

FISHES AND AQUATIC INSECTS OF NIPPERSINK CREEK, MCHENRY COUNTY, ILLINOIS

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ABSTRACT

A survey of the fishes and aquatic insects of Nippersink Creek, a tributary of the upper Fox River, McHenry County, Illinois, was conducted between September 1985 and July 1986. The aquatic fauna of Nippersink Creek is typical of clean, moderate gradient streams with minimal disturbance. A total of 41 fish species representing 10 families and 39 aquatic insect genera representing 24 families was collected. Twelve fish species represent new records for Nippersink Creek upstream of Spring Grove and 4 species represent new distributional records for the Fox Lake drainage. Karr's (1981) Index of Biotic Integrity indicates that the present fish fauna may be rated good to excellent quality. Similarly high ratings were found for the aquatic insect fauna using Hilsenhoff's (1977) Biotic Index. The high quality of the aquatic fauna and environmental conditions in Nippersink Creek contrast sharply with most northeastern Illinois streams. As such, Nippersink Creek represents a valuable natural resource for the region.

INTRODUCTION

Nippersink Creek, located in McHenry County, Illinois, is the largest tributary of the Fox River (Tichacek, 1968). The Fox River drainage has the second highest diversity of fishes in the state with 102 species (Smith, 1971). This high diversity is unusual for northeastern Illinois where extreme disturbance and pollution has resulted in low biotic diversities in most drainages, e.g., the Chicago, DesPlaines, and DuPage rivers, and Salt Creek (Brigham et al., 1978; Karr, 1981; Fausch et al., 1984; Gorman, 1987a).

The Nippersink drainage is situated in a region of complex morainal topography characterized by hilly terrain, lakes, and bogs. There are two large lakes on the drainage, Lake Elizabeth, a natural glacial lake draining into a tributary of the North Branch of Nippersink Creek, and Wonder Lake, an artificial impoundment on the Nippersink mainstream. The region has greater relief and more complex slope patterns than most of northeastern Illinois, resulting in a rather steep stream gradient (17.7 feet/mile; Tichacek, 1968). The complex topography creates a diversity of aquatic habitats that may explain the diversity of fish species in the area. The typical stream habitat is broad, shallow pools with moderate currents separated by short riffle areas with coarse glacial substrates. Small tributaries of Nippersink Creek are typically cool, spring-fed streams. Other tributaries, such as the Lake Elizabeth drain, are clear, sluggish streams with an abundance of macrophytes.

METHODS

Ten sites on the Nippersink drainage above Spring Grove were sampled. Four primary sites (A-D) were sampled seasonally 3 or 4 times on the following dates: 26-27 Sept. and 21-25 Oct. 1985, and 26-27 May and 25-27 July 1986. Six supplementary sites (E-J) were sampled once during the study period on the following dates: 27 Sept. 1985 (Site E) and 25-27 July 1986 (Sites F-J). The ten sites correspond to locations indicated by the letters A-J in Figure 1 and are described briefly below.

Site A (T46N, R8E, sec. 5) was located on the North Branch of Nippersink Creek, 0.5 km S of the Wisconsin-Illinois border.

Site B (T46N, R8E, sec. 9) was located on the N. B. Nippersink Creek, 0.5 km W of the intersection of U.S. Route 12 and Illinois Route 173.

Site C (T46N, R8E, sec. 21) was located on the N.B. Nippersink Creek, 0.5 km E of the intersection of U.S. Rte. 12 and Ill. Rte. 31.

Site D (T46N, R8E, sec. 20) was located on a small unnamed tributary of the mainstream of Nippersink Creek, 1.3 km W of the intersection of U.S. Rte. 12 and Ill. Rte. 31.

Site E (T46N, R8E, sec. 16) was located on the N.B. Nippersink Creek at Hill Road, 0.5 km E of U.S. Rte. 12.

Site F (T46N, R7E, sec. 18) was located on a headwater of the Nippersink Creek mainstream approximately 3 km W of Hebron at Ill. Rte. 173.

Site G (T45N, R7E, sec. 12) was located on the Nippersink Creek mainstream at Jacobsen Park and northeast of the intersection of Thompson and Wondermere roads.

Site H (T46N, R8E, sec. 31) was located on the Nippersink Creek mainstream below Wonderlake and within the boundaries of Glacial Park.

Site I (T46N, R8E, sec. 33) was located on the Nippersink Creek mainstream at Ill. Rte. 31, 6 km S of Richmond.

Site J (T46N, R8E, sec. 26) was located on the Nippersink Creek mainstream near the intersection of U.S. Rte. 12 and Solon Road.

During each visit to primary sampling sites, the following physico-chemical parameters were measured: temperature, dissolved oxygen (DO), conductivity, and pH. Biochemical oxygen demand (BOD) was measured once for each primary sampling site in late May 1986. 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 each sampling site, stream habitat characteristics were measured using the method of Gorman and Karr (1978). This included determination of mean values for channel width, depth, current speed, and substrate size, and determination of typical substrate types, and estimated discharge.

Fishes were sampled at all sites using 3 and 5 mm mesh seines, 1 x 3 m and 1.5 x 5 m, respectively, in size. At each site, a 100 m section of stream channel was repeatedly seined 4 to 8 times. Fishes over 250 mm total length were measured and released. Samples of smaller fishes were preserved in 10% formalin and later transferred to 40% isopropyl alcohol. Fishes were identified with the aid of the following references: Pflieger (1975), Smith (1979), and Trautman (1981). Vouchers 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 composite collections of each stream site to provide a relative measure of stream biological integrity/quality.

Aquatic insects were sampled at primary sites with a fine, 220 μ m mesh 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 insects were taken by picking rocks in riffle areas and collecting those caught in the seine while sampling fish. The Surber samples were picked in the field until most insects were removed or for a maximum of 60 minutes for 2 persons. The samples were preserved in 10% formalin and later transferred to 40% isopropyl alcohol. Keys in Hilsenhoff (1975) were used to identify aquatic insects to the genus level. Hilsenhoff's (1977) Biotic Index was calculated for composite samples of each primary site to provide an independent assessment of the relative biological integrity/quality of the sampling sites.

RESULTS AND DISCUSSION

Physico-chemical Conditions

None of the sites showed extremes in water temperature; temperatures ranged from a low of 13°C in autumn 1985, to a high of 27°C in July 1986. Site D showed little variation in temperature over the study period (14-17.5°C), probably because of spring seeps feeding the stream from the surrounding moraines. Obviously, temperatures were much lower during winter months when sampling was not conducted.

Dissolved oxygen levels ranged from 6-12 ppm over the sampling sites. These levels were within acceptable limits for fish and always within 2 ppm of saturation. There was no measurable BOD at any of the primary sites. Net primary productivity was low, ranging from .5 to 1.5 ppm DO. Conductivities ranged between 600-700 MHO's and pH ranged from 7.5 to 8.2 over the sampling sites. These values are typical for surface waters of McHenry County (Tichacek, 1968).

The water quality of Nippersink Creek appeared to be relatively good. Tichacek (1968) reported that Nippersink Creek had some pollution problems in the early 1960's but these problems have been rectified by construction of modern sewage treatment plants at municipalities throughout the drainage.

Habitat Characteristics

Habitat characteristics of the stream sites are summarized in Table 1. Site D

was the smallest stream sampled (first order, 1.9 m wide), followed by site F (second order, 5 m wide). Sites A, B, D, E, G, H were moderately large streams, 3 to 4th order and 6-15 m wide. Sites I and J were small rivers, 4 to 5th order and 20 m wide. All of the sites exhibited slow to moderate currents which is consistent with the drainage's relatively steep gradient. Headwater sites D and F had silty-sandy substrates while downstream sites had coarser, sandy-gravelly substrates. Although mean substrate values do not indicate the presence of larger substrates, downstream sites had well-developed riffle areas which were strewn with rocks, cobbles, and occasional boulders. Mean depths ranged from 13 cm at Site D to 50 cm at Site J and pools at downstream stations exceeded 2 m in depth. The headwater sites have been channelized and had little channel complexity and virtually no woody riparian vegetation. A section of the stream at Site D, however, had a relatively natural channel with a well-developed riparian canopy where the stream flowed along the base of a wooded moraine. Downstream sites did not appear to have been channelized and had well-developed riparian vegetation dominated by large trees and shrubs. Aquatic vegetation (predominantly *Potamogeton* spp. and *Elodea* spp.) was commonplace along quiet edges at the stream sites.

In comparison to the mainstream of Nippersink Creek, the North Branch was clearer and had coarser substrates and lower levels of silt. This observation probably reflects the different physiographies of the two sub-drainages: the mainstream Nippersink is located mostly on an unconsolidated glacial outwash plain (Tichacek, 1968) and is intensively cultivated, while the North Branch occupies a narrower watershed with more complex topography and includes a natural glacial lake (Lake Elizabeth). The North Branch's watershed does not appear to be as intensively cultivated as pasture is the most common land use.

Fishes

Fish collection data for the stream sites are summarized in Table 2. Overall, 2,681 fish representing 41 species and 10 families were collected in the drainage and fish were relatively abundant at the sampling sites. Mean collection sizes varied from 16 to 219 individuals. Except for Site B, all sites had mean collection sizes in excess of 100 individuals. The fish fauna at the sites was relatively diverse, with a low of 12 species for Site F and a high of 24 species for Site A. The higher diversities obtained at primary sites A-D (16-24) may reflect repeated, seasonal sampling. Seasonal patterns in species abundances at the four primary sites were not evident.

The dominant group of fishes were minnows (*Cyprinidae*) with 2,351 individuals representing 87.7% of the total collection (Table 2). Among minnows, the bigmouth shiner (*Notropis dorsalis*), spotfin shiner (*N. spilopterus*), and sand shiner (*N. stramineus*) were the most abundant species, but the hornyhead chub (*Nocomis biguttatus*), common shiner (*Notropis cornutus*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Camptostoma anomalum*), and fathead minnow (*Pimephales promelas*) also were relatively common. Relatively common non-minnow species included the white sucker (*Catostomus commersoni*), brook stickleback (*Culaea inconstans*), largemouth bass (*Micropterus salmoides*), johnny darter (*Etheostoma nigrum*), and banded darter (*Etheostoma zonale*).

Karr's Index of Biotic Integrity (IBI) indicates that the fish communities may be rated good to very good (50-56) and very good for the Nippersink drainage as a whole ($\bar{x} = 54$; Table 2). In a recent fisheries assessment of the Fox River basin,

Sallee and Bergmann (1986) provide IBI values of 38, 44 and 48 for 3 Nippersink Creek sites sampled in 1982, which are similar to values they calculate for two of Brigham et al.'s (1978) 1976 sites (38,46). As suggested later in this paper, their Nippersink samples do not appear to be very comprehensive, which may explain their relatively low IBI values in comparison to mine. Nevertheless, IBI values from Nippersink Creek are outstanding in comparison to other northeastern Illinois streams. For example, I found ranges of 15-41 (very poor to fair) for stations on tributaries of the DuPage and DesPlaines rivers (Gorman, 1987a). In a more comprehensive analysis of Brigham et al.'s (1978) survey of 8 watersheds in the Fox, DuPage, and DesPlaines river drainages, Fausch et al. (1984) found IBI values ranging from 0 (no fish) to 56 (good-excellent) and a mean index of 31 (poor). These comparative studies indicate that Nippersink Creek is an unusual stream in the northern Illinois region; the stream contains relatively high quality aquatic habitat and a relatively rich fish fauna.

Fifteen fishes were recognized as notable species because they were unusual, rare, or indicators of high water quality (Table 2). Noteworthy status was determined by using information on species distribution and ecology from major ichthyological references (Cross, 1967; Pflieger, 1975; Smith, 1979; Lee et al., 1980; Trautman, 1981). The presence or absence of these species provided an additional tool for evaluating stream sites for habitat and faunal quality. Most of the notable species were rare, sporadically captured, or found at few sites. A ranking of sites by the number of notable species showed primary Sites A-D to be the top four with 4 to 9 species (Table 2). Samples from the remaining supplementary Sites E-J yielded only 1 or 2 notable species.

The presence of nine of these notable species in the North Branch of Nippersink Creek is indicative of a high-quality warm-water stream. These indicator species include the hornyhead chub, northern mimic shiner (*Notropis volucellus volucellus*), rosyface shiner (*Notropis rubellus*), northern hog sucker (*Hypentelium nigricans*), stonecat (*Noturus flavus*), brook silverside (*Labidesthes sicculus*), smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), and banded darter. Five to seven of these species were found together at primary Sites A, B, and C (Table 2). This assemblage is an uncommon one in Illinois but, with the exception of the northern mimic shiner, is typical of those found in clear, spring-fed streams in the Ozarks (Pflieger, 1975; Gorman, 1987b).

Another assemblage of four notable species deserving special mention occurred at Site D. Here springs from the surrounding moraines maintain clear, cool, flowing waters required by the blacknose dace (*Rhinichthys atratulus*), southern red-belly dace (*Phoxinus erythrogaster*), and brook stickleback. The presence of a young northern pike (*Esox lucius*) suggests that this stream contains suitable spawning habitat for the species.

The remaining notable species include the tadpole madtom (*Noturus gyrinus*), represented by one specimen from Site G, and the central mudminnow (*Umbra limi*), which was represented by one specimen from primary Site C. This last species was relatively common in concurrent surveys of marshes and oxbow ponds in the drainage (Murphy and Gorman, 1986).

My collection records for the Nippersink drainage are compared with Smith's (1979) 1950-1972 records, Brigham et al.'s (1978) 1976 records, and Sallee and Bergmann's (1986) 1982 records in Table 3. Smith shows records for 32 species in

Nippersink Creek but only 21 species above Spring Grove. Brigham et al. show 29 species for Nippersink Creek but only 20 species above Spring Grove, Sallee and Bergmann show 32 species for Nippersink Creek but only 18 species above Spring Grove, and my records show 41 species above Spring Grove. A composite of our records shows 53 species in the Nippersink drainage. For the combination of Nippersink Creek and the Fox Lake complex and its related drainages in McHenry and Lake counties (hereafter referred to as the Fox Lake drainage), our composite records show 72 species, which represents about 70% of the 102 known species in the Fox River system (Smith, 1971). My records show 12 new species in Nippersink Creek above Spring Grove and 4 new species in the Fox Lake drainage. The four new species for the Fox Lake drainage are: southern redbelly dace, northern hog sucker, suckermouth minnow, and brook stickleback. The closest post-1950 records for the first two of these species are from the Fox River drainage in Kane County (Brigham et al., 1978; Sallee and Bergmann, 1986). The closest suckermouth minnow record is from the Fox River below the Algonquin Dam, lower McHenry County (Brigham et al., 1978) and the closest brook stickleback record is from Boone Creek, McHenry County (Smith, 1979). The grass pickerel (*Esox americanus*), reported in Nippersink Creek by Sallee and Bergmann (1986), and the rosyface shiner, taken in my samples and reported for Nippersink Creek by Sallee and Bergmann, are also new species to the Fox Lake drainage (Table 3).

My new distributional records suggest that Nippersink Creek has not been thoroughly surveyed in the past or that some species from the lower Nippersink have recently invaded upstream reaches. Five relatively common species in the Fox Lake drainage (common carp [*Cyprinus carpio*], emerald shiner [*Notropis atherinoides*], fathead minnow, brook silverside, and banded darter) in my records but not in Smith's (1979) above Spring Grove, support the suggestion that upper Nippersink Creek has not been thoroughly sampled in the past. The lack of common shiners, bigmouth shiners, and darters in Brigham et al.'s (1978) records for the Nippersink Creek also supports this interpretation. Sallee and Bergmann's (1986) survey appears more comprehensive, but they reported only one darter species and failed to detect any madtoms in Nippersink Creek. These more recent surveys of the Fox Lake drainage, however, are much more comprehensive than the pre-1908 surveys of Forbes and Richardson (1908), when only 37 species were recorded. Most of the additional species in the more recent surveys were probably present prior to 1908.

Aquatic Insects

A composite summary of the aquatic insects from primary Sites A-D is presented in Table 4. A total of 973 aquatic insects representing 39 genera was collected. The fauna was dominated by dipterans, ephemeropterans, and trichopterans. Primary sampling Sites A, B, and C on the North Branch of Nippersink Creek contained the richest insect assemblages, with 13 to 27 genera. Most of the genera collected are considered indicators of high-quality stream conditions (Hilsenhoff, 1977). Hilsenhoff's (1977) Biotic Index indicated that mainstream sites A-C and E had good to excellent aquatic insect communities, which reflects clean, undisturbed to slightly disturbed or enriched conditions. These results are congruent with those of the fish faunal surveys and emphasize the high quality of environmental conditions found in the North Branch of Nippersink Creek. Such high biotic Index ratings are probably unusual in northeastern Illinois where most streams have been seriously degraded (Brigham et al., 1978; Karr, 1981; Fausch et al., 1984). For example, Gorman

(1987a) found aquatic insect communities in streams in Cook and DuPage counties to have Hilsenhoff Biotic Indexes in the poor to very poor range, indicating significant to gross enrichment or disturbance.

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LITERATURE CITED

- Brigham, W.U., D.A. McCormick and M.J. Wetzel. 1978. The watersheds of northeastern Illinois: quality of the aquatic environment based upon water quality and fishery data. Northeastern Illinois Planning Commission Staff Paper No. 31.
- Cross, F.B. 1967. Handbook of Fishes of Kansas. University of Kansas Museum of Natural History Miscellaneous Publication 45.
- Fausch, K.D., J.R. Karr and P.R. Yant. 1984. Regional application of an index of biotic integrity based on stream fish communities. *Transactions of the American Fisheries Society* 113:39-55.
- Forbes, S.A. and R.E. Richardson. 1968. *The Fishes of Illinois*. Illinois State Laboratory of Natural History, Urbana, Illinois, USA.
- Gorman, O.T. 1987a. A survey of the fishes and macroinvertebrates of some small streams in Cook, Lake, and DuPage counties, Illinois. *Trans. Ill. Acad. Sci.* 80: in press.
- Gorman, O.T. 1987b. Habitat segregation in an assemblage of minnows in an Ozark stream. Pages 33-41 in W.J. Matthews and D. Heins, editors. *Community and Evolutionary Ecology of North American Stream Fishes*. University of Oklahoma Press, Norman, Oklahoma, USA.
- Gorman, O.T. and J. Karr. 1978. Habitat structure and stream fish communities. *Ecology* 59:507-515.
- Hilsenhoff, W.L. 1975. Aquatic insects of Wisconsin, with generic keys and notes on biology, ecology, and distribution. Wisconsin Department of Natural Resources Technical Bulletin 89:1-52.
- Hilsenhoff, W.L. 1977. Use of arthropods to evaluate water quality of streams. Wisconsin Department of Natural Resources Technical Bulletin 100:1-15.
- Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6:21-27.
- Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. Illinois Natural History Survey Special Publ. 5.
- Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister and J.R. Stauffer, Jr. 1980. *Atlas of North American Freshwater Fishes*. North Carolina State Museum of Natural History, Raleigh, North Carolina, USA.
- Murphy, J.C., and O.T. Gorman. 1986. An inventory and assessment of the herpetofauna of the FAP 420 corridor in McHenry County, Illinois. Pages 1-21 in W.E. Southern, Project Director. 1985-86 Biological Survey of the FAP 420 Corridor in McHenry County, Illinois. Part II. ENCAP, Inc. technical report submitted to the Illinois Department of Transportation, Springfield, Illinois.
- Pflieger, W.L. 1975. *The Fishes of Missouri*. Missouri Department of Conservation, Jefferson City, Missouri, USA.
- Sallee, R.D., and H.W. Bergmann. 1986. 1982 Fox River basin fisheries assessment. Illinois Department of Conservation Publ. 200-10-86.
- Smith, P.W. 1971. Illinois streams: a classification based on their fishes and an analysis of factors responsible for disappearance of native species. Illinois Natural History Survey Biological Notes 76:1-14.
- Smith, P.W. 1979. *The Fishes of Illinois*. University of Illinois Press, Urbana, Illinois, USA.
- Tichacek, G. 1968. McHenry County Surface Water Resources. Illinois Department of Conservation, Springfield, Illinois, USA.
- Trautman, M.B. 1981. *The Fishes of Ohio*. Ohio State University Press, Columbus, Ohio, USA.
- Wetzel, R.G. and C.E. Likens. 1979. *Limnological Analyses*. W.B. Saunders Co., Philadelphia, Pennsylvania, USA.

Table 1. Habitat characteristics of stream sampling sites in the Nippersink Creek drainage. Typical substrates: st - silt, ss - silty sand, sd - sand, gv - gravel, pb - pebble, rk - rock. Locations of sites are shown in Figure 1.

	SITES									
	A	B	C	D	E	F	G	H	I	J
Stream order	3	3	4	1	4	2	3	4	4	5
Mean channel width (m)	6.5	7.0	8.6	1.9	6.8	5.0	10.0	15.0	20.0	20.0
est. discharge (m ³ /sec)	0.7	0.7	0.8	0.08	0.8	0.1	0.5	1.0	1.5	2.0
Mean depth (m)	.33	.32	.35	.13	.22	.20	.35	.30	.35	.50
Mean current (m/sec)	.21	.18	.18	.07	.24	.10	.15	.22	.20	.22
Mean substrate size (mm)	9.0	5.0	5.1	0.8	11.1	0.8	4.0	6.0	6.0	10.0
Typical substrates	pb gv rk	sd st ss	sd gv pb	sd ss gv	gv pb sd	sd ss gv	sd gv ss	sd pb gv	sd gv ss	gv sd pb

Table 2. Summary of fishes collected at sampling sites in the Nippersink drainage. Site locations are shown in Figure 1.

TAXA	SITE										Total	
	A	B	C	D	E	F	G	H	I	J		
Esocidae												
* <i>Esox lucius</i>	—	—	—	1	—	—	—	—	—	—	—	1
Umbridae												
* <i>Umbra limi</i>	—	—	1	—	—	—	—	—	—	—	—	1
Cyprinidae												
<i>Cyprinus carpio</i>	1	—	1	—	—	—	1	—	7	1	—	11
<i>Semotilus</i>												
<i>atromaculatus</i>	4	—	3	136	1	6	4	3	4	—	—	158
* <i>Nocomis</i>												
<i>biguttatus</i>	71	—	82	—	17	—	—	2	2	18	—	192
* <i>Rhinichthys</i>												
<i>atratulus</i>	—	—	—	50	—	5	—	—	—	—	—	55
<i>Phenacobius</i>												
<i>mirabilis</i>	—	—	—	—	—	—	—	—	—	3	—	3
<i>Notropis</i>												
<i>atherinoides</i>	5	16	4	—	—	—	—	—	—	—	—	25
<i>Notropis cornutus</i>	133	7	11	1	3	7	1	—	—	—	—	163
<i>Notropis dorsalis</i>	13	—	4	446	8	76	10	3	1	—	—	561
* <i>Notropis rubellus</i>	—	—	17	—	1	—	—	—	—	—	—	18
<i>Notropis</i>												
<i>spilopterus</i>	7	—	132	—	9	—	2	137	78	51	—	418
<i>Notropis</i>												
<i>stramineus</i>	11	1	128	58	63	—	1	4	62	57	—	355

Table 2. (continued).

TAXA	SITE										Total	
	A	B	C	D	E	F	G	H	I	J		
* <i>Notropis volucellus</i>	11	3	1	—	—	—	—	—	—	—	—	15
* <i>Phoxinus erythrogaster</i>	—	—	—	33	—	—	—	—	—	—	—	33
<i>Pimephales notatus</i>	1	1	—	2	—	16	39	13	7	14	—	93
<i>Pimephales promelas</i>	63	3	2	19	—	1	—	9	—	—	—	107
<i>Campostoma anomalum</i>	1	—	1	62	—	40	37	1	2	—	—	144
Catostomidae												
<i>Catostomus commersoni</i>	7	4	3	32	—	4	6	11	4	9	—	80
* <i>Hypentelium nigricans</i>	2	—	—	—	—	—	—	—	—	—	—	2
Ictaluridae												
<i>Ictalurus melas</i>	—	—	—	1	—	—	—	2	—	—	—	3
<i>Ictalurus natalis</i>	—	—	—	—	—	1	—	2	—	—	—	3
<i>Ictalurus punctatus</i>	—	1	—	—	—	—	—	1	—	—	—	2
* <i>Noturus flavus</i>	2	1	1	—	—	—	1	—	—	—	—	5
* <i>Noturus gyrinus</i>	—	—	—	—	—	—	1	—	—	—	—	1

Table 2 (continued).

TAXA	SITE											Total					
	A	B	C	D	E	F	G	H	I	J							
Percidae																	
<i>Percia flavescens</i>	—	—	1	—	—	—	—	2	—	—	—	—	—	—	1	—	4
<i>Etheostoma</i>																	
<i>nigrum</i>	15	9	1	—	—	8	1	2	—	—	—	—	—	—	1	—	37
* <i>Etheostoma</i>																	
<i>zonale</i>	23	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	26
<i>Etheostoma</i>																	
<i>flabellare</i>	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—	—	7
<i>Percina caprodes</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Percina maculata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Total number of fish	371	63	429	867	103	179	108	219	171	171	171	108	219	171	171	171	2681
Total number of species	18	18	24	16	12	14	14	18	12	12	12	14	18	12	12	12	41
Mean number of fish/collection	124	16	107	217	103	179	108	219	171	171	171	108	219	171	171	171	142
Notable species (*)	7	7	9	4	2	1	2	2	2	2	2	2	2	2	2	2	15
Karr's Biotic Index**	56	56	56	53	50	54	50	56	50	50	50	50	56	50	56	54	54(̄)
Class	G-E	G-E	G-E	G-E	G	G-E	G	G-E	G	G	G-E	G	G-E	G	G-E	G-E	G-E

*Notable species. These are species identified as rare, unusual, or indicators of high water quality.

**Karr's (1981) Biotic Integrity Index 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 P-VP poor F-P fair F-G good G-E excellent (VP) (P) (F) (G) (E)

Table 3. Composite records of fishes from the upper Nippersink Creek and Fox Lake drainages. Symbols: X = record from upper Nippersink Creek (above Spring Grove, see Fig. 1); LX = record from lower Nippersink Creek (below Spring Grove); F = pre-1908 record for Fox Lake Drainage; + = post-1950 composite record for Nippersink drainage; ? = post-1950 record for Fox Lake drainage; — = no record; * = new record (this report) for upper Nippersink Creek; ** new record (this report) for Fox Lake drainage; † = Spring Grove hatchery release.

TAXA	RECORD					
	Smith (1979)	Brigham et al. (1978)	Sallee & Bergmann (1986)	This Report	Composite (post-1950)	Forbes & Richardson (1908)
Petromyzontidae						
<i>Lamprera appendix</i>	?	—	—	—	?	—
Lepisosteidae						
<i>Lepisosteus osseus</i>	?	—	—	—	?	—
Amiidae						
<i>Amia calva</i>	?	—	—	—	?	F
Salmonidae						
† <i>Salmo gairdneri</i>	LX	—	—	—	+	—
† <i>Salmo trutta</i>	—	LX	—	—	+	—
Umbridae						
<i>Umbra limi</i>	X	?	LX	X	+	F
Esocidae						
<i>Esox americanus</i>	?	—	LX	—	+	F
* <i>Esox lucius</i>	?	LX	—	X	+	—
Cyprinidae						
<i>Cyprinus carpio</i>	?	LX	X	X	+	—
<i>Notemigonus chrysoleucas</i>	?	—	—	—	?	F
<i>Semotilus atromaculatus</i>	X	X	X	X	+	F

Table 3. (continued).

TAXA	RECORD							Composite (post-1950)	Forbes & Richardson (1908)
	Smith (1979)	Brigham et al. (1978)	Sallee & Bergmann (1986)	This Report	Composite (post-1950)	Forbes & Richardson (1908)			
<i>Nocomis biguttatus</i>	X	X	X	X	+	F			
<i>Rhinichthys atratulus</i>	X	—	X	X	+	—			
** <i>Phenacobius mirabilis</i>	—	—	—	X	+	—			
<i>Notropis anogenus</i>	?	—	—	—	?	F			
<i>Notropis atherinoides</i>	?	X	LX	X	+	—			
<i>Notropis</i> <i>chrysocephalus</i>	—	LX	—	—	+	—			
<i>Notropis cornutus</i>	X	—	X	X	+	—			
<i>Notropis dorsalis</i>	X	?	X	X	+	—			
<i>Notropis emiliae</i>	?	—	—	—	?	—			
<i>Notropis heterodon</i>	?	—	—	—	?	F			
<i>Notropis heterolepis</i>	?	—	—	—	?	F			
<i>Notropis hudsonius</i>	?	—	—	—	?	F			
<i>Notropis spilopterus</i>	X	X	X	X	+	—			
<i>Notropis stramineus</i>	X	X	X	X	+	—			
<i>Notropis volucellus</i>	?	X	—	X	+	—			
* <i>Notropis rubellus</i>	—	—	LX	X	+	—			
** <i>Phoxinus erythrogaster</i>	—	—	—	X	+	—			
<i>Pimephales notatus</i>	X	X	X	X	+	F			
<i>Pimephales promelas</i>	?	X	X	X	+	—			
<i>Pimephales vigilax</i>	?	—	—	—	?	—			
<i>Campostoma anomalum</i>	X	—	—	X	+	—			

Catostomidae									
<i>Carpiodes cyprinus</i>	?	LX				LX	+	—	—
<i>Moxostoma carinatum</i>	?	—	—	—	—	—	?	—	—
<i>Moxostoma erythrurum</i>	X	—	—	—	—	LX	+	—	—
<i>Moxostoma macrolepidotum</i>	?	LX	—	—	—	LX	+	F	F
** <i>Hypentelium nigricans</i>	—	—	—	—	—	—	+	F	F
<i>Catostomus commersoni</i>	X	X	—	—	—	X	+	F	F
<i>Erimyzon sucetta</i>	?	—	—	—	—	—	?	—	—
<i>Erimyzon oblongus</i>	—	—	—	—	—	—	—	F	F
Ictaluridae									
<i>Ictalurus melas</i>	LX	X	X	—	—	LX	+	X	F
<i>Ictalurus natalis</i>	?	X	X	—	—	X	+	X	F
<i>Ictalurus nebulosus</i>	?	—	—	—	—	—	?	—	F
* <i>Ictalurus punctatus</i>	?	?	—	—	—	LX	+	X	—
<i>Noturus flavus</i>	LX	X	X	—	—	—	+	X	—
* <i>Noturus gyrinus</i>	?	?	—	—	—	—	+	X	F
Cyprinodontidae									
<i>Fundulus diaphanus</i>	?	—	—	—	—	—	?	—	F
<i>Fundulus dispar</i>	?	—	—	—	—	—	?	—	F
<i>Fundulus notatus</i>	X	—	—	—	—	X	+	X	F
Atherinidae									
<i>Labidesthes sicculus</i>	?	—	—	—	—	X	+	X	F
Gasterosteidae									
** <i>Culaea inconstans</i>	—	—	—	—	—	—	+	X	—
Cottidae									
<i>Cottus bairdi</i>	LX	LX	—	—	—	—	+	—	—
Percichthyidae									
<i>Morone chrysops</i>	?	?	—	—	—	—	?	—	—
<i>Morone mississippiensis</i>	?	X	—	—	—	—	+	—	—

Table 3. (continued).

TAXA	RECORD					
	Smith (1979)	Brigham et al. (1978)	Sallec & Bergmann (1986)	This Report	Composite (post-1950)	Forbes & Richardson (1908)
Centrarchidae						
<i>Micropterus dolomieu</i>	LX	X	LX	X	+	F
<i>Micropterus salmoides</i>	LX	X	LX	X	+	F
<i>Lepomis cyanellus</i>	X	X	X	X	+	F
<i>Lepomis gibbosus</i>	X	X	LX	X	+	F
<i>Lepomis gulosus</i>	?	?	—	—	?	F
<i>Lepomis humilis</i>	X	LX	—	—	+	—
<i>Lepomis macrochirus</i>	X	X	LX	X	+	F
<i>Ambloplites rupestris</i>	LX	X	X	X	+	F
<i>Pomoxis annularis</i>	X	?	—	—	+	F
<i>Pomoxis nigromaculatus</i>	X	?	—	X	+	F
Percidae						
<i>Stizostedion vitreum</i>	—	?	—	—	?	—
* <i>Perca flavescens</i>	LX	LX	LX	X	+	F
* <i>Percina caprodes</i>	?	?	—	X	+	F
* <i>Percina maculata</i>	LX	—	—	X	+	F
<i>Etheostoma exile</i>	?	—	—	—	?	F
<i>Etheostoma flabellare</i>	X	—	X	X	+	—
<i>Etheostoma microperca</i>	—	—	—	—	—	F
<i>Etheostoma nigrum</i>	X	—	—	X	+	—
<i>Etheostoma spectabile</i>	LX	—	—	—	+	—
* <i>Etheostoma zonale</i>	LX	—	—	X	+	—

Summary: species numbers

A.	Smith (1979), upper Nippersink	21
B.	Smith (1979), upper and lower Nippersink	32
C.	Brigham et al. (1978), upper Nippersink	20
D.	Brigham et al. (1978), upper and lower Nippersink	29
E.	Sallee & Bergmann (1986), upper Nippersink	18
F.	Sallee & Bergmann (1986), upper and lower Nippersink	32
G.	This report, upper Nippersink	41
H.	Composite of A-G, Nippersink drainage	53
I.	Post-1950 composite records, Fox Lake drainage	72
J.	Forbes & Richardson (1908), Fox Lake drainage	37
K.	New species to upper Nippersink (this report)	12
L.	New species to Fox Lake drainage (this report)	4

Table 4. Aquatic insects of primary sampling sites in the Nippersink drainage. Site locations are shown in Figure 1.

Taxa	SITE					Total
	A	B	C	D	E	
EPIHEMEROPTERA						
Bactidae						
<i>Baetis</i>	25	47	70	—	40	182
<i>Pseudoclocon</i>	11	14	6	—	—	31
Heptageniidae						
<i>Stenacron</i>	—	19	1	—	5	25
<i>Stenonema</i>	—	—	2	—	—	2
Tricorythidae						
<i>Tricorythodes</i>	—	—	14	—	13	27
ODONATA						
Aeshnidae						
<i>Aeshna</i>	—	—	—	2	—	2
<i>Boyeria</i>	—	1	3	2	—	6
Calopterygidae						
<i>Hetaerina</i>	—	13	9	—	4	26
Gomphidae						
<i>Gomphus</i>	—	1	3	—	—	4
Libellulidae						
<i>Libellula</i>	—	1	—	—	—	1
HEMIPTERA						
Belostomatidae						
<i>Belostoma</i>	2	—	—	—	—	2
Corixidae						
<i>Sigara</i>	—	—	1	—	—	1
Hebridae						
<i>Marragata</i>	—	—	1	—	—	1
Notonectidae						
<i>Notonecta</i>	—	—	6	—	—	6
Veliidae						
<i>Rhagovelia</i>	—	—	1	—	—	1
TRICHOPTERA						
Hydropsychidae						
<i>Hydropsyche</i>	56	35	8	—	14	113
<i>Cheumatopsyche</i>	2	41	—	—	—	43
Leptoceridae						
<i>Oecetis</i>	—	—	—	—	2	2
<i>Nectopsyche</i>	—	—	—	—	1	1
Limnephilidae						
<i>Limnephilus</i>	—	3	—	—	—	3
COLEOPTERA						
Elmidae						
<i>Stenelmis</i>	2	3	7	—	—	12

Table 4. (continued).

Taxa	SITE					Total
	A	B	C	D	E	
Gyrinidae						
<i>Gyrinus</i>	17	3	2	2	—	24
Hydrophilidae						
<i>Tropisternis</i>	—	—	1	—	—	1
Psephenidae						
<i>Psephenus</i>	—	1	—	—	—	1
DIPTERA						
Chironomidae						
<i>Cryptochironomus</i>	—	—	—	1	—	1
<i>Paratendipes</i>	—	—	—	44	—	44
<i>Polypedilium</i>	—	—	4	—	—	4
<i>Microtendipes</i>	—	—	5	—	—	5
<i>Eukiefferiella</i>	—	—	7	1	6	14
<i>Cardiocladius</i>	1	2	3	—	11	17
<i>Cricotopus</i>	7	—	1	—	—	8
Rhagionidae						
<i>Atherix</i>	—	—	—	3	—	3
Simuliidae						
<i>Eusimulium</i>	151	71	30	—	—	252
<i>Prosimulium</i>	13	25	13	1	81	65
<i>Cnephia</i>	—	—	8	—	—	8
Tabanidae						
<i>Chrysops</i>	—	1	—	—	—	1
Tipulidae						
<i>Hexatoma</i>	—	—	1	—	—	1
<i>Tipula</i>	4	2	1	—	—	7
Total number of insects	291	288	209	56	129	973
Total number of genera	13	19	27	8	11	39
Hilsenhoff's Biotic Index*	1.59	2.25	1.83	2.83	1.93	2.09(x)
Water quality	excellent	good	good	fair	good	good

*Hilsenhoff's (1977) Biotic Index for aquatic insect communities. Amphipods and isopods (not shown above) are included in the calculation of this index.

Biotic Index	Water Quality	Stream Condition
<1.75	excellent	clean and 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

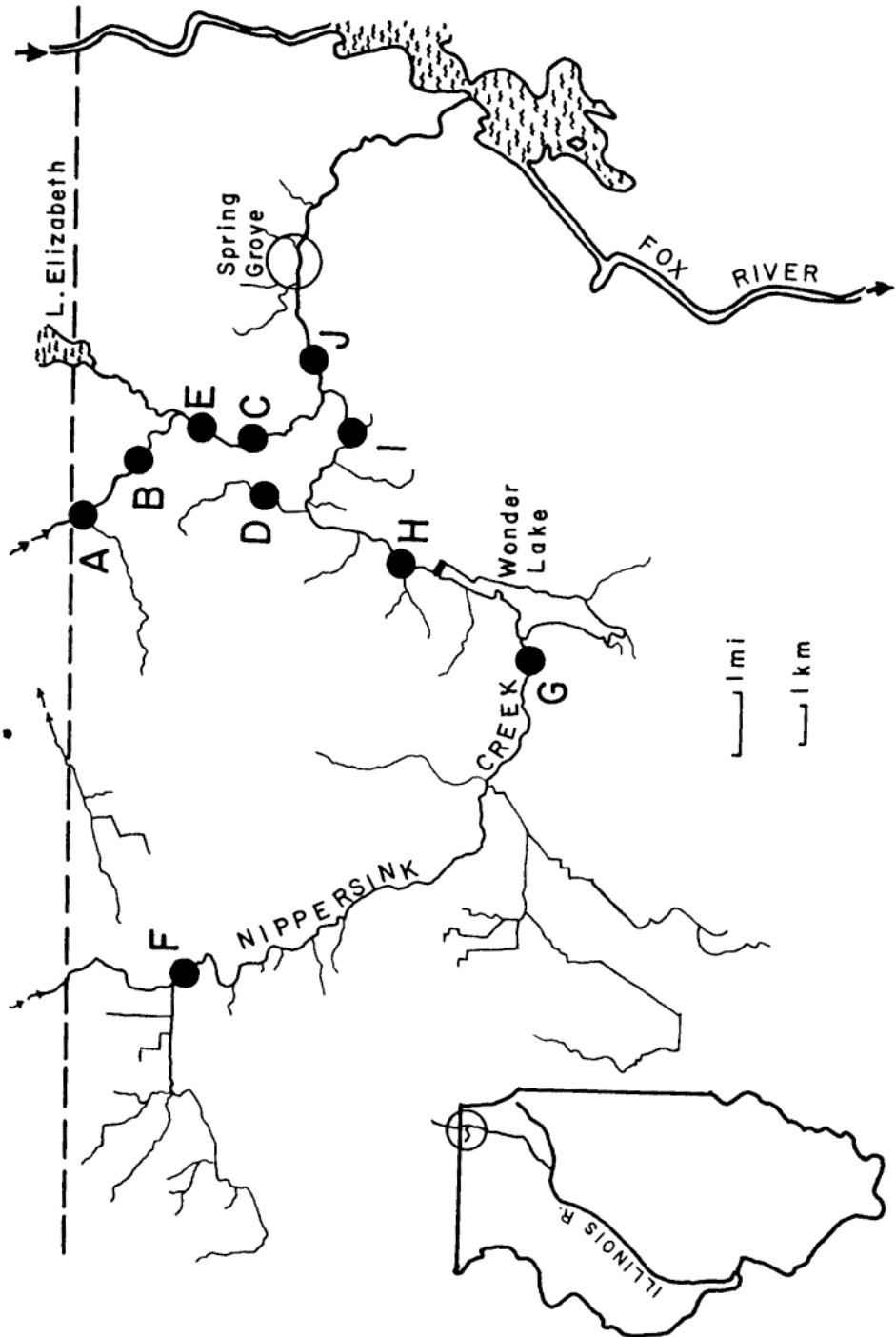


Figure 1. Aquatic fauna sampling sites in the Nippersink Creek drainage in McHenry County, Illinois. Letters and solid dots identify locations of study sites described in the text. Open circle shows the location of Spring Grove. Base map: General Highway Map of McHenry County, Illinois, prepared by the Illinois Department of Transportation, 1983 revision.