THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

DEPARTMENT OF RESEARCH AND DEVELOPMENT

REPORT NO. 82-6-B

1978 ANNUAL SUMMARY REPORT

WATER QUALITY WITHIN THE WATERWAYS SYSTEM OF THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

VOLUME 2

BIOLOGICAL

March 1982

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

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1978 ANNUAL SUMMARY REPORT WATER QUALITY WITHIN THE WATERWAYS SYSTEM OF THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

VOLUME II

BIOLOGICAL

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SUMMARY AND CONCLUSIONS

The results of bacterial, plankton, benthos and fish monitoring all indicate that the Des Plaines River exerted considerable stress on these aquatic life forms. The fecal coliform, oligochaete and fish data suggested that this stress was highest in the central portion of the river (between Ogden and Grand Avenue). This area contains a large number of combined sewer outfalls whose discharges can have high concentrations of ammonia during storm events. Settling of combined sewer overflow solids subsequent to storm events, can exert a demand which may result in dissolved oxygen levels approaching zero.

The following summarizes conditions on the Des Plaines River:

1. Fecal coliform counts throughout the study area ranged from 410 to 34,000 colony forming units per 100 ml of sample. Increases in fecal coliform counts were accompanied by substantial increases in the frequency of Salmonella isolation indicating increased fecal pollution of the study area especially in the central portion of Cook County, between Belmont Avenue and Ogden Avenue.
2. Total plankton counts were high throughout the study averaging 10,000 cells per ml. Chlorophyll a concentrations were also high, being greater than 10 micrograms per liter. The presence of pollution tolerant forms of

algae and weedy species of plankton and periphyton as well as a relatively low number of individual species indicated poor water quality throughout the Des Plaines River study area.

3. The most abundant group of macroinvertebrates present was the oligochaete population. The highest average density of worms was 69,878 per square meter at Roosevelt Road, and the lowest average density of worms was 401 per square meter found at County Line Road. County Line Road was the only station at which the oligochaetes were less than 60 percent of the bottom fauna. At all other stations, there were between 75 and 99.5 percent worms. Using the density of these worms as an index of organic pollution, the Des Plaines River in Cook County was found to be moderately to heavily polluted.

4. Fish species diversity was lowest between Grand Avenue and Salt Creek (upstream of Ogden Avenue). On the average, between 4 and 10 species were found in this area. In the same area, the proportion of goldfish and carp x goldfish hybrids to the total fish population was also high, averaging 33 to 93 percent, according to number, and 5 to 99 percent according to weight. The abundance of these stress-tolerant species as well as poor species diversity indicated poor water quality especially in the central portion of the Des Plaines River, between Grand Avenue (just upstream from Belmont Avenue) and Ogden Avenue.

I. INTRODUCTION

The Metropolitan Sanitary District of Greater Chicago (District) is responsible for the quality of the water in the streams and canals within its jurisdiction. In 1975 the District established its Ecosystematic Study Program to monitor these waterways. The biological research activities under this monitoring program are provided by the Research and Development Department's Biology Research Section. The field monitoring studies are handled by the following biology groups within the Biology Research Section: Analytical Microbiology, Aquatic Biology, Aquatic Ecology, and Fisheries.

From 1975-1977 the deep-draft waterways (Chicago and Calumet River Systems) were studied. For 1978 the monitoring efforts were concentrated in the portion of the Des Plaines River within Cook County.

According to the 1973 Water Quality Standards adopted by the Illinois Pollution Control Board (IPCB), the waters of the Des Plaines River were designated for general use. By definition, this means that the water is to be protected "... for aquatic life, agricultural use, primary and secondary contact use, and most industrial uses, and ensure the aesthetic quality of the State's aquatic environment."

River pollution can alter the community structure of aquatic ecosystems. Evaluation of the existing biological community structure can be useful in detecting pollution and in

quantifying the intensity of its effects. When a waterway is stressed, the more pollution tolerant organisms will increase in abundance, while the less tolerant will decrease. Effects of stress can be detected by examining population density estimates, species composition and species diversity of the aquatic community. The District's Biology Research Section monitored the bacteria, phytoplankton, benthic macroinvertebrate and fish communities of the Des Plaines River during 1978. These baseline data were assessed to establish the present water quality conditions of this waterway.

II. WATER QUALITY MONITORING

Description of Des Plaines River

The Des Plaines River Watershed area covers 428,700 acres (670 square miles) in Kenosha and Racine Counties in Wisconsin and Lake, Cook, Du Page, and Will Counties in Illinois. In Cook County, much of the river's adjacent flood plain is owned by the Cook County Forest Preserve District. As a recreational area it attracts large numbers of the County's population.

The Des Plaines River is a shallow, sluggish stream with an overall average drop of less than 1.0 foot per mile. It flows through a highly urbanized watershed from the Lake-Cook County line downstream to Highway 171 (Archer Avenue). There are five dams affecting the river flow for approximately 18 miles. From Highway 171 downstream to the Lockport Lock and Dam, the Des Plaines River flows parallel and adjacent to the Chicago Sanitary and Ship Canal.

Seven stations were sampled for bacteria, phytoplankton and benthos (See Figure 1 and Table 1); namely County Line Road (Station 39), Oakton Street (Station 41), Belmont Avenue (Station 42), Roosevelt Road (Station 43), Ogden Avenue (Station 46), Willow Springs Road (Station 47), and Stephen Street (Station 48). For fish, nine stations were sampled and are shown in Figure 1 and Table 2.

Types of Biological Samples

Four kinds of biological samples were collected in the

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FIGURE 1

DES PLAINES RIVER WATERWAY SAMPLING STATIONS

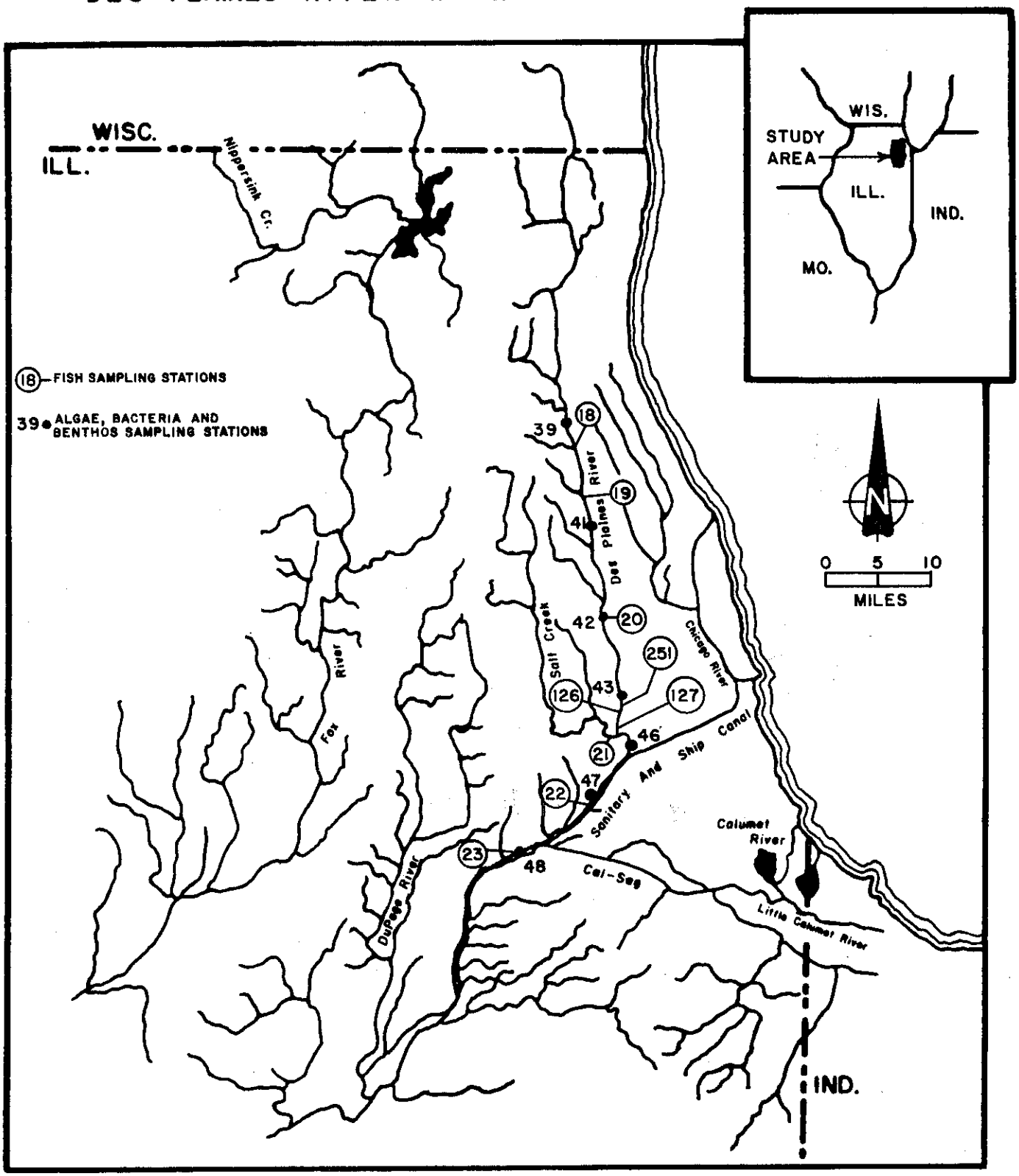

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TABLE 1

LIST OF BACTERIA, BENTHOS AND PHYTOPLANKTON SAMPLING STATIONS ON THE DES PLAINES RIVER

Station	
Number	Location*
39	County Line Road
41	Oakton Street
42	Belmont Avenue
43	Roosevelt Road
46	Ogden Avenue
47	Willow Springs Road
48	Stephen Street

*The water samples for analysis are taken from the upstream side of each bridge.

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TABLE 2

LIST OF FISH SAMPLING STATIONS

Station Number	Location*
18	River mile 74.0, T42N/R11E/S12SE; 1500 meters above Dam No. 1, Dundee Road, Wheeling, Illinois
19	River mile 67.0, T41N/R12E/S8SE; 400 meters upstream of Golf Road, Des Plaines, Illinois;
20	River mile 55.1, T40N/R12E/S27NE; 400 meters upstream from Grand Avenue, River Grove, Illinois;
251	River mile 49.1, T39N/R12E/S23NW; downstream of Roosevelt Road Bridge, Maywood, Illinois;
126	River mile 45.4, T38-39N/R12E/S2NE-35SE; 400 meters above mouth of Salt Creek, Forest Avenue, Lyons, Illinois;
127	River mile 45.2, T38N/R12E/S2NW; mouth of Salt Creek with Des Plaines River, First Avenue, Lyons, Illinois;
21	River mile 45.1, T38N/R12E/S2NW; 50 meters downstream of mouth of Salt Creek, Ogden Avenue, Lyons, Illinois;
22	River mile 35.2, T37N/R12E/S5NW; 515 meters south of Willow Springs Road, Willow Springs, Illinois;

*Station numbers taken from 1976 fish survey report (2). Station 251 at Roosevelt Road was not previously listed.

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TABLE 2 (Continued)

LIST OF FISH SAMPLING STATIONS

Station Number	Location*
23	River mile 28.2, T37N/R11E/S20NW; downstream of Stephen Street, Lemont, Illinois;

*Station numbers taken from 1976 fish survey report (2). Station 251 at Roosevelt Road was not previously listed.

Des Plaines River during the 1978 water quality monitoring program: (A) bacteria, (B) algae, (C) benthos, and (D) fish.

A. Bacteria

Bacterial analyses, which give an indication of the sanitary quality of the water, have been performed routinely on District waterways samples for several years. Coliform, and the more specific fecal coliform and fecal streptococcus tests, are used extensively by the District to determine the bacterial quality of the water. In addition to these routine parameters several other analyses were included in this 1978 study:

1. Total Plate Count - This is a highly empirical procedure which gives an estimate of the total microbial populations.

2. Salmonella - The genus Salmonella contains a variety of species which are pathogenic for man or animals and usually for both.

3. Pseudomonas aeruginosa - This organism is a causative agent of otitis media, otitis externa, chronic ulcerations of the skin and many wound and burn infections.

4. Staphylococcus aureus - The most common infections caused by this organism include pimples, boils, carbuncles and food poisoning.

B. Algae

Algae, either as plankton or periphyton, have been used to indicate water quality. From an industrial and water treatment view, certain algae produce taste, odor, and color

problems in addition to clogging cooling water condensers or sand filters. From a recreational point of view, algae create unsightly beach areas, entangle fishing lines and boat propellers, create unsightly stains and increase maintenance of boats. Algae, also produce toxins that have been found to kill fish, livestock, waterfowl, and humans. Although most of the toxin producing algae are marine species, some fresh water toxic species can be found among the Cyanophycophyta, the blue-green algae. Those commonly found in this region are Microcystis aeruginosa, Anabaena flos-aquae, and Aphanizomenon flos-aquae. Algal densities were corroborated with determinations of chlorophyll a and organic matter (volatile solids).

C. Benthos

Benthic macroinvertebrates are a component of the aquatic ecosystem and have been used to evaluate the water quality of waterways. They have been used as an indirect pollution indicator because they are numerous in most waterways, are limited in mobility, and have relatively long life spans. Their limited mobility with life cycles of a year or more can be used to assess past disturbances of short duration, because once a macroinvertebrate is eliminated from the ecosystem, it will not reappear until the next generation. Experience shows that organic pollution may restrict the variety of organisms (found in a water of a good quality) while favoring the development of large numbers of organisms that are tolerant of these conditions. Pollution by toxic substances, however,

may eliminate almost all benthic macroinvertebrates.

D. Fish

Fish collections and analyses, which give the most meaningful index of water quality to the public, have been performed on the District waterways since 1974. Because fish occupy the upper levels of the aquatic food web, any water quality conditions that significantly affect the other kinds of organisms within the aquatic community will also affect the species composition and abundance of the fish population.

Diversity indices are useful to measure the water quality of the environment for a community of fish species. Their use is based on the generally observed phenomenon that relatively undisturbed environments support communities having large numbers of species with no individual species present in overwhelming abundance. If the species in such an undisturbed community are ranked on the basis of their numerical abundance, one will usually not find a few species with large numbers of individuals, but rather large numbers of species each represented by only a few individuals. Many forms of stress tend to reduce diversity by making the environment unsuitable for some species or by giving other species a competitive advantage.

A water quality survey will lead to a qualitative description of those fish species which inhabit specific areas in each waterway including canals and streams, as well as quantitative enumeration of the relative abundance of each major species

within selected habitat-typical areas.

Methods of Biological Analysis of Waterways Samples

Samples for bacteria, algae, and benthos analysis were collected during May, August, and November. Fish samples were collected during late August and September.

A. Bacteria

Water samples for total coliform (TC), fecal coliform (FC), fecal streptococcus (FS), and total plate counts were collected in sterile 4-ounce reagent bottles containing enough sodium thiosulfate to neutralize 15 mg/l chlorine. Salmonella, Staphylococcus aureus and Pseudomonas aeruginosa samples were collected in sterile one-gallon containers with enough sodium thiosulfate to neutralize 15 mg/l chlorine. All samples were taken one meter below the surface, in the center of the waterway, with a Kemmerer bottle, and were transported on ice to the R&D Laboratory.

Analyses were begun approximately twenty-four hours after collection. Total coliforms (TC) were estimated and verified according to the membrane filter (MF) procedures outlined in Standard Methods for the Examination of Water and Wastewater (3), fecal coliform (FC) determinations and verifications were carried out according to the MF technique described by Geldreich et al. (4). Fecal streptococci (FS) were determined and verified by a MF technique described by Kenner et al. (5). Total plate counts were performed utilizing a MF procedure and plate count agar. Plates were incubated for 48 ±

3 hours at 35°C. Salmonella were determined utilizing a most probable number technique (MPN) described by Kenner and Clark (6). Three 500 ml, three 50 ml and three 5 ml portions of sample were filtered and the filters placed in dulcitol selenite enrichment broth (DSE). The containers of DSE were incubated at 40°C ± 5°C for 48 hours and checked for selenite reduction. Positive tubes were streaked on xylose lysine desoxychloate agar (XLD) and incubated at 40°C for a day. The selective agar plates were then examined for possible Salmonella indicated by black colonies. Suspect colonies were transferred to triple sugar iron agar (TSI). Those showing positive results on TSI (black butt, red slant) were transferred to phenylalanine deaminase (PD) agar, lysine decarboxylase broth, and malonate utilization broth. Isolates able to decarboxylate lysine and unable to deaminate phenylalanine or utilize malonate were considered presumptive Salmonella and were identified biochemically utilizing the API-20 enteric systems. Confirmation of isolates was performed with polyvalent Salmonella "O" antisera. Agglutination of a suspension of the isolate in contact with the antisera was considered evidence of Salmonella. Verification and further serotyping of approximately 20 percent of the isolates were performed by the Illinois Department of Public Health.

Pseudomonas aeruginosa analyses were performed according to a MPN procedure in Standard Methods (3). Five 10 ml, five 1 ml and five 0.1 ml portions of samples were inoculated into

tubes of asparagine enrichment broth. Tubes were incubated for 48 hours at 35°C. Upon subculture to acetamide broth, tubes showing acetamide utilization were considered positive for Pseudomonas aeruginosa and a MPN was calculated.

Staphylococcus aureus was quantified using a MF procedure in Standard Methods (3). Samples were filtered and placed on mannitol salt agar. Colonies which fermented mannitol were verified by gram staining and coagulase testing.

B. Algae

1. Plankton. Surface grab samples were collected from bridges (on the upstream side) by the Industrial Waste Division. A one-half gallon sample was collected at each of the seven sites, it contained 80 ml formalin (4% formalin when full) as a preservative and was kept iced in the dark until delivered to the laboratory. This preserved sample was analyzed for plankton after being split into two aliquots, 200 ml for diatoms and 875 ml for non-diatoms. Diatoms are silica shelled algae and are easily separated from other organisms and organic debris by nitric acid digestion. After digestion, refluxing for 20 minutes, the acid solution was diluted and cooled and the organisms were concentrated on cellulose acetate membrane filters (0.22 μm pores) by vacuum filtration. After air drying, a pie-shaped portion of the filter was cleared with immersion oil on a slide and examined under the highest possible magnification for identification and counting.

The second aliquot of sample, for non-diatom analyses,

was allowed to settle in graduated cylinders after the addition of a surfactant (Ivory Liquid®). After five days or more, 80 percent of the surface volume was siphoned off and the remainder of the sample poured into a 200 ml graduated cylinder. Two additional five-day cycles of settling and siphoning off the supernatant resulted in a final concentrated sample of 4.4 ml. One-tenth milliliter of the concentrated sample was placed into a small reservoir and sealed with a microscope slide. The sample was then examined at the highest magnification possible (high dry objective) and the organisms counted and identified. After calculation of the concentration factor to the original sample, the diatoms and non-diatoms were added to produce the total plankton per milliliter of sample.

2. Periphyton. Periphyton samplers consisting of floats and a plastic cage containing eight microscope slides were placed in the river. A lead rope of at least five feet anchored each sampler. Periphyton, or attached algae, were allowed to develop on these glass slides for three weeks at which time the entire cage of slides was replaced and the developed slides kept in the dark and iced until delivered to the laboratory. In the laboratory, the organisms were scraped off of the slides and analyzed. Diatoms were cleared of organic matter by treatment with 30 percent hydrogen perioxide for 24 hours followed by the addition of dichromate. After this digestion the organisms were allowed to settle and the surface water drawn off and replaced repeatedly with distilled water until all signs of

dichromate were absent. The diatoms were then concentrated to 10 ml by settling and a 2 ml aliquot was dried on a cover slip by heating on a hot plate. The cover slip was mounted on a microscope slide using Hyrax® mounting medium and examined microscopically for diatoms.

The non-diatoms were fixed or preserved with several drops of glutaraldehyde. The volume was adjusted to 10 ml and 0.1 ml placed in a small reservoir and sealed as before. The organisms were then counted and identified microscopically. Total counts and diatom and non-diatom counts were calculated and expressed as organisms per cm^2 of slide area.

3. Chlorophyll a. A one-half gallon sample without formalin was also collected at each site for chlorophyll a analysis. A reasonable aliquot, usually 500 ml, was filtered through a glass fiber filter and refrigerated in the dark in 90 percent acetone until sufficient samples were available for further analyses. The samples were ground in a tissue grinder at 500 rpm for 3 to 5 minutes. The sample was then allowed to steep in 90 percent acetone in the dark at 4°C for a maximum of 24 hours.

For periphyton chlorophyll a, the scrapings from one slide were placed in a tissue grinder with 90 percent acetone, and ground at 500 rpm for 3 to 5 minutes. The sample was then allowed to steep in acetone in the dark at 4°C for a maximum of 24 hours.

From this point the handling and analysis of both types of samples was the same. The sample was centrifuged at over 500 x g for approximately 20 minutes to remove turbidity and the supernatant was scanned in a Beckman DK-2A (bandpass 6 nm at 663 nm) from 750 to 600 nm. The UNESCO equations (16) for chlorophyll (trichromatic method) were used to determine chlorophyll concentrations in the extract and extrapolated to the original sample. The monochromatic method was also used to calculate chlorophyll a with a correction for pheophytin (16).

4. Organic Matter. Organic matter was only determined on the periphyton samples by drying 1-2 slides at 105°C, weighing them and then ashing in the muffle oven and reweighing when cool. The difference yields organic matter/number of slides.

C. Benthos

Bottom samples were taken with a standard (529 sq. cm.) Ponar grab sampler from the center and both sides of the waterway at six of the seven benthic sampling stations (Figure 1). No samples could be taken at Station 48 (Stephen Street) because the substrate there consists only of bedrock. Each of six stations was divided into three sections or substrates (left side, center and right side of Des Plaines River) giving a total of 18 locations. Three replicates were taken at each of these locations about 100 feet upstream of each bridge,

giving a total of 162 samples. In the field, the samples were screened immediately with a large U.S. No. 30 mesh bucket sieve. The debris, including the macroinvertebrates, was placed into gallon containers and transported to the laboratory. There the organisms were removed from the debris for sorting and analysis. When samples containing large numbers of organisms were collected, estimates of their abundance were made by analyzing aliquots.

D. Fish

Fish were collected by use of a 230 volt (8-11 amp) alternating current boat mounted boom electrofisher. Fish were removed from the water with a net after being stunned.

Large fish were identified to species, weighed to the nearest gram, and measured for total length to the nearest millimeter, and released into the stream of capture or buried along the shore. Smaller fish (less than 80 mm total length) were preserved in 10-15 percent formalin and identified, weighed, and measured in the laboratory.

The species diversity index used was Brillouin's (7) as shown in the following equation:

$$H = \frac{1}{N} \left(\ln N! - \sum_{i}^{s} \ln N_i! \right)$$

where N_i = total number of individuals of each species in the collection and N = total number of individuals (all species combined) in the collection; and H = species diversity index.

III. RESULTS AND DISCUSSION OF WATERWAYS QUALITY CONDITIONS

A. Bacteria

Geometric means of the various bacterial parameters monitored during 1978 on the Des Plaines River are presented in Tables 3 and 4. Total coliform, fecal coliform, and total plate count indicators demonstrated a general increase from the first sampling site at County Line Road (Station 39) to Roosevelt Road (Station 43). There was an eventual decline from Roosevelt Road to the final sampling point at Stephen Street (Station 48). Fecal streptococcus levels were about the same at all stations, with the exception of the County Line Road (Station 39) and Oakton Street (Station 41) sampling stations where the levels were 1 to 1.5 orders of magnitude lower than the other stations.

Staphylococcus aureus levels were low (i.e., near or below the detection limit of 2 to 10 S. aureus per 100 ml) at all sampling stations, not exceeding a geometric mean of 62 per 100 ml. Only 4 of 224 colonies picked over the three sampling runs were confirmed as S. aureus. The Pseudomonas aeruginosa levels at County Line Road (Station 39) were one-half to almost two orders of magnitude lower than at the other stations. The levels generally increased from County Line Road to Willow Springs Road (Station 47) followed by a log decline to the next and final sampling point at Stephen Street (Station 48).

Salmonella were recovered at four of seven sampling

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TABLE 3

TOTAL COLIFORM, FECAL COLIFORM, FECAL STREPTOCOCCUS, AND TOTAL PLATE COUNTS FOR THE DES PLAINES RIVER, 1978

Station	Total Coliform*	Fecal Coliform*	Fecal Streptococcus*	Total Plate Count*
39 County Line Road	11,000	1,100	510	2,600,000
41 Oakton Street	200,000	3,900	1,900	4,500,000
42 Belmont Avenue	220,000	6,700	16,000	7,600.000
43 Roosevelt Road	470,000	20,000	11,000	14,000,000
46 Ogden Avenue	660,000	34,000	34,000	15,000,000
47 Willow Springs Road	280,000	6,100	13,000	10,000,000

*Results expressed as colony forming units/100 ml.
Values shown are geometric means of results of samples taken on May 9, August 10, and November 4, 1978.

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TABLE 3 (Continued)

TOTAL COLIFORM, FECAL COLIFORM, FECAL STREPTOCOCCUS, AND TOTAL PLATE COUNTS FOR THE DES PLAINES RIVER, 1978

Station	Total Coliform*	Fecal Coliform*	Fecal Streptococcus*	Total Plate Count*
48 Stephen Street	14,000	410	12,000	3,000,000

*Results expressed as colony forming units/100 ml.
Values shown are geometric means of results of samples taken on May 9, August 10, and November 4, 1978.

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TABLE 4

STAPHLYOCOCCUS AUREUS, PSEUDOMONAS AERUGINOSA, AND SALMONELLA COUNTS FOR THE DES PLAINES RIVER, 1978

Station	Staphylococcus aureus*	Pseudomonas aeruginosa**	Salmonella**
39 County Line Road	< 3.4	500	< 0.15
41 Oakton Street	< 3.4	1,300	< 0.44
42 Belmont Avenue	< 41.0	4,900	0.40
43 Roosevelt Road	< 3.4	2,500	< 0.15
46 Ogden Avenue	< 3.4	5,000	0.37
47 Willow Springs Road	< 62.0	35,000	< 0.15

*Results expressed as colony forming units/100 ml.
Values shown are geometric means of results of samples taken on May 9, August 10, and November 4, 1978
**Most probable number per 100 ml.

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TABLE 4 (Continued)

STAPHLOCOCCUS AUREUS, PSEUDOMONAS AERUGINOSA, AND SALMONELLA COUNTS FOR THE DES PLAINES RIVER, 1978

Station	Staphylococcus aureus*	Pseudomonas aeruginosa**	Salmonella**
48 Stephen Street	< 3.4	3,200	0.18

*Results expressed as colony forming units/100 ml.
Values shown are geometric means of results of samples taken on May 9, August 10, and November 4, 1978.
**Most probable number per 100 ml.

stations. Concentrations were low (i.e., near or below the detection limit of 0.15 Salmonella per 100 ml) in all cases, not exceeding a geometric mean of 0.44 Salmonella per 100 ml at any one station. Results of Salmonella serotyping by the Illinois Public Health Department are presented in Table 5. Eight of seventeen (47 percent) of the isolates were among the ten most commonly isolated Salmonella from clinical laboratories in the United States during 1977.

Confirmation rates are normally in the 60 to 70 percent range for colonies classified as total coliform, 90 to 95 percent for those classified as fecal coliform, 90 to 100 percent for those classified as fecal streptococcus. Confirmation data for the indicators in Des Plaines River water samples are presented in Table 6. Of the 83 typical coliform colonies picked for confirmation, 49 were confirmed for a confirmation rate of 59 percent. This rate is slightly below the 1977 rate of 64 percent (8). Of the 78 fecal coliform colonies picked, 76 were confirmed for a confirmation rate of 97 percent. This compared with a confirmation rate of 94 percent during 1977 (8). Of the 98 fecal streptococcus colonies picked for confirmation, a total of 69 were confirmed for a confirmation rate of 70 percent. Thus the confirmation rate was lower than normal for fecal streptococcus.

Overall, the indicator organism data indicated a waterway with fecal contamination since the individual fecal coliform

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TABLE 5

SALMONELLA SEROTYPING RESULTS FOR 1978 DES PLAINES RIVER SAMPLES

Serotype	Number isolated
Agona	6
Bareilly	6
California	1
Hartford	2
Infantis	1
Typhimurium	1
Total	17

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TABLE 6

TOTAL COLIFORM, FECAL COLIFORM, AND FECAL STREPTOCOCCUS COLONY CONFIRMATIONS FOR 1978 DES PLAINES RIVER SAMPLES

	Total Coliform	Fecal Coliform	Fecal Streptococcus
Number Confirmed	49	76	69
Confirmations Attempted	83	78	98
Percent Confirmed	59	97	70

counts for a given sample on a given sampling day always equalled or exceeded 200 colony forming units per 100 ml of sample.

Geldreich (9) reported in a review that Salmonella occurred in less than 27.6 percent of freshwater samples when the fecal coliform concentration was 200 colony forming units per 100 ml. The frequency of Salmonella rose to 85.2 percent when the fecal coliform count was in the range of 200 to 2,000 colony forming units per 100 ml.

Salmonella were isolated from 7 of the 21 samples collected from the Des Plaines River during 1978; all of which contained fecal coliforms in concentrations which were greater than or equal to 200 colony forming units per 100 ml. This yielded a confirmation rate of 33.3 percent as opposed to Geldreich's reported rate of 85.2 percent of samples containing Salmonella when the fecal coliform count equalled or exceeded 200 colony forming units per 100 ml.

Of the samples where the fecal coliform count was greater than or equal to 1,000 colony forming units per 100 ml, 5 of 15 proved to be Salmonella positive; of those where the fecal coliform count was greater than or equal to 10,000 colony forming units per 100 ml, 4 of 9 were Salmonella positive; and the one sample that contained a fecal coliform count of 10,000 colony forming units per 100 ml was Salmonella positive. These data indicated an increase in the frequency of Salmonella isolation as the fecal coliform count increased, which in turn

indicated increased fecal pollution of the water.

B. Algae

1. Plankton. Planktonic algae were collected in May, August and November (Tables 7, 8 and 9, respectively) from the Des Plaines River at the seven designated stations. The average plankton counts for May and August were 10,000 units per ml. A nuisance algal bloom is considered to be 500 organisms or more per milliliter (17).

The organisms present in the greatest numbers in a sample of river water (in other words, the dominant organisms) can be used to describe the water quality of the portion of river from which the sample was obtained. Those specific plankton which were present in numbers greater than or equal to five percent of the total number of plankton in the samples from the Des Plaines River are listed for each station in Tables 7, 8 and 9. With the exception of Chlorella vulgaris, Chlorococcum humicola (both green algae), Oscillatoria tenuis (a blue green algae), the data indicate that the Des Plaines River is composed of weedy species. Weedy species are those plankton which are dominant in stressed aquatic systems. Another indication that the system is stressed is the relatively low number of species making up the total population. Overall, the plankton data indicate that the Des Plaines River has water of poor quality.

2. Planktonic Chlorophyll a. Chlorophyll a concentrations averaged 15.5 µg/l in May, 41.5 µg/l in August, and

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TABLE 7

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
MAY 9, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a A* (µg/l)	Chlorophyll a B**	Dominant Organisms genus species	Percent of Total Population
39	9,945	15.1	4.8	Chlorella vulgaris	6.6
				Lyngbia limnetica	15.0
41	10,940	12.8	4.8	Cyclotella meneghiniana	5.9
				Chlorella vulgaris	8.2
				Lynbia limnetica	9.0
				Oscillatoria limnetica	19.5
				Phormidium ambiguum	24.8
42	9,850	13.9	5.1	Cyclotella operculata	5.3
				Chlorella vulgaris	13.5
				Lyngbia limnetica	8.1
43	9,300	13.4	5.8	Cyclotella meneghiniana	5.0
				Cyclotella operculata	8.7
				Chlorella vulgaris	5.4
				Lyngbia limnetica	14.9
				Oscillatoria limnetica	17.0
				Oscillatoria tenuis	6.8

*A=trichromatic method

**B=monochromatic method

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TABLE 7 (Continued)

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
MAY 9, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a A* (µg/l)	Chlorophyll a B**	Dominant Organisms genus species	Percent of Total Population
46	12,925	14.0	9.2	Cyclotella operculata	7.4
				Chlorella vulgaris	8.3
				Anabaena wisconsinense	14.2
				Lyngbia limnetica	12.4
				Oscillatoria agardhii	5.0
				Oscillatoria limnetica	22.2
47	8,915	14.7	5.6	Cyclotella operculata	7.1
				Chlorococcum humicola	5.5
				Lyngbia limnetica	10.5
				Oscillatoria limnetica	32.7
				Oscillatoria tenuis	5.0
48	11,975	24.4	13.9	Cyclotella operculata	15.1
				Chlorella vulgaris	11.5
				Dinobryon cylindricum	5.1
				Lyngbia limnetica	6.5
				Scytonema myochrous	7.5
				Oscillatoria limnetica	15.4
Average	10,550	15.5	7.0		

*A=trichromatic method

**B=monochromatic method

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TABLE 8

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
AUGUST 10, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a A* (µg/l)	Chlorophyll a B**	Dominant Organisms genus species	Percent of Total Population
39	8,030	31.9	27.8	Cyclotella glomerata	23.5
				Cyclotella meneghiniana	6.2
				Chlorella vulgaris	5.2
				Microcystis incerta	34.8
41	23,100	59.3	52.9	Cyclotella glomerata	34.0
				Planktospaeria gelatinosa	5.8
				Microcystis incerta	28.8
42	13,210	48.9	37.9	Cyclotella glomerata	49.4
				Chroococcus limneticus	9.2
				Oscillatoria tenuis	9.4
43	8,775	31.1	25.1	Cyclotella glomerata	52.3
				Microcystis incerta	16.6
46	18,155	56.3	53.4	Cyclotella glomerata	67.0
47	9,745	25.0	26.2	Cyclotella glomerata	31.9
				Planktospaeria gelatinosa	6.1
				Microcystis incerta	21.9

*A=trichromatic method

**B=monochromatic method

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TABLE 8 (Continued)

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
AUGUST 10, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a A* (µg/l)	B**	Dominant Organisms genus	species	Percent of Total Population
48	8,805	38.0	33.1	Cyclotella	glomerata	22.7
				Cyclotella	menghiniana	6.6
				Chroococcus	limneticos	6.5
				Oscillatoria	tenuis	20.6
Average	12,831	41.5	36.6			

*A=trichromatic method

**B=monochromatic method

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TABLE 9

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
NOVEMBER 14, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a (µg/l) A*	B**	Dominant Organisms genus species	Percent of Total Population
39	8,700	11	11	Lyngbia limnetica	66.6
41	3,285	19	16	Nitzschia palea	11.4
				Lyngbia limnetica	26.4
				Oscillatoria agardhii	5.3
				Oscillatoria tenuis	4.9
42	3,670	16	27	Hantzschia amphioxys	4.9
				Nitzschia palea	12.7
				Planktonema lauterbornii	8.2
				Anabaena sp.	6.6
				Lyngbia limnetica	31.0
				Oscillatoria lacustris	5.6
43	3,435	16	15	Hantzschia amphioxys	7.4
				Nitzschia palea	16.0
				Planktonema lauterbornii	10.7
				Lyngbia limnetica	25.1

*A=trichromatic method

**B=monochromatic method

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TABLE 9 (Continued)

PLANKTON AND BIOMASS ANALYSIS FOR SAMPLES COLLECTED
NOVEMBER 14, 1978 FROM THE DES PLAINES RIVER

Stations	Total Plankton (cells/ml)	Chlorophyll a (µg/l) A*	B**	Dominant Organisms genus species	Percent of Total Population
46	3,065	14	4	Hantzschia amphioxys	5.6
				Nitzschia palea	18.5
				Planktonema lauterbornii	22.3
				Lyngbia limnetica	17.3
				Oscillatoria agardhii	5.8
47	3,775	23	20	Nitzschia palea	27.6
				Planktonema lauterbornii	13.5
				Lyngbia limnetica	9.1
48	2,855	58	52	Cyclotella glomerata	13.8
				Cyclotella meneghiniana	6.2
				Nitzschia palea	10.8
				Chlamydomonas mucicola	5.2
				Chlamydomonas spagnicola	7.7
				Chroococcus dispersus	7.7
				Lyngbia limnetica	6.8
Average	4,112	22.4	20.7		

*A=trichromatic method **B=monochromatic method

22.4 µg/l in November (see Tables 7, 8 and 9). Since any value for chlorophyll a greater than 10 µg/l is indicative of eutrophic conditions (18) or of water highly enriched with organic matter, these data substantiated the conclusion, previously based on the planktonic algae data, that the Des Plaines River has water of poor quality.

3. Periphyton. Two samples of periphyton were collected from the Des Plaines River during 1978, both from the same location near Station number 39 at County Line Road.

The two successive samples, each of three weeks duration, spanned the time period of October 24 to December 5, 1978. The results of the examination of the samples are listed in Table 10. Of the seven dominant organisms found in the first sample, four are considered to be both weedy species and pollution tolerant algae (10). These organisms are: Gomphonema parvulum, Hantzschia amphioxys, Melosira varians and Protoderma viride. Only two organisms (Protoderma viride and Chroococcus varius) were dominant in the second sample and they accounted for 78.3 percent of the total population. These organisms from the second sample may best be described as weedy in character for they have a wide tolerance range for nutrients and temperature.

The dominance of weedy species of plankton and periphyton indicated a system that is stressed and the dominance of pollution algae further indicates that at least a portion of

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TABLE 10

PERIPHYTON AND BIOMASS DETERMINATIONS FOR SAMPLES COLLECTED
OCTOBER 24 - NOVEMBER 13, 1978 and NOVEMBER 13 - DECEMBER 5, 1978
FROM THE DES PLAINES RIVER AT DUNDEE ROAD

Periphyton Count (cells/cm^2)	Organic Matter (mg/cm^2)	Chlorophyll a A* ($\mu g/cm^2$)	Chlorophyll a B** ($\mu g/cm^2$)	Dominant Organisms genus	Dominant Organisms species	Percent of Total Population
		October 24 - November 13, 1978				
425,870	0.537	7.5	7.0	Achnanthes	lanceolata	8.7
				Gomphonema	parvulum	6.9
				Hantzschia	amphioxys	5.3
				Melosira	varians	25.0
				Navicula	cryptocephala	11.2
				Nitzschia	tryblionella	6.2
				Protoderma	viride	8.6
		November 13 - December 5, 1978				
174,475	0.203	3.0	3.0	Protoderma	viride	26.4
				Chroococcus	varius	51.9

*A=trichromatic method

**B=monochromatic method

that disturbance is due to organic enrichment.

The data indicated that the waters of the Des Plaines River were of poor quality along its entire reach within Cook County. The specific indicators were the high plankton densities (much higher than the nuisance number of 500 organisms per milliliter), the presence of pollution tolerant and weedy species, and the high chlorophyll a concentrations.

C. Benthos

The benthic macroinvertebrate data collected in May, August, and November, 1978, showed that the aquatic worms (segmented worms of the order Oligochaeta) were the most abundant macroinvertebrates present throughout the study area (Tables 11 through 13). The density varied from 57 worms per square meter at Station 39 (east side sample) to more than 200,000 worms per square meter at Station 43 (west side sample). The density of these worms has been used as an index of organic pollution (11). Light pollution is defined as 100 to 999 worms per square meter and moderate pollution as 1,000 to 5,000 worms per square meter. By these standards, the Des Plaines River in Cook County was moderately to heavily polluted.

Other macroinvertebrate groups represented in the bottom samples from the Des Plaines River stations during 1978, in order of the number of sampling stations at which they were collected (greatest to least), were: midge fly larvae

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TABLE 11

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN MAY, 1978

Taxon	Sampling Station					
	County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Turbellaria	0	0	3 (6)	0	0	0
Oligochaeta	906 (930)	29,667 (7,371)	26,667 (11,504)	165,000 (33,867)	2,513 (2,895)	3,067 (764)
Hirudinea	15 (20)	6 (7)	70 (105)	767 (1,328)	7 (6)	0
Isopoda	0	0	3 (6)	0	10 (10)	0
Ephemeroptera	2 (3)	0	0	0	0	0

*Standard deviation listed within parentheses.

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TABLE 11 (Continued)

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN MAY, 1978

Taxon	Sampling Station					
	County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Anisoptera	0	0	0	0	0	3 (6)
Zygoptera	0	0	0	0	3 (6)	0
Elmidae	0	2 (3)	0	0	0	0
Chironomidae	282 (293)	67 (20)	89 (40)	72 (103)	303 (232)	76 (82)
Gastropoda	0	0	25 (11)	0	0	0

*Standard deviation listed within parentheses.

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TABLE 11 (Continued)

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN MAY, 1978

Taxon	Sampling Station: County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Pelecypoda	2 (3)	6 (11)	165 (116)	240 (416)	32 (40)	0
Total Number of Individuals Per Square Meter:	1,207	29,748	27,022	166,079	2,868	3,146
Total Number of Taxa:	5	5	7	4	6	3

*Standard deviation listed within parentheses.

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TABLE 12

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN AUGUST, 1978

Taxon	Sampling Station					
	County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Turbellaria	6 (7)	0	0	0	0	0
Oligochaeta	154 (158)	31,333 (17,559)	14,100 (6,851)	21,100 (19,933)	297 (100)	3,033 (1,234)
Hirudinea	56 (55)	0	1,450 (926)	540 (832)	50 (70)	0
Isopoda	4 (3)	0	13 (22)	4 (3)	35 (15)	0

*Standard deviation listed within parentheses.

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TABLE 12 (Continued)

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN AUGUST, 1978

Taxon	Sampling Station: County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Elmidae	8 (14)	0	0	0	0	0
Chironomidae	34 (31)	202 (277)	4 (3)	18 (26)	307 (153)	8 (14)
Gastropoda	2 (3)	0	65 (61)	42 (46)	96 (34)	0
Pelecypoda	0	13 (11)	10,500 (7,365)	257 (289)	0	0
Totals:						
Total Number of Individuals Per Square Meter:	264	31,548	26,132	21,961	785	3,041
Total Number of Taxa:	7	3	6	6	5	2

*Standard deviation listed within parentheses.

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TABLE 13

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN NOVEMBER, 1978

Taxon	Sampling Station					
	County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Oligochaeta	143 (128)	3,683 (4,031)	11,967 (8,228)	23,533 (27,743)	387 (341)	2,033 (833)
Hirudinea	21 (27)	6 (11)	820 (809)	336 (423)	0	0
Hydracarina	0	0	0	8 (14)	0	0
Isopoda	5 (7)	0	50 (70)	2 (3)	10 (13)	0
Cladocera	0	0	0	5 (9)	0	0
Podocopa	0	0	0	4 (7)	0	0

*Standard deviation listed within parentheses.

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TABLE 13 (Continued)

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN NOVEMBER, 1978

Taxon	Sampling Station					
	County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Ephemeroptera	21 (36)	0	0	0	0	0
Psychodidae	0	0	6 (11)	4 (7)	0	0
Trichoptera	56 (47)	0	0	0	0	0
Chironomidae	953 (703)	41 (51)	134 (161)	83 (53)	48 (20)	25 (11)
Ceratopogonidae	21 (36)	0	0	0	0	0
Gastropoda	2 (3)	0	73 (64)	8 (14)	48 (32)	0

*Standard deviation listed within parentheses.

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TABLE 13 (Continued)

MEAN DENSITY OF BENTHIC MACROINVERTEBRATES COLLECTED FROM THE DES PLAINES RIVER IN NOVEMBER, 1978

Taxon	Sampling Station: County Line Road	Oakton Street	Belmont Avenue	Roosevelt Road	Ogden Avenue	Willow Springs Road
	Organisms Per Square Meter*					
Pelecypoda	0	2 (3)	793 (1,062)	0	0	0
Total Number of Individuals Per Square Meter:	1,222	3,732	13,843	23,983	493	2,058
Total Number of Taxa:	8	4	7	9	4	2

*Standard deviaiton listed within parentheses.

(Chironomidae), leeches (Hirudinea), aquatic sow bugs (Isopoda), fingernail clams (Pelecypoda), snails (Gastropoda), flatworms (Turbellaria), mayfly nymphs (Ephemeroptera), mothfly larvae (Psychodidae), aquatic beetles (Elmidae), water mites (Hydracarina), water fleas (Cladocera and Podocopa), dragonfly nymphs (Anisoptera), damselfly nymphs (Zygoptera), caddisfly nymphs (Trichoptera), and biting midge larvae (Ceratopogonidae), as shown in Tables 11 through 13.

Using the relative abundance of Oligochaeta present in the sediments as an index of pollution, Goodnight and Whitely (12) defined a stream in good condition if the bottom fauna were less than 60 percent aquatic worms, doubtful if 60 to 80 percent, and highly polluted if more than 80 percent aquatic worms. By this standard, the Cook County portion of the Des Plaines River, except for the County Line Road Station, was highly polluted.

D. Fish

Within the period 1967 to 1978, three major fish collections have been reported (2, 13, 14) for the main channel of the Des Plaines River within Cook County besides those of the present study. The fish species collected by use of various methods are listed in Table 14. The number of species collected from the river during each year was 21 during 1967 (13), 22 during 1974 (14), 29 during 1976 (2), and 15 during the present study. A total of 38 species were collected from the

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TABLE 14

FISH SPECIES COLLECTED FROM THE MAIN CHANNEL OF THE DES PLAINES RIVER IN COOK COUNTY DURING THE PERIOD 1967 THROUGH 1978

Fish Species Collected		Year of Collection*			
Scientific Name	Common Name	1967	1974	1976	1978
		---- Fish Presence/Absence** -----			
Amia calva	Bowfin	-	+	-	+
Dorosoma cepedianum	Gizzard shad	-	+	+	+
Umbra limi	Central mudminnow	-	-	+	-
Esox a. vermiculatus	Grass pickerel	-	+	-	-
Esox lucius	Northern pike	+	+	+	-
Campostoma anomalum	Central stoneroller	+	-	-	-
Carassius auratus	Goldfish	+	+	+	+
Cyprinus carpio	Carp	+	+	+	+
C. carpio x C. auratus	Carp x goldfish hybrid	+	+	+	+
Nocomis biguttatus	Hornyhead chub	-	-	+	-
Notemigonus crysoleucas	Golden shiner	+	+	+	-

*Data obtained from References 13, 14, and 2 for 1967, 1974, and 1976 respectively.
**A plus (+) = species present in collection, a minus (-) = species absent from collection.

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TABLE 14 (Continued)

FISH SPECIES COLLECTED FROM THE MAIN CHANNEL OF THE DES PLAINES RIVER IN COOK COUNTY DURING THE PERIOD 1967 THROUGH 1978

Fish Species Collected		Year of Collection*			
Scientific Name	Common Name	1967	1974	1976	1978
		---- Fish Presence/Absence** ----			
Notropis atherinodes	Emerald shiner	-	-	+	-
Notropis cornutus	Common shiner	+	-	-	-
Notropis dorsalis	Bigmouth shiner	+	-	+	-
Notropis heterodon	Blackchin shiner	+	-	-	-
Notropis spilopterus	Spotfin shiner	+	-	+	+
Notropis stramineus	Sand shiner	-	-	+	-
Notropis umbratilis	Redfin shiner	+	+	-	-
Pimephales notatus	Bluntnose minnow	+	+	+	+
Pimephales promelas	Fathead minnow	-	+	+	+
Semotilus atromaculatus	Creek chub	-	-	+	-
Catostomus commersoni	White sucker	+	+	+	+

*Data obtained from References 13, 14, and 2 for 1967, 1974, and 1976 respectively.
**A plus (+) = species present in collection, a minus (-) = species absent from collection

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TABLE 14 (Continued)

FISH SPECIES COLLECTED FROM THE MAIN CHANNEL OF THE DES PLAINES RIVER IN COOK COUNTY DURING THE PERIOD 1967 THROUGH 1978

Fish Species Collected		Year of Collection*			
Scientific Name	Common Name	1967	1974	1976	1978
		---- Fish Presence/Absence** ----			
Ictalurus melas	Black bullhead	+	+	+	+
Ictalurus natalis	Yellow bullhead	+	+	+	-
Ictalurus punctatus	Channel catfish	-	+	-	-
Noturus flavus	Stonecat	-	-	+	-
Noturus gyrinus	Tadpole madtom	-	-	+	-
Fundulus notatus	Blackstripe topminnow	-	-	+	-
Gambusia affinis	Mosquitofish	-	-	+	-
Morone mississippiensis	Yellow bass	-	+	-	+
Ambloplites rupestris	Rock bass	-	+	+	-
Lepomis cyanellus	Green sunfish	+	+	+	+
Lepomis gibbosus	Pumpkinseed	+	+	+	-

*Data obtained from References 13, 14, and 2 for 1967, 1974, and 1976 respectively.
**A plus (+) = species present in collection, a minus (-) = species absent from collection.

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TABLE 14 (Continued)

FISH SPECIES COLLECTED FROM THE MAIN CHANNEL OF THE DES PLAINES RIVER IN COOK COUNTY DURING THE PERIOD 1967 THROUGH 1978

Fish Species Collected		Year of Collection*			
Scientific Name	Common Name	1967	1974	1976	1978
		---- Fish Presence/Absence** ----			
Lepomis gulosus	Warmouth	-	-	+	-
Lepomis macrochirus	Bluegill	+	+	+	+
Micropterus salmoides	Largemouth bass	+	+	+	+
Pomoxis annularis	White crappie	+	+	+	+
Pomoxis nigromaculatus	Black crappie	+	+	+	+
Lepomis cyanellus x Lepomis gibbosus	Green sunfish x pumpkinseed hybrid	-	+	-	-
Lepomis cyanellus x Lepomis macrochirus	Green sunfish x bluegill hybrid	-	-	+	-
Perca flavescens	Yellow perch	+	-	-	-
	TOTAL NUMBER OF SPECIES (hybrids not included)	21	22	29	15

*Data obtained from References 13, 14, and 2 for 1967, 1974, and 1976 respectively.
**A plus (+) = species present in collection, a minus (-) = species absent from collection.

main channel of the Des Plaines River for all four collections combined.

During 1976 (2) eight tributaries to the Des Plaines River within Cook County were also sampled for fish. The only fish species collected from the tributaries which were not found to be present in the main channel were the johnny darter, Etheostoma nigrum, and mottled sculpin, Cottus bairdi. These two species were found only in Black Partridge Creek in Lemont, a tributary entering the Des Plaines River at the southwestern edge of Cook County.

Data on the abundance of fish collected during 1978, by number and by weight (in grams) of fish per 30 minutes of boat electrofishing as well as the relative abundance of each species by number and by weight are presented in the following Tables:

Station	Location	Table
18	Dundee Road	15
19	Golf Road	16
20	Grand Avenue	17
251	Roosevelt Road	18
126	Forest Avenue	19
127	First Avenue	20
21	Ogden Avenue	21
22	Willow Springs Road	22
23	Stephen Street	23

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TABLE 15

BOAT ELECTROFISHING RESULTS FOR DUNDEE ROAD (Station 18), DES PLAINES RIVER, ON SEPTEMBER 28, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	1	0.55	4.00	260.00	142.29	3.58
Carp	13	7.11	52.00	6,487.40	3,550.42	89.37
White sucker	1	0.55	4.00	120.00	65.67	1.65
Black bullhead	1	0.55	4.00	148.00	81.00	2.04
Yellow bass	2	1.09	8.00	47.26	25.86	0.65
Green sunfish	7	3.83	28.00	195.97	107.25	2.70
TOTAL	25	13.68	100	7,258.63	3,972.49	100

*Total electrofishing time was 54.8 minutes, total electrofishing distance was 800 meters.

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TABLE 16

BOAT ELECTROFISHING RESULTS FOR GOLF ROAD (Station 19), DES PLAINES RIVER, ON SEPTEMBER 28, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	5	2.49	7.04	571.94	285.02	2.82
Carp	18	8.97	25.35	17,989.87	8,965.05	88.79
Carp x goldfish	1	0.50	1.41	262.00	130.56	1.29
Spotfin shiner	2	1.00	2.82	7.25	3.61	0.04
Bluntnose minnow	1	0.50	1.41	0.96	0.48	0.00
Black bullhead	5	2.49	7.04	791.46	394.42	3.91
Yellow bass	1	0.50	1.41	176.00	87.71	0.87
Green sunfish	35	17.44	49.30	415.88	207.25	2.05
Bluegill	1	0.50	1.41	1.98	0.99	0.01

*Total electrofishing time was 60.2 minutes, total electrofishing distance was 800 meters.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 16 (Continued)

BOAT ELECTROFISHING RESULTS FOR GOLF ROAD (Station 19), DES PLAINES RIVER, ON SEPTEMBER 28, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
White crappie	1	0.50	1.41	20.39	10.16	0.10
Black crappie	1	0.50	1.41	22.70	11.31	0.11
TOTAL	71	35.39	100	20,260.43	10,096.56	100

*Total electrofishing time was 60.2 minutes, total electrofishing distance was 800 meters.

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TABLE 17

BOAT ELECTROFISHING RESULTS FOR GRAND AVENUE (Station 20), DES PLAINES RIVER, ON SEPTEMBER 1, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	3	2.17	33.33	35.84	25.93	5.42
Carp	3	2.17	33.33	617.89	447.03	93.36
Fathead minnow	2	1.45	22.22	5.42	3.92	0.82
Green sunfish	1	0.72	11.11	2.70	1.95	0.41
TOTAL	9	6.51	100	661.85	478.83	100

*Total electrofishing time was 41.5 minutes, total electrofishing distance was 800 meters.

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TABLE 18

BOAT ELECTROFISHING RESULTS FOR ROOSEVELT ROAD (Station 251), DES PLAINES RIVER, ON AUGUST 31, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Carp x goldfish	1	0.85	50.00	793.80	676.21	87.64
White crappie	1	0.85	50.00	112.00	95.41	12.36
TOTAL	2	1.70	100	905.80	771.62	100

*Total electrofishing time was 35.2 minutes, total electrofishing distance was 800 meters.

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TABLE 19

BOAT ELECTROFISHING RESULTS FOR FOREST AVENUE (Station 126), DES PLAINES RIVER, ON AUGUST 31, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Bowfin	1	0.60	0.85	120.00	72.36	0.94
Goldfish	100	60.30	85.47	6,922.33	4,174.27	54.11
Carp	8	4.82	6.84	3,180.50	1,917.89	24.86
Carp x goldfish	6	3.62	5.13	2,569.15	1,549.24	20.08
Fathead minnow	1	0.60	0.85	0.71	0.43	0.01
Bluegill	1	0.60	0.85	0.83	0.50	0.01
TOTAL	117	70.54	100	12,793.52	7,714.69	100

*Total electrofishing time was 49.8 minutes, total electrofishing distance was 800 meters.

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TABLE 20

BOAT ELECTROFISHING RESULTS FOR FIRST AVENUE (Station 127), DES PLAINES RIVER, ON AUGUST 31, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	30	78.15	78.95	304.72	793.77	92.29
Fathead minnow	1	2.60	2.63	2.57	6.69	0.78
White sucker	1	2.60	2.63	8.83	23.00	2.67
Green sunfish	2	5.21	5.26	6.78	17.66	2.05
Bluegill	3	7.81	7.89	3.89	10.13	1.18
Black crappie	1	2.60	2.63	3.40	8.86	1.03
TOTAL	38	98.97	100	330.19	860.11	100

*Total electrofishing time was 11.5 minutes, total electrofishing distance was 160 meters.

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TABLE 21

BOAT ELECTROFISHING RESULTS FOR OGDEN AVENUE (Station 21).
DES PLAINES RIVER, ON AUGUST 31, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	39	32.25	92.86	1,747.23	1,444.66	98.69
Carp	1	0.83	2.38	19.52	16.14	1.10
Bluntnose minnow	1	0.83	2.38	2.13	1.76	0.12
Green sunfish	1	0.83	2.38	1.48	1.22	0.08
TOTAL	42	34.74	100	1,770.36	1,463.78	100

*Total electrofishing time was 36.3 minutes, total electrofishing distance was 800 meters.

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TABLE 22

BOAT ELECTROFISHING RESULTS FOR WILLOW SPRINGS ROAD (Station 22), DES PLAINES RIVER, ON SEPTEMBER 8, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Gizzard shad	1	0.77	2.50	4.03	3.09	0.05
Goldfish	8	6.14	20.00	1,031.99	791.81	11.93
Carp	8	6.14	20.00	5,469.01	4,196.17	63.24
Carp (mirror)	1	0.77	2.50	820.00	629.16	9.48
Bluntnose minnow	1	0.77	2.50	1.44	1.10	0.02
Black bullhead	6	4.60	15.00	547.30	419.92	6.33
Green sunfish	10	7.67	25.00	739.00	567.01	8.55
Bluegill	1	0.77	2.50	5.14	3.94	0.06
Largemouth bass	4	3.07	10.00	29.80	22.86	0.34
TOTAL	40	30.70	100	8,647.71	6,635.06	100

*Total electrofishing time was 39.1 minutes, total electrofishing distance was 800 meters.

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TABLE 23

BOAT ELECTROFISHING RESULTS FOR STEPHEN STREET (Station 23), DES PLAINES RIVER, ON SEPTEMBER 8, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Goldfish	28	13.10	11.29	1,576.56	737.48	4.76
Carp	41	19.18	16.53	26,286.55	12,296.20	79.37
Carp (mirror)	1	0.47	0.40	740.00	346.15	2.23
Carp x goldfish	5	2.34	2.02	2,449.00	1,145.58	7.39
Bluntnose minnow	69	32.28	27.82	166.01	77.66	0.50
White sucker	4	1.87	1.61	632.15	295.70	1.91
Black bullhead	6	2.81	2.42	219.87	102.85	0.66
Green sunfish	81	37.89	32.67	553.34	258.84	1.68

*Total electrofishing time was 64.1 minutes, total electrofishing distance was 800 meters.

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TABLE 23 (Continued)

BOAT ELECTROFISHING RESULTS FOR STEPHEN STREET (Station 23), DES PLAINES RIVER, ON SEPTEMBER 8, 1978*

Species Collected	Number of Fish Collected			Weight in Grams of Fish Collected		
	Total Per Species	Per 30 Minutes	Percent of Total	Total Per Species	Per 30 Minutes	Percent of Total
Bluegill	4	1.87	1.61	11.50	5.38	0.03
Largemouth bass	4	1.87	1.61	141.11	66.01	0.43
Black crappie	5	2.34	2.02	344.25	161.03	1.04
TOTAL	248	116.02	100	33,120.34	15,492.88	100

*Total electrofishing time was 64.1 minutes, total electrofishing distance was 800 meters.

The goldfish was the most abundant of the species collected from the main channel of the Des Plaines River in Cook County during 1978. Numerically, goldfish average 18.88 fish per 30 minutes of electrofishing, followed by green sunfish (7.97 fish per 30 minutes), carp (4.98 fish per 30 minutes), bluntnose minnow (3.73 fish per 30 minutes), and bluegill (1.26 fish per 30 minutes).

The carp had the greatest weight (3,330 grams per 30 minutes), followed by the goldfish (738 grams per 30 minutes), carp x goldfish hybrid (289 grams per 30 minutes), green sunfish (124 grams per 30 minutes), and the black bullhead (107 grams per 30 minutes).

According to Sparks (15), goldfish are more tolerant of low oxygen concentration than many native species and appear to thrive where other species cannot. It is possible that native predators reduce goldfish populations in relatively unpolluted areas. It is also possible that goldfish do not compete well with native species of similar ecological habits in unpolluted areas, but thrive in polluted environments where there is an absence of competition.

The percent abundance by number and by weight of goldfish for the 1976 and 1978 collection is listed in Table 24. The great abundance of goldfish in the central portion of the Des Plaines River, especially river miles 55.1 through 45.1, suggests that water quality for other fish species is very poor in this area.

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TABLE 24

GOLDFISH AND CARP X GOLDFISH HYBRIDS COMPARED TO TOTAL FISH COLLECTED DURING 1976 and 1978 IN THE DES PLAINES RIVER

Sampling Station		Goldfish and Carp x Goldfish Hybrids Expressed as Percent of Total Fish Collection			
		By Number		By Weight	
Number	River Mile	1976	1978	1976	1978
18	74.0	0.00	4.00	0.00	3.58
19	67.0	0.49	8.45	0.77	4.11
20	55.1	71.13	33.33	50.07	5.42
251	49.1	76.47*	50.00	86.71*	87.64
126	45.4	66.29	90.60	56.89	74.19
127	45.2	25.00	78.95	5.97	92.29

**No boat electrofishing was carried out at Stations 251 or 23 during 1976. Data for Station 251 are from 1976 Station 149; data for Station 23 are from 1976 Stations 23, 156, and 157 (see Dennison, 1978). Gear used was backpack electrofishing and minnow seines.

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TABLE 24 (continued)

GOLDFISH AND CARP X GOLDFISH HYBRIDS COMPARED TO TOTAL FISH COLLECTED DURING 1976 and 1978 IN THE DES PLAINES RIVER

Sampling Station Number	River Mile	Goldfish and Carp x Goldfish Hybrids Expressed as Percent of Total Fish Collection By Number 1976	By Number 1978	By Weight 1976	By Weight 1978
21	45.1	66.67	92.86	99.11	98.69
22	35.2	40.97	20.00	20.76	11.93
23	28.2	8.33**	13.31	27.76**	12.15

**No boat electrofishing was carried out at Stations 251 or 23 during 1976. Data for Station 251 are from 1976 Station 149; data for Station 23 are from 1976 Stations 23, 156, and 157 (see Dennison, 1978). Gear used was backpack electrofishing and minnow seines.

Similarly the number of fish species (Table 25) decreased in the central Cook County area, with the rise at Station 126 (above Salt Creek) suggesting that Salt Creek further degraded the water quality of the river below the mouth.

In order to compare species diversity indices within the river, and to get sufficient individuals (about 100) for computation of the indices, the river was divided in three 15.2 mile sections. The species diversity data are shown in Table 26. Again, the middle Des Plaines River showed poor species diversity, compared with the upper and lower sections.

In terms of the quality of water in the Des Plaines River to support fish populations, the water quality of the Des Plaines River was degraded and of poor quality below Wheeling, Illinois, at Golf Road, and improved in water quality below Willow Springs Road in Willow Springs, Illinois. This conclusion was based on the following factors associated with the river in central Cook County:

1) The decreased occurrence and abundance of fish species other than goldfish in this central portion of the river, with a resultant low species diversity index for this river section.
2) The predominance of goldfish in the central river section. This fish species especially is associated with polluted waters (15).

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TABLE 25

FISH SPECIES DIVERSITY PARAMETERS FOR THE
DES PLAINES RIVER DURING 1976 and 1978

Sampling Location			Number of fish species collected*		
Number	Street/Road	River Mile	1976	1978	Total
18	Dundee Road	74.0	11	6	13
19	Golf Road	67.0	12	10	14
20	Grand Avenue	55.1	7	4	7
251	Roosevelt Road	49.1	4**	1	5
126	Forest Avenue	45.4	8	5	10
127	First Avenue	45.2	3	6	7

*Fish were collected by use of a 230 volt boat electrofisher.
**Fish were collected by use of a 12 volt backpack electrofisher 3.8 miles upstream (River Mile 52.9).
***Fish were collected by use of a 12 volt backpack electrofisher and 15-ft. 3/16 inch mesh minnow seine.

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TABLE 25 (Continued)

NUMBER OF SPECIES OF FISH COLLECTED FROM THE DES PLAINES RIVER DURING 1976 and 1978

Sampling Location			Number of fish species collected*		
Number	Street/Road	River Mile	1976	1978	Total
21	Ogden Avenue	45.1	2	4	4
22	Willow Springs Road	35.2	11	8	11
23	Stephen Street	28.2	8***	9	11

*Fish were collected by use of a 230 volt boat electrofisher.
**Fish were collected by use of a 12 volt backpack electrofisher 3.8 miles upstream (River Mile 52.9).
***Fish were collected by use of a 12 volt backpack electrofisher and 15-ft. 3/16 inch mesh minnow seine.

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TABLE 26

FISH SPECIES DIVERSITY PARAMETERS FOR THE
DES PLAINES RIVER DURING 1976 AND 1978

River Section	River Miles	Station Numbers	Year of Collection					
			1976			1978		
			Parameters*					
			S	N	H	S	N	H
Upper 1/3	74.0-67.0	18,19	16	342	1.601	12**	96	1.547
Middle 1/3	55.1-45.1	20,251,126,21	12**	437	1.355	9**	170	0.713
Lower 1/3	35.2-28.2	22,23	13**	288	1.968	11**	288	1.796

*S = number of species collected, N = number of individual fish collected, H = species diversity index.
**Includes carp x goldfish hybrids.

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