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Evaluation of Stream Quality and Sport Fisheries in the Kankakee River Basin

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Abstract

The 2015 Kankakee River Basin survey is the fifth IDNR evaluation of fish communities in the watershed since 1994. Additional IDNR surveys on the Kankakee River mainstem date back to 1975, representing a 40 year record of fish collections. Overall, the Kankakee River remains a high quality system with relatively stable conditions over the sampling period. Although yearly variations have been noted, no major trends have been observed for species composition, or stream quality. In 2015, fish surveys were conducted at 13 historic stations on the mainstem of the Kankakee River and 11 tributary stations. Two additional stations on the mainstem, one in each of the dam pools at Wilmington and Kankakee were also sampled in 2015. Overall, we collected 16,729 fish representing 76 species for all mainstream and tributary stations combined. Three State Threatened species were collected: Ironcolor Shiner, River Redhorse, and Starhead Topminnow. Asian Carp and Round Goby were not observed or collected. A total of 7,033 fish representing 69 species were collected from the mainstem stations. Species composition was generally similar to previous surveys with minnows, suckers, and sunfishes dominating the catch. Species distribution appeared to be related to stream gradient and longitudinal position, in addition to influence from the dams at Kankakee and Wilmington. Index of Biotic Integrity (IBI) scores ranged from 36 to 57 (60 maximum), with nine of the 13 historic mainstem stations scoring 50 points or more, including four of the five upper river stations between the State Line and Aroma Park. The station located at the confluence with the Des Plaines River was the only historic location with an IBI score below the IEPA threshold (≥41) for full support of aquatic life. This station is impounded by the Dresden Dam located on the Illinois River just below the confluence. The station within the six-mile Kankakee Dam pool also scored below the IEPA threshold with an IBI of 40. The Wilmington Dam pool, which is much shorter (one mile) than the Kankakee Dam pool appeared to maintain some level of free-flowing condition, with an IBI score (46) similar to un-impounded locations. Smallmouth Bass was the most numerous game species collected on the mainstem. Overall catch rate of smallmouth bass was lower in 2015 (14.3 per hour) compared to previous basin surveys (mean = 24.5 per hour), but catch rate of larger individuals (>14 inches) was the highest recorded (7.8 per hour). Young-of-the-year smallmouth bass were in low abundance in 2015, with only four individuals collected. Channel Catfish catch rate (13.8 per hour) was similar to 2010 and above the long term average (6.8 per hour) with many larger fish (>16 inches) present. A total of 9,697 fish representing 42 species were collected at 11 tributary stations. Species composition was similar to previous years with minnows and darters dominating the catch. IBI scores ranged from 30 to 58, with three stations scoring below the level for full support of aquatic life (≥41). Overall, stream quality has been relatively stable since 1994 based on tributary IBI scores, although several stations have had incremental increases in IBI scores in recent years. Larger sportfish were uncommon at tributary sites. However, unlike the mainstem, young-of-the-year Smallmouth Bass were abundant at several locations. Although there has been much discussion and concern regarding the downstream movement of sand from Indiana into the Illinois portion of the Kankakee River, evaluation of fish community and sportfish data from the 2015 basin survey provides no evidence of wide-spread habitat degradation. The Kankakee River is widely acknowledged as one of the most diverse, high quality systems in Illinois, and should remain a high priority for protection and improvement.

Introduction

The Kankakee River Basin was surveyed in 2015 by the Illinois Department of Natural Resources (IDNR) and Illinois Environmental Protection Agency (IEPA) as part of a statewide monitoring program to measure the health of Illinois streams. Data from sampling of fish assemblages, macroinvertebrates, habitat condition, and water quality is used by IEPA for statewide stream quality reporting. Fisheries data from basin surveys is also used for fisheries management permit review, watershed planning, education and outreach, as well as other applications and studies.

This report summarizes results of 2015 fish surveys including species composition, distribution, evaluation of stream quality, and status of the sport fishery. Results were also compared to previous basin surveys conducted in 1994, 2000, 2005, and 2010 as well as other historic records to identify trends for the Kankakee River watershed, widely known as one of the highest quality larger river systems in Illinois. Results of water quality and other parameters will be published separately by IEPA in the biennial 305 (b) report.

Watershed Description

The Kankakee River drains an area of 5,165 square miles, running for a total of 150 miles from its origin near South Bend Indiana to its confluence with the Des Plaines River near Wilmington, IL (Bhowmik and Demissie 2000). In Illinois, the river is 59 miles in length, with a drainage area of 2,169 square miles, encompassing nearly all of Kankakee County, a large portion of Will County, and a small area of Grundy County (Figure 1). The Iroquois River is the largest tributary to the Kankakee River, with its confluence near Aroma Park, IL. Other major tributaries to the Kankakee River include Singleton Ditch, Trim Creek, Spring Creek, Baker Creek/Exline Slough, Rock Creek, Horse Creek, Forked Creek and Prairie Creek. The mainstem of the Kankakee River has been extensively channelized in Indiana, but remains largely unmodified in Illinois (Bhowmik and Demisse 2000). A 12-foot high dam in the city of Kankakee creates a pool that extends upstream to Aroma Park (six miles). The Kankakee Dam fragments the upper and lower section of the river due to the lack of fish passage. Another dam at Wilmington, which is also impassable by fish, impounds a shorter segment of the river (one mile). A third mainstem dam in Momence extends across only one of two channels at this location, leaving

the other channel free-flowing and passable by fish.

The upper Kankakee River from the IL/IN State Line to Momence has a relatively low gradient (2 ft./mi.; Figure 2) meandering through a large floodplain forest known as the Momence Wetlands. After a relatively short increase in gradient at Momence (5 ft./mi.), the channel gradient decreases to 2.5 ft./mi from Momence to Aroma Park Just past Aroma Park, where the river is impounded for roughly six miles by the Kankakee Dam. The substrate upstream of Kankakee contains much bedrock with areas of gravel/cobble and sand substrate (Parker et al. 2017). Areas of sand have reportedly expanded in recent years in the Momence Wetlands and within dam pool which runs from Aroma Park downstream to the Kankakee Dam (Bowmik and Demissee 2001, Terrio and Nazimek 1997). Downstream of the Kankakee Dam, the river increases in gradient to four ft./mi. (Figure 2). The Kankakee River State Park river segment has the highest gradient (six ft./mi.; IDNR 1998), with numerous riffles, pools and islands. In addition to extensive bedrock runs, the substrate includes gravel and cobble areas. Downstream of the Park, gradient decreases to three ft./mi. through Custer Park, before being impounded by the Wilmington Dam. Downstream of the Wilmington Dam, the gradient increases to approximately four ft./mi. to the Des Plaines Conservation Area, where the river is impounded by the Dresden Dam on the Illinois River and becomes very slow-moving, silty and lake-like.

Methods

Fish surveys were conducted at the 13 historic stations on the mainstem of the Kankakee River (Figure 3) from August 11 to September 3, 2015. Eleven tributary stations, (Figure 3) were sampled from August 22 to September 2. Mainstem sampling included 13 historic sites sampled in previous basin surveys and routinely sampled by IDNR from 1975 to 1994 (Pescitelli and Rung 2008). In 2015, we also sampled one station in each of the dam pools at Wilmington and Kankakee in order to evaluate conditions in these impounded reaches. Data from the two dam pool locations were omitted from catch rate and other analysis involving previous collections at the 13 historic locations. Tributary locations were the same as those sampled in 2010. Fewer stations were sampled prior to 2010 (see Table 10). Location information and sampling dates for each 2015 station appear in Table 1. Stream flow was above

normal throughout the survey based on records from USGS Gaging Station at Wilmington (Figure 4). Flow increase somewhat from August 18 to August 26. No sampling was performed during that period.

Locations on the mainstem of the Kankakee River were sampled using DC boat electrofishing. Sampling at each station consisted of two 30 minutes runs, one along each bank. Supplemental collections were made at each boat site with a 30 ft. bag seine with 1/4 inch mesh. Sampling effort for the seine collections consisted of three 50 ft. hauls. All tributary stations were sampled using a 30 ft. electric seine, powered by a single-phase, 2500 watt AC generator (Bayley et al. 1989). At electric seine stations, upstream and downstream limits of each sampling station were blocked by nets to prevent fish escape and/or entry into the station during sampling. Length of the sampling station was approximately 15-20 times the stream width. Sampling with the electric seine was conducted in an upstream direction. For all sampling methods, larger fish were weighed, measured and returned to the stream alive. Smaller individuals were preserved in 10% formalin and identified in the laboratory. Voucher specimens for each species at each station were sent to the Illinois Natural History Survey in Champaign, Illinois.

In addition to fish species abundance, each sampling station was also evaluated using the Index of Biotic Integrity (IBI, Smogor 2004). The IBI is a widely-used stream quality measurement based on attributes of the fish assemblage at a given location. The attributes are evaluated using ten metrics which are compared to established reference conditions for least disturbed streams of similar size and geographic region. The metrics include number and types of species present, and several proportional metrics which evaluate attributes such as food, habitat, spawning substrate, and tolerance to degradation. Each metric receives a score of 0-6 with the sum of the ten metrics equaling the total IBI score, ranging from 0-60 with higher scores indicating better stream quality.

To evaluate differences in IBI among years we performed a one-way analysis of variance (ANOVA) on the mean annual IBI for all stations combined ($\alpha = 0.05$). If ANOVA showed significant variation, a two-tailed T-test with a Bonferroni correction ($\alpha = 0.05$) was used to examine differences between means. Mean IBI scores were correlated to the log-10 of mean

flow during the collection period to examine the effects of stream flows on IBI results for the mainstem stations. In order to analyze patterns in fish communities among the mainstem and tributary stations, non-metric multi-dimensional scaling (NMDS) analysis was performed on catch per unit effort for each species at each sampling locations using the Bray-Curtis (1957) similarity index. For the mainstem stations, analysis included factors based on river segments (established according to longitudinal location), channel gradient and relation to mainstem dams.

Results and Discussion

The 2015 Kankakee River Basin survey is the fifth evaluation of the watershed performed as part of the IDNR/IEPA statewide monitoring program, including surveys completed in 1994, 2000, 2005, and 2010 (Pescitelli and Rung 2012). Results from these studies allow evaluation of conditions over a 21 year period, using similar sampling techniques at historic locations. In addition, IDNR surveys have been conducted at the same 13 locations on the mainstem of the river from 1975 to 1994, allowing identification of trends over a 40 year period.

In 2015, fish were collected at 26 stations throughout the Kankakee River basin, including 15 mainstem (13 historic station and two dam pool stations) and 11 tributary locations (Figure 3, Table 1). Combining all stations, we collected a total of 16,729 individuals from 76 species and 15 families (Table 2). Three State Threatened species were found including Ironcolor Shiner, River Redhorse, and Starhead Topminnow. Ironcolor Shiner and Starhead Topminnow have been collected in each of the last four basin surveys. The State Threatened River Redhorse is relatively common in the mainstem of the river. Abundance and distribution of River Redhorse in 2015 was similar to previous basin surveys (Table 5) and catch rate has been relatively consistent in IDNR collections dating back to 1975 (Pescitelli and Rung 2008). In addition to State Threatened Species, there were eight other fish species collected in 2015 which have been designated as “in Greatest Need of Conservation” (see Table 3) by Illinois Comprehensive Wildlife Plan (IDNR 2005).

Combining all five IDNR basin surveys from 1994 to 2015, a total of 100 fish species have been collected including 93 native and 7 introduced fish species (Table 3). Illinois Natural History Survey records dating back to 1880 (INHS 2015), included 110 fish species with 7 non-native fishes. Non-native fish species recorded in the Kankakee River from previous IDNR surveys include: White Perch (*N*=1; collected in 2005), Threadfin Shad (one individual in 2005 and 2010), and Round Goby collected in 2010. A total of 5 Round Goby were collected at the two stations closest to the confluence with the Des Plaines River (F-01, F-14) below the Wilmington Dam. The Round Goby has become abundant in some areas of northeastern Illinois and could potentially become established in the Kankakee River, especially given the abundance of rocky substrate, their preferred habitat. However, none were collected in the Kankakee Basin in 2015. Grass Carp appeared for the first time in IDNR collections in 2015 at two stations, F-03 and F-04; one at each station. Given the locations of these individuals (upstream of the mainstem dams), the Grass Carp most likely escaped from ponds within the watershed where they are used for aquatic plant control. Although we have not collected Bighead or Silver Carp during any of the basin surveys, sampling by IDNR Aquatic Nuisance Species Program has yielded 63 Silver Carp and 8 Bighead Carp in the Kankakee River downstream of the Des Plaines Conservation Area Boat Ramp (IDNR ANS Database 2015).

Details for the 2015 Kankakee River mainstem and tributary collections are presented below, including discussion of fish species abundance and distribution, stream quality based on the IBI, and status of sportfish populations as well as comparisons to previous basin surveys and routine IDNR monitoring on the mainstem.

Mainstem

Fish Species Abundance and Distribution. A total of 7,033 fish representing 69 fish species were collected at 15 stations on the mainstem of the Kankakee River in 2015 (Table 4). Species richness ranged from 21 (F-08, F-96) to 39 (F-03). The Cyprinid family (minnows) was the most diverse and abundant group on the mainstem with 19 species collected and a total of 4,160 individuals, representing 59% of the total catch. The sucker family (Catostomidae) was also well represented with 1,312 individuals (19% of total) and 13 species. The sunfishes

(Centrachidae) had 12 species and one hybrid taxa with 842 individuals, which was 12% of the total catch.

Fish species with the highest abundance and catch per unit effort (CPUE, no. of fish per hour) for boat electrofishing included (in order of abundance): Shorthead Redhorse, Golden Redhorse, Smallmouth Bass, Channel Catfish, Spotfin Shiner, Sand Shiner, Logperch, Northern Hogsucker, Largemouth Bass, and Gizzard Shad (Table 5). Most of these species had widespread distributions, occurring at 12 or more of the 15 mainstem stations (Table 4). Logperch and Gizzard Shad were only found at 8 of the 15 stations. Other widely distributed fish species (occurring at >75% of the stations) were: Common Carp, Bluntnose Minnow, Quillback, River Redhorse, Silver Redhorse, Flathead Catfish, Longear Sunfish, Bluegill, and Green Sunfish (Table 4). Twenty three fish species had limited distributions, occurring at three stations or less (<25% occurrence; Table 4). The State Threatened species, Starhead Topminnow (*N*=3), and Ironcolor Shiner (*N*=36) were only found at the State Line location (F-03) in an off-channel, backwater area.

Distribution of native species within the mainstem of the Kankakee River appeared to be related to stream gradient, longitudinal position, and the influence of dams at Kankakee and Wilmington, as reported in previous surveys (Pescitelli and Rung 2012). In order to examine the effects of mainstem position on fish assemblages we used NMDS comparing stations in six river segments (Figure 5): UPPER – between the State Line and Aroma Park; SIX MI POOL – Aroma Park to the Kankakee Dam (Impounded area); MID LOWER – from Kankakee Dam to head of the Wilmington Dam pool; US WILM DAM – the Wilmington Dam impoundment (1.5 mi.); LOWER – from Wilmington Dam to Des Plaines Conservation Area; CONFL – between the Des Plaines Conservation Area and confluence with the Des Plaines River, which is impounded by Dresden Dam on the Illinois River..

The influence of channel gradient is implied in the NMDS grouping of stations in the UPPER and MID LOWER segments. Three UPPER stations (F-03, F-06, F-09) grouped together with one MID LOWER station F-08 (Figure 5), which have similar channel gradients (2-3 ft./mi.), despite being located in different stream segments. Conversely, the higher gradient station F-02 at Momence, located in the UPPER segment, grouped together with the higher gradient

stations in the MID LOWER segment. Two stations located below the Wilmington Dam (F-01, F-11) in the segment designated LOWER, grouped together based on similarity in habitat and location. These two stations have a direct connection to the Illinois River, unlike stations upstream of the Wilmington Dam, which is a barrier to fish movement. Station F-14, located near the confluence with the Des Plaines River is unique as indicated by the NMDS plot (CONFL, Figure 5). This river segment is directly connected to the Illinois River but was dissimilar to other stations due to impoundment by the Dresden Dam which creates silty, lake-like conditions. Stations F-96 and F-20 located in the other impounded segments (SIX MI POOL and US WILM DAM) were also unlike all other locations. Despite being located in dam pools, these two stations were dissimilar possible due to the difference in the length of the pool and associated flow conditions, as noted previously. Station F-15 was also not closely associated with other any other location, including other stations in the UPPER segment (Figure 5). The channel throughout much of F-15 was narrow and deep, possibly affecting sampling efficiency.

Although gradient appeared to have an influence on fish species composition and distribution, as found in other Midwestern stream systems (Peterson and Rabeni 2001), the two dams at Kankakee and Wilmington, both of which are impassable to fish, may have also had an influence. For example the stations below the Wilmington Dam were grouped separately in the NMDS plot (Figure 5). The Kankakee Dam may also influence fish species distribution. Longnose Gar and Freshwater Drum were relatively common below the Kankakee Dam but were not observed in the area above the dam (Table 4). Dams have been shown to effect fish species distribution in other northeastern Illinois (Santucci et al. 2005, Slawski et al. 2008) and Midwestern streams (Catalano et al. 2007).

Stream Quality - Index of Biotic Integrity. Although species richness is a useful indicator of habitat diversity and stream condition, the Index of Biotic Integrity (IBI) provides a more comprehensive, ecologically based estimate of stream quality (Simon and Lyons 1995). IBI scores were calculated for each mainstem stations by the extrapolated Smogor (2004) method using boat electrofishing and seine data.

Mainstem IBI scores ranged from 57 to 36 with an overall mean of 50 (Table 6). The lowest IBI score (36) was found at F-14 near the confluence with the Des Plaines River, where

lower gradient, low-flow conditions created areas with extensive silt accumulation. These conditions appeared to favor generalist, non-specialized species resulting in very low scores for related IBI metrics (Table 6). Station F-96, located in lake-like conditions of the 6-mile Kankakee Dam pool, also had a relatively low IBI (40). The Wilmington Dam pool, which impounds only about one mile of river channel, appeared to maintain more riverine conditions with an IBI of 46, similar to some free flowing stations (Table 6).

All stations except the confluence (F-14) and six-mile pool (F-96) had IBI scores greater than 41, which is the minimum threshold for IEPA designation, Full Support of Aquatic Life Use (IEPA 2016). Four stations upstream of the Kankakee Dam at the State Line, Momence, Rt. 17, and Aroma Park had scores of 52 or more, indicating relatively high biotic integrity, despite concerns about accumulation of sand originating from the channelized portion of the the Kankakee River in Indiana (Bhowmik and Demissie 2001). Station F-15 at River Isle has a relatively low score (42) compared to other mainstem stations. The reason for the lower IBI at F-15 is not clear although the narrow, deep channel at this location may have affected sampling effectiveness. IBI scores ranged from 48 to 56 downstream of the Kankakee Dam in the MID LOWER segment with 3 of 5 stations exceeding a score of 50. Both stations in the LOWER segment downstream of the Wilmington Dam had IBI scores of 56, indicating high quality stream conditions.

IBI scores for mainstem stations in 2015 were generally within the range observed for previous basin surveys from 1994 to 2010 (Table 7). No significant differences among years were observed (ANOVA). Some variation in IBI scores is expected, and therefore a difference of >10 IBI points is necessary to represent a “biologically meaningful” change (Smogor 2004). Four stations which decreased by more than 10 IBI points in the 2010 survey (F-12, F-07, F-04, F-11; Pescitelli and Rung 2012) had increased IBI scores in 2015 (Table 7, Figure 6). Aroma Park (F-09) and the State Line (F-03) stations, areas potentially impacted by sand accumulation, have shown relatively stable IBI scores over the sampling period from 1996 to 2015 (Figure 6). Variation in IBI scores was found to be related, in part, to stream flow levels during the collection period (Pescitelli and Rung 2012). Higher flows generally yielded lower IBI scores (Figure 7) possibly related to fish movement patterns or sampling effectiveness.

Sportfish. Smallmouth Bass was the most numerous sportfish species in 2015, with 186 individuals collected at 13 mainstem stations for a mean catch rate of 14.3 per hour of boat electrofishing (Table 5, Figure 5). Smallmouth Bass were present at all 13 historic stations, and were typically more abundant at higher gradient stations such as Momence and the MID LOWER segment stations (Table 4). Fish in the 11 to 16 inch size range made up a large portion of the catch (Figure 9). Young-of-the-year (Y-O-Y, <3 inches) were in very low abundance (N=4) indicating poor reproduction in 2015. The absence of younger fish resulted in a lower overall catch rate compared to previous years. However, the catch rate of fish ≥ 14 inches was very high in 2015 compared to all other years (Figure 8). Catch rates are typically higher for Smallmouth Bass during annual IDNR fall sportfish surveys in the Kankakee River (60-80 per hour, DNR 2016) when water levels are often reduced and lower temperatures help increase capture efficiency. During the 2016 fall sportfish survey Y-O-Y were very abundant, indicating good reproduction.

We collected 180 Channel Catfish by boat electrofishing in 2015 at 13 mainstem stations for a catch rate of 13.8 fish per hour, higher the long term average (Table 5, Figure 10). Channel Catfish were found at all locations, and similar to Smallmouth Bass, were typically more abundant at the higher gradient stations, especially Momence where the catch rate was 48 per hour. The Channel Catfish population was dominated by individuals >16 inches, which made up large portion of the collection (Figure 9). Y-O-Y were very low in abundance.

Catch rate for Rock Bass was four fish per hour in 2015 (Figure 10). Average catch rate for Rock Bass from 1975 to 2005 was 5.5 per hour. Rock Bass were found at 9 of the 15 locations and were most abundant at F-07, downstream of Route 17 (Table 4).

Walleye catch has been similar over the past three surveys with just over 2 fish per hour (Figure 10). Walleye were collected at six stations, with the highest abundance found at the two LOWER segment stations downstream of the Wilmington Dam (Table 4). IDNR initiated a Walleye stocking program in 2000, releasing an average of 90,000, 2-inch fingerlings per year. Only brood stock Walleye from the Kankakee River are used to produce the fingerlings. The stocking program has resulted in an increased number of Walleye in the mainstem. However, electrofishing catch rates during the summer basin survey period have been much lower

compared to the supplemental IDNR spring Walleye sampling which has averaged 30 per hour from 2000 to 2015. Based on recovery of marked individuals, 69% of the fish collected from the Kankakee River were from the IDNR stocking program (Lutterbie et al. 2012). Anglers have also reported higher catch rates of Walleye in recent years.

Northern Pike catch rate in 2015 was 1.2 fish per hour, slightly lower than 2010 (Table 5, Figure 11). All but one of the 18 individuals collected in 2015 were found in the lower gradient areas upstream of the Kankakee Dam (Table 4), where catch rate was 3.1 fish per hour, compared to 0.1 per hour downstream of the dam.

Tributaries

Fish Species Abundance and Distribution. A total of 9,697 fish representing 42 species were collected in 2015 at all tributary stations combined (Table 8). One Ironcolor Shiner, a State Threatened fish species, was collected at Spring Creek. The Minnow family (Cyprinidae) was the most diverse family with 14 native species, accounting for 75% of the total abundance. Darters were also abundant with eight species accounting for 12% of the total catch. Common Carp was the only non-native species captured at the tributary stations.

Fish species richness varied among stations, with the highest number found in Forked Creek (*N*=31) and the lowest number occurring at FKA-02 (Exline Slough) and FF-01 (Rock Creek), each station yielding 12 fish species (Table 8). FKA-02 is a small, channelized creek with very limited habitat, accounting for low fish species richness. Conversely, FF-01 was larger and has very diverse, natural habitat features. Low species richness has been reported in previous years at FF-01, possibly due to a natural rock formation located one mile upstream of the creek mouth, which acts as barrier for fish recruitment from the Kankakee River (Pescitelli and Rung 2008).

Striped Shiner, Bluntnose Minnow, Central Stoneroller, Hornyhead Chub, Mimic Shiner, Rainbow Darter, Johnny Darter, Banded Darter, Rosyface Shiner, and Creek Chub were the most abundant species collected at tributary stations in 2015 (Table 8). Together these species accounted for 83% of the total catch and were widespread in distribution, occurring at eight or more of the 11 locations sampled. One exception was Mimic Shiner, which, similar to previous

surveys, was only found at two locations. Johnny Darter, Smallmouth Bass, Green Sunfish, Rock Bass, and Bluegill and were also widespread, occurring at seven or more stations (Table 8).

Overall, fish species richness and distribution for 2015 Kankakee River tributary sampling stations were similar to previous basin surveys and were largely related to stream size, habitat availability, and location in the watershed. Streams segments in the upstream areas of the watershed were narrower and typically lower gradient than for downstream segments. The upstream segments more likely to be channelized and appeared to have more recent channel clearing or straightening, resulting in poor habitat diversity. Stations located lower in the watershed tended to have less channelization or no recent straightening or channel maintenance.

FM-02 on Spring Creek and FC-01 on lower Horse Creek were unique among the tributary sites as indicated by their separation from other streams in the NMDS plot (Figure 11). Spring Creek is a very low gradient, channelized stream with fine-grained substrate. Station FC-01 was on a channelized segment of Horse Creek with very fine-grained substrate. Both stations had very low overall fish abundance compared to other stations (Table 8). Native minnow species were particularly low in abundance at both locations, perhaps indicating reduced availability of invertebrate forage. Among the other tributary locations, there appeared to be segregation based on longitudinal position, with a cluster of six stations located in the downstream segments of the stream (FB-01, FQ-01, FF-01, FKA-01, FCC-01, and FA-01), separated from three stations in the upstream, channelized segments (FFB-01, FKA-01, and FA-06; Figure 11).

Stream Quality - Index of Biotic Integrity. Tributary IBI scores ranged from 58 on Forked Creek (FB-01) to 30 on Exline Slough (FKA-02; Table 9). The site on Forked Creek was un-channelized with natural habitat features including abundant emergent vegetation. Located lower in the watershed, the channel at FB-01 was relatively wide (Table 1) and within six miles of the Kankakee River (Figure 2). Large habitat area and longitudinal proximity to the mainstem contributed to high fish species richness (*N*=30), including a high number of migratory sucker species. FB-01 had maximum scores on all species metrics (*N*= 6; Table 9). In contrast, the East Branch of Horse Creek (FCC-01) was previously channelized, deeply incised, with a much smaller

channel, yet this location had an IBI score of 55, similar to Forked Creek. FCC-01 was much farther from the mainstem than FB-01 (10 miles; Figure 1) resulting in a low number of sucker species. However, 28 fish species were collected, including many benthic invertivores. Riffle and pool habitat were becoming established at FCC-01 and no recent channel maintenance was evident. FKA-01 on Baker Creek also appeared to be reestablishing natural habitat features following previous channelization, supporting 23 species and an IBI of 48. Trim Creek (FB-01) was never channelized, and retained natural habitat features with a wooded stream corridor and little or no channel incision. FB-01 had an IBI score of 50, but had lower fish species richness than other higher quality sites (Table 9).

The importance of connection to a downstream recruiting source was apparent at FF-01 on Rock Creek, which had only 12 fish species and IBI of 35, despite very high quality habitat and close proximity to the mainstem (2.5 miles). As noted previously, there is a natural rock barrier between the maintstem and FF-01. All other tributary sites had IBI scores ranging from 30 to 44. These stations were generally narrower, channelized stream segments, located in the upstream areas of the watershed.

Three of the eleven tributary stations had IBI scores below the threshold for Full Aquatic Life Use (≥41; IEPA 2016, Table 9). As expected, IBI scores appeared to be somewhat related to habitat conditions. However, as observed in the 2012, Kankakee River tributary habitat quality as estimated by the Qualitative Habitat Evaluation Index (QHEI; Rankin 1989), was poorly correlated with IBI scores (Pescitelli and Rung 2012). Proximity and degree of connection to downstream recruiting sources appeared to be an important factor. As described for Wisconsin streams (Wang et al. 1998), the age of channelization also appeared to influence stream quality for Kankakee River tributaries

IBI scores from the 2015 survey were similar to those in 2010 (Table 10). Differences in scores between the two surveys were minimal at most stations and did not exceed 10 points, the level indicating biologically significant change. IBI scores improved at 7 of the 12 tributary sites, with the largest increase occurring at Trim Creek. Stream quality has been relatively unchanged over the study period from 1994 to 2015 with no significant difference among years (ANOVA, Table 10). Several stations (FB-01, FCC-01, FFB-01, FQ-01) have shown incremental

increases in stream quality in recent surveys (Table 10, Figure 12,).

Sportfish. Rock Bass and Smallmouth Bass were the most abundant sportfish species found at tributary stations in 2015. A total of 189 Rock Bass were collected, appearing at most locations, excluding Prairie Creek and Exline Slough (Table 8). Exline Slough was shallow, with no pool habitat and no other sunfish species. Prairie Creek is a larger stream with diverse habitat, but for unknown reasons has held no Rock Bass in recent surveys. The highest abundance was found in Rock Creek and Baker Creek. Most of the Rock Bass collected were in the four to eight inch size range, with few Y-O-Y present (Figure 13). Smallmouth Bass were also widespread occurring at all locations except Exline Slough (FKA-02). The highest abundance of Smallmouth Bass was found in Rock Creek, typical of past basin surveys. Unlike Rock Bass, Y-O-Y Smallmouth Bass were common, making up a large portion of the population (Figure 13). Few catchable-size individuals were present in the tributaries, with most fish measuring less than 10 inches. The high number of Y-O-Y Smallmouth Bass in the tributaries suggests lower or less variable flows in 2015 compared to the mainstem, where few Y-O-Y were found. Bluegill and Largemouth Bass were also common, but only smaller fish of these species were present. No Channel Catfish were collected at t tributary locations.

Summary

The Kankakee River supports a very diverse assemblage of fishes. Factors contributing to high fish diversity include: a wide range of habitat types, good water quality conditions, and relatively low urban development. Momence Wetlands, one of the few areas in the State with intact forested flood plain, provides unique habitat for rarer fishes preferring low gradient, wetland habitats (Smith 1971). The downstream segments of the Kankakee River provide long, continuous stretches with deep pools, riffles, runs, and side channel habitats. Although the river is not highly fragmented by dams, the two impassable dams on the Kankakee River still appear to effect species distribution.

Sportfish populations in the Kankakee River remain in good condition and among the best in Northeastern Illinois. Smallmouth Bass, historically the most numerous sportfish species in the Kankakee River, continues to be abundant. Although overall numbers were down in

2015, abundance of larger fish was the highest recorded since surveys began in 1975. Y-O-Y were low in abundance in the mainstem in 2015, but were relatively abundant in the tributaries. Smallmouth Bass are known to have variation in reproductive success due to annual variation in river flows during the nesting period (Smith et al. 2005). Supplemental sampling in fall 2016 found high numbers of Y-O-Y at several Kankakee River mainstem locations. Channel catfish numbers remain relatively high, with many catchable sized fish present. Channel Catfish Y-O-Y were also abundant in Fall 2016. Walleye have also been more abundant in recent years due to the IDNR stocking program. However, summer electrofishing catch rates are still relatively low.

The Kankakee River watershed remains largely in agricultural land use. However, one continuing threat to stream quality is urban development. Located just outside the Chicago Metropolitan area, projections for human population growth within the watershed, particularly Will County, have been very high (Openlands 1999). Extensive studies in Northeastern Illinois (Dreher 1996, Harris et al. 2005, Pescitelli et al. 2008) and across the country (Paul and Meyer 2001) demonstrate that increased urban landcover leads to degradation of stream quality, even at levels as low as 10% urban coverage. Although the immediate threat has diminished in recent years due to economic factors, future growth remains a concern, especially if plans for a South Suburban Airport are revived.

There has been much concern regarding downstream movement of sand from Indiana into the Illinois portion of the Kankakee River. IDNR Basin Survey results have provided no clear indication of degradation in the mainstem. Recent studies have documented higher sand levels in the upper river. However, preliminary evidence indicates the sand covered areas are not significantly different in species richness, sportfish abundance, or overall productivity compared to that of rocky areas, although differences were noted for selected species (Parker et al, 2017). Mussel species richness has declined in the Kankakee River since the early 1900's, but overall, the number of mussel species remains high compared to other Illinois Rivers (J. Tiemann, INHS). Additional studies may be warranted to document effects of sand deposition on both localized and river-wide fish and mussel assemblages.

The Kankakee River is widely acknowledged as one the better river systems in Illinois for

native biodiversity (Kwak 1993, Page et al. 1992) and angling opportunities. Protection of this valuable resource should remain a high priority. A wide range of restoration and protection measures have been recommended (Kwak 1993, Bhowmik and Demissie 2000), in addition to studies and discussions among local groups and government agencies related to sedimentation issues.

Acknowledgments

Thanks to all those who contributed to field collection efforts especially Region 2 Fisheries Staff and Illinois IEPA Biologists. Special thanks to Jim Langbein, Regional Fisheries Biologist (retired) for his many years of effort on the Kankakee River including initiating and maintaining routine fisheries monitoring. This study was funded in part by the USFWS Sportfish Restoration Program (F-67-R).

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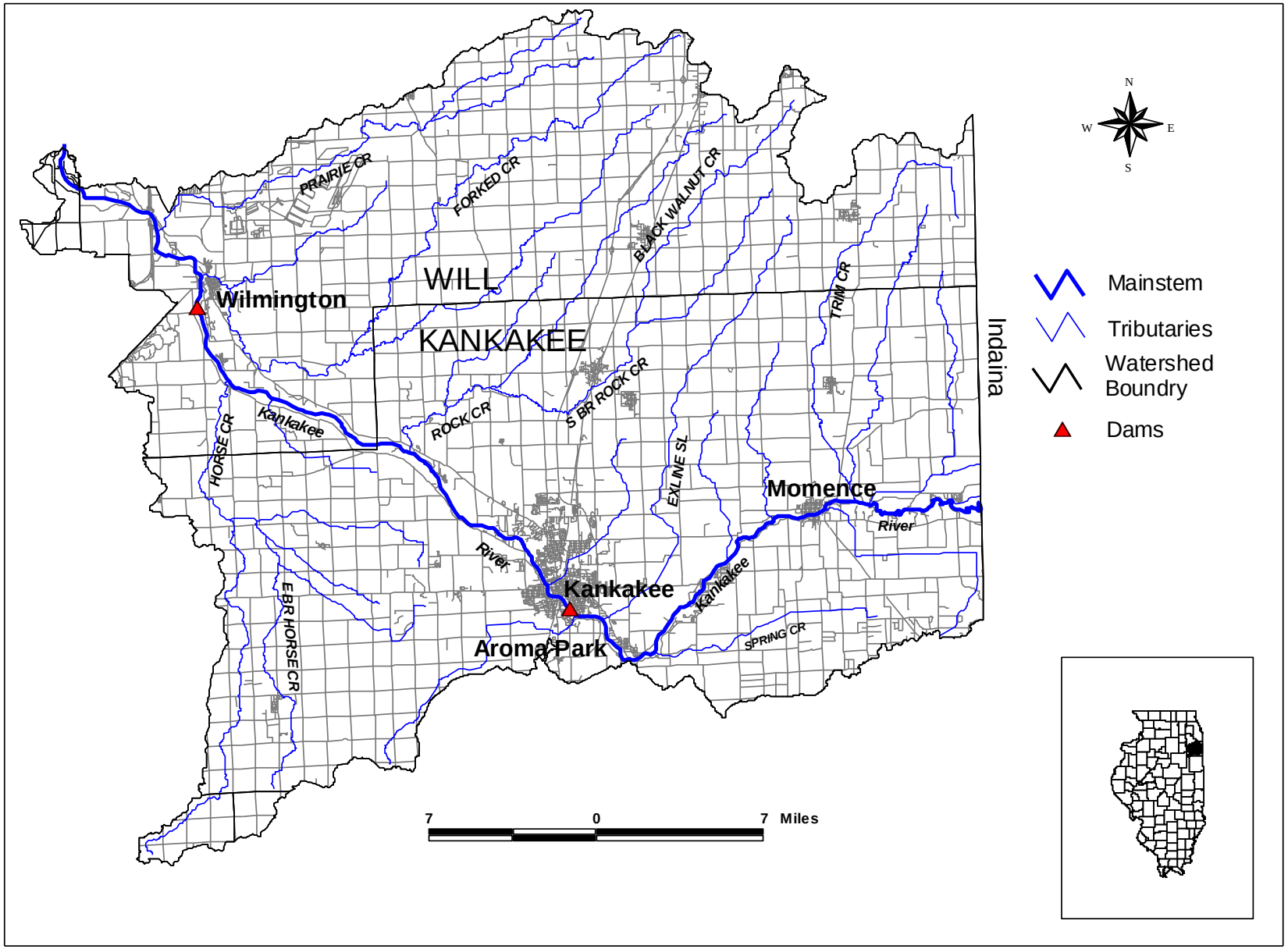


Figure 1. Kankakee River watershed.

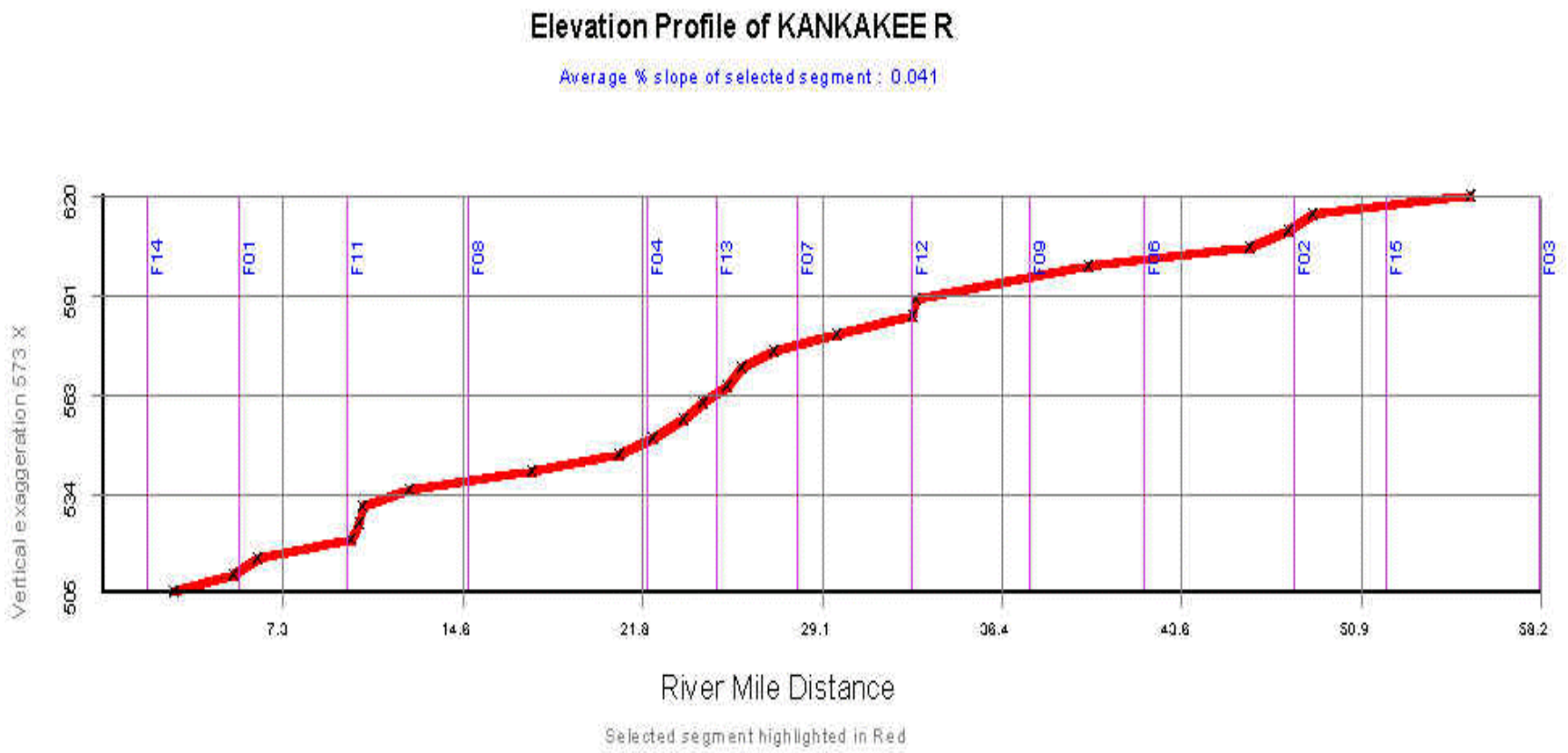


Figure 2. Elevation profile of the Kankakee River mainstem including locations of sampling stations and river mile.

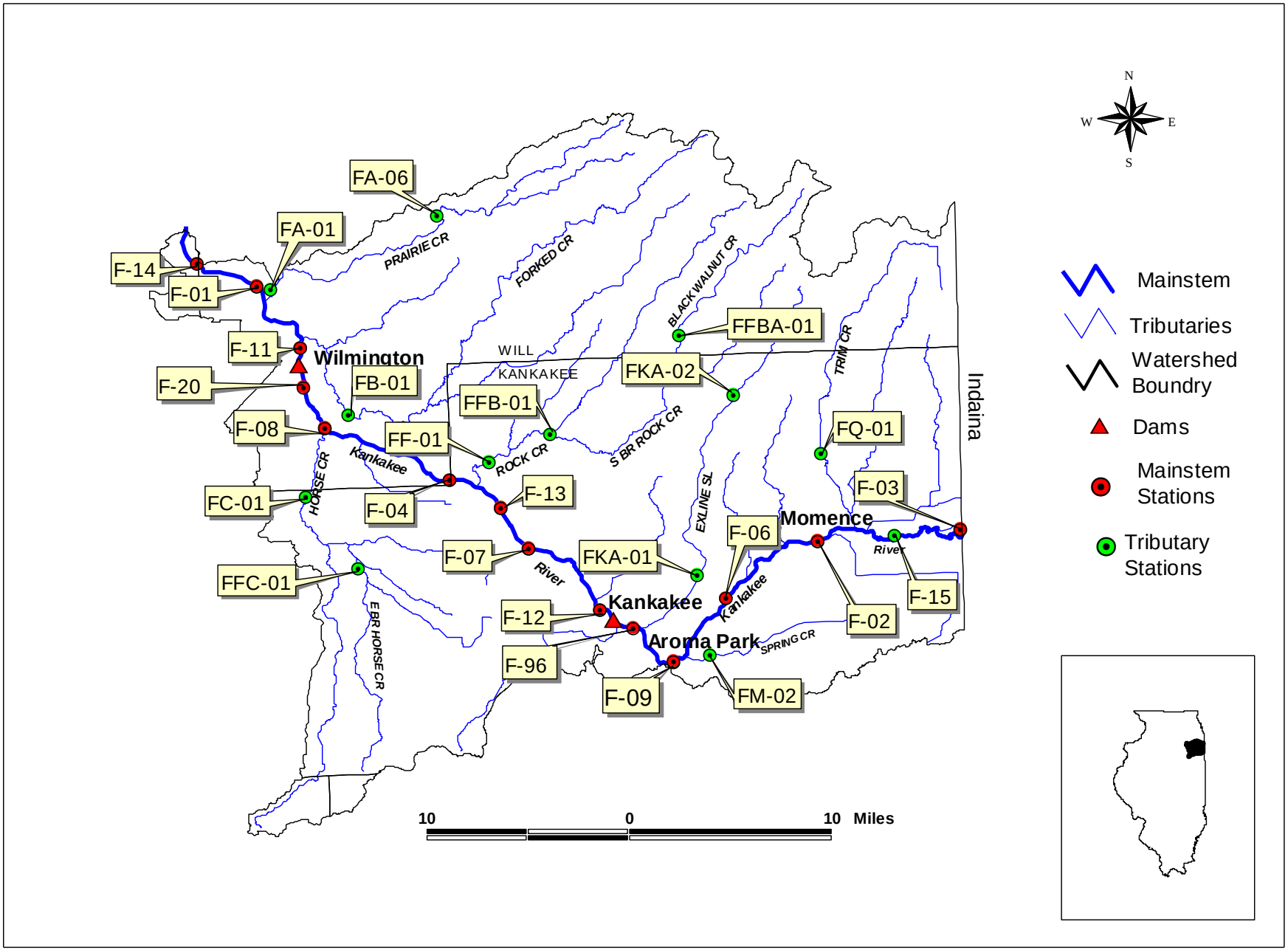


Figure 3. Kankakee River watershed with locations of mainstem and tributary fish sampling locations for the 2015 Basin Survey.

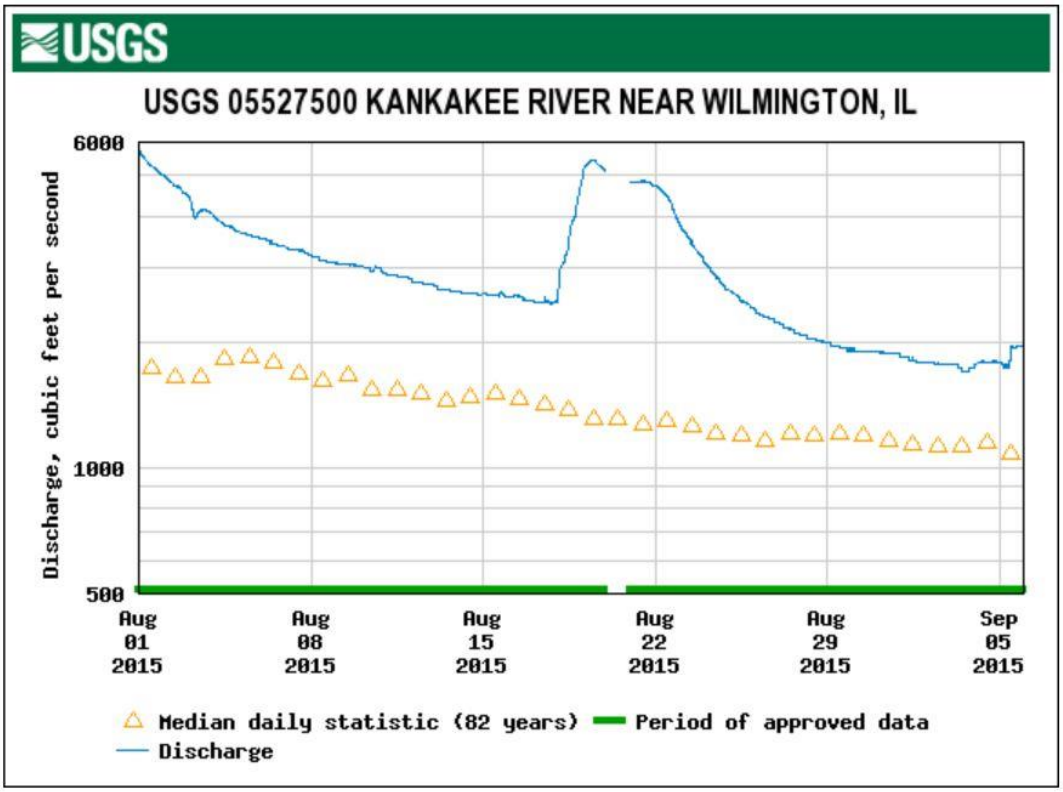
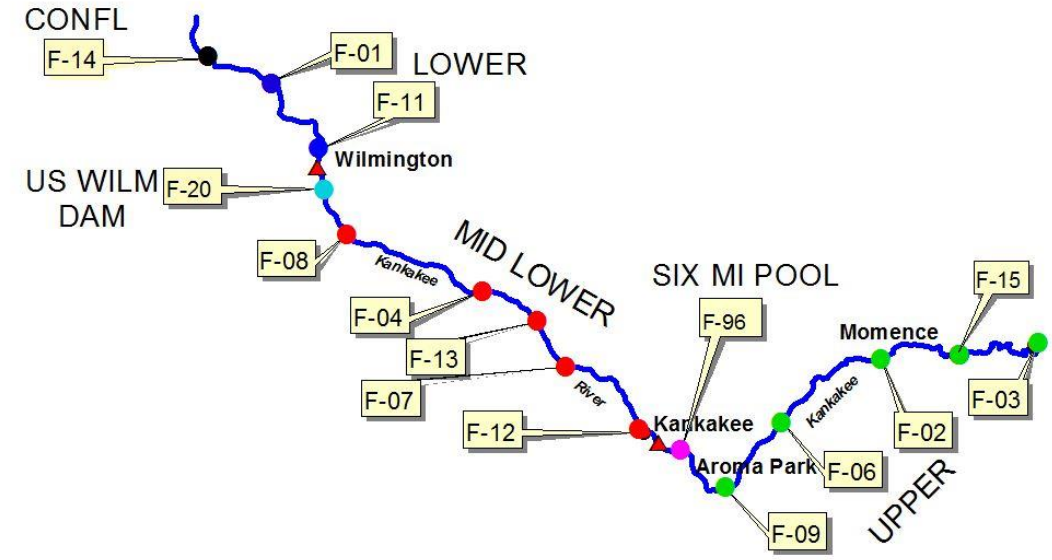


Figure 4. Daily discharge for the Kankakee River during the 2015 basin survey. Data from the United States Geological Survey (USGS) gaging station at Wilmington, recorded in cubic feet per second (cfs).



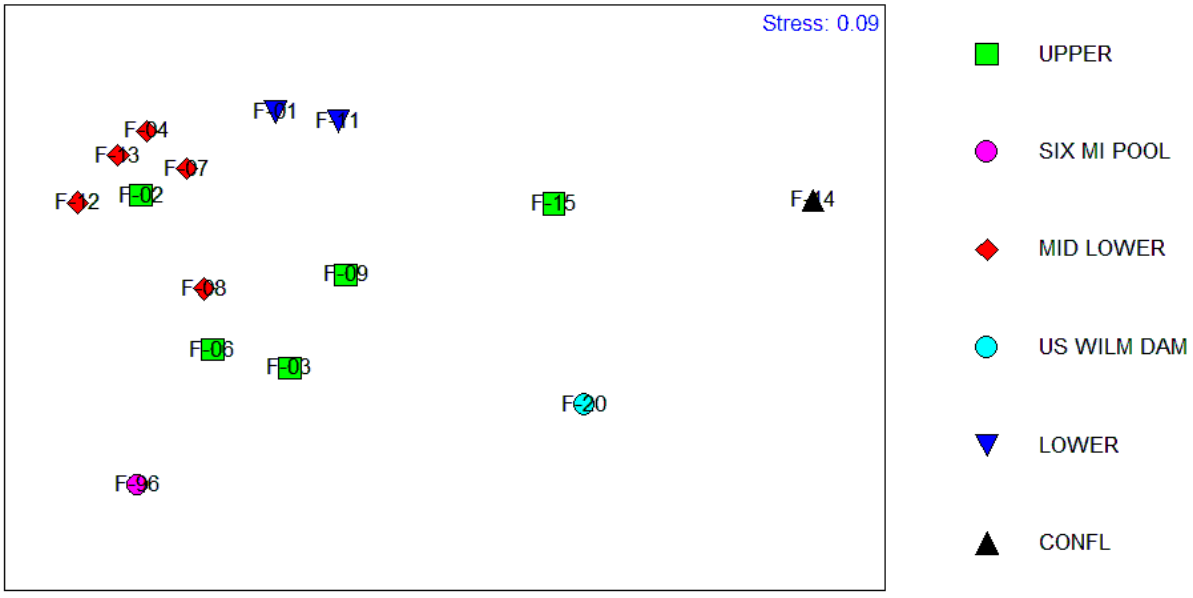


Figure 5. Top: Designated river segments for non-metric multi-dimensional scaling (NMDS) plot of Kankakee River mainstem fish sampling stations. Bottom: NMDS plot based on Bray-Curtis (1957) similarity of catch per unit effort for each fish species at each mainstem station categorized by river segments shown above.

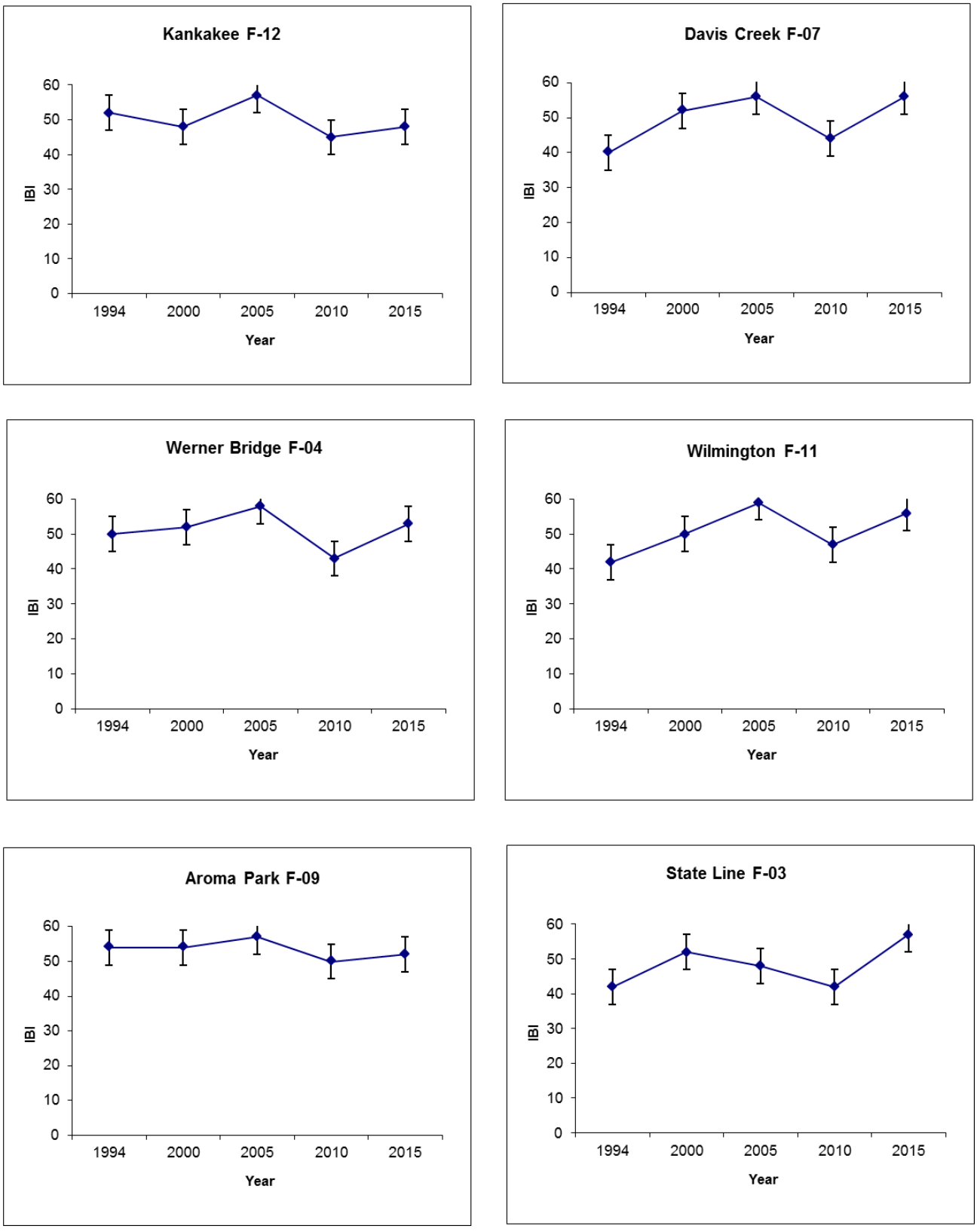


Figure 6. Index of Biotic Integrity (IBI) values for Kankakee River basin surveys at selected mainstem stations from 1994 to 2015. Bars represent range for biologically meaningful change (>10 points, Smogor 2004).

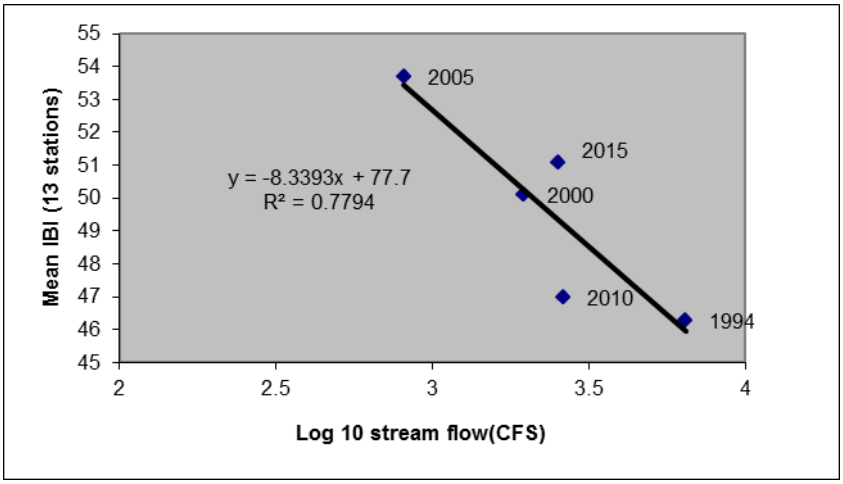


Figure 7. Mean stream flow during fish collection period; Log 10 cubic feet per second (CFS) vs. mean Index of Biotic integrity (IBI) scores for 13 mainstem Kankakee River stations 1994 – 2015.

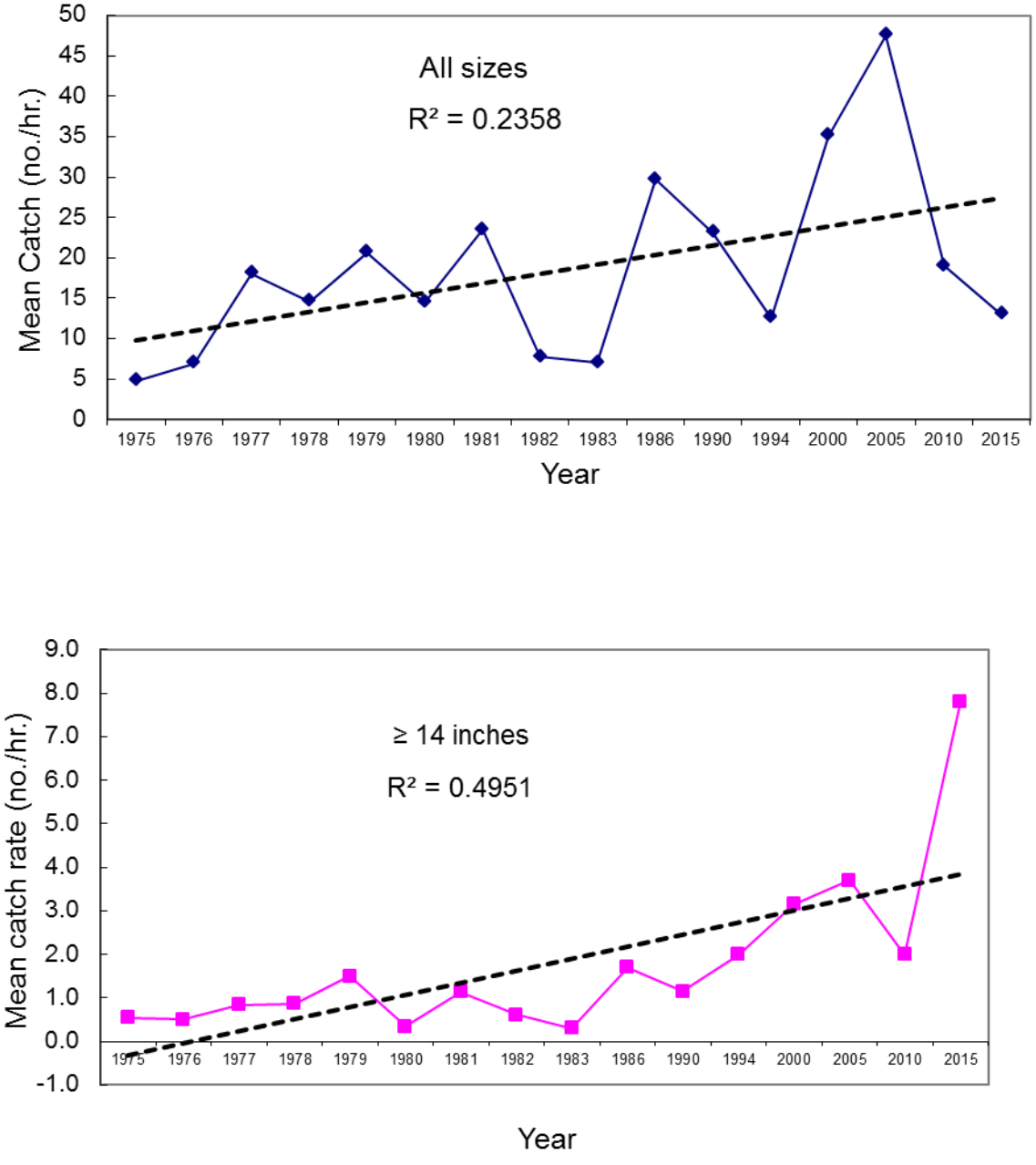
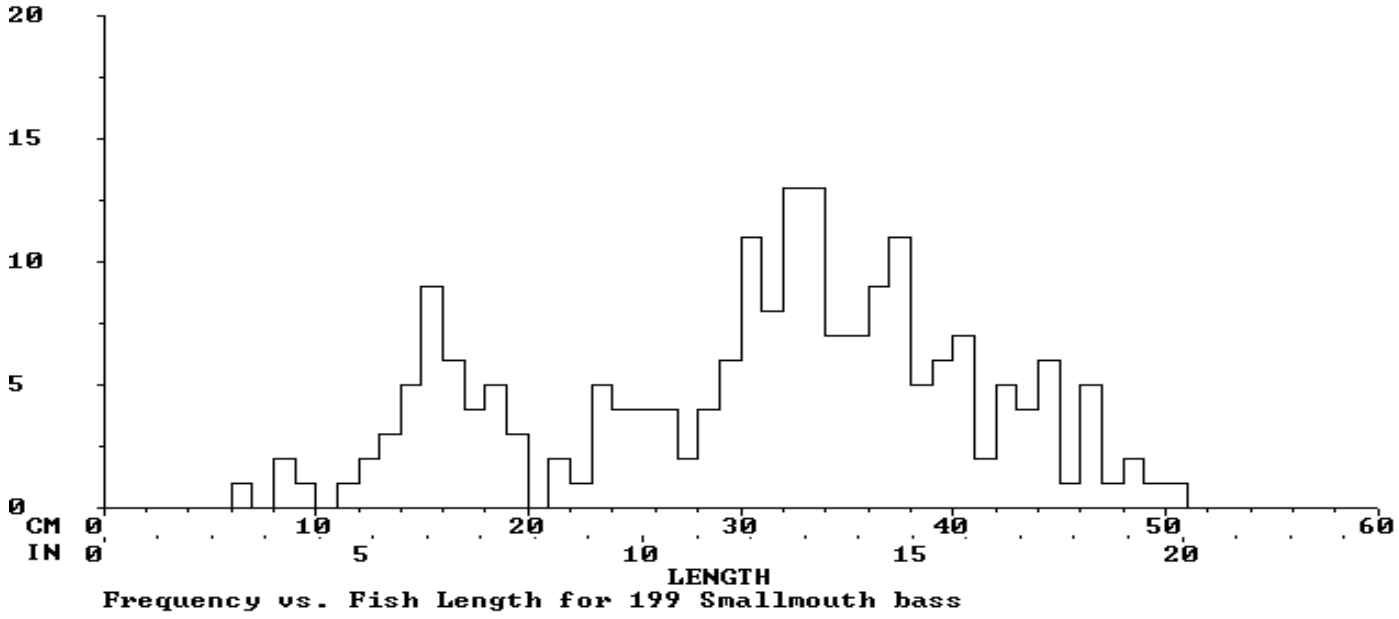


Figure 8. Mean electrofishing catch rate (no. fish/hr.) for Smallmouth Bass of all sizes (top) and for individuals ≥ 14 inches (bottom) at 13 mainstem Kankakee River stations, 1975 to 2015.



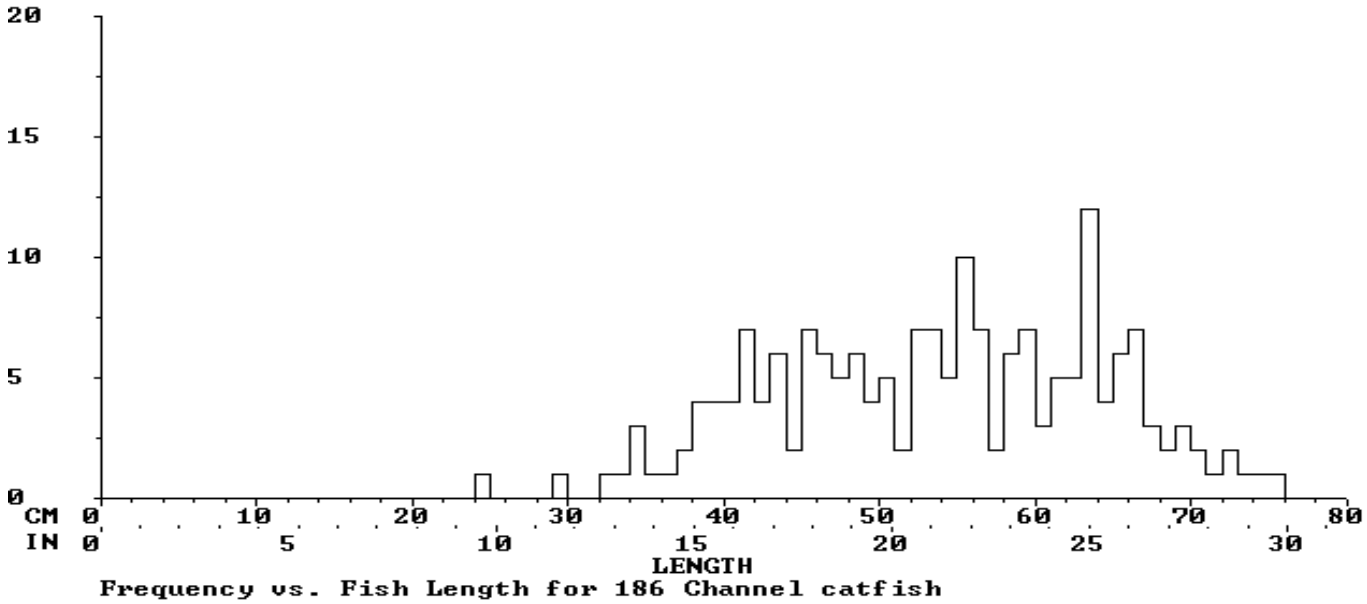


Figure 9. Length-frequency distributions for Smallmouth Bass (top) and Channel Catfish (bottom) at 13 mainstem stations for the 2015 Kankakee River basin survey.

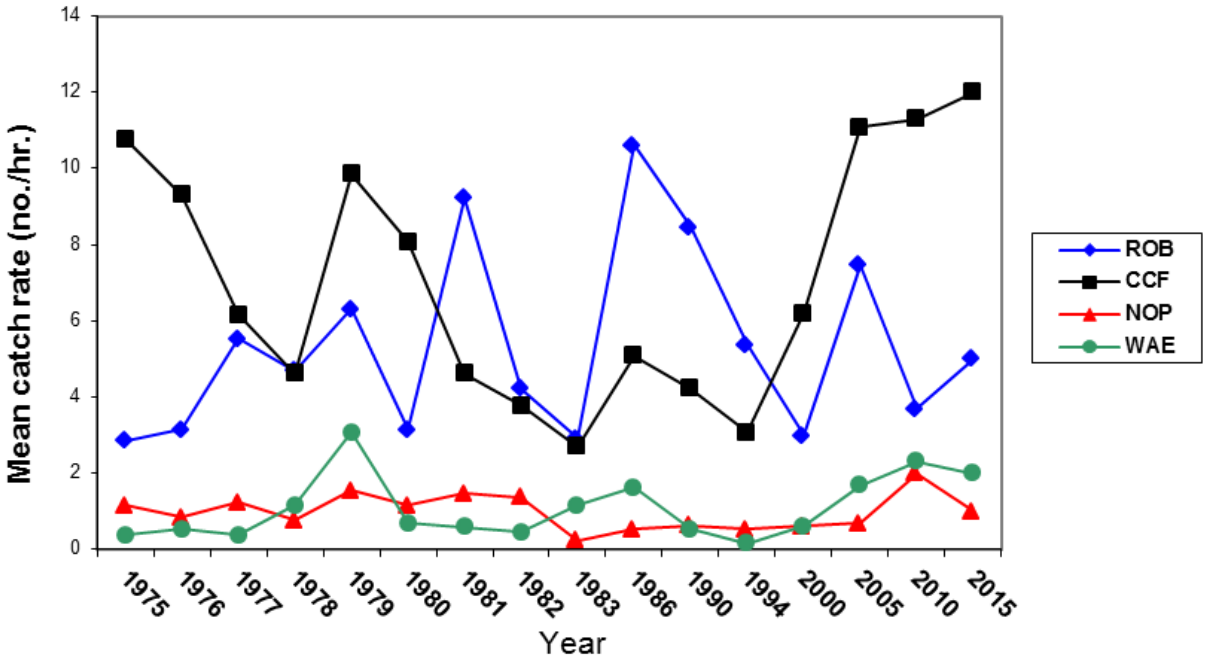


Figure 10. Mean electrofishing rate catch (no. fish/hr.) of Rock Bass (ROB), Channel Catfish (CCF), Northern Pike (NOP), and Walleye (WAE) for 13 mainstem Kankakee River stations from 1975 to 2015.

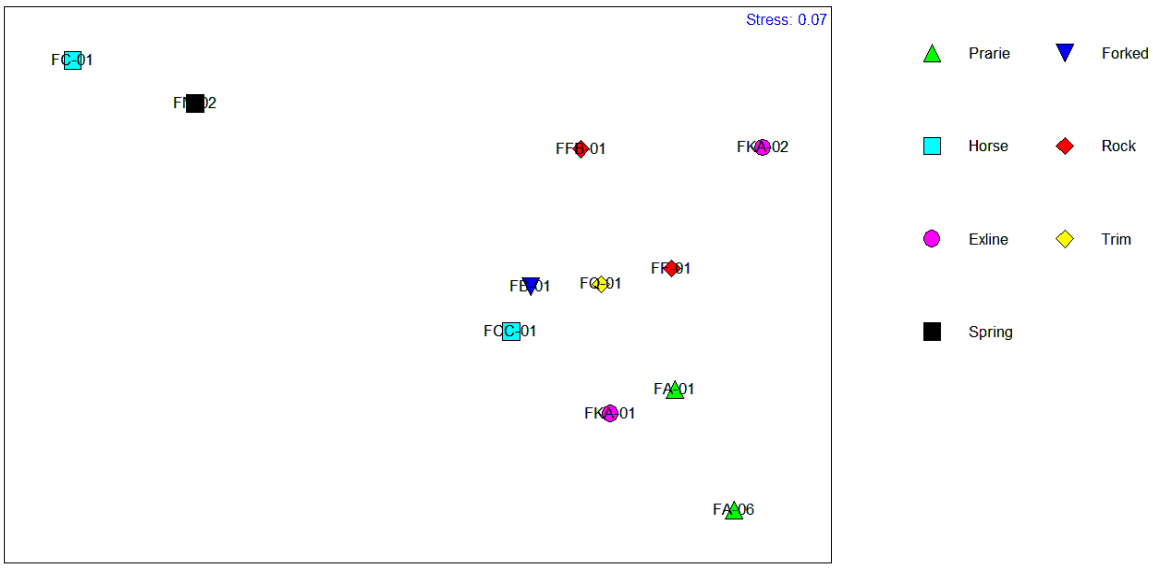


Figure 11. Non-metric multi-dimensional scaling plot based on Bray-Curtis (1957) similarity of catch per unit effort for each fish species at each tributary sampling station.

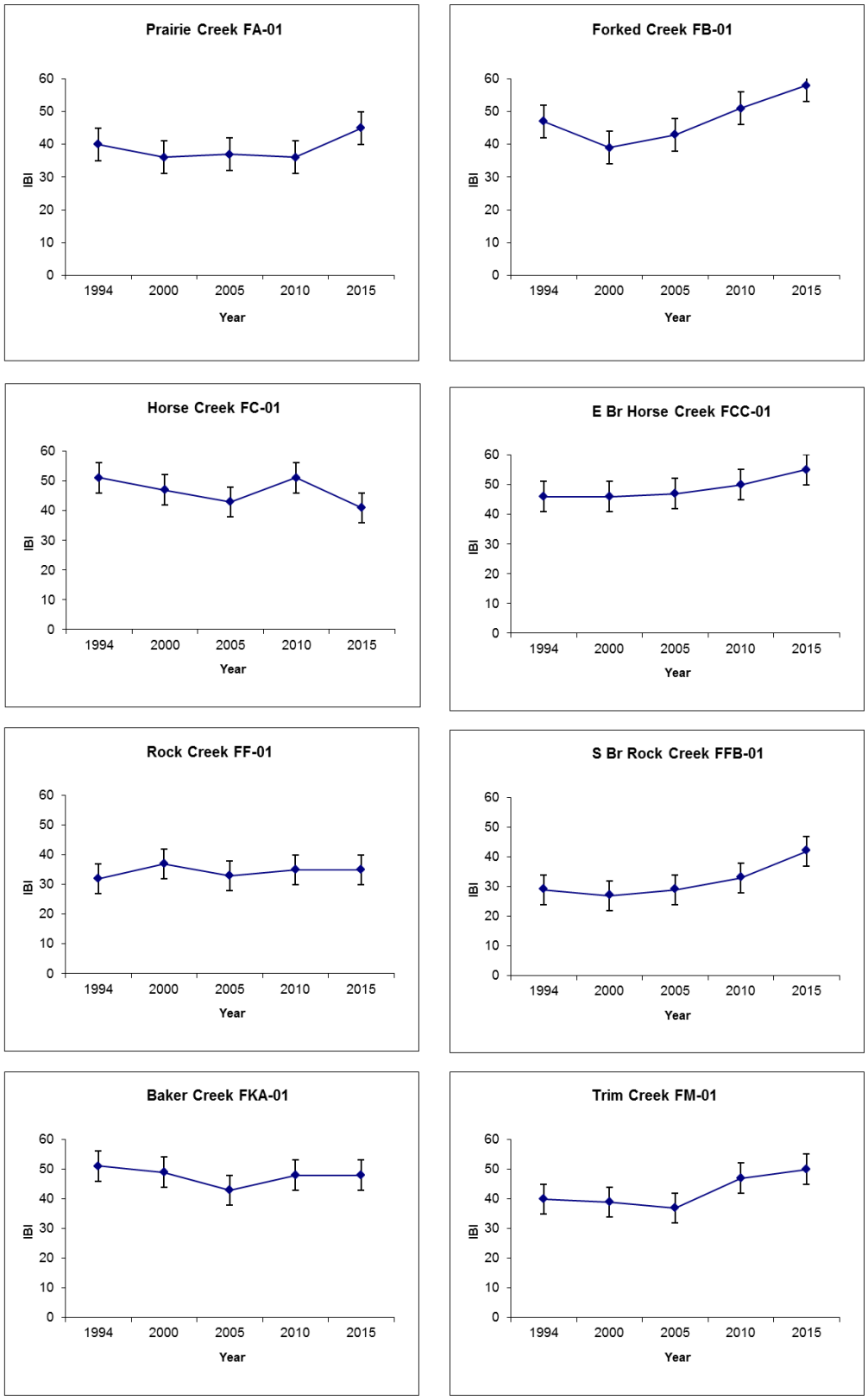
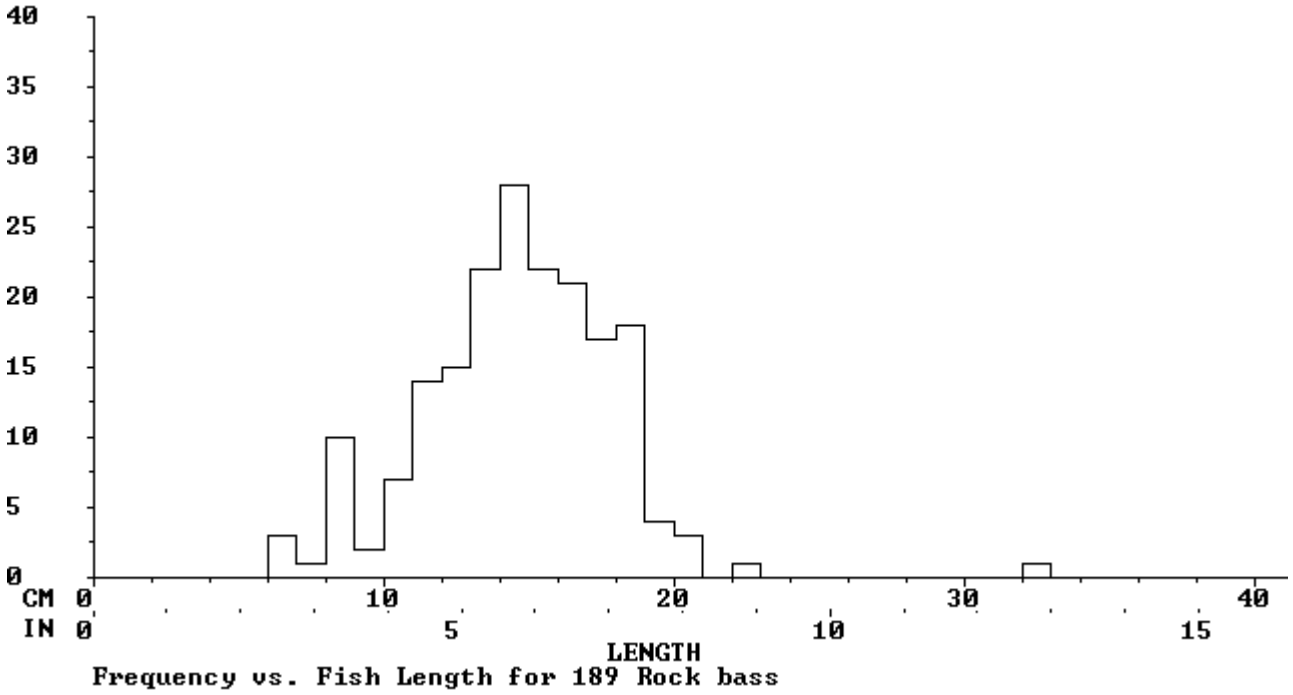


Figure 12. Index of Biotic Integrity (IBI) values for Kankakee River tributaries for stations sampled in all basin surveys from 1994 to 2015. Bar represent range for biologically meaningful change (>10 points, Smogor 2004).



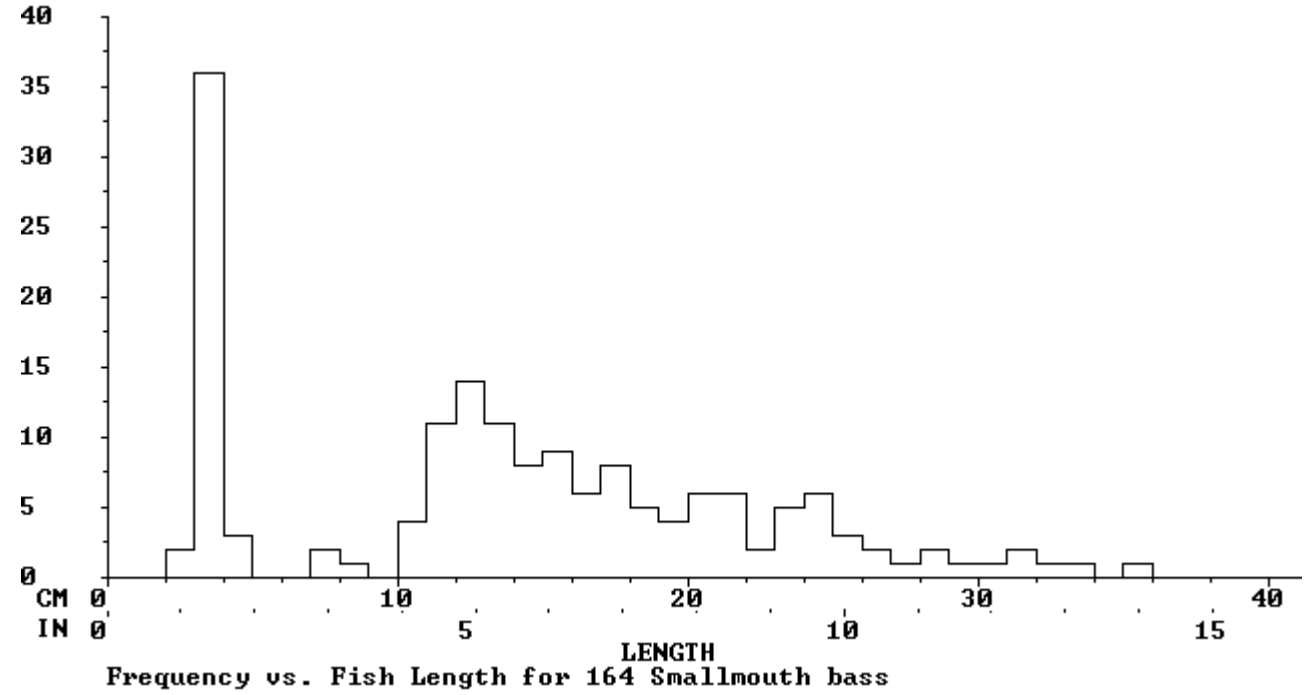


Figure 13. Length-frequency distributions for Rock Bass (top) and Smallmouth Bass (bottom) at 11 tributary stations for the 2015 Kankakee River basin survey.

Table 1. Location, sampling, and station information for 2015 Kankakee River Basin Survey sampling stations, BE = boat electrofishing; SE = seine hauls; ES = electric seine.

IEPA CODE	STREAM	LOCATION	COUNTY	LAT	LONG	SAMPLING DATE	SAMPLING GEAR	SAMPLE TIME (min)	STATION LENGTH (ft.)	STATION WIDTH (ft.)
F-03	KANKAKEE RIVER	ILL-IND STATE LINE	KANKAKEE	41.1660300	-87.5265700	3-Sep	BE, SE	60	NA	125
F-15	KANKAKEE RIVER	2.5 MI W MOMENC,E RIVER ISLE	KANKAKEE	41.1519444	-87.7050000	25-Aug	BE, SE	60	NA	175
F-02	KANKAKEE RIVER	ISLAND PARK MOMENCE	KANKAKEE	41.1601600	-87.6626000	25-Aug	BE, SE	60	NA	250
F-06	KANKAKEE RIVER	1.0 MI DS RT 17 BR 4 MI E KANKAKEE	KANKAKEE	41.1200400	-87.7507700	18-Aug	BE, SE	60	NA	430
F-09	KANKAKEE RIVER	NEAR AROMA PARK	KANKAKEE	41.0825400	-87.8223200	18-Aug	BE, SE	60	NA	410
F-96	KANKAKEE RIVER	UPSTREAM KANKAKEE DAM	KANKAKEE	41.1054810	-87.8585160	17-Aug	BE, SE	60	NA	625
F-12	KANKAKEE RIVER	100 YDS DNS KANKAKEE DAM	KANKAKEE	41.1133600	-87.8683500	17-Aug	BE, SE	60	NA	390
F-07	KANKAKEE RIVER	DAVIS CREEK AREA IN KANK RIVER PARK	KANKAKEE	41.1583900	-87.9378400	14-Aug	BE, SE	60	NA	400
F-13	KANKAKEE RIVER	LANGHAM ISLE IN KANK RIVER ST PARK	KANKAKEE	41.1880556	-87.9633333	14-Aug	BE, SE	60	NA	650
F-04	KANKAKEE RIVER	WILL CO LINE, WERNER BR, KKRSP	WILL	41.2081800	-88.0117700	13-Aug	BE, SE	60	NA	525
F-08	KANKAKEE RIVER	NEAR CUSTER PARK	WILL	41.2475400	-88.1293400	13-Aug	BE, SE	60	NA	460
F-20	KANKAKEE RIVER	UPSTREAM WILMINGTON DAM	WILL	41.2961270	-88.1547450	12-Aug	BE, SE	60	NA	900
F-11	KANKAKEE RIVER	RT 53 BR WILMINGTON	WILL	41.3053972	-88.1517250	12-Aug	BE, SE	60	NA	500
F-01	KANKAKEE RIVER	I-55 BR 3 MI NW WILMINGTON, IL	WILL	41.3500700	-88.1917800	11-Aug	BE, SE	60	NA	600
F-14	KANKAKEE RIVER	17 MI UPS DESPLAINES R	GRUNDY	41.3666694	-88.2492667	11-Aug	BE, SE	60	NA	1050
FQ-01	TRIM CREEK	CO RD 7000N 1M SSW GRANT PK	KANKAKEE	41.2225400	-87.6581400	31-Aug	ES	43	700	22
FM-02	SPRING CREEK	2.2 MI E AROMA PARK ON BOY SCOUT RD	KANKAKEE	41.0797000	-87.7670000	1-Sep	ES	80	460	28
FKA-01	BAKER CREEK	CO RD 0.9 MI SSW EXLINE	KANKAKEE	41.1371500	-87.7775700	1-Sep	ES	45	600	37
FKA-02	EXLINE SLOUGH	5.1MI E MANTENO AT 7000 E US	KANKAKEE	41.2659000	-87.7399000	31-Aug	ES	66	325	20
FF-01	ROCK CREEK	CO RD 5000W KANK R STATE PK	KANKAKEE	41.2212200	-87.9734400	27-Aug	ES	54	700	59
FFB-01	S BR ROCK CREEK	DS 1000W 1.0 MI, OFF BLUEGILL RD,	KANKAKEE	41.2374000	-87.9027000	28-Aug	ES	53	505	50
FC-01	HORSE CREEK	BR 2.5 MI NE ESSEX	KANKAKEE	41.1979800	-88.1479900	26-Aug	ES	45	614	50
FCC-01	E BR HORSE CREEK	CO RD 2000N 2 MI W BONFIELD	KANKAKEE	41.1461800	-88.0998700	27-Aug	ES	70	516	22
FA-01	PRAIRIE CREEK	AT RIVER ROAD	WILL	41.3424000	-88.1824460	2-Sep	ES	34	700	46
FA-06	PRAIRIE CREEK	4.5 E ELWOOD	WILL	41.3931000	-88.0197000	2-Sep	ES	24	432	17
FB-01	FORKED CREEK	AT LEASURE ROAD RITCHIE	WILL	41.2552400	-88.1055700	26-Aug	ES	35	600	52

Table 2. Total number of each fish species collected by all methods for the 2015 Kankakee River Basin Survey, including all mainstem and tributary stations with family, scirentific, and common names.

Family name	Common name	Scientific name	Total	Family name	Common name	Scientific name	Total
Lepistosteidae	Longnose gar	Lepisosteus osseus	41	Catostomidae	Black redhorse	Moxostoma duquesnei	54
Amidae	Bowfin	Amia calva	4		Golden redhorse	Moxostoma erythrurum	391
Clupidae	Gizzard shad	Dorosoma cepedianum	84		Silver redhorse	Moxostoma anisurum	85
	Mooneye	Hiodon tergisus	2	Ictaluridae	Channel catfish	Ictalurus punctatus	185
Escoidae	Grass pickerel	Esox americanus	66		Yellow bullhead	Ameiurus natalis	13
	Northern pike	Esox lucius	18		Flathead catfish	Pylodictis olivaris	29
Cyprinidae	Grass carp**	Ctenopharyngodon idella	3		Stonecat	Noturus flavus	20
	Carp	Cyprinus carpio	117		Tadpole madtom	Noturus gyrinus	22
	Golden shiner	Notemigonus crysoleucas	12		Slender madtom	Noturus exilis	3
	Creek chub	Semotilus atromaculatus	235	Aphredoderidae	Pirate perch	Aphredoderus sayanus	4
	Hornyhead chub	Nocomis biguttatus	872	Cyprinodontidae	Starhead topminnow*	Fundulus notti	3
	Central stoneroller	Campostoma anomalum	969		Blackstripe topminnow	Fundulus notatus	26
	Largescale stoneroller	Campostoma oligolepis	11	Antherinidae	Brook silverside	Labidesthes sicculus	60
	Suckermouth minnow	Phenacobius mirabilis	2	Moronidae	White bass	Morone chrysops	3
	Blacknose dace	Rhinichthys atratulus	1	Centrchidae	Black crappie	Pomoxis nigromaculatus	31
	Striped shiner	Luxilus chrysocephalus	2941		White crappie	Pomoxis annularis	4
	Redfin shiner	Lythrurus umbratilus	71		Rock bass	Ambloplites rupestris	266
	Spotfin shiner	Cyprinella spiloptera	2486		Largemouth bass	Micropterus salmoides	239
	Fathead minnow	Pimephales promelas	4		Smallmouth bass	Micropterus dolomieu	363
	Bluntnose minnow	Pimephales notatus	1996		Green sunfish	Lepomis cyanellus	178
	Bullhead minnow	Pimephales vigilax	53		Bluegill x Green sunfish hybrid	Lepomis macrochirus x L. cyanellus	6
	Emerald shiner	Notropis atherinoides	55		Bluegill	Lepomis macrochirus	279
	Rosyface shiner	Notropis rubellus	350		Redear sunfish	Lepomis microlophus	1
	Ironcolor shiner*	Notropis chalybaeus	37		Pumpkinseed	Lepomis gibbosus	2
	Sand shiner	Notropis ludibundus	446		Longear sunfish	Lepomis megalotis	304
	Mimic shiner	Notropis volucellus	817		Orangespotted sunfish	Lepomis humilis	3
	Spottail shiner	Notropis hudsonius	14	Percidae	Walleye	Stizostedion vitreum	29
	Silverjaw minnow	Notropis buccatus	13		Sauger	Stizostedion canadense	1
Catostomidae	Bigmouth buffalo	Ictiobus cyprinellus	27		Blackside darter	Percina maculata	33
	Smallmouth buffalo	Ictiobus bubalus	50		Slenderhead darter	Percina phoxocephala	16
	Black buffalo	Ictiobus niger	9		Logperch	Percina caprodes	105
	Quillback	Carpiodes cyprinus	47		Johnny darter	Etheostoma nigrum	284
	Highfin carpsucker	Carpiodes velifer	7		Banded darter	Etheostoma zonale	263
	White sucker	Catostomus commersoni	200		Rainbow darter	Etheostoma caeruleum	520
	Spotted sucker	Minytrema melanops	7		Orangethroat darter	Etheostoma spectabile	1
	Lake chubsucker	Erimyzon sucetta	36		Fantail darter	Etheostoma flabellare	76
	Northern hog sucker	Hypentelium nigricans	119		Least darter	Etheostoma microperca	2
	River redhorse*	Moxostoma carinatum	48	Scaenidae	Freshwater drum	Aplodinotus grunniens	31
	Shorthead redhorse	Moxostoma macrolepidotum	524				
						total number	16729
						number fish species	76

Table 3. List of species collected for all Kankakee River Basin surveys 1994 - 2015; all methods and stations combined.

Common name	2015	2010	2005	2000	1994	Common name	2015	2010	2005	2000	1994
American brook lamprey**		X				Northern hog sucker	X	X	X	X	X
Unidentified lamprey					X	River redhorse*	X	X	X	X	X
Shortnose gar				X		Shorthead redhorse	X	X	X	X	X
Longnose gar	X	X	X	X	X	Black redhorse**	X	X	X	X	X
Bowfin	X	X	X	X	X	Golden redhorse	X	X	X	X	X
American eel*					X	Silver redhorse	X	X	X	X	X
Skipjack herring				X	X	Channel catfish	X	X	X	X	X
Gizzard shad	X	X	X	X	X	Yellow bullhead	X	X	X	X	X
Threadfin shad***		X	X			Black bullhead			X		X
Goldeye				X		Brown bullhead				X	
Mooneye	X			X	X	Flathead catfish	X	X	X		X
Central mudminnow		X	X	X		Stonecat	X	X	X	X	X
Grass pickerel	X	X	X	X	X	Tadpole madtom	X	X		X	X
Northern pike**	X	X	X	X	X	Slender madtom	X	X	X	X	X
Goldfish***			X			Trout- perch**					X
Carp***	X	X	X	X	X	Pirate perch	X	X	X	X	X
Grass Carp***	X					Banded Killifish*		X			
Golden shiner	X	X	X	X	X	Starhead topminnow	X	X	X	X	
Southern redbelly dace	X		X	X		Blackstripe topminnow	X	X	X	X	X
Creek chub	X	X	X	X	X	Mosquito fish***		X			
Hornyhead chub	X	X	X	X	X	Brook silverside	X	X	X	X	X
Central stoneroller	X	X	X	X	X	White bass	X			X	X
Largescale stoneroller**	X					Yellow bass	X			X	
Suckermouth minnow	X	X	X	X	X	White perch***			X		
Blacknose dace	X		X	X	X	Black crappie	X	X	X	X	X
Brassy minnow					X	White crappie	X	X	X	X	X
Striped shiner	X	X	X	X	X	Rock bass	X	X	X	X	X
Redfin shiner	X	X	X	X	X	Largemouth bass	X	X	X	X	X
Spotfin shiner	X	X	X	X	X	Smallmouth bass**	X	X	X	X	X
Steelcolor shiner					X	Warmouth		X	X	X	X
Red shiner			X	X	X	Green sunfish	X	X	X	X	X
Fathead minnow	X	X		X	X	Bluegill	X	X	X	X	X
Bluntnose minnow	X	X	X	X	X	Pumpkinseed	X	X	X	X	
Bullhead minnow	X	X	X	X	X	Longear sunfish	X	X	X	X	X
Emerald shiner	X	X	X	X	X	Orangespotted sunfish	X	X	X	X	X
Rosyface shiner**	X	X	X	X	X	Walleye**	X	X	X	X	X
Weed shiner*				X		Sauger**	X	X	X		
Ironcolor shiner*	X	X	X	X		Blackside darter	X	X	X	X	X
Sand shiner	X	X	X	X	X	Slenderhead darter	X	X	X	X	X
Mimic shiner	X	X	X	X	X	Logperch	X	X	X	X	X
Spottail shiner	X		X		X	Johnny darter	X	X	X	X	X
Silverjaw minnow	X	X	X	X	X	Bluntnose darter				X	
Bigmouth buffalo	X	X	X	X	X	Banded darter	X	X	X	X	X
Smallmouth buffalo	X	X	X	X	X	Rainbow darter	X	X	X	X	X
Black buffalo	X	X	X	X	X	Orangethroat darter	X		X	X	
Quillback	X	X	X	X	X	Fantail darter	X	X	X	X	X
River carpsucker		X	X	X	X	Least darter	X	X	X	X	X
Highfin carpsucker**	X	X			X	Freshwater drum	X	X	X	X	X
White sucker	X	X	X	X	X	Round goby***		X			
Spotted sucker	X	X	X	X		Native species	75	74	72	78	74
Creek chubsucker		X				Non- native species	2	3	4	2	1
Lake Chubsucker**	X					Total species	77	77	76	80	75

*State Listed species **IL Species in greatest need of conservation; ***non- native species

Table 4. Number of each fish species collected at fifteen mainstem stations for the 2015 Kankakee River Basin Survey, including number of stations where each fish species was collected. Fish were sampled at each station with DC electofishing (60 minutes) and and seining (3 hauls). Stations are arranged from upstream (left) to downstream (right).

Common Name	Total	No. Stations Occurirng	State Line F-03	River Isle F-15	Mom-ence F-02	Rt. 17 F-06	Aroma Park F-09	US Kank. Dam F-96	Kank akee F-12	Davis Creek F-07	Langham Isle F-13	Werner Road F-04	Horse Creek F-08	US Wilm. Dam F-20	Wilm-ington F-11	I-55 F-01	Confl-uence F-14
Longnose gar	41	8	0	0	0	0	0	0	4	1	2	6	0	1	18	4	5
Bowfin	4	4	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0
Gizzard shad	84	6	1	0	0	0	1	0	0	0	1	0	0	0	18	6	57
Mooneye	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Grass pickerel	39	8	7	1	4	8	0	1	0	0	0	0	1	15	0	0	2
Northern pike	18	6	3	5	7	1	0	1	0	0	0	0	0	1	0	0	0
Grass carp	3	2	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Carp	82	15	10	7	21	3	1	3	7	3	1	3	3	13	4	1	2
Golden shiner	12	5	1	0	0	1	0	0	0	0	0	0	0	2	0	1	7
Hornyhead chub	3	2	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Central stoneroller	19	2	0	8	0	0	0	0	0	0	0	0	0	11	0	0	0
Suckermouth minnow	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Blacknose dace	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Striped shiner	30	6	0	1	0	0	0	3	0	6	1	0	4	0	0	15	0
Redfin shiner	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Spotfin shiner	2417	15	88	360	46	32	21	27	2	60	9	25	74	83	153	97	1340
Fathead minnow	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Bluntnose minnow	830	14	21	26	9	24	58	15	0	4	10	3	1	420	18	4	217
Bullhead minnow	53	5	1	23	0	0	1	0	0	0	0	0	0	26	0	0	2
Emerald shiner	53	4	0	0	0	0	0	0	0	0	0	0	0	6	21	24	2
Rosyface shiner	111	10	0	12	3	0	0	0	0	4	9	5	4	46	11	12	5
Ironcolor shiner*	36	1	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sand shiner	381	12	0	102	5	9	100	1	0	8	0	2	2	81	30	2	39
Mimic shiner	103	7	0	0	2	0	0	0	0	36	0	7	5	5	33	15	0
Spottail shiner	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
Silverjaw minnow	9	2	0	7	0	0	0	0	0	0	0	0	0	2	0	0	0
Bigmouth buffalo	27	6	10	7	0	1	2	6	0	0	0	0	0	0	0	0	1
Smallmouth buffalo	50	10	5	2	3	8	2	4	6	0	0	0	0	0	10	2	8
Black buffalo	9	2	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Quillback	47	13	7	6	2	6	5	1	7	4	2	0	0	3	2	1	1
Highfin carpsucker	7	3	2	0	0	4	0	0	0	1	0	0	0	0	0	0	0
Spotted sucker	7	4	0	1	0	4	0	1	0	0	0	0	0	1	0	0	0
Lake chubsucker	36	1	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern hog sucker	99	12	3	0	15	1	12	0	3	9	3	16	6	1	13	17	0
River redhorse*	48	9	0	3	10	3	1	0	15	3	0	0	5	0	5	3	0
Shorthead redhorse	523	15	23	13	119	10	37	2	59	89	51	31	13	1	34	39	2
Black redhorse	19	5	0	0	0	0	0	0	0	6	3	2	2	0	6	0	0
Golden redhorse	359	14	18	6	15	31	20	0	21	23	21	73	15	19	18	71	8
Silver redhorse	81	13	9	6	1	15	6	9	8	4	2	8	9	1	0	3	0
Channel catfish	186	14	5	4	48	14	16	0	17	3	11	19	3	6	25	14	1
Yellow bullhead	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Flathead catfish	29	11	0	1	1	4	3	5	1	4	0	1	0	0	2	1	6
Stonecat	2	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Tadpole madtom	14	1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pirate perch	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Starhead topminnow*	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blackstripe topminnow	7	3	1	0	0	5	0	0	0	0	0	0	0	1	0	0	0
Brook silverside	60	10	16	0	0	1	1	6	5	0	1	2	0	5	6	17	0
White bass	3	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Black crappie	31	6	13	0	4	8	2	0	0	0	0	0	0	0	1	3	0
White crappie	4	4	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Rock bass	77	9	11	2	8	22	0	0	1	0	0	8	14	10	0	1	0
Largemouth bass	175	15	35	5	9	15	21	15	10	2	3	2	7	13	9	14	15
Smallmouth bass	199	15	5	17	26	9	7	6	14	20	7	33	12	6	16	15	6
Green sunfish	36	11	0	0	4	2	1	6	1	3	3	3	1	3	0	9	0
Bluegill x Green sunfish hybrid	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Bluegill	113	13	37	2	3	9	5	3	9	10	0	2	4	15	0	3	11
Redear sunfish	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Pumpkinseed	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Longear sunfish	201	14	15	0	1	10	2	2	1	2	2	5	21	131	2	4	3
Orangespotted sunfish	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Walleye	28	6	0	0	0	0	3	0	1	0	1	5	0	0	10	8	0
Sauger	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Blackside darter	16	8	2	2	2	1	5	0	0	0	2	1	0	1	0	0	0
Slenderhead darter	15	4	0	0	0	0	0	0	4	1	0	0	0	0	5	5	0
Logperch	106	6	2	0	1	0	1	0	0	0	0	0	0	0	47	53	2
Johnny darter	18	8	0	2	3	1	4	0	0	3	3	0	0	0	1	1	0
Banded darter	7	5	0	0	2	0	1	0	0	0	0	1	0	2	1	0	0
Freshwater drum	31	5	0	0	0	0	0	0	1	0	0	0	0	1	8	17	4
	7033		446	638	377	264	339	117	198	310	148	265	206	935	531	484	1767
	69		39	29	31	32	28	21	22	26	22	26	21	35	33	35	28

Table 5. Total abundance and catch per unit effort (CPUE, no./hr.) for fish species collected by boat electrofishing at 13 Kankakee River mainstem stations for 2015, and previous Basin Surveys, 1994 – 2010. Fish species with less than 15 individuals not included.

	2015		2010		2005		2000		1994		Mean	
	Total	CPUE	Total	CPUE	Total	CPUE	Total	CPUE	Total	CPUE	Total	CPUE
Shorthead redhorse	518	39.8	511	39.3	464	35.7	453	34.8	244	18.8	438	33.7
Golden redhorse	336	25.8	411	31.6	488	37.5	269	20.7	266	20.5	354	27.2
Smallmouth bass	186	14.3	239	18.4	618	47.5	456	35.1	280	21.5	356	27.4
Channel catfish	180	13.8	147	11.3	144	11.1	105	8.1	47	3.6	125	9.6
Spotfin shiner	136	10.5	316	24.3	207	15.9	695	53.5	169	13.0	305	23.4
Sand shiner	112	8.6	75	5.8	4	0.3	53	4.1	42	3.2	57	4.4
Logperch	104	8.0	56	4.3	64	4.9	27	2.1	17	1.3	54	4.1
Northern hog sucker	95	7.3	62	4.8	43	3.3	109	8.4	47	3.6	71	5.5
Largemouth bass	89	6.8	95	7.3	67	5.2	89	6.8	23	1.8	73	5.6
Gizzard shad	82	6.3	216	16.6	437	33.6	133	10.2	371	28.5	248	19.1
Mimic shiner	74	5.7	102	7.8	122	9.4	14	1.1	1	0.1	63	4.8
Silver redhorse	71	5.5	39	3.0	98	7.5	67	5.2	70	5.4	69	5.3
Carp	66	5.1	58	4.5	87	6.7	133	10.2	132	10.2	95	7.3
Rock bass	62	4.8	44	3.4	67	5.2	73	5.6	98	7.5	69	5.3
Bluegill	51	3.9	139	10.7	217	16.7	137	10.5	10	0.8	111	8.5
Longear sunfish	49	3.8	122	9.4	101	7.8	144	11.1	85	6.5	100	7.7
River redhorse	48	3.7	51	3.9	53	4.1	45	3.5	43	3.3	48	3.7
Emerald shiner	47	3.6	2	0.2	111	8.5	17	1.3	10	0.8	37	2.9
Bluntnose minnow	46	3.5	130	10.0	139	10.7	141	10.8	64	4.9	104	8.0
Smallmouth buffalo	46	3.5	19	1.5	14	1.1	12	0.9	8	0.6	20	1.5
Quillback	43	3.3	40	3.1	30	2.3	39	3.0	48	3.7	40	3.1
Longnose gar	39	3.0	22	1.7	11	0.8	16	1.2	12	0.9	20	1.5
Freshwater drum	30	2.3	69	5.3	32	2.5	61	4.7	63	4.8	51	3.9
Walleye	28	2.2	31	2.4	22	1.7	11	0.8	8	0.6	20	1.5
Flathead catfish	24	1.8	10	0.8	7	0.5	0	0.0	6	0.5	9	0.7
Green sunfish	22	1.7	26	2.0	19	1.5	9	0.7	21	1.6	19	1.5
Bigmouth buffalo	21	1.6	11	0.8	20	1.5	7	0.5	0	0.0	12	0.9
Black redhorse	19	1.5	49	3.8	33	2.5	24	1.8	11	0.8	27	2.1
Grass pickerel	17	1.3	14	1.1	1	0.1	9	0.7	1	0.1	8	0.6
Black crappie	17	1.3	8	0.6	4	0.3	6	0.5	2	0.2	7	0.6
Northern pike	15	1.2	21	1.6	9	0.7	8	0.6	8	0.6	12	0.9
Slenderhead darter	14	1.1	11	0.8	21	1.6	1	0.1	6	0.5	11	0.8
Black buffalo	9	0.7	2	0.2	11	0.8	5	0.4	1	0.1	6	0.4
Johnny darter	9	0.7	5	0.4	24	1.8	2	0.2	5	0.4	9	0.7
Rosyface shiner	7	0.5	10	0.8	2	0.2	21	1.6	3	0.2	9	0.7
Highfin carpsucker	7	0.5	1	0.1	0	0.0	0	0.0	1	0.1	2	0.1
Blackside darter	7	0.5	5	0.4	27	2.1	2	0.2	9	0.7	10	0.8

Table 6. Index of Biotic Integrity (IBI) for 2015 Kankakee River mainstem stations, including values and scores for individual metrics, total range for IB I = 0 to 60, with higher scores indicating better stream quality. Includes data from boat electrofisng

	F-14		F-01		F-11		F-20		F-08		F-04		F-13		F-07		F-12		F-96		F-09		F-06		F-02		F-15		F-03	
Metric	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Native fish species	27	6	34	6	32	6	34	6	20	4	24	5	21	4	25	5	21	4	19	4	27	6	31	6	30	6	28	6	37	6
Native minnow species	5	6	8	5	7	5	11	6	6	4	5	4	4	3	6	4	1	1	4	3	4	3	4	3	5	4	8	5	7	5
Native sucker species	5	4	7	5	7	5	6	4	6	4	5	4	6	4	8	6	7	5	6	4	8	6	10	6	7	5	9	6	10	6
Native sunfish species	5	5	8	6	4	4	7	6	6	6	6	6	4	4	5	5	6	6	5	5	6	6	8	6	8	6	4	4	8	6
Benthic invertivore species	5	4	9	6	10	6	7	5	6	4	8	5	7	5	9	6	7	5	4	3	10	6	9	6	10	6	9	6	9	6
Intolerant species	2	2	4	4	6	6	6	6	4	4	5	5	4	4	6	6	3	3	2	2	3	3	4	4	4	4	3	3	5	5
Prop. specialist benthic invertivores	0.01	1	0.4	6	0.25	6	0.03	1	0.24	6	0.5	6	0.57	6	0.45	6	0.56	6	0.09	4	0.26	6	0.24	6	0.45	6	0.05	2	0.16	6
Prop. geneneralist feeders	0.96	1	0.35	6	0.55	6	0.71	4	0.47	6	0.25	6	0.26	6	0.45	6	0.25	6	0.6	5	0.63	5	0.44	6	0.38	6	0.87	2	0.51	6
Prop. mineral-substrate spawners	0.01	1	0.5	6	0.32	6	0.11	2	0.41	6	0.69	6	0.68	6	0.53	6	0.64	6	0.18	4	0.27	5	0.36	6	0.53	6	0.11	2	0.25	5
Prop. tolerant species	0.15	6	0.12	6	0.06	6	0.15	6	0.15	6	0.13	6	0.14	6	0.12	6	0.1	6	0.16	6	0.11	6	0.13	6	0.1	6	0.07	6	0.08	6
IBI		36		56		56		46		50		53		48		56		48		40		52		55		55		42		57

Table 7. Index of Biotic Integrity scores for Kankakee River Basin mainstem stations 1994 - 2015. One-way ANOVA indicated no significant difference among years.

Station location	Code	1994	2000	2005	2010	2015
State Line	F-03	42	52	48	42	57
River Isle	F-15	44	56	48	43	42
Momence	F-02	52	48	49	54	55
DS Rt. 17	F-06	48	50	57	51	55
Aroma Park	F-09	54	54	57	50	52
Kankakee	F-12	52	48	57	45	48
Davis Creek	F-07	40	52	56	44	56
Langham Island	F-13	46	50	54	56	48
Werner Bridge	F-04	50	52	58	43	53
Rivals Club	F-08	50	50	55	52	50
Wilmington	F-11	42	50	59	47	56
I-55 Bridge	F-01	42	48	59	53	56
Confluence	F-14	40	42	41	37	36
	mean	46.3	50.1	53.7	47.46	51.08
	STDEV	4.76	3.28	5.28	5.43	6.03

Table 8. Number of each fish species collected at eleven tributary stations for the 2015 Kankakee River Basin Survey, including number of stations where each fish species was collected. All stations were sampled with electric seine.

Common Name	Total	No. of Stations	Prairie Creek FA-06	Prairie Creek FA-01	Forked Creek FB-01	Horse Creek FC-01	East Br. Horse Creek FCC-01	Rock Creek FF-01	So. Br. Rock Creek FFB-01	Baker Creek FKA-01	Exline Slough FKA-02	Trim Creek FQ-01	Spring Creek FM-02
Striped shiner	2911	9	1150	517	222	0	317	106	32	416	31	120	0
Bluntnose minnow	1166	9	564	245	101	0	131	18	21	24	50	12	0
Central stoneroller	950	9	35	205	191	0	50	50	189	38	0	186	6
Hornyhead chub	869	9	144	262	7	0	26	140	70	160	41	19	0
Mimic shiner	714	2	0	0	474	0	240	0	0	0	0	0	0
Rainbow darter	520	7	0	1	32	4	290	0	0	85	0	65	43
Johnny darter	265	11	30	13	29	3	64	1	45	6	14	49	11
Banded darter	255	8	0	0	52	9	78	10	67	8	0	2	29
Rosyface shiner	239	8	17	52	27	0	41	26	31	35	0	10	0
Creek chub	235	9	66	5	4	0	8	23	43	5	2	79	0
White sucker	200	6	84	17	5	2	0	0	53	0	0	39	0
Rock bass	189	8	0	0	22	4	27	38	54	31	0	6	7
Bluegill	166	7	8	2	1	9	6	0	139	0	0	0	1
Smallmouth bass	164	10	18	14	5	3	6	57	45	11	0	1	4
Green sunfish	142	10	27	38	1	3	4	4	20	20	0	23	2
Longear sunfish	103	6	0	1	15	5	29	0	0	52	0	0	1
Fantail darter	76	7	1	26	7	3	21	0	0	11	0	0	7
Redfin shiner	70	7	51	0	1	0	11	0	0	3	1	2	1
Spotfin shiner	69	5	0	8	24	0	1	0	0	32	0	4	0
Sand shiner	65	7	31	8	5	0	2	0	0	1	12	6	0
Largemouth bass	64	10	12	1	1	2	8	2	20	3	0	12	3
Carp	35	3	0	0	2	0	0	0	31	2	0	0	0
Black redhorse	35	1	0	0	35	0	0	0	0	0	0	0	0
Golden redhorse	33	3	17	2	14	0	0	0	0	0	0	0	0
Grass pickerel	27	6	0	8	0	1	12	0	0	0	2	1	3
Northern hogsucker	20	3	0	0	12	1	7	0	0	0	0	0	0
Blackstripe topminnow	19	4	0	0	0	1	1	0	0	0	2	0	15
Stonecat	18	5	3	3	2	0	8	0	0	0	0	2	0
Blackside darter	17	4	0	0	6	3	0	0	0	1	0	0	7
Yellow bullhead	12	4	4	0	0	0	5	0	0	2	0	0	1
Largescale stoneroller	11	1	0	0	11	0	0	0	0	0	0	0	0
Tadpole madtom	8	3	0	0	0	0	5	0	0	1	2	0	0
Bluegill x Green sunfish hybrid	5	2	0	0	0	1	0	0	0	4	0	0	0
Silverjaw minnow	4	1	0	4	0	0	0	0	0	0	0	0	0
Silver redhorse	4	1	0	0	4	0	0	0	0	0	0	0	0
Least darter	4	2	0	0	0	0	2	0	0	0	2	0	0
Slender madtom	3	1	0	0	0	0	3	0	0	0	0	0	0
Pirate perch	3	1	0	0	0	0	0	0	0	0	3	0	0
Emerald shiner	2	1	0	0	0	0	0	0	0	2	0	0	0
Ironcolor shiner	1	1	0	0	0	0	0	0	0	0	0	0	1
Shorthead redhorse	1	1	0	0	1	0	0	0	0	0	0	0	0
Orangespotted sunfish	1	1	0	0	0	0	0	0	0	1	0	0	0
Slenderhead darter	1	1	0	0	1	0	0	0	0	0	0	0	0
Orangethroat darter	1	1	0	0	1	0	0	0	0	0	0	0	0
Total no. individuals	9697		1877	1432	1313	54	1401	475	860	951	162	638	142
No. fish species	42		19	21	31	15	28	12	15	24	12	19	17

Table 9. Index of Biotic Integrity (IBI) for Kankakee River tributary stations including values and scores for individual metrics. Total range for IB I = 0 to 60, with higher scores indicating better stream quality. .

	Prairie Creek FA-06		Prairie Creek FA-01		Forked Creek FB-01		Horse Creek FC-01		E. Br. Horse Ck. FCC-01		Rock Creek FF-01		S. Br. Rock Ck. FFB-01		Baker Creek FKA-01		Exline Slough FKA-02		Trim Creek FQ-01		Spring Creek FM-02	
Metric	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Native fish species	19	4	21	5	30	6	15	3	28	6	12	2	14	3	23	5	12	3	19	5	17	4
Native minnow species	5	5	9	5	11	6	0	0	10	5	6	4	6	4	10	6	6	3	9	5	3	2
Native sucker species	2	3	2	2	6	6	2	2	1	2	0	0	1	1	0	0	0	0	1	2	0	0
Native sunfish species	5	6	5	6	6	6	6	6	6	6	4	5	5	6	6	6	0	0	4	6	6	6
Benthic invertivore species	4	3	5	4	12	6	6	4	9	6	2	2	2	2	6	4	3	2	4	3	5	4
Intolerant species	3	3	4	4	8	6	4	4	7	6	4	4	4	4	5	5	1	1	5	5	4	4
Prop. specialist benthic invertivores	0.022	1	0.029	1	0.144	5	0.426	6	0.335	6	0.023	1	0.13	5	0.118	4	0.111	4	0.191	6	0.683	6
Prop. geneneralist feeders	0.874	2	0.589	6	0.64	5	0.259	6	0.517	6	0.32	6	0.395	6	0.53	6	0.593	6	0.437	6	0.035	6
Prop. mineral-substrate spawners	0.605	6	0.735	6	0.456	6	0.278	4	0.553	6	0.878	6	0.488	6	0.819	6	0.451	5	0.641	6	0.486	6
Prop. tolerant species	0.263	5	0.19	6	0.167	6	0.133	6	0.143	6	0.25	5	0.357	5	0.217	6	0.167	6	0.211	6	0.118	6
IBI		38		45		58		41		55		35		42		48		30		50		44

Table 10. Index of Biotic Integrity scores for Kankakee River Basin tributary stations 1994 - 2015. One way ANOVA indicated no significant difference among means.

Stream	Code	1994	2000	2005	2010	2015
Prairie Creek	FA-01	40	36	37	36	45
Prairie Creek	FA-06				37	38
Forked Creek	FB-01	47	39	43	51	58
Horse Creek	FC-01	51	47	43	51	41
East. Branch Horse Creek	FCC-01	46	46	47	50	55
Rock Creek	FF-01	32	37	33	35	35
South Branch Rock Creek	FFB-01	29	27	29	33	42
Baker Creek	FKA-01	51	49	43	48	48
Exline Slough	FKA-02			31	34	30
Spring Creek	FM-01			50	37	44
Trim Creek	FQ-01	40	39	37	47	50
	mean	42.0	40.0	39.3	41.7	44.2
	STDEV	7.75	6.73	6.63	7.17	7.95