Staff Paper No. 31

The Watersheds of Northeastern Illinois: Quality of the Aquatic Environment Based Upon Water Quality and Fishery Data

Prepared by
Illinois Natural History Survey

August 1978

STAFF PAPER

areawide clean water planning

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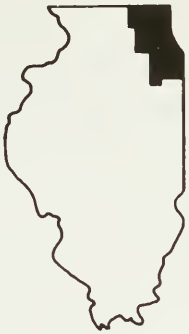

Northeastern Illinois is diverse in its land use and complex in its political structure. It has some of the most productive farms on earth—also one of the world's greatest cities. It contains 3,714 square miles of land and 38 square miles of water. It is home to 7 million people, organized in more than 1,250 units of government.

In 1957, following a decade of rapid urbanization in the Chicago suburban area, the Illinois General Assembly created the Northeastern Illinois Planning Commission (NIPC) to conduct comprehensive planning for the six-county greater Chicago region.

The Commission is expressly directed to meet the problems of metropolitan growth head on. It has three statutory charges: conduct research and collect data for planning, assist local government, and prepare comprehensive plans and policies to guide the development of the counties of Cook, DuPage, Kane, Lake, McHenry and Will.

By necessity, regional planning deals with general development policies not local land use detail. NIPC supports and coordinates county and municipal planning. The Commission has advisory powers only and relies upon voluntary compliance with its plans and policies.

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THE WATERSHEDS OF NORTHEASTERN ILLINOIS:

QUALITY OF THE AQUATIC ENVIRONMENT

BASED UPON WATER QUALITY AND FISHERY DATA

Final Report

Prepared for the

Northeastern Illinois Planning Commission

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This staff paper discusses an important component of Areawide Clean Water Planning, an unprecedented environmental planning effort that will attempt to develop new controls for all sources of water pollution in Cook, DuPage, Kane, Lake, McHenry and Will counties of northeastern Illinois.

The Northeastern Illinois Planning Commission has been assigned, by the U.S. Environmental Protection Agency and the Governor of Illinois, to develop a plan for cleaning up rivers and streams of the region according to the guidelines of Section 208 of the National Water Pollution Control Act Amendments of 1972.

This plan will outline strategies for stopping pollution from "point" sources (such as industries and sewage treatment plants) as well as from "nonpoint" sources such as stormwater runoff. Along with these strategies the plan will propose management approaches for putting the selected water quality strategies into action. Thus, political, financial and legal issues obviously will be major concerns.

Such issues, as well as the important technical components of Areawide Clean Water Planning, will be discussed in this series of staff papers. We invite you to read each of these papers and we welcome your critical reaction to the information they contain.

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CHAPTER ONE: INTRODUCTION

The 1972 amendments (P.L. 92-500) to the Federal Water Pollution Control Act required states to produce long-range plans for water pollution control. The Northeastern Illinois Planning Commission has been charged with the task of formulating a water quality management plan for the six-county region of northeastern Illinois. The initial step was an assessment of existing conditions. A component of this assessment included an inventory of the fishery resources of the area. The second task was to determine the nature and extent to which aquatic habitats are degraded. The present study attempts this in that it evaluates the existing capacity of stream reaches to support various classes of aquatic life based upon water quality and fish population data.

DESCRIPTION OF AREA

The study is limited to the northeastern portion of Illinois (Cook, DuPage, Kane, Lake, McHenry, and Will Counties) (Fig. 1-1; Table 1-1). Information for a portion of Kendall County was included in this study in order to add perspective to fishery resources as affected by the upstream reaches of the Fox River.

The study area was divided into individual watersheds according to the historical drainage pattern of the area. Some provisions were made to accommodate the major alterations of the area by man. In general, these watershed divisions correspond to the watershed management units utilized by the Northeastern Illinois Planning Commission. Areas which did not conform to the designated management units were the Chicago River/Sanitary and Ship Canal, Little Calumet River, and Lake Michigan watersheds. In this study the Little Calumet River watershed included all of the old river channel from the Cal-Sag Channel east to O'Brien Lock and the small portion of the Grand Calumet River. Thus, the Chicago River/Sanitary and Ship Canal watershed terminates at the junction of the Calumet-Sag Channel with the Little Calumet River. The portion of the Calumet River north of O'Brien Locks was included with the Lake Michigan watershed. These differences in watersheds from the management subunits were determined principally by similarities in fish populations or by the extent of contiguous blocks of similar aquatic habitats.

METHODS

Stream Ordering

Drainage systems exhibit a definite morphological pattern of tributaries joining one another to form the main stream. Classification of a drainage system may be based upon various components of this morphological pattern.

Horton (1945) devised one such classification based upon stream branching. His system was later modified by Strahler (1954, 1957). In the Horton-Strahler system, streams which received no tributaries were called order 1 streams. When two order 1 streams meet they form an order 2 stream; two order 2 streams meet to form one order 3 stream; and so on. A stream receiving lower order tributaries does not increase in stream order.

The Horton-Strahler system was derived to reflect the physiographic similarities of streams, yet many biological, chemical, and physical similarities are becoming evident, notably Kuehne's (1962) study of the relationship between the distribution of fish and stream order.

Numbers, length, and drainage areas of the streams of each order are similar, enabling the comparison of various drainage basins. In this study, the mean length and total length of each order, and total length of each drainage system have been calculated. In addition, each system has been compared to a fully bifurcate dendritic drainage system. In a fully bifurcate dendritic system, all stream junctions result in an increase in order. This system is seldom found in nature. More commonly, streams acquire many tributaries of a lower order which increase the flow and size of the drainage basin, yet do not increase the Horton-Strahler order number. Scheidegger (pers. comm.) proposed that stream order could be related to the number of streams of order 1 (n) by the function $(\log_2 n) + 1$. In a fully bifurcate dendritic system the same order numbers would be assigned if classified in accordance to Horton-Strahler or Scheidegger. Under the Scheidegger system, streams with similarities in the physiographic characteristics of their watersheds are grouped into the same stream order, regardless of the type of drainage net (fully bifurcate dendritic, trellis, or intermediate). All streams increase in order based upon the number of order 1 streams and not based upon the arrangement of these order 1 streams in the watershed. For example, the DuPage River watershed contains 127 order-1 streams, 61 order-2 streams, 45 order-3 streams, and 19 order-4 streams. A fully bifurcate dendritic system would theoretically contain 128 order-1 streams, 64 order-2 streams, 32 order-3 streams, 16 order-4 streams, eight order-5 streams, four order-6 streams, two order-7 streams, and one order-8 stream. The DuPage River enters the Des Plaines River as an order 4 stream and never reaches the potential order 8. The river system contains less order 1 and is over-developed at the order 3 level because it contains more order 3 streams (45) than the theoretical fully bifurcate system (32). Order 5 through 8 streams are absent. Most of the remainder of the watershed corresponds to the fully bifurcate dendritic model.

Soil

The chemical content of water varies from region to region reflecting the local geology and climatology. Nienkerk and Flemal (1976) investigated this phenomenon in Illinois and found that the concentration of various chemical constituents of surface waters displayed regional patterns in relation to geological, hydrological, and/or demographic conditions. In a natural system, the chemical constituents of water are primarily a result of the mineral makeup of the soil and to a lesser degree, a

result of atmospheric input. Climatologic conditions throughout northeastern Illinois are sufficiently similar as to preclude their producing major water quality differences within the region. Soils, therefore, would be the principal factor determining water quality under natural conditions. This report includes a discussion of the soils of each watershed to form the basis for a theoretical grouping of "similar" watersheds (water chemistry and, hence, aquatic biota). Any detected change in water chemistry in regions of similar soils, climate, etc., are likely to be due to external modification of the stream system.

Data Bases

Under contract to the Northeastern Illinois Planning Commission, biologists of the Metropolitan Sanitary District of Greater Chicago conducted an inventory of the fishes in a number of key rivers and streams in northeastern Illinois. Collections were made from 248 sites during the period April through December of 1976. Various methods were utilized, including boat and backpack electrofishing, seining, and dip-netting. Most of the quantitative fish population data utilized in the present report are those obtained during the Metropolitan Sanitary District of Greater Chicago inventory.

Fish collections were not taken from the watersheds of the Kankakee River, Kishwaukee River, and Virgil/Union Ditch during the Metropolitan Sanitary District of Greater Chicago 1976 inventory. Quantitative data for these areas were obtained from the Illinois Natural History Survey records. Fishery data for the Kankakee River were supplemented with collections by Westinghouse (1972-1973; 1974-1975). The Lake Michigan watershed was analyzed using the fishery data presented in Brigham (1976).

Non-quantitative data, involving the presence or absence of various fish species in each of the watersheds, were taken from Illinois Natural History Survey records. The Survey collections were secured from the designated sites throughout the watersheds during two time spans, 1876 through 1905 and post-1950.

All the fish species found in the area were evaluated according to the degree of habitat modification they could tolerate. Adaptable species which could survive in a degraded habitat were considered tolerant. The two other categories, moderately tolerant and intolerant, show decreasing amounts of adaptability. Pflieger (1975) and Smith (in press) provided life history data for these evaluations.

Water quality data necessary for the calculation of the bluegill toxicity units were obtained from the annual summaries of water quality data published by the Illinois Environmental Protection Agency (1976). The Illinois Environmental Protection Agency conducts water quality analyses at various locations throughout the study area. Samples are taken at no more than monthly intervals. Therefore, a yearly maximum of 12 samples can contribute to the reported mean values for each station. The number of water quality parameters measured from each sample varies. The 1976 mean values for the following parameters, when measured, were utilized in the present study: ammonia nitrogen, arsenic, boron, cadmium,

chromium (trivalent and hexavalent), copper, cyanide, dissolved oxygen, fluoride, hardness, iron (total), lead, manganese, mercury, methylene blue active substance (MBAS), nickel, nitrate and nitrite, pH, phenol, silver, temperature, and zinc. Frequently, hardness was not measured. As this parameter affects the toxicity of a number of other parameters, it was necessary to obtain hardness values for all of the watersheds. A program of limited water quality analysis was performed at various sites throughout the region as part of the 208 project. The hardness values obtained in these analyses, when applicable and necessary, were utilized in the present study. The mean values of all the stations measured in a watershed were utilized for those sites at which no hardness measurements were taken.

The Illinois Pollution Control Board General Use water quality standards were utilized for comparison throughout the study area. Although certain waterways in the Chicago area do not have to meet these standards, they do apply to the vast majority of the area. In addition, the water quality management planning (of which this report is a component) is likely to result in changes in water quality and water use. The General Use classification probably represents the maximum attainable water quality goals in those areas presently covered by the less restrictive Secondary Contact and Indigenous Aquatic Life standards. Thus, the General Use standards provide a useful basis for comparison of all sites and identify problems to be solved in the other streams.

Diversity and Equitability Indices

Diversity indices were used in evaluating the quality of the fish populations. The two components of species diversity, richness of species and distribution of individuals among the species, are incorporated in the Shannon-Weaver diversity function. The machine formula for this function presented by Lloyd, Zar, and Karr (1968) is:

$$\bar{d} = C/N \left(N \log_{10} N - \sum n_i \log_{10} n_i\right)$$

where $C = 3.321928$ (converts base 10 log to base 2); N = total number of individuals; and n_i = total number of individuals in the i^{th} species. Mean diversity as calculated above may range from zero to $3.321928 \log N$. Wilhm (1970) found in unpolluted waters $3 < \bar{d} < 4$, whereas in polluted water, $\bar{d} < 1$.

The species diversity index makes it possible to summarize large amounts of information about numbers and kinds of organisms. This index frequently provides little new information regarding biological communities. In fact, information frequently is lost through this "summarization" technique. Much of this difficulty arises from the indiscriminate use of the diversity index as an end unto itself rather than as an intermediate product within a larger set of calculations.

Equitability, a step further, is determined to evaluate the component of diversity due to the distribution of individuals among the species. The value is a comparison of the number of species (s) in the sample with the number of species expected (s') from a community which conforms to MacArthur's broken stick model (1957). The distribution resulting from the model is often observed in nature. It consists of a few relatively abundant species and increasing numbers of species represented by only a few individuals. The measure of equitibility is:

$$e = s'/s$$

where s = number of taxa in the sample, and s' = the tabulated value. The level usually ranges from 0 to 1 indicating the sample's relative equitability to the distribution of the MacArthur model. Levels sometimes exceed 1 when few specimens of several taxa are included in a sample. Hence, e improves with increasing sample size. In this study, collections containing fewer than 50 fishes were not amenable to unambiguous interpretation. U.S. Environmental Protection Agency biologists (Weber, 1973) found in polluted water $0.6 < e < 0.8$, whereas in unpolluted waters, $0.0 < e < 0.3$. Many high quality environments, such as trout streams, do not conform to the balanced MacArthur distribution, but show a few abundant species. Thus, equitibility of these populations will be low, implying incorrectly a poor environment. The key is not to assign meaning to arbitrary values of equitability, but to use equitability as a means of comparing a series of populations relative to a common population, here the theoretical MacArthur model.

Bluegill Toxicity Index

The Bluegill Toxicity Index (Lubinski and Sparks, 1974; Sparks, pers. comm.) is a measure of water conditions relative to sustaining a healthy population of bluegill. The index reflects the concentrations of 19 toxicants. A solution having a toxicity of 1.0 BGTU (Bluegill Toxicity Unit) was defined as being lethal to 50 percent of the bluegills exposed to it for 96 hours. The component toxicities are decimal fractions of the 96 hour LC 50 for each of the toxicants. The lethal effect of all the toxicants is assumed to be additive, and the component toxicities are summed to produce a toxicity index for each sampling site. The chemical forms and associated toxicities of many of these pollutants are modified by factors such as dissolved oxygen, pH, hardness, and temperature. Corrections for these factors were included when such modifications were appropriate.

Experience of British aquatic biologists has shown that index values exceeding 0.200 indicate conditions are not suitable for the maintenance of a diverse fishery (Herbert *et. al*, 1965). A larger index value indicated more degraded conditions. Pollutants contributing component toxicity units of 0.100 and greater were considered significant. Some pollutants were never detected in the watersheds. Others were present but in such low concentrations that they did not contribute to the rounded-off toxicity value.

Maps

The fishery, water quality, and demographic information was synthesized to produce contour maps of the habitat quality provided in each basin. The ratings were based primarily on the abundance, composition, and diversity of the fish population and the water quality data (such as Bluegill Toxicity Indices). A rating of high quality signifies that the stream has undergone little modification from its original condition. Good, fair, and poor represent successive steps of increasing habitat degradation.

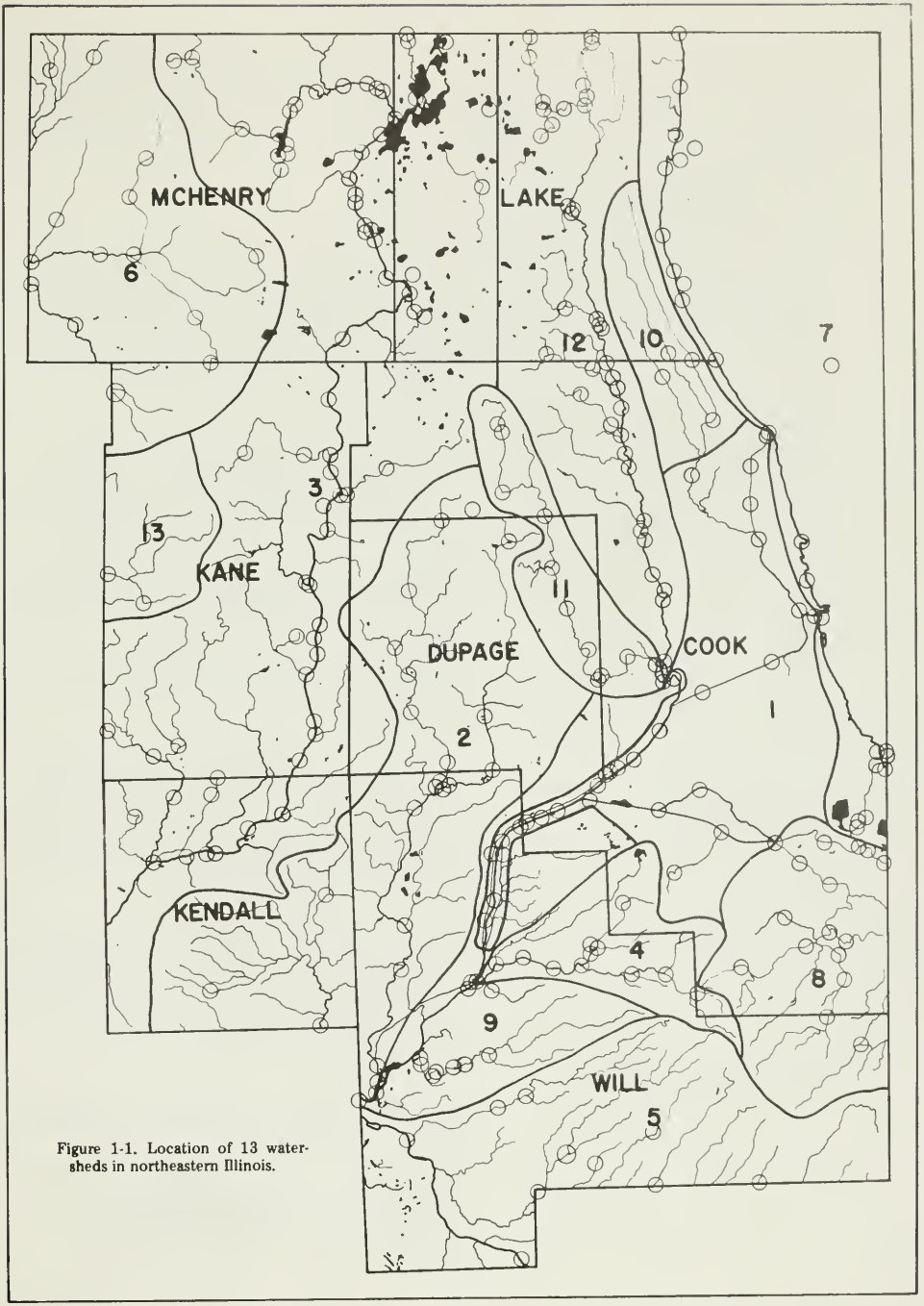


Figure 1-1. Location of 13 watersheds in northeastern Illinois.

Table 1-1. Description of the 13 watersheds in the seven northeastern counties of Illinois.

Watershed	Location
1. Chicago River/Sanitary and Ship Canal	Includes North Branch of the Chicago River south of Touhy Avenue, North Shore Channel, Chicago River, Chicago Sanitary and Ship Canal, Calumet-Sag Channel, and their tributaries contained in Cook, DuPage, and Will Counties.
2. DuPage River	Includes the DuPage River (West and East Branches) and their tributaries contained in DuPage County and northwestern Will County.
3. Fox River	Includes the Fox River and its tributaries contained in Lake, McHenry, Kane, Cook, DuPage, and Kendall Counties.
4. Hickory Creek	Includes Hickory Creek and its tributaries contained in Will and Cook Counties.
5. Kankakee River	Includes the Kankakee River and its tributaries contained in Will County.
6. Kishwaukee River	Includes those parts of the Kishwaukee River, Piscasaw and Cook Creeks, and their tributaries contained in western McHenry and Kane Counties.
7. Lake Michigan	Includes those portions of Lake Michigan adjacent to Lake and Cook Counties, Lake Calumet, Wolf Lake, Calumet River north of O'Brien Locks, and all their tributaries contained in Lake and Cook Counties.
8. Little Calumet River	Includes the Little Calumet River and its tributaries contained in southern Cook and Will Counties.
9. Lower Des Plaines River	Includes the Des Plaines River and its tributaries south of Riverside contained in Cook, DuPage, and Will Counties.

Table 1-1. Completed.

10.	North Branch Chicago River	Includes the Skokie River, the Middle Fork and West Fork of the North Branch of the Chicago River and their tributaries down to Touhy Avenue contained in northeast Cook County and eastern Lake County.
11.	Salt Creek	Includes Salt Creek and its tributaries contained in eastern DuPage County and north and central Cook County.
12.	Upper Des Plaines River	Includes the Des Plaines River and its tributaries north of Riverside contained in Lake and Cook Counties.
13.	Virgil/Union Drainage Ditch	Includes Virgil/Union Drainage Ditch No. 3 and its tributaries contained in Kane County.

CHAPTER TWO: CHICAGO RIVER/SANITARY AND SHIP CANAL BASIN

LOCATION AND BASIN MORPHOMETRY

The watershed investigated includes the Chicago River south of Touhy Avenue, Niles, the North Shore Channel, the Chicago Sanitary and Ship Canal, and the Calumet-Sag Channel. This area is located in Cook, DuPage, and Will Counties (Fig. 2-1). The general flow of the waterway is southwesterly. The watershed provides a drainage for 209,790 ha of Chicago and its suburbs. Water is diverted from Lake Michigan into this drainage system at three sites: at the Wilmette control structure into the North Shore Channel; at the Chicago River Lock into the Chicago River, reversing its flow; and at O'Brien Lock into the Calumet River, reversing its flow.

The largest streams reach order 5 prior to their confluence with the Des Plaines River. The drainage pattern is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The streams are slightly underdeveloped at the order 1 and 3 levels and overdeveloped at the order 2 and especially the order 4 and 5 levels. Morphometric data are summarized in Table 2-1.

Table 2-1. Summary of Morphometric Data, Calumet-Sag Channel, Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel.

Order	Number Links	Mean Length (km)	Total Length (km)
1	31	2.90	89.8
2	17	1.61	27.4
3	7	8.66	60.6
4	3	3.00	36.0
5	8	4.47	35.8
			Total = 249.6

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago 1976 inventory included fish collections from 20 locations in this basin. Sites were located on the Chicago River, North and South Branches of the Chicago River, North Shore Channel, Chicago Sanitary and Ship Canal, an

unnamed tributary to the Chicago Sanitary and Ship Canal, Calumet-Sag Channel, Tinley Creek, Mill Creek, and Stony Creek (Table 2-2; Fig. 2-2). Unsuccessful attempts to collect fish were made at five of the stations. Station 68 was sampled seven times and only two of these collections succeeded in securing fishes. Station 50 was sampled three times, and Station 59 was sampled twice. Only one collection at each of these two sites was successful in securing fishes. No fish were taken from Stations 54 and 56 in spite of three and two attempts.

The Illinois Natural History Survey records indicate that 37 species of fish and the carp x goldfish hybrid should be present in this watershed (Table 2-3). The 1976 inventory included 25 of these fish species and the carp x goldfish hybrid (Table 2-4). In addition, green sunfish x pumpkinseed hybrids were secured from three sites. Eight of the species not included in the 1976 inventory have only been taken from this watershed prior to 1905.

A total of 997 fishes was collected from the Chicago River watershed. Goldfish, an extremely tolerant species, was the most abundant species, representing 17% of the total. Tolerant species made up 60% of the total species list. The remaining 40% was equally divided between moderately tolerant and intolerant species. The intolerant species, which represented 16% of the total fishes collected, were collected primarily near the points of diversion from Lake Michigan.

Fishery quality in the watershed ranged from good to poor. Most of the collections from this area contained few species of fish, and these were taken in limited numbers. The two stations on the North Branch (Stations 54 and 56) were sampled repeatedly, but fish were never secured. Water from Lake Michigan is diverted into the North Shore Channel and Chicago River. Fishery quality was influenced greatly by the lake at the first inland stations on each waterway. Equitability and species diversity values at these sites were high. Yet, the influence of the lake was rapidly eliminated, and a degraded fishery of tolerant species remained. Alewife did persist downstream in the Chicago Sanitary and Ship Canal to Station 48. The remainder of the collection taken from this site and all the other sites on the canal consisted of tolerant species. A collection from the Calumet-Sag Channel also contained an alewife, which probably gained access to the watershed through the O'Brien Locks. Collections from the Calumet-Sag Channel also were extremely poor, with two collections in the channel resulting in only six fish. Collections from the Calumet-Sag Channel tributaries, Tinley Creek and Stony Creek, were slightly more diverse but consisted entirely of fishes showing some degree of ecological tolerance. The limited collection secured from Mill Creek most likely was due to the collecting method.

SUMMARY OF WATER QUALITY DATA

The Chicago River/Sanitary and Ship Canal watershed contained 23 Illinois Environmental Protection Agency water quality analysis sites (Table 2-5; Fig. 2-3). Values for all the parameters needed in the toxicity index

calculations were available, with the following exceptions. Samples from station GI08 were not analyzed for 17 parameters needed in the toxicity calculations. MBAS was not measured at station H01. Hardness values were taken from the Metropolitan Sanitary District of Greater Chicago water analysis data.

All the toxicity parameters were detected in the watershed. Arsenic, boron, cadmium, chromium (trivalent and hexavalent), and mercury were present but at concentrations which were so low that they had no effect on the toxicity index after the index was rounded to three decimal places. Significant concentrations of ammonia nitrogen, cyanide, iron (total), MBAS, and silver resulted in 19 stations exceeding the maximum toxicity level (Table 2-6). Ammonia nitrogen was a significant contributor to the toxicity indices of 17 stations. Cyanide and MBAS each contributed significantly at five stations. Silver (3 stations) and iron (total) (one station) were less frequently encountered. The concentration of copper, an insignificant contributor to the index, exceeded Illinois Pollution Control Board standards at 21 sites. Ammonia nitrogen levels exceeded the standard at 18 sites (Table 2-7). The concentrations of lead and iron (total) either met or exceeded the standards at four sites. Two stations had cyanide concentrations greater than the standard. Fluoride, mercury, and phenol exceeded standards at one site each.

The water quality of the watershed was extremely poor. Only four sites had toxicity indices below the maximum level of 0.2. Two of these sites, HCCA01 and HCB02, were located at the points of diversion of water from Lake Michigan. This accounts for the good water quality in these areas. The other stations, HCC07 and HCC01, were located on the North Branch.

CONCLUSIONS

Conditions throughout the Chicago River/Sanitary and Ship Canal watershed are degraded. Fish were never taken from the North Branch of the Chicago River in spite of the water quality in the upper portion of the river being favorable to a diverse fishery. The North Shore Channel and Chicago River contain diverse fisheries and good water quality only in those areas dominated by diverted Lake Michigan water. Conditions in those areas deteriorated as this water moved inland. All water quality analyses performed on the Chicago Sanitary and Ship Canal indicated that toxic conditions dominated the waterway. Collections from this area included primarily tolerant fish species. Toxic conditions and poor fisheries also dominated the Calumet-Sag Channel. The tributaries to this waterway contain fair fisheries. Water quality analyses were not performed on these streams.

High concentrations of ammonia nitrogen, cyanide, iron (total), MBAS, and silver resulted in toxic conditions at 83% of the stations in this watershed. Ammonia nitrogen levels were toxic at 74% of the sites, making it the pollutant having the greatest effect on toxicity calculations for this watershed. Figure 2-4 illustrates these conclusions.

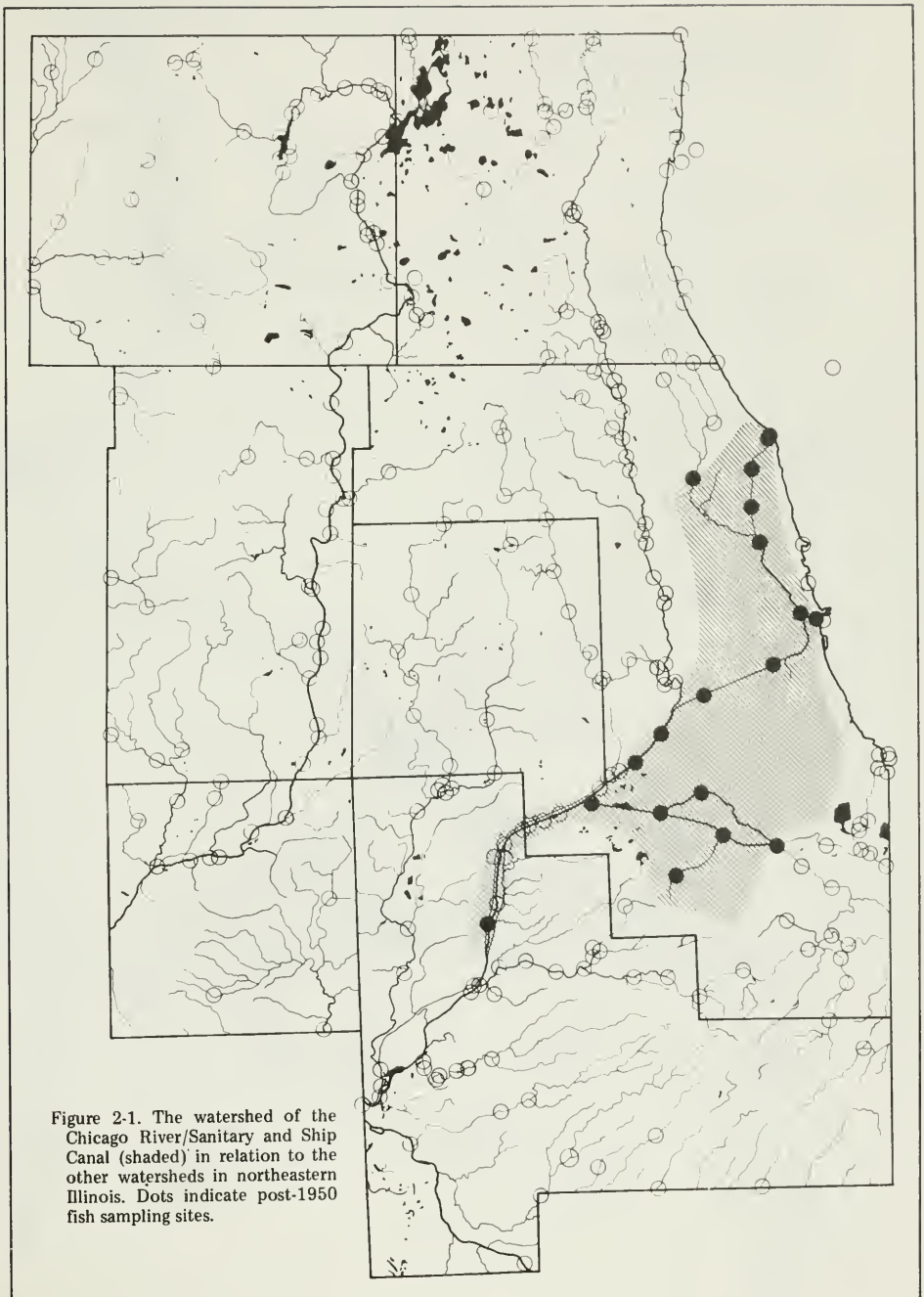


Figure 2-1. The watershed of the Chicago River/Sanitary and Ship Canal (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 2-2. Chicago River/Sanitary and Ship Canal Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

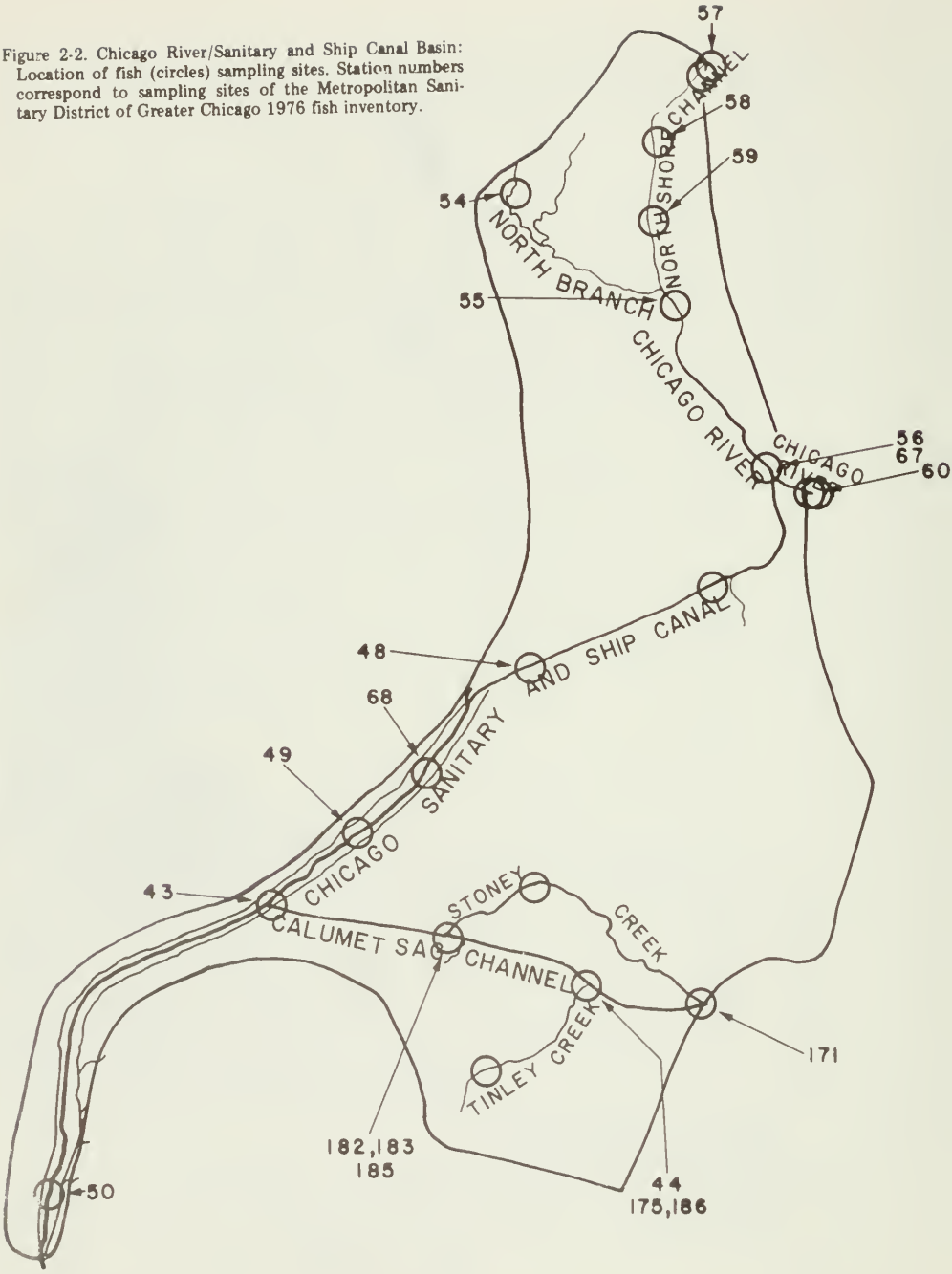


Figure 2-3. Chicago River/Sanitary and Ship Canal Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

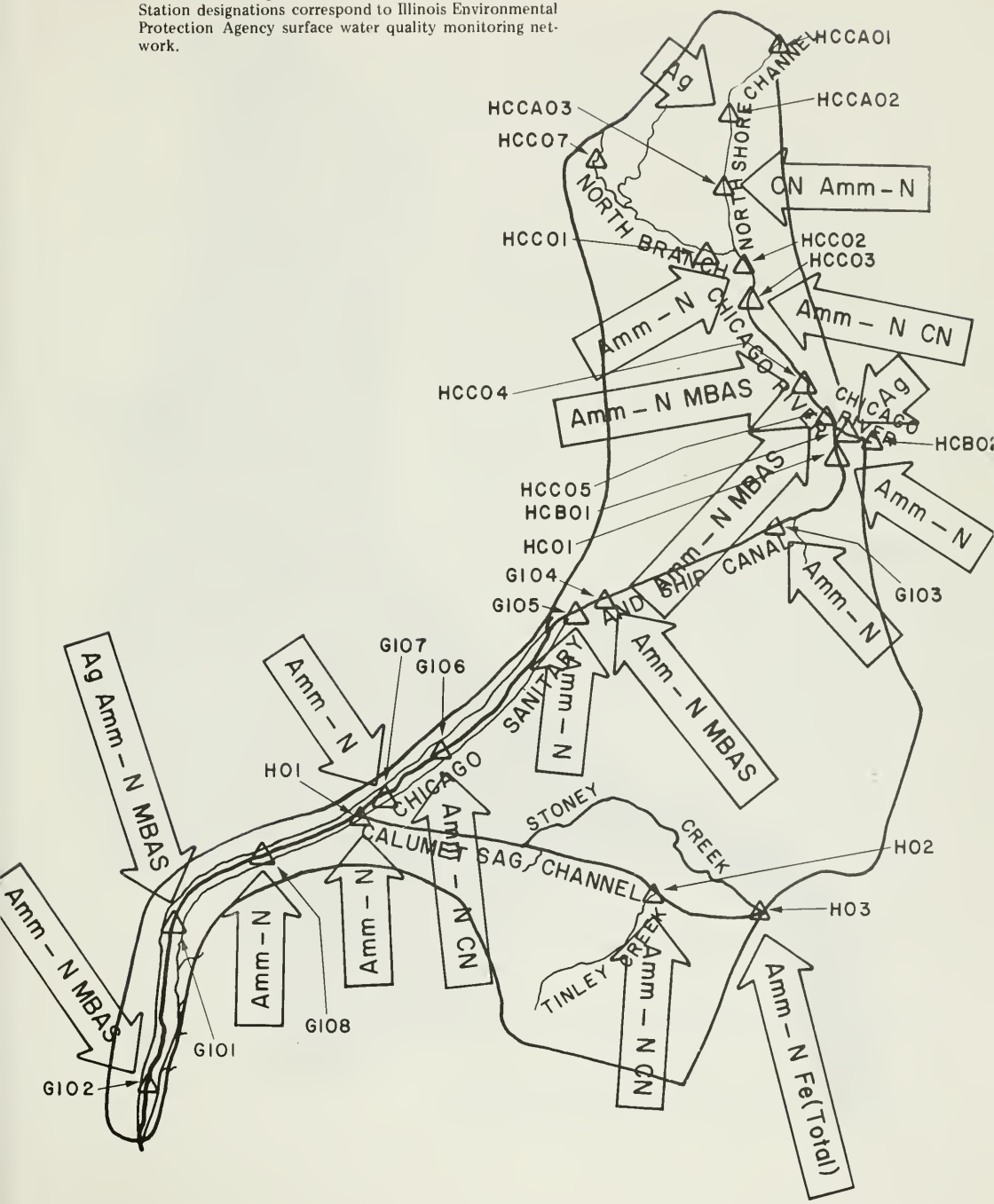


Figure 2-4. Chicago River Sanitary and Ship Canal Basin: Summary of environmental quality

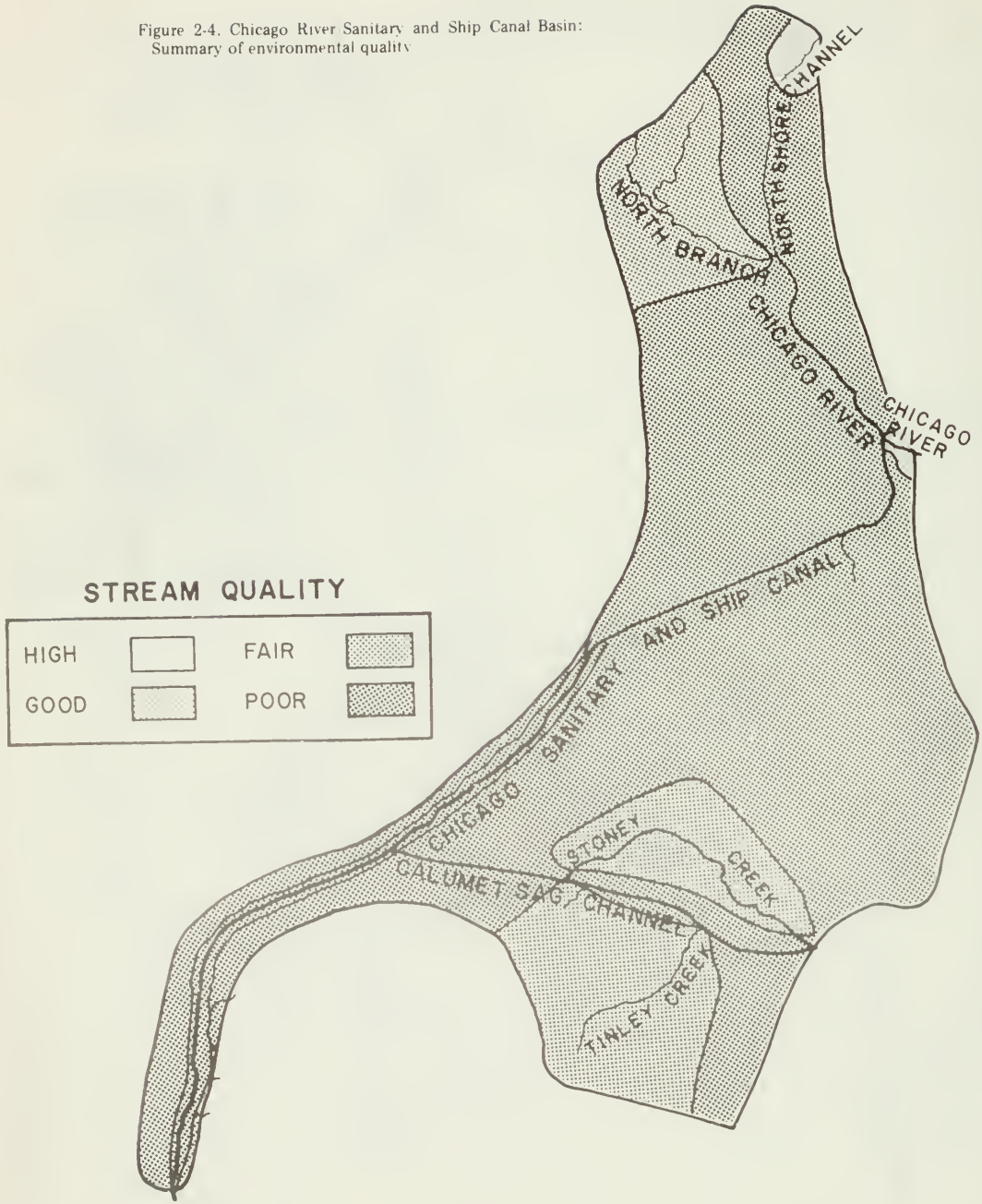


Table 2-2. Location of MSDGC 1976 Fish Sampling Sites, Calumet-Sag Channel, Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel Basins.

Number	Station	Location
43	Calumet-Sag Channel	T37N/R 11E/S 14NE; Cook Co.; 400 meters above RT 83, Sag Bridge, Lemont.
44	Calumet-Sag Channel	T37N/R 13E/S 33NE; Cook Co.; 400 meters below Cicero Avenue.
48	Chicago Sanitary and Ship Canal	T38N/R 13E/S 3NW; Cook Co.; 400 meters above Cicero Avenue, Chicago.
49	Chicago Sanitary and Ship Canal	T38N/R 12E/S 32SE; Cook Co.; 400 meters above Willow Springs RD (Wentworth Ave), Willow Springs.
50	Chicago Sanitary and Ship Canal	T36N/R 10E/S 22SE; Will Co.; downstream of 16th ST, Lockport.
54	North Branch, Chicago River	T41N/R 12E/S 30SE; Cook Co.; Touhy Avenue, Niles.
55	North Branch, Chicago River	T40N/R 13E/S 13NE; Cook Co.; between Montrose and Wilson Avenues, Chicago.
56	North Branch, Chicago River	T39N/R 14E/S 9NW; Cook Co.; 400 meters upstream of Grand Avenue, Chicago.
57	North Shore Channel	T42N/R 13E/S 35NW; Cook Co.; from Maple Ave to sluice gate below Sheridan RD, Wilmette.
58	North Shore Channel	T41N/R 13E/S 14SE; Cook Co.; 400 meters above Dempster ST, Skokie.
59	North Shore Channel	T41N/R 13E/S 35SE; Cook Co.; 400 meters above Devon Avenue, Lincolnwood.
60	Chicago River	T39N/R 14E/S 10SE; Cook Co.; Outer Drive Locks, Chicago Loop, Chicago.
67	North & South BR, Chicago River	T39N/R 14E/S 9SW; Cook Co.; Chicago Loop, from Kinzie ST downstream to Randolph ST, Chicago.
68	Tributary to Chicago Sanitary and Ship Canal	T37N/R 12E/S 22SE; Cook Co.; mouth of tributary with Chicago Sanitary and Ship Canal, downstream of Argo Shell Plant, Justice.
		T37N/R 12E/S 22SE; Cook Co.; 100 meters above mouth with Chicago Sanitary and Ship Canal, Argo Shell Plant, Justice.

Table 2-2. Completed.

Number	Station	Location
171	Calumet-Sag Channel	T37N/R 14E/S 3SE; Cook Co.; 400 meters downstream (west) of Ashland AVE, Blue Island.
175	Tinley Creek	T37N/R 13E/S 33NW; Cook Co.; mouth of Tinley Creek with Calumet-Sag Channel, Crestwood.
182	Stony Creek	T37N/R 12E/S 22NE; Cook Co.; 100 meters above mouth with Calumet-Sag Channel, Palos Hills.
183	Stony Creek	T37N/R 12E/S 22NE; Cook Co.; mouth of Stony Creek with Calumet-Sag Channel, Palos Hills.
185	Mill Creek	T37N/R 12E/S 22NW; Cook Co.; mouth of Mill Creek with Calumet-Sag Channel, Palos Hills.
186	Tinley Creek	T37N/R 13E/S 33NW; Cook Co.; 100-145 meters above mouth with Calumet-Sag Channel, Crestwood.

Table 2-3. Checklist of Fishes Known to Occur in the Calumet-Sag Channel, Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel Basin.

Clupeiformes

Clupeidae - Herrings

Alosa pseudoharengus (Wilson)
Alewife

Dorosoma cepedianum (Lesueur)
Gizzard shad

Salmoniformes

Salmonidae - Trouts

Oncorhynchus kisutch (Walbaum)
Coho salmon

Osmeridae - Smelts

Osmerus mordax (Mitchill)
Rainbow smelt

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Cypriniformes

Cyprinidae - Minnows and Carps

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Hybognathus nuchalis Agassiz
Silvery minnow

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis hudsonius (Clinton)
Spottail shiner

Table 2-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Notropis stramineus (Cope)
Sand shiner

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Rhinichthys cataractae (Valenciennes)
Longnose dace

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus punctatus (Rafinesque)
Channel catfish

Percopsiformes

Percopsidae - Trout-perches

Percopsis omiscomaycus (Walbaum)
Trout-perch

Table 2-3. Continued.

Gadiformes

Gadidae - Codfishes

Lota lota (Linnaeus)
Burbot

Gasterosteiformes

Gasterosteidae - Sticklebacks

Pungitius pungitius (Linnaeus)
Ninespine stickleback

Perciformes

Percichthyidae - Temperate basses

Morone chrysops (Rafinesque)
White bass

Morone mississippiensis Jordan & Eigenmann
Yellow bass

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis annularis Rafinesque
White crappie

Pomoxis nigromaculatus (Lesueur)
Black crappie

Table 2-3. Completed.

Perciformes (continued)

Percidae - Perches

Ethecstoma nigrum Rafinesque
Johnny darter

Perca flavescens (Mitchill)
Yellow perch

Sciaenidae - Drums

Aplodinotus grunniens Rafinesque
Freshwater drum

Cottidae - Sculpins

Cottus bairdi Girard
Mottled sculpin

Table 2-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Chicago River/Sanitary and Ship Canal Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS																		TOTAL NUMBER	% OF TOTAL
	57	58	59	55	67	60	48	68	49	171	44	186	175	182	183	185	43	50		
CLUPEIDAE																				
Alewife	41	--	--	--	11	36	2	--	--	1	--	--	--	--	--	--	--	--	91	9
Gizzard shad	--	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	--	--	3	<1
OSMERIDAE																				
Rainbow smelt	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	<1
UMBRIDAE																				
Central mudminnow	--	--	--	--	--	--	--	--	--	--	--	--	1	--	1	1	1	--	4	<1
CYPRINIDAE																				
Goldfish	18	6	--	1	12	18	7	11	1	--	12	--	10	17	15	--	1	38	167	17
Carp	12	3	2	--	10	9	3	1	1	--	10	--	6	11	17	1		15	101	10
Golden shiner	--	--	--	--	6	2	--	--	--	--	1	--	8	--	--	--	--	--	17	2
Emerald shiner	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	1	<1
Spottail shiner	2	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	<1
Sand shiner	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	1	<1
Bluntnose minnow	86	--	--	--	--	--	--	--	--	--	--	10	26	--	--	--	--	--	122	12
Fathead minnow	22	1	--	--	1	61	--	1	--	--	--	--	--	--	--	--	--	--	86	9
Creek chub	--	--	--	--	--	--	--	--	--	--	2	91	4	--	--	--	--	--	97	10
Carp x goldfish	7	--	--	7	3	1	4	--	--	--	--	--	1	1	4	--	--	6	34	3
CATOSTOMIDAE																				
White sucker	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--	--	3	<1
ICTALURIDAE																				
Black bullhead	--	--	--	1	--	1	--	1	--	--	3	--	--	2	5	2	--	4	19	2
Channel catfish	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1	<1
GASTEROSTEIDAE																				
Ninespine stickleback	2	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	4	<1
CENTRARCHIDAE																				
Rock bass	--	--	--	--	--	63	--	--	--	--	--	--	--	--	--	--	--	--	63	6
Green sunfish	14	--	--	--	--	3	--	20	--	--	25	4	21	5	3	--	--	--	95	10
Pumpkinseed	2	--	--	--	--	4	--	--	--	--	--	--	--	--	1	--	--	--	7	1
Orangespotted sunfish	24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	24	2
Bluegill	--	--	--	1	--	3	--	3	--	--	5	--	14	9	3	--	--	--	38	4
Largemouth bass	--	--	--	--	--	4	--	--	--	--	--	--	--	--	--	--	--	--	4	<1
Black crappie	--	--	--	1	--	1	1	--	--	--	--	--	1	1	--	--	--	1	6	1
Green sunfish x Pumpkinseed	2	--	--	--	--	--	--	--	--	--	1	--	--	--	1	--	--	--	4	<1
PERCIDAE																				
Yellow perch	1	--	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	1	<1
TOTAL NUMBER OF INDIVIDUALS	234	10	3	11	43	209	17	37	2	4	60	105	95	47	50	4	2	64	997	98
TOTAL NUMBER OF SPECIES	12	3	2	4	5	14	4	6	2	2	8	3	10	7	7	3	2	4	25	--
SPECIES DIVERSITY ($\bar{d}$)	2.83	1.30	0.92	1.67	2.30	2.65	2.06	1.72	1.00	0.81	2.40	0.68	2.85	2.37	2.50	1.50	1.00	1.60	--	--
EQUITABILITY (e)	0.7	1.0	1.0	0.8	1.2	0.6	1.0	0.7	1.0	1.0	0.8	0.7	0.9	0.9	0.9	1.3	1.0	0.8	--	--

Table 2-5. Location of 1976 IEPA Water Quality Sampling Sites, Calumet-Sag Channel, Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel Basin.

Basin Code	Station Number	Stream Name	Description
Sanitary & Ship Canal			
GI	01	San & Ship Canal	135th ST BR at Romeoville
GI	02	San & Ship Canal	Division ST BR at Lockport
GI	03	San & Ship Canal	Damen AVE BR
GI	04	San & Ship Canal	RT 50-Cicero AVE BR
GI	05	San & Ship Canal	RT 43-Harlem AVE BR
GI	06	San & Ship Canal	Wentworth AVE BR at Willow Springs
GI	07	San & Ship Canal	RT 83 BR E of Agronne National Lab
GI	08	San & Ship Canal	Stephen ST BR at Lemont
Calumet-Sag Channel			
H	01	Calumet-Sag C	RT 83 BR N of Sag Bridge
H	02	Calumet-Sag C	RT 50-Cicero AVE BR at Alsip
H	03	Calumet-Sag C	Ashland AVE BR at Blue Island
S. Branch Chicago River			
HC	01	S BR Chicago R	Van Buren ST BR
Chicago River			
HCB	01	Chicago River	Wells ST BR
HCB	02	Chicago River	US41-Lake Shore Drive BR
North Branch Chicago River			
HCC	01	N BR Chicago R	Kedzie AVE BR
HCC	02	N BR Chicago R	Wilson AVE BR
HCC	03	N BR Chicago R	Addison ST BR
HCC	04	N BR Chicago R	North AVE BR
HCC	05	N BR Chicago R	Kinzie ST BR
HCC	07	N BR Chicago R	Touhy AVE BR
North Shore Channel			
HCCA	01	North Shore CH	Linden AVE BR in Wilmette
HCCA	02	North Shore CH	Oakton ST BR at E edge Skokie
HCCA	03	North Shore CH	Touhy Ave BR DS from N side STP

Table 2-6. Bluegill Toxicity Indices, Calumet-Sag Channel, Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel Basin. (Derived from mean values of 1976 Environmental Protection Agency data.)

	Station	BGTU
North Branch Chicago River	HCC07	0.138
	HCC01	0.153
North Shore Channel	HCCA01	0.038
	HCCA02	0.959
	HCCA03	0.373
North Branch Chicago River	HCC02	0.341
	HCC03	0.455
	HCC04	0.467
	HCC05	1.369
Chicago River	HCB02	0.028
	HCB01	0.843
Sanitary & Ship Canal	HC01	0.258
	GI03	0.312
	GI04	0.437
	GI05	0.318
	GI06	0.398
	GI07	0.517
Calumet-Sag Channel	H03	0.757
	H02	0.895
	H01	0.351
Sanitary & Ship Canal	GI08	0.563
	GI01	1.710
	GI02	0.679

Table 2-7. Summary, 1976 IEPA Water Quality Data, Calumet-Sag Channel, the Chicago River, Chicago Sanitary and Ship Canal, North and South Branches of the Chicago River, and the North Shore Channel Basin. (Maximum, minimum, mean, and number of analyses [in parentheses] for parameters [based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976] contributing significantly to the BGTU.)

IEPA Station	Amm-N (mg l^{-})	CN (mg l^{-})	Fe Total (mg l^{-})	MBAS (mg l^{-})	Ag (mg l^{-})
North Branch Chicago River					
HCC07	2.60 - 10.00	.010 - .010	.3 - 1.0	.60 - .60	.000 - .000
	7.67 (7)	.010 (3)	.5 (3)	.60 (1)	.000 (3)
HCC01	.00 - 4.20	.000 - .000	.3 - .5	.60 - 1.00	.000 - .000
	1.65 (8)	.000 (3)	.4 (3)	.80 (2)	.000 (3)
HCC02	1.70 - 11.00	.010 - .020	.1 - .3	.60 - .60	.000 - .000
	6.43 (8)	.013 (3)	.2 (3)	.60 (1)	.000 (3)
HCC03	2.20 - 12.00	.010 - .020	.2 - .4	1.00 - 1.00	.000 - .000
	7.21 (8)	.015 (2)	.3 (2)	1.00 (1)	.000 (2)
HCC04	3.00 - 10.00	.000 - .010	.2 - .4	.80 - .90	.000 - .000
	6.93 (8)	.003 (3)	.2 (3)	.85 (2)	.000 (3)
HCC05	2.60 - 10.00	.010 - .010	.3 - 1.0	.60 - .60	.000 - .000
	7.67 (7)	.010 (3)	.5 (3)	.60 (1)	.000 (3)
North Shore Channel					
HCCA01	.05 - .14	.000 - .000	.3 - .8	.10 - .20	.000 - .000
	.08 (7)	.000 (3)	.5 (3)	.15 (2)	.000 (3)
HCCA02	.11 - 2.40	.000 - .020	.5 - 1.8	.20 - .20	.000 - .010
	.92 (8)	.010 (3)	1.0 (3)	.20 (1)	.003 (3)
HCCA03	1.40 - 9.20	.020 - .020	.1 - .2	.80 - .80	.000 - .000
	5.45 (8)	.020 (2)	.1 (2)	.80 (1)	.000 (2)
Chicago River					
HCB01	.01 - 3.40	.000 - .010	.2 - .2	.20 - .20	.000 - .010
	.70 (8)	.003 (3)	.2 (3)	.20 (1)	.000 (2)
HCB02	.00 - .17	.000 - .000	.1 - .2	.20 - .20	.000 - .000
	.06 (7)	.000 (2)	.1 (2)	.20 (1)	.000 (2)
South Branch Chicago River					
HC01	.62 - 9.00	.010 - .010	.3 - .4	.40 - .40	.000 - .000
	4.20 (7)	.010 (3)	.3 (2)	.40 (1)	.000 (2)
Sanitary and Ship Canal					
GI03	1.30 - 6.40	.000 - .010	.3 - .6	.60 - .80	.000 - .000
	3.58 (8)	.007 (3)	.4 (3)	.70 (2)	.000 (3)
GI04	1.80 - 5.80	.000 - .010	.7 - 1.0	.90 - .90	.000 - .000
	3.81 (9)	.007 (3)	.8 (3)	.90 (1)	.000 (3)
GI05	2.10 - 5.40	.000 - .010	.4 - .7	.80 - .80	.000 - .000
	3.17 (9)	.007 (3)	.5 (3)	.80 (1)	.000 (3)
GI06	2.60 - 4.70	.010 - .020	.4 - .7	.70 - .70	.000 - .000
	3.45 (8)	.013 (3)	.5 (3)	.70 (1)	.000 (3)
GI07	1.80 - 13.00	.000 - .010	.3 - 1.0	.60 - .60	.000 - .000
	5.15 (9)	.007 (3)	.6 (3)	.60 (1)	.000 (3)
GI08	1.60 - 7.80	--	--	--	--
	4.42 (7)	--	--	--	--
GI01	1.60 - 8.00	.000 - .020	.4 - 2.3	.60 - .70	.000 - .010
	4.30 (7)	.010 (3)	1.1 (3)	.65 (2)	.003 (2)
GI02	1.80 - 8.20	.000 - .010	.4 - .6	.50 - .50	.000 - .000
	4.42 (7)	.005 (2)	.5 (2)	.50 (1)	.000 (2)
Calumet-Sag Channel					
H01	.04 - 10.00	.000 - .000	.6 - .6	--	.000 - .000
	4.59 (8)	.000 (1)	.6 (1)	--	.000 (1)
H02	2.10 - 12.00	.010 - .040	1.3 - 2.4	.50 - .60	.000 - .000
	7.75 (6)	.027 (4)	1.7 (3)	.55 (2)	.000 (3)
H03	2.00 - 12.00	.020 - .040	.5 - 11.0	.40 - .40	.000 - .000
	7.35 (7)	.027 (3)	4.1 (3)	.40 (1)	.000 (3)
IPCB STANDARDS	1.50	0.025	1.0	--	.005

CHAPTER THREE: DUPAGE RIVER

LOCATION AND BASIN MORPHOMETRY

The DuPage River basin is located in Cook, DuPage, and Will Counties, Illinois (Fig. 3-1), and runs 117 km in a southerly direction, draining an area of approximately 91,427 ha.

The main branch of the DuPage River originates at the confluence of the East and West Branches, about 2.5 km south of the DuPage-Will County line. It empties into the Des Plaines River near Channahon.

The East Branch of the DuPage River is a low-gradient stream (0.74 m km^{-1}). It has essentially become a storm water drain and a waste treatment plant effluent carrier for its surrounding communities. There are approximately a dozen sewage treatment plants which discharge into the East Branch.

The West Branch of the DuPage River also is a low-gradient stream (0.96 m km^{-1}). It drains agricultural land, plus extensive urbanized areas with numerous waste treatment plants. The West Branch flows through an intermorainal valley lying between the Minooka and Valparaiso moraines.

The DuPage River is an order 4 stream at its confluence with the Des Plaines River. The drainage pattern is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The DuPage River is slightly underdeveloped at the order 1 and 2 levels and overdeveloped at the order 3 and 4 levels. It never reaches the potential order 8 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 3-1.

Table 3-1. Summary of Morphometric Data, DuPage River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	127	1.82	230.98
2	61	1.86	113.27
3	45	1.68	75.67
4	19	2.19	41.63
			Total = 461.55

The soils of the DuPage River watershed are developed from the glacial drift deposited by the late Wisconsin glaciation. Major soil associations present are:

1) Drummer - Brenton - Proctor
2) Saybrook - Lisbon - Drummer
3) Zurich - Wauconda
4) Miami - Strawr
5) Lorenzo - Warsaw - Wea
6) Rodman - Casco - Fox
7) Sawmill - Lawson - Warsaw
8) Morley - Blount
9) Elliott - Ashkum - Varna
10) Toledo - Milford - Martinton
11) Elliott - Beecher - Markham
12) Bryce - Swygert - Frankfort

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago secured fishes from 15 sites along the DuPage River. The West and East branches of the DuPage each were sampled at two locations. The remaining sites were located on the main branch of the river and its tributaries (Table 3-2; Fig. 3-2). The river is known to have contained 54 species of fish and carp x goldfish hybrids (Table 3-3). The 1976 Metropolitan Sanitary District of Greater Chicago collection included 37 species of fish and four hybrids (Table 3-4). The hybrids were carp x goldfish, green sunfish x pumpkinseed, green sunfish x longear, and pumpkinseed x bluegill. Thirteen of the 17 fish species not included in the 1976 collection were taken only in collections made before 1905. The majority of the species remaining in the river are considered to have some tolerance to habitat abuse. Seven of the species currently found in the DuPage River are considered intolerant to habitat abuse. However, these intolerant fish represent only 4% of the total number of fish collected in the watershed. The most abundant species collected were green sunfish (a tolerant species), bluntnose minnow (a tolerant species), and spotfin shiner (a moderately tolerant species), which together represented 56% of the total number of fishes.

Throughout its length, the East Branch of the DuPage River contained few species of fish in small numbers. The headwaters of the West Branch also contained a poor quality fishery, but this reach of the river improved downstream. At the confluence of the two arms, the West Branch contained more species in numbers indicative of improved environmental conditions.

The tributaries of the DuPage River in which collections were taken illustrate their positive effect on the river's fish population. Lilly Cache Creek and Hammel Creek sustain species expected in streams which have undergone little degradation. The similar diversity and equitability values for these areas are further proof of this condition. The low number of fishes collected from Station 136 and 137 may have resulted from inadequate collecting methods, since other collections in the immediate area, Hammel Creek for example, included many species. Fishery quality remained good throughout the river south of Lilly Cache Creek with only a slight degrading influence from the Des Plaines River.

SUMMARY OF WATER QUALITY DATA

The DuPage River drainage system contained 30 Illinois Environmental Protection Agency water quality sites (Table 3-5; Fig. 3-3). The Illinois Environmental Protection Agency had not analyzed for hardness at any of these sites in 1976. Also, eight sites were not analyzed for 16 or more parameters needed in the toxicity calculations. Two additional stations were not analyzed for MBAS. Toxicity index calculations indicated 10 stations having indices greater than 0.2 (Table 3-6). High ammonia nitrogen concentrations caused these values at the majority of the stations. Mercury and nickel were never detected in this system. Concentrations of arsenic, boron, cadmium, and chromium (trivalent and hexavalent) were present, yet they did not contribute to the Bluegill Toxicity Units when rounded to the third decimal place. Those parameters which significantly contributed to the toxicity value were ammonia nitrogen, cyanide, and silver. Mean ammonia nitrogen values exceeded the Illinois Pollution Control Board standard at 15 stations (Table 3-7). Cyanide never exceeded the Illinois Pollution Control Board standard, and silver exceeded the standard only at one station. At all the sites where copper was measured, the concentration equalled or exceeded the standard, yet it never contributed significantly to the toxicity index. Two other parameters, insignificant to the toxicity index, lead and fluoride, exceeded the Illinois Pollution Control Board standards at a few sites.

The East Branch of the DuPage River contained toxic concentrations of ammonia nitrogen throughout most of its length. Extreme conditions existed at the Lisle station (GBL05) where not only high ammonia nitrogen concentrations were encountered, but also significant concentrations of cyanide and silver. Two additional sites had high concentrations of MBAS. Water quality was not monitored extensively at the most downstream site of this arm. In spite of this, ammonia nitrogen concentrations were sufficiently high as to yield a high toxicity index.

The West Branch of the DuPage River receives toxic ammonia nitrogen concentrations at its extreme headwaters. Water quality improves when Kress Creek joins with the West Branch. Kress Creek also receives an initial toxic ammonia nitrogen concentration, but rapidly recovers. The next tributary to enter the West Branch, Spring Brook, was not totally analyzed by the Illinois Environmental Protection Agency. Yet, those parameters that were measured indicated toxic ammonia nitrogen concentrations. The toxic conditions in this tributary dominated the river's quality through the next two downstream sampling sites. The second station downstream was not totally monitored, but significantly high ammonia nitrogen levels were recorded.

Water quality improved in the remaining stretch of the West Branch. Only one toxic input was recorded in this area. A toxic concentration of cyanide was detected in one sample from station GBK02.

The water quality of the main channel of the DuPage River resulted from the poor conditions present in the East Branch and the fair but improving conditions in the West Branch. The main channel continued to improve downstream primarily due to the many unaltered tributaries which flow into the river along the remainder of its length.

CONCLUSIONS

The upper branches of the DuPage River are in a degraded condition. Water quality analyses indicate extremely high concentrations of ammonia nitrogen on both arms. This condition was usually encountered at a station in close proximity to a municipal wastewater treatment plant. Fish populations reflected the conditions, in that the abundance of fishes and the number of species were low. The main channel of the DuPage River, which results from the confluence of the two branches, originated with a high ammonia nitrogen concentration from the East Branch. Water quality improved downstream primarily due to the large number of tributaries entering the river. Lilly Cache Creek, one of these tributaries, originates in an urban area and flows south receiving water from several lakes and flooded gravel pits which greatly enhanced the creek's water quality upstream from its confluence with the river. Favorable water quality conditions prevailed through the remainder of the river's length. Environmental quality deteriorated slightly at the river's mouth due to the influence of the Illinois and Michigan canal and the Des Plaines River. A synthesis of this information is expressed on Figure 3-4.

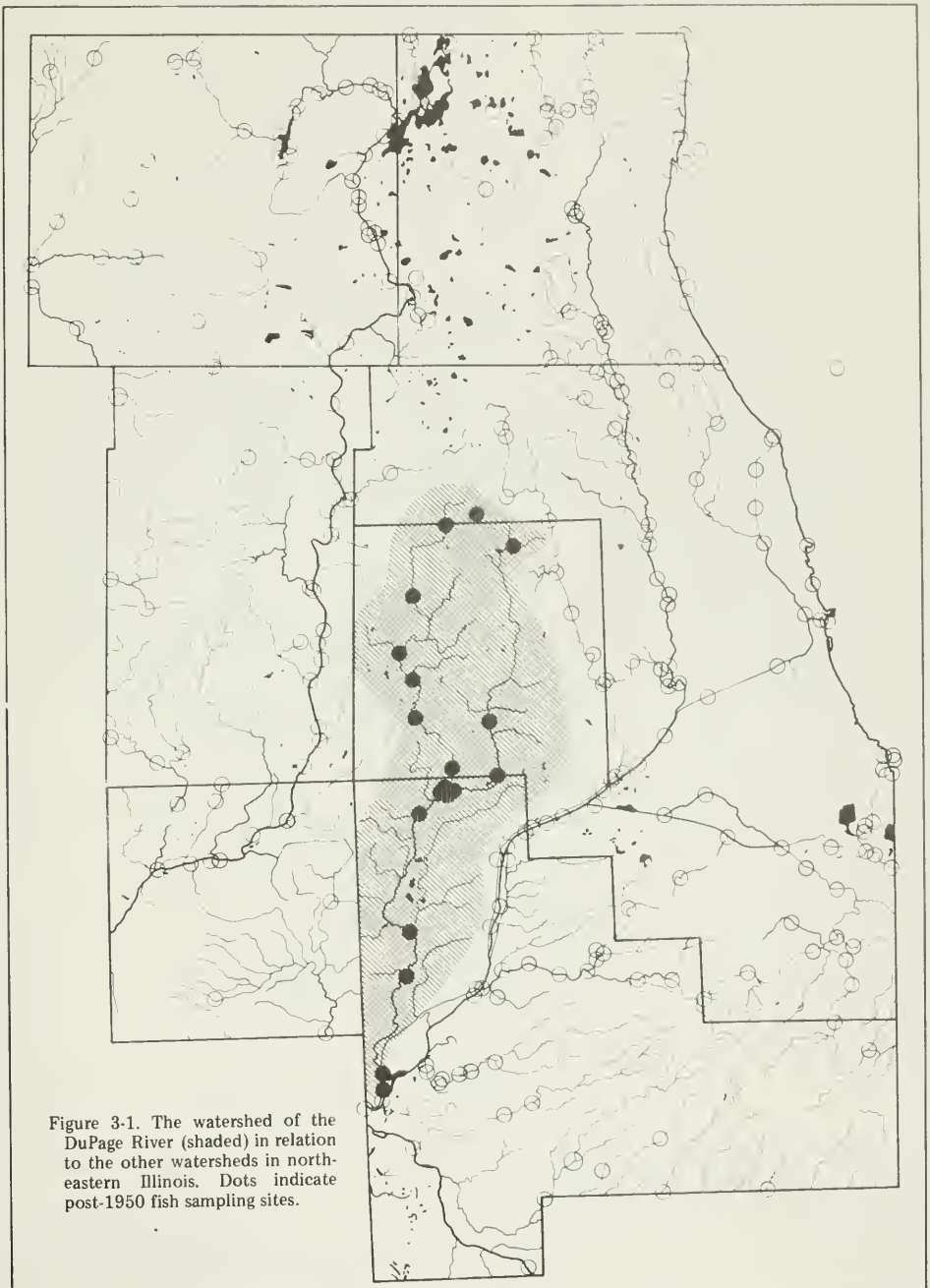


Figure 3-1. The watershed of the DuPage River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

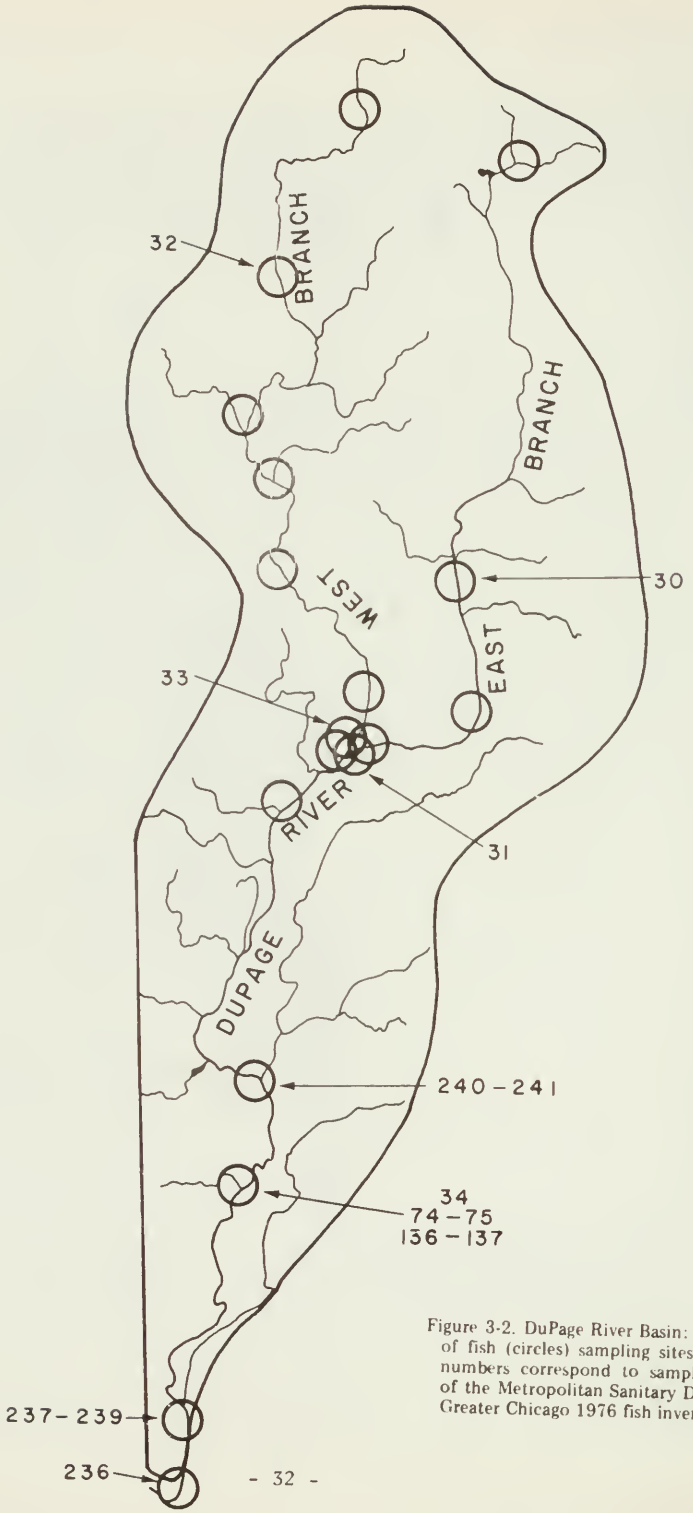


Figure 3-2. DuPage River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

Figure 3-3. DuPage River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

Figure 3-4. DuPage River Basin: Summary of environmental quality.

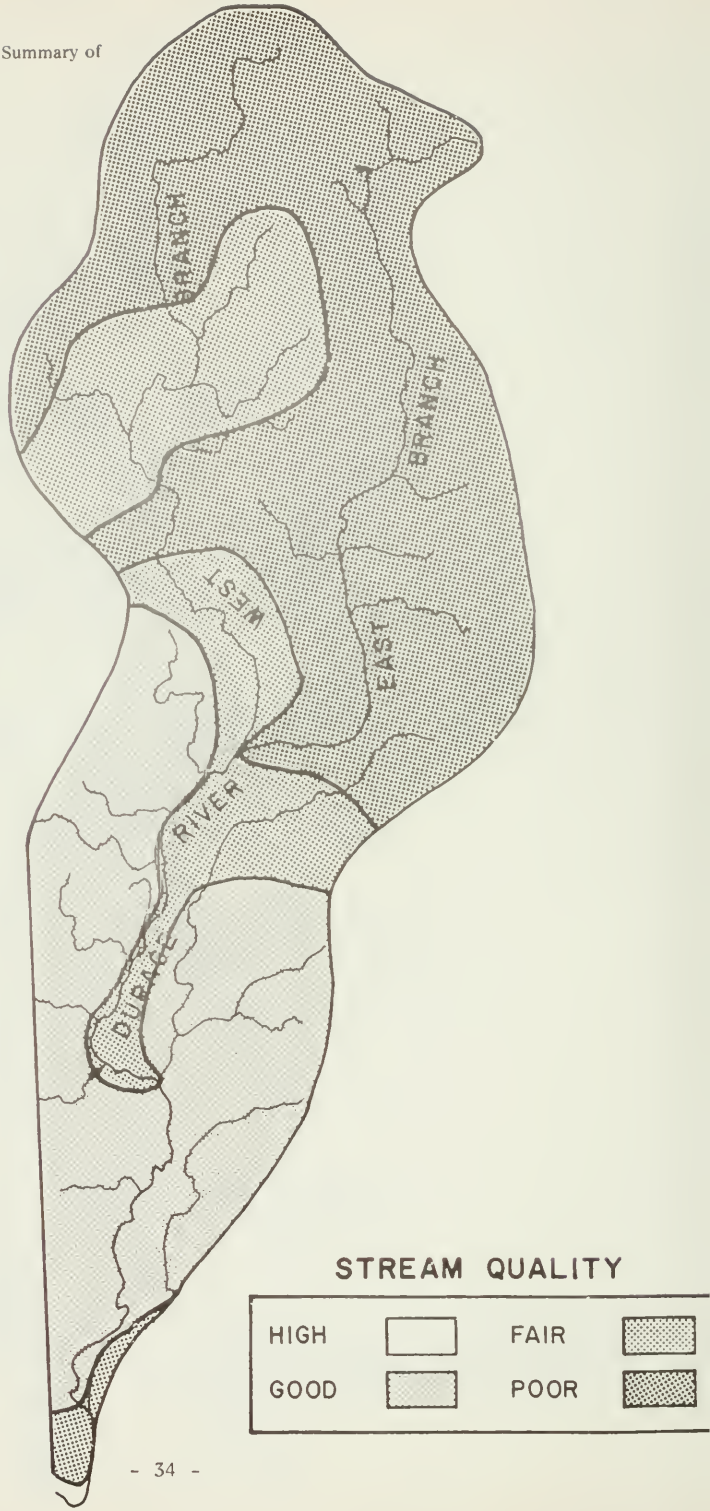


Table 3-2. Location of MSDGC 1976 Fish Sampling Sites, DuPage River Basin.

Number	Stream	Location
30	East Branch, DuPage River	T38N/V 10E/S 15NE; DuPage Co.; immediately upstream and downstream of Maple Ave., Lisle.
31	East Branch, DuPage River	T37N/R 10E/S 7NE; Will Co.; upstream of Naperville Road, Naperville.
32	West Branch, DuPage River	T40N/R 9E/S 35NW; DuPage Co.; immediately upstream and downstream of RT 64 (North Avenue), West Chicago.
33	West Branch, DuPage River	T37N/R 10E/S 6NE; Will Co.; 200 meters upstream of Naperville RD, Naperville.
34	DuPage River	T35N/R 9E/S 10SE; Will Co.; 40 meters and 60 meters above Hammel Woods Dam, Shorewood.
74	Hammel Creek	T35N/R 9E/S 10SE; Will Co.; mouth of Hammel Creek with DuPage River, Hammel Woods, Shorewood.
75	Hammel Creek	T35N/R 9E/S 10SE; Will Co.; 100 meters above confluence with DuPage River, Hammel Woods, Shorewood.
136	DuPage River	T35N/R 9E/S 10SE; Will Co.; forebay and tailrace of stone dam, Shorewood Park off RT 52, Shorewood.
137	DuPage River	T35N/R 9E/S 10SE; Will Co.; 100 meters below stone dam, Shorewood Park off RT 52, Shorewood.
236	DuPage River	T34N/R 9E/S 20NE; Will Co.; mouth of DuPage River with Des Plaines River, Channahon.
237	DuPage River	T34N/R 9E/S 17SW; Will Co.; 150 meters downstream of Channahon ST PK Dam, Channahon.
238	DuPage River	T34N/R 9E/S 17SW; Will Co.; tailrace and forebay of Channahon ST PK Dam, Channahon.
239	DuPage River	T34N/R 9E/S 17SW; Will Co.; 120 meters below Channahon ST PK Dam, Channahon.
240	Lilly Cache Creek	T36N/R 9E/S 27SE; Will Co.; mouth of Lilly Cache Creek with DuPage River, Plainfield.
241	Lilly Cache Creek	T36N/R 9E/S 27SE; Will Co.; 100 meters above mouth with DuPage River, Plainfield.

Table 3-3. Checklist of Fishes Known to Occur in the DuPage River Basin.

Clupeiformes

Clupeidae - Herrings

Dorosoma cepedianum (Lesueur)
Gizzard shad

Salmoniformes

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Esox lucius Linnaeus
Northern pike

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Campostoma oligolepis Hubbs & Green
Largescale stoneroller

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Table 3-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps

Notropis chrysocephalus (Rafinesque)
Striped shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis heterolepis Eigenmann & Eigenmann
Blacknose shiner

Notropis lutrensis (Baird & Girard)
Red shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Pimephales vigilax (Baird & Girard)
Bullhead minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Table 3-3. Continued.

Cypriniformes (continued)

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Moxostoma duquesnei (Lesueur)
Black redhorse

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus natalis (Lesueur)
Yellow bullhead

Noturus exilis Nelson
Slender madtom

Noturus flavus Rafinesque
Stonecat

Noturus gyrinus (Mitchill)
Tadpole madtom

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Fundulus notti (Agassiz)
Starhead topminnow

Table 3-3. Continued.

Atheriniformes (continued)

Atherinidae - Silversides

Labidesthes sicculus (Cope)
Brook silversides

Perciformes

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Lepomis megalotis (Rafinesque)
Longear sunfish

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis nigromaculatus (Lesueur)
Black crappie

Table 3-3. Completed.

Perciformes (continued)

Percidae - Perches

Etheostoma asprigene (Forbes)
Mud darter

Etheostoma flabellare Rafinesque
Fantail darter

Etheostoma microperca Jordan & Gilbert
Least darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma zonale (Cope)
Banded darter

Percina maculata (Girard)
Blackside darter

Table 3-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the DuPage River Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

	STATIONS															TOTAL	% OF
	30	31	32	33	241	240	34	74	75	136	137	237	238	239	236	NUMBER	TOTAL
CLUPEIDAE																	
Gizzard shad	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	6	>1
ESOCIDAE																	
Grass pickerel	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	>1
CYPRINIDAE																	
Stoneroller	-	-	-	1	2	1		25	54	1			29	16		129	6
Goldfish	8	-	-	-	-	1	1	-	-	-	-	5	-	-	-	15	1
Carp	2	8		40	-	-	4	2	-	1	-	8	2	-	-	67	3
Hornyhead chub	-	-	-	1	-	-	-	-	-	-	-	3	10	2	-	16	1
Golden shiner	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	>1
Emerald shiner	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4	>1
Striped shiner	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	4	>1
Common shiner	-	-	-	-	7	1	-	-	-	-	-	-	-	-	-	8	>1
Bigmouth shiner	-	-	-	21	45	-	30	29	4	-	-	-	-	-	1	130	6
Red shiner	-	-	-	-	-	-	-	-	-	-	-	4	1	-	-	5	>1
Spotfin shiner	-	-	-	16	32	11	170	6	3	-	29	18	10	7	5	307	15
Sand shiner	-	2	-	7	30	14	2	-	-	-	2	-	8	9	-	74	4
Redfin shiner	-	-	-	-	34	-	2	18	-	-	-	2	-	-	-	56	3
Suckermouth minnow	-	-	-	-	-	-	-	-	-	-	-	-	16	2	-	18	1
Bluntnose minnow	-	5	3	89	45	47	78	57	12	-	1	1	2	9	61	410	20
Fathead minnow	4	-	43	4	-	-	1	1	1	-	-	-	-	-	-	54	3
Bullhead minnow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	>1
Creek chub	16	2	-	6	1	-	-	10	42	-	-	-	-	-	-	77	4
Carp X Goldfish	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	>1
CATOSTOMIDAE																	
White sucker	4	1	-	2	-	-	-	3	9	-	-	-	-	-	-	19	1
Northern hogsucker	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3	>1
Black redhorse	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	>1
ICTALURIDAE																	
Black bullhead	-	-	3	2	-	-	-	-	1	-	-	-	-	-	-	6	>1
Stonecat	-	-	-	-	-	-	1	-	-	-	1	1	2	-	-	5	>1
Tadpole madtom	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	>1
CYPRINODONTIDAE																	
Blackstripe topminnow	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	3	>1
CENTRARCHIDAE																	
Rock bass	-	-	-	-	-	-	1	-	-	-	-	1	-	-	1	3	>1
Green sunfish	17	7	18	20	1	2	54	102	11	7	-	60	8	24	76	407	20
Pumpkinseed	-	-	-	-	-	-	12	11	-	-	-	7	-	-	7	37	2
Orangespotted sunfish	-	-	-	-	-	-	-	-	-	-	-	3	-	-	6	9	>1
Bluegill	-	-	34	4	1	-	3	-	-	-	-	15	-	-	36	93	5
Longear sunfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	>1
Smallmouth bass	-	-	-	-	-	1	-	-	-	-	-	6	-	-	-	7	>1
Largemouth bass	-	-	-	-	-	-	-	-	-	-	-	4	4	-	-	8	>1
Black crappie	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	2	>1
Green sunfish X Pumpkinseed	-	-	-	1	-	-	2	-	-	1	-	8	-	-	3	15	1
Green sunfish X Longear sunfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	>1
Pumpkinseed X Bluegill	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	>1
PERCIDAE																	
Johnny darter	-	-	-	-	4	7	-	-	-	-	-	-	-	-	-	11	>1
TOTAL NUMBER OF INDIVIDUALS	51	25	101	223	206	86	361	264	137	10	33	151	103	69	203	2023	96
TOTAL NUMBER OF SPECIES	6	6	5	17	13	10	13	11	9	4	4	17	15	7	10	37	-
DIVERSITY ($\bar{d}$)	1.90	2.01	1.65	2.81	2.74	2.01	2.19	2.37	2.17	.99	1.50	3.13	3.14	2.13	2.29	-	-
EQUITABILITY (e)	.83	.92	.80	.56	.69	.55	.43	.64	.67	.63	1.00	.66	.78	.79	.65	-	-

Table 3-5. Location of 1976 IEPA Water Quality Sampling Sites, DuPage River Basin.

Basin Code	Station Number	Stream Name	Description
DuPage River			
GB	01	DuPage River	Old US 6 BR at SW edge Channahon
GB	02	DuPage River	New US 6 BR at NW edge Channahon
GB	03	DuPage River	Co RD BR 1.5 mi NNW of Channahon
GB	04	DuPage River	TWP RD BR 1 mi S of Shorewood
GB	08	DuPage River	Renwick RD BR 1.5 mi SW Plainfld
GB	09	DuPage River	RT 59 BR at Plainfield
GB	10	DuPage River	Plainfield-Naperville RD BR
Illinois and Michigan Canal			
GBA	02	IL & MI Canal	US 6 BR at Channahon
Lilly Cache Creek			
GBE	01	Lilly Cache Creek	US 30 BR 1 mi SE Plainfield
Norman Drain			
GBH	01	Norman Drain	TR 59 BR at 143rd ST Plainfield
DuPage River - West Branch			
GBK	01	W BR DuPage River	Hobson RD BR at Naperville
GBK	02	W BR DuPage River	Washington ST RD BR S Naperville
GBK	03	W BR DuPage River	US 34-9th Ave BR at Naperville
GBK	04	W BR DuPage River	Warrenville RD BR at Warrenville
GBK	05	W BR DuPage River	RT 56-Butterfield RD BR Warrenvl
GBK	06	W BR DuPage River	Mack RD BR N of Warrenville
GBK	07	W BR DuPage River	Garys Mill RD BR S of West Chicago
GBK	09	W BR DuPage River	RT 64 ST Charles RD BR N of W CHCGO
GBK	10	W BR DuPage River	BR at Arlington 1 mi SW Hanover PK
Spring Brook			
GBKA	01	Spring Brook	Winfield RD BR 1 mi N of Warrenvl
Kress Creek			
GBKB	01	Kress Creek	RT 59 BR S of West Chicago
GBKB	03	Kress Creek	Townline RD BR SW of W Chicago
GBKB	04	Kress Creek	McChesney RD BR S of Roosevelt RD
GBKB	05	Kress Creek	Hawthorne W BR at NW edge W CHCGO

Table 3-5. Completed.

Basin Code	Station Number	Stream Name	Description
DuPage River - East Branch			
GBL	01	E BR DuPage River	Hobson RD BR 2 mi S of Lisle
GBL	02	E BR DuPage River	Washington ST RD BR Naperville
GBL	05	E BR DuPage River	Maple Ave BR at Lisle
GBL	07	E BR DuPage River	RT 56-Butterfield RD BR
GBL	08	E BR DuPage River	RT 38-Rossevelt RD BR at Glen Ellyn
GBL	09	E BR DuPage River	RT 64-North Ave BR NR Glendale HTS

Table 3-6. Bluegill Toxicity Indices, DuPage River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
DuPage River - West Branch	GBK10	.386
	GBK09	.111
	GBK07	.060
Kress Creek	GBKB05	.363
	GBKB04	.060
	GBKB03	.065
	GBKB01	.140
DuPage River - West Branch	GBK06	.098
Spring Brook	GBKA01	.448
DuPage River - West Branch	GBK05	.354
	GBK04	.124
	GBK03	.160
	GBK01	.069
	GBK02	.308
DuPage River - East Branch	GBL09	.554
	GBL08	.788
	GBL07	.678
	GBL05	2.204
	GBL01	.434
	GBL02	.134
DuPage River	GB10	.137
Norman Drain	GBH01	.008
DuPage River	GB09	.089
	GB08	.113
Lilly Cache Creek	GBE01	.060
DuPage River	GB04	.053
	GB03	.074
Illinois and Michigan Canal	GBA02	.058
DuPage River	GB02	.081
	GB01	.070

Table 3-7. Summary, 1976 IEPA Water Quality Data, DuPage River Basin. (Maximum, minimum, mean, and number of analyses [in parentheses] for parameters [based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976] contributing significantly to the BGTU.)

IEPA Station	Amm-N (mg l^{-1})	CN (mg l^{-1})	MBAS (mg l^{-1})	Ag (mg l^{-1})
DuPage River - West Branch				
GBK10	.12 - 13.00	.000 - .010	.60 - .60	.000 - .000
	3.95 (9)	.003 (6)	.60 (2)	.000 (6)
GBK09	.09 - 1.40	.000 - .000	.20 - .60	.000 - .000
	.52 (8)	.000 (3)	.40 (2)	.000 (3)
GBK07	.42 - 5.10	--	--	--
	2.13 (8)	--	--	--
Kress Creek				
GBKB05	2.60 - 26.00	.000 - .000	.20 - .20	.000 - .000
	9.43 (8)	.000 (3)	.20 (2)	.000 (3)
GBKB04	.76 - 3.30	--	--	--
	1.77 (7)	--	--	--
GBKB03	.01 - 3.20	.000 - .000	.30 - .30	.000 - .000
	.91 (6)	.000 (3)	.30 (1)	.000 (3)
GBKB01	.06 - 2.50	.000 - .000	.20 - .50	.000 - .000
	.69 (7)	.000 (3)	.35 (2)	.000 (3)
DuPage River - West Branch				
GBK06	.30 - 3.50	.000 - .000	.20 - .20	.000 - .000
	1.12 (7)	.000 (3)	.20 (1)	.000 (3)
Spring Brook				
GBKA01	4.20 - 18.00	--	.70 - .70	--
	9.25 (8)	--	.70 (1)	--
DuPage River - West Branch				
GBK05	.72 - 6.40	.000 - .010	.40 - .80	.000 - .000
	3.05 (7)	.003 (3)	.60 (2)	.000 (3)
GBK04	.65 - 9.00	--	--	--
	3.05 (8)	--	--	--
GBK03	.35 - 8.00	.000 - .000	.20 - .20	.000 - .000
	1.89 (8)	.000 (5)	.20 (1)	.000 (5)
GBK01	.06 - 7.20	--	--	--
	1.32 (8)	--	--	--
GBK02	.02 - 6.40	.000 - .010	.60 - .70	.000 - .000
	1.40 (8)	.003 (3)	.65 (2)	.000 (3)

Table 3-7. Continued.

IEPA Station	Amm-N (mg l^{-})	CN (mg l^{-})	MBAS (mg l^{-})	Ag (mg l^{-})
DuPage River - East Branch				
GBL09	2.20 - 13.00	.010 - .010	1.40 - 1.40	.000 - .000
	6.23 (6)	.010 (1)	1.40 (1)	.000 (1)
GBL08	4.10 - 17.00	--	--	--
	8.43 (6)	--	--	--
GBL07	2.80 - 16.00	.000 - .020	.70 - .90	.000 - .000
	7.20 (7)	.010 (5)	.80 (2)	.000 (5)
GBL05	1.50 - 12.00	.010 - .020	.60 - 1.00	.000 - .020
	4.97 (8)	.017 (3)	.80 (2)	.007 (3)
GBL01	1.40 - 13.00	.000 - .010	.40 - .40	.000 - .000
	5.51 (8)	.002 (5)	.40 (1)	.000 (5)
GBL02	.76 - 10.00	--	--	--
	3.43 (8)	--	--	--
DuPage River				
GB10	7.00 - .45	.000 - .000	.20 - .20	.000 - .000
	2.57 (7)	.000 (4)	.20 (1)	.000 (4)
Norman Drain				
GBH01	.00 - .27	--	--	--
	.10 (4)	--	--	--
DuPage River				
GB09	.02 - .66	.000 - .000	.30 - .60	.000 - .000
	.28 (4)	.000 (2)	.45 (2)	.000 (2)
GB08	4.60 - .01	.000 - .000	.60 - .60	.000 - .000
	1.10 (5)	.000 (2)	.60 (2)	.000 (2)
Lilly Cache Creek				
GBE01	.00 - .75	.000 - .000	.20 - .40	.000 - .000
	.22 (5)	.000 (2)	.30 (2)	.000 (2)
DuPage River				
GB04	.00 - 1.20	.000 - .000	--	.000 - .000
	.37 (5)	.000 (1)	--	.000 (1)
GB03	.00 - .60	.000 - .000	.40 - .60	.000 - .000
	.14 (5)	.000 (2)	.50 (2)	.000 (2)

Table 3-7. Completed.

IEPA Station	Amm-N (mg l^{-1})	CN (mg l^{-1})	MBAS (mg l^{-1})	Ag (mg l^{-1})
Illinois and Michigan Canal				
GBA02	.00 - .95	.000 - .000	.40 - .40	.000 - .000
	.23 (5)	.000 (2)	.40 (1)	.000 (2)
DuPage River				
GB02	.00 - 1.10	.000 - .000	.60 - .60	.000 - .000
	.35 (5)	.000 (2)	.60 (1)	.000 (2)
GB01	.00 - 1.00	.000 - .000	--	.000 - .000
	.33 (5)	.000 (1)	--	.000 (1)
IPCB STANDARDS	1.50	.025	--	.005

CHAPTER FOUR: FOX RIVER

LOCATION AND BASIN MORPHOMETRY

The Fox River is the third largest tributary of the Illinois River. The river is approximately 296 km long and drains an area of 673,400 ha. From its source near Milwaukee, the first 120 km of stream lie within the State of Wisconsin. The Fox River is an order 4 stream when it enters Illinois northwest of Antioch. It follows the border between McHenry and Lake Counties, then enters Kane County and eventually Kendall County. At the point where the Fox River leaves Kendall County, it is an order 5 stream. This investigation encompasses only this four-county area of the Fox River watershed (Fig. 4-1).

The Fox River is a low-gradient stream (0.45 m km^{-1}) and flows in a southerly direction. It enters the Illinois River near Ottawa. Major tributaries include Boone Creek (1.06 m km^{-1}), Dutch Creek (3.96 m km^{-1}), Nippersink Creek (2.39 m km^{-1}), Flint Creek (2.29 m km^{-1}), and Big Rock Creek--all low- to medium-gradient streams. The drainage pattern of the Fox River is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The Fox River is overdeveloped at the order 5 level and underdeveloped at the order 1, 2, 3, and especially order 4 levels. It never reaches the potential order 10 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 4-1.

Table 4-1. Summary of Morphometric Data, Fox River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	433	1.69	730.32
2	212	1.55	328.32
3	104	1.45	150.55
4	31	1.11	34.37
5	88	1.41	124.42
		Total	= 1367.98

The soils of the Fox River watershed, derived from the Wisconsin glaciation, are for the most part gravel, sand and silt. There are 14 soil associations:

1) Marsh-Fox-Boyer
2) Zurich-Grays-Wauconda
3) Miami-Montmorenci

4) Morley-Markham-Houghton
5) Nappanee-Montgomery
6) Warsaw-Lorenzo
7) Fox-Casco
8) Ringwood-Griswold
9) McHenry-Lapem
10) Saybrook-La Rose
11) Miami-Strawn
12) Brenton-Proctor
13) Starks-Camden
14) Houghton-Lena

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago inventory included fish collections from 80 sites along the Fox River and its tributaries. Forty-seven of the collections were taken from 19 tributaries, primarily in the area of their confluences with the Fox River (Table 4-2; Fig. 4-2). Stations 102, 106, and 214 were sampled two times each. One collection at each of these sites was unsuccessful. Station 108 was sampled once without success. Earlier records indicated 88 species and the carp x goldfish hybrid present in this watershed (Table 4-3). The 1976 inventory included 76 species and six hybrid crosses (Table 4-4). The hybrids were carp x goldfish, green sunfish x pumpkinseed, pumpkinseed x bluegill, green sunfish x bluegill, pumpkinseed hybrid, and an unidentified hybrid. Two-thirds of the species from the 1976 collection are considered to have some degree of tolerance to habitat abuse. The remaining 26 species are considered ecologically intolerant. These intolerant species represent 8% of the total number of fish collected. Spotfin shiners (a moderately tolerant species), green sunfish (a tolerant species), and bluegill (a tolerant species) were the most abundant species in this watershed, representing 32% of the total number of fish collected.

Fishery quality throughout the majority of the Fox River is significantly better than that of other watersheds in northeastern Illinois. The river enters Illinois from Wisconsin containing a diverse, high-quality fish population. Sites 101 and 102, south of the Chain O'Lakes, were less diverse due to the influence of the lake fisheries. A good quality fishery is maintained throughout the remainder of the river channel included in this study. Equitability values for the river ranged from 0.4 to 1.0 and the average was 0.7. The average species diversity value was 2.95. Only those stations with greater than 50 total fish were considered in these equitability and diversity calculations.

The equitability and species diversity values of the tributaries also were high. Nippersink Creek, the northernmost tributary sampled by the 1976 inventory, contained a rich assemblage of species. Fewer species were taken from the North Branch of Nippersink Creek, an area with suburban development. Flint Creek collections included only three species of fishes, all of which are considered tolerant. This stream is one of the most degraded in the watershed. No fish were secured from the Tower Lake Drain.

Boone Creek, Mill Creek, and Tyler Creek fisheries became slightly degraded before they converged with the river. Municipalities are located in these areas. Dutch Creek, the Griswald Lake Drain, Crystal Creek, Poplar Creek, and Indian Creek maintained good quality fisheries throughout their length. Jelkes Creek, Norton Creek, Waubonsee Creek, Blackberry Creek, Rob Roy Creek, Big Rock Creek, and Little Rock Creek contained fisheries characteristic of high quality aquatic habitats.

SUMMARY OF WATER QUALITY DATA

The Fox River watershed contained 40 Illinois Environmental Protection Agency water quality sampling sites (Table 4-5; Fig. 4-3). Twenty-two sites are located on the river. The remaining sites are located on 15 of the river's tributaries. Stations DTKA03 and DTZJ01 were not monitored for 17 parameters used in toxicity index calculations. Analysis for MBAS was not performed for stations DT09 and DT33. The Metropolitan Sanitary District of Greater Chicago water quality data included hardness values for many tributaries of the Fox River. These were used when applicable, and a mean hardness value was calculated for all other stations. Chromium (hexavalent), was not detected in the watershed. Arsenic, boron, cadmium, chromium (trivalent), lead, phenol, and mercury were present but at concentrations which were so low that they had no effect on the toxicity index after the index was rounded to three decimal places. Silver was the only parameter contributing significantly to the toxicity index in the watershed and resulted in six stations exceeding the maximum toxicity level (Table 4-6). The silver concentration at each of these stations also exceeded the Illinois Pollution Control Board standard (Table 4-7). The copper standard was exceeded at 31 stations. Lead concentrations exceeded the standard at eight stations. Ammonia nitrogen and total iron exceeded the standards at only one site. Mercury, a parameter which had no effect on the rounded toxicity index, exceeded the standard at three sites.

The water quality for the majority of the Fox River watershed was extremely good. Though six sites had toxic concentrations of silver, all these sites, except station DT11, had only one positive analysis for silver in three attempts. Silver was detected at station DT11 in one sample of four taken from the site. Three of the sites were located on the river, and the others were located at the mouths of Tyler Creek, Ferson Creek, and Big Rock Creek. All the sites were in close proximity to municipalities.

CONCLUSIONS

The majority of the Fox River drainage system is good- to high-quality aquatic habitat. Main river channels usually have the greatest opportunity to undergo degradation. Yet in the Fox River, good water quality and a diverse fish population are maintained. Many of the tributaries apparently have undergone little modification from their original condition, and a

number of fish species rare elsewhere in northeastern Illinois were collected from these areas. Slight degradation of the fish assemblage was observed throughout a few tributaries and at the confluences of others with the river. These degraded areas corresponded to areas undergoing urban development.

Silver was the only significant pollutant found in the watershed, and it was detected only once at each of six sites. Increased monitoring would better explain the extent of silver contamination in the watershed. A summary of these conclusions is illustrated in Figure 4-4.

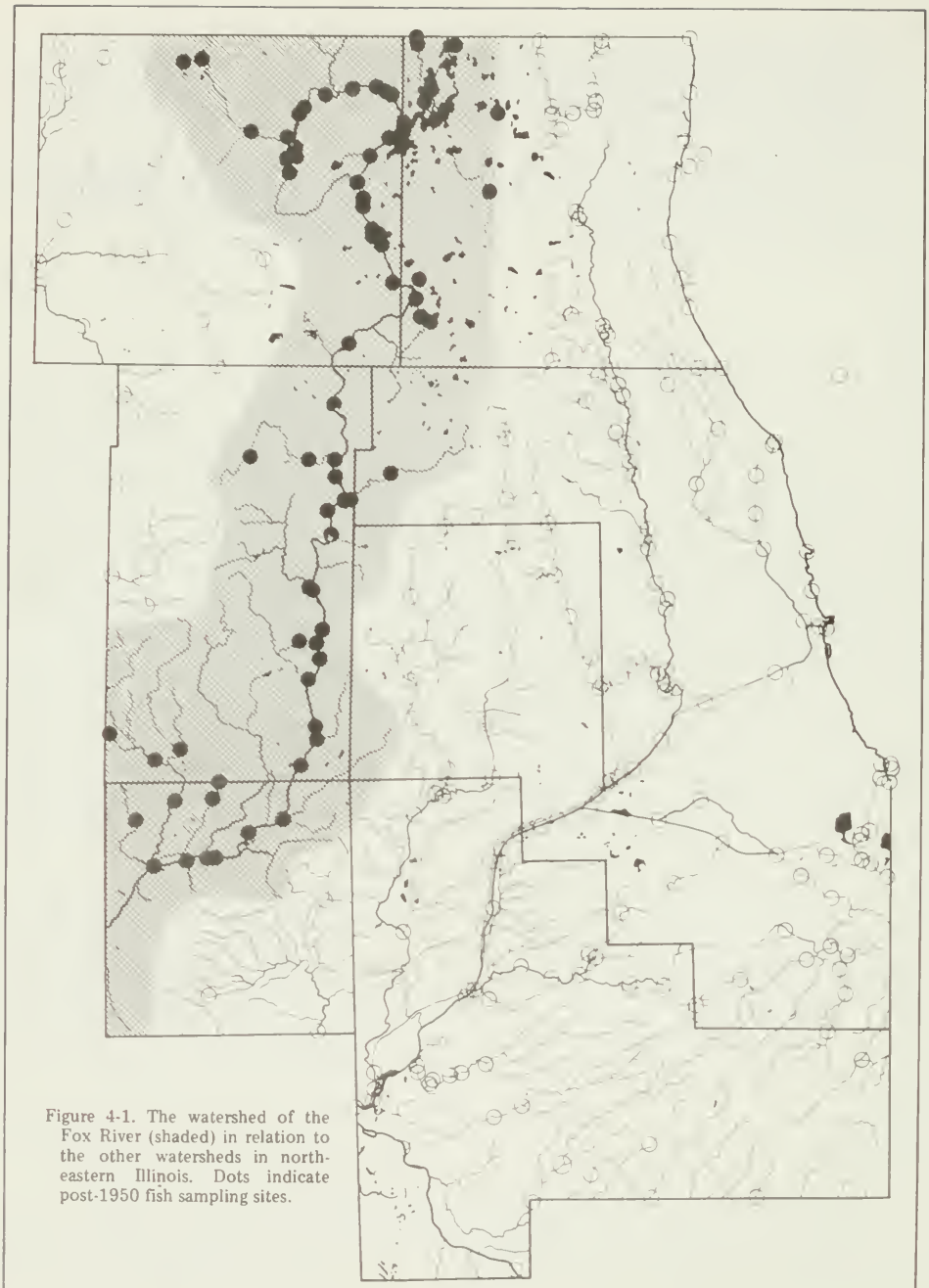


Figure 4-1. The watershed of the Fox River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

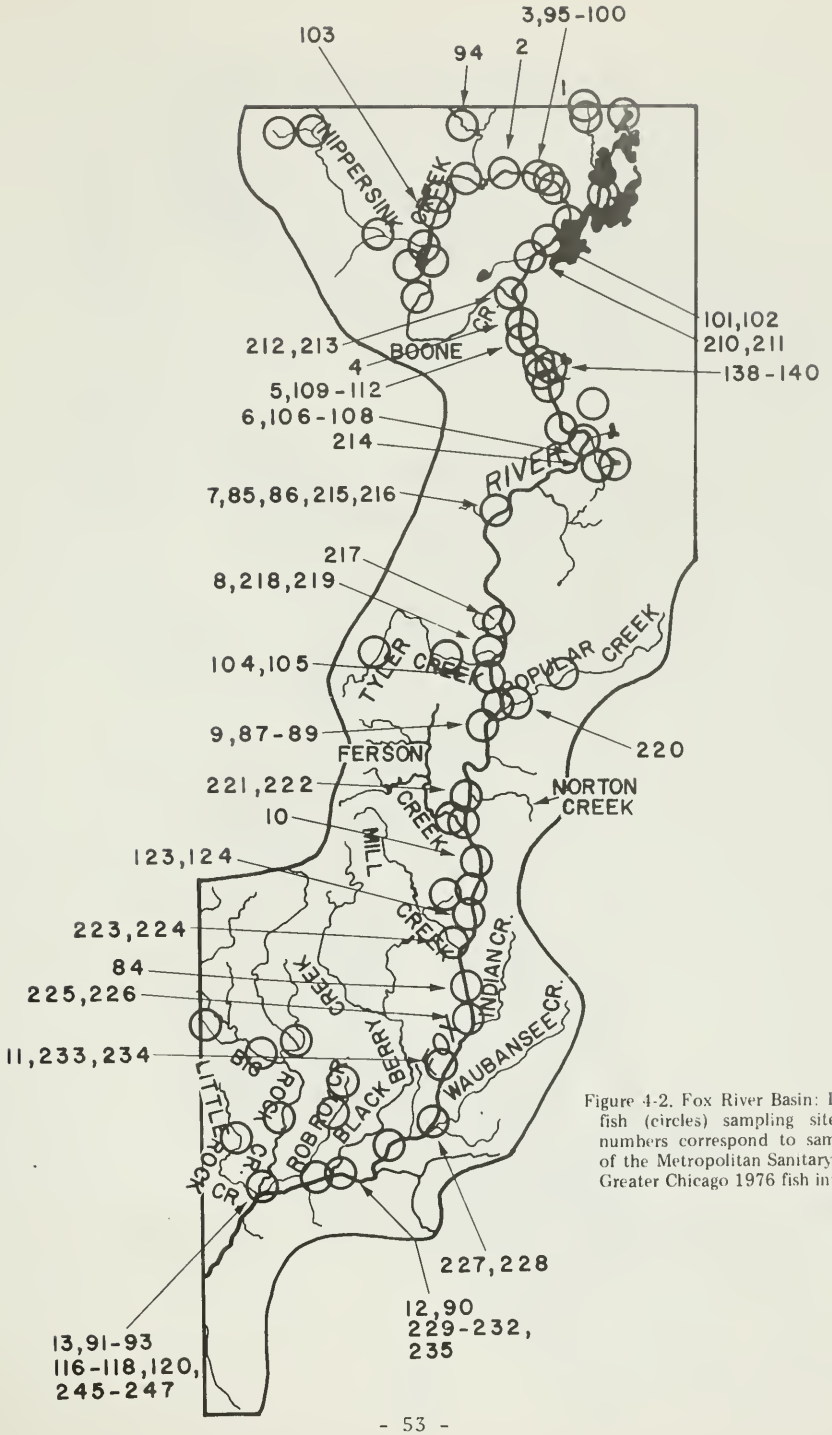


Figure 4-2. Fox River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

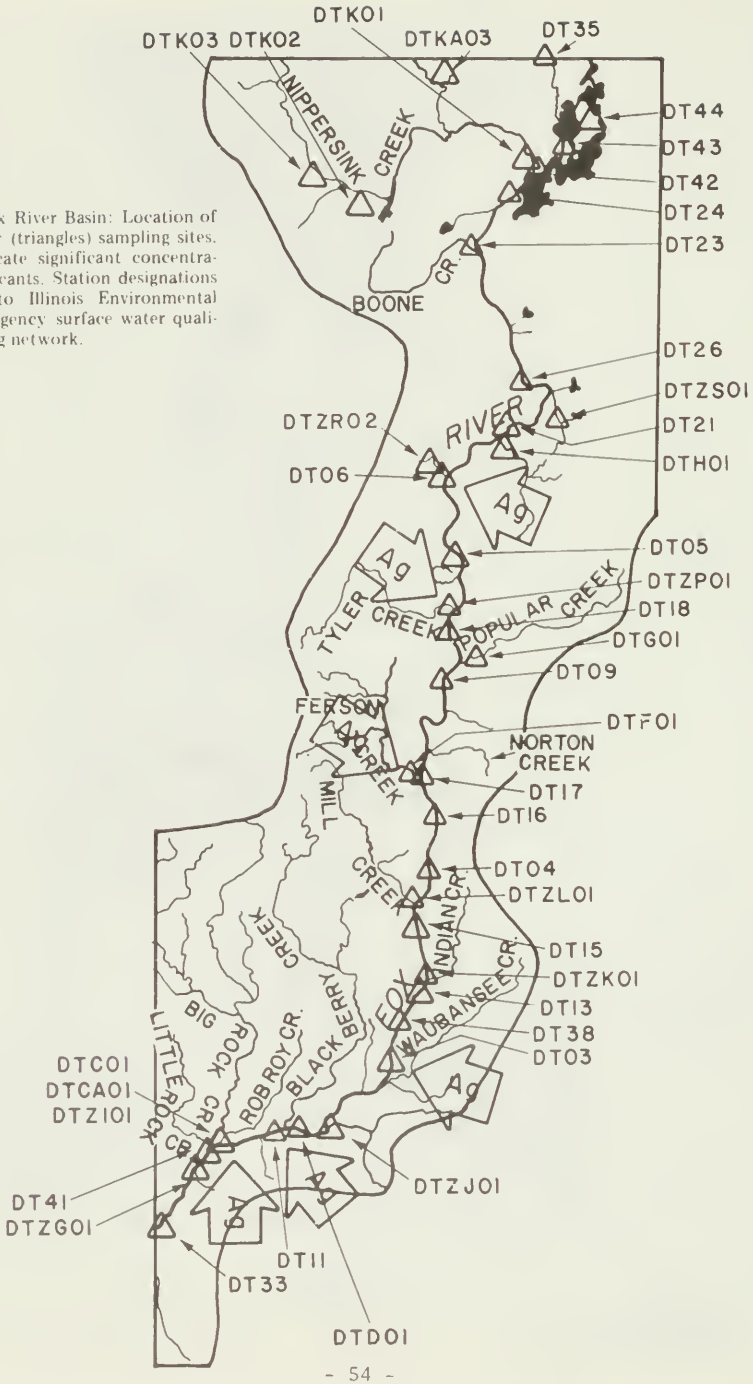


Figure 4-3. Fox River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

Figure 4-4. Fox River Basin: Summary of environmental quality.

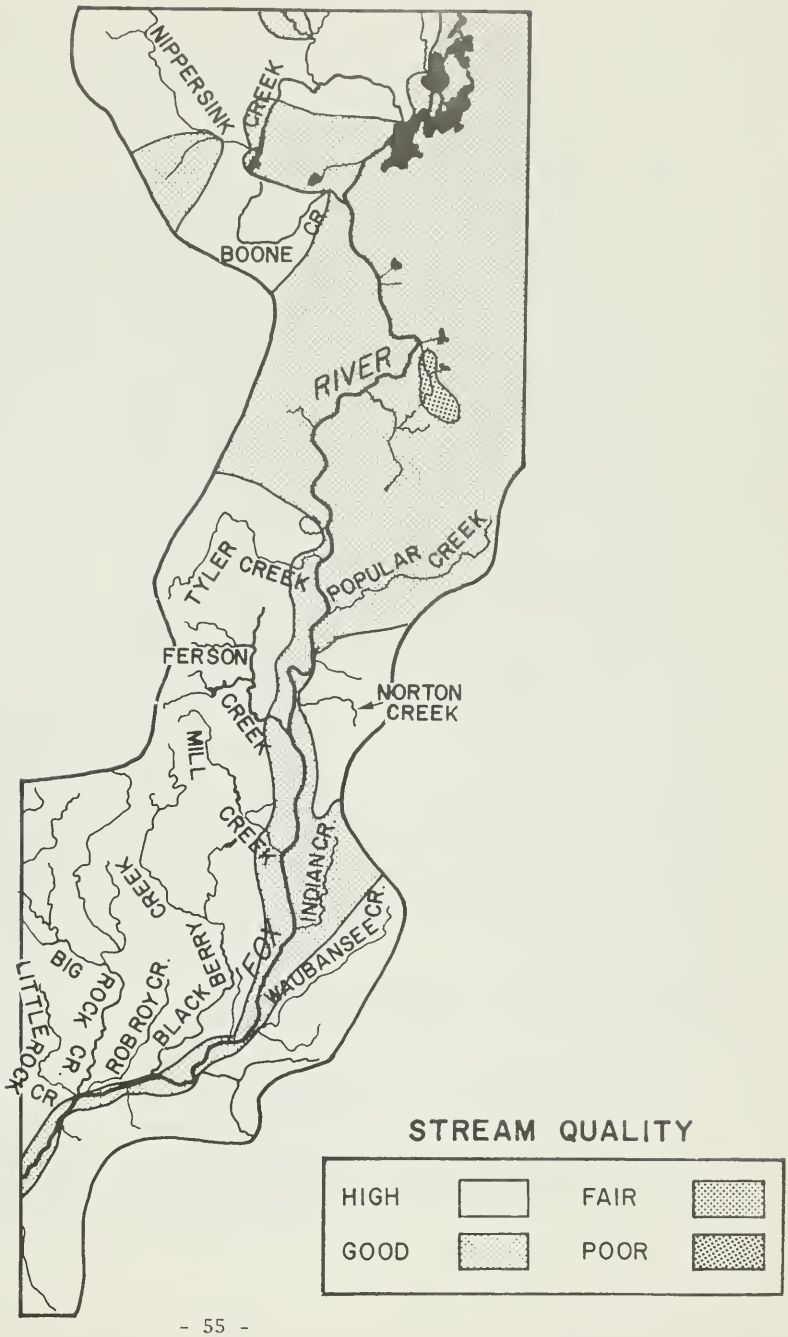


Table 4-2. Location of MSDGC 1976 Fish Sampling Sites, Fox River Basin.

Number	Station	Location
01	Fox River	T1N/R 20E/S 31SW; Lake Co.; 1500 meters downstream of Wilmot, Wisc. Dam
02	Nippersink Creek	T46N/R 8E/S 27NE; McHenry Co.; 150 meters above RT 12 bridge, Solon Mills.
03	Nippersink Creek	T46N/R 8E/S 25NW; McHenry Co.; 110 meters downstream of Winn Road bridge, Spring Grove.
04	Fox River	T44N/R 8E/S 1SW; McHenry Co.; 1150 meters upstream of McHenry Dam, McHenry Shores.
05	Fox River	T44N/R 8E/S 12SE; McHenry Co.; 1500 meters below McHenry Dam, Burton's Bridge.
06	Fox River	T43N/R 8E/S 9SW; Lake Co.; 900 meters downstream from mouth of Flint Creek, Lake Barrington.
07	Fox River	T43N/R 8E/S 13SW; McHenry Co.; 1500 meters upstream of Algonquin RD Dam, Algonquin.
08	Fox River	T41N/R 8E/S 14NE; Kane Co.; 2 miles upstream of Kimball AVE Dam, ½ mile upstream of filtration plant, Slade AVE, Elgin.
09	Fox River	T41N/R 8E/S 35NW; Kane Co.; 400 meters below State Street Dam, South Elgin.
10	Fox River	T39N/R 8E/S 10NE; Kane Co.; upstream of bridge south of Fabayan Park, Geneva.
11	Fox River	T38N/R 8E/S 33NW; Kane Co.; 240 meters south of Montgomery RD, Montgomery.
12	Fox River	T36N/R 7E/S 33NW; Kendall Co.; 400 meters downstream of dam, 150 meters downstream of RT 47, Yorkville.
13	Fox River	T36N/R 6E/S 34SW; Kendall Co.; between mouths of Robroy and confluence of Big Rock/Little Rock Creeks, Silver Springs ST PK, Plano.
84	Fox River	T38N/R 8E/S 15SE; Kane Co.; 160 meters above, 240 meters below RR BR above dam at Ashland AVE, Aurora.
85	Fox River	T43N/R 8E/S 34NW; McHenry Co.; qualitative sample downstream of Algonquin Dam, Algonquin.

Table 4-2. Continued.

Number	Station	Location
86	Fox River	T43N/R 8E/S 34NW; McHenry Co.; qualitative sample immediately below Algonquin Dam, Algonquin.
87	Fox River	T41N/R 8E/S 26SW; Kane Co.; 1500 meters above dam, South Elgin.
88	Fox River	T41N/R 8E/S 35NW; Kane Co.; west bank above dam in lilly pools, South Elgin.
89	Fox River	T41N/R 8E/S 35NW; Kane Co.; west bank below dam, South Elgin.
90	Fox River	T36N/R 7E/S 34NE; Kendall Co.; downstream from Tuma Road, Yorkville.
91	Big Rock Creek	T36N/R 6E/S 34SW; Kendall Co.; 40 meters upstream from confluence with Little Rock Creek, Plano.
92	Little Rock Creek	T36N/R 6E/S 34SW; Kendall Co.; 105 meters upstream from confluence with Big Rock Creek, Plano.
93	Big Rock/Little Rock Creek Confluence	T36N/R 6E/S 34SW; Kendall Co.; confluence of Big Rock/Little Rock Creeks, 100 meters upstream from mouth with Fox River, Plano.
94	North Branch, Nippersink Creek	T46N/R 8E/S 16SE; McHenry Co.; 100 meters downstream of Hill RD, Richmond.
95	Nippersink Creek	T46N/R 8E/S 25NE; McHenry Co.; 140 meters downstream from Winn RD, Spring Grove.
96	Nippersink Creek	T46N/R 8E/S 25NE; McHenry Co.; outflow pipe from ST Fish Hatchery, Spring Grove.
97	Tributary of Nippersink Creek	T46N/R 8E/S 25NE; McHenry Co.; mouth of tributary across from ST Fish Hatchery, Spring Grove.
98	Tributary of Nippersink Creek	T46N/R 8E/S 24SE; McHenry Co.; 81 meters upstream of mouth with Nippersink Creek, Spring Grove.
99	Tributary of Nippersink Creek	T46N/R 8E/S 25NE; McHenry Co.; pool just above mouth with Nippersink Creek, Spring Grove.
100	Nippersink Creek	T46N/R 9E/S 30NW; McHenry Co.; 50 meters downstream of Blevin (Richardson) RD, Spring Grove.

Table 4-2. Continued.

Number	Station	Location
101	Fox River	T45N/R 9E/S 8SW; McHenry Co.; 500 meters downstream of Pistakee Lake, Sunnyside.
102	Fox River	T45N/R 9E/S 8SW; McHenry Co.; west side of Pistakee Lake, east point at exit of Fox River, Sunnyside.
103	Nippersink Creek	T45N/R 9E/S 8SW; McHenry Co.; Wonder Lake spillway, Wonder Lake.
104	Fox River	T41N/R 8E/S 14NE; Kane Co.; tailrace of Kimball AVE Dam, Elgin.
105	Fox River	T41N/R 8E/S 14NE; Kane Co.; 100 meters below Kimball AVE Dam, Elgin.
106	Fox River	T43N/R 8E/S 16NW; Lake Co.; 500 meters below mouth of Flint Creek, Lake Barrington.
107	Flint Creek	T43N/R 8E/S 10NW; Lake Co.; mouth of Flint Creek with Fox River, Lake Barrington.
108	Tower Lake Drain	T43N/R 8E/S 10NW; Lake Co.; mouth of Tower Lake Drain, Lake Barrington.
109	Fox River	T44N/R 8E/S 12NW; McHenry Co.; tailrace of McHenry Dam, McHenry shores.
110	Fox River	T44N/R 8E/S 12NW; McHenry Co.; 200 meters downstream of McHenry Dam, McHenry shores.
111	Fox River	T44N/R 8E/S 12NW; McHenry Co.; tailrace of and McHenry Dam proper, McHenry shores.
112	Fox River	T44N/R 8E/S 12SE-12NW; McHenry Co.; 1500 meters below McHenry Dam, Burton's Bridge, and west bank, 200 meters below McHenry Dam, McHenry shores.
116	Fox River	T36N/R 6E/S 34SE; Kendall Co.; upstream of mouth of Rob Roy Creek on Fox River, Silver Springs ST PK, Plano.
117	Rob Roy Creek	T36N/R 6E/S 34SE; Kendall Co.; mouth of Rob Roy Creek with Fox River, Plano.
118	Confluence of Big Rock/Little Rock Creeks	T36N/R 6E/S 34SW; Kendall Co.; mouth of confluence of Big Rock/Little Rock Creeks with Fox River, Plano.

Table 4-2. Continued.

Number	Station	Location
120	Confluence of Big Rock/Little Rock Creeks* and Rob Roy Creek	T36N/R 6E/S 34SW*, 34SE; Kendall Co.; mouths of confluence* and Rob Roy Creek combined, Plano.
123	Fox River	T39N/R 8E/S 22NE; Kane Co.; below Wilson Avenue, Batavia.
124	Fox River	T39N/R 8E/S 27NW; Kane Co.; tailrace of Batavia Dam, Batavia.
138	Griswald Lake Drain	T44N/R 9E/S 18SE; McHenry Co.; 200 meters across Griswald LK Dam, Burton's Bridge.
139	Griswald Lake Drain	T44N/R 9E/S 18SE; McHenry Co.; mouth of drain with Fox River, Burton's Bridge.
140	Cotton Creek	T44N/R 9E/S 30NE; McHenry Co.; mouth of Cotton Creek with Fox River, Burton's BRG.
210	Dutch Creek	T45N/R 8E/S 24NE; McHenry Co.; mouth of Dutch CR with Fox River, Johnsburg.
211	Dutch Creek	T45N/R 8E/S 24NE; McHenry Co.; 100 meters above mouth with Fox River, Johnsburg.
212	Boone Creek	T45N/R 8E/S 25SW; McHenry Co.; mouth of Boone CR with Fox River, McHenry.
213	Boone Creek	T45N/R 8E/S 25SW; McHenry Co.; 100 meters above mouth with Fox River, McHenry.
214	Flint Creek	T43N/R 8E/S 15NW; Lake Co.; immediately above and below Kelsey RD, Lake Barrington.
215	Crystal Creek	T43N/R 8E/S 34NW; McHenry Co.; mouth of Crystal Creek with Fox River, Algonquin.
216	Crystal Creek	T43N/R 8E/S 34NW; McHenry Co.; 100 meters above mouth with Fox River, between Harrison ST and RT 31, Algonquin.
217	Jelkes Creek	T42N/R 8E/S 27SE; Kane Co.; immediately downstream of RT 31, West Dundee.
218	Tyler Creek	T41N/R 8E/S 11NE; Kane Co.; mouth of Tyler Creek with Fox River.
219	Tyler Creek	T41N/R 8E/S 11NE; Kane Co.; 100 meters above mouth with Fox River, Judson College, Elgin.
220	Poplar Creek	T41N/R 8E/S 25NW; Kane Co.; 10 meters upstream of Raymond ST, Elgin.

Table 4-2. Completed.

Number	Station	Location
221	Norton Creek	T40N/R 8E/S 15SE; Kane Co.; mouth of Norton Creek with Fox River, St. Charles.
222	Norton Creek	T40N/R 8E/S 15SE; Kane Co.; 100-140 meters above mouth with Fox River, St. Charles.
223	Mill Creek	T39N/R 8E/S 33NE; Kane Co.; mouth of Mill Creek with Fox River, Mooseheart.
224	Mill Creek	T39N/R 8E/S 33NE; Kane Co.; 100 meters above mouth with Fox River, Mooseheart.
225	Indian Creek	T38N/R 8E/S 22NE; Kane Co.; mouth of Indian Creek with Fox River, Aurora.
226	Indian Creek	T38N/R 8E/S 22NE; Kane Co.; 100-140 meters above mouth with Fox River, Aurora.
227	Waubonsee Creek	T36N/R 7E/S 17SW; Kendall Co.; mouth of Waubonsee CR with Fox River, Oswego.
228	Waubonsee Creek	T36N/R 7E/S 17SW; Kendall Co.; 100 meters above mouth with Fox River, Oswego.
229	Blackberry Creek	T36N/R 7E/S 32NE; Kendall Co.; mouth of Blackberry CR with Fox River, Yorkville.
230	Blackberry Creek	T36N/R 7E/S 32NE; Kendall Co.; 100 meters above mouth with Fox River.
231	Blackberry Creek	T36N/R 7E/S 32NE; Kendall Co.; tailrace of Blackberry Creek Dam, Yorkville.
232	Blackberry Creek	T36N/R 7E/S 32NE; Kendall Co.; riffles below Blackberry Creek Dam.
233	Fox River	T37N/R 8E/S 33NW; Kane Co.; tailrace of Montgomery Dam, Montgomery.
234	Fox River	T37N/R 8E/S 33NW; Kane Co.; slough above and below dam on east bank, Montgomery.
235	Fox River	T36N/R 7E/S 33NW; Kendall Co.; Yorkville Dam tailrace, Yorkville.
245	Big Rock/Little Rock Creeks	T36N/R 6E/S 34SW; Kendall Co.; mouths of Big Rock/Little Rock Creeks together, Plano.
246	Rob Roy Creek	T36N/R 6E/S 34SE; Kendall Co.; 100 meters above mouth with Fox River, Plano.
247	Confluence of Big Rock/Little Rock Creeks	T36N/R 6E/S 34SW; Kendall Co.; 130 meters at mouth of confluence and two 40 meter sections 100 meters above mouth with Fox River, Plano.

Table 4-3. Checklist of Fishes Known to Occur in the Fox River Basin.

Petromyzontiformes

Petromyzontidae - Lampreys

Lampetra lamottei (Lesueur)
American brook lamprey

Amiiformes

Amiidae - Bowfins

Amia calva Linnaeus
Bowfin

Anguilliformes

Anguillidae - Freshwater eels

Anguilla rostrata (Lesueur)
American eel

Salmoniformes

Salmonidae - Trouts

Salmo gairdneri Richardson
Rainbow trout

Salmo trutta Linnaeus
Brown trout

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Esox lucius Linnaeus
Northern pike

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Table 4-3. Continued.

Cypriniformes - continued

Cyprinidae - Minnows and Carps (continued)

Campostoma oligolepis Hubbs & Greene
Largescale stoneroller

Carrassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Hybognathus hankinsoni Hubbs
Brassy minnow

Hybognathus nuchalis Agassiz
Silvery minnow

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis chrysocephalus (Rafinesque)
Striped shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis emiliae (Hay)
Pugnose minnow

Notropis heterodon (Cope)
Blackchin shiner

Notropis heterolepis Eigenmann & Eigenmann
Blacknose shiner

Notropis hudsonius (Clinton)
Spottail shiner

Table 4-3. Continued.

Cypriniformes - continued

Cyprinidae - Minnows and Carps

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Notropis volucellus (Cope)
Mimic shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Pimephales vigilax (Baird & Girard)
Bullhead minnow

Rhinichthys atratulus Hermann
Blacknose dace

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Carpiodes carpio (Rafinesque)
River carpsucker

Carpiodes cyprinus (Lesueur)
Quillback

Table 4-3. Continued.

Cypriniformes - continued

Catostomidae - Suckers (continued)

Carpiodes velifer (Rafinesque)
Highfin carpsucker

Catostomus commersoni (Lacépède)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Erimyzon sucetta (Lacépède)
Lake chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Ictiobus cyprinellus (Valenciennes)
Bigmouth buffalo

Moxostoma anisurum (Rafinesque)
Silver redhorse

Moxostoma carinatum (Cope)
River redhorse

Moxostoma duquesnei (Lesueur)
Black redhorse

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus natalis (Lesueur)
Yellow bullhead

Ictalurus nebulosus (Lesueur)
Brown bullhead

Table 4-3. Continued.

Siluriformes (continued)

Ictaluridae - Freshwater catfishes (continued)

Ictalurus punctatus (Rafinesque)
Channel catfish

Noturus exilis Nelson
Slender madtom

Noturus flavus Rafinesque
Stonecat

Noturus gyrinus (Mitchill)
Tadpole madtom

Pylodictis olivaris (Rafinesque)
Flathead catfish

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus diaphanus (Lesueur)
Banded killifish

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Fundulus notti (Agassiz)
Starhead topminnow

Atherinidae - Silversides

Labidesthes sicculus (Cope)
Brook silversides

Gasterosteiformes

Gasterosteidae - Sticklebacks

Culaca inconstans (Kirtland)
Brook stickleback

Perciformes

Percichthyidae - Temperate basses

Morone chrysops (Rafinesque)
White bass

Table 4-3. Continued.

Perciformes (continued)

Percichthyidae - Temperate basses (continued)

Morone mississippiensis Jordon & Eignemann
Yellow bass

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis gulosus (Cuvier)
Warmouth

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Lepomis megalotis (Rafinesque)
Longear sunfish

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides Lacépède
Largemouth bass

Pomoxis annularis Rafinesque
White crappie

Pomoxis nigromaculatus (Lesueur)
Black crappie

Percidae - Perches

Etheostoma caeruleum Storer
Rainbow darter

Etheostoma exile (Girard)
Iowa darter

Table 4-3. Completed.

Perciformes (continued)

Percidae - Perches (continued)

Etheostoma flabellare Rafinesque
Fantail darter

Etheostoma microperca Jordon & Gilbert
Least darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma spectabile (Agassiz)
Orangethroat darter

Etheostoma zonale (Cope)
Banded darter

Perca flavescens (Mitchill)
Yellow perch

Percina caprodes (Rafinesque)
Logperch

Percina maculata (Girard)
Blackside darter

Percina phoxocephala (Nelson)
Slenderhead darter

Stizostedion vitreum (Mitchill)
Walleye

Cottidae - Sculpins

Cottus bairdi Girard
Mottled sculpin

Table 4-4 MSDGC 1976 fish inventories. Abundance of fishes at sampling sites in the Fox River Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS											
	1	103	94	2	3	95	96	97	99	98	100	102
AMIIDAE												
Bowfin	--	--	--	--	--	--	--	--	--	--	--	--
ANGUILLIDAE												
American eel	--	--	--	--	--	--	--	--	--	--	--	--
SALMONIDAE												
Browntrout	--	--	--	--	--	--	--	1	14	2	--	--
UMBRIDAE												
Central mudminnow	--	--	--	--	--	--	--	--	--	--	--	--
ESOCIDAE												
Grass pickerel	--	--	--	--	--	--	--	--	--	--	--	--
Northern pike	1	--	--	--	--	--	--	--	1	--	--	--
CYPRINIDAE												
Stoneroller	--	25	--	--	--	--	--	--	--	--	5	--
Largescale stoneroller	--	--	--	--	--	--	--	--	--	--	--	--
Goldfish	--	--	--	--	--	--	--	--	--	--	--	--
Carp	20	--	--	--	3	--	--	--	--	--	--	--
Brassy minnow	--	--	--	--	--	--	--	--	--	--	--	--
Hornyhead chub	--	--	1	--	--	--	1	--	--	--	21	--
Golden shiner	--	--	--	--	--	--	--	--	--	--	--	--
Emerald shiner	16	--	--	--	--	--	--	--	--	--	--	--
Striped shiner	--	--	--	--	--	--	--	--	--	--	1	--
Common shiner	--	--	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	50	--	--	--	--	--	--	--	--	--	--	--
Spottail shiner	--	--	--	--	--	--	--	--	--	--	--	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	141	--	1	--	13	19	2	--	--	--	18	--
Sand shiner	--	--	1	2	--	3	1	--	--	--	2	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--	--	--
Mimic shiner	--	1	--	--	3	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	--	--	--	--	--	--	--	--	--
Southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	6	6	--	--	2	2	--	--	--	--	1	--
Fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--
Bullhead minnow	65	--	--	--	--	--	--	--	--	--	--	--
Blacknose dace	--	--	--	--	--	--	--	--	--	--	--	--
Creek chub	--	--	--	--	--	--	1	1	40	6	10	--
Carp X Goldfish	--	--	--	--	--	--	--	--	--	--	--	--
CATOSTOMIDAE												
River carpsucker	--	--	--	--	--	--	--	--	--	--	--	--
Quillback	--	--	--	--	1	--	--	--	--	--	--	--
Highfin carpsucker	--	--	--	--	--	--	--	--	--	--	--	--
White sucker	--	1	--	--	14	3	--	1	4	--	1	--
Lake chubsucker	--	--	--	--	--	--	--	--	--	--	--	--
Northern hog sucker	--	--	--	--	--	--	--	--	--	--	--	--
Silver redhorse	--	--	--	--	--	--	--	--	--	--	--	--
River redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Black redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Shorthead redhorse	--	--	--	--	1	1	--	--	--	--	--	--
ICTALURIDAE												
Black bullhead	2	7	--	--	1	14	--	--	--	--	--	--
Yellow bullhead	--	1	--	--	--	--	--	--	--	--	--	--
Brown bullhead	--	--	--	--	--	--	--	--	--	--	--	--
Channel catfish	26	--	--	--	--	--	--	--	--	--	--	--
Slender madtom	--	--	--	--	--	--	--	--	--	--	--	--
Stonecat	--	--	2	--	--	--	--	--	--	--	--	--
Tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--
Flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--
CYPRINODONTIDAE												
Blackstripe topminnow	1	--	--	--	--	--	--	--	--	--	--	--
ATHERINIDAE												
Brook silversides	--	--	--	--	--	--	--	--	--	--	--	--
PERCICHTHYIDAE												
White bass	4	--	--	--	--	--	--	--	--	--	--	--
Yellow bass	60	1	--	--	3	--	--	--	--	--	--	--
CENTRARCHIDAE												
Rock bass	--	--	--	--	1	--	--	--	--	--	--	--
Green sunfish	3	33	--	3	1	--	--	--	--	--	10	--
Pumpkinseed	--	6	--	--	--	--	--	--	--	--	1	--
Warmouth	--	--	--	--	--	--	--	--	--	--	--	--
Orangespotted sunfish	25	--	--	--	--	--	--	--	--	--	2	1
Bluegill	44	17	--	--	3	--	--	--	3	--	--	--
Longear sunfish	--	--	--	--	--	--	--	--	--	--	--	--
Smallmouth bass	2	--	1	--	1	--	--	--	--	--	--	--
Largemouth bass	3	19	--	--	--	4	--	--	--	--	1	--
White crappie	5	--	--	--	--	--	--	--	--	--	--	--
Black crappie	1	--	--	--	--	--	--	--	--	--	--	1
Green sunfish X Pumpkinseed	--	--	--	--	--	--	--	--	--	--	--	--
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Pumpkinseed hybrid	--	--	--	--	--	--	--	--	--	--	--	--
Hybrid	--	--	--	--	--	--	--	--	--	--	--	--
PERCIDAE												
Rainbow darter	--	--	--	--	--	--	--	--	--	--	--	--
Iowa darter	--	--	--	--	--	--	--	--	--	--	--	--
Fantail darter	--	--	--	--	--	--	--	--	--	--	--	--
Johnny darter	--	--	--	--	--	--	--	--	--	--	--	--
Orangethroat darter	--	--	--	--	--	--	--	--	--	--	--	--
Banded darter	--	--	--	--	--	--	--	--	--	--	--	--
Yellow perch	19	--	--	--	1	--	--	--	--	--	--	--
Logperch	--	--	--	--	--	--	--	--	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--	--	--
Slenderhead darter	--	--	--	--	--	--	--	--	--	--	--	--
Walleye	--	--	--	--	--	--	--	--	--	--	--	--
COTTIDAE												
Mottled sculpin	--	--	--	--	--	--	--	--	--	1	--	--
TOTAL NUMBER OF INDIVIDUALS	519	128	14	7	61	85	5	3	64	9	75	5
TOTAL NUMBER OF SPECIES	21	14	6	3	15	9	4	3	6	3	13	4
SPECIES DIVERSITY ($\bar{d}$)	3.44	3.04	2.35	1.56	3.19	2.57	1.97	1.58	1.61	1.16	2.88	1.86
EQUITABILITY (e)	0.5	0.9	1.2	1.3	0.9	0.9	1.2	1.3	0.7	1.0	0.8	1.2

Table 4-4. Continued.

	STATIONS											
	101	211	210	213	212	4	109	111	110	112	5	138
AMIIDAE												
Bowfin	--	--	--	--	--	--	--			-	-	2
ANGUILLIDAE												
American eel	--	--	--	--	--			--	-		--	--
SALMONIDAE												
Brown trout	--	--	--	--	--	--			--	--	--	--
UMBRIDAE												
Central mudminnow	--	1	--	--	--	--	--	-	--	--	--	1
ESOCIDAE												
Grass pickerel	--	--	--	--	--	--	--	--	--	--	--	5
Northern pike	--	1	--	--	--	--	--	--	--	1	1	1
CYPRINIDAE												
Stoneroller	--	--	--	--	--	--	--	--	--	-	--	--
Largescale stoneroller	--	--	--	--	--	--	--	--	--	--	--	--
Goldfish	--	--	--	--	--	--	--	--	--	--	--	--
Carp	25	--	--	--	--	24	3	2	6	--	15	--
Brassy minnow	--	--	--	--	--	--	--	--	--	--	--	--
Hornyhead chub	--	--	--	--	--	--	--	--	--	--	--	--
Golden shiner	--	--	--	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	--	--	1	--	--
Striped shiner	--	--	--	--	--	--	--	--	--	--	--	--
Common shiner	--	--	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	--	--	--	--	--	--	--	--	--	--	--	--
Spottail shiner	--	--	--	--	--	--	--	--	--	--	--	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	1	--	--	--	--	--	--	--	--	--	--	--
Sand shiner	--	--	--	--	--	--	--	--	--	1	--	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--	--	--
Mimic shiner	--	--	--	--	--	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	--	--	--	--	--	--	--	--	--
Southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	--	1	--	--	--	--	--	--	--	--	--	--
Fathead minnow	--	--	--	--	--	--	--	--	--	1	--	--
Bullhead minnow	4	--	--	3	1	1	--	--	--	3	--	--
Blacknose dace	--	--	--	--	--	--	--	--	--	10	--	--
Creek chub	--	--	--	--	--	--	--	--	--	--	--	--
Carp X Goldfish	--	--	--	--	--	--	--	--	--	--	--	--
CATOSTOMIDAE												
River carpsucker	--	--	--	--	--	--	--	--	--	--	--	--
Quillback	--	--	--	--	--	--	--	--	--	1	--	--
Highfin carpsucker	--	--	--	--	--	--	--	--	--	--	-	--
White sucker	--	1	--	1	--	--	--	1	--	--	--	--
Lake chubsucker	--	--	--	--	--	--	--	--	--	--	--	7
Northern hog sucker	--	--	--	--	--	--	--	--	--	--	--	--
Silver redhorse	--	--	--	--	--	--	--	--	--	--	--	--
River redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Black redhorse	--	--	--	--	--	--	--	--	--	1	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Shorthead redhorse	--	--	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE												
Black bullhead	9	3	--	--	1	101	--	25	12	2	1	--
Yellow bullhead	--	--	--	--	--	--	--	--	--	--	--	--
Brown bullhead	--	--	--	--	--	--	--	--	--	--	--	--
Channel catfish	42	--	--	--	--	36	--	12	--	43	5	--
Slender madtom	--	--	--	--	--	--	--	--	--	--	--	--
Stonecat	--	--	--	--	--	--	--	--	--	--	--	--
Tadpole madtom	--	4	--	--	--	--	--	--	--	--	--	--
Flathead catfish	--	--	--	--	--	--	1	--	--	--	--	--
CYPRINODONTIDAE												
Blackstripe topminnow	--	--	--	--	--	--	--	--	--	--	--	--
ATHERINIDAE												
Brook silversides	--	2	--	--	--	--	--	--	--	--	--	3
PERCICHTHYIDAE												
White bass	3	--	--	--	--	5	1	--	--	4	--	--
Yellow bass	90	--	--	--	--	18	1	--	1	32	12	--
CENTRARCHIDAE												
Rock bass	1	--	--	--	--	--	--	--	--	--	--	--
Green sunfish	7	7	4	10	13	1	--	15	--	8	--	3
Pumpkinseed	--	--	--	2	6	3	--	6	1	20	1	35
Warmouth	--	--	4	2	3	--	--	1	--	2	--	18
Orangespotted sunfish	1	--	--	--	--	--	--	25	--	5	--	--
Bluegill	5	29	8	13	9	6	--	18	1	45	4	49
Longear sunfish	--	--	--	--	--	--	--	--	--	--	--	--
Smallmouth bass	--	--	--	--	--	--	--	--	--	--	--	--
Largemouth bass	6	9	15	--	3	2	1	12	--	12	3	13
White crappie	1	--	--	--	--	3	--	--	2	--	1	--
Black crappie	1	--	--	--	--	--	1	3	--	--	4	1
Green sunfish X Pumpkinseed	--	--	--	1	--	--	--	1	--	--	-	--
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Pumpkinseed hybrid	--	--	--	--	--	--	--	--	--	--	--	--
Hybrid	--	--	--	--	--	--	--	--	--	--	--	--
PERCIDAE												
Rainbow darter	--	--	--	--	--	--	--	--	--	--	--	--
Iowa darter	--	--	--	--	--	--	--	--	--	--	--	--
Fantail darter	--	--	--	--	--	--	--	--	--	--	--	--
Johnny darter	--	--	--	--	--	--	--	--	--	--	--	--
Orangethroat darter	--	--	--	--	--	--	--	--	--	--	--	--
Banded darter	--	--	--	--	--	--	--	--	--	--	--	--
Yellow perch	3	--	--	--	--	2	--	--	--	18	--	14
Logperch	--	--	--	--	--	--	--	1	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--	--	--
Slenderhead darter	--	--	--	--	--	--	--	--	--	--	--	--
Walleye	1	--	--	--	--	--	1	--	--	--	--	--
COTTIDAE												
Mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL NUMBER OF INDIVIDUALS	200	58	31	32	36	202	9	122	23	210	31	152
TOTAL NUMBER OF SPECIES	16	10	4	6	7	12	7	12	6	19	10	13
SPECIES DIVERSITY ($\bar{d}$)	2.55	2.34	1.77	2.19	2.35	2.29	2.64	3.04	1.89	3.28	2.70	2.81
EQUITABILITY (e)	0.5	0.7	1.0	0.8	1.0	0.6	1.3	0.9	0.8	0.7	0.9	0.8

Table 4-4. Continued.

SPECIES	STATIONS											
	139	140	214	107	106	6	7	86	85	215	216	217
AMIIDAE												
Bowfin	--	--	--	--	--	--	--	--	--	--	--	--
ANGUILLIDAE												
American eel	-	-	--	-	--	--	--		--	--	-	-
SALMONIDAE												
Brown trout	-	-	--	-	-	--	-		--	-	--	-
UMBRIDAE												
Central mudminnow	--	--	1	-	-	--	-	--	-	-	-	-
ESOCIDAE												
Grass pickerel	--	--	--	-	-	--	-	--	-	-	--	-
Northern pike	--	-		-	-	--	-	--	-	-	--	--
CYPRINIDAE												
Stoneroller		-	-	--	-	-	-	1	-	-	-	--
Largescale stoneroller		-	-	-	-	-	-	-	-	-	-	-
Goldfish		-	-	-	--	-	-	-	-	-	-	-
Carp	-	-	-	-	-	22	9	-	3	-	-	1
Brassy minnow	-	-	-	-	-	-	--	--	-	-	-	1
Hornyhead chub	-	-	-	-	-	-	--	--	-	-	--	11
Golden shiner	1	-	--	-	-	-	--	--	-	-	-	-
Emerald shiner	1	-	-	-	-	-	--	--	-	-	-	-
Striped shiner		-	-	-	-	-	-	--	-	-	-	16
Common shiner		-	-	-	-	-	-	-	-	-	1	58
Bigmouth shiner		-	-	-	-	-	-	-	-	-	-	-
Spottail shiner		-	-	-	-	-	-	-	-	--	-	-
Rosyface shiner	-	-	-	-	-	--	-	-	-	-	-	-
Spotfin shiner	-	-	-	-	-	-	-	11	22	3	15	2
Sand shiner	-	-	-	-	-	-	-	-	-	-	-	-
Redfin shiner	-	-	-	-	-	-	-	-	-	-	-	-
Mimic shiner	-	-	-	-	-	-	-	-	-	-	-	-
Suckermouth minnow	-	-	-	-	-	-	-	16	-	-	-	-
Southern redbelly dace	-	-	-	-	-	-	-	-	6	-	1	4
Bluntnose minnow	12	-	-	-	-	-	-	-	2	-	1	1
Fathead minnow	-	-	-	-	-	-	-	-	-	9	2	-
Bullhead minnow	-	-	15	1	-	-	-	-	-	-	-	-
Blacknose dace	-	-	-	-	-	-	-	-	-	-	1	28
Creek chub	-	-	-	-	-	-	-	-	-	-	-	-
Carp X Goldfish	-	-	-	-	-	-	-	-	-	-	-	-
CATOSTOMIDAE												
River carpsucker	-	-	-	-	-	-	-	-	-	-	-	-
Quillback	-	-	-	-	-	-	-	-	-	-	-	-
Highfin carpsucker	-	-	-	-	-	-	-	1	6	-	1	12
White sucker	-	-	-	-	-	-	-	-	-	-	-	-
Lake chubsucker	-	-	-	-	-	-	-	-	-	-	-	-
Northern hog sucker	-	-	-	-	-	-	-	-	-	-	-	-
Silver redhorse	-	-	-	-	-	-	-	-	-	-	-	-
River redhorse	-	-	-	-	-	-	-	-	-	-	-	-
Black redhorse	-	-	-	-	-	-	-	-	-	-	-	-
Golden redhorse	-	-	-	-	-	-	-	-	-	-	-	-
Shorthead redhorse	-	-	-	-	-	-	-	-	-	-	-	-
ICTALURIDAE												
Black bullhead	1	-	-	-	-	1	1	-	-	1	-	19
Yellow bullhead	-	-	-	-	-	-	-	-	-	-	1	1
Brown bullhead	-	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	-	-	-	-	-	2	30	1	1	-	-	-
Slender madtom	-	-	-	-	-	-	-	-	-	-	-	-
Stonecat	-	-	-	-	-	-	-	1	-	-	-	-
Tadpole madtom	-	-	-	-	-	-	-	-	-	-	1	-
Flathead catfish	-	-	-	-	-	-	1	-	-	1	-	-
CYPRINODONTIDAE												
Blackstripe topminnow	-	-	-	-	-	-	-	-	-	-	-	-
ATHERINIDAE												
Brook silverside	-	-	-	-	-	-	-	-	-	-	-	-
PERCICHTHYIDAE												
White bass	1	-	-	-	-	1	-	-	-	-	-	-
Yellow bass	6	39	-	-	4	39	28	-	-	-	-	-
CENTRARCHIDAE												
Rock bass	-	-	-	-	-	-	-	-	-	-	-	-
Green sunfish	4	-	8	1	-	3	1	-	6	-	-	11
Pumpkinseed	5	-	-	-	-	-	-	-	4	3	3	41
Warmouth	1	-	-	-	-	-	-	-	-	-	-	-
Orangespotted sunfish	-	-	-	-	-	-	-	1	-	-	-	-
Bluegill	12	-	-	2	1	24	6	1	10	18	9	63
Longear sunfish	-	-	-	-	-	-	-	-	-	-	-	-
Smallmouth bass	-	-	-	-	-	-	-	-	6	-	3	-
Largemouth bass	3	-	-	1	-	1	-	8	9	1	9	41
White crappie	3	-	-	-	-	-	5	-	-	-	-	-
Black crappie	1	1	-	-	-	-	1	-	1	-	-	1
Green sunfish X Pumpkinseed	-	-	-	-	-	-	-	-	-	-	-	-
Pumpkinseed X Bluegill	-	-	-	-	-	-	-	-	-	-	-	-
Green sunfish X Bluegill	-	-	-	-	-	-	-	-	-	-	-	-
Pumpkinseed hybrid	-	-	-	1	-	-	-	-	-	-	-	-
Hybrid	-	-	-	-	-	-	-	-	-	-	-	-
PERCIDAE												
Rainbow darter	-	-	-	-	-	-	-	-	-	-	-	-
Iowa darter	-	-	-	-	-	-	-	-	-	-	-	-
Fantail darter	-	-	-	-	-	-	-	-	-	-	-	-
Johnny darter	-	-	-	-	-	-	-	-	-	-	-	13
Orangethroat darter	-	-	-	-	-	-	-	-	-	-	-	-
Banded darter	-	-	-	-	-	-	-	11	1	1	-	-
Yellow perch	-	-	-	-	-	-	-	-	1	-	-	-
Logperch	-	-	-	-	-	2	-	-	2	-	-	-
Blackside darter	-	-	-	-	-	-	-	-	-	1	-	-
Slenderhead darter	-	-	-	-	-	-	-	-	-	-	-	-
Walleye	-	-	-	-	-	1	-	-	-	-	-	-
COTTIDAE												
Mottled sculpin	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF INDIVIDUALS	58	41	34	5	5	124	91	58	94	40	101	338
TOTAL NUMBER OF SPECIES	14	3	5	5	3	11	11	13	13	10	14	19
SPECIES DIVERSITY d	3.28	1.37	1.16	1.61	1.56	1.49	1.56	2.91	3.58	2.44	2.44	3.43
EQUITABILITY e	0.9	1.1	1.0	1.2	1.0	0.7	0.7	0.8	1.0	1.0	0.9	0.8

Table 4-4 Continued.

SPECIES	STATIONS											
	219	218	8	104	105	220	87	88	89	9	222	221
AMIIDAE												
Bowfin	--	--	--	--	--	--	--	--	--	--	--	--
ANGUILLIDAE												
American eel	--	--	--	--	--	--	--	--	--	--	--	--
SALMONIDAE												
Brown trout	--	--	--	--	--	--	--	--	--	--	--	--
UMBRIDAE												
Central mudminnow	--	--	--	--	--	--	--	1	--	--	--	3
ESOCIDAE												
Grass pickerel	--	--	--	--	--	--	--	--	--	--	--	--
Northern pike	--	--	--	--	--	--	1	--	--	--	--	1
CYPRINIDAE												
Stoneroller	--	--	--	--	--	1	--	--	--	--	--	--
Largescale stoneroller	--	--	--	--	--	--	--	--	--	--	--	--
Goldfish	--	--	--	--	--	--	2	--	--	--	--	--
Carp	--	--	45	--	--	--	16	5	1	--	--	--
Brassy minnow	--	--	--	--	--	--	--	--	--	--	--	--
Hornyhead chub	3	--	--	2	--	--	--	--	--	--	--	--
Golden shiner	--	--	--	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	--	--	--	--	--
Striped shiner	2	--	--	1	--	11	--	--	--	--	39	1
Common shiner	135	4	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	2	52	--	--	--	6	--	--	--	--	--	--
Spottail shiner	--	--	--	--	--	--	--	--	--	--	--	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	--	2	2	--	--	2	--	--	2	1	50	--
Sand shiner	--	4	--	--	--	--	--	--	--	--	--	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--	--	--
Mimic shiner	--	--	--	--	--	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	7	--	--	--	--	--	--	--	--
Southern redbelly dace	--	--	--	--	--	--	--	--	--	--	1	--
Bluntnose minnow	15	--	--	--	--	26	--	--	1	--	15	--
Fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--
Bullhead minnow	--	--	19	--	--	--	--	--	--	--	--	--
Blacknose dace	--	--	--	--	--	--	--	--	--	--	--	--
Creek chub	--	--	--	--	--	1	--	--	--	--	11	--
Carp X Goldfish	--	--	--	--	--	--	--	--	--	--	--	--
CATOSTOMIDAE												
River carpsucker	--	--	--	--	--	--	--	--	--	--	--	--
Quillback	--	--	6	--	--	--	--	--	--	--	--	--
Highfin carpsucker	--	--	--	--	--	--	--	--	--	--	--	--
White sucker	29	2	4	--	--	1	--	--	1	--	9	--
Lake chubsucker	--	--	--	--	--	--	--	--	--	--	--	--
Northern hog sucker	3	9	--	1	--	1	--	--	--	--	1	--
Silver redhorse	--	--	--	--	--	--	--	--	--	--	--	--
River redhorse	--	--	--	--	--	--	--	--	--	--	--	--
Black redhorse	--	--	--	--	--	--	1	--	--	--	--	--
Golden redhorse	6	--	--	--	--	--	2	--	--	--	--	--
Shorthead redhorse	--	--	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE												
Black bullhead	--	--	3	13	--	1	33	3	7	--	--	1
Yellow bullhead	--	--	--	--	--	2	--	--	1	--	--	--
Brown bullhead	--	--	--	--	--	--	--	--	--	--	--	--
Channel catfish	--	--	19	--	--	--	9	--	--	--	--	--
Slender madtom	--	--	--	--	--	--	--	--	--	--	--	--
Stonecat	--	--	--	5	--	--	--	--	1	1	--	--
Tadpole madtom	1	--	--	--	--	--	--	1	--	--	--	--
Flathead catfish	--	--	2	--	--	--	--	--	1	--	--	--
CYPRINODONTIDAE												
Blackstripe topminnow	--	--	--	--	--	--	--	--	--	--	--	--
ANTHERINIDAE												
Brook silversides	--	--	--	--	--	--	--	--	--	--	--	--
PERCICHTHYIDAE												
White bass	--	--	5	--	--	--	--	--	--	--	--	--
Yellow bass	--	--	31	3	1	--	12	--	2	--	--	--
CENTRARCHIDAE												
Rock bass	--	--	--	--	--	--	--	--	--	--	--	--
Green sunfish	12	3	6	11	5	10	7	--	53	2	23	22
Pumpkinseed	1	--	1	1	--	--	4	--	--	--	--	--
Warmouth	--	--	1	--	--	--	--	--	1	--	--	--
Orangespotted sunfish	--	--	4	--	--	--	--	--	--	--	--	--
Bluegill	21	6	38	--	13	42	7	3	2	2	100	17
Longear sunfish	--	--	--	--	--	--	--	--	--	--	--	--
Smallmouth bass	3	--	15	1	1	--	2	--	1	--	--	--
Largemouth bass	--	2	14	--	--	1	--	10	--	1	--	--
White crappie	--	--	2	1	--	--	--	--	2	--	--	--
Black crappie	--	--	6	--	--	--	--	--	--	1	--	--
Green sunfish X Pumpkinseed	--	--	--	--	--	--	--	--	--	--	--	--
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--	--	--
Pumpkinseed hybrid	--	--	--	--	--	--	--	--	--	--	--	--
Hybrid	--	--	--	--	--	--	--	--	--	--	--	--
PERCIDAE												
Rainbow darter	1	--	--	--	--	--	--	--	--	--	--	--
Iowa darter	--	--	--	--	--	1	--	--	--	--	1	--
Fantail darter	2	--	--	--	--	--	--	--	--	--	--	--
Johnny darter	--	--	--	--	--	--	--	--	--	--	18	1
Orangethroat darter	--	--	--	--	--	--	--	--	--	--	--	--
Banded darter	--	2	--	--	--	--	--	--	--	--	--	--
Yellow perch	--	--	--	--	--	--	--	--	--	--	--	--
Logperch	--	--	1	--	--	--	--	--	1	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--	--	--
Slenderhead darter	--	--	--	--	--	--	--	--	3	--	--	--
Walleye	--	--	--	--	--	--	--	--	--	--	--	--
COTTIDAE												
Mottled sculpin	3	2	--	--	--	--	--	--	--	--	1	--
TOTAL NUMBER OF INDIVIDUALS	239	88	224	46	20	106	96	23	80	8	279	46
TOTAL NUMBER OF SPECIES	16	11	20	11	4	14	12	6	16	6	12	7
SPECIES DIVERSITY ($\bar{d}$)	2.33	2.24	3.53	2.82	1.34	2.58	2.88	2.16	2.12	2.50	2.68	1.78
EQUITABILITY (e)	0.4	0.5	0.8	0.9	0.7	0.6	0.8	1.0	0.4	1.3	0.7	0.6

Table 4-4. Continued.

SPECIES	STATIONS											
	10	124	123	224	223	84	226	225	11	234	233	228
AMIIDAE												
Bowfin	--	-	-	--	-	--	--	--	--	--	-	
ANGUILLIDAE												
American eel	-	-	-		-	--	-					
SALMONIDAE												
Brown trout		--		-		-	-		--	--	-	--
UMBRIDAE												
Central mudminnow	--	-	-	--	-	-	-	-	-	--	--	-
ESOCIDAE												
Grass pickerel		-		-								
Northern pike				--			--	-				
CYPRINIDAE												
Stoneroller							-				-	58
Largescale stoneroller							-	-				5
Goldfish	32		-	1								-
Carp	39	1	5	3		3					33	1
Brassy minnow									-	-		--
Hornyhead chub	-			4	3	--	--		-	--	-	39
Golden shiner		-				-	-		-	-	1	--
Emerald shiner												-
Striped shiner	-			1	-			3				-
Common shiner	-	-			-	-	-	-	-	-	1	4
Bigmouth shiner												
Spottail shiner		-										
Rosyface shiner												
Spotfin shiner	-	16	16		37	4		31	4	-		
Sand shiner					2			3	3			
Redfin shiner	1									1		
Mimic shiner												
Suckermouth minnow			1									
Southern redbelly dace												1
Bluntnose minnow	4		1	3	34	8		11	1			3
Fathead minnow							1					
Bullhead minnow												
Blacknose dace												-
Creek chub		1	-	-		-	139	3	-	-	-	3
Carp X Goldfish	9			-		-	-				1	
CATOSTOMIDAE												
River carpsucker						1				-		
Quillback	29										1	
Highfin carpsucker												
White sucker				1	1	1	1		1			2
Lake chubsucker												
Northern Hog sucker									1			
Silver redhorse						1						
River redhorse	-								-			
Black redhorse						1					20	
Golden redhorse		-		-	-	1	-	-	-	-	13	-
Shorthead redhorse	-	-	-	-	-	3	-	-	-	-	26	-
ICTALURIDAE												
Black bullhead												
Yellow bullhead			1	30		1		1			1	
Brown bullhead											-	
Channel catfish	2					8				1	1	
Slender madtom												
Stonecat						-			1		1	
Tadpole madtom										-		-
Flathead catfish			-									
CYPRINODONTIDAE												
Blackstripe topminnow				-				-		-	-	-
ATHERINIDAE												
Brook silverside	-	1										-
PERCICHTHYIDAE												
White bass	4		1									
Yellow bass	60	3	4			4					-	
CENTRARCHIDAE												
Rock bass	-		-			-						
Green sunfish	37	14	13	106	37	32		87	5	1	1	88
Pumpkinseed	-		-								-	-
Warmouth	-		-			-						
Orangespotted sunfish	-	1		-		14		-				
Bluegill	8	1	1	56	35	35		68	3	-	1	--
Longear sunfish		-				-			-			-
Smallmouth bass		-	1			1			2			
Largemouth bass	1		-	1	-	4		1		8	21	1
White crappie												
Black crappie	1			1					-		1	
Green sunfish X Pumpkinseed				-					-	-		
Pumpkinseed X Bluegill						-	-		-			
Green sunfish X Bluegill						-						
Pumpkinseed hybrid			-									
Hybrid			-									
PERCIDAE												
Rainbow darter		-	-	-	-	-	-					
Iowa darter		-	-	-	-	-						-
Fantail darter			-	-		-						8
Johnny darter	-		-		1							
Orangethroat darter		-	-	-	-	-						-
Banded darter	--	-	-	-	--	-			-		-	--
Yellow perch	-		-	-					-		--	
Logperch	4							--	--	-		
Blackside darter	-				1	--		-		--		
Slenderhead darter	-			--	--	--	-	-	-	--		-
Walleye			-		--			--				
COTTIDAE												
Mottled sculpin	--	-	-	-	-	-			--	--	--	10
TOTAL NUMBER OF INDIVIDUALS	244	39	47	213	151	28	154	262	27	20	144	261
TOTAL NUMBER OF SPECIES	15	9	11	11	9	18	4	9	10	3	18	15
SPECIES DIVERSITY ($\bar{d}$)	3.13	2.18	2.71	2.60	2.31	3.19	0.55	2.31	3.03	1.36	3.21	2.74
EQUITABILITY (e)	0.7	0.7	0.7	0.4	0.8	0.7	0.2	0.8	1.2	1.0	0.7	0.6

Table 4-4. Continued.

SPECIES	STATIONS											
	227	90	12	232	231	230	229	235	116	246	117	13
AMIIDAE												
Bowfin	--	--	--	--	--	--	--	--	--	--	--	--
ANGUILLIDAE												
American eel	--	--	--	-	--	--			--	--		
SALMONIDAE												
Brown trout	--	--	--	--	--	--	--		-	--		
UMBRIDAE												
Central mudminnow	--	--	--	--	-	--	--	--	-	-	-	-
	--	--	-									
ESOCIDAE												
Grass pickerel	--	--	--	--	--	--	--	--	--	--	--	--
Northern pike	--	--	--	--	--	1	--	--	--	--	-	-
CYPRINIDAE												
Stoneroller	66	--	--	--	24	3	--	2	--	2	1	
Largescale stoneroller	29	--	--	--	--	--	--	--	--	--	-	
Goldfish	--	3	--	--	--	1	--	-	--	--	1	1
Carp	1	16	--	1	3	--	--	2	--	--	2	65
Brassy minnow	--	--	--	--	--	--	--	--	--	--	--	
Hornyhead chub	44	--	--	2	9	--	--		--	3	3	--
Golden shiner	--	--	--	--	--	--	--	-	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	-	--	--	--	--
Striped shiner	--	--	--	4	--	4	--	2	--	19	11	--
Common shiner	28	--	--	--	--	7	--	--	--	--	--	--
Bigmouth shiner	--	--	3	--	--	--	--	--	--	16	11	--
Spottail shiner	--	--	--	--	--	--	--	--	--	--	--	1
Rosyface shiner	--	--	--	--	--	--	3	--	--	--	--	--
Spotfin shiner	1	29	25	30	10	45	61	21	26	94	58	15
Sand shiner	--	--	1	30	1	65	60	23	6	9	41	--
Redfin shiner	1	--	--	--	--	4	4	--	--	3	--	--
Mimic shiner	--	--	--	--	2	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	--	--	--	--	2	--	--	--	-
Southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	
Bluntnose minnow	14	8	8	30	1	43	60	2	8	29	74	19
Fathead minnow	--	--	--	1	--	2	--	--	--	--	--	1
Bullhead minnow	--	1	--	--	--	1	--	--	--	--	--	--
Blacknose dace	6	--	--	--	--	--	--	--	--	--	--	--
Creek chub	54	--	--	2	5	26	1	--	--	4	--	--
Carp X Goldfish	1	5	--	--	--	--	--	--	--	--	--	3
CATOSTOMIDAE												
River Carpsucker	--	1	1	--	--	1	1	--	1	--	1	--
Quillback	--	--	--	--	--	--	--	--	--	--	--	10
Highfin carpsucker	--	--	--	--	--	--	--	--	--	--	1	--
White sucker	6	5	1	--	--	--	--	--	--	2	--	--
Lake chubsucker	--	--	--	--	--	--	--	--	--	--	--	--
Northern hog sucker	--	--	--	--	--	--	--	2	--	--	1	--
Silver redhorse	--	--	--	--	--	--	--	--	--	--	-	3
River redhorse	--	--	--	1	--	--	--	--	--	--	-	--
Black redhorse	--	5	--	1	46	8	--	--	--	--	-	5
Golden redhorse	10	--	--	--	--	--	--	1	--	--	--	16
Shorthead redhorse	4	--	--	--	--	--	--	42	--	2	1	56
ICTALURIDAE												
Black bullhead	--	1	--	--	--	--	--	--	--	--	--	1
Yellow bullhead	34	1	--	--	3	4	--	--	--	1	--	--
Brown bullhead	--	1	--	--	--	--	--	--	--	--	--	--
Channel catfish	--	--	--	--	--	--	--	--	--	--	--	8
Slender madtom	--	--	--	1	3	--	--	--	--	--	--	--
Stonecat	3	--	--	1	--	1	--	15	--	--	--	--
Tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--
Flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--
CYPRINODONTIDAE												
Blackstripe topminnow	--	--	--	2	2	6	--	--	--	--	--	1
ATHERINIDAE												
Brook silversides	--	--	--	--	--	--	--	--	--	--	--	--
	--	--										
PERCICHTHYIDAE												
White bass	--	-	--	--	--	--	--	--	--	-	--	--
Yellow bass	-	--	1	--	--	--	--	--	--	--	2	1
CENTRARCHIDAE												
Rock bass	1	2	--	--	--	1	--	-	--	--	1	--
Green sunfish	55	23	--	1	12	42	23	1	1	5	10	75
Pumpkinseed	7	--	--	--	1	--	--	--	--	--	--	1
Warmouth	--	--	--	--	--	--	--	--	--	--	--	--
Orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--
Bluegill	38	1	1	--	14	1	1	--	--	3	23	13
Longear sunfish	1	--	--	--	--	1	--	--	--	--	1	--
Smallmouth bass	1	1	1	2	50	--	--	4	--	--	--	1
Largemouth bass	15	--	1	--	6	2	-	1	-	--	2	11
White crappie	--	--	--	--	--	--	--		--	--	1	2
Black crappie	--	--	--	--	--	--	--	--	--	-	2	2
Green sunfish X Pumpkinseed	3	--	--	--	--	--	--	--	--	--	--	
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--	-
Green sunfish X Bluegill	--	--	-	--	--	2	--	--	--	--	--	-
Pumpkinseed hybrid	--	--		--	--	--	--	--	--	--	--	--
Hybrid	--	--	--	--	--	1	--	--	--	--	--	-
PERCIDAE												
Rainbow darter	--	--	--	2	3	--	--		--	--	--	--
Iowa darter	3	--	--	--	--	--	--			--	-	--
Fantail darter	37	--	--	1	2	--	--		--	--	--	--
Johnny darter	--	--	--	5	-	8	6	--	2	1	1	-
Orangethroat darter	5	--	--	3	2	--	--	--	--	--		
Banded darter	--	--	--	1	--	--	--	5		--		
Yellow perch	--	--	--	--	--	--	--		--	--	--	
Logperch	--	--	--	--	--	-	--		--			
Blackside darter	--	--	--	--	--	--	--	-	--	--		
Slenderhead darter	--	--	--	--	--	--	--		--	--	-	-
Walleye	--		--	--	--	--	--		--	--	-	--
COTTIDAE												
Mottled sculpin	7		--	--	1	--	--	--	-	8	10	--
TOTAL NUMBER OF INDIVIDUALS	475	103	43	120	201	280	220	130	44	201	260	311
TOTAL NUMBER OF SPECIES	26	15	10	19	22	23	10	15	6	16	24	22
SPECIES DIVERSITY ($\bar{d}$)	3.93	3.03	2.06	2.81	3.38	3.35	2.31	2.94	1.74	2.71	3.11	3.26
EQUITABILITY (e)	0.8	0.7	0.6	0.5	0.7	0.6	0.7	0.7	0.7	0.6	0.5	0.6

Table 4-4 Completed

SPECIES	STATIONS							TOTAL NUMBER	% OF TOTAL
	120	91	92	93	245	247	118		
AMIIDAE									
Bowfin	--	--	-	--	-	-	-	2	<1
ANGUILLIDAE									
American eel	-					-	1	1	<1
SALMONIDAE									
Brown trout		-	--			--	-	17	<1
UMBRIDAE									
Central mudminnow	-	-	-			3		8	<1
ESOCIDAE									
Grass pickerel		-			-	1	--	6	<1
Northern pike					-	1		9	<1
CYPRINIDAE									
Stoneroller		2	11	1	--	-	-	312	3
Largescale stoneroller					1			35	<1
Goldfish				-			-	40	<1
Carp	1	2		-				384	4
Brassy minnow	-	-	-	-			--	1	<1
Hornyhead chub	4	9	30		1			180	2
Golden shiner	3		-					17	<1
Emerald shiner	6		-					26	<1
Striped shiner		4	4		1			154	2
Common shiner		34	--		1	2		202	1
Bigmouth shiner	3		74		48	--		359	4
Spottail shiner	1	-	-			--		3	<1
Rosyface shiner		1			8	1		14	<1
Spottail shiner	72	49	40	1	47	60		1104	11
Sand shiner	43	29	34	6	38	--		516	5
Redfin shiner	1	2		1				18	<1
Mimic shiner					40			47	<1
Suckermouth minnow		1	2		4			34	<1
Southern redbelly dace						--		1	<1
Bluntnose minnow	30	20	30	3	28	73		650	7
Fathead minnow	-		1					20	<1
Bullhead minnow	-					1		200	2
Blacknose dace	-							6	<1
Creek chub		-	15					397	4
Carp X Goldfish			-					19	<1
CATOSTOMIDAE									
River carpsucker		-	11	1	-	-	-	21	<1
Quillback	12							69	1
Highfin carpsucker								1	<1
White sucker	4	9	29	4	1			182	2
Lake chubsucker								-	<1
Northern hog sucker	3	13	6	3	16	1	2	63	1
Silver redhorse	6						1	15	<1
River redhorse		-						1	<1
Black redhorse	-		1		6	8	5	113	1
Golden redhorse	-		1		2		1	54	1
Shorthead redhorse	20	-	-				6	159	2
ICTALURIDAE									
Black bullhead				-	-			287	3
Yellow bullhead					1	-	-	88	1
Brown bullhead						-	-	1	<1
Channel catfish						--	-	272	3
Slender madtom							-	4	<1
Stonecat					1		-	40	1
Tadpole madtom							--	9	<1
Flathead catfish								6	<1
CYPRINODONTIDAE									
Blackstripe topminnow	-				--			12	<1
ATHERINIDAE									
Brook silversides			-	-			-	6	1
PERCICHTHYIDAE									
White bass						-	-	33	<1
Yellow bass							-	456	5
CENTRARCHIDAE									
Rock bass		3		1	1	1	1	19	<1
Green sunfish	1	8	1	4	-	50		1070	11
Pumpkinseed	-		-		1	1		176	2
Warmouth	-		-					33	<1
Orangespotted sunfish			--	-		1		8	<1
Bluegill	1		1	-	15	6		983	10
Longear sunfish	-		-	-	-	--		3	<1
Smallmouth bass	6	2	--	1	-	10	1	131	1
Largemouth bass	-	--	4	-	-	4		305	3
White crappie	-	-	-			--		31	<1
Black crappie	-				-	1	1	33	<1
Green sunfish X Pumpkinseed						--	-	5	<1
Pumpkinseed X Bluegill		-			1	-	-	1	<1
Green sunfish X Bluegill					--		--	2	<1
Pumpkinseed hybrid	-				-			1	<1
Hybrid	-	-	--					1	<1
PERCIDAE									
Rainbow darter	-	1	-		-	1	--	8	<1
Iowa darter	-	-	-			--	--	-	<1
Fantail darter	-	-	-	-	-	-		50	1
Johnny darter	-	-	-	-	-	-	-	58	1
Orangethroat darter		--	-	-	1	-	-	13	<1
Banded darter		3	1	--	1	-	-	30	<1
Yellow perch		-		--	--	-	-	59	1
Logperch		-			--	-	--	14	<1
Blackside darter	-	-				-	--	2	<1
Slenderhead darter	-	-	-			--	-	3	<1
Walleye	-	-	-			--	-	3	<1
COTTIDAE									
Mottled sculpin	--	--	--	-	--	--	--	59	1
TOTAL NUMBER OF INDIVIDUALS	220	253	297	28	277	263	19	9752	95
TOTAL NUMBER OF SPECIES	19	20	20	11	24	22	9	76	--
SPECIES DIVERSITY (d)	3.07	3.18	3.34	3.17	3.49	2.83	2.72	-	-
EQUITABILITY (e)	0.6	0.6	0.7	1.2	0.6	0.4	1.0		

Table 4-5. Location of 1976 IEPA Water Quality Sampling Sites, Fox River Basin.

Basin Code	Station Number	Stream Name	Description
Fox River			
DT	03	Fox River	US34-Washington ST BR in Oswego
DT	04	Fox River	FT BR US from Batavia STWW CHL-CMP
DT	05	Fox River	RT 72-Main ST BR at Dundee
DT	06	Fox River	RT 62-Algonquin RD BR--Composite
DT	09	Fox River	State ST BR in S Elgin
DT	11	Fox River	RT 47 BR N of Yorkville--S Channel
DT	13	Fox River	North AVE BR in Aurora--W Channel
DT	15	Fox River	RT 56-State ST BR in N Aurora
DT	16	Fox River	Alt US30-State ST BR in Geneva
DT	17	Fox River	RT 64-Main ST BR in St. Charles
DT	18	Fox River	National ST BR in Elgin
DT	21	Fox River	US14 BR NR Fox River Grove & Cary
DT	23	Fox River	RT 120 BR at McHenry
DT	24	Fox River	Chapel RD BR at Johnsburg NE McHenry
DT	26	Fox River	Rawson BR 2 MI E of Oakwood Hills
DT	33	Fox River	CO RD BR at Millington
DT	35	Fox River	RT 173 BR NR WISC Line--Composite
DT	38	Fox River	Mill ST BR in Montgomery
DT	41	Fox River	CO RD 3 MI S of Plano
DT	42	Fox River	US12 BR at E outlet Nippersink LK
DT	43	Fox River	Grass LK RD BR at Grass LK outlet
DT	44	Fox River	Grass LK RD BR at Bluff LK outlet
Big Rock Creek			
DTC	01	Big Rock Creek	River RD BR 1.5 MI S of Plano
Little Rock Creek			
DTCA	01	Little Rock Creek	CO RD BR 1.5 MI S of Plano NR mouth
Blackberry Creek			
DTD	01	Blackberry Creek	River RD BR at W edge of Yorkville
Ferson Creek			
DTF	01	Ferson Creek	RT 31 BR 1 MI N of St. Charles
Poplar Creek			
DTG	01	Poplar Creek	RT 25 BR at S edge of Elgin
Spring Creek			
DTH	01	Spring Creek	BR NR mouth at SW edge Fox River Grove

Table 4-5. Completed.

Basin Code	Station Number	Stream Name	Description
Nippersink Creek			
DTK	01	Nippersink Creek	US12 BR NR Lake-McHenry CO Line
DTK	02	Nippersink Creek	CO RD BR .25 MI DS from Wonder LK
DTK	03	Nippersink Creek	RT 47 BR 4 MI S of Hebron
DTKA	03	N BR Nippersink Creek	RT 173 BR 1 MI E of Richmond
Hollenback Creek			
DTZG	01	Hollenback Creek	CO RD BR .25 MI NE of Millbrook
Rob Roy Creek			
DTZI	01	Rob Roy Creek	River RD BR S of Plano
Morgan Creek			
DTZJ	01	Morgan Creek	RT 71 BR E of Yorkville
Indian Creek			
DTZK	01	Indian Creek	Farnsworth AVE BR at NE edge of Aurora
Mill Creek			
DTZL	01	Mill Creek	RT 31 BR at Mooseheart
Tyler Creek			
DTZP	01	Tyler Creek	RT 31 BR 200 YD S of I-90 JCT
Crystal Lake Creek			
DTZR	02	Crystal Lake Creek	RT 31 BR SW JCT RT 62 NR Algonquin
Flint Creek			
DTZS	01	Flint Creek	Kelsey RD BR in Lake Barrington

Table 4-6. Bluegill Toxicity Indices, Fox River Basin. (Derived from mean values of 1976 Environmental Protection Agency Data.)

	Station	BGTU
Fox River	DT35	0.043
	DT44	0.032
	DT43	0.047
	DT42	0.034
Nippersink Creek	DTK03	0.035
	DTK02	0.078
	DTKA03	0.005
	DTK01	0.050
Fox River	DT24	0.042
	DT23	0.030
	DT26	0.034
Flint Creek	DTZS01	0.113
Fox River	DT21	0.031
Spring Creek	DTH01	0.040
Fox River	DT06	1.825
Crystal Lake Creek	DTZR01	0.085
Fox River	DT05	0.039
Tyler Creek	DTZP01	1.843
Fox River	DT18	0.038
Poplar Creek	DTG01	0.109
Fox River	DT09	0.036
Ferson Creek (as Otter Creek)	DTF01	1.833
Fox River	DT17	0.044
	DT16	0.036
	DT04	0.038
Mill Creek	DTZL01	0.039
Fox River	DT15	0.071

Table 4-6. Completed.

	Station	BGTU
Indian Creek	DTZK01	0.042
Fox River	DT13	0.048
	DT38	0.048
	DT03	10.311
Morgan Creek	DTZJ01	0.004
Blackberry Creek	DTD01	0.047
Fox River	DT11	5.697
Rob Roy Creek	DTZI01	0.033
Big Rock Creek	DTC01	4.411
Little Rock Creek	DTCA01	0.055
Fox River	DT41	0.059
Hollenback Creek	DTZG01	0.049
Fox River	DT33	0.027

Table 4-7. Summary, 1976 IEPA Water Quality Data, Fox River Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for stations and parameters (based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the BGTU.)

	IEPA Station	Ag (mg l^{-1})
Fox River	DT06	.000 - .020 .040 (3)
Tyler Creek	DTZP01	.000 - .020 .007 (3)
Ferson Creek	DTF01	.000 - .020 .007 (3)
Fox River	DT03	.000 - .120 .040 (3)
	DT11	.000 - .090 .022 (4)
Big Rock Creek	DTC01	.000 - .050 .017 (3)
IPCB STANDARD		0.005

CHAPTER FIVE: HICKORY CREEK

LOCATION AND BASIN MORPHOMETRY

The Hickory Creek watershed is located in Cook and Will Counties, Illinois (Fig.5-1). The creek drains an area of approximately 18,289 ha. Hickory Creek flows in a westerly direction and empties into the Des Plaines River at Joliet.

Hickory Creek is a low-gradient stream (1.94 m km^{-1}). It is an order 5 stream at its confluence with the Des Plaines River. The drainage pattern is trellis-like. Hickory Creek is overdeveloped at all levels, except the order 2 level. It never reaches the potential order 7 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 5-1.

Table 5-1. Summary of Morphometric Data, Hickory Creek.

Order	Number Links	Mean Length (km)	Total Length (km)
1	93	1.69	157.67
2	31	1.15	35.73
3	39	1.02	39.72
4	12	1.30	15.60
5	9	1.82	16.40
			Total = 265.12

The major tributaries of Hickory Creek are Marley Creek, an order 4 stream at its confluence with Hickory Creek, and Spring Creek and Union Ditch, both order 3 streams at their confluences with Hickory Creek.

The soils of Hickory Creek watershed consist primarily of silty clay loams:

1) Drummer
2) Proctor
3) Elliott
4) Beecher

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago biologists collected fishes at 13 sites along Hickory Creek and its tributaries. Eight of the sites were located on Hickory Creek, and the remaining five were on the tributaries (Table 5-2; Fig. 5-2). Earlier records indicated that 36 species and carp x goldfish hybrids occurred in this watershed (Table 5-3). The 1976 Metropolitan Sanitary District of Greater Chicago collection included 31 of these species and the carp x goldfish hybrid (Table 5-4). In addition, a green sunfish x bluegill hybrid and a cyprinid hybrid were taken from the area. Half of the species from the 1976 collections are considered tolerant to habitat abuse. Almost 30% of the species are sensitive to detrimental changes, while the remaining 20% are only moderately sensitive. Green sunfish (a tolerant species), stonerollers (a moderately tolerant species), and striped shiners (a moderately tolerant species) were taken at most of the sites and represented 51% of the total number of fishes collected. The intolerant species represented only 6% of the total number of fishes collected.

An evaluation of the Hickory Creek headwaters was possible only by considering the qualitative data regarding species' presence in this area in the Illinois Natural History Survey records. Fishery quality was high here since the area contains little suburban development. As Hickory Creek progressed downstream, the quality of the habitat dropped, possibly due to the influence of small housing developments. Marley Creek and an unnamed tributary further degraded the habitat. Collections secured from these areas were low in abundance of species, and those species which were taken were tolerant ones. Fishery quality improved as Hickory Creek flowed through the Pilcher Park area and remained high to the vicinity of the confluence of Spring Creek. Spring Creek diversity and equitability indices indicated the quality of this creek remained high throughout its length. Yet, the influence of the city of Joliet and the Des Plaines River dominated at the confluence of Hickory and Spring Creeks, and fishery quality was reduced.

SUMMARY OF WATER QUALITY DATA

The Illinois Environmental Protection Agency had located eight sites along Hickory Creek and its tributaries (Table 5-5; triangles, Fig. 5-3). In 1976, analyses had been performed at each site for all the parameters required in toxicity calculations, except hardness. The Metropolitan Sanitary District of Greater Chicago measured hardness at two sites. A mean of these values was used in toxicity calculations.

The toxicity index value of 0.2 was exceeded only once in the Hickory Creek watershed (Table 5-6), due to an input of silver. Silver was the only parameter contributing significantly to the toxicity index in this watershed. Arsenic, chromium (trivalent), cyanide, and zinc were not

detected in the watershed. Boron, cadmium, chromium (hexavalent), lead, mercury, and phenol were present, but at concentrations which were so low that they had no effect on the toxicity index after the index was rounded to three decimal places.

The silver concentration, though significant in toxicity index calculation, did not exceed the Illinois Pollution Control Board standard (Table 5-7). The Illinois Pollution Control Board standard for copper was exceeded at all of the stations, for total iron at half of the stations, and for ammonia nitrogen at one station (GG07), yet none of these contributed significantly to the toxicity index.

Water conditions throughout the basin are fairly consistent, except for the single high concentration of silver. This concentration represented 90% of the toxicity index for the station. Silver was detected only once at this station. Thus, the calculated mean value resulted from the maximum recorded value and two zero readings.

Water quality analysis also indicated two areas of high total iron concentrations, station GG07 and GG04. Station GG07 also has a high ammonia nitrogen concentration. These concentrations may be the result of input from small waste water treatment plants.

CONCLUSIONS

The Hickory Creek watershed contains areas of various habitat quality ranging from high to fair. Hickory Creek originates in an undeveloped area as a high quality aquatic habitat. As municipalities increased in abundance downstream, the creek degraded slightly. The creek continued to decline due to the detrimental influence of Marley Creek, the unnamed tributary, and an unknown source of silver. Hickory Creek then flows through Pilcher Park where the environmental quality was greatly increased. The quality of the creek remained high until it reached the Joliet area. In this area, the creek again became degraded, possibly because of fishes moving upstream from the Des Plaines River. These factors overcame the good conditions present in Hickory Creek and Spring Creek, a high quality tributary which converges with Hickory Creek in this area.

The fish populations in the watershed were more indicative of the conditions than the water quality data. Silver, the pollutant having the greatest effect on the toxicity index calculations, was detected only once. High iron concentrations existed at various sites, but produced no problem for the fishes. Increased monitoring would better explain the actual water quality conditions and would better explain low quality fisheries which exist in some of the watersheds. Figure 5-4 illustrates these conclusions.

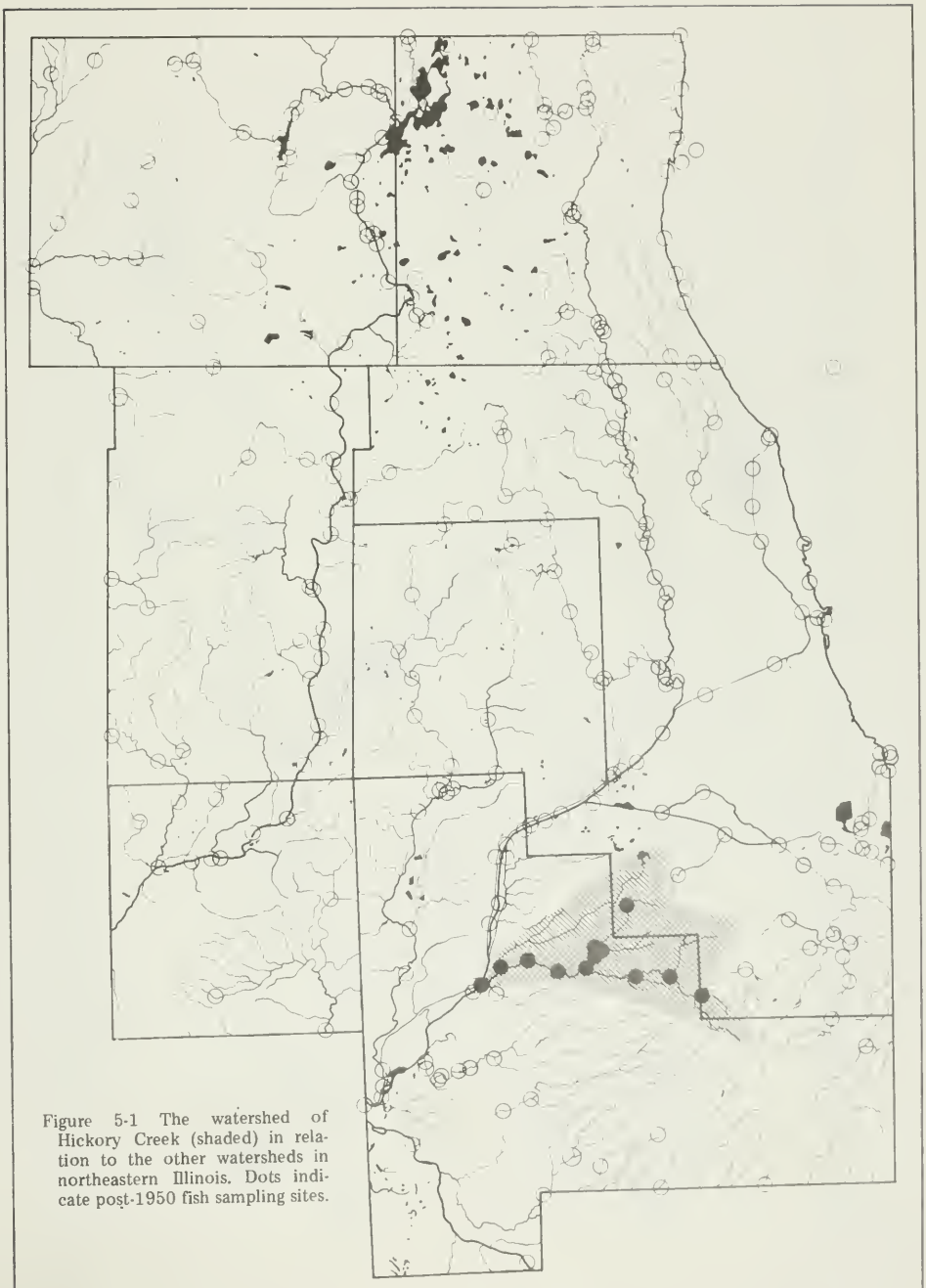


Figure 5-1 The watershed of Hickory Creek (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 5-2. Hickory Creek Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

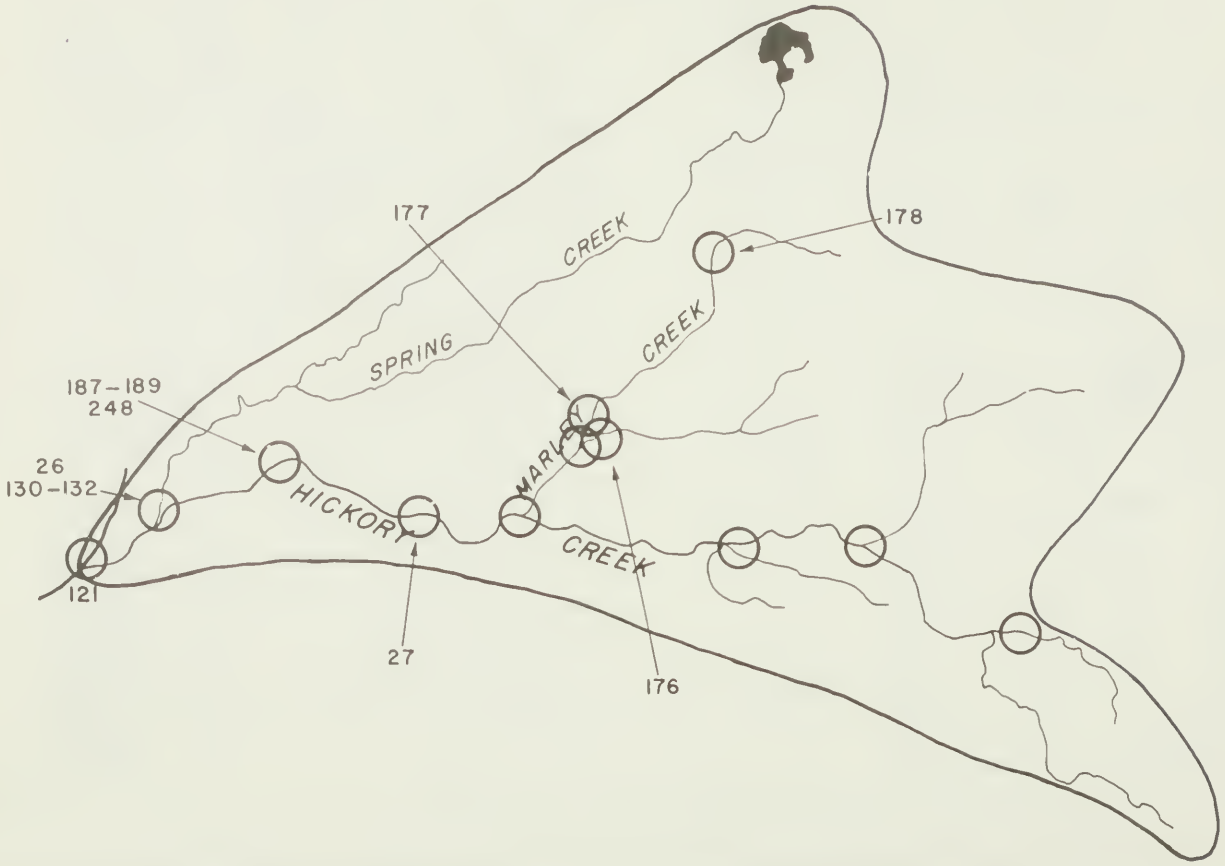


Figure 5-3. Hickory Creek Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

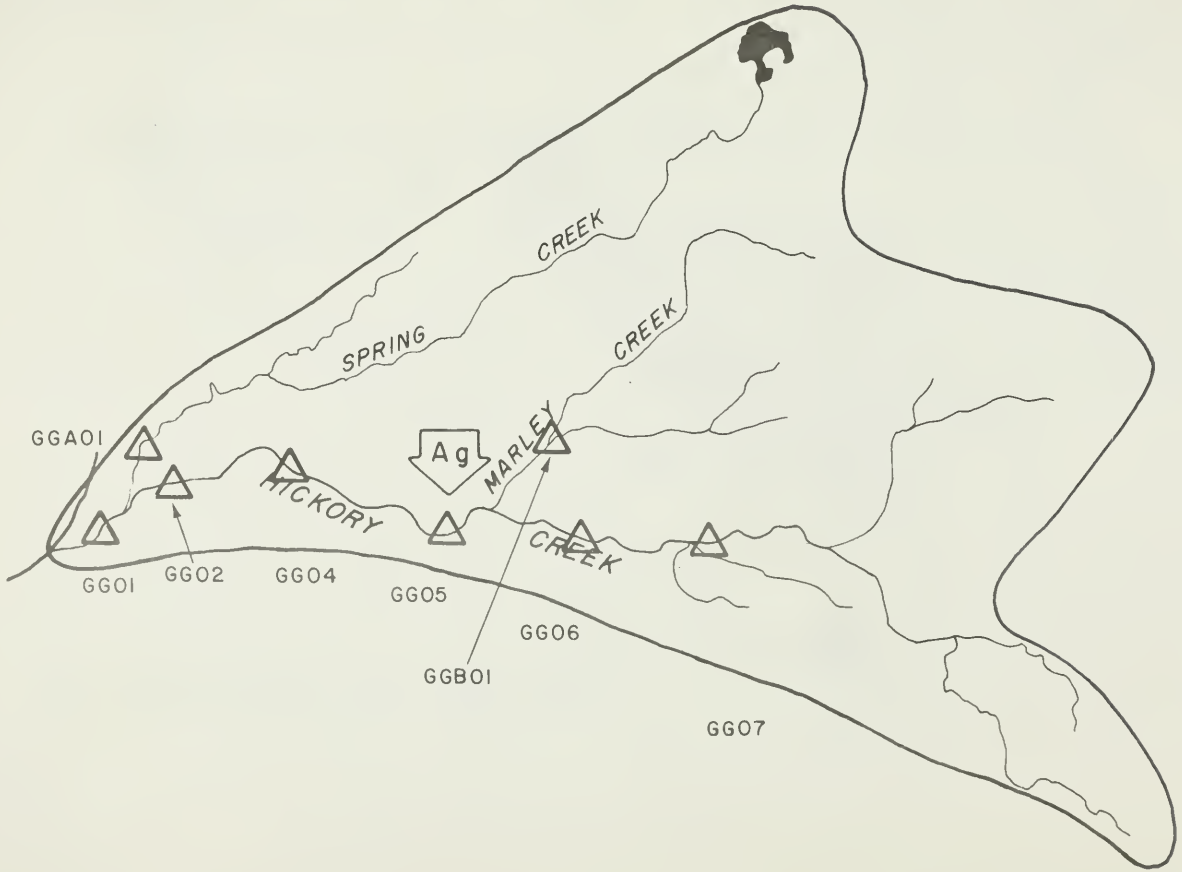


Figure 5-4. Hickory Creek Basin: Summary of environmental quality

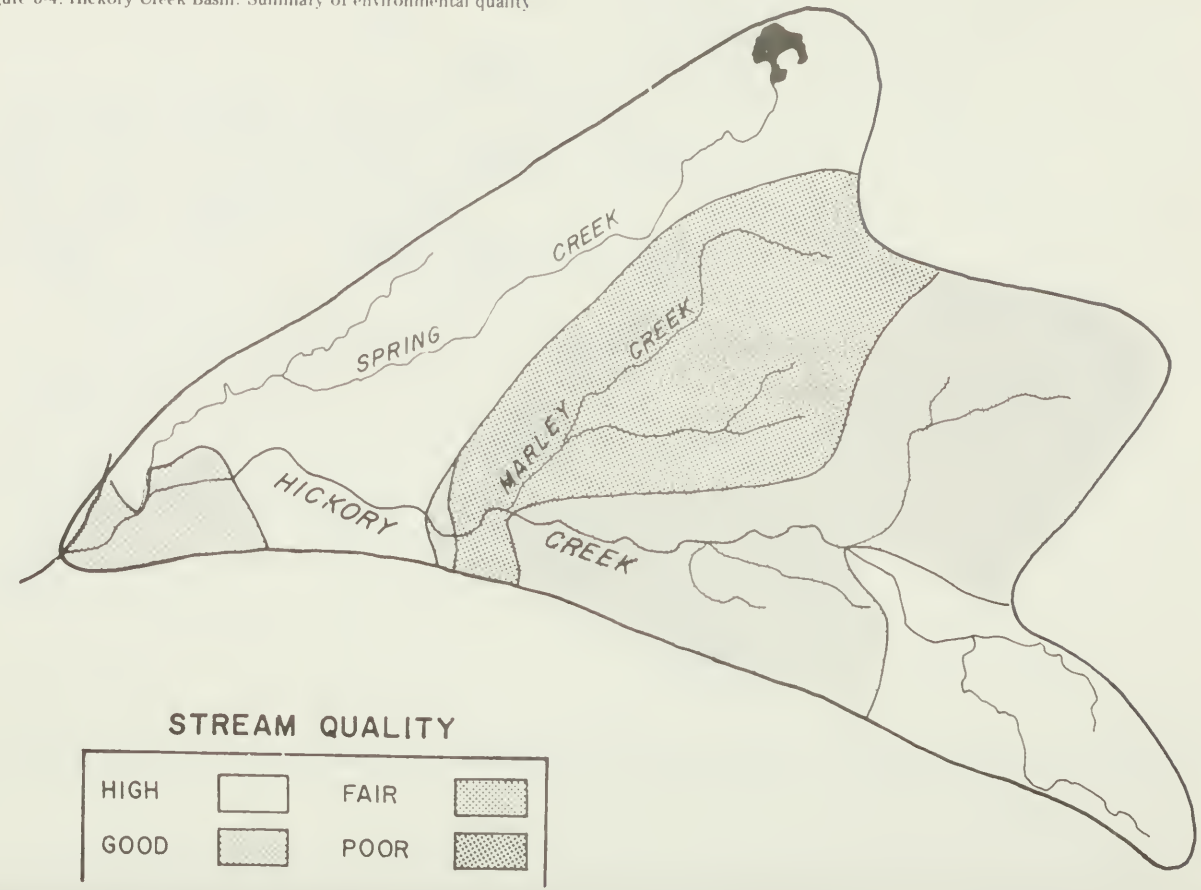


Table 5-2. Location of MSDGC 1976 Fish Sampling Sites, Hickory Creek.

Number	Station	Location
26	Hickory Creek	T35N/R 10E/S 15NE; Will Co.; 100 meters upstream of 2nd Avenue, Joliet.
27	Hickory Creek	T35N/R 11E/S 17NE; Will Co.; upstream of I-80, New Lenox.
121	Hickory Creek	T35N/R 9E/S 21NW; Will Co.; mouth of Hickory Creek below Brandon Dam, Joliet.
130	Spring Creek	T35N/R 10E/S 15NE; Will Co.; mouth of Spring Creek with Hickory Creek, 150 meters upstream of 2nd Avenue, Joliet.
131	Hickory Creek	T35N/R 10E/S 15NE; Will Co.; 60 meters upstream of 2nd Avenue, Joliet.
132	Hickory Creek	T35N/R 10E/S 15NE; Will Co.; riffle area 150 meters above 2nd Avenue at mouth of Spring Creek, Joliet.
176	East Branch, Marley Creek	T36N/R 12E/S 6SW; Will Co.; east and west of Townline Road, between Marley and Mokena.
177	Marley Creek	T36N/R 11E/S 1NW; Will Co.; mouth of Rip Slough Drain and north and south of Rt. 6 (westernmost bridge), Marley.
178	Marley Creek	T36N/R; 12E/S 20NE; Cook Co.; above and below 159th Street, 104th Street and 159th Street intersection, Orland Park.
187	Hickory Creek	T35N/R 10E/S 12SE; Will Co.; 110 meters above dam in Pilcher Park, Joliet.
188	Hickory Creek	T35N/R 10E/S 12SE; Will Co.; tailrace of Pilcher Park Dam, Joliet.
189	Hickory Creek	T35N/R 10E/S 12SE; Will Co.; 100 meters below Pilcher Park Dam, Joliet.
248	Tributary of Hickory Creek	T35N/R 10E/S 12SE; Will Co.; pool south of Pilcher Park Road, Joliet.

Table 5-3. Checklist of Fishes Known to Occur in Hickory Creek.

Clupeiformes

Clupeidae - Herrings

Dorosoma cepedianum (Lesueur)
Gizzard shad

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis chrysocephalus Rafinesque
Striped shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Table 5-3. Continued.

Cyprinidae - Minnows and Carps (continued)

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp x Goldfish hybrid

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Siluriformes

Ictaluridae - Freshwater Catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Atheriniformes

Cypinodontidae - Killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Perciformes

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Table 5-3. Completed.

Centrarchidae - Sunfishes (continued)

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis nigromaculatus (Lesueur)
Black crappie

Percidae - Perches

Etheostoma caeruleum Storer
Rainbow darter

Etheostoma exile (Girard)
Iowa darter

Etheostoma flabellare Rafinesque
Faintail darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma spectabile (Agassiz)
Orangethroat darter

Etheostoma zonale (Cope)
Banded darter

Cottidae - Sculpins

Cottus baindi Girard
Mottled sculpin

Table 5-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Hickory Creek Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS													TOTAL NUMBER	% OF TOTAL
	178	177	176	27	248	187	188	189	130	132	26	131	121		
CLUPEIDAE															
Gizzard shad	-	-	-	-	-	-	16	4	-	3	3	9	11	46	2
CYPRINIDAE															
Stoneroller	-	3	-	1	2	-	83	184	30	10	38	-	-	351	19
Goldfish	-	-	-	-	-	-	-	-	1	-	-	-	-	1	<1
Carp	-	-	-	-	-	40	6	19	2	1	-	-	11	79	4
Hornyhead chub	-	-	-	5	-	-	4	23	10	8	13	-	-	63	3
Golden shiner	-	-	-	-	3	-	2	-	-	-	-	1	-	6	<1
Emerald shiner	-	-	-	-	-	-	-	-	-	-	-	5	23	28	2
Striped shiner	-	5	-	4	5	11	74	22	33	5	29	35	1	224	12
Bigmouth shiner	-	-	-	-	-	-	-	10	31	9	60	2	21	133	7
Rosyface shiner	-	-	-	1	-	-	-	-	-	-	-	-	-	1	<1
Sand shiner	-	-	-	8	-	-	-	-	-	-	6	-	-	14	1
Redfin shiner	-	-	-	1	-	-	-	-	-	-	-	-	-	1	<1
Bluntnose minnow	-	1	2	17	-	12	10	3	31	1	21	5	19	122	7
Creek chub	-	14	-	-	24	-	1	5	2	-	-	-	-	46	2
Carp X Goldfish	-	-	-	-	-	-	1	-	-	-	-	-	-	1	<1
Cyprinid hybrid	-	-	-	-	-	-	1	-	-	-	-	-	-	1	<1
CATOSTOMIDAE															
White sucker	-	4	-	-	-	6	-	-	9	-	-	-	-	19	1
Northern hog sucker	-	-	-	-	-	-	-	-	2	-	1	-	-	3	<1
Golden redhorse	-	-	-	-	-	4	-	-	-	-	-	-	-	4	<1
ICTALURIDAE															
Black bullhead	1	1	-	-	-	1	4	1	-	-	-	-	-	8	<1
CYPRINODONTIDAE															
Blackstripe topminnow	-	-	-	-	-	6	4	10	-	-	-	-	-	20	1
CENTRARCHIDAE															
Rock bass	-	-	-	7	-	1	-	3	1	-	-	-	-	12	1
Green sunfish	3	1	13	133	17	142	22	20	1	-	-	-	8	360	20
Orangespotted sunfish	3	-	-	-	-	105	1	-	-	-	-	-	-	109	6
Bluegill	-	1	-	2	-	87	13	2	-	-	-	-	-	105	6
Smallmouth bass	-	-	-	1	-	1	3	13	6	-	1	-	-	25	1
Largemouth bass	-	-	-	-	-	18	16	1	2	-	-	-	-	37	2
Black crappie	1	-	-	-	-	4	-	2	2	-	-	1	-	10	1
Green sunfish X Bluegill	-	-	-	-	-	1	-	-	-	-	-	-	-		<1
PERCIDAE															
Rainbow darter	-	-	-	-	-	-	-	1	-	-	-	-	-	1	<1
Johnny darter	-	-	-	6	-	-	1	-	-	-	-	-	-	7	<1
Orangethroat darter	-	-	-	2	-	-	-	1	-	1	-	-	-	4	<1
Banded darter	-	-	-	1	-	-	-	-	-	1	1	-	-	3	<1
COTTIDAE															
Mottled sculpin	-	-	-	-	-	-	-	1	-	-	-	-	-	1	<1
TOTAL NUMBER OF INDIVIDUALS	8	30	15	189	51	439	262	325	163	39	173	58	94	1846	98
TOTAL NUMBER OF SPECIES	4	8	2	14	5	14	16	19	15	9	10	7	7	31	-
DIVERSITY ($\bar{d}$)	1.45	2.05	0.00	1.75	1.62	2.41	2.75	2.43	2.84	2.47	2.54	1.44	2.29	-	-
EQUITABILITY (e)	0.9	0.6	0.5	0.3	0.8	0.5	0.5	0.4	0.7	0.8	0.8	0.5	0.9	-	-

Table 5-5. Location of 1976 IEPA Water Quality Sampling Sites, Hickory Creek Basin.

Basin Code	Station Number	Stream Name	Description
Hickory Creek			
GG	01	Hickory Creek	US 52 - RT 53 BR at Joliet
GG	02	Hickory Creek	Washington BR at Joliet
GG	04	Hickory Creek	Cougar RD BR E of Joliet
GG	05	Hickory Creek	Cedar RD BR at New Lenox
GG	06	Hickory Creek	Marley RD BR 1 mi NE of New Lenox
GG	07	Hickory Creek	US 45 BR 1 mi N of Frankfort
Spring Creek			
GGA	01	Spring Creek	Washington ST BR at Joliet
Marley Creek			
GGB	01	Marley Creek	Francis RD BR NE of New Lenox

Table 5-6. Bluegill Toxicity Indices, Hickory Creek Basin. (Derived from mean values of 1976 Illinois Enivronmental Protection Agency data.)

	Station	BGTU
Hickory Creek	GG07	.130
	GG06	.087
Marley Creek	GGB01	.093
Hickory Creek	GG05	.853
	GG04	.109
	GG02	.089
Spring Creek	GGA01	.037
Hickory Creek	GG01	.056

Table 5-7. Summary, 1976 IEPA Water Quality Data, Hickory Creek Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based on Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the BGTU.)

	IEPA Station	Ag (mg l^{-1})
Hickory Creek	GG07	.000 - .000 .000 (3)
	GG06	.000 - .000 .000 (3)
Marley Creek	GGB01	.000 - .000 .000 (3)
Hickory Creek	GG05	.000 - .010 .003 (3)
	GG04	.000 - .000 .000 (3)
	GG02	.000 - .000 .000 (3)
Spring Creek	GGA01	.000 - .000 .000 (3)
Hickory Creek	GG01	.000 - .000 .000 (3)
IPCB STANDARDS		.005

CHAPTER SIX: KANKAKEE RIVER

LOCATION AND BASIN MORPHOMETRY

The portion of the Kankakee River watershed considered in this study is located entirely within Will County, Illinois (Fig. 6-1), a drainage area of approximately 89,096 ha. The Kankakee River has a low gradient (0.53 m km^{-1}). It is an order 5 stream intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The stream is over-developed at all levels and never reaches the potential order 8 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 6-1.

Table 6-1. Summary of Morphometric Data for the Kankakee River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	156	1.90	295.77
2	75	1.61	121.00
3	50	1.39	69.52
4	19	1.75	33.20
5	9	1.76	15.83
		Total =	535.32

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago inventory did not include fish collections from the Kankakee River watershed (Fig. 6-2). Records of the Illinois Natural History Survey and results from two aquatic monitoring programs (1972/1973, 1974/1975) by Westinghouse Environmental Systems Department indicate that 79 species of fish occur in the Kankakee drainage system (Table 6-2). Ongoing collections in this basin by the Illinois Natural History Survey have included 58 of these species and three unrecorded species: American eel, yellow perch, and logperch.

The Kankakee River watershed contains a diverse assemblage of fishes. Many of the species in the watershed are considered to show some degree of ecological tolerance, but one-third of the species are considered to be ecologically intolerant. Thus, a good quality fish fauna exists in the basin.

SUMMARY OF WATER QUALITY DATA

The Kankakee River watershed contained two Illinois Environmental Protection Agency sampling stations (Table 6-3; Fig. 6-3). Both sites are located on the main river channel. Station F01 was not analyzed for 17 parameters needed in the toxicity index calculations. Since no value was available for the Kankakee basin, a mean hardness value derived from the Metropolitan Sanitary District of Greater Chicago water quality data for Hickory Creek was utilized. Hickory Creek is the closest watershed sharing the physical characteristics of the Kankakee watershed.

The toxicity index values for both stations were below the toxic level of 0.2 (Table 6-4). None of the parameters contributed significantly to the toxicity indices. Concentrations of boron and lead were detected, yet they were so low that they had no effect on the toxicity index after the index was rounded to three decimal places. Arsenic, cadmium, chromium (hexavalent and trivalent), cyanide, mercury, nickel, phenol, silver, and zinc were not detected in this drainage system. The concentrations of copper, iron, and lead exceeded the standards set by the Illinois Pollution Control Board at Station F04.

Though sampling was limited, the available data indicated that water quality is good in the main river channel of the Kankakee River.

CONCLUSIONS

The main river channel of the Kankakee River contains a good quality aquatic environment. The diversity and richness of the fish fauna in the channel substantiate the low toxicity indices derived from the water quality data. Most of the river's tributaries, except Jordon Creek and the lower portion of Praire Creek, have very little urban or industrial development within their drainage basins. Therefore, they are considered to contain high quality aquatic habitat. Similarity in land use patterns of the lower portion of Praire Creek and Jordon Creek with the lower portion of Hickory Creek enable evaluation of these areas as degraded. A synthesis of this information is expressed in Figure 6-4.

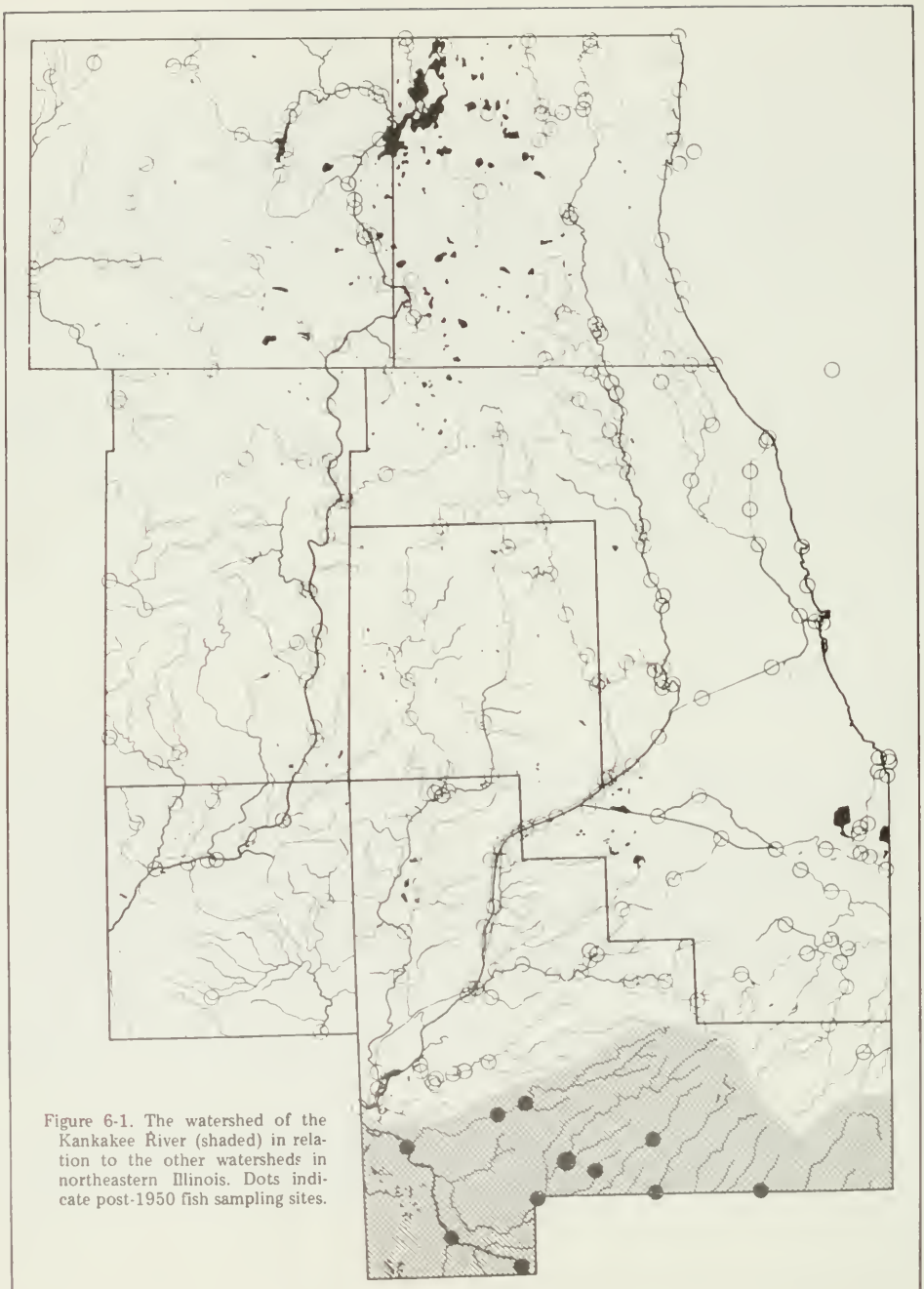


Figure 6-1. The watershed of the Kankakee River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 6-2. Kankakee River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Illinois Natural History Survey and Westinghouse inventories.

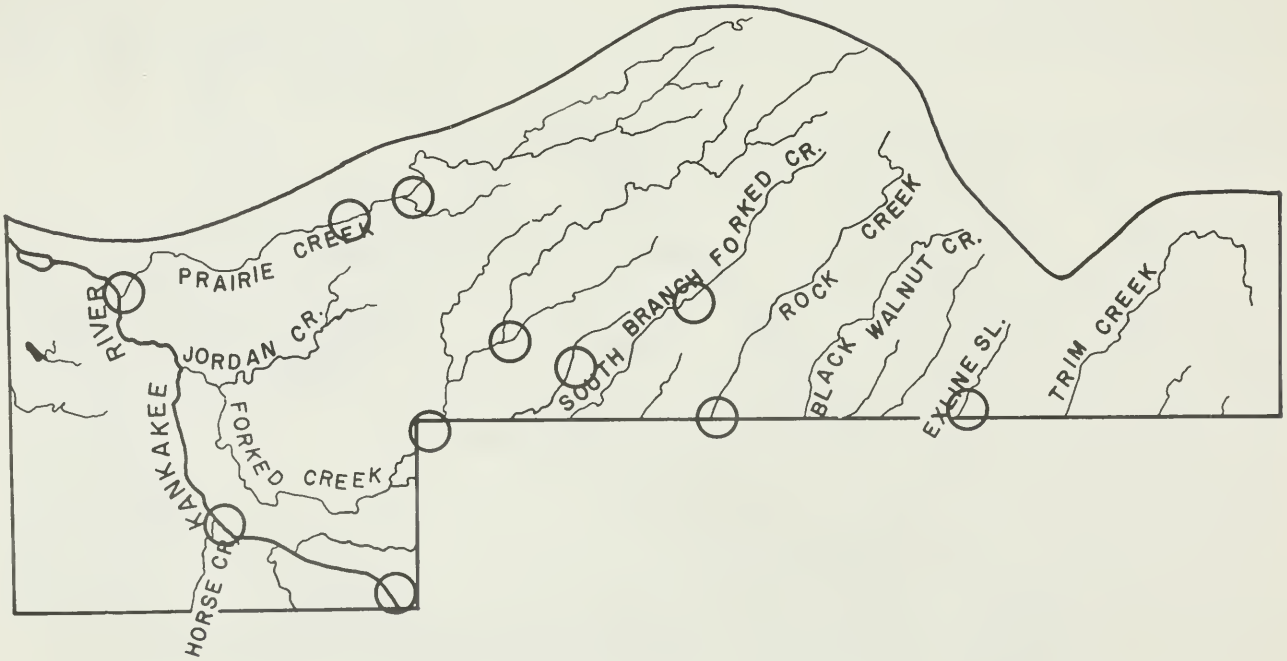


Figure 6-3. Kankakee River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

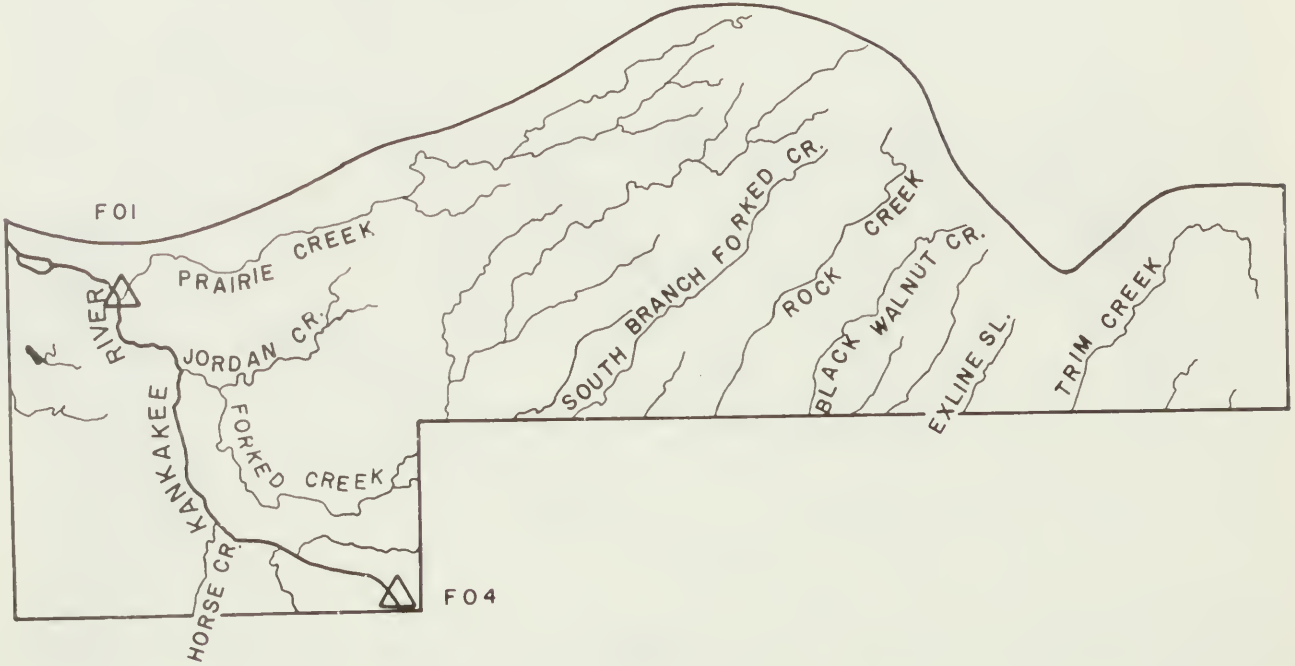


Figure 6-4. Kankakee River Basin: Summary of environmental quality.

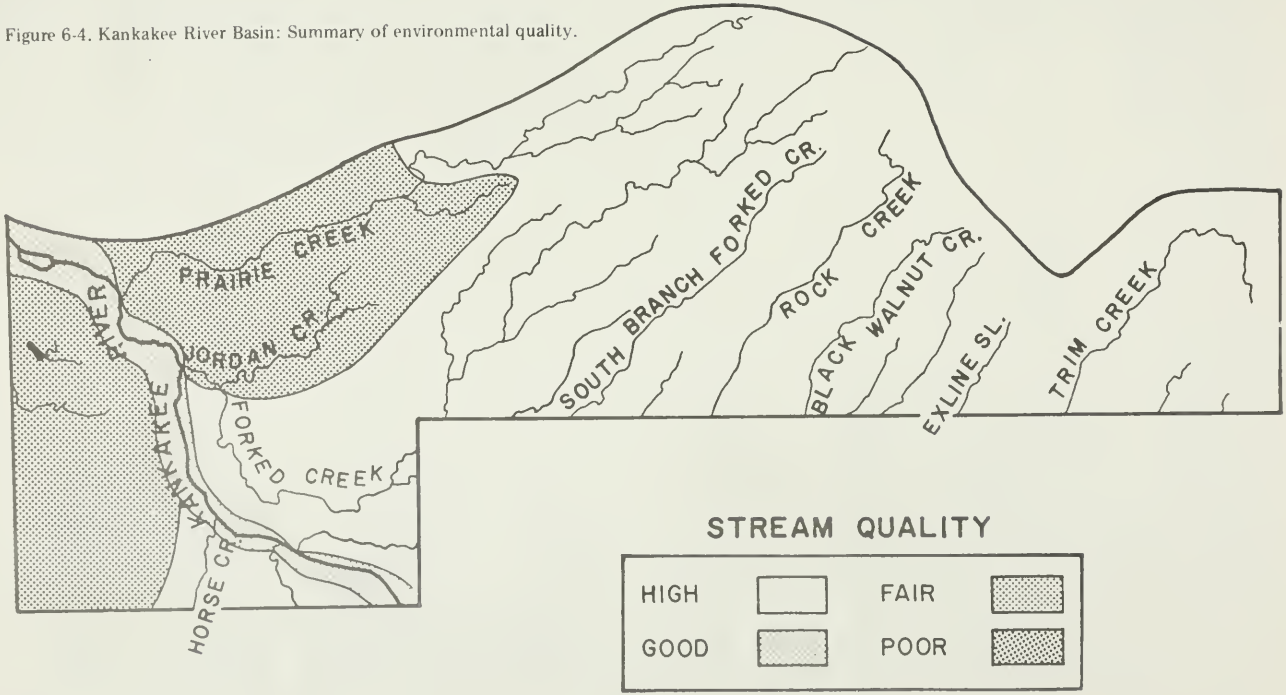


Table 6-2. Checklist of Fishes Known to Occur in the Kankakee River Basin.

Petromyzontiformes

Petromyzontidae - Lampreys

Ichthyomyzon fossor Reighard & Cummins
Northern brook lamprey

Ichthyomyzon unicuspis Hubbs & Trautman
Silver lamprey

Lampetra lamottei (Lesueur)
American brook lamprey

Semionotiformes

Lepisosteidae - Gars

Lepisosteus osseus (Linnaeus)
Longnose gar

Amiiformes

Amiidae - Bowfins

Amia calva Linnaeus
Bowfin

Clupeiformes

Clupeidae - Herrings

Dorosoma cepedianum (Lesueur)
Gizzard shad

Salmoniformes

Salmonidae - Trouts

Salmo gairdneri Richardson
Rainbow trout

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Table 6-2. Continued.

Salmoniformes (continued)

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Esox lucius Linnaeus
Northern pike

Esox masquinongy Mitchill
Muskellunge

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Cyprinus carpio Linnaeus
Carp

Ericymba buccata (Cope)
Silverjaw minnow

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis chalybaeus (Cope)
Ironcolor shiner

Notropis chrysocephalus (Rafinesque)
Striped shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis emiliae (Hay)
Pugnose minnow

Table 6-2. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Notropis heterolepis Eigenmann & Eigenmann
Blacknose shiner

Notropis lutrensis (Baird & Girard)
Red shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis texanus (Girard)
Weed shiner

Notropis umbratilis (Girard)
Redfin shiner

Notropis volucellus (Cope)
Mimic shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Pimephales vigilax (Baird & Girard)
Bullhead minnow

Rhinichthys atratulus (Valenciennes)
Blacknose dace

Semotilus atromaculatus (Mitchill)
Creek chub

Table 6-2. Continued.

Cypriniformes (continued)

Catostomidae - Suckers

Carpiodes carpio (Rafinesque)
River carpsucker

Carpiodes cyprinus (Lesueur)
Quillback

Catostomus commersoni (Lacépède)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Erimyzon sucetta (Lacepede)
Lake chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Ictiobus bubalus (Rafinesque)
Smallmouth buffalo

Minytrema melanops (Rafinesque)
Spotted sucker

Moxostoma anisurum (Rafinesque)
Silver redhorse

Moxostoma carinatum (Cope)
River redhorse

Moxostoma duquesnei (Lesueur)
Black redhorse

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Table 6-2. Continued.

Siluriformes (continued)

Ictaluridae - Freshwater catfishes (continued)

Ictalurus natalis (Lesueur)
Yellow bullhead

Ictalurus punctatus (Rafinesque)
Channel catfish

Noturus flavus Rafinesque
Stonecat

Noturus gyrinus (Mitchill)
Tadpole madtom

Percopsiformes

Aphredoderidae - Pirate perches

Aphredoderus sayanus (Gilliams)
Pirate perch

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Fundulus notti (Agassiz)
Starhead topminnow

Atherinidae - Silversides

Labidesthes sicculus (Cope)
Brook silversides

Perciformes

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Table 6-2. Continued.

Perciformes (continued)

Centrarchidae - Sunfishes (continued)

Lepomis gulosus (Cuvier)
Warmouth

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Lepomis megalotis (Rafinesque)
Longear sunfish

Lepomis microlophus (Gunther)
Redear sunfish

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis annularis Rafinesque
White crappie

Pomoxis nigromaculatus Lesueur)
Black crappie

Percidae - Perches

Etheostoma caeruleum Storer
Rainbow darter

Etheostoma flabellare Rafinesque
Fantail darter

Etheostoma microperca Jordan & Gilbert
Least darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma spectabile (Agassiz)
Orangethroat darter

Etheostoma zonale (Cope)
Banded darter

Table 6-2. Completed.

Perciformes (continued)

Percidae - Perches (continued)

Percina maculata (Girard)
Blackside darter

Percina phoxocephala (Nelson)
Slenderhead darter

Stizostedion vitreum (Mitchill)
Walleye

Table 6-3. Location of 1976 IEPA Water Quality Sampling Sites, Kankakee River.

Basin Code	Station Number	Stream Name	Description
Kankakee River			
F	01	Kankakee River	I-55 BR 3 mi NW of Wilmington
F	04	Kankakee River	CO RD BR at Kankakee-Will CO Line

Table 6-4. Bluegill Toxicity Indices, Kankakee River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Kankakee River	F04	.104
	F01	.004

CHAPTER SEVEN: KISHWAUKEE RIVER

LOCATION AND BASIN MORPHOMETRY

The sampled area of the Kishwaukee River watershed is located in Kane and McHenry Counties, Illinois (Fig. 7-1). The river flows in a westerly direction and empties into the Rock River south of Rockford. The approximate area drained by the portions of the Kishwaukee which flow through Kane and McHenry Counties is 101,787 ha. The average width of the stream is 8 m, and the depth varies from an average of 1 m to a maximum of 2.5 m.

The Kishwaukee River is a low-gradient (1.9 m km^{-1}), order 5 stream when it leaves McHenry County. The drainage pattern is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The Kishwaukee River in McHenry County is underdeveloped at the order 1, 2, and 3 level and overdeveloped at the order 4 and 5 level. It does not reach the potential order 9 of a fully bifurcate dendritic drainage stream. Morphometric data are summarized in Table 7-1.

Table 7-1. Summary of Morphometric Data for the Kishwaukee River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	225	1.90	427.2
2	109	1.74	189.6
3	58	1.80	103.8
4	46	1.47	67.6
5	21	1.15	24.2
			Total = 812.4

The major tributaries of the Kishwaukee River in McHenry County are the North Fork and the South Fork of the North Branch of the main stream, Coon Creek, Piscasaw Creek, and Rush Creek.

The basic soil types in the flood plain are Otter and Millington loams intermingled with Houghton muck and Drummer and Will silty clay loams. The predominant bottom type in the upper reaches is medium sized gravel which changes to sandy silt as one proceeds downstream.

SUMMARY OF FISHERY DATA

Fish collections were not conducted by the Metropolitan Sanitary District of Greater Chicago on the Kishwaukee River. The Illinois Natural History Survey inventory included 11 collections from the Kishwaukee River watershed. Sites were located on the Kishwaukee River, the North Branch and South Branch of the Kishwaukee, Rush Creek, Coon Creek, Piscasaw Creek, and the West Branch of Piscasaw Creek (Table 7-2; Fig. 7-2). Forty-five species of fish have been collected from this area (Table 7-3). The Illinois Natural History Survey's most recent collections included only 40 species (Table 7-4). Yellow perch, black bullhead, rosyface shiner, and largemouth bass were absent from the recent samples. Common shiners were the most abundant fish in the watershed, totaling 27% of the total number of fish collected.

One-third of the collected species are considered sensitive to detrimental changes in the aquatic environment. These intolerant species represented 16% of the total number of fish. The remaining two-thirds was equally divided between tolerant and moderately tolerant fish species.

A high-quality assemblage of fish species exists in the Kishwaukee River and its tributaries. The abundance of fishes collected at most of the sites is reflected in the high species diversity and equitability values. The values for station 4 were low, probably due to the large number of bigmouth shiners collected. Yet, this station contained many ecologically intolerant species, indicating a high-quality aquatic environment. Collections from stations 30 and 32 yielded few fish, but also included ecologically intolerant species.

SUMMARY OF WATER QUALITY DATA

The Kishwaukee River watershed did not contain any Illinois Environmental Protection Agency water quality sampling sites within the boundaries of McHenry County. The three closest sites, in Boone County, were located on the Kishwaukee River, Coon Creek, and Piscasaw Creek (Table 7-5; Fig. 7-3). All parameters needed for toxicity calculations were measured except MBAS and hardness. Since a hardness value is required in the calculations, a value was taken from the Metropolitan Sanitary District of Greater Chicago data on Boone Creek, a watershed similar in location, land use, soil type, and topography to the Kishwaukee basin.

All toxicity indices were below the maximum acceptable level of 0.2 (Table 7-6). The only parameters contributing to the toxicity indices were ammonia nitrogen, copper, fluoride, total iron, manganese, and nitrate-nitrite nitrogen. The remaining 12 parameters either were not detected or the concentrations were so low that the values did not contribute significantly when rounded to three decimals. Total iron and fluoride were the largest contributors to the low toxicity values calculated for the watershed, equalling together 72% to 82% of the total. None of the stations contained concentrations of the toxicity parameters exceeding the Illinois Pollution Control Board standards.

The Kishwaukee River maintains high water quality into Boone County. The tributaries, Coon Creek and Piscasaw Creek, also contain high quality water as they converge with the river.

CONCLUSIONS

The occurrence of the various fish species is easily accepted in view of the high water quality in the Kishwaukee River watershed. Ecologically intolerant fish species were collected throughout the river and its tributaries. The concentration of various toxicants was well below the level which would place any stress on the fish population. Although these conclusions are based upon data from fish collections from the recent past and water quality stations somewhat removed from the study area, similarities in land use, topography, and geology and the lack of recent development throughout this watershed permits extrapolation from these data. A synthesis of this information is expressed in Figure 7-4.

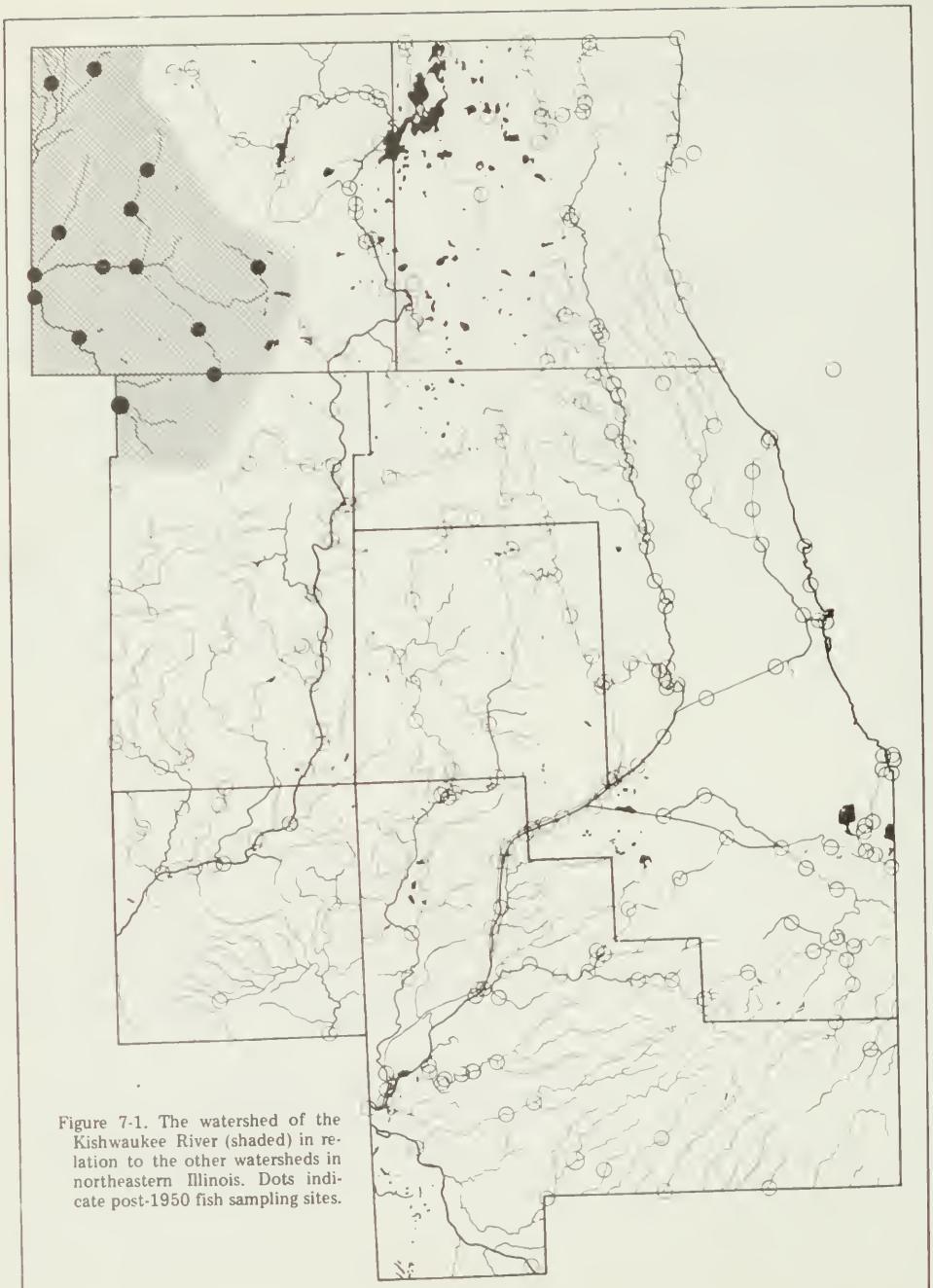


Figure 7-1. The watershed of the Kishwaukee River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

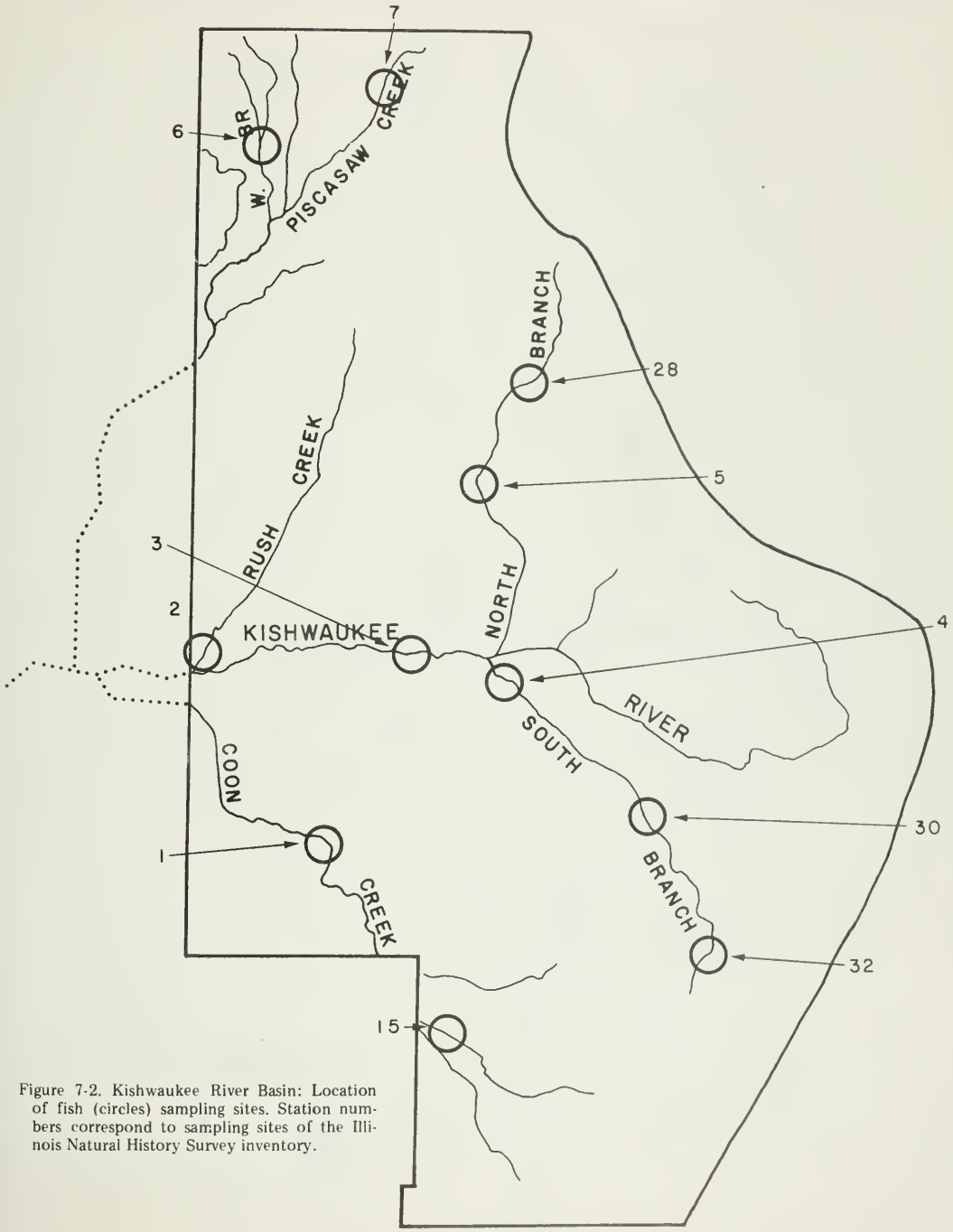


Figure 7-2. Kishwaukee River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Illinois Natural History Survey inventory.

Figure 7-3. Kishwaukee River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

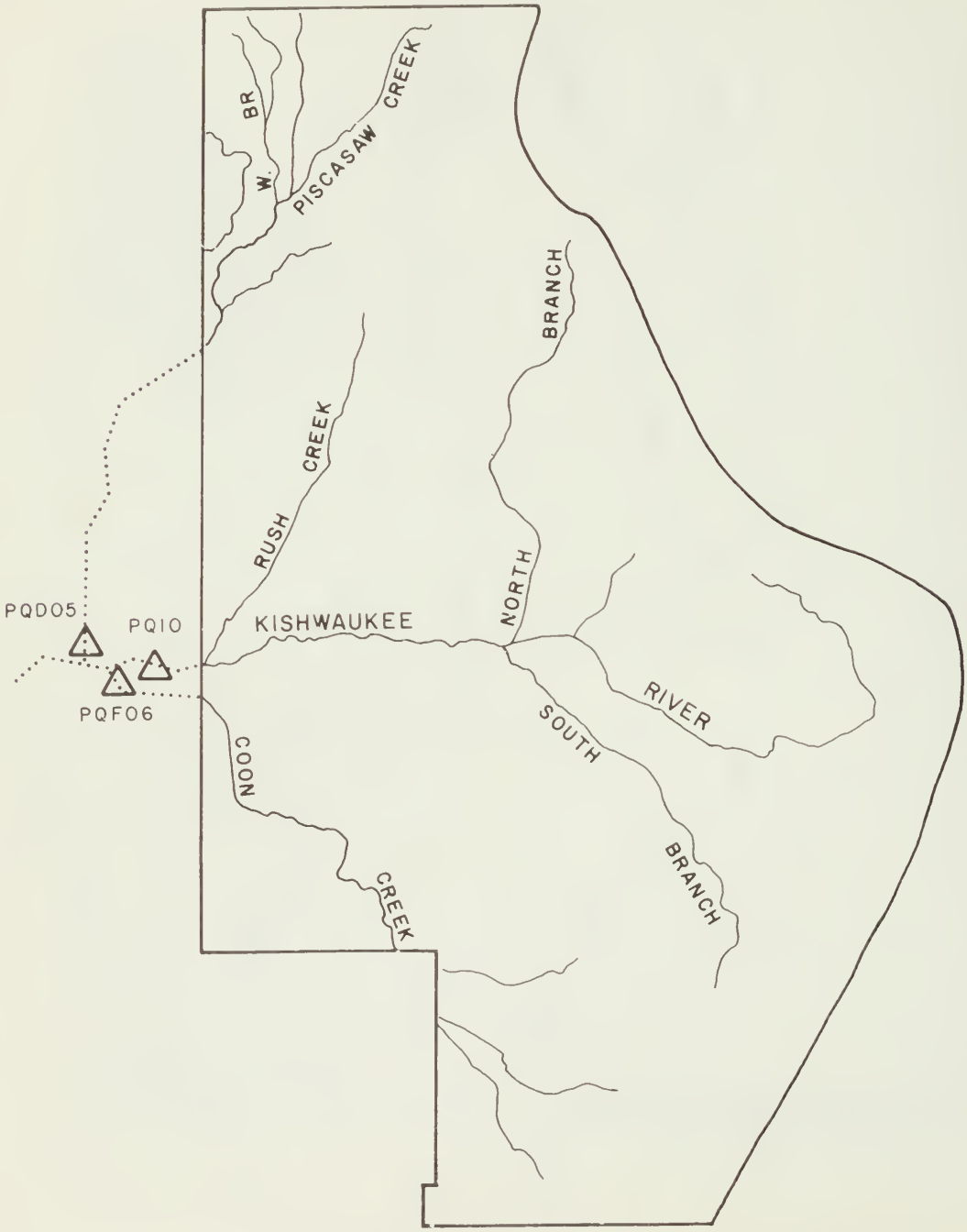


Figure 7-4. Kishwaukee River Basin: Summary of environmental quality.

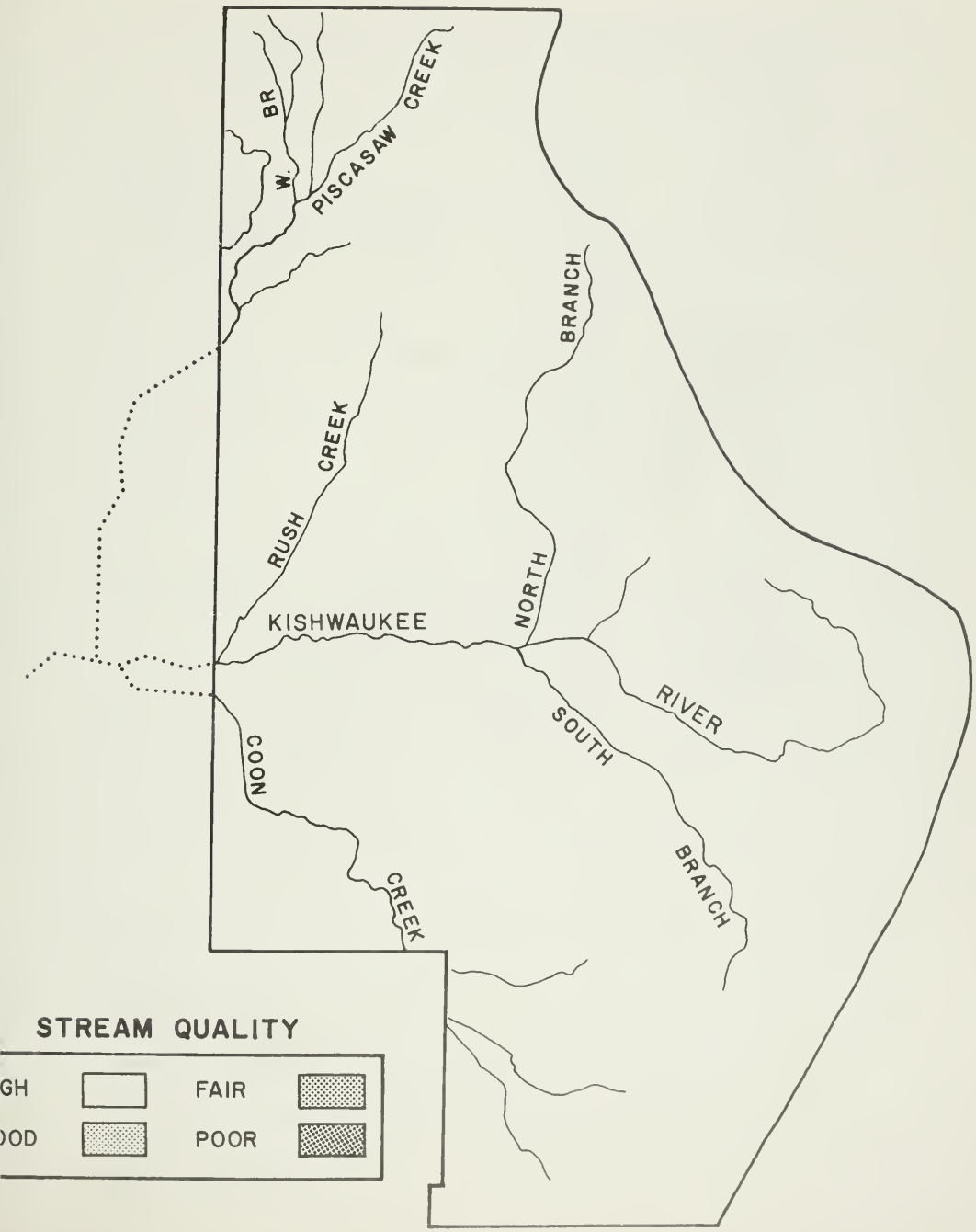


Table 7-2. Location of MSDGC Fish Sampling Sites, Kishwaukee River Basin.

Number	Station	Location
1	Coon Creek	T43N/R 5E/S 27; McHenry Co.; 5 mi S of Marengo.
2	Rush Creek	T44N/R 5E/S 19; McHenry Co.; NW of Marengo.
3	Kishwaukee River	T44N/R 5E/S 27; McHenry Co.; 1 mi NW of Marengo.
4	S. Branch Kishwaukee River	T44N/R 6E/S 33; McHenry Co.; 0.5 mi N of Union.
5	N. Branch Kishwaukee River	T44N/R 6E/S 5; McHenry Co.; 5 mi W of Woodstock.
6	W. Branch Piscasaw Creek	T46N/R 5E/S 20; McHenry Co.; 2 mi N of Chemung.
7	Piscasaw Creek	T46N/R 5E/S 21; McHenry Co.; 1 mi NW of Lawrence.
15	Coon Creek	T42N/R 6E/S 29; Kane Co.; 1.5 mi W of Hampshire.
28	N. Branch Kishwaukee River	T45N/R 6E/S 10; McHenry Co.; 2.5 mi NW of Hartland.
30	S. Branch Kishwaukee River	T43N/R 7E/S 30; McHenry Co.; 1 mi W of Huntley.
32	Dean Creek	T43N/R 7E/S 33; Mc Henry Co.; 0.5 mi S of Huntley.

Table 7-3. Checklist of Fishes Known to Occur in the Kishwaukee River Basin.

Salmoniformes

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Esox lucius Linnaeus
Northern pike

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Campostoma oligolepis Hubbs & Greene
Largescale stoneroller

Cyprinus carpio Linnaeus
Carp

Hybognathus hankinsoni Hubbs
Brassy minnow

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis heterolepis Eigenmann & Eigenmann
Blacknose shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Table 7-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Rhinichthys atratulus (Hermann)
Blacknose dace

Semotilus atromaculatus (Mitchill)
Creek chub

Catostomidae - Suckers

Carpiodes cyprinus (Lesueur)
Quillback

Catostomus commersoni (Lacépède)
White sucker

Erimyzon sucetta (Lacépède)
Lake chubsucker

Hypentelium nigricans (Lesueur)
Northern hogsucker

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Table 7-3. Continued.

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Noturus gyrinus (Mitchill)
Tadpole madtom

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus diaphanus (Lesueur)
Banded killifish

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Gasterosteiformes

Gasterosteidae - Sticklebacks

Culaca inconstans (Kirtland)
Brook stickleback

Perciformes

Centrarchidae - Sunfishes

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis macrochirus Rafinesque
Bluegill

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides Lacépède
Largemouth bass

Table 7-3. Completed.

Perciformes (continued)

Percidae

Etheostoma caeruleum Storer
Rainbow darter

Etheostoma exile (Girard)
Iowa darter

Etheostoma flabellare Rafinesque
Fantail darter

Etheostoma microperca Jordan & Gilbert
Least darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma zonale (Cope)
Banded darter

Perca flavescens (Mitchill)
Yellow perch

Table 7-4. Illinois Natural History Survey 1976 Fish Inventories. Abundance of fishes at sampling sites in the Kishwaukee River. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS													TOTAL NUMBER	% OF TOTAL
	28_4	5_3	32_7	30_4	4_4	3_3	2_1	2_3	15_5	15_6	1_3	6_2	7_3		
UMBRIDAE															
Central mudminnow	18	-	-	1	1	-	-	-	-	2	-	-	-	22	1
ESOCIDAE															
Grass pickerel	3	-	-	-	1	-	-	-	-	-	-	-	-	4	<1
Northern pike	-	-	-	1	1	3	-	10	-	-	-	-	-	15	1
CYPRINIDAE															
Stoneroller	-	87	-	-	2	-	4	15	16	-	54	34	7	219	9
Largescale stoneroller	-	-	-	-	-	-	-	1	-	-	-	11	-	12	1
Carp	-	-	-	3	-	-	-	-	-	-	-	-	-	3	<1
Brassy minnow	-	7	18	-	-	-	-	-	-	-	2	-	-	27	1
Hornyhead chub	-	-	-	2	6	1	-	11	51	-	-	-	-	71	3
Golden shiner	-	5	-	3	-	-	-	-	-	-	-	-	-	8	<1
Common shiner	2	130	6	5	291	60	3	80	60	10	9	-	1	657	27
Bigmouth shiner	-	150	4	-	1	2	9	7	3	1	28	22	56	283	12
Blacknose shiner	-	-	-	-	1	1	2	2	-	3	-	32	1	42	2
Spotfin shiner	-	-	-	-	1	47	-	-	-	-	5	-	-	53	2
Sand shiner	2	3	-	-	-	12	-	-	-	-	12	-	-	29	1
Redfin shiner	-	-	-	-	-	-	-	-	-	-	1	-	-	1	<1
Suckermouth minnow	-	2	-	-	-	-	7	-	-	-	-	-	-	9	<1
Southern redbelly dace	-	1	1	-	-	-	-	-	40	6	-	31	3	82	3
Bluntnose minnow	2	7	-	-	6	12	-	23	-	-	7	19	-	76	3
Fathead minnow	-	-	2	-	-	-	-	-	-	-	-	-	-	2	<1
Blacknose dace	-	19	2	-	-	2	-	-	46	-	-	-	-	69	3
Creek chub	10	32	-	-	3	-	-	13	1	-	8	18	1	86	<1
CATOSTOMIDAE															
Quillback	-	-	-	-	-	-	-	-	-	-	7	-	-	7	<1
White sucker	-	102	-	1	2	1	-	2	-	1	12	4	-	125	5
Lake chubsucker	-	-	-	1	-	-	-	-	-	-	-	-	-	1	<1
Northern hogsucker	-	-	-	-	-	2	-	1	-	-	-	-	-	3	<1
Golden redhorse	-	-	-	-	-	6	-	-	-	-	1	-	-	7	<1
Shorthead redhorse	-	1	-	-	-	2	-	-	-	-	-	-	-	3	<1
ICTALURIDAE															
Tadpole madtom	-	2	-	-	-	-	-	-	-	-	-	-	-	2	<1
CYPRINODONTIDAE															
Blackstripe topminnow	-	3	-	-	1	2	-	-	-	-	2	-	-	8	<1
GASTEROSTEIDAE															
Brook stickleback	-	-	-	-	-	-	-	-	27	25	2	4	-	58	2
CENTRARCHIDAE															
Green sunfish	22	-	-	37	4	-	-	-	-	1	-	-	-	64	3
Pumpkinseed	-	-	-	-	2	-	-	-	-	-	-	-	-	2	<1
Bluegill	-	-	-	-	1	-	-	-	-	-	-	-	-	1	<1
Smallmouth bass	-	-	-	-	-	-	-	-	-	-	1	-	-	1	<1
PERCIDAE															
Rainbow darter	-	3	-	-	-	-	-	2	-	-	4	-	-	9	<1
Iowa darter	-	2	-	-	-	-	-	-	-	-	-	-	-	2	<1
Fantail darter	-	2	-	-	-	-	1	-	1	1	-	11	-	16	1
Least darter	-	13	-	-	-	-	-	-	66	19	-	18	-	116	5
Johnny darter	11	27	-	-	2	1	-	2	57	16	57	17	1	191	8
Banded darter	-	-	-	-	3	-	-	5	-	-	2	-	-	10	<1
TOTAL NUMBER OF INDIVIDUALS	70	598	33	54	329	154	26	174	368	85	214	221	70	2396	97
TOTAL NUMBER OF SPECIES	8	20	6	9	18	15	6	14	11	11	18	12	7	40	-
DIVERSITY ($\bar{d}$)	2.24	2.77	2.07	1.65	0.95	2.42	2.28	2.52	2.98	2.59	3.12	2.46	0.74	-	-
EQUITABILITY	0.8	0.5	0.9	0.4	0.1	0.5	1.0	0.6	1.0	0.8	0.7	0.6	0.3	-	-

$_1$1961 $_2$1963 $_3$1963 $_4$1968 $_5$1969 $_6$1971 $_7$1975

Table 7-5. Location of 1976 IEPA Water Quality Sampling Sites, Kishwaukee River Basin.

Basin Code	Station Number	Stream Name	Description
Kishwaukee River			
PQ	10	Kishwaukee River	Co RD BR .5 mi N of Garden Prairie.
Piscasaw Creek			
PQD	05	Piscasaw Creek	Co RD BR 1.5 mi N, 2 mi E of Belvidere.
Coon Creek			
PQF	06	Coon Creek	US20 BR 2.5 mi E of Belvidere.

Table 7-6. Bluegill Toxicity Indices, Kishwaukee River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Kishwaukee River	PQ10	0.027
Piscasaw Creek	PQD05	0.023
Coon Creek	PQF06	0.024

CHAPTER EIGHT: LAKE MICHIGAN

LOCATION AND BASIN MORPHOMETRY

The Lake Michigan shoreline within Illinois is drained by a number of small streams and ravines which run directly into the lake from Cook and Lake Counties (Fig. 8-1). Most of these have been dredged or diverted through culverts. The larger ones include Pettibone Creek, Little Dead River, Dead River, Bull Creek, Waukegan River, and Kellog Ravine. These are low-gradient streams, all order 1 or order 2. Many of their mouths are often blocked by sand from wave action on Lake Michigan.

These rivers have few natural tributaries. Most of the water received in this system is from industrial outfalls and ditches that drain this urban area.

The Illinois Lake Michigan shoreline is about 100 km long. Morphometric data are summarized in Table 8-1.

Table 8-1. Summary of Morphometric Data for Lake Michigan.

Order	Number Links	Mean Length (km)	Total Length (km)
1	35	1.13	39.70
2	12	0.97	11.62
3	2	2.71	5.42
			Total = 56.74

SUMMARY OF FISHERY DATA

Fish collections from Lake Michigan were not secured during the 1976 inventory by the Metropolitan Sanitary District of Greater Chicago. The Calumet River and Calumet Harbor, areas included in this watershed, were sampled at five locations (Table 8-2; Fig. 8-2). Table 8-3 summarizes the data from these collections. Our knowledge of the present fish fauna of the Illinois portion of Lake Michigan is based largely upon Smith (1965, 1971, in press), Wells (1968), Woods (1970), Lopinot (1970, 1974), Tichacek and Wight (1972), Parsons (1973), Wells and McLain (1973), and Muench (1974). The status of each of the fishes that occurs, or has been reported to occur, in the Illinois section of Lake Michigan is summarized in Tables 8-2 through 8-6.

By the early 1900's, the Chicago and Calumet Rivers were so polluted that few fish ascended them and, if they did, soon perished. During very high water stages, occasional fish would find their way from Lake Michigan into the Illinois River, but in recent years the pollution has formed an effective barrier between the lake and river faunas.

Throughout the first half of this century, water quality gradually deteriorated, and the shoreline became increasingly modified. Because of the immense size and depth of Lake Michigan, it supported a fishery for lake trout, ciscos, and whitefish until about 1950. In 1936, a specimen of the sea lamprey was found in southern Lake Michigan and reported by Hubbs and Pope (1937), who warned that its presence posed a serious threat to the Great Lakes fishery. Native to the Atlantic Ocean, but with a land-locked form in Lake Ontario, the species had been unable to surmount the Niagara Falls barrier until the Welland Canal was constructed in the mid-1820's. Its dispersal into southern Lake Michigan required more than 100 years, possibly because predation on them by native fishes kept their numbers low. The sea lamprey's effect upon large species of native fishes was quick and devastating. In a few years the large fishes and commercially important species succumbed to the combination of lamprey predation and commercial over-exploitation (Moffett 1957).

By 1960, a selective lamprey larvicide, called TFM, was found that gradually brought the lamprey population under control (Applegate, *et al.* 1961), but the natural ecology of Lake Michigan had already been destroyed. Prior to the arrival of the sea lamprey, the food chain consisted of large species (lake trout, burbot) feeding upon small fish (sculpins, small coregonid species, etc.), which in turn fed almost exclusively upon crustaceans. According to Moffett (1957), the removal of a large predatory fish from the food pyramid resulted in great increases in smaller species such as sculpins and the bloater. Commercial fishermen either went out of business or harvested the small, slow-growing, and less desirable bloater, many of which were too small to be marketable.

Apparently, over-harvest of the bloater and other small- and medium-sized coregonids left an unfilled niche in the food chain which was quickly occupied by a second invader from the Atlantic Coast via the Welland Canal: the alewife. First reported in Lake Michigan in 1949, the alewife was a serious problem throughout the 1960's. It was so abundant and prone to regular and massive dieoffs that water intake valves had to be screened and crews of men hired to scoop up the windrows of dead fish along the shoreline. Beaches were closed during the summers, and fishing vessels were contracted to catch and remove live fish. Tons of alewives were used for fertilizer and pet food.

In the middle 1960's, the Michigan Department of Natural Resources began experimenting with releasing coho and other salmon species from the Pacific Northwest into Lake Michigan. Since numerous attempts had been made in the late-19th century to stock Atlantic salmon and Atlantic shad into the Great Lakes without success, Michigan's program was viewed with initial skepticism. However, the rationale for the experiment was that the alewife provided an abundant food supply not being utilized and that Michigan had suitable tributaries for spawning salmon. The coho and later the chinook salmon cooperated and grew at fantastic rates, providing Michigan with an immensely popular sport fishery. Soon the salmon fishery rivaled that of

the American smelt, which had been successfully stocked in the inland Great Lakes about 1912. Whether the salmon populations will be permanent is as yet unknown, but they may have alleviated somewhat the alewife problem and have provided an exciting fishery for almost 10 years in Lake Michigan. Unfortunately there are too few tributaries with suitable spawning habitats to accomodate the large numbers of hatchery-reared smolt each year. Although expensive, the stocking program is justified by the money fishermen expend in fishing for salmon and trout.

Other states adjoining Lake Michigan have developed programs not only to introduce exotic species of salmon and the steelhead (rainbow) and brown trouts, but also to reintroduce stocks of native brook and lake trout.

While the trouts and salmons are the most sought-after species, the yellow perch remains the most abundant sport fish along the Illinois shore of Lake Michigan. However, its numbers have declined in the last 10 years. The catch of American smelt has vascillated over the years, but the species is still important in the fishery of southern Lake Michigan. The chub, *Coregonus hoyi*, is the most commonly taken commercial species. It has been said that 90 to 95% of the fish present in Lake Michigan are alewives (Woods 1970). Yet, the annual harvest of commercial species during the early 1970's was three times that of the early 1960's in terms of total pounds, but far below the annual harvest in the 1930's and 1940's (Lipinot 1974). Both sport and commercial fishing are more intensive now even though there are far fewer desirable fish to be taken.

Although the future may appear ominous, Lake Michigan is an immense body of water, and the deeper parts of the lake have not changed so dramatically as the shoreline waters. The land area has been tremendously modified, but still contains some habitats of great value. During the 1975 investigations, three species of fishes, long assumed to have been extirpated in the basin, were found to be present in Wolf Lake and Powder Horn Lake near the Indiana state line. They were the brown bullhead, banded killifish, and Iowa darter.

SUMMARY OF WATER QUALITY DATA

The Lake Michigan watershed contained 37 Illinois Environmental Protection Agency water quality sampling sites (Table 8-5; Figure 8-3). Thirty-one sites were located on the lake. The remaining sites were located on Kellog Creek, Pettibone Creek, Waukegan River, Calumet River, and Wolf Lake. Analyses for dissolved oxygen, chromium (hexavalent and trivalent), and silver were not performed on stations located on Lake Michigan, Kellog Creek, Pettibone Creek, and Waukegan River. These stations were analyzed for hardness by the Illinois Environmental Protection Agency. Hardness values for the Calumet River and Wolf Lake stations were derived from lake stations which were in close proximity. None of the toxicity indices for the stations exceeded the maximum value of 0.2 (Table 8-6). Cadmium, chromium, (hexavalent and trivalent), mercury, nickel, and silver were never detected in the watershed. Concentrations of arsenic, boron, lead, nitrate-nitrite,

and phenol were present, but in such low concentrations that they did not contribute to the Bluegill Toxicity Index when rounded to the third decimal place. None of the parameters contributed significantly to the toxicity indices.

Water quality in the Lake Michigan watershed was good throughout the monitored area. Toxicity analyses indicated the area was favorable to a diverse fishery.

CONCLUSIONS

Good quality aquatic habitat prevails throughout the Lake Michigan watershed. Water quality analyses indicated the drainage system contained few toxic substances, and, if present, they were in very low concentrations. Fish collections from the watershed included a diverse assemblage of fishes. Yet, many fish, native to the system, have either been extirpated or their numbers vastly depleted. Degradation of the watershed is due primarily to poor fishery management and to the present alewives and (formerly) the sea lamprey. Plankton investigations along the lake shore have shown increases in phytoplankton numbers and species, with blue-green algae showing especially large gains. This may be due to slight increases in the overall fertility of the lake due to urban runoff and waste treatment plant effluents. A synthesis of this information is presented in Figure 8-4.

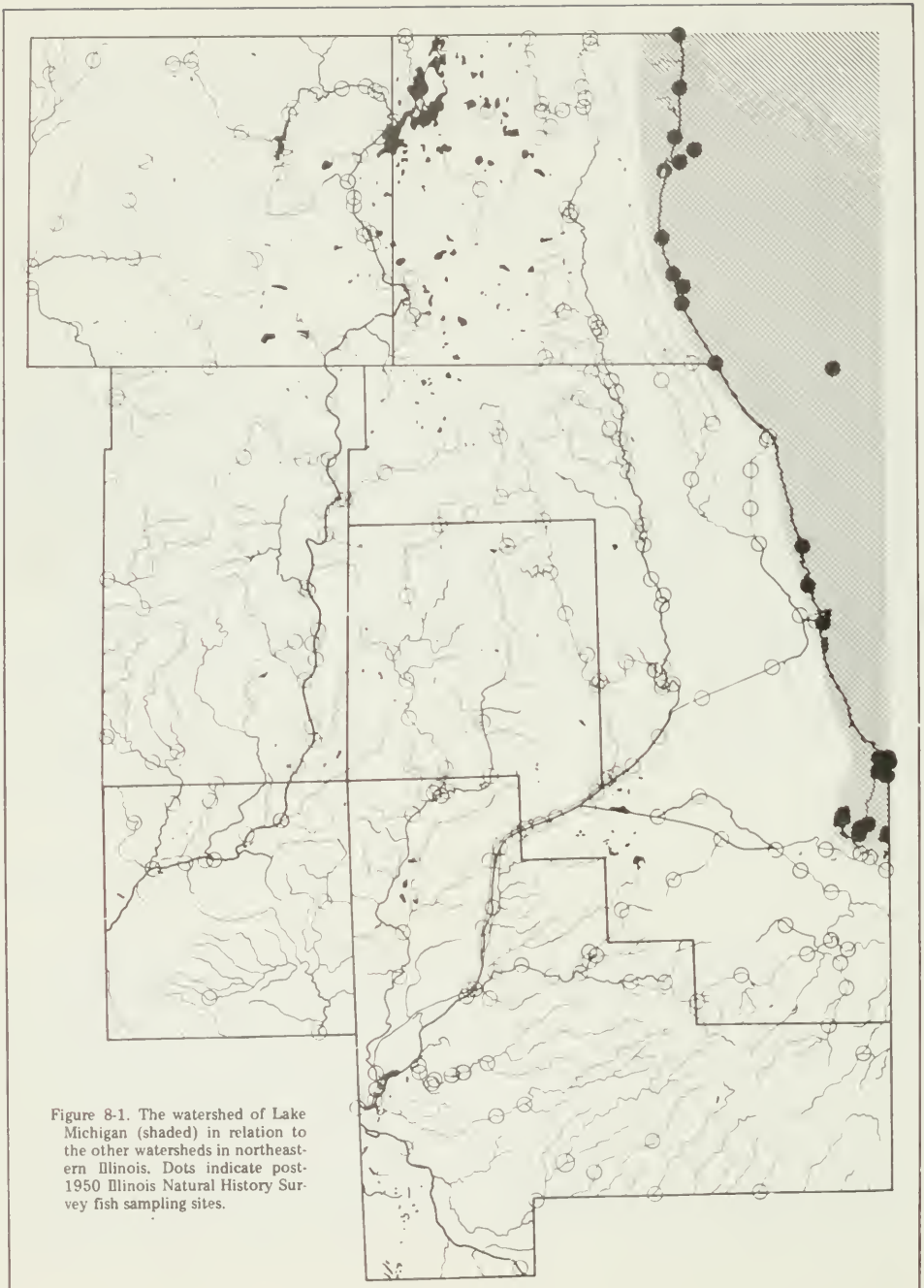


Figure 8-1. The watershed of Lake Michigan (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 Illinois Natural History Survey fish sampling sites.

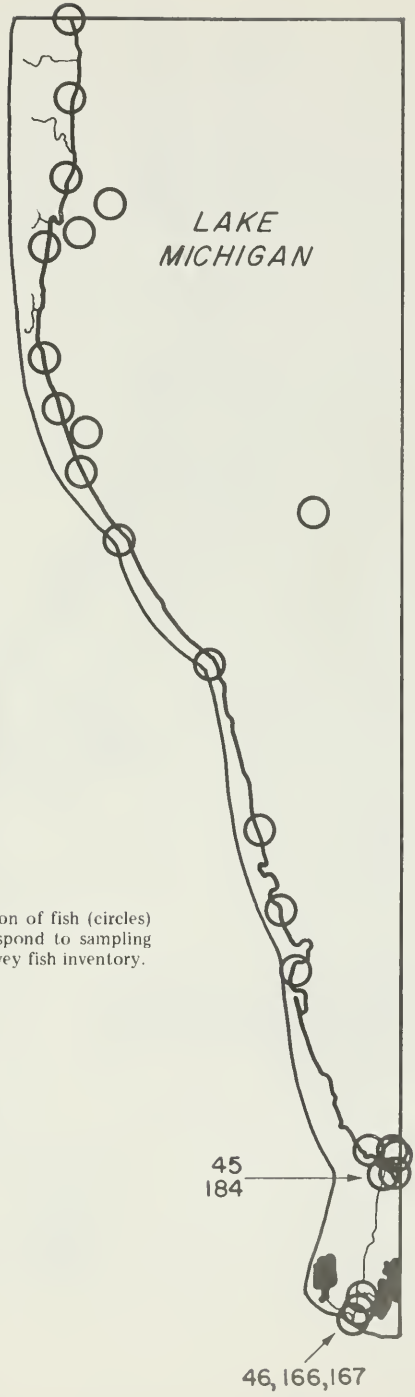


Figure 8-2. Lake Michigan Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Illinois Natural History Survey fish inventory.

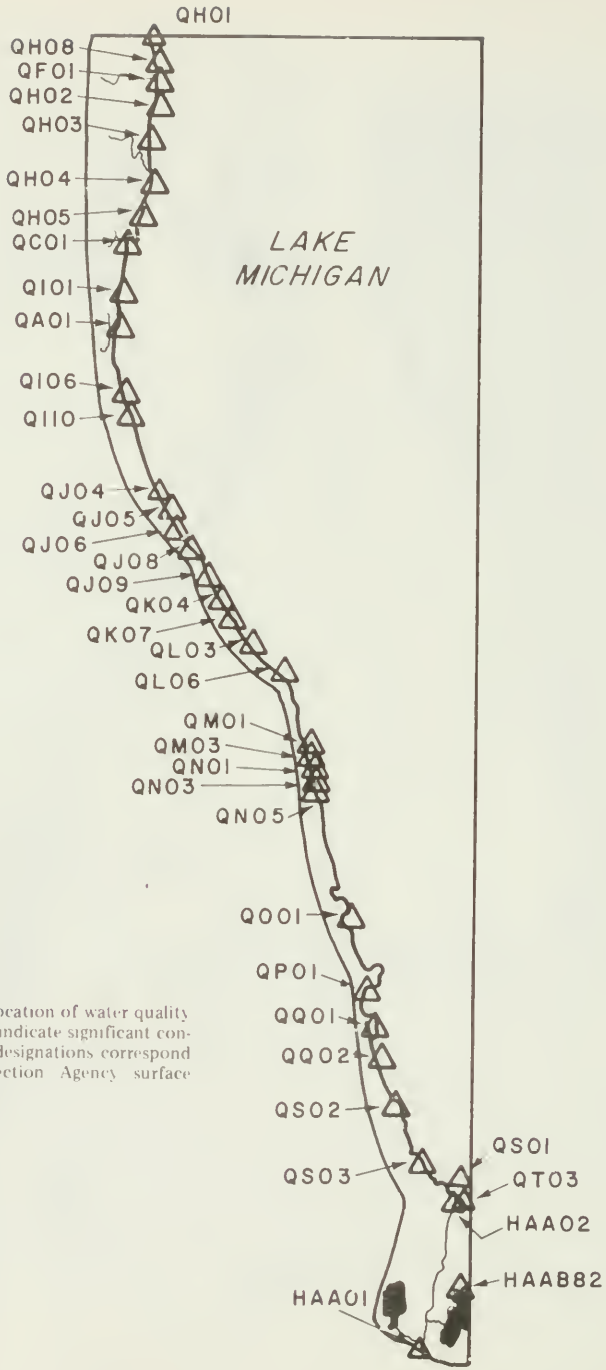


Figure 8-3. Lake Michigan Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

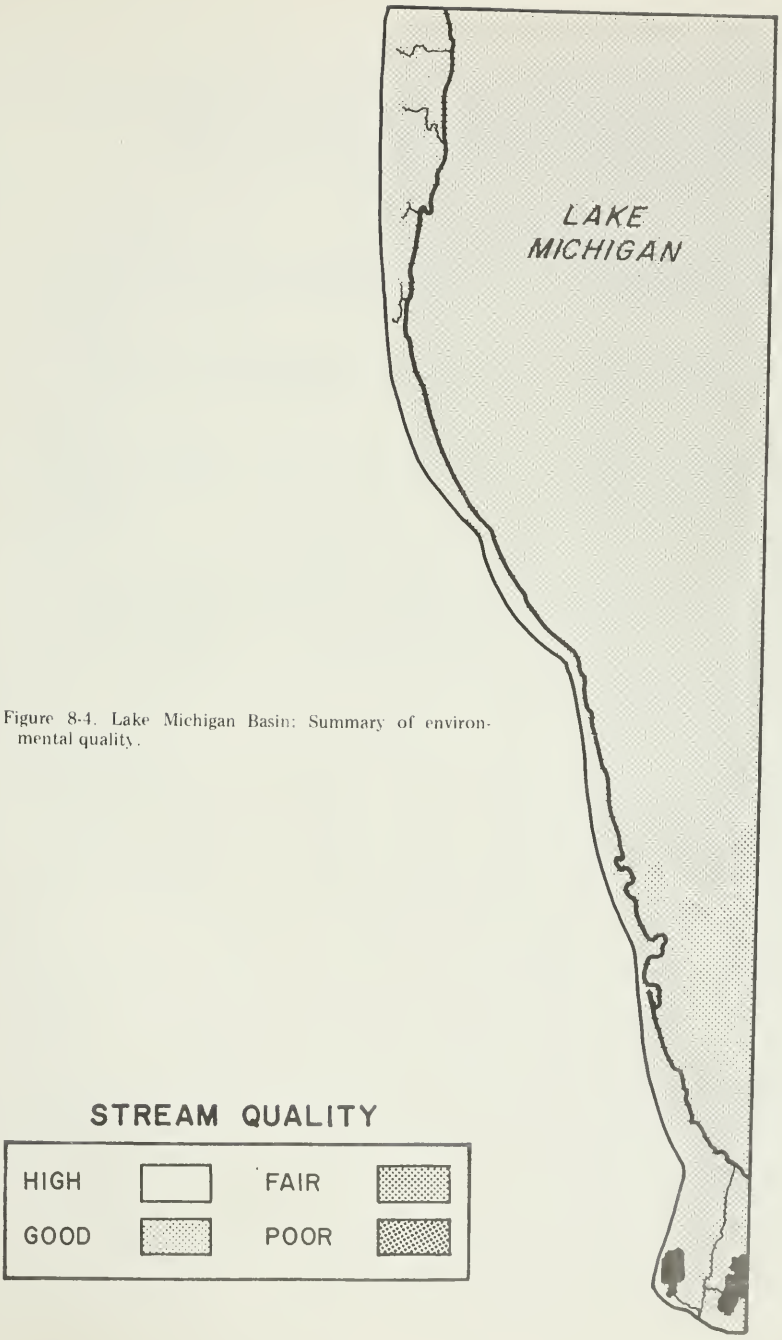


Figure 8-4. Lake Michigan Basin: Summary of environmental quality.

Table 8-2. Location of MSDGC 1976 Fish Sampling Sites, Lake Michigan Basin.

Number	Station	Location
45	Calumet River	T37N/R 14E/S 8NE; Cook Co.; Calumet Harbor at Calumet Yacht Club, CHCGO.
46	Calumet River	T37N/R 14E/S 36NE; Cook Co.; 2000 FT north of O'Brien Lock and Dam, 130th Street, Chicago.
166	Calumet River	T37N/R 14E/S 36NW; Cook Co.; inlet on east bank below 130th ST, Hegwisch.
167	Calumet River	T37N/R 14E/S 36NW; Cook Co.; inlet on east bank below 130th ST, Hegwisch.
184	Calumet Harbor	T37N/R 14E/S 8NE; Cook Co.; along beach breakwater at Calumet Yacht Club, Chicago.

Table 8-3. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Lake Michigan Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS					TOTAL NUMBER	% OF TOTAL
	45	184	46	166	167		
CLUPEIDAE							
Alewife	--	--	4	--	--	4	1
Gizzard shad	--	--	15	--	--	15	4
SALMONIDAE							
Chinook salmon	1	--	--	--	--	1	<1
Rainbow trout	5	--	--	--	--	5	1
CYPRINIDAE							
Goldfish	4	--	6	--	5	15	4
Carp	16	--	22	--	--	38	11
Golden shiner	2	--	--	--	--	2	1
Emerald shiner	2	--	51	--	--	53	15
Bluntnose minnow	--	--	60	16	1	77	22
Fathead minnow	2	--	--	--	--	2	1
Carp x goldfish	1	--	--	--	--	1	<1
CENTRARCHIDAE							
Rockbass	2	--	--	--	--	2	1
Green sunfish	--	--	15	--	--	15	4
Pumpkinseed	4	--	4	--	--	8	2
Bluegill	3	--	--	--	--	3	1
Redear sunfish	1	--	--	--	--	1	<1
Largemouth bass	33	19	41	--	--	93	26
Black crappie	--	--	1	--	--	1	<1
PERCIDAE							
Yellow perch	7	1	12	--	--	20	6
COTTIDAE							
Mottled sculpin	--	1	--	--	--	1	<1
TOTAL NUMBER OF INDIVIDUALS	83	231	16	6	21	357	100
TOTAL NUMBER OF SPECIES	13	11	1	2	3	19	--
SPECIES DIVERSITY ($\bar{d}$)	2.88	2.86	0.00	0.65	0.55	--	--
EQUITABILITY (e)	0.8	0.9	1.0	0.8	0.5	--	--

Table 8-4. Species of Fishes Presently Occurring in Lake Michigan and Adjacent Waters of Illinois.

Species	Tributaries and Adjacent Waters	Shoreline	Open Water	Authority
PETROMYZONTIFORMES				
PETROMYZONTIDAE - Lampreys				
*Petromyzon marinus Linnaeus Sea lamprey			U	INHS
ACIPENSERIFORMES				
ACIPENSERIDAE - Sturgeons				
Acipenser fulvescens Rafinesque Lake sturgeon			R	INHS
CLUPEIFORMES				
CLUPEIDAE - Herrings				
*Alosa pseudoharengus (Wilson) Alewife		C	C	INHS
*Dorosoma cepedianum (Lesueur) Gizzard shad	R	R	R	INHS
SALMONIFORMES				
SALMONIDAE - Trouts				
Coregonus artedii Lesueur Cisco or Lake herring			U	INHS
Coregonus clupeaformis (Mitchill) Lake whitefish			R	Lit.
Coregonus hoyi (Gill) Bloater			C	INHS
*Oncorhynchus kisutch (Walbaum) Coho salmon		C	C	INHS
*Oncorhynchus tshawytscha (Walbaum) Chinook salmon		U	U	INHS
*Salmo gairdneri Richardson Rainbow trout		C	C	Lit.
*Salmo trutta Linnaeus Brown trout		C	C	Lit.
*Salvelinus fontinalis (Mitchill) Brook trout		U	U	INHS
*Salvelinus namaycush (Walbaum) Lake trout			U	INHS
OSMERIDAE - Smelts				
*Osmerus mordax (Mitchill) Rainbow smelt		C	C	INHS
UMBRIDAE - Mudminnows				
Umbra limi (Kirtland) Central mudminnow	C	U		INHS
ESOCIDAE - Pikes				
Esox americanus vermiculatus Lesueur Grass pickerel	C			INHS
Esox lucius Linnaeus Northern pike		U	U	INHS
CYPRINIFORMES				
CYPRINIDAE - Minnows and Carps				
*Carassius auratus (Linnaeus) Goldfish	C	U		INHS
*Couesius plumbeus (Agassiz) Lake chub		U	U	INHS
*Cyprinus carpio Linnaeus Carp	C	C	U	INHS
*Notemigonus crysoleucas (Mitchill) Golden shiner	C	U		INHS
*Notropis atherinoides Rafinesque Emerald shiner		C		INHS
*Notropis cornutus (Mitchill) Common shiner		U		INHS
*Notropis heterodon (Cope) Blackchin shiner	R			INHS
*Notropis hudsonius (Clinton) Spottail shiner	U	C	C	INHS
*Notropis stramineus (Cope) Sand shiner	C	U		INHS
*Pimephales notatus (Rafinesque) Bluntnose minnow	C	U		INHS
*Pimephales promelas Rafinesque Fathead minnow	C	U		INHS
*Rhinichthys cataractae (Valenciennes) Longnose dace	U	C		INHS
*Semotilus atromaculatus (Mitchill) Creek chub	C	U		INHS

* = Species not native to the area
INHS = Collections of the Illinois Natural History Survey
Lit. = Documentation is based upon a published record

R = Rare
U = Uncommon
C = Common

Table 8-4. Completed.

Species	Tributaries and Adjacent Waters	Shoreline	Open Water	Authority
CATOSTOMIDAE - Suckers				
Catostomus catostomus (Forster) Longnose sucker			R	INHS
Catostomus commersoni (Lacépède) White sucker	C	U	U	INHS
Erimyzon sucetta (Lacépède) Lake chubsucker	U			INHS
SILURIFORMES				
ICTALURIDAE - Freshwater catfishes				
Ictalurus melas (Rafinesque) Black bullhead	C	U		INHS
Ictalurus natalis (Lesueur) Yellow bullhead	C	U		INHS
Ictalurus nebulosus (Lesueur) Brown bullhead	U			INHS
Noturus gyrinus (Mitchill) Tadpole madtom	U	U		INHS
PERCOPSIFORMES				
PERCOPSIDAE - Trout-perches				
Percopsis omiscomaycus (Walbaum) Trout-perch		U	U	INHS
GADIFORMES				
GADIDAE - Codfishes				
Lota lota (Linnaeus) Burbot			U	INHS
ATHERINIFORMES				
CYPRINODONTIDAE - Killifishes				
Fundulus diaphanus (Lesueur) Banded killifish	U			INHS
Fundulus notatus (Rafinesque) Blackstripe topminnow	U			INHS
GASTEROSTEIFORMES				
GASTEROSTEIDAE - Sticklebacks				
Culaea inconstans (Kirtland) Brook stickleback	C	U		INHS
Pungitius pungitius (Linnaeus) Ninespine stickleback	C	C	U	INHS
PERCIFORMES				
CENTRARCHIDAE				
Amboplites rupestris (Rafinesque) Rock bass	U	C		INHS
Lepomis cyanellus Rafinesque Green sunfish	C			INHS
Lepomis gibbosus (Linnaeus) Pumpkinseed	C	R		INHS
Lepomis gulosus (Cuvier) Warmouth	C	U		Lit.
Lepomis macrochirus Rafinesque Bluegill	C	U		INHS
Micropterus salmoides (Lacépède) Largemouth bass	C	U		Lit.
Pomoxis annularis Rafinesque White crappie	R	U		INHS
Pomoxis nigromaculatus (Lesueur) Black crappie		R		Lit.
PERCIDAE - Perches				
Etheostoma exile (Girard) Iowa darter	U			INHS
Etheostoma microperca Jordan & Gilbert Least darter	U	R		INHS
Etheostoma nigrum Rafinesque Johnny darter	C	U	R	INHS
Perca flavescens (Mitchill) Yellow perch	C	C	C	INHS
Stizostedion vitreum (Mitchill) Walleye		U		Lit.
COTTIDAE - Sculpins				
Cottus bairdi Girard Mottled sculpin		U		INHS
Cottus cognatus Richardson Slimy sculpin		U	C	INHS
Cottus ricei (Nelson) Spoonhead sculpin			R	Lit.
Myoxocephalus quadricornis (Linnaeus) Fourhorn sculpin			C	INHS

* = Species not native to the area
INHS = Collections of the Illinois Natural History Survey
Lit. = Documentation is based upon a published record

R = Rare
U = Uncommon
C = Common

Table 8-6. Species Not Yet Reported from Illinois Waters of Lake Michigan.*

Species	Authority	Comment
PETROMYZONTIFORMES		
PETROMYZONTIDAE - Lampreys		
Ichthyomyzon castaneus Girard Chestnut lamprey	G. C. Becker, pers. comm.	Wisconsin (Drainage)
SALMONIFORMES		
SALMONIDAE - Trouts		
Coregonus kiyi (Koelz) Kiyi	Wells (1968)	SE Lake Michigan
Coregonus johannae (Wagner) Deepwater cisco	Greene (1935)	Wisconsin (Lake)
Coregonus reighardi (Koelz) Shortnose cisco	Wells (1968)	SE Lake Michigan
Coregonus zenithicus (Jordan & Evermann) Shortjaw cisco	Greene (1935)	Wisconsin (Lake)
****Oncorhynchus nerka*** (Walbaum) Sockeye salmon	Verbal report	Status unknown
****Salmo clarki*** Richardson Cutthroat trout	G. C. Becker, pers. comm.	"
****Salmo salar*** Linnaeus[1]	Verbal report	"
CYPRINIFORMES		
CATOSTOMIDAE - Suckers		
Carpiodes cyprinus (LeSueur) Quillback	Wells (1968)	SE Lake Michigan

*Includes species reported elsewhere in the lake, and species reported but in need of confirmation and documentation.
** = Not native
[1]Hubbs and Lagler (1964) note that it is difficult to distanguish adults of *Salmo salar* and *Salmo trutta*.

Table 8-7. Location of 1976 IEPA Water Quality Sampling Sites, Lake Michigan Basin.

Basin Code	Station Number	Stream Name	Description
Calumet River			
HAA	01	Calumet River	130th ST BR S of LK Calumet
HAA	02	Calumet River	US41-Ewing AVE BR NE Mouth at Lake
Wolf Lake			
HAAB	82	Wolf Lake	Indiana State Line Beach
Pettibone Creek			
QA	01	Pettibone Creek	Great Lakes NTC off Bank at SPLLWY
Waukegan River			
QC	01	Waukegan River	EJ & E RR BR 200 YDS from mouth
Kellog Creek			
QF	01	Kellog Creek	20 YDS upstream from LK Michigan
Lake Michigan			
QH	01	Lake Michigan	Winthrop Harbor Main ST Beach
QH	02	Lake Michigan	Zion FT of RT 173 Extension-21st ST
QH	03	Lake Michigan	ILL Beach ST PK Concession BLDG
QH	04	Lake Michigan	Waukegan North Beach at bath house
QH	05	Lake Michigan	Waukegan Central Beach at bath house
QH	08	Lake Michigan	Zion-Benton WTR INTK at Camp Logan
QI	01	Lake Michigan	N Chicago Foss PK BCH at S end
QI	06	Lake Michigan	Lake Bluff CTR AVE BCH at bath house
QI	10	Lake Michigan	Lake Forest Westminster AVE BCH
QJ	04	Lake Michigan	Highwood Walker AVE BCH
QJ	05	Lake Michigan	Highland PK PD AVE BCH at bath HSE
QJ	06	Lake Michigan	Highland Park water intake
QJ	08	Lake Michigan	Highland PK Ravine DR BCH S of STW
QJ	09	Lake Michigan	Highland PK Cary AVE BCH S of PKG LT
QK	04	Lake Michigan	Glencoe Park AVE BCH at bath house
QK	07	Lake Michigan	Winnetka Lloyd PK BCH at bath HSE
QL	03	Lake Michigan	Kenilworth-Middle KNLWRTH AVE BCH
QL	06	Lake Michigan	Wilmette Lake AVE BCH at bath HSE
QM	01	Lake Michigan	Evanston water intake
QM	03	Lake Michigan	Evanston Dempster ST BCH at S end
QN	01	Lake Michigan	Chicago Touhy AVE BCH FT of Touhy
QN	03	Lake Michigan	Chicago Ardmore-Hollywood BCH-Middle
QN	05	Lake Michigan	Chicago Montrose AVE BCH at bath HSE

Table 8-7. Completed.

Basin Code	Station Number	Stream Name	Description
Lake Michigan (continued)			
QO	01	Lake Michigan	Chicago North AVE BCH at bath HSE
QP	01	Lake Michigan	Chicago Central Water Plant intake
QQ	01	Lake Michigan	Chicago Rossevelt RD BCH at bath HSE
QQ	02	Lake Michigan	Chicago 31st ST BCH at bath HSE
QS	01	Lake Michigan	Chicago South Water Plant intake
QS	02	Lake Michigan	Chicago Jackson PK BCH at bath HSE
QS	03	Lake Michigan	Chicago Rainbow OK BCH at bath HSE
QT	03	Lake Michigan	Chicago 100th ST BCH at bath HSE

Table 8-8. Bluegill Toxicity Indices, Lake Michigan Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Lake Michigan	QH01	.034
	QH08	.023
Kellog Creek	QF01	.082
Lake Michigan	QH02	.031
	QH03	.031
	QH04	.062
	QH05	.034
Waukegan River	QC01	.104
Lake Michigan	QI01	.031
Pettibone Creek	QA01	.068
Lake Michigan	QI06	.030
	QI10	.029
	QJ04	.044
	QJ05	.029
	QJ06	.023
	QJ08	.040
	QJ09	.064
	QK04	.027
	QK07	.020
	QL03	.017
	QL06	.020
	QM01	.022
	QM03	.026
	QN01	.022
	QN03	.025
	QN05	.025
	QO01	.019
	QP01	.015
	QQ01	.030
	QQ02	.025
	QS02	.025
	QS03	.026
	QS01	.015

CHAPTER NINE: LITTLE CALUMET RIVER

LOCATION AND BASIN MORPHOMETRY

The sampled area of the Little Calumet River in Illinois is located in Cook and Will Counties (Fig. 9-1). The river flows in a northwesterly direction and drains an area of approximately 47,397 ha in Illinois. The watershed is almost exclusively undergoing suburban development.

The Little Calumet originates west of La Porte, Indiana, and empties into the Calumet-Sag Channel south of Calumet Park, Illinois. The stream has no detectable gradient (0.00 m km) in Illinois. The Little Calumet River is an order 5 stream at its confluence with the Calumet-Sag Channel. The drainage pattern is trellis-like and overdeveloped at the order 1, 2, and 5 levels. The stream never reaches the potential order 7 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 9-1.

Table 9-1. Summary of Morphometric Data, Little Calumet River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	66	2.16	142.86
2	38	1.33	50.6
3	16	3.29	52.6
4	9	4.22	38.0
5	6	2.40	14.4
			Total = 298.46

The principal tributaries of the Little Calumet River in Illinois are Plum Creek and Thorn Creek, both order 4 streams at their confluences with the Little Calumet River.

The soils of the Little Calumet watershed are mainly silty clay loams:

1) Drummer
2) Will
3) Peotone
4) Ashkum
5) Proctor
6) Elliott
7) Beecher

SUMMARY OF FISHERY DATA

Collections were taken from 19 sites along the Little Calumet River and its tributaries during the 1976 Metropolitan Sanitary District of Greater Chicago fish inventory. Nine of these collection sites were located along the main channels of the Little and Grand Calumet Rivers. The remaining stations were located on Plum Creek, Midlothian Creek, and the Thorn Creek tributary complex south of the river (Table 9-2; Figure 9-2). Most of the sites in the Thorn Creek drainage system were situated at the confluence of various streams with Thorn Creek, the main tributary to the Little Calumet River.

Fish were not secured from three of the collection sites. Stations 159 and 179 were sampled twice and station 47 was sampled four times, all unsuccessfully. Illinois Natural History Survey records indicated 33 species of fish and carp x goldfish hybrids were present in this watershed (Table 9-3). The successful Metropolitan Sanitary District of Greater Chicago collections included 15 species of fish and two hybrid crosses, carp x goldfish and green sunfish x bluegill (Table 9-4). Thus, over half of these species apparently have been extirpated. Almost all of the species collected are considered tolerant to habitat abuse, though the brook silverside, an intolerant species, was taken at the confluence of Midlothian Creek with the Little Calumet River. Creek chubs were the most abundant species in the watershed, yet the majority of these were collected from two sites.

The results of the Metropolitan Sanitary District of Greater Chicago inventory indicated the majority of the Little Calumet River watershed contained a poor fishery. The main river channel, which includes the Grand Calumet and Little Calumet Rivers, was sampled for fishes 15 times. Only seven of these collections were successful, and they included a total of 237 fishes. Degraded populations also existed at most of the tributary sites. Slightly improved conditions were found at the upstream station on North Creek.

The fish population in the headwaters of the tributaries could not be evaluated using the Metropolitan Sanitary District of Greater Chicago data because they did not sample these stream reaches. Conclusions were drawn using Illinois Natural History Survey collection data, where available. These data indicate that the fish populations were good in the tributary headwaters and in Plum Creek. The low number of fishes collected throughout the watershed made the diversity and equitability indices unreliable at all but two sites. The values for these stations, both located on the Little Calumet River, were high for the watershed, yet the species present were all tolerant.

SUMMARY OF WATER QUALITY DATA

Water quality analysis of the Little Calumet River watershed included 21 Illinois Environmental Protection Agency water quality sampling sites

(Table 9-5; Fig. 9-3). Total analyses of the parameters necessary for the calculation of the toxicity index were performed at the majority of the sites. In exception were MBAS which was not measured at stations H06 and HBD03, and hardness, which was taken from the Metropolitan Sanitary District of Greater Chicago water quality analysis. Mercury and nickel were never detected in the watershed. Concentrations of cadmium and chromium (trivalent and hexavalent) were detected, yet they did not contribute to the toxicity index rounded to three decimals. The maximum toxicity level of 0.2 was exceeded at 15 sites (Table 9-6) due to significantly high concentrations (>0.100) of ammonia nitrogen, fluoride, silver, cyanide, MBAS, and total iron. Ammonia nitrogen contributed significantly to the toxicity at all of these sites.

The Illinois Pollution Control Board standard for ammonia nitrogen was exceeded at 17 of the sites (Table 9-7). Ten stations produced total iron concentrations that met or exceeded the standard. The silver standard was exceeded at two sites and the fluoride standard at four sites. The cyanide concentration exceeded the standard at only one site (H04), yet cyanide contributed significantly to the toxicity index at two sites.

All the toxicity indices for the stations located in the Grand and Little Calumet Rivers were in excess of the maximum level of 0.2 due to the presence of high concentrations of ammonia nitrogen, cyanide, fluoride, silver, and MBAS. The complex of tributaries which drain into Thorn Creek and eventually into the Little Calumet River initially contained water of good quality. However, water quality deteriorated before these streams converged with Thorn Creek. Ammonia nitrogen was the only significant toxicant in these streams. Plum Creek, located in the southeastern edge of the Illinois portion of this watershed, drains into the Little Calumet River in Indiana. The reach of Plum Creek located in Illinois contained high water quality. A high concentration of total iron found in this stream probably was due to leaching of naturally occuring iron from the soils of the watershed. Midlothian Creek, which was monitored at its confluence with the Little Calumet River, contained little contamination.

CONCLUSIONS

Due to the poor water quality, the vast majority of the Little Calumet River watershed supports a very limited fish population. Toxicity indices for the main river channel were all above the maximum acceptable level, and only 47% of the fish collections proved successful in securing fish from this area.

Toxicity analyses indicated high concentrations of ammonia nitrogen throughout the Little Calumet River. The river reached toxic concentrations of ammonia nitrogen even before receiving more ammonia

nitrogen from Thorn Creek. Toxic concentrations of cyanide, fluoride, and MBAS were found only at isolated locations along the main river channel. A synthesis of this information is expressed in Figure 9-4.

The Thorn Creek tributaries have acceptable water quality and diverse fish populations at their headwaters. Downstream, conditions deteriorate rapidly with several toxicants, primarily ammonia nitrogen, entering the streams. Thorn Creek then flows into the Little Calumet, further degrading the river's water quality. Plum Creek, a high quality stream in its Illinois portion, is channelized and flows through a suburban area before it enters the Little Calumet in Indiana. Midlothian Creek, also channelized, seems to maintain moderate quality throughout its length.

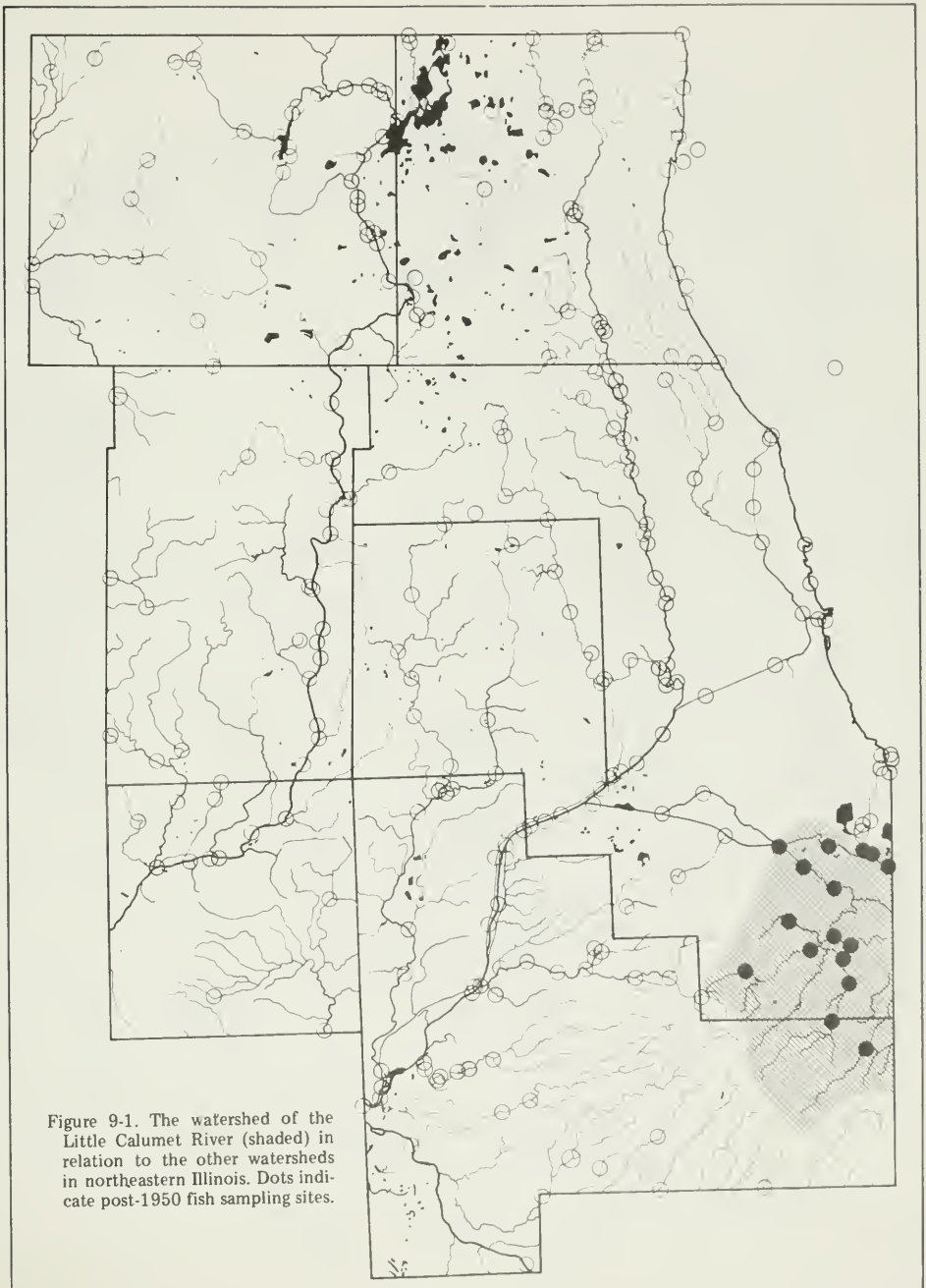
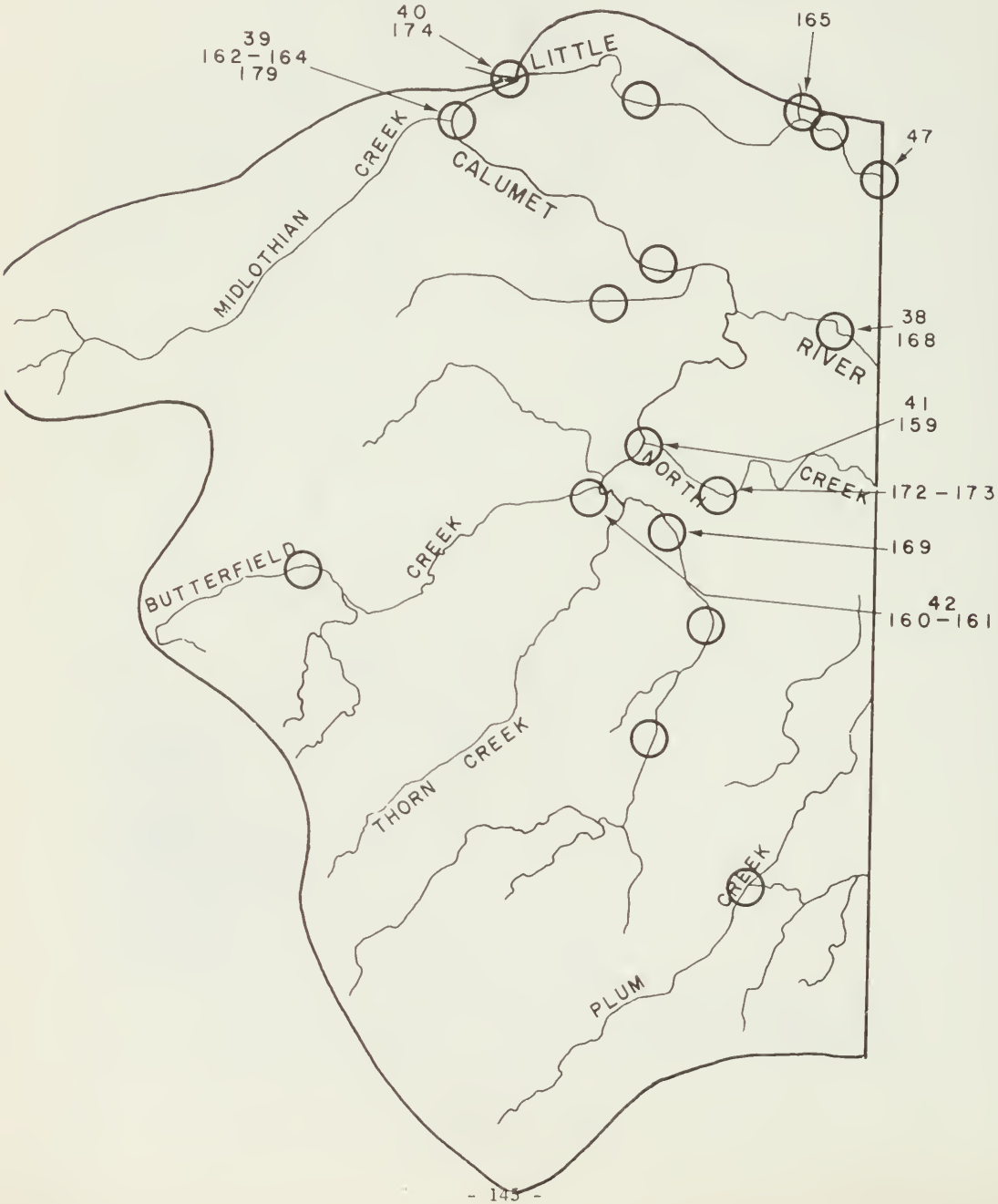


Figure 9-1. The watershed of the Little Calumet River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 9-2. Little Calumet River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 Fish inventory.



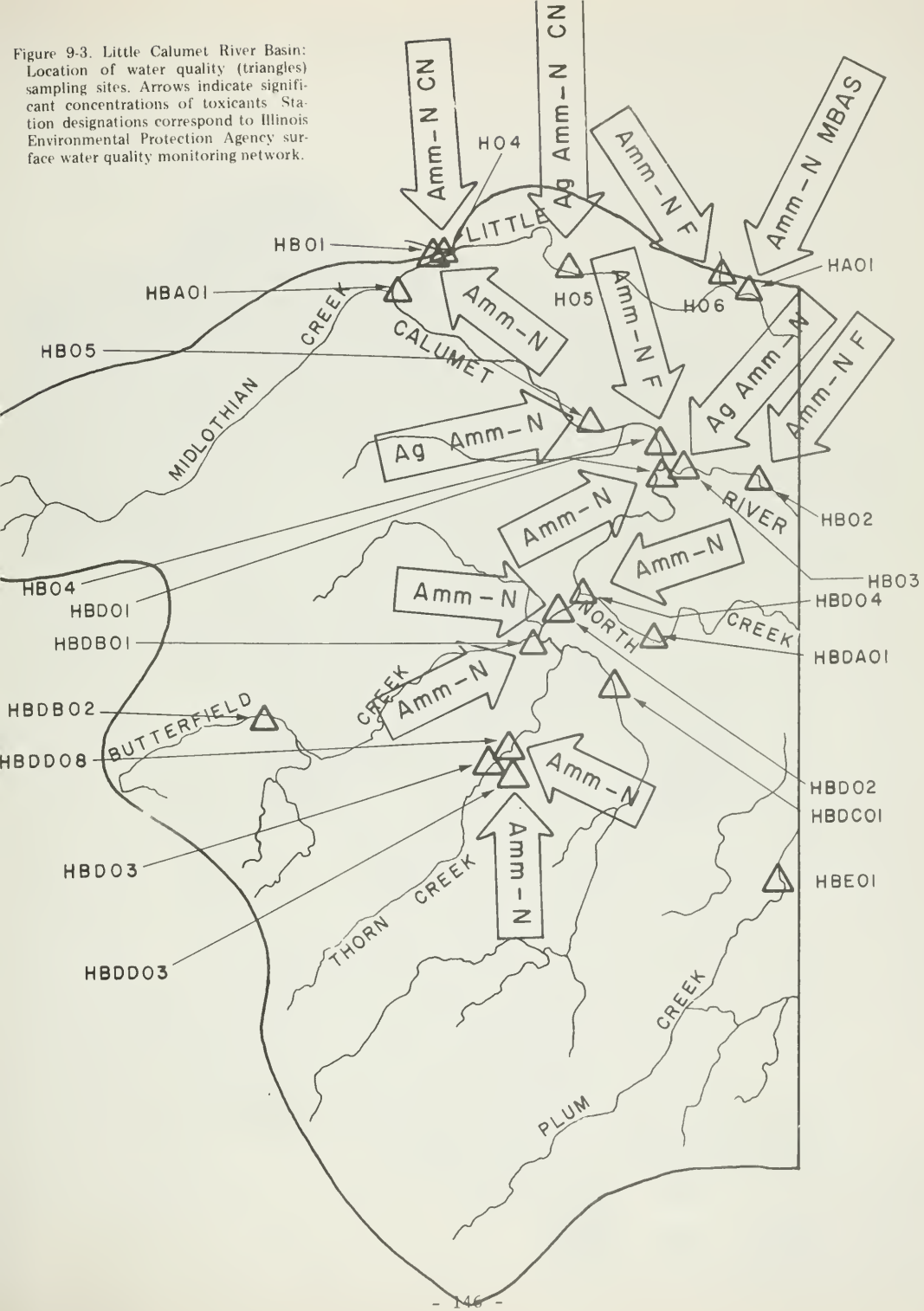


Figure 9-3. Little Calumet River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

Figure 9-4. Little Calumet River Basin: Summary of environmental quality.

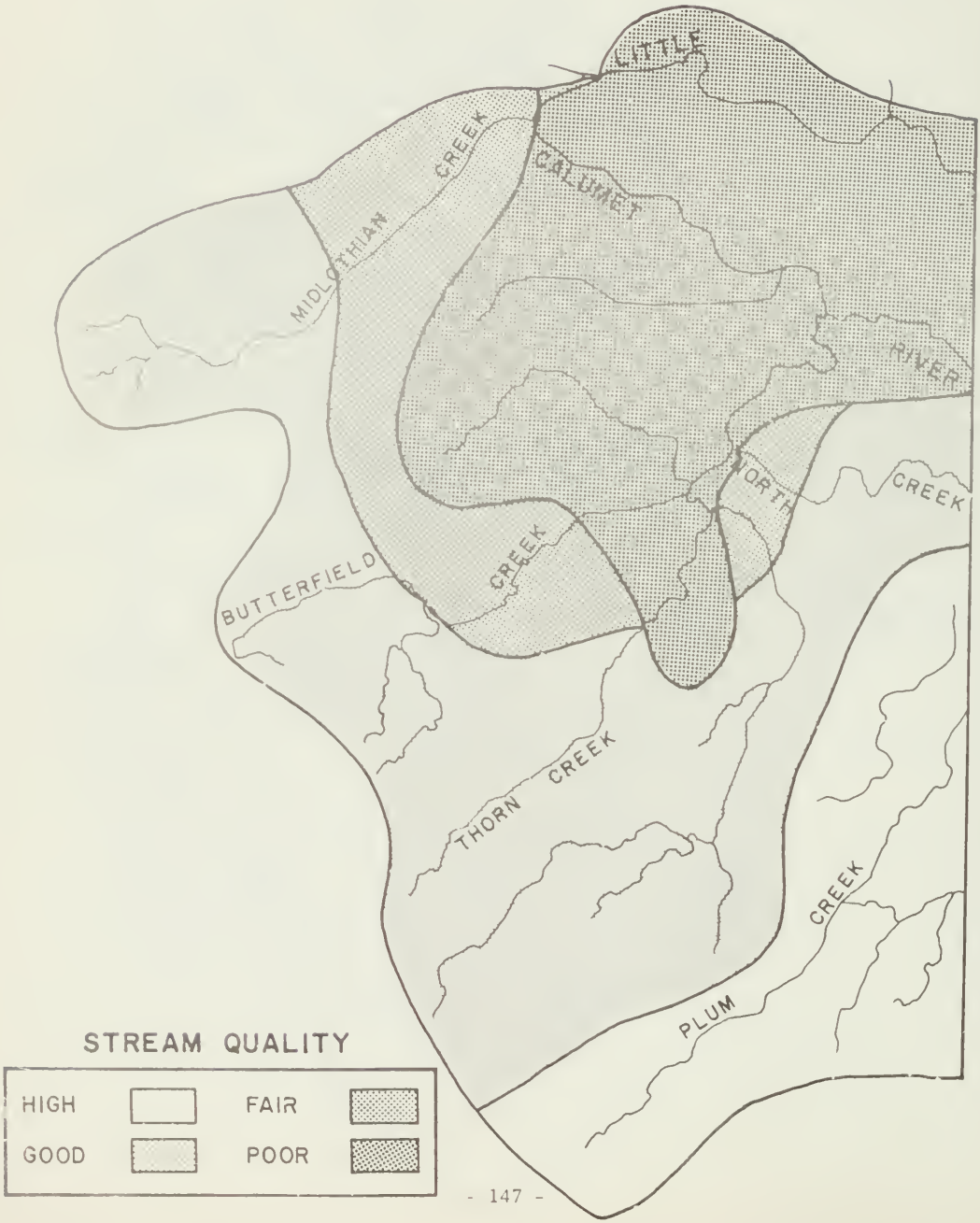


Table 9-2. Location of MSDGC 1976 Fish Sampling Sites, Little Calumet River Basin.

Number	Station	Location
38	Little Calumet River	T36N/R 15E/S 20SW; Cook Co.; 10 meters upstream of Wentworth Avenue, Calumet City.
39	Little Calumet River	T37N/R 14E/S 31SE; Cook Co.; 400 meters above Jackson Street and C & O RR bridge, Blue Island.
40	Little Calumet	T37N/R 14E/S 32NE; Cook Co.; 400 meters above Halsted Street, Calumet Park.
41	Thorn Creek	T36N/R 14E/S 34NW; Cook Co.; 10 meters downstream and immediately upstream of Margaret Street, Thornton.
42	Thorn Creek	T35N/R 14E/S 4SW; Cook Co.; 20 meters below Chicago HTS-Glenwood RD, Glenwood.
47	Grand Calumet River	T36N/R 14E/S 5SW; Cook Co.; below State Line RR bridge, Calumet City.
159	Thorn Creek	T36N/R 14E/S 34NW; Cook Co.; tailrace and forebay of small stone dam 50 meters upstream of Margaret.
160	Butterfield Creek	T35N/R 14E/S 4SW; Cook Co.; upstream of Chicago HTS-Glenwood RD, Glenwood.
161	Butterfield Creek	T35N/R 14E/S 4SW; Cook Co.; 40 meters upstream and downstream of Chicago HTS-Glenwood RD, Glenwood.
162	Midlothian Creek	T37N/R 14E/S 6NW; Cook Co.; mouth of Midlothian Creek with Little Calumet River.
163	Midlothian Creek	T37N/R 14E/S 6NW; Cook Co.; mouth of Midlothian Creek with Little Calumet River, Blue Island.
164	Little Calumet River	T37N/R 14E/S 6NW; Cook Co.; above Midlothian Creek mouth, Blue Island.
165	Little Calumet River	T36N/R 14E/S 2NE; Cook Co.; 400 meters west of Calumet Expressway, Dolton.
168	Little Calumet River	T36N/R 15E/S 20SW; Cook Co.; 50 meters upstream (east) of Wentworth AVE, Calumet City.
169	Deer Creek	T36N/R 14E/S 10NW; Cook Co.; west of State Street, Glenwood.

Table 9-2. Completed.

Number	Station	Location
172	North Creek	T35N/R 14E/S 2NW; Cook Co.; west of Cottage Grove Avenue bridge, Sweet Woods, Thornton.
173	North Creek	T35N/R 14E/S 2NW; Cook Co.; west of Cottage Grove Avenue, Sweet Woods, Thornton.
174	Little Calumet River	T37N/R 14E/S 32SW; Cook Co.; junction of Little Calumet River with Calumet Sag Channel, Blue Island.
179	Little Calumet River	T37N/R 14E/S 31SE; Cook Co.; 50 meters east of Jackson Street bridge, Blue Island.

Table 9-3. Checklist of Fishes Known to Occur in the Little Calumet River Basin.

Amiiformes

Amiidae - Bowfins

Amia calva Linnaeus
Bowfin

Clupeiformes

Clupeidae - Herrings

Alosa pseudoharengus (Wilson)
Alewife

Dorosoma cepedianum (Lesueur)
Gizzard shad

Salmoniformes

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Cypriniformes

Cyprinidae - Minnows and Carps

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Table 9-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus natalis (Lesueur)
Yellow bullhead

Noturus gyrinus (Mitchill)
Tadpole madtom

Atheriniformes

Peociliidae - Livebearers

Gambusia affinis (Baird & Girard)
Mosquitofish

Table 9-3. Completed.

Atheriniformes (continued)

Atherinidae - Silversides

Labidesthes sicculus (Cope)
Brook silversides

Perciformes

Centrarchidae - Sunfishes

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Micropterus salmoides (Lacépède)
Largemouth bass

Percidae - Perches

Etheostoma caeruleum Storer
Rainbow darter

Etheostoma exile (Girard)
Iowa darter

Etheostoma nigrum Rafinesque
Johnny darter

Perca flavescens (Mitchill)
Yellow perch

Percina maculata (Girard)
Blackside darter

Table 9-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Little Calumet River. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS																TOTAL NUMBER	% OF TOTAL
	165	40	174	168	38	169	161	160	42	173	172	41	163	162	164	39		
CLUPEIDAE																		
Gizzard shad	47	--	2	-	--	--	--	--	--	--	--	--	--	--	--	--	49	13
UMBRIDAE																		
Central mudminnow	--	1	--	--	--	--	--	--	--	--	--	--	--	4	--	1	6	2
CYPRINIDAE																		
Goldfish	19	1	--	-	3	19	1	--	--	--	1	1	1	--	2	7	57	15
Carp	24	2	4	--	--	19	--	--	--	--	--	--	--	--	--	3	52	13
Emerald shiner	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	3
Bluntnose minnow	5	--	--	--	--	--	--	3	--	--	1	--	--	--	--	--	9	2
Creek chub	--	--	--	--	--	--	41	6	3	2	7	--	2	30	7	--	98	25
Carp x Goldfish	7	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	9	2
CATOSTOMIDAE																		
White sucker	--	--	--	--	--	--	--	--	--	--	1	--	1	--	--	2	4	1
ICTALURIDAE																		
Black bullhead	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	<1
POECILIIDAE																		
Mosquitofish	--	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	1
ATHERINIDAE																		
Brook silverside	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	<1
CENTRARCHIDAE																		
Green sunfish	1	55	1	1	4	1	--	--	--	1	2	1	1	--	--	7	75	19
Pumpkinseed	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	<1
Bluegill	--	2	1	--	--	--	--	--	--	--	--	--	--	--	--	5	8	2
Largemouth bass	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	<1
Green sunfish x Bluegill	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	<1
TOTAL NUMBER OF INDIVIDUALS	114	67	9	3	7	39	42	9	3	3	12	2	5	34	9	28	386	98
TOTAL NUMBER OF SPECIES	7	7	4	2	2	3	2	2	1	2	5	2	4	2	2	8	15	--
DIVERSITY ($\bar{d}$)	1.98	1.04	1.75	0.00	0.00	0.27	0.00	0.00	0.00	0.00	1.27	0.00	1.49	0.00	0.00	2.58	--	--
EQUITABILITY (e)	0.6	0.3	0.8	0.5	0.5	0.1	0.5	0.5	1.0	0.5	0.6	0.5	0.9	0.5	0.5	0.9	--	--

Table 9-5. Location of 1976 IEPA Water Quality Sampling Sites, Little Calumet River Basin.

Basin Code	Station Number	Stream Name	Description
Little Calumet River			
H	04	Little Calumet River	RT 1 - Halsted BR
H	05	Little Calumet River	Indiana AVE BR at Riverdale
H	06	Little Calumet River	I94-Calumet XWAY BR at Dolton
Grand Calumet River			
HA	01	Grand Calumet River	Torrence AVE BR at Burnham
Little Calumet River			
HB	01	Little Calumet River	Ashland AVE BR NR JCT with CAL-SAG
HB	02	Little Calumet River	Wentworth AVE BR NR Indiana State Line
HB	03	Little Calumet River	US6-RT83-Torrence AVE BR
HB	04	Little Calumet River	US6-159th ST BR
HB	05	Little Calumet River	RT83-147th ST BR at Harvey
Midlothian Creek			
HBA	01	Midlothian Creek	Dixie HWY BR at Blue Island
Thorn Creek			
HBD	01	Thorn Creek	167th ST BR NR S Holland
HBD	02	Thorn Creek	Vincennes AVE BR at Glenwood
HBD	03	Thorn Creek	RT1-Halsted ST in Chicago HTS
HBD	04	Thorn Creek	Thornton-Lansing RD BR at Thornton
North Creek			
HBDA	01	North Creek	Cottage Grove AVE BR NE of Glenwood
Butterfield Creek			
HBDB	01	Butterfield Creek	Chicago HTS Glenwood RD BR
HBDB	02	Butterfield Creek	Pulaski RD (Crawford AVE) BR
Deer Creek			
HBDC	01	Deer Creek	State ST BR at S edge Glenwood

Table 9-5. Completed.

Basin Code	Station number	Stream Name	Description
State Street Ditch			
HBDD	03	State ST Ditch	US30 BR at Chicago Heights
HBDD	08	State ST Ditch	BR off Joe Orr-Calumet,.5 mi W STAT
Plum Creek			
HBE	01	Plum Creek	Steger RD BR NR Indiana ST Line

Table 9-6. Bluegill Toxicity Indices, Little Calumet River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Grand Calumet River	HA01	.869
Little Calumet River	H06	.293
	H05	1.120
	H04	1.159
Plum Creek	HBE01	.160
Little Calumet River	HB02	.483
	HB03	8.254
Thorn Creek	HBD03	.088
State Street Ditch	HBDD03	.579
	HBDD08	.326
Deer Creek	HBDC01	.164
Butterfield Creek	HBDB02	.137
	HBDB01	.438
Thorn Creek	HBD02	.618
North Creek	HBDA01	.125
Thorn Creek	HBD04	.315
	HBD01	.448
Little Calumet River	HB04	.571
	HB05	2.281
Midlothian Creek	HBA01	.095
Little Calumet River	HB01	.298

Table 9-7. Summary, 1976 IEPA Water Quality Data, Little Calumet River Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the SGTU.)

IEPA Station	Amm-N (mg l^{-1})	Ag (mg l^{-1})	F (mg l^{-1})	CN (mg l^{-1})	MBAS (mg l^{-1})	Fe Total (mg l^{-1}
Grand Calumet River						
HA01	5.70 - 15.00	.000 - .000	.9 - .9	.010 - .010	.90 - .90	2.3 - 2.3
	8.90 (7)	.000 (1)	.9 (1)	.010 (1)	.90 (1)	2.3 (1)
Little Calumet River						
H06	3.50 - 6.00	.000 - .000	.7 - .7	.020 - .020	-	.8 - .8
	4.40 (4)	.000 (1)	.7 (1)	.020 (1)	-	.8 (1)
H05	.73 - 9.20	.000 - .010	.3 - .7	.000 - .050	.20 - .50	.4 - 1.0
	3.85 (6)	.003 (3)	.5 (3)	.015 (4)	.35 (2)	.8 (3)
H04	18.00 - 4.60	.000 - .000	1.1 - 1.1	.030 - .060	.80 - .80	.5 - .7
	11.15 (7)	.000 (2)	1.1 (2)	.045 (2)	.80 (1)	.6 (2)
Plum Creek						
H8E01	.00 - .28	.000 - .000	.4 - .4	.000 - .000	.30 - .30	1.0 - 7.0
	.13 (7)	.000 (2)	.4 (2)	.000 (2)	.30 (1)	4.0 (2)
Little Calumet River						
H802	.33 - 11.00	.000 - .000	.6 - 14.5	.000 - .010	.40 - .50	.7 - 4.6
	4.92 (8)	.000 (3)	5.3 (3)	.003 (3)	.45 (2)	2.0 (3)
HB03	.33 - 11.00	.000 - .080	1.3 - 5.5	.000 - .000	.04 - .04	.7 - 2.7
	3.90 (8)	.030 (3)	2.7 (3)	.000 (3)	.04 (1)	1.4 (3)
Thorn Creek						
HBD03	.05 - 4.40	.000 - .000	.9 - 1.0	.000 - .000	-	.5 - 1.0
	1.63 (6)	.000 (2)	.9 (2)	.000 (2)	-	.7 (2)
State Street Ditch						
HBDD03	4.20 - 25.00	.000 - .000	.8 - 1.3	.000 - .000	1.10 - 1.10	.7 - 1.4
	16.97 (7)	.000 (3)	1.0 (3)	.000 (3)	1.10 (1)	1.0 (3)
HBDD08	2.80 - 14.00	.000 - .000	1.2 - 1.4	.000 - .010	.60 - .60	.3 - .9
	8.26 (8)	.000 (2)	1.3 (2)	.005 (2)	.60 (1)	.6 (2)
Deer Creek						
HBDC01	.04 - 7.60	.000 - .000	5 - 8	000 .000	.80 - .80	.2 - .9
	1.44 (7)	.000 (2)	.6 (2)	.000 (2)	.80 (1)	.5 (2)
Butterfield Creek						
HBDB02	.08 - .41	.000 - .000	.4 - .9	.000 - .000	.40 - .40	7.0 - .8
	.18 (7)	.000 (3)	.5 (3)	.000 (3)	.40 (1)	2.8 (3)
HBDB01	.36 - 18.00	.000 - .000	.5 - 1.9	.000 - .010	.70 - .70	.3 - .9
	8.10 (8)	.000 (3)	1.2 (3)	.007 (3)	.70 (1)	.6 (3)
Thorn Creek						
HBD02	1.00 - 20.00	.000 - .000	1.3 - 1.7	.000 - .010	.60 - .60	.4 - .5
	10.86 (5)	.000 (2)	1.5 (2)	.005 (2)	.60 (1)	.4 (2)
North Creek						
HBDA01	.00 - 5.00	.000 - .000	5 - 6	000 .000	.20 - .40	.3 - 5.2
	.86 (8)	.000 (3)	.5 (3)	.000 (3)	.30 (2)	2.3 (3)
Thorn Creek						
HBD04	.62 - 13.00	.000 - .000	.8 - 1.0	.000 - .000	.50 - .50	.6 - .7
	5.97 (8)	.000 (2)	.9 (2)	.000 (2)	.50 (1)	.6 (2)
HBD01	.84 - 14.00	.000 - .000	.8 - .9	.000 - .000	.50 - .50	.6 - .8
	7.65 (8)	.000 (2)	.8 (2)	.000 (2)	.50 (1)	.7 (2)
Little Calumet River						
H804	.43 - 13.00	000 - .000	1.2 - 8.8	.000 - .010	.40 - .40	.9 - 1.2
	6.71 (8)	.000 (2)	5.0 (2)	.005 (2)	.40 (1)	1.0 (2)
H805	.40 14.00	000 - .010	.7 - 1.7	.000 - .000	.40 - 1.00	.3 - 3.6
	6.03 (6)	.007 (3)	1.3 (3)	.000 (3)	.70 (2)	1.4 (3)
Midlothian Creek						
HBA01	.04 - .35	.000 - .000	4 - 1.0	.000 - .000	.20 - .20	.4 - 5.0
	.12 (7)	.000 (3)	.6 (3)	.000 (3)	.20 (1)	1.9 (3)
Little Calumet River						
H801	.46 - 13.00	.000 - .000	1.2 - 1.4	.000 - .000	.40 - .40	.2 - .7
	5.97 (7)	.000 (2)	1.3 (2)	.000 (2)	.40 (1)	.4 (2)
IPCB STANDARDS	1.50	.005	1.4	.025	-	1.0

CHAPTER TEN: LOWER DES PLAINES RIVER

LOCATION AND BASIN MORPHOMETRY

The Lower Des Plaines River is located in Cook, DuPage, and Will Counties, Illinois (Fig. 10-1). The watershed in this study originates at the junction of the river with Salt Creek and terminates where the river leaves Will County. The watersheds of the major tributaries (Sanitary and Ship Canal, Hickory Creek, and the DuPage River) were considered separately, so only a number of smaller streams contribute to this drainage area of approximately 120,435 ha.

The Des Plaines River is a low-gradient stream (0.6 m km^{-1}) with an average width of over 60 m. It is an order 6 stream at the confluence with the DuPage River. The drainage pattern is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The Lower Des Plaines River is overdeveloped at all levels, except the order 4 level. It does not reach the potential order 8 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 10-1.

Table 10-1. Summary of Morphometric Data, Lower Des Plaines River Basin.

Order	Number Links	Mean Length (km)	Total Length (km)
1	165	1.74	286.77
2	88	1.30	114.57
3	51	1.82	92.90
4	5	2.16	10.80
5	25	3.98	99.52
6	7	1.34	9.38
			Total = 613.94

The soils of the Des Plaines River watershed are developed from the glacial drift deposited by the late Wisconsin glaciation. Numerous marshes and swamps are present. Major soil associations are:

1) Saybrook - Lisbon - Drummer
2) Miami - Strawn
3) Morley - Blount
4) Elliott - Beecher - Markham
5) Bryce - Swygert - Frankfort

SUMMARY OF FISHERY DATA

Fish collections were taken from 37 locations on the Lower Des Plaines River and its tributaries (Table 10-2; Fig. 10-2). Eighteen of the sites were located on the river, and the remaining sites were located on seven of the river's tributaries. Stations 170 and 242 were sampled twice with only one successful collection at each site. Station 195 also received two attempts, but no fish were ever taken. Earlier collections reported 66 species and carp x goldfish hybrids to be present in the watershed (Table 10-3). The Metropolitan Sanitary District of Greater Chicago 1976 inventory included 42 of these species, carp x goldfish hybrids, and green sunfish x bluegill hybrids (Table 10-4). Half of the species not included in the 1976 inventory are considered intolerant to habitat abuse. Only five species which are still found in the watershed are ecologically intolerant, and these species represented 6% of the total number of fish collected in 1976. All other species in the collection are considered to have some degree of tolerance. Bluntnose minnows, a tolerant species, were found commonly throughout the watershed. They represented 26% of the total number of fish collected.

The Lower Des Plaines River watershed contains the full range (poor to high) of fishery quality. Collections from the river were diverse, yet dominated by tolerant fish species. Collections from a few river sites, which were in close proximity to good quality tributaries, included creek species. Station 24, located on a side channel of the river, was improved by waters of a nearby tributary, creating a habitat for tadpole madtoms. This species also was included in collections downstream. Stations 29 and 119 at the confluence of Sugar Run and the river were affected favorably by the good quality fishery present in Sugar Run. Yet, tolerant species still dominated the collections. Flag Creek, Sawmill Creek and the Illinois-Michigan Canal were the only tributaries containing degraded fisheries. All other sampled tributaries contained primarily good to high quality fisheries. The upper portions of Jackson Creek and all of Manhattan Creek contained an exceptionally rich assemblage of fish species. Station 28 on Jackson Creek included 19 species. Species diversity and equitability values were accordingly high. Jackson Creek had degraded to fair quality before its confluence with the river.

SUMMARY OF WATER QUALITY

The Lower Des Plaines River watershed contained 11 Illinois Environmental Protection Agency water quality sampling sites (Table 10-5; Fig. 10-3). Eight sites were located on the river, with the remaining three on Jackson Creek and Flag Creek. Station GK02 was not analyzed for 17 parameters needed in the toxicity calculations. MBAS was not measured at Station GC01. The Metropolitan Sanitary District of Greater Chicago water quality data provided hardness values for the watershed. All other parameters needed in toxicity evaluation were measured by the Illinois Environmental Protection Agency.

Toxicity values for three stations exceeded the maximum level of 0.2 (Table 10-6). Significant concentrations of silver were recorded at two of these sites. The remaining site was toxic due to the combined effect of the ammonia nitrogen, MBAS, and cyanide levels. Silver was the only parameter significantly contributing to the toxicity index. Concentrations of arsenic, boron, cadmium, chromium (trivalent), and phenol were present, yet they did not contribute to the Bluegill Toxicity Index when rounded to the third decimal place. Chromium (hexavalent), mercury, and nickel were never detected in this drainage system. The Pollution Control Board standards were exceeded at the following sites: copper at seven sites, iron (total) at five sites, ammonia nitrogen at two sites, and lead and silver at one site each (Table 10-7). Analyses of station GK01 indicated an excessive amount of nitrate-nitrite was present. This value exceeded the potable water supply standard.

The Des Plaines River south of the Salt Creek confluence initially contained substantial but sub-lethal concentrations of toxic substances. In fact, this toxicity level did not exceed the maximum level of 0.2 in this area. The first monitored tributary, Flag Creek, was not completely analyzed for all the parameters needed to calculate the toxicity index. The available data indicated that a high concentration of nitrate-nitrite was present. This value had little effect on the toxicity value, and the stream maintains fair water quality. Station G04, a river station south of Flag Creek, contained concentrations of ammonia nitrogen, MBAS, and cyanide for which the combined toxicity values exceeded the toxic level of 0.2.

Before the river and the Sanitary and Ship Canal and Illinois-Michigan Canal merge, many small tributaries flow into the river, enhancing water quality. One localized toxic measurement of silver was detected at station G02, yet silver was detected only during one of three sampling periods at this site. When the river joins with the Chicago Sanitary and Ship Canal and the Illinois-Michigan Canal, the water quality is degraded. A single toxic concentration of silver was detected at station G12 south of the junction. At this station, varying sub-lethal levels of 14 toxic parameters were detected.

The river, to a large degree, dilutes the toxic waters of the Sanitary and Ship Canal. Jackson Creek, the other monitored tributary, contained very little contamination in the sampled area. The remaining section of the river in the study area maintained substantial levels of toxicity. Yet, the toxicity index remained below the maximum level of 0.2.

CONCLUSIONS

The main river channel of the Lower Des Plaines River maintains fair water quality and a fishery dominated by tolerant fish species. Conditions in the river's tributaries varied. Water quality analyses of Flag Creek indicated the stream should support a diverse fishery. Yet, collections

from this stream were limited to tolerant fish species. Tolerant species were also taken from Sawmill Creek. Black Partridge Creek was one of the many tributaries which enhanced the river's water quality and fishery. River collections in this area and downstream included a limited number of intolerant species. Fish collections from the Illinois-Michigan Canal indicate it maintains a fish population similar to that of the river. The water quality and fishery of the Chicago Sanitary and Ship Canal are extremely degraded as stated elsewhere in this report. The Des Plaines River and Sugar Run, a diverse good-quality stream, dilute the toxic condition of the Canal.

Water quality analyses indicate Jackson Creek to be a good- to high-quality stream. Fishery collections taken from the same area included a diverse assemblage of species. Water quality sampling was not conducted within or downstream from the Joliet arsenal, but fish collections from these downstream reaches progressively degraded.

The watershed contained three sites where the Bluegill Toxicity Index was in excess of 0.2. Two sites had high concentrations of silver. The third site was toxic due to the combined effect of the ammonia-nitrogen, MBAS, and cyanide levels. Figure 10-4 illustrates these conclusions.

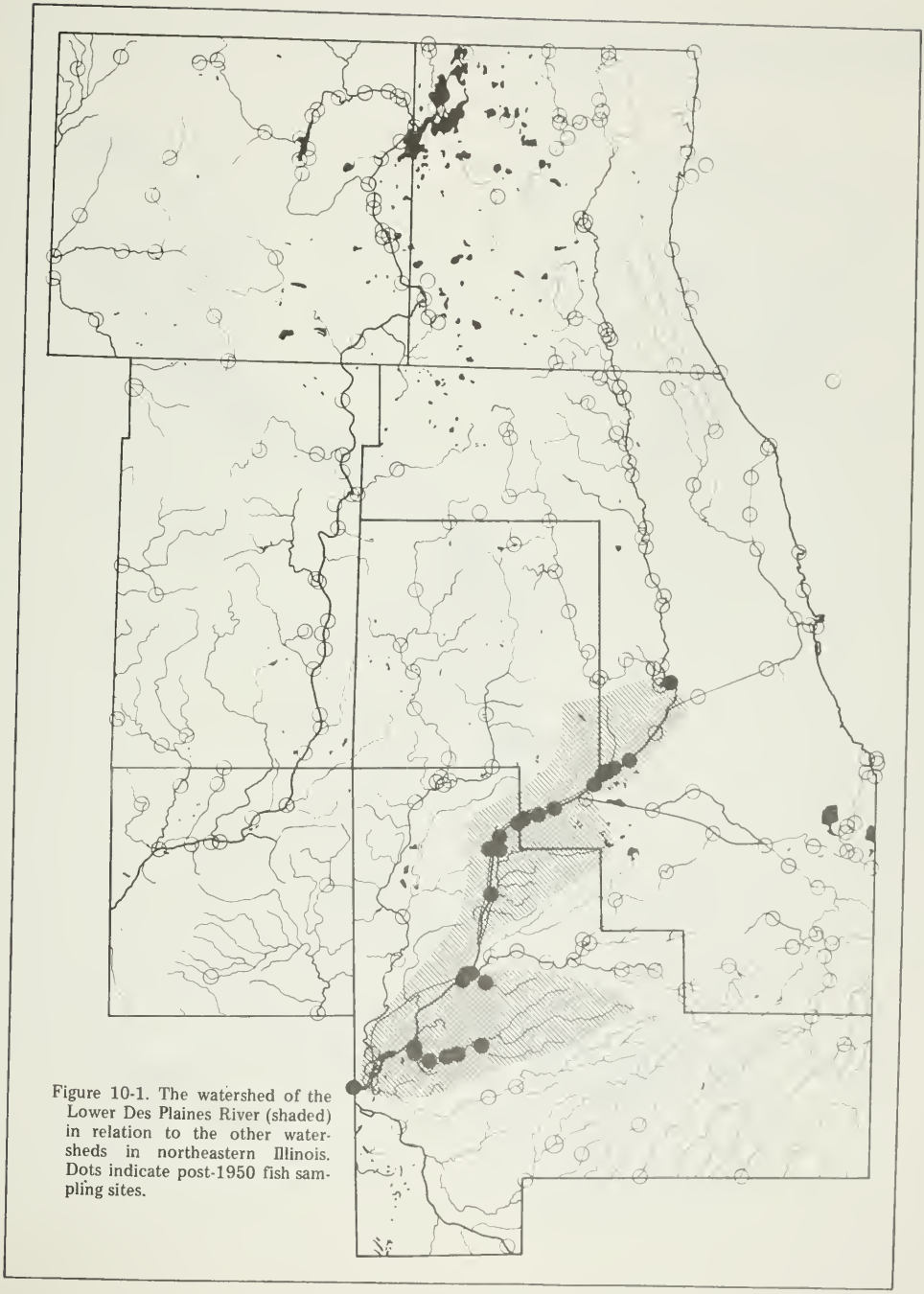


Figure 10-1. The watershed of the Lower Des Plaines River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 10-2. Lower Des Plaines River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

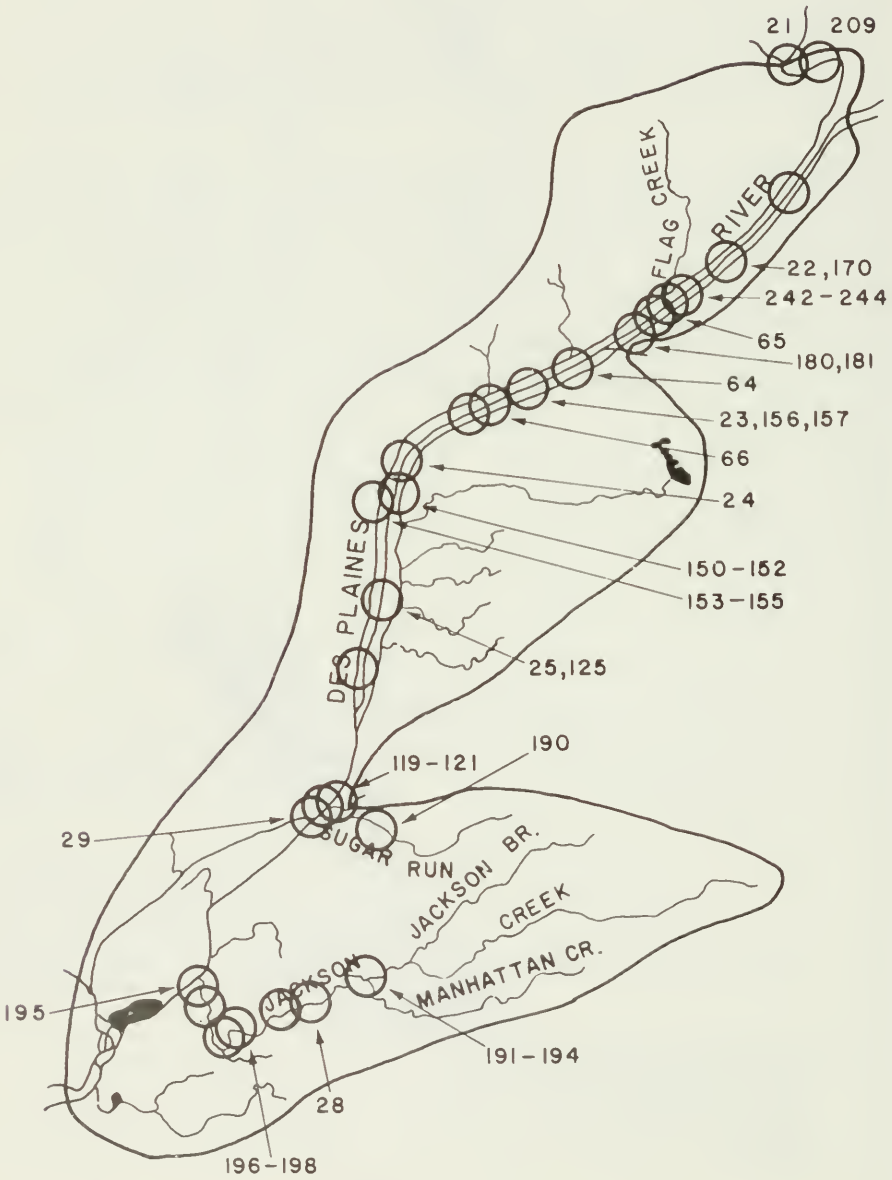


Figure 10-3. Lower Des Plaines River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

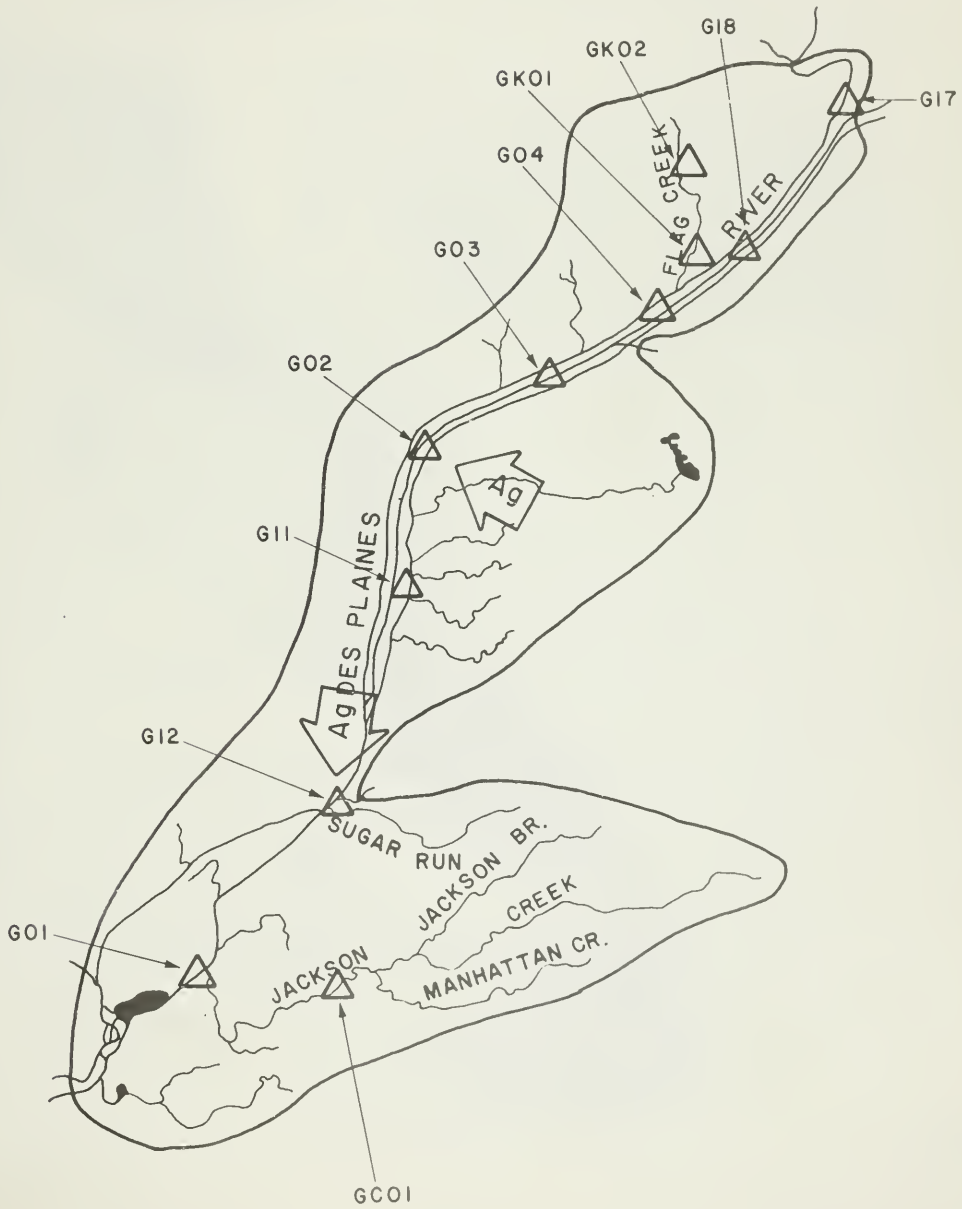


Figure 10-4. Lower Des Plaines River Basin: Summary of environmental quality.

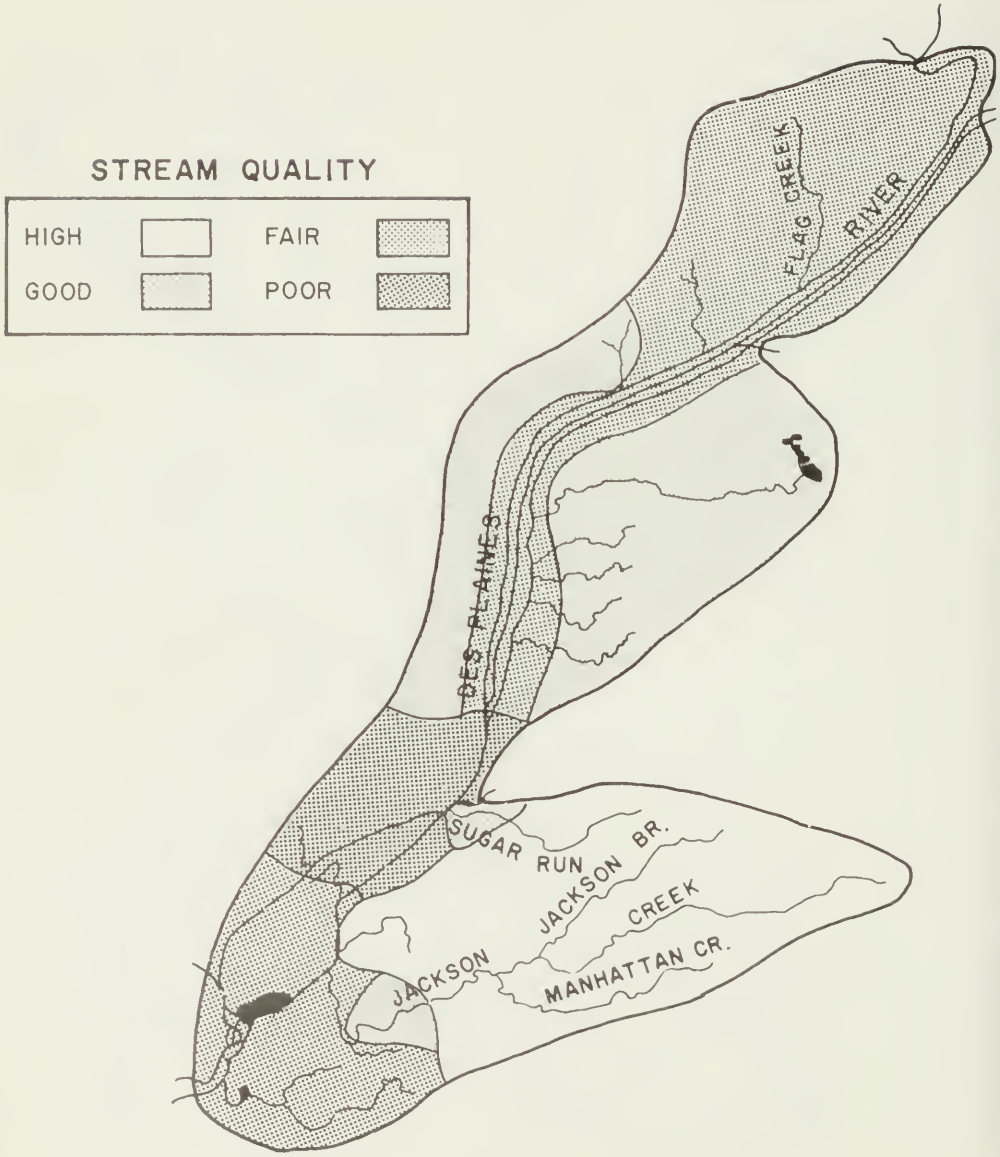


Table 10-2. Location of MSDGC 1976 Fish Sampling Sites, Lower Des Plaines River Basin.

Number	Station	Location
21	Des Plaines River	T38N/R 12E/S 2NW; Cook Co.; 50 meters DNSTRM of mough of Salt Creek, Lyons.
22	Des Plaines River	T37N/R 12E/S 5NW; Cook Co.; 515 meters S of Willow Springs RD (Wentworth AVE), Willow Springs (800 m distance).
23	Des Plaines River	T37N/R 11E/S 20NE; Cook Co.; downstream of Stephen STR, Lemont.
24	Des Plaines River	T36N/R 10E/S 3NE; Will Co.; 15 meters DNSTRM of 135th ST, E channel, Romeoville.
25	Des Plaines River	T36N/R 9E/S 22NE; Will Co.; downstream of 9th AVE, Lockport.
28	Jackson Creek	T34N/R 10E/S 17SW; Will Co.; upstream of Brandon RD, Elwood.
29	Des Plaines River	T35N/R 10E/S 20SE; Will Co.; 400 meters downstream of Brandon RD, Joliet.
64	Sawmill Creek	T37N/R 11E/S 15NW; DuPage Co.; immediately upstream of Santa Fe RR tracks south of Argonne National Laboratory, Lemont.
65	Tributary of old Flag Creek bed	T37N/R 11E/S 1SE; DuPage Co.; south of 91st STR, Tiedtville.
66	Black Partridge Creek	T37N/R 11E/S 19NW; Cook Co.; immediately DNSTRM (S) of Bluff RD, Lemont.
119	Des Plaines River	T35N/R 9E/S 21NW; Will Co.; tailrace of Brandon Dam, Joliet.
122	Sugar Run Creek	T35N/R 9E/S 21NW; Will Co.; mouth of Sugar Run CR with Des Plaines River below Brandon Dam, Joliet.
125	Des Plaines River	T36N/R 9E/S 22NE; Will Co.; downstream of 9th AVE, Lockport.
150	Des Plaines River	T36N/R 10E/S 3NE; Will Co.; east channel, riffle below and pool above stone dam DNSTRM of 135th STR, Romeoville.
151	Des Plaines River	T37N/R 10E/S 34SE; Will Co.; east channel upstream of 135th STR, Romeoville.

Table 10-2. Continued.

Number	Station	Location
152	Des Plaines River	T37N/R 10E/S 35SW; Will Co.; channel to E of E channel, UPSTRM of 135th STR, Romeoville.
153	Des Plaines River	T36N/R 10E/S 3NE; Will Co.; W channel downstream of 135th STR, Romeoville (80 m distance).
154	Des Plaines River	T36N/R 10E/S 3NE; Will Co.; W channel DNSTRM of 135th STR, Romeoville (40 m distance, equipment #8).
155	Des Plaines River	T36N/R 10E/S 3NE; Will Co.; W channel DNSTRM of 135th STR, Romeoville (as above, EQPMT #5).
156	Des Plaines River	T37N/R 11E/S 20NE; Cook Co.; DNSTRM of Stephen STR, Lemont.
157	Des Plaines River	T37N/R 11E/S 20NE; Cook Co.; center of channel DNSTRM of Stephen STR, Lemont.
170	Des Plaines River	T37N/R 12E/S 5NW; Cook Co.; 515 meters S of Willow Springs RD (Wentworth AVE), Willow Springs (40 m distance).
180	Illinois and Michigan Canal	T37N/R 11E/S 14NW; DuPage/Cook Co.; 40 meters in from Calumet-Sag Channel on N bank below RT 83 bridge, Lemont.
181	Illinois and Michigan Canal	T37N/R 11E/S 14NW; DuPage/Cook Co.; mouth of Illinois and Michigan Canal on N bank with Calumet Sag Channel, below RT 83 bridge, Lemont.
190	Sugar Run Creek	T35N/R 10E/S 22SW; Will Co.; N of Mills RD, Nowell Park, Joliet.
191	Manhattan Creek	T34N/R 10E/S 15NW; Will Co.; 100 meters above mouth with Jackson Creek, Elwood.
192	Manhattan Creek	T34N/R 10E/S 15NW; Will Co.; mouth of Manhattan CR with Jackson CR, Elwood.
193	Jackson Creek	T34N/R 10E/S 15NW; Will Co.; 100 meters UPSTRM of mouth of Manhattan Creek, Elwood.
194	Jackson Creek	T34N/R 10E/S 16NE; Will Co.; 100 meters below mouth of Manhattan Creek, Elwood.
195	Jackson Creek	T34N/R 9E/S 23NW; Will Co.; 100 meters UPSTRM of Smith Bridge RD, Millsdale.
196	Jackson Creek	T34N/R 9E/S 15SE; Will Co.; old mouth with Des Plaines River and Mobil Oil Refinery outfall, Millsdale.

Table 10-2. Completed.

Number	Station	Location
197	Diversion Cut Jackson Creek	T34N/R 9E/S 14NW; Will Co.; mouth of Diversion Cut with Des Plaines River, Millsdale.
198	Diversion Cut Jackson Creek	T34N/R 9E/S 14NW; Will Co.; 100 meters above mouth with Des Plaines River, Millsdale.
209	Des Plaines River	T39N/R 12E/S 36SW; Cook Co.; forebay and tailrace of small dam below Hoffman Dam, Riverside.
242	Flag Creek	T37N/R 11E/S 1SE; DuPage Co.; old mouth of Flag Creek with Des Plaines River, Tiedtville.
243	Flag Creek Diversion Cut	T37N/R 11E/S 1SE; Cook/DuPage Co.; mouth of Flag Creek Diversion Cut with Des Plaines River, Tiedtville.
244	Flag Creek Diversion Cut	T37N/R 11E/S 1SE; Cook/DuPage Co.; 100 meters above mouth with Des Plaines River, Tiedtville.

Table 10-3. Checklist of Fishes Known to Occur in the Lower Des Plaines River Basin.

Semionotiformes

Lepisosteidae - Gars

Lepisosteus osseus (Linnaeus)
Longnose gar

Clupeidormes

Clupeidae - Herrings

Alosa chrysochloris (Rafinesque)
Skipjack herring

Alosa pseudoharengus (Wilson)
Alewife

Dorosoma cepedianum (Lesueur)
Gizzard shad

Salmoniformes

Salmonidae - Trouts

Salmo gairdneri Richardson
Rainbow trout

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Table 10-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis chrysocephalus (Rafinesque)
Striped shiner

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis lutrensis (Baird & Girard)
Red shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Notropis volucellus (Cope)
Mimic shiner

Phenacobius mirabilis (Girard)
Suckermouth minnow

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Table 10-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Pimephales promelas Rafinesque
Fathead minnow

Pimephales vigilax (Baird & Girard)
Bullhead minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Carpiodes cyprinus (Lesueur)
Quillback

Catostomus commersoni (Lacepede)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Ictiobus cyprinellus (Valenciennes)
Bigmouth buffalo

Moxostoma duquesnei (Lesueur)
Black redhorse

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus natalis (Lesueur)
Yellow bullhead

Table 10-3. Continued.

Siluriformes (continued)

Ictaluridae - Freshwater catfishes (continued)

Ictalurus punctatus (Rafinesque)
Channel catfish

Noturus exilis Nelson
Slender madtom

Noturus flavus Rafinesque
Stonecat

Noturus gyrinus (Mitchill)
Tadpole madtom

Percopsiformes

Aphredoderidae - Pirate perches

Aphredoderus sayanus (Gilliams)
Pirate perch

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Poeciliidae - Livebearers

Gambusia affinis (Baird & Girard)
Mosquitofish

Gasterosteiformes

Gasterosteidae - Sticklebacks

Pungitius pungitius (Linnaeus)
Ninespine stickleback

Perciformes

Percichthyidae - Temperate basses

Morone chrysops (Rafinesque)
White bass

Table 10-3. Continued.

Perciformes (continued)

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Lepomis megalotis (Rafinesque)
Longear sunfish

Micropterus dolomieui Lacépède
Smallmouth bass

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis annularis Rafinesque
White crappie

Pomoxis nigromaculatus (Lesueur)
Black crappie

Percidae - Perches

Etheostoma exile (Girard)
Iowa darter

Etheostoma flabellare Rafinesque
Fantail darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma spectabile (Agassiz)
Orangethroat darter

Percina caprodes (Rafinesque)
Logperch

Table 10-3. Completed.

Perciformes (continued)

Percidae - Perches (continued)

Percina maculata (Girard)
Blackside darter

Percina phoxocephala (Nelson)
Slenderhead darter

Sciaenidae - Drums

Aplodinotus grunniens Rafinesque
Freshwater drum

Cottidae - Sculpins

Cottus bairdi Girard
Mottled sculpin

Table 10-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Lower Des Plaines River Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS									
	21	209	22	244	243	242	65	64	23	156
CLUPEIDAE										
Gizzard shad	--	1	9	3	--	--	--	--	--	--
UMBRIDAE										
Central mudminnow	--	1	--	--	--	--	4	--	--	--
CYPRINIDAE										
Stoneroller	--	--	--	1	--	--	--	--	--	--
Goldfish	12	36	45	--	--	--	--	34	3	--
Carp	2	14	22	--	--	--	--	--	8	--
Hornyhead chub	--	--	--	--	--	--	--	--	--	--
Golden shiner	--	--	1	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	--	1	--
Striped shiner	--	--	--	--	--	--	--	--	--	--
Common shiner	--	--	--	--	--	--	--	1	--	--
Bigmouth shiner	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	--	--	--	--	--	--	--	--	--	--
Sand shiner	--	--	--	--	1	--	--	--	--	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	--	1	21	80	38	1	--	9	136	--
Fathead minnow	--	--	--	1	--	--	--	6	--	--
Creek chub	--	2	--	9	--	--	10	23	--	--
Carp X Goldfish	4	24	14	--	--	--	--	1	2	--
CATOSTOMIDAE										
Quillback	--	--	--	--	--	--	--	--	--	--
White sucker	--	--	--	3	--	--	--	1	--	--
Creek chubsucker	--	--	--	--	--	--	--	--	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE										
Black bullhead	--	--	5	--	--	--	2	--	--	--
Yellow bullhead	--	--	--	--	--	--	--	--	--	--
Tadpole madtom	--	--	--	--	--	--	--	--	--	--
CYPRINIDONTIDAE										
Blackstripe topminnow	--	--	--	--	--	--	--	--	--	--
POECILIIDAE										
Mosquitofish	--	--	--	--	1	--	--	--	--	33
CENTRARCHIDAE										
Rock bass	--	--	--	--	--	--	--	--	--	--
Green sunfish	--	14	16	21	13	4	10	26	17	--
Pumpkinseed	--	--	1	--	--	--	--	--	--	--
Orangespotted sunfish	--	--	--	--	--	--	--	--	--	--
Bluegill	--	1	6	1	25	--	8	10	--	--
Longear sunfish	--	--	--	--	--	--	--	--	--	--
Smallmouth bass	2	--	--	--	--	--	--	--	--	--
Largemouth bass	--	1	2	--	2	1	--	--	1	--
Black crappie	--	2	2	2	26	--	--	--	1	--
Green sunfish X Bluegill	--	--	--	--	1	--	--	--	--	--
PERCIDAE										
Fantail darter	--	--	--	--	--	--	--	--	--	--
Johnny darter	--	--	--	--	--	--	--	--	--	--
Orangethroat darter	--	--	--	--	--	--	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--
SCIAENIDAE										
Freshwater drum	--	--	--	--	--	--	--	--	--	--
COTTIDAE										
Mottled sculpin	--	--	--	--	--	--	--	--	--	--
TOTAL NUMBER OF INDIVIDUALS	20	102	144	121	107	6	34	111	169	33
TOTAL NUMBER OF SPECIES	3	10	11	9	7	3	5	8	7	1
SPECIES DIVERSITY ($\bar{d}$)	1.57	2.51	2.90	1.65	2.18	1.25	2.13	2.50	1.10	0.00
EQUITABILITY (e)	1.0	0.7	0.8	0.4	0.7	1.0	1.1	0.9	0.4	0.0

Table 10-4. Continued.

SPECIES	STATIONS									
	157	66	24	150	151	152	153	154	155	25
CLUPEIDAE										
Gizzard shad	--	--	--	8	--	1	--	--	--	--
UMBRIDAE										
Central mudminnow	--	--	--	--	--	--	1	--	1	--
CYPRINIDAE										
Stoneroller	--	73	--	--	--	--	--	--	--	1
Goldfish	7	--	--	--	2	8	--	--	4	3
Carp	--	--	2	--	2	1	--	--	--	1
Hornyhead chub	--	--	--	--	--	--	--	--	--	--
Golden shiner	--	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	--	--	1
Striped shiner	--	--	--	--	--	--	--	--	--	--
Common shiner	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	--	--	--	--	--	--	--	--	--	--
Sand shiner	--	--	--	--	--	--	--	--	--	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--
Suckermouth minnow	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	--	--	62	43	14	23	61	6	15	70
Fathead minnow	--	--	--	--	--	--	--	--	--	--
Creek chub	--	39	2	--	--	--	--	--	--	--
Carp X Goldfish	--	--	--	1	--	--	--	1	--	--
CATOSTOMIDAE										
Quillback	--	--	--	--	--	--	--	--	--	--
White sucker	--	43	--	1	--	--	1	--	1	--
Creek chubsucker	--	--	--	--	--	--	--	--	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE										
Black bullhead	--	--	--	--	1	1	--	--	--	--
Yellow bullhead	--	--	--	--	--	--	--	--	--	--
Tadpole madtom	--	--	3	--	--	--	1	--	--	2
CYPRINIDONTIDAE										
Blackstripe topminnow	--	--	--	--	--	--	--	--	--	--
POECILIIDAE										
Mosquitofish	--	--	4	--	--	1	--	--	17	3
CENTRARCHIDAE										
Rock bass	--	--	--	--	--	--	--	--	--	--
Green sunfish	--	21	15	--	2	13	10	--	12	5
Pumpkinseed	--	--	--	--	--	--	--	--	--	--
Orangespotted sunfish	--	--	--	--	--	--	--	--	--	--
Bluegill	--	--	--	--	1	--	--	--	--	--
Longear sunfish	--	--	--	--	--	--	--	--	--	--
Smallmouth bass	--	--	--	--	--	--	--	--	--	--
Largemouth bass	--	--	--	1	--	--	--	--	--	--
Black crappie	--	--	--	--	--	3	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--
PERCIDAE										
Fantail darter	--	--	--	--	--	--	--	--	--	--
Johnny darter	--	1	--	--	--	--	--	--	--	--
Orangethroat darter	--	--	--	--	--	--	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--
SCIAENIDAE										
Freshwater drum	--	--	--	--	--	--	--	--	--	--
COTTIDAE										
Mottled sculpin	--	31	--	--	--	--	--	--	--	--
TOTAL NUMBER OF INDIVIDUALS	7	208	88	54	22	51	74	7	50	86
TOTAL NUMBER OF SPECIES	1	6	6	4	6	8	5	1	6	8
SPECIES DIVERSITY ($\bar{d}$)	0.00	2.23	1.41	0.99	1.76	2.13	0.87	0.99	2.06	1.17
EQUITABILITY (e)	0.0	1.0	0.5	0.4	0.7	0.7	0.4	1.0	1.0	0.4

Table 10-4. Continued.

SPECIES	STATIONS									
	125	181	180	190	122	119	29	191	192	193
CLUPEIDAE										
Gizzard shad	--	4	1	--	39	29	10	--	--	--
UMBRIDAE										
Central mudminnow	--	--	2	--	--	--	--	--	--	--
CYPRINIDAE										
Stoneroller	--	--	--	165	1	--	--	27	1	--
Goldfish	1	14	--	--	2	--	48	1	--	--
Carp	1	4	--	--	12	13	215	--	--	1
Hornyhead chub	--	--	--	--	--	--	--	43	18	25
Golden shiner	--	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	21	8	10	--	--	--
Striped shiner	--	--	--	--	--	--	--	99	16	8
Common shiner	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	--	--	--	26	7	--	1	--	--	--
Spotfin shiner	--	--	--	1	--	--	--	49	43	3
Sand shiner	--	--	--	--	--	--	--	1	--	--
Redfin shiner	--	--	--	1	--	--	--	5	--	6
Suckermouth minnow	--	--	--	--	1	--	--	--	1	2
Bluntnose minnow	19	--	--	125	14	--	2	42	15	20
Fathead minnow	--	--	--	--	--	--	--	--	--	--
Creek chub	1	--	--	106	--	--	--	4	2	--
Carp X Goldfish	--	--	--	--	1	1	3	--	--	--
CATOSTOMIDAE										
Quillback	--	--	--	--	1	--	1	--	--	--
White sucker	--	--	--	1	6	2	--	4	--	3
Creek chubsucker	--	--	--	1	--	--	--	--	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE										
Black bullhead	--	4	1	1	--	--	--	--	--	--
Yellow bullhead	--	--	--	--	--	--	--	3	--	--
Tadpole madtom	--	--	--	--	--	--	--	--	--	--
CYPRINODONTIDAE										
Blackstripe topminnow	--	--	--	--	--	--	--	5	4	--
POECILIIDAE										
Mosquitofish	--	--	--	--	--	--	--	--	--	--
CENTRARCHIDAE										
Rock bass	--	--	--	--	1	--	--	3	1	10
Green sunfish	5	2	8	4	3	2	--	--	--	5
Pumpkinseed	--	1	--	--	--	--	--	--	--	--
Orangespotted sunfish	--	--	--	--	--	--	--	--	--	--
Bluegill	--	39	9	--	--	--	--	--	--	--
Longear sunfish	--	--	--	--	--	--	--	4	--	12
Smallmouth bass	--	--	--	--	2	1	--	1	--	4
Largemouth bass	--	1	7	--	3	--	--	--	--	--
Black crappie	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--
PERCIDAE										
Fantail darter	--	--	--	--	--	--	--	9	4	8
Johnny darter	--	--	--	19	--	--	--	2	7	4
Orangethroat darter	--	--	--	--	--	--	--	2	2	2
Blackside darter	--	--	--	--	--	--	--	1	--	--
SCIAENIDAE										
Freshwater drum	--	--	--	--	--	--	--	--	--	--
COTTIDAE										
Mottled sculpin	--	--	--	--	--	--	--	--	--	--
TOTAL NUMBER OF INDIVIDUALS	27	69	28	450	114	56	290	305	114	113
TOTAL NUMBER OF SPECIES	5	8	6	11	14	6	7	19	12	15
SPECIES DIVERSITY ($\bar{d}$)	1.34	1.97	2.16	2.12	2.94	1.93	1.26	2.98	2.70	3.43
EQUITABILITY (e)	0.6	0.6	1.0	0.5	0.7	0.7	0.4	0.6	0.7	1.1

Table 10-4. Completed.

SPECIES	STATIONS					TOTAL NUMBER	% OF TOTAL
	194	28	198	197	196		
CLUPEIDAE							
Gizzard shad	--	--	--	--	48	153	4
UMBRIDAE							
Central mudminnow	--	--	--	--	--	9	<1
CYPRINIDAE							
Stoneroller	--	10	--	--	--	279	7
Goldfish	--	--	1	1	63	285	8
Carp	--	--	--	6	23	327	9
Hornyhead chub	--	27	--	1	--	114	3
Golden shiner	--	--	--	--	--	1	<1
Emerald shiner	--	--	--	--	71	112	3
Striped shiner	--	21	1	--	--	145	4
Common shiner	--	--	--	1	--	2	<1
Bigmouth shiner	--	--	--	3	--	37	1
Spotfin shiner	1	76	--	--	--	173	4
Sand shiner	--	1	--	--	--	3	<1
Redfin shiner	1	10	--	--	--	23	1
Suckermouth minnow	--	--	--	--	--	4	<1
Bluntnose minnow	8	21	1	36	64	947	25
Fathead minnow	--	--	--	--	--	7	<1
Creek chub	--	6	--	--	--	209	6
Carp X Goldfish	--	--	--	--	--	52	1
CATOSTOMIDAE							
Quillback	--	--	--	--	--	2	<1
White sucker	--	--	--	2	1	69	2
Creek chubsucker	--	--	--	--	--	1	<1
Golden redhorse	1	--	--	--	--	1	<1
ICTALURIDAE							
Black bullhead	--	--	--	--	2	17	<1
Yellow bullhead	--	1	--	--	--	4	<1
Tadpole madtom	--	--	--	1	--	7	<1
CYPRINIDONTIDAE							
Blackstripe topminnow	2	5	--	--	--	16	<1
POECILIIDAE							
Mosquitofish	--	--	--	--	--	59	2
CENTRARCHIDAE							
Rock bass	3	11	--	--	--	29	1
Green sunfish	3	30	19	59	15	354	9
Pumpkinseed	--	--	--	--	--	2	<1
Orangespotted sunfish	--	3	--	--	--	3	<1
Bluegill	1	--	--	2	--	103	3
Longear sunfish	5	26	--	--	--	47	1
Smallmouth bass	2	10	--	--	--	22	1
Largemouth bass	--	--	--	--	--	19	1
Black crappie	--	--	--	--	--	36	1
Green sunfish X Bluegill	--	--	--	--	--	1	<1
PERCIDAE							
Fantail darter	--	3	--	--	--	24	1
Johnny darter	6	4	--	--	--	43	1
Orangethroat darter	--	2	--	--	--	8	<1
Blackside darter	--	1	--	--	--	2	<1
SCIAENIDAE							
Freshwater drum	--	--	--	--	2	2	<1
COTTIDAE							
Mottled sculpin	--	--	--	--	--	31	1
TOTAL NUMBER OF INDIVIDUALS	33	268	22	112	289	3784	100
TOTAL NUMBER OF SPECIES	11	19	4	10	9	41	--
SPECIES DIVERSITY ($\bar{d}$)	3.09	3.43	0.79	1.83	2.53	--	--
EQUITABILITY (e)	1.1	0.8	0.5	0.5	0.9	--	--

Table 10-5. Location of 1976 IEPA Water Quality Sampling Sites, Lower Des Plaines River Basin.

Basin Code	Station Number	Stream Name	Description
Des Plaines River			
G	01	Des Plaines River	I-55/US66 BR 2 mi E of Channahon
G	02	Des Plaines River	135th STR BR at Romeoville
G	03	Des Plaines River	Stephen STR BR at Lemont
G	04	Des Plaines River	RT 83 BR E of Argonne NATL LAB
G	11	Des Plaines River	Division STR BR at Lockport
G	12	Des Plaines River	Brandon RD BR at Joliet
G	17	Des Plaines River	RT 171-Lawndale AVE BR at Summit
G	18	Des Plaines River	Wentworth AVE BR at Willow Springs
Jackson Creek			
GC	01	Jackson Creek	TWP RD BR 3.5 mi E Channahon
Flag Creek			
GK	01	Flag Creek	91st STR BR E of Cook/DuPage CO Line
GK	02	Flag Creek	Plainfield RD BR SE of Hinsdale

Table 10-6. Bluegill Toxicity Indices, Lower Des Plaines River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Des Plaines River	G17	0.153
	G18	0.149
Flag Creek	GK01	0.092
	GK02	0.003
Des Plaines River	G04	0.280
	G03	0.102
	G02	1.892
	G11	0.074
	G12	0.981
Jackson Creek	GC01	0.096
Des Plaines River	G01	0.163

Table 10-7. Summary, 1976 IEPA Water Quality Data, Lower Des Plaines River Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based upon Illinois Environmental Protection Agency Water Quality Network for 1976) contributing significantly to the BGTU.)

	IEPA Station	Ag (mg l^{-1})
Des Plaines River	G17	.000 - .000 .000 (2)
	G18	.000 - .000 .000 (3)
Flag Creek	GK01	.000 - .000 .000 (1)
	GK02	-- --
Des Plaines River	G04	.000 - .000 .000 (3)
	G03	.000 - .000 .000 (2)
	G02	.000 - .020 .007 (3)
	G11	.000 - .000 .000 (2)
	G12	.000 - .010 .003 (3)
Jackson Creek	GC01	.000 - .000 .000 (1)
Des Plaines River	G01	.000 - .000 .000 (1)
IPCB STANDARDS		.005

CHAPTER ELEVEN: NORTH BRANCH OF THE CHICAGO RIVER

LOCATION AND BASIN MORPHOMETRY

The watershed of the North Branch of the Chicago River is located entirely within the suburban portions of Cook and Lake Counties, Illinois (Fig.11-1). The river flows in a southeasterly direction, emptying into the Chicago River in downtown Chicago. The drainage area covers approximately 12,950 ha.

The North Branch is a low-gradient stream (1.23 m km^{-1}). It is an order 3 stream at its confluence with the Chicago River. The drainage pattern is trellis-like. The North Branch is overdeveloped at the order 1 and order 2 levels and never reaches the potential order 5 stream of a fully bifurcate, dendritic drainage pattern. Morphometric data are summarized in Table 11-1.

Table 11-1: Summary of Morphometric Data, North Branch, the Chicago River.

Order	Number of Links	Mean Length of Link(km)	Total Length(km)
1	20	2.16	43.27
2	12	3.30	39.57
3	7	6.72	47.05
			Total = 129.89

The major tributaries of the North Branch are the Skokie River and the West Fork of the North Branch, both order 2 streams at their confluences with the North Branch.

The soils of the North Branch watershed are of five major associations:

1) Mundelein - Pella - Barrington
2) Morley - Beecher - Hennepin
3) Del Ray - Saylesville - Peotone
4) Frankfort - Montgomery - Wauconda
5) Nappanee - Montgomery

It is doubtful, however, that the native soils of the watershed contribute much to the quality of the water in the stream. City and suburban habitats are characterized by having at least 80% and from 20% to 79%, respectively, of the land's surface devoid of vegetative cover, and usually, paved or covered with buildings.

SUMMARY OF FISHERY DATA

Fish were collected during 1976 by the Metropolitan Sanitary District of Greater Chicago from three sites within the watershed of the North Branch of the Chicago River (Table 11-2). Fisheries data are available from one additional site in the North Branch watershed. All fish sampling sites are shown as circles on Figure 11-2. Of the 11 species of fishes known from the river system (Table 11-3), the 1976 collections included 256 fish of 10 species and one hybrid cyprinid (Table 11-4). Golden shiners also have been collected from this watershed since 1950, but were not taken during the 1976 inventory. Green sunfish, fathead minnows, and bluegill were taken at all sites and represented 67% of the total number of fishes collected. Green sunfish was the most abundant species in the watershed, representing 37% of the total number of fishes collected. All of the fish species, except for pumpkinseed and black crappie, are considered tolerant to habitat abuse. Even these species, however, are only slightly more sensitive to pollution.

The Skokie River collection (Station 53) showed the most diversity, containing nine species and the hybrid. Nearly a third of the fishes taken at this site were green sunfish. The number of fishes and number of species were much lower in collections from the other two stations. Station 51, on the West Fork, produced only 69 fishes of five species, and Station 52, on the North Branch, produced only 12 fish of three species. This may have been due to collecting techniques utilized at the sites. A boat shocker was used at the Skokie site, while the others could only be sampled using a backpack shocker. In streams of this size, a boat shocker is more efficient than a backpacker shocker.

Calculations of species diversity ($\overline{d}$) illustrate this trend through the stations. The trend is also evident in the series of equitability levels, in exception, Station 52, which showed a higher level than Station 51. The equitability level of Station 52 reflects the low number of species collected at this site and does not accurately compare the station to the MacArthur model.

SUMMARY OF WATER QUALITY DATA

Ten Illinois Environmental Protection Agency water quality sites were located in this watershed (Table 11-5; Fig. 11-3), and analyses had been performed for all parameters, except hardness, needed in the toxicity index calculations. Half of these sites produced a bluegill toxicity index exceeding the maximum level of 0.2 (Table 11-6). All analyses for cadmium, chromium (hexavalent and trivalent), and nickel at all sites failed to detect these pollutants. Arsenic, boron, and mercury were present, but in such low concentrations that they did not contribute to the bluegill toxicity index when rounded to the third decimal place. The parameters producing the most effect on the calculation were silver, cyanide, and ammonia nitrogen. At sites with a BGTU over 0.2, these parameters resulted in 49 to 97% of the total toxic

value. Mean ammonia nitrogen concentrations in five of the 10 locations exceeded Illinois Pollution Control Board standards (Table 11-7). Silver, when present, always exceeded the standard. The standard for cyanide was never exceeded, yet it often was a significant contributor to the toxicity index. Some parameters often exceeded the standard, yet never were significant contributors to the toxicity index. Of these, copper exceeded the standard at all the stations, lead exceeded the standard at 40% of the stations, and the total iron exceeded the standard at 30% of the stations.

The Skokie River and North Branch contained sampling sites with high concentrations of silver. The Skokie River seemed to receive more than one effluent containing silver, in that the silver concentration increases downstream. On both waterways, the silver was no longer evident in most downstream sites, and the toxicity index became favorable to a diverse fishery.

High concentrations of ammonia nitrogen exist in the West Fork. This was measured at two sites and showed a decreasing concentration at the downstream station, probably indicating oxidation to nitrite and/or nitrate. Yet, both values for this reach of the river are above the maximum toxicity level. The Deerfield Wastewater Treatment Plant has been cited by the IEPA as a large contributor of ammonia nitrogen to the West Fork.

CONCLUSIONS

The occurrence of the various fish species is easily accepted in view of the water quality in the area. The small population of fishes found in the West Fork and North Branch appear to be the result of the poor water quality. The Skokie River fish collection occurred in an area where the water quality had recovered from the heavy input of silver upstream. Hence, we have no knowledge of either the occurrence or abundance of the fish population in the polluted area of the Skokie River.

The principal pollutants in the North Branch watershed were silver, ammonia nitrogen, and cyanide. In 1976, six or seven series of samples were taken from the 10 North Branch sites for monthly ammonia nitrogen analysis. Samples for cyanide and silver analyses were secured only one or two times. The full extent of silver and cyanide pollution would be better understood with increased monitoring of these parameters.

Water quality in the North Branch watershed is extremely degraded. The headwaters of the North Branch carry high concentrations of silver and ammonia nitrogen. This stream receives additional contamination from the Skokie River and West Fork. Both of these tributaries carry high concentrations of cyanide. In addition, the West Fork contains ammonia and the Skokie River contains silver in high concentrations. A synthesis of this information is shown on Figure 11-4.

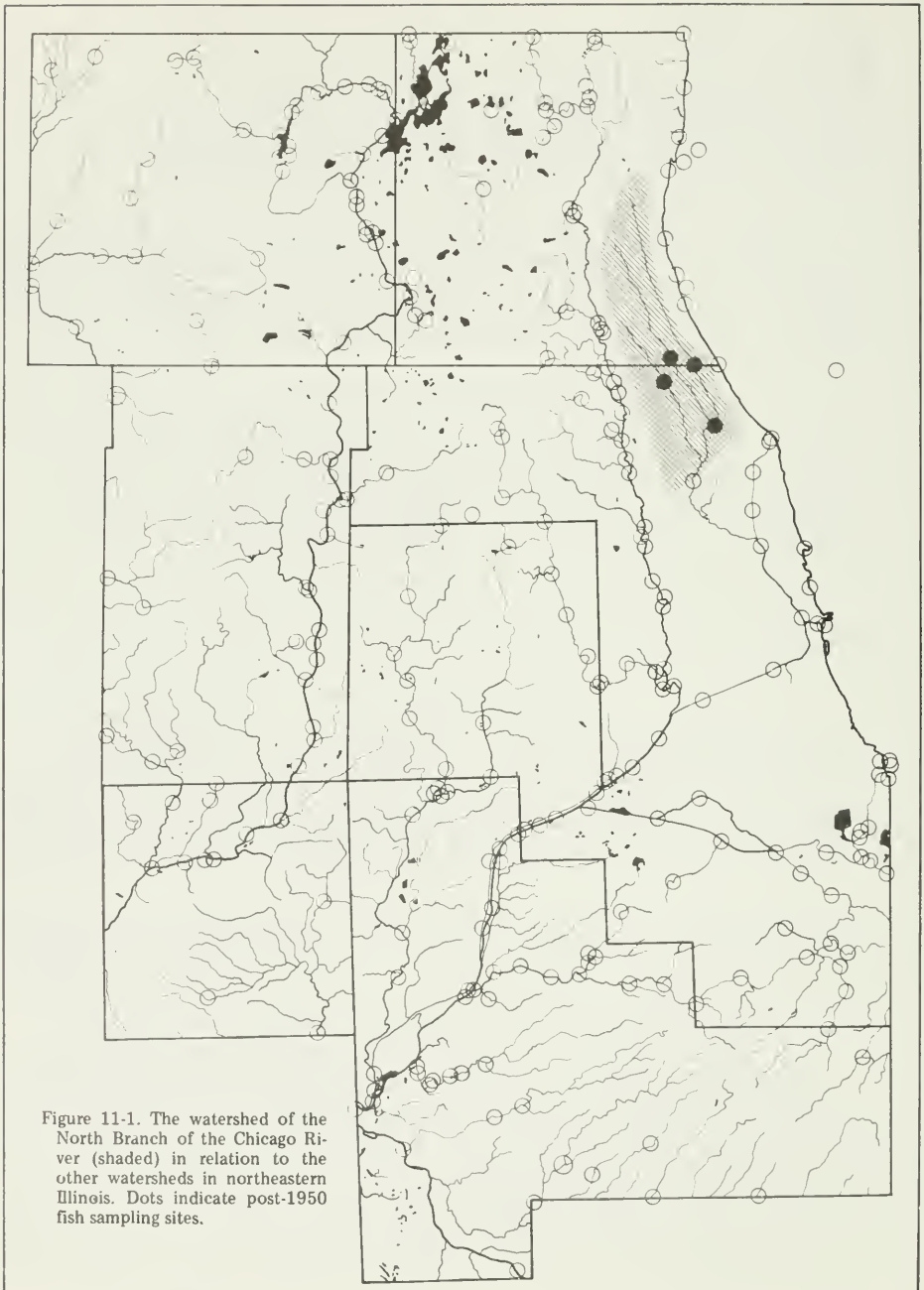


Figure 11-1. The watershed of the North Branch of the Chicago River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

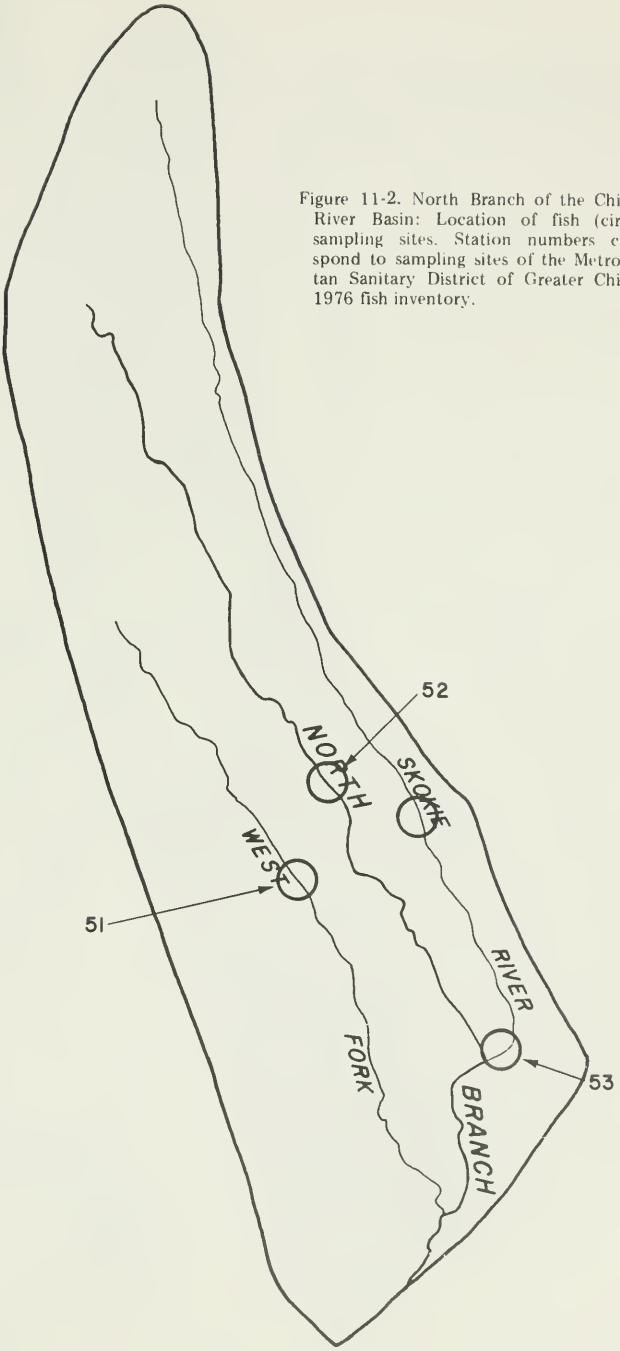
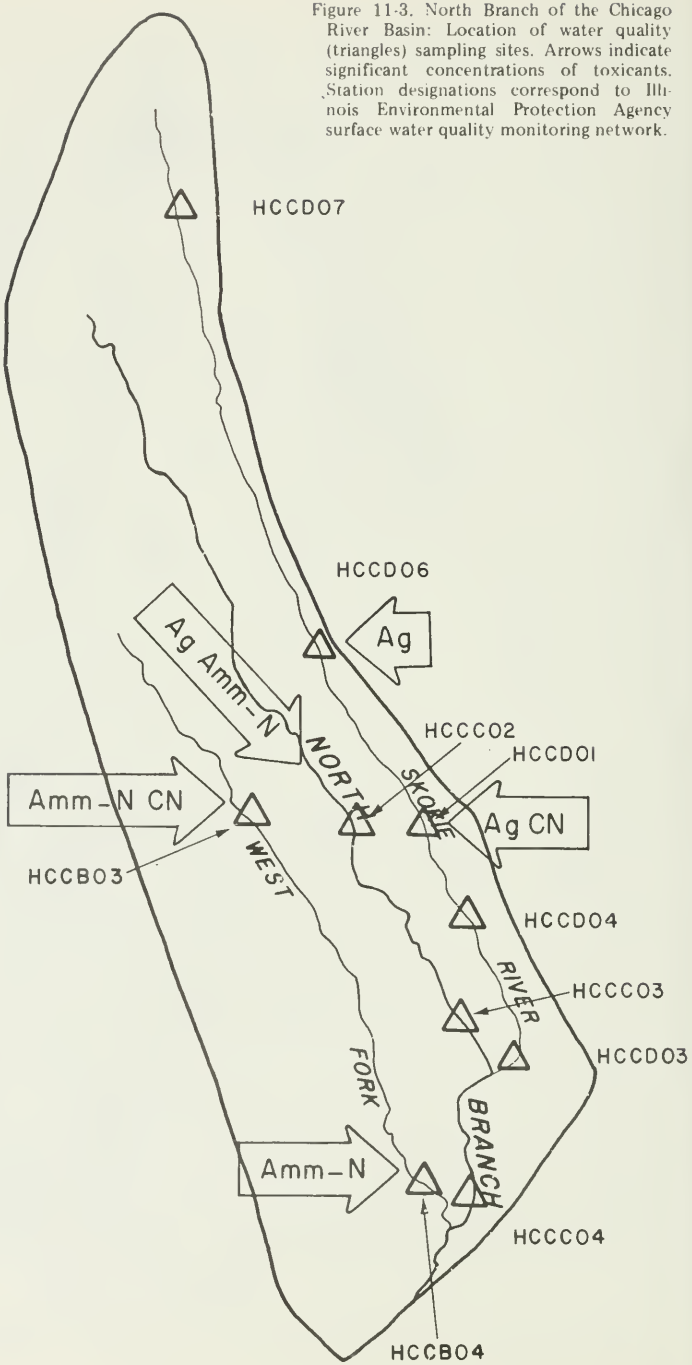


Figure 11-2. North Branch of the Chicago River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

Figure 11-3. North Branch of the Chicago River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.



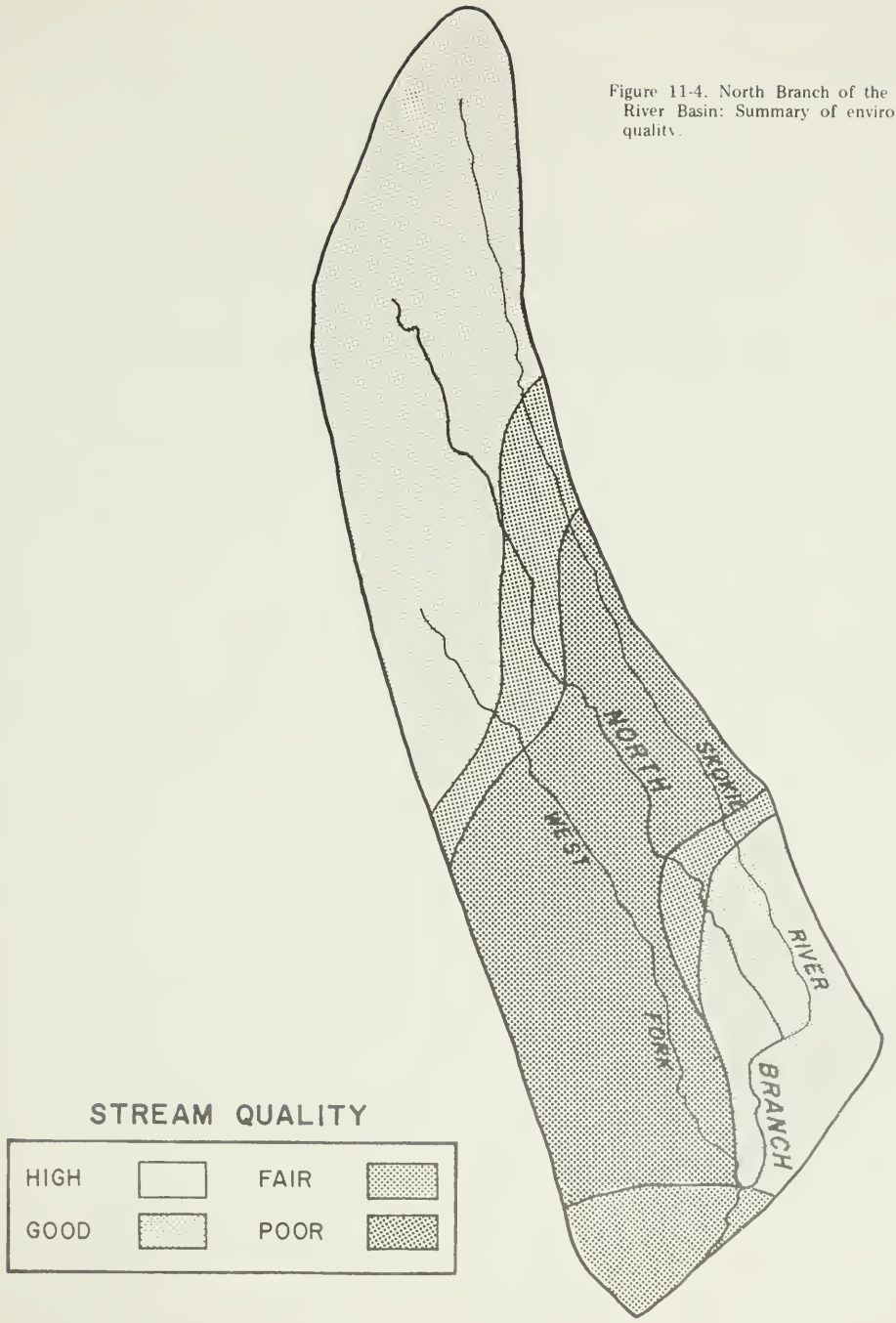


Figure 11-4. North Branch of the Chicago River Basin: Summary of environmental quality.

Table 11-2. Location of MSDGC 1976 Fish Sampling Sites, North Branch, Chicago River Basin.

Number	Stream	Location
51	West Fork, North Branch, Chicago River	T42N/R 12 E/S 9NE; Cook Co.; 40 meters upstream and downstream of Dundee Road, Northbrook.
52	North Branch, Chicago River	T43N/R 12E/S 34NW; Lake Co.; 40 meters downstream of Deerfield Road, Deerfield
53	Skokie River	T42N/R 13E/S 30NE: Cook Co.; 400 meters upstream of west Frontage Road and 140 meters downstream.

Table 11-3. Checklist of Fishes Known to Occur in the North Branch, Chicago River Basin.

Cypriniformes

Cyprinidae - Minnow and Carps

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Notemigonus crysoleucas (Mitchell)
Golden shiner

Pimephales promelas Rafinesque
Fathead minnow

Carp X Goldfish hybrid

Siluriformes

Ictaluridae - Freshwater Catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Perciformes

Centrarchidae - Sunfishes

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseek

Lepomis humilis (Girard)
Orangespotted sunfish

Lepomis macrochirus Rafinesque
Bluegill

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis nigromaculatus (Lesueur)
Black crappie

Table 11-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the North Branch of the Chicago River. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

	STATIONS			TOTAL	% OF
	51	52	53	NUMBER	TOTAL
CYPRINIDAE					
Carp	--	--	18	18	7
Goldfish	--	--	26	26	10
Fathead minnow	29	2	8	39	15
Carp X Goldfish (hybrid)	--	--	8	8	3
ICTALURIDAE					
Black bullhead	--	--	16	16	6
CENTRARCHIDAE					
Green sunfish	30	8	56	94	37
Pumpkinseed	7	--	--	7	3
Orangespotted sunfish	--	--	2	2	1
Bluegill	2	2	35	39	15
Largemouth bass	1	--	4	5	2
Black crappie	--	--	2	2	1
NUMBER OF INDIVIDUALS	69	12	175	256	100%
NUMBER OF SPECIES	5	3	9	10	--
DIVERSITY ($\bar{d}$)	1.1	.7	2.5	--	--
EQUITABILITY (e)	.5	.7	.8	--	--

Table 11-5. Location of 1976 IEPA Water Quality Sampling Sites, North Branch, Chicago River Basin.

Basin Code	Station Number	Stream Name	Description
West Fork			
HCCB	03	W FK N BR CHCGO R	Lake-Cook Co Line RD BR
HCCB	04	W FK N BR CHCGO R	Golf RD BR at S Edge Glenview Club
North Branch			
HCCC	02	MID FK N BR CHCGO R	Lake-Cook Co Line RD BR
HCCC	03	MID FK N BR CHCGO R	Winnetka RD BR at Northfield
HCCC	04	MID FK N BR CHCGO R	Golf RD BR S edge Harms Woods FP
Skokie River			
HCCD	01	SKOKIE RIVER	Lake-Cook Co Line RD BR
HCCD	03	SKOKIE RIVER	Winnetka RD BR at Northfield
HCCD	04	SKOKIE RIVER	Tower RD BR at Skokie Lagoons
HCCD	06	SKOKIE RIVER	Prairie Ave BR N end Highland Park
HCCD	07	SKOKIE RIVER	RT 176 - Scranton Ave - Rockland RD BR

Table 11-6. Bluegill Toxicity Indices, North Branch, Chicago River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
North Branch	HCCC02	6.688
	HCCC03	.086
Skokie River	HCCD07	.171
	HCCD06	3.966
	HCCD01	5.406
	HCCD04	.084
	HCCD03	.084
North Branch	HCCC04	.103
West Fork	HCCB03	.437
	HCCB04	.201

Table 11-7. Summary, 1976 IEPA Water Quality Data, North Branch, Chicago River Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the BGTU.)

IEPA Station	Amm-N (mg l^{-1})	Ag (mg l^{-1})	CN (mg l^{-1})
North Branch			
HCCC02	.07 - 11.00	.000 - .050	.000 - .000
	3.56 (7)	.025 (2)	.000 (2)
HCCC03	.00 - 4.00	.000 - .000	.000 - .000
	.78 (6)	.000 (1)	.000 (1)
Skokie River			
HCCD07	.12 - 4.00	.000 - .000	.000 - .000
	1.70 (7)	.000 (2)	.000 (2)
HCCD06	.01 - .51	.000 - .030	.000 - .010
	.12 (7)	.015 (2)	.005 (2)
HCCD01	.14 - 3.40	.000 - .040	.020 - .020
	1.60 (7)	.020 (2)	.020 (2)
HCCD04	.03 - 2.60	.000 - .000	.000 - .000
	.79 (7)	.000 (2)	.000 (2)
HCCD03	.07 - 2.30	.000 - .000	.000 - .000
	.79 (6)	.000 (1)	.000 (1)
North Branch			
HCCC04	.00 - 1.50	.000 - .000	.000 - .000
	.75 (6)	.000 (1)	.000 (1)
West Branch			
HCCB03	1.06 - 19.00	.000 - .000	.010 - .020
	8.55 (7)	.000 (2)	.015 (2)
HCCB04	.18 - 14.00	.000 - .000	.000 - .000
	3.74 (6)	.000 (2)	.000 (2)
IPCB Standards	1.50	.005	.025

CHAPTER TWELVE: SALT CREEK

LOCATION AND BASIN MORPHOMETRY

The Salt Creek watershed is located in Cook and DuPage Counties, Illinois (Fig. 12-1). The stream originates near Barrington and flows 34 km in a southeasterly direction, emptying into the Des Plaines River at Lyons.

Four principal tributaries to the main stream are an unnamed branch at Arlington Heights, the West Branch, Spring Brook, and Addison Creek.

The Salt Creek watershed covers a total area of approximately 41,181 ha. It is a low-gradient (0.43 m km^{-1}), well-meandered, intermoranic stream. The drainage pattern is trellis-like. Salt Creek is overdeveloped at the order 1 and order 4 levels and is an order 4 stream at its confluence with the Des Plaines River. It never reaches the potential order 6 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 12-1.

Table 12-1. Summary of Morphometric Data, Salt Creek Basin.

Order	Number Links	Mean Length (km)	Total Length (km)
1	38	1.96	74.43
2	19	1.90	36.15
3	9	2.29	20.58
4	9	5.21	46.88
			Total = 178.04

The Salt Creek watershed is young geologically and has a complex topography. The poorly defined natural drainage pattern has resulted in numerous marshes and other wet areas.

The soils of the Salt Creek watershed are developed primarily from the glacial drift deposited by the late Wisconsinan glaciation. Most of the area is characterized by rolling hills and broad nearly parallel moranic ridges. Soil associations present are:

1) Saybrook - Lisbon - Drummer
2) Elliott - Beecher - Marckham
3) Morley - Blount

There has been a rapid suburban development in the watershed since World War II. Such development often results in alteration of the water quality and reduction of the streams' capacity to support a diverse fish population.

SUMMARY OF FISHERY DATA

Fish collections were made at 13 sites along Salt Creek and its tributaries (Table 12-2; Figure 12-2). Unsuccessful attempts to collect fishes were made at four of these stations. Station 36 received five unsuccessful attempts before five fishes were taken. Station 81 received two attempts, and no fish were ever taken. Station 69 was sampled twice, once unsuccessfully, and the other collection contained 12 fishes. Station 73 was established, but whether sampling was done successfully or unsuccessfully was not reported.

Earlier collections reported 23 species and carp x goldfish hybrids to be present in the watershed (Table 12-3). The Metropolitan Sanitary District of Greater Chicago inventory included 15 of these species and carp x goldfish hybrids (Table 12-4). In addition, green sunfish x pumpkinseed hybrids were taken. All of the species not included in the Metropolitan Sanitary District of Greater Chicago collections were taken prior to 1905.

A total of 741 fishes was collected from the Salt Creek watershed. Goldfish alone made up 23% of this number, and, with carp and carp x goldfish hybrids, made up 42% of the total fishes. Moderately tolerant species made up 3% of the total species list. The remaining species are considered tolerant. The moderately tolerant species usually occurred in the headwaters of tributary streams.

Diversity and equitability indices for stations 36, 69, 70, 71, 80, 82, and 127 are of questionable value due to the small total numbers of fish collected. Indices for station 35 and 37 exemplify the degrading trend through the stream. Station 72 and 83 indices are indicative of the higher quality environment found in the tributaries.

SUMMARY OF WATER QUALITY DATA

The Salt Creek watershed contained nine Illinois Environmental Protection Agency water quality sampling sites (Table 12-5; Fig. 12-3). In 1976, none of the stations were evaluated for hardness by the Illinois Environmental Protection Agency. Thus, a hardness value measured by the Metropolitan Sanitary District of Greater Chicago biologists was utilized for the toxicity index calculations. At

station GL03 and station GLB01, 18 of the 23 parameters needed in bluegill toxicity index calculations were not measured.

All analyses for chromium (trivalent), zinc, and nickel failed to detect these parameters. The concentrations of boron, cadmium, lead and mercury were sufficiently low that these parameters contributed insignificantly to the bluegill toxicity indices when the toxicity indices were rounded to three decimals. Silver, cyanide and total iron contributed significantly to the indices. Three of the sites produced a toxicity index in excess of 0.2, the theoretical level above which a diverse fishery cannot be maintained (Table 12-6). At these sites, silver and cyanide accounted for 44% to 95% of the total toxicity index.

Mean total iron concentrations exceeded the Illinois Pollution Control Board standard at five of the seven stations where it was measured (Table 12-7). Yet, it only contributed significantly to the bluegill toxicity units at station GL08, where the mean value exceeded the standard by 2.5 mg l^{-1}. Silver was present at two of the sites and exceeded the Illinois Pollution Control Board standard only at Station GL08. Yet, in summarizing the component toxicities in the toxicity index, the values for silver alone were in excess of the significant effect level (0.2) at both sites. The standard for cyanide was never exceeded, but it was often a significant contributor to the toxicity index.

The water quality of Salt Creek is extremely poor. Throughout most of the stream, evidence of cyanide and ammonia nitrogen pollution existed. Due to high concentrations of silver and cyanide, conditions became excessively toxic in the stream reach south of station GL02. It is possible that toxic conditions exist even farther north, since these parameters were not measured at station GL03. Excluding the presence of a low concentration of cyanide in Addison Creek, the effect of the Salt Creek tributaries cannot be deduced from the available data.

CONCLUSIONS

Water and fishery quality in Salt Creek decreased progressively downstream with little positive influence from the tributaries. The present fish population appeared to be the result of poor water quality. The principle pollutants were silver, cyanide and total iron. The concentrations of ammonia nitrogen also were high, but the levels recorded were below the point of contributing significantly to the toxicity index.

Salt Creek received excessive amounts of silver and cyanide midway through its length. After introduction of these pollutants, the fish population consisted of up to 98% carp, goldfish and carp x goldfish hybrids. These conditions may originate farther north than indicated by the 1976 data. A synthesis of this information is expressed on Figure 12-4.

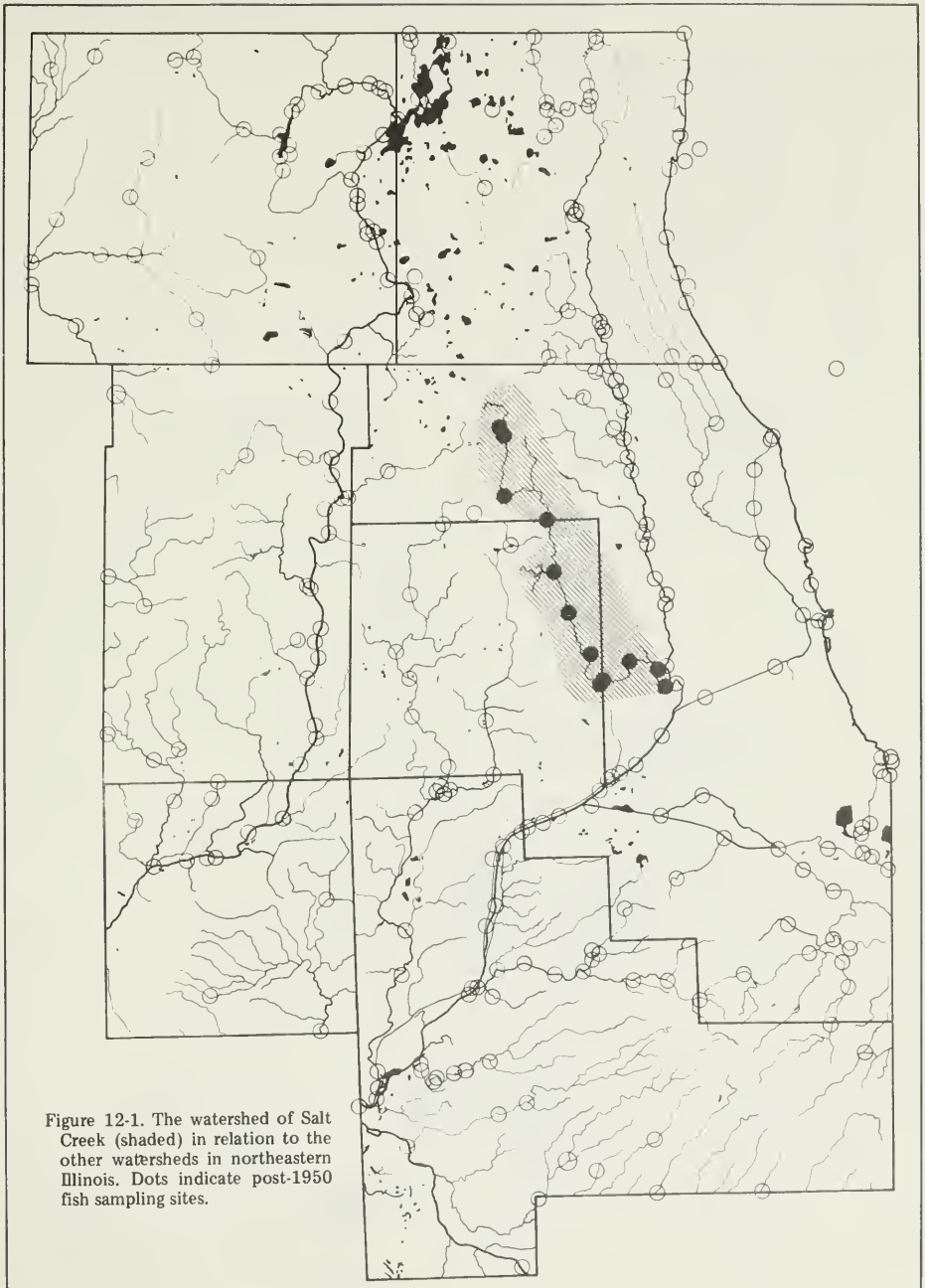
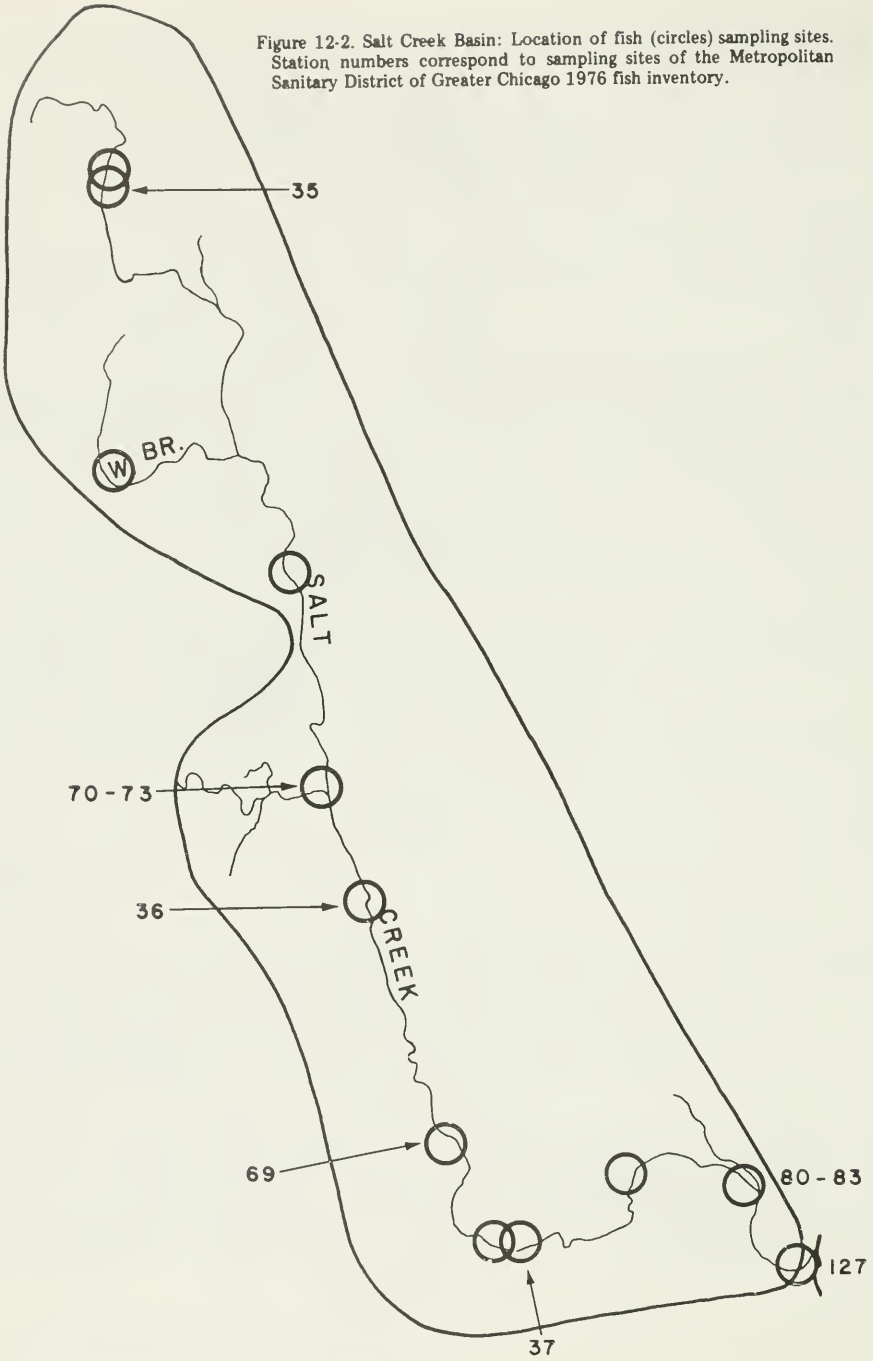


Figure 12-1. The watershed of Salt Creek (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 12-2. Salt Creek Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.



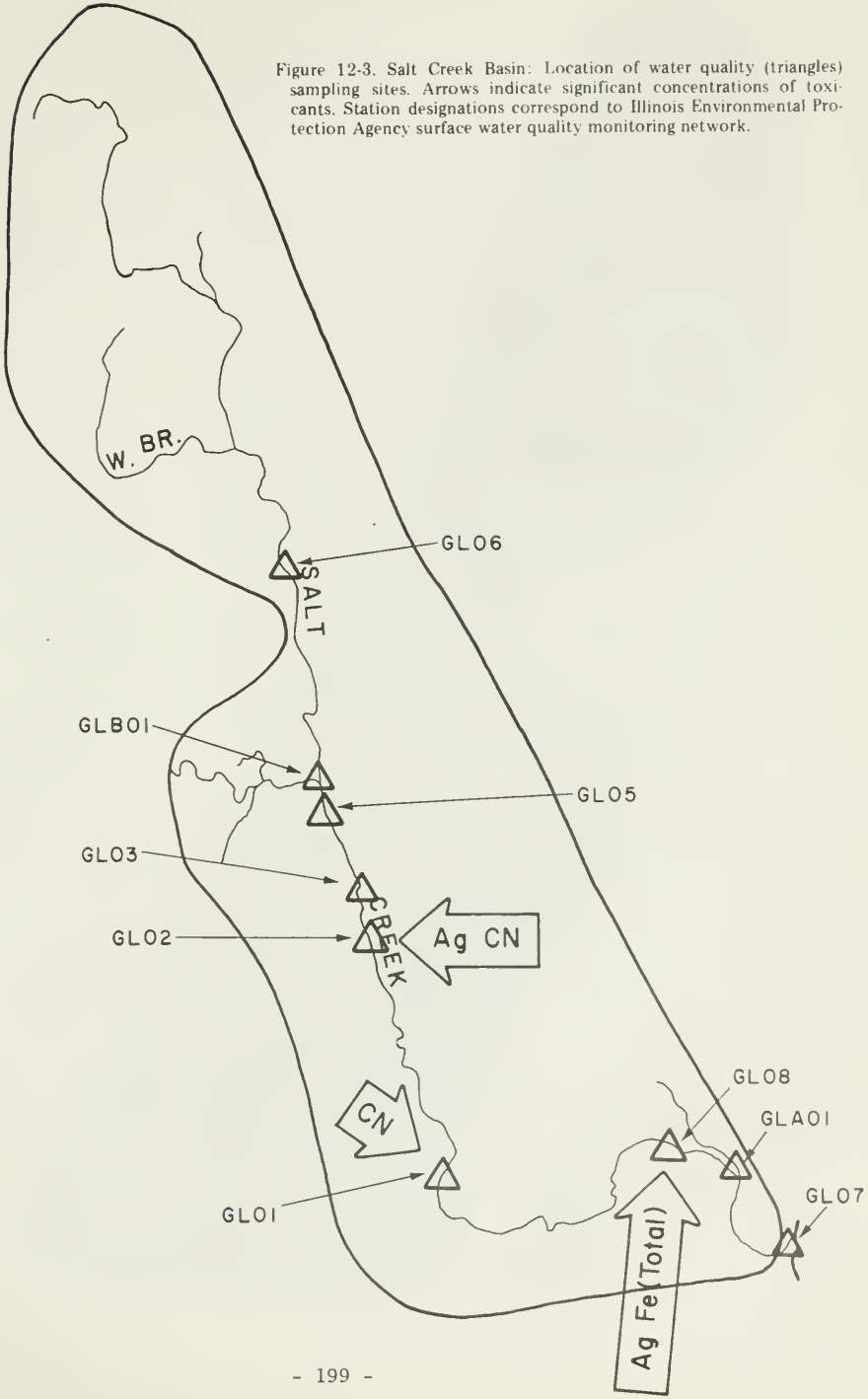


Figure 12-3. Salt Creek Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

Figure 12-4. Salt Creek Basin: Summary of environmental quality.

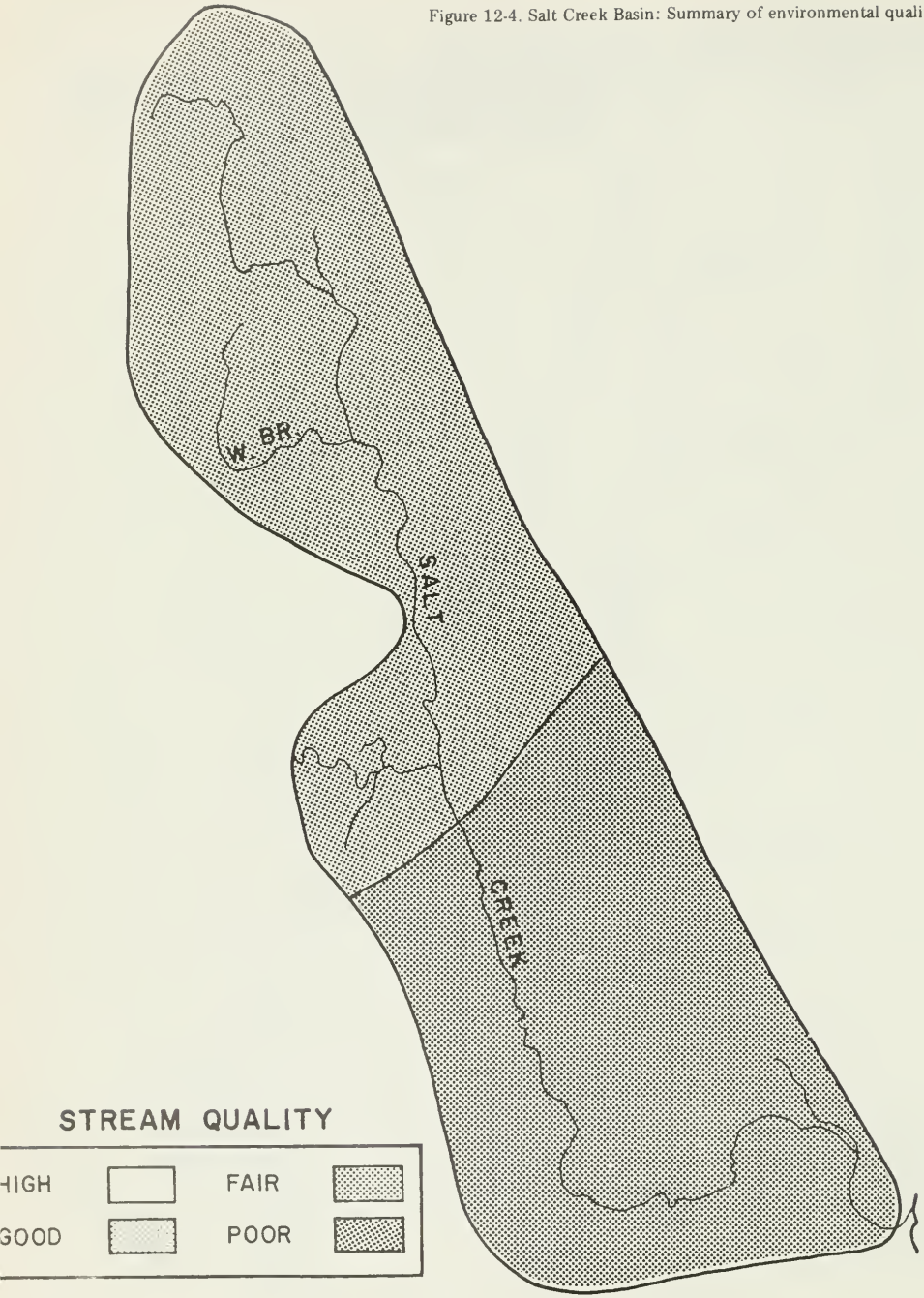


Table 12-2. Location of MSDGC 1976 Fish Sampling Sites, Salt Creek Basin.

Number	Stream	Location
35	Salt Creek	T41N/R 11E/S 21NW; Cook Co; upstream of pool above Rt. 62 (Algonquin Road), Rolling Meadows.
36	Salt Creek	T39N/R 11E/S 11NW; DuPage Co.; 40 meters upstream and 15 meters downstream of Rt. 83, Elmhurst.
37	Salt Creek	T39N/R 12E/S 31SE; Cook Co.; upstream of Wolf Road, Bemis Woods, Western Springs.
69	Ginger Creek	T39N/R 11E/S 26SE; DuPage Co.; 100 meters above mouth with salt Creek, Butler National Golf Course, Oak Brook.
70	Salt Creek	T40N/R 11E/S 9SW; DuPage Co.; 200 meters downstream of mouth of Spring Brook, Wood Dale.
71	Spring Brook	T40N/R 11E/S 9SW; DuPage Co.; mouth of Spring Brook with Salt Creek, Wood Dale.
72	Spring Brook	T40N/R 11E/S 9SW; DuPage Co.; 150 meters above mouth with Salt Creek.
73	Spring Brook	T40N/R 11E/S 9SW; DuPage Co.; 100 meters above mouth with Salt Creek, Wood Dale.
80	Addison Creek	T39N/R 12E/S 27NW; Cook Co.; 140 meters above mouth with Salt Creek, Broadview.
81	Addison Creek	T39N/R 12E/S 27NW; Cook Co.; 100 meters above mouth with Salt Creek, Broadview.
82	Addison Creek	T39N/R 12 E/S 27NW; Cook Co.; mouth of Addison Creek with Salt Creek, Broadview.
83	Salt Creek	T39N/R 12E/S 27NE; Cook Co.; 200 meters downstream of mouth of Addison Creek, Broadview.
127	Salt Creek	T38N/R 12E/S 2NW; Cook Co.; mouth of Salt Creek with Des Plaines River, Lyons.

Table 12-3. Checklist of Fishes Known to Occur in the Salt Creek Basin.

Salmoniformes

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Cypriniformes

Cyprinidae - Minnows and Carps

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis heterolepis Eigenmann and Eigenmann
Blacknose shiner

Notropis umbratilis (Girard)
Redfin shiner

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Catostomus commersoni Lacépède
White sucker

Moxostoma valenciennesi Jordon
Greater redhorse

Table 12-3. Completed.

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Noturus gyrinus (Mitchill)
Tadpole madtom

Noturus nocturnus Jordon and Gilbert
Freckled madtom

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Perciformes

Centrarchidae - Sunfishes

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis macrochirus Rafinesque
Bluegill

Micropterus salmoides (Lacépède)
Largemouth bass

Pomoxis nigromaculatus (Lesueur)
Black crappie

Percidae - Perches

Etheostoma nigrum Rafinesque
Johnny darter

Percina maculata (Girard)
Blackside darter

Table 12-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites in the Salt Creek Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS											TOTAL NUMBER	% OF TOTAL
	35	70	71	72	36	69	37	80	82	83	127		
UMBRIDAE													
Central mudminnow	11	--	--	--	--	--	--	--	--	--	--	11	1
CYPRINIDAE													
Goldfish	4	--	1	20	--	1	91	7	5	44	--	173	23
Carp	8	8	4	60	1	--	9	--	5	6	--	101	14
Golden shiner	1	--	--	3	--	--	--	--	--	--	--	4	1
Bigmouth shiner	80	--	--	--	--	--	--	--	--	--	--	80	11
Bluntnose minnow	69	--	--	--	--	--	--	--	--	--	--	69	9
Fathead minnow	44	--	--	9	4	--	1	--	1	--	--	59	8
Creek chub	6	--	--	--	--	3	--	--	--	--	--	9	1
Carp X Goldfish (hybrid)	--	--	--	2	--	--	2	2	9	19	1	35	5
CATOSTOMIDAE													
White sucker	--	7	5	4	--	--	--	--	--	--	--	16	2
ICTALURIDAE													
Black bullhead	12	2	--	12	--	--	--	--	1	2	1	30	4
CENTRARCHIDAE													
Green sunfish	29	2	--	23	--	8	1	1	1	1	1	67	9
Pumpkinseed	7	--	--	--	--	--	--	--	--	--	--	7	1
Bluegill sunfish	50	--	--	9	--	--	--	2	2	--	--	63	9
Largemouth bass	6	--	--	1	--	--	--	1	2	1	--	11	1
Black crappie	--	1	3	--	--	--	--	--	--	--	1	5	1
Green X Pumpkinseed (hybrid)	--	--	1	--	--	--	--	--	--	--	--	1	<1
NUMBER OF INDIVIDUALS	327	19	12	146	5	12	104	13	26	73	4	741	100
NUMBER OF SPECIES	12	4	4	10	2	3	4	4	7	5	3	15	--
DIVERSITY ($\bar{d}$)	2.87	1.74	1.95	2.64	.72	1.19	.71	1.88	2.56	1.55	1.99	--	--
EQUITABILITY (e)	.78	1.00	1.00	.77	1.00	.83	.40	1.00	1.00	.67	1.25	--	--

Table 12-5. Location of 1976 IEPA Water Quality Sampling Sites, Salt Creek Basin.

Basin Code	Station Number	Stream Name	Description
Salt Creek			
GL	01	Salt Creek	York RD BR below dam at Hinsdale
GL	02	Salt Creek	RT 56 - Butterfield RD BR at Elmhurst
GL	03	Salt Creek	St. Charles RD BR at Villa Park
GL	05	Salt Creek	Irving Park RD BR at Wood Dale
GL	06	Salt Creek	Devon Ave BR at Cook-DuPage Co. line
GL	07	Salt Creek	First Ave BR NR mouth at Lyons
GL	08	Salt Creek	US 12-20-45 - La Grange RD BR WSTCHSTR
Addison Creek			
GLA	01	Addison Creek	Cermak RD BR at S edge Broadview
Spring Brook			
GLB	01	Spring Brook	Prospect Ave BR at Itasca

Table 12-6. Bluegill Toxicity Indices, Salt Creek Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Salt Creek	GL06	.126
Spring Brook	GLB01	.067
Salt Creek	GL05	.162
	GL03	.040
	GL02	.838
	GL01	.365
	GL08	4.049
Addison Creek	GLA01	.158
Salt Creek	GL07	.159

Table 12-7. Summary, 1976 IEPA Water Quality Data, Salt Creek Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based on Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the Bluegill Toxicity Index.)

IEPA Station	Fe Total (mg l^{-1})	Ag (mg l^{-1})	Cn (mg l^{-1})
Salt Creek			
GL06	.2 - 2.2 .9 (5)	.000 - .000 .000 (5)	.000 - .020 .006 (5)
Spring Brook			
GLB01	---	---	---
Salt Creek			
GL05	.4 - 2.4 1.5 (3)	.000 - .000 .000 (3)	.000 - .020 .007 (3)
GL03	---	---	---
GL02	.7 - 1.5 1.1 (6)	.000 - .010 .002 (6)	.010 - .030 .017 (6)
GL01	.8 - 2.8 1.5 (3)	.000 - .000 .000 (3)	.000 - .060 .023 (3)
GL08	1.9 - 5.2 3.5 (2)	.000 - .030 .015 (2)	.000 - .000 .000 (2)
Addison Creek			
GLA01	.2 - .4 .3 (2)	.000 - .000 .000 (2)	.010 - .010 .010 (2)
Salt Creek			
GL07	.5 - 1.6 1.0 (2)	.000 - .000 .000 (2)	.000 - .000 .000 (2)
IPCB STANDARDS	1.0	.005	.025

CHAPTER THIRTEEN: UPPER DES PLAINES RIVER

LOCATION AND BASIN MORPHOMETRY

The Des Plaines River originates in Racine County, Wisconsin, and enters Illinois in Lake County. The area sampled, located within Cook, DuPage, and Lake Counties, Illinois (Fig. 13-1), encompasses an imperfectly drained drainage basin of 83,429 ha, containing numerous small lakes and marshes. Tributaries entering the river include Mill Creek, Indian Creek, Buffalo Creek, Willow Creek, and Salt Creek.

The Des Plaines River is a low-gradient stream (0.23 m km^{-1}) and flows in a southerly direction. The river eventually joins the Kankakee River to form the Illinois River. The portion of the watershed considered here terminates at the confluence of the Des Plaines River and Salt Creek. Previous chapters discuss conditions in the Lower Des Plaines River and Salt Creek. At its confluence with Salt Creek, the Des Plaines River is an order 5 stream. The drainage pattern is intermediate between a fully bifurcate dendritic pattern and a trellis pattern. The Des Plaines is overdeveloped at the order 1, 2, 4, and 5 levels, especially orders 1 and 5. It is slightly underdeveloped at the order 3 level and never reaches the potential order 8 stream of a fully bifurcate dendritic drainage pattern. Morphometric data are summarized in Table 13-1.

Table 13-1. Summary of Morphometric Data, Upper Des Plaines River.

Order	Number Links	Mean Length (km)	Total Length (km)
1	163	1.82	296.38
2	75	1.73	129.93
3	30	2.07	62.18
4	20	3.05	61.05
5	40	2.18	87.17
			Total = 636.71

Bottom type is primarily sand but covered with silt in some locations. There are seven major soil associations in the Upper Des Plaines watershed:

1) Mundelein - Pella - Barrington
2) Zurich - Grays - Wauconda
3) Corwin - Odell
4) Miami - Montmorenci
5) Elliott - Markham
6) Morley - Markham - Houghton
7) Nappanee - Montgomery

SUMMARY OF FISHERY DATA

The Metropolitan Sanitary District of Greater Chicago inventory of the Upper Des Plaines River watershed included fish collections from 44 sites (Table 13-2; Fig. 13-2). Sampling was attempted three times at station 76, with only one attempt yielding fish. Stations 15, 16, 113, and 208 were attempted twice each, with only one successful attempt. Stations 158 and 207 were attempted twice each, and all collections were unsuccessful.

The Illinois Natural History Survey records indicated 58 species and carp x goldfish hybrids present in this area (Table 13-3). The Metropolitan Sanitary District of Greater Chicago collection yielded 39 species of fish and four hybrid crosses (Table 13-4). The hybrids were carp x goldfish, pumpkinseed x bluegill, green sunfish x pumpkinseed, and green sunfish x bluegill. The majority of the species no longer found in the area show some degree of ecological sensitivity. Those species still found in the watershed are almost all considered ecologically tolerant. Only 1% of the total number of fish collected are considered ecologically intolerant. Green sunfish, a tolerant species, was the most abundant species in the watershed, representing 18% of the total number of fish collected. When the number of green sunfish are combined with the number of carp, sand shiners, bluntnose minnows, and bluegills (these species are only slightly less abundant than green sunfish), 67% of the total is represented.

The Des Plaines River, as it flows south into Illinois from Wisconsin, contains a good-quality fishery. Included in the collections from this area were species, such as northern pike, which are sensitive to environmental change. Fishery quality remained good in the river up to the confluence of the Wheeling Drainage Ditch. South of this area, the river's fishery quality is somewhat degraded. Fewer species were collected, and these were usually extremely tolerant.

Most of the tributaries of the Des Plaines River in the northern part of the watershed also contain good quality fishery. In exception are the slightly degraded fisheries of Hasting Creek and the headwaters of the South Branch of Mill Creek. These areas have been subjected to recent suburban developments. The tributaries south of McDonald Creek contain fewer species. Those species found here usually showed a greater degree of ecological tolerance. Especially poor collections were secured from the Feehanville Ditch, Weller's Ditch, and Silver Creek.

SUMMARY OF WATER QUALITY DATA

The Illinois Environmental Protection Agency monitored water quality at 16 sites in the Upper Des Plaines River watershed. The main river channel contained nine stations, and seven were located on the tributaries, primarily at their confluence with the river (Table 13-5; Figure 13-3).

The Metropolitan Sanitary District of Greater Chicago data provided hardness values for many of the tributary systems. A mean of all the hardness values taken from the watershed was used for all the other sites. The remaining parameters needed for the toxicity calculations were measured for all the sites, except for MBAS, which was not measured at station GM01. The toxicity indices for five stations were in excess of the maximum level 0.20 due to significant concentrations of silver, cyanide, MBAS, and ammonia nitrogen detected in the samples (Table 13-6). Arsenic, cadmium, and chromium (trivalent and hexavalent) also were detected, but the concentrations were so low they did not contribute when the toxicity indices were rounded to three decimals. Analyses failed to detect mercury, nickel, and zinc in the watershed. The mean values for three significantly contributing parameters exceeded the Illinois Pollution Control Board standards (Table 13-7).. The ammonia nitrogen concentration exceeded the standard at nine stations. Silver exceeded the Illinois Pollution Control Board standard at three sites, and cyanide exceeded the standard at two sites. Copper, an insignificant contributor, exceeded the standard at 88% of the stations. Two additional insignificant contributors to the toxicity indices, total iron and lead, also exceeded Illinois Pollution Control Board standards at up to one-fourth of the stations.

The Des Plaines River contains good water quality as it flows south accross the Illinois-Wisconsin boundary. Analysis of Mill Creek, the first monitored stream entering the river, indicated a high concentration of silver during one sampling period. A higher concentration of silver was detected at the river station downstream of Mill Creek. Silver was not detected at either site during the two other samplings of each station.

The water quality remains good as Bull Creek, Indian Creek, an unnamed tributary, and the Wheeling Drainage Ditch converge with the river. Toxic concentrations of silver and cyanide are detected at the river site south of Wheeling Drainage Ditch (Station G13). The toxic concentrations were again detected during only one of the three sampling periods. McDonald Creek and Feehanville Ditch are the next tributaries to enter the river. These streams were not monitored by the Illinois Environmental Protection Agency. Weller's Ditch contained extremely toxic conditions due to high concentrations of ammonia nitrogen, silver, and MBAS. The extent of silver and MBAS pollution was not determined since monitoring was limited for these parameters. Silver was measured twice, and MBAS, once. The river station downstream of Weller's Ditch contained ammonia nitrogen and MBAS, but at concentrations below the toxic level. Willow Creek and Crystal Creek also contained toxicants at their confluences with the river, but the concentrations were low. This is also true for the Des Plaines south of these tributaries. A toxic concentration of cyanide was detected in Silver Creek. Analysis for cyanide was performed only once at this site.

CONCLUSIONS

Habitat quality ranging from good to poor is found within the Upper Des Plaines River watershed. The Des Plaines River originates in Wisconsin and enters Illinois as a good quality aquatic environment. Mill

Creek, the first monitored tributary to the river, is slightly degraded in its southern branches and at a tributary entering the North Branch. Yet, when Mill Creek converges with the river, it is also a good quality habitat. The river and its tributaries continue to be of good quality through the convergence of Wheeling Drainage Ditch. At this point, suburban development becomes more extensive along the river. The remaining river segment and its associated tributaries contain degraded aquatic habitat. Especially poor conditions are prevalent in the Feehanville Ditch, Weller's Ditch, and Silver Creek.

The fish populations in the watershed were more indicative of the environmental quality than the water chemistry data. Analyses indicated toxic concentrations of silver, MBAS, cyanide, and ammonia nitrogen. Ammonia nitrogen was monitored extensively, but measurements for the remaining toxicants were limited. Therefore, the true extent of the pollution was not evident. Increased monitoring for these parameters would better explain the actual water quality conditions. Figure 13-4 illustrates these conclusions.

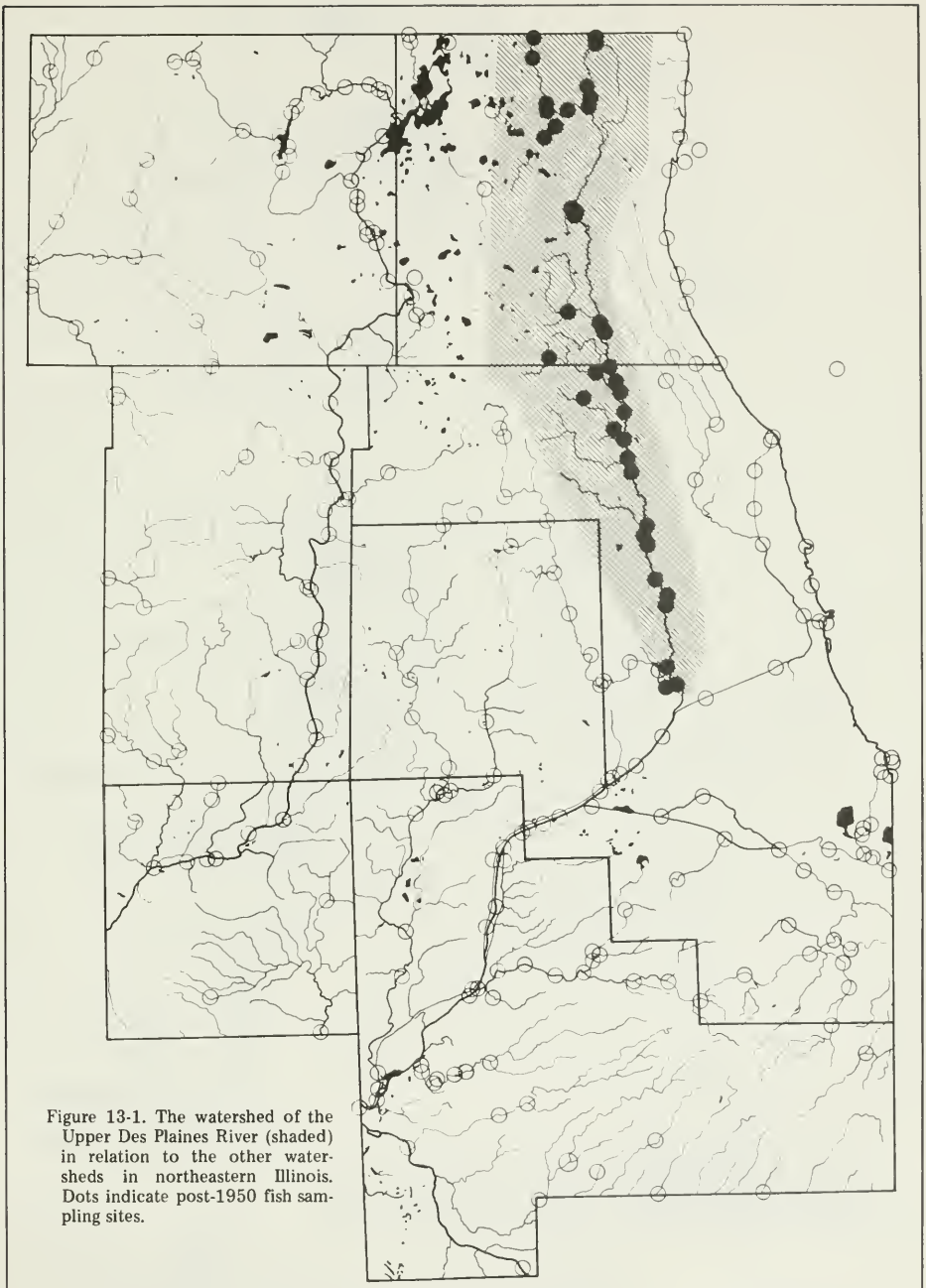


Figure 13-1. The watershed of the Upper Des Plaines River (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

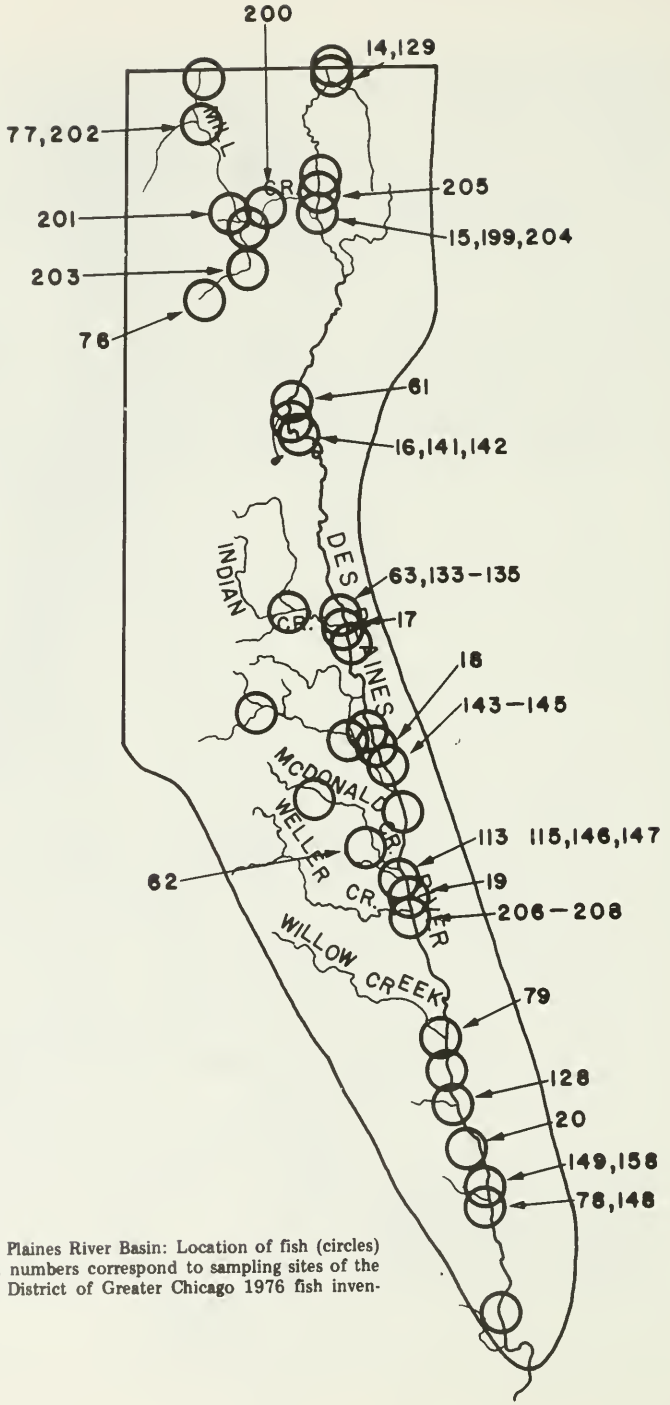


Figure 13-2. Upper Des Plaines River Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Metropolitan Sanitary District of Greater Chicago 1976 fish inventory.

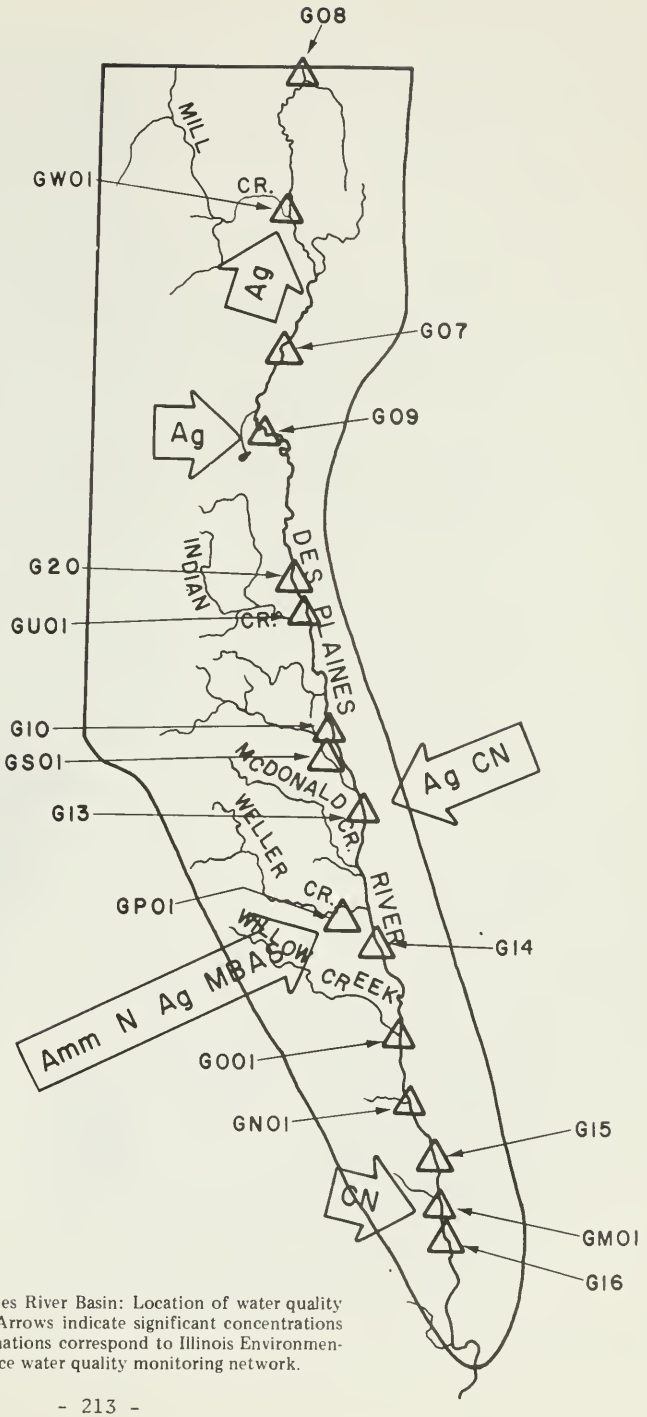


Figure 13-3. Upper Des Plaines River Basin: Location of water quality (triangles) sampling sites. Arrows indicate significant concentrations of toxicants. Station designations correspond to Illinois Environmental Protection Agency surface water quality monitoring network.

Figure 13-4. Upper Des Plaines River Basin: Summary of environmental quality.

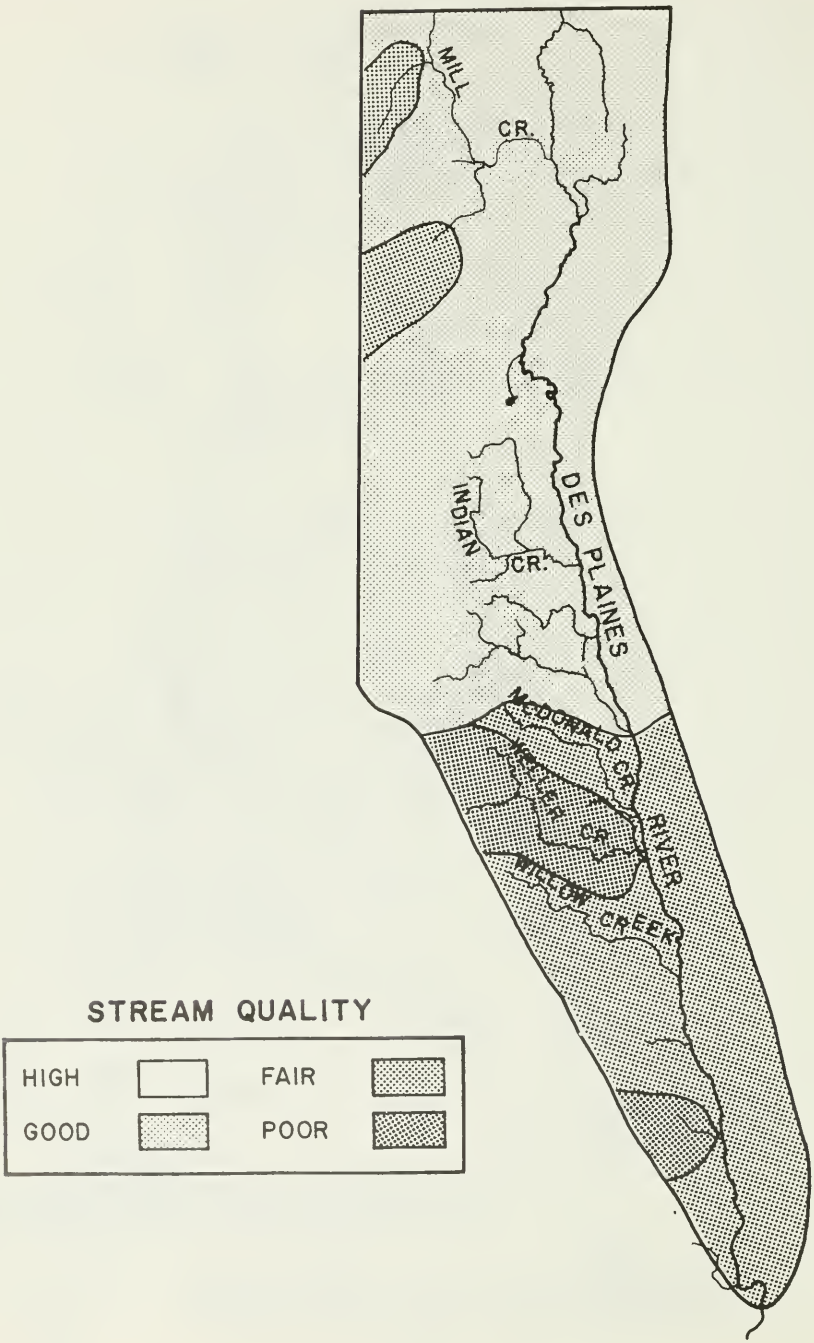


Table 13-2. Location of MSDGC 1976 Fish Sampling Sites, Upper Des Plaines River Basin.

Number	Station	Location
14	Des Plaines River	T46N/R 11E/S 3SE; Lake Co.; 37 meters downstream of Russell RD, Russell.
15	Mill Creek	T46N/R 21E/S 34SW; Lake Co.; below RT 41, 100 meters above mouth with Des Plaines River, Wadsworth.
16	Des Plaines River	T44N/R 11E/S 9NW; Lake Co.; 20 meters above RT 137, Buckley RD, Libertyville.
17	Des Plaines River	T43N/R 11E/S 23NW; Lake Co.; 700 meters downstream of boat launch at Lincolnshire-Halfday, Halfday.
18	Des Plaines River	T42N/R 11E/S 12SE; Cook Co.; 1500 meters above Dam #1, Wheeling.
19	Des Plaines River	T41N/R 12E/S 8SE; Cook Co.; 400 meters upstream of Golf RD, Wheeling.
20	Des Plaines River	T40N/R 12E/S 27NE; Cook Co.; from Grand AVE, 400 meters upstream, River Grove.
61	Bull Creek	T44N/R 11E/S 4SW; Lake Co.; 10-120 meters above mouth with Des Plaines River, Libertyville.
62	McDonald Creek	T42N/R 11E/S 25SW; Cook Co.; N of Foundry RD, E of RR tracks, Mt. Prospect.
63	Indian Creek	T43N/R 11E/S 23NW; Lake Co.; 100 meters above mouth with Des Plaines River, Lincolnshire-Halfday, Halfday.
76	South Branch, Mill Creek	T45N/R 10E/S 13NE; Lake Co.; immediately below RT 45, Wedges Corner.
77	Hastings Creek	T46N/R 10E/S 24SE; Lake Co.; immediately below RT 45, 0.9 MI above mouth with N BR, Mill Creek, Hickory Corners.
78	Silver Creek	T39N/R 12E/S 2SW; Cook Co.; 100 meters above mouth with Des Plaines River, Maywood/Melrose Park.
79	Willow Creek	T40N/R 12E/S 3NW; Cook Co.; 100 meters above mouth with Des Plaines River, S of Higgins RD, Rosemont.

Table 13-2. Continued.

Number	Station	Location
113	Feehanville Ditch	T42N/R 12E/S 36SE; Cook Co.; mouth of Feehanville Ditch with Des Plaines River, Forest River.
114	Feehanville Ditch	T42N/R 12E/S 36SE; Cook Co.; 100 meters upstream of mouth with Des Plaines River, Forest River.
115	McDonald Creek	T42N/R 12E/S 36NE; Cook Co.; mouth of McDonald Creek with Des Plaines River, Forest River.
126	Des Plaines River	T38-39N/R 12E/S 2NE-35SE, Cook Co.; 400 meters above mouth of Salt Creek, Lyons.
128	Crystal Creek	T40N/R 12E/S 15NE; Cook Co.; mouth of Crystal Creek with Des Plaines River, River Grove.
129	Des Plaines River	T46N/R 11E/S 3SE; Lake Co.; 100 meters below Russell RD, Russell.
133	Indian Creek	T43N/R 11E/S 23NW; Lake Co.; 20 meters upstream of mouth with Des Plaines River in riffle area, Lincolnshire-Halfday, Halfday.
134	Des Plaines River	T43N/R 11E/S 23NW; Lake Co.; immediately upstream of boat launch at Lincolnshire-Halfday, Halfday.
135	Indian Creek	T43N/R 11E/S 23NW; Lake Co.; mouth of Indian Creek with Des Plaines River, Lincolnshire-Halfday, Halfday.
141	Des Plaines River	T44N/R 11E/S 9NW; Lake Co.; 60 meters above RT 137 (Buckley RD), Libertyville.
142	Des Plaines River	T44N/R 11E/S 9NW; Lake Co.; immediately downstream of RT 137 (Buckley RD), Libertyville.
143	Des Plaines River	T42N/R 11E/S 12SE; Cook Co., below Dam #1, Wheeling.
144	Des Plaines River	T42N/R 11E/S 12SE; Cook Co.; below Dam #1, Wheeling.
145	Des Plaines River	T42N/R 11E/S 12SE; Cook Co.; tailrace of Dam #1, Wheeling.
146	Des Plaines River	T42N/R 11E/S 25SE; Cook Co.; tailrace of Dam #2, Forest River.

Table 13-2. Completed.

Number	Station	Location
147	Des Plaines River	T42N/R 11E/S 25SE; Cook Co.; 100 meters below Dam #2, Forest River.
148	Silver Creek	T39N/R 12E/S 2SW; Cook Co.; mouth of Silver Creek with Des Plaines River, Maywood.
149	Des Plaines River	T39N/R 12E/S 36SW; Cook. Co.; 100 meters below North AVE Dam, Elmwood Park.
158	Des Plaines River	T39N/R 12E/S 36SW; Cook Co.; tailrace and forebay of North AVE Dam, Elmwood PK.
199	Mill Creek	T46N/R 21E/S 34SE; Lake Co.; mouth of Mill Creek with Des Plaines River, Wadsworth.
200	Mill Creek	T46N/R 21E/S 34SE; Lake Co.; 10 meters downstream (east) of Hunt Club RD (Eric RD), Millburn.
201	North Branch, Mill Creek	T46N/R 21E/S 31NW; Lake Co.; immediately downstream of Millburn RD, Millburn.
202	North Branch, Mill Creek	T46N/R 21E/S 13SE; Lake Co.; immediately downstream of RT 173, Hickory Corners.
203	South Branch, Mill Creek	T45N/R 21E/S 8NW; Lake Co.; 40 meters immediately DWNSTRM and UPSTRM of Stearns RD, Millburn.
204	Des Plaines River	T46N/R 21E/S 34SE; Lake Co.; 100 meters below mouth of Mill Creek, Millburn.
205	Des Plaines River	T46N/R 21E/S 27SE; Lake Co.; immediately UPSTRM of Wadsworth RD, Wadsworth.
206	Weller's Ditch	T41N/R 12E/S 16SW; Cook Co.; mouth of Weller's Ditch with Des Plaines River, Des Plaines.
207	Weller's Ditch	T41N/R 12E/S 16SW; Cook Co.; 100 meters UPSTRM of mouth with Des Plaines River, Des Plaines.
208	Des Plaines River	T41N/R 12E/S 21NW; Cook Co.; forebay and tailrace of RT 14 Dam, Des Plaines.

Table 13-3. Checklist of Fishes Known to Occur in the Upper Des Plaines River Basin.

Amiiformes

Amiidae - Bowfins

Amia calva Linnaeus
Bowfin

Salmoniformes

Umbridae - Mudminnows

Umbra limi (Kirtland)
Central mudminnow

Esocidae - Pikes

Esox americanus vermiculatus Lesueur
Grass pickerel

Esox lucius Linnaeus
Northern pike

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anamalum (Rafinesque)
Stoneroller

Carassius auratus (Linnaeus)
Goldfish

Cyprinus carpio Linnaeus
Carp

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notemigonus crysoleucas (Mitchill)
Golden shiner

Notropis atherinoides Rafinesque
Emerald shiner

Notropis chalybaeus (Cope)
Ironcolor shiner

Notropis chrysocephalus (Rafinesque)
Striped shiner

Table 13-3. Continued.

Cypriniformes (continued)

Cyprinidae - Minnows and Carps (continued)

Notropis cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis heterodon (Cope)
Blackshin shiner

Notropis heterolepis Eigenmann & Eigenmann
Blacknose shiner

Notropis rubellus (Agassiz)
Rosyface shiner

Notropis spilopterus (Cope)
Spotfin shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Notropis volucellus (Cope)
Mimic shiner

Pimephales notatus (Rafinesque)
Bluntnose minnow

Pimephales promelas Rafinesque
Fathead minnow

Rhinichthys atratulus (Hermann)
Blacknose dace

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Carpiodes carpio (Rafinesque)
River carpsucker

Table 13-3. Continued.

Cypriniformes (continued)

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Erimyzon oblongus (Mitchill)
Creek chubsucker

Erimyzon sucetta (Lacépède)
Lake chubsucker

Hypentelium nigricans (Lesueur)
Northern hog sucker

Moxostoma erythrurum (Rafinesque)
Golden redhorse

Siluriformes

Ictaluridae - Freshwater catfishes

Ictalurus melas (Rafinesque)
Black bullhead

Ictalurus natalis (Lesueur)
Yellow bullhead

Ictalurus nebulosus (Lesueur)
Brown bullhead

Ictalurus punctatus (Rafinesque)
Channel catfish

Noturus flavus Rafinesque
Stonecat

Noturus gyrinus (Mitchill)
Tadpole madtom

Percopsiformes

Aphredoderidae - Pirate perches

Aphredoderus sayanus (Gilliams)
Pirate perch

Table 13-3. Continued.

Atheriniformes

Cyprinodontidae - Killifishes

Fundulus diaphanus (Lesueur)
Banded killifishes

Fundulus notatus (Rafinesque)
Blackstripe topminnow

Fundulus notti (Agassiz)
Starhead topminnow

Gasterosteiformes

Gasterosteidae - Sticklebacks

Culaea inconstans (Kirtland)
Brook stickleback

Perciformes

Percichthyidae - Temperate basses

Morone mississippiensis Jordan & Eigenmann
Yellow bass

Centrarchidae - Sunfishes

Amboplites rupestris (Rafinesque)
Rock bass

Lepomis cyanellus Rafinesque
Green sunfish

Lepomis gibbosus (Linnaeus)
Pumpkinseed

Lepomis gulosus (Cuvier)
Warmouth

Lepomis macrochirus Rafinesque
Bluegill

Lopomis microlophus (Gunther)
Redear sunfish

Micropterus dolomieui Lacépède
Smallmouth basss

Micropterus salmoides (Lacépède)
Largemouth bass

Table 13-3. Completed.

Perciformes (continued)

Centrarchidae - Sunfishes (continued)

Pomoxis annularis Rafinesque
White crappie

Pomoxis nigromaculatus (Lesueur)
Black crappie

Percidae - Perches

Etheostoma exile (Girard)
Iowa darter

Etheostoma microperca Jordan & Gilbert
Least darter

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma zonale (Cope)
Banded darter

Perca flavescens (Mitchill)
Yellow perch

Percina maculata (Girard)
Blackside darter

Table 13-4. MSDGC 1976 Fish Inventories. Abundance of fishes at sampling sites on the Upper Des Plaines River. Species diversity ($\bar{d}$) and equitability (e) are expressed for each station.

SPECIES	STATIONS										
	14	129	205	77	202	201	76	203	200	15	199
UMBRIDAE											
Central mudminnow	--	--	--	--	1	--	--	--	--	--	--
ESOCIDAE											
Northern pike	--	1	2	--	--	--	--	2	--	--	--
CYPRINIDAE											
Goldfish	--	--	--	1	--	--	--	--	--	--	--
Carp	--	1	91	2	--	--	7	4	--	1	4
Hornyhead chub	--	--	--	--	--	--	--	--	--	--	--
Golden shiner	--	1	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	--	--	--	--	--
Common shiner	--	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	--	--	--	--	--	--	--	--	--	--	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	6	--
Spotfin shiner	--	3	--	--	--	--	--	--	--	--	1
Sand shiner	--	--	--	--	--	--	--	--	--	49	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	1	13	1	--	--	102	--	--	1	29	3
Fathead minnow	--	--	--	--	--	--	--	--	--	--	--
Creek chub	--	--	--	--	--	--	--	--	--	--	--
Carp X Goldfish	--	--	2	--	--	--	--	--	--	--	--
CATOSTOMIDAE											
White sucker	--	--	--	--	--	1	--	1	1	--	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE											
Black bullhead	1	7	3	--	7	2	2	2	--	13	--
Yellow bullhead	--	--	2	--	1	3	2	3	1	--	--
Channel catfish	--	--	--	--	--	--	--	--	--	1	--
Stonecat	--	--	--	--	--	--	--	--	--	--	--
Tadpole madtom	1	2	--	--	--	--	--	--	--	--	--
CYPRINODONTIDAE											
Blackstripe topminnow	9	--	2	--	--	--	--	--	3	--	--
GASTEROSTEIDAE											
Brook stickleback	--	--	--	--	--	--	--	--	--	--	--
PERICHTHYIDAE											
Yellow bass	--	--	3	--	--	--	--	--	--	--	--
CENTRARCHIDAE											
Rock bass	--	--	--	--	--	--	--	--	--	--	--
Green sunfish	12	2	28	9	15	17	1	1	36	17	1
Pumpkinseed	--	1	1	14	2	3	--	--	4	--	--
Warmouth	--	--	1	--	--	--	--	--	1	--	--
Bluegill	--	1	9	5	3	3	--	3	1	--	--
Smallmouth bass	--	--	--	--	--	--	--	--	--	--	--
Largemouth bass	--	--	2	--	--	--	--	--	7	--	--
White crappie	--	--	3	--	--	--	--	--	--	--	--
Black crappie	--	--	5	2	--	--	--	1	--	--	--
Pumpkinseed X Bluegill	--	--	1	--	--	--	--	--	--	--	--
Green sunfish X Pumpkinseed	--	--	1	--	--	1	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--	--
PERCIDAE											
Johnny darter	22	2	--	--	9	8	--	--	--	1	--
Banded darter	--	--	--	--	--	--	--	--	--	--	--
Yellow darter	--	1	--	--	--	--	--	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	1	1	--
TOTAL NUMBER OF INDIVIDUALS	46	35	158	33	38	140	12	17	56	118	9
TOTAL NUMBER OF SPECIES	6	12	14	6	7	8	4	8	10	9	4
SPECIES DIVERSITY ($\bar{d}$)	1.72	2.78	1.45	1.88	2.14	2.36	1.52	2.61	1.81	2.18	1.37
EQUITABILITY (e)	0.8	0.8	0.2	0.8	0.9	0.8	0.9	1.0	0.5	0.7	0.9

Table 13-4. Continued.

SPECIES	STATIONS										
	143	144	145	114	113	62	115	146	147	19	206
UMBRIDAE											
Central mudminnow	--	--	--	--	--	--	--	--	--	--	--
ESOCIDAE											
Northern pike	--	--	--	--	--	--	--	--	--	--	--
CYPRINIDAE											
Goldfish	1	--	--	1	--	--	--	--	--	1	--
Carp	1	--	1	--	--	--	1	1	8	37	--
Hornyhead chub	--	--	4	--	--	--	--	--	--	--	--
Golden shiner	1	1	--	--	--	--	--	--	--	--	--
Emerald shiner	3	--	--	--	--	--	--	--	--	--	--
Common shiner	--	--	--	--	--	--	--	--	--	--	--
Bigmouth shiner	--	1	2	--	--	2	--	2	1	--	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	1	2	15	--	1	--	11	--	1	6	--
Sand shiner	12	47	134	--	1	25	--	2	3	1	--
Redfin shiner	--	--	--	--	--	--	--	--	--	--	--
Bluntnose minnow	17	1	--	--	--	2	1	--	2	3	2
Fathead minnow	3	1	--	--	--	56	--	--	--	--	--
Creek chub	1	--	1	--	--	--	--	--	--	--	--
Carp X Goldfish	1	--	--	--	--	--	--	--	--	--	--
CATOSTOMIDAE											
White sucker	3	--	2	--	--	1	1	1	1	12	--
Golden redhorse	--	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE											
Black bullhead	13	--	1	--	--	--	1	--	4	11	--
Yellow bullhead	1	--	--	--	1	--	--	--	--	4	--
Channel catfish	--	--	--	--	--	--	--	--	--	--	--
Stonecat	--	--	1	--	--	--	--	--	--	--	--
Tadpole madtom	4	--	1	--	--	--	--	--	1	--	--
CYPRINODONTIDAE											
Blackstripe topminnow	1	--	--	--	--	--	4	--	--	--	--
GASTEROSTEIDAE											
Brook stickleback	--	--	--	--	--	--	--	--	--	--	--
PERICHTHYIDAE											
Yellow bass	--	--	--	--	--	--	--	--	--	--	--
CENTRARCHIDAE											
Rock bass	--	--	1	--	--	--	--	--	--	--	--
Green sunfish	30	--	34	--	7	3	8	17	15	121	9
Pumpkinseed	--	--	--	--	--	--	--	--	1	1	--
Warmouth	--	--	--	--	--	--	--	--	--	--	--
Bluegill	73	1	26	--	4	--	5	28	17	8	1
Smallmouth bass	--	--	--	--	--	--	3	--	--	--	--
Largemouth bass	--	--	1	--	--	--	--	1	--	--	--
White crappie	--	--	--	--	--	--	--	--	--	--	--
Black crappie	3	--	2	--	--	--	--	7	13	2	--
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Pumpkinseed	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	1	--	--	--
PERCIDAE											
Johnny darter	--	--	--	--	--	--	--	--	--	--	--
Banded darter	--	--	--	--	--	--	--	--	--	--	--
Yellow darter	--	--	--	--	--	--	--	--	--	--	--
Blackside darter	--	--	--	--	--	--	--	--	--	--	--
TOTAL NUMBER OF INDIVIDUALS	169	54	226	1	14	89	35	60	67	207	12
TOTAL NUMBER OF SPECIES	17	7	15	1	5	6	9	8	12	12	3
SPECIES DIVERSITY ($\bar{d}$)	2.71	0.76	1.97	0.00	1.57	1.29	2.55	2.02	2.65	2.03	0.47
EQUITABILITY (e)	0.5	0.3	0.3	1.0	0.7	0.5	0.9	0.6	0.7	0.5	0.5

Table 13-4. Continued.

SPECIES	STATIONS										
	204	61	141	16	142	134	63	133	135	17	18
UMBRIDAE											
Central mudminnow	--	9	--	--	--	1	--	--	--	--	--
ESOCIDAE											
Northern pike	1	--	--	--	--	--	--	--	--	--	1
CYPRINIDAE											
Goldfish	--	--	--	--	--	--	--	--	--	--	--
Carp	46	--	--	--	--	3	3	--	--	99	72
Hornyhead chub	--	1	--	--	1	3	--	12	--	--	--
Golden shiner	--	1	--	--	--	--	--	--	--	--	--
Emerald shiner	--	--	--	--	--	--	1	--	--	1	--
Common shiner	--	--	--	--	--	--	--	2	--	--	--
Bigmouth shiner	--	5	--	--	--	--	--	13	--	1	--
Rosyface shiner	--	--	--	--	--	--	--	--	--	--	--
Spotfin shiner	2	--	--	7	22	12	--	4	3	2	--
Sand shiner	--	20	--	--	--	2	--	15	--	--	--
Redfin shiner	--	--	--	--	--	1	--	--	--	--	--
Bluntnose minnow	1	--	--	--	--	3	32	17	2	8	--
Fathead minnow	--	--	--	--	--	--	--	--	--	--	--
Creek chub	--	1	--	--	--	--	--	1	--	--	--
Carp X Goldfish	--	--	--	--	--	--	1	--	--	1	--
CATOSTOMIDAE											
White sucker	1	2	--	--	--	--	5	--	--	--	2
Golden redhorse	--	--	--	--	--	--	--	--	--	--	--
ICTALURIDAE											
Black bullhead	2	--	--	--	--	--	--	--	--	3	2
Yellow bullhead	--	--	--	--	--	--	--	--	--	--	1
Channel catfish	--	--	--	--	--	--	--	--	--	--	--
Stonecat	--	--	--	--	--	--	--	--	--	--	--
Tadpole madtom	--	--	--	--	--	--	--	--	--	--	--
CYPRINODONTIDAE											
Blackstripe topminnow	--	--	--	--	--	--	--	--	--	--	2
GASTEROSTEIDAE											
Brook stickleback	--	1	--	--	--	--	--	--	--	--	--
PERICHTHYIDAE											
Yellow bass	1	--	--	--	--	--	--	--	--	--	--
CENTRARCHIDAE											
Rock bass	--	--	1	--	--	--	--	--	--	--	1
Green sunfish	12	8	--	--	--	15	4	2	2	38	21
Pumpkinseed	1	1	--	--	--	--	--	--	--	3	--
Warmouth	--	--	--	--	--	--	--	--	--	--	--
Bluegill	7	6	--	--	--	15	26	--	10	96	34
Smallmouth bass	--	--	--	--	--	--	--	--	--	--	--
Largemouth bass	2	--	--	--	--	--	1	5	8	3	1
White crappie	--	--	--	--	--	--	--	--	--	--	--
Black crappie	1	1	--	--	--	--	--	--	--	3	3
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Pumpkinseed	--	--	--	--	--	--	--	--	--	--	--
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	--	--	--
PERCIDAE											
Johnny darter	1	2	--	--	2	--	--	--	--	--	--
Banded darter	--	1	--	--	--	--	--	--	--	--	--
Yellow darter	--	--	--	--	--	--	--	--	--	--	--
Blackside darter	--	3	--	--	--	--	--	1	--	--	--
TOTAL NUMBER OF INDIVIDUALS	78	62	1	7	25	55	73	72	25	258	140
TOTAL NUMBER OF SPECIES	13	15	1	1	3	9	7	10	5	11	11
SPECIES DIVERSITY ($\bar{d}$)	2.08	1.86	0.00	0.00	0.41	2.49	1.82	2.58	1.68	1.80	1.94
EQUITABILITY (e)	0.4	0.3	1.0	1.0	0.5	0.8	0.7	0.8	0.8	0.4	0.5

Table 13-4. Completed.

	STATIONS								TOTAL NUMBER	% OF TOTAL
	208	79	128	20	149	78	148	126		
UMBRIDAE										
Central mudminnow	--	--	--	--	--	--	--	--	11	<1
ESOCIDAE										
Northern pike	--	--	--	--	--	--	--	--	7	<1
CYPRINIDAE										
Goldfish	--	1	2	90	9	45	12	63	225	7
Carp	--	1	--	26	--	2	1	33	445	15
Hornyhead chub	--	--	--	--	--	--	--	--	21	1
Golden shiner	--	--	--	--	1	1	--	--	6	<1
Emerald shiner	--	--	--	--	--	--	--	--	5	<1
Common shiner	--	--	--	--	--	--	--	--	2	<1
Bigmouth shiner	--	6	--	--	--	--	--	--	33	1
Rosyface shiner	--	--	--	--	--	--	--	--	6	<1
Spotfin shiner	2	9	--	1	--	--	--	--	105	3
Sand shiner	4	--	--	--	--	--	--	--	315	10
Redfin shiner	--	--	--	--	--	--	--	--	1	<1
Bluntnose minnow	1	55	--	--	--	3	--	--	300	10
Fathead minnow	--	--	1	2	2	22	3	--	90	3
Creek chub	--	--	--	--	--	--	--	--	4	<1
Carp X Goldfish	--	1	1	40	4	91	10	53	205	8
CATOSTOMIDAE										
White sucker	--	--	--	--	--	--	--	--	34	1
Golden redhorse	--	--	--	3	--	--	--	--	3	<1
ICTALURIDAE										
Black bullhead	--	--	--	--	--	--	--	1	75	2
Yellow bullhead	--	--	--	--	--	--	--	--	19	1
Channel catfish	--	--	--	--	--	--	--	--	1	<1
Stonecat	--	--	--	--	--	--	--	--	1	<1
Tadpole madtom	--	--	--	--	--	--	--	--	9	<1
CYPRINODONTIDAE										
Blackstripe topminnow	--	--	--	--	--	--	--	--	21	1
GASTEROSTEIDAE										
Brook stickleback	--	--	--	--	--	--	--	--	1	<1
PERICHTHYIDAE										
Yellow bass	--	--	--	--	--	--	--	--	4	<1
CENTRARCHIDAE										
Rock bass	--	--	--	--	--	--	--	--	3	<1
Green sunfish	--	4	1	9	1	18	1	15	534	18
Pumpkinseed	--	--	--	--	--	--	--	--	32	1
Warmouth	--	--	--	--	--	--	--	--	2	<1
Bluegill	--	--	--	2	--	2	--	4	390	13
Smallmouth bass	--	--	--	--	--	--	--	--	3	<1
Largemouth bass	1	--	1	--	--	--	--	2	35	1
White crappie	--	--	--	--	--	--	--	--	3	<1
Black crappie	--	--	1	--	--	--	--	2	46	2
Pumpkinseed X Bluegill	--	--	--	--	--	--	--	--	1	<1
Green sunfish X Pumpkinseed	--	--	--	--	--	--	--	--	2	<1
Green sunfish X Bluegill	--	--	--	--	--	--	--	--	1	<1
PERCIDAE										
Johnny darter	--	--	--	--	--	--	--	--	47	2
Banded darter	--	--	--	--	--	--	--	--	1	<1
Yellow darter	--	--	--	--	--	--	--	--	1	<1
Blackside darter	--	--	--	--	--	--	--	--	6	<1
TOTAL NUMBER OF INDIVIDUALS	8	77	7	173	17	184	27	173	3058	100
TOTAL NUMBER OF SPECIES	4	6	5	7	4	7	4	7	39	--
SPECIES DIVERSITY ($\bar{d}$)	1.75	1.38	2.32	1.89	1.75	1.55	1.38	2.13	--	--
EQUITABILITY (e)	1.0	0.5	1.1	0.6	0.9	0.4	0.7	0.9	--	--

Table 13-5. Location of 1976 IEPA Water Quality Sampling Sites, Upper Des Plaines River Basin.

Basin Code	Station Number	Stream Name	Description
Des Plaines River			
G	07	Des Plaines River	RT 120-Belvidere RD BR E of GRAYSLK
G	08	Des Plaines River	Russell RD BR 1 MI DS WIS line
G	09	Des Plaines River	RT 137-Buckley RD BR N of LIBERTYVL
G	10	Des Plaines River	Lake-Cook CO line RD BR
G	13	Des Plaines River	Palatine RD BR SW of Northbrook
G	14	Des Plaines River	RT 62-Oakton ST BR at Des Plaines
G	15	Des Plaines River	Irving Park RD BR at Schiller Park
G	16	Des Plaines River	RT 38-Roosevelt RD BR at Forest PK
G	20	Des Plaines River	RT 60-Town Line RD BR S of LIBERTYVL
Silver Creek			
GM	01	Silver Creek	First AVE BR at Maywood
Crystal Creek			
GN	01	Crystal Creek	Des Plaines River RD BR Schiller PK
Willow Creek			
GO	01	Willow Creek	Des Plaines River RD BR Rosemont
Weller's Ditch			
GP	01	Weller's Ditch	Des Plaines River RD BR Des Plaines
Wheeling Drainage Ditch			
GS	01	Wheeling DRNG Ditch	US45-RT 21-Milwaukee AVE BR
Indian Creek			
GU	01	Indian Creek	US45-RT 21-Milwaukee AVE BR
Mill Creek			
GW	01	Mill Creek	US41-Skokie HWY BR at Wadsworth

Table 13-6. Bluegill Toxicity Indices, Upper Des Plaines River Basin. (Derived from mean values of 1976 Illinois Environmental Protection Agency data.)

	Station	BGTU
Des Plaines River	G08	0.070
Mill Creek	GW01	3.425
Des Plaines River	G07	6.133
	G09	0.153
	G20	0.162
Indian Creek	GU01	0.059
Des Plaines River	G10	0.156
Wheeling Drainage Ditch	GS01	0.063
Des Plaines River	G13	1.025
Wellers Ditch	GP01	141.807
Des Plaines River	G14	0.133
Willow Creek	GO01	0.108
Crystal Creek	GN01	0.136
Des Plaines River	G15	0.135
Silver Creek	GM01	1.125
Des Plaines River	G16	0.156

Table 13-7. Summary, 1976 IEPA Water Quality Data, Upper Des Plaines River Basin. (Maximum, minimum, mean, and number of analyses (in parentheses) for parameters (based upon Illinois Environmental Protection Agency Water Quality Network Summary for 1976) contributing significantly to the BGTU.)

IEPA Station	Amm-N (mg l^{-1})	CN (mg l^{-1})	MBAS (mg l^{-1})	Ag (mg l^{-1})
Des Plaines River				
G08	.00 - .47	.000 - .000	.30 - .40	.000 - .000
	.12 (9)	.000 (3)	.35 (2)	.000 (3)
Mill Creek				
GW01	.01 - 1.10	.000 - .000	.30 - .30	.000 - .040
	.33 (7)	.000 (3)	.30 (2)	.013 (3)
Des Plaines River				
G07	.00 - 27.0	.000 - .020	.30 - .40	.000 - .070
	3.47 (9)	.007 (3)	.35 (2)	.023 (3)
G09	.04 - 22.0	.000 - .000	.30 - .40	.000 - .000
	2.90 (9)	.000 (3)	.35 (2)	.000 (3)
G20	.09 - 15.0	.000 - .000	.40 - .40	.000 - .000
	2.90 (9)	.000 (3)	.40 (2)	.000 (3)
Indian Creek				
GU01	.00 - .86	.000 - .000	.30 - .50	.000 - .000
	.31 (8)	.000 (3)	.40 (2)	.000 (3)
Des Plaines River				
G10	.08 - 7.8	.000 - .000	.40 - .40	.000 - .000
	2.45 (8)	.000 (3)	.40 (2)	.000 (3)
Wheeling Drainage Ditch				
GS01	.00 - .14	.000 - .000	.20 - .70	.000 - .000
	.05 (8)	.000 (3)	.45 (2)	.000 (3)
Des Plaines River				
G13	.09 - 4.30	.000 - .060	.40 - .40	.000 - .010
	1.69 (9)	.020 (3)	.40 (2)	.003 (3)
Weller Ditch				
GP01	1.40 - 22.0	.020 - .280	1.20 - 1.20	.000 - .150
	5.53 (8)	.120 (3)	1.20 (1)	.075 (2)
Des Plaines River				
G14	.14 - 3.90	.000 - .000	.20 - .20	.000 - .000
	1.69 (8)	.000 (3)	.20 (1)	.000 (3)
Willow Creek				
GO01	.08 - 5.50	.000 - .000	.80 - .80	.000 - .000
	1.08 (8)	.000 (2)	.80 (1)	.000 (2)
Crystal Creek				
GN01	.25 - 6.10	.000 - .000	.40 - .40	.000 - .000
	2.07 (8)	.000 (3)	.40 (1)	.000 (3)
Des Plaines River				
G15	.16 - 4.20	.000 - .000	.40 - .40	.000 - .000
	1.60 (8)	.000 (2)	.40 (1)	.000 (2)
Silver Creek				
GM01	.02 - 1.70	.130 - .130	--	.000 - .000
	.44 (5)	.130 (1)	--	.000 (1)
Des Plaines River				
G16	.12 - 1.80	.000 - .010	.40 - .40	.000 - .000
	.74 (7)	.003 (3)	.40 (1)	.000 (3)
IPCB STANDARDS	1.50	.025	--	.005

CHAPTER FOURTEEN: UNION/VIRGIL DITCH

LOCATION AND BASIN MORPHOMETRY

The Union/Virgil Ditch watershed considered in this study is located in the northwest corner of Kane County, Illinois (Fig. 14-1). It terminates at the Kane/DeKalb County line in the west and Elburn in the east. The ditch drains a small area of approximately 9,065 ha.

This drainage basin is a network of low gradient ditches (0.6 m km^{-1}). Union Ditch #3 is an order 4 stream when it leaves Kane County. The drainage net is trellis-like. Union Ditch #3 is overdeveloped at the order 1 and order 3 levels and underdeveloped at the order 2 level. It never reaches the potential order 5 stream of a fully bifurcate dendritic pattern. Morphometric data are summarized in Table 14-1.

Table 14-1. Summary of Morphometric Data for Union/Virgil Ditch.

Order	Number Links	Mean Length (km)	Total Length (km)
1	18	2.63	47.3
2	6	1.58	9.5
3	8	2.40	19.2
4	2	2.30	4.6
			Total = 80.6

SUMMARY OF FISHERY DATA

Fish collections were not secured from Union/Virgil Ditch by the Metropolitan Sanitary District of Greater Chicago. Collections had been taken recently from one station by the Illinois Natural History Survey (Table 14-2; Fig. 14-2).

Table 14-2. Location of 1962 Illinois Natural History Survey Fish Sampling Sites, Union/Virgil Ditch Basin.

Number	Stream	Location
7	Union Drainage Ditch	T40N/R R6E 19NW; Kane County; 3 mi E of Maple Park.

Illinois Natural History Survey records indicate that 16 species should be present in Union/Virgil Ditch (Table 14-3). Eleven species were taken in the most recent collection (Table 14-4).

Though data is limited, the available information indicates good quality fisheries exist in the Union/Virgil Ditch watershed. Over one-third of the fishes are considered ecologically intolerant. Also, species diversity and equitability values are high.

SUMMARY OF WATER QUALITY DATA

The Illinois Environmental Protection Agency has no water quality data for Union/Virgil Ditch.

CONCLUSIONS

Fishery and water quality data for Union/Virgil Ditch are limited. The area contains little or no urban and industrial development. Therefore, the good quality fisheries, which were apparent in collection from the recent past, continue to exist in the watershed. Figure 14-3 depicts stream environmental quality.

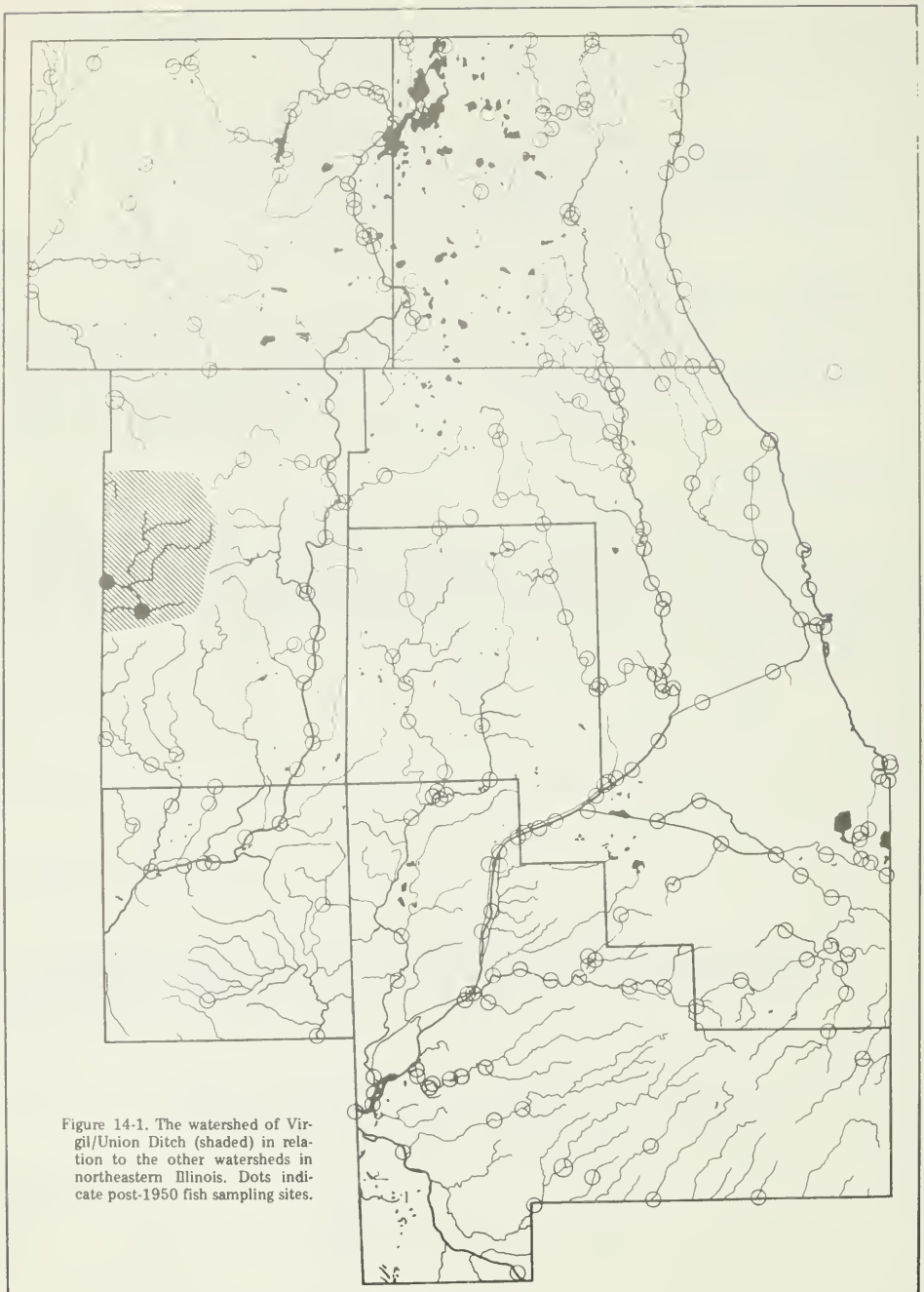


Figure 14-1. The watershed of Virgil/Union Ditch (shaded) in relation to the other watersheds in northeastern Illinois. Dots indicate post-1950 fish sampling sites.

Figure 14-2. Virgil/Union Ditch Basin: Location of fish (circles) sampling sites. Station numbers correspond to sampling sites of the Illinois Natural History Survey fish inventory.

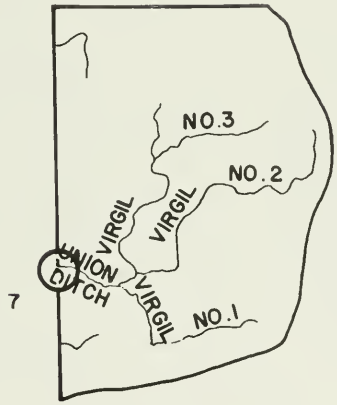


Figure 14-3. Virgil/Union Ditch Basin: Summary of environmental quality.

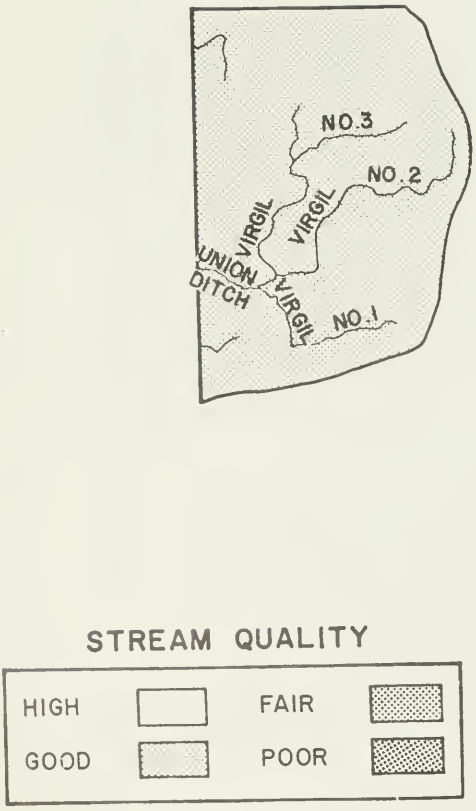


Table 14-3. Checklist of Fishes Known to Occur in Union/Virgil Ditch Basin.

Salmoniformes

Esocidae - Pikes

Esox lucius Linnaeus
Northern pike

Cypriniformes

Cyprinidae - Minnows and Carps

Campostoma anomalum (Rafinesque)
Stoneroller

Nocomis biguttatus (Kirtland)
Hornyhead chub

Notrpois cornutus (Mitchill)
Common shiner

Notropis dorsalis (Agassiz)
Bigmouth shiner

Notropis stramineus (Cope)
Sand shiner

Notropis umbratilis (Girard)
Redfin shiner

Phoxinus erythrogaster (Rafinesque)
Southern redbelly dace

Pimephales notatus (Rafinesque)
Bluntnose minnow

Semotilus atromaculatus (Mitchill)
Creek chub

Carp X Goldfish hybrid

Catostomidae - Suckers

Catostomus commersoni (Lacépède)
White sucker

Moxostoma macrolepidotum (Lesueur)
Shorthead redhorse

Table 14-3. Completed.

Perciformes

Centrarchidae - Sunfishes

Lepomis humilis (Girard)
Orangespotted sunfish

Percidae - Perches

Etheostoma nigrum Rafinesque
Johnny darter

Etheostoma zonale (Cope)
Banded darter

Percina maculata (Girard)
Blackside darter

Table 14-4. Illinois Natural History Survey 1962 Fish Inventory. Abundance of fishes at sampling site in Union/Virgil Ditch Basin. Species diversity ($\bar{d}$) and equitability (e) are expressed.

SPECIES	STATION 7_1	TOTAL NUMBER	% OF TOTAL
CYPRINIDAE			
Stoneroller	5	5	4
Hornyhead chub	1	1	1
Common shiner	8	8	7
Bigmouth shiner	37	37	31
Southern redbelly dace	40	40	34
Bluntnose minnow	10	10	8
Creek chub	2	2	2
CATOSTOMIDAE			
White sucker	2	2	2
PERCIDAE			
Johnny darter	7	7	6
Banded darter	1	1	1
Blackside darter	5	5	4
TOTAL NUMBER OF INDIVIDUALS	118	118	100
TOTAL NUMBER OF SPECIES	11	11	--
SPECIES DIVERSITY ($\bar{d}$)	2.56	--	--
EQUITABILITY (e)	0.7	--	--

$_1$1962

CHAPTER FIFTEEN: INTRODUCTION TO AQUATIC OLIGOCHAETA

This section of the report involves a critical habitat analysis for the aquatic Oligochaeta (Annelida: Clitellata) known or thought to occur throughout the major river systems (Des Plaines, Fox, Little Calumet, Chicago, Kishwaukee Rivers, the Fox Chain O' Lakes area, the Chicago Ship and Cal-Sag Canals, and the North Shore Diversion Channel) in the six county area under the jurisdiction of the Northeastern Illinois Planning Commission. Funding and time precluded analysis of all groups known to occur in this area. It was felt that aquatic Oligochaeta should be included in this report to supplement the fish study and to represent the dominant benthic macroinvertebrate community of the study area.

Aquatic Oligochaeta are collected from habitats associated with wide ranges of physical and chemical water characteristics. Many studies discussed by Brinkhurst and Jamieson (1971) suggest the lack of correlation between the overlying water characteristics, those species present, and the proportions to which those species are represented. Rather, the nature of the sediment or substrate appears to be the most significant factor influencing the distribution of aquatic oligochaetes.

The flow within the waterways of the region, because of its proximity to urban and industrial complexes, is considerably augmented periodically by storm water runoff during periods of rainfall and snowmelt, fluctuations in river traffic, and occasional backflow of water through the locks. This runoff results in severe scouring of the water system, disturbing the established fauna. The composition, distribution and relative abundance of the invertebrate fauna within these waterways is further disturbed and ultimately reduced by the constant investment of sand, gravel, road debris, and oils which are carried in during periods of light and heavy runoff. Heavy surges of calcium, magnesium, and sodium salts from winter month road conditioning may further hinder the establishment of aquatic communities.

A number of studies have addressed the distribution of oligochaete species in relation to depth. However, these studies have not considered lotic (running water) systems. Irwin Polls (pers. comm.) has suggested that *Tubifex tubifex* increases and *Limnodrilus hoffmeisteri* decreases in abundance below the 3 m depth in certain areas of the Metropolitan Sanitary District of Greater Chicago waterways.

In addition, many biological factors influence the distribution of oligochaetes. Respiration rates are directly related to temperature, dissolved oxygen and metabolic demands. Hynes (1960) states that when only very little oxygen remains in the water, or the river bed is completely covered with organic solids or sewage fungus, the main inhabitants are always the sludge-worms of the family Tubificidae. Palmer (1970) and Berg (1962) have shown that the respiration of tubificids is independent of the oxygen concentration of the surrounding water down to a very low level.

Palmer (1970) showed that *Tubifex tubifex* is able to regulate its rate of oxygen consumption down to a level of 1.5 percent of a mixture of oxygen and nitrogen at 20 °C. At this temperature, the actual dissolved oxygen concentration is about 0.6 mg l^{-1}. This is perhaps one of the main reasons for the apparent abundance of tubificids in areas of low dissolved oxygen, when there are few if any other macroinvertebrates or fishes present.

The increase in organic degradation of a particular area results in an increase in biological and chemical oxygen demand followed by a reduction in species diversity. This decrease in diversity is often accompanied by a reduction in interspecific competition for food and space. Oligochaetes, especially tubificids, will survive quite readily under these conditions, often with an increase in standing crop. Streams and rivers less grossly polluted may still support high productivity of oligochaetes, but with a much lower standing crop.

The biological influence of fish on benthic populations is complex. Fish can decrease directly the abundance of invertebrates through predation. Also, widespread disturbance of the water-substrate interface through stirring or behavioral displays destroys the protective microhabitats of the benthic organisms, increasing the availability of the benthos to invertebrate predators.

Differences between time and duration of breeding in different localities are related to productivity. The seasonal changes in population size may be related to breeding activity, climatic conditions, and/or intensity of predation. Natural seasonal variation in the abundance of certain species has the potential of greatly distorting oligochaete assemblages suggested by the results of infrequent or biased sampling procedures. Little is known concerning seasonal fluctuations of naidids. Several life cycle studies on tubificids have been done (Kennedy 1966a, 1966b; Jonasson and Thorhauge 1972). But Kennedy (1966a) strongly discourages generalization and application of tubificid life history studies done for a single locality.

The distributional data for aquatic Oligochaeta throughout these water systems is limited. The available reports concerned with this area are:

Brigham (1975) Illinois Coastal Zone Management Program - Dead River area

Howmiller (1974) - Fox River

Metropolitan Sanitary District of Greater Chicago (MSDGC), "Part II-1975 Summary of Biological Data within the Waterways of the Metropolitan Sanitary District" - Chicago River and the Calumet River Systems

MSDGC (1977a) - North Branch of the Chicago River, North Shore Channel, and Salt Creek

MSDGC (1977b) - Cal-Sag Channel, Chicago Sanitary and Ship Canal, lower branch of the North Branch of the Chicago River, North Shore Channel, and the South Fork of the South Branch of the Chicago River

Schacht (1974) - South Branch of the Kishwaukee River
Schacht and Matsunaga (1975a) - DuPage River
Schacht and Matsunage (1975b) - Des Plaines River

These reports indicate oligochaetes are the dominant group of benthic invertebrates in many of the Chicago area watersheds. Within the Chicago River, oligochaetes represented at least 81% of the total biomass in the southern portion of the river, and at least 87% in the northern portion (MSDGC, 1975). Another study determined that pollution tolerant aquatic oligochaetes were the dominant benthic macroinvertebrates, comprising over 90% of the community at all but two stations in the deep draft waterways in Cook County (MSDGC, 1977b). Aquatic Oligochaeta represented 73% or more of the invertebrate biomass throughout the Calumet River system (MSDGC, 1975). Salt Creek benthos was composed of oligochaetes and chironomids, which totaled greater than 90% of the total biomass (MSDGC, 1977a). Oligochaetes were commonly found in many other watersheds in the study area, yet they were not necessarily the dominant organisms.

Mozley and Howmiller (1977) review the indicator value of species assemblages of aquatic oligochaetes. It is suggested that although little is known concerning the specific factors affecting distribution of these species, certain species seem to regularly occur in like environments. A number of species are listed by Mozley and Howmiller (1977) according to the degree of enrichment of the areas in which they have been collected regularly. This information is used here, in conjunction with the published data, to suggest the type of oligochaetes known or thought to occur in this six county area. The following eight families are known or thought to occur in the study area.

AEOLOSOMATIDA

Aeolosomatida (*sensu* Singer 1977) is a group of mostly freshwater annelids. Members of this family are often overlooked because of their extremely small size (0.5 - 3.5 mm). Aeolosomatid distribution is generally limited by oxygen deprivation and lack of suitable organic substrate for feeding. In lentic habitats, members of the genus *Aeolosoma* are most commonly found grazing on detritus-covered macrophytes and substrate areas. Aeolosomatids are also collected frequently in slow-flowing streams which pass through woodlands. Fast-flowing streams and rivers cannot support populations of these annelids because of the grinding action of waves. However, backwater areas and shallow mud flats along waterways could provide suitable habitats for this group of worms (Singer 1977). The two species of aeolosomatids which may occur within this study area include *Aeolosoma hemprichi* and *A. variegatum*.

BRANCHIOBDELLIDA

These aquatic annelids live attached to the bodies of freshwater crustaceans such as astocoidean crayfish, freshwater shrimp, crabs, and isopods (Holt 1974). Often, the same host harbors several species (Holt 1974). Since these annelids are epizoites on host crustaceans, their water quality requirements are reflected by the host species. Hole (1974) suggests that these annelids are extremely intolerant to some inorganic pollutants such as coal-mine effluents and sulfates. Blackford (1966, as seen in Holt 1974) demonstrated the tolerance of these worms to low oxygen concentrations, suggesting the possibility that they are facultative anaerobes.

ENCHYTRAEIDAE

Howmiller (1974) reviews the major Great Lakes research reports concerning oligochaetes. The most common taxon of the enchytraeids collected from Lake Michigan seems to be of the genus *Lumbricillus*. One other specimen collected appears to be of the *Henlea-Enchytraeus* group. Since the majority of the known enchytraeids are thought to be terrestrial, the possibility exists that some of these same species may also tolerate highly organically enriched water systems in the presence of marginal dissolved oxygen.

GLOSSOSCOLECIDAE

The family Glossoscolecidae is represented in North America by one species, *Sparganophilus tamesis*. Little is known concerning its distribution or life history other than it has been collected in Lake Michigan.

HAPLOTAXIDAE

This family is represented in the study area by one species, *Haplotaxis gordioides*. It is known to be primarily an inhabitant of ground waters, springs and wells. Subterranean sources of water entering the open waters of this study area may account for its presence.

LUMBRICULIDAE

This family is represented in this area by two species, *Stylodrilus heringianus* and *Lumbriculus variegatus*. *Lumbriculus variegatus* will probably be the dominant lumbriculid within the river systems of the study area. The restriction of this species to littoral habitats

(Brinkhurst and Jamieson 1971) and its previous collection from other lotic (flowing water) habitats suggest that it may be more widespread than is presently known. This species probably does not tolerate highly eutrophic conditions, but probably can be found occasionally in waters of good to high quality. Additional documentation of this species is necessary.

NAIDIDAE

Naidids occur widely throughout lentic (still water) as well as lotic (flowing water) habitats, primarily in littoral areas. Their habitat preferences include association with free-floating and rooted aquatic and semi-aquatic vegetation, with some specimens taken from inside the vascular tissue of certain plants. Members of this family have been collected extensively from within mosses and among stones, rocks and coarse sand. Naidids have been collected free-swimming in ponds, marshes, and lakes, as well as flowing systems, seemingly preferring areas with little if any current disturbances, although they have been collected from under sand and rocks in fast-flowing streams. The two subspecies of *Chaetogaster limnaei* are associated with pulmonate gastropods as commensal parasites.

TUBIFICIDAE

This family includes species with the greatest diversity and abundance commonly encountered in the study area. Members of this family also demonstrate a wide range of tolerance within each genus. The assemblages found commonly in the field are a direct result of the adaptability of some species to extreme periodic fluctuations of water quality.

Members of this family are often collected in great numbers, sometimes exclusive of individuals from other families, from areas of high organic ooze, and to a somewhat lesser extent from areas with sandy oozes (Poddubnaya 1973) or areas with organic debris such as decaying leaves, sticks and logs. Tubificids are often collected from sandy areas intermixed with rock, gravel or pebbles, but their abundance within these substrates is very low. Tubificids seem to prefer areas such as silt beds, backwater pools along rivers and streams, and those areas subject to untreated as well as treated municipal, industrial and livestock sewage.

OLIGOCHAETA AS WATER QUALITY INDICATORS

Resh and Unzicker (1975) reviewed water quality monitoring schemes, emphasizing the importance of species level identification. It is unfortunate that in the past, most investigators have referred to those individuals of aquatic Oligochaeta simply as oligochaetes, Tubificidae, or

Tubifex. Whether those identifications were legitimate or not is certainly questionable. For this reason, the majority of the studies reviewed for this critical habitat assessment will rely on biomass data and assessments done on other comparable drainage systems. Distribution of tubificids in relation to pollution have been discussed by Brinkhurst (1966, 1970) and Brinkhurst, *et al* (1969). These studies suggest that although tubificids can be used as indicators of organic pollution, attention should be directed towards the relative abundance of worms to those of other benthic macroinvertebrates and not just to the presence (or absence) of certain species. Table 15-1 lists the species known or thought to occur in this six-county area and their relative abundance within each of the four stream quality designations.

Good and high quality aquatic habitats would contain various species of Oligochaeta, yet these species would not be abundant. Fair quality habitats probably would contain an abundance of three species of Tubificidae: *Limnodrilus cervix* Brinkhurst, *Limnodrilus hoffmeisteri* Claparède, and/or *Tubifex tubifex* (Müller). *Limnodrilus cervix* Brinkhurst and/or *Limnodrilus hoffmeisteri* Claparède would be dominant in a poor quality environment.

CONCLUSIONS

The assignment of species of aquatic Oligochaeta to specific levels of habitat quality without sufficient documented distributional information is questionable. The reader should be aware that many species are thought to occur over a wide range of habitat qualities, with variances noticed in the relative abundance of certain species during different periods of flow and year. The works available presently for assessment of this area are of marginal value for evaluating the oligochaete population, since all but three refer to the oligochaetes at ordinal or familial level. Biomass data suggest the overwhelming dominance of oligochaetes in the benthic communities. This generally implies fair to poor quality of those sampled areas in the waterway systems, especially when common predators of oligochaetes are limited or absent from these polluted sites.

The effect of an organized pollution abatement program with emphasis on aquatic resource planning could be realized in the near future. The initial effect would be an increase in both numbers and diversity of those invertebrates and fish marginally tolerant of pollution, followed later by an increase in diversity and abundance of intolerant organisms. Increased deposition of organic and inorganic pollutants will only serve to stress those few remaining benthic community assemblages, perhaps resulting in the near-complete elimination of aquatic life.

Table 15-1. Relative Abundance of Aquatic Oligochaetes Known or Likely to Occur in the Representative Aquatic Habitats of Northeastern Illinois.

SPECIES	Presence of Species in Representative Habitats[1]			
	High	Good	Fair	Poor
AEOLOSOMATIDA				
Aeolosoma hemprichi Ehrenberg	U	U	R	
A. variegatum Vejdovský	U	U	R	
BRANCHIOBDELLIDA	C	C	U	R
ENCHYTRAEIDAE				
at least two species	U	U	U	
GLOSSOSCOLECIDAE				
Sparganophilus tamesis Benham	R	R	R	
HAPLOTAXIDAE				
Haplotaxis gordioides (Hartmann)	R	R	R	
LUMBRICULIDAE				
Lumbriculus variegatus (Müller)	R	U	R	
Stylodrilus heringianus Claparède	U	R	R	
NAIDIDAE				
Amphichaeta sp.	R	U	R	R
Arcteonais lamondi (Martin)	R	U	R	R
Chaetogaster diaphanus (Gruithuisen)	U	U	R	
C. limnaei limnaei von Baer	U	R	R	
C. limnaei vaghini Gruffydd	R	R	R	
Dero (Aulophorus) furcatus (Müller)	R	R	R	
D. (Aulophorus) vagus Leidy	R	R	R	
D. (Dero) digitata (Müller)	U	U	U	R
Nais sp.	U	U	R	
N. barbata Müller	U	U	R	
N. communis Piguet	U	U	R	
N. elinguis Müller	U	U	R	
N. pardalis Piguet	R	R	R	
N. pseudoobtusa Piguet	U	U	R	
N. simplex Piguet	R	R	R	
Ophidonais serpentina (Müller)	R	R	R	
Piguetiella michiganensis Hiltunen	U	R	R	
Pristina breviseta Bourne	U	R	R	
P. idrensis Sperber	R	R	R	
P. longiseta leidyi Smith	U	R	R	

[1]A = abundant, C = common, U = uncommon, R = rare

Table 15-1. Completed.

SPECIES	Presence of Species in Representative Habitats[1]			
	High	Good	Fair	Poor
NAIDIDAE (continued)				
Slavina appendiculata d'Udekem	R	R	R	
Specaria josinae (Vejdovský)	R	R	R	
Stylaria fossularis Leidy	U	U	R	
S. lacustris (Linnaeus)	U	U	R	
Uncinais uncinata (Ørsted)	R	R	R	
Vejdovskyella intermedia (Bretscher)	R	R	R	
TUBIFICIDAE				
Aulodrilus americanus Brinkhurst & Cook	R	U	U	
A. limnobius Bretscher	R	R	R	
A. pigueti Kowalewski	R	U	U	R
A. pluriseta (Piguet)	U	U	R	
Branchiura sowerbyi Beddard	R	U	U	U
Ilyodrilus templetoni (Southern)	R	U	U	R
Limnodrilus angustipenis Brinkhurst & Cook	R	R	U	
L. cervix Brinkhurst	U	U	A	A
L. claparedianus Ratzel	U	C	C	U
L. cervix-claparedianus variant	U	U	C	C
L. hoffmeisteri Claparède	U	C	A	A
L. hoffmeisteri hybrids	U	U	C	U
L. maumeensis Brinkhurst & Cook	R	R	U	U
L. profundicola (Verrill)	U	R	R	
L. udekemianus Claparède	U	U	U	U
Peloscolex ferox (Eisen)	R	U	U	R
P. freyi Brinkhurst	R	U	R	R
P. multisetosus multisetosus (Smith)	R	U	U	U
P. multisetosus longidentus Brinkhurst & Cook	R	R	U	R
P. superiorensis Brinkhurst & Cook	U	R	R	
P. variegatus Leidy	U	R	R	
Potamothrix hammoniensis (Michaelsen)	R	U	U	R
P. moldaviensis Vejdovský & Mràzek	R	U	U	R
P. vejdovskyi (Hrabě)	R	U	R	R
Psammoryctides curvisetosus Brinkhurst & Cook	R	R	R	
Rhyacodrilus coccineus (Vejdovský)	R	R	R	
R. montana (Brinkhurst)	R	R	R	
Tubifex ignotus (Stôlc)	R	R	R	
T. kessleri americanus Brinkhurst & Cook	U	R	R	
T. tubifex (Müller)	U	U	A	C

[1]A = abundant, C = common, U = uncommon, R = rare

CHAPTER SIXTEEN: CONCLUSIONS

The watersheds in northeastern Illinois have undergone considerable physical and chemical alteration by man. The inner city area of Chicago has undergone the most drastic changes. This area has had canals dug, reversing the flow of rivers, channelization and dredging of existing waterways, and a growing industrial "usage", frequently resulting in toxic run-off. As expected, the lower quality aquatic habitat is centered in this industrial-urban area (Fig. 16-1). The surrounding watersheds increase in quality with distance from the urban core. These areas also exhibit a reduction in urban and industrial development.

The low quality watersheds characteristically had reduced fish populations which consisted of tolerant species and had bluegill toxicity index values which were greater than 0.200. The parameters having the greatest effect on the index calculations and, thus, the habitat, are ammonia nitrogen, silver, cyanide, MBAS, fluoride, and total iron (listed in order of decreasing importance). Other parameters had little efect on the calculations. Nickel, mercury, and chromium (trivalent and hexavalent) were not detected in over half of the watersheds.

There exists a competing interest for the use of water in the study area. In various waterways, industrial use has received priority over other water uses. The quality of the aquatic habitat remains low in these systems. It is perhaps not a best use of current resources to focus intensive restoration efforts on such waterways. Of greater importance at this time are those areas undergoing rapid urban and industrial growth which now contain aquatic habitat of high to fair quality. In these areas, the upcoming management program must first prioritize the uses of the water. It is understood that aquatic life uses must be in competition with industrial and other uses. Based upon our analysis of data from northeastern Illinois we have found that high quality aquatic habitat exists in the Fox River, Hickory Creek, Kankakee River, and Kishwaukee River. We feel that maintenance of the aquatic biota should receive priority in these streams.

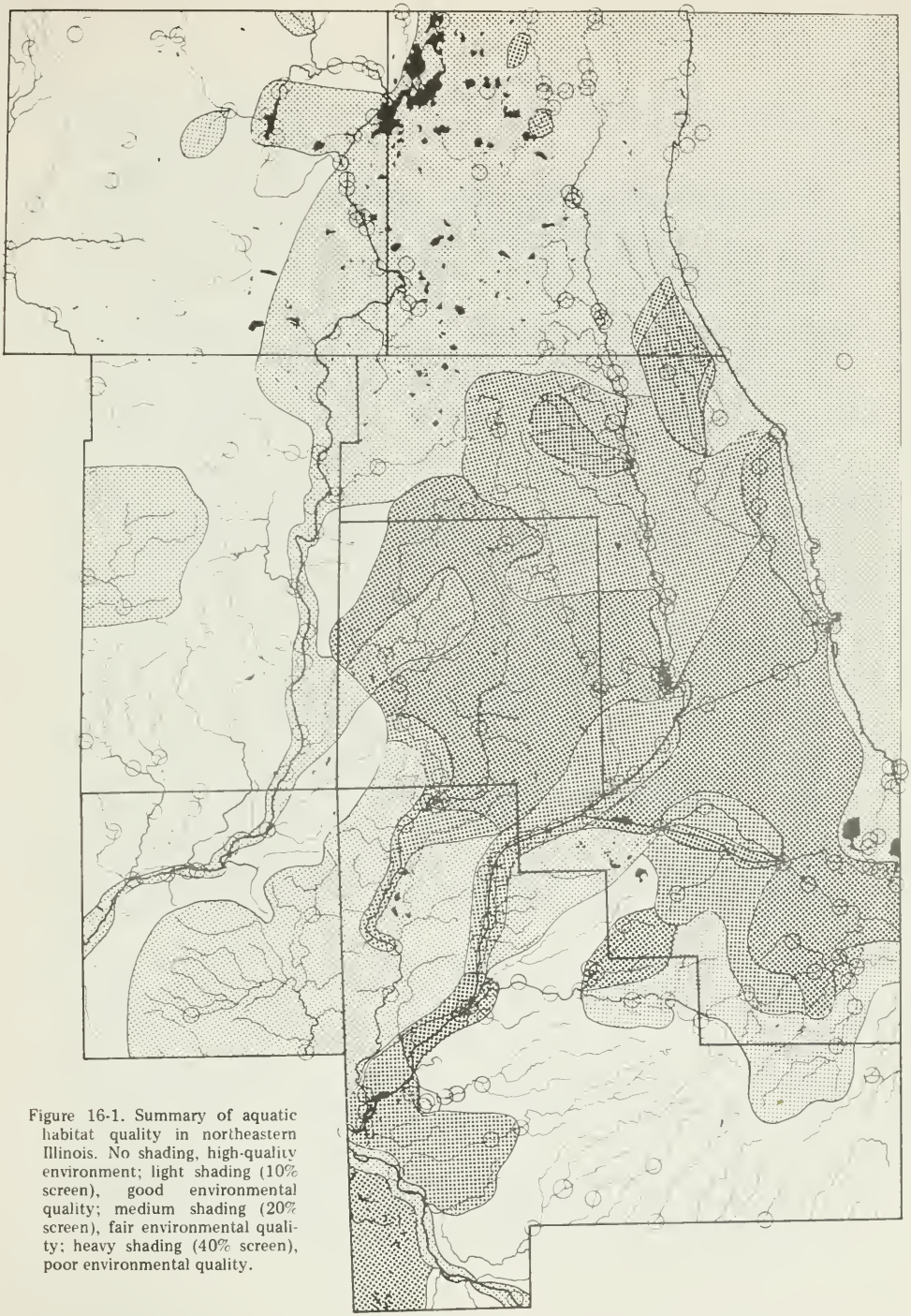


Figure 16-1. Summary of aquatic habitat quality in northeastern Illinois. No shading, high-quality environment; light shading (10% screen), good environmental quality; medium shading (20% screen), fair environmental quality; heavy shading (40% screen), poor environmental quality.

LITERATURE CITED

Anonymous. 1973. Final Report, 1972-1973 aquatic monitoring program for Braidwood station, Westinghouse Environ. Syst. Dept.

Anonymous. 1975. Final Interpretative Report, 1974-1975 aquatic monitoring program for the Braidwood station, Westinghouse Environ. Syst. Dept.

Applegate, C., H. Howell, W. Moffett, B. G. H. Johnson, and A. Smith. 1961. Use of 3-trifluormethyl-4 nitrophenol as a selective sea lamprey larvicide. Great Lakes Fish. Comm. Tech. Rep. 1. 35 pp.

Berg, K., P. Jónasson, and K. W. Ockelmann. 1962. The respiration of some animals from the profundal zone of a lake. Hydrobiologia 19(1):1-39.

Blackford, S. 1966. A study of certain aspects of the ecology and morphology of branchiobdellid annelids epizoic on *Callinectes sapidus*. Unpubl. sr. thesis, Newcomb College, Tulane Univ.

[Brigham, W. U., ed.]. 1976. Illinois coastal zone management program: component study of biological communities, final report. Illinois Nat. Hist. Surv., Urbana. v + 197 pp.

Brinkhurst, R. O. 1966. The Tubificidae (Oligochaeta) of polluted waters. Verh. Internat. Vereirn. Limnol. 16(2):854-859.

Brinkhurst, R. O. 1970. Distribution and abundance of tubificid (Oligochaeta) species in Toronto Harbour, Lake Ontario. J. Fish. Res. Bd. Canada 27(11):1961-1969.

Brinkhurst, R. O., K. E. Chua, and E. Batoosingh. 1969. Modifications in sampling procedures as applied to studies on the bacteria and tubificid oligochaetes inhabiting aquatic sediments. J. Fish. Res. Bd. Canada 26(10):2581-2593.

Brinkhurst, R. O., and B. G. M. Jamieson. 1971. Aquatic Oligochaeta of the world. Univ. Toronto Press, Toronto. 860 pp.

Greene, C. W. 1935. The distribution of Wisconsin fishes. Wisconsin Conserv. Comm., Madison. 235 pp.

Herbert, D. W. M., D. H. M. Jordon, and R. Lloyd. 1965. A study of some fishless rivers in the industrial Midlands. J. Proc. Inst. Sew. Purif. 569 pp.

Holt, P. C. 1974. The branchiobdellid (Annelida: Clitellata) associates of astaciodean crayfishes. Paper presented at the 2nd Internat. Crayfish Symposium, Baton Rouge, Louisiana, April, 1974.

Horton, R. E. 1945. Erosional development of streams and their drainage basins; hydrophysical approach to quantitative morphology. Bull. Geol. Soc. Amer. 56:275-370.

Howmiller, R. P. 1974. Composition of the oligochaeta fauna of central Lake Michigan. Proc. 17th Conf. Great Lakes Res. pt. 1:589-592.

Hubbs, C. L., and K. F. Lagler. 1964. Fishes of the Great Lakes region, 3rd edition. Univ. Michigan Press, Ann Arbor. 213 pp.

Hubbs, C. L., and T. E. B. Pope. 1937. The spread of the sea lamprey through the Great Lakes. Michigan Conserv. 6(12):5-6, 9.

Hynes, H. B. N. 1960. The biology of polluted waters. Univ. Toronto Press, Toronto. 202 pp.

Illinois Environmental Protection Agency. 1976. Water quality network: summary of data, vol. 2, Illinois, Fox, Sangamon, and Kankakee basins. Illinois Environ. Protection Agency, Springfield, pp. 89-245.

Illinois Environmental Protection Agency. 1976. Water quality network: summary of data, vol. 3, Des Plaines River basin. Illinois Environ. Protection Agency, Springfield, pp. 246-382.

Illinois Environmental Protection Agency. 1976. Water quality network: summary of data, vol. 4, Mississippi River/South, South Central, Central, north Central, North, Big Muddy River, Kaskaskia River, and Rock River basins. Illinois Environ. Protection Agency, Springfield, pp. 387-547.

Illinois Environmental Protection Agency. 1976. Water quality network: summary of data, vol. 5, Lake Michigan and its tributaries. Illinois Environ. Protection Agency, Springfield, pp. 548-581.

Jónasson, P. M., and F. Thorhauge. 1972. Life cycle of *Potamothrix hammoniensis* (Tubificidae) in the profundal of a eutrophic lake. Oikos 23(2):151-158.

Kennedy, C. R. 1966a. The life history of *Limnodrilus hoffmeisteri* Clap. (Oligochaeta: Tubificidae) and its adaptive significance. Oikos 17(2):158-168.

Kennedy, C. R. 1966b. The life history of *Limnodrilus udekemianus* Clap. (Oligochaeta: Tubificidae). Oikos 17(1):10-18.

Kuehne, R. A. 1962. A classification of streams, illustrated by fish distribution in an eastern Kentucky creek. Ecology 43(4):608-614.

Lloyd, M., J. H. Zar, and J. R. Karr. 1968. On the calculation of information--theoretical measures of diversity. Amer. Midl. Nat. 79(2):257-272.

Lopinot, A. C. 1970. 1969 creek survey of the Illinois portion of Lake Michigan. Illinois Dept. Conserv. Spec. Fish. Rep. No. 32. 46 pp.

Lopinot, A. C. 1974. Illinois fishery of Lake Michigan. Illinois Dept. Conserv. Div. Fish., Springfield. 47 pp.

Lubinski, K. S., and R. E. Sparks. 1974. The development of toxicity indices dor assessing the quality of the Illinois River. Univ. Illinois Water Res. Cent. Res. Rept. No. 96. 46 pp.

MacArthur, R. H. 1957. On the relative abundance of bird species. Proc. Nat. Acad. Sci. 43:293-295.

Metropolitan Sanitary District of Greater Chicago. 1975. Part II, Summary of biological data within the waterways of the Metropolitan Sanitary District. 67 pp. Mimeo.

Metropolitan Sanitary District of Greater Chicago, Department of Research and Development. 1977a. 1974 annual summary report, water quality within the waterways system of the Metropolitan Sanitary District of Greater Chicago. Vol. 2, Biol. Rept. No. 77-25-B. 69 pp.

Metropolitan Sanitary District of Greater Chicago, Department of Research and Development. 1977b. Sediment oxygen demand of bottom deposits in deep draft waterways in Cook County. 51 pp.

Moffett, J. W. 1957. Recent changes in the deep-water fish populations of Lake Michigan. Trans. Amer. Fish. Soc. 86:393-408.

Mozley, S. C., and R. P. Howmiller. 1977. Environmental status of Lake Michigan. Vol. 6, zoobenthos of Lake Michigan. Argonne Nat. Lab., Argonne, Illinois. ANL/ES-40. 148 pp.

Muench, B. 1974. Unpublished report to Commonwealth Edison Company by Industrial Bio-Test, Inc. on Lake Michigan: Zion and Waukegan.

Nienkerk, M. M., and R. C. Femal. 1976. Regional distribution of the major dissolved solids in the streams of Illinois. Univ. Illinois Water Res. Cent. Res. Rept. No. 109. 56 pp.

Palmer, M. F. 1970. Aspects of the respiratory physiology of *Tubifex tubifex* in relation to its ecology. J. Zool., London. 154(4): 463-473.

Parsons, J. W. 1973. History of salmon in the Great Lakes, 1850-1970. U.S. Bur. Sport Fish. Wildl. Tech. Papers 68. 80 pp.

Pflieger, W. L. 1975. The fishes of Missouri. Missouri Dept. Conserv., Jefferson City. 343 pp.

Poddubnaya, T. L. 1973. Production of tubificids of the Ivan'kovo Reservoir in the vicinity of the discharge of effluent from the Konakovo Power Plant. Hydrobiol. J. 9(6):261-265.

Resh, V. H., and J. D. Unzicker. 1975. Water quality monitoring and aquatic organisms: the importance of species identification. J. Water Pollution Control Fed. 47(1):9-19.

Schacht, R. A. 1974. A biological investigation of the South Branch of the Kishwaukee River. Illinois Environ. Protection Agency, Springfield. 18 pp.

Schacht, R. A., and W. Matsunaga. 1975a. A biological investigation of the DuPage River. Illinois Environ. Protection Agency, Springfield. 28 pp.

Schacht, R. A., and W. Matsunaga. 1975b. A biological investigation of the Des Plaines River from the Wisconsin state line to Joliet, Illinois. Illinois Environ. Protection Agency, Springfield. 59 pp.

Singer, R. G. 1977. The biology of *Aeolosoma* (Annelida). Unpubl. Ph. D. thesis, Univ. Ill., Urbana. 166 pp.

Smith, P. W. 1965. A preliminary annotated list of the lampreys and fishes of Illinois. Illinois Nat. Hist. Surv. Biol. Notes No. 54. 12 pp.

Smith, P. W. 1971. Illinois streams: a classification based on their fishes and an analysis of factors responsible for disappearance of native species. Illinois Nat. Hist. Surv. Biol. Notes No. 76. 14 pp.

Smith, P. W. The fishes of Illinois. Illinois Nat. Hist. Surv. Spec. Publ., Univ. of Illinois, Urbana (in press).

Strahler, A. N. 1954. Quantitative geomorphology of erosional landscapes. C.-R. 19th Internat. Geol. Cong. sec. 13:341-354.

Strahler, A. N. 1957. Quantitative analysis of watershed geomorphology. Trans. Amer. Geophys. Union 38:913-920.

Tichacek, G., and H. Wight. 1973. Lake County surface water resources. Illinois Dept. Conserv. Div. Fish., Springfield. 162 pp.

Weber, C. I. 1973. Biological field and laboratory methods for measuring the quality of surface waters and effluents. U.S. Environ. Protection Agency, Environ. Monit. Ser. EPA-670/4-73-001. Unpaged.

Wells, L. 1968. Seasonal depth distribution of fish in southeastern Lake Michigan. Fish. Bull. 67:1-15.

Wells, L., and A. L. McLain. 1973. Lake Michigan. Man's effect on native fish stocks and other biota. Great Lakes Fish. Comm. Tech. Rept. 20. v + 55 pp.

Wilhm, J. L. 1970. Range of diversity index in benthic macroinvertebrate populations. J. Water Pollution Control Fed. 42(5):R221-R224.

Woods, L. P. 1970. The changing Great Lakes. Field Mus. Nat. Hist. Bull. 41(6):6-10, (8):6-11.