDUM	SASSAFRAS	0.09	0.10	0.09	0.65	
PRUNUS SEROTINA	BLACK CHERRY	0.06	0.07	0.08	0.06	
SHRUBS						
CORNUS RACEMOSA	GRAY DOGWOOD	4.29	5.06	8.51	15.21**	+
RHUS RADICANS	POISON IVY	0.73	0.68	1.41	12.57**	+
CORNUS AMOMUM	SILKY DOGWOOD	0.60	[illegible].74	1.40	4.74*	+
RUBUS FLAGELLARIS	DEWBERRY	0.89	0.76	1.33	3.62*	
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.56	0.62	1.04	2.57	
ILEX VERTICELLATA	WINTERBERRY	0.17	0.21	0.35	0.80	
VIBURNUM DENTATUM	ARROWWOOD	0.00	0.11	0.31	1.93	
HERBS						
SOLIDAGO RUGOSA	ROUGH GOLDENROD	39.65	31.52	34.75	6.07**	-
SOLIDAGO CANADENSIS	CANADA GOLDENROD	24.12	24.58	30.24	7.28**	+
GRASS(UNIDENTIFIED)	-	13.15	20.94	26.90	20.08**	+
POTENTILLA SIMPLEX	CINQUEFOIL	10.58	14.03	14.25	9.25**	+
RUMEX ACETOSELLA	SHEEP SORREL	5.09	9.68	9.71	15.11**	+
SOLIDAGO GRAMINIFOLIA	FLAT-TOPPED GOLDENROD	4.29	4.77	5.25	1.28	
FRAGARIA VIRGINIANA	WILD STRAWBERRY	3.46	5.50	4.18	5.67*	+
SOLIDAGO JUNCEA	EARLY GOLDENROD	2.82	2.66	3.22	0.76	
ASTER PILOSUS	HEATH ASTER	1.26	1.89	2.19	2.59	
HIERACIUM PRATENSE	HAWKWEED	1.56	2.63	1.11	8.91**	
VERONICA OFFICINALIS	COMMON SPEEDWELL	0.90	1.95	0.94	5.94**	
CAREX SP.	SEDGE	1.90	2.10	0.88	13.46**	-
TRIFOLIUM SP.	CLOVER	0.20	0.76	0.74	11.55**	+
DAUCUS CAROTA	QUEEN ANNE'S LACE	1.45	1.15	0.53	14.22**	-
POA PRATENSIS	KENTUCKY BLUEGRASS	6.27	5.54	0.00	7.38*	-

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Table F-42

Vegetation analysis for tree seedlings, shrubs, and herbs in Transmission Corridor Field, 1981.

SPECIES	COMMON NAME	FREQUENCY	RELATIVE FREQUENCY	DOMINANCE (% COVER)	RELATIVE DOMINANCE	IMPORTANCE VALUE
TREE SEEDLINGS						
ACER RUBRUM	RED MAPLE	0.08	30.8	1.78	53.6	84.3
PRUNUS SEROTINA	BLACK CHERRY	0.10	38.5	0.70	21.0	59.5
QUERCUS PALUSTRIS	PIN OAK	0.02	7.7	0.36	11.0	18.7
BETULA POPULIFOLIA	GRAY BIRCH	0.02	7.7	0.33	9.9	17.6
CRATAEGUS SP.	HAWTHORNE	0.02	7.7	0.13	4.0	11.7
POPULUS TREMULOIDES	QUAKING ASPEN	0.02	7.7	0.02	0.6	8.3
SHRUBS						
RUBUS FLAGELLARIS	DEWBERRY	0.96	51.1	23.19	68.6	119.6
RUBUS ALLEGHENIENSIS	BLACKBERRY	0.46	24.5	3.51	10.4	34.8
CORNUS 'CEMOSA	GRAY DOGWOOD	0.14	7.4	2.75	8.1	15.6
VITIS AESTIVALIS	SUMMER GRAPE	0.08	4.3	2.72	8.1	12.3
RHUS RADICANS	POISON IVY	0.10	5.3	0.45	1.3	6.7
CELASTRUS SCANDENS	BITTERSWEET	0.04	2.1	0.25	0.7	2.9
SALIX HUMILIS	PRAIRIE WILLOW	0.02	1.1	0.48	1.4	2.5
LONICERA TARTARICA	TARTARIAN HONEYSUCKLE	0.02	1.1	0.24	0.7	1.8
RHUS GLABRA	SMOOTH SUMAC	0.02	1.1	0.10	0.3	1.4
SAMBUCUS CANADENSIS	COMMON ELDER	0.02	1.1	0.10	0.3	1.3
CORNUS AMOMUM	SILKY DOGWOOD	0.02	1.1	0.03	0.1	1.2
HERBS						
GRASS(UNIDENTIFIED)	-	0.98	9.0	21.06	23.9	32.9
SOLIDAGO JUNCEA	EARLY GOLDENROD	0.92	8.5	9.16	10.4	18.9
FRAGARIA VIRGINIANA	WILD STRAWBERRY	0.90	8.3	8.44	9.6	17.9
SOLIDAGO NEMORALIS	LITTLE GREY GOLDENROD	0.74	6.8	8.73	9.9	16.7
RUMEX ACETOSELLA	SHEEP SORREL	0.90	8.3	4.61	5.2	13.5
HIERACIUM PRATENSE	HAWKWEED	0.68	6.3	2.90	3.3	9.5
MOSS	-	0.32	2.9	5.60	6.4	9.3
ASTER PILOSUS	HEATH ASTER	0.56	5.1	3.30	3.8	8.9
SOLIDAGO RUGOSA	ROUGH GOLDENROD	0.34	3.1	4.63	5.3	8.4
LINARIA VULGARIS	BUTTER-AND-EGGS	0.60	5.5	1.57	1.8	7.3
SOLIDAGO CANADENSIS	CANADA GOLDENROD	0.24	2.2	4.13	4.7	6.9
BOTRYCHIUM DISSECTUM	GRAPE FERN	0.60	5.5	1.15	1.3	6.8
SOLIDAGO GRAMINIFOLIA	FLAT-TOPPED GOLDENROD	0.26	2.4	2.90	3.3	5.7
ASPLENIUM PLATYNEURON	EBONY SPLEENWORT	0.28	2.6	0.63	0.7	3.3
GNAPHALIUM OBTUSIFOLIUM	CUDWEED	0.22	2.0	0.46	0.5	2.5
POTENTILLA SIMPLEX	CINQUEFOIL	0.14	1.3	1.10	1.2	2.5
PHLEUM PRATENSE	TIMOTHY	0.10	0.9	1.36	1.5	2.5
ACHILLEA MILLEFOLIUM	YARROW	0.18	1.7	0.66	0.8	2.4
AGROPYRON REPENS	QUACK GRASS	0.02	0.2	1.76	2.0	2.2
RUDBECKIA HIRTA	BLACK-EYED SUSAN	0.18	1.7	0.35	0.4	2.1
HYPERICUM PUNCTATUM	SPOTTED ST. JOHN'S WORT	0.20	1.8	0.18	0.2	2.0
OENOTHERA BIENNIS	EVENING-PRIMROSE	0.14	1.3	0.26	0.3	1.6
DAUCUS CAROTA	QUEEN ANNE'S LACE	0.12	1.1	0.15	0.2	1.3
OXALIS STRICTA	YELLOW WOOD SORREL	0.12	1.1	0.06	0.1	1.2
SOLANUM CAROLINENSE	HORSE-NETTLE	0.10	0.9	0.16	0.2	1.1
LYCOPODIUM FLABELLIFORME	GROUND PINE	0.08	0.7	0.32	0.4	1.1
TRIFOLIUM SP.	CLOVER	0.10	0.9	0.13	0.1	1.1
ANTENNARIA NEGLECTA	PUSSYTOES	0.08	0.7	0.22	0.2	1.0
CIRSIUM PUMILUM	PASTURE THISTLE	0.08	0.7	0.16	0.2	0.9
PLANTAGO LANCEOLATA	ENGLISH PLANTAIN	0.08	0.7	0.11	0.1	0.9
HYPERICUM PERFORATUM	COMMON ST. JOHN'S WORT	0.08	0.7	0.10	0.1	0.8
VERONICA OFFICINALIS	COMMON SPEEDWELL	0.06	0.6	0.12	0.1	0.7
CAREX SP.	SEDGE	0.06	0.6	0.09	0.1	0.7
APOCYNUM CANNABINUM	INDIAN HEMP	0.04	0.4	0.17	0.2	0.6
AMBROSIA ARTEMISIIFOLIA	RAGWEED	0.04	0.4	0.14	0.2	0.5
LITTER	-	0.02	0.2	0.25	0.3	0.5
UNIDENTIFIED HERB#1	-	0.04	0.4	0.09	0.1	0.5
VIOLA PAPILIONACEA	COMMON BLUE VIOLET	0.04	0.4	0.06	0.1	0.4
BARE SOIL	-	0.02	0.2	0.13	0.1	0.3
DESMODIUM PANICULATUM	TICK-TREFOIL	0.02	0.2	0.11	0.1	0.3
TRICHOSTEMA DICHOTOMUM	BLUE CURLS	0.02	0.2	0.10	0.1	0.3
TARAXACUM OFFICINALE	DANDELION	0.02	0.2	0.10	0.1	0.3
PRUNELLA VULARIS	SELF-HEAL	0.02	0.2	0.09	0.1	0.3
ONOCLEA SENSIBILIS	SENSITIVE FERN	0.02	0.2	0.08	0.1	0.3
ANDROPOGON SCOPARIUS	LITTLE BLUESTEM	0.02	0.2	0.07	0.1	0.3
CHRYSANTHEMUM LEUCANTHEMUM	OX-EYE DAISY	0.02	0.2	0.05	0.1	0.2
TRIODIA FLAVA	PURPLETOP	0.02	0.2	0.05	0.1	0.2
MELAMPYRUM LINEARE	COW-WHEAT	0.02	0.2	0.02	0.0	0.2
ASTER SIMPLEX	ASTER	0.02	0.2	0.02	0.0	0.2
LACTUCA CANADENSIS	WILD LETTUCE	0.02	0.2	0.01	0.0	0.2

Table F-43

Comparison of tree seedlings, shrubs, and herbs (% cover) in Transmission Corridor Field, 1979 and 1981.

SPECIES	COMMON NAME	% COVER 1979	% COVER 1981	F	TREND
TREE SEEDLINGS					
ACER RUBRUM	RED MAPLE	1.09	1.78	1.14	
PRUNUS SEROTINA	BLACK CHERRY	1.21	0.70	1.32	
QUERCUS PALUSTRIS	PIN OAK	0.02	0.36	1.00	
BETULA POPULIFOLIA	GRAY BIRCH	0.00	0.33	1.00	
CRATAEGUS SP.	HAWTHORNE	0.06	0.13	1.00	
POPULUS TREMULOIDES	QUAKING ASPEN	0.00	0.02	1.00	
PRUNUS VIRGINIANA	CHOKE CHERRY	0.01	0.00	1.00	
PRUNUS PENSYLVANICA	PIN CHERRY	0.03	0.00	1.00	
SHRUBS					
RUBUS FLAGELLARIS	DEWBERRY	29.80	23.19	4.96*	-
RUBUS ALLEGHENIENSIS	BLACKBERRY	4.50	3.51	2.33	
CORNUS RACEMOSA	GRAY DOGWOOD	2.39	2.75	0.22	
VITIS AESTIVALIS	SUMMER GRAPE	1.17	2.72	1.49	
SALIX HUMILIS	PRAIRIE WILLOW	1.84	0.48	1.00	
RHUS RADICANS	POISON IVY	2.54	0.45	14.50**	-
PARTHENOCISSUS QUINQUEFOLIA	VIRGINIA CREEPER	0.30	0.00	4.69*	-
HERBS					
GRASS(UNIDENTIFIED)	-	20.77	21.06	0.43	
SOLIDAGO JUNCEA	EARLY GOLDENROD	10.72	9.16	1.62	
SOLIDAGO NEMORALIS	LITTLE GREY GOLDENROD	2.80	8.73	38.44**	+
FRAGARIA VIRGINIANA	WILD STRAWBERRY	16.93	8.44	55.18**	-
MOSS	-	6.76	5.60	0.25	
SOLIDAGO RUGOSA	ROUGH GOLDENROD	4.76	4.63	0.03	
RUMEX ACETOSELLA	SHEEP SORREL	6.80	4.61	4.82*	-
SOLIDAGO CANADENSIS	CANADA GOLDENROD	3.00	4.13	5.39*	+
ASTER PILOSUS	HEATH ASTER	1.70	3.30	11.65**	+
HIERACIUM PRATENSE	HAWKWEED	3.91	2.90	2.02	
SOLIDAGO GRAMINIFOLIA	FLAT-TOPPED GOLDENROD	2.94	2.90	1.03	
LINARIA VULGARIS	BUTTER-AND-EGGS	3.32	1.57	9.63**	-
BOTRYCHIUM DISSECTUM	GRAPE FERN	0.91	1.15	0.40	

* -SIGNIFICANT AT P<=0.05
**-SIGNIFICANT AT P<=0.01

Fig. F-1

Location of vegetation and bird census plots and salt drift transects on the Susquehanna SES site, 1981.

BIRDS

by

Douglas A. Gross, David G. Richie, and James D. Montgomery

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ABSTRACT

Preoperational studies were conducted throughout 1981 to collect data on bird populations near the Susquehanna SES site. None of the 181 species and 2 hybrids observed were listed as threatened or endangered species by the U. S. Department of the Interior. Seasonal censuses in two forest and two field plots showed that densities of most species were similar to past years; however, significant trends were found in all but one of the plots. Density increases of some species in Council Cup Forest were associated with gypsy moth infestation while most increases in Switchyard Field were linked to vegetational succession. During breeding bird censuses, evidence of nesting was found in the same four plots for 52 species and 1 hybrid. Transmission structures in Switchyard Field were used as lookout posts and courtship and nesting sites. River censuses during autumn migration revealed a mean of 1.25 water birds of 14 species per kilometer, a level much lower than in previous years. In the study of bird impaction on the Unit 1 and 2 Cooling Towers, 466 birds of at least 32 species were collected in systematic searches; 97% of this total impacted during the autumn migration. Nearly all of these were small insectivorous birds known to be nocturnal migrants.

INTRODUCTION

Preliminary studies of the bird life at the Susquehanna SES site were conducted from 1971 through 1974. During this period, the literature was surveyed, a species list compiled, and the relative abundance of resident and transient bird species monitored (Ichthyological Associates 1973, 1974; Burton 1976).

Preoperational studies, begun in January 1977, were continued in 1981 to collect data on bird populations at the Susquehanna SES during the final construction phase (Ruhe 1978, Ruhe and Montgomery 1979, Gross et al. 1980, Gross and Montgomery 1981). These baseline data will be compared with similar data collected after the power station begins operation. In addition, the study of bird impaction on the Unit 1 and 2 Cooling Towers of the Susquehanna SES, conducted from 1978 through 1980 (Ruhe and Montgomery 1979, Gross et al. 1980, Gross and Montgomery 1981), was also continued to provide information on bird mortality during the 1981 migrations.

PROCEDURES

Seasonal Census

Four bird census plots (Council Cup Forest, Township Road 419 [TR419] Forest, Switchyard Field, and Transmission Corridor Field) were censused in 1981 (Fig. F-1). Criteria considered in selection of the plots were: 1) the vegetation be representative of the Susquehanna SES site, 2) the

areas remain relatively undisturbed throughout construction, and 3) the plots be of relatively uniform habitat (Hall 1964). Both Council Cup Forest (6.00 hectares) and TR419 Forest (11.05 ha) were wooded; Switchyard Field (5.96 ha) and Transmission Corridor Field (4.34 ha) were abandoned fields. The plots were surveyed and the boundaries marked with flagging. Transect lines in each plot were surveyed and flagged at distances dependent upon vegetation density.

Seasonal censuses were designated and conducted according to the following timetable: winter, 16 December-28 February; spring, 1 March-19 May; summer, 20 May-2 August; autumn, 15 August-30 November. Seven censuses were done in each plot during each season according to methods proposed by Hall (1964) and revised by Van Velzen (1972). Censuses were not conducted during periods of inclement weather, such as heavy rains or high winds. Winter, spring, and autumn censuses were begun prior to 0900 h and summer censuses started within 30 minutes of sunrise. A route along the transect lines was followed in such a way as to cover all sections of the plot without overlap. Each individual bird was counted and identified either visually or aurally. Time and weather conditions were recorded at the start and conclusion of each census. Data were transferred from field notes to bird census code sheets for computer input. The following were calculated for bird species in each plot:

$$\text{Frequency} = \frac{\text{number of censuses in which a species occurs}}{\text{total number of censuses}}$$

$$\text{Mean Density} = \frac{\text{number of a species/km}^2}{\text{total number of censuses}}$$

$$\text{Relative Density} = \frac{\text{density of a species}}{\text{total density of all species}} \text{ X } 100$$

Additional observations were made in areas other than the four study plots to supplement phenological information.

Seasonal censuses data collected in 1981 were compared to data compiled since 1978 using two nonparametric statistical tests: Friedman's two-way analysis of variance (Siegel 1956) and Page's distribution-free test for ordered alternatives (Hollander and Wolfe 1973). Friedman's test (S) was used to detect significant changes in the densities of each species and Page's test (L) was used to detect linear trends among years. In both tests, the 5% probability level was used to determine significance. Data were compared on a census-to-census, year-to-year basis within each season. Comparisons were limited in each plot to cases where seven censuses were conducted during a season for at least three years. By these criteria, data were not tested from winter censuses in any plot or spring and summer censuses in Transmission Corridor Field. These methods were useful for detecting changes and trends in densities of species which were present throughout most of a season.

All species observed were checked against the federal endangered and threatened species list (U. S. Department of the Interior 1979) and the American Birds Blue List (Tate 1981). Species named to the Blue List are those which are "recently or currently giving indications of non-cyclical

population declines or range contractions either locally or widespread" (Tate 1981). Nomenclature follows American Ornithologists' Union (1957; 1973a, b; 1976).

Breeding Bird Census

Two forest (Council Cup and TR419 Forests) and two field (Switchyard and Transmission Corridor Fields) study plots were censused eight times between 1 May and 17 July. The plots were the same as those used in the seasonal censuses with identical boundaries and transects. The census period included the peak breeding and nesting season for most Pennsylvania birds (Wood 1979).

Breeding bird censuses were conducted according to methods proposed by Hall (1964), International Bird Census Committee (1970), and Van Velzen (1972). Censuses were not conducted during periods of inclement weather, such as heavy rains or high winds. Each census began within 30 minutes of sunrise, a period that coincides with the beginning of intense singing by most songbirds (Hall 1964). Starting locations were altered in each plot from census to census to minimize bias that might result from changes in singing intensity. A route along the transect lines was followed in such a way as to cover all sections of the plot without overlap. Birds were censused by the spot-mapping method in which each contact with a bird was located and registered on a daily census map. Each entry on the daily census map indicated species, behavioral activity (e.g. singing, aggression,

nest building), and sex when known. Landmarks and vegetation plot markers were used as mapping reference points.

A bird-banding program was conducted to supplement data obtained from the spot-mapping technique. Banding often yields additional information since numbers of birds can be underestimated even by qualified observers (Preston 1979, DeSante 1981, Karr 1981). Birds were captured in mist nets or, in the case of nestlings, by hand. Each bird was banded with a U. S. Fish and Wildlife Service leg band. Most banding was done in Switchyard Field because underestimates of bird banding data were likely in this plot where high shrub density and high breeding bird density occurred together. In addition, nest searches were conducted in each plot as late as 27 August, with emphasis on those species that are difficult to study with the spot-mapping technique because of their secretive habits, atypical territorial behavior, or semi-colonial nesting habits.

Data from the daily censuses were analyzed to estimate the number of breeding pairs of each species. Registered contacts on the daily census maps were transferred to species maps for each plot. The number of breeding pairs was usually found by counting the number of clusters formed by the registrations of conspicuous territorial males. Mapped nest locations and capture points of banded birds provided additional data. For each species, mean density (number of breeding pairs/km^2) and relative density (number of breeding pairs of one species/total number of breeding pairs of all species) were calculated.

River Bird Census

During six weekly censuses conducted from 9 October through 23 November, waterfowl and other water birds were identified and counted from a boat on a 16-km section of the Susquehanna River. The census route extended from the Shickshinny-Mocanaqua Bridge to the Berwick-Nescopeck Bridge. Conditions limiting the number of censuses were river levels less than 149.5 m above mean sea level at the Susquehanna SES Biological Laboratory, hazardous river conditions such as ice floes and flooding, and inclement weather. Each census was begun between 0800 and 1000 h and lasted about 2½ hours. Data were transferred from field notes to bird census code sheets for computer input and results were tabulated. During periods when censuses were not conducted, observations were made from lookout posts along the river to provide additional phenological information.

Bird Impaction

In 1981, bird impaction studies were continued on the Susquehanna SES site at the completed Unit 1 Cooling Tower and studies were initiated at the Unit 2 Cooling Tower, currently under construction. The tops of both towers are 165 m above ground level and equipped with 480-volt aircraft warning strobe lights (5 on each tower). The towers are also illuminated with 480-volt high-intensity mercury vapor lamps located around the tower lintel, about 12 m above ground level.

Systematic searches for impacted birds were begun prior to 0800 h on weekdays, excluding holidays, from 23 March through 5 June and from 17 August through 6 November. Searches were conducted each day from 8 September through 16 October to coincide with the peak autumn migration period, as determined from past impaction studies on site (Ruhe and Montgomery 1979, Gross et al. 1980, Gross and Montgomery 1981). This intensified collection schedule aided in the identification of birds, especially those which fell into the water of the Unit 1 basin where they were subject to rapid decay. It also may have reduced loss of specimens to scavengers such as crows and skunks and decreased predation upon injured birds as evidenced in similar studies by Avise and Crawford (1981).

Each search included the tower base, cold water inlet, basin interior, and an area extending 10 m out from the base. Construction equipment and debris around the Unit 2 Tower hampered thorough investigation of its perimeter. Also, construction activity occasionally interrupted searches at Unit 2 Cooling Tower. Impacted birds were collected and tagged to indicate point of discovery with reference to compass direction away from the respective tower. Birds collected from the water in the Unit 1 basin were not labeled with respect to direction or exact date of impaction because they probably floated away from the impaction point in the turbulent water within the basin.

An attempt was made to collect all impacted birds during each search; however, specimens recovered from the water in the Unit 1 basin were often in various stages of decay indicating that they had probably impacted one

or more days before collection. All data were, therefore, tabulated in 5-day groups (7-day groups when daily searches were conducted) to reduce day-to-day carry-over of impacted birds. It was also recognized that this procedure did not eliminate carry-over between groups and the data were analyzed accordingly.

Identification was made or checked with the aid of keys and descriptions from Roberts (1955), Robbins (1964), Philips et al. (1966), Robbins et al. (1966), Lanyon and Bull (1967), and Peterson (1980). Location weather conditions were noted daily at the Susquehanna SES site and notes were augmented with data recorded at the Biological Laboratory, Susquehanna SES Meterological tower, and by the National Oceanic and Atmospheric Administration (NOAA 1981) at Avoca, Pennsylvania, for the previous 10 hours.

RESULTS AND DISCUSSION

A total of 228 bird species and 2 hybrids was observed near the Susquehanna SES site from 1971 through 1974 and 1977 through 1981 (Table G-1). During 1981, 181 species and 2 hybrids were observed near the site (Fig. G-1). One species, glossy ibis, and two hybrids, mallard-black duck and Brewster's warbler, were not reported in previous years. None of the species observed in 1981 were listed as threatened or endangered by the U. S. Department of the Interior (1979).

Twenty-five species observed near the Susquehanna SES site in 1981 (Table G-1) were included in the 1981 Blue List (Tate 1981): 3 were

permanent residents, 13 were summer residents, and 9 were transients. Of the species that maintained breeding populations in at least one breeding bird plot, six were on the 1981 Blue List: American kestrel, yellow-billed cuckoo, hairy woodpecker, willow flycatcher, golden-winged warbler, and yellow warbler.

Seasonal Census

The total mean densities of birds in each plot and in each season from 1978 through 1981 are shown in Figs. G-2 and G-3. The populations are divided into two broad categories: permanent residents and migrants. Permanent residents are birds which do not migrate periodically and usually stay in the same area throughout the year; the others are migrants (Terres 1980). The list of species considered as permanent residents was taken from Wood (1979).

Winter

Twenty-three species were observed in the bird study plots during winter censuses (Table G-2). Fifteen species were observed in TR419 Forest, 13 in Council Cup Forest, and 7 each in Switchyard Field and Transmission Corridor Field. Black-capped chickadee had the highest mean density of any species in Council Cup Forest, TR419 Forest, and Transmission Corridor Field. Dark-eyed junco had the highest mean density in Switchyard Field. Council Cup Forest had the highest total mean density of any of the plots.

Compared to the other seasons, the total mean densities were fairly low during winter in all plots (Figs. G-2 and G-3). As in 1980 (Gross and Montgomery 1981), the total mean density in Council Cup Forest was relatively low because of the lack of migrant species, particularly dark-eyed junco. Permanent residents increased as a group over last year because of higher numbers of downy woodpecker and tufted titmouse. Winter bird populations in TR419 Forest were similar to those of previous years with the exception of black-capped chickadee which had a mean density less than half that of any previous winter. The total mean densities of both abandoned field plots were higher in 1981 than in past years. Most birds observed in the field plots during winter flew into the fields from nearby hedgerows while censuses were conducted.

Spring

During spring censuses, 82 species and 2 hybrids were observed in the study plots (Table G-3). Fifty-three species were observed in TR419 Forest, 45 species in Council Cup Forest, 24 species and 1 hybrid in Switchyard Field, and 17 species and 1 hybrid in Transmission Corridor Field. Black-capped chickadee had the highest mean density of any species in Council Cup Forest, brown-headed cowbird in TR419 Forest, and field sparrow in both abandoned field plots. Transmission Corridor Field had the highest total mean density of any of the plots.

All plots except Transmission Corridor Field had a higher total mean density in 1981 than in any previous year (Figs. G-2 and G-3). Overall,

densities in Council Cup Forest were not very different from those of previous springs, with one exception. Yellow-rumped warbler, a midspring migrant, had a mean density that was over 3-fold larger than in any previous year. In TR419 Forest, three species showed significant upward trends over the last three years: blue jay ($L = 92.0$, $P<0.05$), tufted titmouse ($L = 95.0$, $P<0.01$), and brown-headed cowbird ($L = 94.0$, $P<0.01$). Blue jay had a mean density over twice as large as in any previous year because it was present for the first time in early spring. For the third consecutive year, there was an increase in the total mean density in Switchyard Field. Starling ($L = 94.0$, $P<0.01$) and field sparrow ($L = 95.0$, $P<0.01$) both showed significant increasing trends over the past three years. Starlings arrived in the plot earlier than in past years and were nest-searching on transmission towers as early as 17 February. A later migrant, common yellowthroat, had a mean density 3-fold higher than in any previous year. There were no recognizable trends in bird densities in Transmission Corridor Field. As in the past, total mean density was dominated (59.4%) by field sparrow and song sparrow.

Summer

During summer censuses, 62 species and 1 hybrid were observed in the study plots (Table G-4). Thirty-nine species were observed in TR419 Forest, 36 species in Council Cup Forest, 33 species and 1 hybrid in Switchyard Field, and 16 species in Transmission Corridor Field. Black-capped chickadee had the highest mean density in both forest plots and field

sparrow in both field plots. Switchyard Field had the highest total mean density of any of the four study plots and the highest observed in any summer census.

The total mean density in Council Cup Forest was higher than in any past year (Fig. G-2). Several species, including black-capped chickadee, had higher mean densities than in previous summers. Gypsy moth infestation in Council Cup Forest may have increased bird densities by attracting birds to the plot. Many forest species, especially cuckoos (Bent 1964), eat gypsy moth caterpillars (Terres 1980) and may be attracted to areas where infestations occur. One such species, blue jay, showed a significant upward trend ($L = 91.5$, $P<0.05$) over the past three summers. The defoliation of many deciduous trees and saplings, particularly oaks (*Quercus* spp.), by gypsy moth caterpillars (Table F-39) may have attracted species such as eastern wood pewee and cedar waxwing that prefer a more open habitat. Another possible effect of gypsy moth defoliation on the results was that it enabled more accurate censusing due to the better visibility. A species probably not affected by gypsy moth infestation, blue-gray gnatcatcher, also showed a significant upward trend ($L = 91.5$, $P<0.05$) over the last three years in what seemed part of a regional increase reported by other observers (Boyle et al. 1981).

In TR419 Forest, the total mean density was lower in 1981 than in 1980 (Fig. G-2). Numbers of most species were similar to those in past summers. In this period, however, significant trends occurred in three species: blue jay ($L = 92.0$, $P<0.05$) increased while black-and-white

warbler (L = 93.5, P<0.01) and rufous-sided towhee (L = 92.5, P<0.05) decreased. Gypsy moth defoliation was not as severe in TR419 Forest as it was in Council Cup Forest (Table F-39), and it did not seem to affect the bird densities.

The total mean density in Switchyard Field increased for the third consecutive year (Fig. G-3). Many species had higher mean densities than in any former summer and some of these showed significant increasing trends from 1979 through 1981. Among them were prairie warbler (L = 93.0, P<0.01), common yellowthroat (L = 91.0, P<0.05), yellow-breasted chat (L = 95.0, P<0.01), and field sparrow (L = 92.0, P<0.05). Trends in these species were probably due to the successional increase in shrubs and tree saplings in this abandoned field plot (Table F-41). For instance, prairie warbler was not present in the plot before 1980 although it was found in nearby hedgerows in 1979 (Gross and Montgomery 1981). Two other species which had increasing trends, common flicker (L = 91.5, P<0.05) and eastern kingbird (L = 92.0, P<0.05), were attracted to transmission structures in the plot for courtship and nesting sites, respectively. In addition, summer densities of song sparrow significantly differed (S = 7.714, DF = 2, P<0.05) in this three-year period. Their density was highest in 1980 (Gross and Montgomery 1981), probably as a result of territory shifting at the plot's edge.

The total mean density in Transmission Corridor Field in the summer was lower in 1981 than in 1980 (Fig. G-3). As in the spring, field sparrow and song sparrow dominated the bird community and together composed 57.7%

of the total mean density. One warbler, common yellowthroat, decreased in numbers since 1979, while another, yellow warbler, increased.

Autumn

At least 84 species were observed in the study plots during autumn censuses (Table G-5). At least 55 species were observed in TR419 Forest, 50 in Council Cup Forest, 41 in Switchyard Field, and 19 in Transmission Corridor Field. Black-capped chickadee had the highest mean density in Council Cup Forest, cedar waxwing in TR419 Forest, starling in Switchyard Field, and field sparrow in Transmission Corridor Field. Switchyard Field had the highest total mean density of any plot in any season since these studies were begun in 1978.

The total mean density in Council Cup Forest increased for the third consecutive year (Fig. G-3). Permanent residents increased over this period and significant increasing trends were found for black-capped chickadee ($L = 195.5$, $P<0.01$), tufted titmouse ($L = 190.5$, $P<0.05$), and white-breasted nuthatch ($L = 190.5$, $P<0.05$), all hole-nesting permanent residents. Red-breasted nuthatch, a hole-nesting migrant, also significantly increased ($L = 196.0$, $P<0.01$), probably as a result of nesting in or near the plot. Although three migrant warblers, yellow-rumped warbler, Blackburnian warbler, and American redstart, were observed more frequently and had higher mean densities in 1981 than in previous autumns, significant trends were not found for them.

Total mean density changes in TR419 Forest, unlike those of Council Cup Forest, showed no recognizable pattern (Fig. G-2). Increasing trends in blue jay ($L = 203.0$, $P<0.001$) and tufted titmouse ($L = 191.5$, $P<0.05$) occurred over the last four autumns. Three migrant species, American robin, cedar waxwing, and white-throated sparrow, together composed 28.5% of the total mean density. Flocks of all three species were observed feeding on fruits of trees, shrubs, and vines in the plot. Two conifer-forest species, red-breasted nuthatch and pine siskin, were observed in TR419 Forest during autumn migration for the first time.

With the exception of 1980, the total mean density in Switchyard Field increased each year since 1978 (Fig. G-3). Several migrant species, especially white-throated sparrow, had higher mean densities in 1981 than in any previous autumn. Two other migrants, cedar waxwing and American goldfinch, had higher densities as a consequence of their late nesting season; active nests were found as late as 27 August.

The total mean density in Transmission Corridor Field was similar to past years (Fig. G-3). Field sparrow and song sparrow dominated the bird community with a combined relative density of 54.3%. As in Switchyard Field, cedar waxwing had a higher mean density than in previous years because of its late nesting season in 1981; nests were active as late as 26 August.

Breeding Bird Census

A total of 52 species and 1 hybrid of breeding birds occurred in the four study plots (Table G-6). There were 32 species in TR419 Forest, 28 species in Council Cup Forest, 19 species and 1 hybrid in Switchyard Field, and 12 species in Transmission Corridor Field. Species with the highest breeding bird densities in each plot were black-capped chickadee (75.0 pairs/km^2) in Council Cup Forest, rose-breasted grosbeak (54.5 pairs/km^2) in TR419 Forest, common yellowthroat and field sparrow (both 166.5 pairs/km^2) in Switchyard Field, and field sparrow (173.0 pairs/km^2) in Transmission Corridor Field. Switchyard Field had the highest total breeding bird density (807.0 pairs/km^2).

The total breeding bird density (676.0 pairs/km^2) and number of breeding species (28) in Council Cup Forest were the highest found in that plot since breeding bird censuses were begun in 1977. Three species, black-capped chickadee, yellow-billed cuckoo, and blue-gray gnatcatcher, had higher breeding densities than in any previous year. For reasons discussed in the Seasonal Census section, the infestation of gypsy moth caterpillars in Council Cup Forest may have affected breeding bird densities by attracting birds to the plot or by permitting more accurate censuses. Defoliation of trees and saplings in Council Cup Forest may have long-term effects on the breeding bird densities in that plot, especially if infestations occur in future years. One nest each of six species was found in or adjacent to the plot. Nesting pairs of cedar waxwing were observed for the first time in the plot.

In TR419 Forest, the total breeding bird density (494.5 pairs/km^2) increased for the fourth consecutive year. Although the number of breeding species (32) was the same as in 1980, it was higher than in any year previous to that (Gross and Montgomery 1981). Cedar waxwing and yellow-billed cuckoo were the only new breeding species recorded. Four species, tufted titmouse, hooded warbler, scarlet tanager, and rose-breasted grosbeak, had higher densities than in any previous breeding season; the density of rose-breasted grosbeak, for example, was twice that of any previous year. Another species, blue jay, had a higher breeding density in 1981 than in any year except 1977. Eleven nests of six species were found in or adjacent to the plot. Although gypsy moth defoliation was not as severe as in Council Cup Forest (Table F-39), it may have affected the breeding bird densities in TR419 Forest.

Total breeding bird density in Switchyard Field increased for the third consecutive year to a level more than twice that of the first census in 1978. The number of breeding taxa also increased steadily through this period from 11 species in 1978 (Ruhe and Montgomery 1979) to 19 species and 1 hybrid in 1981. Eastern kingbird, cedar waxwing, and Brewster's warbler nested in the plot for the first time in 1981. Brewster's warbler is a fertile hybrid of a golden-winged warbler and blue-winged warbler (Terres 1980); the Brewster's warbler observed in the plot was a female mated to a male golden-winged warbler. Increases in the percent cover of shrubs and tree seedlings (Table F-41) may have attracted more species to the plot and, thus, increased breeding bird densities. Eastern kingbird

and starling nested on transmission towers. Common flicker used the towers and guidewires as courtship sites and American kestrel used transmission structures and lines as lookout posts.

Some estimates of breeding bird densities in Switchyard Field were refined as a result of more thorough coverage achieved by banding and nest-searching. Sixty-two birds of 13 species were banded during the nesting season, and eight birds of four species were recaptured from previous years. Among these were a female yellow-breasted chat and a male common yellowthroat banded in the summer of 1978. Fifteen nests of ten species were located in or adjacent to the plot. As a result of these data, estimates of cedar waxwing, common yellowthroat, yellow-breasted chat, and field sparrow were increased from those obtained by the spot-mapping method.

In Transmission Corridor Field, the total breeding density (633.5 pairs/km^2) and number of breeding species (12) were higher in 1981 than in either previous year. Breeding pairs of yellow warbler, cedar waxwing, and cardinal were observed for the first time in the plot. Three other species, field sparrow, gray catbird, and American goldfinch, had higher breeding densities than in either previous year. Fifteen nests of eight species were found in or adjacent to the plot. As in the past, field sparrow and song sparrow dominated the breeding population with 52.7% of the total breeding density.

In 1981, overall changes in breeding bird densities in study plots did not show any recognizable trends that could be linked to power plant construction. Some changes were possibly linked to either vegetational succession or gypsy moth infestation. Transmission structures also affected breeding densities in Switchyard Field by providing nesting sites, lookout posts, and courtship sites for some birds in this plot.

River Bird Census

A total of 120 water birds of 14 species was observed in six river bird censuses conducted from 9 October through 23 November (Table G-7). A mean of 1.25 birds/km was observed over the 16-km route. The highest count of individuals (40), most of which were mallard, occurred on 16 October and the highest species count (8) occurred on 30 October. The two most abundant species, mallard and great blue heron, composed 45.0% of the total. The following three species were on the 1981 Blue List (Tate 1981): great blue heron, black duck, and osprey. Four other Blue-listed species, common loon, double-crested cormorant, black-crowned night heron, and American bittern, were observed on or in the vicinity of the river during 1981, although not in a census.

Low river levels prevented censusing during most of spring and in early autumn. Surveys conducted in early March indicated that waterfowl populations were high during early spring migration. Mallards were

particularly abundant with 157 observed on 4 March and 119 on 12 March. Overall, however, low river levels seemed to restrict the number of waterfowl along the route. Observations from lookout points along the river shore in mid and late spring revealed few water birds. Numbers of water birds observed during the 1981 autumn censuses were much lower than the numbers recorded in the autumn of 1977 (Ruhe 1978) when river levels were higher (Soya and Jacobsen 1978).

Nests of green heron, mallard, mallard-black duck hybrid, wood duck, killdeer, and belted kingfisher were found near the Susquehanna SES. Observations of immature Canada goose and spotted sandpiper during the summer indicate that these species also nested along the river.

Bird Impaction

In 1981, 466 birds of at least 32 species were collected during systematic searches for impacted birds at the Unit 1 and 2 Cooling Towers of the Susquehanna SES. Fourteen birds of at least 12 species were collected from 23 March through 5 June during the spring migration (Table G-8). About 30-fold more birds, 452 birds of at least 30 species, were collected during the autumn migration period from 17 August through 6 November (Table G-9). Of the 466 birds collected in 1981, 397 (85%) were collected at the Unit 1 Cooling Tower and 69 (15%) were collected at the Unit 2 Cooling Tower.

In general, the number of bird impactions was linked to the intensity of nocturnal bird migration through the area. In the spring, no birds were collected before 28 April. Five birds, 36% of the spring impactions, were found on 22 May. In the autumn, seven birds were collected in August and only one bird was found during the last week in November. Over 72% of the autumn impactions were collected from 27 September through 10 October. The largest numbers of birds were found on 29 September (81 birds) and 30 September (79 birds). These were the two largest single day collections recorded at the Susquehanna SES site since impaction studies were initiated in 1978.

All species of impacted birds collected were small to medium-sized passerines known to be nocturnal migrants (American Ornithologists' Union 1957, Terres 1980). The five most commonly collected species included red-eyed vireo (159), black-throated green warbler (55), magnolia warbler (39), common yellowthroat (32), and solitary vireo (29). No threatened or endangered species (U. S. Department of the Interior 1979) were collected; however, three specimens of the Blue-Listed golden-crowned kinglet (Tate 1981) were found.

Bird impactions at the cooling towers were often associated with the movement of frontal systems through the area. In the spring, birds were found more often after passage of a warm front, during nights with winds from the south or southwest (NOAA 1981). Pettingill (1970), Avery et al. (1977), and Richardson (1978) found that spring migration is greatest during these conditions. In the autumn, most occurrences of high bird

mortality, including the large kills of 29 and 30 September, were associated with passage of a cold front (NOAA 1981) with winds from the north or northwest that are favorable for southward migration (Richardson 1978). These weather conditions produced similar results in other impaction studies (Brewer and Ellis 1958, Crawford 1981). Impactions at the Susquehanna SES were often associated with precipitation during autumn and valley fog often surrounded the station in the early morning hours, but it was not known if fog was present near midnight when nocturnal migration is heaviest (Bellrose 1971).

Although most of the larger collections were made immediately after passage of a frontal system, impacted birds were found scattered around the base of the towers, rather than in one general area. Cochran and Graber (1958) found that nocturnal migrants are confused by tower lights on nights when cloud ceiling is low and birds are forced to fly at an altitude of less than 3000 feet (914 m). The illuminated area around the towers is greatly increased on foggy or overcast evenings due to light refraction by water droplets (Avery et al. 1976). Migrants enter the illuminated area while passing by and become disoriented. As a result, birds fly about in the illuminated area and chances are increased that some birds will strike the tower (Graber 1968). This could explain why birds were collected on all sides of the towers after frontal movement through the area.

Impact mortality at the Unit 1 and 2 Cooling Towers of the Susquehanna SES was relatively low when compared to data collected at other towers in the United States. One day mortality ranged from 23 to 69 birds at a transmission tower (366 m) in North Dakota (Avery et al. 1977) to an estimated 15,000 at a television tower (304 m) in Wisconsin (Kemper 1964). Bellrose (1971) observed that most small nocturnal migrants fly on a broad front at altitudes of 152-457 m above ground level. Although the Unit 1 and 2 Cooling Towers are 165 m above ground level, they only exceed the highest local terrain elevation by about 50 m. Therefore, most nocturnal migrant birds should pass over the towers except for situations in which birds may descend when they suddenly encounter fog or precipitation (Terres 1980).

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Table G-1

Species of birds observed near the Susquehanna SES site, 1973-74 and 1977-81. An * denotes new species observed in 1981; √ denotes a federally-listed endangered species; † denotes Blue-listed birds observed in 1981.

Gaviidae
Gavia immer - common loon†
G. stellata - red-throated loon

Podicipedidae
Podiceps grisegena - red-necked grebe
P. auritus - horned grebe
Podilymbus podiceps - pied-billed grebe

Phalacrocoracidae
Phalacrocorax auritus - double-crested cormorant†

Ardeidae
Ardea herodias - great blue heron†
Butorides striatus - green heron
Florida caerulea - little blue heron
Bubulcus ibis - cattle egret
Casmerodius albus - great egret
Egretta thula - snowy egret
Nycticorax nycticorax - black-crowned night heron†
Ixobrychus exilis - least bittern
Botaurus lentiginosus - American bittern†
Plegadis falcinellus - glossy ibis*

Anatidae
Olor columbianus - whistling swan
Branta canadensis - Canada goose
B. bernicla - brant
Chen caerulescens - snow goose
Anas platyrhynchos - mallard
A. rubripes - black duck†
A. platyrhynchos x A. rubripes - mallard-black duck*
A. acuta - pintail
A. crecca - green-winged teal
A. discors - blue-winged teal
A. americana - American wigeon
Aix sponsa - wood duck
Aythya americana - redhead
A. collaris - ring-necked duck
A. valisineria - canvasback†
A. marila - greater scaup
A. affinis - lesser scaup
Bucephala clangula - common goldeneye
B. albeola - bufflehead
Clangula hyemalis - oldsquaw
Melanitta deglandi - white-winged scoter
M. perspicillata - surf scoter
M. nigra - black scoter
Oxyura jamaicensis - ruddy duck
Lophodytes cucullatus - hooded merganser
Mergus merganser - common merganser
M. serrator - red-breasted merganser

Cathartidae
Cathartes aura - turkey vulture

Accipitridae
Accipiter gentilis - goshawk
A. striatus - sharp-shinned hawk †
A. cooperii - Cooper's hawk †
Buteo jamaicensis - red-tailed hawk
B. lineatus - red-shouldered hawk
B. platypterus - broad-winged hawk
B. swainsoni - Swainson's hawk
B. lagopus - rough-legged hawk
Haliaeetus leucocephalus - bald eagle√
Circus cyaneus - marsh hawk

Pandionidae
Pandion haliaetus - osprey†

Falconidae
Falco peregrinus - peregrine falcon√
F. columbarius - merlin
F. sparverius - American kestrel†

Tetraonidae
Bonasa umbellus - ruffed grouse

Phasianidae
Colinus virginianus - bobwhite
Phasianus colchicus - ring-necked pheasant

Meleagrididae
Meleagris gallopavo - turkey

Rallidae
Rallus limicola - Virginia rail
Porzana carolina - sora
Gallinula chloropus - common gallinule
Fulica americana - American coot

Charadriidae
Charadrius semipalmatus - semipalmated plover
C. vociferus - killdeer
Pluvialis squatarola - black-bellied plover

Scolopacidae
Philohela minor - American woodcock
Capella gallinago - common snipe
Actitis macularia - spotted sandpiper
Tringa solitaria - solitary sandpiper
T. melanoleucus - greater yellowlegs
T. flavipes - lesser yellowlegs
Calidris melanotos - pectoral sandpiper
C. fuscicollis - white-rumped sandpiper
C. minutilla - least sandpiper
C. pusillus - semipalmated sandpiper
Limnodromus griseus - short-billed dowitcher

Laridae
Larus marinus - great black-backed gull
L. argentatus - herring gull
L. delawarensis - ring-billed gull
L. philadelphia - Bonaparte's gull
Sterna hirundo - common tern†

Columbidae
Columba livia - rock dove
Zenaida macroura - mourning dove

Cuculidae
Coccyzus americanus - yellow-billed cuckoo†
C. erythropthalmus - black-billed cuckoo

Strigidae
Otus asio - screech owl
Bubo virginianus - great-horned owl
Asio otus - long-eared owl
A. flammeus - short-eared owl

Table G-1 (cont.)

Caprimulgidae
Chordeiles minor - common nighthawk

Apodidae
Chaetura pelagica - chimney swift

Trochilidae
Archilochus colubris - ruby-throated hummingbird†

Alcedinidae
Megaceryle alcyon - belted kingfisher

Picidae
Colaptes auratus - common flicker
Dryocopus pileatus - pileated woodpecker
Melanerpes carolinus - red-bellied woodpecker
M. erythrocephalus - red-headed woodpecker
Sphyrapicus varius - yellow-bellied sapsucker
Picoides villosus - hairy woodpecker†
P. pubescens - downy woodpecker

Tyrannidae
Tyrannus tyrannus - eastern kingbird
Myiarchus crinitus - great crested flycatcher
Sayornis phoebe - eastern phoebe
Empidonax flaviventris - yellow-bellied flycatcher
E. virescens - acadian flycatcher
E. traillii - willow flycatcher†
E. minimus - least flycatcher
Contopus virens - eastern wood pewee
Nuttallornis borealis - olive-sided flycatcher

Alaudidae
Eremophila alpestris - horned lark

Hirundinidae
Iridoprocne bicolor - tree swallow
Riparia riparia - bank swallow
Stelgidopteryx ruficollis - rough-winged swallow
Hirundo rustica - barn swallow
Petrochelidon pyrrhonota - cliff swallow†
Progne subis - purple martin†

Corvidae
Cyanocitta cristata - blue jay
Corvus brachyrhynchos - common crow
C. ossifragus - fish crow

Paridae
Parus atricapillus - black-capped chickadee
P. bicolor - tufted titmouse

Sittidae
Sitta carolinensis - white-breasted nuthatch
S. canadensis - red-breasted nuthatch

Certhiidae
Certhia familiaris - brown creeper

Troglodytidae
Troglodytes aedon - house wren
T. troglodytes - winter wren
Thryothorus ludovicianus - Carolina wren†
Cistothorus palustris - long-billed marsh wren

Mimidae
Mimus polyglottos - mockingbird
Dumetella carolinensis - gray catbird
Toxostoma rufum - brown thrasher

Turdidae
Turdus migratorius - American robin
Hylocichla mustelina - wood thrush
Catharus guttata - hermit thrush
C. ustulata - Swainson's thrush
C. minima - gray-cheeked thrush
C. fuscescens - veery
Sialia sialis - eastern bluebird†

Sylviidae
Polioptila caerulea - blue-gray gnatcatcher
Regulus satrapa - golden-crowned kinglet†
R. calendula - ruby-crowned kinglet

Motacillidae
Anthus spinoletta - water pipit

Bombycillidae
Bombycilla cedrorum - cedar waxwing

Sturnidae
Sturnus vulgaris - starling

Vireonidae
Vireo griseus - white-eyed vireo
V. flavifrons - yellow-throated vireo
V. solitarius - solitary vireo
V. olivaceus - red-eyed vireo
V. philadelphicus - Philadelphia vireo
V. gilvus - warbling vireo

Parulidae
Mniotilta varia - black-and-white warbler
Protonotaria citrea - prothonotary warbler
Helmitheros vermivorus - worm-eating warbler
Vermivora chrysoptera - golden-winged warbler†
V. pinus - blue-winged warbler
V. chrysoptera x V. pinus - Brewster's warbler*
V. peregrina - Tennessee warbler
V. celata - orange-crowned warbler
V. ruficapilla - Nashville warbler
Parula americana - northern parula warbler
Dendroica petechia - yellow warbler†
D. magnolia - magnolia warbler
D. tigrina - Cape May warbler
D. caerulescens - black-throated blue warbler
D. coronata - yellow-rumped warbler
D. virens - black-throated green warbler
D. cerulea - cerulean warbler
D. fusca - Blackburnian warbler
D. dominica - yellow-throated warbler
D. pensylvanica - chestnut-sided warbler
D. castanea - bay-breasted warbler
D. striata - blackpoll warbler

Table G-1 (cont.)

Parulidae (cont.)
- *D. pinus* - pine warbler
- *D. discolor* - prairie warbler
- *D. palmarum* - palm warbler
- *Seiurus aurocapillus* - ovenbird
- *S. noveboracensis* - northern waterthrush
- *S. motacilla* - Louisiana waterthrush
- *Oporornis formosus* - Kentucky warbler
- *O. agilis* - Connecticut warbler
- *O. philadelphia* - mourning warbler
- *Geothlypis trichas* - common yellowthroat
- *Icteria virens* - yellow-breasted chat
- *Wilsonia citrina* - hooded warbler
- *W. pusilla* - Wilson's warbler
- *W. canadensis* - Canada warbler
- *Setophaga ruticilla* - American redstart

Ploceidae
- *Passer domesticus* - house sparrow

Icteridae
- *Dolichonyx oryzivorus* - bobolink
- *Sturnella magna* - eastern meadowlark †
- *Agelaius phoeniceus* - red-winged blackbird
- *Icterus spurius* - orchard oriole
- *I. galbula* - northern oriole
- *Euphagus carolinus* - rusty blackbird
- *Quiscalus quiscula* - common grackle
- *Molothrus ater* - brown-headed cowbird

Thraupidae
- *Piranga olivacea* - scarlet tanager
- *P. rubra* - summer tanager

Fringillidae
- *Cardinalis cardinalis* - cardinal
- *Pheucticus ludovicianus* - rose-breasted grosbeak
- *Guiraca caerulea* - blue grosbeak
- *Passerina cyanea* - indigo bunting
- *Spiza americana* - dickcissel
- *Hesperiphona vespertina* - evening grosbeak
- *Carpodacus purpureus* - purple finch
- *C. mexicanus* - house finch
- *Pinicola enucleator* - pine grosbeak
- *Carduelis flammea* - common redpoll
- *C. pinus* - pine siskin
- *C. tristis* - American goldfinch
- *Pipilo erythrophthalmus* - rufous-sided towhee
- *Passerculus sandwichensis* - savannah sparrow
- *Ammodramus savannarum* - grasshopper sparrow†
- *Ammospiza caudacuta* - sharp-tailed sparrow
- *Pooecetes gramineus* - vesper sparrow
- *Junco hyemalis* - dark-eyed junco
- *Spizella arborea* - tree sparrow
- *S. passerina* - chipping sparrow
- *S. pusilla* - field sparrow
- *Zonotrichia leucophrys* - white-crowned sparrow
- *Z. albicollis* - white-throated sparrow
- *Passerella iliaca* - fox sparrow
- *Melospiza lincolnii* - Lincoln's sparrow
- *M. georgiana* - swamp sparrow
- *M. melodia* - song sparrow
- *Plectrophenax nivalis* - snow bunting

Table G-2

Frequency (F), mean density (MD), and relative density (RD) of birds observed in Council Cup and TR419 Forests, and Switchyard and Transmission Corridor Fields during the winter census, 16 December 1980 through 28 February 1981.

SPECIES	CC FOREST			TR419 FOREST			SW FIELD			TC FIELD		
	F	MD	RD	F	MD	RD	F	MD	RD	F	MD	RD
MARSH HAWK	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	3.3	2.3
RUFFED GROUSE	0.29	4.8	2.1	0.57	6.5	4.1	0.00	0.0	0.0	0.00	0.0	0.0
TURKEY	0.14	2.4	1.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
LONG-EARED OWL	0.14	2.4	1.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
PILEATED WOODPECKER	0.14	4.8	2.1	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
HAIRY WOODPECKER	0.29	7.1	3.1	0.14	1.3	0.8	0.00	0.0	0.0	0.00	0.0	0.0
DOWNY WOODPECKER	0.71	38.1	16.7	0.71	19.4	12.2	0.14	2.4	2.8	0.29	6.6	4.7
BLUE JAY	0.00	0.0	0.0	0.57	12.9	8.1	0.14	12.0	13.9	0.14	6.6	4.7
COMMON CROW	0.29	9.5	4.2	0.14	6.5	4.1	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-CAPPED CHICKADEE	0.71	64.3	28.1	1.00	24.6	15.4	0.43	16.8	19.4	0.57	52.7	37.2
TUFTED TITMOUSE	0.86	31.0	13.5	0.71	11.6	7.3	0.00	0.0	0.0	0.00	0.0	0.0
WHITE-BREASTED NUTHATCH	0.71	19.0	8.3	0.43	10.3	6.5	0.00	0.0	0.0	0.00	0.0	0.0
RED-BREASTED NUTHATCH	0.14	2.4	1.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
BROWN CREEPER	0.71	14.3	6.3	0.57	11.6	7.3	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN ROBIN	0.00	0.0	0.0	0.00	0.0	0.0	0.14	16.8	19.4	0.00	0.0	0.0
GOLDEN-CROWNED KINGLET	0.57	28.6	12.5	0.71	18.1	11.4	0.00	0.0	0.0	0.00	0.0	0.0
STARLING	0.00	0.0	0.0	0.00	0.0	0.0	0.29	14.4	16.7	0.00	0.0	0.0
CARDINAL	0.00	0.0	0.0	0.57	7.8	4.9	0.00	0.0	0.0	0.29	26.3	18.6
EVENING GROSBEAK	0.00	0.0	0.0	0.14	2.6	1.6	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN GOLDFINCH	0.00	0.0	0.0	0.29	2.6	1.6	0.00	0.0	0.0	0.00	0.0	0.0
DARK-EYED JUNCO	0.00	0.0	0.0	0.43	19.4	12.2	0.14	21.6	25.0	0.29	26.3	18.6
TREE SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	2.8	0.29	19.7	14.0
WHITE-THROATED SPARROW	0.00	0.0	0.0	0.29	3.9	2.4	0.00	0.0	0.0	0.00	0.0	0.0
	-	228.6	100.0	-	159.0	100.0	-	86.3	100.0	-	141.5	100.0

Table G-3

Frequency (F), mean density (MD), and relative density (RD) of birds observed in Council Cup and TR419 Forests, and Switchyard and Transmission Corridor Fields during the spring census, 1 March through 19 May 1981.

	CC FOREST			TR419 FOREST			SW FIELD			TC FIELD		
SPECIES	F	MD	RD	F	MD	RD	F	MD	RD	F	MD	RD
MALLARD-BLACK DUCK HYBRID	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	3.3	0.5
SHARP-SHINNED HAWK	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
BROAD-WINGED HAWK	0.14	2.4	0.4	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
RUFFED GROUSE	0.00	0.0	0.0	0.43	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
MOURNING DOVE	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.5	0.00	0.0	0.0
LONG-EARED OWL	0.14	2.4	0.4	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
CHIMNEY SWIFT	0.14	2.4	0.4	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
COMMON FLICKER	0.29	7.1	1.2	0.57	5.2	1.0	0.14	4.8	0.9	0.14	16.5	2.6
PILEATED WOODPECKER	0.29	4.8	0.8	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
YELLOW-BELLIED SAPSUCKER	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
HAIRY WOODPECKER	0.29	7.1	1.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
DOWNY WOODPECKER	0.86	23.8	4.0	0.71	12.9	2.5	0.00	0.0	0.0	0.00	0.0	0.0
EASTERN KINGBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.5	0.00	0.0	0.0
GREAT CRESTED FLYCATCHER	0.29	9.5	1.6	0.29	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
YELLOW-BELLIED FLYCATCHER	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
EASTERN WOOD PEWEE	0.14	9.5	1.6	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
BLUE JAY	0.43	23.8	4.0	1.00	44.0	8.3	0.14	2.4	0.5	0.14	3.3	0.5
COMMON CROW	0.71	28.6	4.8	0.43	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-CAPPED CHICKADEE	1.00	95.2	15.9	1.00	51.7	9.8	0.00	0.0	0.0	0.00	0.0	0.0
TUFTED TITMOUSE	0.86	23.8	4.0	1.00	25.9	4.9	0.00	0.0	0.0	0.00	0.0	0.0
WHITE-BREASTED NUTHATCH	0.00	0.0	0.0	0.43	7.8	1.5	0.00	0.0	0.0	0.00	0.0	0.0
RED-BREASTED NUTHATCH	0.57	9.5	1.6	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
BROWN CREEPER	0.29	7.1	1.2	1.00	18.1	3.4	0.00	0.0	0.0	0.00	0.0	0.0
HOUSE WREN	0.00	0.0	0.0	0.43	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
GRAY CATBIRD	0.00	0.0	0.0	0.29	3.9	0.7	0.14	4.8	0.9	0.00	0.0	0.0
BROWN THRASHER	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	3.3	0.5
AMERICAN ROBIN	0.14	2.4	0.4	0.71	20.7	3.9	0.29	7.2	1.4	0.29	6.6	1.0
WOOD THRUSH	0.43	14.3	2.4	0.29	15.5	2.9	0.00	0.0	0.0	0.00	0.0	0.0
HERMIT THRUSH	0.43	14.3	2.4	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
VEERY	0.29	4.8	0.8	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
BLUE-GRAY GNATCATCHER	0.29	11.9	2.0	0.57	15.5	2.9	0.00	0.0	0.0	0.00	0.0	0.0
GOLDEN-CROWNED KINGLET	0.14	9.5	1.6	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
RUBY-CROWNED KINGLET	0.29	7.1	1.2	0.43	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
STARLING	0.00	0.0	0.0	0.00	0.0	0.0	0.86	47.9	9.2	0.00	0.0	0.0
SOLITARY VIREO	0.29	7.1	1.2	0.29	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
RED-EYED VIREO	0.14	14.3	2.4	0.29	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-AND-WHITE WARBLER	0.43	14.3	2.4	0.57	16.8	3.2	0.00	0.0	0.0	0.00	0.0	0.0
WORM-EATING WARBLER	0.00	0.0	0.0	0.29	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
GOLDEN-WINGED WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.29	4.8	0.9	0.00	0.0	0.0
BLUE-WINGED WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.29	4.8	0.9	0.00	0.0	0.0
ORANGE-CROWNED WARBLER	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
TENNESSEE WARBLER	0.14	9.5	1.6	0.29	7.8	1.5	0.14	2.4	0.5	0.00	0.0	0.0
NASHVILLE WARBLER	0.00	0.0	0.0	0.29	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
BREWSTER'S WARBLER HYBRID	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.5	0.00	0.0	0.0
YELLOW WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.43	16.5	2.6
CAPE MAY WARBLER	0.00	0.0	0.0	0.29	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-THROATED BLUE WARBLER	0.43	11.9	2.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
YELLOW-RUMPED WARBLER	0.29	45.2	7.6	0.29	7.8	1.5	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-THROATED GREEN WARBLER	0.29	19.0	3.2	0.14	6.5	1.2	0.00	0.0	0.0	0.00	0.0	0.0
BLACKBURNIAN WARBLER	0.14	9.5	1.6	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
CHESTNUT-SIDED WARBLER	0.14	7.1	1.2	0.29	2.6	0.5	0.00	0.0	0.0	0.00	0.0	0.0
BAY-BREASTED WARBLER	0.14	2.4	0.4	0.29	14.2	2.7	0.00	0.0	0.0	0.00	0.0	0.0
BLACKPOLL WARBLER	0.00	0.0	0.0	0.14	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
PINE WARBLER	0.14	2.4	0.4	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
PRAIRIE WARBLER	0.14	2.4	0.4	0.00	0.0	0.0	0.29	16.8	3.2	0.00	0.0	0.0
PALM WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	6.6	1.0
OVENBIRD	0.43	16.7	2.8	0.43	10.3	2.0	0.00	0.0	0.0	0.00	0.0	0.0
COMMON YELLOWTHROAT	0.00	0.0	0.0	0.29	2.6	0.5	0.29	69.5	13.3	0.29	19.7	3.1
YELLOW-BREASTED CHAT	0.00	0.0	0.0	0.00	0.0	0.0	0.29	7.2	1.4	0.00	0.0	0.0
HOODED WARBLER	0.00	0.0	0.0	0.29	5.2	1.0	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN REDSTART	0.29	11.9	2.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
BOBOLINK	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	36.2	5.7
RED-WINGED BLACKBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.71	72.4	11.5
ORCHARD ORIOLE	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.5	0.00	0.0	0.0
NORTHERN ORIOLE	0.29	4.8	0.8	0.43	6.5	1.2	0.14	2.4	0.5	0.00	0.0	0.0
COMMON GRACKLE	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.29	13.2	2.1
BROWN-HEADED COWBIRD	0.86	47.6	8.0	1.00	54.3	10.3	0.00	0.0	0.0	0.00	0.0	0.0
SCARLET TANAGER	0.29	7.1	1.2	0.29	15.5	2.9	0.00	0.0	0.0	0.00	0.0	0.0
CARDINAL	0.14	7.1	1.2	0.43	5.2	1.0	0.43	16.8	3.2	0.43	26.3	4.2
ROSE-BREASTED GROSBEAK	0.43	16.7	2.8	0.43	24.6	4.7	0.00	0.0	0.0	0.00	0.0	0.0
INDIGO BUNTING	0.00	0.0	0.0	0.29	11.6	2.2	0.14	2.4	0.5	0.00	0.0	0.0
EVENING GROSBEAK	0.14	7.1	1.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
PURPLE FINCH	0.14	2.4	0.4	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
PINE SISKIN	0.14	4.8	0.8	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN GOLDFINCH	0.00	0.0	0.0	0.14	3.9	0.7	0.29	24.0	4.6	0.29	13.2	2.1
RUFOUS-SIDED TOWHEE	0.14	4.8	0.8	0.57	15.5	2.9	0.29	16.8	3.2	0.14	3.3	0.5
SAVANNAH SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.29	9.9	1.6
DARK-EYED JUNCO	0.00	0.0	0.0	0.14	5.2	1.0	0.14	7.2	1.4	0.00	0.0	0.0
TREE SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	6.6	1.0
CHIPPING SPARROW	0.00	0.0	0.0	0.14	1.3	0.2	0.14	2.4	0.5	0.00	0.0	0.0
FIELD SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	1.00	189.4	36.2	0.86	207.4	32.8
WHITE-THROATED SPARROW	0.00	0.0	0.0	0.29	24.6	4.7	0.14	9.6	1.8	0.00	0.0	0.0
FOX SPARROW	0.00	0.0	0.0	0.14	2.6	0.5	0.00	0.0	0.0	0.00	0.0	0.0
SONG SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.86	69.5	13.3	1.00	167.9	26.6
	-	597.6	100.0	-	527.5	100.0	-	522.5	100.0	-	632.0	100.0

Table G-4

Frequency (F), mean density (MD), and relative density (RD) of birds observed in Council Cup and TR419 Forests, and Switchyard and Transmission Corridor Fields during the summer census, 20 May through 2 August 1981.

SPECIES	CC FOREST			TR419 FOREST			SW FIELD			TC FIELD		
	F	MD	RD	F	MD	RD	F	MD	RD	F	MD	RD
RED-TAILED HAWK	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
BROAD-WINGED HAWK	0.43	9.5	1.1	0.29	2.6	0.5	0.14	2.4	0.2	0.00	0.0	0.0
AMERICAN KESTREL	0.00	0.0	0.0	0.00	0.0	0.0	0.29	9.6	0.8	0.00	0.0	0.0
RUFFED GROUSE	0.14	9.5	1.1	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
MOURNING DOVE	0.00	0.0	0.0	0.29	5.2	0.9	0.43	12.0	1.0	0.00	0.0	0.0
YELLOW-BILLED CUCKOO	0.57	21.4	2.4	0.29	5.2	0.9	0.14	2.4	0.2	0.00	0.0	0.0
BLACK-BILLED CUCKOO	0.00	0.0	0.0	0.00	0.0	0.0	0.29	4.8	0.4	0.14	3.3	0.3
RUBY-THROATED HUMMINGBIRD	0.14	7.1	0.8	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
COMMON FLICKER	0.57	11.9	1.3	0.43	7.8	1.4	0.86	21.6	1.7	0.00	0.0	0.0
PILEATED WOODPECKER	0.29	4.8	0.5	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
HAIRY WOODPECKER	0.29	4.8	0.5	0.14	2.6	0.5	0.00	0.0	0.0	0.00	0.0	0.0
DOWNY WOODPECKER	0.86	16.7	1.9	0.71	9.0	1.6	0.29	7.2	0.6	0.00	0.0	0.0
EASTERN KINGBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.86	31.2	2.5	0.00	0.0	0.0
GREAT CRESTED FLYCATCHER	0.71	45.2	5.0	0.29	5.2	0.9	0.00	0.0	0.0	0.00	0.0	0.0
EASTERN PHOEBE	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.2	0.00	0.0	0.0
WILLOW FLYCATCHER	0.00	0.0	0.0	0.00	0.0	0.0	0.71	14.4	1.2	0.71	59.2	6.3
EASTERN WOOD PEWEE	1.00	35.7	4.0	1.00	27.1	4.8	0.00	0.0	0.0	0.00	0.0	0.0
BARN SWALLOW	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.2	0.14	3.3	0.3
BLUE JAY	0.86	64.3	7.2	1.00	56.9	10.1	0.00	0.0	0.0	0.00	0.0	0.0
COMMON CROW	0.00	0.0	0.0	0.14	5.2	0.9	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-CAPPED CHICKADEE	1.00	109.5	12.2	1.00	63.3	11.2	0.14	2.4	0.2	0.00	0.0	0.0
TUFTED TITMOUSE	0.71	23.8	2.7	0.86	33.6	5.9	0.00	0.0	0.0	0.00	0.0	0.0
WHITE-BREASTED NUTHATCH	0.57	16.7	1.9	0.14	2.6	0.5	0.00	0.0	0.0	0.00	0.0	0.0
BROWN CREEPER	0.14	4.8	0.5	0.43	9.0	1.6	0.00	0.0	0.0	0.00	0.0	0.0
HOUSE WREN	0.00	0.0	0.0	0.00	0.0	0.0	0.14	7.2	0.6	0.00	0.0	0.0
GRAY CATBIRD	0.00	0.0	0.0	0.71	7.8	1.4	1.00	33.6	2.7	0.43	26.3	2.8
AMERICAN ROBIN	0.43	28.6	3.2	0.71	31.0	5.5	0.29	4.8	0.4	0.14	6.6	0.7
WOOD THRUSH	0.57	33.3	3.7	0.71	29.7	5.3	0.00	0.0	0.0	0.00	0.0	0.0
VEERY	0.00	0.0	0.0	0.43	5.2	0.9	0.00	0.0	0.0	0.00	0.0	0.0
BLUE-GRAY GNATCATCHER	1.00	45.2	5.0	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
CEDAR WAXWING	0.86	59.5	6.6	0.86	19.4	3.4	0.43	52.7	4.3	0.00	0.0	0.0
STARLING	0.00	0.0	0.0	0.00	0.0	0.0	1.00	81.5	6.6	0.00	0.0	0.0
RED-EYED VIREO	1.00	76.2	8.5	0.86	12.9	2.3	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-AND-WHITE WARBLER	0.86	26.2	2.9	0.71	7.8	1.4	0.00	0.0	0.0	0.00	0.0	0.0
WORM-EATING WARBLER	0.14	4.8	0.5	0.14	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
GOLDEN-WINGED WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.43	9.6	0.8	0.00	0.0	0.0
BLUE-WINGED WARBLER	0.00	0.0	0.0	0.14	1.3	0.2	0.29	7.2	0.6	0.00	0.0	0.0
BREWSTER'S WARBLER HYBRID	0.00	0.0	0.0	0.00	0.0	0.0	0.29	4.8	0.4	0.00	0.0	0.0
YELLOW WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.57	26.4	2.1	0.86	32.9	3.5
BLACKBURNIAN WARBLER	0.14	2.4	0.3	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
CHESTNUT-SIDED WARBLER	0.00	0.0	0.0	0.29	3.9	0.7	0.00	0.0	0.0	0.00	0.0	0.0
BLACKPOLL WARBLER	0.14	2.4	0.3	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
PRAIRIE WARBLER	0.00	0.0	0.0	0.00	0.0	0.0	0.71	38.4	3.1	0.14	3.3	0.3
OVENBIRD	0.86	47.6	5.3	0.57	11.6	2.1	0.00	0.0	0.0	0.00	0.0	0.0
NORTHERN WATERTHRUSH	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
COMMON YELLOWTHROAT	0.00	0.0	0.0	0.14	1.3	0.2	1.00	210.9	17.1	0.71	56.0	5.9
YELLOW-BREASTED CHAT	0.00	0.0	0.0	0.00	0.0	0.0	1.00	59.9	4.9	0.00	0.0	0.0
HOODED WARBLER	0.00	0.0	0.0	0.71	12.9	2.3	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN REDSTART	0.29	7.1	0.8	0.71	9.0	1.6	0.00	0.0	0.0	0.14	6.6	0.7
RED-WINGED BLACKBIRD	0.29	7.1	0.8	0.00	0.0	0.0	0.00	0.0	0.0	1.00	82.3	8.7
NORTHERN ORIOLE	0.43	16.7	1.9	0.43	9.0	1.6	0.71	24.0	1.9	0.14	3.3	0.3
COMMON GRACKLE	0.29	11.9	1.3	0.29	3.9	0.7	0.29	4.8	0.4	0.57	29.6	3.1
BROWN-HEADED COWBIRD	0.57	16.7	1.9	0.71	22.0	3.9	0.14	2.4	0.2	0.00	0.0	0.0
SCARLET TANAGER	1.00	54.8	6.1	0.71	31.0	5.5	0.14	2.4	0.2	0.00	0.0	0.0
CARDINAL	0.00	0.0	0.0	1.00	27.1	4.8	0.14	2.4	0.2	0.00	0.0	0.0
ROSE-BREASTED GROSBEAK	0.57	19.0	2.1	1.00	41.4	7.3	0.00	0.0	0.0	0.00	0.0	0.0
INDIGO BUNTING	0.57	31.0	3.4	0.43	11.6	2.1	0.86	24.0	1.9	0.29	9.9	1.0
HOUSE FINCH	0.00	0.0	0.0	0.14	1.3	0.2	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN GOLDFINCH	0.14	4.8	0.5	0.00	0.0	0.0	1.00	79.1	6.4	1.00	79.0	8.3
RUFOUS-SIDED TOWHEE	0.29	4.8	0.5	1.00	22.0	3.9	0.86	40.7	3.3	0.00	0.0	0.0
CHIPPING SPARROW	0.57	11.9	1.3	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
FIELD SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	1.00	306.8	24.9	1.00	325.9	34.4
SONG SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	1.00	98.3	8.0	1.00	220.5	23.3
	-	897.6	100.0	-	565.0	100.0	-	1234.4	100.0	-	948.0	100.0

Table G-5

Frequency (F), mean density (MD), and relative density (RD) of birds observed in Council Cup and TR419 Forests, and Switchyard and Transmission Corridor Fields during the autumn census, 15 August through 30 November 1981.

SPECIES	CC FOREST F	CC FOREST MD	CC FOREST RD	TR419 FOREST F	TR419 FOREST MD	TR419 FOREST RD	SW FIELD F	SW FIELD MD	SW FIELD RD	TC FIELD F	TC FIELD MD	TC FIELD RD
SHARP-SHINNED HAWK	0.14	2.4	0.2	0.00	0.0	0.0	0.14	2.4	0.2	0.00	0.0	0.0
RED-TAILED HAWK	0.00	0.0	0.0	0.29	2.6	0.3	0.00	0.0	0.0	0.00	0.0	0.0
BROAD-WINGED HAWK	0.14	2.4	0.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
RUFFED GROUSE	0.43	11.9	1.0	0.43	6.5	0.7	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN WOODCOCK	0.00	0.0	0.0	0.00	0.0	0.0	0.29	4.8	0.3	0.14	3.3	0.8
MOURNING DOVE	0.00	0.0	0.0	0.14	6.5	0.7	0.29	31.2	2.1	0.14	6.6	1.6
YELLOW-BILLED CUCKOO	0.00	0.0	0.0	0.14	3.9	0.4	0.00	0.0	0.0	0.00	0.0	0.0
RUBY-THROATED HUMMINGBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.2	0.00	0.0	0.0
COMMON FLICKER	0.14	7.1	0.6	0.29	9.0	0.9	0.43	28.8	2.0	0.00	0.0	0.0
PILEATED WOODPECKER	0.14	2.4	0.2	0.14	1.3	0.1	0.00	0.0	0.0	0.00	0.0	0.0
YELLOW-BELLIED SAPSUCKER	0.00	0.0	0.0	0.14	6.5	0.7	0.00	0.0	0.0	0.00	0.0	0.0
HAIRY WOODPECKER	0.71	26.2	2.1	0.43	6.5	0.7	0.14	2.4	0.2	0.00	0.0	0.0
DOWNY WOODPECKER	1.00	54.8	4.4	1.00	23.3	2.4	0.29	4.8	0.3	0.00	0.0	0.0
EASTERN KINGBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.29	12.0	0.8	0.14	3.3	0.8
GREAT CRESTED FLYCATCHER	0.29	4.8	0.4	0.14	1.3	0.1	0.14	2.4	0.2	0.00	0.0	0.0
EASTERN PHOEBE	0.00	0.0	0.0	0.00	0.0	0.0	0.43	7.2	0.5	0.29	13.2	3.1
EMPIDONAX FLYCATCHER SP.	0.00	0.0	0.0	0.29	3.9	0.4	0.14	4.8	0.3	0.00	0.0	0.0
EASTERN WOOD PEWEE	0.29	14.3	1.2	0.43	16.8	1.7	0.00	0.0	0.0	0.00	0.0	0.0
BARN SWALLOW	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	9.9	2.3
BLUE JAY	0.86	42.9	3.5	1.00	75.0	7.8	0.29	4.8	0.3	0.00	0.0	0.0
BLACK-CAPPED CHICKADEE	1.00	188.1	15.2	1.00	85.3	8.8	0.43	14.4	1.0	0.14	16.5	3.9
TUFTED TITMOUSE	0.86	47.6	3.8	0.86	36.2	3.7	0.00	0.0	0.0	0.00	0.0	0.0
WHITE-BREASTED NUTHATCH	0.86	54.8	4.4	0.86	18.1	1.9	0.00	0.0	0.0	0.00	0.0	0.0
RED-BREASTED NUTHATCH	0.71	31.0	2.5	0.71	11.6	1.2	0.00	0.0	0.0	0.00	0.0	0.0
BROWN CREEPER	0.71	28.6	2.3	0.57	12.9	1.3	0.00	0.0	0.0	0.00	0.0	0.0
HOUSE WREN	0.00	0.0	0.0	0.00	0.0	0.0	0.57	38.4	2.6	0.00	0.0	0.0
WINTER WREN	0.00	0.0	0.0	0.29	3.9	0.4	0.00	0.0	0.0	0.00	0.0	0.0
GRAY CATBIRD	0.00	0.0	0.0	0.14	1.3	0.1	0.43	31.2	2.1	0.29	13.2	3.1
BROWN THRASHER	0.00	0.0	0.0	0.00	0.0	0.0	0.14	2.4	0.2	0.00	0.0	0.0
AMERICAN ROBIN	0.43	14.3	1.2	0.57	103.4	10.7	0.29	12.0	0.8	0.14	6.6	1.6
WOOD THRUSH	0.00	0.0	0.0	0.43	6.5	0.7	0.00	0.0	0.0	0.00	0.0	0.0
HERMIT THRUSH	0.29	7.1	0.6	0.14	1.3	0.1	0.00	0.0	0.0	0.00	0.0	0.0
EASTERN BLUEBIRD	0.00	0.0	0.0	0.00	0.0	0.0	0.14	12.0	0.8	0.00	0.0	0.0
BLUE-GRAY GNATCATCHER	0.29	11.9	1.0	0.43	3.9	0.4	0.14	2.4	0.2	0.00	0.0	0.0
GOLDEN-CROWNED KINGLET	0.43	61.9	5.0	0.43	14.2	1.5	0.00	0.0	0.0	0.00	0.0	0.0
RUBY-CROWNED KINGLET	0.43	23.8	1.9	0.14	3.9	0.4	0.00	0.0	0.0	0.00	0.0	0.0
CEDAR WAXWING	0.43	16.7	1.3	0.71	115.1	11.9	0.43	45.5	3.1	0.29	32.9	7.8
STARLING	0.00	0.0	0.0	0.00	0.0	0.0	0.86	280.4	19.3	0.00	0.0	0.0
SOLITARY VIREO	0.29	7.1	0.6	0.14	2.6	0.3	0.00	0.0	0.0	0.00	0.0	0.0
RED-EYED VIREO	0.57	31.0	2.5	0.57	22.0	2.3	0.14	4.8	0.3	0.00	0.0	0.0
PHILADELPHIA VIREO	0.14	2.4	0.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
WARBLER SP.	0.00	0.0	0.0	0.14	3.9	0.4	0.00	0.0	0.0	0.00	0.0	0.0
BLACK-AND-WHITE WARBLER	0.43	23.8	1.9	0.14	11.6	1.2	0.00	0.0	0.0	0.00	0.0	0.0
WORM-EATING WARBLER	0.00	0.0	0.0	0.29	3.9	0.4	0.00	0.0	0.0	0.00	0.0	0.0
GOLDEN-WINGED WARBLER	0.29	4.8	0.4	0.00	0.0	0.0	0.14	4.8	0.3	0.00	0.0	0.0
BLUE-WINGED WARBLER	0.14	2.4	0.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
ORANGE-CROWNED WARBLER	0.14	4.8	0.4	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
TENNESSEE WARBLER	0.14	2.4	0.2	0.14	2.6	0.3	0.00	0.0	0.0	0.00	0.0	0.0
NASHVILLE WARBLER	0.29	7.1	0.6	0.00	0.0	0.0	0.29	1.8	0.3	0.00	0.0	0.0
NORTHERN PARULA WARBLER	0.14	2.4	0.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
MAGNOLIA WARBLER	0.43	19.0	1.5	0.29	5.2	0.5	0.00	0.0	0.0	0.00	0.0	0.0
CAPE MAY WARBLER	0.43	14.3	1.2	0.29	5.2	0.5	0.14	2.4	0.2	0.00	0.0	0.0
BLACK-THROATED BLUE WARBLER	0.43	14.3	1.2	0.14	1.3	0.1	0.00	0.0	0.0	0.00	0.0	0.0
YELLOW-RUMPED WARBLER	0.57	107.1	8.7	0.43	23.3	2.4	0.14	4.8	0.3	0.00	0.0	0.0
BLACK-THROATED GREEN WARBLER	0.29	33.3	2.7	0.43	11.6	1.2	0.00	0.0	0.0	0.00	0.0	0.0
BLACKBURNIAN WARBLER	0.57	59.5	4.8	0.29	9.0	0.9	0.00	0.0	0.0	0.00	0.0	0.0
CHESTNUT-SIDED WARBLER	0.29	9.5	0.8	0.43	9.0	0.9	0.00	0.0	0.0	0.00	0.0	0.0
BAY-BREASTED WARBLER	0.43	26.2	2.1	0.29	7.8	0.8	0.00	0.0	0.0	0.00	0.0	0.0
BLACKPOLL WARBLER	0.14	9.5	0.8	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
PINE WARBLER	0.14	4.8	0.4	0.14	1.3	0.1	0.00	0.0	0.0	0.00	0.0	0.0
PRAIRIE WARBLER	0.14	2.4	0.2	0.00	0.0	0.0	0.14	2.4	0.2	0.00	0.0	0.0
OVENBIRD	0.43	26.2	2.1	0.43	9.0	0.9	0.00	0.0	0.0	0.00	0.0	0.0
COMMON YELLOWTHROAT	0.00	0.0	0.0	0.00	0.0	0.0	0.71	155.8	10.7	0.43	26.3	6.2
HOODED WARBLER	0.00	0.0	0.0	0.43	10.3	1.1	0.00	0.0	0.0	0.00	0.0	0.0
CANADA WARBLER	0.29	16.7	1.3	0.14	5.2	0.5	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN REDSTART	0.57	61.9	5.0	0.43	24.6	2.5	0.00	0.0	0.0	0.00	0.0	0.0
NORTHERN ORIOLE	0.00	0.0	0.0	0.14	2.6	0.3	0.43	9.6	0.7	0.00	0.0	0.0
BROWN-HEADED COWBIRD	0.14	2.4	0.2	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0
SCARLET TANAGER	0.43	26.2	2.1	0.57	23.3	2.4	0.00	0.0	0.0	0.00	0.0	0.0
CARDINAL	0.00	0.0	0.0	0.71	15.5	1.6	0.29	9.6	0.7	0.29	9.9	2.3
ROSE-BREASTED GROSBEAK	0.00	0.0	0.0	0.43	10.3	1.1	0.14	4.8	0.3	0.00	0.0	0.0
INDIGO BUNTING	0.29	14.3	1.2	0.00	0.0	0.0	0.29	14.4	1.0	0.00	0.0	0.0
PURPLE FINCH	0.00	0.0	0.0	0.14	9.0	0.9	0.29	7.2	0.5	0.00	0.0	0.0
PINE SISKIN	0.00	0.0	0.0	0.29	19.4	2.0	0.00	0.0	0.0	0.00	0.0	0.0
AMERICAN GOLDFINCH	0.29	14.3	1.2	0.43	58.2	6.0	0.57	55.1	3.8	0.00	0.0	0.0
RUFOUS-SIDED TOWHEE	0.00	0.0	0.0	0.71	16.8	1.7	0.71	36.0	2.5	0.00	0.0	0.0
VESPER SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	6.6	1.6
DARK-EYED JUNCO	0.29	33.3	2.7	0.29	3.9	0.4	0.00	0.0	0.0	0.14	6.6	1.6
TREE SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.00	0.0	0.0	0.14	9.9	2.3
FIELD SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.86	141.4	9.8	0.86	121.8	28.7
WHITE-CROWNED SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.29	24.0	1.7	0.29	13.2	3.1
WHITE-THROATED SPARROW	0.00	0.0	0.0	0.29	56.9	5.9	0.29	275.6	19.0	0.29	9.9	2.3
LINCOLN'S SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.43	12.0	0.8	0.14	6.6	1.6
SWAMP SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.29	7.2	0.5	0.00	0.0	0.0
SONG SPARROW	0.00	0.0	0.0	0.00	0.0	0.0	0.86	127.0	8.8	1.00	108.6	25.6
	-	1238.1	100.0	-	965.7	100.0	-	1450.1	100.0	-	424.6	100.0

Table G-6

Number, density (no./km^2), and relative density (%) of breeding pairs observed in Council Cup and TR419 Forests, and Switchyard and Transmission Corridor Fields during the breeding census, 1 May through 27 August 1981.

Nest Location/Species	Council Cup Forest			TR419 Forest			Switchyard Field			Transmission Corridor Field		
	Pairs	Density	RD	Pairs	Density	RD	Pairs	Density	RD	Pairs	Density	RD
Ground												
Ruffed grouse	+	0	0	0	0	0	0	0	0	0	0	0
Veery	0	0	0	+	0	0	0	0	0	0	0	0
✓ Black-and-white warbler	2.0	33.5	4.9	1.0	9.0	1.8	0	0	0	0	0	0
✓ Golden-winged warbler*	0	0	0	0	0	0	1.0	16.5	2.1	0	0	0
Blue-winged warbler	0	0	0	0	0	0	0.5	8.5	1.0	0	0	0
Ovenbird	3.0	50.0	7.4	2.0	18.0	3.6	0	0	0	0	0	0
Common yellowthroat	0	0	0	+	0	0	10.0	166.5	20.6	2.5	57.5	9.1
✓ Rufous-sided towhee	0.5	8.5	1.2	1.5	13.5	2.6	2.0	33.5	4.1	0	0	0
✓ Field sparrow	0	0	0	0	0	0	10.0	166.5	20.6	7.5	173.0	27.3
✓ Song sparrow	0	0	0	0	0	0	5.5	91.5	11.3	7.0	161.5	25.4
Total	5.5	92.0	13.6	4.5	40.5	8.3	29.0	483.0	59.7	17.0	392.0	61.8
Cavity												
American kestrel	0	0	0	0	0	0	+	0	0	0	0	0
Common flicker	1.0	16.5	2.5	1.0	9.0	1.8	+	0	0	0	0	0
Pileated woodpecker	+	0	0	0	0	0	0	0	0	0	0	0
Hairy woodpecker	0.5	8.5	1.2	+	0	0	0	0	0	0	0	0
Downy woodpecker	0.5	8.5	1.2	1.5	13.5	2.6	0	0	0	0	0	0
Great crested flycatcher	2.0	33.5	4.9	0.5	4.5	1.0	0	0	0	0	0	0
✓ Black-capped chickadee	4.5	75.0	11.1	3.5	32.0	6.5	0	0	0	0	0	0
Tufted titmouse	1.0	16.5	2.5	3.5	32.0	6.5	0	0	0	0	0	0
White-breasted nuthatch	0.5	8.5	1.2	0.5	4.5	1.0	0	0	0	0	0	0
Red-breasted nuthatch	+	0	0	0	0	0	0	0	0	0	0	0
Brown creeper	0	0	0	1.0	9.0	1.8	0	0	0	0	0	0
House wren	0	0	0	+	0	0	0	0	0	0	0	0
✓ Starling †	0	0	0	0	0	0	2.0	33.5	4.1	0	0	0
Total	10.0	167.0	24.7	11.5	104.5	21.2	2.0	33.5	4.1	0	0	0
Limb												
Broad-winged hawk	+	0	0	0	0	0	0	0	0	0	0	0
✓ Yellow-billed cuckoo	2.0	33.5	4.9	1.5	13.5	2.6	0	9	0	0	0	0
✓ Eastern kingbird †	0	0		0	0	0	1.0	16.5	2.1	0	0	0
✓ Willow flycatcher	0	0	0	0	0	0	1.0	16.5	2.1	2.0	46.0	7.3
Eastern wood pewee	1.5	25.0	3.7	2.0	18.0	3.6	0	0	0	0	0	0
✓ Blue jay	2.5	41.5	6.2	5.0	45.5	9.1	0	0	0	0	0	0
✓ Common crow	0.5	8.5	1.2	0	0	0	0	0	0	0	0	0
✓ Gray catbird	0	0	0	1.0	9.0	1.8	1.0	16.5	2.1	0.5	11.5	1.9
✓ American robin	1.0	16.5	2.5	2.0	18.0	3.6	0	0	0	+	0	0
✓ Wood thrush	2.0	33.5	4.9	4.5	41.0	8.3	0	0	0	0	0	0
Blue-gray gnatcatcher	1.5	25.0	3.7	+	0	0	0	0	0	0	0	0
✓ Cedar waxwing	2.0	33.5	4.9	1.0	9.0	1.8	4.0	66.5	8.2	2.0	46.0	7.3
✓ Red-eyed vireo	3.5	58.5	8.6	3.0	27.5	5.5	0	0	0	0	0	0
✓ Yellow warbler	0	0	0	0	0	0	1.0	16.5	2.1	1.0	23.0	3.6
Chestnut-sided warbler	0	0	0	+	0	0	0	0	0	0	0	0
✓ Prairie warbler	0	0	0	0	0	0	2.5	41.5	5.2	0	0	0
✓ Yellow-breasted chat	0	0	0	0	0	0	2.5	41.5	5.2	0	0	0
Hooded warbler	0	0	0	1.5	13.5	2.6	0	0	0	0	0	0
American redstart	0	0	0	+	0	0	0	0	0	0	0	0
✓ Red-winged blackbird	0	0	0	0	0	0	0	0	0	3.0	69.0	10.9
Northern oriole	0	0	0	0.5	4.5	1.0	0	0	0	0	0	0
Common grackle	0	0	0	0	0	0	0	0	0	+	0	0
✓ Scarlet tanager	4.0	66.5	9.9	4.5	41.0	8.3	0	0	0	0	0	0
Cardinal	0	0	0	1.0	9.0	1.8	0.5	8.5	1.0	+	0	0
✓ Rose-breasted grosbeak	1.0	16.5	2.5	6.0	54.5	11.1	0	0	0	0	0	0
Indigo bunting	+	0	0	+	0	0	1.5	25.0	3.1	0	0	0
✓ American goldfinch	0	0	0	0	0	0	2.5	41.5	5.2	2.0	46.0	7.3
Chipping sparrow	+	0	0	0	0	0	0	0	0	0	0	0
Total	21.5	358.5	53.0	33.5	304.0	61.6	17.5	290.5	36.3	10.5	241.5	38.2
Social Parasite												
Brown-headed cowbird	3.5	58.5	8.6	5.0	45.5	9.3	0	0	0	0	0	0
Total	40.5	676.0	100.0	54.5	494.5	100.0	48.5	807.0	100.0	27.5	633.5	100.0

✓ denotes that at least one nest of this species was found in or adjacent to a plot.
+ denotes a pair that maintained less than 0.5 home range in that plot.
* denotes the male of this pair was a golden-winged warbler and the female was a Brewster's warbler.
† denotes a species that nested on a man-made structure.

Table G-7

Number of water birds observed during six censuses on the Susquehanna River, 9 October through 23 November 1981.

SPECIES	9 OCT	16 OCT	30 OCT	5 NOV	12 NOV	23 NOV	MEAN	% TOTAL
PIED-BILLED GREBE	0	0	0	1	0	0	0.2	0.8
GREAT BLUE HERON	1	6	8	3	2	6	4.3	21.7
CANADA GOOSE	0	0	1	0	0	2	0.5	2.5
MALLARD	2	25	0	0	1	0	4.7	23.3
BLACK DUCK	0	0	2	0	1	12	2.5	12.5
WOOD DUCK	1	3	2	7	0	0	2.2	10.8
REDHEAD	0	0	1	0	0	0	0.2	0.8
GREATER SCAUP	0	0	1	0	0	0	0.2	0.8
BUFFLEHEAD	0	0	1	0	0	0	0.2	0.8
HOODED MERGANSER	0	0	0	0	2	0	0.3	1.7
OSPREY	1	0	0	0	0	0	0.2	0.8
KILLDEER	0	1	0	0	0	0	0.2	0.8
RING-BILLED GULL	0	0	0	0	0	12	2.0	10.0
BELTED KINGFISHER	4	5	2	1	3	0	2.5	12.5
TOTAL	9	40	18	12	9	32	20.0	

Table G-8

Combined weekly bird impaction totals from the Unit 1 and 2 Cooling Towers, 23 March through 5 June 1981.

Species	Mar		Apr				May				Jun	Total
	23-27	30-3	5-10	13-17	20-24	27-1	4-8	11-15	18-22	26-29	1-5	
Troglodytidae												
House wren	0	0	0	0	0	1	0	0	0	0	0	1
Vireonidae												
White-eyed vireo	0	0	0	0	0	0	1	0	0	0	0	1
Solitary vireo	0	0	0	0	0	1	1	0	0	0	0	2
Red-eyed vireo	0	0	0	0	0	0	0	0	0	0	2	2
Vireo - unidentified	0	0	0	0	0	1	0	0	0	0	0	1
Parulidae												
Cape May warbler	0	0	0	0	0	0	0	0	1	0	0	1
Black-throated blue warbler	0	0	0	0	0	0	0	0	1	0	0	1
Black-throated green warbler	0	0	0	0	0	0	0	0	1	0	0	1
Blackburnian warbler	0	0	0	0	0	0	0	0	1	0	0	1
Chestnut-sided warbler	0	0	0	0	0	0	0	0	1	0	0	1
Common yellowthroat	0	0	0	0	0	0	0	1	0	0	0	1
American redstart	0	0	0	0	0	0	0	0	1	0	0	1
Total Individuals	0	0	0	0	0	3	2	1	6	0	2	14
Total Species	0	0	0	0	0	2+	2	1	6	0	1	12+

Table G-9

Combined weekly bird impaction totals from the Unit 1 and 2 Cooling Towers, 17 August through 6 November 1981.

Species	Aug 17-21	Aug 24-28	31-4	Sep 8-11	Sep 12-18[a]	Sep 19-25	26-2	Oct 3-9	Oct 10-16	Oct 19-23	Oct 26-30	Nov 2-6	To
Tyrannidae													
Acadian flycatcher	0	0	0	0	0	0	1	0	0	0	0	0	
Eastern wood pewee	0	0	0	0	0	0	0	1	0	0	0	0	
Flycatcher - unidentified	0	0	0	1	0	0	0	0	0	0	0	0	
Sittidae													
Red-breasted nuthatch	0	0	0	0	0	0	1	0	0	0	0	0	
Mimidae													
Gray catbird	0	0	0	0	1	0	0	0	0	0	0	0	
Turdidae													
Wood thrush	0	0	0	0	0	1	0	1	0	0	0	0	
Sylviidae													
Golden-crowned kinglet	0	0	0	0	0	0	0	0	0	0	3	0	
Ruby-crowned kinglet	0	0	0	0	0	0	1	1	0	0	2	0	
Vireonidae													
Yellow-throated vireo	0	0	0	0	0	0	1	0	0	0	0	0	
Solitary vireo	0	0	0	0	0	0	13	6	1	4	3	0	
Red-eyed vireo	1	2	7	26	8	7	58	41	3	4	0	0	1
Philadelphia vireo	0	0	0	0	0	0	6	2	0	0	1	0	
Warbling vireo	0	0	0	0	0	0	1	0	0	0	0	0	
Vireo - unidentified	0	0	0	0	0	0	6	1	0	0	0	1	
Parulidae													
Black-and-white warbler	0	0	0	1	0	0	1	0	0	0	0	0	
Tennessee warbler	0	0	0	0	0	0	5	2	0	0	0	0	
Nashville warbler	0	0	0	0	0	0	1	0	1	0	0	0	
Northern parula warbler	0	0	0	0	0	2	4	2	0	0	0	0	
Magnolia warbler	0	0	1	2	1	2	24	8	1	0	0	0	
Cape May warbler	0	0	0	0	0	0	2	0	0	0	0	0	
Black-throated blue warbler	0	0	0	0	0	0	7	3	0	0	0	0	
Black-throated green warbler	0	1	0	0	0	2	34	16	1	0	0	0	
Blackburnian warbler	1	0	2	2	0	0	8	5	0	1	0	0	
Chestnut-sided warbler	0	0	0	2	0	0	2	0	0	0	0	0	
Bay-breasted warbler	0	0	0	1	0	1	9	2	0	0	0	0	
Blackpoll warbler	0	0	0	0	0	3	2	1	0	0	0	0	
Pine warbler	0	0	0	0	0	0	1	0	0	0	0	0	
Ovenbird	0	0	1	1	1	2	2	0	0	0	0	0	
Common yellowthroat	1	0	1	5	1	0	14	7	0	1	1	0	
American redstart	0	0	0	2	0	1	3	2	0	0	0	0	
Warbler - unidentified	0	1	0	2	0	0	14	0	0	0	1	0	
Icteridae													
Northern oriole	0	0	0	1	0	0	0	0	0	0	0	0	
Fringillidae													
Rose-breasted grosbeak	0	0	0	0	0	0	1	0	0	0	0	0	
Unidentified spp.	0	0	1	1	0	0	0	0	0	0	0	0	
Total Individuals	3	4	13	47	12	21	222	101	7	10	11	1	4
Total Species	3	2+	5+	10+	5	9	25+	16+	5	4	5+	1	

[a]Impaction studies included weekends and holidays, 12 September through 16 October.

Fig. G-1

Phenological occurrence of birds observed near the Susquehanna SES site, 1981.

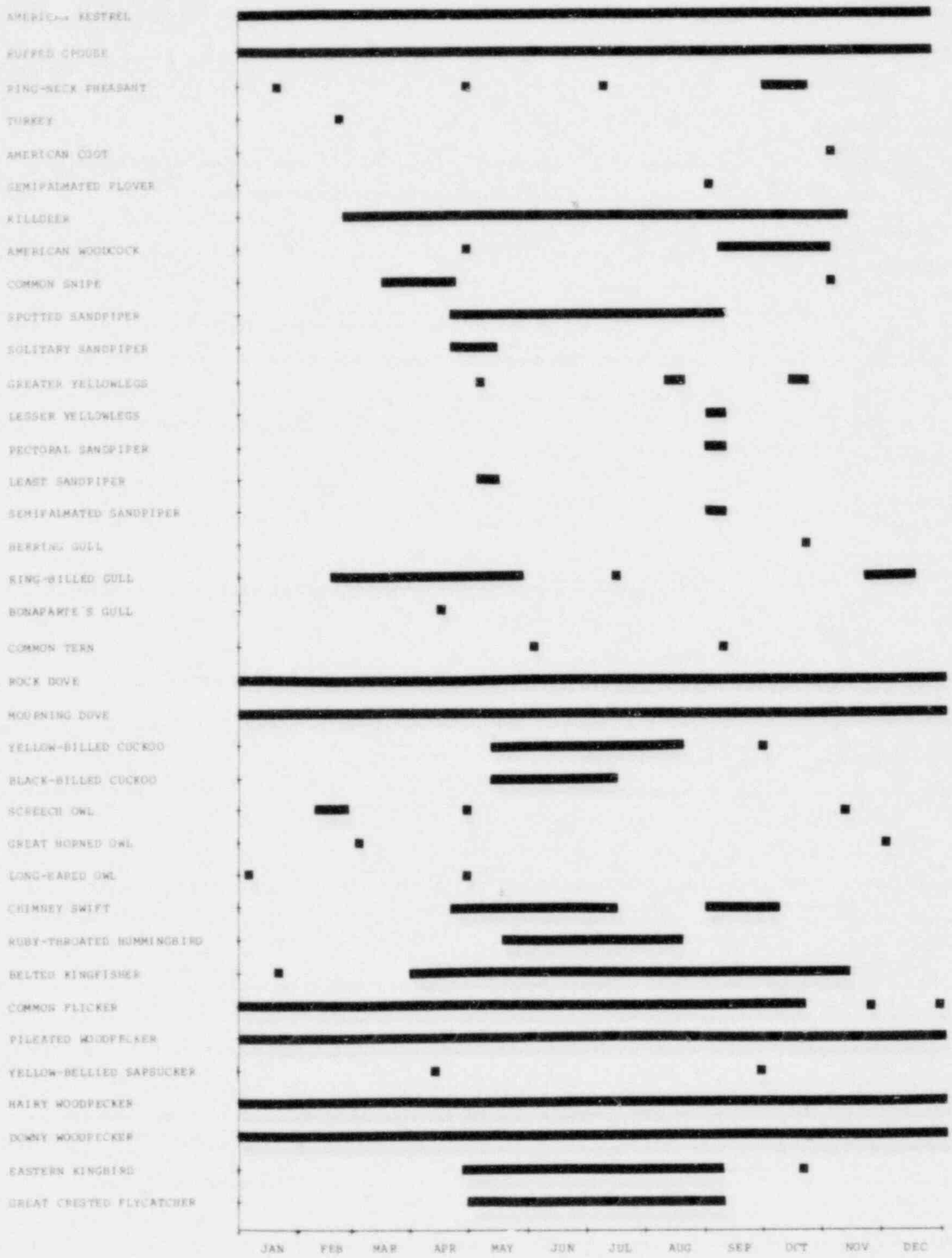
AMERIC KESTREL
RUFFED GROUSE
RING-NECK PHEASANT
TURKEY
AMERICAN COOT
SEMIPALMATED PLOVER
KILLDEER
AMERICAN WOODCOCK
COMMON SNIPE
SPOTTED SANDPIPER
SOLITARY SANDPIPER
GREATER YELLOWLEGS
LESSER YELLOWLEGS
PECTORAL SANDPIPER
LEAST SANDPIPER
SEMIPALMATED SANDPIPER
HERRING GULL
RING-BILLED GULL
BONAPARTE'S GULL
COMMON TERN
ROCK DOVE
MOURNING DOVE
YELLOW-BILLED CUCKOO
BLACK-BILLED CUCKOO
SCREECH OWL
GREAT HORNED OWL
LONG-EARED OWL
CHIMNEY SWIFT
RUBY-THROATED HUMMINGBIRD
BELTED KINGFISHER
COMMON FLICKER
PILEATED WOODPECKER
YELLOW-BELLIED SAPSUCKER
HAIRY WOODPECKER
DOWNY WOODPECKER
EASTERN KINGBIRD
GREAT CRESTED FLYCATCHER
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Fig. G-1 (cont.)


EASTERN PHOEBE
YELLOW-BELLIED FLYCATCHER
ACADIAN FLYCATCHER
WILLOW FLYCATCHER
LEAST FLYCATCHER
EASTERN WOOD PEWEE
HORNED LARK
TREE SWALLOW
BANK SWALLOW
ROUGH-WINGED SWALLOW
BARN SWALLOW
CLIFF SWALLOW
PURPLE MARTIN
BLUE JAY
COMMON CROW
FISH CROW
BLACK-CAPPED CHICKADEE
TUFTED TITMOUSE
WHITE-BREASTED NUTHATCH
RED-BREASTED NUTHATCH
BROWN CREEPER
HOUSE WREN
WINTER WREN
CAROLINA WREN
MOCKINGBIRD
GRAY CATBIRD
BROWN THRASHER
AMERICAN ROBIN
WOOD THRUSH
HERMIT THRUSH
SWAINSON'S THRUSH
VEERY
EASTERN BLUEBIRD
BLUE-GRAY GNATCATCHER
GOLDEN-CROWNED KINGLET
RUBY-CROWNED KINGLET
CEDAR WAXWING
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Fig. G-1 (cont.)

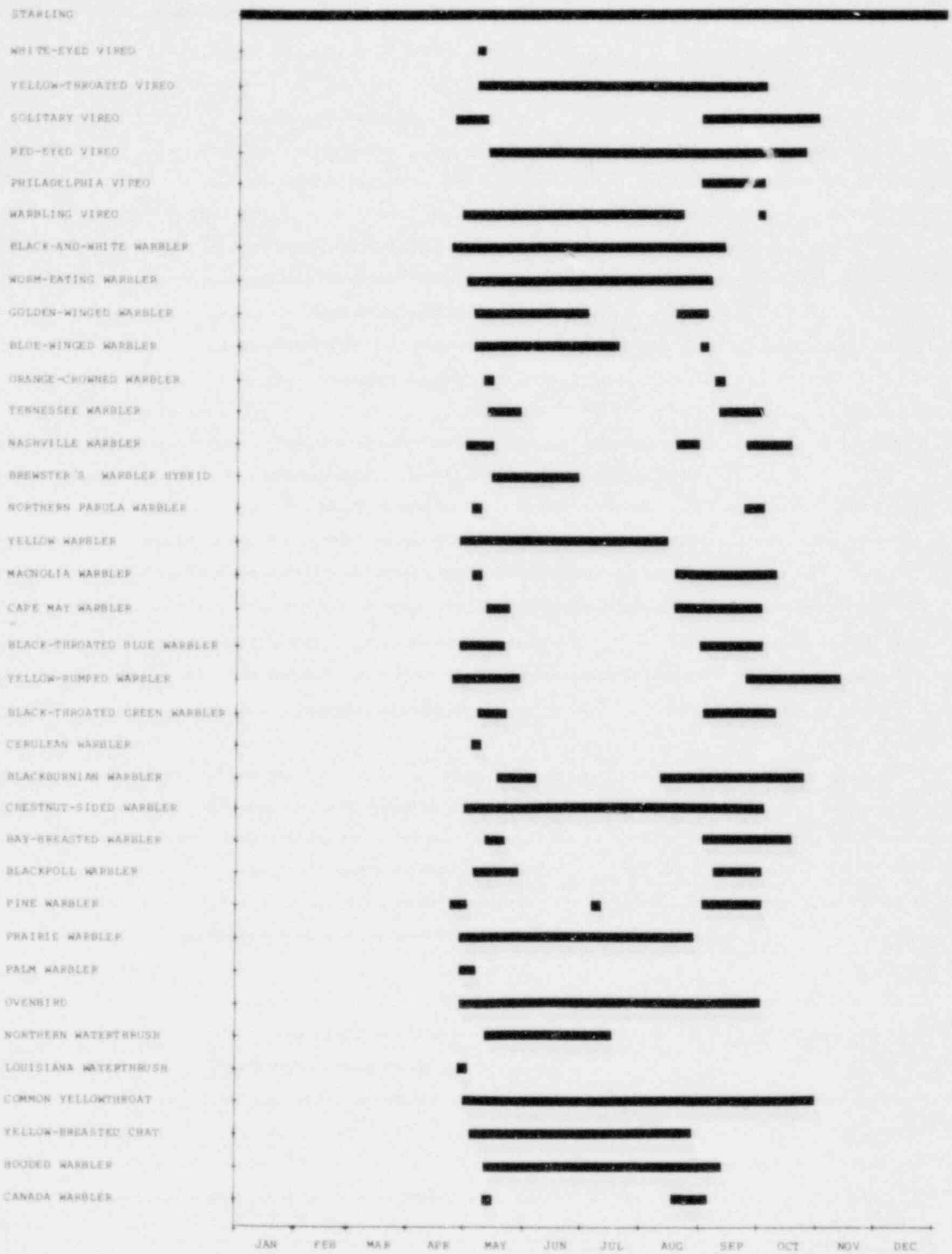
STARLING
WHITE-EYED VIREO
YELLOW-THROATED VIREO
SOLITARY VIREO
RED-EYED VIREO
PHILADELPHIA VIREO
WARBLING VIREO
BLACK-AND-WHITE WARBLER
WORM-EATING WARBLER
GOLDEN-WINGED WARBLER
BLUE-WINGED WARBLER
ORANGE-CROWNED WARBLER
TENNESSEE WARBLER
NASHVILLE WARBLER
BREWSTER'S WARBLER HYBRID
NORTHERN PARULA WARBLER
YELLOW WARBLER
MAGNOLIA WARBLER
CAPE MAY WARBLER
BLACK-THROATED BLUE WARBLER
YELLOW-RUMPED WARBLER
BLACK-THROATED GREEN WARBLER
CERULEAN WARBLER
BLACKBURNIAN WARBLER
CHESTNUT-SIDED WARBLER
BAY-BREASTED WARBLER
BLACKPOLL WARBLER
PINE WARBLER
PRAIRIE WARBLER
PALM WARBLER
OVENBIRD
NORTHERN WATERTHRUSH
LOUISIANA WATERTHRUSH
COMMON YELLOWTHROAT
YELLOW-BREASTED CHAT
HOODED WARBLER
CANADA WARBLER
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Fig. G-1 (cont.)

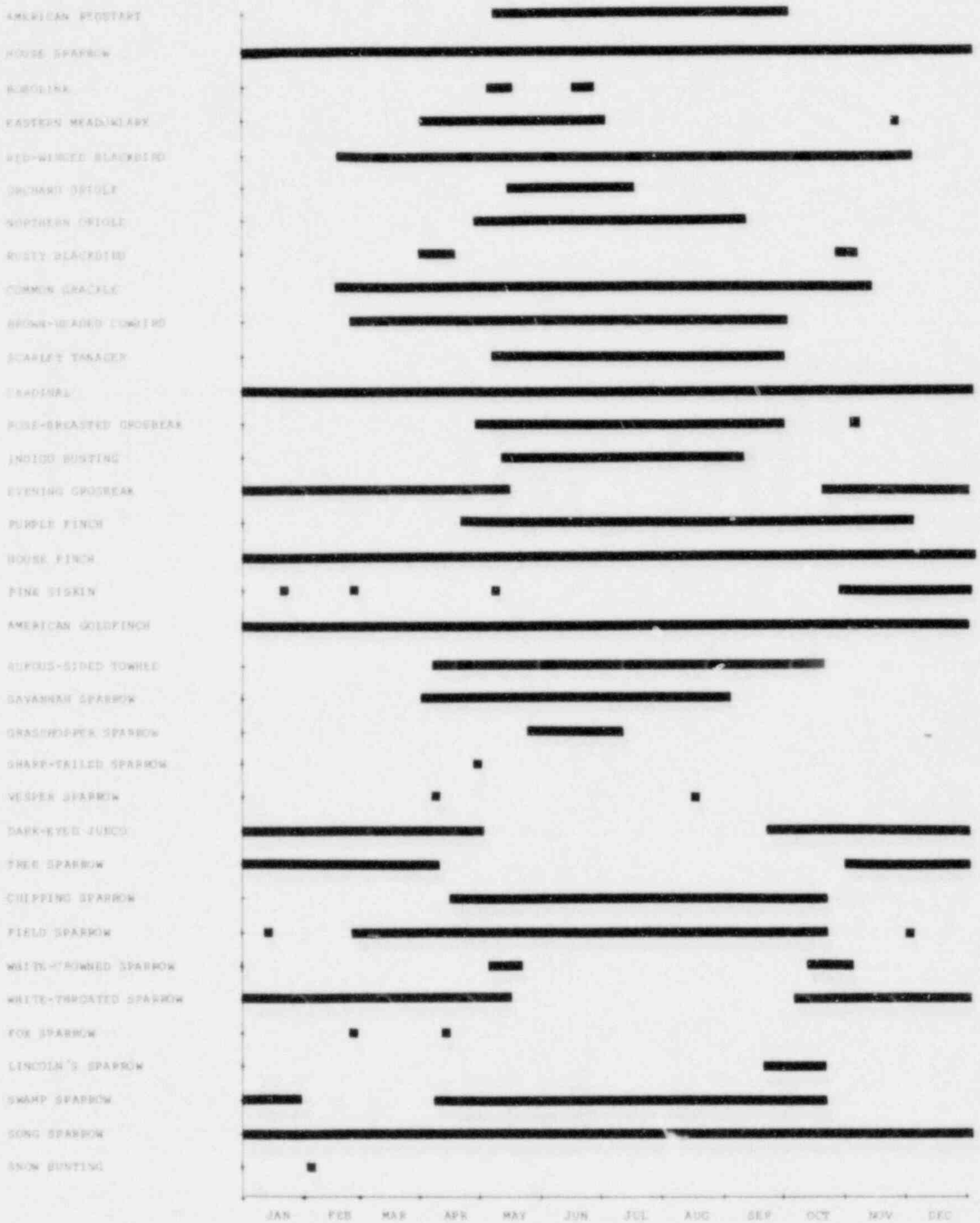
AMERICAN REDSTART
HOUSE SPARROW
BOBOLINK
EASTERN MEADOWLARK
RED-WINGED BLACKBIRD
ORCHARD ORIOLE
NORTHERN ORIOLE
RUSTY BLACKBIRD
COMMON GRACKLE
BROWN-HEADED COWBIRD
SCARLET TANAGER
CARDINAL
ROSE-BREASTED GROSBEAK
INDIGO BUNTING
EVENING GROSBEAK
PURPLE FINCH
HOUSE FINCH
PINE SISKIN
AMERICAN GOLDFINCH
RUFOUS-SIDED TOWHEE
SAVANNAH SPARROW
GRASSHOPPER SPARROW
SHARP-TAILED SPARROW
VESPER SPARROW
DARK-EYED JUNCO
TREE SPARROW
CHIPPING SPARROW
FIELD SPARROW
WHITE-CROWNED SPARROW
WHITE-THROATED SPARROW
FOX SPARROW
LINCOLN'S SPARROW
SWAMP SPARROW
SONG SPARROW
SNOW BUNTING
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Fig. G-1 (cont.)

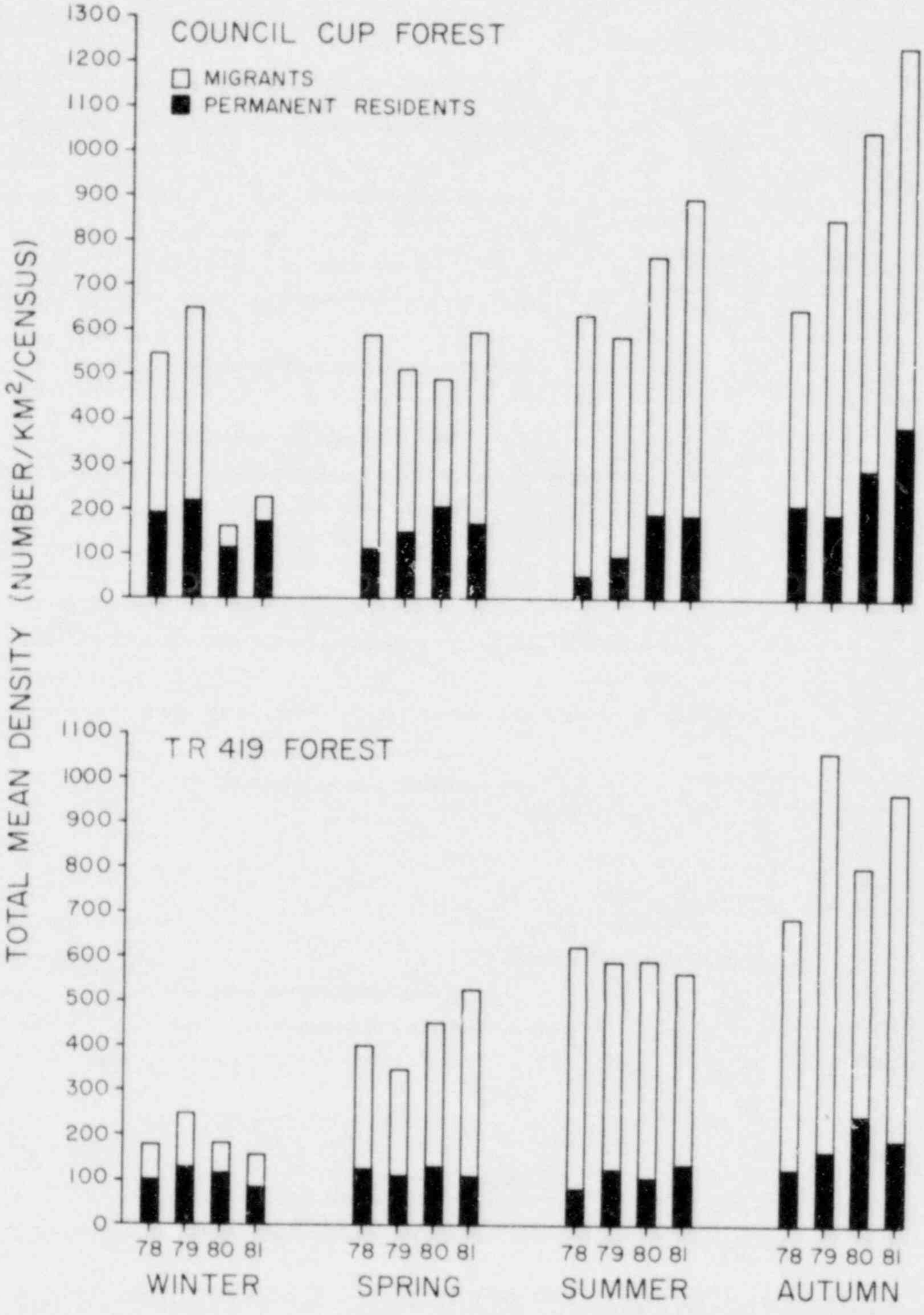

Fig. G-2

Total mean density (number/km^2/census) in Council Cup Forest and TR419 Forest in each season from 1978 through 1981.

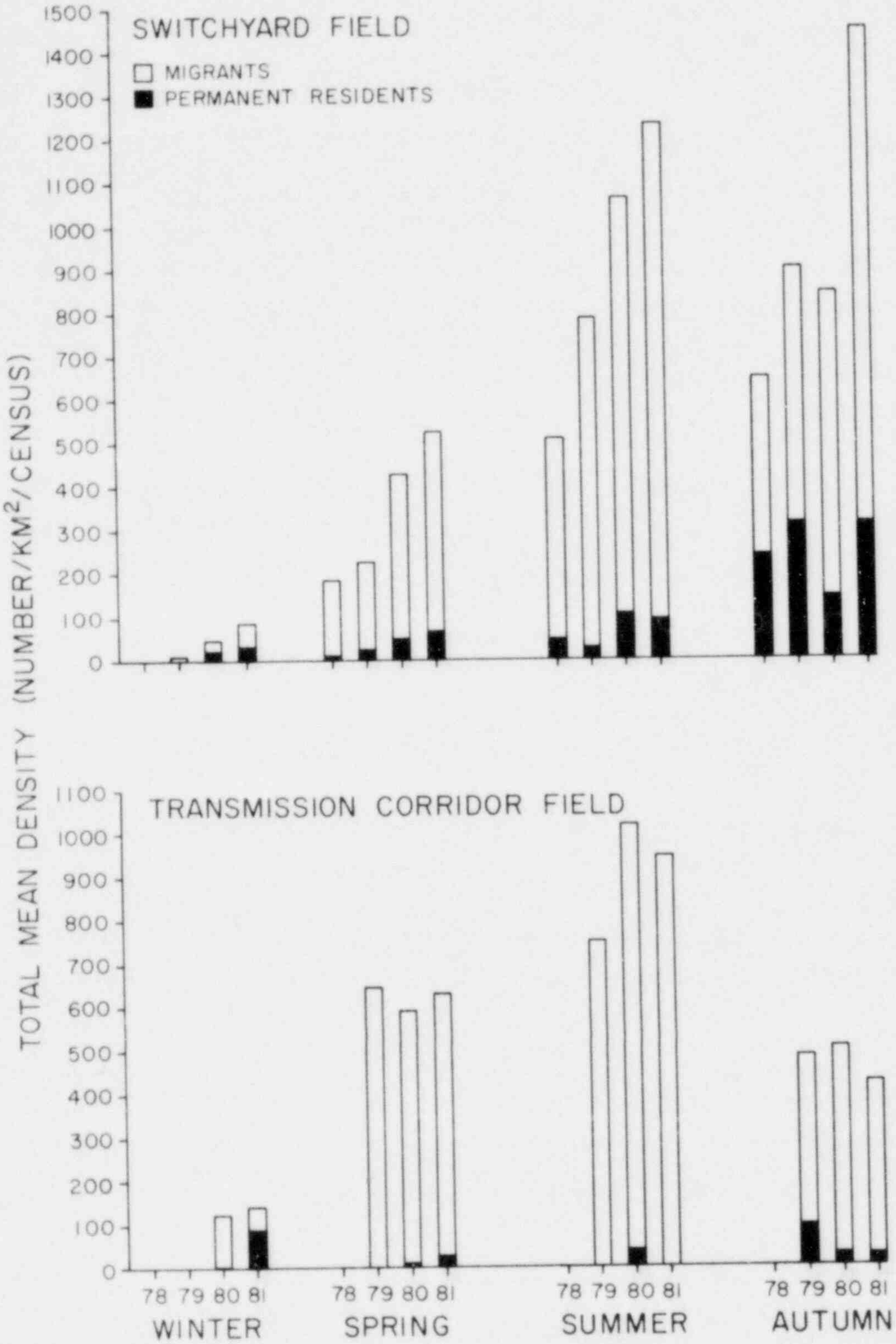

Fig. G-3

Total mean density (number/km^2/census) in each season in Switchyard Field, 1978 through 1981, and Transmission Corridor Field, 1979 through 1981. No censuses were conducted in Transmission Corridor Field in the winter of 1979.

CREEL SURVEY

by

Gerard L. Buynak, Walter J. Soya, and Theodore V. Jacobsen

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ABSTRACT

From January through December 1981, 48 creel surveys were conducted in the 5.5-km section of the Susquehanna River between Gould Island and Hess Sand and Stone, Inc. During these surveys, a total of 584 anglers were interviewed. These anglers fished for 1,210.1 hours, caught 586 fish of at least 18 species, and harvested 161 fish of 13 species. For the year, an estimated 3,696 anglers expended 11,375 hours fishing and caught 3,845 fish of which 1,106 were harvested. Smallmouth bass was the most commonly caught fish and composed 37.2% of the catch. It was followed in abundance by walleye (27.0%), channel catfish (15.9%), carp (5.8%), brown bullhead (3.1%), and muskellunge (2.7%). Smallmouth bass and walleye accounted for 55.3% of the total harvest. Anglers from 13 counties were interviewed; 91.8% resided in Columbia and Luzerne counties. Of the anglers interviewed, 66.8% reported they ate at least a portion of their catch, 30.3% released all fish caught, and 2.9% had other uses for their catch. Significant differences were found in the number of anglers, hours fished, fish caught, and fish harvested between (1) months, (2) zones, (3) weekdays or weekend days, and (4) east bank, west bank, or boat.

INTRODUCTION

Seasonal fluctuations in relative abundance of fishes near the Susquehanna SES have been monitored since 1971 (Buynak et al. 1981). These data indicate that, particularly in recent years, a potentially

good sport fishery exists in the Susquehanna River near the Susquehanna SES. In 1981, walleye and smallmouth bass, two of the most important game fishes in the river, composed 44.1% of the electrofishing catch. During the past six years, the relative abundance of walleye has increased from an average of 6.0% in 1976-77 to a high in 1980 of 29.3%. Although the relative abundance of smallmouth bass has fluctuated since 1976, its highest level occurred in 1981 when they composed 20.8% of the fish observed. Little, however, is known about the sport fishery for these and other game fishes near the Susquehanna SES. In 1981, a creel survey was initiated to collect data on angler usage of the river between Gould Island and Hess Sand and Stone, Inc. The objectives of this study were to (1) estimate fishing pressure and the number of fish caught and harvested and (2) collect other pertinent data from anglers in this portion of the river.

PROCEDURES

Creel surveys were conducted from January through December in six zones that extended 5.5 km from the southern tip of Gould Island to Hess Sand and Stone, Inc. (Fig. H-1). Survey dates were randomly selected and included two weekend days or holidays and two weekdays each month. Data collected on holidays were reported as weekend days since many of the major holidays are now associated with weekends. Some of the surveys had to be postponed until the following day because of hazardous weather or river conditions. Surveys were conducted by boat in all months

except January, February, and part of December because of ice floes and ice cover on the river. In these winter months, surveys were done using an automobile.

On each date, surveys were conducted by a roving survey agent during three 4-hour sampling periods, 0900-1300 h, 1301-1700 h, and 1701-2100 h. Water temperature, river level, weather, and river conditions were recorded at the beginning of each time period. Anglers encountered during the survey were questioned concerning (1) time fishing trip began, (2) species fished for, (3) percentage of fishing time spent angling in the river, (4) county of residence, (5) number and kinds of fish caught, (6) number and kinds of fish released, (7) number and kinds of fish kept or harvested, and (8) if they consumed any of their catch. Additional information recorded for each angler included (1) zone fished in, (2) angling from east bank, west bank, or boat, and (3) age group of anglers (<18, 18-30, 31-65, >65).

Beginning in June, each angler or group of anglers fishing together w re given a preaddressed stamped postcard to be filled out regarding when their fishing trip began and ended, and the number and kinds of fish kept and released. This was initiated to obtain data on a greater number of complete fishing trips. To reduce the bias that only successful anglers would retu n cards, it was stressed to each angler that it was important to return the card even though they did not catch any fish. Of the 167 cards handed out, 82 were returned, 20 of which were from unsuccessful

anglers. Information obtained from complete trips was used to provide an estimate of mean fishing trip length. Data collected from both complete and incomplete trips were used to calculate an estimate of angler number, fish caught, and fish kept (harvested).

Mean survey values ($\bar{x}$) for fish caught, fish kept, and hours fished per angler were calculated for each month and for the entire year using the formula:

$$\bar{x} = \frac{x}{y}$$

where x = surveyed number of fish caught, fish kept, or hours fished and y = surveyed number of anglers.

The estimate of the total number of anglers for the year was derived from the formula:

$$No.\ Anglers = \sum_{i=1}^{12} (Mwe_i)\,(Twe_i) + (Mwd_i)\,(Twd_i)$$

where Mwe_i = mean number of anglers surveyed per weekend day for month "i," Twe_i = total number of weekend days for month "i," Mwd_i = mean number of anglers surveyed per weekday for month "i," and Twd_i = total number of weekdays for month "i."

The total number of fish caught, fish kept, and hours fished in each month were obtained by multiplying the mean monthly survey values ($\bar{x}$) by the estimated number of anglers in each month. Yearly estimates were then obtained by adding the monthly estimates. These estimates are conservative because interviews were only conducted during a 12-hour period on each survey date.

Survey data were analyzed using Friedman's two-way analysis of variance (Hollander and Wolfe 1973). Number of anglers, hours fished, fish caught, and fish harvested were compared to time (months, weekend days or weekdays) and location of anglers (east bank, west bank, or boat and zones).

RESULTS AND DISCUSSION

During the 48 days creel surveys were conducted, a total of 584 anglers was interviewed in the 5.5-km section of the river between Gould Island and Hess Sand and Stone, Inc. from January through December 1981 (Tables H-1 through H-12). These anglers fished for 1,210.1 hours, caught 586 fish of at least 18 species, and kept or harvested 161 fish of 13 species (Tables H-13 and H-14). Mean survey values of fish caught, fish kept, and time spent fishing per angler were 1.00 fish, 0.28 fish, and 3.36 hours, respectively. For the year, an estimated 3,696 anglers expended 11,375 hours fishing and caught 3,845 fish of which 1,106 were harvested.

Six fishes composed 91.6% of the catch and 95.6% of the fish harvested (Table H-14). Smallmouth bass was the most commonly caught fish and composed 37.2% of the catch. It was followed in abundance by walleye (27.0%), channel catfish (15.9%), carp (5.8%), brown bullhead (3.1%), and muskellunge (2.7%). Of these six fishes, 55.6% of the brown bullhead caught were harvested followed by channel catfish (49.5%), muskellunge

(31.3%), walleye (24.1%), smallmouth bass (23.4%), and carp (11.8%).

A larger percentage of brown bullhead and channel catfish were harvested than other game fishes for several reasons. First, there is no closed season or size limit on catfishes. Second, each angler can harvest a combined species creel limit of 50 catfish per day. Third, and perhaps most important, nearly all of the catfishes caught by interviewed anglers were relatively large fish of desirable size.

Although there is also no closed season for smallmouth bass, the species is protected by a minimum size limit of 254 mm. Sublegal smallmouth bass were more commonly caught than legal bass throughout the survey. Vulnerability to angling was seasonal. Only two smallmouth bass were caught in the six-month period from January through April and November through December (Table H-14). Daily mean water temperature during this period was 10 C or less in all months except April (Table A-2). Most smallmouth bass were caught between June and October when the water temperature was well above 10 C.

Muskellunge and walleye are the only two game fishes commonly caught in the river that are protected by both a closed season and minimum size limits. In 1981, the season was closed from 15 March through 8 May. This may have reduced the catch of these two fishes, particularly in April (Table H-14). The minimum size limit of 381 mm for walleye and 762 mm for muskellunge reduced the harvest of these two fishes. In general, anglers fishing for walleye caught and released large numbers of sublegal fish in all six zones. Unlike smallmouth bass, muskellunge and walleye

were caught when the water temperature was 10 C or less (Tables H-1 through H-3, H-11 and H-12).

Electrofishing data collected in the creel survey area show that of the 27 fishes observed at SSES and Bell Bend, smallmouth bass (23.3%) and walleye (20.8%) were the two most abundant (Tables E-13 and E-14). The majority of both species observed, however, were sublegal fish. For example, only an estimated 4% of the 1,154 walleye observed were equal to or greater than the minimum size limit. Large numbers of sublegal fish accounted in part for the reduced importance of both species in the angler's harvest when compared to brown bullhead and channel catfish. Smallmouth bass and walleye, however, still accounted for 55.3% of the total harvest.

Anglers from 13 counties fished in the Susquehanna River between Gould Island and Hess Sand and Stone, Inc. (Table H-15). Local residents from Columbia and Luzerne counties accounted for 91.8% of the total number of anglers. Schuylkill County residents composed 3.9% of the anglers and Carbon County composed 1.7%. Anglers from the remaining 9 counties composed less than 1% each. Most anglers (52.0%) were 31-65 years old, while 45.7% were less than 30 years old, and only 2.4% were over 65. The majority (63.1%) of the anglers spent over 50% of their fishing time angling in the river.

Of the 584 anglers interviewed, 66.8% reported they ate at least a portion of their catch, 30.3% released all fish caught, and 2.9% had other uses for their catch such as trophy mounts, garden fertilizer, and animal

food. Several anglers reported that they ate only certain species of game fishes. For example, some ate only walleye, but not smallmouth bass. Many of the muskellunge anglers stated that they did not eat any of their catch, but would harvest a "trophy" muskellunge. Most anglers which released all of their catch indicated that they fished in the river for recreation and not for food. Many of these individuals felt that fish were not safe to consume because of pollution in the river.

Fishing pressure varied during the three creel survey time periods (0900-1300 h, 1301-1700 h, and 1701-2100 h). Most fishing occu--ed in the evening time period when 46.4% of the total number of anglers ... interviewed (Tables H-1 through H-12). This compared to 26.2% and 27.4% for the morning and afternoon periods, respectively. The number of fish caught per unit effort (0.52 fish per hour) and the number harvested (0.16 fish per hour) was greatest during the morning period. The catch and harvest rates were similar for the other two time periods. In the afternoon period, 0.52 fish per hour were caught and 0.13 fish per hour were harvested whereas in the evening period, 0.44 fish per hour were caught and 0.12 fish per hour were harvested.

Significant differences were found in the number of anglers ($P<0.01$), hours fished ($P<0.01$), fish caught ($P<0.01$), and fish harvested ($P<0.05$) when data from each month were compared (Table H-16). The number of anglers surveyed ranged from 2 in January to 104 in July (Table H-14). The largest number of fish caught (107) and hours fished (260.69) also occurred in July,

but most fish were harvested in October (53) when 32.9% of the year's harvest was taken. The three most abundant species harvested in October were channel catfish, smallmouth bass, and walleye. The catch rate ranged from a low of 0.12 fish per hour in April to 5.82 fish per hour in January. Even though the number of anglers surveyed in October was the third lowest of 1981, the catch rate was the second highest (1.03 fish per hour) and the rate of harvest (0.56 fish per hour) was the highest. For the year, anglers caught 81.6% of the catch from June through November; 44.4% of this catch was taken in July and September (Table H-14). Of the fish harvested, 82.0% were taken from June through November. The catch rate for the year was 0.48 fish per hour and the rate of harvest was 0.13 fish per hour.

Comparison of weekend days to weekdays (Table H-16) revealed significant differences in the number of anglers ($P<0.05$), hours fished ($P<0.05$), and fish caught ($P<0.05$). No significant difference, however, was found in the number of fish harvested. Of the total number of anglers, 71.9% were interviewed on weekend days (Table H-17). They accounted for 70.1% of the total hours fished, 63.8% of the fish caught, and 59.0% of the fish kept. Even though significantly more fish were captured on weekend days, weekday anglers had a higher catch rate (0.58 vs. 0.44 fish per hour) and rate of harvest (0.18 vs. 0.11 fish per hour).

When angling data from the east bank, west bank, and boat were compared, significant differences (Table H-16) were found in the number of anglers ($P<0.01$), hours fished ($P<0.01$), fish caught ($P<0.01$), and fish

harvested ($P<0.01$). Of the 584 anglers interviewed, 82.9% fished on the east bank, 5.1% on the west bank, and 12.0% from a boat. Anglers fishing on the east bank caught 67.4% of the total number of fish caught and harvested 78.3% of the total number harvested. In 1981, 77.9% of the total hours fished were expended on the east bank. This popularity of the east bank can be attributed to overall easier access and to the preference of anglers to fish near the mouth of both Little Wapwallopen and Wapwallopen Creeks. From general observation, anglers tended to concentrate their efforts in areas where creeks enter the river.

Comparison of the six zones revealed significant differences in the number of anglers ($P<0.01$), hours fished ($P<0.01$), fish caught ($P<0.01$), and fish harvested ($P<0.05$) (Table H-16). Zones 5 and 6 accounted for 74.1% of the anglers interviewed, 60.9% of the fish caught, 69.6% of the fish harvested, and 71.2% of the hours fished (Table H-18). Both zones can be reached easily by anglers from PA Route 239 and Legislative Route 655 on the east bank of the river. Zone 5, which had the highest pressure in terms of the number of anglers (46.9% of the total) and hours fished (43.2%) is also readily accessible at the Berwick Boat Club. In addition, this zone includes the area around the mouth of Wapwallopen Creek which is heavily fished throughout the year. Following ice out on 11 February, many anglers fished at this creek mouth in February and early March for muskellunge and walleye.

Less fishing pressure occurred in zones 1 through 4. When these zones were compared, no significant differences were found in the number of anglers, hours fished, fish caught, or fish harvested (Table H-16). Zones 1 and 2 had more anglers and hours fished than zones 3 and 4 (Table H-18). This is due to the accessibility of zone 1 from PA Route 239 and the preference of anglers to fish near the mouth of Little Wapwallopen Creek in Zone 2. Although only 7.4% of the total number of anglers was interviewed in zone 2, their catch rate (0.86 fish per hour) and rate of harvest (0.23 fish per hour) were the highest of all six zones.

REFERENCES CITED

Buynak, G. L., A. J. Gurzynski, H. W. Mohr, Jr., and T. V. Jacobsen. 1981. Fishes. Pages 163-196 *in* T. V. Jacobsen (ed.), Ecological studies of the Susquehanna River in the vicinity of the Susquehanna Steam Electric Station (Annual report for 1980). Ichthyological Associates, Inc., Berwick, Pa.

Hollander, M. and D. A. Wolfe. 1973. Nonparametric statistical methods. John Wiley and Sons, Inc., New York, N.Y. 503 pp.

Table H-1

Data collected during creel surveys conducted on the Susquehanna River on 9, 15, 18, and 31 January 1981.

Date	Friday, 9 Jan			Thursday, 15 Jan			Sunday, 18 Jan			Saturday, 31 Jan		
River level[a]	148.52	148.52	148.52	148.55	148.55	148.55	148.52	148.52	148.52	148.43	148.43	148.43
Water temp. (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	0	0	0	0	0	0	0	1	0	0	1
Fish caught	0	0	0	0	0	0	0	0	11	0	0	21
Fish kept	0	0	0	0	0	0	0	0	0	0	0	1
Hours fished	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	2.50
Catch/effort (h)	--	--	--	--	--	--	--	--	3.67	--	--	8.40
Harvest/effort (h)	--	--	--	--	--	--	--	--	0.00	--	--	0.40
Species Caught												
Yellow perch	0	0	0	0	0	0	0	0	0	0	0	1 K
Walleye	0	0	0	0	0	0	0	0	11 R	0	0	20 R

[a] m above msl
K Kept
R Released

Table H-2

Data collected during creel surveys conducted on the Susquehanna River on 3, 7, 10, and 28 February 1981.

Date	Tuesday, 3 Feb			Saturday, 7 Feb			Tuesday, 10 Feb			Saturday, 28 Feb		
River level[a]	149.04	149.04	149.04	148.98	148.98	149.07	148.89	148.92	148.92	150.87	150.72	150.72
Water temp. (C)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	3.6	3.6
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	0	0	0	0	0	0	0	0	22	21	15
Fish caught	0	0	0	0	0	0	0	0	0	21	5	5
Fish kept	0	0	0	0	0	0	0	0	0	12	2	1
Hours fished	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.10	21.92	30.80
Catch/effort (h)	--	--	--	--	--	--	--	--	--	0.54	0.23	0.16
Harvest/effort (h)	--	--	--	--	--	--	--	--	--	0.31	0.09	0.03
Species Caught												
Brown trout	0	0	0	0	0	0	0	0	0	0	0	1 K
Muskellunge	0	0	0	0	0	0	0	0	0	1 K 1 R	0	0
Carp	0	0	0	0	0	0	0	0	0	2 R	0	0
Quillback	0	0	0	0	0	0	0	0	0	4 R	2 R	0
White sucker	0	0	0	0	0	0	0	0	0	2 R	0	1 R
Brown bullhead	0	0	0	0	0	0	0	0	0	1 K	1 K	0
Channel catfish	0	0	0	0	0	0	0	0	0	10 K	1 R	0
Yellow perch	0	0	0	0	0	0	0	0	0	0	0	1 R
Walleye	0	0	0	0	0	0	0	0	0	0	1 K	2 R

[a] m above msl
K Kept
R Released

Table B-3

Data collected during creel surveys conducted on the Susquehanna River on 3, 7, 19, and 29 March 1981.

Date	Tuesday, 3 Mar			Saturday, 7 Mar			Thursday, 19 Mar			Sunday, 29 Mar		
River level[a]	150.26	150.26	150.20	149.59	149.56	149.56	149.13	149.13	149.13	148.76	148.76	148.76
Water temp. (C)	3.0	3.0	3.1	2.0	2.0	2.2	2.0	2.0	2.0	6.6	7.0	8.2
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	7	0	13	6	4	8	0	0	0	9	16	4
Fish caught	4	0	2	0	0	6	0	0	0	0	5	3
Fish kept	1	0	0	0	0	4	0	0	0	0	2	2
Hours fished	11.30	0.00	15.08	7.00	2.00	15.00	0.00	0.00	0.00	12.23	26.92	8.63
Catch/effort (h)	0.35	--	0.13	0.00	0.00	0.40	--	--	--	0.00	0.19	0.35
Harvest/effort (h)	0.09	--	0.00	0.00	0.00	0.27	--	--	--	0.00	0.08	0.23
Species Caught												
Muskellunge	2 R	0	0	0	0	2 R	0	0	0	0	0	0
Fallfish	0	0	0	0	0	0	0	0	0	0	1 K	0
Quillback	1 R	0	1 R	0	0	0	0	0	0	0	0	0
Sucker spp.	0	0	0	0	0	0	0	0	0	0	1 R	0
Brown bullhead	0	0	0	0	0	0	0	0	0	0	1 R	0
Channel catfish	0	0	1 R	0	0	0	0	0	0	0	1 K 1 R	0
Smallmouth bass	0	0	0	0	0	0	0	0	0	0	0	2 K
Yellow perch	0	0	0	0	0	0	0	0	0	0	0	1 R
Walleye	1 K	0	0	0	0	4 K	0	0	0	0	0	0

[a] m above msl
K Kept
R Released

Table B-4

Data collected during creel surveys conducted on the Susquehanna River on 2, 5, 12, and 13 April 1981.

Date	Thursday, 2 Apr			Sunday, 5 Apr			Sunday, 12 Apr			Monday, 13 Apr		
River level[a]	148.98	149.04	149.04	149.16	149.16	149.16	149.01	149.01	149.01	149.04	149.04	149.04
Water Temp. (C)	10.8	11.8	11.9	13.0	13.0	13.8	12.8	12.8	12.8	12.0	12.0	12.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	0	4	0	5	5	6	9	25	0	1	7
Fish caught	0	0	0	0	1	3	1	0	4	0	0	0
Fish kept	0	0	0	0	0	0	0	0	0	0	0	0
Hours fished	0.00	0.00	2.70	0.00	3.83	6.00	13.18	5.42	34.17	0.00	1.00	9.00
Catch/effort (h)	--	--	0.00	--	0.26	0.50	0.08	0.00	0.12	--	0.00	0.00
Harvest/effort (h)	--	--	0.00	--	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00
Species Caught												
Carp	0	0	0	0	1 R	0	1 R	0	1 R	0	0	0
White sucker	0	0	0	0	0	1 R	0	0	0	0	0	0
Shorthead redhorse	0	0	0	0	0	1 R	0	0	0	0	0	0
Sucker spp.	0	0	0	0	0	0	0	0	1 R	0	0	0
Brown bullhead	0	0	0	0	0	1 R	0	0	2 R	0	0	0

[a] m above msl
R Released

Table H-5

Data collected during creel surveys conducted on the Susquehanna River on 3, 10, 13, and 26 May 1981.

Date	Sunday, 3 May			Sunday, 10 May			Wednesday, 13 May			Tuesday, 26 May		
River level[a]	149.95	149.95	149.89	149.04	149.04	149.04	149.50	149.50	149.53	148.92	148.92	148.89
Water temp. (C)	12.0	12.6	12.8	15.0	16.0	16.5	15.1	15.7	15.8	20.2	20.6	20.7
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	0	5	8	2	11	8	2	0	1	1	4
Fish caught	0	0	0	0	1	4	3	0	0	0	0	7
Fish kept	0	0	0	0	0	0	3	0	0	0	0	1
Hours fished	0.00	0.00	7.92	13.50	16.00	6.75	11.50	1.27	0.00	0.75	1.17	9.67
Catch/effort (h)	--	--	0.00	0.00	0.06	0.59	0.26	0.00	--	0.00	0.00	[illegible]
Harvest/effort (h)	--	--	0.00	0.00	0.00	0.00	0.26	0.00	--	0.00	0.00	[illegible]
Species Caught												
Carp	0	0	0	0	0	1 R	0	0	0	0	0	0
Channel catfish	0	0	0	0	1 R	0	0	0	0	0	0	1 K 2 R
Smallmouth bass	0	0	0	0	0	2 R	2 K	0	0	0	0	3 R
Perch	0	0	0	0	0	1 R	0	0	0	0	0	0
Walleye	0	0	0	0	0	0	1 K	0	0	0	0	1 R

[a] m above msl
K Kept
R Released

Table H-6

Data collected during creel surveys conducted on the Susquehanna River on 2, 6, 8, and 27 June 1981.

Date	Tuesday, 2 Jun			Saturday, 6 Jun			Monday, 8 Jun			Saturday, 27 Jun		
River level[a]	148.76	148.76	148.80	148.89	148.86	148.89	148.80	148.76	148.73	148.92	148.92	148.89
Water temp. (C)	21.8	21.6	21.5	21.6	22.3	22.8	22.0	23.0	22.0	20.5	21.5	22.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	1	20	18	2	3	0	3	13	3	4	2
Fish caught	0	1	10	16	2	0	0	7	10	23	1	12
Fish kept	0	0	3	8	0	0	0	2	0	2	0	6
Hours fished	0.00	1.33	35.13	53.33	4.00	2.17	0.00	13.31	24.50	13.58	2.50	6.58
Catch/effort (h)	--	0.75	0.28	0.30	0.50	0.00	--	0.52	0.41	1.69	0.40	1.82
Harvest/effort (h)	--	0.00	0.09	0.15	0.00	0.00	--	0.00	0.00	[illegible]	0.00	0.91
Species Caught												
Muskellunge	0	0	1 R	0	0	0	0	0	0	0	0	3 K
Chain pickerel	0	0	0	1 K	0	0	0	0	0	0	0	0
Carp	0	0	0	0	0	0	0	0	0	6 R	0	0
Brown bullhead	0	0	0	0	0	0	0	0	0	1 K	0	0
Channel catfish	0	0	0	4 K 3 R	0	0	0	2 R	3 R	1 K 7 R	0	1 K 1 R
Rock bass	0	0	0	0	0	0	0	0	0	4 R	0	0
Smallmouth bass	0	1 R	2 K 5 R	3 K 3 R	2 R	0	0	1 K 3 R	7 R	3 R	1 R	2 K 5 R
Crappie spp.	0	0	0	2 R	0	0	0	0	0	0	0	0
Walleye	0	0	1 K 1 R	0	0	0	0	1 K	0	1 R	0	0

[a] m above msl
K Kept
R Released

Table H-7

Data collected during creel surveys conducted on the Susquehanna River on 8, 12, 25, and 28 July 1981.

Date	Wednesday, 8 Jul			Sunday, 12 Jul			Saturday, 25 Jul			Tuesday, 28 Jul		
River level[a]	148.76	148.76	148.76	148.46	148.46	148.46	148.37	148.37	148.37	148.43	148.43	148.40
Water temp. (C)	26.0	27.2	27.7	26.9	29.0	29.7	23.0	23.0	24.0	23.0	23.2	23.2
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	7	1	0	5	8	8	12	7	31	11	5	9
Fish caught	30	0	0	4	1	5	29	5	15	14	2	2
Fish kept	6	0	0	0	0	3	5	2	6	0	0	1
Hours fished	26.00	7.00	0.00	1.58	7.33	25.83	53.50	8.25	72.57	33.58	4.80	20.25
Catch/effort (h)	1.15	0.00	--	2.53	0.14	0.19	0.54	0.61	0.21	0.42	0.42	0.10
Harvest/effort (h)	0.23	0.00	--	0.00	0.00	0.12	0.09	0.24	0.07	0.00	0.00	0.05
Species Caught												
Chain pickerel	0	0	0	0	0	0	0	0	0	1 R	0	0
Carp	1 K	0	0	0	0	0	4 R	1 K	1 R	0	0	0
Brown bullhead	4 K	0	0	0	0	0	0	0	0	0	0	0
Channel catfish	1 K 1 R	0	0	0	0	1 K	4 K 1 R	1 K	3 K 2 R	2 R	0	0
Rock bass	0	0	0	0	0	0	0	0	0	2 R	0	0
Bluegill	1 R	0	0	0	1 R	0	4 R	0	1 K	0	0	0
Smallmouth bass	14 R	0	0	2 R	0	2 K 2 R	1 K 14 R	3 R	2 K 6 R	9 R	2 R	1 K 1 R
Largemouth bass	0	0	0	2 R	0	0	0	0	0	0	0	0
Crappie spp.	0	0	0	0	0	0	1 R	0	0	0	0	0
Yellow perch	1 R	0	0	0	0	0	0	0	0	0	0	0
Walleye	7 R	0	0	0	0	0	0	0	0	0	0	0

[a] m above msl

K Kept

R Released

Table H-8

Data collected during creel surveys conducted on the Susquehanna River on 11, 21, 23, and 29 August 1981.

Date	Tuesday, 11 Aug			Friday, 21 Aug			Sunday, 23 Aug			Saturday, 29 Aug		
River level[a]	148.55	148.55	148.52	148.34	148.31	148.31	148.28	148.28	148.28	148.22	148.22	148.22
Water Temp. (C)	25.1	27.1	26.6	21.0	23.3	25.0	21.4	24.6	24.9	23.0	24.0	25.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	2	2	0	1	1	0	1	4	11	5	5	0
Fish caught	2	0	0	8	0	0	2	0	2	3	7	0
Fish kept	0	0	0	0	0	0	0	0	0	0	0	0
Hours fished	4.00	11.00	0.00	4.00	1.50	0.00	3.25	9.57	16.00	6.50	10.83	0.00
Catch/effort (h)	0.50	0.00	--	2.00	0.00	--	0.62	0.00	0.13	0.46	0.65	--
Harvest/effort (h)	0.00	0.00	--	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00	--
Species Caught												
Muskellunge	0	0	0	0	0	0	0	0	0	0	1 R	0
Carp	0	0	0	0	0	0	0	0	0	0	3 R	0
Channel catfish	0	0	0	4 R	0	0	0	0	0	1 R	1 R	0
Sunfish spp.	1 R	0	0	0	0	0	0	0	0	0	0	0
Smallmouth bass	1 R	0	0	3 R	0	0	2 R	0	2 R	2 R	1 R	0
Crappie spp.	0	0	0	1 R	0	0	0	0	0	0	0	0
Walleye	0	0	0	0	0	0	0	0	0	0	1 R	0

[a] m above msl

R Released

Table H-9

Data collected during creel surve conducted on the Susquehanna River on 1, 7, 20, and 29 September 1981.

Date	Tuesday, 1 Sep			Monday, 7 Sep			Sunday, 20 Sep			Tuesday, 29 Sep		
River level[a]	148.22	148.22	148.22	148.22	148.22	148.22	148.43	148.43	148.43	148.89	148.89	148.89
Water temp. (C)	22.2	22.6	23.0	21.5	22.5	22.5	18.5	19.0	19.5	15.0	15.5	15.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	7	0	7	10	13	13	2	16	8	0	0	3
Fish caught	8	0	9	21	6	5	1	47	3	0	0	5
Fish kept	4	0	1	10	1	0	1	3	0	0	0	0
Hour fished	12.00	0.00	10.00	38.50	33.50	40.08	3.50	43.67	12.77	0.00	0.00	14.00
Catch/effort (h)	0.67	--	0.90	0.55	0.18	0.12	0.29	1.08	0.23	--	--	0.36
Harvest/effort (h)	0.33	--	0.10	0.26	0.03	0.00	0.29	0.07	0.00	--	--	0.00
Species Caught												
Muskellunge	0	0	0	0	0	0	0	2 R	0	0	0	0
Carp	0	0	0	0	0	0	0	7 R	0	0	0	0
Brown bullhead	1 K	0	0	1 K	0	0	0	0	0	0	0	3 R
Channel catfish	1 K	0	1 K 3 R	5 K 3 R	0	0	0	0	2 R	0	0	1 R
Rock bass	1 R	0	0	0	0	0	0	0	0	0	0	0
Pumpkinseed	0	0	0	0	0	0	0	2 R	0	0	0	0
Smallmouth bass	1 K 3 R	0	1 R	4 K 4 R	1 K 5 R	5 R	1 K	2 K 28 R	0	0	0	1 R
Walleye	1 K	0	4 R	4 R	0	0	0	1 K 5 R	1 R	0	0	0

[a] m above msl
K Kept
R Released

Table H-10

Data collected during creel surveys conducted on the Susquehanna River on 12, 13, 18, and 29 October 1981.

Date	Monday, 12 Oct			Tuesday, 13 Oct			Sunday, 18 Oct			Thursday, 29 Oct		
River level[a]	149.40	149.43	149.43	149.15	149.16	149.16	148.73	148.73	148.73	151.36	151.78	152.03
Water temp. (C)	10.9	11.3	11.5	11.0	11.6	11.6	11.0	11.0	11.0	10.8	10.9	10.9
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	2	1	6	0	4	9	1	2	2	3	1	0
Fish caught	0	0	19	0	33	26	0	0	11	8	0	0
Fish kept	0	0	12	0	19	8	0	0	6	8	0	0
Hours fished	4.33	5.00	18.25	0.00	20.58	25.00	4.00	0.50	7.00	7.00	3.50	0.00
Catch/effort (h)	0.00	0.00	1.04	--	1.60	1.04	0.00	0.00	1.57	1.14	0.00	--
Harvest/effort (h)	0.00	0.00	0.66	--	0.92	0.32	0.00	0.00	0.85	1.14	0.00	--
Species Caught												
Carp	0	0	0	0	1 K 2 R	0	0	0	0	0	0	0
Channel catfish	0	0	0	0	1 K	0	0	0	0	8 K	0	0
Rock bass	0	0	0	0	1 K	0	0	0	0	0	0	0
Smallmouth bass	0	0	9 K 4 R	0	8 K 7 R	3 K 7 R	0	0	4 K 3 R	0	0	0
Walleye	0	0	3 K 3 R	0	8 K 5 R	5 K 11 R	0	0	2 K 2 R	0	0	0

[a] m above msl
K Kept
R Released

Table H-11

Data collected during creel surveys conducted on the Susquehanna River on 1, 8, 17, and 23 November 1981.

Date	Sunday, 1 Nov			Sunday, 8 Nov			Tuesday, 17 Nov			Monday, 23 Nov		
River level[a]	150.53	150.44	150.38	149.31	149.31	149.31	149.50	149.50	149.50	149.77	149.74	149.71
Water temp. (C)	10.0	10.0	10.0	8.0	8.3	8.3	6.8	6.8	6.8	6.0	6.0	6.0
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	9	3	1	5	7	0	3	7	0	0	0
Fish caught	0	0	0	0	31	11	0	8	13	0	0	0
Fish kept	0	0	0	0	5	1	0	5	4	0	0	0
Hours fished	0.00	15.50	6.00	0.17	17.33	12.00	0.00	9.17	13.32	0.00	0.00	0.00
Catch/effort (h)	--	0.00	0.00	0.00	1.79	0.92	--	0.87	0.98	--	--	--
Harvest/effort (h)	--	0.00	0.00	0.00	0.29	0.08	--	0.55	0.30	--	--	--
Species Caught												
Muskellunge	0	0	0	0	0	1 K	0	0	1 R	0	0	0
Carp	0	0	0	0	0	0	0	1 K 1 R	0	0	0	0
Shorthead redhorse	0	0	0	0	0	0	0	1 K	0	0	0	0
Brown bullhead	0	0	0	0	0	0	0	1 K 1 R	0	0	0	0
Channel catfish	0	0	0	0	0	0	0	2 K	4 R	0	0	0
Walleye	0	0	0	0	5 K 26 R	10 R	0	1 R	4 K 4 R	0	0	0

[a] m above msl
K Kept
R Released

Table H-12

Data collected during creel surveys conducted on the Susquehanna River on 6, 16, 20, and 22 December 1981.

Date	Sunday, 6 Dec			Wednesday, 16 Dec			Sunday, 20 Dec			Tuesday, 22 Dec		
River level[a]	149.28	149.28	149.28	149.04	149.04	149.01	148.59	148.98	148.59	148.70	148.70	148.76
Water temp. (C)	3.5	3.5	3.5	0.6	0.6	1.0	0.2	0.4	0.4	0.0	0.5	0.5
Time	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000	0900-1300	1301-1700	1701-2000
No. Per Time Period												
Anglers	0	2	0	0	0	1	0	0	0	0	0	0
Fish caught	0	1	0	0	0	0	0	0	0	0	0	0
Fish kept	0	0	0	0	0	0	0	0	0	0	0	0
Hours fished	0	6.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00
Catch/effort (h)	--	0.33	--	--	--	0.00	--	--	--	--	--	--
Harvest/effort (h)	--	0.00	--	--	--	0.00	--	--	--	--	--	--
Species Caught												
Muskellunge	0	1 R	0	0	0	0	0	0	0	0	0	0

[a] m above msl
R Released

Table H-13

Fishes reported caught during the creel surveys conducted on the Susquehanna River from January through December 1981.

Salmonidae - Trouts
- *Salmo trutta* - brown trout

Esocidae - Pikes
- *Esox masquinongy* - muskellunge
- *E. niger* - chain pickerel

Cyprinidae - Minnows and Carps
- *Cyprinus carpio* - carp
- *Semotilus corporalis* - fallfish

Catostomidae - Suckers
- *Carpiodes cyprinus* - quillback
- *Catostomus commersoni* - white sucker
- *Moxostoma macrolepidotum* - shorthead redhorse
- Unidentified Catostomidae - sucker spp.

Ictaluridae - Freshwater Catfishes
- *Ictalurus nebulosus* - brown bullhead
- *I. punctatus* - channel catfish

Centrarchidae - Sunfishes
- *Ambloplites rupestris* - rock bass
- *Lepomis gibbosus* - pumpkinseed
- *L. macrochirus* - bluegill
- *Lepomis spp.* - sunfish spp.
- *Micropterus dolomieui* - smallmouth bass
- *M. salmoides* - largemouth bass
- *Pomoxis* spp. - crappie spp.

Percidae - Perches
- *Perca flavescens* - yellow perch
- *Stizostedion vitreum* - walleye

Table H-14

Summary of data collected during creel surveys conducted on the Susquehanna River from January through December 1981.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	% TOTAL S
Total Number														
Anglers	2	58	72	62	42	69	104	32	74	31	35	3	585	
Fish caught	32	31	20	9	15	82	107	24	105	97	63	1	586	
Fish kept	1	15	9	0	4	21	23	0	20	53	15	0	161	
Hours fished	5.50	91.82	99.76	75.30	73.53	156.43	260.69	66.63	208.02	94.16	73.49	6.75	1210.10	
Catch/effort (h)	5.82	0.34	0.20	0.12	0.20	0.52	0.41	0.36	0.50	1.03	0.86	0.15	0.48	
Harvest/effort (h)	0.18	0.16	0.09	0.00	0.05	0.13	0.09	0.00	0.10	0.56	0.20	0.00	0.13	
Species Caught														
Brown trout	0	1K	0	0	0	0	0	0	0	0	0	0	1K	0.2
Muskellunge	0	1K 1R	4R	0	0	3K 1R	0	1R	2R	0	1K 1R	1R	5K 11R	2.7
Chain pickerel	0	0	0	0	0	1K	1R	0	0	0	0	0	1K 1R	0.3
Carp	0	2R	0	3R	1R	6R	2K 5R	3R	7R	1K 2R	1K 1R	0	4K 30R	5.8
Fallfish	0	0	1K	0	0	0	0	0	0	0	0	0	1K	0.2
Quillback	0	6R	2R	0	0	0	0	0	0	0	0	0	8R	1.4
White sucker	0	3R	0	1R	0	0	0	0	0	0	0	0	4R	0.7
Shorthead redhorse	0	0	0	1R	0	0	0	0	0	0	1K	0	1K 1R	0.3
Sucker spp.	0	0	1R	1R	0	0	0	0	0	0	0	0	2R	0.3
Brown bullhead	0	2K	1R	3R	0	1K	4K	0	2K 3R	0	1K 1R	0	10K 8R	3.1
Channel catfish	0	10K 1R	1K 2R	0	1K 3R	6K 16R	10K 6R	6R	7K 9R	9K	2K 4R	0	46K 47R	15.9
Rock bass	0	0	0	0	0	4R	2R	0	1R	1K	0	0	1K 7R	1.4
Pumpkinseed	0	0	0	0	0	0	0	0	2R	0	0	0	2R	0.3
Bluegill	0	0	0	0	0	0	1K 6R	0	0	0	0	0	1K 6R	1.2
Sunfish spp.	0	0	0	0	0	0	0	1R	0	0	0	0	1R	0.2
Smallmouth bass	0	0	2K	0	2K 5R	8K 30R	6K 53R	11R	9K 47R	24K 21R	0	0	51K 167R	37.2
Largemouth bass	0	0	0	0	0	0	2R	0	0	0	0	0	2R	0.3
Crappie spp.	0	0	0	0	0	2R	1R	1R	0	0	0	0	4R	0.7
Yellow perch	1K	1R	1R	0	1R	0	1R	0	0	0	0	0	1K 4R	0.9
Walleye	31R	1K 2R	5K	0	1K 1R	2K 2R	7R	1R	2K 14R	18K 21R	9K 41R	0	38K 123R	27.0

K Kept
R Released

Table H-15

Data on use of catch, age of anglers, home county, and percent time river fishing obtained during creel surveys conducted on the Susquehanna River from January through December 1981

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	% TOTAL
Use of Catch														
Eat	2	37	42	41	25	37	79	22	55	26	22	3	391	66.8
Release	0	18	28	21	13	30	24	8	19	3	13	0	177	30.3
Other	0	3	2	0	4	3	1	2	0	2	0	0	17	2.9
Age of Anglers														
<18	0	17	17	15	7	6	24	2	18	6	6	0	118	20.2
18-30	0	11	23	24	14	20	34	5	10	2	6	0	149	25.5
31-65	2	30	31	21	19	44	41	23	45	22	23	3	304	52.0
>65	0	0	1	2	2	0	5	2	1	1	0	0	14	2.4
Home County														
Adams	0	0	0	0	0	0	1	0	0	0	0	0	1	0.2
Berks	0	0	0	0	0	0	0	0	2	0	0	0	2	0.3
Carbon	0	1	1	4	0	2	2	0	0	0	0	0	10	1.7
Clearfield	0	0	0	1	0	0	0	0	0	0	0	0	1	0.2
Columbia	0	22	16	36	12	27	48	12	13	11	9	2	208	35.6
Delaware	0	0	0	0	0	0	0	0	2	0	0	0	2	0.3
Lackawanna	0	0	0	0	1	0	0	0	0	0	0	0	1	0.2
Lehigh	0	0	1	0	0	0	0	2	0	0	1	0	4	0.7
Luzerne	2	32	53	18	29	41	48	16	47	19	23	1	329	56.2
Montgomery	0	0	0	0	0	0	0	1	0	0	0	0	1	0.2
Philadelphia	0	0	0	0	0	0	1	0	0	0	0	0	1	0.2
Schuylkill	0	3	1	3	0	0	2	1	10	1	2	0	23	3.9
York	0	0	0	0	0	0	2	0	0	0	0	0	2	0.3
Percent Time River Fishing														
0-24	2	22	21	15	9	20	32	4	19	10	4	0	158	27.0
25-49	0	7	12	12	8	5	5	3	1	0	4	1	58	9.9
50-74	0	15	24	14	12	23	25	5	20	10	10	0	158	27.0
75-100	0	14	15	21	13	22	42	20	34	11	17	2	211	36.1

Table H-16

Results (x^2 values) of Friedman's two-way analysis of variance test for each comparison (* = P<0.05, ** = P<0.01).

Factor	Months	Weekend Days or Weekdays	East Bank, West Bank or Boat	Zones (1-6)	Zones (1-4)
DF	11	1	2	5	3
No. of anglers	31.8**	5.3*	15.5**	26.0**	1.8
Hours fished	32.3**	8.3*	15.5**	24.6**	3.9
Fish caught	24.8**	5.3*	11.4**	16.4**	2.5
Fish harvested	20.4*	0.8	7.9**	11.2*	1.2

able N-17

mmary of creel survey data collected on weekdays and weekend days on the Susquehanna River from January through December 1981.

	JAN		FEB		MAR		APR		MAY		JUN		JUL	
	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend
tal Number														
Anglers	0	2	0	58	20	52	12	50	16	26	37	32	33	71
Fish caught	0	32	0	31	6	14	0	9	10	5	28	54	48	59
Fish kept	0	1	0	15	1	8	0	0	4	0	5	16	7	16
Hours fished	0.00	5.50	0.00	91.82	26.38	71.38	12.70	62.60	24.36	49.17	74.27	82.16	91.63	169.06
Catch/effort (h)	--	5.82	--	0.34	0.23	0.20	0.00	0.14	0.41	0.10	0.38	0.66	0.52	0.35
Harvest/effort (h)	--	0.18	--	0.16	0.04	0.11	0.00	0.00	0.16	0.00	0.07	0.19	0.08	0.09
ecies Caught														
Brown trout	0	0	0	1K	0	0	0	0	0	0	0	0	0	0
Muskellunge	0	0	0	1K 1R	2R	2R	0	0	0	0	1R	3K	0	0
Chain pickerel	0	0	0	0	0	0	0	0	0	0	0	1K	1R	0
Carp	0	0	0	2R	0	0	0	3R	0	1R	0	6R	1K	1K 5R
Fallfish	0	0	0	0	0	1K	0	0	0	0	0	0	0	0
Quillback	0	0	0	6R	2R	0	0	0	0	0	0	0	0	0
White sucker	0	0	0	3R	0	0	0	1R	0	0	0	0	0	0
Shorthead redhorse	0	0	0	0	0	0	0	1R	0	0	0	0	0	0
Sucker spp.	0	0	0	0	0	1R	0	1R	0	0	0	0	0	0
Brown bullhead	0	0	0	2K	0	1R	0	3R	0	0	0	1K	4K	0
Channel catfish	0	0	0	10K 1R	1R	1K 1R	0	0	1K 2R	1R	5R	6K 11R	1K 3R	9K 3R
Rock bass	0	0	0	0	0	0	0	0	0	0	0	4R	2R	0
Pumpkinseed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bluegill	0	0	0	0	0	0	0	0	0	0	0	0	1R	1K 5R
Sunfish spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smallmouth bass	0	0	0	0	0	2K	0	0	2K 3R	2R	3K 16R	5K 14R	1K 26R	5K 27R
Largemouth bass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crappie spp.	0	0	0	0	0	0	0	0	0	0	0	2R	0	1R
Yellow perch	0	1K	0	1R	0	1R	0	0	0	1R	0	0	1R	0
Walleye	0	31R	0	1K 2R	1K	4K	0	0	1K 1R	0	2K 1R	1R	7R	0

Table H-17 (cont.)

	AUG		SEP		OCT		NOV		DEC		TOTALS	
	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend	weekday	weekend
Total Number												
Anglers	6	26	12	62	17	14	10	25	1	2	164	420
Fish caught	10	14	22	83	67	30	21	42	0	1	212	374
Fish kept	0	0	5	15	35	18	9	6	0	0	66	95
Hours fished	20.50	46.15	36.00	172.02	56.08	38.08	22.49	51.00	0.75	6.00	365.16	848.30
Catch/effort (h)	0.49	0.30	0.61	0.48	1.19	0.79	0.93	0.82	0.00	0.33	0.58	0.44
Harvest/effort (h)	0.00	0.00	0.14	0.09	0.62	0.47	0.40	0.12	0.00	0.00	0.18	0.11
Species Caught												
Brown trout	0	0	0	0	0	0	0	0	0	0	0	1K
Muskellunge	0	1R	0	2R	0	0	1R	1K	0	1R	4R	5K 7R
Chain pickerel	0	0	0	0	0	0	0	0	0	0	1R	1K
Carp	0	3R	0	7R	1K 2R	0	1K 1R	0	0	0	3K 3R	1K 27R
Fallfish	0	0	0	0	0	0	0	0	0	0		1K
Quillback	0	0	0	0	0	0	0	0	0	0	2R	6R
White sucker	0	0	0	0	0	0	0	0	0	0		4R
Shorthead redhorse	0	0	0	0	0	0	1K	0	0	0	1K	1R
Sucker spp.	0	0	0	0	0	0	0	0	0	0		2R
Brown bullhead	0	0	1K 3R	1K	0	0	1K 1R	0	0	0	6K 4R	4K 4R
Channel catfish	4R	2R	2K 4R	5K 5R	9K	0	2K 4R	0	0	0	15K 23R	31K 24R
Rock bass	0	0	1R	0	1K	0	0	0	0	0	1K 3R	4R
Pumpkinseed	0	0	0	2R	0	0	0	0	0	0		2R
Bluegill	0	0	0	0	0	0	0	0	0	0	1R	1K 5R
Sunfish spp.	1R	0	0	0	0	0	0	0	0	0	1R	
Smallmouth bass	4R	7R	1K 5R	8K 42R	11K 14R	13K 7R	0	0	0	0	18K 68R	33K 99R
Largemouth bass	0	0	0	0	0	0	0	0	0	0		2R
Crappie spp.	1R	0	0	0	0	0	0	0	0	0	1R	3R
Yellow perch	0	0	0	0	0	0	0	0	0	0	1R	1K 3R
Walleye	0	1R	1K 4R	1K 10R	13K 16R	5K 5R	4K 5R	5K 36R	0	0	22K 34R	16K 86R

K Kept
R Released

Table H-18

Summary of creel survey data collected in zones 1 through 6 on the Susquehanna River from January through December 1981.

TOTAL NUMBER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
							ZONE 1						
Anglers	0	0	10	6	2	8	12	2	4	2	0	0	46
Fish caught	0	0	1	0	3	8	30	1	1	0	0	0	44
Fish kept	0	0	0	0	0	2	2	0	0	0	0	0	4
Hours fished	0.00	0.00	8.50	8.50	2.00	18.47	47.42	4.00	4.00	0.50	0.00	0.00	93.39
Catch/effort (h)	--	--	0.12	0.00	1.50	0.43	0.63	0.50	0.25	0.00	--	--	0.47
Harvest/effort (h)	--	--	0.00	0.00	0.00	0.11	0.04	0.00	0.00	0.00	--	--	0.04
							ZONE 2						
Anglers	0	5	6	8	1	2	2	0	9	3	6	1	43
Fish caught	0	1	7	1	0	2	3	0	24	18	41	0	97
Fish kept	0	1	4	0	0	0	0	0	4	8	9	0	26
Hours fished	0.00	2.50	16.90	10.93	3.00	3.33	3.00	0.00	39.50	10.00	22.57	0.75	112.48
Catch/effort (h)	--	0.40	0.41	0.09	0.00	0.60	1.00	--	0.61	1.80	1.82	0.00	0.86
Harvest/effort (h)	--	0.40	0.24	0.00	0.00	0.00	0.00	--	0.10	0.80	0.40	0.00	0.23
							ZONE 3						
Anglers	2	0	4	0	2	1	12	2	3	0	3	2	31
Fish caught	32	0	2	0	0	1	13	1	6	0	0	1	56
Fish kept	1	0	0	0	0	1	8	0	2	0	0	0	12
Hours fished	5.50	0.00	1.90	0.00	0.63	2.92	21.20	1.00	21.00	0.00	6.00	6.00	66.15
Catch/effort (h)	5.82	--	1.05	--	0.00	0.34	0.61	1.00	0.29	--	0.00	0.17	0.85
Harvest/effort (h)	0.18	--	0.00	--	0.00	0.34	0.38	0.00	0.10	--	0.00	0.00	0.18
							ZONE 4						
Anglers	0	0	1	2	0	6	4	2	14	2	0	0	31
Fish caught	0	0	0	0	0	0	8	3	21	0	0	0	32
Fish kept	0	0	0	0	0	0	2	0	5	0	0	0	7
Hours fished	0.00	0.00	1.08	0.85	0.00	1.00	15.58	6.00	47.25	4.34	0.00	0.00	76.10
Catch/effort (h)	--	--	0.00	0.00	--	0.00	0.51	0.50	0.44	0.00	--	--	0.42
Harvest/effort (h)	--	--	0.00	0.00	--	0.00	0.13	0.00	0.11	0.00	--	--	0.09
							ZONE 5						
Anglers	0	43	36	25	27	32	40	19	24	12	16	0	274
Fish caught	0	10	7	0	7	21	29	11	37	47	9	0	178
Fish kept	0	3	4	0	2	6	3	0	7	30	1	0	56
Hours fished	0.00	56.40	49.72	24.94	39.48	76.79	110.29	39.87	60.42	40.00	24.82	0.00	522.73
Catch/effort (h)	--	0.18	0.14	0.00	0.18	0.27	0.26	0.32	0.61	1.18	0.36	--	0.34
Harvest/effort (h)	--	0.05	0.08	0.00	0.05	0.13	0.03	0.00	0.20	0.75	0.04	--	0.11
							ZONE 6						
Anglers	0	10	15	21	10	20	34	7	20	12	10	0	159
Fish caught	0	20	3	8	5	50	24	8	16	32	13	0	179
Fish kept	0	11	1	0	2	12	8	0	2	15	5	0	56
Hours fished	0.00	32.92	19.66	30.08	28.42	53.92	63.20	15.78	35.85	39.33	20.10	0.00	339.26
Catch/effort (h)	--	0.61	0.15	0.27	0.18	0.93	0.38	0.51	0.45	0.81	0.65	--	0.53
Harvest/effort (h)	--	0.33	0.05	0.00	0.07	0.22	0.13	0.00	0.06	0.38	0.25	--	0.17

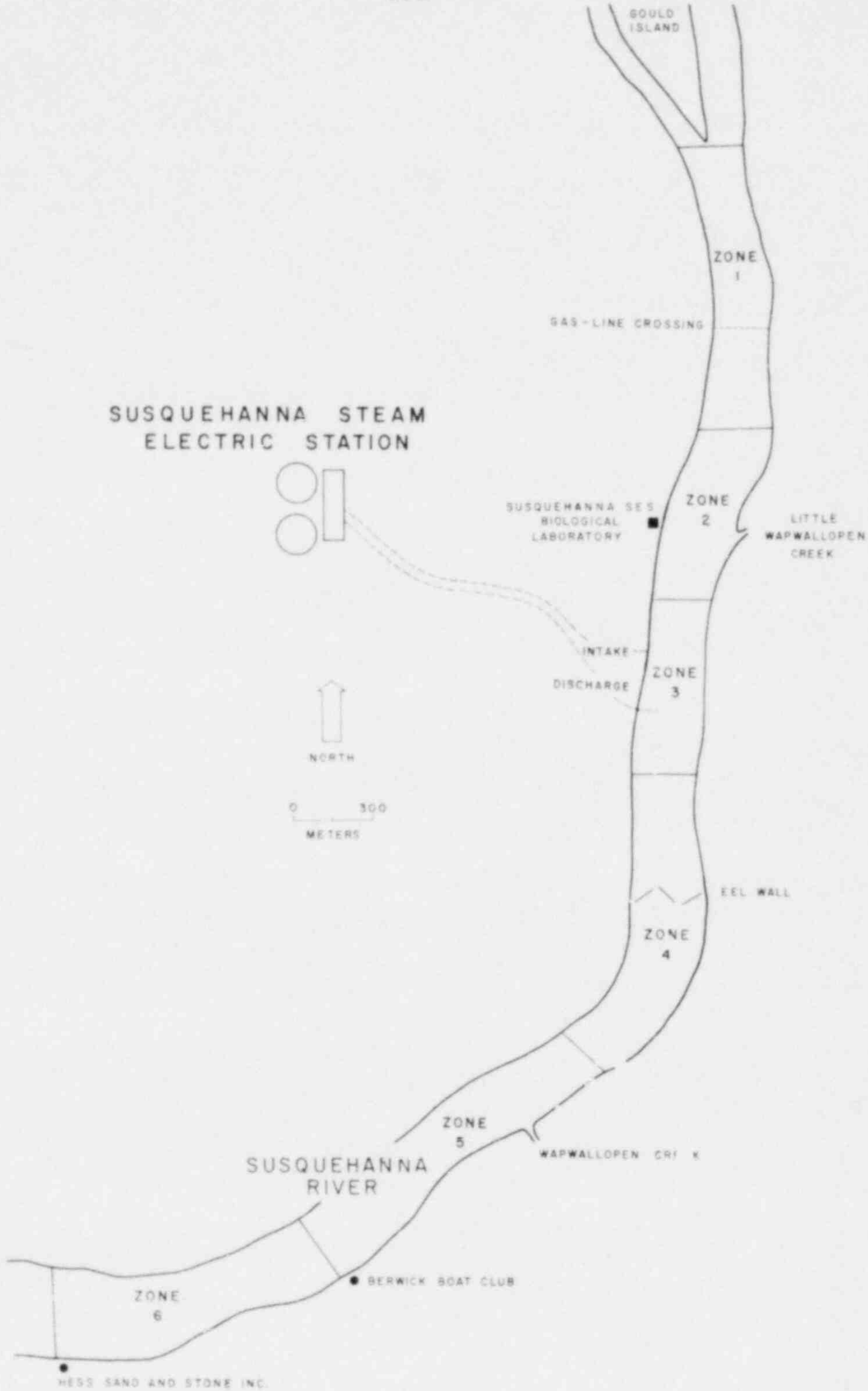

Fig. H-1

Location of zones 1 through 6 used in the creel survey on the Susquehanna River, 1981.

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ABSTRACTS OF SCIENTIFIC PUBLICATIONS BY THE STAFF OF THE SUSQUEHANNA SES BIOLOGICAL LABORATORY, 1981

Buynak, G. L. and H. W. Mohr, Jr. 1980. Key to the identification of sucker larvae in the Susquehanna River near Berwick, Pennsylvania. Proc. Pa. Acad. Sci. 54: 161-164.

A key separating larval quillback (*Carpiodes cyprinus*), white sucker (*Catostomus commersoni*), northern hog sucker (*Hypentelium nigricans*), and shorthead redhorse (*Moxostoma macrolepidotum*) from the Susquehanna River is presented. Included are tables of various morphometric and meristic characteristics examined for each species and several illustrations showing distinguishing characteristics.

Buynak, G. L. and H. W. Mohr, Jr. 1980. Larval development of the common shiner (*Notropis cornutus*) from northeast Pennsylvania. Proc. Pa. Acad. Sci. 54: 165-168.

Total length (TL) of newly hatched common shiner (*Notropis cornutus*) ranged from 4.9 to 5.2 mm (average, 5.0 mm); standard length ranged from 4.7 to 5.0 mm (average, 4.8 mm). They had pectoral fin buds, straight urostyles, and incomplete mouths. Eyes of newly hatched larvae were unpigmented and all body surfaces lacked melanophores. Transformation to the postlarval phase occurred by 7.5 mm TL and to the late postlarval phase by 12.5 mm TL. Readily confused with golden shiner (*Notemigonus crysoleucas*) and comely shiner (*Notropis amoenus*), larval common shiner can be separated from the former by size, pigmentation pattern, preanal myomere number, and pelvic fin origin and from the latter by pigmentation differences and pelvic fin origin.

Buynak, G. L., A. J. Gurzynski, and H. W. Mohr, Jr. 1980. Age and growth, food habits, and abundance of walleye (*Stizostedion vitreum*) in the Susquehanna River near Berwick, Pennsylvania. Proc. Pa. Acad. Sci. 54: 136-140.

Maximum growth of walleye (*Stizostedion vitreum*) in the Susquehanna River near Berwick, Pennsylvania, occurred between July and September. Walleye in the river should enter the fishery as a legal sized fish in their third year of life. Minnows were the most important forage organisms for age 0+, I+, and II+ walleye. Food habits of older walleye could not be determined since too few were captured. Forage consumed by age 0+ and I+ walleye was similar in length, weight, and body depth. Forage consumed by age II+ walleye however, was found to be much larger. There was an increased tendency for walleye to consume more than one forage as they became older. Most feeding occurred during the night. The angling catch of walleye should increase in the next few years as a result of the strong year classes produced in 1978 and 1979.

Chance, J. M. and W. G. Deutsch. 1980. A comparison of four similarity indexes in the cluster analysis of Susquehanna River macrobenthos samples. Proc. Pa. Acad. Sci. 54: 169-173.

Four similarity indexes: Jaccard, percent similarity, Bray-Curtis, and Canberra, were compared for their effectiveness in classifying macrobenthic samples collected with artificial substrates at five stations on the Susquehanna River (Falls to Nescopeck, Pennsylvania), July and September 1972. Water quality in the study area ranged from relatively clean to severely polluted by acid mine drainage and sewage.

Physicochemical characteristics of the stations were used to evaluate the performance of the indexes in classifying the samples. The Bray-Curtis index was determined to be most effective, the percent similarity index was less informative but acceptable, and the Jaccard and Canberra indexes were unacceptable.

Buynak, G. L. and H. W. Mohr, Jr. 1981. Small-scale culture techniques for obtaining spawns from fish. Prog. Fish-Cult. 43(1): 38-39.

This paper describes the small-scale culture techniques used to obtain spawns from fish. These techniques were tested using 13 species of fish of which spawns were obtained from 9. After a spawn was obtained, eggs and larvae were reared for larval development studies. (This abstract was not presented in the paper).

Deutsch, W. G. 1981. Suppression of macrobenthos in an iron-polluted stretch of the Susquehanna River (Pennsylvania). Proc. Pa. Acad. Sci. 55: 37-42.

Macrobenthos from one control and three polluted stations on the rocky-bottomed Susquehanna River in northeastern Pennsylvania was sampled eight times, from July 1972 through June 1973, with artificial substrates (basket samplers). Throughout much of the year, iron compounds and sewage coated the river substrate at polluted stations, and suspended iron reduced the amount of sunlight which reached the substrate.

At the control station, organism density was lowest in February and highest in September. The overall mean density was 4,100 organisms/m^2. Chironomids, hydropsychids, and heptageniids composed 86% of the total organisms. At the most polluted station, density was greatest in June, and at the other stations in September. Overall mean density at polluted stations was 1,700, 1,900, and 3,300 org/m^2. Chironomids and oligochaetes composed from 74 to 91% of total organisms. There were only 10% as many hydropsychids and heptageniids at the polluted stations as at the control. Suppression of these and other filter-feeding and grazing insects seemed to be largely due to physical alterations of benthic habitats and water quality. However, numbers and kinds of macroinvertebrates increased at polluted stations in winter, when the oxidation rate of soluble iron was low, and high river flow scoured the substrate and swept settled iron and sewage downriver.

Gale, W. F. 1981. A floatable, benthic corer for use with scuba. Hydrobiologia 77: 273-275.

A diver-operated corer to sample benthic macroinvertebrates is described. Removable drive-handles allow the 9-cm (ID) barrel to be driven into substrates too firm to be sampled by line-held or conventional diver-operated corers. The sampler is emptied underwater using compressed air and its buoyancy can be controlled by filling a rubber inner tube.

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