Manual of Fisheries Survey Methods

by
Stuart Shipman, chairman

Lake & Reservoirs Work Group
Ed Braun
Dan Carnahan
Larry Koza
Brian Schoenung

River & Streams Work Group
Doug Keller
Dave Kittaka
Tom Stefanavage

Indiana Division of Fish and Wildlife
Fisheries Section
State Office Building
Indianapolis, Indiana 46204

INTRODUCTION

Indiana Division of Fish and Wildlife (DFW) has a long history of developing standards for the collection and reporting of fish community information. In 1968 a memo from the Chief of Fisheries outlined appropriate units of effort for traps (wire), gill nets, seining, and AC electrofishing (based on lake acreage) including how catch data were to be reported. In 1978 formal "Guidelines for the Collection of Survey Data" (James et. al. 1978) were approved and have been utilized, with only minor changes, since that time. These guidelines comprised a comprehensive listing of what, where, how and how much information to collect during standard surveys as well as outlining how findings were to be reported for both lake & stream fish community surveys. Each management district also developed average length-weight and growth tables for all game fish species plus several important non-game species commonly found in their district.

Beginning in 1980 biologists began switching from AC electrofishing to more powerful and effective pulsed DC electrofishing (Smith-Root™). Because both electrofishing units were still in use, no major changes in standard survey guidelines were proposed, although some biologist reduced their electrofishing effort because of higher catches. By the mid-1980's we also increased targeted sampling, especially for largemouth bass, to supplement standard, summer time collections used for most fish community assessments. Separate work plans were developed that outlined targeted sampling methods by species and separate, independently managed spreadsheets were created to analyze those individual collections. Unfortunately, because these spreadsheets (Quartro Pro and Excel) were created by each "keeper of the record" they often contained duplicate information, calculated fields and lacked naming conventions (linked or index fields) making it difficult to associate the spreadsheets and compare information between collections.

By the late 1980's all biologist were equipped with DC electrofishing gear (both boat and barge) and some discussion ensued to rewrite the 1978 sampling guidelines. While the need to update the guidelines was delayed, it was recommended that standard intercepts (Carlander 1982) be used for age and growth analysis and capture data be tracked by gear type to facilitate computation of catch per effort standards. File management software (FileMaker Pro) was first used during this time to electronically store relative abundance by number and weight of many fish collections from southern waters. Presently, over 2,700 sampling events are contained in these files. Apple BASIC programs were also written to automate routine chores like population estimation, age and growth analysis and creel survey summation. By now most copies of the original 1978 guidelines, including whatever additions and deletions had occurred, were not uniformly available.

Recent advancements in computer technology coupled with a greater desire to share data within the Fisheries Section and with other agencies prompted the DFW to work toward development of a comprehensive, computerized information system. The recent move from Macintosh™ computers to Windows™ based systems also dictated that we make some changes in how we manage information. A necessary first step in the development of an information system is describing what the data represents thus improving the utility of analysis and to prevent inappropriate use. The following narrative constitutes the "how to" of standard surveys on lakes, reservoirs, streams and eventually creel surveys, provides the forms for field collection and data input, and the necessary standard output reports used to illustrate those collections. These guidelines will comprise the metadata that describes how the Indiana DFW collects fisheries information, defines the datasets with variable dictionaries (field name, type and size) and characterizes the relationships between various database tables. Many of the data structures used in the DFW Fish Information System were originally developed by the Indiana Department of Environment Management (IDEM) whose support the DFW will continue to foster.

Finally, these standards are considered minimums and are intended to assure data integrity and continuity. However, the guidelines are not intended to replace professional judgement if the biologist feels additional sampling is necessary to answer specific resource questions on more intensively managed lakes and streams. The information contained in these files will eventually be used to develop baseline values of fish community structure across broad geographic areas. Furthermore, it must be understood that these guidelines were developed for professional, experienced biologist with a high level of understanding of the operation of the described gear. It is presumed that the biologist in charge will contact the Division of Enforcement, local lake associations, and in the case of streams surveys riparian land owners, prior to the onset of sampling. This document is a living resource that will be modified as changes in collection methods or system design dictate.

I. LAKE SURVEY GUIDELINES

A. STANDARD EFFORT- COMMUNITY SURVEYS

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1. Introduction

Priorities for surveys will be determined annually as outlined in work plans. Some consideration should be given to sampling waters without recent surveys (including lakes without public access that have never been surveyed) or that may be impacted by some lake or watershed management activity, including implementation of lake enhancement projects. Biologist should attempt to repeat sampling times and effort from historic surveys. During standard surveys all fish species will be collected. If additional sampling targets one or several species, that information should be recorded as a separate sampling event. Species specific surveys can be conducted when only one species is of interest, like the evaluation of a stocking program.

2. Electrofishing Boat

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All electrofishing will be conducted at night. Two fish dippers is the standard. Instances where some sampling occurs before dark or two dippers are not used, should be noted with effort and catch recorded separately. Record the most effective pulse width, voltage and pulse rate used during sampling (should attempt to maintain a current of 5 to 6 amps). Other conditions thought to impact catch rates during a sampling event, especially weather changes or gear failures, should be noted.

Electrofishing stations should be 15 minutes in length and at the same approximate location from survey to survey. The use of a GPS will enable managers to find the same sampling locations between sampling events. Electrofishing catch data can be recorded separately for each sample site or combined for all sites. The amount of effort needed per lake will be determined by the lake size as follows:

Acres	Electrofishing Effort
<50	Entire shoreline or ½ hour (whichever is less)
51 - 300	½ - 1 hour (depending on prior surveys and habitat diversity)
>300	1 hour + 1-15 minute station for each 250 acres of water with a maximum of 7 hours for large lakes

3. Gill Nets

Gill nets should be fished in a variety of habitats including along weed beds, drop offs, points, submerged islands or road beds with total effort generally reflecting the abundance of each habitat type. Always conduct temperature/oxygen monitoring prior to setting nets to prevent fishing in anoxic waters. Gill nets should be set overnight with catch recorded as number caught per over-night lift. Data can be recorded as catch per individual net or combined for all netting effort during the survey. Deviations from standard methods should be noted including damaged nets or when weather conditions prevent running the net.

Each end of the gill net should have a visible float labeled DNR with the respective biologist's contact information. Netting effort can be reduced if the biologist feels that too many game fish are being lost or catch of species like shad, bullheads, crappie or perch making working that number of nets in the available time impractical. If lake conditions are suitable, nets should be moved to a different location each day. Nets should be placed in the same approximate area of the lake as in the lake's previous survey. Net locations should be referenced with GPS coordinates and marked on a map. Netting effort will be determined by lake size as follows:

Acres	Gill Net Effort
<50	2 overnight sets
51 - 150	4 overnight sets
151 - 300	8 overnight sets
>300	8 overnight sets + 2 overnight sets/extra 250 acres of water with a maximum of 24 overnight sets.

4. Trap Nets

Trap nets, like gill nets, are passive gear that require fish movement to be effective and are required for all population assessments where feasible. They should be fished in shallow water habitats associated with shoreline and are typically quite selective for cover seeking species like bluegill and crappie. The end of the lead should be placed on the bank to prevent fish from swimming around the front of the lead. A float should be attached to one of the net frames and labeled DNR with the respective biologist's contact information. As with gill nets, traps should be set overnight with catch recorded as number caught per over-night lift. Data can be tabulated as catch per individual trap-lift or combined for all trapping effort during the survey. Deviations from standard methods should be noted including damaged nets or when weather conditions prevent running the nets each morning. Nets should be moved daily if lake conditions permit. Nets should be placed in the same approximate area of the lake as in the lake's previous survey. Net locations should be referenced with GPS coordinates and marked on a map. Netting effort will be determined by lake size as follows:

Acres	Trap Net Effort
<50	1 overnight sets
51 - 150	2 overnight sets
151 - 300	4 overnight sets
>300	4 overnight sets + 1 overnight set/extra 250 acres of water with a maximum of 12 overnight sets.

5. Other Gear

If additional or non-standard gear is used during the survey, total effort and catch must be reported separately and appropriate descriptions of the gear type provided to the information management coordinator for inclusion in the gear type database. As with the other gear, location of sampling should be mapped with catch tabulated per effort (trap night, seine haul, etc) or combined for the entire survey, specifically for that gear.

B. SPECIES SPECIFIC SURVEYS

Data from sampling for a specific species still needs to be entered into the appropriate databases. A field will be available in the databases to indicate whether the sampling constitutes a fish community survey or a targeted survey and provides opportunities to identify the targeted species. Specific species sampling guidelines should always be identified in individual work plans including gear types and effort to be used. Any deviations from standard methods must be approved either in a specific work plan or by the regional supervisor. It is the responsibility of the biologist in-charge to keep the information management coordinator informed about changes in protocol to insure quality control and quality assurance of data included in the information system.

C. WATER CHEMISTRY

Water chemistry data for each standard survey conducted will include pH, dissolved oxygen (DO), total alkalinity, conductivity, air temperature, water temperatures, and secchi disk readings. Total dissolved solids (TDS) and nutrients are optional parameters which can be monitored at the discretion of the biologist. Measurements should generally be taken at the deepest part of the lake. If the lake is divided into separate basins and the biologist thinks some difference in water quality may exist, then two or more profiles can be taken. Again, these standards are minimums and do not replace professional judgement if additional sampling is deemed important. Water chemistry should be performed before gill nets are set to determine the depth of the thermocline and the presence of oxygen below the thermocline.

Measurements taken at both the water surface and lake bottom will include pH , total alkalinity, and TDS if measured. Total alkalinity and TDS will be recorded in ppm. Water temperatures will be taken at the surface and at two foot intervals down to the lake bottom. Water and air temperatures will be recorded in °F. DO measurements will be recorded in ppm and taken at the surface and at five foot intervals until the oxygen level is zero. Conductivity will be measured at the surface and reported in µS . Secchi disk measurements will be recorded in decimal feet. All chemical parameters will be measured using Hach™ products unless appropriate meters are available. All meters should be routinely calibrated according to the manufacture's specifications. All water chemistry data will be recorded on the water chemistry field form.

D. FISH DATA RECORDING

All fish collected during a survey will be identified and enumerated by species. If a fish cannot be identified in the field, it should be placed in a solution of ten percent formalin for later identification. The total length of each fish will then be determined. Total length is the distance from the tip of the snout to the maximum extended length of the caudal fin when both lobes are compressed dorsal-ventrally. Lengths will be recorded in increments of 0.1 inches and separated by gear type. If more than 500 specimens of a single species are collected, with little deviation in length frequency, additional fish can just be counted. Five scale samples per one-half inch group will be taken from all appropriate game fish species per lake. However, some professional judgement must be employed depending a gear type, with some gears more effective at capturing small or large fish.

Historic surveys recorded weights in increments of 0.01 pounds. Typically a minimum of three weights were recorded per tenth inch group for each species collected. Large collections of game fish within a limited size range were counted and bulk weighed. Bulk weighing was also acceptable when dealing with large numbers of non-game species of any size such as gizzard shad or golden shiners. Sub-sampling is another technique that was applied when dealing with large numbers of non-game species. Sub-sampling consists of recording individual weights for only the first 100 fish of a species that are measured. All other individuals of that species are counted and bulk weighed.

Beginning in 2000 fish will no longer be weighed as part of standard surveys. Biomass estimates will be calculated using the total number and length frequency of collected individuals and a standard length-weight equation for that species. Initially, each district will use the length-weight equation developed for their respective districts. Once adequate historic weight samples are included in the information system, species specific length-weight equations will be developed by resource type. If no length-weight equation is presently available for a particular species, those fish should continue to be weighed, as outlined above, until such time that adequate records are available to calculate an equation for that species. If management at any particular lake is focused on improving the condition of game fish, weight data should continue to be collected. For the purpose of this guide, game fish are defined as black bass (largemouth, smallmouth and spotted), bluegill, redear sunfish, black & white crappie, rock bass, white bass, striped & hybrid striped bass, walleye, sauger, saugeye, yellow perch, northern pike, muskellunge, tiger muskie, catfish (channel, blue and flathead) and stocked salmonids.

All dead fish should be properly disposed of, if possible buried in suitable location out of public view. I all cases, do not bury or dispose of fish in areas with human activity.

E. AQUATIC VEGETATION

1. Introduction

Aquatic vegetation is an important component of fish habitat and an indicator of productivity, water quality and environmental change. Of importance are species present, plant community composition and maximum depth of plant growth. Some species are indicators of water quality while their diversity is generally thought to be an indicator of the general health of the lake's environment.

Aquatic plants vary in abundance and distribution throughout the year. It is important to sample aquatic vegetation consistently in order to monitor changes through time. For this reason, all vegetative sampling should be done at the same time of the year, preferably mid-summer when aquatic vegetation growth is at a maximum. With limited personnel and resources, this will not always be possible. Once a sampling time is chosen, all subsequent vegetative sampling should occur as close to that time as possible. While the time chosen will not allow sampling of all species, it will provide for tracking changes in distribution and abundance. Managers have the option of additional sampling at other times of the year if desired.

Aquatic vegetation should be identified to the species level, when possible, using an appropriate key. Plants which cannot be identified in the field should be collected for later identification. If species are encountered that are presently not in the database, contact the information management coordinator to add that species to the plants database.

2. Sampling Types

a. Mapping Procedures

A lake contour map should be the base map used if mapping vegetation. If a contour map is not available, a copy from the U.S.G.S. topographical map, aerial photo or a freehand sketch may be used. When mapping, do not spend a lot of time determining the exact location of items being mapped. Locate them as best you can, understanding that the location on the map is intended to provide a general picture of where the vegetation beds are located. If greater detail is needed, consider using a video recorder to document vegetation occurrence. The map should identify the general location and size of aquatic vegetation beds and wetlands. This information is needed to monitor changes in aquatic vegetation and assist in permit reviews for aquatic vegetation control.

When mapping vegetation, cruise the shoreline, mid-lake reefs and islands to determine the location of emergent and submergent beds. Map, as accurately as possible, the extent of vegetation along the shoreline and its distance from shore. Indicate location of wetlands. Visual observation is the best tool, however, depth finders should be used to help determine the extent of the vegetation bed and maximum depth of plant growth. Identify species from codes provided in the database. Occasionally sample vegetation (with a grapple if needed) and record major species on the map and their location.

b. Transect Procedures

Transects should be determined prior to the survey. To determine transects, first choose a known location on the map such as the public access site. Next, determine the number of transects needed based on lake size as follows:

Lake Size (acres)	Number of Transects
✁100	4
>100, ✁300	6
>300	add 1 transect/100 acres*

*transects are optional for impoundments >500 acres

Measure the distance around the shoreline using a map wheel if the distance is unknown or with mapping software if available and divide the total length of the shoreline by the number of transects to determine the distance between transects. For example, a 150 acre lake with 2.4 miles of shoreline would require six transects. Dividing 2.4 miles of shoreline by 6 equals 0.4 miles between each transect. Space each transect evenly around the shoreline in a clockwise direction from the starting point. Number each transect consecutively on the map (VT1, VT2, etc.). Additional transects can be established around islands or in mid-lake areas if desired. Be sure to include these on the map.

Establishing transects at the lake, based on their location on the map, will be somewhat subjective. Do not worry about establishing the transect at the exact location of the map, but rather whether or not the transect can be relocated. Latitude and longitude, using GPS, will be recorded where the transect intersects the shoreline. Identify additional landmarks to help locate the transect in the future. Once established, transects remain permanent for all future surveys.

Transects will be conducted in a straight line perpendicular from shore to the maximum depth of vegetation growth. If vegetation extends all the way across the lake, transects will end at the halfway point. At each transect, begin at the water's edge and identify all emergent and submergent species within 10 feet of either side of the boat along the length of the transect. Information should be recorded on the vegetation form. Most species can be observed visually, however in turbid water or as depth increases, you may need to use a grapple to determine the species present. A depth finder is useful to determine if vegetation is present in deep water and how far it extends from shore. Since transects are spaced evenly, some may not contain vegetation. Be sure to include these transects on the form to document the absence of vegetation. Your objective is to provide as accurate a list as possible of all species present at each transect.

Species presence or absence provides a quantitative method for documenting changes in vegetation distribution through time. For example, if Sago Pondweed was present at 75% of all transects during one year and 5% five years later, we would have a quantitative measure of changes that occurred in the distribution of that species. This type of information can be important for evaluating and measuring the effects of watershed improvements or other factors influencing water quality and vegetation.

c. Incidental Vegetation Listing

In addition to transect sampling, all other species encountered or observed should be recorded on the vegetation form as an additional species present. For example, arrowhead or pickerelweed may not be present at the transects but is found near a net or electrofishing station. Also, the presence and abundance of floating vegetation as well as the distribution of vegetation along shore (loosestrife, cattails, rushes, sedges, etc) should be noted on both the map and field comment sheet.

Exotic, threatened or endangered species should be noted on the vegetation form and on the map. The spread of exotic species is a problem. Survey crews should avoid being part of that problem by ensuring that all traces of aquatic vegetation are removed from boats, motors, and sampling gear before moving to another lake.

3. Aquatic Vegetation Field Form Recordings

a. Lake, lake code, date and crew members
b. Transect number
c. GPS coordinates of shore - transects intersection
d. Maximum depth of vegetation at each transect in feet
e. Common name and code of each species identified
f. Percent of each species in the transect based on visual estimate
g. For additional species, give common name, code, location and density (rare, common or abundant).
h. Other observations and special conditions, including herbicide treatment areas that occurred prior to survey.

II. STREAM SURVEY GUIDELINES

A. STANDARD EFFORT

1. Introduction

As with lake surveys, priorities for river and stream sampling should be developed annually through the work plan process. Standard stream surveys will include both fish community and habitat components. Work plan authors should consider monitoring the long-term health of Indiana's stream fish communities (including game, non-game, threatened and endangered species) using a standard sampling approach on a watershed or ecoregion scale when selecting streams to sample. Navigable streams (see Appendix) with average annual discharges greater than 100 cfs offer the most value in terms of recreational opportunities, which should also be considered during work plan review and site selection. These guidelines apply to both the smaller interior streams of the state and larger rivers.

2. Procedures

a. Site Selection

Sampling sites will be located a minimum of 8 river miles apart depending on available access and favorable stream conditions for electrofishing. River miles for most streams can be determined from Hoggatt (1975). Historic sampling sites should be used where possible, including DNR, university, IDEM and other agencies collection efforts. If the stream has never been surveyed, site selection should be based on general stream characteristics, position in the watershed, point and non-point pollution sources, location of tributaries and bridges, and other factors felt to impact the stream resource. Both representative and unique habitats should be considered based on their abundance in the watershed. For example, if most of the corridor is channelized, some sampling should be conducted in channelized sections. Do not select just the best sites, especially if they are atypical of watershed conditions. Fish sampling and habitat evaluation should be collected at the same flow condition, preferably on the same date. A reconnaissance trip is suggested, especially if the biologist is unfamiliar with the stream. During reconnaissance, both the up and down stream limits of the station can be determined. Finally, a reasonable attempt to inform riparian land owners about the sampling event should be made prior to sampling.

b. Sampling

Sites will be electrofished in the daytime typically during summer or fall low-flow conditions (if available check U.S.G.S. stream flow data). For streams with average depths <4 feet, sampling can be conducted anytime after July 1 while streams with average depths >4 feet should be sampled after mid-September (Shipman 1995). Sampling will not be conducted during high flows or earlier than September in larger streams, without sufficient justification.

Each sampling event will consist of one hour of DC boat electrofishing or DC barge electrofishing. One hour barge (wadable) samples can be divided into two 30 minute stations typically spaced at four mile intervals. Wadable sampling should be used in streams with average depths of 1.5 feet or less, even if they contain some pools >3.5 feet. The minimum number of stations per stream is two, one-hour stations or four, ½ -hour stations. DC boat electrofishing with a crew of three is the gear of choice. DC barge electrofishing with a crew of three is acceptable for stream reaches too shallow for boat electrofishing. Deviations from these standards, particularly crew size, should be noted in the field notes. Boat electrofishing will generally be conducted in a downstream direction with each shoreline electrofished for 30 minutes while barge electrofishing will be conducted in an upstream direction. Care should be taken to insure that all representative habitat types are sampled including bars, points and log jams.

A minimum of four seine hauls will be conducted per boat station covering representative habitats. Hauls will be conducted along the bank in a circular upstream direction avoiding debris and other obstacles that may block the net. Riffles or deep fast runs can be effectively sampled by placing the net across the riffle and having crew members kick from upstream towards the net. Care should be taken to keep the net on the bottom to limit escapement of small minnows, sculpins and darters. Seining effort is difficult to quantitative, therefore, seine samples are considered qualitative (enumerating species richness) and catch data should be recorded on separate data sheets from electrofishing data. Each station's index of biologic integrity (IBI) should be calculated from only the electrofishing data and in combination with the seining data using suitable metrics published by IDEM for each ecoregion.

c. Physical and Chemical Characteristics

Measurement of physical parameters will include station length and five channel widths including the up and downstream extent of the station (in feet), depths at ¼, ½, and ¾ distances across the stream channel where width is measured, air and water temperature, and secchi disk transparency at the deepest pool in the sampled section. Chemical parameters including DO, TDS, pH, alkalinity, and conductivity should also be measured with the option to collect additional parameters at the discretion of the biologist. GPS coordinates should be measured at the midpoint of the sampled area. The sampled reach should also be mapped, showing locations of tributaries, open drains, islands and sandbars, significant pools, riffles and log jams, and other prominent features. The location of the site should be referenced with standard township, section, range values, USGS Hydrologic unit codes, Indiana Academy of Science natural region codes, USEPA ecoregion codes and general narrative description of the sample location. Comments on availability and quality of public access and possible locations for new access sites, and any other interesting features should also be included in this section of the field notes.

d. Fish Collections

Attempts should be made to collect all observed fish. Try to keep all fish alive during collection and processing. The length and weight of all game fish and fish species of special interest (such as endangered species) will be recorded. For other species, determine the length range, total number, and total weight. **(Eventually we'll probably want to collect enough length-weight data for all stream species for estimation of length-weight equations, like the recommendation for lakes, rather than continue to count and bulk weigh non-game fish. This needs to be revisited)** Five scale (spine) samples per one-half inch group (typically one scale per 0.1 inch group) will be taken from all appropriate game fish species per stream site. Left pectoral spines will be collected from blue, channel, and flathead catfish. Catfish spine preparation and aging will be contracted on an annual basis. Generally, there is an inadequate number of game fish scales or spines from a single sampling site to detect differences in growth rates, so growth estimates are typically combined and reported for each river reach.

If identification of certain fishes in the field is impossible or impractical, they should be preserved (10% formalin) in appropriately marked containers for later identification in the laboratory. Be sure to keep fish caught during electrofishing separate from those collected with seines. All fish accidental killed during the sampling should be removed from the site for disposal or buried in a suitable site, outside the wetted perimeter of the stream, where they will not be detected by recreational users or riparian owners.

All data will be recorded on the supplied forms and provided electronically to the information manager by February 15 of the next year. Project leaders are required to submit results in standard report form by March 15 of the next year.

B. Qualitative Habitat Evaluation Index (QHEI)

1. Introduction

The Qualitative Habitat Evaluation Index (QHEI) is a physical habitat index designed to provide an empirical, quantified evaluation of the general lotic macrohabitat characteristics that are important to fish communities. A detailed analysis of the development and use of the QHEI is available in Rankin (1995). The QHEI is composed of six principal metrics each of which are described below. The maximum possible QHEI score is 100. Each of the metrics are scored individually and then summed to provide the total QHEI site score. This is completed at least once for each sampling site during each year of sampling at the same flow as the fish sampling, preferably on the same dates. An exception to this convention would be when substantial changes to the macrohabitat have occurred between sampling passes. Standardized definitions for pool, run, and riffle habitat, for which a variety of existing definitions and perceptions exist, are essential for accurately using the QHEI. For consistency the following definitions are taken from Platts et al. (1983). It is recommended that this reference also be consulted prior to scoring individual sites. It is required that in order to maintain consistent QHEI scoring, annual training for fish sampling crew leaders will be coordinated through the project leader (work plan author) and other agencies using these procedures, primarily IDEM.

2. Parameter Definitions

a. Riffle and run habitat

1. Riffle is the area of the stream with fast current velocity and shallow depth; the water surface is visibly broken.
2. Run is the area of the stream with rapid, non-turbulent flows; runs are deeper than riffles with a faster current velocity than pools and are generally located downstream from riffles where the stream narrows; the stream bed is often flat beneath a run and the water surface is not broken.

b. Pool and glide habitat

1. Pool is the area of the stream with slow current velocity and a depth greater than riffle and run areas; the stream bed is often concave and stream width frequently is the greatest; the water slope is nearly zero.
2. Glide is the area of the stream common to most modified stream channels that do not have distinguishable pool, run and riffle habitats; the current and flow is similar to that of a canal; the water surface gradient is nearly zero.

–If a pool or glide has a maximum depth of less than 8 inches, it is deemed to have lost it’s functionality and the metric is scored a 0.

3. Metrics

The following is a description of each of the six QHEI metrics and the individual metric components. Guidelines on how to score each are presented. Generally, metrics are scored by checking boxes. In certain cases the biologist completing the QHEI sheet may interpret a habitat characteristic as being intermediate between the possible choices; in cases where this is allowed (denoted by the term "Double-checking") two boxes may be checked and their scores averaged.

a. Metric 1: Substrate

This metric includes two components, substrate type and substrate quality.

1. **Substrate Type**

Check the two most common substrate types in the stream reach. If one substrate type predominates greater than approximately 75-80% of the bottom area or what is clearly the most functionally predominant substrate type should be checked twice. DO NOT CHECK MORE THAN TWO BOXES. Note the category for artificial substrates. Spaces are provided to note the presences (by check marks, or estimates of %, if time allows) of all substrates types present in pools and riffles that each comprise at least 5% of the site (i.e. they occur in sufficient quantity to support species that may commonly be associated with the habitat type). This section must be filled out completely to permit future analysis of this metric. If there are more than four substrate types in the zone that are present in greater than approximately 5% of the sampling area check the appropriate box.

a. **Bedrock** - solid rock forming a continuous surface
b. **Boulder** - rounded stones 10 inch diameter or large "slabs" more than 10 inch length
c. **Cobble** - stones from 2.5 - 10.0 inch diameter
d. **Gravel** - mixture of rounded course material from 0.08 - 2.50 inch diameter
e. **Sand** - materials .0024-.0787 inch diameter, gritty texture when rubbed between fingers
f. **Silt** - .0002-.0024 inch diameter, generally this is fine material which feels "greasy" when rubbed between fingers
g. **Hardpan** - particles less than 0.004 inch diameter, usually clay, which forms a dense, gummy surface that is difficult to penetrate
h. **Marl** - calcium carbonate; usually greyish-white; often contains fragments of mollusc shells
i. **Detritus** - dead, unconsolidated organic material covering the bottom which could include sticks, wood and other partially or undecayed course plant material
j. **Muck** - black, fine, flocculent, completely decomposed organic matter (does not include sewage sludge)
k. **Artificial** - substrates such as rock baskets, gabions, bricks, trash, concrete etc. placed in the stream for reasons *other* than habitat mitigation; sludge is defined as a thick layer of organic matter, that is decidedly of human or animal origin. Note: sludge that originates from point sources is not included; the substrate score is based on the underlying material.

2. **Substrate Quality**

Substrate *origin* refers to the "parent" material from which the stream substrate is derived. Check ONE Box under the substrate origin column unless the parent material is from multiple sources (e.g., limestone and tills).

a. **Embeddedness**

Embeddedness is the degree that cobble, gravel, and boulder substrates are surrounded, impacted in, or covered by fine materials (sand and silt). Substrates should be considered embedded if > 50% of surface of the substrate are embedded in fine material. Embedded substrates cannot be easily dislodged. This also includes substrates that are concreted or "armor-plated". Naturally sandy streams are not considered embedded; however, a sand predominated stream that is the result of anthropogenic activities that have buried the natural course substrates is considered embedded. Boxes are checked for extensiveness (area of sampling zone) of the embedded substrates as follows: *Extensive* >75% of site area, *Moderate* 50-75%, *Sparse* 25-50%, *Low* <25%.

b. **Silt Cover**

Silt cover is the extent that substrates are covered by a *silt layer* (i.e., more than 1 inch thickness). *Silt Heavy* means that nearly all of the stream bottom is layered with a deep covering of silt. *Moderate* includes extensive coverings of silt, but with some areas of cleaner substrate (e.g., riffles). *Normal* silt cover includes areas where silt is deposited in small amounts along the stream margin or is present as a "dusting" that appears to have little functional significance. If substrates are exceptionally clean the *Silt Free* box should be checked.

3. **Substrate Metric Score**

Although the theoretical maximum metric score > 20 the maximum score allowed for the substrate metric is limited to 20 points.

b. Metric 2: Instream Cover

1. **Cover Type**

All of the cover types that are present in greater than approximately 5% of the sampling area (i.e., they occur in sufficient quantity to support species that may commonly be associated with the habitat type) should be checked. Cover should not be counted when it is in areas of the stream with insufficient depth (usually < 8 inches) to make it useful. For example a logjam in 2 inches of water contributes very little if any cover, and at low flow may be dry. Other cover types with limited utility in shallow water include *undercut banks* and *overhanging vegetation, boulders and rootwads.* Do not check undercut banks AND rootwads unless undercut banks exist along with rootwads as a major component.

a. undercut banks
b. overhanging vegetation
c. shallows (in slow water)
d. logs or woody debris
e. deep pools (>28 inches)
f. oxbows
g. boulders
h. aquatic macrophytes
i. rootwads (tree roots that extend into stream)

2. **Cover Amount**

Under *Amount*, one or two boxes may be checked . *Extensive* cover is that which is present throughout the sampling area, generally greater than about 75% of the stream reach. Cover is *Moderate* when it occurs over 25-75% of the sample area. Cover is *Sparse* when it is present in less than 25% on the stream margins (sparse cover usually exists in one or more isolated patches). Cover is *Nearly Absent* when no large patch of any type of cover exists anywhere in the sampling area. This situation is usually found in recently channelized streams or other highly modified reaches (e.g., ship channels). If cover is thought to be intermediate in amount between two categories, check *two boxes* and *average* their scores.

3. **Cover Metric Score**

Although the theoretical maximum score is > 20 the maximum score assigned for the for the instream cover metric is limited to 20 points.

c. Metric 3: Channel Morphology

This metric emphasizes the quality of the stream channel that relates to the creation and stability of macrohabitat. It includes channel sinuosity (i.e. the degree to which the stream meanders), channel development, channelization, and channel stability. One box under each should be checked unless conditions are considered to be intermediate between two categories; in these cases check two boxes and average their score.

1. **Channel Types**

a. **Sinuosity**

No sinuosity is a straight channel. *Low sinuosity* is a channel with only 1 or 2 poorly defined outside bends in a sampling reach, or perhaps slight meandering within modified banks. *Moderate sinuosity* is more than 2 outside bends, with at least one bend well defined. *High sinuosity* is more than 2 to 3 well defined outside bends with deep areas outside and shallow areas inside. Sinuosity may be more conceptually described by ratio of the stream distance between two points of the channel of a stream and the straight-line distance between these same two points, taken from a topographic map. Check only one box.

b. **Development**

This refers to the development of riffle/pool complexes. *Poor* means riffles are absent, or if present, shallow with sand and fine gravel substrates; pools, if present are shallow. *Glide habitats*, if predominate, receive a *Poor* rating. *Fair* means riffles are poorly developed or absent; however, pools are more developed with greater variation in depth. *Good* means better defined riffles present with larger substrate (gravel, rubble or boulder); pools have variation in depth and there is a distinct transition between pools and riffles. *Excellent* means development is similar to the good category except the following characteristic must be present: pools must have a maximum depth of >40 inches and deep riffles and runs (>20 inches) must also be present. In streams sampled with wading methods, a sequence of riffles, runs, and pools must occur more than once in a sampling zone. Check one box.

c. **Channelization**

This refers to anthropogenic channel modifications. *Recovered* refers to streams that have been channelized in the past, but which have recovered most of their natural channel characteristics. *Recovering* refers to channelized stream which are still in the process of regaining their former, natural characteristic; however, these habitats are still degraded. This category also applies to those streams, especially in the Huron/Erie Lake Plain ecoregion (NW Ohio), that were channelized long ago and have a riparian border of mature trees, but still have poor channel characteristics. *Recent or no Recovery* refers to streams that were recently channelized or those that show no significant recovery of habitat (e.g., drainage ditches, grass lined or rock rip-rap banks, etc.). The specific type of habitat modification is checked in the last two columns but not scored.

d. **Stability**

This refers to channel stability. Artificially stable (concrete) stream channels receive a high score. Even though they are generally a negative influence on fish the negative effects are related to features other than their stability. Channels with *Low* stability are usually characterized by fine substrates in riffles that often change location, have unstable and severely eroding banks, and a high bedload that slowly creeps downstream. Channels with *Moderate* stability are those that appear to maintain stable riffle/pool and channel characteristics, but which exhibit some symptoms of instability, e.g. high bedload, eroding or false banks, or show the effects of wide fluctuation in water level. Channels with *High* stability have stable banks and substrates, and little of no erosion and bedload.

e. **Modifications/Other**

Check the appropriate box if impounded, islands present, or leveed (these are not included in the QHEI scoring) as well as the appropriate source of habitat modifications.

2. **Channel Morphology Metric Score**

The maximum QHEI metric score for channel morphology is 20 points.

d. Metric 4: Riparian Zone and Bank Erosion

This metric emphasizes the quality of the riparian buffer zone and quality of the floodplain vegetation. This includes riparian zone width, floodplain quality, and extent of bank erosion. Each of the three components require scoring the left and right banks (looking downstream). The average of the left and the right banks is taken to derive the component value. One box per bank should be checked unless conditions are considered to be intermediate between two categories; in these cases check two boxes and average their scores.

1. **Width of the Floodplain**

This is width of the riparian (stream side) vegetation. Width estimates are only done for forest, shrub, swamp, and old field vegetation. Old field refers to a fairly mature successional field that has stable, woody plant growth; this generally does not include weedy urban or industrial lots that often still have high runoff potential. <u>Two boxes</u>, one each for the <u>left</u> and <u>right</u> bank (looking downstream), should be <u>checked</u> and then <u>averaged</u>.

2. **Flood Plain Quality**

The two most predominate flood plain quality types should be checked, one each for the left and right banks (includes urban, residential, etc.) and then averaged. By floodplain we mean the areas immediately outside of the riparian zone or greater than 100 feet from the stream, whichever is wider on each side of the stream. These are areas adjacent to the stream that can have direct runoff and erosional effects during normal wet weather. We do not limit it to the riparian zone and it is much less encompassing than the stream basin.

3. **Bank Erosion**

The following Streambank Soil Alteration Rating from Platts et al. (1983) should be used; check one box for each side of the stream and average the scores. False banks are used in the sense of Platts et al. (1983) to mean banks that are no longer adjacent to the normal flow of the channel but have been moved back into the floodplain most commonly as a result of livestock trampling.

a. ***None*** - streambanks are stable and not being altered by water flows or animals (e.g. livestock); score 3

b. ***Little*** - streambanks are stable, but are being lightly altered along the transect line; less than 25% of the stream bank is receiving any kind of stress, and if stress is being received it is very light <25% of the streambank is false, broken down or eroded; score 3

c. ***Moderate*** - streambanks are receiving moderate alteration along the transect line; at least 50% of the stream bank is in a natural stable condition; less than 50% of the streambank is false, broken down or eroding; false banks are rated as altered; score 2

d. ***Heavy*** - streambanks have received major alterations along the transect line; less than 50% of the streambank is in a stable condition; over 50% of the streambank is false, broken down, or eroding; score 1

e. ***Severe*** - streambanks along the transect line are severely altered; less than 25% of the streambank is in a stable condition; over 75% of the streambank is false, broken down, or eroding

4. **Riparian Zone/Bank Erosion Metric Score**

The maximum score for riparian zone and bank erosion metric is 10 points.

e. Metric 5: Pool/Glide and Riffle/Run Quality

This metric emphasizes the quality of the pool, glide and/or riffle/run habitats. This includes pool depth, overall diversity of current velocities (in pools and riffles), pool morphology, riffle/run substrate, and riffle/run quality.

1. **Pool/Glide Quality**

a. **Maximum depth of pool or glide** - check one box only (score 0 to 6); pool or glides with maximum depths less than 8 inches are considered to have lost their function and the total metric is scored a zero; no other characteristic needs to be scored in this case

b. **Current types** - check each current type that is present in the stream (include) riffles and runs; score 2 to 4); current type definitions are:

1. **Torrential** - extremely turbulent and fast flow with large standing waves; water surface is very broken down with no definable, connected surface; usually limited to gorges and dam spillways and tailwaters
2. **Fast** - mostly non-turbulent flow with small standing waves in riffle/run areas; water surface may be partially broken, but there

is a visibly connected surface

3. **Moderate** - non-turbulent flow that is detectable and visible (i.e. floating objects are readily transported downstream); water surface is visibly connected
4. **Slow** - water flow is perceptible, but very sluggish
5. **Eddie** - small areas of circular current motion usually formed in pools immediately downstream from riffle/run areas
6. **Interstitial** - water flow that is perceptible only in the interstitial spaces between substrate particles in riffle/run areas
7. **Intermittent** - no flow is evident anywhere leaving standing pools that are separated by dry areas
8. **Morphology** - check ***Wide*** if pools are wider than riffles, ***Equal*** if pools and riffles are the same width, and ***Narrow*** if the riffles are wider than the pools (score 0-2). If the morphology varies throughout the site average the types. If the entire stream area (including areas outside of the sampling zone) is pool or riffle, then check riffle=pool.

c. **Pool/Glide Quality Metric Score**

Although the theoretical maximum score is > 12 the maximum score assigned for the QHEI for the pool quality metric is limited to 12 points.

2. **Riffle/Run Quality**

Score 0 for this metric if no riffles are present.

a. **Riffle/Run Depth** - select one box that most closely describes the depth characteristics of the riffle (score 0-4). If the riffle is generally less than 2 inches in depth riffles are considered to have lost their function and the entire riffle metric is scored 0

b. **Riffle/Run Substrate Stability**- select one box from each that best the substrate type and stability of the riffle habitats (score 0-2)

c. **Riffle/Run Embeddedness** - embeddedness is the degree that cobble, gravel, and boulder substrates are surrounded or covered by fine material (sand, silt); we consider substrates embedded if >50% of surface of the substrates are embedded in fine material and these substrates cannot be easily dislodged; this also includes substrates that are concreted; boxes are checked for extensiveness (riffle areas of sampling zone) with embedded substrates: *Extensive* >75% of stream area, *Moderate* 50-75%, *Sparse* 25-50%, *Low* <25%

d. **Riffle/Run Quality Metric Score**

The maximum score assigned for the QHEI for the riffle/run quality metric is 8 points.

f. Metric 6: Map Gradient

Local or map gradient is calculated from USGS 7.5 minute topographic maps by measuring the elevation drop through the sampling area. This is done by measuring the stream length between the first contour line upstream and the first contour line downstream of the sampling site and dividing the distance by the contour interval. If the contour lines are closely "packed"a minimum distance of at least one mile should be used. Some judgement may need to be exercised in certain anomalous areas (e.g. in the vicinity of waterfalls, impounded areas, etc.) This can be compared to an in-field, visual estimate which is recorded on the back of the habitat sheet.

Scoring for ranges of stream gradient takes into account the varying influence of gradient with stream size, preferably measured as drainage area in square miles or stream width. Gradient classifications (Table 1) were modified from Trautman (p 139, 1981) and scores were assigned, by stream size category, after examining scatterplots of IBI vs natural log of gradient in feet/mile. Scores are listed in Table 2 .

1. **Map Gradient Metric Score**
   The maximum QHEI metric score of gradient is 10 points.

Table 1 . Classification of stream gradients for Ohio, corrected for stream size. Modified from Trautman (1981). Scores were derived from plots of IBI versus the natural log of gradient for each stream size category.

Average		**Gradient (Feet/Mile), Gradient Score in Bold**						
Stream Width (ft)	Drainage Area (Sq miles)	Very Low	Low	Low/ Moderate	Moderate	Moderate/ High	High	Very High 1

1 to 15'	**0 to9.2**	0-1.0 **2**	1.1-5.0 **4**	5.1-10.0 **6**	10.1-15.0 **8**	15.1-20.0 **10**	20.1-30.0 **10**	30.1-40.0 **8**
15 to 30'	**9.2 to 41.6**	0-1.0 **2**	1.1-3.0 **4**	3.1-6.0 **6**	6.1-12.0 **10**	12.1-18.0 **10**	18.0-30.0 **8**	30.1-40.0 **6**
30 to 45'	**41.6 to 103.7**	0-1.0 **2**	1.1-2.5 **4**	2.6-5.0 **6**	5.1-7.5 **8**	7.6-12.0 **10**	12.1-20.0 **8**	20.1-30.0 **6**
45 to 100'	**103.7 to 622.9**	0-1.0 **4**	1.1-2.0 **6**	2.1-4.0 **8**	4.1-6.0 **10**	6.1-10.0 **10**	10.1-15.0 **8**	15.1-25.0 **6**
>100'	**> 622.9**	-	0-0.5 **6**	0.6-1.0 **8**	1.1-2.5 **10**	2.6-4.0 **10**	4.1-9.0 **10**	>9.0 **8**

1.Any site with a gradient > than the upper bound of the “Very High” Gradient classification is assigned a score of 4.

Table 2: **Computing the Total Score:** To compute the total QHEI score, add the components of each metric score. The QHEI metric scores cannot exceed the metric maximum score indicated below. QHEI SCORING (Maximum = 100)

QHEI Metric	Metric Component	Component scoring Range	Metric Maximum Range
1) Substrate	a)Type b)Quality	0 to 21 -5 to 3	20
2)Instream Cover	a)Type b) Amount	0 to 10 1 to 11	20
3) Channel Morphology	a) Sinuosity b) development c) Channelization d) Stability	1 to 4 1 to 7 1 to 6 1 to 3	20
4) Riparian Zone	a) Width b) Quality c)Bank Erosion	0 to 4 0 to 3 1 to 3	10
5a) Pool Quality	a) Max. Depth b) Current c)Morphology	0 to 6 -2 to 4 0 to 2	12
5b) Riffle Quality	a) Depth b)Substrate. Stability c) Substrate. Embedded.	0 to 4 0 to 2 -1 to 2	8
6) Gradient	See table	2 to 10	10
TOTAL	Maximum Score		100

III. Fish Age and Growth and Stock Density

A. Introduction

Age and growth profiles shall be determined for all game fish species, where at least 20 individuals are collected. Smaller samples may also be evaluated for more rare species like northern pike, muskellunge and walleye at the discretion of the biologist. Catfish can be aged at the discretion of the project leader. Fish will be aged using an anatomical approach based on aging scales, and in some cases, spines or rays. Older gamefish, especially largemouth bass and walleye, are very difficult to age accurately using scales due to the close proximity of the annuli, spawning checks and other checks or split annuli that occur. In these cases, dorsal rays offer an alternative means of aging these individuals (DeVries and Frie 1996). Bony parts, other than scales, are particularly effective in determining age and growth of age III+ and older fish. For catfish, pectoral spines offer the only means of determining age and growth without sacrificing the individual. A minimum of one scale, spine or ray sample per tenth inch group of a species will be used for age determination. Again, this standard does not replace professional judgement if the biologist feels additional samples will allow more accurate age and growth evaluation.

Scales will be removed by scraping with a knife or by forceps noting the correct body area based on the fish taxa being sampled (page 488, DeVries and Frie 1996). Dorsal rays will be collected by clipping the ray as close to the base as possible. The first four rays of the fish should be removed. Pectoral spines used to age catfish, will be removed by twisting and pulling them from the socket so that the entire spine is removed. Samples will be placed in a scale envelope and labeled with date, species, lake or stream site, and total length. Rays should be placed in the envelope with the membrane intact if possible and spread out to facilitate drying. All samples should be air dried thoroughly prior to processing

Scales will be prepared by making impressions of the outer surface on a plastic slide using either a heat or roller press. A sufficient number should be used on a slide to assure at least two good impressions are available. Spines and rays will be sectioned using either a dremmel tool or jewelers saw. The second and third ray of the sample should be used. Location of the sections differs among species but generally should be taken as close to the base of the spine or ray as possible taking care to ensure the cut is as straight as possible. For example, channel catfish spines should be sectioned at the distal end of the basal groove while flathead spine sections should be taken at the articulating process. The ideal section width should be approximately 1/16 of an inch.
The tool should be affixed to a table or base and the ray or spine is then attached to a moveable tray and passed through the saw. The cutting depth should be adjusted to allow some membrane to remain so that the section remains attached to the remainder of the spine or ray. This allows numerous samples to be prepared prior to viewing. Multiple cuts may be made on the same spine or ray if desired. The spine or ray is then placed back in its respective envelope. To view the section, remove it by gently breaking it off with forceps.

Scales will be magnified and viewed using a microfiche reader or other projection device. Spine and ray samples will be viewed using a microscope and transmitted light. Each annulus on the scale, spine or ray will be counted and the distance from the center to each annulus will be measured in (μ)millimeters and recorded. The distance from the center to the outside edge of the scale, spine or ray will also be measured and recorded. Where appropriate magnification of the image will also be recorded.

B. Back Calculating Fish Lengths at Age

Individual fish lengths at annulus formation will be determined using the Fraser-Lee method (DeVries and Frie 1996) following the formula:

$$L_i = ((Lc-a) / Sc) * Si + a$$

Where:

Li = fish length at annulus "i" formation

Lc = length of fish at capture
Sc = radius of hard body part at capture (scale, spine, etc)
Si = radius of hard body part at annulus “i”
a = intercept parameter

The lengths of fish at scale formation, also known as the standard intercept, will be taken from Carlander (1982) and Tillma (1997) (Table 3). The average back-calculated length at each annulus will be reported by year class. Mean length at age for all year classes combined, will be also be calculated for each age. Year classes with less than three individuals in the sample will not be used in these calculations. The length range for each year class as well as the number of individuals aged will also be reported. The mean length at age will not be weighted. The intercept value used in the calculations will be noted for each particular species.

Table 3. Total length at scale formation (standard intercept) for selected species*.

Species	**Intercept (inches)**	**Species**	**Intercept (inches)**
Black crappie	1.4	Smallmouth bass	1.4
Bluegill	0.8	Spotted Bass* *	1.2
Largemouth bass	0.8	Walleye	2.2
Muskellunge	2.1	White bass	0.7
Northern pike	2.1	White crappie	1.4
Redear sunfish	0.6	Yellow perch	1.2
Rock bass	1.0		

* Carlander (1982) ** Tillma (1997)

C. Data Output

After the data have been entered into the database, a length-frequency page will be generated for each game species and any designated non-game species collected. The length-frequency page will divide fish into half-inch length groups and provide number collected by gear type, ages and average weight (calculated from standard length-weight equations or measured during the survey) for each of these groups. Half-inch groups will be determined as follows. Fish that measure from X.8 to X.2 inches inclusive will be considered part of the X.0 inch size group. Fish that measure from X.3 toX.7 inches inclusive will be considered part of the X.5 inch size group. If a species has been sub-sampled, the length-frequency will typically only represent those fish that were measured for the sub-sample. The entire sample may be included in the length-frequency, if desired, by applying the percentages by half-inch group of the sub-sample to the entire sample. In either case, the method used should be noted on the length-frequency page and catch by size and gear reported.

Species composition and relative abundance by number and weight of the entire collection will also be reported. This report will arrange each species by common name in order of descending abundance. These values can be calculated by gear type or for all gears combined. Length ranges for each species will also be reported. For stream surveys, separate species composition and relative abundance reports will be prepared by site as well as for the entire stream reach with a grid describing the number of sites each species was collected.

Other reports include a summary of water quality measurements, effort per gear type including sampling location, vegetation summary and mapping for lake surveys, or a description of the stream sampling location.

D. Stock Densities

In addition to length-frequency, the number of fish that are stock, quality, preferred, memorable and trophy size for each game species will be reported. The minimum lengths used for these categories will be those proposed by Gablehouse, Jr. (1984) (Table. 4). Lengths used to determine category placement will be the exact length. Example: minimum length of a quality size largemouth bass is >12.0 inches, not 11.8 inches.

Proportional Stock Density will be determined for largemouth bass and bluegill. Proportional Stock Density (PSD) is defined as the percentage of stock size fish in a population that are also quality size. PSD’s may be calculated using only the electrofishing catch or by using the catch from all sampling methods. The method used should be noted. A biologist desiring to use PSD data from additional species in a project should include the species in a work plan if the PSD needs to be generated from the database.

Relative Stock Density (RSD) is another method of assessing stocks using length-frequency data. RSD is the proportion of a designated size group in a stock. For example, RSD_{15} for largemouth bass is the percentage of stock size bass in a population that are also 15 inches in length or larger. A biologist desiring to use RSD data in a project should include the designated size range in a work plan if the RSD needs to be generated from the database.

Table 4. Minimum lengths in inches of five size categories for selected species.

Species	Stock	Quality	Preferred	Memorable	Trophy
Black crappie	**5**	**8**	**10**	**12**	**15**
Bluegill	**3**	**6**	**8**	**10**	**12**
Channel catfish	**11**	**16**	**24**	**28**	**36**
Hybrid striped bass	**8**	**12**	**15**	**20**	**25**
Largemouth bass	**8**	**12**	**15**	**20**	**25**
Muskellunge	**20**	**30**	**38**	**42**	**50**
Northern pike	**14**	**21**	**28**	**34**	**44**
Redear sunfish	**4**	**7**	**9**	**11**	**13**
Rock bass	**4**	**7**	**9**	**11**	**13**
Sauger	**8**	**12**	**15**	**20**	**25**
Smallmouth bass	**7**	**11**	**14**	**17**	**20**

Spotted bass	**7**	**11**	**14**	**17**	**20**
Striped bass	**12**	**20**	**30**	**35**	**45**
Walleye	**10**	**15**	**20**	**25**	**30**
White bass	**6**	**9**	**12**	**15**	**18**
White crappie	**5**	**8**	**10**	**12**	**15**
Yellow perch	**5**	**8**	**10**	**12**	**15**

IV. DATABASES

Many of the database structures listed below were developed by the Indiana Department of Environmental Management (IDEM), Office of Water Management, Water Quality Surveillance and Standards Branch, Biological Studies Section. Both agencies have a strong desire to share information on Indiana's aquatic resources and sharing system designs and information facilitates information transfer.

1. SAMPLELAKE.dbf

This database allows the manager of a lake, reservoir, municipal pond or impoundment to record the details behind a sampling occurrence. Specific catch information for each occurrence will retrieved through the ID field.

Field	Description
ID	Lake identification number from Allwaters.dbf.
LAKE	Lake name from Allwaters.dbf.
DATE	Date sampling occurred **(nets set or run)**
BIOLOGIST NAME	Manager in charge
WATER TEMPERATURE	Surface water temperature degrees Fahrenheit.
AIR TEMPERATURE	Recorded in degrees Fahrenheit **(start of work, end, midpoint)**.
EFFORT	Electrofishing effort recorded in hours. Net effort recorded as number of overnight lifts.
COMMENTS	Additional comments.
CONDUCTIVITY	Measured at the surface. Recorded in microhmos/cm³.
SECCHI	Water clarity as measured with secchi dish (feet, inches)
G.P.S. COORDINATES	Coordinates taken at the middle station sampled. Recorded in decimal degrees **(UTM?)**.
TYPE OF SURVEY	Standard survey or specific species survey.
CREW	One or two dippers for electrofishing.
BOX SETTINGS	Amps, voltage, pulse width

GEAR SAMPLE Night electrofishing, gill net, trap net, specialized net (striped bass gill net, Lake Michigan gill net, trap net, etc..).

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
Samplelake.dbf	**ID**	**A**	**11**	
	Lake	**A**	**30**	
	Date	**D**		
	Biologist Name	**A**	**15**	
	WaterTemp (F)	**N**		
	AirTemp (F)	**N**		
	Effort	**S**		
	Comments	**A**	**75**	
	Conductivity	**N**		
	G.P.S.	**N**		
	Secchi (ft.in)	**N**		
	Crew	**A**	**40**	
	Box Settings	**A**	**20**	
	Gear_Sample	**A**	**2**	

SAMPLE FIELD AND DATA INPUT FORMS WILL BE FINALIZED ONCE MANAGERS AGREE ON INPUT VARIABLES.

2. DEPTH PRO.Dbf

This database allows the manager to record the water profile of the lake at the time of the sampling occurrence.

Field	Description
ID	Lake identification number
DATE	Date sample was taken
DEPTH	Water depth of sample in feet
TEMPERATURE	Water temperature in degrees Fahrenheit. Water temperatures should be measured every two feet.
DISSOLVED OXYGEN	Measured in ppm. Measurements taken every 5 feet.
TOTAL ALKALINITY	Measured in ppm. Measurements taken at surface and bottom.
pH	Measurements taken at surface and bottom.
COMMENTS	General comments concerning the chemistry profile.

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
DPTH_PRO.dbf	ID	A	11	
	Date	D		

	Depth (ft)	S		
	Temperature (F)	N		
	DO (ppm)	N		
	TOTALK (ppm)	N		
	PH	N		
	Comments	A	50	

3. COUNT.dbf

This database allows the manager to input the catch of each individual fish species by gear type for a body of water and an individual sampling occurrence.

Field	Description
ID	Water body identification code (see all_water.dbf)
Date	Date of sample
Gear	Specific gear type (see gear.dbf)
Voucher	Voucher code of specific fish (see fishname.dbf)
Catch	Catch of species (for that species in that gear on that date)
Min_Length (in)	Minimum length of specific species
Max_Length (in)	Maximum length of specific species
Weight (lbs)	Total collective weight of specific species

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
COUNT.dbf	ID	A	11	
	Date	D		
	Gear_Sample	A	2	
	VOUCHER	S		
	Catch	S		
	Min_Length (in)	N		
	Max_Length (in)	N		
	Weight (lbs)	N		

4. LEN_FREQ.dbf

This database allows the manager to input the length frequency distribution of the catch for an individual species by gear type and an individual sampling occurrence.

Field	Description
ID	Identification for specific sample on a waterbody
Waterbody	Water body identification code

Date	Date of sample
Gear	Specific gear type
Voucher	Voucher code of specific fish
< 3 in	Catch of this size group
3.5 in	Catch of this size group
...	... catch of size groups between 3.5 and 49.5 inches
49.5 in	Catch of this size group
> = 50 in	Catch of this size group

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
LEN_FREQ.dbf	ID	A	11	
	Waterbody	A	30	
	Date	D		
	Gear	A	1	
	Vouchercode	N		
	<3 inches	N		
	3.5	N		
	4.0	N		
	...	N		
	49.5 inches	N		
	>50 inches	N		

5. AGE_GROW.dbf

This table allows the manager to take age and growth summary data from a specific survey. It contains average growth values for each age group plus the length at last annulus by year class.

Field	Description
ID	Identification for specific sample on a waterbody
Waterbody	Water body identification code
Voucher	Voucher code of specific fish
No_Aged	Number of fish aged
Las_Anu 1	Average length at annulus formation-age 1
...	Average length at annulus formation-age i
Las_Anu 10	Average length at annulus formation-age 10
Avg_Age 1	Average length age 1 for all fish in sample
...	Average length age i for all fish in sample
Avg_Age 10	Average length age 10 for all fish in sample
Intercept used	Value used as standard intercept using Fraser-Lee Method

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
AGE_GROW.dbf	ID	A	11	
	Waterbody	A	30	
	VOUCHERCD	S		
	No_Aged	S		

	Las_Anu1	N		
	...	N		
	Las_Anu10	N		
	Avg_Age1	N		
	...	N		
	Avg_Age10	N		
	Intercept used	N		

6. Plantid. dbf (List of Indiana Aquatic Plant Species)

Field	Description
Code	three digit numeric code for each species
Common_name	Common name of Indiana's aquatic plants
genus_species	Genus and species of Indiana's aquatic plants

Code	Common Name	*Scientific Name*
001	American Elodea	*Elodea canadensis*
002	American Lotus	*Nelumbo lutea*
003	American Pondweed	*Potamogeton americanus*
004	Arrow-arum	*Peltandra virginica*
005	Arrowhead	*Sagittaria spp.*
006	Beaked Sedge	*Carex rostrata*
007	Big Burreed	*Sparganium eurycarpum*
008	Bladderwort	*Utricularia spp.*
009	Blunt Spikerush	*Eleocharis obtusa*
010	Bluntscale Bullrush	*Scirpus smithii*
011	Bog Rush	*Juncus pelocarpus*
012	Brazilian Elodea	*Egeria densa*
013	Brittle Naiad	*Najas minor*
014	Broadleaf Arrowhead	*Sagittaria latifolia*
015	Broadleaf Cattail	*Typha latifolia*
016	Broadleaf Waterplantain	*Alisma plantago-aquatica*
017	Bulrush	*Scirpus spp.*
018	Bur Arrowhead	*Sagittaria rigida*
019	Buttonbush	*Cephalanthus occidentalis*
020	Cabomba	*Cabomba caroliniana*
021	Cattail	*Typha spp.*
022	Chara	*Chara*
023	Clasping-leaf Pondweed	*Potamogeton richardsonii*
024	Common Bladderwort	*Utricularia vulgaris*
025	Common Duckweed	*Lemna minor*
026	Common Naiad	*Najas flsexilis*
027	Common Spikerush	*Eleocharis palustris*
028	Common Threesquare	*Scirpus americanus*
029	Coontail	*Ceratophyllum demersum*

030	Creeping Water Primrose	*Jussiaea repens*
031	Curly-leaf Pondweed	*Potamogeton crispus*
032	Dotted Smartweed	*Polygonum punctatum*
033	Dwarf Spikerush	*Eleocharis parvula*
034	Eastern Bladderwort	*Utricularia gibba*
035	Eastern Burreed	*Sparganium americanum*
036	Eastern Watermilfoil	*Myriophylum pinnatum*
037	Eel Grass	*Vallisneria americana*
038	Engelmann Arrowhead	*Sagittaria engelmanniana*
039	Eurasian Watermilfoil	*Myriophylum spicatum*
040	Filamentous Algae	*Many*
041	Flat-stemmed Pondweed	*Potamogeton zosteriformis*
042	Floating Burreed	*Sparganium fluctuans*
043	Floating-leaf Pondweed	*Potamogeton natans*
044	Flowering Rush	*Butomus umbellatus*
045	Giant Cutgrass	*Zizaniopsis miliacea*
046	Goldenpert	*Gratiola aurea*
047'	Hardstem Bullrush	*Scirpus acutus*
048	Heartleaf Pondweed	*Potamogeton pulcher*
049	Horned Pondweed	*Zannechellia palustris*
050	Hydrilla	*Hydrilla verticillata*
051	Illinois Pondweed	*Potamogeton illinoensis*
052	Lake Cress	*Armoracia aquatica*
053	Lake Sedge	*Carex riparia*
054	Large-leaf Pondweed	*Potamogeton amplifolius*
055	Lavender Bladderwort	*Utricularia resupinata*
056	Leafy Pondweed	*Potamogeton foliosus*
057	Little Burreed	*Sparganium minimum*
058	Little Floating Bladderwort	*Utricularia radiata*
059	Little Watermilfoil	*Myriophylum alterniflorum*
060	Littorella	*Littorella uniflora*
061	Marestail	*Hippuris vulgaris*
062	Marsh Boltonia	*Boltonia asteroides*
063	Marsh Hibiscus	*Hibiscus moscheutos*
064	Marsh Mermaidweed	*Proserpinaca palustris*
065	Marsh Smartweed	*Polygonum coccineum*
066	Marsh-purslane	*Ludwigia palustris*
067	Narrowleaf Cattail	*Typha angustifolia*
068	Narrowleaf Waterplantain	*Alisma grmineum*
069	Nitella	*Nitella*
070	Nodding Smartweed	*Polygonum apathifolium*
071	Northern Arrowhead	*Sagittaria cuneata*
072	Northern Bladderwort	*Utricularia minor*
073	Northern Jointed Spikerush	*Eleocharis equisetoides*
074	Northern Pipwort	*Eriocaulon septangulare*
075	Northern Waterlily	*Nymphaea tetragona*
076	Northern Watermilfoil	*Myriophylum exalbescens*

077	Oakes Pondweed	*Potamogeton oakesianus*
078	Parrot Feather	*Myriophylum brasiliense*
079	Phragmites	*Phragmites phragmites*
080	Pickerelweed	*Pontederia cordata*
081	Pithophora	*Pithophora spp.*
082	Planktonic Algae	*Many*
083	Prairie Cordgrass	*Spartina pectinata*
084	Purple Bladderwort	*Utricularia purpurea*
085	Purple Loosestrife	*Lythrum salicaria*
086	Reed Canarygrass	*Phalaris arundinacea*
087	Reed Mannagrass	*Glyceria grandis*
088	Rice Cutgrass	*Leersia oryzoides*
089	River Bullrush	*Scirpus fluviatilis*
090	Riverweed	*Podostemum ceratophyllum*
091	Sago Pondweed	*Potamogeton pectinatus*
092	Sharpscale Mannagrass	*Glyceria acutiflora*
093	Shining Burreed	*Sparganium androcladum*
094	Slender Arrowhead	*Sagittaria graminea*
095	Slender Bullrush	*Scirpus heterochaetus*
096	Slender Burreed	*Sparganium simplex*
097	Slender Spikerush	*Eleocharis acidularis*
098	Slough Sedge	*Carex trichocarpa*
099	Small Pondweed	*Potamogeton pusillus*
100	Soft Rush	*Juncus effusus*
101	Softstem Bullrush	*Scirpus validus*
102	Soldier Rush	*Juncus militaris*
103	Southern Naiad	*Najas guadalupensis*
104	Spatterdock	*Nuphar luteum*
105	Spikerush	*Eleocharis spp.*
106	Squarestem Spikerush	*Eleocharis quadrangulata*
107	Star Duckweed	*Lemna trisulca*
108	Swamp Loosestrife	*Decodon verticillatus*
109	Swamp Smartweed	*Polygonum hydropiperoides*
110	Sweetflag	*Acorus calamus*
111	Trianglestem Spikerush	*Eleocharis robbinsii*
112	Upright Burhead	*Echinodorus berteroi*
113	Variable Watermilfoil	*Myriophylum heterophyllum*
114	Walking Spikerush	*Eleocharis rostellata*
115	Walter Millet	*Echinochloa walteri*
116	Water Bullrush	*Scirpus subterminalis*
117	Water Buttercup	*Ranunculus spp.*
118	Water Horsetail	*Equisetum fluviatile*
119	Water Lily	*Nymphae spp.*
120	Water Lobelia	*Lobelia dortmanna*
121	Water Pennywort	*Hydrocotyle spp.*
122	Water shield	*Brasenia schreberi*
123	Water Smartweed	*Polygonum spp.*

124	Water Smartweed	*Polygonum amphibium*
125	Water Willow	*Justica americana*
126	Water-Marigold	*Bidens beckii*
127	Watermeal	*Wolffia spp.*
128	Watermilfoil	*Myriophylum spp.*
129	Water-Purslane	*Peplis diandra*
130	Waterstargrass	*Heteranthera dubia*
131	Water-Starwort	*Callitriche spp.*
132	Waterthread Pondweed	*Potamogeton diversifolius*
133	White Waterlily	*Nymphaea odorata*
134	Whitestem Pondweed	*Potamogeton praelongus*
135	Whitetop	*Scolochloa festucacea*
136	Whorled Watermilfoil	*Myriophylum verticillatum*
137	Widgeon Grass	*Ruppia maritima*
138	Wild Millet	*Echinochloa crusgalli*
139	Wildrice	*Zizania aquatica*
140	Willow	*Salix spp.*
141	Zigzig Bladderwort	*Utricularia subulata*

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
Plantid.dbf	Code	N		
	common_name	A	30	
	genus_species	A	30	

7. SAMPLESTREAM.dbf

Field	Description
SAMPLE NUMBER	Each sampling occasion will have its own unique sample number. Four components will form the sample number: biologist's initials, the district the station is in, year, and the station number (station 1 is the most downstream). If District 5 sampled four stations on Sugar Creek in 1998, the sample number for the uppermost station would be - DCK5984.
WATERBODY CODE	DOW list of codes for rivers and streams
DATE COLLECTED	Date when the sampling run was made.
TIME OF SAMPLE	Report the time the sampling was conducted.
STREAM NAME	Official stream name as recognized in Hoggatt. If the site is on an oxbow, the stream name would be the name of the stream that formed the oxbow as recognized in Hoggatt followed by the word oxbow. Do not use any local names for an oxbow, a local name can be put in the notes.
TYPE OF BODY	Choose from one of the following: free flowing, impounded reach (due to a lowhead dam), or oxbow.
COUNTY	County the station is in.
LOCATION	Nearest municipality to the station.
SURVEYORS INITIALS	List only the initials of the biologist.

NOTES	Provide a brief description of the sample site. If there is a local name for an oxbow, it can be included here.
ECOREGION	We will use the ecoregion and sub-ecoregions (**ECOREGIONS.dbf**). For example, the lower Tippecanoe River is in the "Loamy, high lime till plains of the eastern corn belt plains", therefore in the database a site on the lower Tippecanoe would be listed as 55b. The ecoregions will likely continue to evolve, therefore we will use the most updated ecoregion map.
UTM	We will use Universal Transverse Mercator Projection (UTM) rather than latitude and longitude. You can figure UTM's on a topographic map, but it would be much more accurate for everyone to purchase a handheld GPS unit (most will be accurate to 100 meters). To greatly improve the accuracy of a reading, you can connect the GPS to a DGPS receiver. For those of you who do not know what a UTM looks like, the UTM for the District 5 office is **0552994E and 4365267N**. A GPS reading will be taken at the upper and lower ends of each station.
HYDROLOGIC UNIT CODE (HUC)	All watersheds and sub-watersheds in the state have been coded (**DATABASE ?**). We will report HUC down to the sub-watershed. All districts will receive the "Watershed and Hydrologic Unit Map of Indiana".
DRAINAGE AREA	Report how many square miles of land drains into the sampling station. Hoggatt shows the drainage area for most streams in the state, even those that drain less than 5 square miles.
GAUGING STATION	What is the location of the nearest gauging station? To find gauging stations on a particular stream you can visit the following U.S.G.S. web site: **http://www-dinind.er.usgs.gov/rts_table.html** These gauging stations are valuable because they are in "real-time" meaning you can find out the current flow conditions on a graph along with the previous five days. You can even go back and look at data for as long as that particular gauge has been reporting. Some streams do not have gauging stations. If you are working on a stream in which this is the case, report the nearest gauge downstream. If you are on a stream that has a gauging station, but the nearest one is on the receiving stream, report the gauge that is on the stream you are sampling. For instance, District 5 samples at river mile 5 on Sugar Creek. There is a gauge in Crawfordsville at river mile 40.4 and there is a gauge on the Wabash River just downstream of the mouth of Sugar Creek. The gauge at Crawfordsville would be listed since it is on the same stream being sampled even though it is further away than the Wabash gauge.
MEAN STREAM FLOW	The mean stream flow is the average of all flows since

	data has been collected from a gauging station. Report the mean stream flow from the nearest gauging station (even if the gauge is not on the stream you are sampling). You can find this at the U.S.G.S. web site. The mean stream flow for Sugar Creek at the Crawfordsville gauging station is 368 cfs (Appendix 3).
CURRENT STREAM FLOW	Report the stream flow in cfs at the time of the sample. Once you have completed sampling, visit the U.S.G.S. web site and see what the flow was at the at the nearest gauging station at the time of sampling. If District 5 sampled a site on Sugar Creek just upstream of Crawfordsville at noon on October 30, 1998, the flow was approximately 45 cfs.
GRADIENT	To determine gradient, measure the distance between the nearest 10 foot contour lines above and below the station surveyed. Divide 10 by the number of miles between contour lines to arrive at the gradient. Report gradient to the nearest 0.1 foot per mile.
SEGMENT	See for the segment number for streams in Indiana.
SEGMENT NAME	Write out the segment name that corresponds with the segment number
BASIN NAME	Describe which basin the stream is in
RIVER MILE	Use Hoggatt to find the river mile where the nearest tributary enters. On a topographic map, you can then measure the distance from that tributary to the center of the station. This distance would be added or subtracted accordingly to the river mile given in Hoggatt. River miles will be rounded to the nearest 0.1 mile.
TOPOGRAPHIC MAP	Use the code given in for the topographic map where the station is located.
TOPOGRAPHIC NAME	Name of the topographic map where the station is located.
IASNRI	Indiana Academy of Science Natural Regions Inventory has identified 12 major natural regions within Indiana (**see IASNRI.dbf** listed in Shared Databases). Natural regions of Indiana maps can be purchased through our map sales section for $4.00.
TOWNSHIP	Legal township.
RANGE	Legal range.
SECTION	Legal section.
AIR TEMPERATURE	Temperature of air in degrees Fahrenheit.
WATER TEMPERATURE	Temperature of water in degrees Fahrenheit. Be sure the temperature is taken in a representative part of the stream. Water temperature may be higher if you take the temperature in a stagnant area or may be cooler where a small tributary enters the stream.
DISSOLVED OXYGEN	Measure dissolved oxygen in parts per million in a representative part of the stream.
WATER CLARITY	Measure water clarity to the nearest 0.1 foot with a secchi disk.

CONDUCTIVITY	Measure conductivity in microohms.
AVERAGE WIDTH	Measure the width of the stream at the upper and lower ends and ¼, ½ and ¾ of the distance of the station and determine width to the nearest foot.
AVERAGE DEPTH	At the same stream spots where stream width is measured, conduct three measurements at ¼, ½ and ¾ of the total distance across the stream. Calculate average depth to the nearest 0.1 foot.
MAXIMUM DEPTH	Find the maximum depth of the station and report to the nearest 0.1 foot.

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
SAMPLESTREAM.dbf	Sample Number	A	11	
	Waterbody	A	30	
	Date	D		
	Time	A	6	
	Stream Name	A	24	
	Type	A	3	
	County	A	11	
	Location	A	30	
	Initials	A	3	
	Notes	M	50	
	Ecoregion	A	3	
	LAT UTM	N		
	LONG UTM	N		
	HUC	N		
	Drainage	N		
	Gauge	N		
	Mean Flow	N		
	Current Flow	N		
	Gradient	N		
	Segment	N		
	Segment Name	A	11	
	Basin	A	11	
	River Mile	N		
	Topo Map	A	4	
	Topo Name	A	24	
	IASNRI	A	3	
	Township	A	7	
	Range	A	7	
	Section	A	11	
	Air Temp	N		
	Water Temp	N		
	DO	N		
	Clarity	N		
	Conductivity	N		
	Avg Width	N		

	Avg Depth	N		
	Max Depth	N		

8. FISHNAME.dbf

This file contains the coding of the taxonomic species for fish in Indiana based on the EPA-STORET Taxa File. It is used for establishing phylogeny of fish species identified in Indiana waterbodies. The STORET code builds upon itself as one proceeds down toward the species level of organization. The first two digits represent the phylum code, the next two the class code, the next two the order code, etc. The various taxonomic codes are a breakdown of the STORET code. The key relational field is VOUCHERCD which ties the assigned fish species voucher code (vouchercd) with scientific species name and phylogenetic relationship as well as American Fisheries Society accepted common name.

NAME FIELD	FIELD DESCRIPTION
VOUCHERCD	Voucher Code
PHYLU_CODE	Phylum Code
CLASS_CODE	Class Code
ORDER_CODE	Order Code
FAMLY_CODE	Family Code
GENUS_CODE	Genus Code
SPECS_CODE	Species Code
PHYLUM	Phylum Name
CLASS	Class Name
ORDER	Order Name
FAMILY	Family Name
GENUS	Genus Name
SPECIES	Species Name
COMMON_NAM	Species Common Name
AUTHOR	Author of Species
RANGE	Range Distribution Code
ABUNDANCE	Abundance Code
FED_STATUS	Federal Status Code
ST_STATUS	State Status Code
FEED_GUILD	Feeding Guild Code
REPR_GUILD	Reproductive Guild Code
TOLERANCE	Tolerance Function Code
LARGERIVSP	Large River Species (Y/N)
IBISENSITV	IBI Sensitives S=Sensitive T=Highly Tolerant
RNDBODYSUC	Round Body Sucker (Y or N)
HWSPECIES	Head Water species? (Y or N)
EXANDNON	Exotic and non-native species where E=Exotic, N=Non-native.
COOLCOLD	Cool and cold water species designation where CL=Cool and CD=Cold.
HYBRIDSPS	Hybrid species? (Y or N)

PIONEERSP	Pioneer species? (Y or N)
BENTHINSEC	Benthic insectivore (Y or N)
DMS_MET	Darter, madtom, sculpin species(?) D=Darter, M=Madtom, S=Sculpin.
OHIORIVER	Inhabitant of Ohio River Drainage? (Y or N)
MISSISSIPP	Inhabitant of the Mississippi River basin drainage? (Yor N)
GREATLAKES	Inhabitant of the Great Lakes basin drainage ? (Y or N)

VOUCHERCD	COMMON_NAM	GENUS	SPECIES	ST_STATUS
17.	ALABAMA SHAD	Alosa	alabamae	
18.	ALEWIFE	Alosa	pseudoharengus	X
14.	ALLIGATOR GAR	Lepisosteus	spatula	SE
2.	AMERICAN BROOK LAMPREY	Lampetra	appendix	
16.	AMERICAN EEL	Anguilla	rostrata	
33.	ATLANTIC SALMON	Salmo	salar	X
189.	BANDED DARTER	Etheostoma	zonale	
139.	BANDED KILLIFISH	Fundulus	diaphanus	
206.	BANDED PYGMY SUNFISH	Elassoma	zonatum	
150.	BANDED SCULPIN	Cottus	carolinae	
166.	BANTAM SUNFISH	Lepomis	symmetricus	
74.	BIGEYE CHUB	Notropis	amblops	
68.	BIGEYE SHINER	Notropis	boops	
116.	BIGMOUTH BUFFALO	Ictiobus	cyprinellus	
69.	BIGMOUTH SHINER	Notropis	dorsalis	
117.	BLACK BUFFALO	Ictiobus	niger	
131.	BLACK BULLHEAD	Ameiurus	melas	
171.	BLACK CRAPPIE	Pomoxis	nigromaculatus	
110.	BLACK REDHORSE	Moxostoma	duquesnei	
70.	BLACKCHIN SHINER	Notropis	heterodon	
27.	BLACKFIN CISCO	Coregonus	nigripinnis	
52.	BLACKNOSE DACE	Rhinichthys	atratulus	
71.	BLACKNOSE SHINER	Notropis	heterolepis	
194.	BLACKSIDE DARTER	Percina	maculata	

140.	BLACKSPOTTED TOPMINNOW	Fundulus	olivaceus	
142.	BLACKSTRIPE TOPMINNOW	Fundulus	notatus	
26.	BLOATER	Coregonus	hoyi	
120.	BLUE CATFISH	Ictalurus	furcatus	
114.	BLUE SUCKER	Cycleptus	elongatus	SC
179.	BLUEBREAST DARTER	Etheostoma	camurum	SE
160.	BLUEGILL	Lepomis	macrochirus	
172.	BLUNTNOSE DARTER	Etheostoma	chlorosomum	
79.	BLUNTNOSE MINNOW	Pimephales	notatus	
15.	BOWFIN	Amia	calva	
47.	BRASSY MINNOW	Hybognathus	hankinsoni	
127.	BRINDLED MADTOM	Noturus	miurus	
145.	BROOK SILVERSIDE	Labidesthes	sicculus	
147.	BROOK STICKLEBACK	Culaea	inconstans	
36.	BROOK TROUT	Salvelinus	fontinalis	
133.	BROWN BULLHEAD	Ameiurus	nebulosus	
34.	BROWN TROUT	Salmo	trutta	X
81.	BULLHEAD MINNOW	Pimephales	vigilax	
138.	BURBOT	Lota	lota	
42.	CENTRAL MUDMINNOW	Umbra	lima	
77.	CENTRAL STONEROLLER	Campostoma	anomalum	
121.	CHANNEL CATFISH	Ictalurus	punctatus	
201.	CHANNEL DARTER	Percina	copelandi	
207.	CHANNEL SHINER	Notropis	wickliffi	
5.	CHESTNUT LAMPREY	Ichthyomyzon	castaneus	
31.	CHINOOK SALMON	Oncorhynchus	tshawytscha	X
25.	CISCO OR LAKE HERRING	Coregonus	artedi	SC
30.	COHO SALMON	Oncorhynchus	kisutch	X
43.	COMMON CARP	Cyprinus	carpio	X
93.	COMMON SHINER	Luxilus	cornutus	
51.	CREEK CHUB	Semotilus	atromaculatus	
106.	CREEK CHUBSUCKER	Erimyzon	oblongus	

204.	CRYSTAL DARTER	Ammocrypta	asprella	
48.	CYPRESS MINNOW	Hybognathus	hayi	
152.	DEEPWATER SCULPIN	Myoxocephalus	thompsoni	
192.	DUSKY DARTER	Percina	sciera	
203.	EASTERN SAND DARTER	Ammocrypta	pellucida	SC
45.	EASTERN SILVERY MINNOW	Hybognathus	regius	
59.	EMERALD SHINER	Notropis	atherinoides	
181.	FANTAIL DARTER	Etheostoma	flabellare	
80.	FATHEAD MINNOW	Pimephales	promelas	
129.	FLATHEAD CATFISH	Pylodictis	olivaris	
157.	FLIER	Centrarchus	macropterus	
123.	FRECKLED MADTOM	Noturus	nocturnus	
205.	FRESHWATER DRUM	Aplodinotus	grunniens	
60.	GHOST SHINER	Notropis	buchanani	
193.	GILT DARTER	Percina	evides	SE
19.	GIZZARD SHAD	Dorosoma	cepedianum	
111.	GOLDEN REDHORSE	Moxostoma	erythrurum	
49.	GOLDEN SHINER	Notemigonus	crysoleucus	
22.	GOLDEYE	Hiodon	alosoides	
44.	GOLDFISH	Carassius	auratus	X
83.	GRASS CARP	Ctenopharyngod on	idella	X
39.	GRASS PICKEREL	Esox	americanus vermiculatus	
91.	GRAVEL CHUB	Erimystax	x-punctatus	
41.	GREAT LAKES MUSKELLUNGE	Esox	masquinongy	
112.	GREATER REDHORSE	Moxostoma	valenciennesi	SC
158.	GREEN SUNFISH	Lepomis	cyanellus	
177.	GREENSIDE DARTER	Etheostoma	blennioides	
119.	HARELIP SUCKER	Lagochila	lacera	
182.	HARLEQUIN DARTER	Etheostoma	histrio	SE
104.	HIGHFIN CARPSUCKER	Carpiodes	velifer	
55.	HORNYHEAD CHUB	Nocomis	biguttatus	
208.	HYBRID SUNFISH	Lepomis	sp.	

180.	IOWA DARTER	Etheostoma	exile	
56.	IRONCOLOR SHINER	Notropis	chalybaeus	
175.	JOHNNY DARTER	Etheostoma	nigrum	
82.	LAKE CHUB	Couesius	plumbeus	
105.	LAKE CHUBSUCKER	Erimyzon	sucetta	
8.	LAKE STURGEON	Acipenser	fulvescens	SE
35.	LAKE TROUT	Salvelinus	namaycush	
24.	LAKE WHITEFISH	Coregonus	clupeaformis	
168.	LARGEMOUTH BASS	Micropterus	salmoides	
78.	LARGESCALE STONEROLLER	Campostoma	oligolepis	
1.	LEAST BROOK LAMPREY	Lampetra	aepyptera	
185.	LEAST DARTER	Etheostoma	microperca	
191.	LOGPERCH	Percina	caprodes	
163.	LONGEAR SUNFISH	Lepomis	megalotis	
53.	LONGNOSE DACE	Rhinichthys	cataractae	
11.	LONGNOSE GAR	Lepisosteus	osseus	
100.	LONGNOSE SUCKER	Catostomus	catostomus	
64.	MIMIC SHINER	Notropis	volucellus	
46.	MISSISSIPPI SILVERY MINNOW	Hybognathus	nuchalis	
23.	MOONEYE	Hiodon	tergisus	
149.	MOTTLED SCULPIN	Cottus	bairdi	
124.	MOUNTAIN MADTOM	Noturus	eleutherus	
176.	MUD DARTER	Etheostoma	asprigene	
40.	MUSKELLUNGE	Esox	masquinongy	
146.	NINESPINE STICKLEBACK	Pungitius	pungitius	
6.	NORTHERN BROOK LAMPREY	Ichthyomyzon	fossor	
134.	NORTHERN CAVEFISH	Amblyopsis	spelaea	SE
113.	NORTHERN HOG SUCKER	Hypentelium	nigricans	
128.	NORTHERN MADTOM	Noturus	stigmosus	
38.	NORTHERN PIKE	Esox	lucius	
141.	NORTHERN STUDFISH	Fundulus	catenatus	SC
4.	OHIO LAMPREY	Ichthyomyzon	bdellium	

162.	ORANGESPOTTED SUNFISH	Lepomis	humilis	
174.	ORANGETHROAT DARTER	Etheostoma	spectabile	
10.	PADDLEFISH	Polyodon	spathula	
75.	PALLID SHINER	Notropis	amnis	
136.	PIRATE PERCH	Aphredoderus	sayanus	
66.	POPEYE SHINER	Notropis	ariommus	SE
98.	PUGNOSE MINNOW	Opsopoeodus	emiliae	
65.	PUGNOSE SHINER	Notropis	anogenus	
161.	PUMPKINSEED	Lepomis	gibbosus	
102.	QUILLBACK	Carpiodes	cyprinus	
178.	RAINBOW DARTER	Etheostoma	caeruleum	
37.	RAINBOW SMELT	Osmerus	mordax	
32.	RAINBOW TROUT	Oncorhynchus	mykiss	X
87.	RED SHINER	Cyprinella	lutrensis	
164.	REDEAR SUNFISH	Lepomis	microlophus	
96.	REDFIN SHINER	Lythrurus	umbratilis	
50.	REDSIDE DACE	Clinostomus	elongatus	SE
95.	RIBBON SHINER	Lythrurus	fumeus	
103.	RIVER CARPSUCKER	Carpiodes	carpio	
54.	RIVER CHUB	Nocomis	micropogon	
196.	RIVER DARTER	Percina	shumardi	
109.	RIVER REDHORSE	Moxostoma	carinatum	SC
67.	RIVER SHINER	Notropis	blennius	
156.	ROCK BASS	Ambloplites	rupestris	
94.	ROSEFIN SHINER	Lythrurus	ardens	
58.	ROSYFACE SHINER	Notropis	rubellus	
85.	RUDD	Scardinius	erythrophthalmus	
198.	SADDLEBACK DARTER	Percina	vigil	
62.	SAND SHINER	Notropis	stramineus	
200.	SAUGER	Stizostedion	canadense	
210.	SAUGEYE	Stizostedion	vitreum X canadense	
3.	SEA LAMPREY	Petromyzon	marinus	

107.	SHORTHEAD REDHORSE	Moxostoma	macrolepidotum	
29.	SHORTJAW CISCO	Coregonus	zenithicus	
28.	SHORTNOSE CISCO	Coregonus	reighardi	
13.	SHORTNOSE GAR	Lepisosteus	platostomus	
9.	SHOVELNOSE STURGEON	Scaphirhynchus	platorynchus	
86.	SILVER CARP	Hypophthalmichthys	molitrix	X
97.	SILVER CHUB	Macrhybopsis	storeriana	
7.	SILVER LAMPREY	Ichthyomyzon	unicuspis	
108.	SILVER REDHORSE	Moxostoma	anisurum	
72.	SILVER SHINER	Notropis	photogenis	
61.	SILVERBAND SHINER	Notropis	shumardi	
73.	SILVERJAW MINNOW	Notropis	buccatus	
20.	SKIPJACK HERRING	Alosa	chrysochloris	
125.	SLENDER MADTOM	Noturus	exilis	
195.	SLENDERHEAD DARTER	Percina	phoxocephala	
148.	SLIMY SCULPIN	Cottus	cognatus	
173.	SLOUGH DARTER	Etheostoma	gracile	
167.	SMALLMOUTH BASS	Micropterus	dolomieu	
115.	SMALLMOUTH BUFFALO	Ictiobus	bubalus	
135.	SOUTHERN CAVEFISH	Typhlichthys	subterraneus	SE
84.	SOUTHERN REDBELLY DACE	Phoxinus	erythrogaster	
99.	SPECKLED CHUB	Macrhybopsis	aestivalis	
151.	SPOONHEAD SCULPIN	Cottus	ricei	
88.	SPOTFIN SHINER	Cyprinella	spiloptera	
186.	SPOTTAIL DARTER	Etheostoma	squamiceps	SE
57.	SPOTTAIL SHINER	Notropis	hudsonius	
169.	SPOTTED BASS	Micropterus	punctulatus	
184.	SPOTTED DARTER	Etheostoma	maculatum	SE
12.	SPOTTED GAR	Lepisosteus	oculatus	
118.	SPOTTED SUCKER	Minytrema	melanops	
165.	SPOTTED SUNFISH	Lepomis	punctatus	
197.	STARGAZING DARTER	Percina	uranidea	

143.	STARHEAD TOPMINNOW	Fundulus	dispar	
89.	STEELCOLOR SHINER	Cyprinella	whipplei	
126.	STONECAT	Noturus	flavus	
90.	STREAMLINE CHUB	Erimystax	dissimilis	
153.	STRIPED BASS	Morone	saxatilis	X
92.	STRIPED SHINER	Luxilus	chrysocephalus	
183.	STRIPETAIL DARTER	Etheostoma	kennicotti	
76.	SUCKERMOUTH MINNOW	Phenacobius	mirabilis	
122.	TADPOLE MADTOM	Noturus	gyrinus	
21.	THREADFIN SHAD	Dorosoma	petenense	
211.	TIGER MUSKIE	Esox	lucius X masquinongy	
187.	TIPPECANOE DARTER	Etheostoma	tippecanoe	SE
137.	TROUT-PERCH	Percopsis	omiscomaycus	
188.	VARIEGATE DARTER	Etherostoma	variatum	SE
199.	WALLEYE	Stizostedion	vitreum	
159.	WARMOUTH	Lepomis	gulosus	
63.	WEED SHINER	Notropis	texanus	
144.	WESTERN MOSQUITOFISH	Gambusia	affinis	X
202.	WESTERN SAND DARTER	Ammocrypta	clara	
154.	WHITE BASS	Morone	chrysops	
130.	WHITE CATFISH	Ameiurus	catus	X
170.	WHITE CRAPPIE	Pomoxis	annularis	
101.	WHITE SUCKER	Catostomus	commersoni	
209.	WIPER	Morone	chrysops X saxatilis	
155.	YELLOW BASS	Morone	mississippiensis	
132.	YELLOW BULLHEAD	Ameiurus	natalis	
190.	YELLOW PERCH	Perca	flavescens	
212.	f. madtom v. stonecat	Noturus	nocturnus X flavus	
110.1	yoy redhorse	Moxostoma	sp.	
96.1	yoy shiner	ge.	sp.	

9. ALLWATER.dbf

This file contains a list of water bodies in the state, including natural lakes, **rivers**, pits, reservoirs, **streams**, etc. For the purpose of this list a lake is defined as any body of water under jurisdiction of any of the following statues.

IC 14-26-2	Lake Preservation Act
IC 14-26-5	Lowering of Ten Acre Lake Act
IC 14-27-7	Dams, Dikes and Levees Act
IC 14-28-1	Flood Control Act

This would include any lake (natural or manmade) with an area of at least 10 acres, or any lake which; has a drainage area >1 sq mi, has a dam >20 ft in height measured from the point above the natural stream bed, has a volume of >100 ac ft at either the elevation of the spillway or at "legal level". The physical description and location of the lakes are also included. **(Note to staff: Depending on how DOW creates their lake/stream? database we may want to split this file into two separate files. Currently, Water may only be including location and name information for lakes)**

FIELD NAME	DESCRIPTION
WATERNUM	Waternum refers to the lake identification number unique to that body of water.
NAME	List the legal water name.
COUNTY	County or counties the body of water is in.
TYPE	Identify the waterbody type. Lake types assigned based on the lake classification system developed by Pearson et. al. 1991.
ACRES	Size of the water body in acres.
FISH	List if the fish are state owned. (Y nor N)
ACCESS	What type of access exists (state, state1, local, private, unknown)
MWBCODE	Water body code (Developed by DOW)
UTM'S	Record location of the lake (center) in UTM coordinates.
QUAD NAME	Name of quadrangle that the body of water is located in.
TOWNSHIP	Legal township.
RANGE	Legal range.
SECTION	Legal section or sections.
USGSHYDR	List the 8-digit hydrological unit code area the lake is in (See USGSHYDR table).
MEAN DEPTH	Average depth of the water body.
MAX DEPTH	Maximum depth of the water body.
SHORELINE	All manmade development that effects the shoreline should be listed.
NATREGIAS	Indiana Academy of Science Natural Regions Inventory (See IASNRI table)
WATERSHED NAME	Watershed name based on NRCS breakdown (See NRCS table).
WATERSHED SIZE	Size of the watershed in acres.
CLASS	
ALT_NAME	List other local names by which the body of water is

known.

DESCRIPTION	
RETENTION TIME	Hydraulic retention time in days.
MAX DISCHARGE	Maximum allowable discharge in CFS.
MIN DISCHARGE	Minimum allowable discharge in CFS.
SUMMER POOL_ELEV	Elevation in feet above sea level at summer pool.
WINTER POOL ELEV.	Elevation in feet above sea level at winter pool.
% LITTORAL AREA	List the percent littoral area.

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
ALLWATER.db	WATERNUM	S		*
	NAME	A	25	*
	DISTRICT	N		
	COUNTY	A	11	
	TYPE	A	14	
	ACRES	N		
	SURVEY	N		
	FISH	A	7	
	ACCESS	A	8	
	EL	S		
	MWBCODE	A	7	
	LATDEG	N		
	LATMIN.SEC	N		
	LONGDEG	N		
	LONGMIN.SEC	N		
	SECTION	A	2	
	TOWNSHIP	A	3	
	RANGE	A	3	
	USGSHYDR	A	8	
	MEAN DEPTH	N		
	MAX DEPTH	N		
	SHORELINE	S		
	NATREGIAS	S		
	WATERSHED NAME	A	14	
	WATERSHED SIZE	S		
	CLASS	N		
	C	N		
	D	N		
	Comment	A	250	

Pearson J., et al. 1991. Lake types in Indiana

1. <u>natural lake</u>
   - A. small < 50 acres
   - B. medium 51 - 300 acres
   - C. large 300+ acres
3. <u>strip pit</u>
4. <u>quarry</u>
5. <u>borrow pit</u>
6. <u>municipal pond</u>

2. impoundment
   A. small < 50 acres
   B. medium 51 - 300 acres
   C. large 300+

7. farm pond
8. marsh
9. oxbow

10. GEAR.dbf

This is a list of gear types commonly used throughout Indiana waterways. Other gear types may be added to this structure as seen fit by the project leader. Description of what constitutes an Indiana DC electrofishing boat as well as other standard gears are included below.

GEAR TYPE	DESCRIPTION
A	Night electrofishing (DC boat mounted)
B	Day electrofishing (DC boat mounted)
C	Night electrofishing (AC boat mounted)
D	Day electrofishing (AC boat mounted)
E	Gill netting (250 foot standard, experimental panels)
F	Gill netting (300 foot in length)
G	Trap netting (Indiana standard; single or double throated)
H	Trap netting (Michigan inland trap net)
I	Trap netting (Lake Michigan trap net)
J	Tote barge
K	Backpack electrofisher (pulsed DC)
L	Draining
M	Rotenone (cove or stream)
N	Drop seine
O	Otter trawl
P	Fyke net
Q	Hoop net
R	Trammel net
S	Wire traps
T	Multiple gears
U	Other
V	None
W	Miscellaneous size gill nets recorded in comments

DATABASE NAME	FIELD NAME	TYPE	SIZE	KEY
GEAR.db	Gear Sample	A	2	
	Gear	A	125	

STANDARD GEAR

1. Electrofishing Boat
   a. 5,000 watt generator
   b. Two booms, each one with a 36 inch hoop to attach the electrodes.
   c. Six, ¾ inch diameter electrodes per hoop
   d. 3/4 inch electrode diameter.

e. Type VI-A Smith Root electrofishing box.

f. Dip nets

- 6 foot in length W/GQDA fiberglass handles
- 17.5 inch by 17.5 inch frame
- maximum ♎ inch knotless nylon mesh bag, minimum 18 inches in depth

g. Aluminum (riveted or all-weld) or plate flat bottomed boat

- Coast Guard bow (modified V)
- minimum length 16 feet
- minimum size outboard 25 horsepower

h. Safety system

- two foot switches on bow
- emergency shutoff mounted on generator
- foot switch or outboard type kill switch cord for boat operator
- **cell phone for emergency communication?**

2. Experimental Gill Net

a. 250 feet long, 6 feet deep.

b. Five successive 50 foot mesh panels. Each with a mesh measuring, ¾ inch, 1 inch, 1¼ inch, 1 ½ inch, and 2 inches respectively.

c. No. 69 multifilament nylon line for the ¾ inch, 1 inch, 1¼ inch mesh panels. No.104 multifilament nylon line for the 1 ½ inch and 2 inch mesh panels.

d. Lead line consisting of ¼ inch lead core line having an appropriate weight of not less than 0.8 ounces per foot.

e. Float line should be ♎ inch polyethylene core float line.

f. Both float and lead line to extend at least 4 feet beyond each end of net.

g. The last row of netting at each end of the net should be tied to a ♎ inch polyethylene rope which runs from float line to the lead line.

3. Trap Net

a. Frame net with double front frame, 4 rear hoops, and lead net.

b. Overall length of net (excluding lead) approximately 16 feet.

c. Two 6' x 3' front frames to be 5/16 inch diameter galvanized spring steel and center braced.

d. Four 30 inch diameter hoops to be ¼ inch galvanized spring steel.

e. Distance between hoops should be 2 feet.

f. Box end netting to be ½ inch square measure knotless nylon, treated. Netting to be tied so as to suspend from hoops and frames, not tied over hoops and frames. Cod end of net to have a draw string and tail rope.

g. Lead net to be 50' in length and 3' deep, ½ inch square knotless nylon netting, treated.

h. Lead net to be attached to center brace of second frame and sewn to frame netting at top and bottom and to first frame.

i. Lead net to have lead weights at 2' intervals and hard foam floats at 3' intervals on top line.

j. Net to be double throated with one 8 inch throat to be placed at the first and third hoops.

5. Electrofishing tote barge
   a. Smith-Root 2.5 GPP electrofishing system including pulsator and 2,500 watt generator.
   b. 6 foot length fiberglass tote barge and stainless steel bottom plate to serve as cathode (Smith-Root SR-6)
   c. Two, one piece 6 foot long electrode poles with cord and 11 inch diameter electrode rings
   d. Remote control box to operate two anode poles
   e. Two, anode/cathode extension cables, 25 foot long with belt and floats
   f. Cell phone for emergency communication?

6. Seine
   a. ♍ inch mesh, 6 feet deep, 50 inches in length

7. Other Gear Information and Units
   a. DC boat electrofishing
      - amps, volts and pulses/second
   b. DC barge electrofishing
      - amps, volts and pulses/second
   c. Seine haul
      - length, height and mesh
   d. Hoop nets
      - length, height and mesh
   e. Gill nets
      - length, height, mesh and material (monofilament or multi-filament)
   f. Trammel nets
      - length, height, mesh and material (monofilament or multi-filament)
   e. Effort Units
      1. Minutes (for all except seine hauls)
      2. Number of seine hauls
      3. Distance sampled (electrofishing only)

11. <u>IASNRI.dbf</u>

Indiana Academy of Science Natural Regions Inventory has identified 12 major natural regions within Indiana (Appendix 6). Natural regions of Indiana maps can be purchased through our map sales section for $4.00.

1. Lake Michigan Natural Region
2. Northwestern Morainal Natural Region
   - 2A. Valparaiso Moraine Section
   - 2B. Chicago Lake Plain Section
   - 2C. Lake Michigan Border Section
3. Grand Prairie Natural Region
   - 3A. Grand Prairie Section
   - 3B. Kankakee Sand Section
   - 3C. Kankakee Marsh Section

4. Northern Lakes Natural Region
5. Central Till Plain Natural Region
    - 5A. Entrenched Valley Section
    - 5B. Tipton Till Plain Section
    - 5C. Bluffton Till Plain Section
6. Black Swamp Natural Region
7. Southwestern Lowlands Natural Region
    - 7A. Plainville Sand Section
    - 7B. Glaciated Section
    - 7C. Driftless Section
8. Southern Bottomlands Natural Region
9. Shawnee Hills Natural Region
    - 9A. Crawford Upland Section
    - 9B. Escarpment Section
10. Highland Rim Natural Region
    - 10A. Mitchell Karst Plain Section
    - 10B. Brown County Hills Section
    - 10C. Knobstone Escarpment Section
11. Bluegrass Natural Region
    - 11A.. Scottsburg Lowland Section
    - 11B. Muscatatuck Flats and Canyons Section
    - 11C. Switzerland Hills Section
12. Big Rivers Natural Region

12. COUNTY.dbf

Listing of counties names, associated number codes (Fipscode) and fisheries management district assigned that county.

COUNTY	FIPSCODE	DISTRICT
ADAMS	1	4
ALLEN	2	3
BARTHOLOMEW	3	8
BENTON	4	1
BLACKFORD	5	4
BOONE	6	5
BROWN	7	8
CARROLL	8	1
CASS	9	1
CLARK	10	8
CLAY	11	6
CLINTON	12	5

CRAWFORD	13	7
DAVIESS	14	6
DEARBORN	15	8
DECATUR	16	8
DEKALB	17	3
DELAWARE	18	4
DUBOIS	19	7
ELKHART	20	2
FAYETTE	21	5
FLOYD	22	8
FOUNTAIN	23	5
FRANKLIN	24	5
FULTON	25	1
GIBSON	26	7
GRANT	27	4
GREENE	28	6
HAMILTON	29	5
HANCOCK	30	5
HARRISON	31	8
HENDRICKS	32	5
HENRY	33	5
HOWARD	34	4
HUNTINGTON	35	4
JACKSON	36	8
JASPER	37	1
JAY	38	4
JEFFERSON	39	8
JENNINGS	40	8
JOHNSON	41	5
KNOX	42	6
KOSCIUSKO	43	3

LAGRANGE	44	2
LAKE	45	1
LAPORTE	46	1
LAWRENCE	47	6
MADISON	48	4
MARION	49	5
MARSHALL	50	1
MARTIN	51	6
MIAMI	52	4
MONROE	53	6
MONTGOMERY	54	5
MORGAN	55	5
NEWTON	56	1
NOBLE	57	3
OHIO	58	8
ORANGE	59	7
OWEN	60	6
PARKE	61	5
PERRY	62	7
PIKE	63	7
PORTER	64	1
POSEY	65	7
PULASKI	66	1
PUTNAM	67	5
RANDOLPH	68	4
RIPLEY	69	8
RUSH	70	5
SCOTT	72	8
SHELBY	73	5
SPENCER	74	7
ST. JOSEPH	71	1

STARKE	75	1
STEUBEN	76	2
SULLIVAN	77	6
SWITZERLAND	78	8
TIPPECANOE	79	1
TIPTON	80	4
UNION	81	5
VANDERBURGH	82	7
VERMILLION	83	5
VIGO	84	6
WABASH	85	4
WARREN	86	1
WARRICK	87	7
WASHINGTON	88	8
WAYNE	89	5
WELLS	90	4
WHITE	91	1
WHITLEY	92	4

13. ECOREGION.dbf

Listing of ecoregions and subregions in Indiana. See EPA ecoregion map for location of each region.

Ecoregion number	Subregion	Ecoregion names
54		CENTRAL CORN BELT PLAINS
	54G	CENTRAL CORN BELT PLAINS
	54M	CENTRAL CORN BELT PLAINS
55		EASTERN CORN BELT PLAINS
	55G	EASTERN CORN BELT PLAINS
	55M	EASTERN CORN BELT PLAINS
56		S. MICHIGAN, INDIANA TILL PLAINS
	56G	S. MICHIGAN, INDIANA TILL PLAINS
	56M	S. MICHIGAN, INDIANA TILL PLAINS
57		HURON/ERIE LAKE PLAIN
	57G	HURON/ERIE LAKE PLAIN

	57M	HURON/ERIE LAKE PLAIN
71		INTERIOR PLATEAU
	71G	INTERIOR PLATEAU
	71M	INTERIOR PLATEAU
72		INTERIOR RIVER LOWLAND
	72G	INTERIOR RIVER LOWLAND
	72M	INTERIOR RIVER LOWLAND

FILE NAME	FIELD NAME	TYPE	SIZE	KEY
ECOREGION.dbf	ECOREGION	A	3	*
	ECOREGION NAME	A	46	

14. QHEI.dbf

This table contains QHEI metric scores for all stream sampling. See QHEI sampling section for description of each variable.

FILE NAME	FIELD NAME	TYPE	SIZE	KEY
QHEI.dbf (Qualitative Habitat Evaluation Index)	SAMPLE NUMBER	A	8	*
	SAMPLE DATE	D		
	SITE	A	24	
	COUNTY	A	11	
	LOCATION	A	30	
	SURVEYOR	A	3	
	SUBSTRATE SCORE	N		
	COVER SCORE	N		
	CHANNEL SCORE	N		
	RIPARIAN SCORE	N		
	POOL SCORE	N		
	RIFFLE SCORE	N		
	GRADIENT SCORE	N		
	GRADIENT	N		

	TOTAL SCORE	N		
	PERCENT POOL	N		
	PERCENT RUN	N		
	PERCENT RIFFLE	N		
	SUBJECTIVE RATE	N		
	AESTHETIC RATE	N		
	CANOPY COVER	N		
	AVERAGE WIDTH	N		
	AVERAGE DEPTH	N		
	MAXIMUM DEPTH	N		
	QHEI	A		
	DRAINAGE	N		
	DRAINAGE SCORE	N		

V. Stream Navigability

A. Introduction

Property rights relative to Indiana waterways often are determined by whether the waterway is "*navigable*". Both common law and statutory law make distinctions founded upon whether a river, stream, embayment, or lake is navigable.

A landmark decision in Indiana with respect to determining and applying navigability is State v. Kivett, 228 Ind. 629, 95 N.E. 2d 148 (1950). The Indiana Supreme Court stated that the test for determining navigability is whether a waterway: *was available and susceptible for navigation according to the general rules of river transportation at the time [1816) Indiana was admitted to the Union. It does not depend on whether it is now navigable....The true test seems to be the capacity of the stream, rather than the manner or extent of use. And the mere fact that the presence of sandbars or driftwood or stone, or other objects, which at times render the stream unfit for transportation, does not destroy its actual capacity and susceptibility for that use.*

A modified standard for determining navigability applies to a body of water which is artificial. The test for a man-made reservoir, or a similar waterway which did not exist in 1816, is whether it is navigable in fact. Reed v. United States, 604 F. Supp. 1253 (1984).

The court observed in Kivett that "*whether the waters within the State under which the lands lie are navigable or non-navigable, is a federal" question and is "determined according to the law and usage recognized and applied in the federal courts, even though" the waterway may not be "capable of use for navigation in interstate or foreign commerce."* Federal decisions applied to particular issues of navigability are useful precedents, regardless of whether the decisions originated in Indiana or another state.

The primary issue in Kivett was ownership of the river bed from which the defendant was removing materials. If the waterway was navigable on the date of statehood, title to the bed of the river passed to the state of Indiana and could not ordinarily be conveyed incident to the adjoining riparian property. Also, once a waterway is found to be navigable it remains so, even if the waterway is no longer used for purposes of commercial navigation. United States v. United States Steel Corporation, 482 F. 2d 439 (7^{th} Cir. 1973).

In the absence of a contrary state boundary, the appropriate line of demarcation for a navigable waterway is the ordinary high watermark. The Indiana Water Resource, Governor's Water Resource Study Commission, State of Indiana (Indiana Department of Natural Resources, 1980), page 107. The Natural Resources Commission has also adopted this standard by rule. 310 IAC 21-2-8.5. If not navigable, title to the bed of the river passes to the adjacent property owner or owners.

Ownership is not the only issue determined by whether a waterway is navigable. Public recreational and commercial usage of the surface of a river or stream often depends upon whether the water is navigable. Other legal foundations may, however, authorize public usage. A prescriptive easement may exist. A waterway may be a "*public freshwater lake*" subject to IC 14-26-2 and 310 IAC 6-2. Pursuant to IC 14-29-8, the Natural Resources Commission may, by rule, declare a waterway to be a "*recreational stream*."

State legislation also establishes regulatory functions which rest upon a determination of navigability. For example, a permit is typically required from the Indiana Department of Natural Resources before a person can

- place, fill, or erect a permanent structure in;
- remove water from; or
- remove material from a navigable waterway. IC 14-29-1-8 and 310 IAC 21.

Other notable regulatory standards applicable to navigable waters include IC 14-18-6 (Lake Michigan fills), IC 14-29-4-5 (dedication of channels into navigable waters), IC 14-19-1-1 (general charge of Indiana navigable waters placed in DNR), and IC 14-29-3 (removal of sand and gravel from the beds of navigable waters).

B. Stream List

Anderson River (including Middle Fork): Navigable in Spencer County from its junction with the Ohio River for 28.4 river miles to the Perry-Spencer County Line. The Middle Fork is navigable from its junction with the Anderson River for

3.3 river miles.

Armuth Ditch: See Black Creek.

Arnold Creek: Navigable in Ohio County from its junction with the Ohio River for 4.4 river miles.

Baker Creek: Navigable in Spencer County from its junction with Little Pigeon Creek 1.8 river miles.

Bald Knob Creek: Navigable in Perry County from its junction with Oil Creek for 0.5 river miles.

Banbango Creek: See Baugo Creek.

Baugo Creek: Navigable from its junction with the St. Joseph River in South Bend for 15.2 river miles to the main forks (near Wakarusa).

Bayou Creek: Navigable in Vanderburgh County from its junction with the Ohio River for 1.5 river miles.

Beanblossom Creek: Navigable in Monroe County from its junction with the West Fork of the White River for 17.7 river miles to Griffy Creek.

Bear Creek: Navigable in Perry County from its junction with the Ohio River for 1.6 river miles.

Big Blue River: Navigable from its junction with Sugar Creek (to form the Driftwood River) for 55.46 river miles to the Henry-Rush County Line.

Big Blue River: See, also, Blue River.

Big Creek: Navigable in Posey County from its junction with the Wabash River for 25.4 river miles (near Cynthiana). See, also, Little Fork of Big Creek.

Big Deer Creek: See Deer Creek.

Big Indian Creek: See Indian Creek (Morgan County).

Big Oil Creek: Navigable in Perry County from its junction with the Ohio River for 10.6 river miles.

Big Poison Creek: Navigable in Perry County from its junction with the Ohio River for 6.3 river miles.

Big Raccoon Creek: Navigable from its junction with the Wabash River for 42.35 river miles to the Parke-Putnam County Line (now Cecil M. Harden Lake). The dam for Harden Lake is located at river mile 33.7.

Big Saluda Creek: Navigable in Jefferson County from its junction with the Ohio River for 1.0 river miles.

Big Sandy Creek: See Sandy Creek.

Big Vermillion River: Navigable from its junction with the Wabash River for 10.8 river miles to the Illinois State Line. (This river is navigable to Carmargo, Illinois.)

Black Creek: Navigable from its junction with the West Fork of the White River (near Edwardsport) for 11.8 river miles (near Marco).

Blue River: Navigable from its junction with the Ohio River for 57.15 river miles to Fredricksburg.

Blue River: See, also, Big Blue River.

Bryant Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.6 river miles.

Buck Creek: Navigable in Harrison County from its junction with the Ohio River for 5.8 river miles.

Buck Creek: Navigable in Perry County from its junction with the Ohio River for 0.7 river miles.

Buck Run: Navigable in Ohio County from its junction with the Ohio River for 1.1 river miles.

Bull Creek: Navigable in Clark County from its junction with Ohio River for 1.1 river miles.

Bull Hollow: Navigable in Perry County from its junction with Big Oil Creek for 0.7 river miles.

Burns Ditch: See Portage Burns Waterway

Burns Waterway Harbor: Navigable as an extension of Lake Michigan for 1.3 river miles to the Little Calumet River.

Busseron Creek: Navigable from its junction with the Wabash River in Knox County for 20.96 river miles. A channelization and relocation of Busseron Creek is navigable from its junction with the Wabash River in Sullivan County (near Rogers Ditch) for 2.85 river miles to its junction with the original channel.

Busserou Creek: See Busseron Creek.

Cagles Mill Lake: See Eel River, and see Mill Creek.

Calumet River: See Grand Calumet River; also Little Calumet River.

Calumet River Canal: See Indiana Harbor Canal.

Cammie Thomas Ditch: Navigable for 7.45 river miles as a channelization of the Muscatatuck River.

Camp Creek: Navigable in Clark County from its junction with the Ohio River for 1.7 river miles.

Caney Branch: Navigable in Perry County from its junction with Big Poison Creek for 0.2 river miles.

Caney Branch: Navigable in Perry County from its junction with Little Deer Creek for 0.8 river miles.

Caney Creek: Navigable in Spencer County from its junction with the Ohio River for 2.8 river miles.

Carman's Creek: See Turman Creek.

Cecil M. Harden Lake: See Big Raccoon Creek.

Clear Creek: Navigable in Monroe County from its junction with Salt Creek for 2.55 river miles (near Harrodsburg).

Clear Creek: Navigable from its junction with Little Pigeon Creek for 2.4 river miles.

Clover Lick Creek: Navigable in Perry County from its junction with Big Oil Creek for 0.7 river miles.

Conns Creek: Navigable (although with private ownership of the creek bed) from its junction with the Flatrock River for 11.5 river miles to the Rush-Shelby County Line.

Crooked Creek: Navigable in Spencer County from its junction with the Ohio River for 7.7 river miles.

Cypress Creek (including Cypress Creek Diversion Channel): Navigable in Warrick County from its junction with the Ohio River for 6.6 river miles. (The original bed of Cypress Creek is also navigable west of Cypress Creek Diversion Channel for 1.95 river miles, except where the creek bed has emerged and is no longer inundated.)

Deer Creek: Navigable in Perry County from its junction with the Ohio River for 5.9 river miles.

Driftwood River: Navigable from its junction with the East Fork of the White River (near Columbus) 15 river miles to its junction with the Big Blue River (near Edinburgh).

Dry Run Creek: Navigable in Crawford County from its junction with the Big Blue River for 1.4 river miles.

East Calumuck River: See Little Calumet River.

East Deer Creek: Navigable in Perry County from its junction with Deer Creek for 0.6 river miles.

East Fork of the White River: Navigable from its junction with the White River 189 river miles to its junction with the Flatrock and Driftwood Rivers (near Columbus).

East Fork of the Whitewater River: Navigable from its junction with the Whitewater River for 26.25 river miles to the Union-Wayne County Line.

Eel River: Navigable from its junction with the West Fork of the White River for 51.2 river miles to its junction with Mill Creek (now within Cagles Mill Lake).

Elk Creek: Navigable in Washington County from its junction with the Cammie Thomas Ditch for 3.0 river miles.

Fanny Creek: Navigable in Perry County from its junction with the Ohio River for 0.8 river miles.

Fawn River: Navigable for 13.45 river miles within Indiana. The Fawn River has two navigable segments in Indiana, separated by segments in Michigan. Navigability commences at the Indiana-Michigan state line (near Gilmore Lake and two mile south of Sturgis, Michigan) and continues downstream. The Fawn River has been found to be nonnavigable at Greenfield Mills (river mile 32).

Flat Creek: Navigable from its junction with the Patoka River for 12.0 river miles (near Otwell).

Flatrock River: Navigable from its junction with the East Fork of the White River (Columbus) 93 river miles to its uppermost point in Henry County (near Mooreland).

Fourteen Mile Creek: Navigable in Clark County from its junction with the Ohio River for 2.9 river miles.

Garrett Creek: Navigable in Spencer County from its junction with the Ohio River for 2.2 river miles.

Goose Creek: Navigable in Switzerland County from its junction with the Ohio River for 1.5 river miles.

Grand Calumet River: Navigable from the Illinois State Line (near Hammond) for 15.4 river miles to Marquette Park. (The river is also navigable in Illinois.)

Grants Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.5 river miles.

Great Miami River: Navigable for 1.4 river miles in Dearborn County. (Most of this river lies within Ohio; the Great Miami River has been determined to be navigable from its junction with the Ohio River for 117 river miles. The waterway enters Indiana at two locations.)

Harden Lake: See Big Raccoon Creek.

Harris Ditch: Navigable in Posey County from its junction with the Ohio River for 0.9 river miles to Little Pitcher Lake.

Hogan Creek (including North Fork and South Fork): (The Main Stem of) Hogan Creek is navigable in Dearborn County from the junction on the Ohio River for its entire length of 0.4 river miles. The North Fork is navigable from the junction with Hogan Creek for 4.9 river miles. The South Fork is navigable from the junction with Hogan Creek for 5.0 river miles.

Honey Creek: Navigable in Spencer County from its junction with the Ohio River for 1.8 river miles.

Houchins Ditch: See Patoka River.
Hurricane Fork: See Little Fork of Big Creek.

Independence Creek: See Indian Creek Harrison County).

Indian Creek: Navigable in Harrison County from its junction with the Ohio River for 4.8 river miles.

Indian Creek: Navigable in Martin County from its junction with the East Fork of the White River for 15.0 river miles to the Lawrence-Martin County Line.

Indian Creek: Navigable in Morgan County from its junction with the West Fork of the White River for 3.3 river miles (near Martinsville).

Indian Creek: Navigable in Switzerland County from its junction with the Ohio River for 4.1 river miles.

Indian Fork: Navigable in Perry County from its junction with Big Oil Creek for 1.4 river miles.

Indian-Kentuck Creek: Navigable in Jefferson County from its mouth on the Ohio River for 3.8 river miles.

Indiana Harbor and Ship Canal (including Calumet River Canal and Lake George Canal): The (Main Stem of the) Indiana Harbor and Ship Canal is navigable in Lake County for 3.0 river miles from the Indiana Harbor to where it branches into the Calumet River Canal and the Lake George Canal. The portion of the Main Stem that is ordinarily referred to as the "Indiana Harbor" is lakeward of the historic shoreline of Lake Michigan and is surrounded by manmade land comprising LTV Steel and Inland Steel. The "Ship Canal" (also called the "Indiana Harbor Canal") is the portion of the Main Stem landward of the historic shoreline. The Calumet River Canal is navigable in Lake County from the Indiana Harbor Canal for 1.95 river miles to the Grand Calumet River. The Lake George Canal is navigable in Lake County from the Indiana Harbor Canal for 0.85 river miles (near White Oak Avenue if extended southerly).

Iroquios River: Navigable from the Indiana-Illinois State Line for 39 river miles to the Dexter Ditch (near Parr).

Island Branch: Navigable in Ohio County from its junction with the Ohio River for 1.0 river miles.

Jackson Creek: Navigable in Spencer County from its junction with the Ohio River for 1.8 river miles.

Kankakee River: Navigable from the Indiana-Illinois State Line for 86.3 river miles to the Indiana-Michigan State Line. (This river is also navigable downstream in Illinois.)

Kelly Bayou: Navigable in Sullivan County from its downstream junction with an oxbow of the Wabash River for 5.8 river miles to its upstream junction with the Wabash River.

Kelly Hollow: Navigable in Perry County from its junction with Millstone Creek for 1.0 river miles.

Kemper Ditch: See Little Calumet River.

Kingly Creek: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Knob Creek: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Lake Drain: Navigable in Spencer County from its junction with the Ohio River for 1.6 river miles.

Lake George Canal: See Indiana Harbor Canal.

Lake Michigan: Navigable throughout Indiana.

Lancassange Creek: Navigable in Clark County from its junction with the Ohio River for 0.3 river miles.

Laughery Creek: Navigable from its junction with the Ohio River for 10.8 river miles (near Milton).

Lick Creek: Navigable in Orange County from its junction with the Lost River for 19.5 river miles to Old Spring Mill (near Paoli).

Little Blue River: Navigable in Crawford County from its junction with the Ohio River (near Alton) for 10.6 river miles.

Little Blue River: Navigable from its junction with the Big Blue River (Shelbyville) for 25.6 river miles to its junction with Ball Run.

Little Calumet River: Navigable from the Indiana-Illinois State Line for 21.24 river miles to Burns Waterway Harbor; and navigable for an additional 17.75 river miles to its junction (as Kemper Ditch) with Interstate 94. (The river is also navigable in Illinois.)

Little Creek: See Little Fork of Big Creek.

Little Deer Creek: Navigable from its junction with Deer Creek for 3.9 river miles.

Little Fork of Big Creek: Navigable in Posey County from its junction with Big Creek for 5.1 river miles.

Little Oil Creek: Navigable from its junction with Big Oil Creek for 4.4 river miles.

Little Pigeon Creek: Navigable from its junction with the Ohio River for 15.8 river miles.

Little Pitcher Lake: Navigable in Posey County as an extension of Harris Ditch.

Little Raccoon Creek: Navigable in Parke County from its junction with Big Raccoon Creek for 5.3 river miles (Nevins Covered Bridge).

Little River: Navigable from its junction with the Wabash River 20.2 river miles to Ellison Road (near Fort Wayne).

Little Sandy Creek: Navigable in Spencer County from its junction with the Ohio River for 2.0 river miles.

Little Wabash River: See Little River.

Locust Creek: Navigable in Vanderburgh County from its junction with Pigeon Creek for 1.5 river miles.

Log Lick Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.3 river miles.

Lost River: Navigable from its junction with the East Fork of the White River for 48.87 river miles (near Orangeville).

McFadden Creek: Navigable in Posey County from its junction with the Ohio River for 2.3 river miles.

Marble Powers Ditch: See Kankakee River.

Maumee River: Navigable from the Indiana-Ohio State Line 27.05 river miles to the Hosey Dam, Fort Wayne. (The river is also navigable in Ohio; the river may be alternatively described as navigable to total river mile 134.9. The Indiana-Ohio State Line is located at total river mile 107.85.)

Middle Fork of Anderson River: See Anderson River.

Mill Creek: Navigable from its junction with the Eel River (now Cagles Mill Lake) for 32.45 river miles to the Hendricks-Morgan County Line. See, also, Mill Creek Ditch.

Mill Creek: Navigable in Crawford County from its junction with the Little Blue River for 1.4 river miles.

Mill Creek Ditch: Navigable from its junction with Mill Creek upstream for 1.35 river miles to the Hendricks-Morgan

County Line.

Millstone Creek: Navigable in Perry County from its junction with the Ohio River for 1.4 river miles.

Mississinewa River: Navigable from its junction with the Wabash River for 109.75 river miles to the Indiana-Ohio State Line.

Monroe Lake: See Salt Creek.

Mosquito Creek: Navigable in Harrison County from its junction with the Ohio River for 2.8 river miles.

Mud Creek: Navigable from its junction with Mill Creek (near Little Point) for 5.6 river miles to Tudor Road (near Hazelwood).

Muscatatuck River: Navigable from its junction with the East Fork of the White River for 24.25 river miles to the main forks. See, also, Vernon Fork of Muscatatuck River, South Fork of Muscatatuck River, and Cammie Thomas Ditch.

Neglie Creek: Navigable in Perry County from its junction with Little Deer Creek for 0.5 river miles.

North Fork of Hogan Creek: See Hogan Creek.

North Fork of Muscatatuck River: See Vernon Fork of Muscatatuck River.

North Fork of Salt Creek: Navigable from its junction with Salt Creek for 36.7 river miles to its junction with David Branch (near Nashville).

Ohio River: Navigable throughout the state (from total river mile 491.34 to total river mile 848.0).

Oil Creek: See Big Oil Creek.

Patoka River: Navigable from its junction with the Wabash River for 146.6 river miles (within Greenfield Township, Orange County).

Pickamink River: Iroquois River.

Pigeon Creek: Navigable from its junction with the Ohio River for 5.9 river miles.

Plum Creek: Navigable in Switzerland County from its junction with the Ohio River for 2.9 river miles.

Poison Creek: See Big Poison Creek.

Portage Burns Waterway: Navigable in its entirety (1.3 river miles) as a connection between the Little Calumet River and Lake Michigan. (The point at which Portage Burns Waterway connects with the Little Calumet River is now considered the separation between the East Branch and the West Branch of the Little Calumet River.)

Potato Run: Navigable in Harrison County from its junction with the Ohio River for 0.4 river miles.

Raccoon Creek: See Big Raccoon Creek.

Rock River: See Sugar Creek.

Rider Ditch: Navigable in Jackson County as a channelization of the Vernon Fork of the Muscatatuck River.

St. Joseph River: Navigable throughout Indiana (Elkhart and St. Joseph Counties) for 39.57 river miles. The river enters Indiana from Michigan and returns to Michigan. (The river is also navigable downstream in Michigan; and the river may be alternatively described as navigable from total river mile 49.93 to total river mile 89.5.)

Salt Creek: Navigable from its junction with the East Fork of the White River into Monroe Lake. See also the North Fork of Salt Creek.

Sample Run: Navigable in Perry County from its junction with the Ohio River for 0.2 river miles.

Sand Creek: Navigable in Switzerland County from its junction with Bryant Creek for 0.9 river miles.

Sand Run: See Sand Creek.

Sandy Creek: Navigable in Spencer County from its junction with the Ohio River for 2.6 river miles.

Silver Creek: Navigable in Clark County from its junction with the Ohio River for 3.0 river miles.

Smart Ditch: Navigable in Jackson County as a channelization of the Muscatatuck River (and the Vernon Fork of the Muscatatuck River).

South Fork of Big Creek: See Little Fork of Big Creek.

South Fork of Hogan Creek: See Hogan Creek.

South Fork of Muscatatuck River: Navigable from its junction with the Muscatatuck River 28.1 river miles to its junction with Graham Creek.

Sugar Creek: Navigable from its junction with the Big Blue River (to form the Driftwood River) for 24.4 river miles (near Boggstown).

Sugar Creek: Navigable from its junction on the Wabash River (near West Union) for 56.83 river miles to the Montgomery-Boone County Line.

Tanners Creek: Navigable from its junction with the Ohio River in Lawrenceburg for 10.6 river miles.

Tate's Hollow: Navigable in Perry County from its junction with the Ohio River for 0.3 river miles.

Thomas Ditch: See Cammie Thomas Ditch.

Trail Creek: Navigable in LaPorte County from its junction with Lake Michigan for 1.0 river miles. For purposes of this delineation, the shoreline of Lake Michigan is identified at the approximate site of the Franklin Street "Draw" Bridge.

Turman Creek: Navigable in Sullivan County from its junction with the Wabash River for 7.9 river miles (near Dodds Bridge).

Turtle Creek: Navigable in Switzerland County from its junction with the Ohio River for 1.3 river mi.

Twin Creek: Navigable in Washington County from its junction with the East Fork of the White River for 7.98 river miles to the Cox Ferry Road Bridge near the Jefferson-Brown Township Line.

Vermillion River: See Big Vermillion River.

Vernon Fork of Muscatatuck River: Navigable from its junction with the Muscatatuck River for 39.3 river miles to Vernon (S.R. 7). See also Rider Ditch.

Wabash River: Navigable from its junction with the Ohio River for 441.9 river miles to the Wells- Adams County Line.

Webb Branch: Navigable in Perry County from its junction with Big Oil Creek for 0.9 river miles.

West Fork of the White River: Navigable from its junction with the White River 277 river miles to Smithfield, Delaware County.

West Fork of the Whitewater River: Navigable from its junction with the Whitewater River for 64.3 river miles to the three forks (near Connersville).

White River: Navigable from its junction with the Wabash River for 49.5 river miles to where it branches into the East Fork of the White River and the West Fork of the White River.
Whitewater River: Navigable from the Ohio State Line for 29.65 river miles to where it branches into the East Fork of the Whitewater River and the West Fork of the Whitewater River. (The river is also navigable downstream in Ohio; the river may be alternatively described as navigable from total river mile 7.9 to total river mile 96.9.)

Wilson Creek: Navigable in Dearborn County from its junction with the Ohio River for 1.9 river miles.

Yellow River: Navigable from its junction with the Kankakee River for 41.0 river miles to Plymouth.

VI. OUTPUT REPORTS

Enclosed are copies of the output reports current being used for lake and stream surveys. The committees have recommend some edits in these forms but I would also like your suggestions. These are the copies that Jerri created but your printer setups will make them appear to spill over to a second page. Once these reports are migrated into Access you can make the appropriate editing changes to accommodate your specific printers. The stream reports are in Qpro and will be FAXED separately.

LAKE SURVEY REPORT

State Form 24753R

Lake name	**County**	**Date of survey (Month, day, year)**
Biologist's name		**Date of approval (Month, day, year)**

LOCATION		
Quadrangle name	Range	Section
Township name	Nearest town	

ACCESSIBILITY					
State owned public access site		Privately owned public access site		Other access site	
Surface acres	Maximum depth Feet	Average depth Feet	Acre feet	Water level MSL	Extreme fluctuations
Location of benchmark					

INLETS		
Name	Location	Origin

OUTLET	
Name	Location
Water level control	

POOL	**ELEVATION *(Feet MSL)***	***ACRES***	*Bottom Type* ☐ *Boulder* ☐ *Gravel* ☐ *Sand* ☐ *Muck* ☐ *Clay* ☐ *Marl*
TOP OF DAM			
TOP OF FLOOD CONTROL POOL			
TOP OF CONSERVATION POOL			
TOP OF MINIMUM POOL			
STREAMBED			

Watershed use
Development of shoreline
Previous surveys and investigations

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF:									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT *(Pounds)*	AGE OF FISH	TOTAL LENGTH *(inches)*	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT *(Pounds)*	AGE OF FISH
1.0					14.5				
1.5					15.0				
2.0					15.5				
2.5					16.0				
3.0					16.5				
3.5					17.0				
4.0					17.5				
4.5					18.0				
5.0					18.5				
5.5					19.0				
6.0					19.5				
6.5					20.0				
7.0					20.5				
7.5					TOTAL				
8.0									
8.5									
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.5									

12.5									
13.5									
13.5									
14.0									

ELECTROFISHING CATCH		GILL NET CATCH		TRAP NET CATCH	

*estimated weight

SAMPLING EFFORT			
ELECTROFISHING	Day Hours	Night Hours	Total Hours
TRAPS	Number of traps	Hours	Total Hours
GILL NETS	Numbers of nets	Hours	Toatal hours

PHYSICAL AND CHEMICAL CHARACTERISTICS	
Color	Turbidity Ft. Inches (SECCHI DISK)

TEMPERATURE					
DEPTH FEET	**DEGREES F☜**	**DEPTH FEET**	**DEGREES F☜**	**DEPTH FEET**	**DEGREES F☜**
SURFACE		40		80	
2		42		82	
4		44		84	
6		46		86	
8		48		88	
10		50		90	
12		52		92	
14		54		94	
16		56		96	
18		58		98	
20		60		100	

22		62			
24		64			
26		66			
28		68			
30		70			
32		72			
34		74			
36		76			
38		78			

DISSOLVED OXYGEN (D.O.) - TOTAL ALKALINITY - pH								
DEPTH FEET	D.O. (ppm)*	ALKALINITY (ppm)*	pH	DEPTH FEET	D.O. (ppm)*	ALKALINITY (ppm)*	pH	Comments:
SURFACE				35				
5				40				
10				45				
15				50				
20				55				
25				60				
30				65				

SAMPLING EFFORT							
ELECTROFISHING	Day Hours	Night Hours	Total Hours	GILL NETS	Number	Lifts	Total Lifts
TRAPS	Number	Lifts	Total Lifts	SHORELINE SEINING	Number of 100' Seine Hauls		
ROTENONE	Gallons	ppm	Acre Feet Treated				

PHYSICAL AND CHEMICAL CHARACTERISTICS	
Color	Turbidity Ft. Inches (SECCHI DISK)

TEMPERATURE			
DEPTH FEET	DEGREES F	DEPTH FEET	DEGREES F
SURFACE		40	
2		42	
4		44	
6		46	

8		48	
10		50	
12		52	
14		54	
16		56	
18		58	
20		60	
22		62	
24		64	
26		66	
28		68	
30		70	
32		72	
34		74	
36		76	
38		78	

TOTAL ALKALINITY - pH					
DEPTH FEET	D.O. ppm	ALKALINITY ppm	pH	TDS ppm	Comments
SURFACE					
5					
10					
15					
20					
25					

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT

at Lake - 199.

*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE *(inches)*	WEIGHT *(pounds)*	PERCENT

*Common names of fishes recognized by the American Fisheries Society

State form 24753PAGE_____OF_____SCALE MEASUREMENTS

SPECIES____________________LAKE______________________________DATE________________________

ANNULUS LENGTH

	FISH LENGTH	I	II	III	IV	V	VI	VII	VIII	XI	X	SCALE LENGTH
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												

Species	Year Class	Number	Back Calculated Length					
			I	II	III	IV	V	VI
intercept =.8"	1994							
	1993							
	1992							
	1991							
	1990							
	1989							
	Average							
	Number		( )	( )	( )	( )	( )	( )

Species	Year Class	Number	Back Calculated Length					
			I	II	III	IV	V	VI
intercept =.8"	1994							
	1993							
	1992							
	1991							
	1990							
	1989							
	Average							
	Number		( )	( )	( )	( )	( )	( )

Species	Year Class	Number	Back Calculated Length					
			I	II	III	IV	V	VI
intercept =.8"	1994							
	1993							
	1992							
	1991							
	1990							
	1989							
	Average							
	Number		( )	( )	( )	( )	( )	( )

Species	Year Class	Number	Back Calculated Length					
			I	II	III	IV	V	VI
intercept =.8"	1994							
	1993							
	1992							
	1991							
	Average							
	Number	( )	( )	( )	( )	( )	( )	

INDIANA DIVISION OF FISH AND WILDLIFE

AQUATIC VEGETATION FORM

Body of Water:______________________________________ Code:_________________ Date:_________________________ Page_____of_______

Data Recorder, Crew:____

		Aquatic Vegetation Transect Number (enter % of transect for each species found)														
Common Name	Code															
Max. Depth of Vegetation																
GPS Coordinate Shore																
GPS Coordinate Lakeward																

ADDITIONAL SPECIES FOUND

Common Name	Code	Comments	Common Name	Code	Comments

Comments:____

COMMON SPECIES OF AQUATIC PLANTS			
COMMON NAME OF PLANT	SCIENTIFIC NAME OF PLANT	DEPTH FOUND	PERCENT OF LAKE COVERED

*Not included in average calculations

Comments:			

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*Not included in average calculations

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*Not included in average calculations