

A SURVEY OF THE FISHES AND MACROINVERTEBRATES OF SOME SMALL STREAMS IN COOK, LAKE, AND DUPAGE COUNTIES, ILLINOIS

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ABSTRACT

A survey of the fishes and macroinvertebrates of six Chicago-area streams in Illinois was conducted in 1984-85. The faunas were typical of highly disturbed and enriched streams; at most sites the number of individuals and species was low and intolerant species were not collected. A total of 17 fish species representing 6 families, and 20 aquatic insect genera representing 14 families was collected. Karr's (1981) index of biotic integrity indicated that the fish faunas of most of the streams sampled were of poor to very poor quality. Similar results were obtained for the aquatic insect faunas with Hilsenhoff's (1977) biotic index. A comparison of records of Chicago-area fishes from the late 19th and early 20th century with contemporary post-1950 records, shows massive changes in the composition of the region's fish fauna in the past 100 years. These changes appear to be a consequence of the widespread disturbance and pollution of streams that accompanied the development of the Chicago region. Stream biotas can contribute significantly to downstream water quality by processing nutrients received from runoff, but without a thriving biota, headwater streams function merely as conduits. By disrupting the establishment and function of stream biotas, continued perturbation of headwater streams and their watersheds in the Chicago area may prevent the achievement of future water quality goals for the region.

INTRODUCTION

In the mid-19th century, Kennicott (1855) published a list of 30 species of fishes

from Cook County streams before the region was heavily settled. More comprehensive late 19th and early 20th century surveys by Forbes and Richardson (1908) and Meek and Hildebrand (1910) reported more than 60 species. These later studies provide a record of the fish communities once found in Chicago-area streams. Surveys conducted since 1950 have documented the dramatic loss of fish species and aquatic habitat that accompanied the development of the Chicago region after the turn of the century (Smith, 1971, 1979; Brigham et al., 1978; Karr, 1981; Karr et al., 1985; Fausch et al., 1984; Bertrand, 1984).

The 1984-85 survey reported here emphasizes repeated, seasonal sampling of small headwaters because these streams are most sensitive to perturbation (Karr and Gorman, 1975; Karr and Dudley, 1978; Gorman and Karr, 1978), are often under-represented in area surveys, and are often overlooked in assessing environmental impacts. In addition to fishes, a survey of aquatic macroinvertebrates and measures of physicochemical parameters were included in the assessment of these streams. Indexes of biotic integrity for fishes (Karr, 1981; Karr et al., 1986) and aquatic insects (Hilsenhoff, 1977) were calculated for each sampling site. These indexes allow assessment and comparison of the quality of biological communities on a regional basis.

STUDY AREAS

Seven sites on six streams were sampled in the Chicago region (Cook, DuPage, and Lake counties; Fig. 1). The streams sampled were the West Branch of the DuPage River (Site A), Meacham Creek (Site B), Salt Creek (Site C), Willow Creek (Site D), Bensenville Ditch (Site E), and Aptakisic Creek (Sites F and G). The two sites on Aptakisic Creek (F and G) were sampled once in September 1984 and the remaining sites A-E were sampled monthly from May through October 1985. The sites are described briefly below.

Site A. Bensenville Ditch (T40N, R11E, section 13). This first order stream was located in Cook County on the O'Hare Airport property and is a tributary of the DesPlaines River. The stream has been channelized and the local watershed has undergone repeated, massive disturbances from ongoing construction on airport property.

Site B. Willow Creek (T40N, R11E, section 11). This site was located in DuPage County just west of the intersection of Thorndale Avenue and York Road. The first-order stream is a headwater of Willow Creek, a tributary of the DesPlaines River. The stream's original channel has been relocated since the area was developed, and above the sampling site the stream is contained within underground storm sewers and drains an industrial park complex.

Site C. Salt Creek (T40N, R11E, section 4). This site was located in DuPage County where Thorndale Road crosses the stream approximately 2.5 km west of the intersection with Ill. Rte. 83. Salt Creek is a 3-4th order tributary of the DesPlaines River and the watershed above the sampling site contains a large portion of highly urbanized western Cook County. Approximately 3 km north, Salt Creek has been dammed to form Busse Wood Reservoir. The site has been channelized and the immediate vicinity was undergoing industrial park development during the period of study.

Site D. Meacham Creek (T40N, R10E, section 1 and T41N, R10E, section 36). This site was located in DuPage County between Nerge and Meacham Roads. The

stream is a small, first-order, channelized headwater of Meacham Creek, a tributary of Salt Creek. The stream drains a residential area in DuPage and Cook counties, and starting at Jenson Park, the upstream portion is contained within underground storm sewers.

Site E. West Branch of the DuPage River (T41N, R10E, section 31). This site was located in western Cook County on the Metropolitan Sanitary District of Chicago (MSD) property just north of the Milwaukee RR. A supplementary site was located downstream at Ill. Rte. 20 in DuPage County (T40N, R10E, section 6). The stream is a 1st-2nd order headwater that drains urban and residential areas of Hanover Park and Schaumburg. The upper DuPage River has undergone massive modification and channelization in the last 30 years as the area became urbanized. North of Irving Park Road (Ill. Rte. 19) the stream is contained within an underground storm sewer system. Just north of MSD property, output from a large sewage treatment plant dominates the discharge of the stream (est. > 90%).

Site F. Aptakisic Creek at Busch Road (T43N, R11E, section 28). This site was located in Lake County at Busch Road. The stream is headwater of Aptakisic Creek, a second order tributary of the DesPlaines River. At the time of the sampling, the upper watershed was largely agricultural but subsequently has undergone extensive residential development. The stream in this area had been channelized about 20 years earlier.

Site G. Aptakisic Creek at the DesPlaines River (T43N, R11E, section 35). This site was located in Lake County above the mouth of Aptakisic Creek on the floodplain of the DesPlaines River.

METHODS

During each visit to study sites A-E, the following physico-chemical parameters were measured with portable instrumentation: temperature, dissolved oxygen (DO), conductivity, and pH. Biochemical oxygen demand (BOD) was measured for stream sites A-E in August or September 1985. BOD was expressed as the difference between initial DO and dark bottle DO concentrations, and net primary productivity was expressed as the difference between light bottle and initial DO concentrations (after Wetzel and Likens, 1979). A modified Winkler method (Hach DO kits) was used for light and dark bottle DO determinations.

For stream sites A-E, habitat was measured using the method of Gorman and Karr (1978) to describe stream habitat characteristics. This included determination of mean channel width, estimated sustained discharge, mean depth, mean current speed, and mean substrate size and typical substrate types. A minimum of 30 habitat sample points were taken at each site. Description of habitat characteristics for sites F and G were based on observations recorded in field notes.

Fishes were sampled using 3 and 5 mm mesh seines, 1 x 3 and 1.5 x 5 m, respectively, in size. At each site, 100 m of stream channel was scined 4 to 8 times. Fishes over 250 mm in length were measured and released. Samples of smaller fishes were initially preserved with 10% formalin, later washed, and finally stored in 40% isopropyl alcohol. Fishes were identified with the aid of the following references: Cross (1967), Pflieger (1975), Smith (1979), and Trautman (1981). Vouchers of species collected have been deposited in the Field Museum of Natural History at Chicago and in the Museum of Natural History at the University of Kansas. Karr's index

of biotic integrity (Karr, 1981; Karr et al., 1986) was calculated for the composite collections for each stream site to provide a relative measure of stream biological integrity/quality.

Macroinvertebrates were sampled at sites A-E with a fine, 220 μm Surber sampler. Four Surber samples were taken during each site visit. To obtain a representative invertebrate sample for each site, each Surber sample was taken over a different substrate type. Additional invertebrates were collected from the seine while sampling fish. The samples were picked in the field until most invertebrates were removed or for a maximum of 60 minutes for 2 persons (2 man-hours). The samples were initially preserved in 10% formalin and later transferred to 40% isopropyl alcohol. Keys in Hilsenhoff (1975) and Pennak (1978) were used to identify invertebrates to the genus level. Hilsenhoff's (1977) Biotic Index was calculated for composite samples of aquatic insects from each primary site to provide an independent assessment of the relative biological integrity/quality of the sampling sites.

RESULTS

Physico-chemical Conditions

None of the sites experienced extremes in temperature which can be attributed to the mild summer conditions in 1985. During the summer months of 1985 (June-Sept.) the water temperature ranged from 19 to 27.2 C.

Dissolved oxygen (DO) at most sites and sample periods was adequate for fishes and usually close to saturation level. Exceptions occurred at sites A, B, and D where DO sometimes dropped below saturation to 3.0 ppm or less, a level stressful or inadequate for most fish. Examples of supersaturation (0.1-3.8 ppm above saturation) were recorded at sites C, D, and E. The high densities of algae (e.g., *Spirogyra*, *Cladophora*, *Hydrodictyon*) and macrophytes (e.g., *Potamogeton*, *Elodea*, *Ceratophyllum*) present at these sites may have been responsible for the supersaturation.

BOD was measured to identify sites with serious organic pollution problems and to assess relative net primary productivities. None of the sites showed BODs in excess of 1.6 ppm, but this result contrasts sharply with another northeastern Illinois stream, Nippersink Creek (McHenry County), where no measureable BOD's were recorded (Gorman, 1987). The relatively high BODs at sites A, B, and D (1.4-1.6 ppm) may have exacerbated the occasional near-anoxic conditions recorded at these sites. Except for Site A, none of the sites showed very much net productivity (usually <1.0 ppm; Site A was 6.3 ppm). However, sites C and D showed negative net productivities (-1.5 and -1.2, respectively), indicating that there was very little photosynthetic activity in the samples to overcome BOD and that most of the BOD could not be attributed to phytoplankton respiration.

Conductivities were usually over 1000 μMHOs at most sites and sample periods and showed a pattern of increase during the summer and decline during the autumn. For comparison, typical tap water in DeKalb, Illinois (well water) has conductivities in the 500-600 range. The pH ranged from 7.4 to 8.2 over the stream sites and sample periods.

Habitat Characteristics

Habitat characteristics of the stream sites are summarized in Table 1. Sites A, B, D, and F were small, shallow streams with sluggish currents and small discharges while Sites C and E were larger, deeper streams with considerable current and dis-

charge. Substrates were typically fine, with exposed clay deposits and silts being most common. Substrates at sites A, D, and F consisted of soft, silty deposits rich in organic matter. Substrates at the other stream sites were more firm and consisted of exposed clay pans, gravel, and sand. All streams had been channelized and had steep banks, and most streams had poorly developed woody riparian vegetation. Sites A and B had well-developed stands of cattails (*Typha*) along their stream channels, but the stand at Site B was removed by dredging during July, 1985. The dominant riparian vegetation at the remaining stream sites consisted mainly of exotic canary grass (*Phalaris arundinacea*).

Fishes

A composite summary of the fish collection data is presented in Table 2. In total, 573 fish representing 17 species and 6 families were recorded in 27 collections. The mean number of fishes per collection at most of the stream sites was low: for the 27 collections, the overall mean was 21 (means for sites A-E ranged from 0 to 31). Sites A and B harbored very few fish (totals were 15 and 1, respectively). Only a single fish, a goldfish (*Carassius auratus*), was collected at Site B (Willow Creek) and this specimen was found near-dead and floundering in the stream. This capture is notable because goldfish are very tolerant of poor environmental conditions (Smith, 1979). Only three species were found at Site A (Bensenville Ditch): fathead minnow (*Pimephales promelas*), mosquito fish (*Gambusia affinis*), and green sunfish (*Lepomis cyanellus*). These species are known for their tolerance of poor environmental conditions (Smith, 1979; Karr, 1981; Trautman, 1981). While more fish were caught at Site C (Salt Creek), the mean number per collection was still relatively low for a stream of this size (Karr, 1981; Gorman, pers. obs.), and one of the most common species, the carp (*Cyprinus carpio*), is not an indicator of good environmental quality (Smith, 1979; Karr, 1981; Trautman, 1981). The fauna at Site D (Meacham Creek) was dominated by the green sunfish, indicating poor environmental conditions (Smith, 1979; Karr, 1981). Site E (DuPage River) harbored the most diverse assemblage of fishes (12 spp.) and also yielded the most individuals (31) per collection for seasonally sampled sites. However, the mean number fish per collection was below normal for a stream with this level of discharge (Karr, 1981; Gorman, pers. obs.), and the fauna was dominated by creek chub (*Semotilus atromaculatus*), sand shiner (*Notropis stramineus*), bluntnose minnow, fathead minnow, and green sunfish, all of which are considered environmentally tolerant species (Smith, 1979; Trautman, 1981). Other environmentally tolerant species captured were goldfish (only one captured, but many more were sighted) and mosquito fish. Three white suckers (*Catostomus commersoni*), a relatively tolerant species (Smith, 1979; Trautman, 1981), were taken but two were found dead in the stream. Sites F and G, which were sampled once, yielded the greatest number of fish per collection (136 and 103, respectively). Site F (Aptakisic Creek) represented the best headwater community with 9 species, but was dominated by creek chub, bigmouth shiner (*N. dorsalis*), fathead minnow, and black bullhead (*Ictalurus melas*), all of which are considered tolerant species (Smith, 1979). Site G, which was close to the relatively large DesPlaines River, had a surprisingly low number of species (7). Karr's (1981) index of biotic integrity was calculated for the composite fish collections for each stream site (Table 2). The indexes ranged from very poor for sites A and B (22, 15 respectively) to fair for Site F (41).

Macroinvertebrate Fauna

A composite summary of the macroinvertebrate collection data from sites A-E is presented in Table 3. Overall, more than 772 aquatic insects representing 20 genera and 14 families were collected. The insect fauna consisted mainly of odonates, hemipterans, and dipterans. The total absence of ephemeropterans, plecopterans, and trichopterans is noteworthy. Species in these orders are generally much less tolerant of stressful environmental conditions (Hilsenhoff, 1977). At most sites the insect fauna was dominated by anisoptera, corixids, notonectids, and chironomids. The eutrophic conditions caused by effluent from an upstream sewage treatment plant at Site E (DuPage River) explains the preponderance of simuliids at this site. These insect communities are typical of disturbed and highly eutrophic streams (Hilsenhoff, 1977; Welch, 1980; Kondratieff et al., 1984; Ward, 1984). Hilsenhoff's (1977) biotic index was calculated to estimate the relative quality of the insect communities (Table 3). The indexes ranged from 3.07 to 3.81, indicating poor to very poor environmental conditions (significant to gross disturbance or enrichment).

Gastropods and crayfish were relatively abundant, particularly at sites A and D where large quantities of organic matter were present. *Tubifex* were very abundant at Site B, indicating a severe pollution problem (Pennak, 1978). Isopods (*Asellus* spp.) were abundant at Site D, indicating severe eutrophication (Hilsenhoff, 1977).

DISCUSSION

A comparison of late 19th and early 20th century records from Forbes and Richardson (1908) and Meek and Hildebrand (1910) with more contemporary records from Smith (1979), Brigham et al. (1978), Bertrand (1984), and this report shows great changes in the fish fauna of Chicago-area streams (Table 4). Overall, the number of species for the region decreased from 67 species to 58, but 21 species were extirpated and 12 new species appeared. A more informative analysis shows that since 1908-10, 45 species were extirpated or became more restricted in distribution in the region while 21 species were added or increased their distribution. Most of the new species are characteristic of disturbed streams, e.g., goldfish, carp, bigmouth shiner, red shiner (*Notropis lutrensis*), and fathead minnow. Some species with increased distributions are considered environmentally tolerant species, e.g., green sunfish. One new species, the brook stickleback (*Culaea inconstans*), was probably always present in the Chicago area but was not detected in the late 19th century surveys probably because of insufficient sampling effort. The greater number of species detected in the late 19th century surveys is more noteworthy for this reason; approximately 19 sites were sampled while at least 73 were sampled in the post-1950 surveys (Table 4). Many of the environmentally intolerant species collected in the older surveys are now rare or extirpated in Illinois or have been extirpated from the Chicago region, e.g., pugnose shiner (*Notropis anogenus*), blackchin shiner (*N. heterodon*), blacknose shiner (*N. heterolepis*), greater redhorse (*Moxostoma valenciennesi*), banded killifish (*Fundulus diaphanus*), and banded darter (*Etheostoma zonale*). Of these fishes, the pugnose shiner and blacknose shiner are listed as threatened species in Illinois (Smith and Page, 1981).

A composite of the post-1950 records indicates the presence of 11 to 40 species in the major Chicago-area watersheds (Table 4). I have omitted the Calumet River drainage because it has been recently studied by Greenfield and Rogner (1984). The

Chicago, DuPage, and DesPlaines river and Salt Creek drainages are considered to have below-average fish diversities for their size in Illinois (Smith, 1971). The Chicago River drainage, with the lowest diversity of fishes in the area, appeared to have been impacted by urban development by the late 19th century when it served "an indispensable purpose to the City of Chicago . . . in conveying away their liquid wastes" (Forbes and Richardson, 1908, p. xxxix). Similarly, Forbes and Richardson commented on the turbidity and pollution in the lower DesPlaines River (p. xxxiv). Forbes and Richardson commented more extensively on the negative impact of human disturbance on another Chicago-area drainage, the lower Fox River (pp. xlvii-xlviii): "It is claimed that the stream has fallen off one-half in its low-water volume since the clearing and cultivating of the land and the draining of swamps". They went on to explain the purpose of the watershed's natural basins—"These numerous lakelets, ponds, marshes, and bogs furnish, in their aggregate, a considerable storage for flood waters, and the volume of the stream is consequently comparatively uniform and its changes of level are relatively slow." They remarked that some of the watershed's morainic lakes had been "drained so thoroughly that they have become small prairies", and "though much of the riverbed below Elgin is rock, the tributaries often bring large amounts of sediment, and various manufactories along the river discharge a large amount of refuse in the stream, and it has, of late years, become so foul that nearly all fish except carp and other filth-enduring species have been drowned out". Apparently, the fish faunas of some streams in the region had already declined by the time of the late 19th century surveys.

Prior to 1910, Hickory Creek appeared to have a relatively rich fauna for a third-order stream and included a number of environmentally intolerant species, e.g., pugnose shiner, blackchin shiner, blacknose shiner, least darter (*Etheostoma microperca*), and banded darter (Table 4). Records in Meek and Hildebrand (1910) show that two small streams, Pettibone Creek in North Chicago and a ditch in Glenco, harbored blacknosed dace (*Rhinichthys atratulus*) and southern redbellied dace (*Phoxinus erythrogaster*). The former species has been extirpated from Chicago region and the latter may still persist in some portions of the DuPage River and Hickory Creek drainages. A comparison of species found in the Chicago area in the late 19th century (Table 4) with species now found in Nippersink Creek in McHenry County (Gorman, 1987) shows striking similarities. Although the Nippersink Creek is not pristine, it still harbors most of the species originally found in northeastern Illinois streams. Smith (1971) indicated that Hickory Creek is the outstanding stream in the Chicago area and his records are supported by those of Brigham et al. (1978) and Bertrand (1984).

My survey has provided new distributional records for the mosquitofish (*Gambusia affinis*) in the upper DuPage River and middle DesPlaines River drainages. The presence of mosquitofish in the Chicago region is unusual considering the closest records shown by Smith (1979) are farther south in the lower Rock and Illinois rivers. Possibly, they are able to persist through severe winters in the Chicago area because of the moderation of water temperatures by ground seeps and sewage treatment plant effluents.

During my 1984-85 survey, destruction of aquatic habitat throughout the region was observed as an ongoing, everyday occurrence. For example, sometime after the completion of Smith's post-1950 surveys, the larger south branch of Aptakisic Creek

was diverted into the Wheeling Ditch which empties into the DesPlaines River below Wheeling (Fig. 1). The headwater Site F on the north branch was destroyed by rechannelization immediately after our sampling in the fall of 1984. Most of the Aptakisic Creek watershed now consists of housing developments, shopping centers, and industrial parks. During 1985 I observed similar examples of disturbance at other sites: the Bensenville Ditch (Site A) was converted into a storm sewer as part of a construction project on the O'Hare Airport property; the Willow Creek headwater Site B, the Meacham Creek headwater Site D, and the Salt Creek Site C were dredged; massive landscape alterations and construction activities were under way in the immediate vicinity of sites A, C, B, and F. My failure to find central mudminnows, which typically inhabits marsh habitat (Smith, 1979), is notable because I sampled numerous marshes in the region (Gorman, 1985). However, these marshes were remnants of previously extensive ones; most were partially drained and filled so that standing water was present only in the spring and early summer.

Two independent biotic integrity indexes, Karr's (1981) for fish and Hilsenhoff's (1977) for aquatic insects, both indicated that the aquatic communities of the streams sampled were of low quality and that the environments were severely disturbed and enriched (Tables 2 and 3). My findings are comparable to those of Smith (1971, 1979), Brigham et al. (1978), Karr (1981), Fausch et al. (1984), and Bertrand (1984) who also found streams in the Chicago area to be severely disturbed and polluted and contained fish assemblages of low diversity. Karr (1981) reported biotic indexes similar to mine for some Chicago-area streams (based on Brigham et al.'s 1976 surveys)—very poor to poor biological integrity (22-32, $\bar{x} = 27$). Bertrand's 1983 survey of Chicago-area streams showed similar biotic indexes—very poor to fair (16-44, $\bar{x} = 27$). In contrast, Karr's (1981) Fox River sites indicated fair to good biotic indexes (44-52, $\bar{x} = 49$), and for sites on the Nippersink Creek, a Fox River tributary, I found indexes ranging from good to very good (50-56, $\bar{x} = 54$). Bertrand (1984) has commented that widespread disease in Chicago-area stream fish populations is a reflection of poor water quality. Bertrand further argues that poor water quality and not a lack of adequate stream habitat structure is the major impediment to an improvement in the quality of Chicago-area stream fish communities.

While present development of the Chicago region does not reflect concern for the biological integrity of the area's streams, it does reflect an emphasis on flood control; retention basins have been constructed in areas of new development to control expected increases in runoff. While the proliferation of these basins and ponds at first appears to restore lost aquatic habitat, a closer examination suggests otherwise. Many of these retention basins impound small streams and block upstream movement of fish, and the sunfish and bass stocked in these ponds eventually replace the stream fishes if they were not eradicated by construction activities. Also, because these basins are steep-sided to maximize volume, they are relatively unproductive and contain few fish. In a 1961 Division of Waterways report (Dept. Publ. Works, 1961), these flood retention basins are cited as having the potential to improve the water quality of polluted streams, but the proliferation of these basins since the 1960's throughout the Chicago region appears to have had little impact on water quality.

The widespread nature of the destruction of Chicago-area streams is alarming and previous warnings concerning consequences for aquatic faunas of the region appear to have been largely ignored (e.g., Smith, 1971, 1979; Brigham et al., 1978;

Karr et al., 1985). Even the survival of the low-quality aquatic faunas of small Chicago-area streams may be in question because of the unabated and extensive nature of the region's development. My survey purposely emphasized small, headwater streams because they are often overlooked in regional management plans for water and land resources. Small streams perform vital biological functions in local ecosystems, e.g., nutrient processing and productivity (Hall, 1972; Vannote et al., 1980) and provide spawning habitats and nurseries for many downstream fish species (Hall, 1972; Karr and Gorman, 1975). By processing nutrients received from runoff, the biotas of headwater streams can contribute significantly to downstream water quality (Karr and Dudley, 1981; Karr et al., 1985). But because of their intimate association with the land, headwater streams are readily impacted by pollutants, alterations of the landscape, and poor land-management practices (Karr and Schlosser, 1978; Karr et al., 1983). Karr et al. (1985) argue that to realize a recovery of water quality in stream systems, an integrated approach emphasizing the biological integrity of streams coupled with watershed-level resource management must be implemented. Present water quality standards that emphasize criteria for specific contaminants ignore the important function of biological systems in achieving water quality standards, and ultimately will fail to achieve water quality goals (Karr et al., 1985).

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Table 1. Summary of habitat characteristics of streams at sampling sites in Cook, DuPage, and Lake counties, Illinois. Values for Sites F and G are estimates based on field notes. Rank order of the 3 most predominant substrates is shown. Sampling site locations are shown in Figure 1.

	SITES						
	A	B	C	D	E	F	G
stream order	1	1	3-4	1	1-2	1	2
mean channel width (m)	3.0	2.4	14.5	3.5	4.4	1.0	2.0
est. sustained discharge (cu. m/sec.)	<.01	<.04	>2.0	<.01	<.30	<.01	<.10
mean depth (m)	.30	.14	.99	.21	.42	.10	.25
mean current (m/sec.)	.00	.02	.18	.01	.13	.01	.10
mean substrate size (mm)	<.06	.09	1.54	.05	1.67	<.10	1.50
predominant substrates							
clay pan	3	1	2	2	2	2	—
silt	1	2	3	1	—	1	2
sand	—	—	—	—	1	—	1
gravel	—	3	1	3	3	—	3
detritus	2	—	—	—	—	3	—

Table 2. Summary of fish collections from streams in Cook, DuPage, and Lake Counties, Illinois. Sampling site locations are shown in Figure 1.

taxa:	SITE							total
	A	B	C	D	E	F	G	
Cyprinidae								
<i>Cyprinus carpio</i>	—	—	33	1	4	—	3	41
<i>Carassius auratus</i>	—	1	—	—	1	—	—	2
<i>Notemigonus crysoleucas</i>	—	—	—	3	—	2	—	5
<i>Semotilus atromaculatus</i>	—	—	—	—	49	16	—	65
<i>Notropis dorsalis</i>	—	—	—	—	—	78	—	78
<i>N. spilopterus</i>	—	—	2	—	—	—	80	82
<i>N. stramineus</i>	—	—	—	—	35	—	8	43
<i>Pimephales promelas</i>	5	—	7	9	23	14	—	58
<i>P. notatus</i>	—	—	48	—	21	5	2	76
Catostomidae								
<i>Catostomus commersoni</i>	—	—	—	—	3	—	—	3
Ictaluridae								
<i>Ictalurus melas</i>	—	—	—	—	1	11	1	13

Table 2. (continued).

Cyprinodontidae								
<i>Fundulus notatus</i>	—	—	—	—	—	—	2	2
Pociliidae								
<i>Gambusia affinis</i>	6	—	—	—	2	—	—	8
Centrarchidae								
<i>Micropterus salmoides</i>	—	—	—	19	1	2	—	22
<i>Lepomis cyanellus</i>	4	—	4	37	13	5	—	63
<i>I. macrochirus</i>	—	—	—	—	1	3	7	11
<i>Pomoxis nigromaculatus</i>	—	—	1	—	—	—	—	1
Total number of fish	15	1	95	69	154	136	103	573
Total number of species	3	1	6	5	12	9	7	17
Number of collections	5	5	5	5	5	1	1	27
Mean No. fish/collection	3	0	19	14	31	136	103	21
Karr's biotic index*	22	15	25	30	34	41	33	29(\bar{x})
	VP	VP	P-VP	P	P	F	P	P

*Karr's (1981) index of biotic integrity for stream fish communities:
index

≤23	24-27	28-35	36-38	39-44	45-47	48-52	53-56	57-60
class								
very poor (VP)	P-VP	poor (P)	F-P	fair (F)	G-F	good (G)	E-G	excellent (E)

Table 3. Macroinvertebrate fauna of small stream sampling sites in Cook and DuPage Counties, Illinois. Sampling site locations are shown in Figure 1.

taxa:	SITES					TOTAL
	A	B	C	D	E	
INSECTA						
Odonata						
Coenagrionidae						
<i>Enallagma</i>	—	—	—	1	—	1
<i>Ischnura</i>	5	17	—	—	—	22
Lestidae						
<i>Lestes</i>	—	—	—	2	2	4
Aeshnidae						
<i>Anax</i>	20	—	—	—	—	20
Libellulidae						
<i>Leucorrhinia</i>	3	—	—	1	—	4
<i>Libellula</i>	10	—	—	1	—	11
Corduliidea						
<i>Somatochlora</i>	22	2	—	—	—	24
Hemiptera						
Belostomatidae						
<i>Belostoma</i>	3	—	—	—	—	3
Corixidae						
<i>Sigara</i>	61	1	4	70	1	137
Notonectidae						
<i>Notonecta</i>	29	1	1	24	—	55
Naucoridae						
<i>Pelocoris</i>	1	—	—	—	—	1
Coleoptera						
Haliplidae						
<i>Haliphys</i>	3	—	—	1	—	4
Hydrophilidae						
<i>Hydrochara</i>	1	—	—	—	—	1
Diptera						
Chironomidae						
<i>Chironomus</i>	12	72	—	15	3	102
<i>Cryptochironomus</i>	—	2	—	37	—	39
<i>Dicrotendipes</i>	31	—	2	—	41	74
<i>Endochironomus</i>	4	—	3	—	—	7
<i>Procladius</i>	3	48	—	9	—	60
Culicidae						
<i>Culex</i>	—	3	—	—	—	3
Simuliidae						
<i>Simulium</i>	—	—	—	—	200 +	200 +

Table 3. (continued).

taxa:	SITES					TOTAL
	A	B	C	D	E	
CRUSTACEA						
Isopoda						
Asellidae						
<i>Asellus</i>	—	—	—	86	—	86
Decapoda						
Astacidae						
<i>Procambarus acutus</i>	81	5	—	35	—	121
unident. spp.	—	—	9	—	—	9
MOLLUSCA						
Gastropoda						
Lymnaeidae						
<i>Lymnea</i>	3	—	—	20	—	23
Physidae						
<i>Physa</i>	37	3	—	56	11	107
Planorbidae						
<i>Gyraulus</i>	57	2	—	6	7	72
Bivalvia						
Sphaeriidae						
<i>Musculium</i>	4	—	—	7	1	12
ANNELIDA						
Oligochaeta						
Tubificidae						
<i>Tubifex</i>	—	300 +	—	—	—	300 +
Hirudinea						
Erpobdellidae						
<i>Erpobdella</i>	2	—	—	3	—	5
Hirudidae						
<i>Haemopsis</i>	—	—	—	1	—	1
TOTALS	392	456 +	19	375	266 +	1508 +
Insect totals	208	146	10	161	247 +	772 +
Hilsenhoff's biotic index*	3.55 poor	3.07 poor	3.20 poor	3.60 poor	3.81 very poor	3.45(\bar{x}) poor

*Hilsenhoff's biotic index (1977) for aquatic insect communities. Amphipods and isopods are included in the calculation of this index.

biotic index	water quality	stream condition
<1.75	excellent	clean or undisturbed
1.75-2.25	good	some enrichment or disturbance
2.25-3.00	fair	moderate enrichment or disturbance
3.00-3.75	poor	significant enrichment or disturbance
>3.75	very poor	gross enrichment or disturbance

Table 4. Historical records of fishes of the Chicago region of Illinois (Cook, DuPage, Lake, and Will counties). Except as noted, records from the DuPage River drainage are from above Plainfield, records from Salt Creek are from above Lyons, and records from the DesPlaines River drainage are from between Lyons and Libertyville. Symbols: f – pre-1908 record from Forbes and Richardson (1908); m – pre-1910 record from Meek and Hildebrand (1910); s – 1950-1972 record from Smith (1979); b – 1976 record from Brigham et al. (1978); d – 1983 record from Bertrand (1984); g – 1984-85 record from Gorman (this report); ? – uncertain record; * – record from DuPage River below Plainfield or from DesPlaines River above Libertyville (post-1950 records not counted in summary or composite); x – species present in composite record; † – decrease, or ‡ – increase in the number of drainages a species was recorded since 1908-10.

TAXA	Drainage						composite	
	DuPage	DesPlaines	Salt	N. Chicago	Hickory	1910	pre-	post-
Lepisosteidae								
<i>Lepisosteus osseus</i>	—	—	—	f	—	x	—	†
Clupeidae								
<i>Dorsoma cepedianum</i>	d	d	—	—	b	—	—	x†
Umbridae								
<i>Umbra limi</i>	s,d	m,s,b	m,s,b	—	m	x	—	x
Esocidae								
<i>Esox americanus</i>	f,s,d	f,m,s*,d	m	—	m	x	—	x†
<i>E. lucius</i>	f	f,m,s,b,d	—	—	—	x	—	x†
Cyprinidae								
<i>Carassius auratus</i>	s,b,d,g	s,b,d,g	s,b,d	b	s,b	—	—	x†
<i>Cyprinus carpio</i>	s,b,d,g	s,b,d,g	s,b,d,g	s,b	b,d,	—	—	x†
<i>Notemigonus crysoleucas</i>	s,b,d	m,s,b,d,g	f,m,s,b,d,g	s	m,s,b	x	—	x†
<i>Semotilus atromaculatus</i>	f,s,b,d,g	f,s,b,d,g	s,b	—	m,s,b,d	x	—	x†
<i>Nocomis biguttatus</i>	f,s,b,d	f,m,b,d	—	—	m,s?,b,d	x	—	x
<i>Phenacobius mirabilis</i>	—	—	—	—	m	x	—	†
<i>Notropis anogenus</i>	—	—	—	—	m	x	—	†

Table 4. (continued).

TAXA	Drainage						composite	
	DuPage	DesPlaines	Salt	N. Chicago	Hickory	1910	1950	
<i>N. atherinoides</i>	f, b	f, b	—	f	b	x	x	
<i>N. chalybaeus</i>	—	f	—	—	—	x	—	
<i>N. chrysocephalus</i>	f, s, b, d*	f	—	—	s, b, d	x	x	
<i>N. cornutus</i>	f, s, d	f, m, s, b, d	m	—	m	x	x†	
<i>N. dorsalis</i>	s, b, d	s, b, d, g	s	—	b, d	—	x†	
<i>N. heterodon</i>	—	s	—	—	m	x	x†	
<i>N. heterolepis</i>	f	f	f, m	—	m	x	—	
<i>N. hudsonius</i>	d*	m	—	—	m	x	—	
<i>N. lutrensis</i>	d*	d	—	—	—	x	—	
<i>N. rubellus</i>	f	—	—	—	—	—	x†	
<i>N. spilopterus</i>	s*, b, d	s, b, d, g	—	—	m, s, b, d	x	x†	
<i>N. stramineus</i>	b, d, g	m, s, b, d, g	g	—	—	—	x†	
<i>N. umbratilis</i>	f, s, d	f, m, s*, b	f	—	m, s, b, d	x	x†	
<i>Phoxinus erythrogaster</i>	s	—	—	—	m, s	x	x†	
<i>Hybognathus nuchalis</i>	—	—	—	f	—	x	—	
<i>Pimephales notatus</i>	f, s, b, d, g	f, m, s, b, d, g	f, m, s, b, g	m	m, s, b, d	x	x†	
<i>P. promelas</i>	s, b, d, g	s, b, d, g	s, b, d, g	s, b, d	s	—	x†	
<i>Campostoma anomalum</i>	f, s, b, d	f, m, s, d	—	—	m, s, b, d	x	x	
<i>F. oligolepis</i>	f	—	—	—	—	x	—	
Catostomidae								
<i>Carpoides cyprinus</i>	d	—	—	—	—	—	x†	
<i>Moxostoma erythrum</i>	f*, d	f, b	—	—	m, s, b	x	x	
<i>M. macrolepidotum</i>	d*	—	—	f	—	x	—	
<i>M. valenciennesi</i>	—	—	f	—	—	x	—	
<i>Hypentelium nigricans</i>	f*, d	f	—	—	m, s	x	x†	

<i>Catostomus commersoni</i>	f	f, s, b, d, g	f, m, s, b, d	f, s, b, d	—	m, s, b, d	x	x
<i>Erimyzon oblongus</i>	f	—	m	—	—	m	x	—
Ictaluridae								
<i>Ictalurus melas</i>	f, s, b, d, g	f, s, b, d, g	f, m, s, b, d, g	f, m, b, s	m, s, b	m, s, b, d	x	x
<i>I. natalis</i>	f, d	—	f, s, b, d	—	—	—	x	x
<i>I. nebulosus</i>	—	—	m	—	—	—	x	—
<i>Noturus exilis</i>	f	—	—	—	—	m, s	x	x
<i>N. flavus</i>	—	—	f	—	—	m, s	x	x
<i>N. gyrinus</i>	f, s	—	f, m, s	f	m	—	x	x
<i>N. nocturnus</i>	—	—	f	—	—	—	x	—
Aphredoderidae								
<i>Aphredoderus sayanus</i>	—	—	f, s*	m	—	—	x	x
Cyprinodontidae								
<i>Fundulus diaphanus</i>	—	—	m	—	—	—	x	—
<i>F. dispar</i>	f	—	f	—	—	—	x	—
<i>F. notatus</i>	f	—	f, m?, s*, b, d, g	f	—	m, b	x	x
Poecillidae								
<i>Gambusia affinis</i>	g	—	g	—	—	—	—	x
Atherinidae								
<i>Labidesthes sicculus</i>	f*	—	—	d	—	—	x	x
Gasterosteidae								
<i>Culaea inconstans</i>	s	—	s*, b	—	—	—	—	x
Cottidae								
<i>Cottus bairdi</i>	—	—	—	—	—	f?, b	x	x
Percichthyidae								
<i>Morone chrysops</i>	—	—	—	—	f	—	x	—
<i>M. mississippiensis</i>	—	—	b	—	f	—	x	x
Centrarchidae								
<i>Micropterus dolomieu</i>	f, d	—	m	—	—	m, s, b	x	x
<i>M. salmoides</i>	d, g	—	m, s, b, d, g	b, d, g	b	s, b	x	x
<i>Lepomis cyanellus</i>	s, b, d, g	—	m, s, b, d, g	m, s, b, d, g	m, s, b, d	m, s, b, d	x	x
<i>L. gibbosus</i>	f, s, d*	—	m, s, b, d	s, b	s, b	—	x	x

Table 4. (continued)

TAXA	Drainage							composite	
	DuPage	DesPlaines	Salt	N. Chicago	Hickory	1910	pre-	post-	
<i>L. gulosus</i>	—	m?	—	m	m	x	—	1950	
<i>L. humilis</i>	—	—	—	b	s, b	—	x†	—	
<i>L. megalotis</i>	—	m	—	—	m	x	—	—	
<i>L. macrochirus</i>	s, b, d, g	m, s, b, d, g	s, b, d	m, s, b, d	m, s, b, d	x	x†	—	
<i>Ambloplites rupestris</i>	f	f, m, b	m	—	m, s, b	x	x†	—	
<i>Pomoxis annularis</i>	d	m, s	—	f	—	x	x†	—	
<i>P. nigromaculatus</i>	f, b, d	s, b, d	b, d, g	b	m, b, d	x	x†	—	
Percidae									
<i>Percu flavescens</i>	d*	s	—	f	m	x	x†	—	
<i>Percina caprodes</i>	—	m	—	—	s	x	x†	—	
<i>P. maculata</i>	s	f, m, s*, b	f, m	—	s	x	x†	—	
<i>P. phoxocephala</i>	f*	—	—	—	—	x	—	—	
<i>Etheostoma atrigene</i>	f*	—	—	—	—	x	—	—	
<i>E. caeruleum</i>	—	m	—	—	m, s, b	x	x†	—	
<i>E. exile</i>	—	m, s	—	—	f?	x	x†	—	
<i>E. flabellare</i>	s	m	—	—	f?, m, d	x	x†	—	
<i>E. microperra</i>	f, s	—	f	—	m	x	x†	—	
<i>E. nigrum</i>	f, s	f, s	m	m	m, s, b, d	x	x†	—	
<i>E. spectabile</i>	s?	—	—	—	s, b, d	—	x†	—	
<i>E. zonale</i>	f	—	—	—	m, b	x	x†	—	
Scaenidae									
<i>Aplodinotus grunniens</i>	—	—	—	f	—	x	—	—	

SUMMARY

Maximum stream order	4	5	4	3	3
Minimum No. sample sites					
pre-1910	5	6	2	2	4
post-1950	14	29	13	4	13
No. species:					
pre-1910	33	45	18	16	39
post-1950	40	40	17	11	39
lost since 1910	13	18	12	13	12
gained since 1910	20	13	11	8	12
decreased distribution					45 (t)
increased distribution					21 (t)

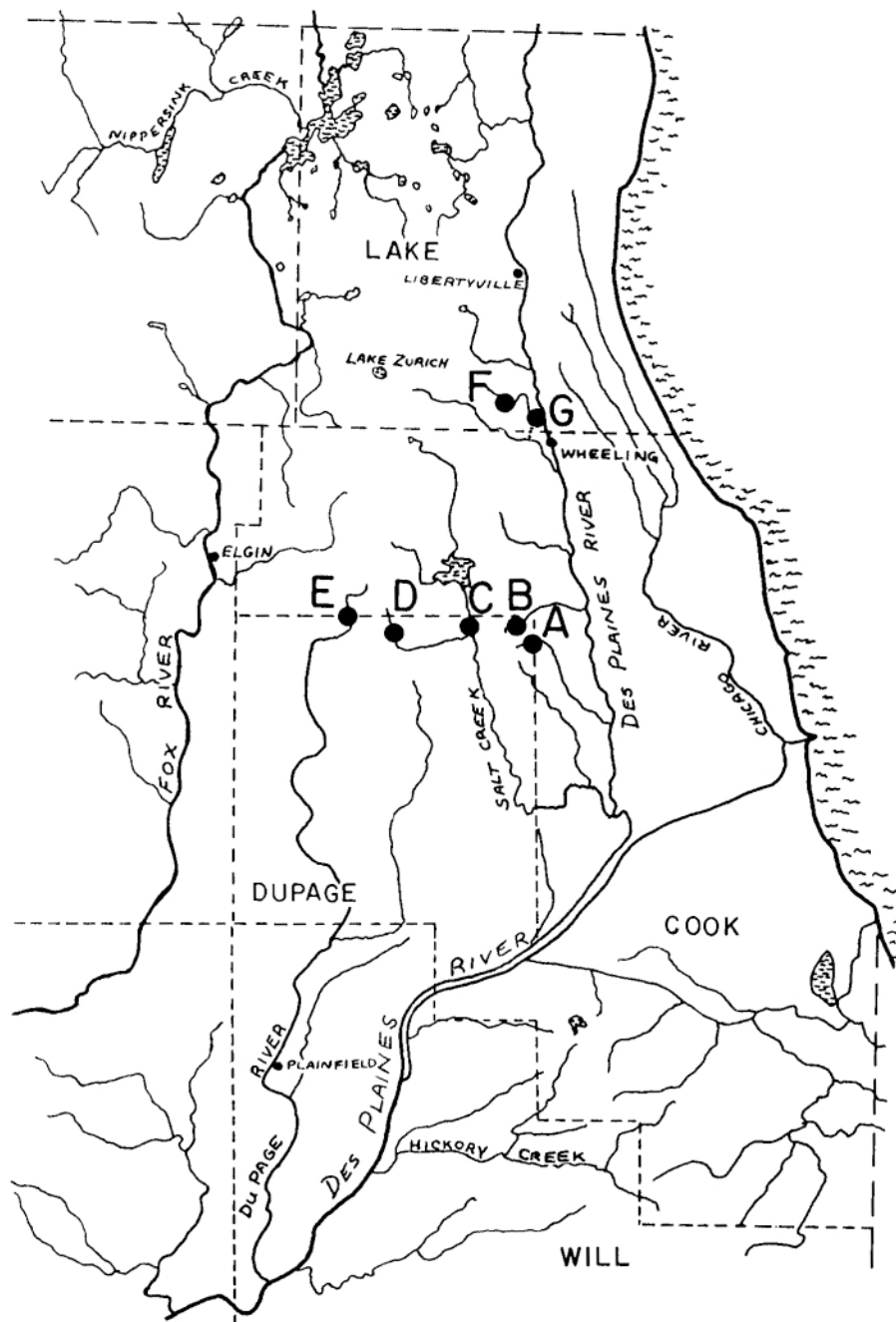


Fig. 1. Map showing locations of aquatic sampling sites in the DesPlaines River, Salt Creek, and DuPage River drainage systems of Cook, DuPage, and Lake Counties, Illinois. Dashed lines show state and county boundaries. Descriptions of sampling sites are provided in the text under STUDY AREAS. Base maps: USGS State of Illinois base map, 1:500,000 scale, 1948 revision, and Illinois Dept. Transportation general highway maps, Cook and DuPage Counties, 1982 revision.