Biological Study of the Fox and Wisconsin Rivers

by

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INTRODUCTION

At the request of the Water Division and in cooperation with the Western District Office, the Central Regional Laboratory Biology Section was asked to conduct a biological survey of the Fox and Wisconsin Rivers at Portage, Wisconsin. This was done in support of an Environmental Impact Statement (EIS) currently in preparation.

This report includes biological findings during three different sampling periods, namely June 12-16, July 10-13, and August 14-17, 1978. In addition, to general physical chemistry such as temperature, pH, dissolved oxygen and specific conductance, the biological parameters collected include phytoplankton, zooplankton, periphyton, macroinvertebrates, and chlorophyll. During the August sampling period, fish sampling was conducted on both rivers.

It should be noted that on the last day of the June survey, the field notebook describing the sampling locations and results of general chemical analysis performed in the field was lost. Biologists in the field reconstructed, to the best of their knowledge, all information that was included in the notebook. Because most of the data had been collected within a two day period, the biologists are confident in their reconstruction descriptions of each sampling location as well as the general chemical and physical data collected.

SUMMARY

Biological conditions in the Wisconsin and Fox Rivers varied from station to station and from one sampling period to another, resulting in a shift from moderately enriched conditions (Mesotrophic) to more seriously enriched conditions (eutrophic). The following is a brief classification of each of the three stations studied on both rivers.

1. Station one on the Fox River was considered to be moderately to heavily enriched, while the Wisconsin River at Station one was classified as being moderately enriched.
2. Both rivers at Station two appeared to be somewhat similar in terms of biological productivity during the June and July sampling period. However, in August, there seemed to be a trend on the Fox River toward a greater number of pollution tolerant forms, while the Wisconsin River remained relatively constant.
3. The Wisconsin River at Station three was more enriched as compared to the same station on the Fox River throughout most of the study period. During the latter part of the study both rivers showed a decline in water quality as shown by the disappearance of certain pollution intolerant forms.

STATION DESCRIPTION

Fox River

Station one was located approximately 3/4 of a mile downstream of Swan Lake. The River, at this point, was 20 meters wide with a depth of one meter. Submerged aquatic vegetation covered the sampling area. The bottom substrate consisted of soft and "mucky" organic matter with numerous empty snail shells. The surrounding land was a marsh-type area with numerous grasses, cattails, and shrubs lining the shoreline.

Station two was located at Highway 33 East Bridge approximately one-quarter of a mile downstream of the Portage Sewage Treatment Plant. The channel width was 15 meters, with a depth of one meter. The bottom substrate consisted of sand and "mucky" organic matter. The shoreline was lined with tall grasses and small shrubs. Submerged aquatic vegetation covered the sampling site. At certain times of the year, duckweed lines the sides of the channel.

Station three was located downstream of the Portage Sewage Treatment Plant at the Clark Street Bridge. The channel width was 15 meters. The depth of the river was one meter with a bottom substrate consisting of rock, sand, "mucky" organic matter, and numerous empty snail shells. The shoreline was lined with grasses and cattails. At times, duckweed lines both sides of the channel and submerged aquatic vegetation covers the sampling site.

Wisconsin River

Station one was located approximately one mile upstream of Highway 78 Bridge at the point where the river starts to bend on the left bank. An island was located one-half mile upstream of the station where the river seperates into two channels. Channel width was 250 meters. The bottom substrate consisted of fine to coarse sand. Numerous trees and shrubs lined

the left bank of the river, while a sandy shoreline with grasses lined the right bank. Due to the width of the channel, three substations were located along a transect across the river. Substations A and C were located 50 meters from the right and left bank respectively, while substation B was located in the middle of the channel.

Station two was located across from the radio station WPDR antenna on the right bank of the river. The channel width was 200 meters. The bottom substrate consisted of fine to coarse sand. Channel depth was between 1.0-1.5 meters. This section of the Wisconsin River consisted of numerous sandbars and islands interdispersed with very shallow areas. The main flow of the river appeared to be along the left bank. The shoreline of both sides was lined with numerous trees and shrubs. Due to the width of the channel, three substations were taken along a transect across the channel. Substations A and C were located forty meters from the right and left banks, respectively. Substation B was located in the middle of the channel.

Station three was located adjacent to the public boat access landing at Dekorra Park. The channel width was 200 meters with a bottom substrate consisting of fine to coarse sand. Three substations were located along a transect across the river. Substations A and C were located forty meters from the right and left banks, respectively. Substation B was located in the middle of the channel. The depth at this station was 1.5-2.0 meters. The shoreline along the left bank was lined with numerous trees, whereas the right bank was lined with sandstone cliffs.

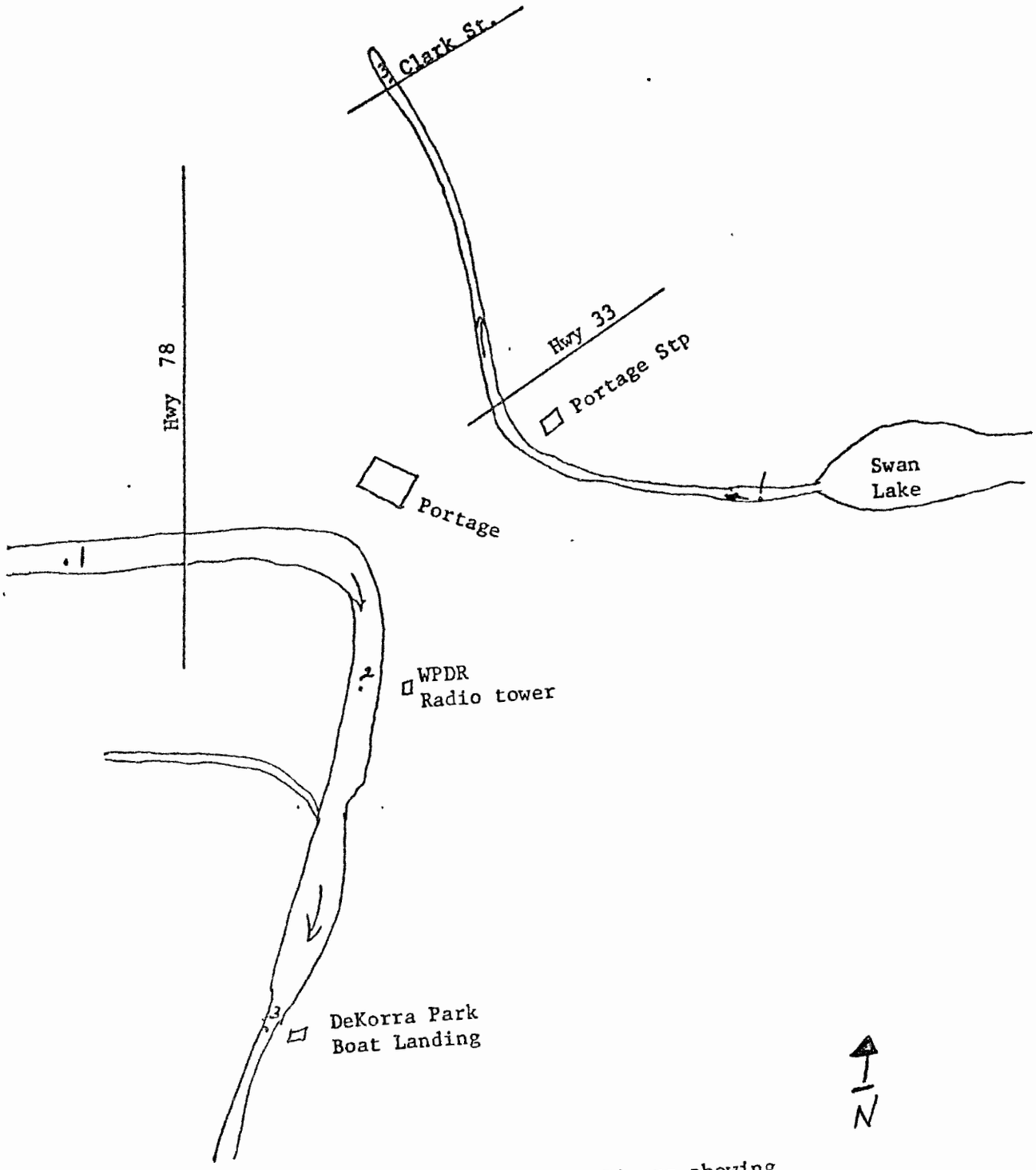

Figure 1. Map of Fox and Wisconsin Rivers showing biological sampling sites.

METHODS

Macroinvertebrates

Macroinvertebrates referred to in this report are aquatic organisms that can be retained by a U.S. Standard No. 30 sieve (28 mesh per inch) and live at least part of their life cycle within or upon underwater substrates.

Qualitative macroinvertebrate samples were obtained by washing organisms from rocks, logs and other substrates at the sampling sites. Organisms were washed into a Surber sampling net. All organisms collected were placed into a quart glass jar and preserved with 5% formalin.

Quantitative macroinvertebrate samples were obtained by using a Ponar dredge. The samples were washed in the field through a No. 30 mesh sieve. All organisms collected were placed into a quart glass jar and preserved with 5% formalin. Two indepdendent samples were taken at each sampling station.

Phytoplankton

Phytoplankton refers to microscopic plants (algae) suspended in a body of water that are incapable of sustained mobility in directions counter to the water currents.

Phytoplankton samples were obtained by taking a grab sample at the waters surface using a 500 ml plastic bottle. Samples were preserved with lugols solution.

Zooplankton

Zooplankton refers to the microscopic animals of the plankton community which graze upon the phytoplankton as a source of food.

Quantitative zooplankton samples were obtained by using an eight liter Niskin bottle. Four independent grab samples were obtained approximately one meter below the waters surface at each station. The contents of each

Niskin bottle were then pooled. The organisms in the pooled samples were concentrated by passing the sample through a plankton funnel fitted with a 53 μ mesh net. The sample was placed into a 500 ml plastic bottle, appropriately labeled and preserved with 5% formalin.

Chlorophyll

Chlorophyll refers to all plantlife containing a pigment known as chlorophyll*a*. The measurement of this pigment can yield some insight into the relative amount of alga standing crop. Chlorophyll samples were prepared in the field by filtering a known aliquot of water through a Gelman A/E glass fiber filter. A $MgCO_3$ suspension was then filtered through to prevent the sample from becoming too acidic. The filter was immediately wrapped in aluminum foil and placed inside a metal cannister which had been appropriately labeled. The sample was then placed on dry ice for transport back to the laboratory.

Periphyton

Periphyton refers to an assemblage of organisms that grow on underwater subsrtates, and includes such organisms as algae, molds and protozoa. All of the organisms are not necessarily attached to the substrate but at least live in association with attached organisms.

Periphyton were collected on 1"x3" glass microscope slides by means of a periphytometer. The length of exposure was four weeks, at which time the slides were retrieved. The slides collected were placed into a 100 ml plastic bottle and preserved with lugols solution.

Fish-Electrofishing

A boat mounted pulsating direct current electrofishing unit was utilized. (Colfelt electronics model VV-20). The electric current was directed into the water through a pair of steel cables which were suspended from booms extending from the bow of the boat. Each sampling area was electrofished for a period of between 20-26 min.

All stunned fish were dip-netted from the water and transferred to a holding tank, where they recovered from the electroshocking. All fish captured were identified to species when possible, counted, measured, weighed, and returned to the water.

Chemistry

Dissolved oxygen and temperature were measured using a YSI model 54A oxygen and temperature meter (Yellow Spring Instrument Co.). The oxygen meter was calibrated daily against the Iodometric method for D.O. analysis as outlined in Standard Methods for the Examination of Water and Wastewater, 14th edition 1975. The pH was measured using an Oion Ionalyzer model 407A pH meter. Specific conductance was measured using an Industrial Instruments model RB3 Solu Bridge conductivity meter and probe.

CUSTODY PROCEDURE

Custody procedures were followed throughout the study. All samples collected at a particular station were immediately placed into ice chests. While the stations were being sampled, ice chests were kept secured in a government vehicle. At the end of each day, all samples collected were recorded onto custody sheets and signed. Samples were returend to the ice chest and sealed with custody labels for transport back to the laboratory. Back in the laboratory, custody procedures were followed as prescribed by the Central Regional Laboratory Custody Manual.

RESULTS

Chemistry

General chemistry data is presented in Table I. As can be seen, specific conductance concentrations were greater in the Fox River than the Wisconsin River. Between June and August, specific conductance concentrations in the Fox River ranged between 360-560 µohms/cm compared to a range of 140-160 µohms/cm in the Wisconsin River. The pH and temperature were similar in the two rivers. The two river systems did differ with regard to the amount of dissolved oxygen present at the various stations. In the Wisconsin River dissolved oxygen concentrations remained between 7.1-8.8 mg/l. However, in the Fox River, a significant oxygen sag was present at Stations two and three, located downstream of the Portage Sewage Treatment Plant.

In July and August, Station two had dissolved oxygen concentrations of 2.6 to 3.8 mg/l, while Station three had concentrations of 2.2-3.9 mg/l. In June, Station two had a D.O. concentration of 7.0 mg/l. This higher D.O. concentration compared to the values obtained in July and August could be due to the higher D.O. water from Station one (12.2 to 14.4) flowing into Station two.

Fish

Results of the fish shocking are presented in Tables 2, 3, and 4. Five species of fish were captured from station one on the Fox River. The most abundant species was Lepomis microlophus (Redear sunfish). A total of four fish were caught. The other species present were bowfin (Amia calva), green sunfish (Lepomis cyanellus), brown bullhead (Ictalurus nebulosus), and yellow perch (Perca flavescens). Fifteen young of the year sunfish were also retrieved but these were not identified to species.

In the Wisconsin River, only two species of fish were present at Station one. The most abundant fish present were minnows, which were not identified to species. One large (64 oz.) quilback carpsucker (Carpoides cyprinus) was caught. At Station two, four species of fish were captured. Only one of each of these species was retained. The species represented were quilback carpsucker (Carpoides cyprinus), smallmouth bass (Micropterus dolomieui), yellow perch (Perca flavescens), and minnows. Station three was represented by the following fish species; quilback carpsucker (Carpoides cyprinus), largemouth bass (Micropterus salmoides), silver redhorse (Moxustoma anisurum), and minnows. Minnows were the most abundant group represented.

Zooplankton

Fox River

Except for June, Station one supported a considerably larger zooplankton population than Station three (Table 5,6). This was most evident in July and August when Station one supported 161 and 188 org/l respectively, compared with Station three, which had only 34 org/l in July and 17 org/l in August. Members of the Rotifera dominated the zooplankton present during the study. The rotifera was most represented by Keratella cochlearis, Polyarthra vulgaris,

Keratella earlinae and Trichocerca sp. Members belonging to the order copepoda were present in relatively low numbers. The copepoda, during all three months, were represented by species in the early form of development (Cyclops juveniles and Nauplii).

Wisconsin River

Throughout the study period, Station one supported a larger zooplankton population than Station three. This difference was most noticeable in June and July. In June, Station one had a total of 139 org/l compared to 98 org/l at Station three, while in July, Station one contianed 65 org/l compared to 34 org/l at Station three. In August, there was only a slight difference between Station one (28 org/l) and Station three (24 org/l). Members of the Rotifera dominated the zooplankton present during the study. The Rotifera were represented by Keratella cochlearis, Syncharta sp., Trichocerca similis, and Polyarthra vulgaris. The Copepoda were represented by early life stages of species (Cyclops juveniles and Nauplii). These species, however, never became numerically important.

Phytoplankton

Fox River

Throughout the entire study period, Station one supported a considerably larger phytoplankton population than Stations two and three (Tables 7, 8 and 9). In June, Station one was dominated by the blue-green algae, namely Anabaena sp., and Aphanizomenon flos aquae. However, later in the summer, a noticeable change in the algal population occurred. By July, the flagellated algae consisting of Cryptomonas sp., and other miscellaneous flagellate species increased substantially from June (612 cells/ml to 5860 cells/ml), thus accounting for the dominance by both the blue-green algae and flagellates.

By August, the flagellate population continued to increase reaching a concentration of 12,970 cells/ml. The blue-green population had decreased from a concentration of 7250 cells/ml in July to 1130 cells/ml in August. Thus, in August the flagellate population dominated comprising 87.0 per cent of the population.

Station two showed shifts in population numbers and composition between June and August. In terms of cell concentration in June, Station two supported a population of 5253 cells/ml. However, by July, the numbers of phytoplankton encountered decrease to 2940 cells/ml and by August to 2720 cells/ml. During this same time period, changes in the dominant algal forms also changed. In June, the centric diatoms consisting of Cyclotella spp., comprised 68% of the species, however, by July the flagellated algae became dominant (62%) and this trend continued through the August study.

Station three, unlike Station two, showed an increase in the phytoplankton population from June until August. In June, the algal cell concentration was 2907 cells/ml. By July, the algae had increased to 6230 cells/ml, and in August, to 10,940 cells/ml. With regard to species composition, the June study showed a diverse population of all major groups of algae with no one form showing complete dominance. However, by July, the flagellated algae (consisting of Cryptomonas sp.and misc. flagellates) began to increase in numbers and became the dominant algae. This group continued to dominate in August.

Wisconsin River

Station one on the Wisconsin River showed shifts in species composition between June and August. In June, the algal population was dominated by the blue-green alga, Aphanizomenon flos-aquae, the flagellated algae comprised of Cryptomonas erosa and miscellaneous flagellates and the centric diatom

Melosira spp. In July, diverse algal population existed with no major algal group showing complete dominance. However, by August, the flagellated algae had continued to increase, and along with the centric diatoms became the dominant algal forms. The flagellated algae were largely comprised of Cryptomonas ovata, Chlamydomonas sp., and miscellaneous forms. The centric diatoms were represented largely by Melosira spp.

Station two exhibited a population structure similar to Station one. Throughout the study, the flagellated algae and centric diatoms dominated. The species represented were similar to those present at Station one.

Station three, during the study period, consistantly supported a larger phytoplankton population than Stations one and two. In terms of cell concentration, phytoplankton numbers changed little between June and August. In June, 9486 cells/ml were present, compared to 9510 cells/ml in July and 11,840 cells/ml in August. Although cell concentration changed little during this time period, species composition increased. In June, the flagellates, centric diatoms, and blue-green algae dominated. Species represented were the same as were present at Station one. By July, the centric diatoms became less important and the flagellates and blue-green algae dominated. In August, the blue-green population decreased substantially and flagellates and centric diatoms became numerically important. The green algae also began to increase in August being comprised predominantly of Crucogenia quadrata and Ankistrodesmus falcatus.

It should be noted that throughout the study, green particulate matter visible to the naked eye was suspended in the water of the Wisconsin River. At all sampling stations, biological examination of the water in June and July did not show any unusual increase in any of the phytoplankton species encountered. In August, this green particulate matter continued to be present, and due to heavy winds at the time of sampling, a large amount of

this material began to collect along the Eastern shoreline between stations one and two. Biologocal examination revealed the substance to be the algal species Microcystis aeruginosa. This species had reached bloom conditions in August and the heavy winds were accumulating the cells into a mat along the windward shoreline.

Chlorophyll

Fox River

Station one showed a substantial increase in the amount of chlorophyll a present in the water compared to Station three during the months of June and July (Table 10). This difference was most noticeable in the June survey when Station one had an average chlorophyll a concentration of 47.5 µg/1, compared to 9.13 µg/1 at Station three. It should be noted that this difference was probably due to the large number of phytoplankton cells observed suspended in the water at Station one and in Swan Lake. The algal population was apparently approaching "bloom" conditions, although cell counts of water samples did not show a "bloom" condition to be present.

This large population of algae was not observed to be present in July, accounting for the significantly lower chlorophyll a values obtained at Station one during July. However, there still remained a substantial difference in the amount of algal biomass produced at Station One (15.9 µg/1) compared to Station three (6.72 µg/1).

In August however, unlike the previous two months, Station three showed a substantial increase (25.1 µg/1) of chlorophyll a present compared to that at Station one (9.0 µg/1).

Wisconsin River

Station three throughout the study period contained a greater amount of algal biomass compared to Station one. The most significant difference occurred in June when Station three had an average chlorophyll *a* value of 23.1 µg/l, while Station one had a value of 13.4 µg/l. This trend continued during July and August, however, the differences between the two stations was not as pronounced. In July, Station one had an average chlorophyll *a* value of 10.4 µg/l, while Station three had a concentration of 13.3 µg/l. In August, Station one had a value of 22.0 µg/l, while Station three had 27.7 µg/l of chlorophyll *a* present.

Periphyton

Fox River

Examination of the periphyton community in July showed Station one on the Fox River to be more productive than Station two further downstream. As one can see from Tables 11 and 12, Station one supported 23,298 cells/mm^2 compared to only 5978 cells/mm^2 at Station two. Unfortunately, the periphytometer at Station three was either lost or stolen, thus no comparison between the other stations could be made.

With regard to species composition, Station one was dominated by the blue-green algae, represented by *Oscillatoria sp.* and *Coelosphaerium kuetzingianum* and the pennate diatom *Cocconeis pediculus*. Station two was dominated by *Oscillatoria sp.* and *Cocconeis pediculus*.

Wisconsin River

The periphyton community on the Wisconsin River showed Station one to be less productive than either stations two or three. Tables 11 and 12 shows that in July, Station one supported 221 cells/mm^2, Station two

4928 cells/mm^2 and Station three an average of 4948 cells/mm^2.

Species composition showed Station one to be dominated by the centric diatom Melosira spp. Station two was dominated by Oscillatoria sp., and Cocconeis pediculus. Station three was best represented by the blue-green algal species Aphanizomenon flos-aquae and Oscillatoria sp., and by the pennate diatom Cocconeis pediculus.

Macroinvertebrates

Fox River

The results of the qualitative and quantitative macroinvertebrate samples are contained in Table 13. Station one data showed a great diversity of organisms in the qualitative samples for all months sampled (June - 24 taxa, July 24 taxa, August - 37 taxa). For the most part, these organisms were associated with the stream margins, in and among the rooted vegetation.

Quantitative samples indicated habitation of the bottom sediments by a highly diverse population in early summer (31 different taxa in June) and moderate diversity in July and August, with 19 and 20 taxa respectively.

The population at Station one showed a mixture of pollution tolerant, facultative and intolerant forms.

Station two had a high diveristy in the qualitative sample for July (43 taxa) and a lower diversity in August (12 taxa). Ponar samples showed a decrease in diversity as the summer progressed. This was most likely due to the decrease in dissolved oxygen and an increase in water temperature. Also, the intolerant forms were not found in the August samples, as they had been in June and July.

Taxa diveristy decreased at Station three during the summer months. The quantitative samples had 45 taxa in June, 20 taxa in July, and 15 taxa in August. Here again, only the tolerant organisms were encountered at the end of the summer. The qualitative samples had a high diversity of organisms collected from among the abundant aquatic vegetation and along the margins of the stream. The pollution intolerant forms found thorughout the summer were for the most part, those organisms which live at the water - air interface, and on the vegetation near the surface of the water (i.e., - Helisoma limosa and Amnicola integra).

Wisconsin River

Table 13 contains the qualitative and quantitative macroinvertebrate data collected for the Wisconsin River during June, July and August. The quantitative data for all stations, for all months, exhibited low diversity and low total numbers of individuals. The moderately fast river current and substrate composition (a mixture of fine to coarse sand) are responsible for the reduction of the organisms, since such conditions greatly inhibit perminant colonization of the bottom sediment by the macroinvertebrate groups.

The extensive colonization of the artificial substrate periphyton samples and heavy utilization of overhanging trees and submerged vegetation by organisms indicates that where the shifting sand substrate can be avoided, a diverse population of individuals (as high as 34 taxa at Station three in July) can develop. The decrease in the number of taxa for the month of August on the Wisconsin River is probably due to the drastic drop in the water level, which exposed large sections of previously inhabited areas of the river bed.

The macroinvertebrate populations at all stations were a mixture of pollution tolerant, facultative, and intolerant forms. This existed throughout the summer.

DISCUSSION

Station 1

When comparing Station one on the Fox River to that on the Wisconsin River, it appears that during the study period, the Fox River is biologically more productive than the Wisconsin River. This is supported by the fact that during the entire study period, phytoplankton cell concentrations were substantionally greater in the Fox River than the Wisconsin River. In June, the Fox River supported 9741 cells/ml, in July, 14,300 cells/ml and in August, 14,910 cells/ml. This compares to Station one on the Wisconsin River, which in June, produced only 7344 cells/ml, in July 5680 cells/ml and in August, 8679 cells/ml. Examination of the periphyton community present during the July study, further supports the fact that Station one on the Fox River is more productive than that on the Wisconsin River. The Fox River supported 23,298 cells/mm^2 compared with only 221 cells/mm^2 on the Wisconsin River.

Except for August, chlorophyll *a* concentrations showed greater productivity in the Fox River. Zooplankton populations (except in June) were also considerably greater in the Fox River.

It should be noted that in July and August, several species of rotifers were present at Station one on both the Fox and Wisconsin Rivers, which are indicators of eutrophic conditions. Although these species were present in relatively low numbers, their presence may indicate that these stations are approaching eutrophic conditions. The species represented were *Brachionus angularis*, *Keratella cochlearis*, *P. tecta*, *Trichocerca multicrinis*, *Filinia longiseta* and *Pompholyx sulcata*.

In terms of macroinvertebrate findings, Station one qualitative samples from the Wisconsin River had a lower diversity of taxa (15) as compared to the Fox River (29). Quantitative substrate samples also showed the Fox River at Station one to be more productive than the Wisconsin River for the same station. Both rivers at this location had benthic communities composed of tolerant, facultative and intolerant forms, which was characteristic throughout the summer.

Based upon the biological parameters measured at Station one, the Fox River was classified as mesotrphic to eutrophic in nature, while the Wisconsin River was classified as being mesotrophic.

Station 2

Station two on he Fox and Wisconsin Rivers, for most of the summer, appear to be similar in terms of phytoplankton productivity. In June and July, both rivers supported approximatley the same concentration of phytoplankton. The Fox River supported 5253 cells/ml in June and 2940 cells/ml in July compared to the Wisconsin River which supported 6018 cells/ml in June and 3830 cells/ml in July. In August, however, the Wisconsin River supported a considerably greater phytoplankton population (9560 cells/ml) compared to that in the Fox River (2729 cells/ml).

A similarity, during June and July, between Station two on the Fox and Wisconsin Rivers is further supported by examination of the periphyton population. Both stations supported approximately equal numbers of organisms. The Wisconsin River supported 4928 cells/mm^2 compared to 5978 cells/mm^2 on the Fox River.

Fewer macroinertebrate taxa were encountered on the Fox River, Station two (average of 23 taxa in the qualitative samples) as compared to the same station on the Wisconsin River (29 taxa in the qualitative samples). As the

summer progressed, the biological quality of the benthis community on the Fox River at Station two deteriorated toward a greater number of pollution tolerant forms, while the Wisconsin River remained relatively constant.

The overall condition of Station two was considered to be eutrophic to mesotrophic for the Fox River and mesotrophic for the Wisconsin River.

Station 3

In June and July, the Wisconsin River supported a considerably greater pollution enriched biological community than the Fox River. This is substantiated by the fact that the phytoplankton population in the Wisconsin River in June reached 9485 cells/ml compared to only 2907 cells/ml in the Fox River. Chlorophyll *a* concentrations in the Wisconsin River (23.1 µg/l) and the Fox River (9.1 µg/l) also supported this evidence. The Wisconsin River also supported a much greater zooplankton population (98 org/l) than the Fox River (19 org/l). In July, the phytoplankton and chlorophyll *a* also showed greater biological productivity in the Wisconsin River, while both rivers supported similar zooplankton populations.

Table 1 Chemical and physical analysis of water collected from the Fox and Wisconsin Rivers June, July and August, 1978.

	Parameter	Fox River Station 1	Fox River Station 2	Fox River Station 3	Wisconsin River Station 1	Wisconsin River Station 2	Wisconsin River Station 3
June Survey	Temp. °C	23.5	17.0	16.0	17.0	21.0	17.0
	Dissolved Oxygen mg/l	12.2-14.4	7.0	2.2	8.4	8.4	8.4
	pH	8.9	7.8	7.6	7.4	7.4	7.4
	Specific conductance µohms/cm	560	600	600	160	160	160
July Survey	Temp. °C	23.5	21.5-22.0	20.5	23.0-24.0	20.5-21.0	21.0-22.0
	Dissolved Oxygen (mg/l)	8.4	3.7-3.8	2.2	7.45-9.6	6.8-7.4	6.6-7.5
	pH	8.0	6.9	8.25	7.6	7.5-7.55	7.1-7.5
	Specific conductance (µohms/cm^{1})	360	400	400	140-156	150-160	160
August Survey	Temp. °C	23.9	21.0	23.4	26-26.3	24-24.5	23.0
	Dissolved oxygen mg/l	5.9	2.7	3.90	8.75-8.80	7.6-8.3	7.05-7.3
	pH	---	--	7.25	7.7-8.0	7.5-7.75	--
	Specific conductance µohms/cm	400	400	400	150	150	160

Table 2 Length and weight measurements of fish captured in the Wisconsin River during August Survey 1978.

Station 1

Species	Number Captured	Weight (range in oz.)	Length (range in inches)
Carpoides cyprinus (Quilback carpsucker)	1	64.0	16.5
Minnows	3	--	1.0-2.5

Station 2

Species	Number Captured	Weight (range in oz.)	Length (range in inches)
Carpoides cyprinus (Quilback carpsucker)	1	64.0	16.0
Micropterus dolomeiui (Smallmouth bass)	1	16.0	9.5
Minnows	1	--	3.0
Perca flavescens yellow perch	1	8.0	6.75

Station 3

Species	Number Captured	Weight (range in oz.)	Length (range in inches)
Carpoides cyprinus (Quilback carpsucker)	2	7.0	5.5-5.75
Micropterus salmoides (Largemouth bass)	1	9.5	8.5
Moxostomo anisurum (Silver redhorse)	1	40.0	15.5
Minnows	5	--	2.0-3.25

Table 3 Length and weight measurements of fish captured in the Fox River during August Survey 1978.

Station 1 *

Species	Number Captured	Weight (range in oz.)	length (range in inches)
Amia calva (Bow fin)	1	9.0	7.5
Lepomis cyanellus (Green sunfish)	1	2.0	3.5
Ictalurus nebulosus (Brown bullhead)	1	9.0	7.5
Lepomis microlophus (Redear sunfish)	4	--	2.75-3.50
Perca flavescens (yellow perch)	1		
Sunfish (young of the year)	15	--	--

* Due to a malfunctioning of the Electroshocker, no fish samples were taken at Stations 2 and 3.

Table 4 Fish species collected by electroshocking on the Fox and Wisconsin Rivers during August 1978 survey.

Species	Fox River Station			Wisconsin River Station		
	1	2	3	1	2	3
Amia calva (Bowfin)	X					
Carpoides cyprinus (Quilback carpsucker)		N	N	X	X	X
Lepomis cyanellus (Green sunfish)	X	O	O			
Lepomis microlophus (Redear sunfish)	X					
Micropterus dolomieui (Smallmouth bass)		S	S		X	
Micropterus salmoides (Largemouth bass)		A M	A M			X
Moxostoma anisurum (Silver redhorse)		P	P			X
Ictalurus nebulosus (Brown bullhead)	X	L	L			
Perca flavescens (Yellow perch)	X	E	E			
Stizostedion vitreum (Walleye)					X	
Minnows (Unidentifed)				X	X	X
Sunfish (Young of the year)	X					

Table 5 Zooplankton in organisms/l collected from the Fox and Wisconsin Rivers in June, July and August 1978.

Species	June Survey				July Survey				August Survey			
	Fox R.		Wisc. R.		Fox R.		Wisc. R.		Fox R.		Wisc. R.	
	Station No.				Station No.				Station No.			
	1	3	1	3	1	3	1	3	1	3	1	3
Rotifera												
Asplanchna priodonta									2			
Brachionus angularis											2	2
Chromogaster ovalis					2				5			
Colurella sp.					8			2				
Conochilus unicornis					2	2	2					
Euchlanis sp.		8			2	2				2		
Filinia longiseta								2	2			
Kellicottia bostonensis							2					
Kellicottia longispina			2									
Keratella cochlearis	5	2	36	27	75	6	14	6	105		12	16
Keratella cochlearis v·tecta							2				2	
Keratella crassa							2		6			
Keratella carlinae					23		3	2	9			
Monostyla lunaris						3	2	2				2
Monostyla quadridentata		2										
Monostyla sp.		2	2	2							2	2
Polyarthra major									6			
Polyarthra romata			7	5	8		2	2		3		2
Polyarthra vulgaris					19	3	8	3				
Polyarthra sp.												
Pompholyx sulcata					3				2			
Synchaeta sp.		2	81	53	5		5	8		5	2	
Trichocerca multicrinis									5		2	
Trichocerca rousseleti			8	2							2	
Trichocerca similis												
Trichocerca sp.							5		19			
Trichotria tetractis						3						
Unid. spp.		2				6	2		5		2	
OG					6		2					
CLADOCERA												
Clydorus sphaericus	2						3					
Eubosmina coregoni				2								
COPEPODA												
Cyclops juveniles					3					2		
Cyclops sp.										2		
Diaptomus juveniles	2											
Nauplii	2		3	5	5	9	6	5	22	3	2	

Table 6 Major zooplankton groups collected from the Fox and Wisconsin Rivers in June, July and August 1978.

	Species	Fox River org/l Station No. 1	Fox River org/l Station No. 3		Wisconsin River org/l Station No. 1	Wisconsin River org/l Station No. 3
June Survey	Rotifers	5	18		136	91
	Cladocera	2	--		--	2
	Copepods	4	--		3	5
	Total	11	18		139	98
July Survey	Rotifers	153	25		56	29
	Cladocera	--	--		3	--
	Copepods	8	9		6	5
	Total	161	34		65	34
August Survey	Rotifers	166	10		26	24
	Cladocera	--	--		--	--
	Copepods	22	7		2	
	Total	188	17		28	24

Table 7 Phytoplankton in cells/ml collected from the Fox and Wisconsin Rivers in June, July and August 1978.

Species	June Survey							July Survey							August Survey						
	Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.			
	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3
BLUE-GREEN ALGAE				51																	
Agmenellum sp.										110	230	110	90	60			1100	240	100		240
Anabaena sp.	5610	51		51	102	51	51	90			30			30	70			30	30		
Anacystis cynea								290	90	30	110	200	200	230	140	30	280	210	720		450
Anacystis sp.											30										
Aphanizomenon flos-aquae	3315	204	51	2142	510	714	1938	5850	260	140	520	290	170	3160	830	100	280	70	100		30
Chroococcus sp.								90		90		30		140							
																				N	
Coelosphaerium								90	60	110	90			30	30				70	O	30
Coelospharium sp.																					
Lyngbya martensiana															30						
Microcystis aeruginosa				51																	
Oscillatoria limnetica															30						100
Oscillatoria sp.		153			51	51	51	90	110	230		30	30			100	210		210		
GREEN ALGAE																					
Actinastrium hantzschii							51														
Actinastrium sp.												30					210				70
Ankistrodesmus falcatus			204	204	153	153	357			110	490	170	260				1040	410	140	S	550
																				A	
Closterium sp.									30											M	
Coelastrum microporum			51			51														P	
Coelastrum sp.							51							110			70			L	30
Cosmarium sp.														30						E	
Crucigenia quadrata										170	350		170				140	210	140		720
Crucigenia tetrapedia											60			230							
Crucigenia sp.			102	102		102						140									
Dictyosphaerium pulchellum			51			51			30									30			
Dictyosphaerium sp.										30											
Golenkinia sp.									60	30											
Kirchneriella sp.																			100		
Micractinium sp.												60		30				30			
Oocystis sp.									90	110				30	140	70	350	70	30		30
Pediastrum boryanum			51	51	153	102	153	30		30	30		30						30		
Quadrigula lacustris																					

Table 7 Phytoplankton in cells/ml collected from the Fox and Wisconsin Rivers in June, July and August 1978.

1 cont'd

Species	June Survey							July Survey							August Survey						
	Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.			
	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3
Scenedesmus abundans				153							60	60	30								
Scenedesmus bijuga			51																		
Scenedesmus quadricauda		51	153	357	153	153	204			60	30		60	60	30	70	70	30	70		170
Scenedesmus dimorphus							51														
Scenedesmus sp.					51	153					30		30	60			70	70	140		140
Schroederia setigera								90	30	30	110	60	110	230	30		30	30			70
Selenastrum sp.					153						30	60									
Tetraedron caudatum										30											
Tetraedron minimum												30					70				
Tetraedron sp.							51			60			30					30	30		
Tetrastrum staurogeniaeforme																	70	100			30
Tetrastrum sp.			51				102														
Misc. greens												110									
FLAGELLATES																					
Ceratium hirundinella	51														280						
Chlamydomonas sp.		51								60	30						410	410			270
Cryptomonas erosa	51	102	306	765	663	459	459			110	170	90	90		70				30		410
Cryptomonas ovata								90	60	230	230	350	350	350	70	30	140	410	70		310
Cryptomonas sp.	408	51	153		403	408	765	820	410	430	290	290	460	350	240		350		140		210
Eudorina sp.																					30
Euglena sp.		51							30	30					30	30	30		60		30
Mallomonas sp.						51		60	30	30	30				30			30	30		70
Pandorina sp.				51						30											
Phacus sp.										30	30		60				30				30
Trachelomonas sp.		51	51														30	30			
Misc. flagellates	102	612	510	714	510	612	1632	1940	1300	2260	1480	1100	750	3010	12250	1860	4140	2760	3100		2970
CENTRIC DIATOMS																					
Cyclotella sp.		3570	459	102		204	612	30	60	110	30	110	110	90	30	100	550	280	310		1000
Melosira sp.			306	2244	2295	2091	1683	430	60	1160	1040	670	670	1100	140	30	550	2760	2860		1690
Microsiphona potamos											90		30	30			690	100	790		1860
Stephanodiscus sp.				51	51	51	102				30	60				30		100	30		
PENNATE DIATOMS																					
Asterionella formosa						408	816														

Table 7 Phytoplankton in cells/ml collected from the Fox and Wisconsin Rivers in June, July and August 1978.

2 cont'd

	June Survey							July Survey							August Survey						
	Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.			
Species	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3
Cocconeis sp.	51		102					30	30	110					30	30	70				
Cymbella sp.		51																			
Diatoma sp.														30				30			
Fragilaria crotonensis										30					310		210				
Fragilaria construens			204		1020																
Gomphonema sp.								30													
Navicula sp.								30	30	60				30	100		70				140
Nitzschia acicularis										30						30		30			240
Nitzschia palea	51	204		153		102	204		110	60	30	30				210	70		100		70
Nitzschia sp.	102	51	51	102	51		153		90			30		90			210	140	100		
Synedra acus												30						30			30
Synedra ulna										90											30
Synedra sp.																			30		

Table 8 Major phytoplankton groups collected from the Fox and Wisconsin Rivers in June, July and August 1978.

	Species	Fox River NO/ml Station No. 1	2	3	Wisconsin River NO/ml Station No. 1	2a*	2c	3
June Survey	Blue-green algae	8925	408	51	2295	663	867	2040
	Green algae	--	51	714	867	663	765	1020
	Flagellates	612	918	1020	1530	1581	1530	2856
	Centric diatoms	--	3570	765	2397	2346	2346	2397
	Pennate diatoms	204	306	357	255	1071	510	1173
	Total	9741	5253	2907	7344	6324	6018	9486
July Survey	Blue-green algae	7250	520	710	1010	660	490	3650
	Green algae	140	210	660	1190	860	820	780
	Flagellates	5860	1830	3210	2260	1830	1710	3710
	Centric diatoms	870	120	1270	1190	840	810	1220
	Pennate diatoms	180	260	380	30	90	--	150
	Total	14300	2940	6230	5680	4280	3830	9510
August Survey	Blue-green algae	1130	230	1940	550	1230	NO	850
	Green algae	200	140	2050	1010	680	S	1810
	Flagellates	12970	1920	5160	3640	3430	A	4120
	Centric Diatoms	170	160	1790	3240	3990	MP	4550
	Pennate diatoms	440	270	630	230	230	LE	510
	Total	14910	2720	10940	8670	9560		11840

* The letters A and C following the station number are used to denote substations which were taken along a transect across the river channel at that station.

Table 9 Diatom species proportional count by percent of phytoplankton collected from the Fox and Wisconsin Rivers in June, July and August 1978.

	June Survey							July Survey							August Survey						
	Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.			
Species	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3
Achnathes sp.					<1		<1		1		2	2	<1	2		2	1		<1		<1
Amphora sp.	2				<1												<1				
Asterionella formosa				11	18	15	10		<1	<1		1	2	2				2	3		
Cocconeis pediculus								6	34	17	<1	1	<1	<1	1	19	15		3		1
Cocconeis placentula									3	<1	<1		<1	<1		4	<1				<1
Cocconeis sp.	6	2	16	<1	<1	<1															
Cyclotella comta								<1													
Cyclotella glomerata														1							
Cyclotella meneghiniand	3	90	20	1	<1	<1	<1		9	13	<1	<1		1	<1	4	7	2	<1		2
Cyclotella stelligera				<1			<1					1	<1	<1							
Cyclotella sp.	25	2						<1	<1	3	<1	1	1	7	<1	38	7		3		<1
Cymbella sp.	2	<1		<1	<1	<1		5	<1	<1	<1		<1	<1	<1	<6	<1		<1		
Diatoma tenua v.elongatrum				<1							<1		2	3			1		<1		1
Diatoma vulgare													<1								
Diatoma sp.			3	2	2	<1	2		5	3	<1	1	<1	2							
Diploneis sp.														<1							
Epithemia sp.						<1		2				<1		<1	<1	2					
Fragilaria capucina										3											
Fragilaria crotonensis		1		1	1	3		20	3	3	2	5			93						1
Fragilaria construens									13	4	2	5	4	<1			4	3			8
Fragilaria intermedia								<1		6											
Fragilaria leptostauron														<1							
Fragilaria pinnata																					<1
Fragilaria sp.	42	2	15	3	10	2	2	2			2	2	9		<1	16	10				3
Gomphonema olivaceum									<1												
Gomphonema sp.		<1						5	<1	<1	<1	1		2			<1				
Melosira ambigua								43	4	12	37	49	38	40			4	7	24		11
Melosira distans			27	4	5		1			2	1	4	5	7			1	13	7		22
Melosira granulata								5						1			3	8	1		4
Melosira longispina												2									
Melosira islandica																		3			5

Table 9 continued

Species	June Survey							July Survey							August Survey						
	Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.				Fox River Station No.			Wisc. River Station No.			
	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3	1	2	3	1	2a	2c	3
Melosira italica								1		9	40	14	16	12							
Melosira varians			11	<1	2	1	<1		<1	2			<1	1			8	3			
Melosira sp.	13		3	70	54	71	79								1		15	45	42		26
Navicula sp.	2	3	3	3	2	10	3	6	16	4	4	5	9	7	1	12	5	7	3		3
Neidium sp.	2																				
Nitzschia acicularis		<1	<1	<1	<1	<1										4	2	3	3		3
Nitzschia holsatica					10	2															
Nitzschia palea									4	2		<1		<1			6	2	1		2
Nitzschia sp.	2			1	<1		<1	1	<1	8	<1	1	2	3							
Pinnularia sp.													<1								
Rhoicosphenia curvata													<1								
Stauroneis sp.							<1			<1				<1							<1
Stephanodiscus niagarae	4		<1	1	1	1	1	1	2	1	2	1	3	2		2	6	1	1		<1
Stephanodiscus sp.							<1	2			2	2	4		1		<1	1	4		5
Surirella sp.				<1	<1					<1		1		<1							
Synedra acus							<1														
Synedra ulna		<1	2		<1					3			<1			2	1		1		
Synedra sp.									3	<1	<1	2	<1	1					<1		<1
Tabellaria fenestrata																			<1		
Thallosira fluviatilis							<1			2							1				

Table 10 Chlorophyll a concentrations of water collected from the Fox and Wisconsin Rivers in June, July and August 1978.

		Chlorophyll a (corrected for phaeophytin) µg/l					
	River	* 1a	1b	1c	3a	3b	3c
June Survey	Fox River	48.8	65.9	28.0	9.0	9.6	8.8
	Wisconsin R.	13.9	13.0	13.2	23.8	19.8	25.6
July Survey	Fox River	16.40	15.63	15.58	7.20	5.19	7.76
	Wisconsin R.	10.92	9.85	10.54	12.80	13.67	13.37
August Survey	Fox River	8.4	9.6	9.0	19.8	33.2	22.4
	Wisconsin R.	18.90	25.53	21.60	26.2	27.8	28.95

* The letters a, b and c following the station numbers are used to denote substations which were taken along a transect across the river channel at that station.

Table 11 Periphyton in cells/mm^2 collected from the Fox and Wisconsin Rivers July 1978

Species	Wisconsin River Station 1	2	3a	3c	Fox River Station 1	2	3
Blue-Green algae							
Agmenellum sp.			25				
Anabaena sp.		24					N
Aphanizomenon flos-aquae			1530				O
Coelosphaerium kuetzingianum					2800	40	
Oscillatoria sp.		3000	4300	86	5950	5450	
Green Algae							
Actinastrum sp.				<1			
Ankistrodesmus falcatus		24		<1	14	<1	
Closterium sp.		2					
Pediastrum boryanum				<1			S
Scenedesmus dimorphus		9				3	A
Scenedesmus falcatus		3					M
Scenedesmus quadricauda	5	16	3			3	P
Scenedesmus sp.	3	19					L
Stigeoclonium glomerata					70		E
Flagellates							
Chrysococcus sp.		2					
Cryptomonas ovata					28		
Chlamydomonas sp.				<1		3	
Cryptomonas erosa				9		1	
Mallomonas sp.						<1	
Trachelomonas sp.				<1			
Misc. flagellates	31	67	12	4	218	94	
Centric Diatoms							
Cyclotella sp.	5					4	
Melosira sp.	122	176	60	5	252	31	
Pennate Diatoms							
Asterionella formosa	8						
Cocconeis sp.		1380	628	1304	13594	336	
Cymbella sp.			21				
Gomphonema sp.	3		521	1	14	<1	
Navicula sp.	34	57	18	2	15	5	
Nitzschia sp.	10	86	34	3	126	8	
Snyedra ulna						<1	

Table 12 Diatom Species proportional count by percent of periphyton collected from the Fox and Wisconsin Rivers in July 1978.

	July Survey						
	Fox River Station			Wisconsin River Station			
Species	1	2	3	1	2a	2c	3
Achnathes lanceolata				1			<1
Achnathes sp.		<1		<1		<1	<1
Amphora sp.							
Anomoeoneis sphaerophora	<1		N		N		
Asterienella formosa			O		O	<1	
Cocconeis pediculus	98	74		79		77	96
Cocconeis placentula	<1	<1		1		<1	<1
Cyclotella glomerata							
Cyclotella meneghiana		<1	S		S	<1	
Cyclotella sp.		3	A	1	A	3	<1
Cymbella sp.	<1	<1	M		M	<1	
Diatoma tenue v. elongatum			P		P	<1	
Diatoma sp.		<1	L	1	L	<1	
Epithemia sp.			E		E	<1	<1
Eunotia sp.							<1
Fragilaria construens	<1	3		3		1	
Fragilaria crotonensis	<1					<1	
Fragilaria intermedia		1		1		3	
Fragilaria sp.							<1
Gomphonema olivaceum	<1	1				<1	<1
Gomphonema sp.							
Melosira ambigua				3		<1	<1
Melosira distans				1		2	
Melosira italica				4		3	<1
Melosira varians		4				<1	<1
Melosira sp.						3	<1
Navicula sp.	<1	6		2		1	<1
Nitzschia acicularis		<1					
Nitzschia palea		<1					
Nitzschia sp.		1		<1		<1	<1
Pinnularia sp.							<1
Stephanodiscus binderanus						<1	
Stephanodiscus niagarae		1		<1		<1	
Stephanodiscus sp.		1					
Surirella angustata							
Surirella sp.							<1
Synedra ulna							
Synedra sp.		1		2		<1	<1
Tabellaria fenestrata						<1	
Tabellaria fenestrata V. geniculata						<1	
Thallosira fluviatilis						<1	

Macroinvertebrate Data For the Fox River, Portage, Wisconsin

Diptera	Qualitative Samples									Quantitative Samples									Tolerance
	June			July			August			June			July			August			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
Ablabesmyia sp.		/										2							I
Ceratopogonidae	1	/					32			8			8			2			F
Chironomus sp.	1	/			1					20	27	1	12	77					T
Clinotanypus sp.		/								4									F
Cricotopus sp	3	/	2					1			18	21			29		1		F
Cryptochironomus sp	1	/								4			60	13		11	4		
Diamesa sp		/									1								I
Dicrotendipes sp	19	/	6		1		12		1	148	3	14	28			11	1		F
Endochironomus sp	37	/	1	80	14		132	3	1	30	2	4		1		6			F
Eukiefferiella sp.		/																	
Glyptotendipes sp	31	No Sample Taken	6	30	1					16		11	476	2	4	2			T
Goeldichironomus sp													4						
Harnischia sp.	1									26				2					
Kiefferulus sp.										6			8						
Micropsectra sp		/								10									
Microtendipes sp.		/																	I
Parachironomus sp	8	/	1	4	3	1				4	12	2		8	9				F
Paratendipes sp	8	/								4		2							
Pentaneurini tribe		/	2		7				2	2	1			4		6		4	
Phaenopsectra sp		/	14				204					17							I-F
Polypedilum sp	5	/	3		1			1	13	112	1	9		9	20			2	F

Macroinvertebrate Data For the Fox River, Portage, Wisconsin

	Qualitative Sample										Quantitative Sample											
	June			July			August				June			July			August					
	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	1	2	3		Tolerance	
Diptera		/																				
Procladius sp	1	/			3		12				116	40	1	34	6		29	4				T-F
Psectrocladius sp		/	1									1	1									F
Pseudochironomus sp		/														4						F-I
Simuliidae family		/				1																F
Simuliidae pupae		/																				
Tanypus sp		/			1							2										F
Tanytarsini tribe	172	/	8	2	25		20		2		942		10	192	7		175					
Thienemanniella sp.		/																				
Tipulidae family		/																				
Tribelos sp.		/										1										
Trichocladius sp		/												8								
Unidentified pupae		/	1	10	2		8		2		46		1	20			3					
Unidentified sp		/	1								20	1	1	1								

No Sample Taken

Table 13 cont'd

	Qualitative Samples									Quantitative Samples										Tolerance
	June			July			August			June			July			August				
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
TRICHOPTERA																				
Agrayles sp.	3									3										
Coraclea sp.							1													
Cheumato psyche sp.															4					
Cheumatopsyche sp. (pupae)																				
Hydropsychidae				4																
Hydropsyche sp.																				
Hydropsyche sp. (pupae)																				
Hydroptila sp.									3								1			
Hydroptilidae																	1			
Leptoceridae			1									4								
Leptocerus sp.												1								
Lype sp.							2													
Micrasema sp.																				
Nectopsyche sp.							1													
Neureclipsis sp.					1															
Oecetis sp.			1	3	3		4		1	6				10		2				
Polycentropidae																				
Sericostoma sp.							1													
Theliopsyche sp.																				
Unidentified sp.				1																

	June			July			August			June			July			August			Tolerance			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
ODONATA																						
Aeschna sp.							2															
Anax sp.				1																		
Coenagrionidae	1			1								1										
Ischnura sp.				1	10		64	3	9								1					
Libellulidae																	1					
Nehalennia irene																						
Perithemus domitia	1																					
Tetragoneuria sp.							5									2						
Zygoptera			1											1								
Unidentified sp.									1						4							
EPHEMEROPTERA																						
Baetidae																						
Caenis sp.							8				3	2										
Centroptilum sp.																						
Ephoron sp.																						
Heptageniidae																						
Hexagenia limbala																						
Hexagenia sp.																						
Neoephemera bicolor									2					2								
Siphlonurus sp.																						

	Quantitative Samples										Quantitative Samples										
	June			July			August				June			July			August				
	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	1	2	3		Tolerance
EPHEMEROPTERA																					
Stenonema sp																					
Unidentified sp									1												
COLEOPTERA																					
Berosus sp																					
Coptotomus sp				1																	
Dineutus sp				2		1		30	12												
Dubiraphia sp.												1					3				
Enochrus sp									1												
Gyrinidae																					
Gyrinus sp									43		2										
Haliplus sp							3	1													
Hydrophilidae																					
Hydroporinae sp					1																
Laccophilus sp					1				1												
Peltodytes sp					1	5			7												
Unidentified sp																					

	Qualitative									Quantitative										
	June			July			August			June			July			August			Tolerance	
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
HEMIPTERA																				
Abedus sp					4															
Corixidae				8	1		1		3											
Lethocerus sp																				
Mesoveliidae																				
Notonecta sp					2		3										1			
Pelocoris sp.					6															
Plea striola							2													
Ranatra sp.							5													
Sigara sp.																				
LEPIDOPTERA																				
Pyralididae							4													
COLLEMBOLA																				
Isotoma sp.																		1		
Isotomurus palustris																				

Table 13 cont'd

Species	Qualitative Samples									Quantitative Samples									Tolerance
	June			July			August			June			July			August			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
ISOPODA																			
Asellus sp.																			
A. racovitzai			5			3			47			6	19			16			
CLADOCERA																			
Alona sp.														4					
Daphnia galeata										2	5								
D. juveniles																			
D. pulex																			
D. sp.				8	14	1	2						40	10					
Eubosmina coregoni																			
Eurycercus lamellatus			2																
Leptadora kindtii					2														
Sida crystallina			2																
Simocephalus serrulata			8																
Unidentified sp.					18	12							3		4	3	6		

	Quantitative Samples									Qualitative Samples										
	June			July			August			June			July			August			Tolerance		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
AMPHIPODA																					
Gammarus sp.																					
Hyalella sp.	205		38	51	252	5	303		39	8	14	21	56	21		70	2				
COPEPODA																					
Copepoda										4	36										
Cyclopoida						3								1							
Cyclops bicuspidatus																					
PELECYPODA																					
Musculinum lacustre												4									
Sphaeriidae			2						3		2	2						3			
GASTROPODA																					
Amnicola integra			53		6	10			1			95									
Amnicola limosa									53		2	2									
Amnicola sp.																	1				
Campeloma decisa																					
Gyraulus hirsutus					32				2					4							
Gyraulus parvus	78		6	70	15		2		6												
Helisoma trivolvis			25		63	1						13		4							

	Qualitative Samples									Quantitative Samples										Tolerance
	June			July			August			June			July			August				
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
GASTROPODA (cont'd)																				
Hydrobia nicklíniana											1									
Lymnaea sp.				9	1	2														
Physa elliptica																				
Physa integra	13		14	27	23	3	2		1		5	44								
Physidae														2						
Planorbidae																				
Pleurocera acuta																				
Pleurocera sp.									1											
Promenetus exacuous			2						15		22									
Valvata sp.							1													
Valvata tricarnata	1		2	2	3				3		3	37						2		
Unidentified sp.															5					
OTHER																				
BRYOZOA							INC													
TURBELLARIA																				
Cura foremanii												84								
COELENTERATA																				
Hydra sp.	4			1	5					1	1	23		4						
Hydracarina sp.							1													
NEMATODA								3		15	8	2	76	46	21	24	14	6		

	Qualitative Samples									Quantitative Samples												
	June			July			August			June			July			August					
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Tolerance			
OTHER (cont'd)																						
NEMATOMORPHA																						
Paragordius sp.																						
TURBELLARIA																						
Cura foremanii	54			6	35	8	123	1	2	2	74		36	60	124	18	24	12				
Total taxa	26	NS	33	24	43	22	37	12	37	31	31	45	19	30	20	20	17	15				

Table 14 Qualitative and Quantitative Macroinvertebrate Date Collected from the Wisconsin River during June, July and August, 1978 at Portage, Wisconsin

	Qualitative Samples									Quantitative Samples									
Month	June			July			August			June			July			August			
Station	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Tolerance
DIPTERA Ablabesmyia sp.																9	6	33	I
Ceratopogonidae										7	7	15	3	8	18				F
Chironomus sp.	2	8	-		1							2							T
Clinotanypus sp.																			F
Cricotopus sp.	2	-8 -	1			27						3							F
Cryptochironomus sp.					1						1								
Diamesa sp.			1	13															I
Dirotendipes sp.	48		6		1														F
Endochironomus sp.	2	88	2		12	2									1				F
Eukiefferiella sp.					5	8													
Glyptotendipes sp.	82	112		4															T
Goeldichironomus sp.	1				1														
Harnischia sp.																			
Kiefferulus sp.																			
Micropsectra sp.																			
Microtendipes sp.	2	-																	I
Parachironomus sp.	9	24	4		1	1													F
Paratendipes sp.																			
Pentaneurini tribe																			
Phaenopsectra sp.			2								2								F-I
Polypedilum sp.	34	2	12	9	72	90					8	7			1				F

Table 14
#1 cont'd

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August				
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		Tolerance
Diptera (cont'd)																				
Procladius sp.																				T-F
Psectrocladius sp.																				F
Pseudochironomus sp.	1		1																	F-I
Simuliidae family				147	1	385						1			1					F
Simuliidae pupae				7	2	3														
Tanypus sp.																				F
Tanytarsini tribe	6			3	5	12	6				3									
Thienemanniella sp.					1	4														
Tipulidae family									1		3					1	1			
Tribelos sp.					1															
Trichocladius sp.						1														
Unidentified pupae					1	2														
Unidentified sp.	9	4	1			1					1	1		4				1		

Table 14 cont'd
#2

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August				
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		Tolerance
TRICHOPTERA																				
Cheumatopsyche sp.	20			420	198	147	25		3		1	2			2			4		T
Cheumatopsyche sp.(pupae)				27	4	20														
Hydropsychidae											5									
Hydropsyche sp.				70	25	85							4		3					F
Hydropsyche sp.(pupae)				3			15				2									
Hydroptila sp.																				
Hydroptilidae						3														
Leptoceridae						1														
Leptocerus sp.																				F
Lype sp.																				
Micrasema sp.							1													
Nectopsyche sp.			8						1											
Neureclipsis sp.	2				1	2														
Oecetis sp.																				
Polycentropidae							2													
Sericostoma sp.																				
Theliopsyche sp.			1																	
Unidentified sp.				1	1		2													

Table 14 cont'd
#3

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August			Tolerance	
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
ODONATA																				
Aeschna sp.																				
Anax sp.																				
Coenagrionidae																				
Ischnura sp.																				
Libellulidae																				
Nehalennia irene																				
Perithemus domitia																				
Tetragoneuria sp.																				
Zygoptera			1																	
Unidentifed sp.						1														
EPHEMEROPTERA																				
Baetidae		1																		
Caenis sp.																				F
Centroptilum sp.				26	39	33														
Ephoron sp.											1									I
Heptageniidae	3																			
Hexagenia limbala		1																		
Hexagenia sp.					1															
Neoephemera bicolor																				
Siphlonurus sp.																				

Table 14 cont'd
#4

	Qualitative Samples									Quantitative Samples												
	June			July			August			June			July			August					
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Tolerance			
EPHEMEROPTERA																						
Stenonema sp.									3													
Unidentified sp.	1	1			1	1										2						
COLEOPTERA																						
Berosus sp.		2																				
Coptotomus sp.																						
Dineutus sp.		1			3																F	
Dubiraphia sp.																						
Enochrus sp.																						
Gyrinidae			2																			
Gyrinus sp.			2																		T	
Haliplus sp.			1																			
Hydrophilidae			1																		T	
Hydroporinae sp.																						
Laccophilus sp.																						
Peltodytes sp.																						
Unidentifed sp.		1																				

Table 14 cont'd
#5

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August			Tolerance	
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
HEMIPTERA																				
Abedus sp.																				
Corixidae		7	45	3						1	2								F	
Lethocerus sp.			1																	
Mesoveliidae			1																	
Notonecta sp.																				
Pelocoris sp.																				
Plea striola																				
Ranatra sp.																				
Sigara sp.					65	70						5								
LEPIDOPTERA																				
Pyralididae																				
COLLEMBOLA																				
Isotoma sp.																				
Isotomurus palustris	1																			

Table 14 cont'd
#6

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August			Tolerance
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
OLIGOCHEATA																			
Dero sp.										1									
Limnodrilus sp.					18	1													T
Naididae		61		5	1	69					1								
Nais sp.			9									1							F
Peloscolex sp.											1								
Stylaria lacustris																			
Unidentified		33			1	10					2	1							
HIRUDINEA																			
Batracobdella paludosa																			
B. phalera																			
Dina microstoma																			T
Dina parva																			T
Eropbdellidae																			
Glossiphonia complanata						1													T
G. heteroclita																			
Helobdella elongata																			
H. fusca																			
H. lineata																			
H. papillata																			

Table 14 cont'd
#7

	Qualitative Samples									Quantitative Samples											
	June			July			August			June			July			August			Tolerance		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
H. stagnalis																					T
H. sp.																					
Illinobdella sp.																					
Piscicolidae																					
Placobdella ornata																					
Unidentifed sp.																					

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August			Tolerance
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
ISOPODA																			
Asellus sp.						1													
A. racovitzai		12	6		2														F
CLADOCERA																			
Daphnia galeata						3				12									
D. juveniles										6									
D. pulex					1														
D. sp.		77	16			5					11	25			1				
Eubosmina coregoni										2									
Eurycercus lamellatus					2														
Leptodora kindtii		2	3								1	3							
Sida crystallina															1				
Simocephalus serrulata																			
Unidentified	3														2				

Table 14 cont'd
#9

	Qualitative Samples									Quantitative Samples											
	June			July			August			June			July			August					
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			Tolerance
AMPHIPODA																					
Crangonyx sp.	3																				F
Hyalella azteca		4	27		2	7											3				F
COPEPODA																					
Cyclopoida						1															
Cyclops bicuspidatus						1															
PELECYPODA																					
Musculium lacustre																					
Sphaeriidae			3																		
GASTROPODA																					
Amnicola integra																					I
Amnicola limosa																					I
Amnicola sp.																					I
Campeloma decisa			17																		I
Gyraulus hirsutus		2																			F
Gyraulus parvus									7												
Helisoma trivolvis																					F

Table 14 cont'd
#10

	Qualitative Samples									Quantitative Samples										
	June			July			August			June			July			August			Tolerance
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
GASTROPODA (cont'd)																			
Hydrobia nickliniana																			
Lymnaea sp.																			F
Physa elliptica			10																
Physa integra	4	30		5															I-F
Physidae																			
Planorbidae			1																
Pleurocera acuta			169																F
Pleurocera sp.						1			21										
Promenetus exacuous																			
Valvata sp.																			
Valvata tricarinata																			I
Unidentifies sp.																			
OTHER																			
BRYOZOA																			
TURBELLARIA																			
Cura foremanii			12																
COELENTERATA																			
Hydra sp.	9	2	1																
Hydracarina sp.		1																	
NEMATODA			1		1					4	6								

Table 14 cont'd
#11

	Qualitative Samples									Quantitative Samples												
	June			July			August			June			July			August			Tolerance			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
OTHER (cont'd)																						
NEMATOMORPHA																						
Paragordius sp.											1											
TURBELLARIA																						
Cura foremanii	37	2		3	3	3																
Total Taxa	22	25	32	16	33	34	6	NS	6	7	19	12	2	2	10	2	3	3				