# *HABITAT CONDITIONS*

## Channel Alterations

The Missouri portion of the Fox River basin supports 257.9 miles of permanent and intermittent streams (Table 1, contact authors for Table 1 information). At present, 205.3 miles, or 80%, are unchannelized. Extensive modifications, however, have taken place on a number of streams in the basin. Hemp Slough has been converted into a drainage ditch, and is 85% channelized. Many small streams of the Alluvial Plain have been altered in an attempt to facilitate drainage. For example, Big Branch is 61% channelized. Larger streams of the basin have also suffered. The Little Fox River is 49 percent, Sugar Creek is 41 percent and Honey Creek is 28 percent channelized. Insufficient information existed prior to channelization to determine the total miles of stream lost to modification.

Perhaps the most significant alteration that has occurred in the basin involved Honey Creek. Historically, Honey Creek was never a tributary of Fox River. The stream currently flows northeasterly after leaving the Kahoka Hills (Figure 1, contact authors for Figure 1 information). However, prior to its alteration, it flowed southeasterly, entering the Mississippi River in northern Lewis County. The alteration occurred in 1912 by the newly formed Gregory Drainage District (Mr. F.G. Neumann, personal communication). Two levees were constructed that diverted flow into the channelized portion of Sugar Creek (which occurred before 1900). Flow was diverted by first using straw bales, then later through additional levee work. Honey Creek, therefore, was never originally channelized but simply diverted between two levees. This explains why Honey Creek presently ceases to flow as it enters the Alluvial Plain. The channel bed is several feet above the normal contour of the land. Lost mileage for Honey Creek is not exactly known. It seems, however, that the stream was at least 12 miles longer than it is today.

By contrast, Fox River has undergone very little channel modification in the State of Missouri. At present, it flows freely for a distance of 49.8 miles; only 2.5 miles are channelized. Channelization occurred in the Upper Fox and Little Fox rivers in the late 1910s and early 1920s. Information derived from old topographic maps shows that Fox River flowed for 55.8 miles before modification.

The upper Fox River has been subjected to numerous channel modifications and dredging activities. Channelization first took place in 1917 and 1918, originating in the state of Iowa and continuing into Missouri for approximately 1.5 miles.

Channelization efforts ceased near the current northern boundary of Charlie Heath State Forest. Water velocity decreases at the point where the downstream end of a channelization reach meets the upstream end of an unchannelized reach. The downstream end of the channelized portion of Fox River quickly filled with sand; it was subsequently dredged in 1940-41, 1961 and again in 1974. However, by the mid-1970s, the channel was filled with sand and debris for approximately 0.7 mile. In response, the river formed a new channel, flowing south and then southeast before rejoining an old channel in Charlie Heath State Forest. The new channel is considerably narrower and somewhat straighter than the old

channel. Consequently, flood frequency and severity have increased along this stretch of the river. In addition, Fox River in Charlie Heath State Forest was shortened by approximately 0.5 mile.

Many streams in the Alluvial Plain have been leveed. Much of this activity occurred early in this century. Fox River's lower 11 miles, 7.2 miles of Honey Creek and 2.8 miles of Sugar Creek have been leveed.

## Unique Habitats

Despite intense agricultural development, a few natural communities of local and statewide significance can still be found in the basin. Most notable is the privately owned wetland known as Goose Pond (Figure hb). This area is thought to have been a former channel of the Des Moines River. As the Des Moines migrated away from this location, it left an oxbow that has undergone succession and is today classified as a deep fresh marsh (Alexander 1983). A network of drainage ditches and levees now surround the marsh and flow into the Fox River watershed. Goose Pond is approximately 320 acres located in S32 and 33, T65N, R6W and S4 and 5, T64N, R6W in Clark County.

Goose Pond is of statewide significance because of its diversity of wetland flora and fauna. Three Missouri endangered species are known to the marsh, the Illinois mud turtle (*Kinosternon flavescens*), Blanding's turtle (*Emydoideablandingii*) and the central mudminnow (*Umbra limi*). The Illinois mud turtle and the central mudminnow are restricted to the Fox River basin in Missouri. Indeed, ecosystems of this type, with their unique species assemblages, have largely been eliminated from the Fox River basin.

One unique ecosystem was known as Britton Prairie, located on Honey Creek in S21, 22, 27, 28 and 33, T64N, R6W. This area, drained and leveed beginning in the 1910s, undoubtedly supported a rich diversity of hydrophilic life, perhaps similar to what exists today at Goose Pond and the Rose Pond Natural History Area (NHA). According to Mr. F.G. Neumann (personal communication), the area encompasses over 1,000 acres of native wet prairie. Apparently, it was a haven for waterfowl. During dry periods large prairie fires broke out. Today, only about 5 acres remain.

Rose Pond NHA (Figure hb), obtained by the Missouri Department of Conservation in 1983, supports two endangered species—the Blanding's turtle and the Illinois mud turtle—in addition to unique wetland flora. Rose Pond, like Britton Prairie, was a marsh and has undergone extensive leveeing and dredging that lowered its water table in the early 1970s.

The Waterloo Cemetery (Figure hb) overlooks Fox River at S9, T65N, R7W, northeast of Kahoka. Approximately one acre of undisturbed natural prairie may be found on an unused portion of the cemetery.

Alexander (1983) listed the Fox River from Missouri State Highway 81 to U.S. Highway 136, a distance of approximately 15 miles, as a "significant aquatic area." Dr. William L. Pflieger selected this stretch of Fox River to represent "some of the best remaining stream habitat in northeast Missouri." To

qualify for this distinction, the streams must be unchannelized and support a diversity of aquatic life.

Based upon habitat and fish surveys in the basin, there do not seem to be any habitat or fish assemblages that are unique to Fox River or northeastern Missouri. There are, however, a few species of fish that are rather distinctive of this region (see account under stream biota). Interesting geological features are present in the basin and offer a diversity of habitats, leading to a somewhat rich assemblage of stream fishes.

One of these interesting geological areas occurs on Fix River near the town of Chambersburg at the southern ½ of S9, T66N, R8W. Here, a large outcrop of bedrock has been exposed forming an isolated area in the Drift Plain more characteristic of the Kahoka Hills region (Figure hb). Expansive pools are separated by short cobble and rubble riffles. The substrate is exclusively bedrock, often covered with silt, sand and gravel. A 1:1 pool/riffle ratio, relatively deep water and diversity of habitat promote high species richness for a stream of this size. At no other location in the basin did we observe such pronounced bedrock exposure and sharp contrast in adjoining habitats (prairie and woodland).

Exposed geode deposits are common in the basin and in northeastern Missouri in general. However, the largest deposit known to the basin and perhaps to northwestern Missouri was documented during the 1987 survey (Figure 10). Located in the northeastern 1/4 of S23, T65N, R7W, this deposit spans the width of the river bottom and continues outward from each bank for several hundred feet. Goedes in diameters greater than two feet were found. Commonplace were geodes 6 to 12 inches in diameter. Riffles were composed entirely of broken and intact geodes. Benthic fishes were particularly abundant in this reach.

Upstream from the geode deposit, approximately 1.5 miles, is yet another unusual geological formation (Figure hb). Here a natural bridge spans the width of a small tributary to Fox River in the northeast 1/4 of S14, T65N, R7W. The opening is large enough to walk through. It may be the only such geological phenomenon in northeastern Missouri.

Honey Creek from river mile 22 to river mile 8 flows through the heart of the Kahoka Hills region (Figure 3, contact authors for Figure 3 information). This region characterized by steep bluffs of limestone, forms a rather unique stream habitat. The pool/riffle ratio approaches 1:1 and the substrate is composed chiefly of gravel and rubble. Steep wooded bluffs combined with the limestone outcrops, rocky bottoms, somewhat clear water, and increased species richness is more reminiscent of habitat found in the lower Fabius River system in Marion County (Hrabik, unpublished data and personal observations). Despite some degradation due to siltation and channel alteration, this reach of Honey Creek represents some of the finest stream habitat remaining in the basin and is deemed significant.

## Improved Projects

To date, no projects have been initiated specifically to improve fish habitat, perpetuate rare and/or endangered species or to enhance the quality of fishing in any streams in this basin.

One bank stabilization project was completed in 1980. The U.S. Army Corps of Engineers laid a blanket of rip-rap on an eroding bank of the Fox River in S25, T65N, R7W at river mile 17.5. The bank was graded to a 2:1 slope and an 18-inch blanket of rip-rap was laid for a distance of 1,000 feet. The purpose of the project was to protect a county road in danger of becoming undermined. An inspection of this site in 1987 revealed that the project had halted erosion in the meander.

## Sample Site Selection

Thirty-one sites in the Fox River basin were selected for habitat assessment during the summer of 1987. Due to drought conditions, only 19 sites were sampled (Table 7).

Stream order was determined for all streams in the basin to demarcate major sampling boundaries. Representative reaches within a given stream order were then determined. First gradient plots were constructed. Local variation in slope was used to divide a gradient plot into blocks. Within each gradient block, habitats, based on riparian corridor conditions, channel morphology, surrounding topography, land use, unique geological features and substrate type were stratified into segments. All habitat parameters could be determined by aerial photography or topographic maps with the exception of substrate type. Substrate type was often inferred based on surrounding topography, land use and channel morphology.

Similar habitat segments were grouped and, using a stratified random approach, sample sites were selected as "representative reaches" within a stream segment of a gradient block. (See Appendix A for clarification). Representative reaches with access were given preference.

## Habitat Evaluation Methods

Habitat quality was determined by the Missouri Department of Conservation's in-house Stream Habitat Assessment Device (SHAD, Version 1) which ranks ten parameters from best to worst. SHAD was derived and modified from the Stream Habitat Evaluation Procedure (SHEP, Fajen and Wehnes 1981). Numerical scores were assigned to categories within each parameter being evaluated. All assessments were subjective and reflected inter-site comparisons and the experience of the evaluator. For purposes of discussion in this report, a reach of stream having a SHAD score of less than .70 out of a possible score of 1.00 is considered degraded and in need of habitat improvement.

Average scores derived from SHAD are site specific; and because site selection was not entirely random, they do not represent habitat quality of entire subbasins. Furthermore, scores indicative of quality habitat (greater than .70) may combine high scores for several parameters with a low score for one or more parameters, thereby masking degradation that may affect fish populations.
Habitat evaluations were based upon total length of stream sampled for fish population information (Table 8). This was done in order to establish meaningful relationships between habitat and fish population data.

Various habitat parameters were measured or estimated and recorded on a standardized data sheet (Appendix B, contact authors for Appendix B information). Substrate composition was estimated by the points sampling method (Wright et.al. 1981) in which particle size within standardized areas (points) of a grid system is visually determined, tallied and converted into percent coverage. Substrate particle size followed that of Cummins (1962) and the modified Wentworth classification. The one deviation from the modified Wentworth scale was the recognition of rubble size material (250-450 mm in diameter), thereby elevating the size of boulder material to be greater than 450 mm in diameter. Percent shading was estimated visually by observing the shaded portion of the stream when the sun was at its highest point over the channel. An average shading figure was approximated over the entire reach and was reported as percent shading.

The description of the ecological area and erosion potential were subjective evaluations based on historical land use and the erosiveness of streambank soils. Ecological areas were divided into prairie, prairie/woodland integrade, and woodland ecotones. Erosion potential was separated into slight, moderate and substantial categories. Erosion potential was also addressed in SHAD not only by estimating the erosiveness of bank materials, but also taking into account man-induced influences. Each bank was evaluated when using SHAD. The erosion potential determination recorded on the standardized data sheet attempts to account for soil erosiveness, but without considering man's impact.

Using information collected for SHAD analysis, each sample site was categorized into one of four broad habitat classes: unchannelized with a wide riparian corridor where both banks had an average riparian corridor width close to or exceeding 100 feet (UW), unchannelized with a narrow riparian corridor where both banks had an average riparian corridor width less than 100 feet (UN), channelized, wide corridor (CW) and channelized, narrow corridor (CN). No sites were sampled in the CW category.

## Habitat Evaluation

A total of 15,417 feet (2.92 miles) of Fox River and its major tributaries were evaluated in 1987 for habitat quality and fish population characteristics (Table 8).

Habitat quality can be characterized by physiographic landform within the basin. Streams originating in the Drift Plain region were small, shallow and had somewhat narrow channels. Pool depth averaged 1.7 feet and rarely exceeded 4 feet. Substrates were mostly sand-silt; however, gravel and limestone outcrops occurred locally. Channels were generally quite sinuous where channelization had not occurred. Riffles were uncommon or non-existent in most streams of the region, occurring only in rare areas of gravel deposit and/or bedrock outcrop. There was some evidence of embedded riffles in the upper Fox River.

Instream cover was particularly limiting to fish populations. At most sample sites, instream cover (root wads, snags, etc.) was embedded or of insufficient size to provide adequate habitat. Erosion potential of uplands and streambanks was classified as moderate to high. The average SHAD score 0.73 did not indicate major stream habitat problems in this region. However, the score did indicate that some habitat parameters were borderline degraded and in need of improvement.

Reasons for degradation in the Drift Plain are many. Channelization has adversely affected approximately one-half of the Little Fox River. Though most of the small streams (orders 1-3) of the reg are unchannelized, some have been altered at least 20 percent (Table 1). As a result of channelization a few streams, and in particular the Little Fox River, have suffered head cutting, widened channels and sand deposition. However, because channelization occurred over 70 years ago, banks were fairly stable and the quality of the narrow riparian corridors was surprisingly good.

Steams originating in or flowing through the Kahoka Hills region contained higher quality fish habitat than those originating in the Drift Plain. These stream channels were generally straight and narrow. Pool depth averaged 1.9 feet and rarely exceeded 6 feet. Many small streams originate in the Kahoka Hills but most are intermittent, so stream beds were often covered with vegetation over substrates of sand and silt. Permanent streams were characterized by a variety of instream habitat and substrate types. Cobble and rubble size substrate material was found over the entire region, and were occasionally predominant substrate types. However, the substrate in most permanent streams of the Kahoka Hills region was sand-gravel or sand-cobble.

Unlike streams in the Drift Plain, streams in the Kahoka Hills had lots of riffle habitat. Pool/riffle ratios of 1.5:1 were typical. Channels typically had long, straight, narrow pools often with hairpin turns as the stream meandered between adjacent bluffs. Riffles separated most pools with frequent interspersion of shallow sandy or gravelly runs. Instream cover was abundant in the Kahoka Hills. In some areas, rootwads in excess of two feet in diameter numbered 15-20 in a 1/4-mile stretch of stream. Log jams seemed to be less frequent in this region than in the Drift Plain. Erosion potential ranged from low to high depending upon streambank materials. In general, banks were more stable than in the Drift Plain because soils were less erosive and riparian corridor quality was higher. The average SHAD score, however, was slightly lower in the Kahoka Hills region than in the Drift Plain, due primarily to poor elevations given to Brush Creek, degraded by domestic discharge from the City of Kahoka, and lower Honey Creek, where flow subsided into unconsolidated streambed materials. The average SHAD score of .70 indicates that streams of the region need improvement.

Excessive bedload was the primary habitat problem in streams of the Kahoka Hills region. Many of the streams were much too shallow for their size and order. Although rocky substrates were exposed in riffle or run areas, pools which may have historically consisted of bedrock or rocky substrates were often covered with a layer of silt or sand now functioning as the streambed. The main cause of excessive bedload was probably intensive grazing of the uplands and riparian corridors.

Almost all streams flowing through the Alluvial Plains were channelized and/or converted into drainage ditches. The streams were very shallow (<2 feet deep, except for lower Fox River at its confluence with the Mississippi River), and often ceased to flow during dry seasons. Substrates were sand, silt and to a lesser degree, gravel. There were no riffles, but gravelly runs could be found in Fox River. Due to channelization and levees, most streams in the region had straight and narrow channels. There was very little fish habitat in most streams of the region, however, lower Honey Creek and Fox River had tree stumps and brush piles of sufficient size to provide cover for many species of sport fish.

All streams entering the Alluvial Plain had moderate to high erosion potential due to channelization and erosive soils. Erosion potential was much less in lower Honey Creek and Fox River near the confluence of the Mississippi River because of high quality riparian corridors. Elsewhere in the ion, riparian corridors were in extremely poor condition. Average SHAD score was .68, the lowest of any physiographic region.

Channelization was the primary reason for degradation in streams of the Alluvial Plain, resulting in heavy bedload and limited fish populations. In addition, in-stream cover was rare except in lower Honey Creek and Fox River.

Fox River had the highest average SHAD score (.81) in the basin. This was due to several factors: 1) water quality was very good; 2) riparian corridors were generally of good width and quality; and 3) only five percent of the river has been channelized. The subbasin is not without problems, however. Insufficient pool depth and lack of instream cover reduces habitat suitability for large fish.

The Little Fox River had a much lower average SHAD score (0.70) than Fox River primarily because of extensive channelization. However, altered portions of the river have not been maintained, so the channel has developed a "natural" appearance. Although many riparian corridors were narrow, they were generally in good condition. Therefore, streambanks were usually stable even in channelized sections. As in the Fox River subbasin, depth was poor, bedload (sand and silty-sand) was heavy and instream cover was inadequate.

Sugar Creek scored 0.68 using SHAD at one locality. Riparian corridor quality was similar to other reaches in the Kahoka Hills region. Streambank soils were only slightly erosive and water quality problems were infrequent. However, Sugar Creek was marred by shallow pools filled with unconsolidated sediment (usually sand). Instream cover was nonexistent. Sugar Creek was 100% channelized in the Alluvial Plain where flow often subsides after it leaves the Kahoka Hills.

Honey Creek was characterized by the most interesting and the worst habitat in the basin. The average SHAD score was 0.62, lowest among the three major Fox River tributaries. Habitats throughout much of the Drift Plain and Kahoka Hills were in good condition. Riparian corridors were often narrow but usually of high quality. Sedimentation did not s to be excessive, although most pools showed signs of deposition. Instream cover, such as crevice habitat and root wads, as more abundant than in other subbasins. The diversity of substrate and microhabitats increased species richness and diversity. However, an abrupt transformation occurred as the stream left the Kahoka Hills and entered the Alluvial Plain. Sediment rapidly deposits as gradient levels off near the lower end of the Kahoka Hills. Almost all of lower Honey Creek in the Alluvial Plain was channelized. Pools were shallow, instream cover nonexistent, and riparian corridors were of unacceptable width and quality. The SHAD scores assigned to these lower stations were the poorest in the basin.

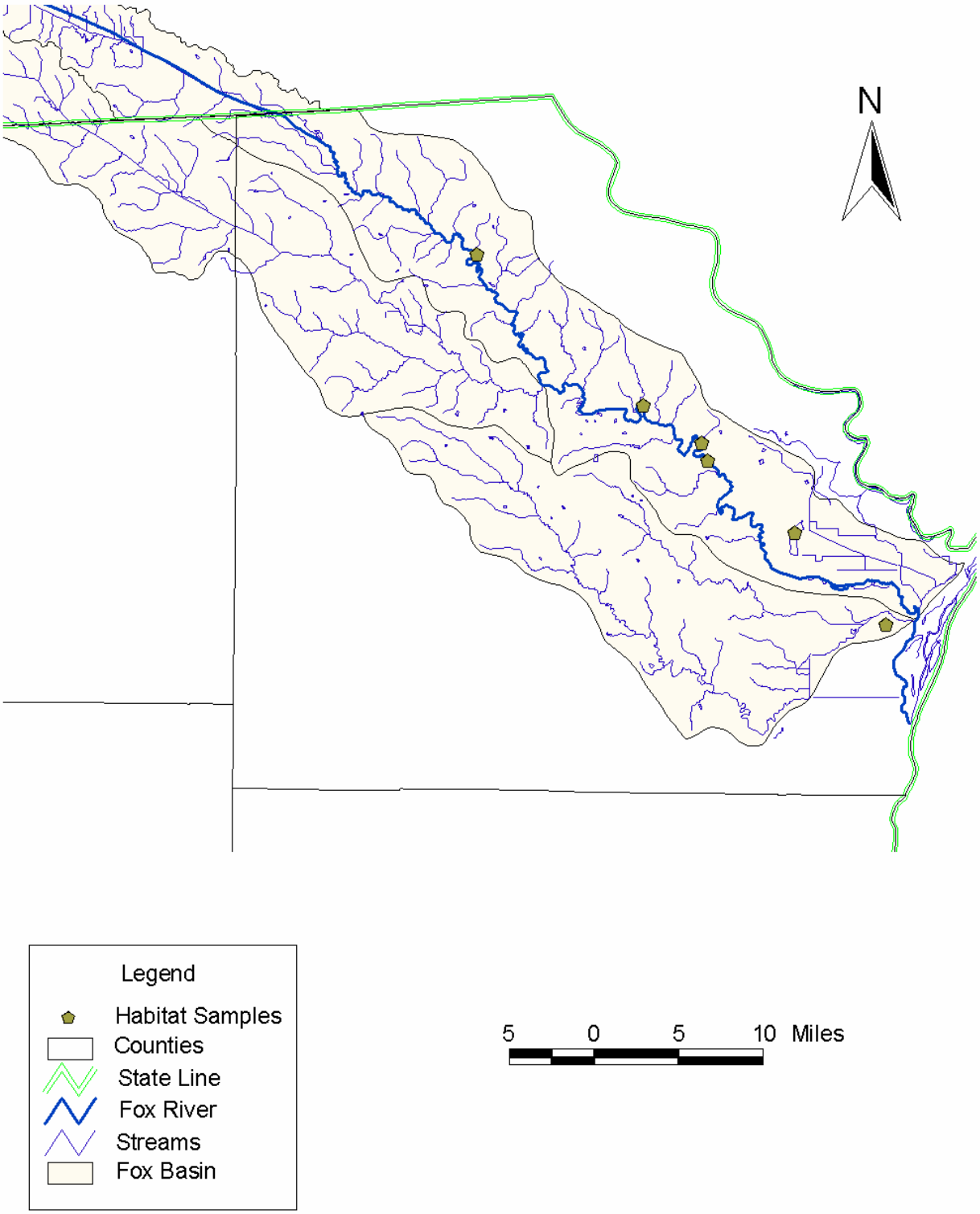


Figure hb. Habitat sample sites in the Fox River Basin, in Missouri.

**Table 7. Stream Habitat and Fish Sample Sites in the Fox River Basin, 1987.**

| Stream Code/Name | Site | Order | River Mile | Location Township-Range-Section | Topographic Map | Survey Date |
|---|---|---|---|---|---|---|
| 37521000 - Little Fox River | 1 | 3 | 22.9 | 67N-10W-19 | Azen | 08-12 |
| 37521000 - Little Fox River | 2 | 3 | 14.6 | 66N-09W-08 | Mount Sterling | 08-12 |
| 37521000 - Little Fox River | 4 | 4 | 3.7 | 65N-08W-04 | Medill | 08-17 |
| 37521000 - Little Fox River | 8 | 4 | 0.0 | 65N-08W-22 | Kahoka | 08-18 |
| 37500000 - Fox River | 10 | 4 | 44.0 | 66N-08W-06 | Anson | 08-19 |
| 37500000 - Fox River | 11 | 4 | 38.7 | 66N-08W-16 | Anson | 08-19 |
| 37500000 - Fox River | 12 | 4 | 35.0 | 66N-08W-27 | Medill | 08-20 |
| 37500000 - Fox River | 16 | 5 | 24.6 | 65N-07W-09 | Kahoka | 08-20 |
| 37514000 - Brush Creek | 17 | 2 | 1.4 | 65N-07W-16 | Kahoka | 08-26 |
| 37500000 - Fox River | 19 | 5 | 19.2 | 65N-07W-23 | Kahoka | 08-26 |
| 37500000 - Fox River | 20 | 5 | 10.6 | 64N-06W-19 | Kahoka S.E. | 09-01 |
| 37500000 - Fox River | 22 | 5 | 4.0 | 64N-06W-18 | Warsaw | 09-02 |
| 37512000 - Hemp Slough | 23 | - | 4.8 | 65N-06W-35 | Wayland | 09-01 |
| 37511100 - Sugar Creek | 26 | 3 | 4.6 | 64N-06W-07 | Kahoka S.E. | 08-06 |
| 37511000 - Honey Creek | 27 | 3 | 21.6 | 64N-07W-17 | St. Patrick | 0804 |
| 37511000 - Honey Creek | 28 | 3 | 14.1 | 64N-07W-26 | St. Patrick | 08-04 |
| 37511000 - Honey Creek | 29 | 3 | 12.3 | 64N-07W-36 | Kahoka S.E. | 08-05 |
| 37511000 - Honey Creek | 30 | 3 | 5.8 | 64N-06W-28 | Kahoka S.E. | 08-06 |
| 37511000 - Honey Creek | 31 | 4 | 1.8 | 64N-06W-14 | Kahoka S.E. | 08-05 |

## Table 8. Habitat Parameters in the Fox River Basin, 1987.

| Streamcode/Name | Site # | Sample Length (ft) | Average Channel Width (ft) | Average Depth Pools (ft) | Substrate Composition** | Pool/ Riffle Ratio | Ecological Area Land Use | Erosion Potential | SHAD | Habitat Class |
|---|---|---|---|---|---|---|---|---|---|---|
| 37521000-Little Fox River | 1 | 200 | 10 | .84 | SA70, SL30 | --- | prairie-meadow/row crop | moderate | .55 | CN |
| 37521000-Little Fox River | 2 | 370 | 10 | 1.00 | SA70, SL30 | --- | rolling prairie/row crop | moderate | .80 | UN |
| 37521000-Little Fox River | 4 | 800 | 15 | 2.00 | SA80, SL20 | --- | floodplain prairie/row crop | moderate | .82 | UN |
| 37521000-Little Fox River | 8 | 1850 | 25 | 2.40 | SA90, SL10 | --- | floodplain prairie/row crop | high | .61 | UN |
| 37500000-Fox River | 10 | 655 | 20 | 2.17 | SA60,SL40 | --- | rolling prairie pasture/row crop | moderate | .76 | UN |
| 37500000-Fox River | 11 | 750 | 40 | 2.00 | BD45,SL20, SA15, CB15, RB5 | 1:1 | prairie/woodland timber/row crop | low | .88 | UW |
| 37500000-Fox River | 12 | 710 | 35 | 2.00 | SA50, SL50 | --- | rolling prairie/row crop | moderate-high | .82 | UN |
| 37500000-Fox River | 16 | 1152 | 40 | 2.50 | SA40, SL30, RB20, CB10 | --- | prairie/woodland timber/row crop | moderate | .84 | UW |
| 37514000-Brush Creek | 17 | 450 | 10 | 2.00 | SA40, SL30, GR25, CB10 | 1:1 | prairie/urban/row crop | moderate | .67 | UN |
| 37500000-Fox River | 19 | 1700 | 40 | 2.00 | CB30, BD20, RB20, SL10, SA7.5, GR7.5, BL5 | 1.5:1 | prairie/woodland pasture/row crop | low-moderate | .79 | UW |
| 37500000-Fox River | 20 | 1850 | 40 | 2.00 | SA45, SL35, GR20 | --- | floodplain timber/row crop | moerate-high | .71 | CN |
| 37500000-Fox Creek | 22 | 1550 | 40 | 6.00 | SA50, SL50 | --- | floodplain woodland/row crop | low moderate | .88 | UW |
| 37512000-Hemp Slough | 23 | 140 | 30 | 3.00 | SL100 | --- | floodplain prairie/row crop | low | -- | CN |
| 37511100-Sugar Creek | 26 | 50 | 10 | 0.84 | SA80, SL20 | --- | woodland/row crop | moderate | .68 | UW |
| 37511000-Honey Creek | 27 | 490 | 18 | 1.50 | SA50, SL40, GR1 | --- | prairie pasture/row crop | moderate | .71 | UW |
| 37511000-Honey Creek | 28 | 1100 | 23 | 2.00 | RB70, GR15,SA15 | 1.5:1 | woodland/row crop | low-moderate | .73 | UW |
| 37511000-Honey Creek | 29 | 250 | 12 | 1.00 | SA90, SL10 | --- | woodland/row crop | moderate-high | .47 | UN |
| 37511000-Honey Creek | 30 | 150 | 30 | 2.50 | SA50, SL50 | --- | prairie/marsh/row crop | high | .47 | CN |
| 37511000-Honey Creek | 31 | 1200 | 18 | 1.50 | SA50, SL50 | --- | floodplain woodland/woodland | low | .68 | UW |

***SA=sand, SL=silt, BD=bedrock, GR=gravel, CB=cobble, RB=rubble, BL=boulder**
***CN=channelized, narrow corridor; UN=unchannelized, narrow corridor; UW=unchannelized, wide corridor**