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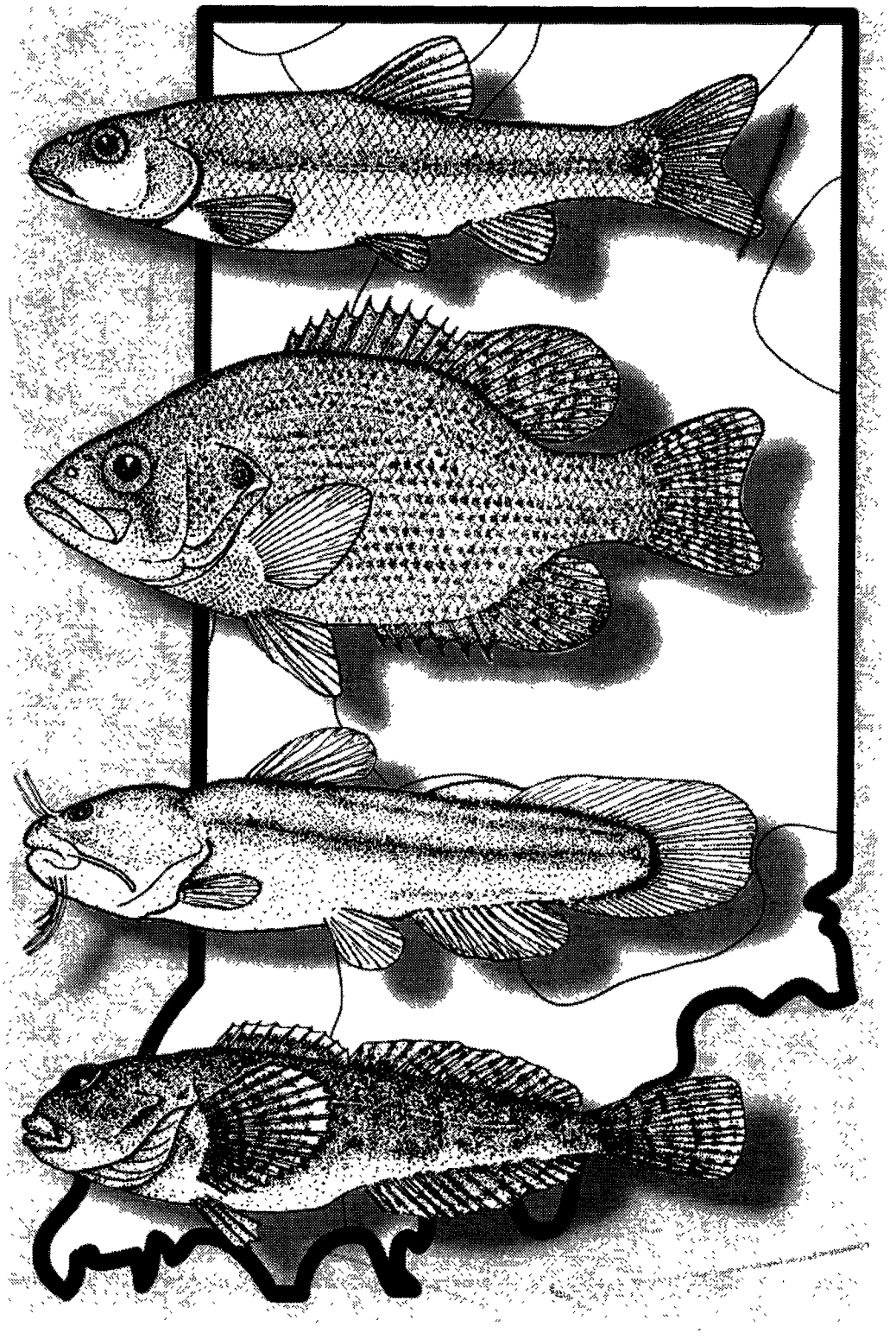
Development of Index of Biotic Integrity Expectations for The Ecoregions of Indiana V. Eastern Corn Belt Plain



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Development of Index of Biotic Integrity Expectations for the Ecoregions of Indiana: V. Eastern Corn Belt Plain

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September 30, 1998

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EXECUTIVE SUMMARY

The Clean Water Act Amendments of 1987 suggest the development of biological criteria for evaluating the quality of the nation's surface waters. The watersheds of the Eastern Corn Belt Plain were investigated in Indiana to determine water resource expectations. A total of 130 sites were sampled in the ecoregion in order to develop and calibrate an Index of Biotic Integrity for use in this region of Indiana. Based on anticipated variance within the ecoregion, sub-drainages were established within natural divisions as recognized by Homoya et al. (1985).

Eight sub-drainages are recognized in our analysis and include the major drainage units of the Tippecanoe, Wabash, Eel, Mississinewa, Salamonie, White, Wildcat, and St. Joseph River drainages. Graphical analysis of the data enabled the construction of maximum species richness lines for calibrating the Index of Biotic Integrity for 12 metrics, as modified for application to headwater and mid-sized wadable rivers. Metrics were primarily based on the previous works of Karr (1981), Karr et al. (1986), Ohio EPA (1987), and Simon (1991, 1994, 1997). Metrics are similar to those developed for the Northern Indiana Till Plain. This includes the number of minnow species, sunfish species, a combination of sensitive species to replace the intolerant metric, a combined darter, madtom, and sculpin metric, and the use of percentage of headwater species and pioneer species as separate metrics.

Separate metrics were developed for headwater streams (< 20 miles^2) and wadable river (20-1000 miles^2) drainage area. Scoring criteria modifications were instituted when less than 50 individuals were collected from a sampling location. This affected the trophic composition, tolerance, simple lithophil, and DELT proportional metrics. Stations with drainage areas less than 20 miles^2 used a metric which included darters, madtoms, and sculpins (all benthic insectivores). These species are sensitive indicators of a high quality aquatic resource. In reaches with drainage areas greater than 20 miles^2 a metric evaluating only darter species was used following the original IBI. The proportion of pioneer species was substituted for the proportion of carnivores in small headwater streams. The number of sunfish species was retained for wadable stream sizes. The percentage of individuals as headwater species were substituted for headwater sites as a replacement metric.

ACKNOWLEDGEMENTS

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Development of Index of Biotic Integrity Expectations for the Ecoregions of Indiana. V. Eastern Corn Belt Plain

1.0 INTRODUCTION

The term "biological integrity" originated in the Water Pollution Control Act Amendments of 1972 (PL 92-500) and has likewise appeared in subsequent versions (PL 95-217; PL 100-1). Karr and Dudley (1981) defined biological integrity as, "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region". The use of a biological component to evaluate the ambient lotic aquatic community of our nations surface waters has been well discussed elsewhere (Karr *et al.* 1986; Ohio EPA 1987; Whittier *et al.* 1987; Simon *et al.* 1988; Davis 1990; Fausch *et al.* 1990; Karr 1991).

An assessment of the Eastern Corn Belt Plain enabled an objective evaluation of specific metrics performance and evaluation of reference conditions for the Eastern Corn Belt Plain. The ecoregion has impacts associated with channelization and damming, agriculture, and municipal and point source dischargers. The primary point sources are municipal facilities, chemical manufacturers, and hydro-electric power generating stations distributed in the main population centers of the basin. The affects of channelization and agriculture have been well documented including thermal increases (Raney and Menzel 1969; Brown 1976; Brungs and Jones 1977; Hokanson and Biesinger 1980; USEPA 1980; McCormick *et al.* 1981; EPRI 1981); increased nutrient and allochthanous input, and runoff and riparian zone clearing.

The objective of this study was to evaluate the biological integrity of Indiana water resources based on "least impacted" reference conditions for establishing baseline conditions (Hughes *et al.* 1986). Least impacted reference sites are representative of the watershed under study and reflect the better sites with minimum anthropogenic change. Least impacted is not synonymous with pristine. Rather, sites are selected for their representativeness of the area. The Eastern Corn Belt Plain has been dramatically changed over the last 250 years with the draining of the riverine wetlands and the intensive ditching projects that completely changed the landscape. The following project goals were addressed during the Eastern Corn Belt Plain biological criteria project:

- o Develop biological criteria for headwater, mid-size, and large river reaches using the Index of Biotic Integrity;
- o Identify areas of least disturbance within the Eastern Corn Belt Plain for establishing reference conditions;
- o Develop maximum species richness (MSR) lines from the reference database for each IBI metric as a log function of drainage area;
- o Compare biocriteria to States of Ohio and Michigan expectations for the ecoregion.

This technical report includes specific Index of Biotic Integrity criteria including the development of metrics and maximum species richness lines, to delineate areas of least disturbance in the Eastern Corn Belt Plain ecoregion. Limited field collection has been conducted in Indiana since the completion of Gerking's distribution of Indiana fishes. Less than 2% of Indiana's surface

waters had been assessed at the beginning of this study. Since limited information was available for the selection of least disturbed stations, we attempted to sample representative stream types of this region in order to determine where least impacted stream segments occurred.

Definition of Reference Conditions

In order to make accurate evaluations of the biological condition of the region, various baseline geological, geographic, and climatic differences need to be assessed. The goal is not to provide a definition of pristine conditions, since these types of conditions are either few in number or nonexistent in heavily populated states (Hughes *et al.* 1982; Whittier *et al.* 1987). Our expectations are determined from the structural and functional attainable natural conditions of "least impacted" or reference conditions. Assessment of these criteria need to be modified nationally, since regional differences can be attributed to the expectations based on structure and function that determine the distribution of fishes. The ecoregion concept is useful for clustering large homogeneous regions, since these areas are influenced by different physical processes (Omernik 1987).

In order to select stations for sampling it is necessary to know the geographical boundary of the "ecoregions" within the State of Indiana. A valid ecoregion has boundaries where ecosystem variables and patterns emerge (Hughes *et al.* 1986). Omernik (1987) mapped the ecoregions of the conterminous United States from maps of land-surface form, soil types, potential natural vegetation, and land use. Each ecoregion was then based on areas of regional homogeneity. Ecoregions became a very useful mechanism for determining community complexity and for establishing boundaries associated with various land forms.

Ecoregions provide a geographical framework for determining the appropriate response for streams of similar proportion and complexity. Reference conditions are used for establishing the areas of "least impact", and will reveal the current conditions of the surface waters of Indiana. Once ecoregional expectations are determined it is important to consider that conditions do not remain static. On the contrary, repeat monitoring and sampling of stations, both reference and site specific will need to be conducted in order to document change over time and further refine the IBI.

Reference conditions are not the same as reference sites. Reference conditions are the subtle patterns that emerge from the regional database. Few if any nonimpacted sites occur in North America, thus in order to determine the extent of degradation important attributes of stream fish communities are analyzed to determine the patterns of "least impacted" communities. The relevance of including some sites that are not considered pristine or "reference sites" is not important because it is only the upper 5% of the sites that determine the maximum species richness lines or 95th percentile lines.

Because of subregional differences, further demarcation was made by examining the role of the basin or the watersheds within ecoregions. Fish composition and community structure is determined, within a natural area by the availability of water of appropriate quality and quantity to ensure existence, provide routes of emigration, sustain growth, and increase fitness through reproduction. Likewise, species-specific differences exist in community structure that may not reveal

differences in current water quality but may be determined by historical geomorphic (Leopold *et al.* 1964) or zoogeographic processes (Hocutt and Wiley 1986). Trends in Indiana water quality were therefore evaluated using a watershed approach within an ecoregion framework.

Criteria for Selecting Reference Sites

Several procedures are available for determining reference conditions. Larsen *et al.* (1986) and Whittier *et al.* (1987) chose sites after careful examination of aerial photographs, watershed specific information review, on-site reconnaissance, and expert consultation. This procedure requires that a limited number of high-quality sites be sampled in order to predict regional expectations. The methods chosen for site selection were based on the evaluation of Regional Water Quality Planning Maps (USGS undated) that identified known impact sources and diffuse nonpoint sources that could potentially influence a site. A balanced distribution of sites within all parts of the Eastern Corn Belt Plain drainage was maintained against historic collections sites (Jordan 1877; Gerking 1945; IDEM 1990). All sites were rigorously sampled in order to get representative, distance specific, quantitative estimates of species richness and biomass. Maximum species richness lines were then compiled (see methods below), followed by calculations of the Index of Biotic Integrity values to reveal those stations that were the "least impacted" stations for the ecoregion.

Reference sites are defined as the stations that cumulatively define the 95th percentile line of the individual metrics. Evaluation of habitat and other physical parameters refined the final list of reference sites. Sites that had habitat or water quality deficiencies, but still attained high index ratings would have been removed from the final list. This action was not required, since poor habitat and water quality affected various portions of the community resulting in a lowered index score. These sites are not pristine or undisturbed (few exist in Indiana), but they do represent the best conditions given the background activities (i.e. anthropogenic impacts; channelization; cultural eutrophication).

Sampling was conducted in all size classes of river reaches in the eight River categories from the headwater (<20 mile^2) to the largest mainstem drainage area (ca. 1,000 mile^2) in Indiana.

2.0 STUDY AREA

Indiana has an area of 36,291 square miles, and drains the Ohio, the upper Mississippi, and Great Lakes Regions (Seaber *et al.* 1984). These three regions were further subdivided into nine subregions (Fig. 1), five of which drain 86% of the State (USGS 1990). The State of Indiana lies within the limits of latitude 37° 46' 18" and 41° 45' 33" north, for an extreme length of 275.5 miles in a north-south direction; and between longitude 84° 47' 05" and 88° 05' 50" west with an extreme width in an east-west direction of 142.1 miles.

The State has a maximum topographic relief of about 900.9 ft, with elevations ranging from about 300.3 ft above mean sea level at the mouth of the Wabash River to slightly more than 1,201.2 ft in Randolph County in the east-central part of the state.

This report considers only the Eastern Corn Belt Plain. The main watersheds of the ecoregion include the Wabash River tributaries and the Joseph River drainage.

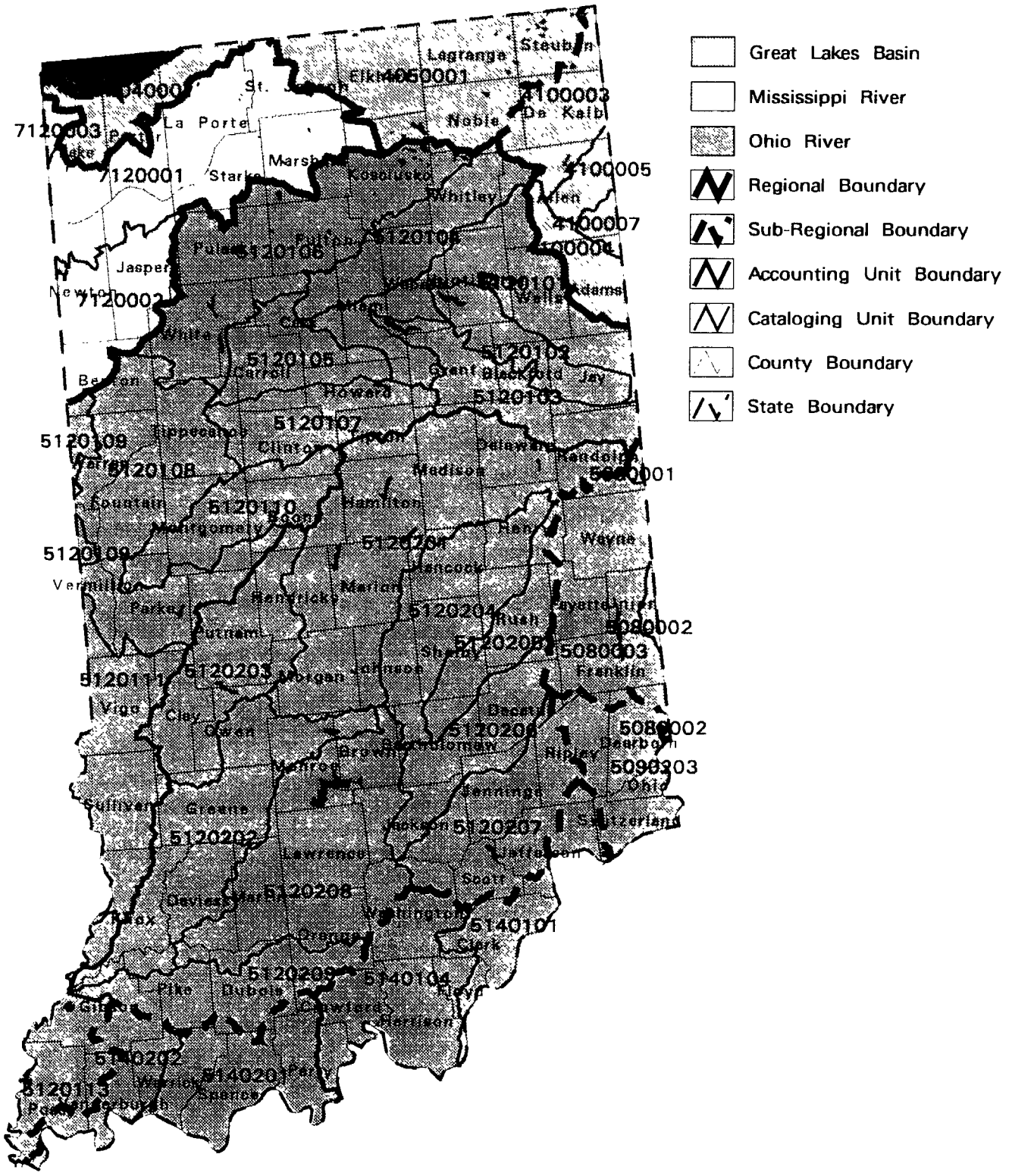

Figure 1. Map of Indiana showing Major and Minor drainage basins. (from USGS data).

The entire Eastern Corn Belt Plain extends into Ohio, Michigan, and Indiana (Omernik and Gallant, 1988). Within Indiana, the ecoregion is found within the central portion of the state, however, a finger entends along the St. Joseph River in northcentral and northeastern Indiana that drains in a northeastern direction into Ohio and eventually Lake Erie through the Maumee River.

The Wabash River drains an area of 32,910 square miles (Hoggatt 1975). It crosses two ecoregions and is the largest drainage in Indiana. Principal tributary streams include the White River, which drains the Eastern Corn Belt Plain and Interior River Lowland ecoregions (Omernik and Gallant, 1988). Large tributaries that drain the Eastern Corn Belt Plain include the Tippecanoe, East and West Forks of the White, Driftwood, Big Blue, Flatrock, Eel, and Muscatatuck Rivers. The St. Joseph River drains an area of 4,285 mile^2 (Hoggatt 1975). It is contained within a single ecoregion and drains 4.7% of Indiana.

Physiographic Provinces

Fenneman (1946) divided the State into two physiographic provinces based on the maximum extent of glaciation. The glaciated portion of the State contains the Central Lowland province, which includes the majority of the Eastern Corn Belt Plain, and the unglaciated portion is termed the Interior Low Plateaus province.

Schneider (1966) further divided Indiana into three broad physiographic areas that closely reflect the surface-water characteristics of the State. The St. Joseph River drains a portion of the Northern Lake and Moraine Region, while the Wabash River drains a portion of the Tipton Till Plain, Scottsburg Lowland, Norman Upland, Crawford Upland, Dearborn Upland, and Mitchell Plain. The Tipton Till Plain is characterized by a depositional plain of low relief that has been modified only slightly by postglacial stream erosion. The southern section of the State includes the Wisconsinan glacial boundary and represents a series of north- and south-trending uplands and lowlands. Landforms in this area are principally due to normal degradation processes.

The Northern Lake and Moraine Region covers the northern one-fourth of the State and is of variable relief. Its characteristic deep peat deposits and small lakes that are restricted to the rugged, terminal moraines. Numerous broad lacustrine and outwash plains occur, often marked by wide marshes (or marshes now drained) broken by low sand ridges or knolls. The northern section of the State was covered during the most recent Wisconsinan glacial event.

The last major glaciation event dramatically altered northern Indiana during the Wisconsinan period (14,000 to 22,000 years ago). As glaciers advanced and retreated, the land surface was dramatically altered as the landforms were either scoured by advancing glacial ice or the scoured materials were deposited by retreating glaciers. Two distinct glacial lobes are known to have advanced into Indiana, from the northeast out of Lake

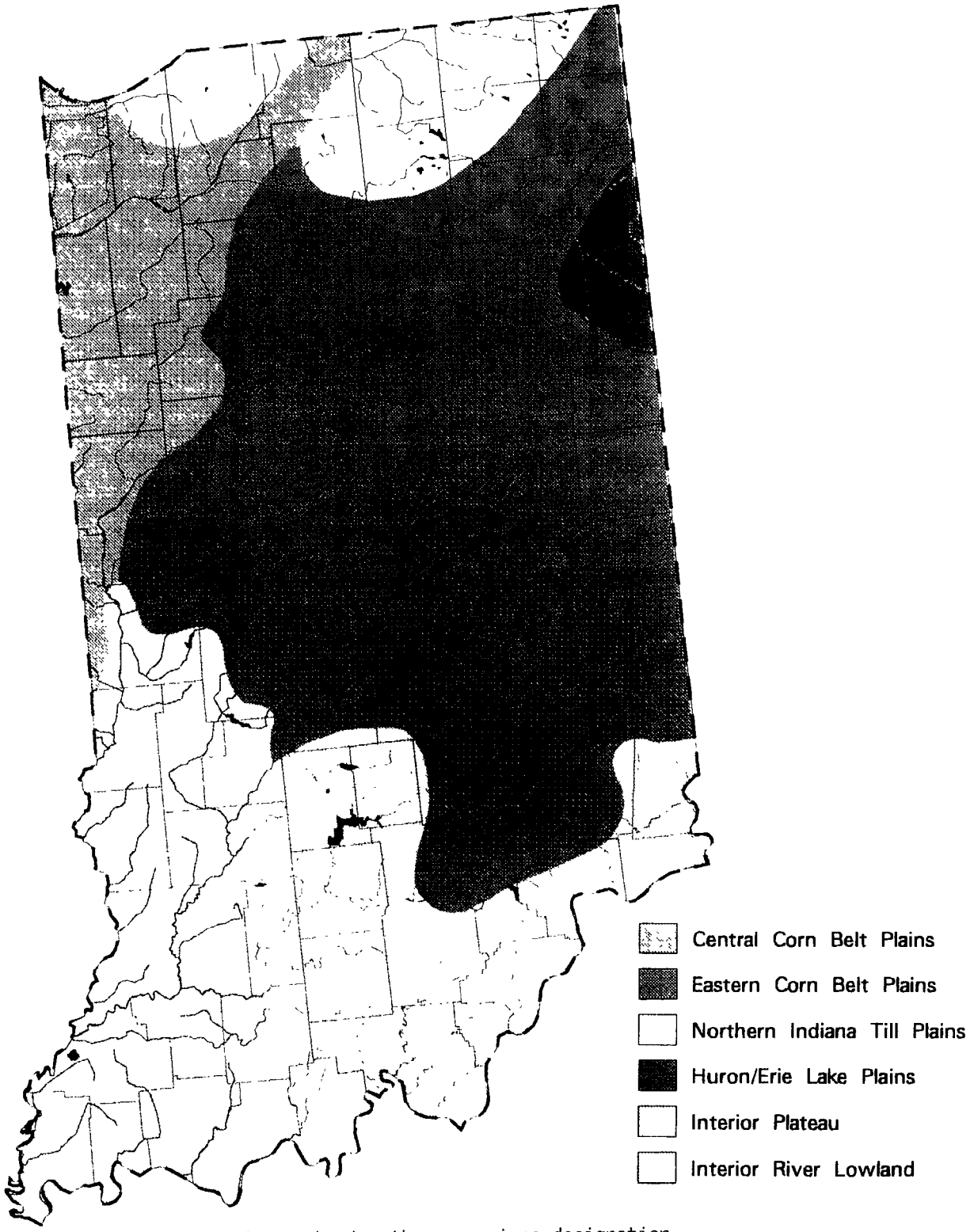

Figure 2. Map of Indiana showing the ecoregions designation of Omernik and Gallant (1988)

Erie and Saginaw Bay basins and from the north from the Lake Michigan basin.

Ecoregions

Omernik and Gallant (1988) characterized the attributes of ecoregions of the midwestern states. Indiana has six recognized ecoregions: Central Corn Belt Plain, Huron-Erie Lake Plain, Southern Michigan-Northern Indiana Till Plain (referred to as Northern Indiana Till Plain), Eastern Corn Belt Plain, Interior Plateau, and Interior River Lowland (Fig. 2). The current study includes only the Eastern Corn Belt Plain ecoregion (Omernik and Gallant 1988).

Eastern Corn Belt Plain

Much of the ecoregion consists of extensive cropland agriculture. It is distinguished from the Western Corn Belt Plains by its natural forest cover and associated soils. The gently rolling glacial till plain is broken by moraines, kames, and outwash plains. Elevations range between 399.3 ft to greater than 1320 ft. The ecoregion is characterized by low relief, typically less than 66 ft; however, some morainal hills occur in the northern portion near Lake Erie. Stream valleys are long and sinuous and generally narrow and shallow throughout the 31,800 miles^2 of the ecoregion. Small streams have narrow valley floors; larger streams have broad valley floors. Precipitation occurs mainly during the growing season and averages from 35 to 40 inches annually. The ecoregion has few reservoirs or natural lakes.

Both perennial and intermittent streams are common in the ecoregion. Constructed drainage ditches and channelized streams further assist in soil drainage in flat, poorly drained areas. Stream density is approximately one half mile per square mile in the most typical portions of the ecoregion (Fig. 2).

The ecoregion is almost entirely farmland. The major crops produced are corn and soybeans. A total of 75% of the landuse is cropland, while the remaining 25% is permanent pasture, small woodlots, or urban. Emphasis on livestock includes the growing of feed grains and hay. Swine, beef and dairy cattle, chickens, and turkey are raised.

Most of the soils were developed under the influence of deciduous forest vegetation. The soils are loamy calcareous glacial till, overlain by loess deposits. The soils are lighter in color and more acid than the adjacent Central Corn Belt Plain. Hapludolls and Ochraqualf's are the dominant soil groups on dry and wet upland sites, respectively. Argiaquolls, Haplaquolls, and Medisaprists have developed in flats and depressions. Hapludalf's and Fragiudalf's are common on well drained slopes of valleys. Shallow Hapludolls occur on some valley sides where erosion has removed the glacial material and exposed the underlying shale limestone. Udifluvents and Fluvaquents have derived from silty alluvium in narrow floodplains.

The natural vegetation of the area consists of diverse hardwood forests, predominantly American beech and sugar maple. However, a significant amount of white oak, black oak, northern red oak, yellow popular, hickory, white ash, and black walnut exists. Many of the trees are common in adjacent ecoregions, but most are comprised of oak and hickory. Wetter sites include white oak, pin oak, northern red oak, yellow popular, ash, and sweetgum primarily, and shingle oak, black oak, and hickory also occur. Silver maple, cottonwood, sycamore, pin oak, elm, and sweetgum grow along rivers and stream corridors.

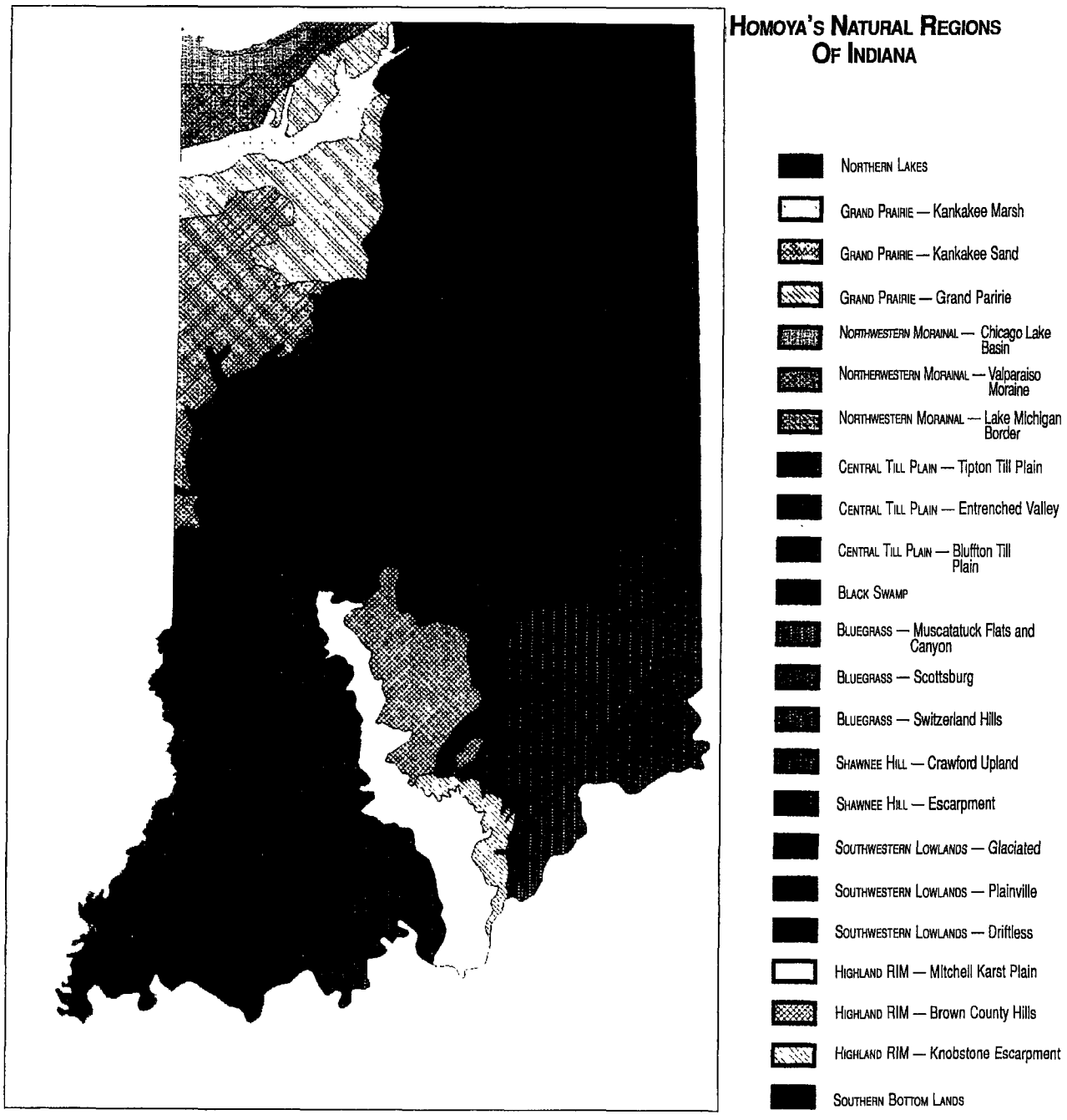

Figure 3: **Map of Indiana indicating the natural areas designation of Homoya et al. (1985)**

Natural Areas

A natural region is a major, generalized unit of the landscape where a distinctive assemblage of natural features is present (Homoya et al. 1985). It is similar to the ecoregion concept integrating several natural features, including climate, soils, glacial history, topography, exposed bedrock, presettlement vegetation, and physiography. It differs from the ecoregion concept in the utilization of biodiversity of the fauna and flora to delineate areas of relative homogeneity.

The Wabash River drainage incorporates the Central Till Plain, Southwestern Lowlands, portions of the Highland Rim, Bluegrass, Southern Bottomlands, and Big River Natural Regions (Fig. 3).

The Central Till Plain is the largest natural region in Indiana, formerly in the forested Wisconsinan till in the central portion of the state. The Region is topographically homogeneous although glacial moraines are common. The region is a major divide between the communities with a strong northern affinity and those with strong southern affinity, the Entrenched Valley is a concentrated continuum of northern, southern, eastern and western affinities. The Tipton Till Plain subsection is the predominant subsection of the West and upper East Fork drainages. The Tipton Till Plain is characterized by loamy Wisconsinan till. This section is mostly undissected plain formerly covered by an extensive beech-maple-oak forest.

The soils are predominantly neutral silt and silty clay loams. The northern flatwoods community associated with these poorly drained soils were ubiquitous but are now confined to the scattered woodlots. Species common to the woodlots include red maple, pin oak, bur oak, swamp white oak, Shumard's oak, American elm, and green ash. In slightly better drained soils occur beech, sugar maple, black maple, white oak, red oak, shagbark hickory, tulip popular, red elm, basswood, and white ash.

The Southwestern Lowlands Natural Region is characterized by low relief and extensive aggraded valleys. The lower White River and the lower portions of the East and West Forks occur in this Natural Region. Much of the area is nearly level, undissected, and poorly drained, although in several areas the topography is hilly and well drained. The region was glaciated by the Illinoian ice sheet. Three sections include the Plainville Sand section, Glaciated section, and Driftless Area section. The Glaciated Section is the only area that incorporates a portion of the West Fork White River.

The Glaciated Section corresponds with the Illinoian till plain. The soils are acid to neutral silt loams with a thick layer of loess. Natural communities include flatwoods forest in the Driftless Section which include shagbark hickory, shellbark hickory, pin oak, shingle oak, hackberry, green ash, red maple, and silver maple. This section had the greatest amount of prairie habitat south of the Wisconsian glacial boundary.

The Highland Rim physiographic region of the Interior Plateau ecoregion is subdivided into three subsections: Mitchell Karst Plain Section, Brown County Hills Section, and Knobstone Escarpment Section (Homoya et al. 1985). The Highland Rim is a discontinuous belt of underlying strata of Mississippian age, although some Pennsylvanian aged strata crop out in places. The region is unglaciated, with the exception of a relatively unmodified glaciated area at the northern and eastern boundary. The area possesses a large expanse of karst topography, rugged hills,

and steep cliffs. Most of the area was forested during presettlement times, but large barrens occurred along with smaller areas of limestone and siltstone and gravel wash.

The major feature of the Mitchell Karst Plain include several natural community types most notably the karst plain which comprises caves, sinkhole ponds and swamps, flatwoods, barrens, limestone glade and several upland forest types. The plain is relatively level except for the limestone cliffs and rugged hills along the periphery of the range. Caves are common, the soil is generally well drained with silty loams derived from loess and weathered limestone. Acid cherry Baxter silty loam occurs mostly in the south. Along the gravel wash is primarily composed of limestone and chert gravel that border most streams. Characteristic species include Indian grass, Carolina willow, big bluestem, ninebark, pale dogwood, and bulrush. Several forest communities occur, however, the western mesophytic forest type predominates and include white oak, sugar maple, shagbark hickory, pignut hickory, and white ash.

The Brown County Hills Section is characetrized by deeply dissected uplands underlain by siltstone, shale, and sandstone. The soils are well drained acid silt loams with minor amounts of loess. Bedrock is near the surface but rarely crops out. The natural communities are uniform dominated by oak-hickory, especially chestnut oak, and ravines with mesic species including beech, red oak, sugar maple, and white ash. Upper slopes usually have pure monotypic stands of chestnut oak, a thick growth of greenbrier, low growing shrubs, and a carpet of sedges.

The Knobstone Escarpment Section is similar in substrate and topography to the Brown County Hills Section. The major difference is the presence of Virginia pine in the upland forest communities. The pine is commonly co-dominant with chestnut oak on the many ridge crests and south facing slopes. American chestnut was historically dominant and has been taken over by Chestnut oak. Rock outcrops are rare and restricted to the ridge tops. Glades with shaly substrates are present, but rare, and occur on south facing slopes. They are usually sterile environments due to the unstable substrates and harsh conditions.

The Southern Bottomlands Natural Region is an alluvial bottomland along the rivers and larger streams in southwestern Indiana. It is distinguished from other bottomland regions in Indiana by the faunal affinity to the lower Mississippi River Valley and Gulf Coastal Plain. The Illinoian glacial border bisects the region placing the northern portion in the Central Lowlands physiographic province and the southern portion in the Interior Plateau's province. The glacial border has had little effect on the bottomland community. The soils of this Natural Region are mostly neutral to acid silt loams and are frequently flooded. The natural communities included bottomland forest, swamp, ponds, sloughs, and formerly marsh and prairie. The bottomland forest included pecan, sugarberry, swamp chestnut, pin oak, swamp white oak, red maple, silver maple, catalpa, shellbark hickory, sycamore, and green ash. The southern swamps and sloughs have bald cypress, swamp cottonwood, water locust, pumpkin ash, and overcup oak. The unique fauna of the region includes cottonmouth, hieroglyphic turtle, diamondbacked watersnake, eastern mud turtle, northern copperbelly, swamp rabbit, harlequin darter, and yellow crowned night heron. The Bluegrass natural region is named for its similarity to the physiography and

natural communities of the Kentucky bluegrass region. The entire natural region has been covered by one or more pre-Wisconsin ice sheets but today only a thin veneer of till is present. The northern boundary of the region approximates the southern terminus of the Wisconsin glaciation. Most of the natural area was forested, although a few glade, cliff, and barren remnants remain, as well as non-forested aquatic communities. The natural area is comprised of three sections, Scottsburg Lowland, Muscatatuck Flat and Canyon, and Switzerland Hills Section. Only the Scottsburg Lowland Section is included in this discussion of the East Fork of the White River.

The Scottsburg Lowland Section is wide alluvial and lacustrine plains bordering major streams. Major soils are acid to neutral silt loams with a sizeable eolian sand occurring just east of the East Fork of the White River. No unique communities or species are known to be associated with it. Bedrock rarely crops out, with the major exception being the Falls of the Ohio. Predominant natural communities are floodplain forest and swamp. The swamp community is characterized by the occurrence of swamp cottonwood, red maple, pin oak, river birch, green ash, stiff dogwood, and buttonbush. The slightly better drained floodplain forest includes sweetgum, swamp chestnut oak, swamp white oak, American elm, black gum, beech, shellbark hickory, and occassionally pecan. The rare southern pale green orchid and northern copperbelly, eastern ribbon snake, are restricted to this area. Wetland features include swamps, acid seep springs, low-gradient, silt-bottomed, streams, rivers and ponds.

The Big River natural region is defined by aquatic habitat where the average flow is 7000 cfs or greater. This includes the Wabash River and its principal tributary, the lower White River to its confluence at the junction with the East and West Forks. The natural area is based on the presence of several fish species (lake sturgeon, shovelnose sturgeon, alligator gar, shortnose gar, skipjack herring, smallmouth buffalo, goldeye, mooneye, and blue sucker) and several mussel species. The alligator snapping turtle, hellbender, and riverweed are also rare species restricted to this area.

Drainage Features of the Wabash River

The Wabash River basin begins in the State of Ohio where it originates in Beaver Lake. The river drains 285 square miles in Ohio and enters Indiana in Adams and Jay County. The Wabash River drains 23,950 square miles exclusively in Indiana. The River flows east across central Indiana incorporating the Mississinewa, Salamonie and Eel Rivers. Near Tippecanoe County the Tippecanoe River enters the River and the flow begins to bend to the southwest. The River flows south to Vigo County where it forms the political boundary of the States of Illinois and Indiana. This shared portion of the River includes 8,704 square miles. The Wabash River flows southwest and incorporates its major tributary of the White River at the southern extreme of Knox County. Numerous minor tributaries include Raccoon Creek, Sugar Creek, and the Patoka River. The minor tributaries fluctuate with seasonal flows. The lower Wabash River baseflow varies dramatically from groundwater and contributions from the East and West Forks. Average discharge for the Wabash River, downstream of the Southern Railway bridge, at Mount Carmel, (Gibson County) is 28,130 cfs with ranges of 6,144 cfs during 7 day, 10 year low flow and 428,000 cfs during 100 year flood periods in March 1913 (Stewart et al., 1995).

Historical Eastern Corn Belt Plain Data

The Wabash River is considered one of Indiana's highest quality resources. The biology of the Wabash River and its main tributary the White River has been intensively examined (Gammon numerous studies, 1991; Public Service of Indiana 1977, Kostka et al. 1986; WAPORA 1976; EA Science and Technology 1992). Although this is not intended to be an exhaustive list, included are a few of the most significant studies in the Eastern Corn Belt Plain.
The primary reasons for study were a result of assessing thermal impacts from generating facilities at Cayuga, Wabash Generating Facility, and the Breed Plant (Gammon 1991). The aquatic communities of the Wabash River have been correlated with water quality (Limnotech 1979; Environmental Science and Engineering 1987). The fish community has also been well studied including distribution (Jordan 1890; Evermann and Jenkins 1910; Gerking 1945); thermal influence (Gammon numerous studies, summarized in 1991; Public Service of Indiana 1977; Smith 1979; Lewis et al. 1989); and fisheries potential (Pearson 1975). Additional studies have concentrated on the upper Wabash River (Aderkas and McReynolds 1962; Pearson 1975; Braun 1982, Walterhouse 1988, Braun 1990), middle Wabash (Robertson 1975), and lower Wabash River (Forbes and Richardson 1920).

The Wabash River possesses a highly diverse fish community. Previous studies have documented a total of 151 species of fish in the Wabash River basin (Burr and Page 1986). The earliest records of Jordan (1877) suggest the river was abundant with both food and non-game species. The Wabash River shares 91 native species with the Ohio River. That amounts to a 75% faunal resemblance between the systems. The Wabash River has the greatest native species richness compared to the tributaries and mainstem of the Ohio and upper Mississippi drainage (Burr and Page 1986). The faunal similarity of the Wabash River is most like the White River (ca. 82%) and the Green River, Kentucky (ca. 77%). These Ohio River tributaries formed a phenetic cluster based on fish community presence (Burr and Page 1986) suggesting the Ohio River fauna is different from the upper Mississippi River fauna.

3.0 MATERIALS AND METHODS

Sampling

Site Specific

In order to answer basin-specific questions and to calibrate an IBI for evaluating ecosystem health, a sufficient number of samples were required from each of the various drainages. A total of 130 locations (Fig. 4) were surveyed during June through August 1991 to 1994 in order to compile the data needed to evaluate the maximum species richness lines for calibration of the Index of Biotic Integrity. Site and collection records are maintained within the State of Indiana files. Since the primary purpose of this study was to evaluate the water quality of Indiana using biological methodology, no further evaluation of site specific data (e.g. site specific taxonomic species lists) will be included other than an overall taxa list.

To ensure repeat sampling at the exact same site, all locations are based on latitude and longitude. Narrative descriptions for mileage are from the center point rather than the edge of the nearest town since the boundaries of many Indiana towns will change over the next

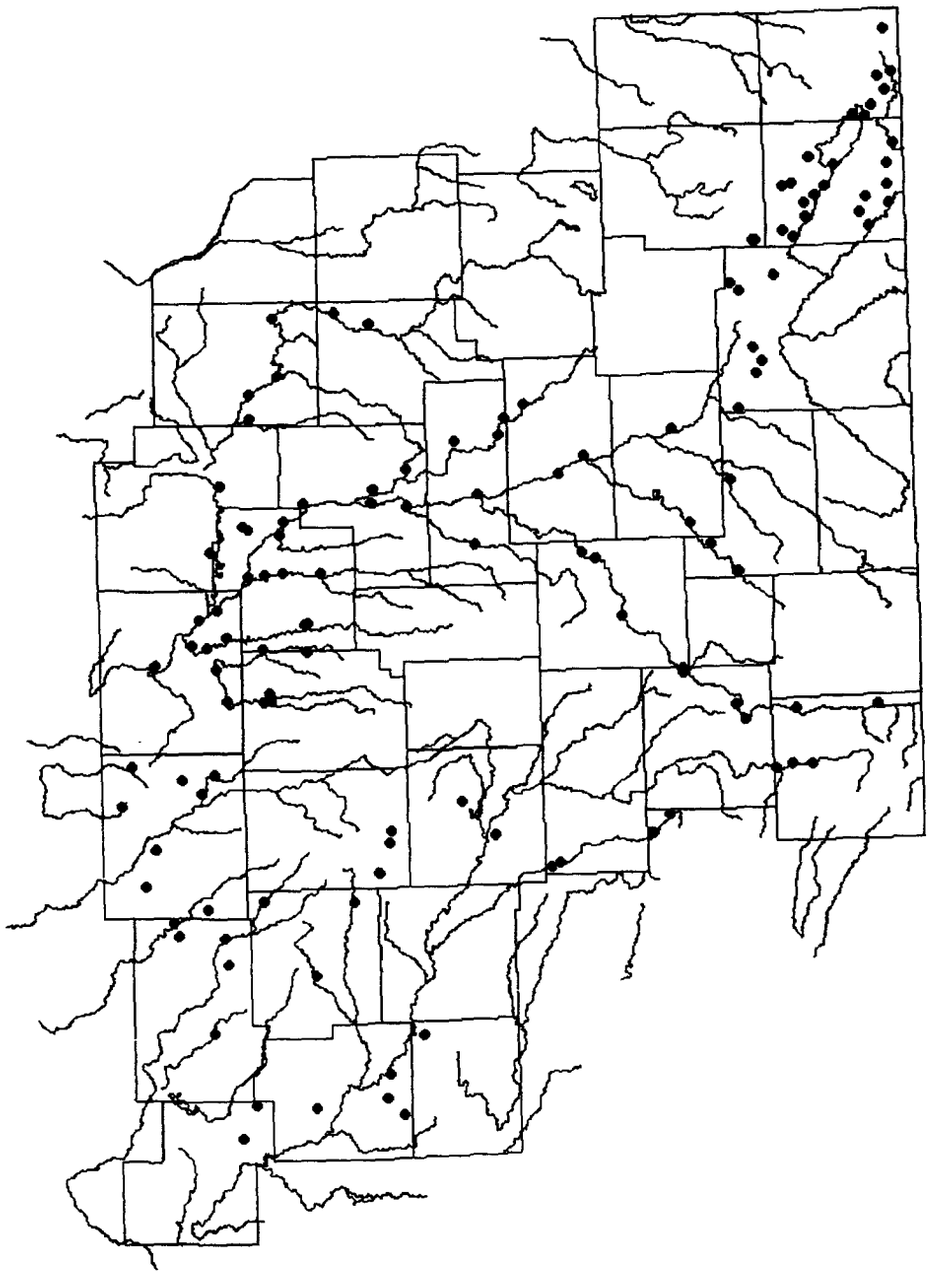

Figure 4. Eastern Corn Belt Plain indicating the location of sampled locations during 1991 to 1994.

century. All sites were evaluated based on drainage area, since this provides a reliable quantification (Hughes *et al.* 1986) of stream size. As drainage area increases fewer locations are available for comparative analysis.

Habitat

The diversity of habitats sampled has a major effect on data collection. A "representative" sample always requires that the entire range of riffle, run, pool, and extra-channel habitat be sampled, especially when large rivers are surveyed. Atypical samples result when unrepresentative habitats are sampled adjacent to the sampling site. Species richness near bridges or near the mouths of tributaries entering large rivers, lakes, or reservoirs are more likely to be characteristic of large-order habitats than the one under consideration (Fausch *et al.* 1984).

A general site description of each established sampling location was conducted using the field observation procedure of Ohio EPA (1989) and Rankin (1989). The Qualitative Habitat Evaluation Index (QHEI) takes into account important attributes of the habitat that increases heterogeneity. Scoring incorporates information on substrate composition, instream cover, channel morphology, riparian zone and bank erosion, and pool and riffle quality. Physical/chemical parameters were recorded for each sample site to assist in assessing the biological data further: dissolved oxygen, pH, temperature, and specific conductivity. Equipment utilized for physical water quality analysis was a Hydrolab SVR2-SU meter following the specifications of the manufacturer.

Community Analysis

Sample Considerations

Only one electrofishing gear type is needed at each location to collect a representative sample (Jung and Libosvarsky 1965; Ohio EPA 1989). A T&J pulsed-DC generator capable of 300 volt output, 1750 watts was mounted in a Coleman Sport-canoe, floated in a Sport-Yak, or attached to a long-line (see Ohio EPA 1989 or USEPA 1988 for discussion of gear). We collected by wading in shallow riffles and runs, and floated through pools and unwadeable habitat. Sampling included both shorelines in streams > 5 m or followed a serpentine pattern on both shores for streams < 5 m.

All fish encountered were collected at each site. Adult and juvenile specimens from each stream reach were identified to species utilizing the taxonomic keys of Gerking (1955), Trautman (1981), and Becker (1983). Cyprinid taxonomy follows Mayden (1989), changes in species nomenclature are listed in Appendix C for comparability with previous investigations. The young-of-the-year fish less than 20 mm in length are not included in Index of Biotic Integrity or composite totals analysis. Early life stages exhibit high initial mortality (Simon 1989) and are difficult to collect with gear designed for larger fish (Angermeier and Karr 1986). Collection of fish from this category will be retained for possible future use in State water monitoring programs (e.g. ichthyoplankton index (I^2)). Specimens greater than 20 mm TL are easily collected using our gear. Juvenile specimen survival at lengths > 20 mm TL also show many species begin to function in distinct trophic guilds and reflect mature species attributes.

Many different study designs can be employed to assimilate a reference

database. Two broad categories of random and nonrandom designs can enable sampling localities to be targeted for specific habitat types or provide a representative picture of the area under consideration. We used a nonrandom study design since our intentions were to avoid known point and non-point sources of pollution.

An additional consideration for choosing a non-random design includes spatial coverage. Numerous studies (Ohio EPA, 1989) have utilized a reference site approach that compares the very best an area has to offer against typical or representative portions of the region. Additional study is needed to evaluate site variation and seasonal trends causing sites to have to be repeat sampled. Ohio has had a significant advantage in determining where "least impacted" or reference sites exist because of the extensive work of Trautman (1981), and other ichthyologists before him. Unfortunately, the historic record for Indiana begins in the late 1800's and ends at approxiamtely 1945 with the published work of Shelby Gerking. Little sampling of the fish community of Indiana has been completed since this time. Based on information presented in the National 305(b) report to Congress, Indiana had less than 2% of the surface waters assessed prior to 1990. We initiated this project to determine where these "least impacted" sites occurred and assimilated a database to address immediate data needs for biocriteria development. We suggest that the criteria presented in this document is a "first attempt" to evaluate Indiana surface waters.

During 1991-1994, drought conditions prevailed for the streams and inland rivers of the Eastern Corn Belt Plain in each of the respective areas surveyed. Further research is needed to evaluate the response of the criteria under differing water cycles.

The length of stream reach sampled is an important consideration. Karr *et al.* (1986) recommended in larger streams to select several contiguous riffle-pool sequences rather than relying on a standard length. When electrofishing equipment was employed in larger rivers (i.e. > 1,000 mi^2), samples were taken in units of 0.5 to 1.0 km (Gammon *et al.* 1981). The length of the sample reach was long enough to include all major habitat types. Distances of 11 to 15 stream widths were generally adequate to sample two cycles of habitat (Leopold *et al.* 1964). Ohio EPA (1989) suggested that after 150-200 m of stream length no significant increases in the IBI are observed, however species richness may still increase until 250-300 m. The additional increase in effort is not justified by the assessment capability of the index so the minimum distance of 15 times the mean stream width was adopted. Additional site information (e.g. photographs; latitude and longitude) were recorded on the data sheet.

Selecting the appropriate time of year for sampling is critical. Karr *et al.* (1986) found that periods of low-to moderate stream flow are preferred and the relatively variable flow conditions of early spring and late autumn/winter should be avoided. Species richness tends to be higher later in summer due to the presence of young-of-the-year of rare species, but this can be avoided if data analysis does not incorporate young-of-the-year species. Samples of limited area may be less variable in early summer than comparable samples taken later in the year. Each site was sampled for a single pass on both shorelines for nonwadeable locations.

Sample Site Selection

Fish sample sites were selected based upon several factors:

1) Choosing stream reaches not affected by point source dischargers that were typical of the region under study;
2) Stream use issues (i.e. municipal treatment works, non-point source, nutrient reduction);
3) Location of physical stream features (e.g. dams, changes in geology, changes in stream order, presence of stream confluence, etc.);
4) Location of non-point sources of pollution (e.g. urban areas or obvious farm runoff);
5) Variations in habitat suitability for fish;
6) Atypical habitat not representative of River reach or basin.

Whenever possible, sites were located upstream from pollution sources and adjacent tributaries (Gammon 1973). Stations were selected to include natural areas, parks (Federal, State, County, and Local), exceptional designated streams, and from historical sampling locations whenever available.

When non-impacted areas were not present, "least impacted" areas were selected based on the above criteria. Sites were chosen that indicated recovery from channelization or potential non-point source areas, and had a suitable riparian buffer on the shoreline. When a series of point source dischargers were located on a river, every effort was made to sample upstream of the discharger or to search for areas of recovery between dischargers (Krumholz 1946).

When impoundments or other physical habitat alterations had been imposed on a river, sampling was conducted in the tailwaters of a dam (area immediately downstream). Tailwaters possess the greatest resemblance of the lotic habitat. The serial discontinuity concepts of Stanford *et al.* (1988) predicts that the thermal character of a stream below a dam will be "reset" toward that typical of the stream reaches above the dam. In areas where sampling could not be accomplished downstream of the physical structure due to lack of access, stream tributary segments were located upstream of the dam away from the immediate influence of the pooled portion. Likewise, bridges were sampled on the upstream side, away from the immediate vicinity of the structure and latent bridge construction effects. If downstream sampling was conducted because of better habitat considerations, sampling was terminated at least 50 m downstream of the bridge.

Fish from each location were identified to species and enumerated. Smaller and more difficult to identify taxa were preserved for later examination and identification in the laboratory. All fish were examined for the presence of gross external anomalies. Incidence of these anomalies was defined as the presence of externally visible morphological anomalies (i.e. deformities, erosion, lesions/ulcers). Specific anomalies include: anchor worms; leeches; pugheadedness; fin rot; Aeromonas (causes ulcers, lesions, and skin growth, and formation of pus-producing surface lesions accompanied by scale erosion); dropsy (puffy body); swollen eyes; fungus; ich; curved spine; and swollen-bleeding mandible or opercle. Incidence is expressed as percent of anomalous fish among all fish collected. Incidence of occurrence was computed for each species at each station.

Hybrid species encountered in the field (e.g. hybrid centrarchids, cyprinids) were recorded on the data sheet, and when possible, potential parental combinations recorded.

Table 1. Attributes of Index of Biotic Integrity (IBI) classification, total IBI scores, and integrity classes from Karr *et al.* (1986).

Total IBI score	Integrity Class	Attributes
58-60	Excellent	Comparable to the best situation without human disturbance; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with a full array of age (size) classes; balance trophic structure.
48-52	Good	Species richness somewhat below expectations, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundances or size distributions; trophic structure shows some signs of stress.
40-44	Fair	Signs of additional deterioration include loss of intolerant forms, fewer species, highly skewed trophic structure (e.g. increasing frequency of omnivores and other tolerant species); older age classes of top predators may be rare.
28-34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.
12-22	Very Poor	Few fish present, mostly introduced or tolerant forms; hybrids common; disease, parasites, fin damage, and other anomalies regular.
0	No Fish	Repeated sampling finds no fish.

Index of Biotic Integrity

The ambient environmental condition was evaluated using the Index of Biotic Integrity (Karr 1981; Karr *et al.* 1986). This index relies on multiple parameters (termed "metrics") based on community concepts, to evaluate a complex biotic system. It incorporates professional judgement in a systematic and sound manner, but sets quantitative criteria that enables determination of a continuum between very poor and excellent based on species richness and composition, trophic and reproductive constituents, and fish abundance and condition. The twelve original Index of Biotic Integrity metrics reflect insights from several perspectives and cumulatively are responsive to changes of relatively small magnitude, as well as broad ranges of environmental degradation.

Since the metrics are differentially sensitive to various perturbations (e.g. siltation or toxic chemicals), as well as various degrees or levels of change within the range of integrity, conditions at a site can be determined with considerable accuracy. The interpretation of the index scoring is provided in six narrative

Table 2. Index of Biotic Integrity metrics used to evaluate headwater stream (≤20 miles² drainage area) sites in the Eastern Corn Belt Plain.

Metric Category	Metric	Scoring Classification 5	3	1
Species Composition	Total Number of Species	Varies with drainage area (Fig. 5)		
	Number Darter/Madtom/Sculpin Spp	Varies with drainage area (Fig. 6)		
	% Headwater Species	Varies with drainage area (Fig. 7)		
	Number of Minnow Species	Varies with drainage area (Fig. 9)		
	Number Sensitive Species	Varies with drainage area (Fig. 11)		
	% Tolerant Individuals	<25%	25-50%	>50% (Fig.12)
Trophic Composition	% Omnivore Individuals[1] ≤ 20 square miles	<25%	25-50%	>50% (Fig. 13)
	% Insectivores Individuals[1] ≤ 20 square miles	>50%	25-50%	<25 (Fig. 14)
	% Pioneer Species Individuals[1]	< 25%	25-50%	>50% (Fig. 15)
Fish Condition	Catch per Unit Effort[1]	Varies with drainage area (Fig. 17)		
	% Simple Lithophil Individuals[1]	>40%	20-40%	<20% (Fig. 18)
	% DELT Individuals[1]	<0.1%	0.1-1.3%	>1.3% (Fig. 19)

[1] Special scoring procedures are required when less than 50 individual fish are collected.

categories that have been tested in the midwestern United States (Karr 1981; Table 1).

Several of the metrics are drainage size dependent and require calibration to determine numerical scores (Tables 2-3). Drainage size effects were determined by evaluating trends in species or proportions of individuals with increasing (log adjusted) drainage area. The ecoregion approach developed by USEPA-Corvallis, Oregon, was utilized to compare "least impacted" zones within the region (Omernik 1987). Ohio EPA (1987), modified several of the original 12 metrics in order to make them more sensitive to environmental effects based on their experiences in Ohio and to account for stream and river size, faunal differences, and sampling gear selectivity. The current study utilizes the experiences of the Ohio EPA and Karr *et al.* (1986) in developing an IBI for Indiana streams and rivers.

Table 3. Index of Biotic Integrity metrics used to evaluate wadable river (>20 - <1,000 miles^2 drainage area) sites in the Eastern Corn Belt Plain.

Metric Category	Metric	Scoring Classification 5	3	1
Species Composition	Total Number of Species	Varies with drainage area (Fig. 5)		
	Number of Darter Species	Varies with drainage area (Fig. 6)		
	Number of Sunfish Species	> 3	2-3	< 2 (Fig 8)
	Number of Sucker Species	>3	2-3	<2 (Fig. 10)
	Number of Sensitive Species	Varies with drainage area (Fig. 11)		
	% Tolerant Individuals	<25%	25-50%	>50% (Fig. 12)
Trophic Composition	% Omnivore[1] Individuals < 1,000 square miles	<25%	25-50%	>50% (Fig. 13)
	% Insectivores[1] Individuals < 1,000 square miles	>50%	25-50%	<25% (Fig. 14)
	% Carnivores[1] Individuals	>10-25%	25-50% & 5-10%	>50% (Fig. 16) & <5%
Fish Condition	Catch per Unit Effort	Varies with drainage area (Fig. 17)		
	% Simple Lithophils Individuals	>40%	20-40%	<20% (Fig. 18)
	% DELT [1] Individuals	<0.1%	0.1-1.3%	>1.3% (Fig. 19)

[1] Special scoring procedures are required when less than 100 individual fish are collected.

Metrics

In general, the metrics utilized for the current study are those developed by the State of Ohio (Ohio EPA 1989) for analysis of surface water designated use-attainment. This includes modification of several of the original Index of Biotic Integrity metrics as proposed by Karr (1981).

Although the methodology and application of the ecoregional expectations are similar in approach to Ohio and much of the information below is taken directly from the Ohio document (Ohio EPA 1989), a significant difference exists between the Indiana and Ohio reference conditions. This difference exists in how the metric expectations are developed. In Ohio, the ecoregional reference stations were

combined into a single data set for the entire State, and later modifications were developed for a single ecoregion.

In Indiana, "least impacted" conditions are being developed on a regional basis, with *a priori* recognition of basin differences within ecoregion, based on the natural division classification of Homoya *et al.* (1985). Further evaluation at the completion of the study will determine if differential metric treatment is warranted for basin specific or larger scale criteria development.

The Index of Biotic Integrity is sensitive to differences in collection effort and gear type. In order to account for these inherent biases, separate expectations are developed for each of the two stream classification types utilized in the current study. Headwater stream sites (< 20 miles^2) were primarily sampled for 50-100 m using wading techniques. These sites were sampled using a long-line configuration usually off bridges, while larger wadable rivers (> 20-1000 miles^2) were sampled using the sport-yak configuration. This technique requires a sampling distance of 100-300 m and wading in all available habitats.

Below is an explanation of each of the twelve metrics utilized for the calibration of the Indiana Index of Biotic Integrity for the Eastern Corn Belt Plain. Due to inherent differences at approximately 20 miles^2 drainage area, different metrics were necessary to evaluate both headwater (<20 miles^2 drainage area) and wadable rivers (>20-1000 miles^2 drainage area). No differences were observed between the subbasins for most metrics. This was anticipated due to the limitations of the gear type chosen and that large rivers tend to be integrators of the upstream drainage area. Maximum species richness lines were drawn following the procedure of Fausch *et al.* (1984) and Ohio EPA (1987). Scatter plot data diagrams of individual metrics were first evaluated for basin specific patterns. The trisection method was used to depict the maximum species richness lines. This requires the uppermost line to be drawn so that 95% of the data area lies beneath. The other two lines are then drawn so the remainder of the area beneath the 95th percentile line is divided into three equivalent areas. In situations where no significant deviation in relationship was observed within the three basin segments, the segments were pooled to reflect an ecoregional consensus. Likewise, if no relationship with increasing drainage area was observed, the maximum species richness lines either leveled off at the point where no additional increases were exhibited or horizontal plots were delineated indicating no increase with drainage area.

Differentiation between headwater and wadable stream and river sites are indicated on the graphs by a vertical dashed line on the appropriate metrics. This relationship was determined by searching for bimodal patterns in the basin specific data set plots. The tails of distribution of the data are not significant. However the point where the data differentiates into two distinct peaks suggest that the transition between headwater and wadable streams is at 20 miles^2 (% headwater taxa) and between wadable and large rivers at 1,000 miles^2 (% large river individuals). Finally, a comparison was made between criteria established for the ecoregion between Ohio, Michigan, and Indiana.

Metric 1. Total Number of Fish Species (Headwater and Wadable Sites)

Impetus

This metric is utilized for all of the stream classification types used for calibrating the Indiana Index of Biotic Integrity. Unlike the Ohio metric, exotic species are included in the total number of taxa. The premise behind this metric is based on the observation that the number of fish species increases directly with environmental complexity and quality of the aquatic resource (Karr 1981; Karr *et al.* 1986). Although the number of exotic or introduced species may be indicative of a loss of integrity (Karr *et al.* 1986; Ohio EPA 1989), the differences between lower levels of biotic integrity resolution may be due to colonization of habitats by pioneer or tolerant taxa that tend to incorporate exotic species.

This single metric is considered to be one of the most powerful metrics in resolving water resource issues since a direct correlation exists between high quality resources and the numbers of species for warmwater assemblages (Ohio EPA 1987; Davis and Lubin 1989; Plafkin *et al.* 1989; Simon, 1991). As total number of species increases, species become more specialized and have narrower niche breadths, numerous higher level interactions occur and presumably enable greater efficiency in resource utilization. The delimitation between headwater and wadable Indiana streams was made primarily on the data from this metric. Headwater and wadable streams are differentiated at 20 miles^2 drainage area.

Headwater and Wading Sites

The number of species is strongly correlated with drainage area at headwater, wadable stream, and river sites up to ca. 1,000 miles^2. Determining the Index of Biotic Integrity scoring criteria for this metric did not require the recognition of watersheds. Comparison of maximum species richness lines for the appropriate basin and drainage area did not reveal any significant differences between ecoregion or subwatershed (Fig. 5; headwater and wading sites).

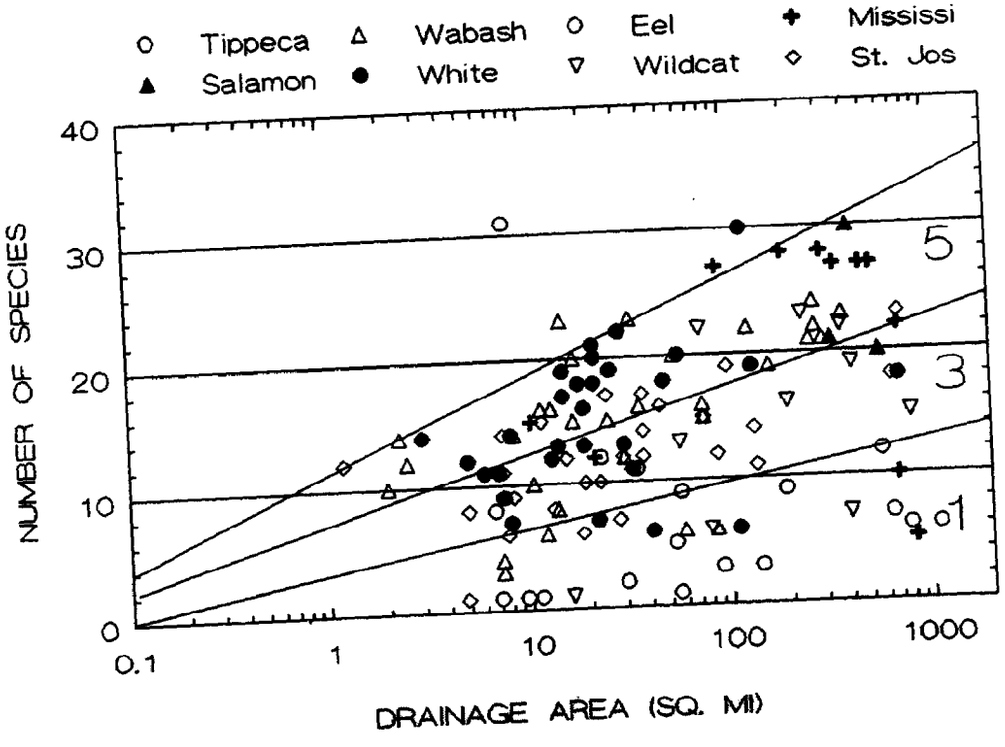

Figure 5. Maximum species richness lines for determining trends in total number of species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 2. Number of Darter/Madtom/Sculpin Species (Headwater ≤ 20 miles^2) Number of Darter Species (Wadable Rivers > 20- ≤1,000 miles^2)

Impetus

Karr *et al.* (1986) indicated that the presence of members of the tribe Etheostomatini are indicative of a quality resource. Darters require high dissolved oxygen concentrations, are intolerant of toxicants and siltation, and thrive over clean substrates.

Life history information for all of the 28 Indiana species indicates darters are insectivorous, habitat specialists, and sensitive to physical and chemical environmental disturbances (Page 1983; Kuehne and Barbour 1983). Darters are excellent indicators of a quality resource, and are generally found in riffle habitats.

Headwater and Wadable Streams and Rivers

The darters include the genera: Ammocrypta, Crystallaria, Etheostoma, and Percina. Of the 28 species recorded from Indiana, six are commonly found throughout the State and are not restricted to a particular stream size (Gerking 1945). Thirteen of these 28 species are confined to the Ohio River basin; none of the species are restricted to the Mississippi River basin; and a single species occurs only in the Great Lakes drainage.

For sites having drainage areas less than 20 miles^2, this metric also includes members of the family Cottidae and Ictaluridae (madtoms; genus Noturus)(Table 4). The sculpins and madtoms are benthic insectivores and functionally occupy the same type of niche as darters. Their inclusion enables a greater degree of sensitivity in evaluating streams that naturally have significantly fewer darter species. By adding madtoms and sculpins this metric does not asymptote with increased drainage area for headwater sites (<20 miles^2)(Fig. 6). The number of darter, madtom and sculpin species was found to increase with increasing drainage area for each of the eight watersheds. No differences in watershed expectations were observed between sites of the Eastern Corn Belt Plain.

Wadable River Sites

Madtoms and sculpins are more difficult to collect with increasing drainage area, since madtoms are typically nocturnal in their habits. The expected number of sculpin and madtom species declines in the Eastern Corn Belt Plain with increasing drainage area. Thus, only the number of darter species are included in cumulative scoring for drainage areas greater than 20 miles^2 due to sampling bias and the patchy distribution of sculpins and madtoms in wadeable rivers (>20-1000 mi^2). This conforms with the original IBI and is consistent with Karr's original intentions (Karr 1981).

Table 4. The distributional characteristics of Indiana darter (Etheostomatini), madtom (Noturus), and sculpin (Cottus) species.

Species	Distribution in Indiana Drainages			
	Statewide	Ohio River	Great Lakes	Mississippi River
Ammocrypta pellucida	X			
A. clara		X		
Crystallaria asprella		X		
Etheostoma asprigene	X			
E. blennioides	X			
E. caeruleum	X			
E. camurum		X		
E. chlorosoma	X			
E. exile			X	
E. flabellare	X			
E. gracile		X		
E. histrio		X		
E. maculatum		X		
E. microperca[1]	X			
E. nigrum	X			
E. spectabile		X		X
E. squamiceps		X		
E. tippecanoe		X		
E. variatum		X		
E. zonale		X		X
Percina caprodes	X			
P. copelandi		X		
P. evides		X		
P. maculata	X			
P. phoxocephala			X	X
P. sciera		X		
P. shumardi		X		X
P. vigil		X		
Noturus eleutherus		X		
N. flavus	X			
N. gyrinus	X			
N. exilis		X		
N. miurus		X		X
N. nocturnus		X		
N. stigmosus	X			
Cottus bairdi	X			
C. carolinae		X		
C. cognatus			X	

[1] Restricted to northern portions of these drainages.

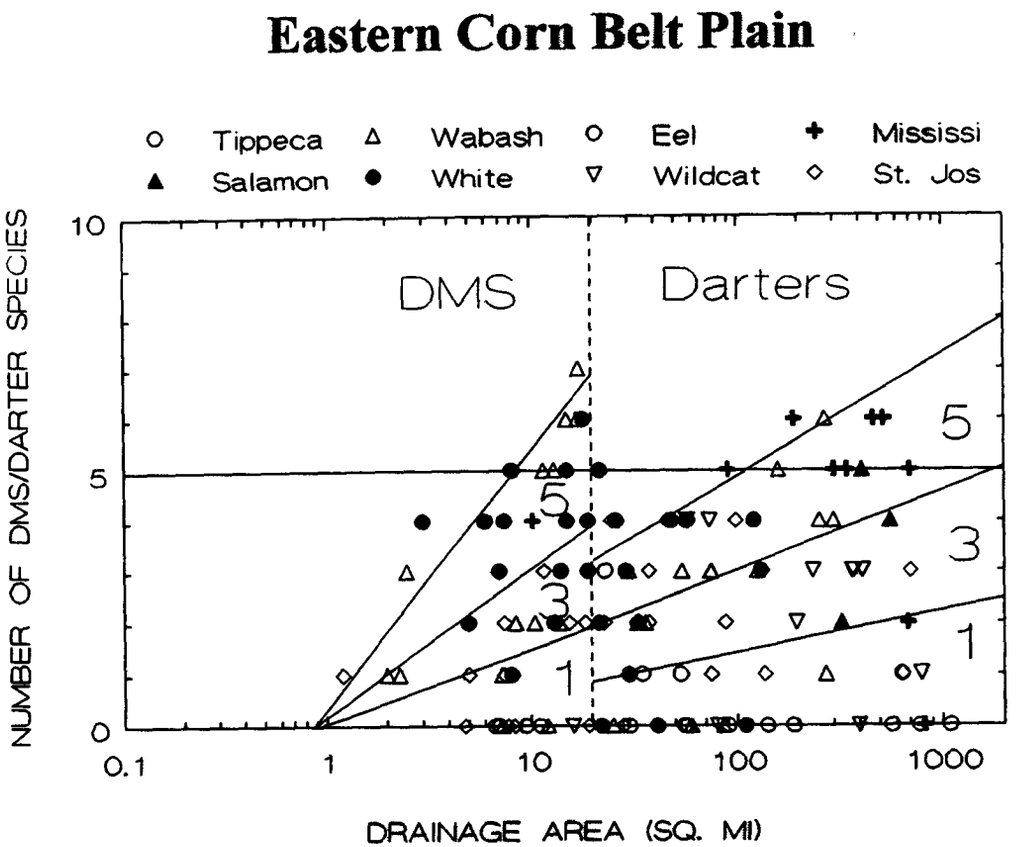

Figure 6. Maximum species richness lines for determining trends in number of darter/madtom/sculpin species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 3. Percent Individuals as Headwater Species (Headwater ≤20 miles^2) Number of Sunfish Species (Wadable Sites >20 - ≤1,000 miles^2)

Impetus

This metric followed Karr (1981) and Karr *et al.* (1986) by including the number of sunfish species (family Centrarchidae) and excluding the black basses (Micropterus spp). Unlike the Ohio metric, the redear sunfish Lepomis microlophus is included because it is native to Indiana (Table 6). Hybrid sunfish are not included in this metric following Ohio EPA (1989).

This metric is an important measure of pool habitat quality. It includes all members of the sunfish genera Ambloplites (rock bass), Centrarchus (round sunfish), Lepomis (sunfish), and Pomoxis (crappies), as well as, the ecological equivalent Elassomatidae (Elassoma zonatum). Sunfish normally occupy slower moving water that may act as "sinks" for the accumulation of toxins and siltation. This metric measures degradation of rock substrates (i.e. gravel and boulder) and instream cover (Pflieger 1975; Trautman 1981), and the associated aquatic macroinvertebrate community that are an important food resource for sunfish (Forbes and Richardson 1920; Becker 1983). Sunfish are important components of the aquatic community since they are wide ranging, and distributed in most streams and rivers of Indiana. They are also very susceptible to sampling using electrofishing gear. Karr *et al.* (1986) found sunfish to occupy the intermediate to upper ends of sensitivity of the index of biotic integrity (IBI).

Headwater Streams

Pool habitat is a limiting factor in many headwater streams. This prohibits sunfish colonization because of their deep-bodied morphology. I replaced the number of sunfish species with the proportion of headwater species at sites with drainage areas less than 20 miles^2 (Ohio EPA, 1987). Nine headwater species were defined by Ohio EPA (1987) and their presence indicates permanent habitat with low environmental stress (Table 5). The presence of headwater species does not show a trend with increased drainage area (Fig. 7).

Table 5. List of Indiana fish species considered to be headwater species for evaluating permanent habitat in streams (Smith, 1971).

Common Name	Scientific Name
Least brook lamprey	Lampetra aepyptera
American brook lamprey	L. appendix
Redside dace	Clinostomus elongatus
Blacknose dace	Rhinichthys atratulus
So Redbelly dace	Phoxinus erythrogaster
Brook stickleback	Culaea inconstans
Fantail darter	Etheostoma flabellare
Mottled sculpin	Cottus bairdi
Banded sculpin	C. cognatus

Wadable Streams and Rivers

Sunfish colonization is limited by the amount of pool habitat in many river

reaches. This metric did not show any difference in scoring based on sub-basin. The number of sunfish species increased with increasing drainage area (Fig. 8).

Table 6. List of Indiana sunfish species for evaluating quality pool habitat.

Common Name	Scientific Name
Rock bass	*Ambloplites rupestris*
Flier	*Centrarchus macropterus*
Green sunfish	*Lepomis cyanellus*
Pumpkinseed	*L. gibbosus*
Warmouth	*L. gulosus*
Orangespotted sunfish	*L. humilis*
Bluegill	*L. macrochirus*
Longear sunfish	*L. megalotis*
Redear sunfish	*L. microlophus*
Spotted sunfish	*L. punctatus*
Bantam sunfish	*L. symmetricus*
White crappie	*Pomoxis annularis*
Black crappie	*P. nigromaculatus*
Banded pygmy sunfish	*Elassoma zonatum*

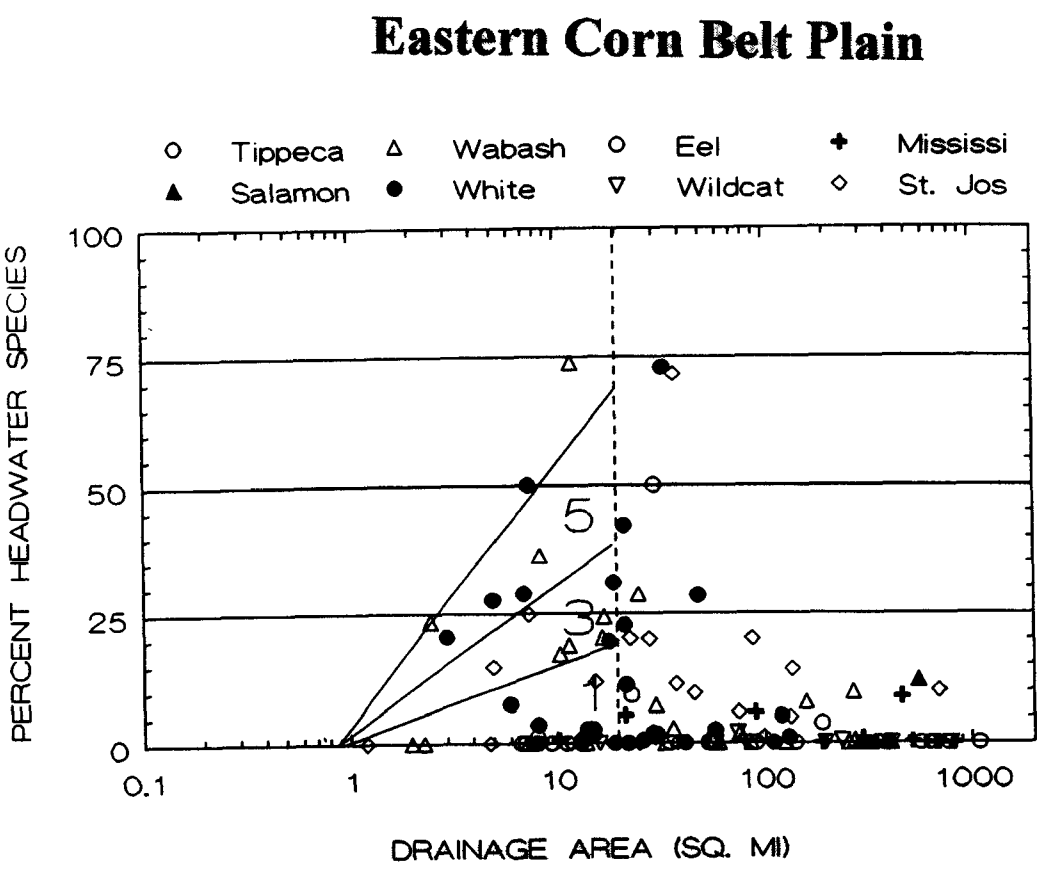

Figure 7. Maximum species richness lines for determining trends in the proportion of headwater species with increasing drainage area for the Eastern Corn Belt Plain.

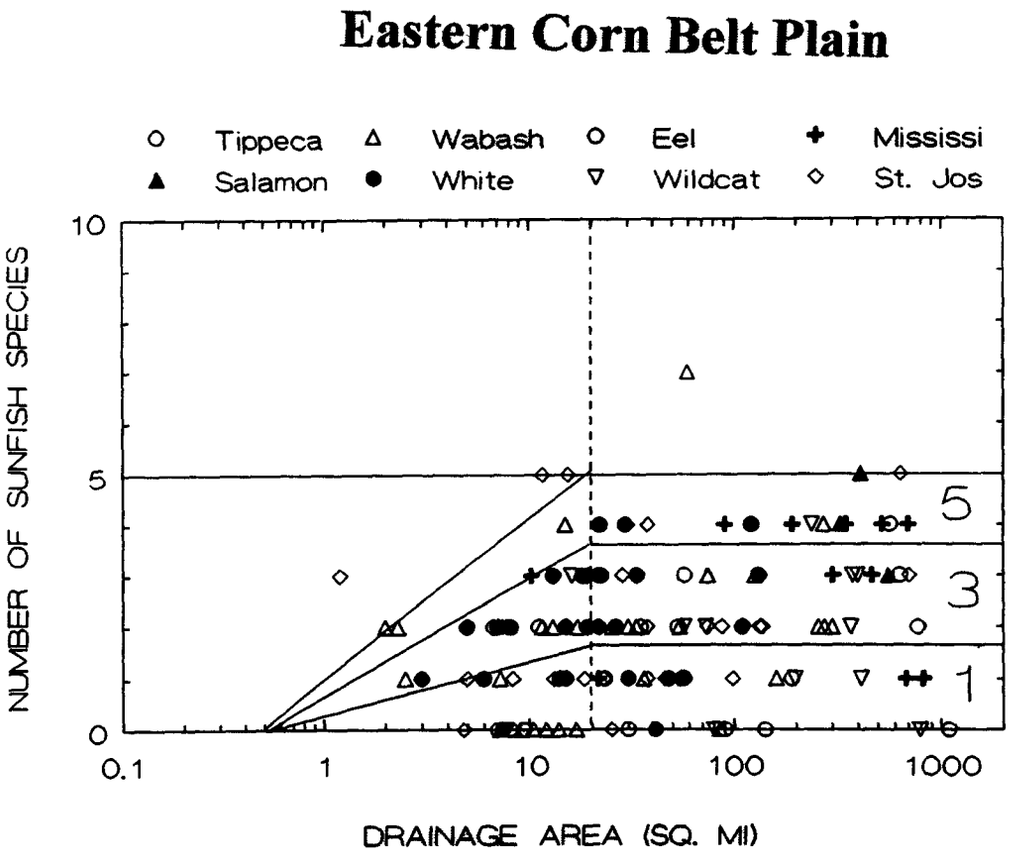

Figure 8. Maximum species richness lines for determining trends in number of sunfish species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 4. Number of Minnow Species (Headwater Sites < 20 miles^2) Number of Sucker Species (Wadable Sites (>20-≤ 1000 miles^2)

Impetus

The original Index of Biotic Integrity metrics included the number of sucker species (Karr 1981; Karr *et al.* 1986). Suckers represent a major component of the Indiana fish fauna since their total biomass usually ranks them among the highest biomass contributors in the community. Most sucker species are intolerant to habitat and water quality degradation (Phillips and Underhill 1971; Karr *et al.* 1986; Trautman 1981; Becker 1983) and this results in metric sensitivity at the higher end of environmental quality. Suckers, due to their long life span (10-20 years), provide a long-term assessment of past environmental conditions. Of the 19 species historically found in Indiana, Lagochila lacera is considered extinct, seven species are widely distributed throughout the State (Table 7). Extant sucker genera include: Cycleptus, Carpiodes, Catostomus, Erimyzon, Hypentelium, Ictiobus, Minytrema, and Moxostoma.

Headwater Sites

The number of minnow species is substituted for the number of sucker species in headwater sites (Fig. 9). The number of sucker species decreases rapidly with declining drainage area (Fig. 10). While few different sucker species have been observed at locations with drainage areas less than 20 miles^2. The number of minnow species generally correlates with increased environmental quality. This metric includes members able to represent a wide variety of biological integrity. Species such as the hornyhead chub (Nocomis biguttatus) and rosyface shiner (Notropis rubellus) are examples of minnow species that can occur in high quality headwater streams. Minnow species represent both ends of the biological integrity continuum. A direct relationship exists between increasing number of minnow species and increasing drainage area (Fig. 9).

Wadable River Sites

The number of sucker species, with the exception of Catostomus commersoni, Ictiobus and Carpiodes, represent sensitive species intolerant to thermal, siltation, and toxins stresses. The redhorses are particularly important indicator organisms in rivers. The most sensitive suckers include members of the genera Cycleptus, Hypentelium, Moxostoma, Minytrema, and Erimyzon. These species are effectively sampled with electrofishing gear and comprise a significant component of riverine fish faunas. Their feeding and reproductive requirements are sensitive to turbidity and marginal to poor water quality. The number of species were not significantly different among the four watersheds (Fig. 10).

Table 7. Distribution characteristics of Indiana sucker species (family Catostomidae).

Species	Statewide	Large Rivers	Rare Taxa
Cycleptus elongatus		X	X
Carpiodes carpio	X	X	
C. cyprinus	X		
C. velifer		X	X
Catostomus catostomus			X
Catostomus commersoni	X		
Erimyzon oblongus	X		
E. sucetta			X
Hypentelium nigricans		X	X
Ictiobus bubalus	X	X	
I. cyprinellus		X	X
I. niger			X
Lagochila lacera	EXTINCT		
Minytrema melanops	X		
Moxostoma anisurum	X	X	
M. carinatum		X	X
M. duquesnei	X	X	
M. erythrurum	X	X	
M. macrolepidotum	X	X	
M. valenciennesi		X	X

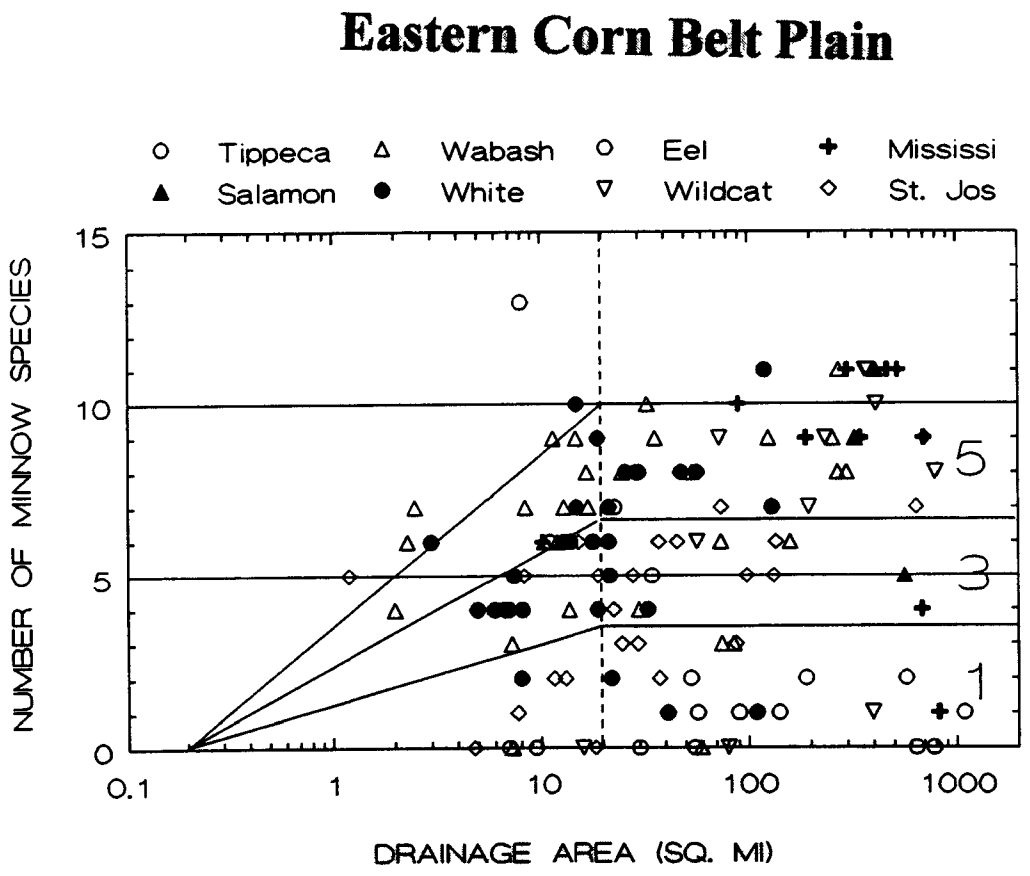

Figure 9. Maximum species richness lines for determining trends in number of minnow species with increasing drainage area for the Eastern Corn Belt Plain.

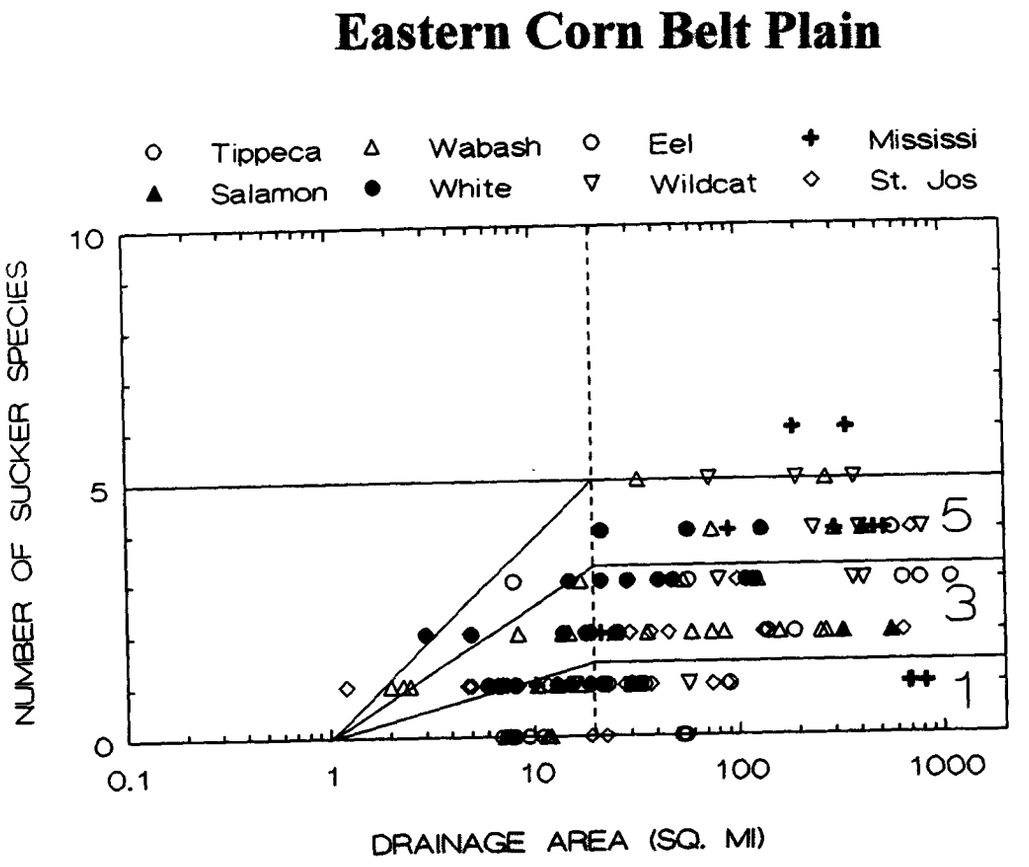

Figure 10. Maximum species richness lines for determining trends in number of sucker species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 5. Number of Sensitive Species (Headwater and Wadable Sites)

Impetus

The number of sensitive species metric distinguishes between streams of highest quality. Designation of too many species as intolerant will prevent this metric from discriminating among the highest quality resources. However, Karr (1981) and Karr *et al.* (1986) calibrated expectations based on watershed scales and not regional or state scales. Only species that are highly intolerant to a variety of disturbances were included in this metric so it will respond to diverse types of perturbations (Table 8; see Appendix A for species-specific information).
The number of intolerant taxa (Ohio EPA 1989) is a modification of the original index as developed by Karr (1981). The intolerant species metric is not synonymous with the sensitive species metric. The metric includes moderately intolerant species when sampling at headwater sites. This combination is called sensitive species since few intolerant taxa are expected. The moderately intolerant species meet most of the established criteria of Ohio EPA (1987). An absence of these species would indicate a severe anthropogenic stress or loss of habitat.

The criteria for determining intolerance is based on the numerical and graphical analysis of Ohio's regional data base, Gerking's (1945) documentation of historical changes in the distribution of Indiana species, and supplemental information from regional ichthyofaunal texts (Pflieger 1975; Smith 1979; Trautman 1981; Becker 1983; Burr and Warren 1986). Intolerant taxa are those that decline with decreasing environmental quality and disappear, as viable populations, when the aquatic environment degrades to the "fair" category (Karr *et al.* 1986). The intolerant species list was divided into three categories, all are included in this metric for scoring:

1). common intolerant species (I): species that are intolerant, but are widely distributed in the best streams in Indiana;

2). uncommon or geographically restricted species (S): species that are infrequently captured or that have restricted ranges;

3). rare or possibly extirpated species (R):intolerant species that are rarely captured or that lack recent status data.

Commonly occurring intolerant species should comprise 5-10% of the common species in Indiana, however represent 35-40% of the entire statewide list. This was a recommended guideline of Karr (1981) and Karr *et al.* (1986). Although the addition of species designated as uncommon or rare sensitive species (categories 2 and 3), inflates the number of intolerant species above the 10% guideline, nowhere in the State do all of the species coexist. In order to evaluate streams in the headwater and wadable site categories, only the sensitive species metric will be used until further resolution is possible with additional ecoregion sampling.

Headwater and Wadable Streams and Rivers

The number of sensitive species increases with drainage area among headwater and wading sites (Fig. 11). Intolerant taxa are scarce in headwaters of the ecoregion and increase at larger wading sites.

Table 8. List of Indiana fish species considered to be sensitive to a wide variety of environmental disturbances including water quality and habitat degradation.

Common Name	Scientific Name	Common Name	Scientific Name
Ohio lamprey	Ichthyomyzon bdellium	Mountain madtom	Noturus eleutherus
Northern brk lamprey	I. fossor	Slender madtom	N. exilis
Least brook lamprey	Lampetra aepyptera	Stonecat	N. flavus
American brk lamprey	L. appendix	Brindled madtom	N. miurus
		Freckled madtom	N. nocturnus
Paddlefish	Polyodon spathula	Northern madtom	N. stigmosus
Goldeye	Hiodon alosoides	Southern cavefish	Amblyopsis spelaea
Mooneye	H. tergisus	Southern cavefish	I subterraneus
		Northern studfish	Fundulus catenatus
Redside dace	Clinostomus elongatus	Starhead topminnow	E. dispar
Streamline chub	Erimystax dissimilis		
Gravel chub	E. x-punctata	Brook silverside	Labidesthes sicculus
Speckled chub	Extrarius aestivalis		
Bigeye chub	Hybopsis amblops	Rock bass	Ambloplites rupestris
Pallid shiner	H. amnis	Longear sunfish	Lepomis megalotis
Rosefin shiner	Lythrurus ardens	Smallmouth bass	Micropterus dolomieui
Hornyhead chub	Nocomis biguttatus		
River chub	N. micropogon	Western sand darter	Ammocrypta clara
Pugnose shiner	Notropis anogenus	Eastern sand darter	A. pellucida
Popeye shiner	N. ariommus	Greenside darter	E blennioides
Bigeye shiner	N. boops	Rainbow darter	E. caeruleum
Ironcolor shiner	N. chalybaeus	Bluebreast darter	E. camurum
Blackchin shiner	N. heterodon	Harlequin darter	E. histrio
Blacknose shiner	N. heterolepis	Spotted darter	E. maculatum
Sand shiner	N. ludibundis	Spottail darter	E. squamiceps
Silver shiner	N. photogenis	Tippecanoe darter	E. tippecanoe
Rosyface shiner	N. rubellus	Variegate darter	E. variatum
Weed shiner	N. texanus	Banded darter	E. zonale
Mimic shiner	N. volucellus	Logperch	Percina caprodes
Pugnose minnow	Opsopoeodus emiliae	Channel darter	P. copelandi
Longnose dace	Rhinichthys cataractae	Gilt darter	P. evides
Blue sucker	Cycleptus elongatus	Slenderhead darter	P. phoxocephala
Highfin carpsucker	Carpiodes velifer	Dusky darter	P. sciera
Northern hogsucker	Hypentelium nigricans	Saddleback darter	P. vigil
Silver redhorse	Moxostoma anisurum		
River redhorse	M. carinatum		
Black redhorse	M. duquesnei		
Golden redhorse	M. erythurum		
Shorthead redhorse	M. macrolepidotum		
Greater redhorse	M. valenciennesi		

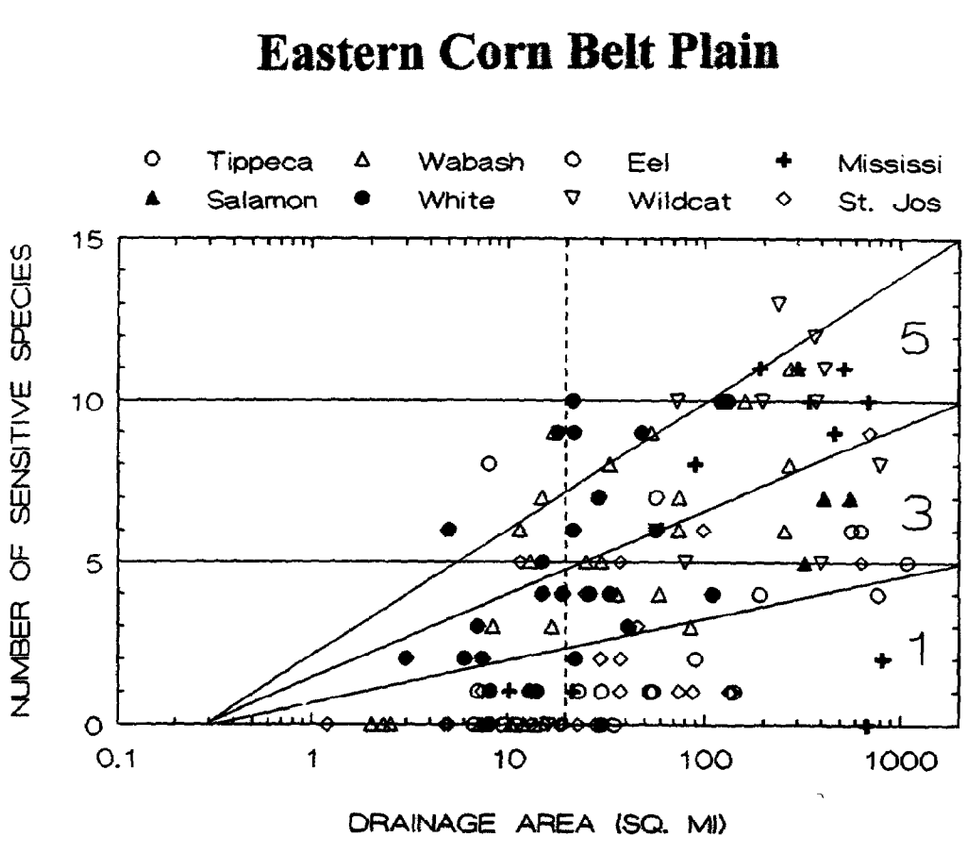

Figure 11. Maximum species richness lines for determining trends in number of sensitive species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 6. Percent Abundance of Tolerant Individuals (Headwater and Wadable Sites)

Impetus

This metric is a modification of the original index metric, the percentage of green sunfish (Karr *et al.* 1986), by Ohio EPA (1989). This metric detects a decline in stream quality from fair to poor categories. The green sunfish, Lepomis cyanellus, is a species that is often present in moderate numbers in many Midwest streams and can become a dominant member of the community in cases of degradation or poor water quality. Competitive advantage in disturbed environments enables the green sunfish to survive and reproduce even under perturbed conditions. Although the green sunfish is widely distributed in the Midwest, it is most commonly collected in headwater streams. This introduces an inherent bias for moderate to large rivers. Karr *et al.* (1986) suggested additional species could be substituted for the green sunfish if they responded in a similar manner. Several species in Indiana meet this criteria of increasing in proportion with increasing degradation of stream quality. This increase in the number of tolerant species increases the sensitivity of this metric for various sized streams and rivers. Since different species have habitat requirements that are correlated with stream size, compositional diversity of the tolerant species metric does not change with drainage area.

Indiana's tolerant species are listed in Table 9. This list is based on a numerical and graphical analysis of Ohio EPA (1989) and checked against Indiana catch data and historical changes in the distribution of fishes throughout Indiana (Gerking 1945). Species listed as tolerant taxa exhibit diverse tolerance to thermal loadings, siltation, habitat degradation, and certain toxins (Gammon 1983; Ohio EPA 1989). Tolerant species were selected based on the following criteria:

1) present at poor or fair sites: Based on our data base of Indiana collections these species are commonly collected at sites ranked either fair or poor.

2) historically increases in abundance: Based on historical collection information (Gerking 1945) these species increase in abundance and have not indicated any reduction in distribution.

3) increased tolerance to degraded conditions: these species increased in community dominance when environmental conditions shifted from good to fair or poor environmental quality.

Headwater and Wadable Streams and Rivers

No relationship was evident for drainage areas (Fig. 12), nor was there any relationship with sub-basin apparent for the Eastern Corn Belt Plain.

Table 9. List of Indiana fish species considered to be highly tolerant to a wide variety of environmental disturbances including water quality and habitat degradation.

Tolerant Species Common Name	Scientific Name
Longnose gar[1]	Lepisosteus osseus
Shortnose gar[1]	L. platostomus
Gizzard shad	Dorosoma cepedianum
Central mudminnow	Umbra limi
Carp	Cyprinus carpio
Goldfish	Carrasius auratus
Red shiner	Cyprinella lutrensis
Golden shiner	Notemigonus crysoleucas
Bluntnose minnow	Pimephales notatus
Fathead minnow	P. promelas
Blacknose dace	Rhinichthys atratulus
Creek chub	Semotilus atromaculatus
River carpsucker[1]	Carpiodes cyprinus
Quillback[1]	C. carpio
Smallmouth buffalo[1]	Ictiobus bubalus
Bigmouth buffalo[1]	I. cyprinellus
White sucker	Catostomus commersoni
Channel catfish[1]	Ictalurus punctatus
Flathead catfish[1]	Pylodictis olivaris
Yellow bullhead	Amieurus natalis
Brown bullhead	A. melas
Banded killifish	Fundulus diaphanus
Freshwater drum[1]	Aplodinotus grunniens
White bass[1]	Morone chrysops
Green sunfish	Lepomis cyanellus

[1] Species indicated are considered tolerant only for drainage areas > 1,000 mi^2

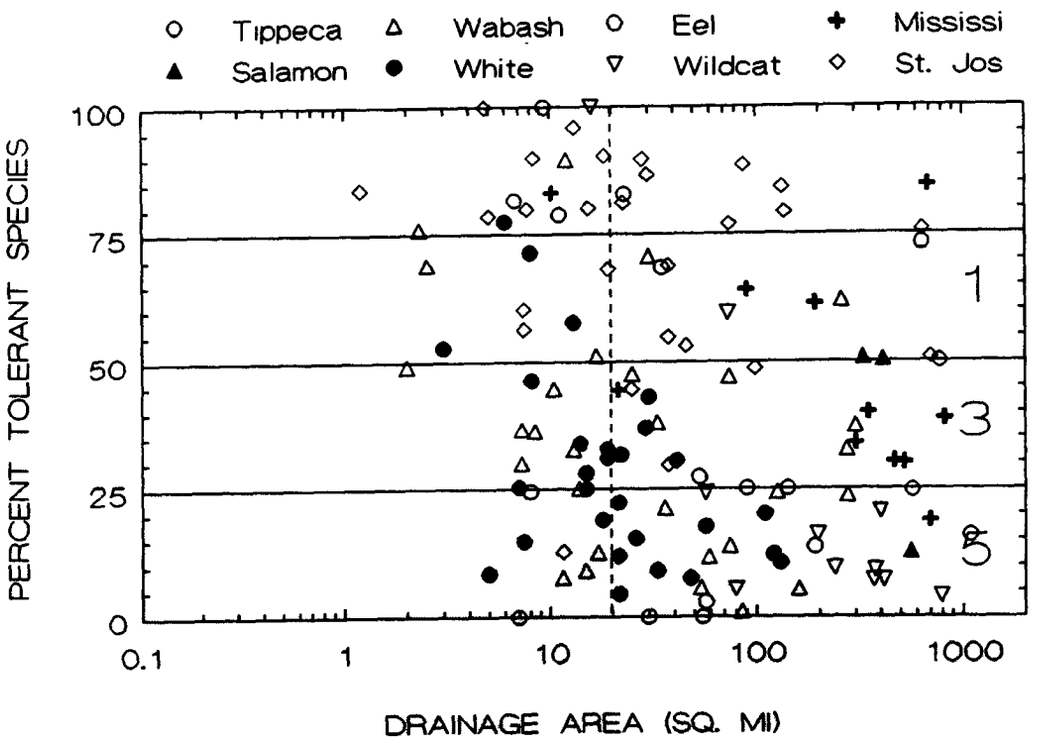

Figure 12. Maximum species richness lines for determining trends in the proportion of tolerant species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 7. Proportion of Omnivores (Headwater and Wadable Rivers)

Impetus

The definition of an omnivore follows that of Karr (1981) and Karr *et al.* (1986), that requires species to consume significant quantities of both plant and animal materials (including detritus) and have the ability (usually indicated by the presence of a long gut and dark peritoneum) to utilize both. Omnivores are species whose diets include at least 25% plant and 25% animal foods. Fishes that do not feed on plants but on a variety of animal material are not considered omnivores. Dominance of omnivores suggests specific components of the food base are less reliable, increasing the success of more opportunistic species. Specialized filter-feeders are not included in this metric after Ohio EPA (1989) since these species are sensitive to environmental degradation, e.g. paddlefish, Polyodon spathula and lamprey ammocoetes, Lampetra and Ichthyomyzon. Facultative species that shift diet due to degraded environmental conditions are also not considered omnivores, e.g. Semotilus atromaculatus and Rhinichthys atratulus. This metric evaluates the intermediate to low categories of environmental quality (Table 10; see Appendix A for species-specific feeding guild classification).

Headwater and Wadable Streams and Rivers

Only those species that consistently feed as omnivores were included in our analysis. These values differ from the omnivore percentages of Karr *et al.* (1986) but resemble Ohio EPA's (1987) classification. No relationship with drainage area was found for headwater or wadable stream and river sites (Fig. 13).

Table 10. List of Indiana fish species considered omnivores.

Common Name	Scientific Name
Gizzard shad	Dorosoma cepedianum
Threadfin shad	D. petenense
Central mudminnow	Umbra limi
Goldfish	Carassius auratus
Grass carp	Ctenopharyngodon idella
Carp	Cyprinus carpio
Cypress minnow	Hybognathus hayi
Miss. silvery minnow	H. nuchalis
Silver carp	Hypopthalmichthys molitrix
Black carp	Mylopharyngodon piceus
Bluntnose minnow	Pimephales notatus
Fathead minnow	P. promelas
Bullhead minnow	P. vigilax
Rudd	Scardinius erythrophthalmus
River carpsucker	Carpiodes carpio
Quillback	C. cyprinus
Highfin carpsucker	C. velifer
White sucker	Catostomus commersoni

The lack of a drainage area pattern is anticipated since degraded habitats are not exclusive to any particular size waterbody.

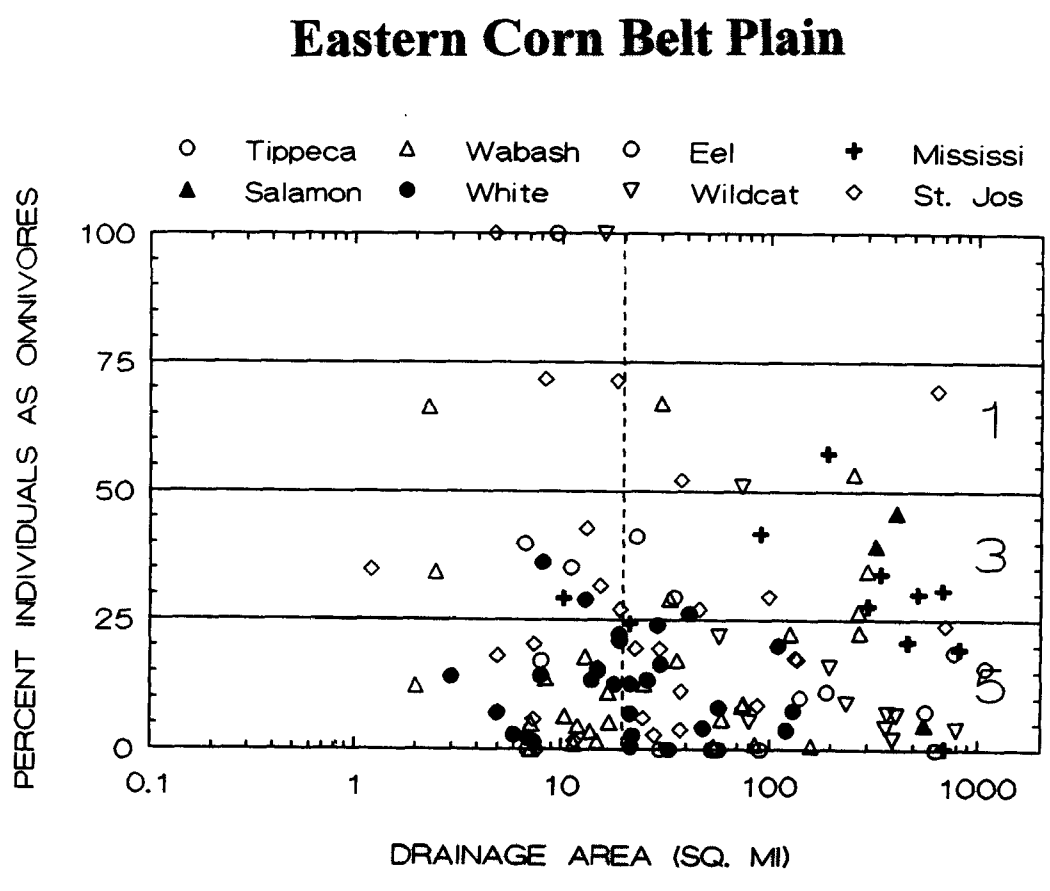

Figure 13. Maximum species richness lines for determining trends in the proportion of omnivores with increasing drainage area for the Eastern Corn Belt Plain.

Metric 8. Proportion of Insectivore Individuals (Headwater and Wadable Sites)

Impetus

The proportion of insectivores is a modification of Karr *et al.*'s (1986) original metric, i.e. proportion of insectivorous cyprinidae. This metric is intended to respond to a depletion of the benthic macroinvertebrate community that comprises the primary food base for most insectivorous fishes. As disturbance increases, the diversity of insect larvae decreases, triggering an increase in the omnivorous trophic level. Thus, this metric varies inversely with metric 7 with increased environmental degradation. The inclusion of all insectivorous species was based on the observation that all regions of Indiana do not possess high proportions of insectivorous cyprinids in high quality streams, e.g. Central Corn Belt Plain and Interior Plateau ecoregions. This metric was recalibrated following the recommendation of Karr *et al.* (1986; see Appendix A for species-specific trophic level classifications) and includes classifications insectivores (I) and invertivores (V).

Headwater and Wadable Streams and Rivers

Insectivorous species are an important link in transfering energy between lower trophic levels to keystone predator species. Species designations generally conforms to that provided in Karr *et al.* (1986), however, I concur with Ohio EPA in the elimination of the opportunistic feeding creek chub, Semotilus atromaculatus, and blacknose dace, Rhinichthys atratulus, from the insectivore designation. Leonard and Orth (1986) felt that the current trophic definitions of Karr *et al.* (1986) were rather arbitrary since they observed a negative correlation between insectivores and biotic integrity in a West Virginia stream. Plots of the MSR lines showed no relationship existed between drainage area and proportion of insectivorous fishes in the eight sub-basins in the Eastern Corn Belt Plain (Fig. 14).

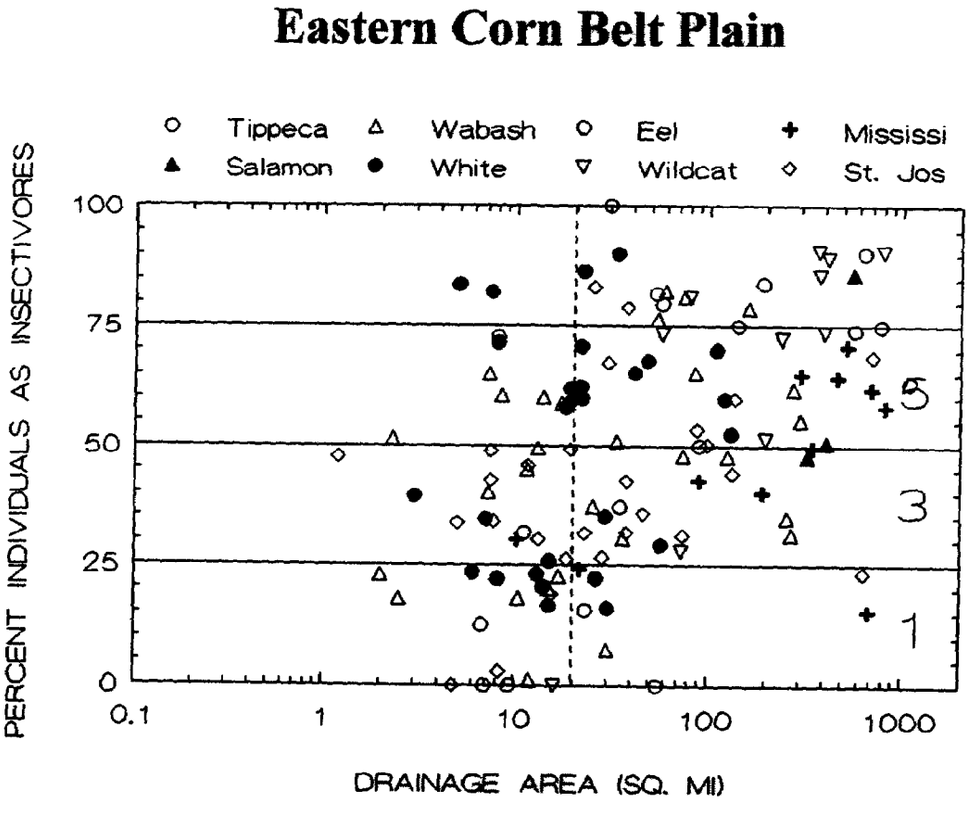

Figure 14. Maximum species richness lines for determining trends in the proportion of insectivores with increasing drainage area for the Eastern Corn Belt Plain.

Metric 9. Proportion of Pioneer Species (Headwater Streams) Proportion of Carnivores (Wadable Rivers)

Impetus

Karr (1981) developed the carnivore metric to measure community integrity in the upper trophic levels of the fish community. It is only in high quality environments that upper trophic levels are able to flourish. This metric includes individuals of species in which the adults are predominantly piscivores, although some may feed on invertebrates and fish as larvae or juveniles. Species that are opportunistic do not fit into this metric, e.g. creek chub or channel catfish, Ictalurus punctatus (Karr *et al.* 1986; Ohio EPA 1987). Karr *et al.* (1986) suggest that some members of this group may feed extensively on crayfish and various vertebrates, *e.g.* frogs. Species-specific classifications are included in Appendix A and include piscivores (P) and carnivores (C).

Headwater Streams

Carnivores are generally not abundant in headwater streams. An alternate metric was developed by Ohio EPA (1987) to determine the permanence of the stream habitat. Smith (1971) identified a signature assemblage of small stream species that he termed "pioneer species" (Table 11). These are species that are the first to colonize sections of headwater streams after desiccation. These pioneer species predominate in unstable environments affected by anthropogenic stresses and temporal desiccation. A high proportion of pioneer species indicates an environment temporally unavailable or stressed. The metric does not change with increases in drainage area (Fig. 15).

Table 11. List of Indiana fish species considered to be pioneer species, indicators of temporal habitats (Larimore and Smith 1963; Smith 1971).

Common Name	Scientific Name
Central stoneroller	Campostoma anomalum
Largescale stoneroller	C. oligolepis
Silverjaw minnow	Ericymba buccata
Bluntnose minnow	Pimephales notatus
Fathead minnow	Pimephales promelas
Creek chub	Semotilus atromaculatus
Creek chubsucker	Erimyzon oblongus
Lake chubsucker	E sucetta
Green sunfish	Lepomis cyanellus
Johnny darter	Etheostoma nigrum
Orangethroat darter	Etheostoma spectabile

Wadable Sites

Karr (1981) suggested that the proportion of carnivores should be a reflection of drainage area. Such a correlation in streams greater than 20 miles^2 was not found by Ohio EPA or previous ecoregion studies (Simon, 1991). An increasing percent of individuals as carnivores was observed with increasing drainage area in the Eastern Corn Belt Plain. The proportion of carnivores from the current data base was considerably higher than that approximated in Karr *et al.*'s (1986) original numbers (Fig. 16).

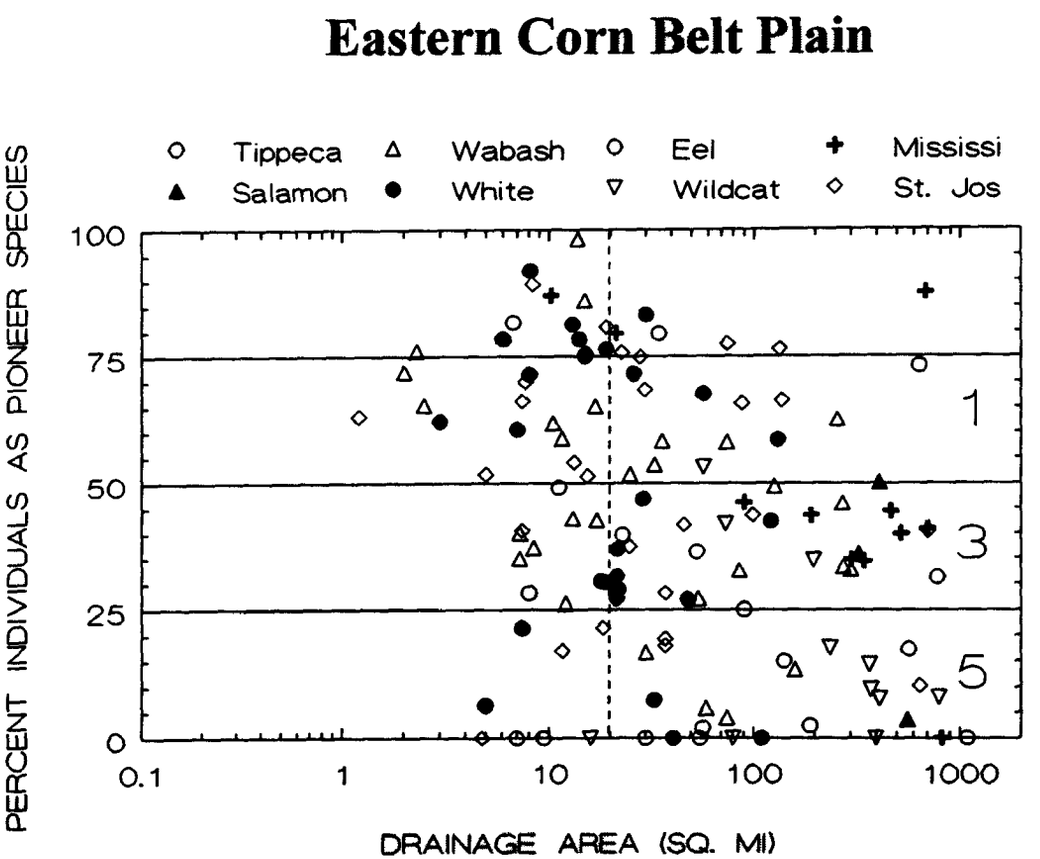

Figure 15. Maximum species richness lines for determining trends in the proportion of pioneer species with increasing drainage area for the Eastern Corn Belt Plain.

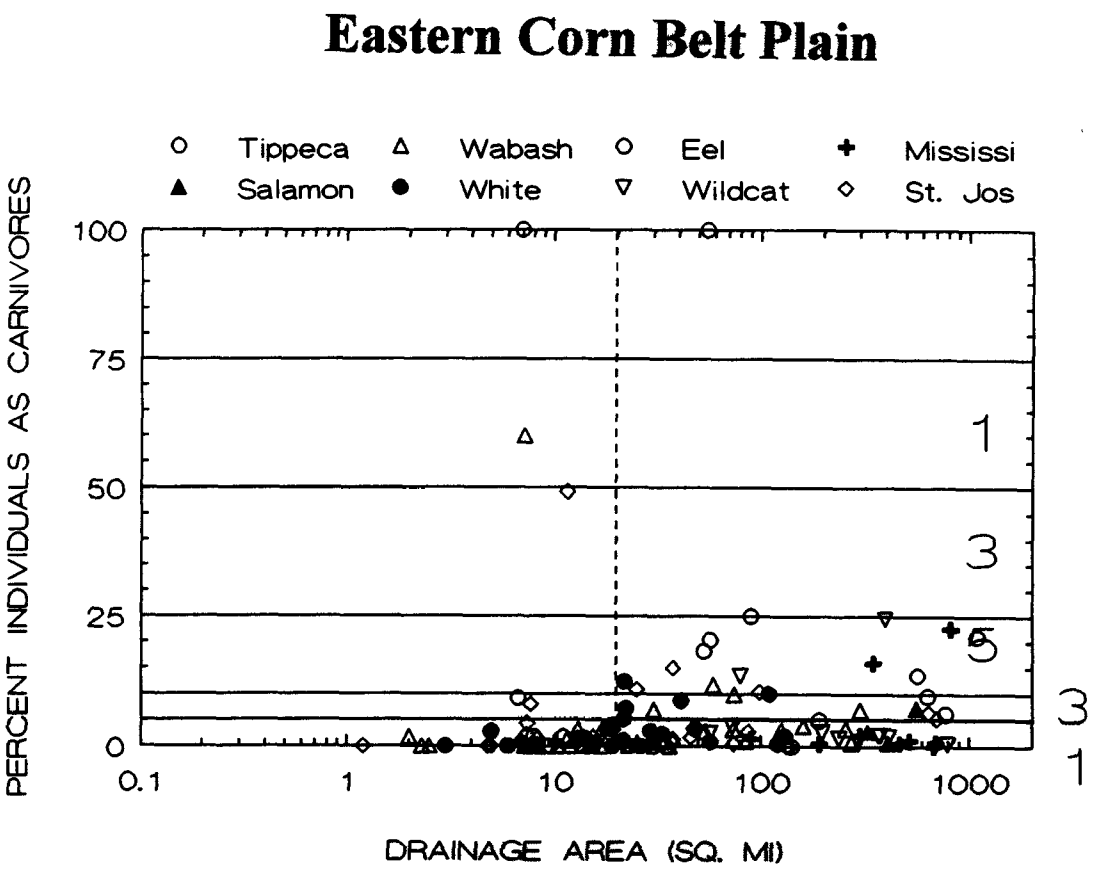

Figure 16. Maximum species richness lines for determining trends in the proportion of carnivores with increasing drainage area for the Eastern Corn Belt Plain.

Metric 10. Relative Number of Individuals (CPUE) (Headwater and Wadable Sites)

Impetus

This metric evaluates population density and is expressed as catch-per-unit-effort. Effort is expressed by the relative number of individuals per length of reach sampled, per unit of area sampled, or per unit time spent depending on the gear used. Karr *et al.* (1986) suggest that this metric is most sensitive at intermediate to low ends of the sensitivity continuum. When low numbers of individuals are observed the normal trophic relationships are generally disturbed. Because of this effect, scoring adjustments are encouraged for sites when less than 50 individuals are collected (see next section for details). As integrity increases, total abundance increases and becomes more variable only depending on the level of energy and other natural chemical factors limiting production. Under certain circumstances, *e.g.* channelization, increases in the abundance of tolerant fishes can be observed (Ohio EPA 1987). Lyons (1992) found that abundance, excluding tolerant species, was greatest at fair quality sites in Wisconsin warmwater streams and lower at sites classified as excellent. In this study, catch-per-unit-effort was determined based on the total number of individuals collected per 15 times the channel width without modification for tolerant taxa. The level of effort sampled within a reach was 50 m if the stream was < 3.4 m wide or 100 m minimum distance if the stream was > 3.4 m wide. A maximum distance of 1000 m was sampled for stream widths > 66.7 m. Each shocking run was conducted with a standardized effort of 30 minutes of sampling per shoreline in 1000 m sites and 15 minutes per shoreline at 500 m sites including both shorelines.

Headwater and Wadable Streams and Rivers

A drainage area-dependent relationship was observed for the Eastern Corn Belt Plain (Fig. 17). Lyons (1992) found in small streams in Wisconsin that excessive nutrients could artifically stimulate production in some degraded sites. In order to account for sites with inflated number of individuals, we adjusted scoring criteria to reflect declining quality with increasing numbers of individuals.

Based on our experience, if fewer than 50 fish are collected during a sampling event, alternate scoring procedures are required (see next section for details).

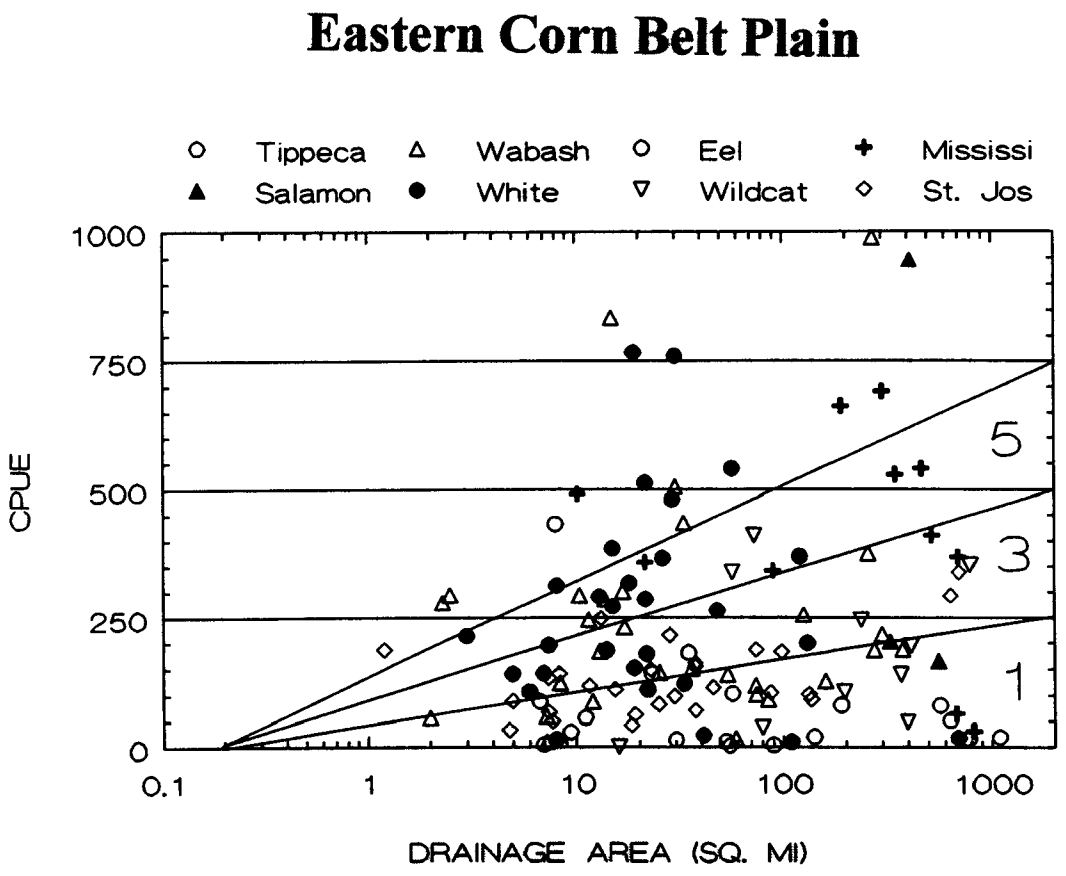

Figure 17. Maximum species richness lines for determining trends in the catch per unit effort with increasing drainage area for the Eastern Corn Belt Plain.

Metric 11. Proportion of Individuals as Simple Lithophilic Spawners (Headwater and Wadable Rivers)

Impetus

Ohio EPA (1987) replaced the original index metric, proportion of hybrids (Karr *et al.* 1986), with this metric. The hybrid metric was abandoned since the original intent of the metric was to assess the extent that degradation has altered reproductive isolation among species. Difficulties of identification, lack of occurrence in headwater and impacted streams, and presence in high quality streams among certain taxa, e.g., cyprinids and centrarchids, caused a lack of sensitivity for the hybrid metric.

Spawning guilds have been shown to be affected by habitat quality (Balon 1975; Berkman and Rabeni 1987) and have been suggested as an alternative metric (Angermeier and Karr 1986). Reproductive attributes of simple spawning behavior requires clean gravel or cobble for success (i.e. lithophilous) and are the most environmentally sensitive (Ohio EPA 1987). Simple lithophils broadcast eggs that come into contact with the substrate. Eggs develop in the interstitial spaces between sand, gravel, and cobble substrates without parental care. Berkman and Rabeni (1987) observed an inverse correlation between simple lithophilic spawners and the proportion of silt in streams. Historically, some simple lithophilic spawners have experienced significant range reductions due to increased silt loads in streams. Some simple lithophils do not require clean substrates for reproduction. Larvae of these species are buoyant, adhesive, or possess fast developing eggs with phototactic larvae that have minimal contact with the substrate (Balon 1975) and are not included in the above designation. Simple lithophils are sensitive to environmental disturbance, particularly siltation. Designated lithophilic species are included in Table 12 (see Appendix A for species-specific ratings).

Headwater and Wadable Streams and Rivers

No relationship with drainage area was observed at stream and river sites for the proportion of lithophilic species in the Eastern Corn Belt Plain (Fig. 18). Scoring was completed using the trisection method of Fausch *et al.* (1984). The lack of an increasing percentage of simple lithophils with increasing drainage area in the largest drainage reaches was thought to be a reflection of degraded conditions. Best professional judgement was used in evaluating this metric. Simple lithophils are major components of fish communities indicating the importance of clean gravel and cobble substrates.

Table 12. List of Indiana species considered to be simple lithophilic spawners.

Simple Lithophils			
Common Name	Scientific name	Common Name	Scientific Name
Paddlefish	Polyodon spatula	Spotted sucker	Minytrema melanops
Lake sturgeon	Acipenser fulvescens	Silver redhorse	Moxostoma anisurum
Shovelnose sturgeon	Scaphirhynchus platorynchus	River redhorse	M. carinatum
		Black redhorse	M. duquesnei
Redside dace	Clinostomus elongatus	Golden redhorse	M. erythrurum
Lake chub	Couesius plumbeus	Shorthead redhorse	M. macrolepidotum
Streamline chub	Erimystax dissimilis	Greater redhorse	M. valenciennesi
Gravel chub	E. x-punctata		
Cent silvery minnow	Hybognathus hayi	Burbot	Lota lota
Miss. silvery minnow	H. nuchalis		
Bigeye chub	Hybopsis amblops	Western sand darter	Ammocrypta clara
Pallid shiner	H. amnis	Eastern sand darter	A. pellucida
Striped shiner	Luxilus chrysocephalus	Rainbow darter	Etheostoma caeruleum
Common shiner	Luxilus cornutus	Bluebreast darter	E. camurum
Rosefin shiner	Lythrurus ardens	Orangethroat darter	E. spectabile
Popeye shiner	N. ariommus	Tippecanoe darter	E. tippecanoe
River shiner	N. blennius	Variegate darter	E. variatum
Bigeye shiner	N. boops	Crystal darter	Crystallaria asprella
Silver shiner	N. photogenis	Logperch	Percina caprodes
Rosyface shiner	N. rubellus	Channel darter	P. copelandi
Silverband shiner	N. shumardi	Gilt darter	P. evides
Suckermouth minnow	Phenacobius mirabilis	Blackside darter	P. maculata
Southn redbelly dace	Phoxinus erythrogaster	Slenderhead darter	P. phoxocephala
Blacknose dace	Rhinichthys atratulus	Dusky darter	P. sciera
Longnose dace	R. cataractae	River darter	P. shumardi
		Saddleback darter	P. vigil
Blue sucker	Cycleptus elongatus	Sauger	Stizostedioncanadense
Longnose sucker	Catostomus catostomus	Walleye	S. vitreum
White sucker	C. commersoni		
Northern hogsucker	Hypentilium nigricans		

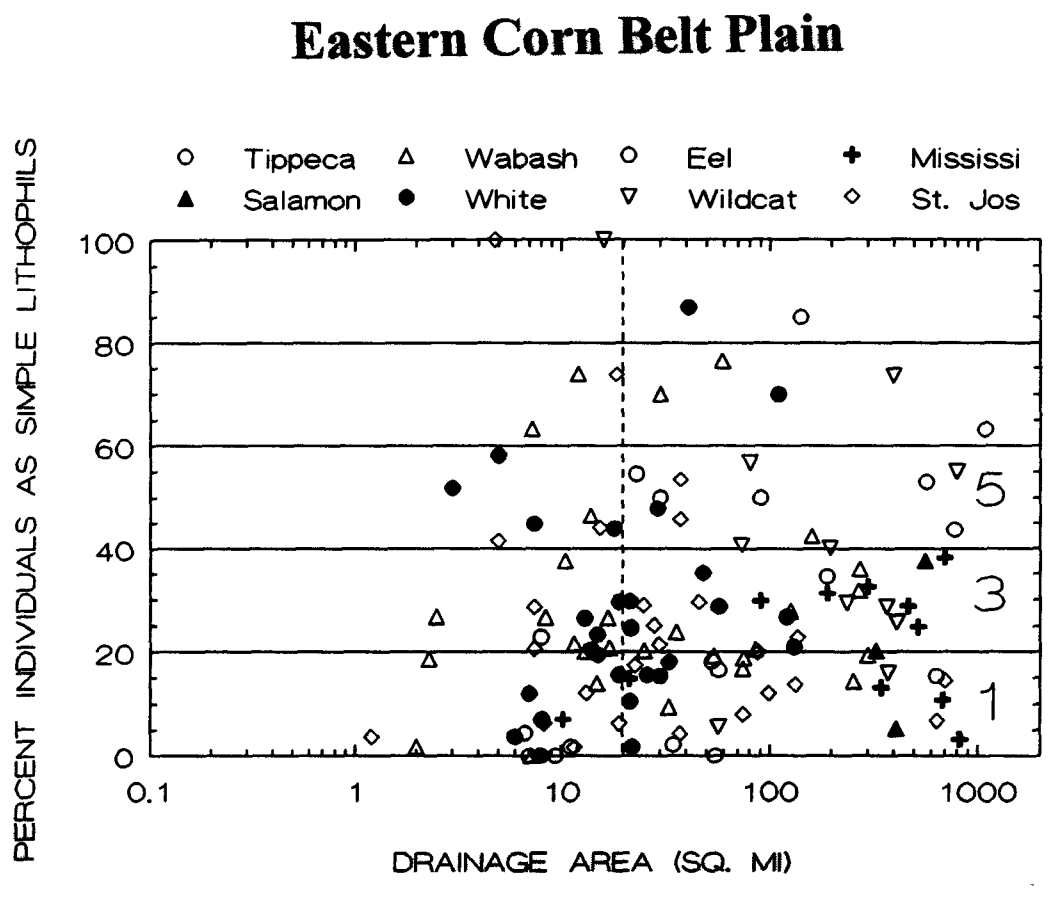

Figure 18. Maximum species richness lines for determining trends in the proportion of simple lithophil species with increasing drainage area for the Eastern Corn Belt Plain.

Metric 12. Proportion of Individuals with Deformities, Eroded Fins, Lesions,and Tumors (Headwater and Wadable Sites)

Impetus

This metric evaluates the individual condition of fish based on the percent occurrence of external anomalies. DELT corresponds to the percent of diseased fish in Karr's (1981) original index. Studies of fish populations indicate that anomalies are either absent or occur at very low rates naturally, but reach higher percentages at impacted sites (Mills *et al.* 1966; Berra and Au 1981; Baumann *et al.* 1987). Common causes for deformities, eroded fins, lesions, and tumors are a result of bacterial, fungal, viral, and parasitic infections; neoplastic diseases; and chemicals (Allison *et al.* 1977; Post 1983; Ohio EPA 1987). An increase in the frequency of occurrence of these anomalies is an indication of physical stress due to environmental degradation, chemical pollutants, overcrowding, improper diet, excessive siltation, and other perturbations. The presence of black spot is not included in the above analyses since infestation varies in degree and is a function of the presence of snails, thus it is not solely related to environmental degradation (Allison *et al.* 1977; Berra and Au 1981). Whittier *et al.* (1987) showed no relationship between Ohio stream quality and black spot. Other parasites are also excluded due to the lack of a consistent relationship with environmental degradation.

In Ohio and in the current study, the highest incidence of deformities, eroded fins, lesions, and tumors occurred in fish communities downstream from dischargers of industrial and municipal wastewater, and areas subjected to the intermittent stresses from combined sewers and urban runoff. Leonard and Orth (1986) found this metric to correspond to increased degradation in streams in West Virginia. Karr *et al.* (1986) observed this metric to be most sensitive at the lowest ranges of the Index of Biotic Integrity.

Headwater and Wadable Streams and Rivers

The scoring criteria used for this metric follows the more extensive dataset developed by Ohio EPA (1987) that was developed by analyzing wading data. According to Ohio protocols, if a single fish in a sample of less than 200 fish was captured with anomalies this would have been enough to exceed the established criterion. Ohio EPA scoring modifications enable a single diseased fish to be present at a site to score a "5" and two fish at a site to score a "3" when less than 200 individuals are collected (Fig. 19).

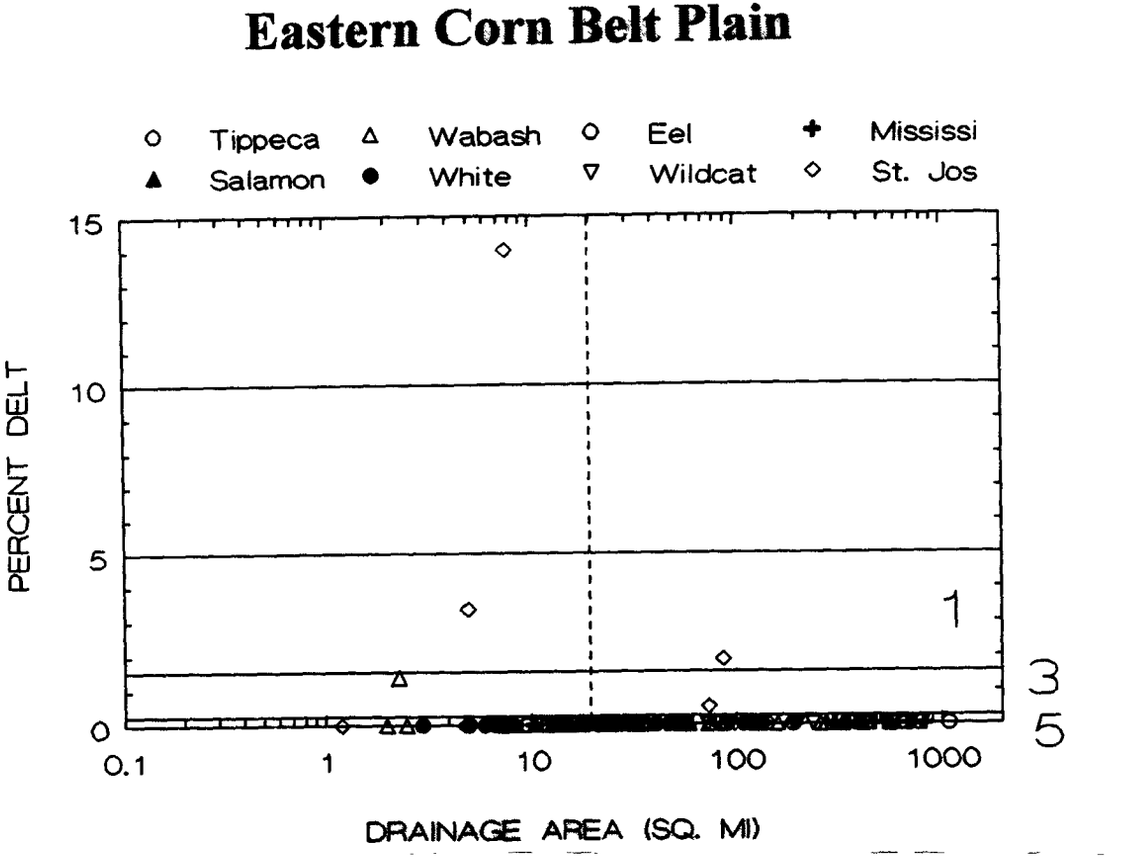

Figure 19. Maximum species richness lines for determining trends in the proportion of diseased, eroded fins, lesions, and tumors (DELT) with increasing drainage area for the Eastern Corn Belt Plain.

Scoring Modifications

Samples with extremely low numbers in the catch can present a scoring problem in some of the proportional metrics unless adjustments are made to reduce the possibility of bias towards higher scoring of degraded sites. Aquatic habitats impacted by anthropogenic disturbances may exhibit a disruption in the food base and the sample will reflect very few individuals. At such low population sizes the normal structure of the community is unpredictable (Ohio EPA 1987). Based on Ohio EPA experiences, the proportion of omnivores, insectivorous fishes, and percent individuals affected by anomalies do not always match expected trends at these sample sizes. Although scores are expected to deviate strongly from those of high quality areas, this is not always observed. Rather, at these times the opposite deviation of metric score is achieved due to low numbers of individuals or absence of certain taxa.

Scoring very degraded sites without modifying scoring criteria for the proportional metrics can overestimate the total index score for these sites. The following scoring modifications proposed by Ohio EPA (1987) were adopted for evaluating Indiana sites with low numbers of individuals.

Proportion of omnivores for headwater streams and wadable river sites a score of "1" is assigned if less than 50 total individuals are collected. When less than 150 individuals are collected, but are dominated (>50%) by such species as creek chub and blacknose dace, a "1" can be assigned when dominated by generalist feeders. This is left up to the biologists best professional judgement.

Proportion of insectivores is scored a "1" when a high proportion of insectivores are observed and less than 50 individuals are collected. At sites with less than 150 individuals, this metric can be scored "1" if the community was dominated (>50%) by either striped shiner, common shiner, or spotfin shiner. These species can act as functional omnivores under certain conditions (Angermeier and Karr 1986).

Proportion of top carnivores metric should be scored a "1" when dominated by high numbers (> 50%) of grass pickerel in impacted wading areas.

Proportion of simple lithophils always scores a "1" at sites with less than 50 total individuals. Based on Ohio EPA data (1987) this is rarely different from the metric score without the adjustment.

Proportion of individuals with deformities, erosion, lesions and tumor anomalies is scored a "1" when less than 50 individuals are collected. A high proportion of young fishes may also be sufficient reason to score a "1" since they will not have had sufficient time to develop anomalies from exposure to chemical contaminants.

Proportion of pioneer species is scored a "1" at headwater site if less than 50 individuals are collected at drainage areas greater than 8 miles^2 or 25 individuals at drainage areas less than 8 miles^2.

No scoring adjustments are necessary for proportion of tolerant species.

4.0 RESULTS AND DISCUSSION
Eastern Corn Belt Plain

Species Composition: A total of 130 sites were sampled in the Eastern Corn Belt Plain between 1991 and 1994. A total of 86 species were collected (Table 13) and were numerically dominated by cyprinid, centrarchid, and percid species.

The Eastern Corn Belt Plain possesses several species unique to the State of Indiana; river chub Nocomis micropogon, streamline chub Erimystax dissimilis, banded sculpin Cottus carolinae;and gilt darter Percina evides. Of special interest was the collection of the greater redhorse Moxostoma valenciennesi, largescale stoneroller Campostoma oligolepis, and gilt darter. Moxostoma valenciennesi is considered state endangered. The capture of Campostoma oligolepis is the first record for northcentral Indiana. Species such as the river chub and streamline chub are considered large river species. Several gilt darters were collected from the Tippecanoe River.

Species Trends: Round-bodied suckers, minnows, and darters are good indicator taxa revealing good to exceptional biotic integrity. The Eastern Corn Belt Plain possessed a high number of round-bodied suckers, minnows, and darters.

Thirteen species of suckers were collected from the Eastern Corn Belt Plain. Round-bodied suckers are considered the most sensitive of the Catostomidae species. A total of 9 species, excluding the species Catostomus commersoni, which tends to be a ubiquitous species found in a variety of habitats, represented round-bodied suckers. Six species of redhorse and the northern hogsucker are regularly represented in catches from the ecoregion and the larger tributaries. These species are insectivores and are highly intolerant to thermal pollution (Gammon 1976).

The minnows are a diverse group of North American fish with close to 200 recognized species. Twenty-seven species of the family Cyprinidae were collected from the Eastern Corn Belt Plain. Less than half (45%) of the species are considered to represent good-fair biotic integrity (Karr *et al.* 1986). Many (40%) of the species are representative of pioneering taxa that colonize recently disturbed or water limited stations (Ohio EPA 1989). The trophic composition of the species showed 25% of the species are omnivores. Omnivores can utilize a greater proportion of the resource, however, tend to dominate when the habitat is degraded and resources are unpredictable.

The darters are a group of small, benthic insectivores that require high dissolved oxygen conditions and clean substrates for reproduction (Page 1983; Kuehne and Barbour 1983). The darters have close to 150 recognized species. Many of the species exhibit simple lithophilic modes of reproduction, while a few species have evolved more complex reproductive behaviors. A total of 11 darter species were collected from the Eastern Corn Belt Plain. A few additional taxa were expected based on historical data, however, not all historical sites were visited.

Biocriteria Comparison of the Eastern Corn Belt Plain

The States of Ohio and Michigan share the Eastern Corn Belt Plain ecoregion with Indiana. Ohio in an attempt to develop the most stringent biological criteria evaluated statewide biological criteria for the ecoregions and sampled extensively during the late 1980's in an attempt to find additional reference sites or "least

Table 13. Species list of taxa collected in the Eastern Corn Belt Plain, Indiana, between 1991 to 1994.

Petromyzontidae - lampreys
Lampetra appendix, American brook lamprey
Amiidae - bowfin
Amia calva, bowfin
Clupeidae - herring
Dorosoma cepedianum, gizzard shad
Esocidae - pikes
Esox americanus, grass pickerel
E. lucius, northern pike
Umbridae - mudminnows
Umbra limi, central mudminnow
Cyprinidae - carps and minnows
Campostoma anomulum, stoneroller
C. oligolepis, largescale stoneroller
Cyprinella lutrensis, red shiner
C. spiloptera, spotfin shiner
C. whipplei, steelcolor shiner
Carassius auratus, goldfish
Cyprinus carpio, carp
Ericymba buccata, silverjaw minnow
Erimystax dissimilis, streamline chub
Hybopsis amblops, bigeye chub
Luxilus chrysocephalus, striped shiner
L. cornutus, common shiner
Lythrurus umbratilis, redfin shiner
Nocomis biguttatus, hornyhead chub
N. micropogon, river chub
Notemigonus crysoleucus, golden shiner
Notropis atherinoides, emerald shiner
N. boops, bigeye shiner
N. ludibundus, sand shiner
N. rubellus, rosyface shiner
N. volucellus, mimic shiner
N. wickliffi, channel shiner
Phenacobius mirabilis, suckermouth minnow
Phoxinus erythrogaster, southern redbelly dace
Pimephales notatus, bluntnose minnow
P. promelas, fathead minnow
Rhinichthys atratulus, blacknose dace
Semotilus atromaculatus, creek chub
Catostomidae - suckers and buffalo
Carpiodes carpio, river carpsucker
C. cyprinus, quillback
C. velifer, highfin carpsucker
Catostomus commersoni, white sucker
Erimyzon oblongus, creek chubsucker
Hypentelium nigricans, northern hogsucker
Minytrema melanops, spotted sucker
Moxostoma anisurum, silver redhorse
M. carinatum, river redhorse
M. duquesnei, black redhorse
M. erythurum, golden redhorse
M. macrolepidotum, shorthead redhorse
M. valenciennesi, greater redhorse
Ictaluridae - bullhead and catfish
Ameiurus melas, black bullhead
A. natalis, yellow bullhead
A. nebulosus, brown bullhead
Ictalurus punctatus, channel catfish
Noturus flavus, stonecat
N. gyrinus, tadpole madtom
N. miurus, brindled madtom
Pylodictis olivaris, flathead catfish
Fundulidae - topminnows
Fundulus notatus, blackstripe topminnow
Atherinidae - silversides
Labidesthes sicculus, brook silverside
Centrarchidae - black bass and sunfish
Ambloplites rupestris, rock bass
Lepomis cyanellus, green sunfish
L. gibbosus, pumpkinseed
L. gulosus, warmouth
L. humilis, orangespotted sunfish
L. macrochirus, bluegill
L. megalotis, longear sunfish
L. microlophus, redear sunfish
Micropterus dolomieu, smallmouth bass
M. salmoides, largemouth bass
M. punctulatus, spotted bass
Pomoxis annularis, white crappie
P. nigromaculatus, black crappie
Moronidae - temperate basses
Morone saxatilis, striped bass
Percidae - perch and darters
Etheostoma blennioides, greenside darter
E. caeruleum, rainbow darter
E. camurum, bluebreast darter
E. flabellare, fantail darter
E. nigrum, johnny darter

E. spectabile, orangethroat darter
Percina caprodes, logperch
P. evides, gilt darter
P. maculata, blackside darter
P. phoxocephala, slenderhead darter
P. sciera, dusky darter
Stizostedion vitreum, walleye
Cottidae - sculpins
Cottus bairdi, mottled sculpin
C carolinae, banded sculpin
Sciaenidae - drum
Aplodinotus grunniens, freshwater drum

Total Number of Species	86

impacted stations (Hughes 1995).

The U.S. Environmental Protection Agency, Environmental Research Laboratory-Corvallis and Ohio EPA collaborated on a project to determine reference conditions for the state. The Stream Regionalization Project culminated in the development of statewide reference condition expectations for Ohio (Whittier *et al.* 1987; Ohio EPA 1989). Within Ohio, only the Huron-Erie Lake Plain was recognized as having limitations for warmwater habitat designations as defined by Ohio Water Quality Standards (Ohio EPA 1989). Ohio EPA biologists determined that none of the wading and headwater sites sampled in this ecoregion reflected "least impacted" conditions relative to reference sites from the remainder of the State. Intensive rowcrop agriculture and drainage practices (i.e. channel modifications to increase subsurface drainage) have preserved few headwater streams. As a result the IBI reflects this lowered biological integrity. In order to determine warmwater habitat criteria for headwater and mid-sized streams and rivers the Ohio EPA examined results from all sites sampled between 1979 and 1986. The criteria was derived from metric values that delineated the upper 10% of all sites sampled. They also reviewed historical literature to determine expectations.

Ohio EPA developed a "modified warmwater habitat" designation for streams in the Huron-Erie Lake Plain and some streams in the Eastern Corn Belt Plain in order to properly characterize the extensive landscape modifications, yet protect the chemical, physical, and biological integrity of these streams. The modified designation is used to protect streams and rivers that function as warmwater fish communities but because of structural and functional modifications of these communities caused by human induced practices the community cannot fully attain warmwater status. The return of biological integrity to sufficient levels representative of "least impacted" conditions are not expected in the near future due to the physical modification of the stream channel and substrate. Recovery of such areas to "least impacted" conditions is not possible without some recovery of the stream channel and an increase in gradient to a pre-modified condition or extensive landuse changes within the drainage.

Michigan Department of Environmental Quality (MDEQ) has formulated biological expectations for the Eastern Corn Belt Plain ecoregion based on a state wide database. It was a primary goal of this study to determine if reference condition expectations developed from the Indiana portion of the ecoregion could advance biological criteria expectations for this region.

Michigan DEQ developed sampling protocols and biological expectations for the state as part of their Procedure 51 (Creal *et al.* 1996). The Michigan procedure uses a modified scoring expectation based on two standard deviations from the mean. Thus, scoring is either +1, 0, or -1 for sites performing outside those found at

excellent sites. Sites are calibrated based on stream width, similar to Wisconsin (Lyons 1992). Maximum Species Richness (MSR) lines are developed using two approaches. Several metrics, such as the number of darter, sunfish, and suckers, were not found to have significant ranges in species richness and were divided following the approach of Karr (1981). The usual approach was to evaluate expectations based on two standard deviations from the mean. For several of the percentile metrics, modifications were made when two standard deviations were outside of the 0-100% range. The modification placed the expectation at either 1 or 99% for the percentage of piscivores, insectivores, simple lithophilic spawners, and tolerant species.

IBI Scoring ranges for Michigan fish assemblage procedures are between +10 and -10, since procedure 51 is based on only 10 metrics. Scores greater than +5 are considered excellent, while those less than -5 are classified as poor. Scores between ±4 are considered intermediate with scores of 0 being neutral (Creal *et al.* 1996)

Despite the widespread degradation found in the headwater streams some of the Eastern Corn Belt Plain qualify as "least impacted" areas. Streams such as the Tippecanoe River, portions of the upper and middle East Fork White River, Burnett's Creek, and portions of the South Fork Wildcat Creek are typical reference streams for the Eastern Corn Belt Plain. This is undoubtably a function of zoogeography. The reduction of available dispersal routes post-glaciation required many species to reinvade the area only after the glaciers receeded some 10,000 years ago (Underhill 1986). Species recolonization of the Till Plain was aided by the glacial connection between the Wabash and Maumee Rivers by the Little Wabash River and by the Grand River connection across Michigan. As the Saginaw lobe retreated across Michigan a large pool of water remained that was the precursor of Lake Erie. Species capable of tolerating lentic, turbid, cold water was able to reinvade the system first. Many species were unable to disperse into the Great Lakes, thus, the Great Lakes as a whole are biologically limited in comparison to riverine systems such as the Mississippi and Ohio River systems. A study by Smith *et al.* (1981) in the Raisin River system demonstrates this effect with the headwaters of the system reflecting more structural and functional attributes of the Eastern Corn Belt Plain fish community, while lower sections of the river were dominated by the most tolerant species. The Eastern Corn Belt Plain has riffles and other macrohabitat features but has lost much of the riverine wetland habitat. The lack of wetlands, low-gradient, seiche directed streams and rivers of this region would have precluded many of the sensitive species. Thus, reference conditions need to reflect not only high gradient "least impacted" streams but also the typical low-gradient types of habitats which occurred along the Great Rivers.

In order to compare the criteria and direction of the individual metrics to determine if Ohio EPA and Michigan DEQ biological criteria could benefit from the effort conducted in Indiana it is necessary to compare the associated variance of the reference conditions. The State of Michigan developed biological criteria from the analysis of over 800 reference sites statewide. After careful analysis of the results, the various ecoregions are scored based on differences in stream width while Ohio based their expectations on drainage area. In order to compare metric expectations, datasets from

Table 14. Comparison of Michigan DEQ (1996) Procedure 51 and Ohio EPA (1989) reference conditions with reference conditions developed from Indiana's portion of the Eastern Corn Belt Plain.

	Reference Conditions					
	Michigan		Indiana		Ohio	
Metric	10 ft[a]	20 ft[b]	Head	Wadable	Head	Wadable
1. Total Number of Species	> 11	>11	12	18	17	23
2. Number of darter species	> 4	>4	4	4	> 4	> 5
3. Number of Sunfish species	> 2	>3	>3	> 3	--	> 3
Proportion of Headwater Species	--	--	> 35%	--	--	--
Number of headwater Species	--	--	--	--	> 3	--
4. Number of Minnow species	--	--	> 6	--	≥ 7	--
Number of Sucker species	> 2	> 2	> 3	> 3	--	> 5
5. Number of Sensitive species	> 3	> 4	> 4	≥ 8	> 6	> 5[c]
6. Proportion Tolerant species	< 53%	< 53%	< 25%	< 25%	< 30%	< 20%
7. Proportion of Omnivores	< 36%	< 36%	< 25%	< 25%	< 18%	< 18%
8. Proportion of Insectivores	> 47%	> 47%	> 50%	> 50%	> 48%	> 53%
9. Proportion Pioneer species	--	--	< 25%	--	< 34%	--
Proportion of Carnivores	> 5%	> 5%	--	10%-25%	--	> 5%
10. Catch per unit of effort	--	--	> 250	>375	> 750	> 750
11. % Simple Lithophils	> 33%	> 33%	> 40%	> 40%	> 36%	> 36%
12. Proportion of DELT	--	--	< 0.1%	< 0.1%	< 0.1%	< 0.1%

[a] Maximum value from 95th percentile of Maximum Species Richness lines at 20 mi^2;
[b] Maximum value from 95th percentile of Maximum Species Richness lines at 300 mi^2.
[c] Intolerant species are designated for > 20 mi^2, while sensitive taxa are < 20mi^2

each of the 10 metrics was compared from Michigan DEQ (1996) and Ohio EPA to the current metric criteria adjusted for similar sized streams. The Indiana dataset is based on a 95th percentile of the reference condition. Results of the comparison are summarized in Table 14 between Michigan, Ohio EPA, and Indiana. .

Michigan IBI Comparison

In a comparison (student t-test, alpha =

0.05) between the two reference conditions, metrics that did not differ statistically between Michigan criteria and Indiana Eastern Corn Belt Plain expectations include total number of species at headwater sites, number of sunfish species, number of sucker species, number of sensitive species for headwater sites, proportion of omnivores, proportion of insectivores, and proportion of simple lithophils. The proportion of pioneer species, headwater species, catch-per-unit effort, and proportion of deformities, eroded fins, lesions, and tumors are not used in the Michigan version of the IBI.

Metrics that exhibited a statistical difference between Michigan criteria and Indiana's expectations included total number of species for wadable sites, number of sensitive species at wadable sites, and proportion of omnivores. Of the three metrics that had significant differences, all of the metrics were more stringent when using Indiana's criteria.

The number of species metric showed differences at both sites perhaps because Michigan collects up to 100 specimens or for 30 minutes. This may have underestimated the species area curve for this metric. This would have been exaggerated at larger drainage areas where more habitat complexity would have been exhibited. The Michigan expectations for the proportion of tolerant species suggests that double the percentage of tolerant species are expected in Michigan.

The number of sensitive species showed similar trends with Michigan criteria at headwater sites, however, differences in species membership to the list are the probable cause. For Indiana we used a modified metric that includes intolerant, as well as, sensitive species following Ohio EPA (1989). Species such as longear sunfish, northern hogsucker, and redhorse species are taxa that did not appear on the Michigan list that were commonly collected in the Eastern Corn Belt Plain. As stream size increases these additional species are more commonly collected increasing proportions.

The collection of data differently may have prohibiting further comparison. The catch-per-unit effort was expressed as the number of fish per 15 x the stream width or collected within the first 30 minutes of electrofishing. Samples from this collection included 15x the stream width with a minimum of 50 m sampled and the longest distance sampled was 500 m. The number of sensitive species at wadable sites also deviated in collection and categorizing strategy. Michigan DEQ uses the intolerant species designation even at headwater sites. At larger wadable sites, the Michigan IBI uses an intolerant species metric that reduces the number of recognized sensitive species from the headwater category. This makes the criteria inherently more stringent and prohibits comparison of reference conditions between the two datasets.

Ohio IBI Comparison

Metrics that had similar expectations between the Ohio and Indiana IBI's included number of darter species, number of sunfish species, number of minnow species, number of sensitive species at headwater sites, proportion of tolerant species, proportion of omnivores, proportion of insectivores, proportion of pioneer species, proportion of simple lithophils, and proportion of deformities, eroded fins, lesions and tumors.

Metrics that exhibited a statistical difference between Ohio criteria and Indiana's expectations included total number of species,number of sucker species, number of sensitive species at

wadable sites, proportion of carnivores, and catch per unit of effort. Of the five metrics that had significant differences, 60% (3 of 5) of the metrics were more stringent when using Ohio's criteria.

The number of species metric showed differences at both sites perhaps because Indiana collects for only 50 m minimum distance while Ohio's minimum distance is 150 m, while in larger streams the minimum Ohio distance is 300 m and 150 m for Indiana. This may have slightly underestimated the species area curve for this metric. This would have been exaggerated at larger drainage areas where more habitat complexity would have been exhibited. The Indiana expectations for the number of sucker species are less than Ohio expectations. There is no causal explanation for this difference. The abundance metric is approximately 3 times more the Indiana expectation for headwater sites and double the wadable sites. This suggests that the difference in distance sampled accounts for the difference in number of fish.

The number of sensitive species showed similar trends with Ohio criteria at headwater sites, however, differences in species membership to the list are the probable cause for differences in wadable sites. For Indiana we used a modified metric that includes intolerant, as well as, sensitive species following Ohio EPA headwater criterion (1989). Species such as longear sunfish, northern hogsucker, and redhorse species are taxa that did not appear on the intolerant list that are used in wadable rivers in Ohio.

The proportion of carnivores for Indiana were double the proportion expected for Ohio. There is no explanation for this difference.

The result of this comparison suggests that the Eastern Corn Belt Plain criteria developed during this study is directly comparable between Michigan and Ohio. For a few metrics, more stringent criteria resulted in the protection of surface waters using Ohio criteria. It must be mentioned that differences in regional framework approaches may be the difference between these three State strategies. In the case of every significant difference, the Indiana metrics provide more stringent expectations than what was observed from Michigan, while 60% of the differences in Ohio metrics were more stringent than Indianain expectations. Sixteen metrics are not significantly different in expectations between Indiana and Ohio or Michigan. Biological expectations within the same ecoregion and across political boundaries are similar for 66.7% of the metrics incorporated into the different State IBI's. Similar metrics and expectations suggest that the three states have adequately addressed differences in expectations and that "least impacted" conditions have been estimated for the ecoregion based on reference conditions developed across political boundaries.

5.0 LITERATURE CITED

Alderkas E. and H:E. McReynolds. (undated - assumed 1962). Upper Wabash River stream survey. Indiana Dept. Consv., Division of Fish and Game, Indianapolis, IN. 7 pp.

Allison, L.N., J.G. Hnath, and W.G. Yoder. 1977. Manual of common diseases, parasites, and anomalies of Michigan fishes. **Michigan Department of Natural Resources, Lansing. Fisheries Management Report No. 8**. 132 pp.

Angermeier, P.L. and J.R. Karr. 1986. Applying an index of biotic integrity based on stream fish communities: considerations in sampling and interpretation. ***N. Am. J. Fish. Man.*** 6: 418-429.

Arvin, D.V. 1989. Statistical summary of streamflow data for Indiana. **U.S. Geological Survey, Indianapolis, IN. Open File Report 89-62**. 964 pp.

Bailey, Z.C., T.K. Greeman, and E.J. Crompton. 1985. Hydrologic effects of ground- and surface-water withdrawals in the Howe area, LaGrange County. U.S. Geological Survey Water Resources Investigations Report 85-4163

Balon, E.K. 1975. Reproductive guilds of fishes: a proposal and definition. ***J. Fish. Res. Board Can.*** 32: 821-864.

Bauman, P.C., W.D. Smith, and W.K. Parland. 1987. Tumor frequencies and contaminant concentrations in brown bullhead from an industrialized river and a recreational lake. ***Trans. Am. Fish. Soc.*** 116: 79-86.

Becker, G.C. 1983. **Fishes of Wisconsin**. University of Wisconsin Press: Madison. 1052 p.

Berkman, H.E. and C.F. Rabeni. 1987. Effect of siltation on stream fish communities. ***Env. Biol. Fishes*** 18: 285-294.

Berra, T.M. and R. Au. 1981. Incidence of teratological fishes from Cedar Fork Creek, Ohio. ***Ohio J. Sci***. 81: 225.

Braun, E.R. 1982. The walleye population in the Wabash River (Huntington, Wabash, Miami, Cass Counties). Indiana Department of Natural Resources, Fisheries Section, Division of Fish and Wildlife, Indianapolis, IN. 68 pp.

Braun, E.R. 1990. A survey of Upper Wabash River fishes. Indiana Department of Natural Resources, Fisheries Section, Division of Fish and Wildlife, Indianapolis, IN. 18 pp.

Brown, H.W. 1976. Handbook of the effects of temperature on some North American fishes. American Electric Power Corporation, Canton, OH. 524 pp + appendices.

Brungs, W.A. and B.R. Jones. 1977. Temperature criteria for freshwater fish: protocol and procedures. U.S. Environmental Protection Agency, Env. Res. Lab.-Duluth, MN. EPA 600/3-77/061. 130 pp.

Burr, B.M. and M.L. Warren, Jr. 1986. **A distributional atlas of Kentucky fishes**. Kentucky Nature Preserves Commission Scientific and Technical Series No. 4. Frankfort.

Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1996. Update of GLEAS Procedure 51 metric scoring and interpretation. Michigan Department of Environmental Quality, Lansing. MI/DEQ/SWQ-96/068.

Davis, W.S. (ed.) 1990. **Proceedings of the 1990 Midwest Pollution Control Biologists Meeting**. U.S. Environmental Protection Agency, Region V, Environmental Sciences Division, Chicago, IL. EPA 905/9-90/005.

Davis, W.S. and A. Lubin. 1989. Statistical validation of Ohio EPA's invertebrate community index. p. 23-32. In W.S. Davis and T.P. Simon (eds). **Proceedings of the 1989 Midwest Pollution Control Biologists Meeting, Chicago, Illinois**. U.S. Environmental Protection Agency, Region V, Chicago, IL. EPA 905/9-89-007.

EA Engineering, Science, and Technology. 1992. Fish studies of the White River in Indiana near the Frank E. Ratts Power Plant, September 1991. EA Engineering, Science, and Technology, Deerfield, IL. EA Report 60307.

Environmental Science and Engineering. 1987. 1986 Survey of the communities and water quality of the lower 200 miles of the West Fork and main stem White River. ESE, Inc. St. Louis, MO. 90 pp. + appendices.

Fatout, P. 1985. **Indiana Canals**. Purdue University Press: West Lafayette, Indiana. 216 p.

Fausch, K.D., J.R. Karr, and P.R. Yant. 1984. Regional application of an index of biotic integrity based on stream-fish communities. ***Trans. Am. Fish. Soc.*** 113: 39-55.

Fausch, K.D., J. Lyons, J.R. Karr, and P.L. Angermeier. 1990. Fish communities as indicators of environmental degradation. ***Am Fish. Soc. Symposium*** 8: 123-144.

Fenneman, N.M. 1946. **Physical division of the United States**: Washington D.C., U.S. Geological Survey Special Map.

Forbes, S.A and R.E. Richardson. 1920. **The fishes of Illinois**. (2nd edition). State Natural History Survey of Illinois 3: 1-357.

Gammon, J.R. 1973. **The effects of thermal input on the populations of fish and macroinvertebrates in the Wabash River**. Purdue University Water Resources Research Center Tech. Rept. 32. 106 pp.

Gammon, J.R. 1976. **The fish populations of the middle 340 km of the Wabash River**. Purdue Univ. Water Resources Research Center Technical Report 86. 73 pp.

Gammon, J.R. 1983. Changes in the fish community of the Wabash River following power plant start-up: projected and observed. pp. 350-366. in W.E. Bishop, R.D. Cardwell, and B.B. Heidolph (eds). **Aquatic Toxicology and Hazard Assessment: Sixth Symposium**. ASTM STP 802.

Gammon, J.R. 1991. The Environment and Fish Communities of the Middle Wabash River. DePauw University, Department of Biological Sciences, Greencastle, IN. 129 pp. + appendices.

Gammon, J.R., A. Spacie, J.L. Hamelink, and R.L. Kaesler. 1981. Role of electrofishing in assessing environmental quality of the Wabash River. p. 307-324. In J.M. Bates and C.I. Weber (eds.). **Ecological Assessments of Effluent Impacts on Communities of Indigenous Aquatic Organisms**. Am. Soc. Test. Materials, STP 730, Phil., PA.

Gerking, S.D. 1945. Distribution of the fishes of Indiana. ***Inv. Ind. Lakes and Streams*** 3: 1-137.

Gerking, S.D. 1955. Key to the fishes of Indiana. ***Inv. Ind. Lakes and Streams*** 4: 49-86.

Glatfelter, D.R. 1984. Techniques for estimating magnitude and frequency of floods on streams in Indiana. U.S. Geological Survey water Resources Investigations Report 84-4134.

Gooding, A.M. 1973. **Characteristics of late Wisconisan Tills in eastern Indiana.** Geological Survey Bull. 49: 1-28.
Gray,M. in preparation. Quarternary geologic map of Indiana. Indiana Geological Surv. Misc. Map.

Hocutt, C.H. and E.O. Wiley. 1986. **Zoogeography of North American freshwater fishes**. John Wiley and Sons Press: New York.

Hoggatt, R.E. 1975. **Drainage Areas of Indiana Streams**. U.S. Geological Survey, Indianapolis, IN. 231 pp.

Hokanson, K.E.F. and K.E. Biesinger. 1980. A national compendium of freshwater fish and water temperature requirements. U.S. Environmental Protection Agency, Env. Res. Lab., Duluth, MN. 142 pp.

Homoya, M.A., D.B. Abrell, J.R. Aldrich, and T.W. Post. 1985. The natural regions of Indiana. ***Proc. Indiana Acad. Sci. 94: 245-268.***

Hughes, R.M., J.H. Gakstatter, M.A. Shirazi, and J.M. Omernik. 1982. An approach for determining biological integrity in flowing waters. pp. 877-888. In T.B. Braun (ed.). **Inplace resource inventories: principles and practices, a National Workshop.** Soc. Am. Foresters, Bethesda, MD.

Hughes, R.M., D.P. Larsen, and J.M. Omernik. 1986. Regional reference sites: a method for assessing stream pollution. ***Env. Mgmt.*** 10: 629-635.

Indiana Department of Environmental Management (IDEM). 1994. Indiana 305(b) report 1990-92. **Indiana Department of Environmental Management, Indianapolis.**

Indiana Department of Natural Resources (IDNR). 1980. The Indiana water resource: availability, uses, and needs. **Indiana Department of Natural Resources, Indianapolis.** 508 pp.

Jordan, D.S. 1890. Report of explorations made during the summer and autumn of 1888, in the Allegheny region of Virginia, North Carolina, and Tennessee, and in western Indiana, with an account of the fishes found in each of the river basins of those regions. ***Bull. U.S. Fish. Comm.*** 1888, 8:97-173.

Jung, C.O. and J. Libovarsky. 1965. Effect of size selectivity on population estimates based on successive removals with electrofishing gear. ***Zoologicke Listy*** 14: 171-178.

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. ***Fisheries*** 6:21-27.

Karr, J.R. 1991. Biological integrity: a long-neglected aspect of water resource management. ***Ecological Applications*** 1: 66-84.

Karr, J.R. and D.R. Dudley. 1981. Ecological perspective on water quality goals. ***Env. Mgmt.*** 5: 55-68.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. ***Ill. Nat. Hist. Surv. Sp. Publ. 5.*** 28 pp.

Krumholz, L.A. 1946. Repopulation of the West Fork. ***Outdoor Indiana*** 13(2): 12.

Kuehne, R.A. and R.W. Barbour. 1983. **The American darters**. University of Kentucky Press: Lexington.

Larimore, R.W. and P.W. Smith. 1963. The fishes of Champaign County, Illinois, as affected by 60 years of stream changes. ***Ill. Nat. Hist. Surv. Bull.*** 28: 299-382.

Larsen, D.P., J.M. Omernik, R.M. Hughes, C.M. Rohm, T.R. Whittier, A.J. Kinney, A.L. Gallant, and D.R. Dudley. 1986. Correspondence between spatial patterns in fish assemblages in Ohio streams and aquatic ecoregions. ***Env. Man.*** 10: 815-828.

Leonard, P.M. and D.J. Orth. 1986. Application and testing of an Index of Biotic Integrity in small, cool water streams. ***Trans. Am. Fish. Soc.*** 115: 401-414.

Leopold, L.B., M.G. Woolman, and J.P. Miller. 1964. **Fluvial processes in geomorphology**. W.H. Freeman, San Francisco, CA.

Lewis, R.B., R.K. Cox, and J.E. Bonnell. 1989. Fish community analysis near the Wabash River generating station: May-November 1988. Public Service of Indiana, Environmental Programs, Plainsfield, Indiana EPW-033. 37 pp + appendices.

Limnotech, Inc. 1979. Model of Wabash River dissolved oxygen concentrations downstream of the Cayuga Generating Station. Public Service of Indiana, Plainfield, IN.

Lyons, J. 1992. **Using the Index of Biotic Integrity (IBI) to measure environmental quality in warmwater streams of Wisconsin**. U.S. Dept. Agriculture, Forest Service, General Technical Report NC-149.

Mayden, R.L. 1989. Phylogenetic studies of North American minnows, with emphasis on the genus Cyprinella (Teleostei: Cypriniformes). ***Misc. Publ. Univ. Kans. Mus. Nat. Hist. No. 80***. 189 pp.

McCormick, J.H., M.J. Ross, and D.B. Siniff. 1981. Where do yellow perch (Perca flavescens) go in winter when given the option between ice covered waters or a heated discharge. Can. Tech. Rept. Fish. Aquat. Sci. 990: 33-45.

Mills, H.B., W.C. Starrett, and F.C. Bellrose. 1966. Man's effect on the fish and wildlife of the Illinois River. Ill. Nat. Hist. Surv. Biol. Notes 57. 27 pp.

Ohio Environmental Protection Agency (OEPA). 1987. **Water Quality implementation manual**. QA Manual (3rd update). Fish. Ohio Environmental Protection Agency, Columbus.

Ohio Environmental Protection Agency (OEPA). 1987. **Biological criteria for the protection of aquatic life. Volume II. Users Manual for Biological field assessment of Ohio surface waters**. Ohio Environmental Protection Agency, Columbus.

Ohio Environmental Protection Agency (OEPA). 1989. **Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities.** Ohio Environmental Protection Awgncy, Columbus.

Omernik, J.M. 1987. Ecoregions of the conterminous United States. ***Ann. Ass. Am. Geo.*** 77:118-125.

Omernik, J.M. and A.L. Gallant. 1988. **Ecoregions of the upper Midwest States.** USEPA, ERL, Corvallis, OR. EPA/600/3-88/037.

Page, L.M. 1983. **Handbook of Darters**. TFH Publications, Neptune, NJ.

Pearson, J. 1975. Age, growth and condition of dominant fish species in the Upper Wabash River. Indiana Dept. Nat. Resources, Fisheries Section, Div. Fish and Wildl., Indianapolis, IN. 21 pp.

Pearson, J. 1975a. Upper Wabash River access survey report: supplement to the Upper Wabash River Fisheries Survey Report). Indiana Dept. Nat. Resources, Fisheries Section, Div. Fish and Wildlife, Indianapolis, IN. Unnumbered report.

Pflieger, W.L. 1975. **The Fishes of Missouri**. Mo. Dept. Conserv.: Columbia. 343 pp.

Phillips, G.L. and J.C. Underhill. 1971. Distribution and variation of the Catostomidae of Minnesota. ***Bell Mus. Nat. Hist. Univ. Minn., Occ. Pap. No. 10***. 45 pp.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. **Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates.** U.S. Environmental Protection Agency, Monitoring and Data Support Division, Washington, D.C. EPA 444/4-89-001.

Post, G. 1983. **Textbook of fish health.** TFH Publications, Neptune, NJ.

Raney, E.C. and B.W. Menzel. 1969. Heated effluents and effects on aquatic life with emphasis on fishes. Ichthyological Associates Bulletin 2., 468 pp.

Rankin, E.T. 1989. The use of the qualitative habitat evaluation index for use attainability studies in streams and rivers in Ohio. **Ohio Environmental Protection Agency, Division of Water Quality Planning and Assessments, Columbus, Ohio.**

Robertson, R. 1975. Middle Wabash River Stream survey report: Cass, Carroll, Tippecanoe, Warren, and Fountain Counties. Indiana Dept. Nat. Resources, Fisheries Section, Indianapolis, IN.. Unnumbered report.

Schneider, A.F. 1966. Physiography, pp. 40-56, In A.A. Lindsey (ed). **Natural Features of Indiana.** Univ. Notre Dame Press: Notre Dame, IN.

Seaber, P.R., S.P. Kapinost, and G.L. Knapp. 1984. State hydrologic unit maps. **U.S. Geol. Survey Open-file report. 84-708**. 198 pp.

Simon, T.P. 1989. Rationale for a family-level ichthyoplankton index for use in evaluating water quality. pp. 41-65 + appendix. In Davis, W.S. and T.P. Simon. **Proceedings of the 1989 Midwest Pollution Control Biologists Meeting, Chicago, Illinois, February 14-17, 1989.** U.S. Environmental Protection Agency, Chicago, IL. EPA 905/9-89-007.

Simon, T.P. 1991. **Development of Index of Biotic Integrity expectations for the ecoregions of Indiana. I. Central Corn Belt Plain.** U.S. Environmental Protection Agency, Region V, Chicago, IL. EPA 905/9-91/025.

Simon, T.P. 1994. **Development of Index of Biotic Integrity expectations for the ecoregions of Indiana. II. Huron-Erie Lake Plain.** U.S. Environmental Protection Agency, Region V, Chicago, IL. EPA 905/R-92/006.

Simon, T.P. 1997. **Development of Index of Biotic Integrity expectations for the ecoregions of Indiana. III. Northern Indiana Till Plain.** U.S. Environmental Protection Agency, Region V, Chicago, IL. EPA 905/R-96/002.

Simon, T.P., L.L. Holst, and L.J. Shepard. 1988. **Proceedings of the First National Workshop on Biological Criteria, Lincolnwood, Illinois, December 2-4, 1987.** U.S. Environmental Protection Agency, Region V, Chicago. EPA 905/9-89/003.

Smith, G.R., J.N. Taylor, and T.W. Grimshaw. 1981. Ecological survey of fishes in the Raisin River drainage, Michigan. ***Michigan Academician*** 13: 275-305.

Smith, P.W. 1979. **The Fishes of Illinois.** University of Illinois Press: Champaign, IL.

Smith, P.W. 1971. Illinois streams: a classification based on their fishes and an analysis of factors responsible for the disappearance of native species. ***Ill. Nat. Hist. Surv. Biol. Notes*** 76.

Steedman, R.J. 1988. Modification and assessment of an Index of Biotic Integrity to quantify stream quality in southern Ontario. ***Canadian Journal of Fisheries and Aquatic Sciences*** 45: 492-501.

Stewart, J.A. 1983. **Low-flow characteristics of Indiana streams**. U.S. Geological Survey Open File Report 82-1007.

Trautman, M.B. 1981. **The Fishes of Ohio**. The Ohio State University Press: Columbus, OH. 782 pp.

Underhill, J.C. 1986. The fish fauna of the laurentian Great Lakes, the St. Lawrence lowlands, a Newfoundland and Labrador. p. 105-136 In C.H. Hocutt and E.O. Wiley (eds.). **The Zoogeography of North American Freshwater Fishes**. John Wiley & Sons, Interscience, New York.

U.S. Geological Survey (USGS). undated. **Indiana State 208 Water Quality Management Planning Maps**. Region 1B. U.S. Geological Survey, Indianapolis, IN.

U.S. Geological Survey (USGS). 1990. **National Water Summary**. U.S. Geological Survey, Resnick, VA.

U.S. Environmental Protection Agency (USEPA). 1980. **Spatial distribution and temperature selection of fish near the thermal outfall of a power plant during fall, winter, and spring.** USEPA, Env. Res. Lab.-Duluth, MN. EA 600/3-80/009.

U.S. Environmental Protection Agency (USEPA). 1988. **Standard Operating Procedures for conducting rapid assessment of ambient surface water quality using fish.** USEPA, Region V, Central Regional Laboratory, Chicago, IL.

Wallus, R., T.P. Simon, and B.L. Yeager. 1990. Reproductive Biology and Early Life History Stages of fishes from the Ohio River drainage. Tennessee Valley Authority, Chattanooga, Tennessee.

Walterhouse, M.B., 1988. A fisheries survey of the Upper Wabash River reservoir's tributaries. Indiana Department of Natural Resources, Fisheries Section, Indianapolis, IN. 47 pp.

WAPORA. 1976. The effect of the H.T. Prichard generating station thermal effluent on the biota of the West Fork of the White River. Report to Indianapolis Power and Light, Indianapolis, IN. Proj. No. 183E. 312 pp.

Whittier, T.R., D.P. Larsen, R.M. Hughes, C.M. Rohm, A.L. Gallant, and J.M. Omernik. 1987. **The Ohio Stream Regionalization Project: A compendium of results**. USEPA, Environmental Research Laboratory, Corvallis, OR.

APPENDICES

A. Tolerance, trophic, and reproductive guilds classification for computing the Index of Biotic Integrity for Indiana taxa.

B. Site classification percentages based on individual metric attributes.

C. Fish nomenclature changes for the species of fish occurring within the political boundaries of Indiana.

APPENDIX A. Tolerance, trophic, and reproductive guild classifications for computing the Index of Biotic Integrity for Indiana taxa.

VOUCHERCD	GENUS	SPECIES	COMMON_NAM	FEED_GUILD	REPR_GUILD	TOLERANCE
1.00	Lampetra	aepyptera	LEAST BROOK LAMPREY	F	N	R
2.00	Lampetra	appendix	AMERICAN BROOK LAMPR	F	N	R
3.00	Petromyzon	marinus	SEA LAMPREY	P	N	-
4.00	Ichthyomyzon	bdellium	OHIO LAMPREY	P	N	S
5.00	Ichthyomyzon	castaneus	CHESTNUT LAMPREY	P	N	-
6.00	Ichthyomyzon	fossor	NORTHERN BROOK LAMP	F	N	S
7.00	Ichthyomyzon	unicuspis	SILVER LAMPREY	P	N	-
8.00	Acipenser	fulvescens	LAKE STURGEON	V	S	-
9.00	Scaphirhynchus	platorynchus	SHOVELNOSE STURGEON	I	S	-
10.00	Polyodon	spathula	PADDLEFISH	F	S	S
11.00	Lepisosteus	osseus	LONGNOSE GAR	P	M	-
12.00	Lepisosteus	oculatus	SPOTTED GAR	P	M	-
13.00	Lepisosteus	platostomus	SHORTNOSE GAR	P	M	-
14.00	Atractosteus	spatula	ALLIGATOR GAR	P	M	-
15.00	Amia	calva	BOWFIN	P	C	-
16.00	Anguilla	rostrata	AMERICAN EEL	C	-	T
17.00	Alosa	alabamae	ALABAMA SHAD	-	N	-
18.00	Alosa	pseudoharengus	ALEWIFE	F	M	-
19.00	Dorosoma	cepedianum	GIZZARD SHAD	O	M	-
20.00	Alosa	chrysochloris	SKIPJACK HERRING	P	M	-
21.00	Dorosoma	petenense	THREADFIN SHAD	O	M	-
22.00	Hiodon	alosoides	GOLDEYE	I	M	R
23.00	Hiodon	tergisus	MOONEYE	I	M	R
24.00	Coregonus	clupeaformis	LAKE WHITEFISH	V	M	-
25.00	Coregonus	artedi	CISCO OR LAKE HERRING	F	M	-
26.00	Coregonus	hoyi	BLOATER	-	M	-
27.00	Coregonus	nigripinnis	BLACKFIN CISCO	-	N	-
28.00	Coregonus	reighardi	SHORTNOSE CISCO	-	N	-
29.00	Coregonus	zenithicus	SHORTJAW CISCO	-	M	-
30.00	Oncorhynchus	kisutch	COHO SALMON	P	N	M
31.00	Oncorhynchus	tshawytscha	CHINOOK SALMON	P	N	M
32.00	Oncorhynchus	mykiss	RAINBOW TROUT	P	N	M
33.00	Salmo	salar	ATLANTIC SALMON	P	N	M
34.00	Salmo	trutta	BROWN TROUT	P	N	M
35.00	Salvelinus	namaycush	LAKE TROUT	P	N	M
36.00	Salvelinus	fontinalis	BROOK TROUT	P	N	M
37.00	Osmerus	mordax	RAINBOW SMELT	V	M	-
38.00	Esox	lucius	NORTHERN PIKE	P	M	-
39.00	Esox	americanus	GRASS PICKEREL	P	M	P
40.00	Esox	ohioensis	MUSKELLUNGE	P	M	-
41.00	Esox	masquinongy	GREAT LAKES MUSKELLU	P	M	-
42.00	Umbra	limi	CENTRAL MUDMINNOW	O	C	T
43.00	Cyprinus	carpio	CARP	O	M	T
44.00	Carassius	auratus	GOLDFISH	O	M	T
46.00	Hybognathus	nuchalis	MISSISSIPPI SILVERY MINN	O	S	-
47.00	Hybognathus	hankinsoni	BRASSY MINNOW	O	-	-
48.00	Hybognathus	hayi	CYPRESS MINNOW	O	M	-
49.00	Notemigonus	crysoleucus	GOLDEN SHINER	I	M	T
50.00	Clinostomus	elongatus	REDSIDE DACE	I	S	R
51.00	Semotilus	atromaculatus	CREEK C[illegible]B	G	N	T

APPENDIX A. **Continued**

VOUCHERCD	GENUS	SPECIES	COMMON_NAM	FEED_GUILD	REPR_GUILD	TOLERANCE
52.00	Rhinichthys	atratulus	BLACKNOSE DACE	G	S	T
53.00	Rhinichthys	cataractae	LONGNOSE DACE	I	S	R
54.00	Nocomis	micropogon	RIVER CHUB	I	N	I
55.00	Nocomis	biguttatus	HORNYHEAD CHUB	I	N	I
56.00	Notropis	chalybaeus	IRONCOLOR SHINER	I	M	I
57.00	Notropis	hudsonius	SPOTTAIL SHINER	I	M	P
58.00	Notropis	rubellus	ROSYFACE SHINER	I	S	I
59.00	Notropis	atherinoides	EMERALD SHINER	I	M	-
60.00	Notropis	buchanani	GHOST SHINER	I	M	-
61.00	Notropis	shumardi	SILVERBAND SHINER	I	S	I
62.00	Notropis	ludibundus	SAND SHINER	I	M	M
63.00	Notropis	texanus	WEED SHINER	I	M	R
64.00	Notropis	volucellus	MIMIC SHINER	I	M	I
65.00	Notropis	anogenus	PUGNOSE SHINER	I	M	S
66.00	Notropis	ariommus	POPEYE SHINER	I	S	S
67.00	Notropis	blennius	RIVER SHINER	I	S	-
68.00	Notropis	boops	BIGEYE SHINER	I	S	I
69.00	Notropis	dorsalis	BIGMOUTH SHINER	I	M	-
70.00	Notropis	heterodon	BLACKCHIN SHINER	I	M	R
71.00	Notropis	heterolepis	BLACKNOSE SHINER	I	M	S
72.00	Notropis	photogenis	SILVER SHINER	I	S	R
73.00	Euricymba	buccata	SILVERJAW MINNOW	I	M	-
74.00	Hybopsis	amblops	BIGEYE CHUB	I	S	I
75.00	Hybopsis	amnis	PALLID SHINER	I	S	R
76.00	Phenacobius	mirabilis	SUCKERMOUTH MINNOW	I	S	-
77.00	Campostoma	anomalum	CENTRAL STONEROLLER	H	N	-
78.00	Campostoma	oligolepis	LARGESCALE STONEROLL	H	N	-
79.00	Pimephales	notatus	BLUNTNOSE MINNOW	O	C	T
80.00	Pimephales	promelas	FATHEAD MINNOW	O	C	T
81.00	Pimephales	vigilax	BULLHEAD MINNOW	O	C	-
82.00	Couesius	plumbeus	LAKE CHUB	I	S	-
83.00	Ctenopharyngodon	idella	GRASS CARP	O	M	T
84.00	Phoxinus	eythrogaster	SOUTHERN REDBELLY DA	H	S	-
85.00	Scardinius	erythrophthalmus	RUDD	O	M	T
86.00	Hypophthalmichthys	molitrix	SILVER CARP	O	M	T
87.00	Cyprinella	lutrensis	RED SHINER	I	N	T
88.00	Cyprinella	spiloptera	SPOTFIN SHINER	I	M	-
89.00	Cyprinella	whipplei	STEELCOLOR SHINER	I	M	-
90.00	Erimystax	dissimilis	STREAMLINE CHUB	I	S	R
91.00	Erimystax	x-punctatus	GRAVEL CHUB	I	S	M
92.00	Luxilus	chrysocephalus	STRIPED SHINER	I	S	-
93.00	Luxilus	cornutus	COMMON SHINER	I	S	-
94.00	Lythrurus	ardens	ROSEFIN SHINER	I	S	M
95.00	Lythrurus	fumeus	RIBBON SHINER	I	M	-
96.00	Lythrurus	umbratilis	REDFIN SHINER	I	N	-
97.00	Macrhybopsis	storeriana	SILVER CHUB	I	M	-
98.00	Opsopoeodus	emiliae	PUGNOSE MINNOW	I	M	R
99.00	Extrarius	aestivalis	SPECKLED CHUB	I	M	R
100.00	Catostomus	catostomus	LONGNOSE SUCKER	I	S	-
101.00	Catostomus	commersoni	WHITE SUCKER	O	S	T

APPENDIX A. **Continued**

VOUCHERCD	GENUS	SPECIES	COMMON_NAM	FEED_GUILD	REPR_GUILD	TOLERANCE
102.00	Carpiodes	cyprinus	QUILLBACK	O	M	-
103.00	Carpiodes	carpio	RIVER CARPSUCKER	O	M	-
104.00	Carpiodes	velifer	HIGHFIN CARPSUCKER	O	M	S
105.00	Erimyzon	sucetta	LAKE CHUBSUCKER	I	M	-
106.00	Erimyzon	oblongus	CREEK CHUBSUCKER	I	M	-
107.00	Moxostoma	macrolepidotum	SHORTHEAD REDHORSE	I	S	M
108.00	Moxostoma	anisurum	SILVER REDHORSE	I	S	M
109.00	Moxostoma	carinatum	RIVER REDHORSE	I	S	R
110.00	Moxostoma	duquesnei	BLACK REDHORSE	I	S	R
111.00	Moxostoma	erythrurum	GOLDEN REDHORSE	I	S	M
112.00	Moxostoma	valenciennesi	GREATER REDHORSE	I	S	R
113.00	Hypentilium	nigricans	NORTHERN HOGSUCKER	I	S	M
114.00	Cycleptus	elongatus	BLUE SUCKER	I	S	R
115.00	Ictiobus	bubalus	SMALLMOUTH BUFFALO	I	M	-
116.00	Ictiobus	cyprinellus	BIGMOUTH BUFFALO	I	M	-
117.00	Ictiobus	niger	BLACK BUFFALO	I	M	-
118.00	Minytrema	melanops	SPOTTED SUCKER	I	S	-
119.00	Lagochila	lacera	HARELIP SUCKER	-	-	S
120.00	Ictalurus	furcatus	BLUE CATFISH	C	C	-
121.00	Ictalurus	punctatus	CHANNEL CATFISH	C	C	-
122.00	Noturus	gyrinus	TADPOLE MADTOM	I	C	-
123.00	Noturus	nocturnus	FRECKLED MADTOM	I	C	R
124.00	Noturus	eleutherus	MOUNTAIN MADTOM	I	C	R
125.00	Noturus	exilis	SLENDER MADTOM	I	C	R
126.00	Noturus	flavus	STONECAT	I	C	I
127.00	Noturus	miurus	BRINDLED MADTOM	I	C	R
128.00	Noturus	stigmosus	NORTHERN MADTOM	I	C	R
129.00	Pylodictus	olivaris	FLATHEAD CATFISH	P	C	-
130.00	Ameiurus	catus	WHITE CATFISH	-	C	-
131.00	Ameiurus	melas	BLACK BULLHEAD	I	C	T
132.00	Ameiurus	natalis	YELLOW BULLHEAD	I	C	P
133.00	Ameiurus	nebulosus	BROWN BULLHEAD	I	C	P
134.00	Amblyopsis	spelaea	NORTHERN CAVEFISH	G	C	S
135.00	Typhlichthys	subterraneus	SOUTHERN CAVEFISH	G	C	S
136.00	Aphredoderus	sayanus	PIRATE PERCH	I	M	-
137.00	Percopsis	omniscomaycus	TROUT-PERCH	I	M	-
138.00	Lota	lota	BURBOT	-	S	-
139.00	Fundulus	diaphanus	BANDED KILLIFISH	I	M	-
140.00	Fundulus	olivaceus	BLACKSPOTTED TOPMINN	I	M	-
141.00	Fundulus	catenatus	NORTHERN STUDFISH	I	M	R
142.00	Fundulus	notatus	BLACKSTRIPE TOPMINNO	I	M	-
143.00	Fundulus	dispar	STARHEAD TOPMINNOW	I	M	R
144.00	Gambusia	affinis	WESTERN MOSQUITOFISH	I	N	-
145.00	Labidesthes	sicculus	BROOK SILVERSIDE	I	M	M
146.00	Pungitius	pungitius	NINESPINE STICKLEBACK	I	C	-
147.00	Culaea	inconstans	BROOK STICKLEBACK	I	C	-
148.00	Cottus	cognatus	SLIMY SCULPIN	-	C	-
149.00	Cottus	bairdi	MOTTLED SCULPIN	I	C	-
150.00	Cottus	carolinae	BANDED SCULPIN	I	C	-
151.00	Cottus	ricei	SPOONHEAD SCULPIN	I	C	-

APPENDIX A. **Continued**

VOUCHERCD	GENUS	SPECIES	COMMON_NAM	FEED_GUILD	REPR_GUILD	TOLERANCE
152.00	Myoxocephalus	thompsoni	DEEPWATER SCULPIN	-	C	-
153.00	Morone	saxatilis	STRIPED BASS	P	M	-
154.00	Morone	chrysops	WHITE BASS	P	M	-
155.00	Morone	mississippiensis	YELLOW BASS	P	M	-
156.00	Ambloplites	rupestris	ROCK BASS	C	C	M
157.00	Centrarchus	macropterus	FLIER	I	C	-
158.00	Lepomis	cyanellus	GREEN SUNFISH	I	C	T
159.00	Lepomis	gulosus	WARMOUTH	C	C	-
160.00	Lepomis	macrochirus	BLUEGILL	I	C	P
161.00	Lepomis	gibbosus	PUMPKINSEED	I	C	P
162.00	Lepomis	humilis	ORANGESPOTTED SUNFIS	I	C	-
163.00	Lepomis	megalotis	LONGEAR SUNFISH	I	C	M
164.00	Lepomis	microlophus	REDEAR SUNFISH	I	C	-
165.00	Lepomis	punctatus	SPOTTED SUNFISH	I	C	-
166.00	Lepomis	symmetricus	BANTAM SUNFISH	I	C	-
167.00	Micropterus	dolomieu	SMALLMOUTH BASS	C	C	M
168.00	Micropterus	salmoides	LARGEMOUTH BASS	C	C	-
169.00	Micropterus	punctulatus	SPOTTED BASS	C	C	-
170.00	Pomoxis	annularis	WHITE CRAPPIE	-	C	-
171.00	Pomoxis	nigromaculatus	BLACK CRAPPIE	-	C	-
172.00	Etheostoma	chlorosomum	BLUNTNOSE DARTER	I	M	-
173.00	Etheostoma	gracile	SLOUGH DARTER	I	N	-
174.00	Etheostoma	spectabile	ORANGETHROAT DARTER	I	S	-
175.00	Etheostoma	nigrum	JOHNNY DARTER	I	C	-
176.00	Etheostoma	asprigene	MUD DARTER	I	M	-
177.00	Etheostoma	blennioides	GREENSIDE DARTER	I	M	M
178.00	Etheostoma	caeruleum	RAINBOW DARTER	I	S	M
179.00	Etheostoma	camurum	BLUEBREAST DARTER	I	S	R
180.00	Etheostoma	exile	IOWA DARTER	I	M	-
181.00	Etheostoma	flabellare	FANTAIL DARTER	I	C	-
182.00	Etheostoma	histrio	HARLEQUIN DARTER	I	M	S
184.00	Etheostoma	maculatum	SPOTTED DARTER	I	S	R
185.00	Etheostoma	microperca	LEAST DARTER	I	N	-
186.00	Etheostoma	squamiceps	SPOTTAIL DARTER	I	C	-
187.00	Etheostoma	tippecanoe	TIPPECANOE DARTER	I	S	R
188.00	Etheostoma	variatum	VARIEGATE DARTER	I	S	R
189.00	Etheostoma	zonale	BANDED DARTER	I	M	M
190.00	Perca	flavescens	YELLOW PERCH	-	M	-
191.00	Percina	caprodes	LOGPERCH	I	S	M
192.00	Percina	sciera	DUSKY DARTER	I	S	M
193.00	Percina	evides	GILT DARTER	I	S	R
194.00	Percina	maculata	BLACKSIDE DARTER	I	S	-
195.00	Percina	phoxocephala	SLENDERHEAD DARTER	I	S	I
196.00	Percina	shumardi	RIVER DARTER	I	S	-
197.00	Percina	uranidea	STARGAZING DARTER	I	S	S
198.00	Percina	vigil	SADDLEBACK DARTER	I	S	M
199.00	Stizostedion	vitreum	WALLEYE	P	S	-
200.00	Stizostedion	canadense	SAUGER	P	S	-
201.00	Percina	copelandi	CHANNEL DARTER	I	S	S
202.00	Ammocrypta	clara	WESTERN SAND DARTER	I	S	R

APPENDIX A. **Continued**

VOUCHERCD	GENUS	SPECIES	COMMON_NAM	FEED_GUILD	REPR_GUILD	TOLERANCE
203.00	Ammocrypta	pellucida	EASTERN SAND DARTER	I	S	R
204.00	Crystallaria	asprella	CRYSTAL DARTER	I	S	S
205.00	Aplodinotus	grunniens	FRESHWATER DRUM	-	M	P
206.00	Elassoma	zonatum	BANDED PYGMY SUNFISH	I	C	-
207.00	Notropis	wickliffi	CHANNEL SHINER	I	M	I
208.00	Esox	lucius x maspuinongy	TIGER MUSKIE	P	M	-
209.00	Morone	chrysops x saxatilis	WIPER	P	M	-
210.00	Stizostedion	canadense x vitreum	SAUGEYE	P	S	M
211.00	Lepomis	x-hybrid	SUNFISH HYBRID			
212.00	Gymnocephalus	cernuus	RUFFE	C	S	-
213.00	Mylopharyngodon	piceus	BLACK CARP	O	M	T
214.00	Hypophthalmichthys	noblis	BIGHEAD CARP	H	M	T
215.00	Neogobius	malanostomus	ROUND GOBY	I	C	M
216.00	Proterorhinus	marmoratus	TUBE NOSE GOBY			
217.00	Morone	americana	WHITE PERCH	P	M	-
218.00	Moxostoma	m. breviceps	OHIO REDHORSE	I	S	M
219.00	Menidia	beryllina	INLAND SILVERSIDE	I	M	P
220.00	Gasterosteus	aculeatus	THREESPINE STICKLEBAC	I	C	-

Feeding Guild: C = carnivore; F = filter feeder; G = generalist feeder; H = herbivore; I = insectivore; O = omnivore; P = piscivore; Pa = Parasite; V = invertivore; -- = feeding guild behaviorally plastic.

Reproductive Guild: C = complex with parental care; M = simple, miscellaneous; N = complex, no parental care; S = simple lithophil.

Tolerance/Sensitivity: I = common intolerant; M = moderately intolerant; P = moderately tolerant; R = rare intolerant; S = special intolerant; T = highly tolerant; -- = tolerance classification moderate.

APPENDIX B. Site classification percentages based on individual metric attributes.

Eastern Corn Belt Plains

Site Specific Index of Biotic Integrity Scores

Sample Number	94,001.00
Site:	STONEY CREEK
County:	HAMILTON
Location	166th Street & Cumberland
Drainage	21.50 (sq. mi)

INDEX METRICS	Actual Observation
1. Total number of species	18.00
2. Percent Round-bodied Suckers	0.35
Number of Minnow Species	6.00
3. Number of Darter Species	2.00
Number of Darter, Madtom, Sculpin	4.00
4. Number of Sunfish	3.00
Percent Pioneer Species	31.47
5. Number of Sensitive Species:	6.00
6. Percent Tolerant Species	11.89
7. Percent Omnivores	6.99
8. Percent Insectivores	62.24
9. Percent Carnivores	5.24
Percent Headwater Species	22.73
10. Number of individuals	286.00
11. Percent Simple Lithophils	10.49
12. Percent DELT Anomalies	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,002.00
Site:	HINKLE CREEK
County:	HAMILTON
Location:	216 street
Drainage:	19.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	13.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	30.92
Number of sunfish sp:	3.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	30.92
7. Percent omnivore:	21.05
8. Percent insectivore:	61.84
9. Percent pioneer:	30.26
Percent carnivore:	3.95
10. Percent lithophil:	29.61
11. CPUE (number individuals):	152.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,003.00
Site:	LICK CREEK
County:	MADISON
Location:	S.R. 13
Drainage:	21.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	21.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	5.00
3. Percent headwater sp:	42.19
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	22.27
7. Percent omnivore:	12.70
8. Percent insectivore:	70.70
9. Percent pioneer:	27.15
Percent carnivore:	1.17
10. Percent lithophil:	29.69
11. CPUE (number individuals):	512.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,004.00
Site:	FALL CREEK
County:	MADISON
Location:	Fall Creek Pk
Drainage:	121.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	30.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	4.00
3. Percent headwater sp:	5.14
Number of sunfish sp:	4.00
4. Number of minnow sp:	11.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	12.16
7. Percent omnivore:	3.78
8. Percent insectivore:	59.73
9. Percent pioneer:	42.43
Percent carnivore:	0.54
10. Percent lithophil:	26.76
11. CPUE (number individuals):	370.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,005.00
Site:	MISSISSINEWA RIVER
County:	RANDOLPH
Location:	S.R. 1
Drainage:	191.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	28.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	6.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	6.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	61.33
7. Percent omnivore:	57.40
8. Percent insectivore:	40.03
9. Percent pioneer:	43.66
Percent carnivore:	0.60
10. Percent lithophil:	31.27
11. CPUE (number individuals):	662.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,006.00
Site:	STONEY CREEK
County:	RANDOLPH
Location:	Windson Pike Road
Drainage:	48.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	18.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	28.41
Number of sunfish sp:	1.00
4. Number of minnow sp:	8.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	7.58
7. Percent omnivore:	4.17
8. Percent insectivore:	67.80
9. Percent pioneer:	26.89
Percent carnivore:	3.41
10. Percent lithophil:	35.23
11. CPUE (number individuals):	264.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,006.00
Site:	STONEY CREEK
County:	RANDOLPH
Location:	Windson Pike Road
Drainage:	48.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	18.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	28.41
Number of sunfish sp:	1.00
4. Number of minnow sp:	8.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	7.58
7. Percent omnivore:	4.17
8. Percent insectivore:	67.80
9. Percent pioneer:	26.89
Percent carnivore:	3.41
10. Percent lithophil:	35.23
11. CPUE (number individuals):	264.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,007.00
Site:	CABIN CREEK
County:	RANDOLPH
Location:	Windsor Pike Road
Drainage:	18.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	18.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	5.00
3. Percent headwater sp:	19.50
Number of sunfish sp:	3.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	18.87
7. Percent omnivore:	12.58
8. Percent insectivore:	57.86
9. Percent pioneer:	30.50
Percent carnivore:	3.46
10. Percent lithophil:	44.03
11. CPUE (number individuals):	318.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,008.00
Site:	SPARROW CREEK
County:	RANDOLPH
Location:	Baseline Road
Drainage:	6.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	11.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	7.48
Number of sunfish sp:	1.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	77.57
7. Percent omnivore:	2.80
8. Percent insectivore:	23.36
9. Percent pioneer:	78.50
Percent carnivore:	0.00
10. Percent lithophil:	3.74
11. CPUE (number individuals):	107.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,009.00
Site:	MISSISSINEWA RIVER
County:	RANDOLPH
Location:	C.R. 300E
Drainage:	90.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	27.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	5.00
3. Percent headwater sp:	5.85
Number of sunfish sp:	4.00
4. Number of minnow sp:	10.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	8.00
6. Percent tolerants:	64.04
7. Percent omnivore:	41.81
8. Percent insectivore:	42.69
9. Percent pioneer:	46.20
Percent carnivore:	0.88
10. Percent lithophil:	29.82
11. CPUE (number individuals):	342.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,010.00
Site:	DEER CREEK
County:	HENRY
Location:	Mechanicsburg Road
Drainage:	7.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	11.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	28.87
Number of sunfish sp:	2.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	25.35
7. Percent omnivore:	2.11
8. Percent insectivore:	34.51
9. Percent pioneer:	60.56
Percent carnivore:	0.70
10. Percent lithophil:	11.97
11. CPUE (number individuals):	142.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,011.00
Site:	FALL CREEK
County:	HENRY
Location:	Mechanicsburg Road
Drainage:	5.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	27.66
Number of sunfish sp:	2.00
4. Number of minnow sp:	4.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	8.51
7. Percent omnivore:	7.09
8. Percent insectivore:	83.69
9. Percent pioneer:	6.38
Percent carnivore:	2.84
10. Percent lithophil:	58.16
11. CPUE (number individuals):	141.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,012.00
Site:	HONEY CREEK
County:	HENRY
Location:	C.R. 800N
Drainage:	7.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	9.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	50.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	5.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	14.80
7. Percent omnivore:	1.53
8. Percent insectivore:	82.14
9. Percent pioneer:	21.43
Percent carnivore:	0.00
10. Percent lithophil:	44.90
11. CPUE (number individuals):	196.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,013.00
Site:	BELL CR
County:	DELEWARE
Location:	CR 350 S
Drainage:	33.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	11.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	72.95
Number of sunfish sp:	3.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	9.02
7. Percent omnivore:	0.00
8. Percent insectivore:	90.16
9. Percent pioneer:	7.38
Percent carnivore:	2.46
10. Percent lithophil:	18.03
11. CPUE (number individuals):	122.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,014.00
Site:	CAMPBELL CREEK
County:	DELEWARE
Location:	C.R. 500E
Drainage:	10.20 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.61
Number of sunfish sp:	3.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	83.30
7. Percent omnivore:	29.12
8. Percent insectivore:	30.14
9. Percent pioneer:	87.17
Percent carnivore:	0.81
10. Percent lithophil:	7.13
11. CPUE (number individuals):	491.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,015.00
Site:	MISSISSINEWA RIVER
County:	DELEWARE
Location:	W/S 700N Bridge
Drainage:	300.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	28.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	5.00
3. Percent headwater sp:	0.87
Number of sunfish sp:	3.00
4. Number of minnow sp:	11.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	33.86
7. Percent omnivore:	27.64
8. Percent insectivore:	64.83
9. Percent pioneer:	34.73
Percent carnivore:	1.01
10. Percent lithophil:	32.56
11. CPUE (number individuals):	691.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,016.00
Site:	MISSISSINEWA RIVER
County:	DELEWARE
Location:	Granville Bridge
Drainage:	347.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	27.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	5.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	6.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	39.96
7. Percent omnivore:	33.90
8. Percent insectivore:	49.62
9. Percent pioneer:	34.47
Percent carnivore:	15.91
10. Percent lithophil:	13.07
11. CPUE (number individuals):	528.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,017.00
Site:	MISSISSINEWA RIVER
County:	GRANT
Location:	C.R. 900 S.Bridge,3.5mi Upland
Drainage:	465.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	27.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	6.00
3. Percent headwater sp:	8.89
Number of sunfish sp:	3.00
4. Number of minnow sp:	11.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	30.19
7. Percent omnivore:	20.74
8. Percent insectivore:	64.26
9. Percent pioneer:	44.44
Percent carnivore:	0.56
10. Percent lithophil:	28.70
11. CPUE (number individuals):	540.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,017.10
Site:	PIKE CREEK
County:	DELEWARE
Location:	Wheeling, IN
Drainage:	21.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	5.31
Number of sunfish sp:	1.00
4. Number of minnow sp:	5.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	44.41
7. Percent omnivore:	24.30
8. Percent insectivore:	24.02
9. Percent pioneer:	79.61
Percent carnivore:	0.00
10. Percent lithophil:	14.80
11. CPUE (number individuals):	358.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,018.00
Site:	MISSISSINEWA RIVER
County:	GRANT
Location:	S.R. 22 Bridge, Jonesboro
Drainage:	521.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	27.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	6.00
3. Percent headwater sp:	0.24
Number of sunfish sp:	4.00
4. Number of minnow sp:	11.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	29.93
7. Percent omnivore:	22.38
8. Percent insectivore:	70.80
9. Percent pioneer:	39.90
Percent carnivore:	0.97
10. Percent lithophil:	24.82
11. CPUE (number individuals):	411.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,019.00
Site:	MISSISSINEWA RIVER
County:	GRANT
Location:	S.R. 15 Bridge
Drainage:	695.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	5.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	18.70
7. Percent omnivore:	0.27
8. Percent insectivore:	61.79
9. Percent pioneer:	40.92
Percent carnivore:	0.27
10. Percent lithophil:	38.21
11. CPUE (number individuals):	369.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,020.00
Site:	MISSISSINEWA RIVER
County:	GRANT
Location:	C.R. 500N Bridge
Drainage:	682.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	10.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	84.62
7. Percent omnivore:	30.77
8. Percent insectivore:	15.38
9. Percent pioneer:	87.69
Percent carnivore:	0.00
10. Percent lithophil:	10.77
11. CPUE (number individuals):	65.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,021.00
Site:	ROCK CREEK
County:	WELLS
Location:	C.R. 200N Bridge
Drainage:	74.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	1.68
Number of sunfish sp:	3.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	47.06
7. Percent omnivore:	8.40
8. Percent insectivore:	47.90
9. Percent pioneer:	57.98
Percent carnivore:	3.36
10. Percent lithophil:	16.81
11. CPUE (number individuals):	119.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,022.00
Site:	SALAMONIE RIVER
County:	WELLS
Location:	Willow Road
Drainage:	256.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	21.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	9.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	61.97
7. Percent omnivore:	53.46
8. Percent insectivore:	34.84
9. Percent pioneer:	62.50
Percent carnivore:	3.46
10. Percent lithophil:	14.36
11. CPUE (number individuals):	376.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,023.00
Site:	SALAMONIE RIVER
County:	WELLS
Location:	C.R. 1100 S. Bridge
Drainage:	327.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	21.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	50.74
7. Percent omnivore:	39.41
8. Percent insectivore:	47.78
9. Percent pioneer:	35.96
Percent carnivore:	2.96
10. Percent lithophil:	20.20
11. CPUE (number individuals):	203.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,024.00
Site:	SALAMONIE RIVER
County:	HUNTINGTON
Location:	S.R. 5 Bridge, Warren
Drainage:	409.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	30.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	5.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	5.00
4. Number of minnow sp:	11.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	50.42
7. Percent omnivore:	45.98
8. Percent insectivore:	50.74
9. Percent pioneer:	50.11
Percent carnivore:	0.32
10. Percent lithophil:	5.39
11. CPUE (number individuals):	946.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,025.00
Site:	LITTLE WABASH RIVER
County:	HUNTINGTON
Location:	N. Broadway,1 1/4mi East
Drainage:	271.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	24.00
2. Number of d/m/s sp:	8.00
Number of darter sp:	6.00
3. Percent headwater sp:	9.81
Number of sunfish sp:	4.00
4. Number of minnow sp:	8.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	8.00
6. Percent tolerants:	32.56
7. Percent omnivore:	26.59
8. Percent insectivore:	31.34
9. Percent pioneer:	46.01
Percent carnivore:	0.81
10. Percent lithophil:	31.75
11. CPUE (number individuals):	989.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,026.00
Site:	SALAMONIE RIVER
County:	WABASH
Location:	Durnbaugh Rd.
Drainage:	560.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	20.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	4.00
3. Percent headwater sp:	12.12
Number of sunfish sp:	3.00
4. Number of minnow sp:	5.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	12.73
7. Percent omnivore:	4.85
8. Percent insectivore:	86.06
9. Percent pioneer:	3.64
Percent carnivore:	2.42
10. Percent lithophil:	37.58
11. CPUE (number individuals):	165.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,027.00
Site:	TREATY CREEK
County:	WABASH
Location:	Water Works Dr.
Drainage:	30.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	7.33
Number of sunfish sp:	2.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	70.69
7. Percent omnivore:	67.13
8. Percent insectivore:	7.33
9. Percent pioneer:	16.63
Percent carnivore:	6.93
10. Percent lithophil:	70.10
11. CPUE (number individuals):	505.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,028.00
Site:	BEARGRASS CREEK
County:	WABASH
Location:	Reahard Rd, C.R. 800 N
Drainage:	23.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	9.22
Number of sunfish sp:	1.00
4. Number of minnow sp:	7.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	82.98
7. Percent omnivore:	41.13
8. Percent insectivore:	15.60
9. Percent pioneer:	39.72
Percent carnivore:	0.00
10. Percent lithophil:	54.61
11. CPUE (number individuals):	141.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,029.00
Site:	PIPE CREEK
County:	MIAMI
Location:	C.R. 300E Road Bridge
Drainage:	141.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	3.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	1.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	25.00
7. Percent omnivore:	10.00
8. Percent insectivore:	75.00
9. Percent pioneer:	15.00
Percent carnivore:	0.00
10. Percent lithophil:	85.00
11. CPUE (number individuals):	20.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,030.00
Site:	MISSISSINEWA RIVER
County:	MIAMI
Location:	S.R. 124 Bridge
Drainage:	822.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	5.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	1.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	38.71
7. Percent omnivore:	19.35
8. Percent insectivore:	58.06
9. Percent pioneer:	0.00
Percent carnivore:	3.20
10. Percent lithophil:	3.23
11. CPUE (number individuals):	31.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,031.00
Site:	WEESAU CREEK
County:	MIAMI
Location:	S.R. 16 Bridge
Drainage:	21.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,033.00
Site:	PAW PAW CREEK
County:	MIAMI
Location:	C.R. 580E Bridge
Drainage:	55.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	1.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	100.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	3.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,034.00
Site:	EEL RIVER
County:	MIAMI
Location:	C.R. 700E Bridge
Drainage:	570.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	2.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	24.69
7. Percent omnivore:	7.41
8. Percent insectivore:	74.07
9. Percent pioneer:	17.28
Percent carnivore:	13.58
10. Percent lithophil:	53.09
11. CPUE (number individuals):	81.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,035.00
Site:	TIPPECANOE RIVER
County:	FULTON
Location:	C.R. 375W Bridge
Drainage:	636.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	7.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	0.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	73.08
7. Percent omnivore:	0.00
8. Percent insectivore:	90.38
9. Percent pioneer:	73.08
Percent carnivore:	9.62
10. Percent lithophil:	15.38
11. CPUE (number individuals):	52.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,036.00
Site:	TIPPECANOE RIVER
County:	FULTON
Location:	C.R. 900W Bridge
Drainage:	776.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	0.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	50.00
7. Percent omnivore:	18.75
8. Percent insectivore:	75.00
9. Percent pioneer:	31.25
Percent carnivore:	6.25
10. Percent lithophil:	43.75
11. CPUE (number individuals):	16.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,037.00
Site:	MINNOW CREEK
County:	CASS
Location:	near mouth
Drainage:	7.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	1.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	100.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	5.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,038.00
Site:	PIPE CREEK
County:	CASS
Location:	C.R. 250S
Drainage:	190.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	9.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	0.00
3. Percent headwater sp:	3.70
Number of sunfish sp:	2.00
4. Number of minnow sp:	2.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	13.58
7. Percent omnivore:	11.11
8. Percent insectivore:	83.95
9. Percent pioneer:	2.47
Percent carnivore:	4.94
10. Percent lithophil:	34.57
11. CPUE (number individuals):	81.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,039.00
Site:	TWELVE MILE CREEK
County:	CASS
Location:	C.R. 300N
Drainage:	53.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	5.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	2.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	27.27
7. Percent omnivore:	0.00
8. Percent insectivore:	81.82
9. Percent pioneer:	36.36
Percent carnivore:	18.18
10. Percent lithophil:	18.18
11. CPUE (number individuals):	11.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,040.00
Site:	TICK CREEK
County:	CASS
Location:	Bridge nearest mouth
Drainage:	8.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	31.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	5.00
3. Percent headwater sp:	1.15
Number of sunfish sp:	7.00
4. Number of minnow sp:	13.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	8.00
6. Percent tolerants:	24.48
7. Percent omnivore:	17.09
8. Percent insectivore:	72 52
9. Percent pioneer:	28.18
Percent carnivore:	1.85
10. Percent lithophil:	22.86
11. CPUE (number individuals):	433.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,041.00
Site:	CROOKED CREEK
County:	CASS
Location:	C.R. 150S Bridge
Drainage:	59.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	0.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	11.76
7. Percent omnivore:	5.88
8. Percent insectivore:	82.35
9. Percent pioneer:	5.88
Percent carnivore:	11.76
10. Percent lithophil:	76.47
11. CPUE (number individuals):	17.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,042.00
Site:	SUGAR CREEK
County:	TIPPECANOE
Location:	C.R. 775
Drainage:	25.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	0.00
3. Percent headwater sp:	28.67
Number of sunfish sp:	2.00
4. Number of minnow sp:	8.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	47.55
7. Percent omnivore:	12.59
8. Percent insectivore:	37.06
9. Percent pioneer:	51.75
Percent carnivore:	0.70
10. Percent lithophil:	20.28
11. CPUE (number individuals):	143.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,043.00
Site:	BUCK CREEK
County:	TIPPECANOE
Location:	C.R. 600E Bridge
Drainage:	12.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	73.86
Number of sunfish sp:	0.00
4. Number of minnow sp:	6.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	89.77
7. Percent omnivore:	4.55
8. Percent insectivore:	1.14
9. Percent pioneer:	26.14
Percent carnivore:	0.00
10. Percent lithophil:	73.86
11. CPUE (number individuals):	88.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,044.00
Site:	NORTH FORK WILDCAT CREEK
County:	TIPPECANOE
Location:	C.R. 900E Bridge
Drainage:	412.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	10.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	7.18
7. Percent omnivore:	6.67
8. Percent insectivore:	89.23
9. Percent pioneer:	7.69
Percent carnivore:	2.05
10. Percent lithophil:	25.64
11. CPUE (number individuals):	195.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,045.00
Site:	SOUTH FORK WILCAT CREEK
County:	TIPPECANOE
Location:	C.R. 100 N Bridge
Drainage:	368.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	11.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	12.00
6. Percent tolerants:	7.14
7. Percent omnivore:	4.29
8. Percent insectivore:	90.71
9. Percent pioneer:	14.29
Percent carnivore:	2.14
10. Percent lithophil:	28.57
11. CPUE (number individuals):	140.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,046.00
Site:	WILCAT CREEK
County:	TIPPECANOE
Location:	Eisenhower Road
Drainage:	794.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	8.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	8.00
6. Percent tolerants:	3.95
7. Percent omnivore:	4.80
8. Percent insectivore:	90.68
9. Percent pioneer:	7.91
Percent carnivore:	0.56
10. Percent lithophil:	55.08
11. CPUE (number individuals):	354.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,047.00
Site:	BIG WEA
County:	TIPPECANOE
Location:	S.R. 25
Drainage:	160.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	5.00
3. Percent headwater sp:	7.87
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	5.51
7. Percent omnivore:	0.79
8. Percent insectivore:	78.74
9. Percent pioneer:	13.39
Percent carnivore:	3.94
10. Percent lithophil:	42.52
11. CPUE (number individuals):	127.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,048.00
Site:	SOUTH FORK WILDCAT CREEK
County:	TIPPECANOE
Location:	C.R. 900E Bridge
Drainage:	197.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	7.00
Number of sucker sp:	5.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	15.89
7. Percent omnivore:	15.89
8. Percent insectivore:	51.40
9. Percent pioneer:	34.58
Percent carnivore:	2.80
10. Percent lithophil:	40.19
11. CPUE (number individuals):	107.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,049.00
Site:	SOUTH FORK WILDCAT CREEK
County:	TIPPECANOE
Location:	C.R. 200S Bridge
Drainage:	237.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	23.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.41
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	13.00
6. Percent tolerants:	9.39
7. Percent omnivore:	8.98
8. Percent insectivore:	72.24
9. Percent pioneer:	17.55
Percent carnivore:	1.63
10. Percent lithophil:	29.39
11. CPUE (number individuals):	245.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,052.00
Site:	BIG CREEK
County:	WHITE
Location:	Springboro Road
Drainage:	57.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	9.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	1.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	2.91
7. Percent omnivore:	0.00
8. Percent insectivore:	79.61
9. Percent pioneer:	1.94
Percent carnivore:	19.40
10. Percent lithophil:	16.50
11. CPUE (number individuals):	103.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,053.00
Site:	PIKE CREEK
County:	WHITE
Location:	S.R. 39 Bridge
Drainage:	30.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	2.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	0.00
3. Percent headwater sp:	50.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	100.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	50.00
11. CPUE (number individuals):	14.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,054.00
Site:	INDIAN CREEK
County:	PULASKI
Location:	S.R. 119 Bridge
Drainage:	110.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	1.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	20.00
7. Percent omnivore:	20.00
8. Percent insectivore:	70.00
9. Percent pioneer:	0.00
Percent carnivore:	10.00
10. Percent lithophil:	70.00
11. CPUE (number individuals):	10.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,055.00
Site:	TIPPECANOE RIVER
County:	PULASKI
Location:	C.R. 575 S. Bridge
Drainage:	1,089.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	1.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	15.79
7. Percent omnivore:	15.79
8. Percent insectivore:	63.16
9. Percent pioneer:	0.00
Percent carnivore:	21.05
10. Percent lithophil:	63.16
11. CPUE (number individuals):	19.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,056.00	
Site:	MILL CREEK	
County:	PULASKI	
Location:	S.R. 35	
Drainage:	90.00	(sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	3.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	1.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	25.00
7. Percent omnivore:	0.00
8. Percent insectivore:	50.00
9. Percent pioneer:	25.00
Percent carnivore:	25.00
10. Percent lithophil:	50.00
11. CPUE (number individuals):	4.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,057.00
Site:	DILTS-ANSTIS DITCH
County:	PULASKI
Location:	Winomac Fish&Wildlife Preserve
Drainage:	7.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,058.00
Site:	ROCK CREEK
County:	CARROLL
Location:	C.R. 850N/250W Bridge
Drainage:	85.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	3.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	1.09
7. Percent omnivore:	1.09
8. Percent insectivore:	65.22
9. Percent pioneer:	32.61
Percent carnivore:	1.09
10. Percent lithophil:	20.65
11. CPUE (number individuals):	92.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,059.00
Site:	BURNETTS CREEK
County:	CARROLL
Location:	Towpath Road
Drainage:	21.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,060.00
Site:	RATTLESNAKE CREEK
County:	CARROLL
Location:	C.R. 100 N Bridge
Drainage:	7.20 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	4.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	3.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	36.67
7. Percent omnivore:	5.00
8. Percent insectivore:	65.00
9. Percent pioneer:	35.00
Percent carnivore:	0.00
10. Percent lithophil:	63.33
11. CPUE (number individuals):	60.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,061.00
Site:	RATTLESNAKE CREEK
County:	CARROLL
Location:	C.R. 950N Bridge
Drainage:	8.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	36.29
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	36.29
7. Percent omnivore:	13.71
8. Percent insectivore:	60.48
9. Percent pioneer:	37.10
Percent carnivore:	0.00
10. Percent lithophil:	26.61
11. CPUE (number individuals):	124.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,062.00
Site:	DEER CREEK
County:	CARROLL
Location:	S.R. 18/39/421, Riley Park
Drainage:	299.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	21.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	8.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	37.33
7. Percent omnivore:	34.56
8. Percent insectivore:	55.30
9. Percent pioneer:	32.72
Percent carnivore:	5.07
10. Percent lithophil:	19.35
11. CPUE (number individuals):	217.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,063.00
Site:	DEER CREEK
County:	CARROLL
Location:	C.R. 300N Bridge
Drainage:	274.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.54
Number of sunfish sp:	1.00
4. Number of minnow sp:	11.00
Number of sucker sp:	5.00
5. Number of sensitive sp:	11.00
6. Percent tolerants:	23.66
7. Percent omnivore:	22.58
8. Percent insectivore:	61.83
9. Percent pioneer:	33.33
Percent carnivore:	1.08
10. Percent lithophil:	36.02
11. CPUE (number individuals):	186.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,064.00
Site:	BATCHELORS CREEK
County:	CARROLL
Location:	C.R. 300 N Bridge
Drainage:	36.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	2.65
Number of sunfish sp:	2.00
4. Number of minnow sp:	9.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	21.19
7. Percent omnivore:	17.22
8. Percent insectivore:	30.46
9. Percent pioneer:	58.28
Percent carnivore:	0.00
10. Percent lithophil:	23.84
11. CPUE (number individuals):	151.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,065.00
Site:	LITTLE DEER CREEK
County:	CARROLL
Location:	C.R. 300N Bridge
Drainage:	54.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	20.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	1.43
Number of sunfish sp:	3.00
4. Number of minnow sp:	8.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	5.71
7. Percent omnivore:	0.71
8. Percent insectivore:	76.43
9. Percent pioneer:	27.14
Percent carnivore:	2.86
10. Percent lithophil:	19.29
11. CPUE (number individuals):	140.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,066.00
Site:	WILDCAT CREEK
County:	CARROLL
Location:	C.R. 50 E Bridge
Drainage:	375.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	23.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	11.00
Number of sucker sp:	5.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	9.04
7. Percent omnivore:	6.91
8. Percent insectivore:	85.64
9. Percent pioneer:	9.57
Percent carnivore:	2.13
10. Percent lithophil:	15.96
11. CPUE (number individuals):	188.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,067.00
Site:	WILDCAT CREEK
County:	CARROLL
Location:	S.R. 39 Bridge
Drainage:	396.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	7.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	1.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	20.41
7. Percent omnivore:	2.04
8. Percent insectivore:	73.47
9. Percent pioneer:	0.00
Percent carnivore:	6.10
10. Percent lithophil:	73.47
11. CPUE (number individuals):	49.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,069.00
Site:	SPRING CREEK
County:	CLINTON
Location:	C.R. 200 N Bridge
Drainage:	16.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	1.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	100.00
7. Percent omnivore:	100.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	100.00
11. CPUE (number individuals):	1.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,070.00
Site:	SOUTH FORK WILDCAT CREEK
County:	CLINTON
Location:	Hamilton Road
Drainage:	80.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	0.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	5.41
7. Percent omnivore:	5.41
8. Percent insectivore:	81.08
9. Percent pioneer:	0.00
Percent carnivore:	13.51
10. Percent lithophil:	56.76
11. CPUE (number individuals):	37.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,071.00
Site:	KILMORE CREEK
County:	CLINTON
Location:	N. Hamilton Road
Drainage:	73.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	1.95
Number of sunfish sp:	2.00
4. Number of minnow sp:	9.00
Number of sucker sp:	5.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	59.51
7. Percent omnivore:	50.98
8. Percent insectivore:	27.80
9. Percent pioneer:	41.95
Percent carnivore:	3.90
10. Percent lithophil:	40.73
11. CPUE (number individuals):	410.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,072.00
Site:	MIDDLE FK WILDCAT CREEK
County:	CLINTON
Location:	C.R. 680 W Bridge
Drainage:	57.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	13.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	24.19
7. Percent omnivore:	21.83
8. Percent insectivore:	73.16
9. Percent pioneer:	53.10
Percent carnivore:	2.65
10. Percent lithophil:	5.60
11. CPUE (number individuals):	339.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,073.00
Site:	EAGLE CREEK
County:	BOONE
Location:	S.R. 32 Bridge
Drainage:	26.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.55
Number of sunfish sp:	2.00
4. Number of minnow sp:	8.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	15.30
7. Percent omnivore:	13.39
8. Percent insectivore:	22.13
9. Percent pioneer:	71.58
Percent carnivore:	0.00
10. Percent lithophil:	15.57
11. CPUE (number individuals):	366.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,074.00
Site:	MOUNTS RUN
County:	BOONE
Location:	C.R. 950 E Bridge
Drainage:	15.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	17.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	2.57
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	25.00
7. Percent omnivore:	15.07
8. Percent insectivore:	25.74
9. Percent pioneer:	75.00
Percent carnivore:	0.37
10. Percent lithophil:	19.49
11. CPUE (number individuals):	272.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,075.00
Site:	FISHBACK CREEK
County:	BOONE
Location:	S.R. 334 Bridge
Drainage:	13.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	57.73
7. Percent omnivore:	28.87
8. Percent insectivore:	23.02
9. Percent pioneer:	81.44
Percent carnivore:	1.37
10. Percent lithophil:	26.46
11. CPUE (number individuals):	291.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,076.00
Site:	WHITE LICK CREEK
County:	HENDRICKS
Location:	S.R. 267 Bridge
Drainage:	22.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	7.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	2.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	31.53
7. Percent omnivore:	2.70
8. Percent insectivore:	86.49
9. Percent pioneer:	28.83
Percent carnivore:	7.21
10. Percent lithophil:	1.80
11. CPUE (number individuals):	111.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,077.00
Site:	BIG WALNUT CREEK
County:	HENDRICKS
Location:	C.R. 900 N Bridge
Drainage:	41.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	1.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	30.43
7. Percent omnivore:	26.09
8. Percent insectivore:	65.22
9. Percent pioneer:	0.00
Percent carnivore:	4.35
10. Percent lithophil:	86.96
11. CPUE (number individuals):	23.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,078.00
Site:	NW FK WHITLICK CREEK
County:	HENDRICKS
Location:	C.R. 100S. Bridge
Drainage:	29.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	3.00
3. Percent headwater sp:	1.88
Number of sunfish sp:	4.00
4. Number of minnow sp:	8.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	36.88
7. Percent omnivore:	23.96
8. Percent insectivore:	35.00
9. Percent pioneer:	46.88
Percent carnivore:	2.92
10. Percent lithophil:	47.92
11. CPUE (number individuals):	480.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,083.00
Site:	HONEY CREEK
County:	JOHNSON
Location:	CR 550 W
Drainage:	14.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	13.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	2.69
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	33.87
7. Percent omnivore:	13.44
8. Percent insectivore:	20.43
9. Percent pioneer:	78.49
Percent carnivore:	1.61
10. Percent lithophil:	20.43
11. CPUE (number individuals):	186.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,084.00
Site:	CROOKED CREEK
County:	MORGAN
Location:	S.R. 37 BRIDGE
Drainage:	15.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	4.00
3. Percent headwater sp:	1.56
Number of sunfish sp:	1.00
4. Number of minnow sp:	10.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	28.05
7. Percent omnivore:	15.58
8. Percent insectivore:	16.62
9. Percent pioneer:	75.58
Percent carnivore:	0.52
10. Percent lithophil:	23.38
11. CPUE (number individuals):	385.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,085.00
Site:	STOUTS CREEK
County:	MORGAN
Location:	CR 600 E
Drainage:	57.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	20.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	2.41
Number of sunfish sp:	1.00
4. Number of minnow sp:	8.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	17.59
7. Percent omnivore:	8.15
8. Percent insectivore:	29.07
9. Percent pioneer:	67.59
Percent carnivore:	0.93
10. Percent lithophil:	28.70
11. CPUE (number individuals):	540.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,086.00
Site:	SOUTH PRONG STOTTS
County:	MORGAN
Location:	CR 00 Bridge
Drainage:	19.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	9.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	32.72
7. Percent omnivore:	22.16
8. Percent insectivore:	59.19
9. Percent pioneer:	76.53
Percent carnivore:	0.00
10. Percent lithophil:	15.65
11. CPUE (number individuals):	767.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	94,087.00
Site:	SOUTH PRONG STOTTS
County:	JOHNSON
Location:	Nast Chapel Road
Drainage:	30.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	13.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	1.71
Number of sunfish sp:	1.00
4. Number of minnow sp:	8.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	43.03
7. Percent omnivore:	16.45
8. Percent insectivore:	16.05
9. Percent pioneer:	83.29
Percent carnivore:	0.79
10. Percent lithophil:	15.39
11. CPUE (number individuals):	760.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,192.00
Site:	DEER CREEK
County:	PUTNAM
Location:	C.R. 325 S.
Drainage:	21.70 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	20.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	5.00
3. Percent headwater sp:	11.17
Number of sunfish sp:	4.00
4. Number of minnow sp:	5.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	4.47
7. Percent omnivore:	0.56
8. Percent insectivore:	59.78
9. Percent pioneer:	36.87
Percent carnivore:	12.29
10. Percent lithophil:	24.58
11. CPUE (number individuals):	179.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,194.00
Site:	BIG RACCOON CREEK
County:	PUTNAM
Location:	S.R. 231
Drainage:	126.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	22.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	9.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	24.31
7. Percent omnivore:	22.35
8. Percent insectivore:	47.84
9. Percent pioneer:	49.41
Percent carnivore:	2.35
10. Percent lithophil:	27.84
11. CPUE (number individuals):	255.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,195.00
Site:	NORTH RAMP CREEK
County:	PUTNAM
Location:	C.R. 1000 N.
Drainage:	16.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	5.00
3. Percent headwater sp:	20.27
Number of sunfish sp:	0.00
4. Number of minnow sp:	8.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	51.16
7. Percent omnivore:	10.96
8. Percent insectivore:	22.59
9. Percent pioneer:	65.12
Percent carnivore:	0.00
10. Percent lithophil:	26.58
11. CPUE (number individuals):	301.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,196.00
Site:	BIG WALNUT CREEK
County:	PUTNAM
Location:	C.R. 1050 N.
Drainage:	131.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	1.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	7.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	10.00
6. Percent tolerants:	10.50
7. Percent omnivore:	7.50
8. Percent insectivore:	52.50
9. Percent pioneer:	58.50
Percent carnivore:	2.00
10. Percent lithophil:	21.00
11. CPUE (number individuals):	200.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,197.00
Site:	PLUM CREEK
County:	PUTNAM
Location:	C.R. 600 N.
Drainage:	3.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	20.56
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	52.80
7. Percent omnivore:	14.02
8. Percent insectivore:	39.25
9. Percent pioneer:	62.15
Percent carnivore:	0.00
10. Percent lithophil:	51.87
11. CPUE (number individuals):	214.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,203.00
Site:	LITTLE POTATO CREEK
County:	MONTGOMERY
Location:	C.R. 700 E.
Drainage:	33.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	23.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	10.00
Number of sucker sp:	5.00
5. Number of sensitive sp:	8.00
6. Percent tolerants:	37.93
7. Percent omnivore:	28.97
8. Percent insectivore:	51.03
9. Percent pioneer:	53.56
Percent carnivore:	0.92
10. Percent lithophil:	9.43
11. CPUE (number individuals):	435.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,204.00
Site:	LYE CREEK
County:	MONTGOMERY
Location:	C.R. 650 N.
Drainage:	74.60 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	1.98
Number of sunfish sp:	3.00
4. Number of minnow sp:	3.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	13.86
7. Percent omnivore:	8.91
8. Percent insectivore:	81.19
9. Percent pioneer:	3.96
Percent carnivore:	9.90
10. Percent lithophil:	18.81
11. CPUE (number individuals):	101.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,205.00
Site:	LYE CREEK DRAIN
County:	MONTGOMERY
Location:	C.R. 800 N.
Drainage:	13.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	8.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	4.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	25.17
7. Percent omnivore:	3.50
8. Percent insectivore:	60.14
9. Percent pioneer:	98.25
Percent carnivore:	0.00
10. Percent lithophil:	46.50
11. CPUE (number individuals):	286.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,206.00
Site:	NORTH FORK COAL CREEK
County:	MONTGOMERY
Location:	C.R. 575 W.
Drainage:	13.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	5.00
3. Percent headwater sp:	1.09
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	32.61
7. Percent omnivore:	17.93
8. Percent insectivore:	49.46
9. Percent pioneer:	42.93
Percent carnivore:	3.26
10. Percent lithophil:	20.11
11. CPUE (number individuals):	184.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,207.00
Site:	CLARKSON DITCH
County:	MONTGOMERY
Location:	C.R. 500 N.
Drainage:	2.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	23.39
Number of sunfish sp:	1.00
4. Number of minnow sp:	7.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	69.15
7. Percent omnivore:	34.24
8. Percent insectivore:	17.97
9. Percent pioneer:	65.42
Percent carnivore:	0.00
10. Percent lithophil:	26.78
11. CPUE (number individuals):	295.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,208.00
Site:	INDIAN CREEK
County:	MONTGOMERY
Location:	S.R. 47
Drainage:	11.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	5.00
3. Percent headwater sp:	18.78
Number of sunfish sp:	2.00
4. Number of minnow sp:	9.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	7.76
7. Percent omnivore:	1.22
8. Percent insectivore:	44.90
9. Percent pioneer:	58.78
Percent carnivore:	1.22
10. Percent lithophil:	21.63
11. CPUE (number individuals):	245.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,209.00
Site:	OFFIELD CREEK
County:	MONTGOMERY
Location:	C.R. 200 W.
Drainage:	17.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	20.00
2. Number of d/m/s sp:	7.00
Number of darter sp:	5.00
3. Percent headwater sp:	24.35
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	12.61
7. Percent omnivore:	5.22
8. Percent insectivore:	58.70
9. Percent pioneer:	42.61
Percent carnivore:	3.48
10. Percent lithophil:	20.87
11. CPUE (number individuals):	230.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,210.00
Site:	HAW CREEK
County:	MONTGOMERY
Location:	C.R. 550 E.
Drainage:	14.90 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	23.00
2. Number of d/m/s sp:	6.00
Number of darter sp:	6.00
3. Percent headwater sp:	2.51
Number of sunfish sp:	4.00
4. Number of minnow sp:	9.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	7.00
6. Percent tolerants:	9.10
7. Percent omnivore:	1.56
8. Percent insectivore:	20.12
9. Percent pioneer:	86.11
Percent carnivore:	0.24
10. Percent lithophil:	14.01
11. CPUE (number individuals):	835.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,100.00
Site:	CEDAR CREEK
County:	DEKALB
Location:	C.R. 27 (U/S)
Drainage:	24.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	17.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	4.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	5.00
4. Number of minnow sp:	3.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	4.00
6. Percent tolerants:	44.58
7. Percent omnivore:	6.02
8. Percent insectivore:	83.13
9. Percent pioneer:	37.35
Percent carnivore:	10.84
10. Percent lithophil:	28.92
11. CPUE (number individuals):	83.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,101.00
Site:	MATSAN DITCH
County:	DEKALB
Location:	S.R. 6 (D/S)
Drainage:	15.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	11.71
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	80.18
7. Percent omnivore:	31.53
8. Percent insectivore:	18.92
9. Percent pioneer:	51.35
Percent carnivore:	1.80
10. Percent lithophil:	44.14
11. CPUE (number individuals):	111.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,102.00
Site:	FISH CREEK
County:	STEUBEN
Location:	CR 775 S
Drainage:	37.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	17.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	4.00
4. Number of minnow sp:	2.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	68.94
7. Percent omnivore:	52.17
8. Percent insectivore:	31.68
9. Percent pioneer:	18.01
Percent carnivore:	14.91
10. Percent lithophil:	4.35
11. CPUE (number individuals):	161.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,103.00	
Site:	FISH CREEK	
County:	DEKALB	
Location:	CR 16	
Drainage:	98.80	(sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	19.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	1.09
Number of sunfish sp:	3.00
4. Number of minnow sp:	5.00
Number of sucker sp:	3.00
5. Number of sensitive sp:	6.00
6. Percent tolerants:	48.63
7. Percent omnivore:	29.51
8. Percent insectivore:	50.27
9. Percent pioneer:	43.72
Percent carnivore:	10.38
10. Percent lithophil:	12.02
11. CPUE (number individuals):	183.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,104.00
Site:	BIG RUN
County:	DEKALB
Location:	C.R. 75 (U/S)
Drainage:	28.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	7.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	20.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	5.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	89.77
7. Percent omnivore:	2.79
8. Percent insectivore:	26.51
9. Percent pioneer:	74.88
Percent carnivore:	0.00
10. Percent lithophil:	25.12
11. CPUE (number individuals):	215.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,105.00
Site:	BUCK CREEK
County:	DEKALB
Location:	C.R. 40 (D/S)
Drainage:	13.20 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	8.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	1.21
Number of sunfish sp:	2.00
4. Number of minnow sp:	2.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	95.97
7. Percent omnivore:	42.74
8. Percent insectivore:	30.24
9. Percent pioneer:	54.03
Percent carnivore:	0.00
10. Percent lithophil:	12.10
11. CPUE (number individuals):	248.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,106.00
Site:	SAL SHANK DITCH
County:	DEKALB
Location:	C.R. 59 (U/S)
Drainage:	18.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	2.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	0.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	90.48
7. Percent omnivore:	71.43
8. Percent insectivore:	26.19
9. Percent pioneer:	21.43
Percent carnivore:	2.38
10. Percent lithophil:	73.81
11. CPUE (number individuals):	42.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,107.00
Site:	BEAR CREEK
County:	DEKALB
Location:	C.R. 56 (U/S)
Drainage:	22.70 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	10.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	20.13
Number of sunfish sp:	1.00
4. Number of minnow sp:	4.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	81.21
7. Percent omnivore:	19.46
8. Percent insectivore:	31.54
9. Percent pioneer:	75.84
Percent carnivore:	0.00
10. Percent lithophil:	17.45
11. CPUE (number individuals):	149.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,108.00
Site:	WITZGALL DITCH
County:	ALLEN
Location:	FEIGHNER RD. (D/S)
Drainage:	2.30 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,109.00
Site:	ROBINSON CREEK
County:	ALLEN
Location:	COVERDALE RD. (U/S)
Drainage:	7.20 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	3.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	30.00
7. Percent omnivore:	0.00
8. Percent insectivore:	40.00
9. Percent pioneer:	40.00
Percent carnivore:	60.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	10.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,110.00
Site:	LITTLE RIVER
County:	ALLEN
Location:	SMITH RD. (U/S)
Drainage:	2.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	10.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	49.12
7. Percent omnivore:	12.28
8. Percent insectivore:	22.81
9. Percent pioneer:	71.93
Percent carnivore:	1.75
10. Percent lithophil:	1.75
11. CPUE (number individuals):	57.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,111.00
Site:	GRAHAM MCCULLOCH DITCH 1
County:	ALLEN
Location:	SOUTH BEND RD. (U/S)
Drainage:	10.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	10.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	17.06
Number of sunfish sp:	0.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	44.71
7. Percent omnivore:	6.48
8. Percent insectivore:	18.09
9. Percent pioneer:	61.77
Percent carnivore:	0.00
10. Percent lithophil:	37.54
11. CPUE (number individuals):	293.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,112.00
Site:	JOHN DIEHL DITCH
County:	DEKALB
Location:	S.R. 327 (U/S)
Drainage:	7.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	24.81
Number of sunfish sp:	2.00
4. Number of minnow sp:	5.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	56.39
7. Percent omnivore:	20.30
8. Percent insectivore:	48.87
9. Percent pioneer:	40.60
Percent carnivore:	2.26
10. Percent lithophil:	28.57
11. CPUE (number individuals):	133.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,113.00
Site:	OBER DITCH
County:	DEKALB
Location:	C.R. 19 (U/S) BRIDGE
Drainage:	7.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	11.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	5.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	60.29
7. Percent omnivore:	5.88
8. Percent insectivore:	42.65
9. Percent pioneer:	66.18
Percent carnivore:	4.41
10. Percent lithophil:	20.59
11. CPUE (number individuals):	68.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,114.00
Site:	CEDAR CREEK
County:	DEKALB
Location:	C.R. 35 (D/S)
Drainage:	74.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	5.88
Number of sunfish sp:	2.00
4. Number of minnow sp:	7.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	77.01
7. Percent omnivore:	8.02
8. Percent insectivore:	31.02
9. Percent pioneer:	77.54
Percent carnivore:	0.53
10. Percent lithophil:	8.02
11. CPUE (number individuals):	187.00
12. Percent delt:	0.53

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,115.00
Site:	CEDAR CREEK
County:	DEKALB
Location:	S.R. 8 (U/S)
Drainage:	87.30 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	20.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	3.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	88.57
7. Percent omnivore:	8.57
8. Percent insectivore:	53.33
9. Percent pioneer:	65.71
Percent carnivore:	2.86
10. Percent lithophil:	20.00
11. CPUE (number individuals):	105.00
12. Percent delt:	1.90

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,116.00
Site:	JOHN DIEHL DITCH
County:	DEKALB
Location:	AUBURN DR. (C.R. 48) (D/S)
Drainage:	37.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	2.00
3. Percent headwater sp:	71.61
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	54.84
7. Percent omnivore:	3.87
8. Percent insectivore:	42.58
9. Percent pioneer:	19.35
Percent carnivore:	0.65
10. Percent lithophil:	45.81
11. CPUE (number individuals):	155.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,117.00
Site:	CEDAR CREEK
County:	DEKALB
Location:	S.R. 427 (D/S)
Drainage:	133.60 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	4.90
Number of sunfish sp:	2.00
4. Number of minnow sp:	5.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	84.31
7. Percent omnivore:	17.65
8. Percent insectivore:	44.12
9. Percent pioneer:	76.47
Percent carnivore:	0.00
10. Percent lithophil:	13.73
11. CPUE (number individuals):	102.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,118.00
Site:	LITTLE CEDAR CREEK
County:	DEKALB
Location:	C.R. 64 (D/S)
Drainage:	45.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	16.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	4.00
3. Percent headwater sp:	9.57
Number of sunfish sp:	1.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	3.00
6. Percent tolerants:	53.04
7. Percent omnivore:	26.96
8. Percent insectivore:	35.65
9. Percent pioneer:	41.74
Percent carnivore:	1.74
10. Percent lithophil:	29.57
11. CPUE (number individuals):	115.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,119.00
Site:	CEDAR CREEK
County:	DEKALB
Location:	C.R. 68 (D/S)
Drainage:	136.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	11.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	14.13
Number of sunfish sp:	2.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	79.35
7. Percent omnivore:	17.39
8. Percent insectivore:	59.78
9. Percent pioneer:	66.30
Percent carnivore:	0.00
10. Percent lithophil:	22.83
11. CPUE (number individuals):	92.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,120.00
Site:	ST. JOSEPH RIVER
County:	DEKALB
Location:	S.R. 8 (D/S)
Drainage:	641.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	18.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	5.00
4. Number of minnow sp:	7.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	75.77
7. Percent omnivore:	69.62
8. Percent insectivore:	23.21
9. Percent pioneer:	10.24
Percent carnivore:	6.48
10. Percent lithophil:	6.83
11. CPUE (number individuals):	293.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,121.00
Site:	ST. JOSEPH RIVER
County:	DEKALB
Location:	C.R. 64 (U/S)
Drainage:	703.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	23.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	10.03
Number of sunfish sp:	3.00
4. Number of minnow sp:	9.00
Number of sucker sp:	4.00
5. Number of sensitive sp:	9.00
6. Percent tolerants:	50.74
7. Percent omnivore:	23.89
8. Percent insectivore:	68.73
9. Percent pioneer:	40.41
Percent carnivore:	5.01
10. Percent lithophil:	14.45
11. CPUE (number individuals):	339.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,176.00
Site:	BRUSH CREEK
County:	OWEN
Location:	C.R. 1150 N.
Drainage:	8.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	7.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	2.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	71.43
7. Percent omnivore:	14.29
8. Percent insectivore:	71.43
9. Percent pioneer:	71.43
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	14.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	93,177.00
Site:	LIMESTONE CREEK
County:	OWEN
Location:	C.R. 650 N.
Drainage:	8.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	5.00
Number of darter sp:	3.00
3. Percent headwater sp:	3.51
Number of sunfish sp:	2.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	1.00
6. Percent tolerants:	46.33
7. Percent omnivore:	36.10
8. Percent insectivore:	22.04
9. Percent pioneer:	92.01
Percent carnivore:	0.32
10. Percent lithophil:	7.03
11. CPUE (number individuals):	313.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,013.00
Site:	GELLER DITCH
County:	ALLEN
Location:	S.R. 3 BRIDGE (U/S)
Drainage:	9.40 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	1.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	100.00
7. Percent omnivore:	100.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	29.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,016.00
Site:	CLEAR LAKE CREEK
County:	STEUBEN
Location:	C.R. 500N BRIDGE (D/S)
Drainage:	4.80 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	1.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	100.00
7. Percent omnivore:	100.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	100.00
11. CPUE (number individuals):	33.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,019.00
Site:	FISH CREEK
County:	STEUBEN
Location:	C.R.200 S Bridge (u/s)
Drainage:	29.60 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	2.00
Number of darter sp:	1.00
3. Percent headwater sp:	1.02
Number of sunfish sp:	4.00
4. Number of minnow sp:	3.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	2.00
6. Percent tolerants:	86.73
7. Percent omnivore:	19.39
8. Percent insectivore:	67.35
9. Percent pioneer:	68.37
Percent carnivore:	1.02
10. Percent lithophil:	21.43
11. CPUE (number individuals):	98.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,020.00
Site:	UN-NAMED TRIB. W. BRANCH
County:	STEUBEN
Location:	CR 200 S Bridge (d/s)
Drainage:	1.20 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	12.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	1.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	5.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	83.96
7. Percent omnivore:	34.76
8. Percent insectivore:	47.59
9. Percent pioneer:	63.10
Percent carnivore:	0.00
10. Percent lithophil:	3.74
11. CPUE (number individuals):	187.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,022.00
Site:	FISH CREEK
County:	STEUBEN
Location:	BALL LAKE LANE BRIDGE (D/S)
Drainage:	11.60 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	15.00
2. Number of d/m/s sp:	3.00
Number of darter sp:	3.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	5.00
4. Number of minnow sp:	2.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	12.71
7. Percent omnivore:	1.69
8. Percent insectivore:	45.76
9. Percent pioneer:	16.95
Percent carnivore:	49.15
10. Percent lithophil:	1.69
11. CPUE (number individuals):	118.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,023.00
Site:	BLACK CREEK
County:	STEUBEN
Location:	C.R. 550E BRIDGE (U/S)
Drainage:	8.30 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	9.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	1.00
4. Number of minnow sp:	5.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	90.07
7. Percent omnivore:	71.63
8. Percent insectivore:	2.84
9. Percent pioneer:	89.36
Percent carnivore:	1.42
10. Percent lithophil:	6.38
11. CPUE (number individuals):	141.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,024.00
Site:	FISH CREEK
County:	STEUBEN
Location:	850E BRIDGE (U/S)
Drainage:	37.50 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	14.00
2. Number of d/m/s sp:	4.00
Number of darter sp:	3.00
3. Percent headwater sp:	11.27
Number of sunfish sp:	2.00
4. Number of minnow sp:	6.00
Number of sucker sp:	2.00
5. Number of sensitive sp:	5.00
6. Percent tolerants:	29.58
7. Percent omnivore:	11.27
8. Percent insectivore:	78.87
9. Percent pioneer:	28.17
Percent carnivore:	1.41
10. Percent lithophil:	53.52
11. CPUE (number individuals):	71.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,040.00
Site:	EEL RIVER
County:	ALLEN
Location:	S.R. 33 BRIDGE (D/S)
Drainage:	34.70 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,041.00
Site:	JOHNSON DITCH
County:	ALLEN
Location:	S.R. 33 BRIDGE (D/S)
Drainage:	11.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,060.00
Site:	LITTLE CEDAR CREEK
County:	NOBLE
Location:	1150E (D/S)
Drainage:	5.00 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	8.00
2. Number of d/m/s sp:	1.00
Number of darter sp:	0.00
3. Percent headwater sp:	14.61
Number of sunfish sp:	1.00
4. Number of minnow sp:	4.00
Number of sucker sp:	1.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	78.65
7. Percent omnivore:	17.98
8. Percent insectivore:	33.71
9. Percent pioneer:	51.69
Percent carnivore:	0.00
10. Percent lithophil:	41.57
11. CPUE (number individuals):	89.00
12. Percent delt:	3.37

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,061.00
Site:	BLACK CREEK
County:	NOBLE
Location:	C.R. 450S (U/S)
Drainage:	19.10 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	10.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	3.00
4. Number of minnow sp:	5.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	68.25
7. Percent omnivore:	26.98
8. Percent insectivore:	49.21
9. Percent pioneer:	80.95
Percent carnivore:	3.17
10. Percent lithophil:	6.35
11. CPUE (number individuals):	63.00
12. Percent delt:	0.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,062.00
Site:	WILLOW CREEK
County:	NOBLE
Location:	C.R. 1000N (D/S)
Drainage:	7.70 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	6.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	2.00
4. Number of minnow sp:	1.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	80.00
7. Percent omnivore:	0.00
8. Percent insectivore:	34.00
9. Percent pioneer:	70.00
Percent carnivore:	8.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	50.00
12. Percent delt:	14.00

Eastern Corn Belt Plain

Site Specific Index of Biotic Integrity Scores

Sample number:	91,083.00
Site:	SNYDER DITCH
County:	ALLEN
Location:	HESSEN CASSEL RD. (U/S)
Drainage:	6.70 (sq mi)

INDEX METRICS	Actual Observation
1. Numer of species:	0.00
2. Number of d/m/s sp:	0.00
Number of darter sp:	0.00
3. Percent headwater sp:	0.00
Number of sunfish sp:	0.00
4. Number of minnow sp:	0.00
Number of sucker sp:	0.00
5. Number of sensitive sp:	0.00
6. Percent tolerants:	0.00
7. Percent omnivore:	0.00
8. Percent insectivore:	0.00
9. Percent pioneer:	0.00
Percent carnivore:	0.00
10. Percent lithophil:	0.00
11. CPUE (number individuals):	0.00
12. Percent delt:	0.00

APPENDIX C. Fish nomenclature changes for the species of fish occurring within the political boundaries of Indiana.

	Previous Nomenclature
Petromyzontiformes - lampreys	
Petromyzontidae - lamprey	
Lampetra appendix (DeKay), American brook lamprey	*Lampetra lamottei*
Lepisosteiformes - gars	
Lepisosteidae - gars	
Atractosteus spatula (Lacepede), alligator gar	*Lepisosteus spatula*
Salmoniformes - trout, salmon, whitefish	
Salmonidae - trout, salmon, whitefish	
Oncorhynchus mykiss Walbaum, rainbow trout	*Salmo gairdneri*
Cypriniformes - carps and minnows	
Cyprinidae -carps and minnows	
Campostoma oligolepis Hubbs and Greene, largescale stoneroller	previously considered *Campostoma anomalum pullum*
Cyprinella lutrensis (Baird and Girard), red shiner	*Notropis lutrensis*
Cyprinella spiloptera Cope, spotfin shiner	*Notropis spiloptera*
Cyprinella whipplei (Girard), steelcolor shiner	*Notropis whipplei*
Erimystax dissimilis Kirtland, streamline chub	*Hybopsis dissimilis*
Erimystax x-punctata Hubbs and Crowe, gravel chub	*Hybopsis x-punctata*
Extrarius aestivalis Girard, speckled chub	*Hybopsis aestivalis*
Hybopsis amnis Hubbs and Greene, pallid shiner	*Notropis amnis*
Luxilus chrysocephalus (Rafinesque), striped shiner	*Notropis chrysocephalus*
Luxilus cornutus (Mitchell), common shiner	*Notropis cornutus*
Lythrurus ardens (Cope), rosefin shiner	*Notropis ardens*
Lythrurus fumeus Evermann, ribbon shiner	*Notropis fumeus*
Lythrurus umbratilis (Girard), redfin shiner	*Notropis umbratilis*
Macrhybopsis storeriana (Kirkland), silver chub	*Hybopsis storeriana*
Notropis ludibuundus Cope, sand shiner	*Notropis stramineus*
Opsopoeodus emiliae Hay, pugnose minnow	*Notropis emiliae*
Siluriformes - bullhead and catfish	
Ictaluridae - bullhead and catfish	
Ameiurus catus (Linnaeus), white catfish	*Ictalurus catus*
Ameiurus melas (Rafinesque), black bullhead	*Ictalurus melas*
Ameiurus natalis (Lesueur), yellow bullhead	*Ictalurus natalis*
Ameiurus nebulosus (Lesueur), brown bullhead	*Ictalurus nebulosus*
Atheriniformes - topminnows, silversides	
Fundulidae - topminnows	previously Cyprinodontidae
Perciformes - basses, sunfish, perch, darters	previously Percichthyidae
Moronidae - temperate basses	
Morone chrysops (Rafinesque), white bass	
Morone mississippiensis Jordan and Eigenmann, yellow bass	
Morone saxatilis (Walbaum), striped bass	
Elassomatidae - pygmy sunfish	previously Centrarchidae
Elassoma zonatum Jordan, banded pygmy sunfish	
Percidae - perches and darters	
Crystallaria asprella Jordan, crystal darter	*Ammocrypta asprella*