GEOLOGICAL SURVEY OF ALABAMA

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ECOSYSTEMS INVESTIGATIONS PROGRAM

CALIBRATION OF THE INDEX OF BIOTIC INTEGRITY FOR THE TENNESSEE VALLEY ICHTHYOREGION IN ALABAMA

OPEN-FILE REPORT 1004

by

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and the Alabama Department of Conservation and Natural Resources

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ABSTRACT

The Tennessee Valley ichthyoregion in north Alabama was sampled from May through October 2009 to develop data for creating and calibrating the Index of Biotic Integrity (IBI). Ninety-seven sampling sites were selected to represent a range of watershed areas and levels of human disturbance. Watersheds ranged in area from 1.76 square miles (mi^2) to 308 mi^2 with 45 percent of the watersheds <20 mi^2, 42 percent ranging from 21 to100 mi^2, and 11 percent were >100 mi^2. Rapid habitat assessments were completed for each sample and eight measures of human disturbance were derived for each site from a geographic information system. Thirty-four candidate IBI metrics were screened for inclusion in the IBI by evaluating their relationship to the habitat assessment and human disturbance metrics. Both human disturbance metrics and habitat metrics were correlated with IBI metrics. Twelve metrics were selected for the Tennessee Valley IBI: number of native species, number of shiner species, number of sucker species, number of darter+madtom species, number of intolerant species, proportion of tolerant species, proportion of *Lepomis* species, proportion of invertivores, proportion of omnivores and herbivores, proportion of top carnivores, proportion with DELT+hybrids (DELT=deformities, eroded fins, lesions, tumors) and number of lithophilic spawning species. The IBI was effective in discriminating sites with good habitat scores from sites with poor habitat scores. Thirty-two percent of the sites scored in the poor to very poor range, 40 percent in the fair range, and 28 percent in the good to excellent range. The Tennessee Valley IBI scoring criteria were adjusted slightly lower than criteria developed for the Ridge & Valley/Piedmont and Southern Plains ichthyoregions. The Tennessee Valley IBI integrity classes were applied to the USEPA biological condition gradient concept for tiered aquatic life uses to model the response of biological condition to ecosystem stress in the region. This model can be used to better assess stream aquatic life use in Tennessee Valley streams and provide an additional tool for screening streams for water quality and habitat impairment.

INTRODUCTION

The Geological Survey of Alabama (GSA), in cooperation with the Alabama Department of Environmental Management (ADEM) and the Wildlife and Freshwater

Fisheries Division (WFFD) of the Alabama Department of Conservation and Natural Resources (ADCNR), has initiated a multi-year research effort to develop and calibrate a comprehensive fish community bioassessment tool, known as the Index of Biotic Integrity (IBI), for the state of Alabama. This tool will be useful in helping agencies assign designated water-use classifications for all the state's waters to manage water quality more efficiently and effectively, to understand aquatic resources more broadly and in greater depth, and to better manage aquatic habitat. Additionally, this tool will be useful in managing the state's water resources by communicating to the public and water-management agencies more clearly the need for and benefits of incorporating biological perspectives into water resource protection and management. Specifically, the process of establishing minimum instream flows and evaluating environmental flows will benefit substantially by incorporating biological monitoring and assessment methodologies.

The process of biological assessment is a systems approach for evaluating water resources that focuses on the actual condition of the resource, assessing chemical and physical water quality, biotic interactions, hydrology, energy and trophic interactions, and habitat structure. Ultimately, it is the measurable performance of the natural biological system relative to a reference condition that should be a goal for determining whether or not regulatory programs have successfully maintained or improved water quality or whether instream flows are adequate to sustain biological condition.

Biological assessments can now be used with confidence for water resource evaluation for several reasons. First, technical support for the use of standardized techniques and methods has been developed (Karr and others, 1986; Plafkin and others, 1989; Barbour and others, 1999). Second, field and laboratory techniques have been refined and modified for use within a regulatory scheme. Third, a practical, working definition of biological integrity has been developed (Karr and Dudley, 1981) from which the process of biological assessment can be defended and biological performance measured. And finally, the concept of using data from ecoregional reference watersheds has been incorporated into the evaluation process, compensating for the natural variation inherent in biological populations and systems (U.S.

Environmental Protection Agency (USEPA, 2005). Full integration of the chemical-specific, toxicity, and biological water-quality assessment approaches is essential for a broad-based, technically sound, and cost-effective system for regulating and managing water resources.

One of the many assets of the IBI method is its ability to reduce very complex ecological processes into simple terms that managers, industry and business representatives, regulators, and the public can understand. Application of the IBI to fishery management problems and water-quality issues can be done with confidence because the science behind the IBI method is extensive and peer reviewed. The GSA applied the IBI to a large regional watershed, the Cahaba River, in 1997 (Shepard and others, 1997), developing metrics and associated scoring criteria for the first time in an Alabama watershed. Later, in conjunction with ADEM, GSA developed another application of the IBI for streams in the Cahaba and Black Warrior River systems (O'Neil and Shepard, 2000a, b). Since these studies, the GSA has applied the IBI to the Locust Fork system (Shepard and others, 2004), the Mulberry Fork system (Shepard and others, 2002), the Cahaba River system again (O'Neil, 2002), and the Hatchet Creek system (O'Neil and Shepard, 2005). The IBI sampling methodology was refined and the new protocol applied in a study of the Terrapin Creek watershed (O'Neil and others, 2006). The Tennessee Valley Authority (TVA) has used the IBI for many years to assess the biological condition of streams throughout the Tennessee River drainage and several aspects of the TVA sampling methodology were incorporated into the Alabama Cooperative IBI method (O'Neil and others, 2006).

Although the IBI is routinely used for water-quality regulation in other states and has been successfully applied in selected drainages in Alabama, it is underutilized in Alabama as an assessment tool. Several needs have been identified that should be met before the IBI biomonitoring method can be fully implemented statewide in Alabama for assessing streams and other aquatic habitats. Some of these needs have been met and other research needs are currently underway.

The GSA, in conjunction with WFFD, recently developed a standardized stream sampling protocol during a 3-year study in the Terrapin Creek watershed (O'Neil and others, 2006) for use with the IBI. This sampling protocol is now being used for all IBI fish bioassessments by ADEM, WFFD, and GSA. Research is currently underway to explore lake, reservoir, and nonwadeable river sampling protocols.

Alabama's high fish biodiversity was evaluated with respect to its high ecoregional and drainage diversity (O'Neil and Shepard, 2007) in order to reduce the set of unique eco-biotic regions to a manageable number for IBI scoring criteria development. This preliminary analysis resulted in five unique ecological-ichthyological regions in Alabama which were termed ichthyoregions. These were named the Tennessee Valley, Ridge & Valley/Piedmont, Plateau, Hills and Coastal Terraces, and Southern Plains (fig. 1). Preliminary IBI scoring criteria for the Ridge & Valley/Piedmont ichthyoregion have been developed (O'Neil and others, 2006). Results of criteria development for the Southern Plains were presented in O'Neil and Shepard (2009). Criteria development for the Hills and Coastal Terraces and Plateau ichthyoregions is slated for 2011 and 2012.

Application of the IBI requires accurate species identifications by well-trained individuals. Individuals applying the IBI in Alabama must take this requirement into account because of Alabama's high fish biodiversity and consequently higher probability of mis-identifications. As such, unsure identity of collected specimens will require that they be brought to the laboratory for identification and verification by outside experts. "Green" non-destructive sampling, meaning identifications are made on site and individuals are returned to the stream, should also be a priority given the impaired state of many waterways and fish species in Alabama.

A list of standardized ecological and tolerance designations for all species of fishes in the state has been presented in other reports (O'Neil and Shepard, 2000b; O'Neil and others, 2006) and was updated for this report. This list should be peer reviewed by fisheries biologists, fish ecologists, and ichthyologists familiar with the state's fishes. Ichthyoregional and (or) drainage-specific reference sites should be established and sampled systematically over time. The ADEM has established ecoregional reference sites for their macroinvertebrate program, and these sites should be sampled for fishes on a prescribed basis. The WFFD has recognized that

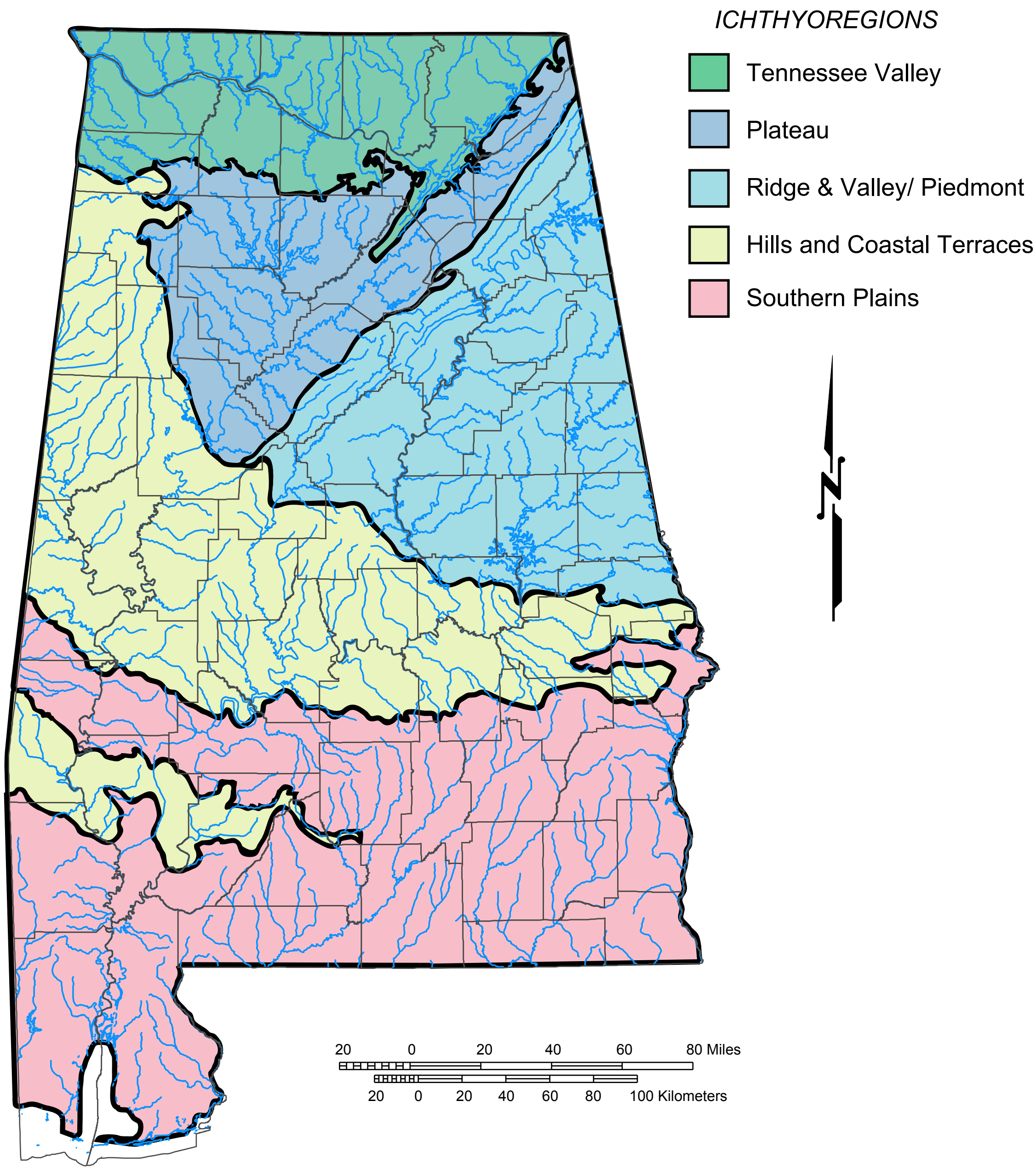

Figure 1. Preliminary ichthyoregion classification for Alabama.

additional stream and reservoir assessment tools will be needed to manage habitat and stream resources to benefit fish populations in the state.

ACKNOWLEDGMENTS

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OBJECTIVES

The goal of year 3 of the Alabama Cooperative IBI Project was to develop a workable and calibrated IBI for the Tennessee Valley ichthyoregion. This was accomplished by completing several objectives:

- Select, by way of in-house analysis and field reconnaissance, IBI sampling sites that reflect a range of watershed sizes and degree of human disturbance and habitat degradation ranging from highly disturbed to minimally disturbed. The sampling sites should also flow during dry periods and be readily accessible by road and bridge crossings. Emphasis was placed on sites that presented sufficient riffle, run, and pool habitat to produce adequate samples for evaluating IBI metrics and scoring criteria.
- Attempt to sample approximately 100 sites in the Tennessee Valley ichthyoregion. The GSA was tasked with sampling 40 sites, the WFFD in conjunction with the GSA was assigned 20 sites, and ADEM was assigned 40 sites.
- Sample selected sites using the standard 30+2 IBI sampling protocol and use the resulting data to establish IBI metrics and scoring criteria specific for the Tennessee Valley ichthyoregion.

STUDY AREA

TENNESSEE VALLEY ICHTHYOREGION

Classifying the state into unique regions of similar fish community structure and composition—known as ichthyoregions in the Alabama IBI program (fig. 1)—is especially important in Alabama because of the state's high biodiversity of fishes, large number of unique aquatic habitats, and its unique and complex physiographic, geologic, and ecoregional footprint (O'Neil and Shepard, 2007) (fig. 2). The Tennessee Valley ichthyoregion is large, extending from east to west across the northern fourth of Alabama and encompasses a number of stream systems including Bear Creek, Shoal Creek, Elk River, Spring Creek, Town Creek, Big Nance Creek, Flint Creek, Flint River, Paint Rock River, Short Creek, Town Creek, Mud Creek, and Big Coon Creek.

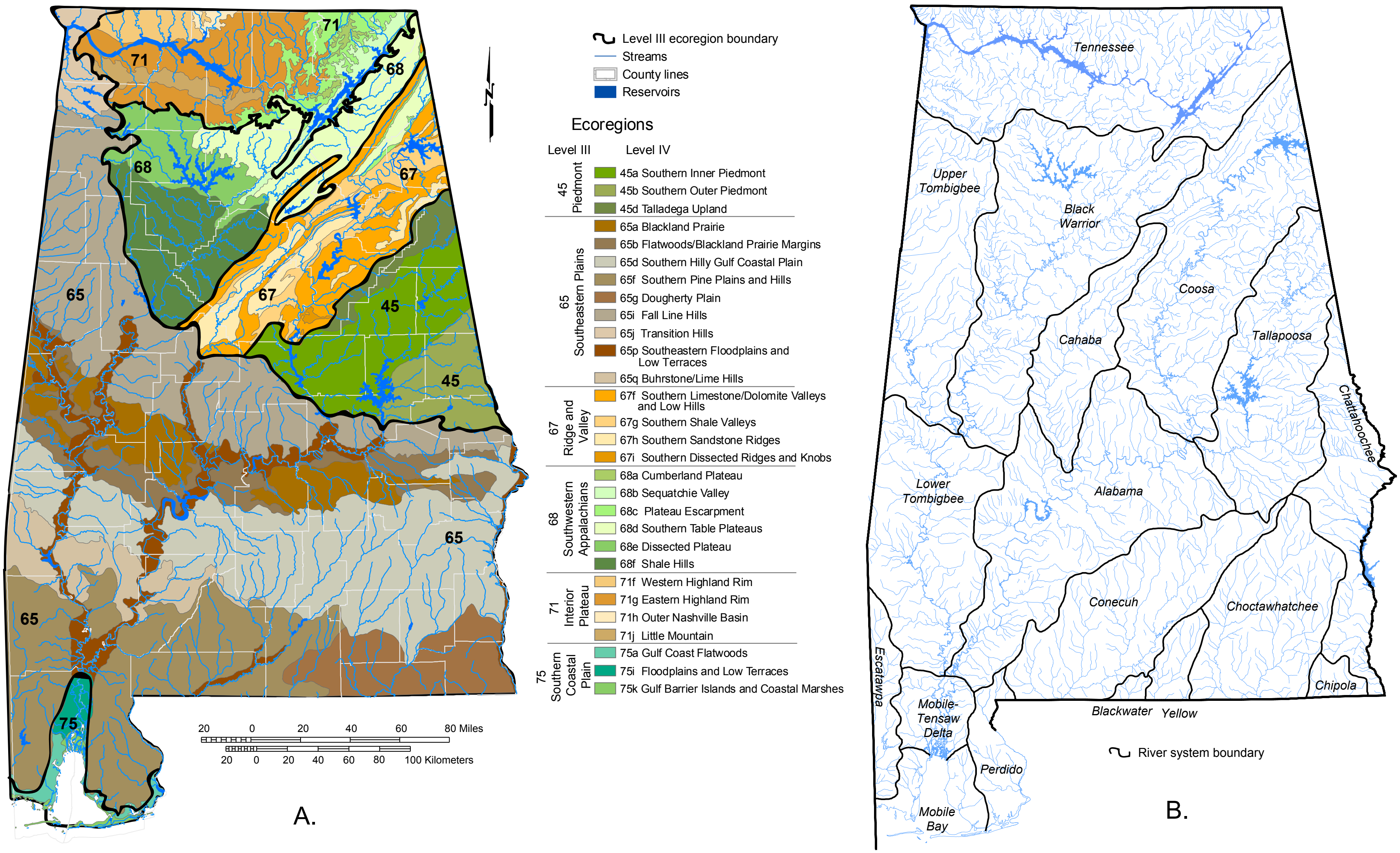


Figure 2. Ecoregions (A) and river systems (B) in Alabama.

Ecoregions encompassed in the Tennessee Valley ichthyoregion (fig. 1) are 65i - Fall Line Hills, 65j - Transitional Hills, 71f - Western Highland Rim, 71g - Eastern Highland Rim, 71h - Outer Nashville Basin, 71j - Little Mountain, 68a - Cumberland Plateau, 68b - Sequatchie Valley, 68c - Plateau Escarpment, and 68d - Southern Table Plateaus (fig. 2) (Griffith and others, 2001). This is a large ichthyoregion with highly variable stream types, habitat quality, disturbance and pollution stress, geomorphology, and hydrology.

METHODS

IBI SAMPLE COLLECTION

A study completed in an earlier phase of the cooperative IBI project (O’Neil and others, 2006) outlined protocol for collecting a representative fish community sample from which an IBI score could be calculated. Results of the study indicated that sampling should be stratified over four habitat types (riffles, runs, pools, and shorelines) with a minimum of 10 sampling efforts each dedicated to riffle, run, and pool habitats with two additional sampling efforts along stream shorelines. This sampling regime, termed the “30+2" method, was determined sufficient to yield a fish community sample acceptable for calculating IBIs that reflect biological condition in wadeable streams. A minimum of 32 efforts were completed at all sites, and for those sites with missing or reduced habitat components, the effort that would have been expended in that habitat component was proportioned to other habitats that were present.

The effectiveness of sampling fishes depends on many factors such as stream size, substrate conditions, flow, amount of cover in the stream channel, type of sampling gear, and the expertise and knowledge of the collectors. Karr (1981) indicated that one of the basic foundations of the IBI is that all species of the fish community should be adequately sampled relative to their proportions in nature with minimal bias towards certain species or size classes of fishes. This is difficult to accomplish unless a standardized sampling protocol like the 30+2 method has been adopted that assures a representative and valid fish sample will be collected.

Fish samples collected for purposes other than bioassessment can be problematical when used in the IBI process because these samples are usually biased to the intended use of the data. For example, samples collected for taxonomic purposes target species of research interest and are generally restricted to narrowly defined habitat types, while sampling gear for fisheries investigations typically selects for large, commercially important species or sport fishes.

Within the 30+2 IBI sampling method, small-mesh minnow seines serve as a complement to the electroshocker and are used to catch, scoop, or dip stunned fishes and to trap fishes in sloughs and backwaters. At other times, seines are used as the primary device for capturing fishes in pools and runs and along shoals. Each sampling team had a variety of seine lengths for different size streams. The standard nylon minnow seine used was 10 to 15 feet wide and 6 feet deep with a delta weave of 3/16 inch. An 8-foot-wide seine was sometimes necessary for very narrow streams, while a 15-foot seine was used in larger streams and rivers.

An effective sampling technique was to use the backpack shocker in combination with the seine. In riffles, runs, and glides the seine was set in shallow, rocky areas or deeper, swifter chutes; the backpacker then walked upstream for 15 to 20 feet outside of the area to be sampled and shocked downstream through the habitat, walking toward the seine while disturbing the bottom. Stunned fishes in the water column were washed into the net, while benthic fishes were dislodged from the bottom by kicking the substrate. A variation of this technique involved a crew member walking behind the backpacker and skating his feet from side to side to disturb the bottom and dislodge stunned benthic fishes. Most microhabitats in riffle and run habitats were sampled because they are quite often very productive areas. Vegetated shorelines along riffle and shoal margins were usually very productive areas as were areas where stream flow becomes turbulent when entering or leaving runs and riffles. Plunge pools where runs and riffles transition to pools often yielded a diverse catch of species.

Deeper stream runs and glides between pools were also productive and were sampled by either seining downstream or by moving from bank to bank across the stream in a downstream direction with the seine, either alone or following the backpack shocker. Following the electroshocker was effective in pools, and trapping fishes against the shore or in a slough at the end of a seine haul was also effective. Deep pools with structure were sampled by blocking the downstream end with the seine and working the upstream area for a few minutes with a shocker and dip nets. Wider seines were more advantageous in pools for trapping fishes.

Shorelines along pools, runs, and riffles can have complex habitat structure and yield sunfish and sucker species not normally found in the basic riffle-run or run-pool sequence in Tennessee Valley streams. The shoreline sampling technique consisted of a crew member working the electroshocker in an upstream direction along a shoreline reach for about 150 feet, shocking around all habitat features. The field crew followed closely, scooping the stunned individuals with dip nets. Distance was measured with a forestry-type hip chain. A minimum of two 150-foot shoreline samples were collected per station.

HABITAT MEASURES

A rapid habitat assessment was completed for each IBI sample collected. Habitat evaluations are an integral part of efforts to describe biological conditions because good biological condition is quite often predicated on the presence of stable and diverse habitat. “Habitat” is an inclusive term that incorporates several features and processes in streams including the physical components such as rock and rubble, logs, mud, and channel and substrate condition; the chemical and physical components of water quality such as pH, dissolved chemical constituents, temperature, and dissolved gases; and flow components such as flood and drought frequencies, velocity regimes, and discharge. For a quantitative assessment, the habitat concept is generally narrowed to include the physical components of habitat and substrate structure, the degree of channel alteration, and the condition of banks and the adjacent riparian corridor. All of these components directly affect the structure and function of the aquatic biological community and they can be visually assessed for quality and relative degree of impairment. The visual riffle-run and glide-pool assessment procedures used in this study to quantify habitat conditions were originally reported in Plafkin and others (1989) and modified by Barbour and others (1999).

Stream habitat assessments entail evaluating the structure of the surrounding physical habitat that influences water resource quality and thus the condition of the resident biological community (Barbour and others, 1999). Generally, three habitat characteristics contribute to the maintenance and health of aquatic biological communities: the availability and quality of the habitat-substrate components and instream cover, morphology of the instream channel, and structure of the bank and riparian vegetation zone (Plafkin and others, 1989). Barbour and others (1999) developed two sets of habitat metrics, one for evaluating upland stream habitat dominated by riffle-run microhabitats and hard substrates and the other for evaluating lowland and Coastal Plain streams that are dominated by glide-pool and run-pool habitats with unconsolidated sandy substrates (appendix A). The 11 habitat metrics of the glide-pool index and 12 metrics of the riffle/run index are individually scored on a scale of 0 (poor quality) to 20 (optimal quality) then summed to give a final score. The maximum possible habitat score is 220 for the glide-pool method and 240 for the riffle-run method. Final habitat scores are sometimes compared to reference streams that are minimally, or least impaired, in the area. Habitat quality is also sometimes taken as a percentage of the maximum habitat score possible. The percent maximum habitat score method was adopted for this study.

HABITAT METRICS

Instream cover - This habitat metric refers to the quantity and variety of natural substrate features such as fallen trees, logs, branches, undercut banks, and hard substrate particles that aquatic organisms can use as refugia, feeding sites, or for spawning. A diversity of substrate objects and microhabitat types leads to a diverse and productive aquatic community and, hence, a good biological condition. The presence of clean gravel, cobble, and log snags in flowing streams is generally most desirable. However, other objects such as tree roots, aquatic vegetation, and undercut banks provide good habitat for many species.

Epifaunal surface - This parameter evaluates the relative amount and types of natural structures in the stream. Examples include cobble, boulders, trees, logs and branches, and undercut banks, which serve as places for spawning and habitat for aquatic macroinvertebrates and fishes. As variety and abundance of structures decreases, habitat structure becomes simplified and biodiversity will decrease.

Embeddedness - Embeddedness is a measure of the relative degree to which rocks and snags are covered or sunken into the silt, sand, and mud. As substrate features become buried, the available high-quality surfaces for shelter, spawning, and feeding decrease, resulting in reduced biodiversity. This parameter is evaluated in riffle and run habitats and is a substitute for the pool substrate character and variability parameter of the glide-pool method.

Velocity/depth regimes - High-quality riffle-run streams generally have four velocity/depth regimes present: slow-deep, slow-shallow, fast-deep, and fast-shallow. The presence of these regimes determines in part the stream's ability to create stable aquatic habitat and reflects the degree of geomorphic stability. This parameter is a substitute for the pool variability parameter of the glide-pool method.

Man-made channel alteration – This metric quantifies the degree of channel alteration, usually in the form of stream channelization. Channelization changes the fundamental hydrodynamic and energy-flow relationships of a stream resulting in bank erosion and habitat degradation. Channel alteration can result in deposition on the inside of bends, below channel constrictions, and where stream gradient flattens. Channelization decreases stream sinuosity, thereby increasing velocities and the potential for channel and bank scour and possibly accelerated downcutting of the channel.

Sediment deposition - This characteristic quantifies the amount of sediment that has accumulated in pools and changes that have taken place on stream bottoms from erosion and sedimentation. The character of sediment deposits is an indication of the severity of watershed erosion, bank erosion, and stability of the stream. Sediment bars will appear and increase in coverage with continual upstream erosion in the watershed.

Frequency of riffles - Riffles are high-quality habitat in upland streams and this parameter assesses the frequency of occurrence of riffles in a stream. More riffle habitat generally results in a greater variety and abundance of aquatic organisms. This parameter is a substitute for the channel sinuosity parameter of the glide-pool method for low-gradient streams.

Channel flow status – The degree to which a channel is filled with water is important because, as flow volume decreases, the amount of suitable substrate for aquatic organisms also decreases and biological condition can degrade. Having a suitable amount of submerged area and volume of flow is also important for maintaining acceptable water quality.

Condition of banks – Bank stability is a measure of whether banks are eroded or are potentially erodible. Steep banks are more likely to collapse and are more prone to erosion than are gently sloping banks and are, therefore, considered unstable. Crumbling and unvegetated banks, exposed tree roots, and exposed soil are indicators of accelerated bank erosion.

Bank vegetative protection – This metric is an evaluation of the vegetative protection on stream banks and the near-stream portion of the riparian zone. Roots hold soil in place and reduce erosion potential thus enhancing the local aquatic biological community.

Grazing or other disruptive pressure – The degree to which streamside cover has been removed by animal grazing, mowing or herbicides, and mechanical tree removal is evaluated for this metric. Streams with natural vegetative cover have been shown to have a higher standing crop and variety of organisms compared to streams that are routinely disrupted or managed through mowing and grazing.

Riparian vegetative zone width – The riparian zone serves to buffer the stream from runoff, controls erosion, and provides organic matter and nutrients to the stream. Undisturbed riparian zones with natural vegetation help maintain highly diverse and functional aquatic communities while narrow and impaired riparian zones yield poor biological conditions and are associated with roads, fields, parking lots, and lawns.

The glide pool habitat assessment method is used to evaluate stream habitat that does not have rocky riffles as found in upland streams above the Fall Line. The glide pool method substitutes three habitat metrics in order to capture habitats characterized by unconsolidated mud and sand substrates and extensive run and glides zones.

Pool substrate characterization – This metric is substituted for embeddedness in the riffle-run index for high-gradient streams and evaluates the type and condition of bottom substrates in pools. Firm substrates, such as gravel and sand, and aquatic vegetation generally support a greater variety of aquatic organisms compared to pools with unconsolidated mud, bedrock, and silt with no aquatic vegetation.

Pool variability – This metric evaluates the overall mixture of pool types in the stream relative to size and depth. Pools of variable sizes and depths (large-deep, large-shallow, small-deep, and small-shallow) are preferable to pools of uniform depth (small or large-shallow) because they will generally support a greater variety of organisms. Extreme bedload sedimentation will lead to pools of uniform width and depth which strongly impairs aquatic biodiversity.

Channel sinuosity – Streams with a higher degree of sinuosity provide a greater variety of habitats which support increased biodiversity. Streams with sinuous channels also attenuate floods and storm flows more effectively by dissipating energy and protecting banks from excessive erosion.

THE HUMAN DISTURBANCE GRADIENT

Stresses to aquatic resources are diverse in type and magnitude and affect ecosystem processes variably. A conceptual model for what is termed a generalized stressor gradient has been defined by the USEPA (2005) to characterize environmental stresses that cause biological responses within aquatic communities. Events and activities that alter aquatic ecosystems are termed **disturbances**. Aquatic ecosystems normally operate at varying levels of disturbance within their ambient range of natural variation such as flood events and other extreme weather-related phenomena. Disturbances outside of this ambient range are human induced and exert **pressures** on aquatic systems by changing the fundamental environmental processes and ultimately generating **stressors** on the resident biota. Stressors are defined as physical, chemical, or biological factors that cause an adverse response in aquatic biota (USEPA, 2000) with the degree of response determined by the magnitude, frequency, and duration of exposure to stressors. This conceptual process is outlined in figure 3 with an example of how riparian tree removal leads to altered biological condition. Unstable banks (disturbance), caused by tree removal (pressures), leads to increased erosion of fine sediments from stream banks (mechanism). This mechanism causes in-stream siltation (stressor) which smothers the substrate with fine particles and causes gill irritation in fishes (mechanism). The stressor ultimately leads to fish and invertebrate mortality or emigration (biological response) out of the disturbed area.

Karr and others (1986) listed five factors that define the structural and functional integrity of aquatic resources and are the major receptors of ecosystem disturbance: water-quality, flow regime, biotic factors, energy source, and habitat structure. Water-quality factors such as hardness, nutrient concentrations, dissolved oxygen, turbidity, toxic trace metals, and toxic organic compounds all affect, either directly or indirectly, the survival of biota. Factors related to flow regime, including velocity gradients,

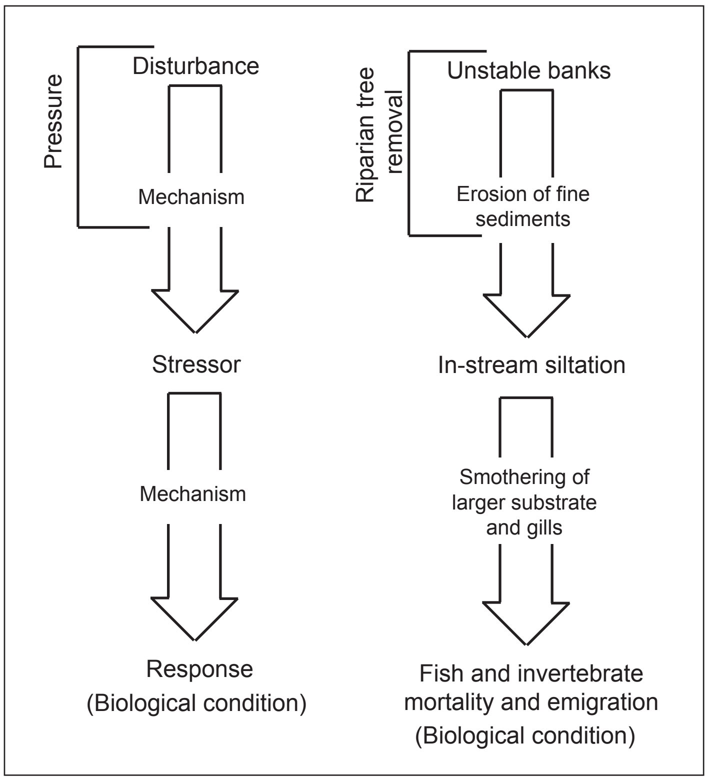


Figure 3. Conceptual model illustrating the relationship between disturbance, stressor, and response (adapted from USEPA, 2005).

groundwater inflows, diversions, dams, and relative variability of stream flows indirectly shape habitat quality. Severe disruption of natural flow regimes can accelerate channel scour, introduce additional bedload material, lower base flows, and weaken stream banks. Biotic factors such as increased rates of disease, parasitism, predation, and competition can directly affect the survival of the resident biota by weakening a population’s ability to cope with added environmental stress. Removal of riparian vegetation through logging or urban development disrupts vital sources of energy for the stream including allochthonous organic matter and larger woody debris. Removal of riparian cover also exposes the stream to more sunlight which increases stream temperature and, when coupled with increased nutrient input, can lead to excessive algal growth and eutrophic conditions. Reach-specific habitat variables very often are significant determinants of biological integrity. Increased embeddedness of a naturally variable substrate with fine sediments can lead to loss of habitat diversity and a parallel loss of species diversity. The degree that finer sediments are embedded within coarser substrate, the stability and quality of riparian vegetation cover, and the quality of habitat components such as riffles, pools, and runs are all determinants of biological condition and ultimately to water resource viability.

Biological assessment tools are useful for evaluating stream and habitat conditions in relation to human disturbance. Human activities will degrade water resources by altering one or more of the five basic factors of ecosystem structure and function—water quality, flow regime, biotic factors, energy source, and habitat structure—(Karr and Chu, 1999) through the disturbance-stressor-response model. Because the multimetric IBI is sensitive to changes in these five factors, it can be used to quantify biological effects over a broad range of human disturbance activities. Understanding how the IBI and its individual metrics respond to human disturbance (sensitivity) is therefore a basic step in creating and calibrating an effective IBI index for a region or watershed.

The diverse array of human activities can make the task of defining and quantifying human disturbance difficult, but recent advances in geographic information systems (GIS) technology have refined our ability to quantify landscape-scale human disturbance. Landscape features that stream ecologists have qualitatively known for years to be sources of ecosystem stress such as type of land cover, type and intensity of land use, number of road-stream intersections, number of point-source discharges, population density, and agricultural animal density can now be quantified into useable datasets for GIS analysis.

Disturbance can be quantified on a number of levels ranging from human disturbance metrics that describe landscape-level features (Brown and Vivas, 2003; Fore, 2004) to the rapid habitat assessment metrics that describe reach-level features (Rankin, 1989; Barbour and others, 1999). Both landscape- and reach-level measures were used in this investigation and are important for quantifying disturbance and relating it to multimetric indices such as the IBI.

The Analytical Tools Interface for Landscape Assessments (ATtILA) program has been developed by the USEPA to readily calculate many common landscape metrics. ATtiLA (version 2004), an Arc View extension, uses GIS data in order to create landscape metrics. Shape files containing population density and roads coverage for each county (U.S. Bureau of the Census), streams (National Hydrography Database), and a raster grid of land cover (National Land Cover Database 2001) were used to develop the following metrics for this project:

- ❏ Human density - (population count / watershed area in square kilometers).
- ❏ Phosphorus load- kilograms/hectare/year (kg/ha/yr).
- ❏ Percent urban (percentage of watershed that is urban).
- ❏ Percent barren (percentage of the watershed that is man-made barren).
- ❏ Percent pasture (percentage of the watershed that is pasture).
- ❏ Percent crop (percentage of the watershed that is crop land).
- ❏ Road density (kilometerof roads / square kilometer of watershed).
- ❏ Road x stream crossings (Number of road-stream crossings per kilometer of stream in the watershed).

The HDG was calculated by weighting the eight selected landscape features listed above by a factor known as the Landscape Development Intensity (LDI) index (Brown and Vivas, 2003) which relates the intensity of human land use to nonrenewable energy flow. The LDI ranges from 0, natural systems, to 10, high intensity central business districts. These weighted values were then summed to yield the final HDG index.

IBI METRICS AND SCORING CRITERIA

Biological responses to stressors in the environment are quantified into measures called metrics that are calculated from fish collection data. Typical IBI metrics can be classified into one of four basic types. Diversity metrics generally evaluate total fish community diversity, such as total native species, or components of community diversity, such as darter or sucker species diversity; trophic metrics evaluate the trophic or production status of a fish community and quantify proportions of fishes in certain feeding guilds; tolerance and intolerance metrics measure the relative proportions and(or) counts of species present that are either tolerant or intolerant of pollutants, stressors, and habitat degradation; and reproduction/fish health metrics measure the relative proportions of species within certain reproductive guilds and the relative presence of health problems that may be environmentally caused such as deformities, eroded fins, lesions, and tumors.

Testing and validating biological responses across a gradient of habitat and(or) human disturbance is an important step in IBI development (Karr and Chu, 1997; Smogor and Angermeier, 1999a). The ability of individual metrics, and ultimately the IBI itself, to segregate most from least degraded and disturbed sites was evaluated by comparing a sample of stations with similar-sized watershed areas from each end of the habitat disturbance gradient similar to the method of Teels and Danielson (2001). All sites were first ordered according to watershed area and this distribution was split into two groups, one consisting of sites with a watershed area <25 mi^2 and the other of sites with a watershed area $\geq$25 mi^2. Within each group, the sites were ordered from those with lowest habitat scores (most disturbed) to those with highest habitat scores (least disturbed). From these arrays, the ten most and least disturbed sites were selected from the ends of the distributions to compare statistically. The mean metric values for these two samples were then compared using the Student t-test. In similar fashion, the ten most and least disturbed sites from watersheds $\geq$25 mi^2 were also compared using the Student t-test. This process was repeated with the data array ordered by watershed size and human disturbance then analyzed in identical fashion.

DESIGNATION OF GUILDS

Biological responses to aquatic ecosystem stressors are manifested through changes in the structure (species diversity and abundance) and function (trophic relationships and reproductive patterns) of faunal communities. Within the fish community, species must be classified into appropriate trophic and reproductive guilds so accurate and responsive IBI metrics can be constructed (Goldstein and Simon, 1999; Simon, 1999a). Guild determination should be based on regionally specific ichthyology texts and natural history information. Recent books of Alabama fishes (Mettee and others, 1996; Boschung and Mayden, 2004) and fish books of adjoining states, Etnier and Starnes (1993) for Tennessee and Ross (2001) for Mississippi, contain excellent information for establishing guild associations for southeastern fishes. O’Neil and Shepard (2000b) provided a list of all Alabama freshwater fishes with ecological and distributional characteristics that included trophic status and tolerance. This list was modified using definitions and descriptions by Smoger and Angermeier (1999a) and Dauwalter and others (2003) to refine trophic guilds and add reproductive guild designations (appendix B).

Two classification factors were considered for assigning reproductive guild: spawning substrate and spawning behavior. Lithophilic spawners prefer clean mineral substrates (cobble, gravel, sand) to deposit their eggs in or on top of. The non-lithophilic spawner guild uses the remaining types of substrate or spawning surfaces (aquatic vegetation, coarse organic matter, and other features not related to lithophilic substrates). Simple spawners typically invest little energy in nest preparation or parental care and generally broadcast or bury their eggs. Manipulative spawners construct simple nests such as depressions, mounds, or cavities and(or) have some form of parental care such as egg or young guarding. Four reproductive guilds were designated for Alabama fishes: (1) simple lithophils, (2) manipulative lithophils, (3) simple non-lithophilic spawners, and (4) manipulative non-lithophilic spawners.

Trophic guild classifications were slightly more complex with three classification factors considered by Smogor and Angermeier (1999b): number of food types consumed, feeding behavior, and foods consumed. Fish food types were grouped into four categories: detritus, algae or vascular plants, invertebrates, and fish-crayfish. Generalist feeders were those that eat three or more food types, specialists eat only one or at most two types. Benthic versus non-benthic feeding behaviors were also considered in the classification process with benthic behaviors associated with bottom-feeding species. Seven trophic guilds were established: (1) DAH - detritivore, algivore, herbivore. Detritus, algae, and(or) vascular plants comprise the major diet items for this guild with *Campostoma* and *Hybognathus* as examples. (2) AHI - algivore, herbivore, invertivore. This guild is similar to DAH, but species consume less detritus and more invertebrates with *Erimyzon*, *Polyodon*, carp, and *Hypentelium* as examples. (3) INV - invertivore. These species consume a variety of invertebrate taxa including crustaceans, insects, and mollusks. Examples are *Moxostoma, Fundulus, Ictalurus*, and *Ameiurus.* (4) INS - insectivore. Many species consume insect immatures as their major food type. Practically all of the darters and many cyprinid species are insectivores. (5) PIS - piscivore. Piscivores, such as *Lepisosteus* and *Morone*, consume fishes almost exclusively as adults. (6) IP - invertivore, piscivore. Many large predators, such as *Micropterus* and *Esox,* will consume fishes and larger invertebrates as adults. (7) PAR - parasite. This is a very restricted classification for those species (such as *Ichthyomyzon*) that may parasitize other fishes.

RESULTS AND DISCUSSION

SAMPLING SITES AND COLLECTION RESULTS

Ninety-one sites in 15 counties across north Alabama were sampled from May through October 2009 and six sites in the Bear Creek system were sampled from July through September 2008 (fig. 4, table 1, appendix C) to assess fish communities for use in calibrating IBI metrics for the Tennessee Valley ichthyoregion. Sites were selected to represent a range of watershed areas and levels of human disturbance (fig. 5). Watershed areas at sampled sites ranged from 1.76 mi^2 up to 308 mi^2 with 42.3 percent (41 sites) of the watersheds <20 mi^2, 40.2 percent (39 sites) ranging from 21 to 100 mi^2, and 17.5 percent (17 sites) ranging from 101 to 308 mi^2 in area.

Collections were widely distributed throughout the Tennessee Valley ichthyoregion with a few samples taken from the adjacent Plateau ichthyoregion. Twenty-one samples were taken from the Bear Creek hydrologic unit code (HUC), 18 from the Pickwick HUC, four from the lower Elk River HUC, 32 samples were taken from the Wheeler Lake HUC, 16 from the Guntersville Lake HUC, five from the upper Locust Fork HUC, and one sample was taken from the Chickamauga Lake HUC (table 1).

In total, 40,666 individuals in 107 species and one hybrid (table 2) were captured, identified, and released during the study with 36 species representing the Cyprinidae (minnows and carps), 8 species in the Catostomidae (suckers), 10 species in the Ictaluridae (catfishes and madtoms), 14 species of sunfishes and one hybrid in the family Centrarchidae, and 25 species of darters in the family Percidae. The average total catch per sample varied across the ichthyoregion from 270 individuals in the Guntersville HUC to 521 individuals in the Pickwick HUC, excluding the Locust Fork and Chickamauga HUCs.

Minnows in the family Cyprinidae dominated the fauna, comprising 51.2 percent of all individuals collected at the 97 sites (table 2). Three cyprinid species comprised close to one-third of all individuals collected: *Campostoma oligolepis* (largescale stoneroller) 26.2 percent, *Luxilus chrysocephalus* (striped shiner)

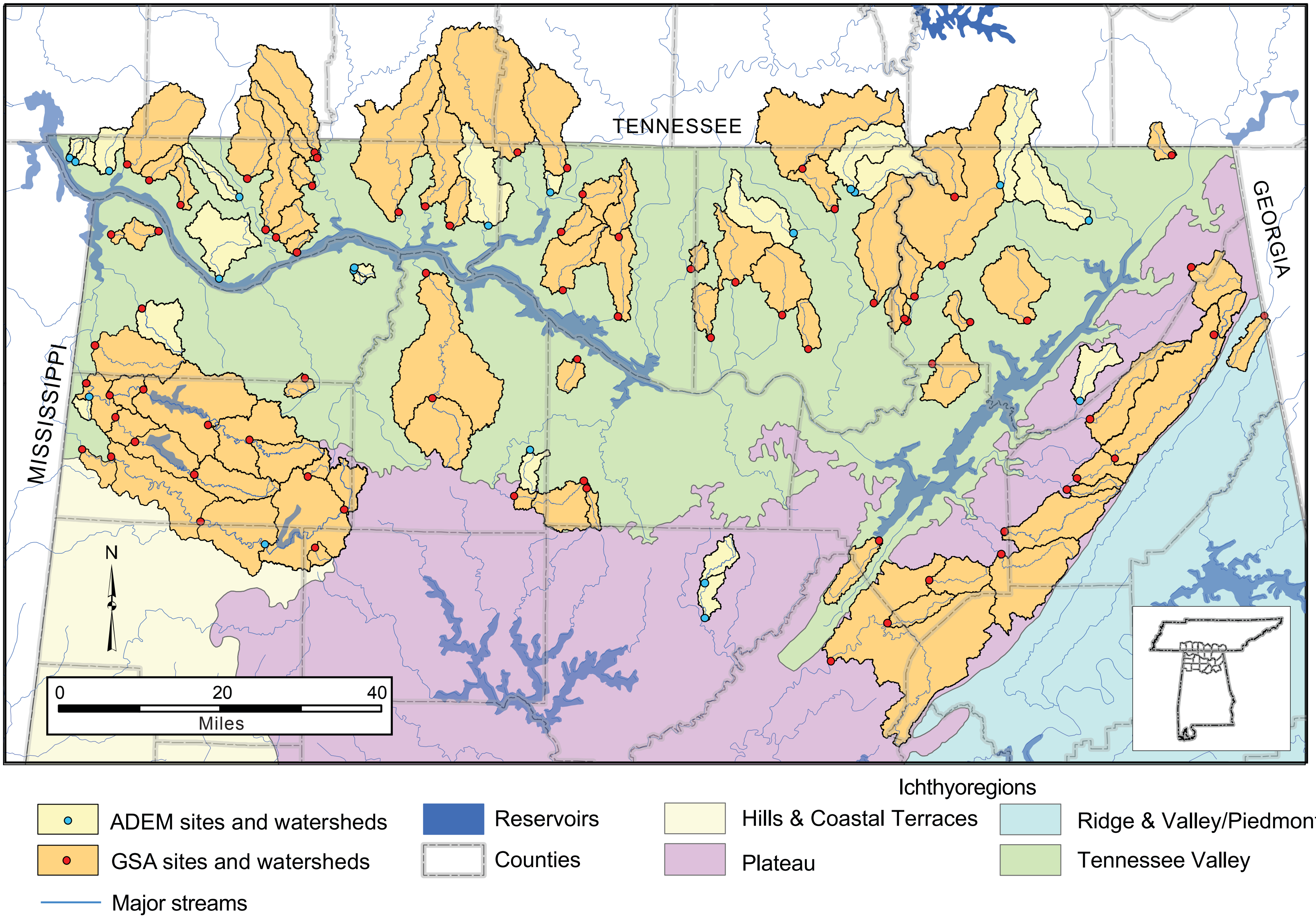


Figure 4. Location of IBI sampling sites in the Tennessee and Black Warrior River systems.

Table 1. IBI sampling sites in the Tennessee Valley and Plateau ichthyoregions, 2008-09.

Stream code	Stream name	County	Latitude	Longitude	Section, township, range	Watershed area (mi^2)	Ecoregion	GSA No.	Sample date
Bear Creek - Tennessee River- 06030006									
BEA-2	Bear Creek at Ala. Hwys. 241 and 17	Marion	34.2769	87.7186	sec. 17, T. 9 S., R. 11 W.	119	65j	1962	2-Sep-09
BERF-2	Bear Creek at Ala. Hwy. 24	Franklin	34.4441	88.1157	sec. 21, T. 7 S., R. 15 W.	262	65j	1917	10-Jul-09
BERF-4	Bear Creek at Co. Hwy. 57	Franklin	34.3164	87.8585	sec. 36, T. 8 S., R. 13 W.	182	65i	2047	27-May-09
BERF-5	Bear Creek at Co. Hwy. 93	Franklin	34.3397	87.5472	sec. 23/24, T. 8 S., R. 10 W.	19.1	68e	1924	8-Jul-09
BERF-11	Bear Creek at farm road off Co. Hwy. 25	Franklin	34.4319	88.0533	sec. 15, T. 8 S., R. 13 W.	250	65j	2298	5-Aug-08
BCBC-1	Buck Branch at Co. Hwy. 1	Colbert	34.8309	88.0584	sec. 1, T. 3 S., R. 15 W.	1.96	65j	2192	9-Sep-08
BZDC-1	Buzzard Roost Creek at Co. Hwy. 21	Colbert	34.6983	87.9891	sec. 22, T. 4 S., R. 14 W.	26.5	65j	1964	1-Sep-09
CDRF-22	Cedar Creek at Ala. Hwy. 247	Franklin	34.5527	87.9851	sec. 10, T. 6 S., R. 14 W.	186	65j	1906	11-Aug-09
CERF-2	Cedar Creek downstream of dam	Franklin	34.5469	87.9773	sec. 11/14, T. 6 S., R. 14 W.	183	65j	1907	11-Aug-09
CEDF-21	Cedar Creek at Co. Hwy 524 (abandoned)	Franklin	34.4898	87.8250	sec. 31, T. 6 S., R. 12 W.	85.6	65i	2293	7-Aug-08
CDRL-1	Cedar Creek at Co. Hwy. 105	Lauderdale	34.9679	88.1508	sec. 18, T. 1 S., R. 11 W.	3.34	65j	1965	24-Jun-09
CDRF-2	Cedar Creek at Co. Hwy. 23	Franklin	34.5420	88.0576	sec. 16, T. 4 S., R. 15 W.	199	65j	2091	20-Aug-09
CERF-1	Cedar Creek near Pogo	Franklin	34.5628	88.1091	sec. 9, T. 6 S., R. 15 W.	308	65j	2050	28-May-09
CDRF-5	Cedar Creek at U.S. Hwy. 43	Franklin	34.4659	87.7530	sec. 12, T. 7 S., R. 12 W.	30.5	71g	2046	19-May-09
LTBF-14	Little Bear Creek at Ala. Hwy. 187	Franklin	34.4012	87.8733	sec. 35, T. 7 S., R. 13 W.	34.2	65i	2048	27-May-09
LTBF-12	Little Bear Creek at Ala. Hwy. 24	Franklin	34.4593	88.0026	sec. 15, T. 7 S., R. 14 W.	67.3	65i	2104	31-Jul-08
LTBF-11	Little Bear Creek at Co. Hwy. 23	Franklin	34.5026	88.0445	sec. 31, T. 6 S., R. 14 W.	84.3	65j	2049	28-May-09
LTBF-1	Little Bear Creek at Co. Hwy. 34	Franklin	34.3992	87.6267	sec. 31, T. 7 S., R. 10 W.	7.04	68e	1921	8-Jul-09
MLBF-1	Mill Branch at Co. Hwy. 11	Franklin	34.5390	88.1025	sec. 15, T. 6 S., R. 15 W.	4.58	65j	1970	2-Sep-09
QTRW-2	Quarter Creek off of George Ave., Haleyville	Winston	34.2712	87.6099	sec. 17, T. 9 S., R. 10 W.	5.61	68e	2287	20-Aug-08
RCKC-11	Rock Creek at Co. Hwy. 1	Colbert	34.6318	88.0910	sec. 15, T. 5 S., R. 15 W.	50.6	65j	2295	6-Aug-08
Pickwick Lake - Tennessee River - 06030005									
BLFL-1	Bluff Creek at Gravelly Springs	Lauderdale	34.8858	87.9077	sec. 16, T. 2 S., R. 13 W.	10	71f	2043	20-May-09
BRHL-1	Brush Creek at Co. Hwy. 133	Lauderdale	34.9289	87.9765	sec. 35, T. 1 S., R. 14 W.	11.8	71f	2044	20-May-09
BMPL-2	Bumpass Creek at Co. Hwy. 14	Lauderdale	34.9450	87.0645	sec. 25, T. 1 S., R. 15 W.	16.1	65j	1963	4-Aug-09
BTLL-1	Butler Creek near mouth at Co. Hwy. 302	Lauderdale	34.9766	87.6089	sec. 17, T. 1 S., R. 10 W.	60.6	71f	1933	30-Sep-09
CLBC-11	Colbert Creek at Colbert Creek Park	Colbert	34.8380	87.9554	sec. 36, T. 2 S., R. 14 W.	9.94	71g	2045	20-May-09
COXL-1	Cox Creek at Old Jackson Road	Lauderdale	34.8290	87.6986	sec. 4, T. 3 S., R. 11 W.	16.6	71f	2019	13-May-09
FXTC-1	Foxtrap Creek at Co. Hwy. 37	Colbert	34.5758	87.6339	sec. 31 T. 5 S., R. 10 W.	6.79	71j	2051	28-May-09
INCL-1	Indiancamp Creek at Co. Hwy. 135	Lauderdale	34.9216	87.6210	sec. 31, T. 1 S., R. 10 W.	8.41	71f	1934	30-Sep-09
LDYL-1	Lindsey Creek at Co. Hwy. 277	Lauderdale	34.9010	87.7797	sec. 11, T. 2S, R. 12 W.	12.6	71f	1966	5-Aug-09
LBTL-1	Little Butler Creek at Co. Hwy. 61	Lauderdale	34.9819	87.6162	sec. 8, T. 1 S., R. 10 W.	7.99	71f	2018	13-May-09
LCPL-2	Little Cypress Creek at Old Jackson Road	Lauderdale	34.8428	87.7219	sec. 32, T. 2 S., R. 11 W.	51.3	71f	2042	21-May-09
MCKC-1	McKiernan Creek at Co. Hwy. 48	Colbert	34.7700	87.5289	sec. 25, T. 3 S., R. 10 W.	1.76	71g	1967	3-Sep-09
MDCL-2	Middle Cypress Creek at Ala. Hwy. 157	Lauderdale	34.9344	87.7633	sec. 26, T. 1 S., R. 12 W.	38.4	71f	2041	21-May-09
PNTL-1	Panther Creek at unnamed road crossing	Lauderdale	34.9611	88.1378	sec. 20, T. 1 S., R. 15 W.	5.77	65j	1957	15-Jul-09
SNDL-3	Second Creek at Fords Mill Church	Lauderdale	34.9572	88.0256	sec. 20, T. 1 S., R. 4 W.	65.2	65j	2020	13-May-09
SHGC-1	Shegog Creek at Co. Hwy. 48	Colbert	34.7754	87.5288	sec. 19, T. 3 S., R. 9 W.	3.04	71g	1968	3-Sep-09
SNKL-7	Sinking Creek off Co. Hwy. 4	Lauderdale	34.7532	87.8225	sec. 32, T. 3 S., R. 12 W.	43.8	71g	1969	4-Aug-09
SWTL-1	Sweetwater Cr. at Union Street-Florence	Lauderdale	34.8022	87.6559	sec. 12, T. 3 S., R. 11 W.	5.12	71f	1935	30-Sep-09

Table 1. IBI sampling sites in the Tennessee Valley and Plateau ichthyoregions, 2008-09.

Stream code	Stream name	County	Latitude	Longitude	Section, township, range	Watershed area (mi^2)	Ecoregion	GSA No.	Sample date
Lower Elk River - Tennessee River - 06030004									
ANDL-8	Anderson Creek at Snake Road Bridge	Lauderdale	34.8515	87.2361	sec 26, T. 2 S., R. 7 W.	48.9	71f	1961	2-Sep-09
SHOL-1	Shoal Creek at Leggtown Road	Limestone	34.9553	87.0644	sec. 16, T. 1 S., R. 5 W.	57	71h	2026	15-May-09
SGRL-3	Sugar Creek at Lester	Limestone	34.9832	87.1730	sec. 8, T. 1 S., R. 6 W.	139	71h	2040	21-May-09
SLRL-1	Sulphur Creek at Easter Ferry Road	Limestone	34.9078	87.0304	sec. 32, T. 1 S., R. 5 W.	17.5	71g	2021	14-May-09
Wheeler Lake - Tennessee River - 06030002									
ALDM-234	Aldridge Creek at Green Mountain Road	Madison	34.6289	86.5395	sec. 4, T. 5 S., R. 1 E.	13.9	68c	2024	15-May-09
BAKM-2	Bakers Creek at Ipsco Road	Morgan	34.6115	87.0422	sec. 15, T. 5 S., R. 5 W.	10.5	71g	2016	12-May-09
BPTL-1	Baptizing Branch at Ala. Hwy. 99	Limestone	34.9111	87.1014	sec. 21, T. 1 S., R. 5 W.	4.42	71h	1958	8-Oct-09
BVDM-17	Beaverdam Creek at U.S. Hwy. 431	Madison	34.8377	86.5712	sec. 25, T. 2 S., R. 1 W.	37.1	71g	1951	29-Sep-09
BIGL-14	Big Creek at Townsend Ford Road	Limestone	34.8404	87.0781	sec. 29, T. 2 S., R. 5 W.	13.8	71f	1932	29-Sep-09
BGNL-37	Big Nance Creek at Co. Hwy. 314	Lawrence	34.7662	87.3718	sec. 27, T. 3 S., R. 8 W.	187	71g	2058	5-Jun-09
BLWL-11	Bluewater Creek at Co. Hwy. 33	Lauderdale	34.8748	87.4323	sec. 19, T. 2 S., R. 8 W.	110	71f	2028	14-May-09
BFDM-1	Bradford Creek at James Record Road	Madison	34.6506	86.7519	sec. 29, T. 4 S., R. 2 W.	15.3	71g	2015	12-May-09
CLEJ-100	Clear Creek at Ala. Hwy. 65	Jackson	34.7223	86.3079	sec. 30, T. 4 S., R. 3 E.	18.0	71g	2032	20-May-09
CSPJ-70	Cole Spring Branch at Ala. Hwy. 65	Jackson	34.6827	86.3298	sec. 20, T. 4 S., R. 3 E.	10.0	71g	2031	20-May-09
CSPJ-70A	Cole Spring Branch off Ala. Hwy. 65	Jackson	34.6816	86.3286	sec. 20, T. 4 S., R. 3 E.	11.6	71g	2034	20-May-09
CPRL-1	Copperrun Creek at Capshaw Road	Limestone	34.7730	86.7953	sec. 13/14, T. 3 S., R. 3 W.	6.29	71g	2023	14-May-09
CRDM-1	Crowdabout Creek at Near Massey	Morgan	34.3931	87.0291	sec. 35, T. 7 S., R. 5 W.	38.4	71g	1937	1-Oct-09
FIRL-1	First Creek at Co. Hwy. 70	Lauderdale	34.8507	87.3207	sec. 25, T. 2 S., R. 8 W.	14.6	71f	2017	12-May-09
FLTM-1	Flint River at Oscar Patterson Road	Madison	34.8826	86.4783	sec. 12, T. 2 S., R. 1 E.	132	71g	2061	4-Jun-09
HERM-1	Herrin Creek at New Cut Road	Morgan	34.3792	87.0223	sec. 1, T. 8 S., R. 5 W.	6.37	71g	1936	1-Oct-09
HESM-1	Hester Creek at unnamed Co. Hwy.	Madison	34.9108	86.4375	sec. 32, T. 1 S., R. 2 E.	39.6	71g	1953	29-Sep-09
HSBM-242A	Huntsville Spring Branch at Johnson Road	Madison	34.6905	86.5962	sec. 14, T. 4 S., R. 1 W.	42.1	71g	2030	19-May-09
HURM-11	Hurricane Creek at U.S. Hwy. 72 at Gurley	Madison	34.7113	86.3965	sec. 10, T. 4 S., R. 2 E.	64.1	71g	2060	4-Jun-09
INDM-250	Indian Creek at U.S. Hwy. 72	Madison	34.7500	86.6974	sec. 26, T. 3 S., R. 2 W.	38.6	71g	2039	22-May-09
LRKJ-11	Larkin Fork off Co. Hwy. 27	Jackson	34.9008	86.2194	sec. 4, T. 1 S., R. 4 E.	32.4	68a	2038	22-May-09
LPNT-1	Little Paint Creek at Ala. Hwy. 5	Jackson	34.6011	86.2708	sec. 13, T. 5 S., R. 3 E.	35.7	68a	2035	21-May-09
MCDL-360	McDaniel Creek at Co. Hwy. 336	Lawrence	34.4482	87.1445	sec. 10, T. 7 S., R. 6 W.	10.9	71g	1947	17-Sep-09
MTNM-2	Mountain Fork near Hester Creek	Madison	34.9107	86.4369	sec. 5, T. 2 S., R. 2 E.	32.6	71g	1955	1-Oct-09
MFBN-2	Muddy Fork at Co. Hwy. 236	Lawrence	34.5410	87.3379	sec. 10, T. 6 S., R. 8 W.	49.9	71j	2052	29-May-09
PRRJ-21	Paint Rock River off Ala. Hwy. 65	Jackson	34.7780	86.2481	sec. 18, T. 3 S., R. 4 E.	217	68a	2033	20-May-09
RNIL-400	Round Island Creek at Browns Ferry Road	Limestone	34.7354	87.0734	sec. 32, T. 3 S., R. 5 W.	33.8	71g	2022	14-May-09
SCDL-11	Second Creek at Co. Hwy. 76	Lauderdale	34.8859	87.3739	sec. 9, T. 2 S., R. 8 W.	45.3	71f	2027	14-May-09
SWNL-1	Swan Creek at Elkton Road	Limestone	34.8318	86.9515	sec. 33, T. 2 S., R. 4 W.	19.5	71g	2025	15-May-09
SWNL-302	Swan Creek at U.S. Hwy. 31	Limestone	34.6886	86.9531	sec. 16, T. 4 S., R. 4 W.	54.1	71g	1931	29-Sep-09
WFLL-15	West Flint Creek at Co. Hwy. 81	Lawrence	34.4383	87.1854	sec. 34, T. 6 S., R. 6 W.	5.59	68e	2029	19-May-09
WFFM-1	West Fork Flint River at Fisk	Madison	34.9610	86.5718	sec. 13, T. 1 S., R. 1 W.	111	71g	2059	4-Jun-09

Table 1. IBI sampling sites in the Tennessee Valley and Plateau ichthyoregions, 2008-09.

Stream code	Stream name	County	Latitude	Longitude	Section, township, range	Watershed area (mi^2)	Ecoregion	GSA No.	Sample date
Guntersville Lake - Tennessee River - 06030001									
BCNJ-1	Big Coon Creek at Co. Hwy. 55	Jackson	34.8566	85.9268	sec. 19, T. 2 S., R. 7 E.	42.3	68c	1952	30-Sep-09
BWSM-1	Browns Creek at Browns Valley Road	Marshall	34.2843	86.3884	sec. 1, T. 9 S., R. 2 E.	21.0	68b	2066	10-Jun-09
CFRJ-161	Flat Rock Creek at Ala. Hwy. 117	Jackson	34.7697	85.7057	sec. 20, T. 3 S., R. 9 E.	28.4	68d	2055	4-Jun-09
HURR-1	Hurricane Creek at end of Co. Hwy. 9	Jackson	34.9209	86.1193	sec. 29, T. 1 S., R. 5 E.	42.6	68c	1954	30-Sep-09
JNSJ-2	Jones Creek at Co. Hwy. 74	Jackson	39.9718	85.7442	sec. 12, T. 1 S., R. 8 E.	9.20	68b	2056	4-Jun-09
KBYJ-1	Kirby Creek at Co. Hwy. 38	Jackson	34.5326	85.9510	sec. 7, T. 6 S., R. 7 E.	21.7	68d	1956	24-Sep-09
NSTJ-2	North Sauty Creek at Co. Hwy. 119	Jackson	34.6751	86.1876	sec. 22, T. 4 S., R. 4 E.	7.68	68b	2036	21-May-09
REDD-1	Reedy Creek at Co. Hwy. 328	Dekalb	34.3734	85.9805	sec. 2, T. 8 S., R. 6 E.	8.98	68d	2063	10-Jun-09
RBYJ-2	Roseberry Creek at Ala. Hwy. 35	Jackson	34.6791	86.0613	sec. 23, T. 4 S., R. 5 E.	50.1	68a	2037	21-May-09
SCRL-2	Scarham Creek at Co. Hwy. 372	Marshall	34.2984	86.1166	sec. 33, T. 8 S., R. 5 E.	54.5	68d	1950	17-Sep-09
SCRL-2	Scarham Creek at Co. Hwy. 372 (duplicate)	Marshall	34.2985	86.1165	sec. 33, T. 8 S., R. 5 E.	54.5	68d	2053	3-Jun-09
SHM-3A	Short Creek at Co. Hwy. 543	Marshall	34.2581	86.1239	sec. 9, T. 9 S., R. 5 E.	71.7	68d	2067	10-Jun-09
SSTD-1	South Sauty Creek at Co. Hwy. 47	Dekalb	34.4991	85.9289	sec. 20, T. 6 S., R. 7 E.	44.1	68d	2068	11-Jun-09
TWND-61	Town Creek at Ala. Hwy. 117	Dekalb	34.6487	85.6577	sec. 36, T. 4 S., R. 9 E.	11.7	68d	2054	21-Jul-09
TWND-4	Town Creek at Co. Hwy. 843	Dekalb	34.3933	85.9584	sec. 25, T. 7 S., R. 6 E.	130	68d	2069	11-Jun-09
TCD-3	Town Creek near Guest at Co. Hwy. 50	Dekalb	34.4275	85.8761	sec. 14, T. 7 S., R. 7 E.	111	68d	2057	5-Jun-09
Chickamauga Lake - Middle Tennessee River - 06020001									
WFLDE-1	West Fork Lookout Creek	Dekalb	34.6805	85.5467	sec. 24, T. 4 S., R. 10 E.	15.1	67f	2014	3-Jun-09
Locust Fork - Black Warrior River - 03160111									
BMDB-1	Big Mud Creek at Co. Hwy. 21	Marshall	34.1354	86.3720	sec. 30, T. 10 S., R. 3 E.	19.0	68d	2064	11-Jun-09
LFKB-11	Locust Fork at Co. Hwy. 26	Blount	34.0678	86.4942	sec. 24, T. 11 S., R. 1 E.	268	68d	2062	10-Jun-09
SLAM-3	Slab Creek at Ala. Hwy. 75	Marshall	34.2128	86.2798	sec. 36, T. 9 S., R. 3 E.	26.3	68d	2065	11-Jun-09
Mulberry Fork - Black Warrior River - 03160109									
BINC-192	Brindley Creek at Ala. Hwy. 69	Cullman	34.2095	86.7665	sec. 32, T. 9 S., R. 2 W.	13.9	68d	1949	9-Oct-09
BINC-190	Brindley Creek at Eightmile Creek	Cullman	34.1457	86.7669	sec. 29, T. 10 S., R. 2 W.	24.9	68d	1948	16-Sep-09

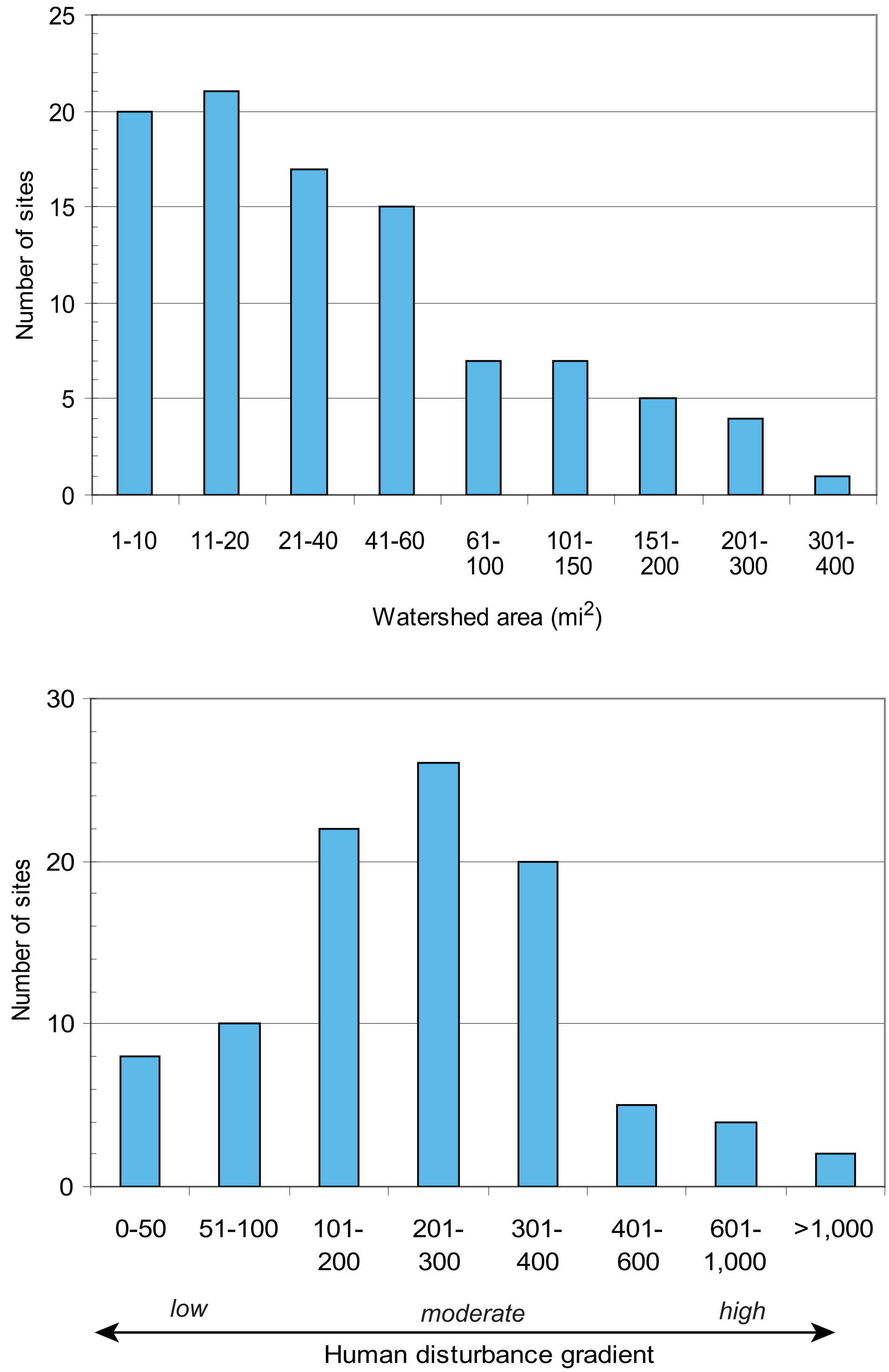


Figure 5. Frequency distribution of sampling sites by watershed area and human disturbance.

Table 2. Fish species collected in the Tennessee and Black Warrior River systems.

Family / Species - common name	Warrior River		Tennessee River												Total	
			Chickamauga		Guntersville		Wheeler		Lower Elk		Pickwick		Bear			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Lepisosteidae - gars																
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	1	0.01	--	--	--	--	--	--	1	--
Lepisosteus osseus - longnose gar	--	--	--	--	--	--	1	0.01	--	--	--	--	1	0.01	2	--
Clupeidae - shads																
Dorosoma cepedianum - gizzard shad	--	--	--	--	1	0.02	10	0.07	--	--	--	--	1	0.01	12	0.03
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	73	0.50	--	--	--	--	1	0.01	74	0.18
Cyprinidae - minnows and carps																
Campostoma oligolepis - largescale stoneroller	119	18.25	122	15.80	1,098	25.40	3,614	24.86	268	15.56	2,799	29.87	2,618	28.19	10,638	26.16
Clinostomus funduloides - rosyside dace	--	--	--	--	--	--	4	0.03	--	--	273	2.91	88	0.95	365	0.90
Cyprinella callistia - Alabama shiner	106	16.26	--	--	--	--	--	--	--	--	--	--	--	--	106	0.26
Cyprinella galactura - whitetail shiner	--	--	26	3.37	163	3.77	125	0.86	80	4.65	3	0.03	46	0.50	443	1.09
Cyprinella spiloptera - spotfin shiner	--	--	--	--	107	2.48	204	1.40	22	1.28	43	0.46	185	1.99	561	1.38
Cyprinella venusta - blacktail shiner	65	9.97	--	--	--	--	4	0.03	--	--	--	--	--	--	69	0.17
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	1	0.01	--	--	--	--	--	--	1	--
Erimystax insignis - blotched chub	--	--	--	--	--	--	23	0.16	--	--	--	--	--	--	23	0.06
Hemitremia flammea - flame chub	--	--	--	--	1	0.02	131	0.90	4	0.23	6	0.06	--	--	142	0.35
Hybopsis amblops - bigeye chub	--	--	17	2.20	19	0.44	213	1.47	44	2.56	53	0.57	41	0.44	387	0.95
Luxilus chrysocephalus - striped shiner	--	--	62	8.03	213	4.93	1,438	9.89	208	12.08	606	6.47	1,082	11.65	3,609	8.87
Luxilus coccogenis - warpaint shiner	--	--	11	1.42	2	0.05	--	--	--	--	46	0.49	--	--	59	0.15
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	--	--	--	--	38	0.41	38	0.09
Lythrurus fasciolaris - scarlet shiner	--	--	75	9.72	152	3.52	867	5.96	101	5.87	697	7.44	84	0.90	1,976	4.86
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	1	--
Lythrurus lirus - mountain shiner	--	--	--	--	3	0.07	41	0.28	1	0.06	1	0.01	--	--	46	0.11
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	--	--	--	--	--	--	78	0.84	78	0.19
Notemigonus crysoleucas - golden shiner	2	0.31	--	--	9	0.21	3	0.02	--	--	4	0.04	1	0.01	19	0.05
Notropis baileyi - rough shiner	--	--	--	--	--	--	--	--	--	--	--	--	284	3.06	284	0.70
Notropis boops - bigeye shiner	--	--	--	--	--	--	8	0.06	--	--	1	0.01	16	0.17	25	0.06
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	56	0.39	--	--	172	1.84	--	--	228	0.56
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	4	0.04	4	0.01
Notropis photogenis - silver shiner	--	--	--	--	--	--	3	0.02	--	--	--	--	--	--	3	0.01
Notropis stilbius - silverstripe shiner	24	3.68	--	--	--	--	--	--	--	--	--	--	--	--	24	0.06
Notropis telescopus - telescope shiner	--	--	8	1.04	17	0.39	49	0.34	11	0.64	92	0.98	--	--	177	0.44
Notropis texanus - weed shiner	--	--	--	--	--	--	--	--	--	--	25	0.27	20	0.22	45	0.11
Notropis volucellus - mimic shiner	--	--	--	--	5	0.12	5	0.03	2	0.12	--	--	--	--	12	0.03
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	3	0.07	6	0.04	--	--	--	--	--	--	9	0.02

Table 2. Fish species collected in the Tennessee and Black Warrior River systems.

Family	Species - common name	Warrior River		Tennessee River: Chickamauga		Guntersville		Wheeler		Lower Elk		Pickwick		Bear		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cyprinidae - *continued*																	
	Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	--	2	0.02	--	--	2	--
	Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	52	0.55	14	0.15	66	0.16
	Pimephales notatus - bluntnose minnow	1	0.15	--	--	5	0.12	501	3.45	94	5.46	113	1.21	48	0.52	762	1.87
	Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	3	0.03	3	0.01
	Pimephales vigilax - bullhead minnow	--	--	--	--	1	0.02	4	0.03	--	--	--	--	68	0.73	73	0.18
	Rhinichthys atratulus - blacknose dace	--	--	2	0.26	--	--	60	0.41	1	0.06	53	0.57	13	0.14	129	0.32
	Semotilus atromaculatus - creek chub	5	0.77	--	--	51	1.18	53	0.36	5	0.29	127	1.36	78	0.84	319	0.78
	Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	100	1.08	100	0.25
Catostomidae - suckers																	
	Catostomus commersoni - white sucker	--	--	--	--	2	0.05	2	0.01	--	--	--	--	--	--	4	0.01
	Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	6	0.04	--	--	11	0.12	34	0.37	51	0.13
	Hypentelium etowanum - Alabama hogsucker	3	0.46	--	--	--	--	--	--	--	--	--	--	--	--	3	0.01
	Hypentelium nigricans - northern hogsucker	--	--	22	2.85	33	0.76	153	1.05	8	0.46	74	0.79	215	2.32	505	1.24
	Minytrema melanops - spotted sucker	--	--	--	--	--	--	1	0.01	1	0.06	--	--	2	0.02	4	0.01
	Moxostoma duquesnei - black redhorse	--	--	3	0.39	--	--	2	0.01	1	0.06	2	0.02	3	0.03	11	0.03
	Moxostoma erythrurum - golden redhorse	--	--	4	0.52	1	0.02	4	0.03	2	0.12	18	0.19	21	0.23	50	0.12
	Moxostoma poecilurum - blacktail redhorse	8	1.23	--	--	--	--	--	--	--	--	--	--	--	--	8	0.02
Ictaluridae - North American catfishes																	
	Ameiurus melas - black bullhead	2	0.31	--	--	--	--	--	--	--	--	2	0.02	--	--	4	0.01
	Ameiurus natalis - yellow bullhead	5	0.77	--	--	32	0.74	22	0.15	1	0.06	71	0.76	45	0.48	176	0.43
	Ictalurus punctatus - channel catfish	--	--	--	--	1	0.02	1	0.01	--	--	--	--	4	0.04	6	0.01
	Noturus exilis - slender madtom	--	--	--	--	--	--	23	0.16	14	0.81	66	0.70	3	0.03	106	0.26
	Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	2	0.02	2	--
	Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--	5	0.05	5	0.01
	Noturus leptacanthus - speckled madtom	9	1.38	--	--	2	0.05	--	--	--	--	--	--	--	--	11	0.03
	Noturus miurus - brindled madtom	--	--	--	--	--	--	--	--	--	--	--	--	10	0.11	10	0.02
	Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	1	--
	Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	4	0.04	4	0.01
Esocidae - pikes																	
	Esox niger - chain pickerel	--	--	--	--	1	0.02	--	--	--	--	5	0.05	2	0.02	8	0.02
Atherinopsidae - new world silversides																	
	Labidesthes sicculus - brook silverside	--	--	--	--	--	--	23	0.16	--	--	2	0.02	139	1.50	164	0.40

Table 2. Fish species collected in the Tennessee and Black Warrior River systems.

Family / Species - common name	Warrior River		Tennessee River												Total	
			Chickamauga		Guntersville		Wheeler		Lower Elk		Pickwick		Bear			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fundulidae - topminnows																
Fundulus catenatus - northern studfish	--	--	3	0.39	3	0.07	26	0.18	52	3.02	26	0.28	42	0.45	152	0.37
Fundulus notatus - blackstriped topminnow	--	--	--	--	2	0.05	83	0.57	--	--	--	--	--	--	85	0.21
Fundulus olivaceus - blackspotted topminnow	--	--	10	1.30	54	1.25	117	0.80	12	0.70	68	0.73	142	1.53	403	0.99
Poeciliidae - livebeaers																
Gambusia affinis - western mosquitofish	1	0.15	--	--	45	1.04	254	1.74	8	0.46	27	0.29	44	0.47	379	0.93
Cottidae - scuplins																
Cottus bairdi - mottled sculpin	--	--	--	--	2	0.05	--	--	--	--	195	2.08	--	--	197	0.48
Cottus carolinae - banded sculpin	--	--	32	4.15	215	4.97	705	4.85	63	3.66	339	3.62	169	1.82	1,523	3.75
Centrarchidae - sunfishes																
Ambloplites rupestris - rock bass	--	--	1	0.13	28	0.65	99	0.68	6	0.35	48	0.51	55	0.59	237	0.58
Lepomis auritus - redbreast sunfish	115	17.64	11	1.42	516	11.94	462	3.18	1	0.06	26	0.28	--	--	1,131	2.78
Lepomis cyanellus - green sunfish	36	5.52	--	--	253	5.85	900	6.19	26	1.51	246	2.63	90	0.97	1,551	3.81
Lepomis gulosus - warmouth	1	0.15	--	--	18	0.42	49	0.34	3	0.17	10	0.11	1	0.01	82	0.20
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	7	0.07	--	--	7	0.02
Lepomis macrochirus - bluegill	81	12.42	1	0.13	819	18.95	628	4.32	83	4.82	307	3.28	334	3.60	2,253	5.54
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	1	0.01	1	--
Lepomis megalotis - longear sunfish	13	1.99	--	--	69	1.60	648	4.46	62	3.60	384	4.10	477	5.14	1,653	4.06
Lepomis microlophus - redear sunfish	--	--	--	--	154	3.56	27	0.19	--	--	2	0.02	7	0.08	190	0.47
Lepomis miniatus - redspotted sunfish	--	--	74	9.59	36	0.83	5	0.03	--	--	--	--	4	0.04	119	0.29
Micropterus dolomieui - smallmouth bass	--	--	--	--	3	0.07	10	0.07	--	--	6	0.06	--	--	19	0.05
Micropterus punctulatus - spotted bass	1	0.15	1	0.13	8	0.19	14	0.10	4	0.23	3	0.03	82	0.88	113	0.28
Micropterus salmoides - largemouth bass	3	0.46	1	0.13	30	0.69	54	0.37	1	0.06	16	0.17	49	0.53	154	0.38
Pomoxis nigromaculatus - black crappie	5	0.77	--	--	1	0.02	2	0.01	--	--	--	--	--	--	8	0.02
hybrid centrarchid	--	--	--	--	4	--	14	--	--	--	--	--	2	--	20	--
Percidae - perches and darters																
Etheostoma blennioides - greenside darter	--	--	12	1.55	2	0.05	128	0.88	8	0.46	25	0.27	140	1.51	315	0.77
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	--	--	45	0.48	--	--	45	0.11
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	1	0.01	--	--	--	--	--	--	1	--
Etheostoma caeruleum - rainbow darter	--	--	--	--	5	0.12	302	2.08	36	2.09	644	6.87	210	2.26	1,197	2.94
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	11	0.12	--	--	11	0.03
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	8	0.09	--	--	8	0.02
Etheostoma duryi - black darter	--	--	--	--	58	1.34	741	5.10	31	1.80	136	1.45	68	0.73	1,034	2.54
Etheostoma flabellare - fantail darter	--	--	--	--	1	0.02	54	0.37	12	0.70	551	5.88	--	--	618	1.52
Etheostoma jessiae - blueside darter	--	--	14	1.81	10	0.23	52	0.36	4	0.23	2	0.02	20	0.22	102	0.25
Etheostoma kennicotti - stripetail darter	--	--	--	--	7	0.16	165	1.13	--	--	8	0.09	--	--	180	0.44
Etheostoma nigripinne - blackfin darter	--	--	--	--	--	--	155	1.07	60	3.48	64	0.68	26	0.28	305	0.75

Table 2. Fish species collected in the Tennessee and Black Warrior River systems.

Family	Species - common name	Warrior River		Tennessee River: Chickamauga		Guntersville		Wheeler		Lower Elk		Pickwick		Bear		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Percidae - *continued*																	
	Etheostoma nigrum - johnny darter	--	--	--	--	1	0.02	30	0.21	--	--	2	0.02	--	--	33	0.08
	Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	3	0.03	3	0.01
	Etheostoma rufilineatum - redline darter	--	--	188	24.35	7	0.16	604	4.15	305	17.71	577	6.16	1,343	14.46	3,024	7.44
	Etheostoma tennesseense - Tennessee darter	--	--	72	9.33	23	0.53	367	2.52	73	4.24	106	1.13	292	3.14	933	2.29
	Etheostoma stigmaeum - speckled darter	3	0.46	--	--	--	--	--	--	--	--	--	--	40	0.43	43	0.11
	Etheostoma zonale - banded darter	--	--	--	--	--	--	44	0.30	--	--	2	0.02	--	--	46	0.11
	Etheostoma zonistium - bandfin darter	--	--	--	--	--	--	--	--	--	--	--	--	15	0.16	15	0.04
	Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	21	0.23	21	0.05
	Perca flavescens - yellow perch	--	--	--	--	2	0.05	--	--	--	--	--	--	--	--	2	--
	Percina burtoni - blotchside logperch	--	--	--	--	--	--	2	0.01	--	--	--	--	--	--	2	--
	Percina caprodes - logperch	--	--	--	--	25	0.58	59	0.41	4	0.23	59	0.63	141	1.52	288	0.71
	Percina evides - gilt darter	--	--	--	--	--	--	--	--	--	--	2	0.02	22	0.24	24	0.06
	Percina nigrofasciata - blackbanded darter	44	6.75	--	--	--	--	--	--	--	--	--	--	--	--	44	0.11
	Percina sciera - dusky darter	--	--	--	--	--	--	2	0.01	--	--	--	--	8	0.09	10	0.02
Sciaenidae - drums																	
	Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	1	0.01	--	--	--	--	--	--	1	--
Elassomatidae - pygmy sunfishes																	
	Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	36	0.39	36	0.09
	Total individuals collected	652		772		4,323		14,539		1,722		9,371		9,287		40,666	
	Number of species collected	23		24		53		70		40		61		69		107	
	Total collections	5		1		16		32		4		18		21		97	
	Average catch per sample	130		772		270		454		431		521		442		419	
	Average catch per effort	4.08		24.13		8.44		14.19		13.45		16.27		13.81		13.10	

8.9 percent, and *Lythrurus fasciolaris* (scarlet shiner) 4.9 percent (table 7). Largescale stonerollers dominated the fauna across all Tennessee River tributaries and are an important component of some IBI metrics. Eight sucker species were collected and this family only represented about 1.6 percent of the total catch, while 10 species of catfishes and madtoms were collected representing less than 1 percent of the catch. Sunfishes in the family Centrarchidae were common and represented about 18.5 percent of the catch. The bluegill, *Lepomis macrochirus*, dominated the sunfish catch at 5.5 percent followed by the longear sunfish, *Lepomis megalotis*, at 4.1 percent, the green sunfish, *Lepomis cyanellus*, at 3.8 percent, and the redbreast sunfish, *Lepomis auritus*, at 2.8 percent of the total catch. Darters in the family Percidae accounted for about 20.4 percent of the catch with the redline darter, *Etheostoma rufilineatum*, most common at 7.4 percent followed by the rainbow darter, *E. caeruleum* at 2.9 percent, and the black darter, *E. duryi*, at 2.5 percent.

Rapid habitat assessment scores were summed for each site (table 3) to yield a raw total habitat score. This raw value was then divided by the highest possible habitat score for the index (220 for the glide-pool method, 240 for the riffle-run method) to yield a value which was termed percent of maximum habitat (percent max habitat). About 28 percent of the sites ranked in the very poor (≤50 percent max habitat score) to poor (51-60 percent) range, 18 percent in the fair (61 -70 percent) range, 39 percent in the good (71-80 percent) range, and six percent in the excellent (>80 percent) habitat quality range.

Eight measures of human disturbance were calculated using GIS (table 4). These values were then weighted by the LDI (table 5) and the resulting values summed to yield the HDG score for each site. This value allowed comparison of watersheds relative to the degree of disturbance due to human causes–primarily urban and agricultural. The HDG is a unitless measure and varied from <50, a low level of disturbance, to more than 1,000, a high level of disturbance (fig. 5). Nineteen percent of the sites scored in the least disturbed range (<100), 23 percent in the low disturbance range (101-200), 47 percent in the moderately disturbed range (201-400), and 11 percent of the sites scored in the highest disturbed range (>400) (fig. 5).

Table 3. Rapid habitat assessment scores for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Rapid habitat assessment metrics [1]															Sum	Percent max habitat
	Riffle-run												Glide-pool				
	INCOV	EPISUR	EMBED	VELDEP	CHALT	SEDDEP	RIFREQ	CHSTA	BKCON	BKVEG	DISP	RIPVEG	PSUB	PVAR	CHSIN		
ALDM-234	5	4	5	9	6	3	1	16	6	11	9	3	--	--	--	78	32.50
ANDL-8	17	11	15	15	16	14	14	13	13	15	16	18	--	--	--	177	73.75
BAKM-2	15	14	10	12	12	10	15	16	9	16	16	8	--	--	--	153	63.75
BCBC-1	17	14	13	10	16	10	16	14	10	12	10	9	--	--	--	151	62.92
BCNJ-1	5	9	6	11	14	9	0	16	13	16	16	10	--	--	--	125	52.08
BEA-2	16	12	19	14	17	19	18	9	16	18	18	18	--	--	--	194	80.83
BERF-11	10	12	6	15	16	7	17	16	7	13	16	6	--	--	--	141	58.75
BERF-2	12	8	10	11	15	13	4	16	5	14	14	5	--	--	--	127	52.92
BERF-4	16	14	11	12	16	12	15	17	15	18	18	16	--	--	--	180	75.00
BERF-5	9	5	2	11	16	4	10	16	5	14	12	12	--	--	--	116	48.33
BFDM-1	17	16	11	12	13	15	13	17	15	16	16	12	--	--	--	173	72.08
BGNL-37	16	14	17	16	13	16	12	17	15	12	18	16	--	--	--	182	75.83
BIGL-14	12	9	18	9	18	17	17	16	14	14	18	18	--	--	--	180	75.00
BINC-190	12	13	13	17	16	12	16	17	10	14	18	16	--	--	--	174	72.50
BINC-192	18	12	12	14	16	12	16	15	14	13	16	16	--	--	--	174	72.50
BLFL-1	15	18	16	11	17	13	18	19	17	18	18	16	--	--	--	196	81.67
BLWL-11	16	17	12	16	15	10	17	17	18	16	18	14	--	--	--	186	77.50
BMDB-1	13	16	10	13	16	15	14	16	12	14	16	12	--	--	--	167	69.58
BMPL-2	16	16	16	16	17	15	18	16	16	18	18	18	--	--	--	200	83.33
BPTL-1	16	7	9	11	13	10	10	15	15	15	17	18	--	--	--	156	65.00
BRHL-1	14	15	16	11	13	12	16	8	15	18	20	17	--	--	--	175	72.92
BTLL-1	18	18	16	17	14	12	13	17	11	14	18	14	--	--	--	182	75.83
BVDM-17	16	16	14	14	15	14	14	17	12	15	15	12	--	--	--	174	72.50
BWSM-1	4	6	9	7	15	6	3	17	14	16	16	18	--	--	--	131	54.58
BZDC-1	18	13	13	13	16	11	12	15	12	11	7	5	--	--	--	146	60.83
CDRF-2	17	15	13	15	16	16	9	15	15	16	16	13	--	--	--	176	73.33
CDRF-22	16	13	12	12	15	10	12	15	8	14	12	15	--	--	--	154	64.17
CDRF-5	10	8	9	12	15	11	8	17	11	15	18	16	--	--	--	150	62.50
CDRL-1	18	15	17	14	17	13	18	10	16	17	17	12	--	--	--	184	76.67
CEDF-21	16	10	13	12	17	14	12	14	12	16	14	12	--	--	--	162	67.50
CERF-1	12	9	10	15	16	8	7	16	8	12	16	15	--	--	--	144	60.00
CERF-2	16	12	12	16	16	14	10	16	4	12	16	12	--	--	--	156	65.00
CFRJ-161	10	5	17	13	16	17	16	16	15	16	15	13	--	--	--	169	70.42
CLBC-11	17	16	16	17	15	11	17	14	15	18	16	18	--	--	--	190	79.17
CLEJ-100	16	14	10	14	1	7	12	16	6	10	11	6	--	--	--	123	51.25

[1] INCOV-instream cover, EPISUR-epifaunal surface development, EMBED-embeddedness, VELDEP-velocity/depth regimes, CHALT-man-made channel alteration, SEDDEP-sediment deposition, RIFREQ-frequency of riffles, CHSTA-channel flow status, BKCON-bank condition, BKVEG-bank vegetative protection, DISP-bank disruptive pressure, RIPVEG-riparian vegetative zone width, PSUB-pool substrate characterization, PVAR-pool variability, CHSIN-channel sinuosity,

Table 3. Rapid habitat assessment scores for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Rapid habitat assessment metrics [1]															Sum	Percent max habitat
	Riffle-run												Glide-pool				
	INCOV	EPISUR	EMBED	VELDEP	CHALT	SEDDEP	RIFREQ	CHSTA	BKCON	BKVEG	DISP	RIPVEG	PSUB	PVAR	CHSIN		
COXL-1	14	12	9	13	15	10	14	16	5	11	14	10	--	--	--	143	59.58
CPRL-1	17	17	15	17	16	8	16	16	6	12	10	6	--	--	--	156	65.00
CRDM-1	7	9	10	7	12	7	1	18	9	4	13	14	--	--	--	111	46.25
CSPJ-70	8	9	9	12	3	9	6	14	8	12	12	2	--	--	--	104	43.33
CSPJ-70A	8	9	11	6	10	12	0	16	15	16	16	0	--	--	--	119	49.58
FIRL-1	14	14	19	15	15	16	14	16	18	15	15	13	--	--	--	184	76.67
FLTM-1	16	16	17	16	15	10	14	17	14	12	12	14	--	--	--	173	72.08
FXTC-1	17	17	12	16	16	11	17	16	16	18	18	16	--	--	--	190	79.17
HERM-1	8	9	3	8	7	4	0	16	10	10	6	4	--	--	--	85	35.42
HESM-1	17	17	16	15	15	16	13	16	15	14	13	8	--	--	--	175	72.92
HSBM-242A	12	8	14	11	0	13	6	17	13	16	12	0	--	--	--	122	50.83
HURM-11	15	12	16	12	10	16	11	18	8	8	10	12	--	--	--	148	61.67
HURR-1	14	15	13	17	14	13	15	17	13	16	16	15	--	--	--	178	74.17
INCL-1	16	16	18	12	18	13	16	14	19	18	20	16	--	--	--	196	81.67
INDM-250	11	13	7	16	13	10	13	17	11	12	16	18	--	--	--	157	65.42
JNSJ-2	10	--	--	--	16	10	--	16	9	16	16	14	10	16	16	149	67.73
KBYJ-1	16	9	15	14	13	16	14	16	15	14	11	5	--	--	--	158	65.83
LBTL-1	17	18	19	16	15	14	17	18	12	17	15	16	--	--	--	194	80.83
LCPL-2	14	15	17	17	11	10	15	14	12	18	14	18	--	--	--	175	72.92
LDYL-1	16	14	14	15	16	12	16	11	13	16	13	14	--	--	--	170	70.83
LFKB-11	11	12	5	15	16	7	8	16	10	16	16	13	--	--	--	145	60.42
LPNT-1	10	14	11	16	12	13	17	17	9	16	13	5	--	--	--	153	63.75
LRKJ-11	19	19	19	19	19	16	13	16	13	16	18	16	--	--	--	203	84.58
LTBF-1	16	16	10	11	16	13	14	15	10	14	16	13	--	--	--	164	68.33
LTBF-11	17	17	16	17	17	10	16	1	10	16	18	13	--	--	--	168	70.00
LTBF-12	18	18	16	17	16	17	15	15	12	16	16	13	--	--	--	189	78.75
LTBF-14	10	11	7	13	16	5	9	16	8	12	16	16	--	--	--	139	57.92
MCDL-360	8	10	11	11	14	9	16	14	9	7	11	8	--	--	--	128	53.33
MCKC-1	16	9	13	11	11	10	6	6	3	9	6	2	--	--	--	102	42.50
MDCL-2	14	16	17	18	14	11	17	14	14	16	18	18	--	--	--	187	77.92
MFBN-2	3	--	--	--	14	6	--	16	4	14	18	13	12	11	7	118	53.64
MLBF-1	9	--	--	--	16	10	--	12	11	14	17	15	11	9	14	138	62.73
MTNM-2	17	15	14	16	17	16	18	16	15	16	16	14	--	--	--	190	79.17
NSTJ-2	1	4	4	6	9	4	0	16	4	12	10	2	--	--	--	72	30.00
PNTL-1	17	10	18	13	18	13	17	10	15	16	18	12	--	--	--	177	73.75

[1] INCOV-instream cover, EPISUR-epifaunal surface development, EMBED-embeddedness, VELDEP-velocity/depth regimes, CHALT-man-made channel alteration, SEDDEP-sediment deposition, RIFREQ-frequency of riffles, CHSTA-channel flow status, BKCON-bank condition, BKVEG-bank vegetative protection, DISP-bank disruptive pressure, RIPVEG-riparian vegetative zone width, PSUB-pool substrate characterization, PVAR-pool variability, CHSIN-channel sinuosity,

Table 3. Rapid habitat assessment scores for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Rapid habitat assessment metrics [1]															Sum	Percent max habitat
	Riffle-run												Glide-pool				
	INCOV	EPISUR	EMBED	VELDEP	CHALT	SEDDEP	RIFREQ	CHSTA	BKCON	BKVEG	DISP	RIPVEG	PSUB	PVAR	CHSIN		
PRRJ-21	17	16	11	16	17	15	15	17	14	18	18	15	--	--	--	189	78.75
QTRW-2	8	10	9	8	16	7	8	14	9	14	12	7	--	--	--	122	50.83
RBYJ-2	2	3	1	2	4	1	0	16	4	12	12	4	--	--	--	61	25.42
RCKC-11	16	16	15	14	16	9	15	15	5	16	16	16	--	--	--	169	70.42
REDD-1	16	5	16	15	16	16	16	16	14	16	16	16	--	--	--	178	74.17
RNIL-400	8	9	11	10	10	10	8	17	9	13	14	11	--	--	--	130	54.17
SCDL-11	9	12	7	7	10	6	12	16	14	14	14	12	--	--	--	133	55.42
SCRL-2	16	13	12	17	14	12	16	16	12	8	16	16	--	--	--	168	70.00
SCRL-2	16	16	8	16	16	10	13	16	13	16	16	13	--	--	--	169	70.42
SGRL-3	12	13	18	16	17	16	15	16	12	14	16	14	--	--	--	179	74.58
SHGC-1	15	10	11	12	13	7	14	9	7	11	12	10	--	--	--	131	54.58
SHM-3A	8	7	11	10	15	10	4	13	10	12	14	14	--	--	--	128	53.33
SHOL-1	13	17	16	17	16	10	15	15	14	16	14	14	--	--	--	177	73.75
SLAM-3	4	14	3	13	16	5	9	16	8	14	16	14	--	--	--	132	55.00
SLRL-1	13	16	17	13	16	12	15	16	10	14	16	13	--	--	--	171	71.25
SNDL-3	17	17	16	16	16	16	17	16	15	15	16	15	--	--	--	192	80.00
SNKL-7	16	12	5	13	16	6	16	12	7	13	15	15	--	--	--	146	60.83
SSTD-1	13	14	16	16	14	11	13	17	16	14	16	16	--	--	--	176	73.33
SWNL-1	16	17	16	12	11	10	16	15	10	14	16	12	--	--	--	165	68.75
SWNL-390	15	11	16	16	12	15	10	17	14	14	14	16	--	--	--	170	70.83
SWTL-1	9	11	9	4	0	6	8	18	1	16	2	0	--	--	--	84	35.00
TCD-3	16	12	11	13	16	15	15	16	14	14	16	14	--	--	--	172	71.67
TWND-4	11	10	12	13	17	13	10	17	10	14	18	16	--	--	--	161	67.08
TWND-61	16	15	6	16	16	10	12	16	10	16	16	16	--	--	--	165	68.75
WFFM-1	15	16	18	14	16	10	13	17	15	16	16	14	--	--	--	180	75.00
WFLDE-1	15	16	8	16	16	9	13	16	6	14	12	4	--	--	--	145	60.42
WFLL-15	14	12	9	12	16	7	13	16	4	16	18	18	--	--	--	155	64.58

[1] INCOV-instream cover, EPISUR-epifaunal surface development, EMBED-embeddedness, VELDEP-velocity/depth regimes, CHALT-man-made channel alteration, SEDDEP-sediment deposition, RIFREQ-frequency of riffles, CHSTA-channel flow status, BKCON-bank condition, BKVEG-bank vegetative protection, DISP-bank disruptive pressure, RIPVEG-riparian vegetative zone width, PSUB-pool substrate characterization, PVAR-pool variability, CHSIN-channel sinuosity,

Table 4. Human disturbance metrics for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Human density (no./km^2)	Phosphorus load (kg/ha/yr)	Land cover (percent) Urban	Barren	Pasture	Cropland	Road density (km/km^2)	Stream-road crossings (no./km)
ALDM-234	462.84	0.820	51.42	0.00	11.17	0.76	4.841	1.141
ANDL-8	17.46	0.794	5.79	0.00	48.48	9.30	1.861	0.823
BAKM-2	173.16	0.902	27.37	0.41	29.46	11.45	2.812	1.252
BCBC-1	1.73	0.272	2.41	0.00	3.18	1.76	0.702	0.418
BCNJ-1	3.02	0.351	1.20	0.01	7.59	2.39	0.621	0.357
BEA-2	26.27	0.509	7.29	0.48	26.36	2.13	1.872	0.411
BERF-11	19.33	0.465	3.21	0.02	15.08	1.04	1.655	0.347
BERF-2	18.90	0.462	25.77	1.22	21.99	1.50	1.628	0.345
BERF-4	23.88	0.501	7.00	0.34	24.64	2.47	1.846	0.401
BERF-5	6.67	0.376	6.74	0.40	15.14	1.68	1.267	0.241
BFDM-1	331.88	1.146	52.79	0.03	12.13	16.28	4.242	1.824
BGNL-37	29.98	0.711	6.95	0.22	37.97	9.20	1.638	0.586
BIGL-14	77.98	0.882	7.08	0.00	53.05	11.77	2.133	0.687
BINC-190	50.75	0.884	7.51	0.21	45.79	13.76	2.051	0.586
BINC-192	45.77	0.939	6.68	0.00	49.04	15.75	1.907	0.636
BLFL-1	13.57	0.476	4.56	0.00	1.68	10.76	1.499	0.557
BLWL-11	28.16	0.750	6.46	0.01	43.75	8.18	1.878	0.626
BMDB-1	33.22	0.979	6.77	0.08	52.13	16.33	1.967	0.650
BMPL-2	3.44	0.434	2.85	0.00	3.36	7.97	0.854	0.223
BPTL-1	23.66	0.586	3.91	0.00	32.04	4.87	1.629	0.955
BRHL-1	6.24	0.369	2.65	0.00	1.75	5.99	0.679	0.240
BTLL-1	13.82	0.505	4.84	0.06	22.76	4.01	1.342	0.592
BVDM-17	65.50	1.281	7.08	0.07	23.87	41.04	1.444	0.462
BWSM-1	12.16	0.663	3.52	0.52	36.19	7.87	1.036	0.545
BZDC-1	2.17	0.262	2.29	0.00	1.09	0.72	0.722	0.159
CDRF-2	28.34	0.400	6.50	0.37	14.78	1.77	1.636	0.486
CDRF-22	30.15	0.406	2.29	0.00	1.12	0.75	1.688	0.499
CDRF-5	11.37	0.383	2.90	1.03	17.67	1.07	1.143	0.319
CDRL-1	0.00	0.307	3.10	0.00	0.00	4.41	1.468	0.712
CEDF-21	54.23	0.511	4.89	0.00	30.48	1.07	2.164	0.629
CERF-1	21.33	0.386	5.65	0.27	14.51	1.58	1.485	0.394
CERF-2	30.46	0.406	2.28	0.00	1.05	0.21	1.694	0.501
CFRJ-161	32.75	0.658	6.16	0.04	34.15	6.83	1.937	0.671
CLBC-11	1.61	0.375	1.68	0.00	12.07	2.66	0.652	0.246
CLEJ-100	2.87	0.334	0.73	0.00	8.67	1.15	0.335	0.282
COXL-1	342.13	0.966	48.81	0.08	24.35	5.52	4.449	1.654
CPRL-1	309.25	1.201	39.72	0.00	19.57	22.58	4.145	1.419
CRDM-1	15.53	0.623	3.64	0.06	42.00	4.27	1.286	0.516
CSPJ-70	19.42	0.738	4.90	0.05	27.62	13.02	1.300	0.674
CSPJ-70A	17.24	0.782	4.94	0.09	27.21	15.40	1.295	0.642
FIRL-1	24.95	0.892	5.42	0.00	46.19	15.17	1.823	0.717
FLTM-1	47.61	1.136	7.44	0.02	41.83	27.41	1.606	0.597
FXTC-1	19.97	0.631	4.12	0.03	52.47	1.14	1.090	0.278
HERM-1	17.23	0.676	4.08	0.30	51.91	3.27	1.377	0.440
HESM-1	23.43	1.107	5.53	0.04	38.72	27.71	1.413	0.696
HSBM-242A	700.11	0.962	69.29	1.38	4.75	1.69	6.867	1.967
HURM-11	17.53	0.566	3.58	0.01	21.33	7.35	0.778	0.358
HURR-1	2.66	0.278	0.92	0.00	2.99	0.13	0.571	0.181
INCL-1	44.96	0.597	6.92	0.00	31.09	5.03	1.913	0.806
INDM-250	132.04	1.110	21.75	0.10	22.38	25.95	2.417	0.958

Table 4. Human disturbance metrics for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Human density (no./km^2)	Phosphorus load (kg/ha/yr)	Land cover (percent) Urban	Barren	Pasture	Cropland	Road density (km/km^2)	Stream-road crossings (no./km)
JNSJ-2	6.04	0.350	1.58	0.00	11.04	0.71	0.485	0.160
KBYJ-1	42.50	0.939	7.70	0.02	35.57	19.66	2.317	0.731
LBTL-1	11.35	0.406	2.87	0.02	14.13	3.04	1.160	0.442
LCPL-2	54.51	0.681	10.00	0.04	28.24	8.79	1.749	0.536
LDYL-1	35.00	1.090	7.49	0.02	21.86	32.41	1.854	0.889
LFKB-11	40.64	0.746	8.58	0.12	38.73	8.64	1.987	0.714
LPNT-1	15.97	0.475	3.71	0.02	17.50	4.16	1.176	0.389
LRKJ-11	2.36	0.307	1.33	0.00	5.72	0.59	0.699	0.442
LTBF-1	13.07	0.498	6.03	0.23	21.16	2.27	1.640	0.405
LTBF-11	10.33	0.370	4.48	0.13	15.00	1.08	1.333	0.274
LTBF-12	11.62	0.386	5.65	0.27	14.52	1.58	1.421	0.277
LTBF-14	18.58	0.451	5.77	0.32	23.49	0.92	1.687	0.359
MCDL-360	17.93	0.685	4.37	0.05	45.77	5.78	1.185	0.512
MCKC-1	55.40	0.880	6.04	0.00	48.90	14.69	1.415	0.773
MDCL-2	14.00	0.617	4.08	0.00	24.76	9.66	1.362	0.515
MFBN-2	40.50	0.728	8.87	0.12	51.07	4.86	1.824	0.787
MLBF-1	3.60	0.261	2.41	0.00	4.57	0.30	0.564	0.100
MTNM-2	13.46	0.655	2.89	0.00	12.52	14.80	0.555	0.167
NSTJ-2	17.40	0.491	3.01	0.04	23.38	3.23	1.001	0.493
PNTL-1	0.08	0.361	2.16	0.00	2.38	6.33	1.039	0.659
PRRJ-21	2.82	0.321	1.10	0.00	5.79	1.40	0.619	0.303
QTRW-2	113.62	0.641	6.14	0.24	21.44	2.25	3.553	1.052
RBYJ-2	15.03	0.577	2.88	0.04	21.14	8.62	1.183	0.456
RCKC-11	1.49	0.271	7.03	0.34	24.63	2.47	0.791	0.137
REDD-1	19.54	0.855	5.27	0.07	43.97	13.71	1.963	0.626
RNIL-400	48.48	0.953	6.80	0.01	44.96	18.38	1.531	0.741
SCDL-11	18.12	0.755	5.37	0.01	49.24	7.34	1.796	0.725
SCRL-2	38.79	0.855	7.98	0.04	48.99	10.69	2.302	0.826
SCRL-2	38.79	0.855	7.98	0.04	49.00	10.69	2.302	0.826
SGRL-3	15.36	0.642	4.88	0.04	39.50	5.07	1.555	0.731
SHGC-1	41.05	0.838	2.91	0.00	60.44	9.46	1.087	0.644
SHM-3A	51.89	0.845	8.41	0.05	48.20	10.29	2.580	0.901
SHOL-1	14.67	0.499	4.29	0.02	29.27	1.53	1.523	0.860
SLAM-3	125.46	0.905	25.03	0.04	40.42	7.85	3.212	1.111
SLRL-1	35.51	0.757	5.03	0.00	32.50	12.86	1.409	0.380
SNDL-3	4.36	0.345	2.41	0.02	6.70	3.07	0.903	0.332
SNKL-7	15.30	1.308	5.97	0.04	39.50	37.37	1.305	0.487
SSTD-1	52.61	0.854	8.84	0.02	44.28	11.89	2.452	0.821
SWNL-1	44.83	0.767	5.73	0.02	42.04	10.63	1.550	0.574
SWNL-390	142.33	0.976	21.24	0.02	32.45	16.42	2.858	0.975
SWTL-1	779.08	1.199	96.33	0.00	1.33	1.26	10.329	2.801
TCD-3	33.04	0.775	6.91	0.08	40.78	10.07	2.175	0.658
TWND-4	32.36	0.780	6.85	0.07	41.45	10.09	2.147	0.642
TWND-61	19.44	0.640	5.13	0.25	24.71	9.68	1.734	0.681
WFFM-1	45.83	1.123	7.29	0.02	44.40	25.91	1.627	0.610
WFLDE-1	9.93	0.413	3.89	0.11	16.67	1.76	1.324	0.343
WFLL-15	4.49	0.265	0.90	0.00	2.33	0.04	0.399	0.130

Table 5. LDI-weighted human disturbance metrics for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Human density (no./km^2)	Phosphorus load (kg/ha/yr)	Land cover (percent)				Road density (km/km^2)	Stream-road crossings (no./km)	Sum
			Urban	Barren	Pasture	Cropland			
	LDI values								
	1.00	**1.00**	**8.00**	**7.00**	**3.10**	**4.70**	**8.30**	**8.30**	
ALDM-234	462.84	4.101	411.38	0.00	34.63	3.58	40.181	9.472	966.18
ANDL-8	17.46	3.968	46.35	0.00	150.29	43.73	15.450	6.829	284.08
BAKM-2	173.16	4.511	218.96	2.84	91.32	53.84	23.338	10.395	578.35
BCBC-1	1.73	1.360	19.29	0.00	9.86	8.30	5.823	3.470	49.82
BCNJ-1	3.02	1.753	9.57	0.04	23.53	11.24	5.157	2.961	57.27
BEA-2	26.27	2.546	58.30	3.39	81.71	10.01	15.535	3.411	201.17
BERF-11	19.33	2.325	25.69	0.14	46.74	4.88	13.736	2.882	115.72
BERF-2	18.90	2.309	206.16	8.57	68.18	7.04	13.512	2.863	327.53
BERF-4	23.88	2.504	55.99	2.36	76.40	11.61	15.321	3.327	191.39
BERF-5	6.67	1.879	53.92	2.82	46.93	7.92	10.512	2.001	132.65
BFDM-1	331.88	5.732	422.34	0.22	37.60	76.50	35.211	15.138	924.63
BGNL-37	29.98	3.557	55.62	1.57	117.70	43.23	13.595	4.860	270.12
BIGL-14	77.98	4.409	56.65	0.00	164.44	55.31	17.703	5.705	382.20
BINC-190	50.75	4.418	60.09	1.47	141.95	64.68	17.026	4.862	345.25
BINC-192	45.77	4.696	53.47	0.00	152.02	74.01	15.830	5.282	351.07
BLFL-1	13.57	2.381	36.47	0.00	5.20	50.58	12.444	4.625	125.28
BLWL-11	28.16	3.749	51.69	0.10	135.62	38.44	15.588	5.199	278.54
BMDB-1	33.22	4.895	54.15	0.59	161.59	76.73	16.330	5.397	352.91
BMPL-2	3.44	2.172	22.80	0.00	10.40	37.46	7.091	1.850	85.22
BPTL-1	23.66	2.932	31.24	0.00	99.32	22.87	13.519	7.925	201.47
BRHL-1	6.24	1.844	21.20	0.00	5.44	28.16	5.635	1.993	70.51
BTLL-1	13.82	2.523	38.71	0.39	70.54	18.84	11.141	4.917	160.88
BVDM-17	65.50	6.404	56.65	0.51	74.00	192.91	11.982	3.833	411.78
BWSM-1	12.16	3.315	28.15	3.63	112.17	37.00	8.599	4.525	209.55
BZDC-1	2.17	1.309	18.35	0.00	3.39	3.40	5.993	1.316	35.93
CDRF-2	28.34	2.002	51.99	2.58	45.81	8.31	13.577	4.033	156.65
CDRF-22	30.15	2.032	18.29	0.00	3.46	3.53	14.010	4.143	75.62
CDRF-5	11.37	1.915	23.21	7.22	54.78	5.04	9.491	2.646	115.67
CDRL-1	0.00	1.534	24.78	0.00	0.00	20.72	12.181	5.912	65.12
CEDF-21	54.23	2.556	39.10	0.00	94.50	5.02	17.963	5.220	218.59
CERF-1	21.33	1.928	45.23	1.92	44.97	7.43	12.327	3.267	138.39
CERF-2	30.46	2.032	18.23	0.00	3.26	1.00	14.064	4.155	73.20
CFRJ-161	32.75	3.289	49.31	0.30	105.88	32.12	16.075	5.571	245.29
CLBC-11	1.61	1.876	13.47	0.00	37.41	12.49	5.412	2.044	74.31
CLEJ-100	2.87	1.672	5.87	0.00	26.86	5.42	2.783	2.337	47.82
COXL-1	342.13	4.830	390.49	0.54	75.50	25.94	36.925	13.727	890.09
CPRL-1	309.25	6.005	317.76	0.00	60.67	106.12	34.403	11.774	845.98
CRDM-1	15.53	3.116	29.10	0.39	130.20	20.06	10.672	4.284	213.35
CSPJ-70	19.42	3.689	39.23	0.34	85.64	61.21	10.791	5.595	225.90
CSPJ-70A	17.24	3.909	39.54	0.65	84.36	72.38	10.747	5.331	234.15
FIRL-1	24.95	4.461	43.39	0.00	143.19	71.32	15.132	5.950	308.39
FLTM-1	47.61	5.681	59.50	0.13	129.67	128.84	13.327	4.952	389.70
FXTC-1	19.97	3.155	32.98	0.18	162.64	5.34	9.049	2.304	235.62
HERM-1	17.23	3.381	32.66	2.10	160.93	15.39	11.426	3.654	246.77
HESM-1	23.43	5.535	44.27	0.28	120.02	130.25	11.730	5.780	341.29
HSBM-242A	700.11	4.809	554.30	9.69	14.73	7.95	56.996	16.329	1364.91
HURM-11	17.53	2.831	28.64	0.04	66.12	34.53	6.460	2.973	159.12
HURR-1	2.66	1.388	7.37	0.03	9.28	0.62	4.736	1.505	27.59
INCL-1	44.96	2.985	55.37	0.00	96.37	23.63	15.875	6.691	245.87
INDM-250	132.04	5.549	173.99	0.69	69.38	121.97	20.061	7.948	531.63

Table 5. LDI-weighted human disturbance metrics for sites in the Tennessee Valley and Plateau ichthyoregions.

Stream sites	Human density (no./km^2)	Phosphorus load (kg/ha/yr)	Land cover (percent) Urban	Barren	Pasture	Cropland	Road density (km/km^2)	Stream-road crossings (no./km)	Sum
LDI values									
	1.00	**1.00**	**8.00**	**7.00**	**3.10**	**4.70**	**8.30**	**8.30**	
JNSJ-2	6.04	1.750	12.61	0.00	34.21	3.32	4.024	1.324	63.28
KBYJ-1	42.50	4.694	61.63	0.17	110.27	92.38	19.235	6.065	336.94
LBTL-1	11.35	2.032	22.99	0.15	43.81	14.30	9.628	3.671	107.93
LCPL-2	54.51	3.405	80.00	0.31	87.55	41.33	14.515	4.446	286.06
LDYL-1	35.00	5.448	59.96	0.15	67.78	152.33	15.385	7.379	343.44
LFKB-11	40.64	3.729	68.60	0.83	120.06	40.59	16.495	5.925	296.87
LPNT-1	15.97	2.373	29.65	0.11	54.25	19.57	9.761	3.231	134.91
LRKJ-11	2.36	1.533	10.67	0.00	17.72	2.79	5.800	3.665	44.54
LTBF-1	13.07	2.490	48.23	1.64	65.60	10.65	13.616	3.363	158.66
LTBF-11	10.33	1.851	35.88	0.93	46.51	5.05	11.064	2.275	113.89
LTBF-12	11.62	1.928	45.24	1.92	45.00	7.41	11.797	2.303	127.21
LTBF-14	18.58	2.255	46.18	2.24	72.80	4.30	14.006	2.980	163.34
MCDL-360	17.93	3.426	34.99	0.36	141.90	27.19	9.836	4.246	239.87
MCKC-1	55.40	4.400	48.35	0.00	151.60	69.07	11.745	6.414	346.97
MDCL-2	14.00	3.084	32.67	0.00	76.76	45.39	11.308	4.275	187.48
MFBN-2	40.50	3.639	70.93	0.85	158.32	22.83	15.138	6.535	318.75
MLBF-1	3.60	1.305	19.31	0.00	14.17	1.40	4.684	0.832	45.30
MTNM-2	13.46	3.275	23.08	0.00	38.81	69.56	4.606	1.388	154.19
NSTJ-2	17.40	2.454	24.07	0.25	72.46	15.17	8.308	4.094	144.21
PNTL-1	0.08	1.805	17.29	0.00	7.37	29.74	8.621	5.467	70.38
PRRJ-21	2.82	1.605	8.78	0.01	17.95	6.59	5.136	2.512	45.40
QTRW-2	113.62	3.205	49.14	1.71	66.46	10.59	29.486	8.733	282.93
RBYJ-2	15.03	2.885	23.04	0.30	65.52	40.50	9.821	3.783	160.88
RCKC-11	1.49	1.354	56.27	2.35	76.36	11.62	6.563	1.141	157.14
REDD-1	19.54	4.275	42.18	0.46	136.32	64.44	16.291	5.194	288.71
RNIL-400	48.48	4.764	54.38	0.08	139.39	86.38	12.705	6.152	352.33
SCDL-11	18.12	3.776	42.97	0.06	152.64	34.48	14.908	6.016	272.96
SCRL-2	38.79	4.275	63.81	0.30	151.88	50.24	19.102	6.853	335.25
SCRL-2	38.79	4.275	63.83	0.30	151.90	50.26	19.107	6.857	335.31
SGRL-3	15.36	3.211	39.02	0.31	122.46	23.83	12.907	6.068	223.15
SHGC-1	41.05	4.190	23.26	0.00	187.36	44.44	9.024	5.344	314.67
SHM-3A	51.89	4.226	67.30	0.34	149.41	48.35	21.414	7.475	350.40
SHOL-1	14.67	2.497	34.34	0.15	90.73	7.19	12.638	7.137	169.34
SLAM-3	125.46	4.524	200.24	0.26	125.30	36.90	26.660	9.221	528.56
SLRL-1	35.51	3.784	40.28	0.00	100.74	60.43	11.695	3.151	255.58
SNDL-3	4.36	1.727	19.26	0.13	20.77	14.42	7.492	2.755	70.91
SNKL-7	15.30	6.541	47.73	0.25	122.46	175.64	10.831	4.039	382.80
SSTD-1	52.61	4.271	70.70	0.15	137.28	55.89	20.353	6.818	348.07
SWNL-1	44.83	3.835	45.83	0.15	130.31	49.94	12.862	4.767	292.53
SWNL-390	142.33	4.882	169.88	0.13	100.58	77.16	23.718	8.094	526.77
SWTL-1	779.08	5.995	770.62	0.00	4.12	5.93	85.729	23.247	1674.73
TCD-3	33.04	3.877	55.30	0.57	126.41	47.33	18.054	5.459	290.06
TWND-4	32.36	3.901	54.79	0.49	128.51	47.44	17.818	5.331	290.64
TWND-61	19.44	3.200	41.06	1.75	76.60	45.48	14.394	5.656	207.58
WFFM-1	45.83	5.613	58.31	0.13	137.64	121.78	13.502	5.065	387.88
WFLDE-1	9.93	2.064	31.12	0.76	51.69	8.28	10.989	2.851	117.68
WFLL-15	4.49	1.325	7.17	0.00	7.23	0.18	3.315	1.075	24.78

SELECTION AND SCORING OF TENNESSEE VALLEY IBI METRICS

For IBI metrics to be useful they should have desirable statistical properties, have predictability as to their response to environmental variables, and have the power to discriminate between impaired streams and those least or minimally impaired. Thirty-five candidate metrics were evaluated for inclusion in the Tennessee Valley IBI and were selected because of their use in other applications of the IBI in Alabama by GSA (O'Neil and Shepard, 2000b; O'Neil and others, 2006; O'Neil and Shepard, 2009) and because of the extensive literature evaluating most of these metrics for use in other IBIs (Karr, 1981; Karr and others, 1986; Miller and others, 1988; Paller and others, 1996; Barbour and others, 1999; Simon, 1999b; Schleiger, 2000; McCormick and others, 2001; Teels and Danielson, 2001; Dauwalter and others, 2003; Compton and others, 2003). Angermeier and Karr (1986) conducted a detailed investigation into the relative contribution of various combinations of metrics to IBIs developed for Illinois, Ohio, and West Virginia. One of the important findings of their investigation was that "no metric appeared consistently best or worst at detecting degradation, and an IBI comprising all 12 metrics probably features greater utility than an IBI with fewer metrics."

Metrics were selected for inclusion in the IBI by evaluating responsiveness, scoring range, and redundancy (Hughes and others, 1998; McCormick and others, 2001). Responsiveness was evaluated by counting the number of significant correlations between IBI metric values and both habitat metric values (table 6) and human disturbance metric values (table 7). It was desirable to have at least five (25 percent) significant correlations, preferably distributed in both habitat and disturbance categories. Although for some metrics significant correlations were clumped into one of the two categories (for example, significant correlations for the metric number of omnivores and herbivores were clumped in the human disturbance category). The scoring range of diversity metrics was acceptable if it was >2 and for percentage metrics if it was >50 percent (table 8).

Table 6. Correlation coefficients between candidate IBI metrics and habitat assessment metrics.

Candidate IBI metrics	Habitat metrics [1]												
	INCOV	EPISUR	EMBED	VELDEP	CHALT	SEDDEP	RIFREQ	CHSTA	BKCON	BKVEG	DISP	RIPVEG	THAB
Species Richness and Composition													
Number of native species *	0.162	0.399	0.225	0.338	0.023	0.127	0.093	0.240	0.100	0.209	0.201	0.107	0.263
Number of cyprinid species	0.210	0.465	0.218	0.291	0.089	0.107	0.217	0.259	0.130	0.272	0.199	0.124	0.310
Number of shiner species *	0.224	0.411	0.202	0.369	0.150	0.154	0.217	0.219	0.145	0.281	0.294	0.230	0.351
Number of sucker species *	0.221	0.399	0.201	0.365	0.188	0.176	0.203	0.099	-0.005	0.243	0.213	0.121	0.295
Number of *Lepomis* species	-0.171	-0.142	-0.120	0.073	-0.130	-0.038	-0.168	0.308	0.073	-0.079	0.061	0.080	-0.049
Number of centrarchid species	-0.050	0.037	-0.049	0.190	-0.016	0.037	-0.090	0.331	0.083	0.000	0.077	0.127	0.068
Number of darter species	0.185	0.407	0.290	0.321	-0.015	0.184	0.069	0.185	0.076	0.163	0.192	0.085	0.256
Number of darter+madtom species *	0.198	0.420	0.300	0.342	0.015	0.174	0.099	0.145	0.078	0.168	0.217	0.105	0.273
Number of terete minnow species	0.069	0.276	0.043	-0.006	-0.056	-0.062	0.074	0.206	-0.022	0.137	-0.058	-0.095	0.052
Tolerance - Intolerance													
Percent dominant species	-0.060	-0.237	0.019	-0.190	-0.057	-0.098	-0.058	-0.199	-0.073	0.029	-0.232	-0.048	-0.139
Number of intolerant species *	0.194	0.335	0.237	0.291	0.088	0.189	0.137	0.215	0.162	0.188	0.183	0.087	0.277
Percent tolerant species *	-0.175	-0.369	-0.226	-0.241	-0.155	-0.176	-0.174	-0.174	-0.224	-0.402	-0.273	-0.273	-0.347
Percent green sunfish	-0.061	-0.278	-0.132	-0.125	-0.096	-0.086	-0.052	-0.198	-0.142	-0.464	-0.257	-0.124	-0.228
Percent stonerollers	0.190	0.177	0.175	0.082	-0.019	0.120	0.228	-0.032	0.028	0.153	-0.135	-0.038	0.124
Percent GSF+YBH [2]	-0.009	-0.284	-0.054	-0.108	-0.028	-0.042	0.006	-0.269	-0.067	-0.384	-0.186	-0.112	-0.166
Percent GSF+BG+ YBH+CC [2]	-0.242	-0.450	-0.229	-0.257	-0.038	-0.135	-0.139	-0.099	-0.095	-0.379	-0.167	-0.111	-0.281
Percent *Lepomis* species *	-0.389	-0.495	-0.392	-0.271	-0.078	-0.229	-0.321	0.063	-0.123	-0.374	-0.133	-0.055	-0.352
Percent sunfish	-0.384	-0.487	-0.388	-0.267	-0.075	-0.229	-0.317	0.063	-0.116	-0.373	-0.133	-0.051	-0.347
Trophic Structure													
Percent omnivores *	0.151	0.181	0.140	0.072	-0.065	0.090	0.207	0.001	0.009	0.160	-0.143	-0.101	0.090
Percent insectivorous cyprinids	0.126	0.215	0.118	0.165	0.063	0.073	0.080	0.123	-0.026	0.172	0.165	0.134	0.168
Percent invertivores *	-0.480	-0.377	-0.460	-0.237	0.025	-0.269	-0.363	0.187	-0.102	-0.144	0.063	0.049	-0.284
Percent top carnivores *	0.070	0.099	-0.029	-0.032	0.137	0.072	0.053	0.028	0.052	0.045	0.030	0.048	0.072
Abundance, Condition, and Reproduction													
Catch per effort	0.147	0.238	0.202	0.111	-0.053	0.078	0.091	0.051	0.132	0.292	-0.002	0.027	0.158
Percent DELT	-0.154	-0.106	-0.083	-0.261	-0.282	-0.097	-0.139	0.153	-0.220	0.014	-0.303	-0.161	-0.214
Percent hybrids	-0.016	0.020	-0.177	-0.034	-0.137	-0.080	-0.070	0.105	0.038	0.026	-0.140	-0.126	-0.085
Percent with DELT+hybrids *	-0.155	-0.105	-0.093	-0.262	-0.289	-0.102	-0.143	0.159	-0.218	0.016	-0.311	-0.168	-0.218
Percent simple lithophils	0.179	0.315	0.181	0.290	0.133	0.073	0.160	0.044	0.174	0.329	0.279	0.281	0.300
Percent manipulative lithophils	-0.040	-0.175	-0.114	-0.137	-0.059	-0.097	0.016	-0.051	-0.139	-0.202	-0.251	-0.117	-0.159
Percent lithophilic spawners	0.159	0.122	0.049	0.149	0.075	-0.057	0.221	-0.023	0.004	0.098	-0.037	0.168	0.127
Number of lithophilic spawners *	0.254	0.502	0.267	0.416	0.131	0.138	0.225	0.211	0.111	0.252	0.246	0.204	0.361
Percent simple miscellaneous	-0.170	-0.105	-0.095	-0.029	0.048	0.091	-0.203	0.186	-0.047	-0.015	0.163	0.017	-0.039
Percent manipulative miscellaneous	-0.036	-0.056	0.040	-0.179	-0.157	-0.019	-0.087	-0.176	0.046	-0.124	-0.128	-0.257	-0.136
Percent manipulative spawners	-0.058	-0.204	-0.097	-0.224	-0.134	-0.108	-0.025	-0.136	-0.119	-0.264	-0.316	-0.240	-0.226
Percent miscellaneous spawners	-0.159	-0.122	-0.046	-0.148	-0.073	0.058	-0.220	0.022	-0.004	-0.099	0.038	-0.166	-0.126
Percent simple lithophils+tolerants	-0.036	-0.136	-0.096	-0.009	-0.057	-0.139	-0.053	-0.163	-0.100	-0.162	-0.057	-0.055	-0.125

***** - metric included in Tennessee Valley ichthyoregion IBI.

Shaded box highlights coefficients statistically different from 0, critical r value = 0.203 [p=0.05, df=92]. Only sites evaluated with riffle-run protocol included.

[1] INCOV-instream cover; EPISUR-epifaunal surface quality; EMBED-embeddedness; VELDEP-velocity/depth combinations; CHALT-channel alteration; SEDDEP-sediment deposition; RIFFREQ-frequency of riffles; CHSTA-channel flow status; BKCON-bank condition; BKVEG-bank vegetative protection; DISP-grazing or other disruptive pressure; RIPVEG-riparian vegetation zone width; THAB-total habitat score.

[2] GSF-green sunfish, BG-bluegill, YBH-yellow bullhead, CC-channel catfish

Table 7. Correlation coefficients between candidate IBI metrics and human disturbance metrics.

Candidate IBI metrics	Human disturbance metrics [1]								
	HUDEN	PLOAD	PURB	PMMB	PPAS	PCROP	RDDENS	STXRD	HDG
Species Richness and Composition									
Number of native species *	-0.172	-0.359	-0.197	-0.031	-0.314	-0.225	-0.276	-0.267	-0.284
Number of cyprinid species	-0.113	-0.252	-0.150	-0.130	-0.251	-0.149	-0.171	-0.185	-0.206
Number of shiner species *	-0.216	-0.318	-0.238	-0.103	-0.169	-0.233	-0.228	-0.232	-0.294
Number of sucker species *	-0.095	-0.335	-0.097	0.045	-0.370	-0.213	-0.190	-0.247	-0.207
Number of Lepomis species	-0.043	0.161	-0.050	0.049	0.199	0.164	-0.113	0.007	0.017
Number of centrarchid species	-0.103	0.086	-0.096	0.075	0.132	0.111	-0.138	-0.050	-0.055
Number of darter species	-0.152	-0.360	-0.165	0.013	-0.319	-0.228	-0.269	-0.282	-0.262
Number of darter+madtom species *	-0.169	-0.388	-0.182	0.009	-0.333	-0.247	-0.275	-0.297	-0.283
Number of terete minnow species	0.135	-0.026	0.089	-0.080	-0.254	0.019	0.046	-0.007	0.059
Tolerance - Intolerance									
Percent dominant species	0.335	0.213	0.339	-0.037	0.011	0.068	0.396	0.361	0.348
Number of intolerant species *	-0.161	-0.284	-0.183	-0.062	-0.189	-0.185	-0.220	-0.175	-0.239
Percent tolerant species *	-0.048	0.103	-0.083	-0.066	0.205	0.101	-0.088	-0.025	-0.009
Percent green sunfish	-0.046	0.301	-0.040	-0.119	0.376	0.286	-0.046	0.046	0.077
Percent stonerollers	0.455	0.375	0.454	-0.025	-0.035	0.213	0.491	0.418	0.476
Percent GSF+YBH [2]	-0.071	0.202	-0.066	-0.138	0.260	0.231	-0.069	0.035	0.020
Percent GSF+BG+YBH+CC [2]	-0.095	0.186	-0.094	-0.120	0.292	0.184	-0.059	0.015	-0.005
Percent *Lepomis* species *	-0.078	0.241	-0.050	0.016	0.420	0.166	-0.022	0.038	0.049
Percent sunfish	-0.084	0.239	-0.056	0.012	0.422	0.167	-0.029	0.031	0.043
Trophic Structure									
Percent omnivores *	0.444	0.363	0.438	-0.024	-0.020	0.191	0.468	0.393	0.462
Percent insectivorous cyprinids	-0.037	-0.130	-0.060	0.003	-0.115	-0.074	-0.072	-0.076	-0.083
Percent invertivores *	-0.114	0.070	-0.085	0.078	0.252	0.014	-0.039	-0.036	-0.043
Percent top carnivores *	-0.083	-0.090	-0.067	0.096	-0.001	-0.113	-0.019	-0.076	-0.089
Abundance, Condition, and Reproduction									
Catch per effort	0.109	-0.087	0.073	-0.116	-0.225	-0.070	0.061	0.037	0.032
Percent DELT	0.454	0.197	0.468	-0.054	-0.019	-0.069	0.549	0.447	0.444
Percent hybrids	0.151	0.170	0.162	0.002	0.050	0.072	0.160	0.229	0.177
Percent with DELT+hybrids *	0.462	0.206	0.477	-0.054	-0.016	-0.064	0.558	0.459	0.453
Percent simple lithophils	-0.199	-0.368	-0.177	0.087	-0.205	-0.284	-0.193	-0.232	-0.271
Percent manipulative lithophils	0.264	0.352	0.256	-0.040	0.127	0.260	0.261	0.271	0.323
Percent lithophilic spawners	0.156	0.081	0.171	0.046	-0.059	0.044	0.159	0.125	0.156
Number of lithophilic spawners *	-0.168	-0.345	-0.183	-0.068	-0.342	-0.181	-0.271	-0.275	-0.275
Percent simple miscellaneous	-0.131	0.066	-0.117	-0.016	0.172	0.064	-0.065	-0.059	-0.075
Percent manipulative miscellaneous	-0.078	-0.191	-0.114	-0.048	-0.107	-0.133	-0.155	-0.116	-0.140
Percent manipulative spawners	0.233	0.268	0.207	-0.064	0.079	0.202	0.193	0.222	0.263
Percent miscellaneous spawners	-0.158	-0.083	-0.173	-0.046	0.059	-0.045	-0.161	-0.128	-0.158
Percent simple lithophils+tolerants	-0.246	-0.227	-0.268	0.004	0.049	-0.151	-0.288	-0.250	-0.268

***** - metric included in Tennessee Valley ichthyoregion IBI.

Shaded box highlights coefficients statistically different from 0, critical r value = 0.200 [p=0.05, df=95]. All sites included in analysis.

[1] HUDEN-human density; PLOAD-phosphorus load; PURB-percent urban cover; PMMB-percent man-made barren cover.
PPAS-percent pasture cover; PCROP-percent cropland cover; RDDENS-road density; STXRD-number of stream-road crossings;
HDG-total human disturbance gradient score.

[2] GSF-green sunfish, YBH-yellow bullhead, BG-bluegill, CC-channel catfish

Table 8. Statistical and responsive measures for candidate IBI metrics.

Candidate IBI metric	No. of significant correlations				Statistical characteristics					
	HDG[1]	Habitat	Total	%	Avg.	Min.	Max.	Range	SD	CV
Species Richness and Composition										
Number of native species	6	7	13	65	18.39	4	37	33	7.714	41.94
Number of cyprinid species	3	8	11	55	5.24	1	12	11	2.680	51.17
Number of shiner species	7	10	17	85	2.61	0	7	7	1.823	69.9
Number of sucker species	5	8	13	65	1.09	0	3	3	0.891	81.51
Number of *Lepomis* species	0	1	1	5	3.55	0	7	7	1.331	37.53
Number of centrarchid species	0	1	1	5	4.97	0	9	9	1.704	34.3
Number of darter species	6	4	10	50	3.98	0	10	10	3.132	78.72
Number of darter+madtom species	6	5	11	55	4.27	0	11	11	3.268	76.56
Number of terete minnow species	1	2	3	15	2.28	0	5	5	1.097	48.14
Tolerance - Intolerance										
Percent dominant species	6	2	8	40	35.88	13.97	85.75	71.78	13.668	38.1
Number of intolerant species	3	5	8	40	0.52	0	4	4	0.855	165.93
Percent tolerant species	1	8	9	45	30.02	1.52	100	98.48	21.967	73.17
Percent green sunfish	3	4	7	35	7.07	0	57.14	57.14	11.865	167.72
Percent stonerollers	7	1	8	40	21.15	0	85.75	85.75	18.280	86.45
Percent GSF+YBH[2]	3	3	6	30	8.31	0	64.77	64.77	13.522	162.72
Percent GSF+YBH+BG+CC[2]	1	6	7	35	16.84	0	78.24	78.24	20.035	118.97
Percent *Lepomis* species	2	8	10	50	25.26	0	94.29	94.29	22.992	91.03
Percent sunfish	2	8	10	50	25.76	0	94.29	94.29	22.830	88.63
Trophic Structure										
Percent omnivores	6	1	7	35	23.08	0	85.75	85.75	18.201	78.87
Percent insectivorous cyprinids	0	1	1	5	20.18	0	69.91	69.91	15.395	76.29
Percent invertivores	1	7	8	40	22.15	0	76.36	76.36	18.063	81.56
Percent top carnivores	0	0	0	0	1.47	0	19.57	19.57	2.251	152.79
Abundance, Condition, and Reproduction										
Catch per effort	1	2	3	15	13.10	1.09	72.16	71.07	10.035	76.59
Percent DELT	5	5	10	50	0.69	0	25.8	25.8	3.214	467.95
Percent hybrids	1	0	1	5	0.07	0	0.88	0.88	0.186	279.44
Percent with DELT+hybrids	6	5	11	55	0.75	0	25.8	25.8	3.221	427.51
Percent simple lithophils	5	6	11	55	17.59	0	73.03	73.03	17.546	99.76
Percent manipulative lithophils	7	1	8	40	61.60	14.98	100	85.02	21.616	35.09
Percent lithophilic spawners	0	1	1	5	79.19	29.63	100	70.37	14.236	17.98
Number of lithophilic spawners	5	10	15	75	11.52	2	24	22	4.744	41.19
Percent simple miscellaneous	0	1	1	5	11.59	0	68.52	68.52	11.169	96.37
Percent manipulative miscellaneous	0	1	1	5	9.15	0	52.27	52.27	10.106	110.44
Percent manipulative spawners	6	6	12	60	70.75	17.23	100	82.77	21.142	29.88
Percent miscellaneous spawners	0	1	1	5	20.74	0	70.37	70.37	14.250	68.71
Percent simple lithophils+tolerants	6	0	6	30	47.61	8.43	100	91.57	18.439	38.73

shaded box highlights metrics included in Tennessee Valley ichthyoregion IBI.

[2] HDG-human disturbance gradient

We retained 12 metrics divided among the broad categories of species richness and composition, tolerance-intolerance level, trophic structure, and abundance-condition-reproduction based in part on the methods above (tables 6, 7, 8) . Two retained metrics, percent DELT+hybrids and percent top carnivores, did not meet these performance standards. McCormick and others (2001) rejected the DELT metric based on the fact that anomalies occurred rarely in their dataset. We have always included this metric in Alabama IBIs as an additional measure of urban disturbance and as a metric to further discriminate urban streams from rural and least disturbed streams. Percent top carnivores is usually low for most sites, but we have observed that in high quality streams with a well structured fish community that a top carnivore trophic level is usually present. As such, this metric can help segregate the very high quality, excellent sites from the good to very good sites.

The redundancy of these metrics was evaluated by calculating a correlation coefficient matrix (table 9). McCormick and others (2001) and Compton and others (2003) rejected metrics if correlation coefficients were >0.75. The majority of the 12 selected Tennessee Valley IBI metrics met this criterion. Number of native species was highly correlated with shiner species, darter+madtom species, and number of lithophilic spawners, while the number of lithophilic spawners was also correlated with shiner species and darter+madtom species. We felt that although these highly significant correlations were present, these metrics were desirable to maintain in the IBI for their usefulness in evaluating different fish community functions. The darter+madtom metric is critical for assessing substrate quality, while the shiner metric evaluates the condition of a fish guild that broadly uses many unique habitat components that are sensitive to degradation. The metric ‘number of lithophilic spawning species’ was retained because the other reproduction metrics that were significantly related to habitat and disturbance were strongly influenced by the presence of largescale stonerollers, which is the major component of the omnivore and herbivore metric. Number of lithophilic spawning species is influenced by the entire species suite of lithophilic spawners, not just stonerollers.

Table 9. Redundancy analysis for Tennessee Valley ichthyoregion IBI metrics.

IBI metric	IBI metric											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Number of native species	1											
2. Number of shiner species	0.784	1										
3. Number of sucker species	0.651	0.481	1									
4. Number of darter+madtom species	0.921	0.682	0.615	1								
5. Number of intolerant species	0.723	0.742	0.393	0.639	1							
6. Percent tolerant species	-0.462	-0.496	-0.410	-0.448	-0.305	1						
7. Percent Lepomis species	-0.541	-0.482	-0.477	-0.563	-0.366	0.694	1					
8. Percent invertivores	-0.093	-0.107	0.058	-0.141	0.007	-0.273	-0.339	1				
9. Percent omnivores	-0.343	-0.263	-0.265	-0.382	-0.307	0.285	0.772	-0.359	1			
10. Percent top carnivores	0.019	0.083	0.001	-0.023	-0.030	0.018	0.006	-0.013	0.083	1		
11. Percent with DELT+hybrids	-0.249	-0.108	-0.163	-0.245	-0.112	-0.077	-0.037	0.222	-0.070	-0.054	1	
12. Number of lithophilic spawners	0.935	0.788	0.671	0.863	0.726	-0.468	-0.546	-0.066	-0.359	0.027	-0.235	1

shaded box highlights coefficients >0.750

The method of Karr and others (1986) was used in scoring the 12 IBI metrics for datasets with some modifications intended to make the index more sensitive to local conditions. Scoring criteria for metrics 1 through 12 were developed by plotting values for these categories as a function of drainage area. Based on these plots, maximum species richness lines were drawn, and the area below this line was generally trisected to derive ranges for the scores: 5 (best), 3, or 1 (worst). Several of the IBI metrics that measure species richness and composition are strongly related to stream size with larger streams supporting more species. This relationship is in many cases drainage specific and is generally valid up to a certain critical watershed size, after which species richness remains relatively constant. Regional differences in faunal composition are strongly apparent in Alabama, with distributions of many species highly correlated with ecoregion and (or) specific drainage basins (Mettee and others, 1996). Tolerance and trophic metrics are often unrelated to stream size, and scoring criteria were derived by drawing two horizontal lines at metric values that divided the data approximately into thirds.

The 5-3-1 and trisection scoring methods will continue to be utilized as the IBI is developed for the different ecoregions in Alabama. Once complete, statewide sample data have been compiled, we will then convert to a system that scores on a 0 to 100 range as suggested by Hughes and others (1998). However, we need to wait until the full range of metric values can be determined for all regions of the state. This system will be more compatible with multimetric applications used in other states and will provide a refinement to the process for establishing criteria classes.

METRICS SELECTED FOR THE TENNESSEE VALLEY IBI

1. NUMBER OF NATIVE SPECIES

The negative relationship between species richness and habitat degradation is well documented (Karr, 1981; Karr and others, 1986; Ohio EPA, 1987a). Species richness was found to be the metric most closely correlated with overall IBI score in a study of several regional applications of the IBI by Angermeier and Karr (1986). Hughes and Oberdorff (1999) found the species richness metric was used in all IBI applications they examined outside of the U.S. and Canada. Species richness is strongly related to stream size, stream order, and watershed area in small- to medium-sized watersheds (Karr and others, 1986). In our comparison of candidate metrics we found that total number of native species was positively correlated with habitat metrics, in particular those associated with high quality substrate and a varied flow environment. This metric discriminated sites with poor habitat and sites that were disturbed from reference sites that were $\geq$25 mi^2. Discrimination power was less evident in smaller watersheds (fig. 6). The mean metric values for sites with poor and(or) disturbed habitat were statistically lower than sites with low disturbance and good habitat. We selected number of native species over total number of species in order to exclude several species of nonnative fishes distributed throughout the state which are generally tolerant, invasive, and could detract from the responsiveness of this metric in impaired streams. Hughes and Oberdorff (1999) also recommended that the native species metric was an improvement over total species, particularly where nonnatives are common or highly invasive.

2. NUMBER OF SHINER SPECIES

Shiners are a diverse and abundant group in the family Cyprinidae and include species in the genera *Cyprinella, Luxilus, Lythrurus, Notemigonus, Notropis*, and *Pteronotropis*. Shiners are common and abundant throughout the Tennessee Valley ichthyoregion with a range of tolerances, habitat preferences, and trophic and reproductive guilds. Shiners as a group are adapted to a wide variety of habitats and habitat disturbances and can thrive in highly variable substrate and sediment regimes. Shiner diversity is generally high in streams with complex snag and pool variability as well as run habitats with variable flow velocities. The number of shiner species decreased with increasing disturbance and poor habitat scores (fig. 7). Mean number of shiner species was significantly lower in streams with poor habitat and high disturbance for large watersheds while this relationship was poor in small watersheds.

3. NUMBER OF SUCKER SPECIES

Diversity of sucker species was incorporated in the original midwestern IBI (Karr, 1981) because suckers are sensitive to physical and chemical degradation and because most species are long-lived and adapt to environmental changes over a

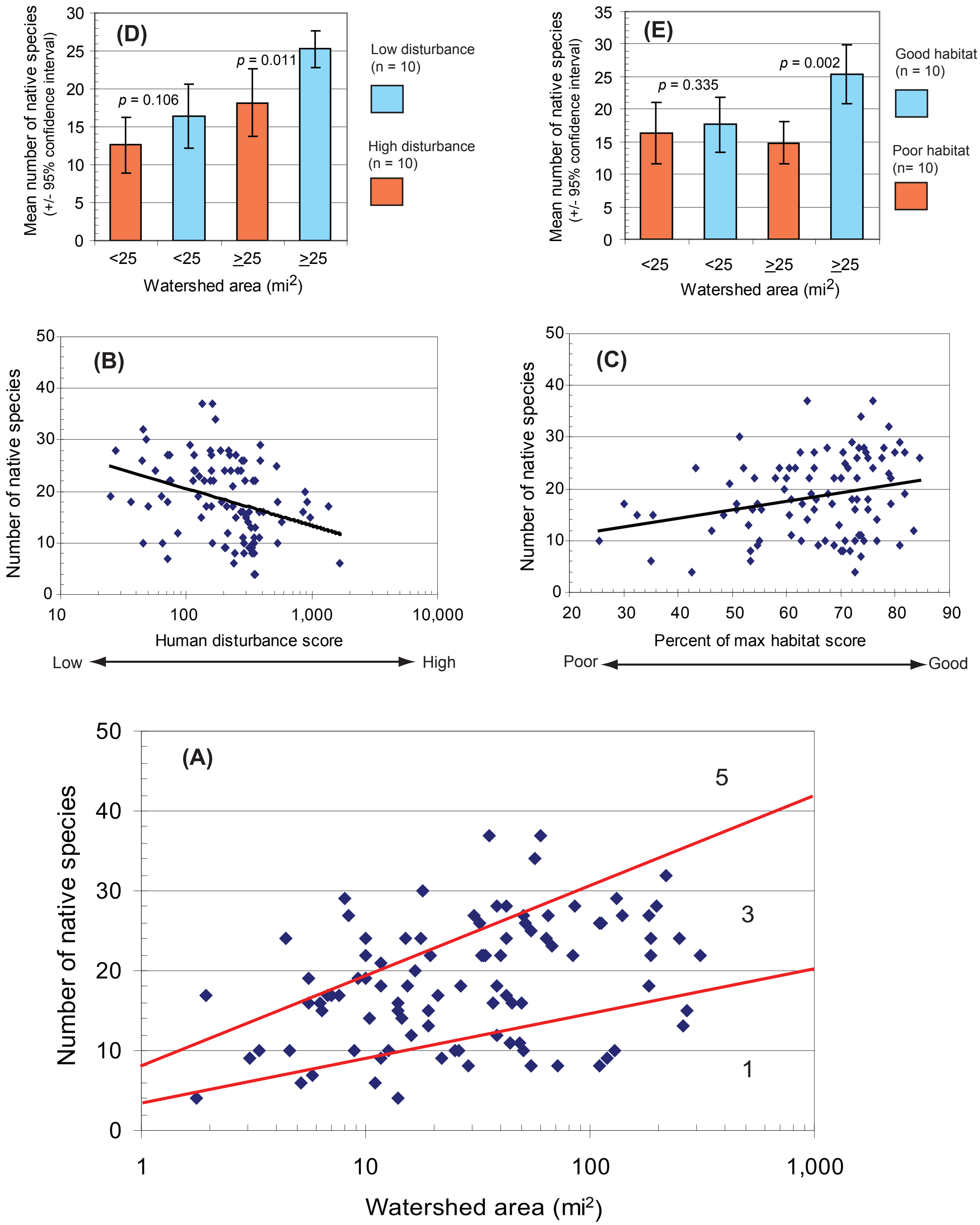


Figure 6. Relationships between the IBI metric number of native species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

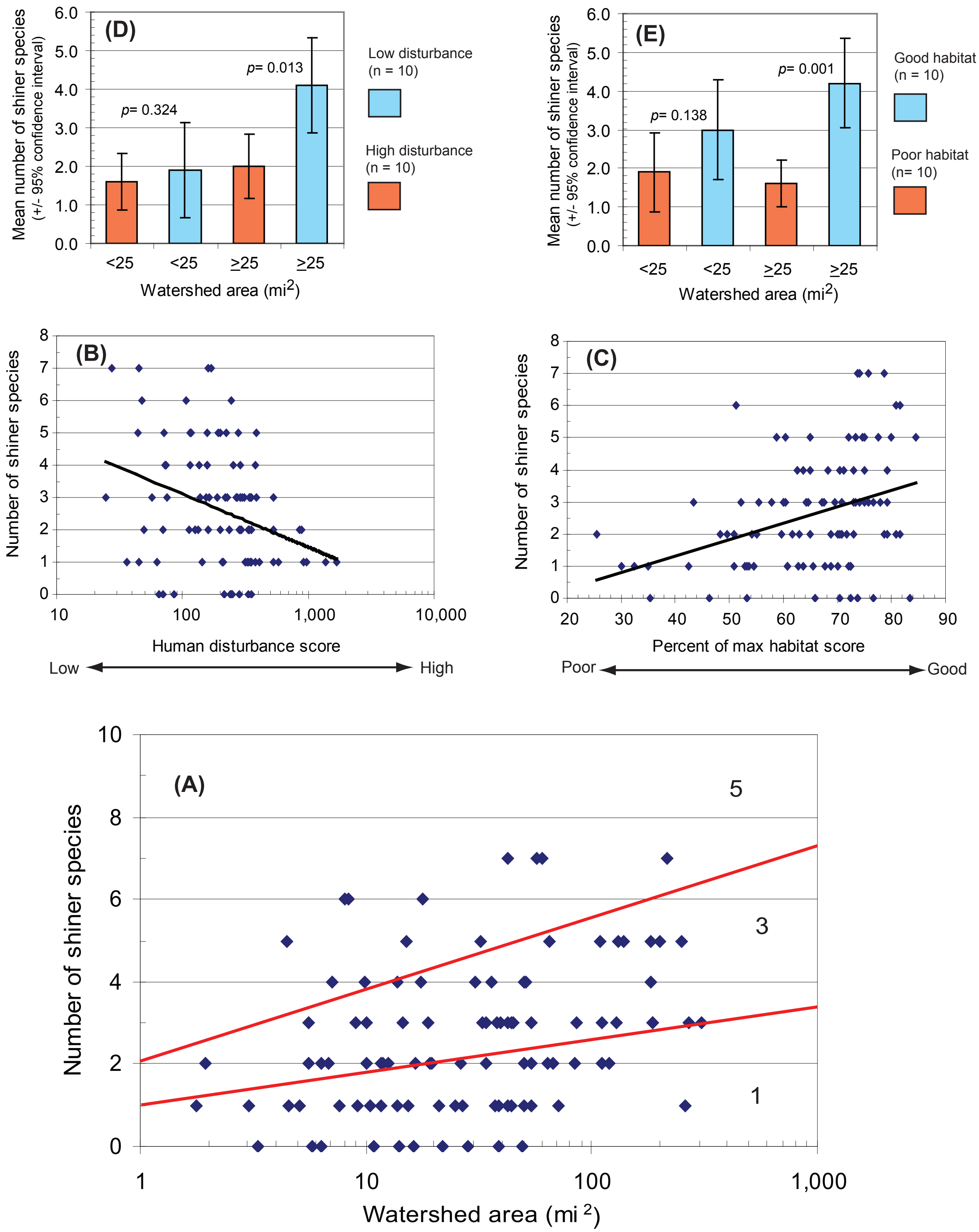


Figure 7. Relationships between the IBI metric number of shiner species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

number of years. Number of sucker species declined with increasing disturbance and(or) habitat disruption in the Tennessee Valley ichthyoregion (fig. 8). This metric was able to discriminate sites with poor habitat from sites with good habitat in all watershed sizes. It also discriminated highly disturbed sites from least disturbed sites in larger watersheds.

4. NUMBER OF DARTER + MADTOM SPECIES

Darters and madtoms are benthic species and generally intolerant of habitat impairments, particularly sedimentation which covers their preferred microhabitats. Karr (1981) used darter species richness as one of the original IBI metrics because, as a group, they are sensitive to disturbance. The darters are an even more speciose group in Alabama than in the midwest with nearly 75 species occurring in the state (Mettee and others, 1996). Paller and others (1996) and Schleiger (2000) have modified the darter metric to include madtoms or madtoms+sculpins since these groups are also benthic and are similar to darters in their feeding and spawning requirements. We evaluated the darter metric alone and with madtoms and sculpins but settled on the darter+madtom metric as sufficient. This metric declined with increasing habitat disturbance and increasing watershed disturbance. Mean number of darter+madtom species was significantly greater at sites with good habitat and low disturbance for large watersheds while these relationships were poor for smaller watersheds (fig. 9). Like darters, madtoms are benthic species and in Tennessee Valley streams can be frequently found in snags, leaf packs, root masses, and woody debris along banks as well as gravel and rubble in runs and riffles. These habitat components are important for both darters and madtoms, and their loss or degradation generally leads to fewer darter and madtom species.

5. NUMBER OF INTOLERANT SPECIES

The number of intolerant species is used as a metric to distinguish high quality stations from moderately impaired ones (Karr,1981; Karr and others, 1986; Hughes and Oberdorff, 1999). Intolerant species are the first to disappear after some form of disturbance to a stream. Ideally, these species should be sensitive to several types of degradation such as siltation, low dissolved oxygen, or chemical contamination and

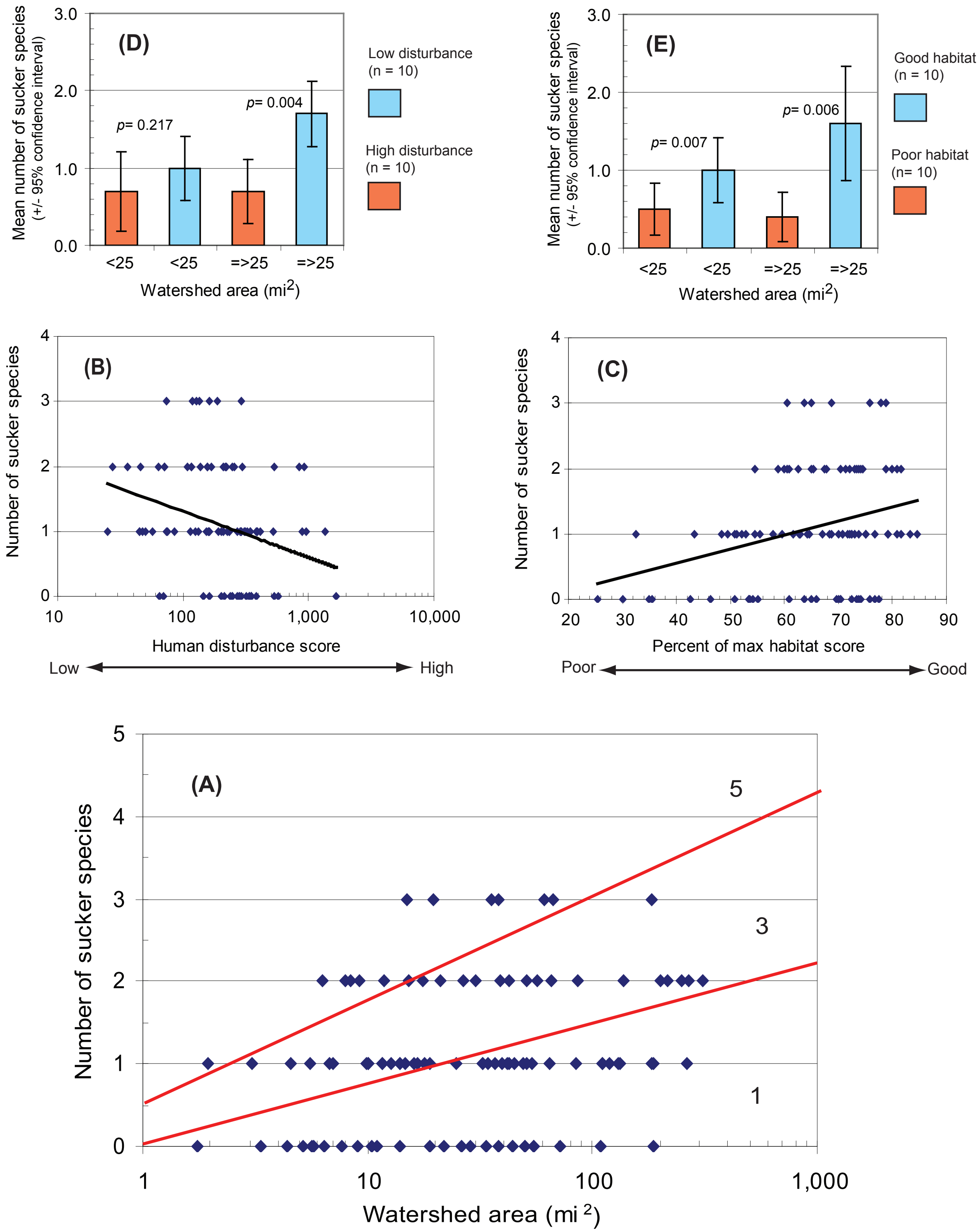


Figure 8. Relationships between the IBI metric number of sucker species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

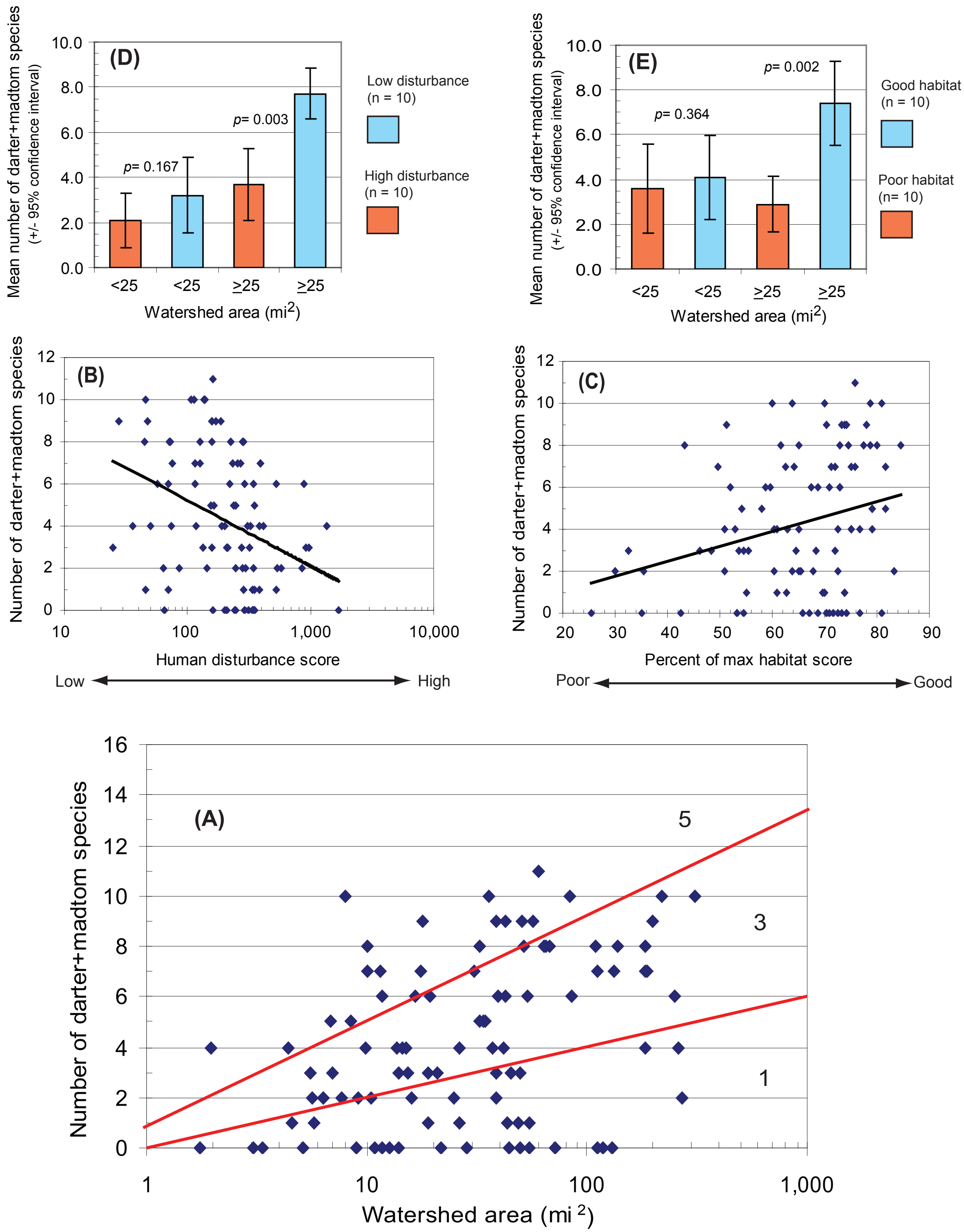


Figure 9. Relationships between the IBI metric number of darter+madtom species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

should represent less than 5 to 10 percent of the total species for a stream (O'Neil and Shepard, 2000b). Species classified as intolerants are listed in appendix B. In our dataset, this metric distinguished sites with poor habitat from those with good habitat as well as sites with low from high disturbance in larger drainage areas. These relationships were less evident in smaller drainages (fig. 10).

6. PROPORTION AS TOLERANT SPECIES

The disproportionate presence of tolerant species is a clear indication that habitat is disturbed or that water-quality conditions are well below optimum, and tolerant species may become very abundant in highly disturbed streams. Species occurring in the Tennessee Valley ichthyoregion that were included in this metric were striped shiners, bluntnose and bullhead minnows, creek chubs, golden shiners, blacknose dace, spotted suckers, mosquitofish, yellow and brown bullheads, green sunfish, and bluegills. This metric was negatively related to habitat quality and increased as habitat disturbance increased (fig. 11). This metric was used by O'Neil and others (2006) as a replacement for Karr's (1981) original green sunfish metric as recommended by Karr and others (1986), Ohio EPA (1987a), and Hughes and Oberdorff (1999). Mean proportion of tolerant species was significantly higher in poor habitats in both small and large streams (fig. 11). This metric was not related to stream size, and scoring criteria were adopted from those established for streams in the Valley and Ridge/Piedmont ichthyoregion (O'Neil and others, 2006).

7. PROPORTION AS <u>LEPOMIS</u>

The metric proportion as *Lepomis* corresponded well to both reach-level habitat degradation and landscape-level measures of human disturbance (fig. 12). *Lepomis* as a group are highly tolerant of disturbed habitats and diminished water quality and can thrive in environments ranging from near pristine to very impaired. *Lepomis* populations generally become more abundant as habitat changes from a more riffle-run dominated system to a more pool dominated system. This can occur in areas of increasing habitat degradation due to scour, deposition, and increase of structure. Mean percent *Lepomis* was significantly different between sites with good and poor habitat and between sites with low and high disturbance.

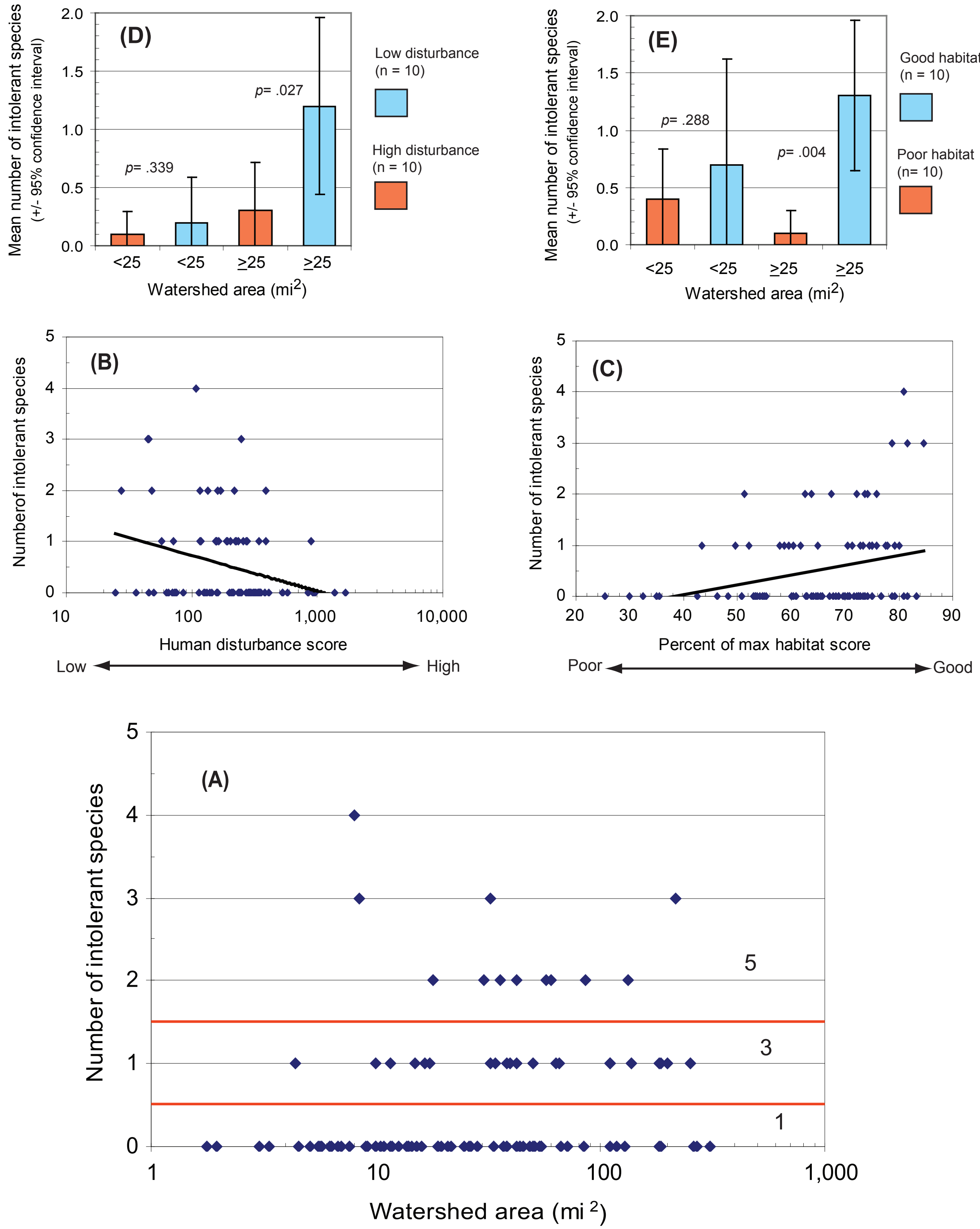


Figure 10. Relationships between the IBI metric number of intolerant species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

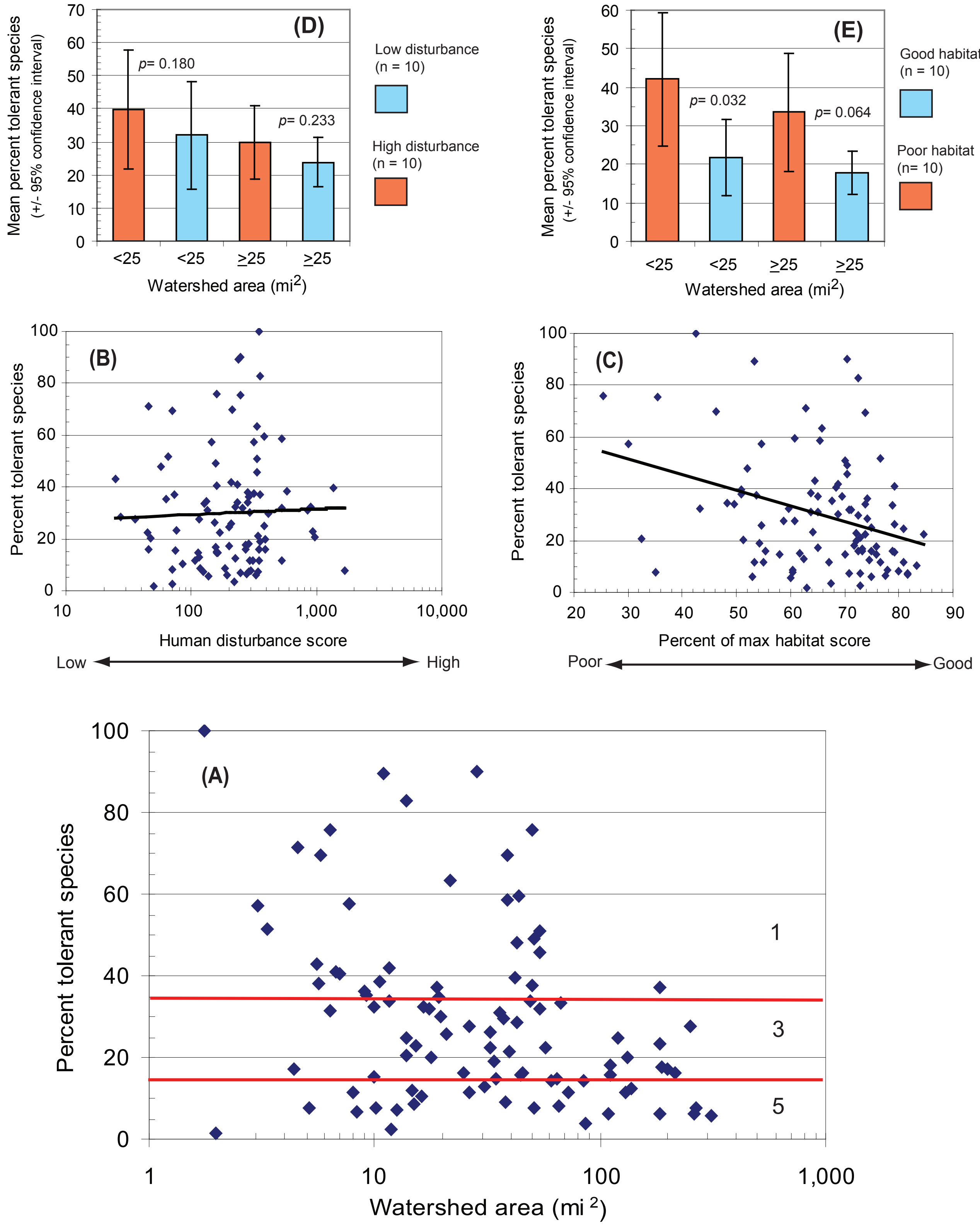


Figure 11. Relationships between the IBI metric percent tolerant species and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

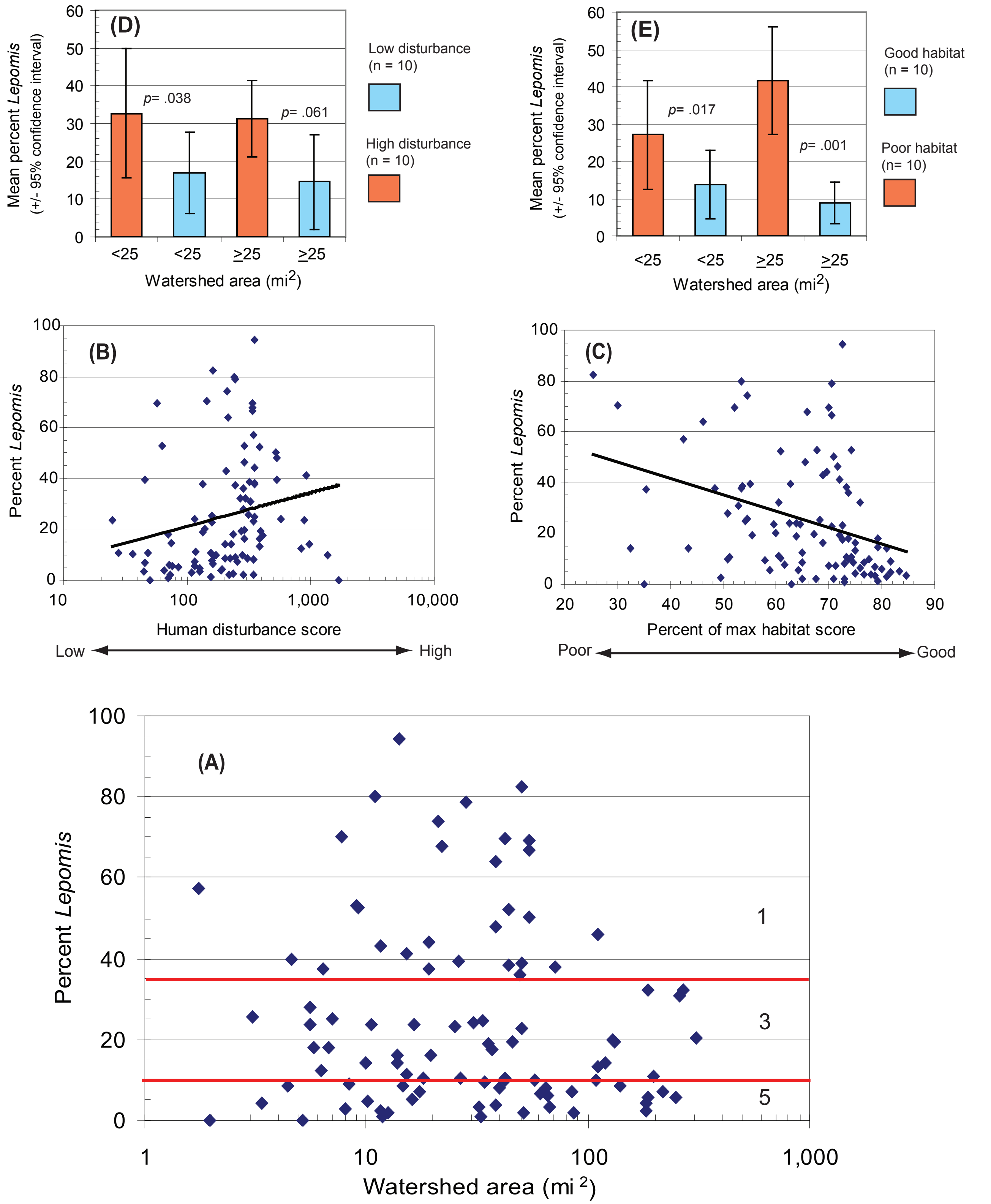


Figure 12. Relationships between the IBI metric percent *Lepomis* and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

8. PROPORTION AS INVERTIVORES

We have adopted this as an additional trophic metric. Hughes and Oberdorff (1999) recommend this metric, since it is more inclusive and ecologically accurate than percent insectivorous cyprinids, as another measure for assessing the degree to which the invertebrate community is degraded. The performance of this metric has varied in the previous IBI studies completed in Alabama to date. It related poorly to habitat quality in the Southern Plains ichthyoregion (O'Neil and Shepard, 2009) and declined with increasing disturbance in the Valley & Ridge/Piedmont icthyoregion (O'Neil and others, 2006), discriminating between disturbed and undisturbed sites in large streams but not in smaller streams in that study. As applied in the Tennessee Valley this metric includes blacktail and steelcolor shiners, rosyside dace, flame chubs, most sucker species, catfish, topminnows, and selected sunfishes. This metric increased with decreasing habitat scores, while the correlation with human disturbance was poor. Mean percent invertivores was generally greater at sites with poor habitat and high disturbance especially in the larger drainages (fig. 13).

9. PROPORTION AS OMNIVORES AND HERBIVORES

Percent omnivores and herbivores is one of the original metrics proposed by Karr (1981) and is used to detect alterations in the food base caused by physical or chemical impairment that favors species which consume substantial quantities of plant and animal material (Hughes and Oberdorff, 1999). In this metric we include species such as *Campostoma* and Pimephales, which can both become dominant in impacted streams, particularly those with high nutrient inputs (O'Neil and Shepard, 2000b). In our experience large stoneroller numbers is an excellent measure of stream disturbance, generally from over nutrification. This metric increased with increasing human disturbance and was poorly related to local habitat degradation. Mean percent omnivores and herbivores was significantly higher at highly disturbed sites in small and large watersheds (fig. 14).

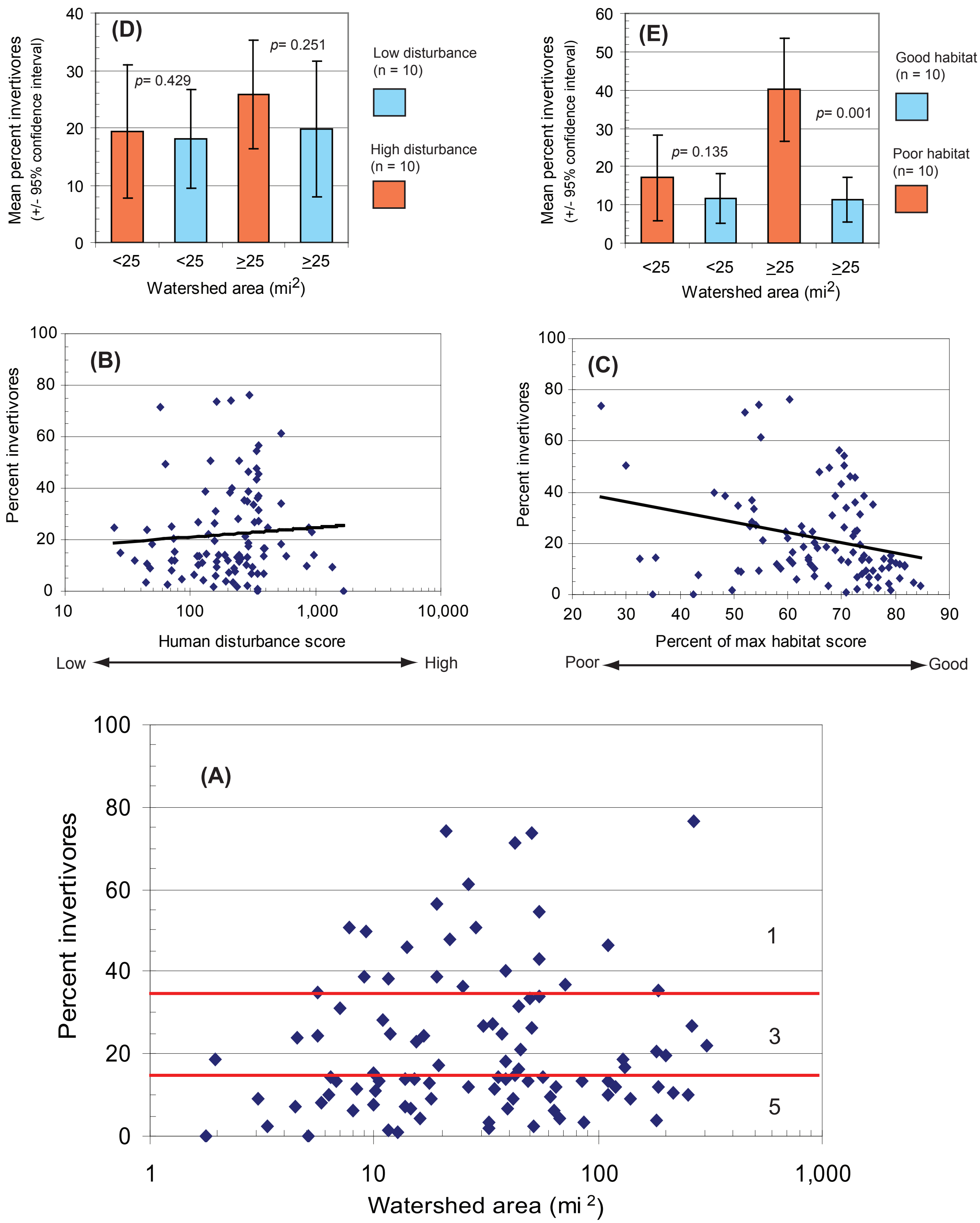


Figure 13. Relationships between the IBI metric percent invertivores and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

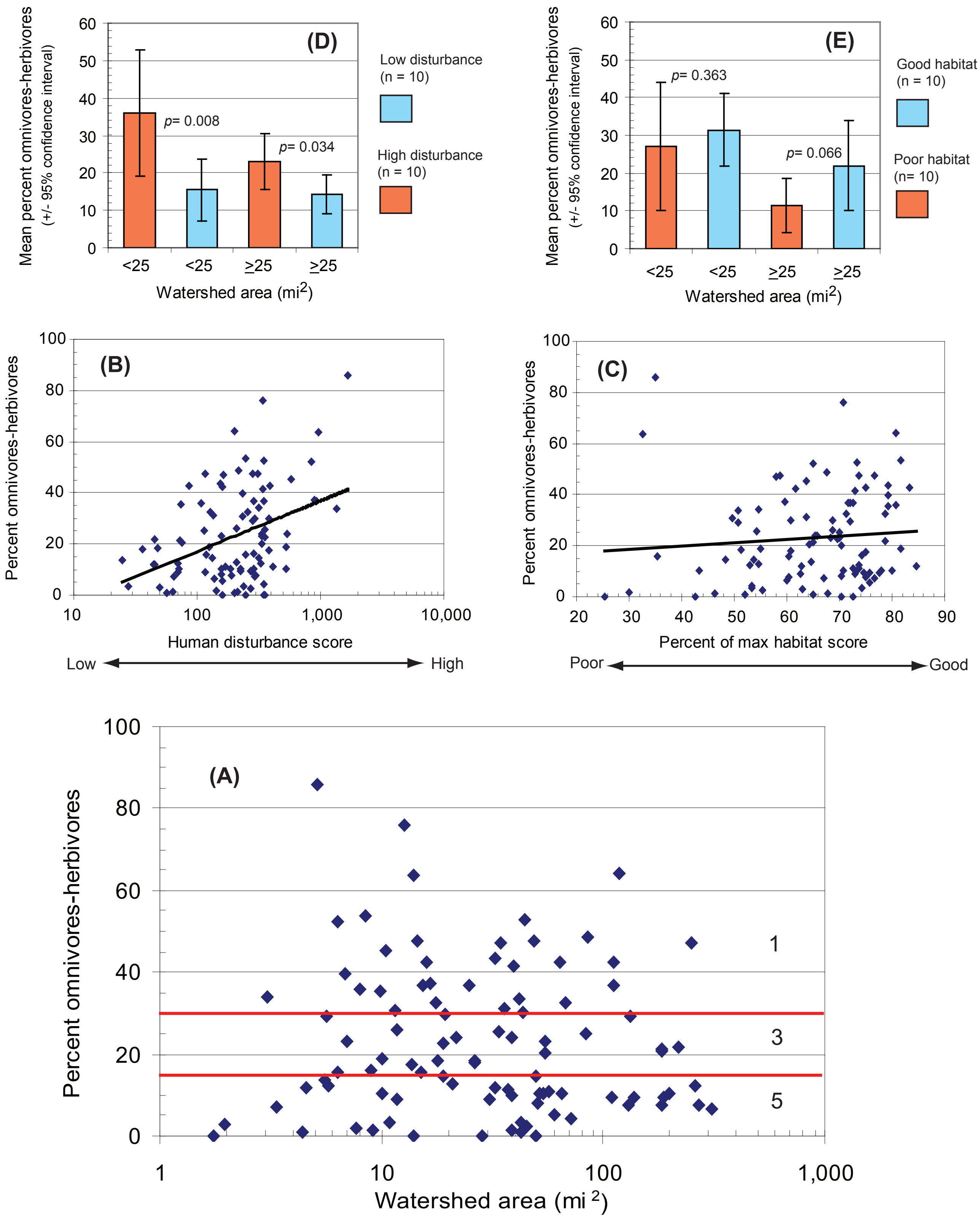


Figure 14. Relationships between the IBI metric percent omnivores-herbivores and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

10. PROPORTION AS TOP CARNIVORES

Karr (1981) proposed this metric because healthy populations of top carnivores indicate a relatively functional, trophically diverse community. The top carnivore metric was designed to measure biological integrity in the upper functional levels of the fish community. To be considered a top carnivore, a species has to consume primarily fish, vertebrates, or crayfish, while species that equally consume other organisms as well are not considered top carnivores. Top carnivores include all black bass, temperate bass, crappie, rock and shadow bass, pickerel, walleye, bowfin, and gar species. Hughes and Oberdorff (1999) also point out that top carnivores are susceptible to bioaccumulation of toxins and can be affected by long-term physical and chemical impacts since they are typically long-lived. In our data, the top carnivore metric decreased with both increasing disturbance and degraded habitat scores although these relationships were not clear in figure 15. This metric performed well in the Valley and Ridge/Piedmont ichthyoregion (O'Neil and others, 2006). Ohio EPA (1987b) reported that top carnivores are absent or present in very low abundance in headwater streams and they have substituted the top carnivore metric with the proportion of pioneering species metric in watersheds <20 mi^2. This metric will be examined further as more data are collected statewide.

11. PROPORTION WITH DELT+HYBRIDS

Incidence of unhealthy individuals as expressed in deformities, eroded fins, lesions, and tumors (DELT) is frequently used as a metric that reflects the fish community's health and condition. These abnormalities, however, are relatively rare except in all but the most highly degraded streams (Karr and others, 1986). Similarly, hybridization between species is indicative of highly disturbed habitats but it is usually rare in moderately disturbed streams. Proportion of individuals with DELTs and as hybrids are treated as two separate metrics in the original IBI (Karr and others, 1986). Since both conditions are rare, except in highly degraded habitats, we have combined the two as a single metric to help distinguish highly degraded sites affected by chemical and discharged pollutants from moderately degraded ones and adjusted the scoring criteria accordingly. Only about 30 percent of the samples from the

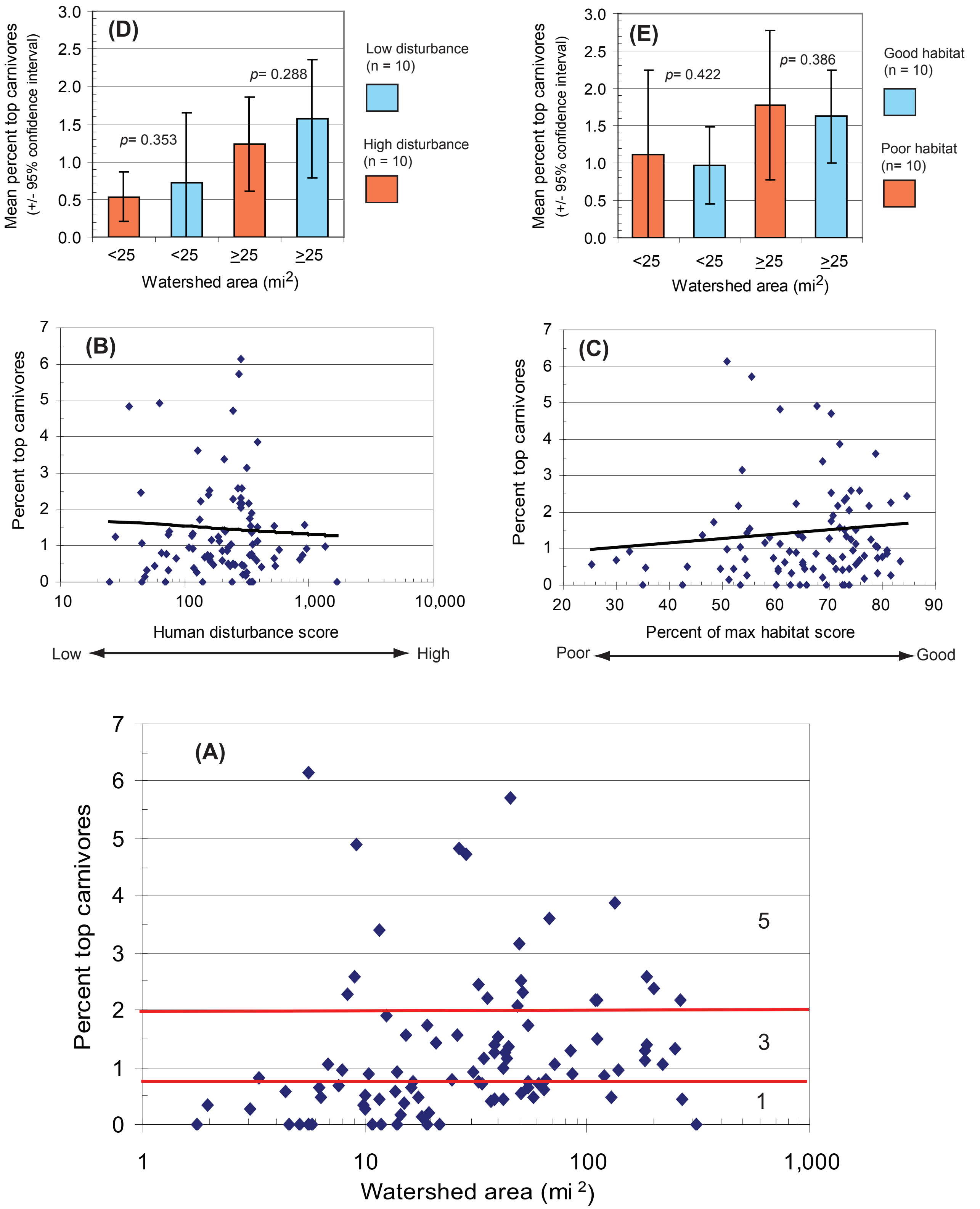


Figure 15. Relationships between the IBI metric percent top carnivores and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

Tennessee Valley had individuals with DELTs or hybrids (fig. 16). McCormick and others (2001) decided not to use this metric because of its relative rarity in fish populations. However, we decided to retain the metric as a way to capture degradation outside the usual nonpoint sources in rural areas (sediment and nutrients).

12. NUMBER OF LITHOPHILIC SPAWNING SPECIES

Number of lithophilic spawners refers to the number of species that utilize rock and mineral substrates for spawning either simply by depositing eggs in the sediment or complexly by manipulating substrate, building gravel or sand nests, or broadcasting eggs over rock and mineral substrates. This metric includes a host of species such as stonerollers, several genera of cyprinids, suckers, selected sunfish, and some darter species. This metric was significantly related to habitat quality and disturbance with more species found in good quality habitats and sites with low disturbance. Fewer species were found in poor versus good habitats and in low versus high disturbance watersheds in both small and large streams; some of these comparisons were statistically significant (fig. 17).

IBI DEVELOPMENT FOR THE TENNESSEE VALLEY ICHTHYOREGION

The 12 selected metrics were used to calculate IBI scores for the sampled sites (tables 10, 11). Biotic integrity classes were derived by evaluating the percentile distribution (10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles) of the 97 calculated IBI values and comparing these values with integrity classes established for the Ridge & Valley/Piedmont (O'Neil and others, 2006) and the Southern Plains ichthyoregions (O'Neil and Shepard, 2009) . The percentile marks were used as guides to place integrity class endpoints which were then adjusted (table 12) to create a balanced distribution of values across the range of the IBI (fig.18). Approximately 40 percent of the IBIs scored in the fair class, 32 percent scored in the very poor and poor classes, and 28 percent scored in the good to excellent classes. The IBI was significantly correlated with percent maximum habitat scores and performed well at statistically segregating poor habitat from good habitat sites in small and large watersheds (fig. 19). It was also significantly correlated with human disturbance, performing well at

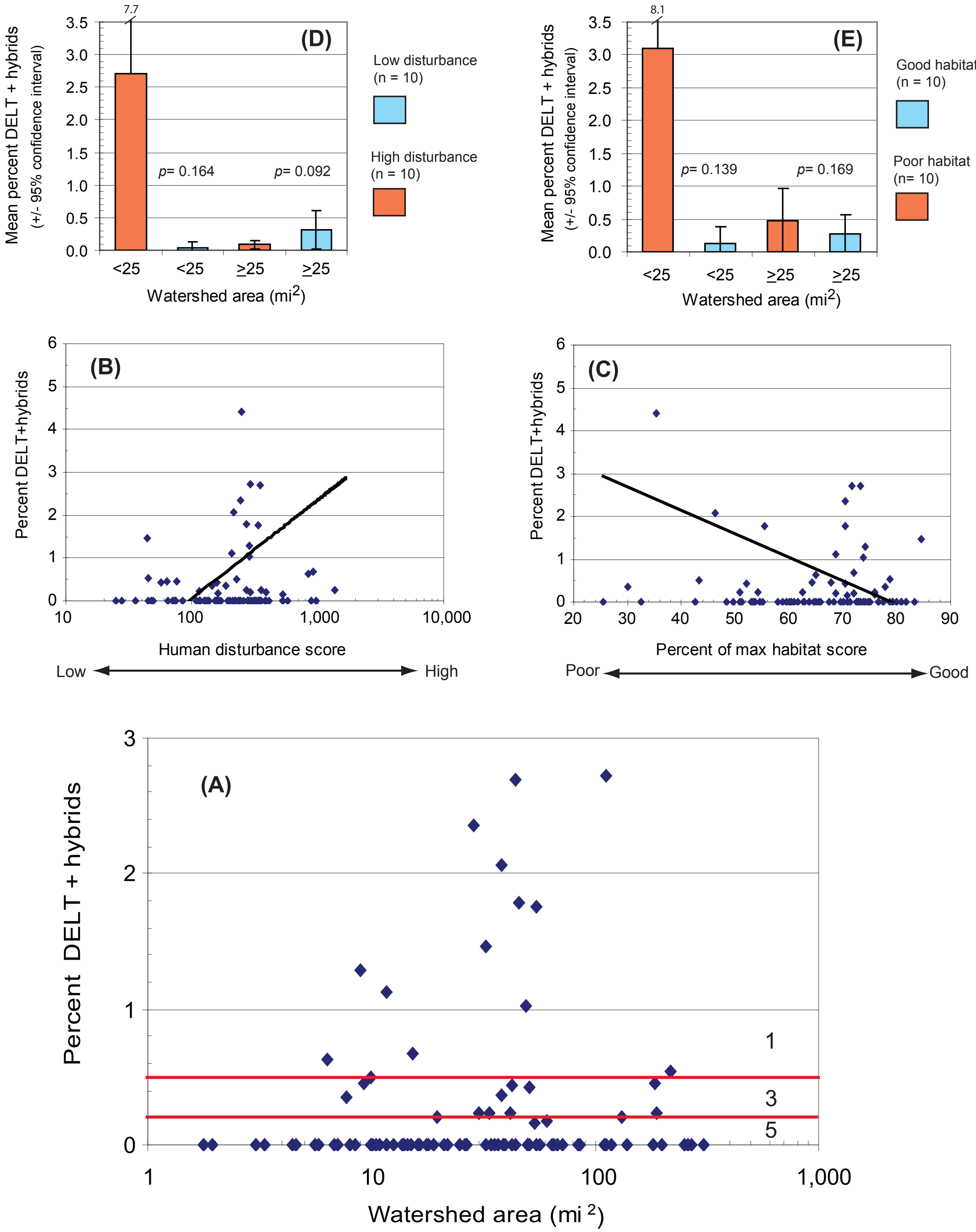


Figure 16. Relationships between the IBI metric percent DELT+hybrids and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

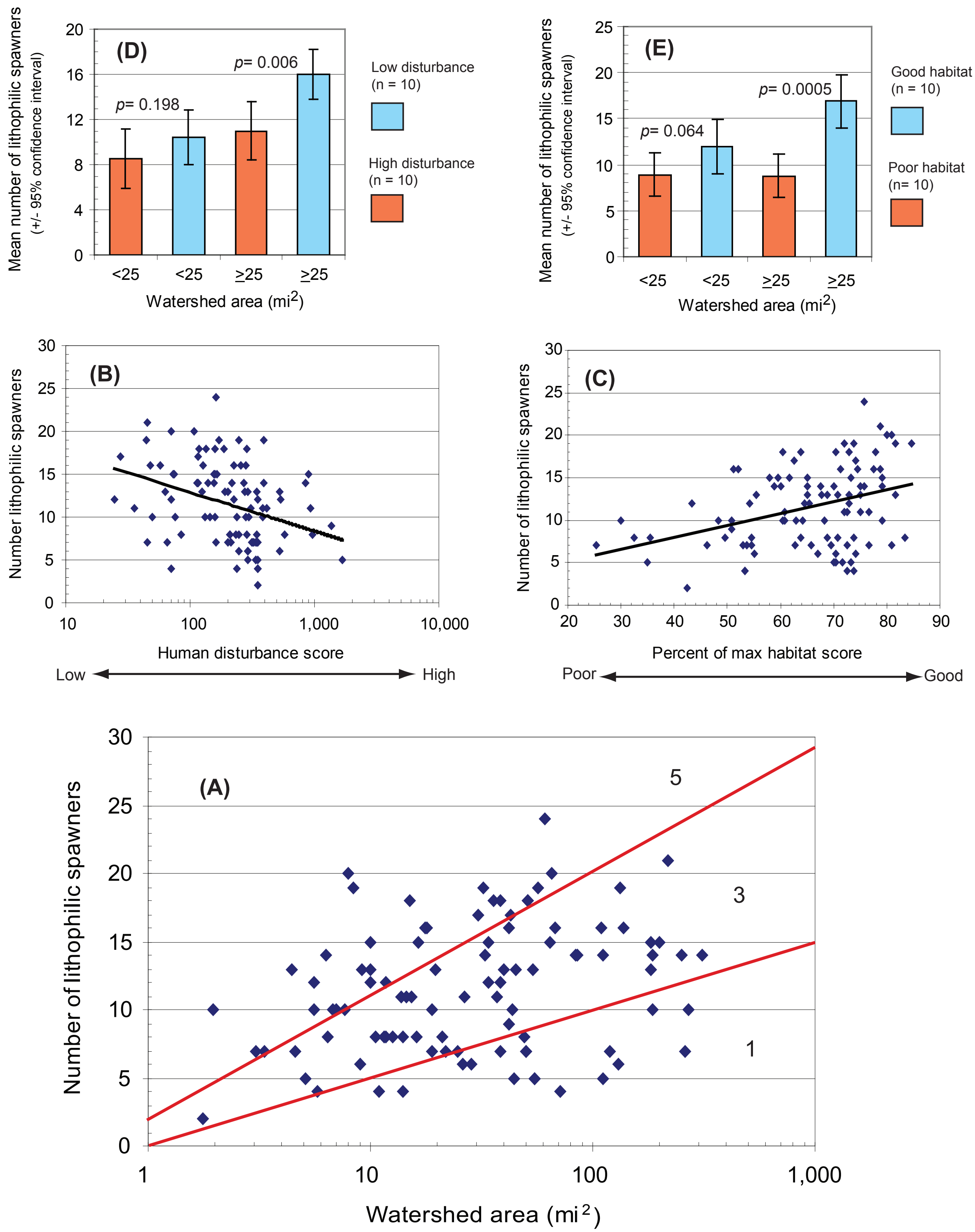


Figure 17. Relationships between the IBI metric number of lithophilic spawners and watershed area, disturbance, and habitat. Scoring criteria for metric in relation to watershed area (A); metric relationships to disturbance (B) and habitat (C); and mean metric value in relation to watershed area for disturbance (D) and habitat (E).

Table 10. Fish community values for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1]											
	1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO
ALDM-234	15	1	1	3	0	20.61	14.2	14.09	63.56	0.93	0	8
ANDL-8	11	0	1	1	0	34.02	36.08	13.4	47.42	2.06	1.03	8
BAKM-2	14	1	0	2	0	38.39	23.88	13.62	45.31	0.89	0	8
BCBC-1	17	2	1	4	0	1.52	0.17	18.44	2.88	0.34	0	10
BCNJ-1	24	3	1	6	1	47.88	69.64	71.39	0.88	0.44	0.44	16
BEA-2	9	2	1	0	0	24.57	14	12	64.29	0.86	0	7
BERF-11	24	5	2	6	1	27.63	5.53	10.26	47.37	1.32	0	14
BERF-2	13	1	1	4	0	5.98	30.98	26.63	12.5	2.17	0	7
BERF-4	18	5	1	4	1	5.99	4.12	3.75	7.49	1.12	0	13
BERF-5	15	2	1	3	0	34.68	37.57	38.73	14.45	1.73	0	10
BFDM-1	18	1	2	3	0	22.85	41.18	22.85	36.88	1.58	0.68	11
BGNL-37	24	3	0	7	1	17.65	32	35.29	9.41	2.59	0.24	14
BIGL-14	16	4	1	4	0	25	16.28	6.98	17.44	0.58	0	11
BINC-190	10	1	1	2	0	16.15	23.08	36.15	36.92	0.77	0	7
BINC-192	4	0	0	0	0	82.86	94.29	45.71	0	0	0	4
BLFL-1	19	2	1	7	0	7.48	4.76	10.88	18.78	0.27	0	13
BLWL-11	26	5	0	8	1	6.28	9.74	10.17	9.52	2.16	0	16
BMDB-1	13	3	0	1	0	36.96	44.2	56.52	22.46	0	0	7
BMPL-2	12	0	1	2	0	10.32	5.16	4.52	42.58	0.65	0	8
BPTL-1	24	5	0	4	1	17.15	8.58	7.41	0.78	0.58	0	13
BRHL-1	18	2	2	6	0	2.5	0.74	25.04	8.84	0	0	12
BTLL-1	37	7	3	11	2	14.46	6.62	9.41	5.4	0.7	0.17	24
BVDM-17	16	1	1	4	0	29.71	17.57	24.69	11.3	0.42	0	11
BWSM-1	17	1	2	3	0	25.94	74.06	74.06	12.74	1.42	0	8
BZDC-1	18	1	2	4	0	27.42	10.48	12.1	17.74	4.84	0	11
CDRF-2	28	5	2	9	1	16.96	10.87	19.57	10.43	2.39	0	15
CDRF-22	22	3	1	7	0	23.33	5.54	12.01	20.55	1.39	0.46	10
CDRF-5	27	4	2	7	2	12.81	24.03	26.77	8.92	0.92	0.23	17
CDRL-1	10	0	0	0	0	51.61	4.03	2.42	7.26	0.81	0	7
CEDF-21	28	3	2	6	2	3.59	2.04	3.25	48.55	0.87	0	14
CERF-1	22	3	2	10	0	5.56	20.2	22.22	6.57	0	0	14
CERF-2	27	4	3	8	0	37.23	2.16	20.35	21.21	1.3	0	15
CFRJ-161	8	0	0	0	0	90	78.82	50.59	0	4.71	2.35	6
CLBC-11	22	4	1	4	0	15.34	14.41	15.14	35.29	0.33	0	15
CLEJ-100	30	6	1	9	2	20.06	10.55	9.06	18.57	0.15	0	16
COXL-1	20	2	1	6	1	32.45	23.77	24.53	37.36	0.75	0	15
CPRL-1	16	2	2	2	0	31.25	12.5	10	52.19	0.63	0.63	14
CRDM-1	12	0	0	3	0	69.66	64.14	40	1.38	1.38	2.07	7
CSPJ-70	24	3	1	8	1	32.5	14	7.75	10.25	0.5	0.5	12
CSPJ-70A	21	2	1	7	1	34	2.46	1.57	30.87	0.45	0	8

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis* ; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 10. Fish community values for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1] 1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO
FIRL-1	14	3	1	4	0	11.74	8.62	6.79	47.52	0.18	0	11
FLTM-1	29	5	1	7	2	19.96	19.31	16.52	29.4	3.86	0.21	19
FXTC-1	17	2	1	5	0	41	18.2	13.18	39.54	1.05	0	10
HERM-1	15	0	0	2	0	75.49	37.25	14.22	15.69	0.49	4.41	8
HESM-1	22	3	1	6	1	21.26	8.24	6.9	41.38	1.53	0	13
HSBM-242A	17	1	1	4	0	39.51	10	9.27	33.66	0.98	0.24	9
HURM-11	24	2	1	8	1	14.91	7.87	6	42.24	0.62	0	15
HURR-1	28	7	2	9	2	28.53	10.66	15.05	3.45	1.25	0	17
INCL-1	27	6	2	5	3	6.69	8.86	11.53	53.55	2.27	0	19
INDM-250	18	1	2	2	0	58.67	48	18.22	23.85	0.44	0	12
JNSJ-2	19	1	2	2	0	35.27	52.68	49.55	1.34	4.91	0.45	13
KBYJ-1	9	0	0	0	0	63.32	67.84	47.74	24.12	0	0	7
LBTL-1	29	6	2	10	4	11.53	3.02	6.24	35.73	0.95	0	20
LCPL-2	26	4	1	8	0	7.47	2.06	2.19	10.31	2.32	0	18
LDYL-1	10	2	1	0	0	7.17	2	1.05	76.08	1.9	0	8
LFKB-11	15	3	2	2	0	7.73	32.27	76.36	7.73	0.45	0	10
LPNT-1	37	4	3	10	2	31.01	18.83	14.56	31.17	2.22	0	18
LRKJ-11	26	5	1	8	3	22.22	3.43	3.43	11.93	2.45	1.47	19
LTBF-1	17	4	1	3	0	40.43	25.11	31.06	22.98	19.57	0	10
LTBF-11	22	2	1	10	0	14.47	7.23	13.62	25.11	1.28	0	14
LTBF-12	23	2	3	8	0	33.56	3.34	4.41	32.62	3.61	0	16
LTBF-14	22	3	1	5	1	14.78	9.52	11.66	47.13	1.15	0	15
MCDL-360	6	0	0	0	0	89.41	80	28.24	3.53	0	0	4
MCKC-1	4	1	0	0	0	100	57.14	0	0	0	0	2
MDCL-2	28	3	3	9	1	8.83	3.96	14.05	10.09	1.26	0.36	18
MFBN-2	16	1	0	3	0	37.41	38.81	33.57	14.69	3.15	0	7
MLBF-1	10	1	1	1	0	71.29	39.6	23.76	11.88	0	0	7
MTNM-2	22	3	1	5	1	26.26	1.12	1.86	43.58	0.74	0	14
NSTJ-2	17	1	0	2	0	57.44	70.24	50.52	1.73	0.69	0.35	10
PNTL-1	7	0	0	1	0	69.32	18.18	7.95	12.5	0	0	4
PRRJ-21	32	7	2	10	3	16.07	6.96	10.71	21.79	1.07	0.54	21
QTRW-2	16	2	0	2	0	38.11	27.88	34.78	29.16	6.14	0	10
RBYJ-2	10	2	0	0	0	75.84	82.58	73.6	0	0.56	0	7
RCKC-11	27	4	2	9	1	48.95	22.69	26.26	7.98	2.52	0.42	18
REDD-1	10	3	0	0	0	36.13	52.9	38.71	16.13	2.58	1.29	6
RNIL-400	22	2	0	5	0	19.08	24.88	27.05	25.6	0.72	0.24	12
SCDL-11	16	3	1	3	0	16.07	19.29	21.07	2.5	5.71	1.78	13
SCRL-2	8	2	0	0	0	45.61	66.67	54.39	20.18	1.75	1.76	5
SCRL-2	8	1	0	1	0	50.75	69.4	43.28	23.13	0.75	0	5
SGRL-3	27	5	2	8	1	12.58	8.49	9.12	9.43	0.94	0	16

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis*; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 10. Fish community values for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1]											
	1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO
SHGC-1	9	1	1	0	0	57.38	25.63	9.19	33.98	0.28	0	7
SHM-3A	8	1	0	0	0	11.58	37.89	36.84	4.21	1.05	0	4
SHOL-1	34	7	2	9	2	22.31	10	14.15	11.08	0.46	0	19
SLAM-3	10	2	0	1	0	11.63	39.53	61.24	18.6	1.55	0	6
SLRL-1	24	4	2	7	1	31.81	7.31	12.79	32.57	0.46	0	16
SNDL-3	27	5	2	8	1	8.01	6.05	12.11	10.35	0.78	0	20
SNKL-7	11	1	0	1	0	59.66	52.27	16.48	30.11	1.14	0	10
SSTD-1	11	3	0	0	0	15.77	38.29	31.53	52.7	1.35	2.7	5
SWNL-1	22	2	3	6	0	30.12	16.19	17.42	29.71	0.2	0.2	13
SWNL-390	25	3	1	6	0	31.74	50.16	33.88	10.2	0.66	0.16	13
SWTL-1	6	1	0	0	0	7.57	0	0	85.75	0	25.8	5
TCD-3	8	2	1	0	0	17.93	46.2	46.2	36.96	2.17	2.72	5
TWND-4	10	3	1	0	0	11.57	19.91	18.52	7.41	0.46	18.06	6
TWND-61	9	1	1	0	0	41.81	42.94	38.42	25.99	3.39	1.12	8
WFFM-1	26	3	1	7	1	15.86	13.35	13.45	42.67	1.51	0	14
WFLDE-1	24	5	3	4	1	8.42	11.14	13.73	15.8	0.39	0	18
WFLL-15	19	3	1	3	0	42.93	23.56	24.61	13.61	0	0	12

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis* ; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 11. Scores for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1] 1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO	Final IBI	Biological condition
ALDM-234	3	1	3	3	1	3	3	5	1	3	5	3	34	Fair
ANDL-8	1	1	1	1	1	3	1	5	1	5	1	1	22	Poor
BAKM-2	3	1	1	1	1	1	3	5	1	3	5	3	28	Poor
BCBC-1	5	3	5	5	1	5	5	3	5	1	5	5	48	Good
BCNJ-1	3	3	1	3	3	1	1	1	5	1	3	3	28	Poor
BEA-2	1	1	1	1	1	3	3	5	1	3	5	1	26	Poor
BERF-11	3	3	3	3	3	3	5	5	1	3	5	3	40	Fair
BERF-2	1	1	1	1	1	5	3	3	5	5	5	1	32	Fair
BERF-4	3	3	1	1	3	5	5	5	5	3	5	3	42	Good
BERF-5	3	3	3	3	1	3	1	1	5	3	5	3	34	Fair
BFDM-1	3	1	5	3	1	3	1	3	1	3	1	3	28	Poor
BGNL-37	3	3	1	3	3	3	3	1	5	5	3	3	36	Fair
BIGL-14	3	5	3	3	1	3	3	5	3	1	5	3	38	Fair
BINC-190	1	1	1	1	1	3	3	1	1	3	5	3	24	Poor
BINC-192	1	1	1	1	1	1	1	1	5	1	5	1	20	Very Poor
BLFL-1	3	3	3	5	1	5	5	5	3	1	5	5	44	Good
BLWL-11	3	3	1	3	3	5	5	5	5	5	5	3	46	Good
BMDB-1	3	3	1	1	1	1	1	1	3	1	5	3	24	Poor
BMPL-2	3	1	3	1	1	5	5	5	1	1	5	3	34	Fair
BPTL-1	5	5	1	5	3	3	5	5	5	1	5	5	48	Good
BRHL-1	3	3	5	5	1	5	5	3	5	1	5	5	46	Good
BTLL-1	5	5	5	5	5	5	5	5	5	1	5	5	56	Excellent
BVDM-17	3	1	1	3	1	3	3	3	5	1	5	3	32	Fair
BWSM-1	3	1	3	3	1	3	1	1	5	3	5	3	32	Fair
BZDC-1	3	1	3	3	1	3	3	5	3	5	5	3	38	Fair
CDRF-2	3	3	3	3	3	3	3	3	5	5	5	3	42	Good
CDRF-22	3	3	1	3	1	3	5	5	3	3	3	1	34	Fair
CDRF-5	5	3	3	5	5	5	3	3	5	3	3	5	48	Good
CDRL-1	3	1	1	1	1	1	5	5	5	3	5	5	36	Fair
CEDF-21	3	3	3	3	5	5	5	5	1	3	5	3	44	Good
CERF-1	3	3	3	3	1	5	3	3	5	1	5	3	38	Fair
CERF-2	3	3	3	3	1	1	5	3	3	3	5	3	36	Fair
CFRJ-161	1	1	1	1	1	1	1	1	5	5	1	1	20	Very Poor
CLBC-11	5	5	3	3	1	3	3	3	1	1	5	5	38	Fair
CLEJ-100	5	5	3	5	5	3	3	5	3	1	5	5	48	Good
COXL-1	3	3	3	5	3	3	3	3	1	1	5	5	38	Fair
CPRL-1	3	3	5	3	1	3	3	5	1	1	1	5	34	Fair
CRDM-1	3	1	1	1	1	1	1	1	5	3	1	1	20	Very Poor
CSPJ-70	5	3	3	5	3	3	3	5	5	1	3	5	44	Good
CSPJ-70A	5	3	3	5	3	3	5	5	1	1	5	3	42	Good

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis*; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 11. Scores for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1] 1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO	Final IBI	Biological condition
FIRL-1	3	3	3	3	1	5	5	5	1	1	5	3	38	Fair
FLTM-1	3	3	1	3	5	3	3	3	3	5	3	3	38	Fair
FXTC-1	3	3	3	5	1	1	3	5	1	3	5	5	38	Fair
HERM-1	3	1	1	3	1	1	1	5	3	1	1	3	24	Poor
HESM-1	3	3	1	3	3	3	5	5	1	3	5	3	38	Fair
HSBM-242A	3	1	1	3	1	1	5	5	1	3	3	3	30	Fair
HURM-11	3	1	1	3	3	5	5	5	1	1	5	3	36	Fair
HURR-1	5	5	3	5	5	3	3	3	5	3	5	5	50	Excellent
INCL-1	5	5	5	5	5	5	5	5	1	5	5	5	56	Excellent
INDM-250	3	1	3	1	1	1	1	3	3	1	5	3	26	Poor
JNSJ-2	5	1	5	3	1	1	1	1	5	5	3	5	36	Fair
KBYJ-1	1	1	1	1	1	1	1	1	3	1	5	3	20	Very Poor
LBTL-1	5	5	5	5	5	5	5	5	1	3	5	5	54	Excellent
LCPL-2	3	3	1	5	1	5	5	5	5	5	5	5	48	Good
LDYL-1	3	3	3	1	1	5	5	5	1	3	5	3	38	Fair
LFKB-11	1	3	3	1	1	5	3	1	5	1	5	1	30	Fair
LPNT-1	5	3	5	5	5	3	3	5	1	5	5	5	50	Excellent
LRKJ-11	5	5	1	5	5	3	5	5	5	5	1	5	50	Excellent
LTBF-1	3	5	3	3	1	1	3	3	3	5	5	5	40	Fair
LTBF-11	3	1	1	5	1	5	5	5	3	3	5	3	40	Fair
LTBF-12	3	1	5	3	1	3	5	5	1	5	5	3	40	Fair
LTBF-14	3	3	1	3	3	5	5	5	1	3	5	3	40	Fair
MCDL-360	1	1	1	1	1	1	1	3	5	1	5	1	22	Poor
MCKC-1	1	1	1	1	1	1	1	5	5	1	5	3	26	Poor
MDCL-2	5	3	5	5	3	5	5	5	5	3	3	5	52	Excellent
MFBN-2	3	1	1	1	1	1	1	3	5	5	5	1	28	Poor
MLBF-1	3	1	3	1	1	1	1	3	5	1	5	3	28	Poor
MTNM-2	3	3	1	3	3	3	5	5	1	1	5	3	36	Fair
NSTJ-2	3	1	1	3	1	1	1	1	5	1	3	5	26	Poor
PNTL-1	1	1	1	1	1	1	3	5	5	1	5	3	28	Poor
PRRJ-21	3	5	3	3	5	3	5	5	3	3	1	3	42	Good
QTRW-2	3	3	1	3	1	1	3	3	3	5	5	5	36	Fair
RBYJ-2	1	1	1	1	1	1	1	1	5	1	5	1	20	Very Poor
RCKC-11	5	3	3	5	3	1	3	3	5	5	3	5	44	Good
REDD-1	3	3	1	1	1	1	1	1	3	5	1	3	24	Poor
RNIL-400	3	3	1	3	1	3	3	3	3	1	3	3	30	Fair
SCDL-11	3	3	1	1	1	3	3	3	5	5	1	3	32	Fair
SCRL-2	1	1	1	1	1	1	1	1	3	3	1	1	16	Very Poor
SCRL-2	1	1	1	1	1	1	1	1	3	1	5	1	18	Very Poor
SGRL-3	3	3	3	3	3	5	5	5	5	3	5	3	46	Good

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis*; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 11. Scores for Tennessee Valley IBI metrics.

Stream sites	IBI metrics [1]												Final IBI	Biological condition
	1 TOTSP	2 SHINR	3 SUCK	4 DARMD	5 INTSP	6 TOL	7 LEPOM	8 INVER	9 OMNI	10 TC	11 DELHY	12 LITHO		
SHGC-1	3	1	3	1	1	1	3	5	1	1	5	5	30	Fair
SHM-3A	1	1	1	1	1	5	1	1	5	3	5	1	26	Poor
SHOL-1	5	5	3	5	5	3	5	5	5	1	5	5	52	Excellent
SLAM-3	1	3	1	1	1	5	1	1	3	3	5	1	26	Poor
SLRL-1	5	3	3	5	3	3	5	5	1	1	5	5	44	Good
SNDL-3	3	3	3	3	3	5	5	5	5	3	5	5	48	Good
SNKL-7	1	1	1	1	1	1	1	3	1	3	5	3	22	Poor
SSTD-1	1	3	1	1	1	3	1	3	1	3	1	1	20	Very Poor
SWNL-1	3	3	5	3	1	3	3	3	3	1	5	3	36	Fair
SWNL-390	3	3	1	3	1	3	1	3	5	1	5	3	32	Fair
SWTL-1	1	1	1	1	1	5	5	5	1	1	1	3	26	Poor
TCD-3	1	1	1	1	1	3	1	1	1	5	1	1	18	Very Poor
TWND-4	1	3	1	1	1	5	3	3	5	1	1	1	26	Poor
TWND-61	1	1	3	1	1	1	1	1	3	5	1	3	22	Poor
WFFM-1	3	3	1	3	3	3	3	5	1	3	5	3	36	Fair
WFLDE-1	5	5	5	3	3	5	3	5	3	1	5	5	48	Good
WFLL-15	5	3	3	3	1	1	3	3	5	1	5	5	38	Fair

[1] TOTSP-no. native species; SHINR-no. of shiner species; SUCK-no. sucker species; DARMD-no. darter+madtom species; INTSP-no. of intolerant species; TOL-proportion of tolerant species; LEPOM-proportion of *Lepomis* ; INVER-proportion of invertivores; OMNI-proportion of omnivores and herbivores; TC-proportion of top carnivores; DELHY-proportion with DELT+hybrids; LITHO-no. lithophilic spawners.

Table 12. IBI integrity classes for the Ridge & Valley/Piedmont, Southern Plains and Tennessee Valley ichthyoregions.

Integrity classes	Ridge & Valley/ Piedmont	Southern Plains	Tennessee Valley
Very poor - VP	$\leq$ 25	$\leq$ 25	$\leq$ 21
Poor - P	26 - 37	26 - 35	22 - 28
Fair - F	38 - 46	36 - 43	29 - 40
Good - G	47 - 55	44 - 50	41 - 49
Excellent - E	>55	>50	$\geq$ 50

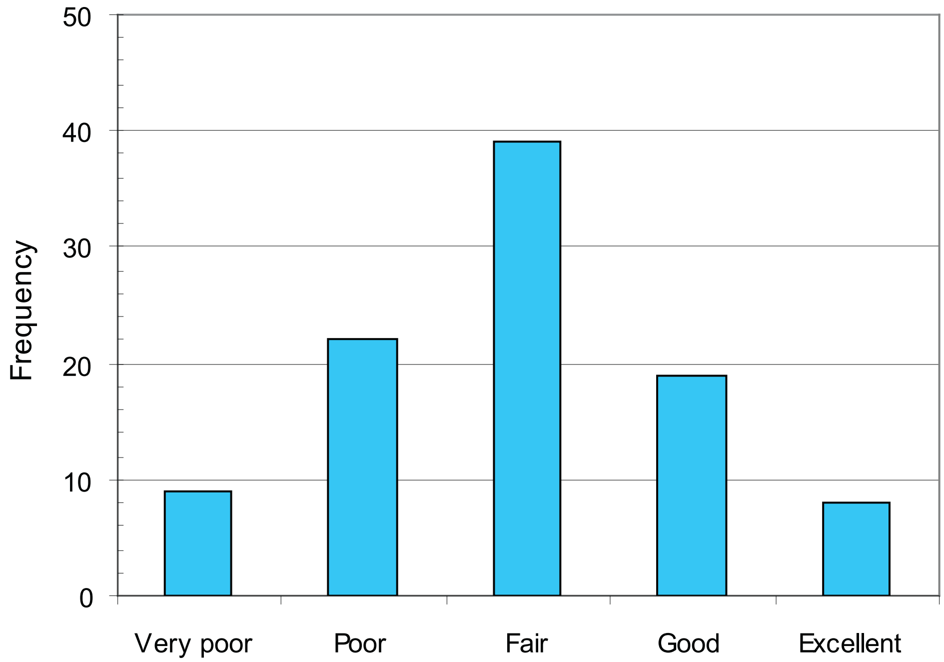
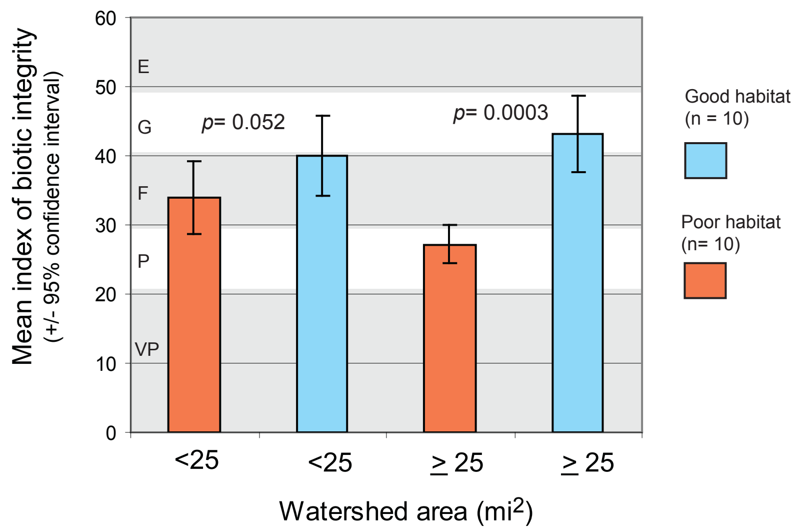


Figure 18. Frequency distribution of IBI integrity classes for sites in the Tennessee Valley ichthyoregion.



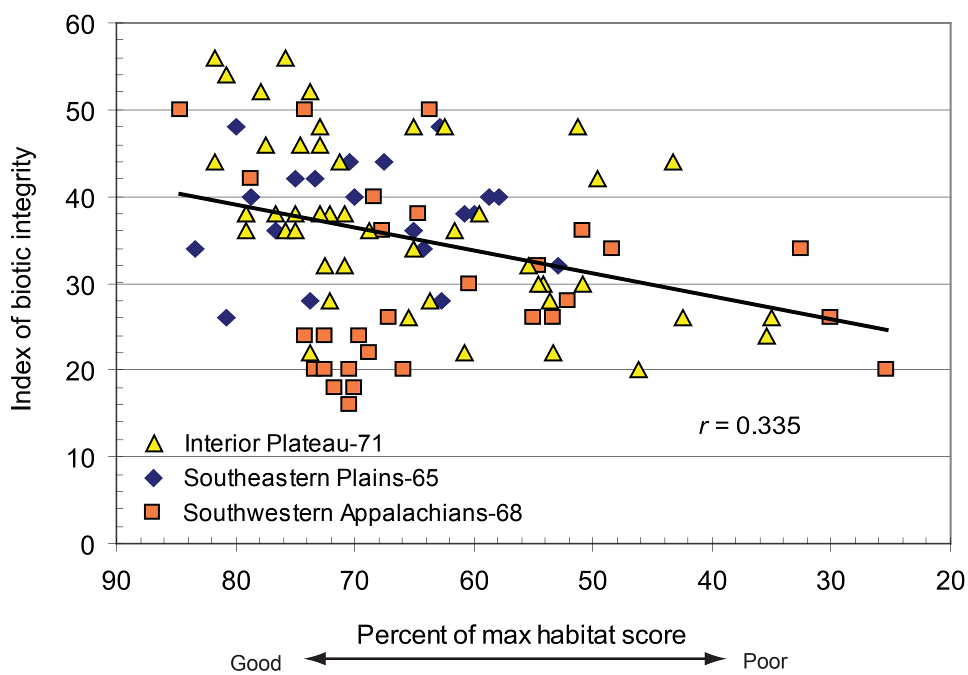
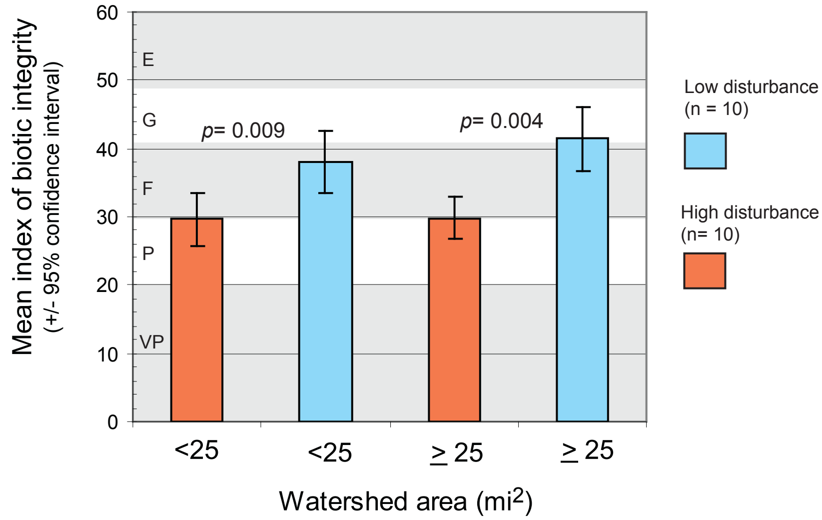


Figure 19. Comparison of the IBI in level III ecoregions relative to habitat quality and a comparison of IBI scores for small and large watersheds relative to habitat quality.

statistically segregating sites with low disturbance from sites with high disturbance in both small and large watersheds (fig. 20).

The Tennessee Valley IBI was developed as a regional tool for evaluating biological condition in streams of the Tennessee River drainage and perhaps streams in the upper Black Warrior on the Plateau ichthyoregion. To be regionally useful, this tool should be reasonably independent of local faunal influences such as river system and ecoregion. The relationships depicted in figures 19 and 20 among the IBI, habitat, and disturbance were further evaluated by segregating data into level IV ecoregions for both habitat scores (fig. 21) and human disturbance scores (fig. 22). These bivariate plots show several interesting relationships relative to the utility of the IBI throughout the Tennessee Valley ichthyoregion as delineated. Sites in the Southeastern Plains ecoregion were poorly related to habitat scores and disturbance scores indicating that the Tennessee Valley IBI is perhaps inappropriate for these streams. The IBI appeared to relate well to streams in the Interior Plateau with reasonably high correlation coefficients; r = -0.517 between IBI and human disturbance, r = -0.515 between IBI and habitat scores.

The correlation between IBI and human disturbance for streams in the Southwestern Appalachians, including all level IV ecoregions (68a - 68e), was also relatively high (r = -0.646). However, the relationship between IBI and habitat scores for all sites in this same ecoregion was poor (r = -0.112). When examined in detail we see that sites in ecoregions 68d (Southern Table Plateaus) and 68e (Dissected Plateau), for both the Tennessee River and upper Black Warrior River, did not appear to fit into the Tennessee Valley IBI relationships. Streams in 68d have poor biological condition which is likely due to a combination of natural reasons (isolation on an elevated plateau) and pollution from multiple sources. As such, we think that streams in 68d and 68e should be placed into criteria which will soon to be developed for the Plateau ichthyoregion. Likewise, Tennessee River streams in the Southeastern Plains may be better described by criteria yet to be developed for the Hills and Coastal Terraces ichthyoregion.



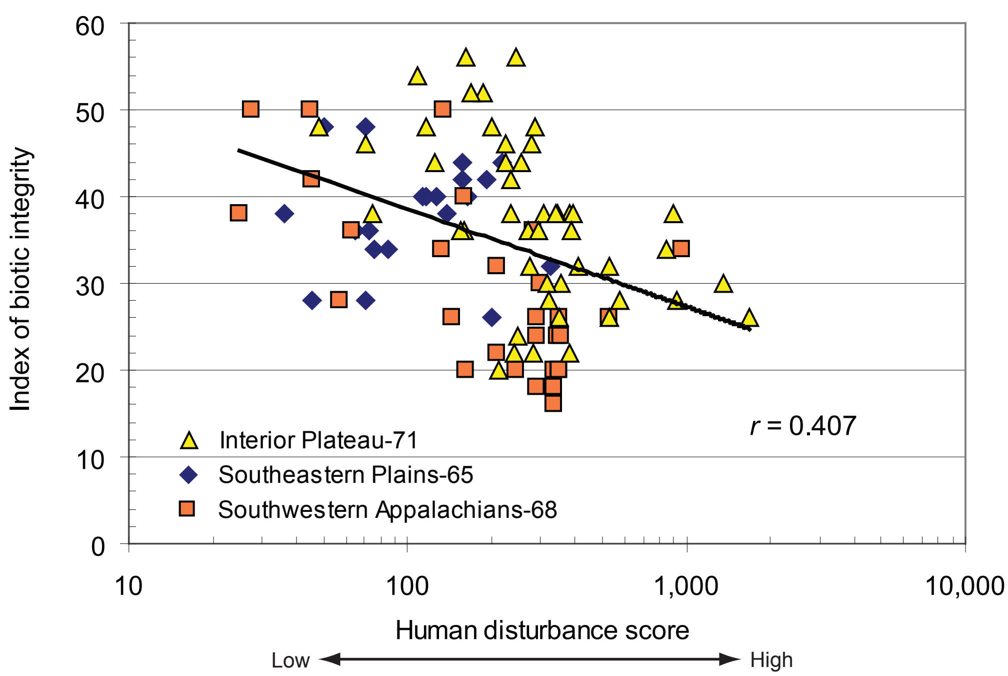


Figure 20. Comparison of the IBI in level III ecoregions relative to human disturbance and a comparison of IBI scores for small and large watersheds relative to human disturbance.

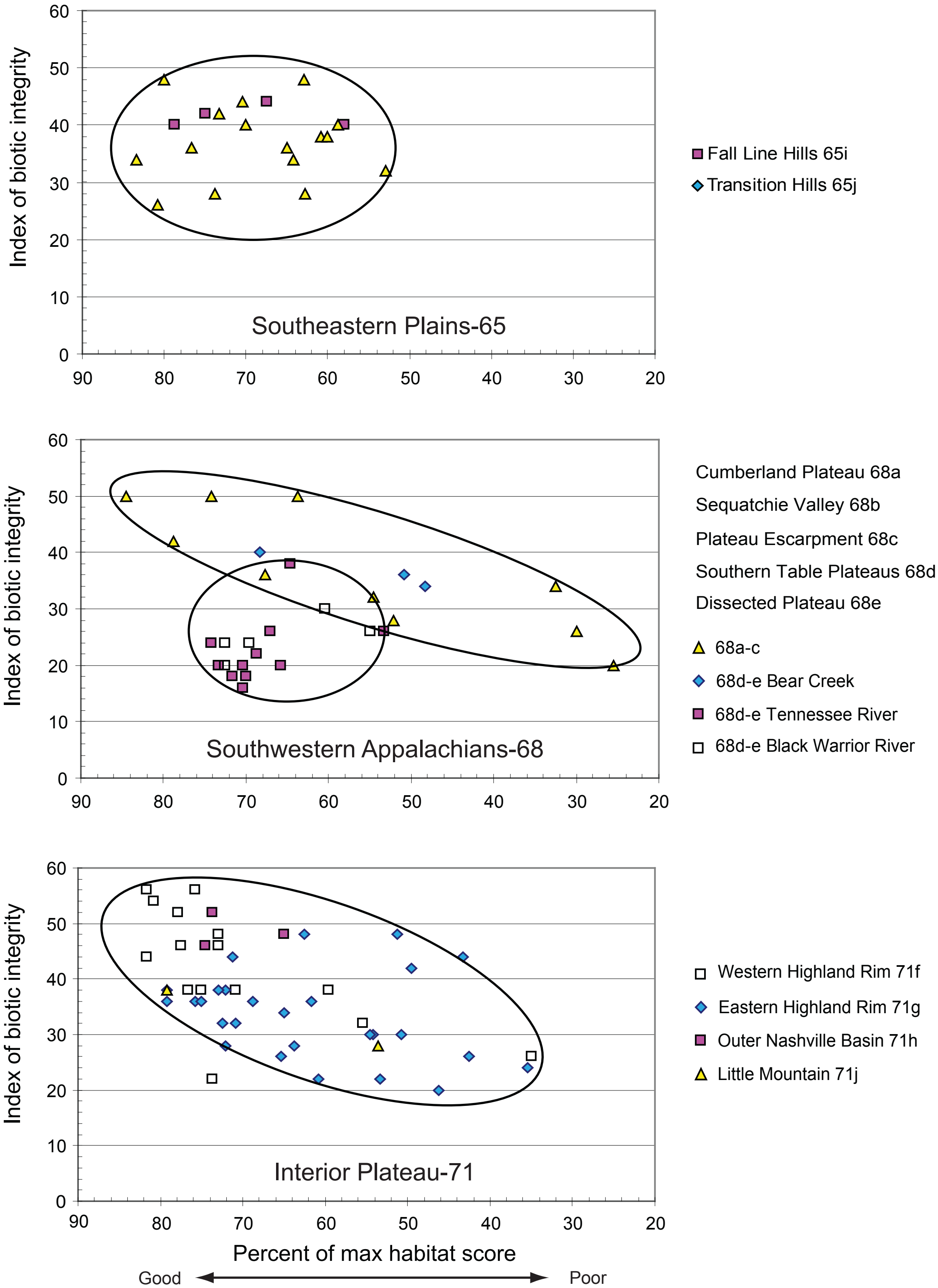


Figure 21. Comparison of the IBI relative to habitat quality for for level IV ecoregions in the Tennessee Valley ichthyoregion.

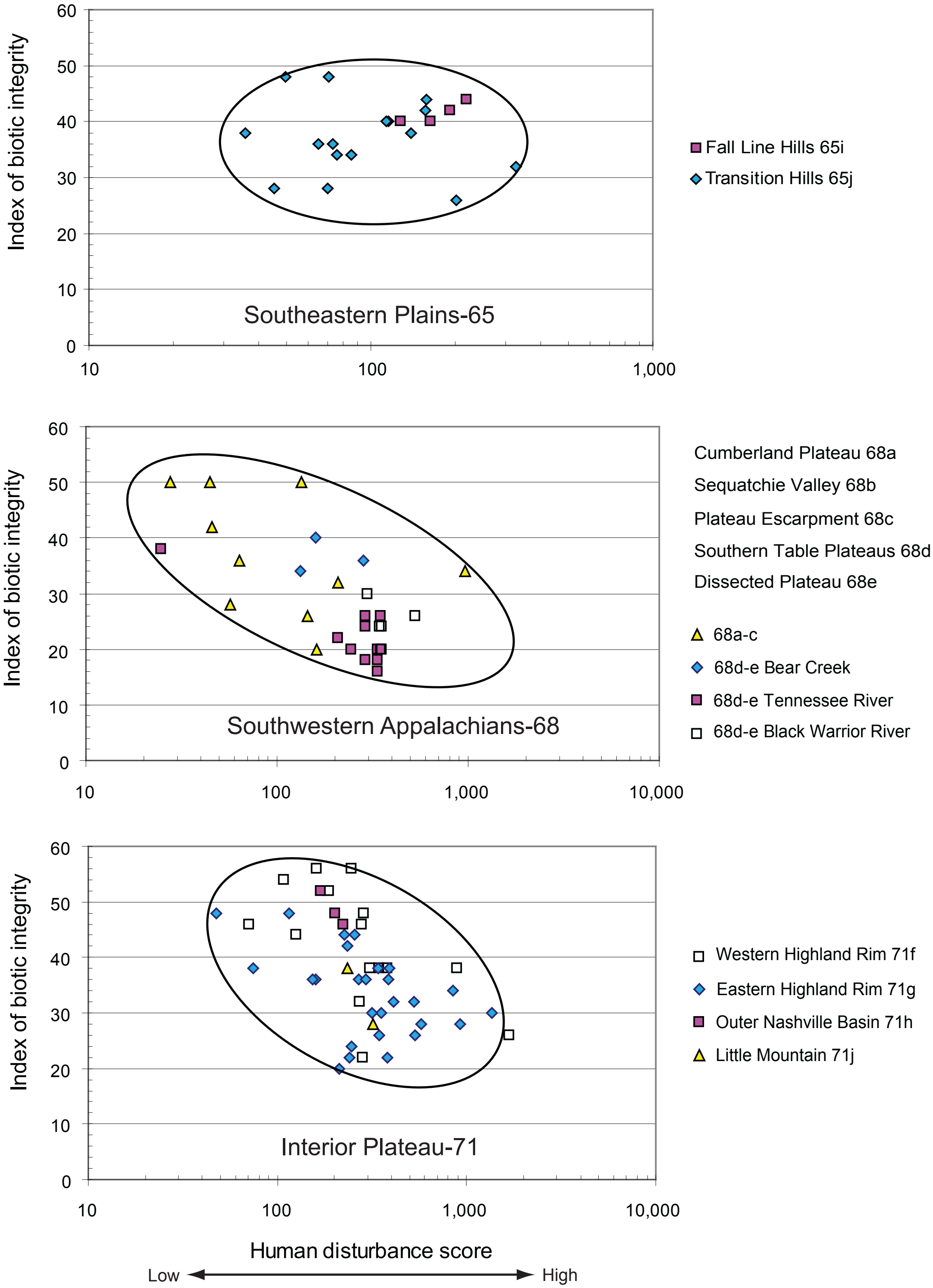


Figure 22. Comparison of the IBI relative to human disturbance for level IV ecoregions in the Tennessee Valley ichthyoregion.

The concept of biologically based tiered aquatic-life uses (TALU) is emerging as a tool to incorporate ecologically relevant information into water-quality management decisions, biologically quantify water-quality improvements, and to merge the practice of biological monitoring and assessment with the implementation of water-quality standards (USEPA, 2005). Implementation of aquatic-life uses into water-quality management is developing around a scientific model known as the Biological Condition Gradient (BCG), which describes how certain attributes of aquatic ecosystems, such as community structure, condition of organisms, and ecosystem function, respond to increasing levels of stressors (USEPA, 2005). The BCG can be considered an instream-based aquatic community analog of the classical laboratory-based dose-response toxicity relationship for single species. Dose in the BCG model (x axis) equals increasing levels of stressors and response (y axis) equals some measure of biological condition, such as the IBI.

The BCG model can be applied to the calibrated IBI for the Tennessee Valley ichthyoregion with the IBI serving as the measure of biological condition (y axis) and habitat quality (percent of maximum attainable habitat) or human disturbance serving as the measure of increasing level of ecosystem stress (x axis) (fig. 23). The Tennessee Valley IBI was integrated with the BCG model by using the IBI integrity classes (table 12) as tiers and the IBI endpoints within each tier to define a subset of data for calculating statistical limits (95% confidence interval) for graphical description. Curves were hand fitted to the biological integrity tiers (fig. 24) ranging from a more gradually declining logistic relationship, curve A, that adequately captures the middle tiers (good, fair, poor), to the very steep relationship depicted in curve C that captures all of the tiers and describes a threshold “all-or-none” relationship where biological condition degrades precipitously when habitat degradation or human disturbance reaches a critical threshold. These results were similar to those reported for the Southern Plains ichthyoregion (O’Neil and Shepard, 2009), and the BCG relationship may be best described by an intermediate type of curve such as “B” in figure 24. Given that the lowest tier, very poor, responded similarly for the Southern Plains and Tennessee Valley IBIs it may be that we are ultimately not able to clearly designate five tiers of

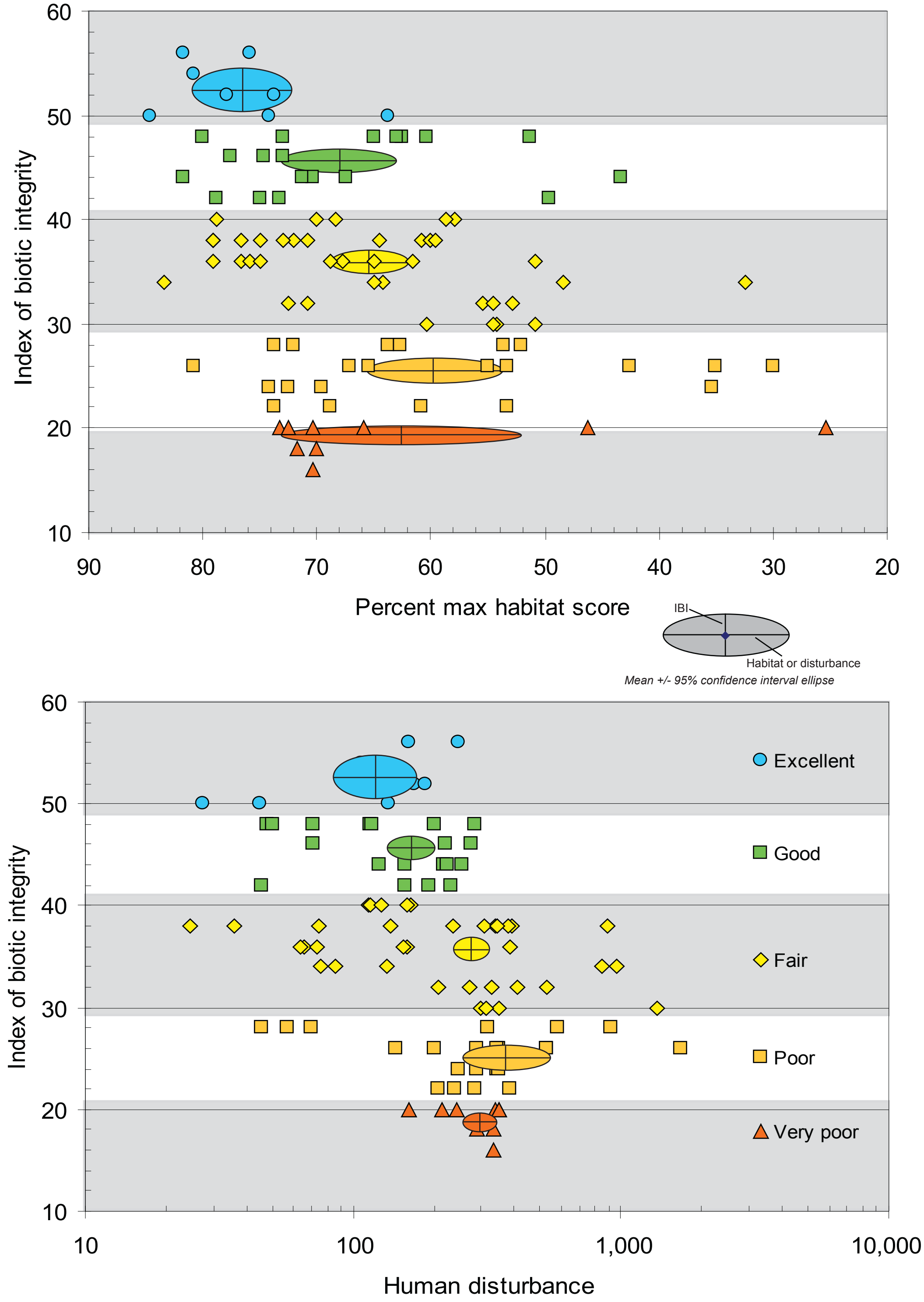


Figure 23. Tiered aquatic life use relationships between the IBI, habitat quality, and human disturbance for sites in the Tennessee Valley ichthyoregion.

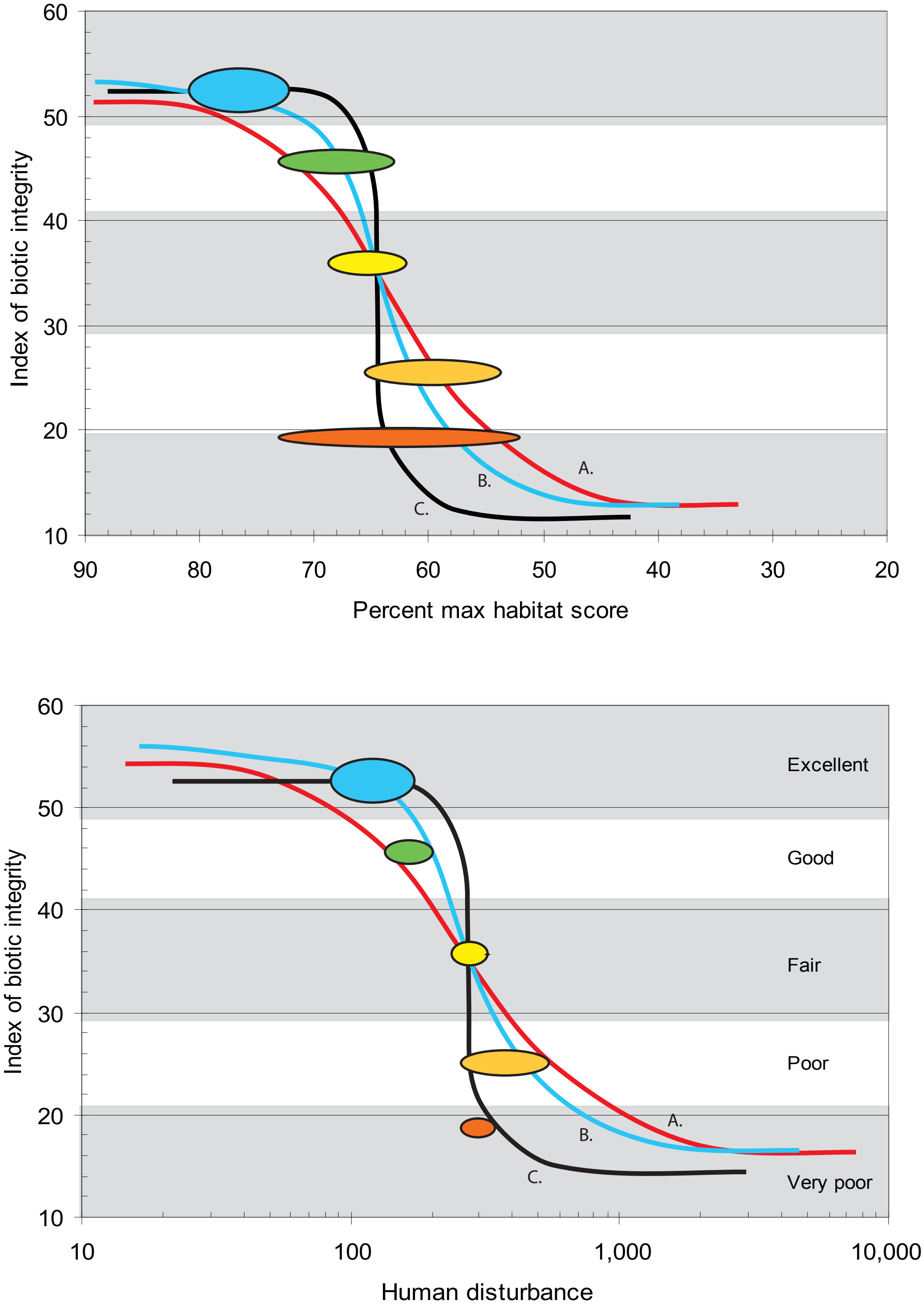


Figure 24. Biological condition gradient models for the Tennessee Valley ichthyoregion.

biological condition using the IBI. With further sampling and development of metrics and criteria for the remaining ecoregions, we may find it prudent to reduce the number of workable tiers to four. Should the relationship between biological condition and habitat quality be closer to curve C, then it can be estimated from the curve that when habitat scores decline to 62 to 66 percent of the maximum then biological condition will decline abruptly to poor scores, similar to results found for the Southern Plains. The form of BCG relationships in the Tennessee Valley ichthyoregion can only be theorized at this time until development of the IBI across the state is complete. Further sampling in streams with very poor habitat and streams that are the very least disturbed will be required before the form of this relationship can be determined with any certainty.

CONCLUSIONS

The IBI has been demonstrated in many states to correspond negatively to increasing levels of human disturbance and habitat degradation. We found this to be true for the Tennessee Valley ichthyoregion. Fish communities inhabiting streams in this region have been exposed to widespread agricultural and logging activities and expanding urban centers for many years. Watersheds in the eastern and western parts of the Tennessee Valley ichthyoregion support some of the most diverse fish communities in the state, particularly in the Cypress and Shoal Creek systems and in the Paint Rock River, while other streams support a fauna substantially impaired. We obtained better correlations and relationships between the IBI and measures of habitat degradation and human disturbance for Tennessee Valley streams compared to those in the Southern Plains in southeast Alabama. This can be attributed in part to the more prevalent hard rock substrates, and parallel more complex habitat structure, in north Alabama streams compared to the sandy bottomed, more uniform habitat streams in southeast Alabama.

With the exception of streams on the Cumberland Plateau physiographic section which includes level IV ecoregions 68d (Southern Table Plateaus) and 68e (Dissected Plateau), and streams in the Bear Creek system on the East Gulf Coastal Plain which includes the Southeastern Plains and Southwestern Appalachians level III ecoregions, the IBI as formulated should be applicable throughout most of the Tennessee River drainage in Alabama. We think the procedure is robust enough to be broadly applicable across the region and, if needed, can be calibrated to specific level IV reference sites. This calibration of the Tennessee Valley IBI is an important initial step in its development as a tool for evaluating biological stream quality for the region but it will need to be reevaluated and refined as new sampling data are collected in the future.

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Appendix A

Habitat evaluation forms

ADEM-FIELD OPERATIONS-MONTGOMERY BRANCH
RIFFLE/RUN HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody ______________________________ Date: ______________

Station Number ______________ Investigators ______________________________

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1 **Instream Cover**	>50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	50-30% mix of boulder, cobble, or other stable habitat; adequate habitat.	30-10% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	<10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2 **Epifaunal surface**	Well-developed riffle and run; riffles as wide as stream and length is 2x the width of stream; abundance of cobble.	Riffle is as wide as stream, but length is <2 times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is <2 times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3 **Embeddedness**	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are >75% surrounded by fine sediment.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4 **Velocity/Depth Regimes**	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-shallow, fast-deep).	Only 3 of 4 regimes present. (if fast-shallow is missing, score lower.)	Only 2 of 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5 **Man-made Channel Alteration**	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; and 40 - 80% of stream reach is channelized and disrupted.	Banks shored with gabion or cement; >80% of the stream reach channelized and disrupted.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6 **Sediment Deposition**	Little or no enlargement of islands or point bars and less than 5 % of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel or coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; > 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 **Frequency of Riffles** (Distance between riffles/ stream width)	<5 5 6 7	8 9 11 13 15	16 18 21 23 25	26 28 30 32 34 ≥ 35
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8 **Channel flow Status**	Water reaches base of both lower banks.	Water fills >75% of the available channel.	Water fills 75 - 25% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9 **Condition of Banks**	Banks stable; no evidence (<5%) of erosion or bank failure.	Moderately stable; infrequent, small areas (5-30%) of erosion mostly healed over.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent Along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10 **Bank Vegetative Protection**	>90% of the streambank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the streambank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0
11 **Grazing or other disruptive pressure**	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; < 1/2 of the potential plant stubble height remaining.	Disruption of streambank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0
12 **Riparian vegetative zone (each bank)**	Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 60 - 40 feet; human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0

ADEM-FIELD OPERATIONS-MONTGOMERY BRANCH
GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody ______________________________ Date: ____________________

Station Number ____________________ Investigators ______________________________

Habitat Parameter	Category: Optimal	Suboptimal	Marginal	Poor
1 **Instream Cover**	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2 **Pool Substrate Characterization**	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3 **Pool Variability**	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4 **Man-made Channel Alteration**	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5 **Sediment Deposition**	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6 **Channel Sinuosity**	Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 **Channel flow Status**	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8 **Condition of Banks**	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
Score ______	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9 **Bank Vegetative Protection (each bank)**	> 90% of the streambank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the streambank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0
10 **Grazing or other disruptive pressure (each bank)**	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; >1/2 of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; <1/2 of the potential plant stubble height remaining.	Disruption of streambank vegetation is very high; vegetation has been removed to ≤ 2 inches average stubble height.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0
11 **Riparian vegetative zone Width (each bank)**	Width of riparian zone >60 feet; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 60 - 40 feet; human activities have impacted zone only minimally.	Width of riparian zone 40 - 20 feet; human activities have impacted zone a great deal.	Width of riparian zone <20 feet; little or no riparian vegetation due to human activities.
Score (LB) ______	10 9 8	7 6	5 4 3	2 1 0
Score (RB) ______	10 9 8	7 6	5 4 3	2 1 0

Appendix B

Reproduction and trophic guild classifications for Alabama fishes

Explanation

Conservation status (Cons. Status)
(from Mirarchi, 2004)
- P1-highest concern
- P2-high concern
- P3-moderate concern
- P4-low concern
- P5-lowest concern
- E-endangered
- T-threatened

Vulnerability (Vulner.)
(From Jelks and others, 2009)
- CS-currently stable
- V-vulnerable

Habitat
- I-impoundment
- R-river
- S-stream
- H-headwater
- Sp-spring
- Ca-cave
- Sw-swamp
- E-estuarine

Distribution (Dist.)
- W-widespread
- R-restricted
- D-disjunct
- Ex-extirpated
- I-introduced

Abundance (Abund.)
- C-common
- O-occasional
- U-uncommon
- R-rare
- Unk-unknown

Reproduction guild (Repro. guild)
- 1-simple lithophils
- 2-manipulative lithophils
- 3-simple miscellaneous spawners
- 4- manipulative misc. spawners

Feeding guild
- DAH-detritovore-algivore-herbivore
- AHI-algivore-herbivore-invertivore
- INV-invertivore
- INS-insectivore
- PIS-piscivore
- PAR-parasite
- IP-invertivore, piscivore

Tolerance
- INT-intolerant
- TOL-tolerant

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
PETROMYZONTIDAE- LAMPREYS								
Ichthyomyzon bdellium- Ohio lamprey	P5	CS	R, S	R	O	2	PAR	--
I. castaneus- chestnut lamprey	P5	CS	I, R, S	W	O	2	PAR	--
I. gagei- southern brook lamprey	P5	CS	R, S	W	O	2	DAH	--
I. greeleyi- mountain brook lamprey	P3	CS	S, H	R	U	2	DAH	INT
Lampetra aepyptera- least brook lamprey	P5	CS	S, H	W	O	2	DAH	--
L. appendix- American brook lamprey	P3	CS	S	R	U	2	DAH	--
CARCHARHINIDAE- REQUIEM SHARKS								
Carcharhinus leucas- bull shark	P5	CS	E, R	R	R	3	PIS	--
ACIPENSERIDAE- STURGEONS								
Acipenser fulvescens- lake sturgeon	Ex	V	R	Ex	Unk	1	INV	--
A. oxyrhinchus desotoi- Atlantic sturgeon	P2, T	T	R	R	U	1	INV	INT
Scaphirhynchus platorynchus- shovelnose sturgeon	Ex	CS	R	Ex	Unk	1	INV	--
S. suttkusi- Alabama sturgeon	P1, E	E	R	R	R	1	INV	INT
POLYODONTIDAE- PADDLEFISH								
Polyodon spathula- paddlefish	P4	V	R, I	W	O	3	AHI	--
LEPISOSTEIDAE- GARS								
Atractosteus spatula- alligator gar	P3	V	R	R	O	3	IP	--
Lepisosteus oculatus- spotted gar	P5	CS	R, I, Sw	W	C	3	IP	--
L. osseus- longnose gar	P5	CS	R, I	W	C	3	IP	TOL
L. platostomus- shortnose gar	Ex	CS	R, I	Ex	Unk	3	IP	TOL
AMIIDAE- BOWFIN								
Amia calva- bowfin	P5	CS	R, I, Sw	W	O	4	IP	--
HIODONTIDAE- MOONEYES								
Hiodon alosoides- goldeye	Ex	CS	R, I	Ex	Unk	1	IP	--
H. tergisus- mooneye	P4	CS	R, I	W	O	1	IP	--
ANGUILLIDAE- FRESHWATER EELS								
Anguilla rostrata- American eel	P4	CS	R, I	W	O	3	IP	--
CLUPEIDAE-HERRINGS								
Alosa alabamae- Alabama shad	P2	T	R	W	R	3	INV	INT
A. chrysochloris- skipjack herring	P3	CS	R	W	C	3	INV	--
Dorosoma cepedianum- gizzard shad	P5	CS	I, R, S	W	C	3	AHI	TOL
D. petenense- threadfin shad	P5	CS	I, R, S	W	C	3	AHI	--
ENGRAULIDAE- ANCHOVIES								
Anchoa mitchilli- bay anchovy	P5	CS	E, R	R	C	3	INV	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
CYPRINIDAE- CARPS AND MINNOWS								
Campostoma oligolepis- largescale stoneroller	P5	CS	S, H	W	C	2	DAH	--
C. pauciradii- bluefin stoneroller	P3	CS	S, H	R	C	2	DAH	--
Carassius auratus- goldfish	P5	CS	I	I, R	U	3	AHI	TOL
Clinostomus funduloides- rosyside dace	P5	CS	S, H	R	O	1	INV	--
Ctenopharyngodon idella- grass carp	Exotic	CS	R, I	I, W	U	3	AHI	TOL
Cyprinella caerulea- blue shiner	P2, T	E	S	R, D	R	3	INS	INT
C. callistia- Alabama shiner	P5	CS	R, S	W	C	3	INV	--
C. callitaenia- bluestripe shiner	P3	V	R, S	R	U	3	INS	INT
C. galactura- whitetail shiner	P5	CS	S	R	C	3	INS	--
C. gibbsi- Tallapoosa shiner	P4	CS	S, H	R	C	3	INS	--
C. lutrensis- red shiner	Exotic	CS	I, S	R	R	3	INS	TOL
C. spiloptera- spotfin shiner	P5	CS	I, R, S	R	C	3	INS	--
C. trichroistia- tricolor shiner	P5	CS	R, S	R	C	3	INS	--
C. venusta- blacktail shiner	P5	CS	I, R, S	W	C	3	INV	--
C. whipplei- steelcolor shiner	P5	CS	I, R, S	W	C	3	INV	TOL
Cyprinus carpio- carp	Exotic	CS	I, R	I, W	C	3	INV,DAH	TOL
Erimonax monachus- spotfin chub	T	T	S	Ex	R	3	INS	INT
Erimystax dissimilis- streamline chub	P2	CS	S	R	U	1	INS	INT
E. insignis- blotched chub	P3	CS	S	R	U	1	INS	--
Hemitremia flammea- flame chub	P4	V	Sp, H	R	O	3	INV	--
Hybognathus hayi- cypress minnow	P4	CS	R, I, Sw	W	U	1	DAH	--
H. nuchalis- Mississippi silvery minnow	P4	CS	R, I	W	C	1	DAH	--
Hybopsis amblops- bigeye chub	P5	CS	S	R	O	1	INS,INV	INT
H. lineapunctata- lined chub	P5	V	S, H	R	C	1	INS	INT
H. winchelli-clear chub	P5	CS	R, S, I	W	C	1	INS	--
H. sp. cf winchelli-	P5	CS	R, S	W	C	1	INS	--
Hypophthalmichthys molitrix- silver carp	Exotic	CS	I, R	I	U	3	DAH	TOL
H. nobilis- bighead carp	Exotic	CS	I, R	I	U	3	DAH,INV	TOL
Luxilus chrysocephalus- striped shiner	P5	CS	S, H	W	C	2	INS,DAH	TOL
L. coccogenis- warpaint shiner	P4	CS	S, H	R	O	1	INS,INV	--
L. zonistius- bandfin shiner	P5	CS	S, H	R	O	1	INS,DAH	--
Lythrurus alegnotus- Warrior shiner	P5	CS	S, H	R	O	1	INS	--
L. atrapiculus- blacktip shiner	P5	CS	S, H	R	C	1	INS	--
L. bellus- pretty shiner	P5	CS	S, H	W	C	1	INS	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
L. fasciolaris- scarlet shiner	P5	CS	S, H	R	C	1	INS	--
L. fumeus- ribbon shiner	P3	CS	S	R	U	1	INS	--
L. lirus- mountain shiner	P4	CS	S, H	R	O	1	INS	INT
L. roseipinnis- cherryfin shiner	P5	CS	S, H	R	C	1	INS	--
Macrhybopsis a. hyostoma- shoal chub	P2	CS	R, S	R	R	1	INS	INT
M. sp cf aestivalis- undescribed chubs	P4	T, V	R, S	W	O	1	INS	INT
M. sp. cf aestivalis- Florida chub	P4	V	R, S	W	O	1	INS	INT
M. storeriana- silver chub	P5	CS	I, R, S	W	O	1	INS,INV	--
Nocomis leptocephalus- bluehead chub	P5	CS	S, H	W	C	2	INS,AHI	--
N. micropogon- river chub	P4	CS	S, C	W	U	2	INV	--
Notemigonus crysoleucas- golden shiner	P5	CS	I, R, S	W	O	3	INS,AHI	TOL
Notropis albizonatus- palezone shiner	P1, E	E	S, H	R	R	1	INS,AHI	INT
N. ammophilus- orangefin shiner	P5	CS	R, S	W	C	1	INS,DAH	--
N. ariommus- popeye shiner	Ex	V	S	Ex	Unk	1	INS,DAH	--
N. asperifrons- burrhead shiner	P5	CS	S	W, D	O	1	INS,DAH	INT
N. atherinoides- emerald shiner	P5	CS	I, R, S	W	C	1	INS,AHI	--
N. baileyi- rough shiner	P5	CS	S, H	W	C	2	INS,DAH	--
N. boops- bigeye shiner	P5	CS	S, H	R	U	1	INS,DAH	INT
N. buccatus- silverjaw minnow	P5	CS	R, S	W	C	1	INS,AHI	--
N. buchanani- ghost shiner	P2	CS	I, R	R	U	1	INS,DAH	INT
N. cahabae- Cahaba shiner	P1, E	E	R	R	R	3	INS,DAH	INT
N. candidus- silverside shiner	P5	CS	I, R	W	C	1	INS,DAH	--
N. chalybaeus- ironcolor shiner	P1	V	S, Sp	W	U	1	INS,DAH	INT
N. chrosomus- rainbow shiner	P5	CS	H	W, D	O	2	INS,DAH	INT
N. cummingsae- dusky shiner	P2	CS	H, Sw	R	U	1	INS,DAH	INT
N. edwardraneyi- fluvial shiner	P5	CS	I, R	W	C	1	INS,AHI	--
N. harperi- redeye chub	P5	CS	H, Sp	R	U	1	INS,DAH	INT
N. hypsilepis- highscale shiner	P3	V	S, H	R	O	1	INS,DAH	INT
N. leuciodus- Tennessee shiner	P4	CS	S, H	R	O	2	INS,DAH	INT
N. longirostris- longnose shiner	P5	CS	R, S	W	C	1	INS,DAH	--
N. maculatus- taillight shiner	P4	CS	S, Sw	W	U	3	INS,AHI	--
N. melanostomus- blackmouth shiner	P1	T	S	R	R	2	INS	INT
N. micropteryx- highlands shiner	P3	CS	S	R	U	1	INS,DAH	INT
N. petersoni- coastal shiner	P5	CS	S	R	O	1	INS,DAH	--
N. photogenis- silver minnow	P3	CS	S	R	U	1	INS,AHI	INT

FAMILY NAME **Scientific name - common name**	**Cons. status**	**Vulner.**	**Habitat**	**Dist.**	**Abund.**	**Reprod. guild**	**Feeding guild**	**Tolerance**
N. stilbius- silverstripe shiner	P5	CS	S	W	C	1	INS,DAH	--
N. telescopus- telescope shiner	P5	CS	S, H	R	O	1	INS,DAH	--
N. texanus- weed shiner	P5	CS	I, R, S	W	C	1	INS,DAH	--
N. uranoscopus- skygazer shiner	P3	CS	R	R	C	1	INS,DAH	INT
N. volucellus- mimic shiner	P5	CS	R, S	W	C	3	INS,AHI	--
N. sp cf volucellus- Mobile basin form	P5	CS	R, S	W	C	3	INS,AHI	--
N. wickliffi- channel shiner	P5	CS	I, R	R	U	3	INS,DAH	--
N. xaenocephalus- Coosa shiner	P5	CS	S, H	R	C	1	INS,DAH	--
N. sp cf spectrunculus (sawfin shiner)	P4	CS	S, H	R	U	1	INS,DAH	INT
Opsopoeodus emiliae- pugnose minnow	P5	CS	I, R, S	W	O	4	AHI	--
Phenacobius catostomus- riffle minnow	P5	CS	R, S	W	O	1	INS	--
P. mirabilis- suckermouth minnow	P1	CS	S	R	U	1	INS	INT
P. uranops- stargazing minnow	P2	CS	S	R	U	1	INS	INT
Phoxinus erythrogaster- southern redbelly dace	P5	CS	S, H	R	O	1	AHI	--
Pimephales notatus- bluntnose minnow	P5	CS	R, S, H	W	C	4	DAH,INV	TOL
P. promelas- fathead minnow	P5	CS	I, R, S	I	U	4	DAH,INV	TOL
P. vigilax- bullhead minnow	P5	CS	I, R, S	W	C	4	DAH,INV	TOL
Pteronotropis euryzonus- broadstripe shiner	P2	V	S, Sw	R	O	1	INS,DAH	INT
P. grandipinnis- Apalachee shiner	P3	CS	S, H	W	C	1	INS,DAH	--
P. hypselopterus- sailfin shiner	P5	CS	S, H	W	C	1	INS,DAH	--
P. merlini- orangetail shiner	P4	V	S, H	W	C	1	INS,DAH	--
P. signipinnis- flagfin shiner	P5	CS	S, Sw	R	O	1	INS,DAH	--
P. welaka- bluenose shiner	P2	V	S, Sw	W	U	1	INS,DAH	INT
Rhinichthys atratulus- blacknose dace	P5	CS	S, H, Sp	R	O	1	INS	TOL
Semotilus atromaculatus- creek chub	P5	CS	S, H, Sp	W	C	2	IP,INS	TOL
S. thoreauianus- Dixie chub	P5	CS	S, H, Sp	W	O	2	IP,INS	--
CATOSTOMIDAE- SUCKERS								
Carpiodes carpio- river carpsucker	P5	CS	I, R	R	O	3	DAH,INV	--
C. cyprinus- quillback	P5	CS	I, R	W	C	3	DAH,INV	--
C. velifer- highfin carpsucker	P5	CS	I, R	W	C	3	DAH,INV	--
Catostomus commersoni- white sucker	P5	CS	S, H, Sp	R	O	1	INV,AH	--
Cycleptus elongatus- blue sucker	P3	V	I, R	R	U	1	AHI	INT
Cycleptus meridionalis- southeastern blue sucker	P4	V	I, R	W	C	1	AHI	--
Erimyzon oblongus- creek chubsucker	P5	CS	S, H	W	C	2	INV,AH	--
E. sucetta- lake chubsucker	P5	CS	S, Sw	W	O	2	AHI	--
E. tenuis- sharpfin chubsucker	P5	CS	S, Sw	W	O	2	AHI	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
Hypentelium etowanum- Alabama hog sucker	P5	CS	R, S	W	C	1	AHI	--
H. nigricans- northern hog sucker	P5	CS	R, S	R	C	1	AHI	--
Ictiobus bubalus- smallmouth buffalo	P5	CS	I, R	W	C	3	INV	--
I. cyprinellus- bigmouth buffalo	P5	CS	I, R	R	O	3	INV	--
I. niger- black buffalo	P5	CS	I, R	R	O	3	INV	--
Minytrema melanops- spotted sucker	P5	CS	I, R, S	W	C	1	INV,DAH	TOL
Moxostoma anisurum- silver redhorse	P5	CS	I, R, S	R	O	1	INV	--
M. breviceps- smallmouth redhorse	P5	CS	I, R, S	R	O	1	INV	--
M. carinatum- river redhorse	P5	CS	I, R	W	O	1	INV	INT
M. duquesnei- black redhorse	P5	CS	I, R, S	W	C	1	INV	--
M. erythrurum- golden redhorse	P5	CS	I, R, S	W	C	1	INV	--
M. lacerum- harelip sucker	Extinct	X	--	Extinct	--	1	INV	--
M. poecilurum- blacktail redhorse	P5	CS	I, R, S	W	C	1	INV	--
M. sp cf poecilurum- Apalachicola redhorse	P4	CS	I, R, S	R	O	1	INV	--
Scartomyzon lachneri- greater jumprock	P5	CS	I, R, S	R	C	1	INV	--
ICTALURIDAE- BULLHEAD CATFISHES								
Ameiurus brunneus- snail bullhead	P4	V	I, R, S	R	O	4	IP,DAH	--
A. catus- white catfish	P4	CS	I, R, S	W	U	4	IP,DAH	--
A. melas- black bullhead	P5	CS	R, S	W	O	4	AHI,PIS	TOL
A. natalis- yellow bullhead	P5	CS	I, R, S	W	C	4	AHI,PIS	TOL
A. nebulosus- brown bullhead	P5	CS	I, R, S, Sw	W	U	4	IP,DAH	TOL
A. serracanthus- spotted bullhead	P3	V	I, R	R	U	4	AHI,PIS	--
Ictalurus furcatus- blue catfish	P5	CS	I, R	W	C	4	INV	--
I. punctatus- channel catfish	P5	CS	I, R, S	W	C	4	INV	--
Noturus sp cf elegans- Chucky madtom (crypticus)	Ex	E	R, S	Ex	Unk	4	INS,INV	INT
N. eleutherus- mountain madtom	P2	CS	R, S	R	R	4	INS,INV	INT
N. exilis- slender madtom	P5	CS	S	R	U	4	INS,AH	--
N. funebris- black madtom	P5	CS	S, H	W	C	4	INV	--
N. gyrinus- tadpole madtom	P5	CS	S, H	W	C	4	INS,INV	--
N. leptacanthus- speckled madtom	P5	CS	S, H	W	C	4	INS	--
N. miurus- brindled madtom	P2	CS	S	R	U	4	INS,INV	INT
N. munitus- frecklebelly madtom	P2	V, E	R, S	D	R	4	INS,INV	INT
N. nocturnus- freckled madtom	P5	CS	S	W	U	4	INS,INV	--
N. sp. cf flavus- highlands stonecat	P2	CS	R, S	R	U	4	INS,AH,PIS	INT
Pylodictis olivaris- flathead catfish	P5	CS	I, R	W	O	4	IP	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
ESOCIDAE-PIKES								
Esox americanus- redfin pickerel	P5	CS	S, H, Sw	W	O	3	IP	--
E. masquinongy - muskellunge	Exotic	CS	I, R, S	I, R	R	3	IP	--
E. niger- chain pickerel	P5	CS	I, R, S, Sw	W	O	3	IP	--
SALMONIDAE- TROUTS								
Oncorhynchus mykiss- rainbow trout	Exotic	CS	S	I, R	U	1	IP	INT
Salmo trutta- brown trout	Exotic	CS	S	I, R	R	1	IP	INT
APREDODERIDAE- PIRATE PERCH								
Aphredoderus sayanus- pirate perch	P5	CS	S, H, Sw	W	O	4	INS, PIS	--
AMBLYOPSIDAE- CAVEFISHES								
Speoplatyrhinos poulsoni- Alabama cavefish	P1, E	E	Ca	R	R	4	DAH,INV	INT
Typhlichthys subterraneus- southern cavefish	P3	V	Ca	R	U	4	DAH,INV	INT
MUGILIDAE								
Mugil cephalus- striped mullet	P5	CS	E, I, R	W	O	3	DAH,INV	--
ATHERINOPSIDAE- NEW WORLD SILVERSIDES								
Labidesthes sicculus- brook silverside	P5	CS	I, R, S	W	C	3	INV	--
Menidia audens- Mississippi silverside	P5	CS	E, R	R	O	3	INV	--
M. beryllina- inland silverside	P5	CS	E, R	R	O	3	INV	--
BELONIDAE- NEEDLEFISHES								
Strongylura marina- Atlantic needlefish	P5	CS	I, R	W	O	3	PIS	--
FUNDULIDAE- TOPMINNOWS AND KILLIFISHES								
Fundulus albolineatus- whiteline topminnow	Extinct	X	--	Extinct	Unk		INV	--
F. bifax- stippled topminnow	P3	V	R, S, Sw	R	O	1	INV	--
F. blairae- western starhead topminnow	P4	CS	S, Sw	W	U	3	INV	--
F. catenatus- northern studfish	P5	CS	S, H	R	O	1	INV	--
F. chrysotus- golden topminnow	P4	CS	Sw	R	U	3	INS,INV	--
F. cingulatus- banded topminnow	P4	CS	S, Sp, Sw	R	U	3	INV	--
F. confluentus- marsh killifish	P3	CS	S, Sw	R	R	3	INV	--
F. dispar- starhead topminnow	P3	CS	I, S, Sw	W	O	3	INV	--
F. escambiae- russetfin topminnow	P5	CS	R, S, Sw	W	C	3	INV	--
F. jenkinsi- saltmarsh topminnow	P3	CS	S, Sw	R	R	3	INV	--
F. notatus- blackstripe topminnow	P5	CS	I, R, S, Sw	W	O	3	AHI	--
F. nottii- bayou topminnow	P5	CS	I, R, S, Sw	W	C	3	AHI	--
F. olivaceus- blackspotted topminnow	P5	CS	R, S, Sw, H	W	C	3	INV	--
F. pulvereus- bayou killifish	P3	CS	R, Sw	R	U	3	INV	--
F. stellifer- southern studfish	P5	CS	R, S	W	O	1	INV	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
Leptolucania ommata- pygmy killifish	P4	CS	Sw	R	U	3	INS	--
Lucania goodei- bluefin killifish	P3	CS	Sw, Sp	R	O	3	INS	--
L. parva- rainwater killifish	P4	CS	E, Sw	R	O	3	INS	--
POECILIIDAE- LIVEBEARERS								
Gambusia affinis- western mosquitofish	P5	CS	I, R, S, Sw, H	W	C	4	INS,AHI	TOL
G. holbrooki- eastern mosquitofish	P5	CS	I, R, S, Sw	W	C	4	INS,AHI	TOL
Heterandria formosa- least killifish	P4	CS	Sw	R	U	4	INS,AHI	--
Poecilia latipinna- sailfin molly	P5	CS	Sw	R	O	4	INV	--
CYPRINODONTIDAE- PUPFISHES								
Cyprinodon variegatus	P5	CS	Brackish	R	C	2	INV	--
COTTIDAE- SCULPINS								
Cottus bairdi- mottled sculpin	P5	CS	S, H	R	O	2	INS,IP	--
C. carolinae- banded sculpin	P5	CS	S, H, Sp	W	C	2	INS,IP	--
C. sp. cf carolinae- Tallapoosa sculpin	P3	CS	S, H, Sp	W	C	2	IP	--
C. paulus- pygmy sculpin	P1, T	E	Sp	R	R	2	INV	INT
MORONIDAE- TEMPERATE BASSES								
Morone chrysops- white bass	P5	CS	I, R	W	O	3	IP	--
M. mississippiensis- yellow bass	P5	CS	I, R	W	O	3	IP	--
M. saxatilis- striped bass	P3	CS	I, R	W	O	3	IP	--
M. chrysops x saxatilis	--		I, R	W	O		IP	--
CENTRARCHIDAE- SUNFISHES								
Ambloplites ariommus- shadow bass	P5	CS	R, S	W	O	2	IP	INT
A. rupestris- rock bass	P5	CS	R, S	R	O	2	IP	INT
Centrarchus macropterus- flier	P5	CS	R, S, Sw	W	U	4	INV	--
Enneacanthus gloriosus- bluespotted sunfish	P4	CS	Sw	R	U	4	INV	--
E. obesus- banded sunfish	P3	CS	Sw	R	U	4	INV	--
Lepomis auritus- redbreast sunfish	P5	CS	I, R, S	W	C	2	INV	--
L. cyanellus- green sunfish	P5	CS	R, S, H	W	C	2	IP	TOL
L. gulosus- warmouth	P5	CS	R, S. H	W	O	4	IP	--
L. humilis- orangespotted sunfish	P5	CS	R, S	W	O	2	INV	--
L. macrochirus- bluegill	P5	CS	I, R, S, H	W	C	2	INV	TOL
L. marginatus- dollar sunfish	P5	CS	R, S	W	O	2	INV	--
L. megalotis- longear sunfish	P5	CS	I, R, S, H	W	C	2	INV	--
L. microlophus- redear sunfish	P5	CS	I, R, S	W	C	2	INV	--
L. miniatus- redspotted sunfish	P5	CS	R, S, H, Sw	W	C	2	INV	--

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
Micropterus cataractae- shoal bass	P2	V	I, R, S	R	O	2	IP	INT
M. coosae- redeye bass	P5	CS	R, S	R	C	2	IP	--
M. dolomieui- smallmouth bass	P5	CS	I, R, S	R	C	2	IP	--
M. punctulatus- spotted bass	P5	CS	I, R, S, H	W	C	4	IP	--
M. salmoides- largemouth bass	P5	CS	I, R, S, Sw	W	C	4	IP	--
Pomoxis annularis- white crappie	P5	CS	I, R, S	W	O	4	IP	--
P. nigromaculatus- black crappie	P5	CS	I, R, S	W	O	4	IP	--
PERCIDAE- DARTERS AND PERCHES								
Ammocrypta beanii- naked sand darter	P5	CS	R, S	W	O	1	INS	--
A. bifascia- Florida sand darter	P5	CS	R, S	R	O	1	INS	--
A. meridiana- southern sand darter	P5	CS	R, S	W	O	1	INS	--
Crystallaria asprella- crystal darter	P3	V	R	W	U	1	INS	INT
Etheostoma artesiae- redspot darter	P5	CS	S, H	W	C	3	INS	--
E. bellator- Warrior darter	P3	CS	S, H	R	U	3	INS	INT
E. sp. cf bellator- Locust Fork darter	P2	E	S, H	R	U	3	INS	INT
E. sp. cf bellator- Sipsey darter	P2	T	S, H	R	U	3	INS	INT
E. blennioides- greenside darter	P5	CS	R, S, H	R	O	3	INS	--
E. blennius- blenny darter	P4	CS	S	R	U	1	INS	INT
E. boschungi- slackwater darter	P1, T	E	S, H	R	U	3	INS	INT
E. brevirostrum- holiday darter	P1	E	S, H	R	U	3	INS	INT
E. caeruleum- rainbow darter	P5	CS	S, H, Sp	R	C	1	INS	--
E. camurum- bluebreast darter	P2	CS	R, S	R	U	1	INS	INT
E. chermocki- vermilion darter	P1, E	E	S, H, Sp	R	U	3	INS	INT
E. chlorosomum- bluntnose darter	P5	CS	S, H	W	O	3	INS	--
E. chuckwachatte- lipstick darter	P2	V	S, H	R	O	1	INS	INT
E. cinereum- ashy darter	Ex	E	S	Ex	Unk	3	INS	INT
E. colorosum- coastal darter	P5	CS	S, H	R	C	3	INS	--
E. coosae- Coosa darter	P5	CS	S, H	R	C	3	INS	--
E. corona- crown darter	P5	T	S, H	R	C	4	INS	--
E. crossopterum- fringed darter	P3	CS	S, H	R	O	4	INS	--
E. davisoni- Choctawhatchee darter	P5	CS	S, H	R	O	4	INS	--
E. ditrema- coldwater darter	P2	T	S, H, Sp	R	U	3	INS	INT
E. douglasi- Tuskaloosa darter	P3	CS	S, H	R	O	1	INS	INT
E. duryi- black darter	P5	CS	S, H	R	C	3	INS	--
E. edwini- brown darter	P5	CS	S, H, Sw	W	O	3	INS	INT

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
E. flabellare- fantail darter	P5	CS	S, H	R	C	4	INS	--
E. fusiforme- swamp darter	P5	CS	Sw, H	W	U	3	INS	--
E. histrio- harlequin darter	P5	CS	R, S	W	U	3	INS	--
E. jessiae- blueside darter	P4	CS	S, H	R	U	1	INS	--
E. jordani- greenbreast darter	P5	CS	R, S, H	W	O	1	INS	INT
E. kennicotti- stripetail darter	P5	CS	S, H	R	O	4	INS	--
E. lachneri- Tombigbee darter	P5	CS	S, H	W	C	3	INS	--
E. lynceum- brighteye darter	P1	CS	S	R	U	3	INS	INT
E. neopterum- lollipop darter	P1	V	H	R	U	4	INS	INT
E. nigripinne- blackfin darter	P5	CS	S, H	R	C	4	INS	--
E. nigrum- johnny darter	P5	CS	S, H	W	C	4	INS	--
E. nuchale- watercress darter	P1, E	E	Sp	R	R	3	INS	INT
E. parvipinne- goldstripe darter	P5	CS	S, H	W	U	3	INS	--
E. phytophilum- rush darter	P1	E	S, H	R	R	3	INS	INT
E. proeliare- cypress darter	P5	CS	H, Sw	W	O	3	INS	--
E. ramseyi- Alabama darter	P5	CS	S, H	W	C	3	INS	--
E. rufilineatum- redline darter	P5	CS	R, S	R	C	1	INS	--
E. rupestre- rock darter	P5	CS	R, S	W	O	1	INS	--
E. simoterum- snubnose darter	P5	CS	S, H	R	O	3	INS	--
E. stigmaeum- speckled darter	P5	CS	S, H	W	C	1	INS	--
E. swaini- gulf darter	P5	CS	S, H	W	O	3	INS	--
E. tallapoosae- Tallapoosa darter	P4	CS	S, H	R	C	3	INS	--
E. trisella- trispot darter	P1	E	S,H	R	U	3	INS	INT
E. tuscumbia- Tuscumbia darter	P2	T	Sp	R	O	1	INS	INT
E. wapiti- boulder darter	P1, E	E	R, S	R	R	1	INS	INT
E. zonale- banded darter	P4	CS	R, S	R	O	3	INS	--
E. zonifer- backwater darter	P5	CS	H, Sw	W	U	3	INS	--
E. zonistium- bandfin darter	P2	CS	S, H	R	O	3	INS	INT
E. sp. cf zonistium- blueface darter	P2	T	S, H	R	U	3	INS	INT
Perca flavescens- yellow perch	P4	CS	I, R, S	W	O	3	IP	--
P. aurolineata- goldline darter	P1, T	T	R, S	R-D	R	1	INS	INT
P. austroperca- southern logperch	P3	CS	R, S	R	U	1	INS	--
P. brevicauda- coal darter	P2	T	R, S	R	U	1	INS	INT
P. burtoni- blotchside logperch	P1	T	R, S	R	R	1	INS	INT
P. caprodes- logperch	P5	CS	R, S	R	C	1	INS	--
P. crypta- halloween darter	P1	V	R, S	R	U	1	INS	INT
P. evides- gilt darter	P2	CS	R, S	R	U	1	INS	INT

FAMILY NAME Scientific name - common name	Cons. status	Vulner.	Habitat	Dist.	Abund.	Reprod. guild	Feeding guild	Tolerance
P. kathae- Mobile logperch	P5	CS	R, S	W	O	1	INS	--
P. lenticula- freckled darter	P3	T	R, S	W	U	1	INS	--
P. maculata- blackside darter	P5	CS	S, H	W	U	1	INS	INT
P. nigrofasciata- blackbanded darter	P5	CS	R, S, H	W	C	1	INS	--
P. palmaris- bronze darter	P5	CS	R, S	R	C	1	INS	--
P. phoxocephala- slenderhead darter	P1	CS	R, S	R	U	1	INS	INT
P. sciera- dusky darter	P5	CS	R, S	W	O	1	INS	--
P. shumardi- river darter	P5	CS	R, S	W	O	1	INS	--
P. sipsi- Bankhead darter	P1	E	R, S	R	R	1	INS	INT
P. smithvanizi- muscadine darter	P3	V	R, S	R	U	1	INS	--
P. suttkusi- Gulf logperch	P5	CS	R, S	W	U	1	INS	--
P. tanasi- snail darter	P1, T	T	R, S	R	R	1	INS,INV	INT
P. vigil- saddleback darter	P5	CS	R, S	W	O	1	INS	INT
Sander canadense- sauger	P5	CS	I, R	R	O	1	IP	--
S. vitreus- walleye	P3	CS	I, R	W	U	1	IP	--
SCIAENIDAE- DRUMS								
Aplodinotus grunniens- freshwater drum	P5	CS	I, R	W	C	3	INV	--
ELASSOMATIDAE- PYGMY SUNFISHES								
Elassoma alabamae- spring pygmy sunfish	P1	E	Sw, Sp	R	R	4	INV,INS	INT
E. evergladei- Everglades pygmy sunfish	P4	CS	H, Sp	R	O	4	INV,INS	--
E. zonatum- banded pygmy sunfish	P4	CS	S, H, Sw	W	C	4	INV,INS	--
PARALICHTHYIDAE- SAND FLOUNDERS								
Paralichthys lethostigma- southern flounder	P5	CS	E, I, R	R	O	1	IP	--
ACHIRIDAE- SOLES								
Trinectes maculatus- hogchoker	P5	CS	E, I, R	R	O	1	IP	--

Appendix C

Tennessee Valley ichthyoregion fish community sampling data

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	ALDM-234	ANDL-8	BAKM-2	BCBC-1	BCNJ-1	BEA-2	BERF-11	BERF-2	BERF-4	BERF-5	BFDM-1	BGNL-37	BIGL-14
GSA no.	2024	1961	2016	2192	1952	1962	2298	1917	2047	1924	2015	2058	1932
Date	15-May-09	2-Sep-09	12-May-09	9-Sep-08	30-Sep-09	2-Sep-09	5-Aug-08	10-Jul-09	27-May-09	8-Jul-09	12-May-09	5-Jun-09	29-Sep-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	535	46	187	17	2	225	112	23	17	25	163	28	30
Clinostomus funduloides - rosyside dace	--	--	--	88	--	--	--	--	--	--	--	--	--
Cyprinella callistia - Alabama shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	--	--	--	--	--	19	--	--	--	--	--	--	9
Cyprinella spiloptera - spotfin shiner	--	--	--	--	3	--	32	31	23	--	--	2	28
Cyprinella venusta - blacktail shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Hybopsis amblops - bigeye chub	--	--	--	--	19	--	--	--	--	--	--	4	--
Luxilus chrysocephalus - striped shiner	148	--	91	6	34	37	34	--	6	7	9	12	9
Luxilus coccogenis - warpaint shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	6	28	--	--	--
Lythrurus fasciolaris - scarlet shiner	--	--	--	--	60	--	--	--	--	--	--	17	2
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	1	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	62	--	--	--	--	2	1	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis baileyi - rough shiner	--	--	--	241	--	--	--	--	4	--	--	--	--
Notropis boops - bigeye shiner	--	--	--	--	--	--	5	--	--	--	--	--	--
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	3	--	--	--	--
Notropis photogenis - silver shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	--	3	--	--	--	--	--	--
Notropis volucellus - mimic shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	14	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow	11	--	15	--	4	--	--	--	3	--	--	12	--
Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow	--	--	1	--	--	--	68	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	1	--	--	--	--	--	--	--	--	--	--	--	--
Semotilus atromaculatus - creek chub	1	--	--	--	--	4	1	--	--	3	--	--	7
Semotilus thoreauianus - dixie chub	--	--	--	100	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	ALDM-234 2024 15-May-09	ANDL-8 1961 2-Sep-09	BAKM-2 2016 12-May-09	BCBC-1 2192 9-Sep-08	BCNJ-1 1952 30-Sep-09	BEA-2 1962 2-Sep-09	BERF-11 2298 5-Aug-08	BERF-2 1917 10-Jul-09	BERF-4 2047 27-May-09	BERF-5 1924 8-Jul-09	BFDM-1 2015 12-May-09	BGNL-37 2058 5-Jun-09	BIGL-14 1932 29-Sep-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimyzon oblongus - creek chubsucker	--	--	--	21	--	--	--	--	--	--	1	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	2	1	--	--	1	13	6	12	3	3	4	--	6
Minytrema melanops - spotted sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma erythrurum - golden redhorse	--	--	--	--	--	--	1	--	--	--	--	--	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	6	--	3	1	--	--	--	--	--	1	--	--	--
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	2	--	--	--	--	--	--
Noturus exilis - slender madtom	--	10	--	--	--	--	--	--	--	--	--	--	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	1	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--	1	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	1	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	1	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	--	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	--	--	--	--	--	--	13	--	--	--	--	--	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Fundulus notatus - blackstriped topminnow	12	--	--	--	--	--	--	--	--	--	1	--	--
Fundulus olivaceus - blackspotted topminnow	--	--	--	--	23	--	2	3	--	4	--	24	--
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	9	2	5	1	19	--	--	--	--	--	2	4	--
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	--	--
Cottus carolinae - banded sculpin	--	1	--	--	3	--	41	6	--	--	--	15	19
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	--	1	--	--	3	--	--	--	--	--	--	10	--
Lepomis auritus - redbreast sunfish	121	--	14	--	39	--	--	--	--	--	36	33	--
Lepomis cyanellus - green sunfish	1	21	46	1	9	7	--	11	1	2	67	9	15
Lepomis gulosus - warmouth	--	1	--	--	2	--	--	--	--	--	15	1	1
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis macrochirus - bluegill	--	10	11	--	262	38	2	--	6	47	23	38	12
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	--	3	35	--	22	4	19	46	4	16	40	52	--
Lepomis microlophus - redear sunfish	--	--	1	--	115	--	--	--	--	--	1	3	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	28	--	--	--	--	--	--	--	--
Micropterus dolomieui - smallmouth bass	--	--	--	--	--	--	--	--	--	--	--	--	--
Micropterus punctulatus - spotted bass	--	1	--	1	--	3	4	3	1	3	4	--	--
Micropterus salmoides - largemouth bass	8	--	4	1	--	--	--	1	2	--	3	1	1
Pomoxis nigromaculatus - black crappie	--	--	--	--	--	--	--	--	--	--	1	--	--
hybrid centrarchid	--	--	--	--	1	--	--	--	--	--	3	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	ALDM-234	ANDL-8	BAKM-2	BCBC-1	BCNJ-1	BEA-2	BERF-11	BERF-2	BERF-4	BERF-5	BFDM-1	BGNL-37	BIGL-14
GSA no.	2024	1961	2016	2192	1952	1962	2298	1917	2047	1924	2015	2058	1932
Date	15-May-09	2-Sep-09	12-May-09	9-Sep-08	30-Sep-09	2-Sep-09	5-Aug-08	10-Jul-09	27-May-09	8-Jul-09	12-May-09	5-Jun-09	29-Sep-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	--	--	--	--	1	--	--	1	3	--	--	9	--
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	--	--	--	2	--	--	--	--	--	--	--	--	7
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	--	--	31	--	5	--	3	1	--	--	57	7	17
Etheostoma flabellare - fantail darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma jessiae - blueside darter	--	--	--	--	4	--	--	--	--	--	--	--	--
Etheostoma kennicotti - stripetail darter	1	--	--	--	2	--	--	--	--	--	--	2	--
Etheostoma nigripinne - blackfin darter	2	--	--	17	--	--	--	--	--	--	8	4	6
Etheostoma nigrum - johnny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	3	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	--	--	--	--	--	--	21	45	179	--	--	135	--
Etheostoma tennesseense - Tennessee darter	--	--	--	--	12	--	--	--	--	--	--	1	--
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	--	--	2	22	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	15	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	10	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	1	--	4	--	12	--	--	--	2	--	4	2	3
Percina evides - gilt darter	--	--	--	--	--	--	3	--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	4	1	--	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	859	97	448	591	685	350	380	184	267	173	442	425	172
Number of species collected	15	11	14	17	24	9	24	13	18	15	18	24	16
Catch per effort	26.8	3.0	14.0	18.5	21.4	10.9	11.9	5.8	8.3	5.4	13.8	13.3	5.4

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name	Site code / GSA no. / Date	BINC-190 1948 16-Sep-09	BINC-192 1949 9-Oct-09	BLFL-1 2043 20-May-09	BLWL-11 2028 14-May-09	BMDB-1 2064 11-Jun-09	BMPL-2 1963 4-Aug-09	BPTL-1 1958 8-Oct-09	BRHL-1 2044 20-May-09	BTLL-1 1933 30-Sep-09	BVDM-17 1951 29-Sep-09	BWSM-1 2066 10-Jun-09	BZDC-1 1964 1-Sep-09	CDRF-2 2091 20-Aug-09
Lepisosteidae - gars														
Lepisosteus oculatus - spotted gar		--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar		--	--	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads														
Dorosoma cepedianum - gizzard shad		--	--	--	--	--	--	10	--	--	--	1	--	--
Dorosoma petenense - threadfin shad		--	--	--	--	--	--	73	--	--	--	--	--	--
Cyprinidae - minnows and carps														
Campostoma oligolepis - largescale stoneroller		48	--	138	44	31	66	4	60	30	26	26	22	46
Clinostomus funduloides - rosyside dace		--	--	40	--	--	--	--	157	--	--	--	--	--
Cyprinella callistia - Alabama shiner		--	--	--	--	12	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner		--	--	--	27	--	--	2	--	3	--	--	--	2
Cyprinella spiloptera - spotfin shiner		--	--	--	2	--	--	--	--	15	--	--	--	2
Cyprinella venusta - blacktail shiner		18	--	--	--	16	--	4	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub		--	--	--	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub		--	--	--	--	--	--	--	--	--	52	--	--	--
Hybopsis amblops - bigeye chub		--	--	--	6	--	--	--	--	11	--	--	--	--
Luxilus chrysocephalus - striped shiner		--	--	10	17	--	--	35	5	68	15	--	22	66
Luxilus coccogenis - warpaint shiner		--	--	--	--	--	--	--	--	10	--	--	--	--
Lythrurus bellus - pretty shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner		--	--	161	2	--	--	252	25	85	--	--	--	3
Lythrurus fumeus - ribbon shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub		--	--	--	--	--	--	--	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner		--	--	--	1	2	--	--	--	1	--	1	--	--
Notropis baileyi - rough shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis boops - bigeye shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis leuciodus - Tennessee shiner		--	--	--	--	--	--	3	--	119	--	--	--	--
Notropis micropteryx - highland shiner		--	--	--	--	--	--	--	--	--	--	--	--	1
Notropis photogenis - silver shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis texanus - weed shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis volucellus - mimic shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner		--	--	--	--	--	--	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow		--	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace		--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow		--	--	--	--	--	--	--	--	1	1	--	--	2
Pimephales promelas - fathead minnow		--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow		--	--	--	--	--	--	--	--	--	--	1	--	--
Rhinichthys atratulus - blacknose dace		--	--	21	7	--	--	--	--	--	12	--	--	--
Semotilus atromaculatus - creek chub		--	2	4	1	3	2	1	8	1	4	--	1	--
Semotilus thoreauianus - dixie chub		--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code GSA no. *Species* - common name / Date	BINC-190 1948 16-Sep-09	BINC-192 1949 9-Oct-09	BLFL-1 2043 20-May-09	BLWL-11 2028 14-May-09	BMDB-1 2064 11-Jun-09	BMPL-2 1963 4-Aug-09	BPTL-1 1958 8-Oct-09	BRHL-1 2044 20-May-09	BTLL-1 1933 30-Sep-09	BVDM-17 1951 29-Sep-09	BWSM-1 2066 10-Jun-09	BZDC-1 1964 1-Sep-09	CDRF-2 2091 20-Aug-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	1	--	--
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	--	1	--	--	--	1	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	--	--	5	--	--	7	--	23	7	1	1	5	11
Minytrema melanops - spotted sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	--	--	--	--	1	--	--	--	--
Moxostoma erythrurum - golden redhorse	--	--	--	--	--	--	--	--	7	--	--	--	7
Moxostoma poecilurum - blacktail redhorse	5	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	2	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	--	--	--	1	1	8	1	4	1	--	1	5	--
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	--	--	--	--	1	--	--
Noturus exilis - slender madtom	--	--	4	12	--	26	--	14	4	--	--	1	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	9	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--	--	--	--	--	--	--	5
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	2
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	2	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	--	--	--	--	--	--	6	--	2	--	--	--	21
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	--	--	--	2	--	--	--	--	4	--	--	--	1
Fundulus notatus - blackstriped topminnow	--	--	--	--	--	--	30	--	--	--	--	--	--
Fundulus olivaceus - blackspotted topminnow	--	--	5	2	--	2	--	7	4	--	--	1	12
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	--	--	--	--	--	--	11	--	1	--	4	--	6
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	92	--	--	--	--	91	--	--	--	--	--
Cottus carolinae - banded sculpin	--	--	--	23	--	32	10	1	20	30	--	3	--
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	--	--	2	9	--	--	--	--	3	1	--	4	3
Lepomis auritus - redbreast sunfish	3	6	--	31	17	--	--	--	1	--	99	--	--
Lepomis cyanellus - green sunfish	6	17	--	2	10	3	12	--	2	35	2	36	1
Lepomis gulosus - warmouth	--	--	--	--	1	--	4	--	--	--	--	--	--
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis macrochirus - bluegill	15	10	20	--	33	3	18	--	8	4	45	6	3
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	1	--
Lepomis megalotis - longear sunfish	6	--	15	12	--	2	3	5	27	3	--	6	46
Lepomis microlophus - redear sunfish	--	--	--	--	--	--	7	--	--	--	11	--	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Micropterus dolomieui - smallmouth bass	--	--	--	1	--	--	--	--	1	--	--	--	--
Micropterus punctulatus - spotted bass	--	--	--	--	--	1	3	--	--	--	--	--	6
Micropterus salmoides - largemouth bass	1	--	--	--	--	--	--	--	--	--	3	--	--
Pomoxis nigromaculatus - black crappie	--	--	--	--	5	--	--	--	--	--	--	--	--
hybrid centrarchid	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	BINC-190 1948 16-Sep-09	BINC-192 1949 9-Oct-09	BLFL-1 2043 20-May-09	BLWL-11 2028 14-May-09	BMDB-1 2064 11-Jun-09	BMPL-2 1963 4-Aug-09	BPTL-1 1958 8-Oct-09	BRHL-1 2044 20-May-09	BTLL-1 1933 30-Sep-09	BVDM-17 1951 29-Sep-09	BWSM-1 2066 10-Jun-09	BZDC-1 1964 1-Sep-09	CDRF-2 2091 20-Aug-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	--	--	--	32	--	--	--	--	3	--	--	1	11
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	5	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	--	--	70	12	--	--	16	79	34	8	--	2	--
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	2	--	--	--	--
Etheostoma duryi - black darter	--	--	19	5	--	--	1	4	1	23	3	5	3
Etheostoma flabellare - fantail darter	--	--	77	16	--	--	--	178	--	--	--	--	--
Etheostoma jessiae - blueside darter	--	--	--	--	--	--	--	--	1	--	--	--	1
Etheostoma kennicotti - stripetail darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma nigripinne - blackfin darter	--	--	47	--	--	--	6	7	--	23	--	--	4
Etheostoma nigrum - johnny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	--	--	4	172	--	--	--	10	52	--	--	--	160
Etheostoma tennesseense - Tennessee darter	--	--	1	22	--	--	--	--	36	1	1	--	17
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	--	--	--	1	--	3	1	--	1	--	11	--	7
Percina evides - gilt darter	--	--	--	--	--	--	--	--	2	--	--	--	11
Percina nigrofasciata - blackbanded darter	19	--	--	--	5	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	130	35	735	462	138	155	513	679	574	239	212	124	460
Number of species collected	10	4	19	26	13	12	24	18	37	16	17	18	28
Catch per effort	4.1	1.1	23.0	14.4	4.3	4.8	16.0	21.2	17.9	7.5	6.6	3.9	14.4

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	CDRF-22 1906 11-Aug-09	CDRF-5 2046 19-May-09	CDRL-1 1965 24-Jun-09	CEDF-21 2293 7-Aug-08	CERF-1 2050 28-May-09	CERF-2 1907 11-Aug-09	CFRJ-161 2055 4-Jun-09	CLBC-11 2045 20-May-09	CLEJ-100 2032 20-May-09	COXL-1 2019 13-May-09	CPRL-1 2023 14-May-09	CRDM-1 1937 1-Oct-09	CSPJ-70 2031 20-May-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	1	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	1	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	1	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	87	32	9	1116	10	92	--	529	94	99	167	1	14
Clinostomus funduloides - rosyside dace	--	--	--	--	--	--	--	5	--	--	2	--	--
Cyprinella callistia - Alabama shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	11	--	--	--	2	2	--	--	--	--	--	--	--
Cyprinella spiloptera - spotfin shiner	10	19	--	57	3	8	--	14	84	--	--	--	1
Cyprinella venusta - blacktail shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	1	--	--	--	--
Erimystax insignis - blotched chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	--	--	--	--	--	--	--	--	--	--	--	--	5
Hybopsis amblops - bigeye chub	--	12	--	2	--	--	--	--	24	1	--	--	36
Luxilus chrysocephalus - striped shiner	92	28	--	60	3	159	--	164	65	26	52	--	68
Luxilus coccogenis - warpaint shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner	--	62	--	--	--	--	--	57	37	6	2	--	--
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	--	--	1	--	--	--	1
Notropis baileyi - rough shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis boops - bigeye shiner	--	4	--	5	--	--	--	--	2	--	--	--	--
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis photogenis - silver shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	2	--	21	--	--	--	--	--
Notropis volucellus - mimic shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow	2	7	--	5	3	6	--	--	31	--	--	1	27
Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	--	--	13	--	--	--	--	--	--	--	10	--	--
Semotilus atromaculatus - creek chub	--	--	35	--	--	--	20	--	--	3	1	--	--
Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code / GSA no. / Date — *Species* - common name	CDRF-22 1906 11-Aug-09	CDRF-5 2046 19-May-09	CDRL-1 1965 24-Jun-09	CEDF-21 2293 7-Aug-08	CERF-1 2050 28-May-09	CERF-2 1907 11-Aug-09	CFRJ-161 2055 4-Jun-09	CLBC-11 2045 20-May-09	CLEJ-100 2032 20-May-09	COXL-1 2019 13-May-09	CPRL-1 2023 14-May-09	CRDM-1 1937 1-Oct-09	CSPJ-70 2031 20-May-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	1	--	--
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	10	8	--	84	3	19	--	9	1	2	7	--	6
Minytrema melanops - spotted sucker	--	1	--	--	--	1	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	1	--	--	--	--	--	--	--	--
Moxostoma erythrurum - golden redhorse	--	--	--	6	--	3	--	--	--	--	--	--	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	--	--	12	2	--	1	7	1	3	--	--	--	--
Ictalurus punctatus - channel catfish	1	--	--	--	--	1	--	--	--	--	--	--	--
Noturus exilis - slender madtom	--	--	--	--	1	--	--	--	--	--	--	--	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	3	--	--	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	1	--	--	--	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	--	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	24	--	--	7	--	74	--	--	--	--	--	--	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	6	2	--	15	3	5	--	--	9	2	--	--	--
Fundulus notatus - blackstriped topminnow	--	--	--	--	--	--	--	--	3	--	--	--	9
Fundulus olivaceus - blackspotted topminnow	4	15	1	1	--	--	--	9	1	4	--	--	--
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	--	4	--	10	--	1	--	5	2	--	--	27	4
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	--	--
Cottus carolinae - banded sculpin	--	1	48	--	2	--	--	91	54	12	15	1	47
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	3	2	--	4	--	1	--	--	--	2	--	--	--
Lepomis auritus - redbreast sunfish	--	--	--	--	--	--	--	9	2	2	1	16	17
Lepomis cyanellus - green sunfish	7	6	3	1	--	--	46	3	21	4	11	35	30
Lepomis gulosus - warmouth	--	--	--	--	--	--	2	--	--	--	--	--	--
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis macrochirus - bluegill	--	9	1	4	5	4	80	57	11	53	26	38	--
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	17	89	1	42	31	6	--	146	37	4	2	4	5
Lepomis microlophus - redear sunfish	--	1	--	--	4	--	3	1	--	--	--	--	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	--	3	--	--	--	--	--	4
Micropterus dolomieui - smallmouth bass	--	--	--	--	--	--	--	2	--	--	--	--	--
Micropterus punctulatus - spotted bass	2	1	1	3	--	2	--	--	--	--	--	--	--
Micropterus salmoides - largemouth bass	1	--	--	12	--	3	8	3	1	--	2	2	2
Pomoxis nigromaculatus - black crappie	--	--	--	--	--	--	--	--	--	--	--	--	--
hybrid centrarchid	2	--	--	--	--	--	1	--	--	--	2	--	2

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code	CDRF-22	CDRF-5	CDRL-1	CEDF-21	CERF-1	CERF-2	CFRJ-161	CLBC-11	CLEJ-100	COXL-1	CPRL-1	CRDM-1	CSPJ-70
GSA no.	1906	2046	1965	2293	2050	1907	2055	2045	2032	2019	2023	1937	2031
Species - common name / Date	11-Aug-09	19-May-09	24-Jun-09	7-Aug-08	28-May-09	11-Aug-09	4-Jun-09	20-May-09	20-May-09	13-May-09	14-May-09	1-Oct-09	20-May-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	1	13	--	79	5	--	--	--	--	--	--	--	1
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	2	47	--	128	--	9	--	292	23	8	6	--	9
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	4	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	6	6	--	5	1	7	--	35	5	4	13	11	90
Etheostoma flabellare - fantail darter	--	--	--	--	--	--	--	--	--	19	--	--	--
Etheostoma jessiae - blueside darter	--	--	--	--	2	2	--	--	25	--	--	--	2
Etheostoma kennicotti - stripetail darter	--	--	--	--	--	--	--	--	46	--	--	--	1
Etheostoma nigripinne - blackfin darter	1	1	--	--	--	2	--	5	2	--	--	7	12
Etheostoma nigrum - johnny darter	--	--	--	--	--	--	--	--	14	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	136	31	--	398	101	35	--	--	32	2	--	--	--
Etheostoma tennesseense - Tennessee darter	7	24	--	162	5	9	--	--	41	8	--	--	6
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	1	11	--	98	4	7	--	41	1	--	--	--	1
Percina evides - gilt darter	--	--	--	--	5	1	--	--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	1	--	--	--	--	--	--	2	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	433	437	124	2309	198	462	170	1499	673	265	320	145	400
Number of species collected	22	27	10	28	22	27	8	22	30	20	16	12	24
Catch per effort	13.5	13.7	3.9	72.2	6.2	14.4	5.3	46.8	21.0	8.3	10.0	4.5	12.5

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	CSPJ-70A 2034 20-May-09	FIRL-1 2017 12-May-09	FLTM-1 2061 4-Jun-09	FXTC-1 2051 28-May-09	HERM-1 1936 1-Oct-09	HESM-1 1953 29-Sep-09	HSBM-242A 2030 19-May-09	HURM-11 2060 4-Jun-09	HURR-1 1954 30-Sep-09	INCL-1 1934 30-Sep-09	INDM-250 2039 22-May-09	JNSJ-2 2056 4-Jun-09	KBYJ-1 1956 24-Sep-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	61	259	127	115	1	207	124	203	10	509	136	3	48
Clinostomus funduloides - rosyside dace	--	--	--	--	--	--	--	--	--	21	--	--	--
Cyprinella callistia - Alabama shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	--	38	14	--	--	15	--	--	--	--	--	--	--
Cyprinella spiloptera - spotfin shiner	2	--	1	--	--	--	--	--	1	13	--	--	--
Cyprinella venusta - blacktail shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub	--	--	11	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	1	--	--	--	5	--	--	--	--	--	7	--	--
Hybopsis amblops - bigeye chub	24	--	16	--	--	7	--	2	--	33	--	--	--
Luxilus chrysocephalus - striped shiner	33	25	32	56	--	87	138	40	90	30	47	--	--
Luxilus coccogenis - warpaint shiner	--	--	--	--	--	--	--	--	--	8	--	--	--
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner	--	70	14	63	--	66	--	14	92	15	--	--	--
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	--	--	--	--	--	--	--	--	3	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	--	--	--	--	--	3	--
Notropis baileyi - rough shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis boops - bigeye shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	--	--	--	50	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis photogenis - silver shiner	--	--	3	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	--	--	--	--	--	--	--	17	1	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis volucellus - mimic shiner	--	--	--	--	--	--	--	--	5	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	--	--	--	3	--	--	--	--
Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	1	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow	77	--	10	74	31	8	14	1	1	11	25	--	--
Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow	--	--	--	--	--	1	--	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	--	--	--	--	--	--	--	--	--	--	21	--	--
Semotilus atromaculatus - creek chub	--	--	--	3	11	--	--	--	--	5	--	2	5
Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	CSPJ-70A 2034 20-May-09	FIRL-1 2017 12-May-09	FLTM-1 2061 4-Jun-09	FXTC-1 2051 28-May-09	HERM-1 1936 1-Oct-09	HESM-1 1953 29-Sep-09	HSBM-242A 2030 19-May-09	HURM-11 2060 4-Jun-09	HURR-1 1954 30-Sep-09	INCL-1 1934 30-Sep-09	INDM-250 2039 22-May-09	JNSJ-2 2056 4-Jun-09	KBYJ-1 1956 24-Sep-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	--	1	--
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	12	2	1	--	--	9	13	7	2	1	19	2	--
Minytrema melanops - spotted sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	--	--	--	--	--	1	1	--	--
Moxostoma erythrurum - golden redhorse	--	--	--	2	--	--	--	--	1	--	--	--	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	2
Ameiurus natalis - yellow bullhead	--	--	--	1	1	--	1	--	--	--	--	--	9
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus exilis - slender madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	--	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	3	--	--	--	--	--	--	--	--	--	--	--	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	--	--	1	--	--	--	--	--	3	4	--	--	--
Fundulus notatus - blackstriped topminnow	7	--	--	--	--	--	1	--	--	--	--	--	--
Fundulus olivaceus - blackspotted topminnow	3	--	2	--	--	1	--	1	10	3	--	2	--
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	31	--	--	--	52	--	2	1	--	1	1	2	--
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	2	--
Cottus carolinae - banded sculpin	38	62	49	--	2	35	--	78	5	21	5	33	--
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	--	--	14	--	--	6	--	1	2	22	--	8	--
Lepomis auritus - redbreast sunfish	--	--	9	--	15	16	12	--	11	--	12	40	13
Lepomis cyanellus - green sunfish	11	10	15	23	51	8	--	8	--	3	209	10	33
Lepomis gulosus - warmouth	--	--	1	3	1	--	3	2	--	--	1	--	7
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	5
Lepomis macrochirus - bluegill	--	29	36	39	8	7	7	22	--	15	93	62	77
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	--	8	26	22	1	12	18	5	20	68	9	--	--
Lepomis microlophus - redear sunfish	--	--	3	--	--	--	1	1	--	--	--	4	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	--	--	--	3	--	--	2	--
Micropterus dolomieui - smallmouth bass	--	1	--	--	--	--	--	--	--	--	--	--	--
Micropterus punctulatus - spotted bass	--	--	1	--	--	--	--	--	2	--	--	--	--
Micropterus salmoides - largemouth bass	2	--	3	5	1	2	4	2	--	--	3	2	--
Pomoxis nigromaculatus - black crappie	--	--	--	--	--	--	--	--	--	--	--	--	--
hybrid centrarchid	--	--	1	--	1	--	1	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code / GSA no. / *Species* - common name / Date	CSPJ-70A	FIRL-1	FLTM-1	FXTC-1	HERM-1	HESM-1	HSBM-242A	HURM-11	HURR-1	INCL-1	INDM-250	JNSJ-2	KBYJ-1
GSA no.	2034	2017	2061	2051	1936	1953	2030	2060	1954	1934	2039	2056	1956
Date	20-May-09	12-May-09	4-Jun-09	28-May-09	1-Oct-09	29-Sep-09	19-May-09	4-Jun-09	30-Sep-09	30-Sep-09	22-May-09	4-Jun-09	24-Sep-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	2	--	8	--	--	4	--	5	1	4	--	--	--
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	6	27	20	37	--	9	--	1	3	56	--	2	--
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	83	7	7	24	12	4	9	26	4	18	83	43	--
Etheostoma flabellare - fantail darter	--	--	--	--	--	--	26	--	1	49	--	--	--
Etheostoma jessiae - blueside darter	--	--	--	--	--	--	--	--	6	--	--	--	--
Etheostoma kennicotti - stripetail darter	1	--	1	8	--	--	31	--	5	--	--	--	--
Etheostoma nigripinne - blackfin darter	5	4	--	--	11	3	--	22	--	--	--	--	--
Etheostoma nigrum - johnny darter	--	--	--	2	--	--	--	--	1	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	--	--	27	--	--	--	--	23	7	--	--	--	--
Etheostoma tennesseense - Tennessee darter	43	--	11	1	--	14	--	11	10	8	--	--	--
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	--	--	2	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	1	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	2	3	2	--	--	1	5	5	--	--	2	--	--
Percina evides - gilt darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	1	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	447	545	466	478	204	522	410	483	319	971	675	224	199
Number of species collected	21	14	29	17	15	22	17	24	28	27	18	19	9
Catch per effort	14.0	17.0	14.6	14.9	6.4	16.3	12.8	15.1	10.0	30.3	21.1	7.0	6.2

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code / GSA no. / Date — *Species* - common name	LBTL-1 2018 13-May-09	LCPL-2 2042 21-May-09	LDYL-1 1966 5-Aug-09	LFKB-11 2062 10-Jun-09	LPNT-1 2035 21-May-09	LRKJ-11 2038 22-May-09	LTBF-1 1921 8-Jul-09	LTBF-11 2049 28-May-09	LTBF-12 2104 31-Jul-08	LTBF-14 2048 27-May-09	MCDL-360 1947 17-Sep-09	MCKC-1 1967 3-Sep-09	MDCL-2 2041 21-May-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	1	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	--	--	--	1	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	162	80	722	16	82	68	52	58	238	286	3	--	56
Clinostomus funduloides - rosyside dace	10	--	--	--	--	--	--	--	--	--	--	--	33
Cyprinella callistia - Alabama shiner	--	--	--	94	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	--	--	--	--	--	--	--	--	--	10	--	--	--
Cyprinella spiloptera - spotfin shiner	1	--	--	--	14	--	--	--	--	--	--	--	--
Cyprinella venusta - blacktail shiner	--	--	--	2	--	--	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	--	--	--	--	--	--	--	--	--	--	--	--	6
Hybopsis amblops - bigeye chub	3	--	--	--	45	--	--	--	--	27	--	--	5
Luxilus chrysocephalus - striped shiner	29	52	59	--	2	118	18	19	237	48	--	--	38
Luxilus coccogenis - warpaint shiner	24	3	2	--	--	--	--	--	--	--	--	--	1
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	4	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner	41	73	--	--	4	--	--	5	5	1	--	--	102
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	1	--	--	--	7	28	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	2	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	1	--	--	--	--	3	--
Notropis baileyi - rough shiner	--	--	--	--	--	--	1	--	--	--	--	--	--
Notropis boops - bigeye shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis leuciodus - Tennessee shiner	3	--	--	--	--	53	--	--	--	--	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis photogenis - silver shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	11	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	50	--	--	--	45	--	--	--	--	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis volucellus - mimic shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	5	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow	1	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow	27	--	--	1	113	5	--	1	6	--	--	--	--
Pimephales promelas - fathead minnow	--	--	--	--	--	--	2	--	--	1	--	--	--
Pimephales vigilax - bullhead minnow	--	--	--	--	2	--	--	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	--	--	--	--	--	--	--	--	--	--	--	--	--
Semotilus atromaculatus - creek chub	5	--	--	--	--	--	12	--	--	--	--	1	2
Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code GSA no. *Species* - common name / Date	LBTL-1 2018 13-May-09	LCPL-2 2042 21-May-09	LDYL-1 1966 5-Aug-09	LFKB-11 2062 10-Jun-09	LPNT-1 2035 21-May-09	LRKJ-11 2038 22-May-09	LTBF-1 1921 8-Jul-09	LTBF-11 2049 28-May-09	LTBF-12 2104 31-Jul-08	LTBF-14 2048 27-May-09	MCDL-360 1947 17-Sep-09	MCKC-1 1967 3-Sep-09	MDCL-2 2041 21-May-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	3	--	--	--	--	--	9
Hypentelium etowanum - Alabama hogsucker	--	--	--	3	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	3	3	10	--	3	2	--	2	17	14	--	--	2
Minytrema melanops - spotted sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	1	--	--	--	2	--	--	--	--
Moxostoma erythrurum - golden redhorse	2	--	--	--	2	--	--	--	4	--	--	--	1
Moxostoma poecilurum - blacktail redhorse	--	--	--	3	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	--	--	--	3	2	--	3	--	--	4	--	--	--
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus exilis - slender madtom	1	--	--	--	--	--	--	1	--	--	--	--	1
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	1	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--	--	1	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	1	1	--	--	--	--	--	--	--	--	--	4
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	--	--	--	--	--	--	--	--	--	--	--	--	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	3	4	--	--	--	1	--	9	--	1	--	--	4
Fundulus notatus - blackstriped topminnow	--	--	--	--	9	9	--	--	--	--	--	--	--
Fundulus olivaceus - blackspotted topminnow	2	1	--	--	2	5	14	6	3	13	4	--	8
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	--	1	--	--	25	--	--	13	--	--	10	14	--
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	--	--
Cottus carolinae - banded sculpin	45	24	119	--	7	57	--	5	19	30	--	--	74
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	5	13	15	--	8	12	--	3	23	4	--	--	--
Lepomis auritus - redbreast sunfish	--	1	--	51	48	1	--	--	--	--	2	--	--
Lepomis cyanellus - green sunfish	--	4	9	2	32	6	3	--	--	1	48	24	5
Lepomis gulosus - warmouth	--	--	--	--	--	--	--	--	1	--	--	--	--
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis macrochirus - bluegill	--	1	--	11	19	7	56	1	8	36	18	--	4
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	16	10	10	7	12	7	--	16	16	20	--	--	13
Lepomis microlophus - redear sunfish	--	--	--	--	8	--	--	--	--	1	--	--	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Micropterus dolomieui - smallmouth bass	--	1	--	--	--	3	--	--	--	--	--	--	--
Micropterus punctulatus - spotted bass	--	--	2	1	2	--	35	--	3	1	--	--	--
Micropterus salmoides - largemouth bass	--	3	--	--	2	--	11	--	1	2	--	--	3
Pomoxis nigromaculatus - black crappie	--	--	--	--	1	--	--	--	--	--	--	--	--
hybrid centrarchid	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code GSA no. *Species* - common name Date	LBTL-1 2018 13-May-09	LCPL-2 2042 21-May-09	LDYL-1 1966 5-Aug-09	LFKB-11 2062 10-Jun-09	LPNT-1 2035 21-May-09	LRKJ-11 2038 22-May-09	LTBF-1 1921 8-Jul-09	LTBF-11 2049 28-May-09	LTBF-12 2104 31-Jul-08	LTBF-14 2048 27-May-09	MCDL-360 1947 17-Sep-09	MCKC-1 1967 3-Sep-09	MDCL-2 2041 21-May-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	11	4	--	--	32	15	--	3	19	--	--	--	3
Etheostoma blennius - blenny darter	--	18	--	--	--	--	--	--	--	--	--	--	21
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	17	14	--	--	--	49	--	4	2	11	--	--	21
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	7
Etheostoma crossopterum - fringed darter	6	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	8	--	--	--	28	9	--	6	9	6	--	--	15
Etheostoma flabellare - fantail darter	7	24	--	--	--	--	--	--	--	--	--	--	63
Etheostoma jessiae - blueside darter	1	--	--	--	9	5	--	3	11	--	--	--	--
Etheostoma kennicotti - stripetail darter	--	--	--	--	9	41	--	--	--	--	--	--	--
Etheostoma nigripinne - blackfin darter	--	--	--	--	1	--	--	--	--	--	--	--	--
Etheostoma nigrum - johnny darter	--	--	--	--	10	--	--	--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	62	373	--	--	41	21	--	74	71	70	--	--	48
Etheostoma tennesseense - Tennessee darter	31	15	--	--	27	38	--	3	51	14	--	--	6
Etheostoma stigmaeum - speckled darter	--	--	--	3	--	--	6	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	2	--	--	16	--	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	11	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	2	--	--	--	--	--	--	--
Percina caprodes - logperch	2	1	--	--	5	--	--	--	1	8	--	--	--
Percina evides - gilt darter	--	--	--	--	--	--	--	1	1	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	12	--	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	--	1	--	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	529	776	949	220	632	612	235	235	748	609	85	42	555
Number of species collected	29	26	10	15	37	26	18	22	23	23	6	4	28
Catch per effort	16.5	24.3	29.7	6.9	19.8	19.1	7.3	7.3	23.4	19.0	2.7	1.3	17.3

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	MFBN-2 2052 29-May-09	MLBF-1 1970 2-Sep-09	MTNM-2 1955 1-Oct-09	NSTJ-2 2036 21-May-09	PNTL-1 1957 15-Jul-09	PRRJ-21 2033 20-May-09	QTRW-2 2287 20-Aug-08	RBYJ-2 2037 21-May-09	RCKC-11 2295 6-Aug-08	REDD-1 2063 10-Jun-09	RNIL-400 2022 14-May-09	SCDL-11 2027 14-May-09	SCRL-2 1950 17-Sep-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	--	12	228	5	11	114	114	--	25	25	82	7	31
Clinostomus funduloides - rosyside dace	--	--	2	--	--	--	--	--	--	--	--	--	--
Cyprinella callistia - Alabama shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	--	--	4	--	--	--	--	--	--	38	--	4	--
Cyprinella spiloptera - spotfin shiner	--	--	--	--	--	7	--	--	--	4	--	--	--
Cyprinella venusta - blacktail shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub	--	--	--	--	--	12	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	--	--	3	1	--	2	--	--	--	--	--	--	--
Hybopsis amblops - bigeye chub	--	--	4	--	--	--	--	--	--	--	--	--	--
Luxilus chrysocephalus - striped shiner	--	10	125	2	--	70	24	1	206	1	8	23	1
Luxilus coccogenis - warpaint shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner	76	--	10	--	--	--	--	--	8	--	105	42	--
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	--	--	--	--	--	6	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	11	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	--	4	--	--	--	--	--
Notropis baileyi - rough shiner	--	--	--	--	--	--	38	--	--	--	--	--	--
Notropis boops - bigeye shiner	--	--	--	--	--	6	--	--	2	--	--	--	--
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis photogenis - silver shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	--	--	--	--	4	--	--	--	--	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	--	--	--	15	--	--	--	--
Notropis volucellus - mimic shiner	--	--	--	--	--	5	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	1	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales notatus - bluntnose minnow	42	--	6	--	--	8	--	--	13	--	24	--	--
Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	--	--	5	--	--	--	--	--	--	--	--	--	--
Semotilus atromaculatus - creek chub	--	11	2	--	--	--	11	--	--	--	6	--	--
Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	MFBN-2	MLBF-1	MTNM-2	NSTJ-2	PNTL-1	PRRJ-21	QTRW-2	RBYJ-2	RCKC-11	REDD-1	RNIL-400	SCDL-11	SCRL-2
GSA no.	2052	1970	1955	2036	1957	2033	2287	2037	2295	2063	2022	2027	1950
Date	29-May-09	2-Sep-09	1-Oct-09	21-May-09	15-Jul-09	20-May-09	20-Aug-08	21-May-09	6-Aug-08	10-Jun-09	14-May-09	14-May-09	17-Sep-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimyzon oblongus - creek chubsucker	--	8	--	--	--	--	--	--	1	--	--	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	--	--	16	--	--	12	--	--	5	--	--	9	--
Minytrema melanops - spotted sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Moxostoma erythrurum - golden redhorse	--	--	--	--	--	2	--	--	--	--	--	--	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	3	11	--	--	45	--	3	--	2	1	1	--	6
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus exilis - slender madtom	--	--	--	--	1	--	--	--	--	--	1	--	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	2	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	3	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	2
Noturus miurus - brindled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	--	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	4	--	--	--	--	--	--	--	--	--	1	--	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	--	--	--	--	--	5	--	--	--	--	--	2	--
Fundulus notatus - blackstriped topminnow	--	--	--	2	--	--	--	--	--	--	--	--	--
Fundulus olivaceus - blackspotted topminnow	13	6	--	19	3	17	36	--	21	--	20	7	--
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	15	--	2	3	--	--	8	17	1	--	2	--	--
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	--	--	--	--	--	--
Cottus carolinae - banded sculpin	--	1	49	47	12	2	--	8	13	--	7	35	--
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	2	--	4	--	--	6	--	--	8	--	--	15	--
Lepomis auritus - redbreast sunfish	13	--	3	9	--	1	--	17	--	27	14	--	32
Lepomis cyanellus - green sunfish	31	30	1	69	12	5	9	11	7	22	11	4	35
Lepomis gulosus - warmouth	1	--	--	8	--	--	--	5	--	--	1	--	--
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis macrochirus - bluegill	16	10	--	92	4	7	94	102	4	32	27	18	26
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	50	--	2	17	--	25	5	--	93	--	49	32	--
Lepomis microlophus - redear sunfish	--	--	--	8	--	--	1	12	--	1	1	--	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	1	--	--	4	--	--	--	--
Micropterus dolomieui - smallmouth bass	--	--	--	--	--	--	--	--	--	--	--	1	--
Micropterus punctulatus - spotted bass	--	--	--	--	--	--	9	--	4	--	--	--	1
Micropterus salmoides - largemouth bass	7	--	--	1	--	--	15	1	--	4	3	--	--
Pomoxis nigromaculatus - black crappie	--	--	--	--	--	--	--	--	--	--	--	--	--
hybrid centrarchid	--	--	--	--	--	2	--	--	--	--	--	2	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	MFBN-2 2052 29-May-09	MLBF-1 1970 2-Sep-09	MTNM-2 1955 1-Oct-09	NSTJ-2 2036 21-May-09	PNTL-1 1957 15-Jul-09	PRRJ-21 2033 20-May-09	QTRW-2 2287 20-Aug-08	RBYJ-2 2037 21-May-09	RCKC-11 2295 6-Aug-08	REDD-1 2063 10-Jun-09	RNIL-400 2022 14-May-09	SCDL-11 2027 14-May-09	SCRL-2 1950 17-Sep-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	1	--	7	--	--	4	--	--	4	--	--	--	--
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter	--	--	10	--	--	5	--	--	3	--	--	30	--
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	8	2	21	3	--	2	--	--	8	--	42	38	--
Etheostoma flabellare - fantail darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma jessiae - blueside darter	--	--	--	--	--	11	--	--	1	--	--	--	--
Etheostoma kennicotti - stripetail darter	4	--	--	--	--	8	--	--	--	--	6	--	--
Etheostoma nigripinne - blackfin darter	--	--	9	--	--	--	--	--	1	--	1	--	--
Etheostoma nigrum - johnny darter	--	--	--	--	--	6	--	--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	--	--	--	--	--	114	--	--	22	--	--	--	--
Etheostoma tennesseense - Tennessee darter	--	--	24	--	--	62	--	--	--	--	--	--	--
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	10	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	26	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	1	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	--	--	--	2	--	2	--	--	2	--	2	11	--
Percina evides - gilt darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	--	--	1	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	286	101	537	289	88	560	391	178	476	155	414	280	134
Number of species collected	16	10	22	17	7	32	16	10	27	10	22	16	8
Catch per effort	8.9	3.2	16.8	9.0	2.8	17.5	12.2	5.6	14.9	4.8	12.9	8.8	4.2

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code	SCRL-2	SGRL-3	SHGC-1	SHM-3A	SHOL-1	SLAM-3	SLRL-1	SNDL-3	SNKL-7	SSTD-1	SWNL-1	SWNL-390	SWTL-1
GSA no.	2053	2040	1968	2067	2026	2065	2021	2020	1969	2068	2025	1931	1935
Species - common name Date	3-Jun-09	21-May-09	3-Sep-09	10-Jun-09	15-May-09	11-Jun-09	14-May-09	13-May-09	4-Aug-09	11-Jun-09	15-May-09	29-Sep-09	30-Sep-09
Lepisosteidae - gars													
Lepisosteus oculatus - spotted gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepisosteus osseus - longnose gar	--	--	--	--	--	--	--	--	--	--	--	--	--
Clupeidae - shads													
Dorosoma cepedianum - gizzard shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Dorosoma petenense - threadfin shad	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinidae - minnows and carps													
Campostoma oligolepis - largescale stoneroller	23	30	122	4	38	24	154	53	53	117	134	56	668
Clinostomus funduloides - rosyside dace	--	--	--	--	--	--	--	7	--	--	--	--	--
Cyprinella callistia - Alabama shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Cyprinella galactura - whitetail shiner	3	5	--	--	29	--	46	--	--	7	--	--	--
Cyprinella spiloptera - spotfin shiner	--	--	--	49	5	--	17	--	--	5	--	62	--
Cyprinella venusta - blacktail shiner	--	--	--	--	--	29	--	--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimystax insignis - blotched chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemitremia flammea - flame chub	--	1	--	--	3	--	--	--	--	--	43	2	--
Hybopsis amblops - bigeye chub	--	3	--	--	30	--	11	--	--	--	--	--	--
Luxilus chrysocephalus - striped shiner	7	27	58	--	84	--	97	29	26	--	68	11	15
Luxilus coccogenis - warpaint shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus bellus - pretty shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner	--	9	--	--	44	--	48	69	--	--	17	52	--
Lythrurus fumeus - ribbon shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Lythrurus lirus - mountain shiner	--	--	--	--	1	--	--	--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub	--	--	--	--	--	--	--	--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner	--	--	--	--	--	--	--	--	--	1	--	--	--
Notropis baileyi - rough shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis boops - bigeye shiner	--	--	--	--	--	--	--	1	--	--	--	--	--
Notropis leuciodus - Tennessee shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis micropteryx - highland shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis photogenis - silver shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Notropis stilbius - silverstripe shiner	--	--	--	--	--	13	--	--	--	--	--	--	--
Notropis telescopus - telescope shiner	--	4	--	--	7	--	--	41	--	--	--	--	--
Notropis texanus - weed shiner	--	--	--	--	--	--	--	4	--	--	--	--	--
Notropis volucellus - mimic shiner	--	1	--	--	1	--	--	--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenacobius uranops - stargazing minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace	--	--	--	--	--	--	--	--	--	--	--	--	52
Pimephales notatus - bluntnose minnow	--	--	--	--	34	--	60	--	--	--	11	6	--
Pimephales promelas - fathead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Pimephales vigilax - bullhead minnow	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace	--	--	--	--	--	--	1	--	--	--	--	--	32
Semotilus atromaculatus - creek chub	--	--	78	--	1	--	4	--	--	1	17	--	10
Semotilus thoreauianus - dixie chub	--	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Site code GSA no. *Species* - common name Date	SCRL-2 2053 3-Jun-09	SGRL-3 2040 21-May-09	SHGC-1 1968 3-Sep-09	SHM-3A 2067 10-Jun-09	SHOL-1 2026 15-May-09	SLAM-3 2065 11-Jun-09	SLRL-1 2021 14-May-09	SNDL-3 2020 13-May-09	SNKL-7 1969 4-Aug-09	SSTD-1 2068 11-Jun-09	SWNL-1 2025 15-May-09	SWNL-390 1931 29-Sep-09	SWTL-1 1935 30-Sep-09
Catostomidae - suckers													
Catostomus commersoni - white sucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--	--	1	--	--	5	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--	--	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	--	3	--	--	1	--	3	12	--	--	2	1	--
Minytrema melanops - spotted sucker	--	--	--	--	1	--	--	--	--	--	1	--	--
Moxostoma duquesnei - black redhorse	--	1	--	--	--	--	--	--	--	--	--	--	--
Moxostoma erythrurum - golden redhorse	--	--	6	--	--	--	2	--	--	--	--	--	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--	--	--	--	--	--	--	--
Ictaluridae - North American catfishes													
Ameiurus melas - black bullhead	--	--	--	--	--	--	--	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	2	--	2	4	1	1	--	--	--	3	--	--	--
Ictalurus punctatus - channel catfish	--	--	--	--	--	--	--	--	--	--	--	1	--
Noturus exilis - slender madtom	--	--	--	--	4	--	--	15	--	--	6	4	--
Noturus funebris - black madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--	--	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Esocidae - pikes													
Esox niger - chain pickerel	--	--	--	--	--	--	--	--	--	--	--	--	--
Atherinopsidae - new world silversides													
Labidesthes sicculus - brook silverside	--	--	--	--	--	--	--	--	--	--	--	9	--
Fundulidae - topminnows													
Fundulus catenatus - northern studfish	--	3	--	--	12	--	37	5	--	--	--	--	--
Fundulus notatus - blackstriped topminnow	--	--	--	--	--	--	--	--	--	--	--	2	--
Fundulus olivaceus - blackspotted topminnow	--	--	--	--	12	--	--	20	--	--	2	3	--
Poeciliidae - livebeaers													
Gambusia affinis - western mosquitofish	--	3	--	--	3	1	--	3	--	--	1	41	2
Cottidae - scuplins													
Cottus bairdi - mottled sculpin	--	--	--	--	--	--	--	12	--	--	--	--	--
Cottus carolinae - banded sculpin	--	34	--	--	17	--	11	5	2	--	--	--	--
Centrarchidae - sunfishes													
Ambloplites rupestris - rock bass	--	--	--	--	2	--	3	--	1	--	1	--	--
Lepomis auritus - redbreast sunfish	33	--	--	28	1	38	--	--	--	55	--	36	--
Lepomis cyanellus - green sunfish	14	1	65	--	1	1	3	2	63	15	43	113	--
Lepomis gulosus - warmouth	--	2	--	1	--	--	--	--	--	--	2	1	--
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--	--	--	2	--	--	--	--
Lepomis macrochirus - bluegill	29	9	3	7	20	12	44	7	16	15	6	22	--
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	--	15	24	--	43	--	1	22	10	--	28	132	--
Lepomis microlophus - redear sunfish	--	--	--	--	--	--	--	--	1	--	--	1	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Micropterus dolomieui - smallmouth bass	--	--	--	--	--	--	--	2	--	--	--	4	--
Micropterus punctulatus - spotted bass	--	2	1	--	1	--	--	--	1	2	--	--	--
Micropterus salmoides - largemouth bass	2	1	--	1	--	2	--	2	--	1	--	--	--
Pomoxis nigromaculatus - black crappie	--	--	--	1	--	--	--	--	--	--	--	--	--
hybrid centrarchid	1	--	--	--	--	--	--	--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	SCRL-2	SGRL-3	SHGC-1	SHM-3A	SHOL-1	SLAM-3	SLRL-1	SNDL-3	SNKL-7	SSTD-1	SWNL-1	SWNL-390	SWTL-1
GSA no.	2053	2040	1968	2067	2026	2065	2021	2020	1969	2068	2025	1931	1935
Date	3-Jun-09	21-May-09	3-Sep-09	10-Jun-09	15-May-09	11-Jun-09	14-May-09	13-May-09	4-Aug-09	11-Jun-09	15-May-09	29-Sep-09	30-Sep-09
Percidae - perches and darters													
Etheostoma blennioides - greenside darter	--	6	--	--	1	--	1	--	--	--	--	--	--
Etheostoma blennius - blenny darter	--	--	--	--	--	--	--	1	--	--	--	--	--
Etheostoma boschungi - slackwater darter	--	--	--	--	--	--	--	--	--	--	1	--	--
Etheostoma caeruleum - rainbow darter	--	17	--	--	4	--	15	16	--	--	34	2	--
Etheostoma corona - crown darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma crossopterum - fringed darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma duryi - black darter	--	11	--	--	12	--	8	8	--	--	40	41	--
Etheostoma flabellare - fantail darter	--	3	--	--	7	--	2	134	--	--	--	--	--
Etheostoma jessiae - blueside darter	--	4	--	--	--	--	--	--	--	--	--	--	--
Etheostoma kennicotti - stripetail darter	--	--	--	--	--	--	--	--	--	--	6	2	--
Etheostoma nigripinne - blackfin darter	--	3	--	--	14	--	43	5	--	--	20	3	--
Etheostoma nigrum - johnny darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma rufilineatum - redline darter	--	108	--	--	185	--	12	26	--	--	--	--	--
Etheostoma tennesseense - Tennessee darter	--	12	--	--	27	--	34	--	--	--	--	--	--
Etheostoma stigmaeum - speckled darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonale - banded darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma zonistium - bandfni darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Perca flavescens - yellow perch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina burtoni - blotchside logperch	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina caprodes - logperch	--	--	--	--	4	--	--	10	1	--	--	1	--
Percina evides - gilt darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter	--	--	--	--	--	8	--	--	--	--	--	--	--
Percina sciera - dusky darter	--	--	--	--	--	--	--	--	--	--	--	--	--
Sciaenidae - drums													
Aplodinotus grunniens - freshwater drum	--	--	--	--	--	--	--	--	--	--	--	--	--
Elassomatidae - pygmy sunfishes													
Elassoma zonatum - banded pygmy sunfish	--	--	--	--	--	--	--	--	--	--	--	--	--
Total individuals collected	114	318	359	95	650	129	657	512	176	222	488	608	779
Number of species collected	8	27	9	8	34	10	24	27	11	11	22	25	6
Catch per effort	3.6	9.9	11.2	3.0	20.3	4.0	20.5	16.0	5.5	6.9	15.3	19.0	24.3

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name	Site code / GSA no. / Date	TCD-3	TWND-4	TWND-61	WFFM-1	WFLDE-1	WFLL-15
	GSA no.	2057	2069	2054	2059	2014	2029
	Date	5-Jun-09	11-Jun-09	21-Jul-09	4-Jun-09	3-Jun-09	19-May-09
Lepisosteidae - gars							
Lepisosteus oculatus - spotted gar		--	--	--	--	--	--
Lepisosteus osseus - longnose gar		--	--	--	--	--	--
Clupeidae - shads							
Dorosoma cepedianum - gizzard shad		--	--	--	--	--	--
Dorosoma petenense - threadfin shad		--	--	--	--	--	--
Cyprinidae - minnows and carps							
Campostoma oligolepis - largescale stoneroller		68	16	46	423	122	6
Clinostomus funduloides - rosyside dace		--	--	--	--	--	--
Cyprinella callistia - Alabama shiner		--	--	--	--	--	--
Cyprinella galactura - whitetail shiner		--	115	--	12	26	--
Cyprinella spiloptera - spotfin shiner		12	33	--	--	--	1
Cyprinella venusta - blacktail shiner		--	--	--	--	--	--
Cyprinella whipplei - steelcolor shiner		--	--	--	--	--	--
Erimystax insignis - blotched chub		--	--	--	--	--	--
Hemitremia flammea - flame chub		--	--	--	1	--	10
Hybopsis amblops - bigeye chub		--	--	--	45	17	--
Luxilus chrysocephalus - striped shiner		8	3	7	62	62	28
Luxilus coccogenis - warpaint shiner		--	--	--	--	11	--
Lythrurus bellus - pretty shiner		--	--	--	--	--	--
Lythrurus fasciolaris - scarlet shiner		--	--	--	80	75	5
Lythrurus fumeus - ribbon shiner		--	--	--	--	--	--
Lythrurus lirus - mountain shiner		--	--	--	--	--	--
Nocomis leptocephalus - bluehead chub		--	--	--	--	--	--
Notemigonus crysoleucas - golden shiner		--	--	--	--	--	--
Notropis baileyi - rough shiner		--	--	--	--	--	--
Notropis boops - bigeye shiner		--	--	--	--	--	--
Notropis leuciodus - Tennessee shiner		--	--	--	--	--	--
Notropis micropteryx - highland shiner		--	--	--	--	--	--
Notropis photogenis - silver shiner		--	--	--	--	--	--
Notropis stilbius - silverstripe shiner		--	--	--	--	--	--
Notropis telescopus - telescope shiner		--	--	--	--	8	--
Notropis texanus - weed shiner		--	--	--	--	--	--
Notropis volucellus - mimic shiner		--	--	--	--	--	--
Notropis sp cf *spectrunculus* - sawfin shiner		--	--	--	--	--	--
Phenacobius uranops - stargazing minnow		--	--	--	--	--	--
Phoxinus erythrogaster - southern redbelly dace		--	--	--	--	--	--
Pimephales notatus - bluntnose minnow		--	--	--	2	--	20
Pimephales promelas - fathead minnow		--	--	--	--	--	--
Pimephales vigilax - bullhead minnow		--	--	--	--	--	--
Rhinichthys atratulus - blacknose dace		--	--	--	--	2	4
Semotilus atromaculatus - creek chub		--	--	28	--	--	2
Semotilus thoreauianus - dixie chub		--	--	--	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name / Site code / GSA no. / Date	TCD-3	TWND-4	TWND-61	WFFM-1	WFLDE-1	WFLL-15
GSA no.	2057	2069	2054	2059	2014	2029
Date	5-Jun-09	11-Jun-09	21-Jul-09	4-Jun-09	3-Jun-09	19-May-09
Catostomidae - suckers						
Catostomus commersoni - white sucker	--	--	--	--	--	1
Erimyzon oblongus - creek chubsucker	--	--	--	--	--	--
Hypentelium etowanum - Alabama hogsucker	--	--	--	--	--	--
Hypentelium nigricans - northern hogsucker	2	2	13	18	22	--
Minytrema melanops - spotted sucker	--	--	--	--	--	--
Moxostoma duquesnei - black redhorse	--	--	--	--	3	--
Moxostoma erythrurum - golden redhorse	--	--	--	--	4	--
Moxostoma poecilurum - blacktail redhorse	--	--	--	--	--	--
Ictaluridae - North American catfishes						
Ameiurus melas - black bullhead	--	--	--	--	--	--
Ameiurus natalis - yellow bullhead	5	3	--	--	--	--
Ictalurus punctatus - channel catfish	--	--	--	--	--	--
Noturus exilis - slender madtom	--	--	--	--	--	--
Noturus funebris - black madtom	--	--	--	--	--	--
Noturus gyrinus - tadpole madtom	--	--	--	--	--	--
Noturus leptacanthus - speckled madtom	--	--	--	--	--	--
Noturus miurus - brindled madtom	--	--	--	--	--	--
Noturus nocturnus - freckled madtom	--	--	--	--	--	--
Pylodictis olivaris - flathead catfish	--	--	--	--	--	--
Esocidae - pikes						
Esox niger - chain pickerel	--	--	--	--	--	--
Atherinopsidae - new world silversides						
Labidesthes sicculus - brook silverside	--	--	--	--	--	--
Fundulidae - topminnows						
Fundulus catenatus - northern studfish	--	--	--	6	3	--
Fundulus notatus - blackstriped topminnow	--	--	--	--	--	--
Fundulus olivaceus - blackspotted topminnow	--	--	--	8	10	2
Poeciliidae - livebeaers						
Gambusia affinis - western mosquitofish	--	--	--	7	--	--
Cottidae - scuplins						
Cottus bairdi - mottled sculpin	--	--	--	--	--	--
Cottus carolinae - banded sculpin	--	--	--	9	32	56
Centrarchidae - sunfishes						
Ambloplites rupestris - rock bass	--	--	--	10	1	--
Lepomis auritus - redbreast sunfish	65	24	37	--	11	9
Lepomis cyanellus - green sunfish	--	3	8	2	--	8
Lepomis gulosus - warmouth	--	--	--	12	--	3
Lepomis humilis - orangespotted sunfish	--	--	--	--	--	--
Lepomis macrochirus - bluegill	20	16	31	85	1	20
Lepomis marginatus - dollar sunfish	--	--	--	--	--	--
Lepomis megalotis - longear sunfish	--	--	--	34	--	5
Lepomis microlophus - redear sunfish	--	--	--	--	--	--
Lepomis miniatus - redspotted sunfish	--	--	--	--	74	--
Micropterus dolomieui - smallmouth bass	--	--	3	--	--	--
Micropterus punctulatus - spotted bass	--	1	--	4	1	--
Micropterus salmoides - largemouth bass	4	--	3	1	1	--
Pomoxis nigromaculatus - black crappie	--	--	--	--	--	--
hybrid centrarchid	--	--	1	--	--	--

Table--. Fish species collected in the Tennessee Valley and Plateau ichthyoregions.

Species - common name	Site code / GSA no. / Date	TCD-3 2057 5-Jun-09	TWND-4 2069 11-Jun-09	TWND-61 2054 21-Jul-09	WFFM-1 2059 4-Jun-09	WFLDE-1 2014 3-Jun-09	WFLL-15 2029 19-May-09
Percidae - perches and darters							
Etheostoma blennioides - greenside darter		--	--	--	8	12	--
Etheostoma blennius - blenny darter		--	--	--	--	--	--
Etheostoma boschungi - slackwater darter		--	--	--	--	--	--
Etheostoma caeruleum - rainbow darter		--	--	--	28	--	--
Etheostoma corona - crown darter		--	--	--	--	--	--
Etheostoma crossopterum - fringed darter		--	--	--	--	--	--
Etheostoma duryi - black darter		--	--	--	19	--	2
Etheostoma flabellare - fantail darter		--	--	--	12	--	--
Etheostoma jessiae - blueside darter		--	--	--	--	14	--
Etheostoma kennicotti - stripetail darter		--	--	--	3	--	3
Etheostoma nigripinne - blackfin darter		--	--	--	--	--	6
Etheostoma nigrum - johnny darter		--	--	--	--	--	--
Etheostoma parvipinne - goldstripe darter		--	--	--	--	--	--
Etheostoma rufilineatum - redline darter		--	--	--	39	188	--
Etheostoma tennesseense - Tennessee darter		--	--	--	66	72	--
Etheostoma stigmaeum - speckled darter		--	--	--	--	--	--
Etheostoma zonale - banded darter		--	--	--	--	--	--
Etheostoma zonistium - bandfni darter		--	--	--	--	--	--
Etheostoma sp cf *zonistium* - blueface darter		--	--	--	--	--	--
Perca flavescens - yellow perch		--	--	--	--	--	--
Percina burtoni - blotchside logperch		--	--	--	--	--	--
Percina caprodes - logperch		--	--	--	--	--	--
Percina evides - gilt darter		--	--	--	--	--	--
Percina nigrofasciata - blackbanded darter		--	--	--	--	--	--
Percina sciera - dusky darter		--	--	--	--	--	--
Sciaenidae - drums							
Aplodinotus grunniens - freshwater drum		--	--	--	--	--	--
Elassomatidae - pygmy sunfishes							
Elassoma zonatum - banded pygmy sunfish		--	--	--	--	--	--
	Total individuals collected	184	216	177	996	772	191
	Number of species collected	8	10	9	26	24	19
	Catch per effort	5.8	6.8	5.5	31.1	24.1	6.0

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