ILLINOIS NATURAL HISTORY SURVEY
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ROUTES 53/120 CORRIDOR

BIOTIC INTEGRITY OF MACROINVERTEBRATE COMMUNITIES ALONG THE ILLINOIS ROUTES 53 & 120 CORRIDOR

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EXECUTIVE SUMMARY

- Sampled macroinvertebrates following ILEPA protocol at nine sites in August and September 2015 in the proposed IL Route 53 and 120 corridor and calculated biotic integrity metrics
- Assessed sites based on the Qualitative Stream Habitat Assessment Procedure (SHAP)
- Measured physical (width, depth, velocity) and chemical (pH, conductivity, salinity, total dissolved solids) characteristics
- Habitat assessment showed impairment compared to Illinois reference conditions at all sites
- Macroinvertebrate Index of Biotic Integrity rated one site as "Good" (Des Plaines River at Rt. 120), seven sites as "Fair," and one site as "Poor" (Buffalo Cr. at Tall Oaks Dr.)
  - ▹ Total taxa richness ranged from 8 to 19 across sites
  - ▹ % EPT ranged from 0 to 22.4 across sites
  - ▹ No Plecoptera (stoneflies), indicators of good water quality, were collected from any site
  - ▹ Ephemeroptera (mayflies) were absent from three of the nine sites

INTRODUCTION

The Illinois Toll Highway Authority (Tollway) has committed to conducting an Environmental Impact Study (EIS) for the proposed Illinois Routes 53 and 120 Project corridor, in which the Tollway will examine multiple alignments and scenarios with the intent of relieving congestion and improving traffic flow in Lake County. The EIS will include aspects of previously studied alignments and, to facilitate the effort, the Tollway requested previous corridor surveys be updated. Surveys in the proposed corridor tasked by the Illinois Department of Transportation began in 1992. The initial surveys focused on amphibians, aquatic macroinvertebrates, birds, fishes, freshwater mussels, reptiles, and water quality. Specifically, several surveys for fishes were conducted in 1992 (Ceas et al., 1992), 1993 (Harris et al., 1993; Taylor and Laird, 1993; Taylor et al, 1993 a,b), 1994 (Taylor et al, 1994), and 1995 (Taylor and Wetzel, 1995 a,b; Taylor et al., 1995 a,b). Freshwater mussels were assessed in 1993 (Harris et al., 1993; Kitchell, 1993), 1994 (Taylor et al., 1994, Kitchell, 1994), and 1995 (Taylor et al., 1995 a,b). Finally, aquatic macroinvertebrates were surveyed in 1993 and 1995 (Harris et al., 1993; Taylor et al., 1995 b). Our report updates the previous macroinvertebrate surveys of the corridor.

Macroinvertebrates (e.g., insects, crustaceans, mollusks) have multiple functional roles in stream ecosystems. They are a key linkage between primary producers and higher-level consumers in aquatic food webs and are a particularly important food resource for fish (Wallace and Webster, 1996). Due to their various feeding modes, or functional feeding groups, they play a role in both

nutrient cycling and organic matter processing. Furthermore, aquatic insects connect aquatic and terrestrial ecosystems; they spend the larval portion of their life cycle in freshwater and then emerge as terrestrial adults.

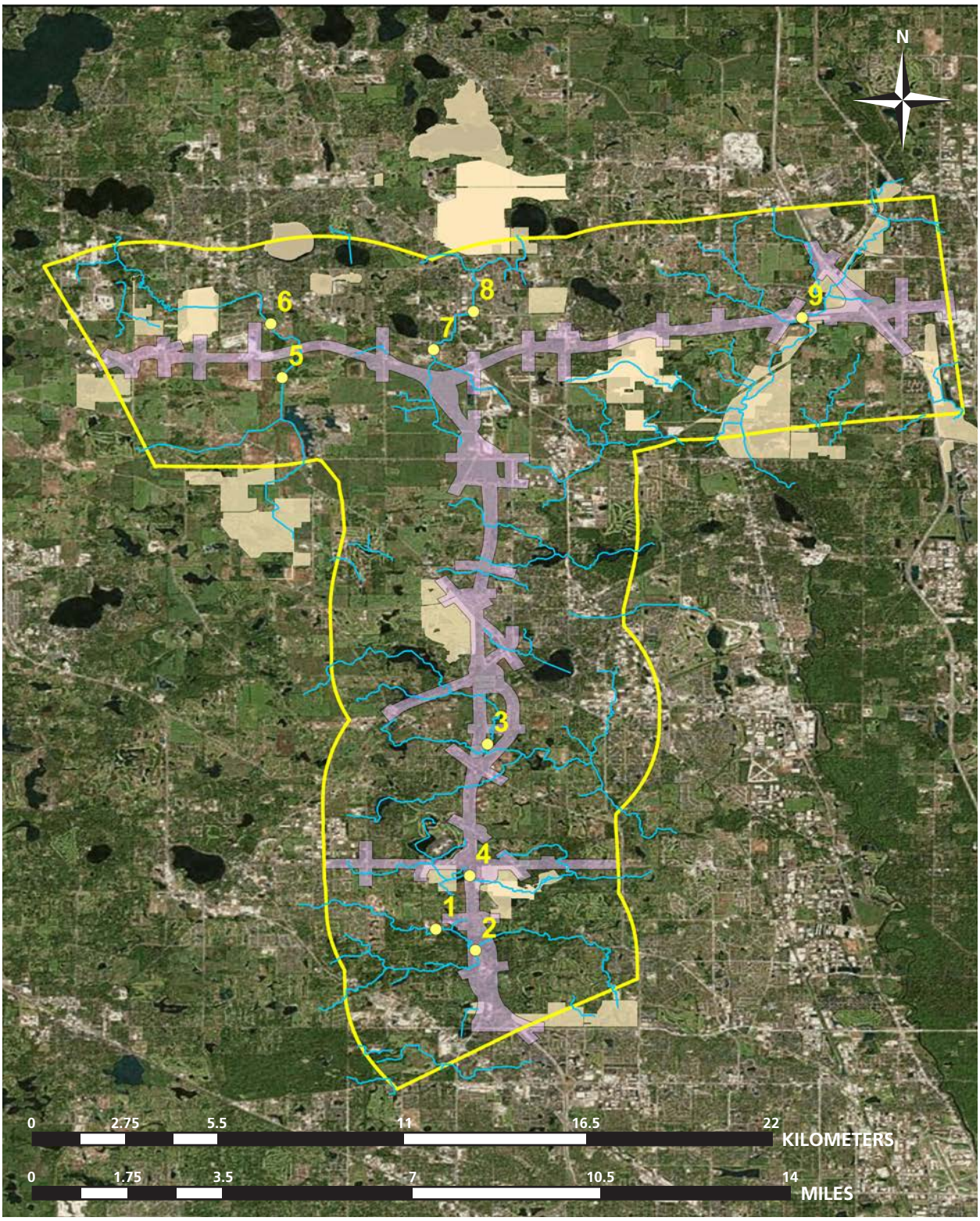
In addition to their ecological significance, macroinvertebrates are the most commonly and widely used group of freshwater organisms to assess lotic environments (Rosenberg and Resh, 1993). They exhibit a wide range of tolerances to point and nonpoint source pollution. They are ubiquitous in freshwater habitats, are sedentary relative to fish, and have long life cycles relative to other organisms. Therefore, temporal variation in environmental conditions is integrated into their community composition (Rosenberg and Resh, 1993, Merritt et al., 2008). The Illinois Environmental Protection Agency (ILEPA) has used macroinvertebrates in some capacity for stream assessment since the agency's beginnings (ILEPA, 2007). Protocols for rapid bioassessment typically integrate habitat and water quality characteristics along with biological measures as means of identifying potential stressors to detected impacts (Barbour et al., 1999). In the current study, we sampled nine stream crossings in the Illinois Route 53 and 120 Project corridor (Map 1; Table 1) in August or September 2015 (see Appendix for sample dates) to assess the biotic integrity of resident macroinvertebrate communities. All sites were in the Des Plaines River watershed.

Table 1. Stream name, description, and coordinates for the nine sites sampled in the Illinois Routes 53 and 120 corridor.

Stream Name	Description	Latitude (N)	Longitude
1. Buffalo Creek	Tall Oaks Drive, Kildeer, IL	42.17990	-88.03911
2. Buffalo Creek	Surrey Road, Long Grove, IL	42.17427	-88.02849
3. Indian Creek	W. Seneca Drive, Hawthorn Woods, IL	42.22946	-88.02527
4. S. Br. Indian Creek	Salem Lake Road, Kildeer, IL	42.19418	-88.03004
5. Squaw Creek	Townline Road, Grayslake, IL	42.32757	-88.08025
6. Squaw Creek	Route 120, Round Lake Park, IL	42.34199	-88.08330
7. Mill Creek	Wicks Street, Grayslake, IL	42.33504	-88.03971
8. Mill Creek	Center Street, Grayslake, IL	42.34522	-88.02903
9. Des Plaines R.	Route 120, Gurnee, IL	42.34363	-87.94107

Table 2. Habitat metrics and habitat quality categories for the qualitative Stream Habitat Assessment Procedure (SHAP). Minimum and maximum values for metrics from DWPC-ILEPA (1994; Table 5.1).

			Habitat Quality Categories							
			Poor		Fair		Good		Excellent	
		Metric	Min	Max	Min	Max	Min	Max	Min	Max
Substrate and In-stream Cover	1	Bottom Substrate	1	5	6	10	11	15	16	20
	2	Deposition	1	3	4	6	7	9	10	12
	3	Substrate Stability	1	4	5	8	9	12	13	16
	4	In-stream Cover	1	3	4	6	7	9	10	12
	5	Pool Substrate	1	5	6	10	11	15	16	20
Channel Morphology and Hydrology	6	Pool Quality	1	4	5	8	9	12	13	16
	7	Pool Variability	1	4	5	8	9	12	13	16
	8	Channel Alteration	1	2	3	4	5	6	7	8
	9	Channel Sinuosity	1	3	4	6	7	9	10	12
	10	Width/Depth	1	4	5	8	9	12	13	16
	11	Hydrolic Diversity	1	3	4	6	7	9	10	12
Riparian and Bank Features	12	Canopy Cover	1	3	4	6	7	9	10	12
	13	Bank Vegetation	1	4	5	8	9	12	13	16
	14	Immediate Land Use	1	2	3	4	5	6	7	8
	15	Flow-Related Refugia	1	3	4	6	7	9	10	12



Map 1. Site locations for the nine sites sampled in the Illinois Routes 53/120 corridor. Site numbers correspond to stream names and descriptions as numbered in Table 1. Blue lines indicate streams. The yellow outline denotes a two-mile buffer for the proposed project area (purple fill).

METHODS

Habitat assessment.—We selected sites based on suitable habitat for sampling macroinvertebrates, i.e., we avoided culverts, artificial substrates, and channelized stream segments. We completed the Qualitative Stream Habitat Assessment Procedure (SHAP) described in detail in Section 5.0—Qualitative Stream Habitat Assessment Procedures (SHAP) of the DWPC Field QA Manual (DWPC-ILEPA, 1994; Appendix E-5.1). A total score based on 15 parameters provides an overall habitat quality rating for the stream reach. The total score could, theoretically, range from 15 to 208 (Table 2), but because different metrics may be better or worse, extreme values for the total score are unlikely. The ILEPA does not provide overall score cutoff points for "Poor," "Fair," "Good," and "Excellent;" rather, habitats are standardized and compared to reference conditions based on relative percent similarity (Table 3). We standardized the habitat scores from each site on a scale of 0 to 100, based on the maximum value for each metric.

Physical and chemical measurements.—At each site, we measured temperature (°C), pH, Total Dissolved Solids (TDS; mg/L), conductivity (µS/cm), and salinity (mg/L) concordantly with macroinvertebrate sampling. We used an Oakton multi-parameter handheld tester (35 Series, Eutech Instruments) for pH, TDS, temperature, conductivity, and salinity. We also recorded stream width at three randomly selected transects with multiple depth readings across each transect. We measured streamflow (m/s) using a Flowatch scientific portable flowmeter (NTech USA) with the 60-mm water impeller. Velocity measurements were combined with the width/depth measurements to calculate stream discharge (m/s) via the cross-sectional area method. Percent mineral substrate composition and surrounding land use were also estimated at each site.

Macroinvertebrate sampling and laboratory procedures.—We carried out aquatic macroinvertebrate sampling and sample processing using the ILEPA 20-Jab Allocation method for wadeable streams (ILEPA, 2011a; ILEPA, 2011c; Barbour et al., 1999). The 20 jabs were allocated to appropriate bank and bottom habitats across an approximately 300-ft-long stream reach, as outlined by ILEPA (ILEPA, 2011b). Aquatic macroinvertebrates and associated organic and mineral material were collected with a D-frame net (500-micron mesh), and the 20 jabs combined in the field to produce a single sample preserved with 95% ethanol and transported to the laboratory. Laboratory subsampling requires a random subsample comprising ~300 (+/- 60) aquatic macroinvertebrate specimens (ILEPA, 2011c). Specimens were identified to the lowest taxonomic level possible, but in the interest of time, chironomid midges were not identified beyond family or subfamily (Tanypodinae were distinguished from non-Tanypodinae for functional feeding group analyses). We enumerated each taxon for analyses.

Calculation of macroinvertebrate metrics.—Each

Table 3. Stream habitat percent similarity categories for site comparability assessments (from Michigan DNR [1991], as given in the DWPC Field QA Manual [DWPC-ILEPA 1994; Table 5.2]).

Habitat Quality Category	Description	Percent Similarity
Excellent	Very Similar to Reference	>= 90%
Good	Slightly Different	75-89%
Fair	Moderately Different	60-74%
Poor	Substantially Different	<=59%

Table 4. Metrics calculated for aquatic macroinvertebrates with the response of metric to perturbation and best values (ILEPA 2011c; Table 1).

Metric	Response to Perturbation	Best Value
Total Taxa	Decrease	46
Intolerant Taxa	Decrease	9
Ephemeroptera	Decrease	10.2
Coleoptera	Decrease	5
MBI	Increase	4.9
Percent Scraper	Decrease	29.6
Percent EPT	Decrease	74

Table 5. Macroinvertebrate IBI quality categories (ILEPA 2011c; Table 2).

mIBI Index Score			
Lower Boundary	Upper Boundary	Comparison to Reference	Narrative Description
73.0	100.0	>75th percentile	Exceptional
41.8	72.9	>10th percentile	Good
20.9	41.8	bisect 10th percentile (upper)	Fair
0.0	20.8	bisect 10th percentile (lower)	Poor

Table 6. SHAP scores and standardized SHAP scores with categorical assessment.

Site	SHAP	Standardized SHAP	Category
Squaw Creek at Townline Road	41	14.8	Poor
Squaw Creek at Route 120	61	24.8	Poor
Mill Creek at Wicks Street	60	25.5	Poor
South Branch Indian Creek	75	33.2	Poor
Indian Creek at Seneca Drive	77	35.4	Poor
Buffalo Creek at Tall Oaks Drive	91	41.2	Poor
Mill Creek at Center Street	103	45.7	Poor
Buffalo Creek at Surrey Road	107	50.5	Poor
Des Plaines River at Route 120	112	50.9	Poor

taxon was assigned a tolerance value (from 0–10) and functional feeding group category (i.e., scraper, predator, collector-gatherer, filterer-collector, shredder, parasite, piercer), based on values and designations from ILEPA (2010). However, it should be noted that not all taxa have assigned tolerance values or functional feeding groups. Using the identifications, counts, tolerance values, and functional feeding groups, we calculated site-level scores for seven metrics (Table 4). The seven metrics included four richness metrics (i.e., total number of taxa, intolerant taxa, Ephemeroptera, and Coleoptera), two percent-composition metrics (Percent Scrapers and Percent Ephemeroptera + Trichoptera + Plecoptera, or EPT), and the Macroinvertebrate Biotic Index (MBI). The MBI is calculated as,

$$MBI = \sum (n_i * t_i)/N$$

where, n_i is the number of individuals of each taxon, t_i is the tolerance value assigned to the given taxon, and N is the total number of individuals in the subsample.

We standardized the calculated metrics based on Illinois Best Values (Table 4) and then averaged them by site to produce the final Macroinvertebrate Index of Biotic Integrity (mIBI). The mIBI provides a basis for categorizing sites into one of four mIBI quality categories (i.e., "Exceptional," "Good," "Fair," "Poor") based upon analyses of the aquatic macroinvertebrate fauna (Table 5).

We used R statistical analysis software (R Core Team, 2012) to calculate the seven metrics and mIBI score for each site. The calculations involved reading in a reference file of ILEPA tolerance values and functional feeding groups for all Illinois aquatic macroinvertebrates (ILEPA, 2010). We utilized packages *plyr* (Wickham, 2011) and *reshape* (Wickham, 2007) for the analyses.

RESULTS

Habitat.—Although SHAP scores ranged from 42 to 112 (standardized= 14.8–50.9), the categorical assessment was "Poor" at all sites (Table 6). In general, sites in the Illinois Routes 53 and 120 proposed project corridor had low substrate quality, lacked hydraulic diversity, and had experienced channel alteration. The two Squaw Creek sites had the lowest scores, whereas the Des Plaines River at Route 120 and Buffalo Creek at Surrey Road had the best scores in the Illinois Routes 53 and 120 proposed corridor.

Physical-chemical parameters.—Mill Creek at Center Street had the highest concentration of ions as measured via conductivity, TDS, and salinity (values = 1561 µS/cm, 1110 mg/L, and 782 mg/L, respectively; Table 7). pH was between 8.0 and 8.8 across sites. Chemistry was relatively similar between sites within the same stream. However, ion concentrations varied between the two Buffalo Creek sites. For example, conductivity at Buffalo Creek at Tall Oaks Drive (=1221 uS/cm) was approxi-

Table 7. Summary of water chemistry variables and date of measurement at each of the nine Illinois Routes 53 and 120 sites.

Site	Water Temp (°C)	pH	Conductivity (µS/cm)	Salinity (mg/L)	TDS (mg/L)
Buffalo Creek at Tall Oaks Drive	19.3	8.4	1221	597	856
Buffalo Creek at Surrey Road	23.8	8.8	658	328	483
Indian Creek at Seneca Drive	16.4	8.6	1028	501	729
South Branch Indian Creek	15.3	8.4	1168	561	815
Squaw Creek at Townline Road	27.4	8.1	906	446	643
Squaw Creek at Route 120	22.9	8.0	931	658	458
Mill Creek at Wicks Street	21.4	8.3	1341	667	953
Mill Creek at Center Street	23.7	8.4	1561	782	1110
Des Plaines River at Route 120	22.7	8.3	1090	596	771

Table 8. Summary of results of the mIBI at each site and the seven metrics used in its calculation. Sites are listed in order of increasing mIBI score.

Site	mIBI	Total Taxa	Intolerant	Ephemeroptera	Coleoptera	MBI	% Scrapers	% EPT
Buffalo Creek at Tall Oaks Drive	15.7	8	0	0	0	6.1	3.4	0
Squaw Creek at Route 120	20.9	10	0	0	2	5.9	0	1.3
Squaw Creek at Townline Road	29.3	13	2	2	2	5.5	0.8	1.5
Mill Creek at Wicks Street	30.5	17	1	2	3	6.0	0.7	1.1
South Branch Indian Creek	33.0	13	1	1	3	5.9	10.8	1.9
Buffalo Creek at Surrey Road	33.5	17	0	2	3	5.3	4.0	8.6
Mill Creek at Center Street	36.4	16	1	0	3	4.7	5.5	22.4
Indian Creek at Seneca Drive	40.6	19	2	1	5	5.1	4.2	0.4
Des Plaines River at Route 120	42.8	18	3	2	4	3.9	5.5	6.5

mately double that of the downstream site at Surrey Road (= 658 uS/cm). Water temperature varied between sites, being coldest at the South Branch of Indian Creek (=15.3 °C) and warmest at Squaw Creek at Townline Road (= 27.4).

Macroinvertebrates.—Due to limitations in taxonomy, or small or damaged specimens, richness values are commonly underestimated in bioassessment studies. Bioassessment protocols such as the one employed are not intended as a complete inventory of species. Nevertheless, a bioassessment approach allows for comparisons of taxa richness and other metrics by employing standardized sampling methods across all sites. Taxa richness at the best scoring mIBI sites was more than double taxa richness at the poorest mIBI site (Table 8). mIBI scores varied across sites, ranging from 15.7 (Poor) at Buffalo Creek at Tall Oaks Drive to 42.8 (Good) at Des Plaines River at Route 120 (Table 8). All other sites scored as Fair. EPT taxa were most abundant at Mill Creek at Center Street, due to the abundance of hydropsychid caddisflies. Ephemeroptera (mayflies) were present at six of the nine sites. Similarly, six of the nine sites had at least one intolerant taxon. No Plecoptera (stoneflies) were collected at any site. Coleoptera (beetles), and more specifically the elmid beetle *Dubiraphia vitatta*, were present at all sites except Buffalo Creek at Surrey Road. Coenagrionids (damselflies) were collected at all sites except the South Branch of Indian Creek. Chironomid midges were ubiquitous across sites in the Illinois Routes 53 and 120 proposed corridor.

CONCLUSIONS

Macroinvertebrate communities from stream sites throughout the proposed Illinois Routes 53 and 120 corridor suggest impairment has occurred to streams across the region. The low relative abundance of sensitive and indicator taxa (e.g., EPT), as well as depressed total taxa richness, led to most sites scoring in the mIBI range of "fair." Habitat assessment and water quality measurements corroborated the biotic results and provide additional insight into potential mechanisms of impairment to macroinvertebrate assemblages. The mIBI was designed to address macroinvertebrate community response primarily to nonpoint and habitat-related disturbances. Habitat degradation, both in- and near-stream, has direct consequences for macroinvertebrates. Plecoptera (stoneflies) are particularly sensitive to habitat conditions, requiring cool, fast-moving, and well-oxygenated streams (Merritt et al., 2008). The absence of stoneflies may reflect overall poor habitat conditions as the stream segments in the study lacked appropriate riffles, and high ion concentrations at most sites point to watershed activities that may be influencing stream condition (Allan, 2004; Roy et al. 2003); Paul and Meyer, 2001). Furthermore, six of the nine sites surveyed in this study had no Ephemeroptera (mayflies), and one site had no EPTs.

Comparison of the types of macroinvertebrates collected in 2015 with data collected in 1993 and 1995 from several sites on Indian and Buffalo creeks suggest little change in taxonomic composition in 20 years (Harris et al., 1993; Taylor et al., 1995b). Many of the same taxa were collected in our recent surveys. However, we cannot comment on stability or changes in impairment status of macroinvertebrates and their habitats over this timeframe. Previous surveys of macroinvertebrates in the region employed different collection methods from the protocol used in this study, and, thus, comparisons of relative abundances of macroinvertebrates are not appropriate. mIBI and other bioassessment data were

not available from the 1990s surveys.

More recent surveys of the Des Plaines River at Route 120 were performed with similar methods by ILEPA as part of the Intensive Basin Survey Monitoring Program (ILEPA, 2007) in August 2008 and 2013. Of the 19 taxa identified from the Des Plaines River in the present study, 14 and 13 of them were also identified in the ILEPA 2008 and 2013 studies, respectively (Howard Essig, ILEPA, pers. comm.). mIBI data were not available at this time for comparison with our bioassessment results. However, we were able to make some general relative composition comparisons. Percent EPT declined from 66 to 6.7 between 2008 and 2013 (ILEPA studies). Our 2015 data also tracked the decrease in EPT (6.5%). No Plecoptera were collected as part of any of the surveys on the Des Plaines, but Ephemeroptera and Trichoptera richness appeared to decline after 2008. The decline in relative abundance of EPT from 2008 to 2013 and 2015 coincided with an increase in the relative proportion of amphipods in both 2013 and 2015. In 2008, the percent Amphipoda at Des Plaines River was 5%. In 2013 and 2015, amphipods comprised 46% and 58%, respectively, of total individuals collected. While we cannot explain these observations, the replacement of pollution-sensitive groups with more tolerant amphipods suggest negative changes to stream quality are occurring in the Des Plaines River.

Macroinvertebrate assemblages in the proposed corridor of Illinois Routes 53 and 120 demonstrated a range of impairment, from "Poor" to "Good," with most sites rated "Fair." The mIBI for Buffalo Creek at Tall Oaks Drive was "Poor" and individual metrics demonstrated diversity loss (e.g., no EPT taxa, no intolerant taxa) at this site compared to others in the region. The Des Plaines River at Route 120 was the only site in the study assessed as "Good." However, changes in macroinvertebrate composition over time suggest a decline in biodiversity and sensitive taxa, with possible increased impairment in the river. Although the Des Plaines is the best mIBI-rated site in the study, a decline in-stream quality is especially disconcerting because such habitats can serve as regional refugia for biodiversity. In other words, the Des Plaines may be an important recolonization source for restored or improved habitats in the region. With the majority of sites assessed as "Fair," habitat restoration and mitigation of watershed activities will be important for maintenance and improvement of macroinvertebrate assemblages and overall stream condition in the future.

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APPENDIX I

Site-specific Results. Site 1. Buffalo Creek, Tall Oaks Drive, Kildeer, IL.

PLATE 1. Site photograph of Buffalo Creek looking upstream toward Tall Oaks Drive taken on 27 August 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Buffalo Creek at Tall Oaks Drive Site was located downstream of the culvert at Tall Oaks Drive (Plate 1). The average width was 2.1 m. Average depth was 0.2 m. We were unable to detect flow with our flowmeter. Substrate types were estimated as 45% silt, 40% sand, 10% clay, and 5 % cobble. Surrounding land use was estimated as 60% residential and 40% field/pasture. Individual habitat metrics scored mostly in the fair to poor range (Figure 1). Immediate land use was the best-scoring metric because this site was at the upper end of a reach that flowed through a large area of open space in a subdivision.

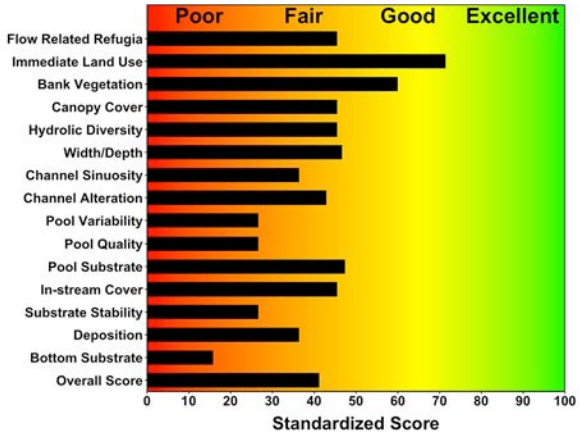

FIGURE 1. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Buffalo Creek at Tall Oaks Drive (Lake County, IL) on 27 August 2015.

Macroinvertebrates.—We collected few taxa (eight) from Buffalo Creek at Tall Oaks Drive (Table 9). Chironomid midges and flatworms (Platyhelminthes) were the most relatively abundant taxa, as reflected in the high proportion (~83%) of the functional feeding group collector-gatherers (Figure 2). Buffalo Creek at Tall Oaks Drive had the lowest mIBI score of all the Illinois Routes 53 and 120 sites. It was the only site in which we collected no EPT individuals (Figure 3).

APPENDIX I [CONTD.]

Site-specific Results. Site 1. Buffalo Creek, Tall Oaks Drive, Kildeer, IL. (contd.)

Table 9. List of taxa collected from Buffalo Creek at Tall Oaks Drive on 27 August 2015 using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Platyhelminthes	Turbellaria	Tricladida	NA	NA	Tricladida	115
Annelida	Clitellata	NA	NA	NA	Clitellata	2
Annelida	Clitellata	Rhynchobdellida	Glossiphoniidae	*Helobdella*	*Helobdella stagnalis*	1
Arthropoda	Arachnida	Hydracarina	NA	NA	Hydracarina	1
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	2
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	2
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	25
Arthropoda	Insecta	Hemiptera	NA	NA	Hemiptera	2
Arthropoda	Insecta	Hemiptera	Gerridae	NA	Gerridae	7
Arthropoda	Insecta	Hemiptera	Veliidae	*Microvelia*	*Microvelia* sp.	1
Arthropoda	Insecta	Diptera	NA	NA	Diptera	1
Arthropoda	Insecta	Diptera	Culicidae	*Culex*	*Culex* sp.	1
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	120
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	10

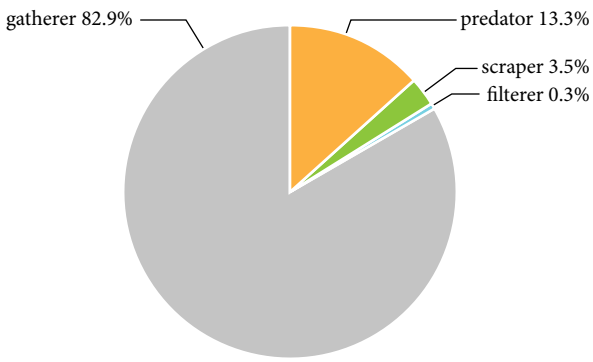

FIGURE 2. Macroinvertebrate functional feeding group (FFG) percent composition of Buffalo Creek at Tall Oaks Drive.

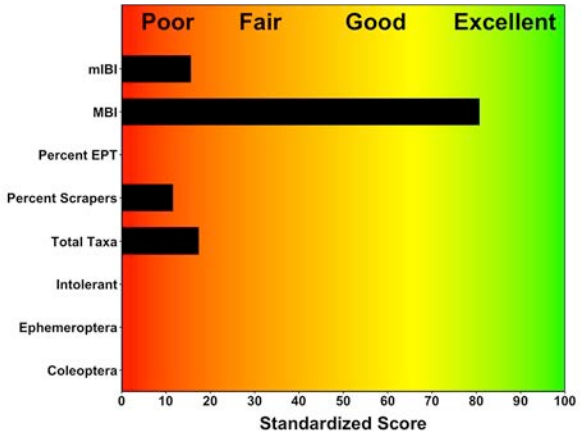

FIGURE 3. mIBI and standardized metrics used in calculation of mIBI for Buffalo Creek at Tall Oaks Drive.

APPENDIX I [CONTD.]

Site-specific Results. Site 2. Buffalo Creek at Surrey Road, Long Grove, IL.

PLATE 2. Site photograph of Buffalo Creek at Surrey Road on 1 September 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Surrey Road Site on Buffalo Creek was located at the upstream end of a wetland complex (Plate 2). Thus, the stream was wide (average = 8.2 m), deep (average = 0.65 m), and slow (velocity below detection). The substrate was primarily sand and silt, 50 and 40%, respectively, with some gravel (10%). Land use in the immediate area was 90 % field/pasture and 10% residential. Individual habitat metrics were variable (Figure 4) and in part reflect the wetlandlike characteristics of this site. For example, canopy cover, bottom substrate, and substrate deposition were poor, but bank vegetation and width/depth were good to excellent. It is not certain whether the wetland immediately downstream of this site is a natural feature, but we scored channel alteration as unaltered because it did not appear channelized.

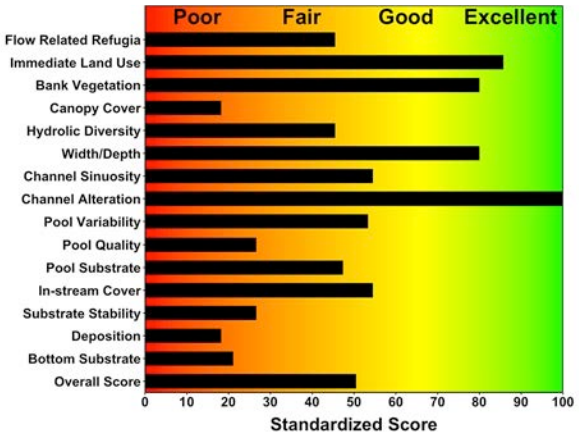

FIGURE 4. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Buffalo Creek at Surrey Road (Lake County, IL) on 1 September 2015.

Macroinvertebrates.—Taxa richness at Buffalo Creek at Surrey Road (17) was more than twice that of the upstream site at Tall Oaks Drive (Table 8). We collected numerous taxa of Diptera (true flies). Damselflies were among the most relatively abundant insects at the site (Table 10). Two genera of mayflies (Ephemeroptera), *Caenis* and *Callibaetis*, were present. Both of these taxa are associated with slow-moving or lentic conditions. Predators comprised almost one-third of functional feeding group composition because of the relative abundance of damselflies (Figure 5). The mIBI metrics scores were variable (Figure 6), which could reflect the wetlandlike conditions of the site.

APPENDIX I [CONTD.]

Site-specific Results. Site 2. Buffalo Creek at Surrey Road, Long Grove, IL. (contd.)

Table 10. List of taxa collected from Buffalo Creek at Surrey Road on 1 September 2015 using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Annelida	Clitellata	NA	NA	NA	Clitellata	3
Arthropoda	Arachnida	Hydracarina	NA	NA	Hydracarina	16
Arthropoda	Crustacea	Amphipoda	Hyalellidae	*Hyalella*	*Hyalella* sp.	37
Arthropoda	Insecta	Ephemeroptera	Baetidae	NA	Baetidae	6
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Callibaetis*	*Callibaetis* sp.	7
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis*	*Caenis* sp.	2
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	37
Arthropoda	Insecta	Odonata	Coenagrionidae	*Ischnura*	*Ischnura* sp.	1
Arthropoda	Insecta	Hemiptera	NA	NA	Hemiptera	3
Arthropoda	Insecta	Coleoptera	Dryopidae	*Pelonomus*	*Pelonomus* sp.	4
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	2
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	13
Arthropoda	Insecta	Diptera	Tipulidae	NA	Tipulidae	1
Arthropoda	Insecta	Diptera	Culicidae	*Culex*	*Culex* sp.	1
Arthropoda	Insecta	Diptera	Culicidae	*Culex*	*Culex salinarius*	2
Arthropoda	Insecta	Diptera	Ceratopogonidae	NA	Ceratopogonidae	1
Arthropoda	Insecta	Diptera	Ceratopogonidae	*Bezzia*	*Bezzia* sp.	1
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	26
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	3
Arthropoda	Insecta	Diptera	Stratiomyidae	*Odontomyia*	*Odontomyia* sp.	1
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	2
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	NA	Lymnaeidae	3
Mollusca	Gastropoda	Basommatophora	Planorbidae	NA	Planorbidae	2

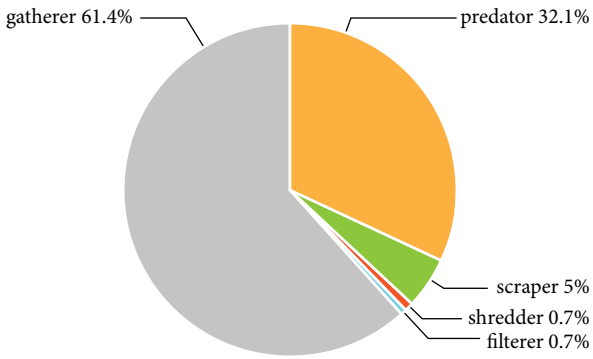

FIGURE 5. Macroinvertebrate functional feeding group (FFG) percent composition at Buffalo Creek at Surrey Road.

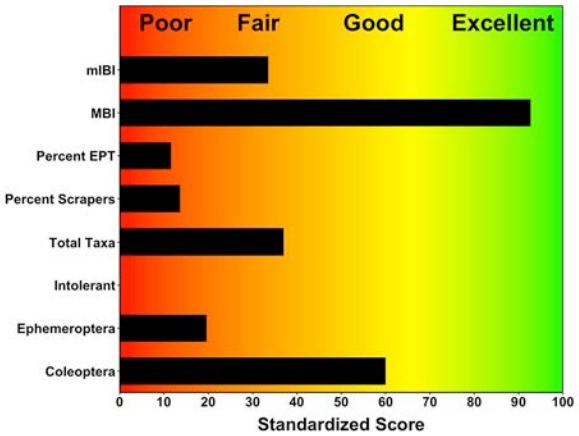

FIGURE 6. mIBI and standardized metrics used in calculation of mIBI for Buffalo Creek at Surrey Road.

APPENDIX I [CONTD.]

Site-specific Results. Site 3. Indian Creek at West Seneca Drive, Hawthorn Woods, IL.

PLATE 3. Site photograph of Indian Creek at W. Seneca Dr. (Lake County, IL) on 27 August 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Indian Creek site was located downstream of several residential neighborhoods in an open wetland meadow area (Plate 3). The stream averaged 1 m wide and 0.15 m deep. We were unable to detect streamflow. We estimated substrate composition in Indian Creek to be 70% silt and 30% sand. The surrounding land use was 90% field/pasture and 10% residential. Most of the individual habitat metrics were in the poor to fair range (Figure 7).

Macroinvertebrates.—Total taxa richness (19) at Indian Creek was highest of the Illinois Routes 53 and 120 sites (Table 8). Corixid bugs were the most relatively abundant macroinvertebrate (Table 11), and explain the high proportion of predators (66%) at the site (Figure 8). Indian Creek had the highest total taxa richness (19) and highest Coleoptera richess (5), and the mIBI score (40.6) was the second highest of the Illinois Routes 53 and 120 sites sampled (Table 8). The individual mIBI metrics mostly scored in the poor to fair range (Figure 9).

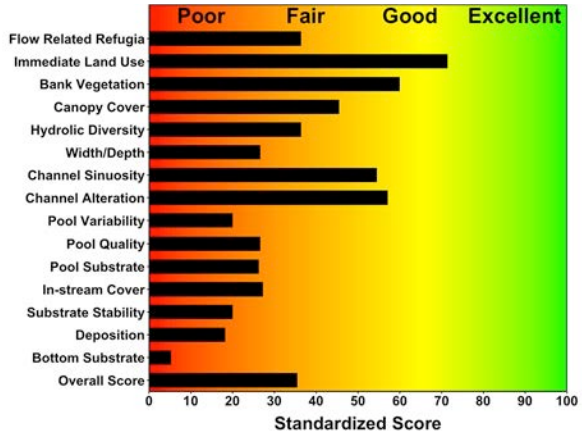

FIGURE 7. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Indian Creek at Seneca Drive (Lake County, IL) on 27 August 2015.

APPENDIX I [CONTD.]

Site-specific Results. Site 3. Indian Creek at West Seneca Drive, Hawthorn Woods, IL. (contd.)

Table 11. List of taxa collected from Indian Creek at Seneca Drive on 27 August 2015 using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Platyhelminthes	Turbellaria	NA	NA	NA	Turbellaria	7
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	3
Arthropoda	Crustacea	Amphipoda	NA	NA	Amphipoda	6
Arthropoda	Crustacea	Amphipoda	Hyalellidae	*Hyalella*	*Hyalella* sp.	1
Arthropoda	Crustacea	Amphipoda	Crangonyctidae	*Crangonyx*	*Crangonyx* sp.	22
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis*	*Caenis* sp.	1
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	20
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	9
Arthropoda	Insecta	Odonata	Coenagrionidae	*Ischnura*	*Ischnura* sp.	2
Arthropoda	Insecta	Hemiptera	Gerridae	NA	Gerridae	1
Arthropoda	Insecta	Hemiptera	Veliidae	NA	Veliidae	1
Arthropoda	Insecta	Hemiptera	Corixidae	NA	Corixidae	28
Arthropoda	Insecta	Hemiptera	Corixidae	*Trichocorixa*	*Trichocorixa* sp.	94
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	3
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	2
Arthropoda	Insecta	Coleoptera	Elmidae	*Macronychus*	*Macronychus* sp.	3
Arthropoda	Insecta	Coleoptera	Elmidae	*Macronychus*	*Macronychus glabratus*	1
Arthropoda	Insecta	Coleoptera	Elmidae	*Stenelmis*	*Stenelmis* sp.	1
Arthropoda	Insecta	Diptera	Tipulidae	*Dicranota*	*Dicranota* sp.	1
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	40
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	2
Arthropoda	Insecta	Diptera	Empididae	*Hemerodromia*	*Hemerodromia* sp.	1
Mollusca	Gastropoda	Mesogastropoda	Hydrobiidae	NA	Hydrobiidae	8
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	1
Mollusca	Gastropoda	Basommatophora	Ancylidae	NA	Ancylidae	1

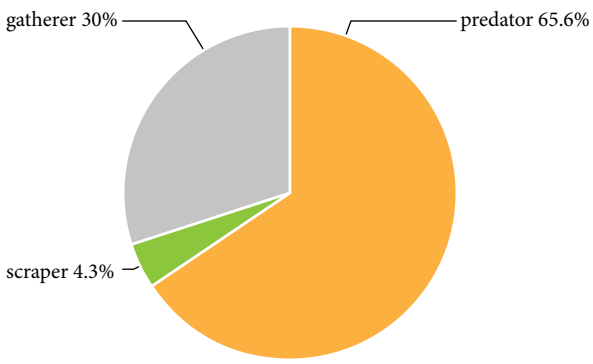

FIGURE 8. Macroinvertebrate functional feeding group (FFG) percent composition of Indian Creek at Seneca Drive.

FIGURE 9. mIBI and standardized metrics used in calculation of mIBI for Indian Creek at Seneca Drive.

APPENDIX I [CONTD.]

Site-specific Results. Site 4. South Branch Indian Creek at Salem Lake Road, Kildeer, IL.

PLATE 4. Site photograph of South Branch Indian Creek at Salem Lake Road on 27 August 2015. Photo by E. Bilger.

Site description and physical characteristics.—The South Branch Indian Creek site was located downstream of the Salem Lake Road culvert (Plate 4). It is a small stream with width averaging 1.7 m and depth 0.1 m. Flow was not detectable in areas deep enough to take a reading. Substrate composition was primarily silt (60%), with some sand (35%), and very little cobble (5%). Areas of the streambed were dry the day of sampling, and we found desiccated pupating caddisflies (Uenoidae: *Neophylax* sp.) attached to rocks. Surrounding land use was a mix of forest (50%), residential (40%), and agriculture (10%). Habitat characteristics were mostly poor to fair (Figure 10).

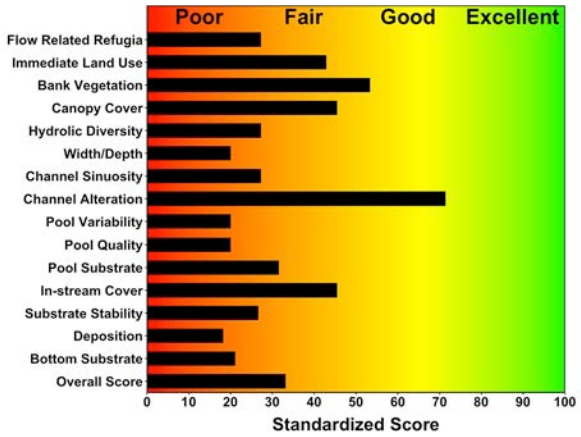

FIGURE 10. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Indian Creek at Salem Lake Road (Lake County, IL) on 27 August 2015.

Macroinvertebrates.—The most notable result of macroinvertebrate sampling at South Branch Indian Creek was the high proportion of flatworms (Turbellaria) (Table 12). The mayfly (Ephemeroptera), *Caenis*, and the caddisflies (Trichoptera), *Cheumatopsyche* and *Neophylax*, were collected, but in low relative abundance. Multiple functional feeding groups were represented, including collector-gatherers, predators, filterers, and scrapers (Figure 11). This site had the highest proportion of scrapers (11%) of all the sites surveyed. Most mIBI metrics were fair (Figure 12), as was the overall mIBI score.

APPENDIX I [CONTD.]

Site-specific Results. Site 4. South Branch Indian Creek at Salem Lake Road, Kildeer, IL. (contd.)

Table 12. List of taxa collected from South Branch Indian Creek at Salem Lake Road on 27 August 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Platyhelminthes	Turbellaria	Tricladida	NA	NA	Tricladida	216
Annelida	Clitellata	Arhynchobdellida	Erpobdellidae	NA	Erpobdellidae	3
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	33
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis*	*Caenis* sp.	1
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	10
Arthropoda	Insecta	Hemiptera	Gerridae	*Aquarius*	*Aquarius remigis*	2
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	*Cheumatopsyche* sp.	2
Arthropoda	Insecta	Trichoptera	Limnephilidae	*Neophylax*	*Neophylax* sp.	4
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	3
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	3
Arthropoda	Insecta	Coleoptera	Elmidae	*Stenelmis*	*Stenelmis* sp.	35
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	14
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	4
Mollusca	Pelecypoda	Veneroida	Sphaeriidae	NA	Sphaeriidae	31

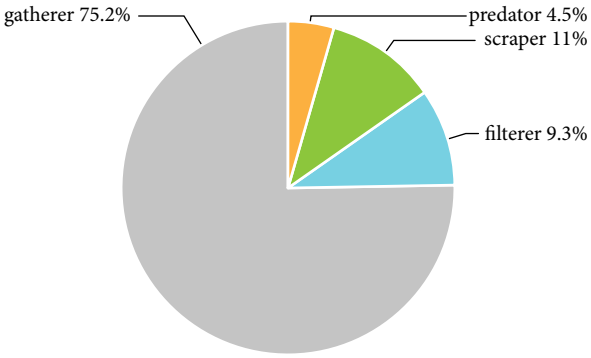

FIGURE 11. Macroinvertebrate functional feeding group (FFG) percent composition of South Branch Indian Creek at Salem Lake Road.

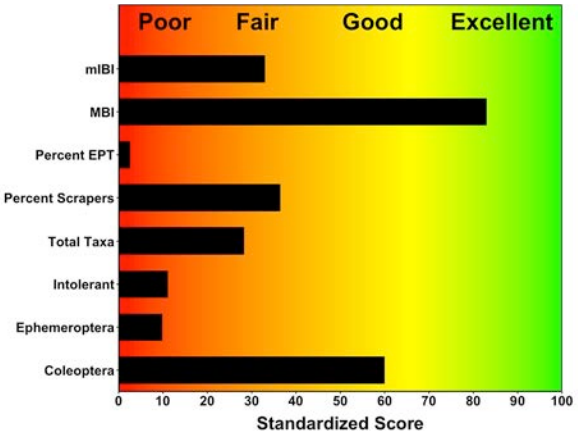

FIGURE 12. Standardized metrics used in calculation of mIBI for South Branch Indian Creek at Salem Lake Road.

APPENDIX I [CONTD.]

Site-specific Results. Site 5. Squaw Creek at Townline Road, Grayslake, IL.

PLATE 5. Site photograph of Squaw Creek with Townline Road bridge (Lake County, IL) on 1 September 2015. Photo by E. Moen.

Site description and physical characteristics.—The Townline Road Site was the upstream site on Squaw Creek (Plate 5). The stream at this site is channelized and open (Fig. 13), with a silt (70%) and clay (30%) substrate. The average depth was 0.35 m, and it was approximately 3 m wide. The water was highly discolored (Plate 5). We estimated surrounding land use as 80% field/pasture and 20% residential. Habitat conditions were poor at the site (Figure 13).

Macroinvertebrates.—We collected a high proportion of the Elmid beetle, *Dubiraphia vittata*, from the site on Squaw Creek (Table 13). Two taxa of mayflies, *Caenis* and *Callibaetis*, were present. This was the only site in the study from which we collected two taxa of Megaloptera, *Sialis* and *Chauliodes*. Both of these genera are associated with lentic habitats, and their presence is indicative of the slow-moving stream segment we sampled (Thorp and Covich, 1991). Functional feeding group composition was characterized by a preponderance of collector-gatherers (Figure 14). The individual metrics at Squaw Creek were mostly poor, as reflected in the overall low mIBI score (Figure 15); however, two intolerant taxa were found (*Boyeria* and *Atrichopogon*).

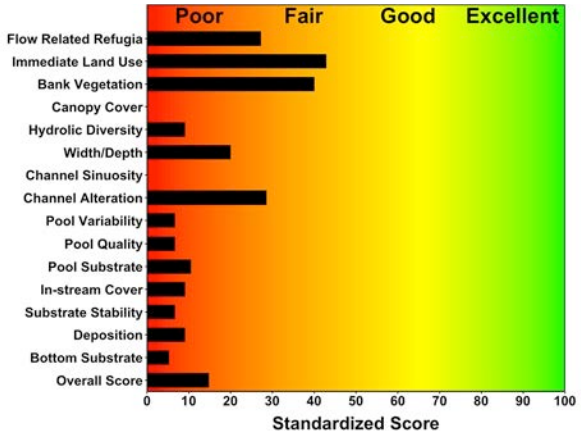

FIGURE 13. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Squaw Creek at Townline Road (Lake County, IL) on 1 September 2015.

APPENDIX I [CONTD.]

Site-specific Results. Site 5. Squaw Creek at Townline Road, Grayslake, IL. (contd.)

Table 13. List of taxa collected from Squaw Creek at Townline Road on 1 September 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Arthropoda	Crustacea	Amphipoda	Crangonyctidae	*Crangonyx*	*Crangonyx* sp.	156
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Callibaetis*	*Callibaetis* sp.	1
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis*	*Caenis* sp.	5
Arthropoda	Insecta	Odonata	Aeshnidae	*Boyeria*	*Boyeria* sp.	1
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	19
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma*	*Enallagma* sp.	6
Arthropoda	Insecta	Hemiptera	Nepidae	*Ranatra*	*Ranatra fusca*	1
Arthropoda	Insecta	Hemiptera	Corixidae	NA	Corixidae	9
Arthropoda	Insecta	Megaloptera	Sialidae	*Sialis*	*Sialis* sp.	2
Arthropoda	Insecta	Megaloptera	Corydalidae	*Chauliodes*	*Chauliodes* sp.	1
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	21
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	147
Arthropoda	Insecta	Diptera	Ceratopogonidae	*Atrichopogon*	*Atrichopogon* sp.	1
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	20
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	2
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	3

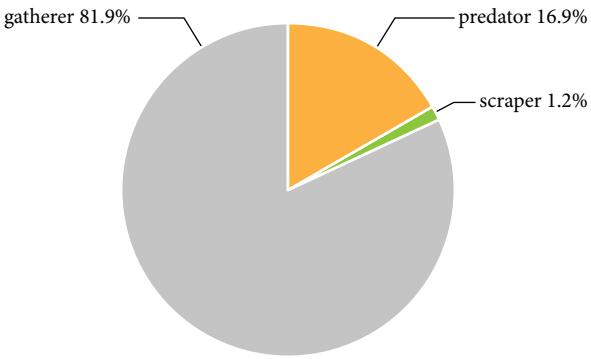

FIGURE 14. Macroinvertebrate functional feeding group (FFG) percent composition of Squaw Creek at Townline Road.

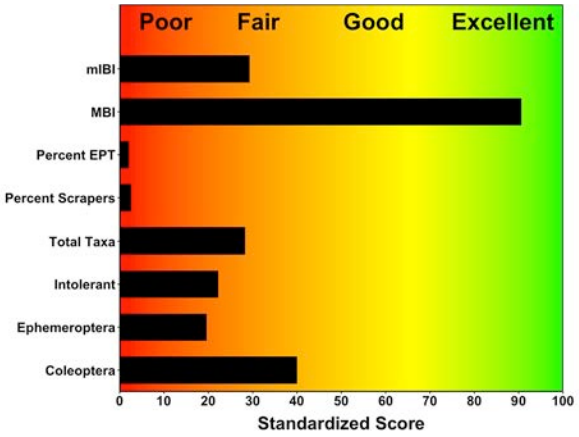

FIGURE 15. Standardized metrics used in calculation of mIBI for Squaw Creek at Townline Road.

APPENDIX I [CONTD.]

Site-specific Results. Site 6. Squaw Creek at Route 120, Round Lake Park, IL.

PLATE 6. Site photograph of Squaw Creek upstream of the Route 120 bridge (Lake County, IL) on 1 September 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Squaw Creek site at the Route 120 bridge was similarly discolored as the upstream Townline Road site (Plate 6). It also contained trash and debris (e.g., tires). The stream was approximately 3 m wide and 0.25 m deep. Flow was not measureable at this site. Substrate composition was 60% sand and 40% silt. We estimate surrounding land use as 100% industrial. The individual habitat metric scores reflected the poor substrate and channel conditions (e.g., channelization, unstable substrate, deposition, etc.) at this site (Figure 16).

Macroinvertebrates.—The macroinvertebrate community of Squaw Creek at Route 120 had low richness (10) and was dominated by a single taxon, *Dubiraphia* (Table 14). Both adults and larvae of the elmid beetle were collected. Functional feeding group composition was dominated by collector-gatherers (Figure 17). We collected no scrapers, intolerant taxa, or Ephemeroptera at the site, and the mIBI reflected the low metric scores (Figure 18).

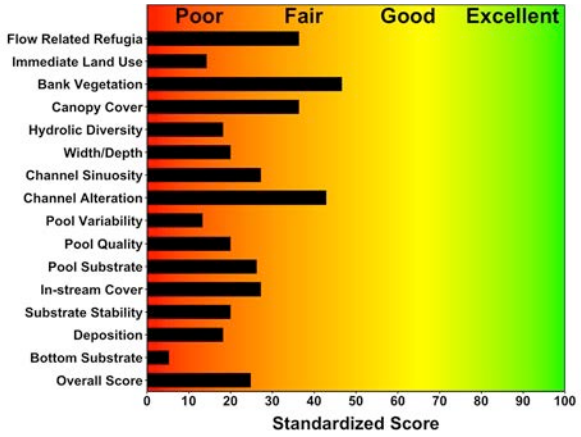

FIGURE 16. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Squaw Creek at Route 120 (Lake County, IL) on 1 September 2015.

APPENDIX I [CONTD.]

Site-specific Results. Site 6. Squaw Creek at Route 120, Round Lake Park, IL. (contd.)

Table 14. List of taxa collected from Squaw Creek at Route 120 on 1 September 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Annelida	Clitellata	NA	NA	NA	Clitellata	1
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	1
Arthropoda	Crustacea	Amphipoda	NA	NA	Amphipoda	5
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	1
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	1
Arthropoda	Insecta	Hemiptera	Corixidae	NA	Corixidae	1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	*Cheumatopsyche* sp.	3
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	106
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	104
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	13
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	3
Arthropoda	Insecta	Diptera	Empididae	*Hemerodromia*	*Hemerodromia* sp.	1

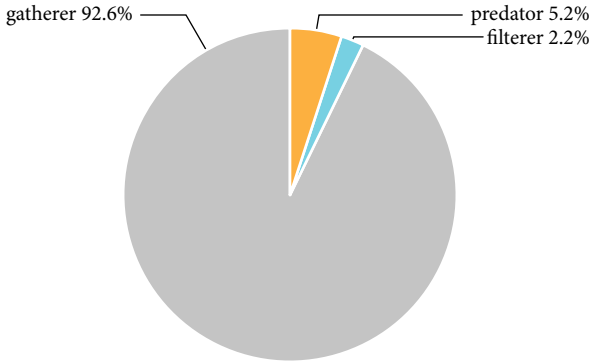

FIGURE 17. Macroinvertebrate functional feeding group (FFG) percent composition of Squaw Creek at Route 120.

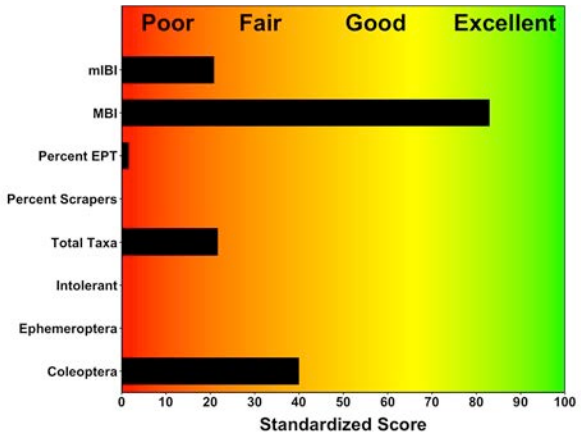

FIGURE 18. Standardized metrics used in calculation of mIBI for Squaw Creek at Route 120.

APPENDIX I [CONTD.]

Site-specific Results. Site 7. Mill Creek at Wicks Street, Grayslake, IL.

PLATE 7. Site photograph of Mill Creek taken from the Wicks Street bridge (Lake County, IL) on September 2, 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Mill Creek at Wicks Street Site was located downstream of the bridge (Plate 7). The stream flows through a subdivision at this location, and surrounding land use was estimated as 85% residential and 15% forest. The stream averaged 2 m wide and 0.25 m deep. We were unable to detect flow at this site. Substrate composition was silt (40%), clay (35%), and sand (25%). Individual habitat metrics scored poorly, particularly metrics associated with substrate quality (Figure 19).

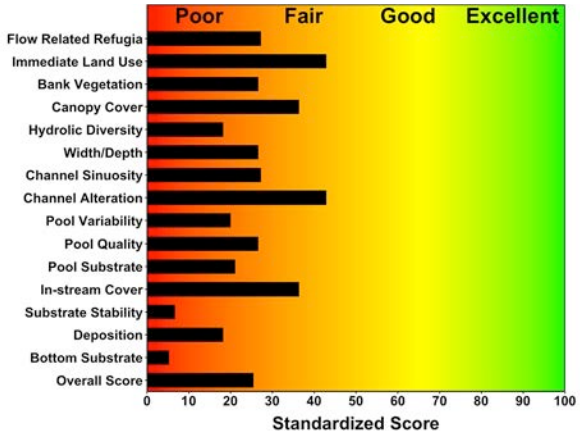

FIGURE 19. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Mill Creek at Wicks Street (Lake County, IL) on 2 September 2015.

Macroinvertebrates.—Despite poor habitat quality at Mill Creek, this was the only site from which any Heptageniid mayflies were collected (Table 15). These mayflies are associated with fast-moving water and stable substrates (Merritt et al., 2009). A small riffle upstream of the study reach may have been the source of this individual, but we cannot be certain. *Dubiraphia* sp. were relatively abundant, as were damselflies (*Calopterxy maculata* and *Enallagma* sp.). Predators comprised half of the individuals collected and were represented by the damselflies, several taxa of Hemiptera, and tanypod midges (Figure 20). Overall mIBI was fair, but individual metrics were variable (Figure 21).

APPENDIX I [CONTD.]

Site-specific Results. Site 7. Mill Creek at Wicks Street, Grayslake, IL. (contd.)

Table 15. List of taxa collected from Mill Creek at Wicks Street on 2 September 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Annelida	Clitellata	NA	NA	NA	Clitellata	15
Annelida	Clitellata	Arhynchobdellida	Erpobdellidae	NA	Erpobdellidae	2
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	7
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.	45
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	NA	Heptageniidae	1
Arthropoda	Insecta	Ephemeroptera	Caenidae	*Caenis*	*Caenis* sp.	3
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	2
Arthropoda	Insecta	Odonata	Coenagrionidae	*Enallagma*	*Enallagma* sp.	91
Arthropoda	Insecta	Hemiptera	Gerridae	*Rheumatobates*	*Rheumatobates* sp.	3
Arthropoda	Insecta	Hemiptera	Veliidae	*Microvelia*	*Microvelia* sp.	1
Arthropoda	Insecta	Hemiptera	Pleidae	*Neoplea*	*Neoplea* sp.	1
Arthropoda	Insecta	Hemiptera	Corixidae	NA	Corixidae	1
Arthropoda	Insecta	Megaloptera	Corydalidae	*Chauliodes*	*Chauliodes* sp.	1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	*Cheumatopsyche* sp.	1
Arthropoda	Insecta	Coleoptera	Haliplidae	*Haliplus*	*Haliplus* sp.	2
Arthropoda	Insecta	Coleoptera	Haliplidae	*Peltodytes*	*Peltodytes* sp.	1
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Helocombus*	*Helocombus* sp.	2
Arthropoda	Insecta	Coleoptera	Elmidae	NA	Elmidae	2
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	39
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	165
Arthropoda	Insecta	Coleoptera	Elmidae	*Stenelmis*	*Stenelmis* sp.	2
Arthropoda	Insecta	Diptera	NA	NA	Diptera	1
Arthropoda	Insecta	Diptera	Culicidae	NA	Culicidae	1
Arthropoda	Insecta	Diptera	Culicidae	*Anopheles*	*Anopheles* sp.	1
Arthropoda	Insecta	Diptera	Culicidae	*Anopheles*	*Anopheles crucians*	1
Arthropoda	Insecta	Diptera	Culicidae	*Anopheles*	*Anopheles quadrimaculatus*	1
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	47
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	9

APPENDIX I [CONTD.]

Site-specific Results. Site 7. Mill Creek at Wicks Street, Grayslake, IL. (contd.)

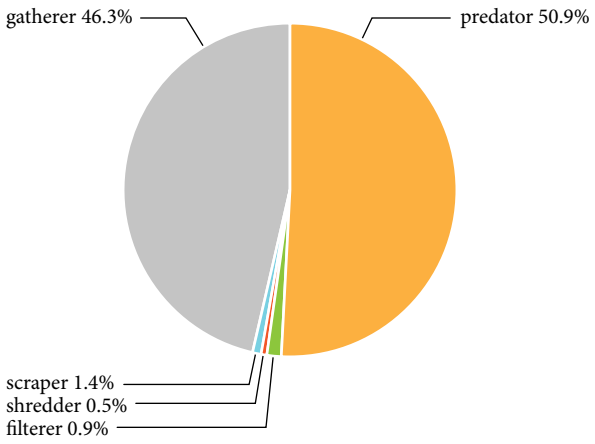

FIGURE 20. Macroinvertebrate functional feeding group (FFG) percent composition for Mill Creek at Wicks Street.

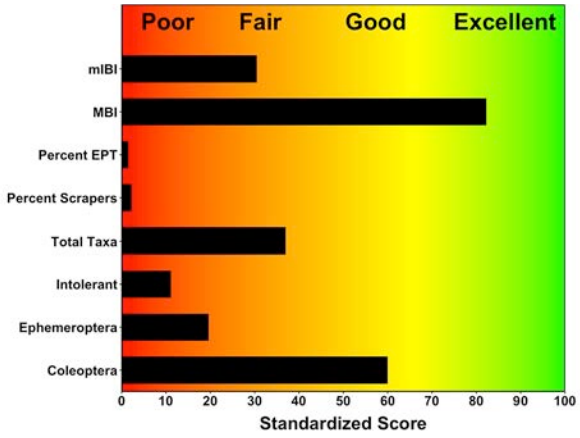

FIGURE 21. Standardized metrics used in calculation of mIBI for Mill Creek at Wicks Street.

Site-specific Results. Site 8. Mill Creek at Center Street, Grayslake, IL..

PLATE 8. Site photograph of Mill Creek at Center Street with Zeigler Drive at the bottom of the reach (Lake County, IL) taken on 1 September 2015. Photo by E. Bilger.

Site description and physical characteristics.—Mill Creek at Center Street is downstream of the Wicks Street location. The stream flows through the town of Grayslake before reaching Center St. (Plate 8). Average stream width at the site was 2.5 m, and depth was 0.2 m. Flow averaged 0.3 m/s in areas where the flowmeter could detect streamflow. Substrate composition was estimated as 45% gravel, 25% sand, 25% silt, and 5% cobble. We estimated land use in the surrounding area as 30% forest, 30% field/pasture, 30% residential, and 10% industrial. Most in-stream habitat characteristics rated fair to good (Figure 22).

Macroinvertebrates.—Mill Creek at Center Street was unique functionally in this study in the proportion of filter-feeders (Figure 23). Fingernail clams (Sphaeriidae) and hydropsychid caddisflies are filter-feeders and comprised over half of the individuals collected (Table 16). Percent EPT (22.4%) was due entirely to the proportion of caddisflies. The %EPT score was fair, even though Mill Creek at Center Street scored highest for this metric (Figure 24).

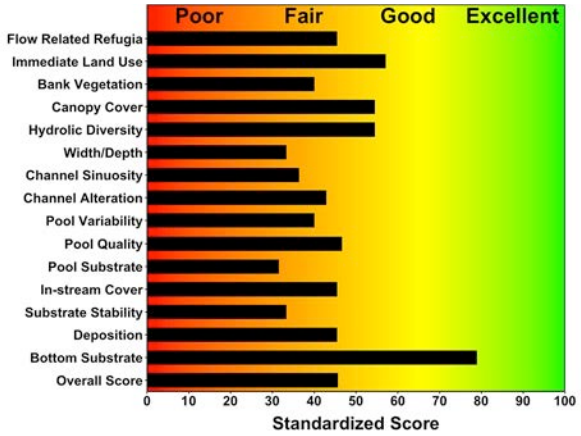

FIGURE 22. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Mill Creek at Center Street (Lake County, IL) on 1 September 2015.

APPENDIX I [CONTD.]

Site-specific Results. Site 8. Mill Creek at Center Street, Grayslake, IL. (contd.)

Table 16. List of taxa collected from Mill Creek at Center Street on 1 September 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Platyhelminths	Turbellaria	NA	NA	NA	Turbellaria	1
Annelida	Clitellata	Rhynchobdellida	NA	NA	Rhynchobdellida	1
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	9
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.	127
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	5
Arthropoda	Insecta	Hemiptera	Veliidae	NA	Veliidae	1
Arthropoda	Insecta	Hemiptera	Veliidae	*Microvelia*	*Microvelia* sp.	1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	NA	Hydropsychidae	1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	*Cheumatopsyche* sp.	59
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche*	*Hydropsyche* sp.	8
Arthropoda	Insecta	Trichoptera	Leptoceridae	*Oecetis*	*Oecetis* sp.	1
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	4
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	13
Arthropoda	Insecta	Coleoptera	Elmidae	*Stenelmis*	*Stenelmis* sp.	11
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	17
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	2
Arthropoda	Insecta	Diptera	Empididae	*Hemerodromia*	*Hemerodromia* sp.	1
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	6
Mollusca	Pelecypoda	Veneroida	Sphaeriidae	NA	Sphaeriidae	40

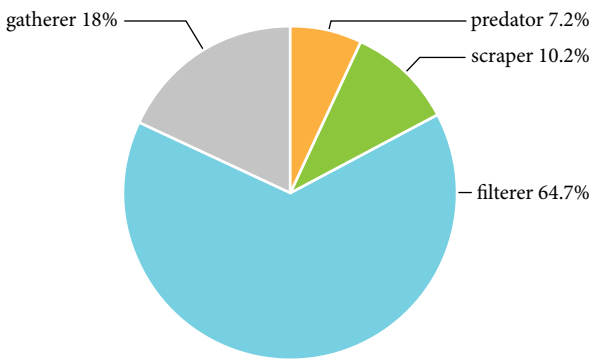

FIGURE 23. Macroinvertebrate functional feeding group (FFG) percent composition for Mill Creek at Center Street.

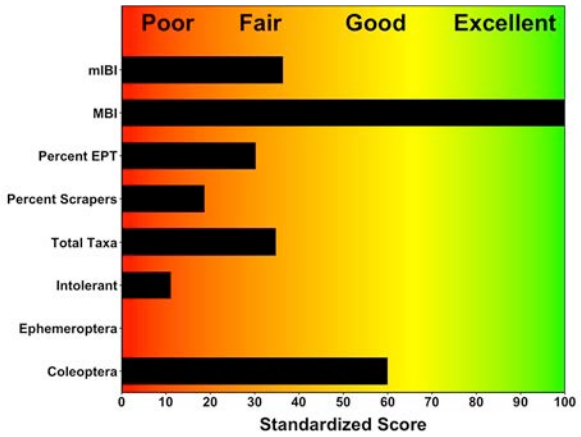

FIGURE 24. Standardized metrics used in calculation of mIBI for Mill Creek at Center Street.

APPENDIX I [CONTD.]

Site-specific Results. Site 9. Des Plaines River at Route 120, Gurnee, IL.

PLATE 9. Site photograph of Des Plaines River with the Route 120 bridge (Lake County, IL) taken on 2 September 2015. Photo by E. Bilger.

Site description and physical characteristics.—The Des Plaines River at Route 120 was the largest site in the study (Plate 9). Average depth was 1 m, and the stream is roughly 30 m wide. The substrate was 50% gravel, 40% sand, and 10% silt. We estimated surrounding land use as 90% forest and 10% residential. Habitat condition metrics mostly scored in the good range (Figure 25), and the overall habitat score was the best of all the Illinois Route 53 and 120 sites.

Macroinvertebrates.—The macroinvertebrate community of the Des Plaines at Route 120 was composed of a variety of groups, including multiple taxa of mayflies (Ephemeroptera) and caddisflies (Trichoptera). The amphipod, *Gammarus* sp., was the most abundant invertebrate at this site. Functional feeding group composition was represented by multiple feeding types, and no one type dominated composition (Figure 26). The mIBI metrics were variable, with Coleoptera richness and MBI scoring in the excellent range and the remaining metrics scoring poor to fair (Figure 27). The Des Plaines site had the highest overall mIBI score.

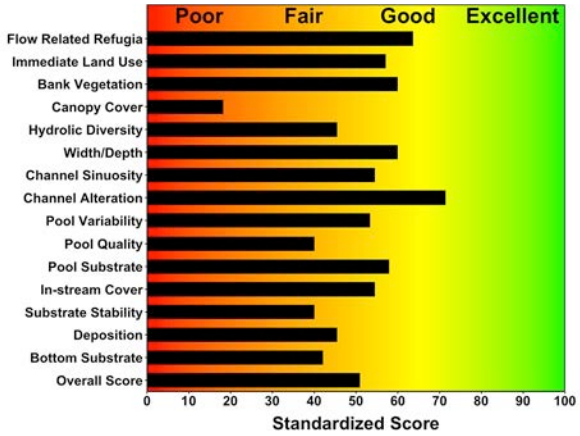

FIGURE 25. Summary of standardized values of the 15 metrics used to calculate the habitat assessment score for Des Plaines River at Route 120 (Lake County, IL) on 2 September 2015.

APPENDIX I [CONTD.]

Site-specific Results. Site 9. Des Plaines River at Route 120, Gurnee, IL. (contd.)

Table 17. List of taxa collected from Des Plaines River at Route 120 on 2 September 2015, using the 20-jab allocation method.

Phylum	Class	Order	Family	Genus	Taxon	N
Annelida	Clitellata	NA	NA	NA	Clitellata	2
Arthropoda	Crustacea	Isopoda	Asellidae	*Caecidotea*	*Caecidotea* sp.	5
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	*Gammarus* sp.	225
Arthropoda	Insecta	Ephemeroptera	Baetidae	*Baetis*	*Baetis* sp.	9
Arthropoda	Insecta	Ephemeroptera	Tricorythidae	*Tricorythodes*	*Tricorythodes* sp.	5
Arthropoda	Insecta	Odonata	Calopterygidae	*Calopteryx*	*Calopteryx maculata*	1
Arthropoda	Insecta	Odonata	Coenagrionidae	NA	Coenagrionidae	16
Arthropoda	Insecta	Hemiptera	Gerridae	*Metrobates*	*Metrobates* sp.	1
Arthropoda	Insecta	Hemiptera	Gerridae	*Rheumatobates*	*Rheumatobates* sp.	1
Arthropoda	Insecta	Hemiptera	Corixidae	NA	Corixidae	32
Arthropoda	Insecta	Trichoptera	Hydropsychidae	*Hydropsyche*	*Hydropsyche* sp.	6
Arthropoda	Insecta	Trichoptera	Hydroptilidae	*Hydroptila*	*Hydroptila* sp.	1
Arthropoda	Insecta	Trichoptera	Leptoceridae	*Oecetis*	*Oecetis* sp.	4
Arthropoda	Insecta	Coleoptera	Hydrophilidae	*Hydrochus*	*Hydrochus* sp.	2
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia* sp.	5
Arthropoda	Insecta	Coleoptera	Elmidae	*Dubiraphia*	*Dubiraphia vittata*	6
Arthropoda	Insecta	Coleoptera	Elmidae	*Macronychus*	*Macronychus glabratus*	6
Arthropoda	Insecta	Coleoptera	Elmidae	*Stenelmis*	*Stenelmis* sp.	11
Arthropoda	Insecta	Diptera	Chironomidae	NA	Chironomidae	29
Arthropoda	Insecta	Diptera	Chironomidae	NA	Tanypodinae	3
Mollusca	Gastropoda	Mesogastropoda	Hydrobiidae	NA	Hydrobiidae	1
Mollusca	Gastropoda	Mesogastropoda	Physidae	NA	Physidae	8
Mollusca	Pelecypoda	Veneroida	Corbiculidae	*Corbicula*	*Corbicula* sp.	6

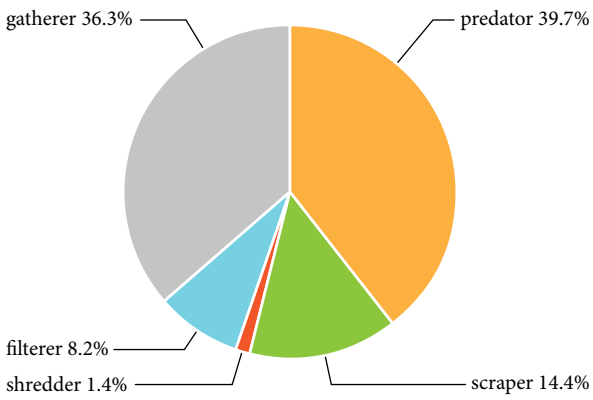

FIGURE 26. Macroinvertebrate functional feeding group (FFG) percent composition for Des Plaines River at Route 120.

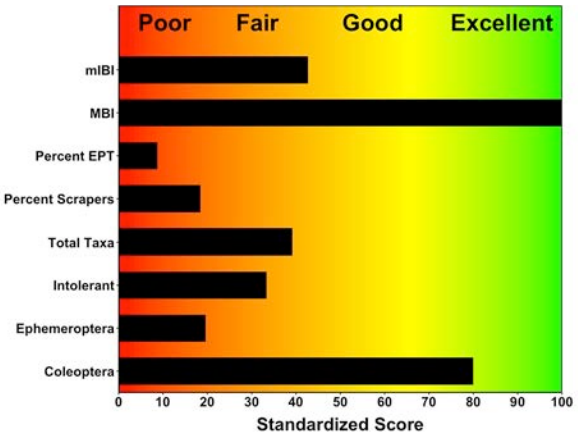

FIGURE 27. Standardized metrics used in calculation of mIBI for Des Plaines River at Route 120.