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TEMPORAL DYNAMICS OF FISH AND MACROINVERTEBRATE ASSEMBLAGES ON MILITARY LAND IN WESTERN LOUISIANA

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TEMPORAL DYNAMICS OF FISH AND MACROINVERTEBRATE ASSEMBLAGES ON MILITARY LAND IN WESTERN LOUISIANA

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Abstract

Headwater streams are known to have an impact on higher order river systems downstream; therefore, it is important to monitor their water quality. The United States Army is mandated to ensure their training activities do not have a negative impact on freshwater biotic communities and the overall water chemistry. The goals of this study include: (1) to quantify the long-term effects of military land management practices on headwater stream biodiversity in western Louisiana using biological indices and (2) to measure changes in fish and macroinvertebrate assemblages over time using multivariate techniques. Because the natural disturbance regime in these streams is more 'harsh,' it was expected that anthropogenic disturbances would have less of an impact on the fish and macroinvertebrate assemblages. Also, because insects at different life history stages can choose breeding sites based on environmental conditions at a stream locality and have the potential to cross drainage basin boundaries, it was anticipated that macroinvertebrate assemblages would not vary statistically between drainages. In contrast, most fish species are constrained to their historically defined drainage basins; therefore, it was predicted that environmental factors relating to both year and drainage would affect fish assemblage composition. From 2001 to 2016, 19 streams from the Calcasieu, Red, and Sabine River drainages were sampled to determine the structure of fish and macroinvertebrate assemblages. Over 15,000 macroinvertebrates and 3,000 fish were collected and analyzed. As predicted, macroinvertebrate water quality scores did not differ across drainage basins, and multivariate analysis confirmed this pattern. In contrast, fish water quality scores did differ across drainage basins; again, this pattern was confirmed by multivariate analysis, also supporting the original hypothesis. Overall, when the trends across years are examined, community structure of fish and macroinvertebrates in these streams are quite stable. These long-term datasets are important from a conservation perspective to understand how humans are impacting aquatic ecosystems.

Introduction

The southern United States supports more native fishes than any area of comparable size on the North American continent north of Mexico; a high proportion of its fishes are in need of conservation action (Warren et al., 2000). Decline of native fishes in the southern United States is generally caused by widespread, complex habitat degradation across the landscape that reduces and fragments ranges and increases isolation of fish populations (Angermeier, 1995; Warren et al., 1997). Physical alterations such as channelization, sedimentation, and flow alteration have attributed to a 125% increase in the number of endangered, threatened, and vulnerable fish species in the southeastern US (Warren et al., 2000). Aquatic macroinvertebrates are one of the most important organism groups selected by the Water Framework Directive (WFD) to evaluate the integrity of biological communities within the ecological status assessment process (European Commission, 2000). Macroinvertebrates make up an important link between energy sources and top predators in fluvial ecosystems (Allan, 1995). Additionally, macroinvertebrate assemblages have been considered a useful biomonitoring tool because they are good indicators of anthropogenic disturbances such as water pollution and hydrological and geomorphological alterations (Alvarez-Cabria et al., 2010).

Quantifying the relationship between fish and macroinvertebrate assemblages and their environment is an important area of research in aquatic ecology (Gorman and Karr, 1978; Tonn et al., 1983; Allan and Castillo, 2007). These relationships are highly dependent on the spatial and temporal scales examined (Wiens et al., 1986; Lohr and Fausch, 1997; Vinson and Hawkins, 1998; Lammert and Allan, 1999). Spatial scales for fish and macroinvertebrate assemblages can best be described using a hierarchical analysis of watersheds which tend to be nested and integrated through their connectivity (Schlosser, 1991; Poff, 1997; Kimmel and Argent, 2016). At large spatial and temporal scales, factors such as climate, geomorphology, and zoogeographic history influence regional species pools (Vinson and

Hawkins, 1998; Williams et al., 2002). Regional pools are, in turn, affected by biotic interactions and abiotic factors at smaller spatial scales, producing local species assemblages (Williams et al., 2005). Spatial and temporal changes in lotic systems provide a shifting mosaic of abiotic and biotic conditions. Sources of this variability include: the disturbance caused by rapid changes in the volume of water, the accompanying movements of substratum that result from a change in discharge, and anthropogenic factors (Resh et al., 1988). Understanding patterns of distribution and abundance of lotic species requires that we test theoretical predictions about functional relationships between species and their environments across a range of spatial and temporal scales (Poff, 1997).

Anthropogenic modification disrupts stream macroinvertebrate and fish assemblage by affecting biotic interactions and altering habitat heterogeneity (Larsen and Ormerod, 2014). Roads and bridges can alter the development of shorelines, stream channels, floodplains, and wetlands. Because of the energy associated with moving water, physical effects often propagate long distances from the site of a direct road incursion (Richardson et al., 1975). Alteration of hydrodynamics and sediment deposition can result in changes in stream geomorphology many kilometers away. Roads on floodplains disturb the natural connection between the stream and its floodplain, redirecting water, sediment, and nutrients between streams and wetlands and their riparian ecosystems, to the detriment of water quality and ecosystem health. Persistent barriers may encourage local selection for behaviors that do not include natural migration patterns, potentially reducing both the distribution and productivity of a population (Kershner et al., 1997; Rieman et al., 1997).

Headwater streams are known to have an impact on higher order river systems downstream; therefore, it is important to monitor their water quality (Meyer et al., 2003). For assessing the health of an aquatic ecosystem, organisms that live in these environments are used as indicators of degradation. Biological assessments have become a standard practice to monitor water quality throughout the U.S. and the world. The growing realization that maintaining water chemistry standards alone does not necessarily protect biological integrity (Karr and Chu, 1999) has led to the proliferation of stream bioassessment programs. The successful implementation of bioassessment for streams and the growing recognition of the value of wetlands have led researchers to apply bioassessment to wetlands over the last 10 years. Since the passing and legal enforcement of the Clean Water Act, point-source pollution has been reduced. Today, however, aquatic systems primarily face different threats, for example, non-point-source pollution produced from land use practices such as agriculture, timber harvesting, and urban and suburban development (Felix, 2012). However, it has been previously hypothesized that these communities have evolved a tolerance for variation in hydrology. Headwater streams in the gulf coastal plain are naturally flashy, and organisms that occur in them must have evolved mechanisms to deal with floods and droughts (Williams et al., 2007). These adaptations to historical changes in environmental conditions has resulted in communities of organisms in the gulf coastal plain that are tolerant of abiotic disturbances (Conner and Suttkus, 1986). The taxa in the gulf coastal plain streams are dominated by tolerant and/or generalist species (Williams et al., 2007).

There are two common ways ecologists commonly measure community structure: the first being biological indices, and the other being multivariate analyses. Texas Commission on Environmental Quality (TCEQ) uses macroinvertebrate and fish assemblages to develop Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) metrics, respectively. While chemical water quality indicators are important, biotic integrity scores were deemed more informative because these biological metrics are the combined result of chemical, physical, and biological processes in the aquatic environment (Karr and Chu, 1999). Because macroinvertebrate and fish assemblages provide insight on different temporal scales, they were both sampled. Macroinvertebrates are good indicators of localized conditions, providing more short-term indications of organic pollution; whereas, fish assemblages are better indicators of long-term effects and broad habitat conditions (TCEQ, 2016).

In addition to TCEQ B-IBI and IBI, multivariate techniques were used to assess community structure. Recent authors have used similar multivariate techniques to test hypotheses about species-environment relationships at different spatial and temporal scales (Gerth and Herlihy, 2006; Wang et al., 2003) and the effects of disturbances on aquatic assemblages (Jongman et al., 1995; Williams et al., 2005). For complex, large-scale questions in community ecology, standard parametric multivariate tools (such as MANOVA) often are inappropriate for testing hypotheses, and data rarely meet assumptions of these tests (Williams et al., 2005). Univariate analyses are inappropriate for these community analyses because intercorrelated response variables do not adequately express the complex relationships between dependent and independent variables (McCune and Mefford, 2011). Therefore, multivariate analyses based on randomization procedures are better at representing patterns affecting community structure (Williams et al., 2005).

The United States Army is mandated to ensure their training activities do not have a negative impact on water quality. The goals of this study include: (1) to quantify the long-term effects of military land management practices on headwater stream biodiversity in western Louisiana using biological indices and (2) to measure changes in fish and macroinvertebrate assemblages over time using multivariate techniques. Overall, because the natural disturbance regime in these streams is more ‘harsh,’ it is expected that anthropogenic disturbances will have less of an impact on the fish and macroinvertebrate assemblages (Peckarsky, 1983). Also, because insects at different life history stages can choose breeding sites based on environmental conditions at a stream locality and have the potential to cross drainage basin boundaries, it was anticipated that macroinvertebrate assemblages would not vary statistically between drainages (Anderson and Wallace, 1995). In contrast, most fish species are constrained to their historically defined drainage basins; therefore, it was predicted that environmental factors relating to both year and drainage would affect fish assemblage composition (Williams, 2003b).

Study Area

The main portion of the base in Fort Polk is referred to as the Joint Readiness Training Center (JRTC); whereas, the secondary training area approximately 10 miles northeast of Leesville is generally referred to as Peason Ridge Training Area (PRTA; Figure 1). Co-owned JRTC and adjacent Kisatche National Forest land covers over 200,000 acres. PRTA covers approximately 51,000 acres, with over half of the property devoted strictly to military training and housing. Nineteen streams on Fort Polk and its associated lands were sampled across Vernon, Sabine, and Natchitoches Parishes in western Louisiana. Each first-order stream is part of either the Calcasieu River drainage, the Red River drainage, or the Sabine River drainage. These headwater streams in the gulf coastal plain are naturally flashy, and organisms that occur in them must have evolved mechanisms to be resilient to abrupt changes in stream flow and seasonal influxes of silt and shifting sand (Williams et al., 2007). These adaptations to historical changes in environmental conditions have resulted in communities of organisms in the gulf coastal plain that are tolerant of abiotic disturbances (Conner and Suttkus, 1986).

No timber harvesting was conducted around Little Sandy Creek during the study period, but moderate to extensive timber harvests were conducted along Odom and Tiger Creeks in 2003. The local forests are dominated by longleaf pine (*Pinus palustris*), interspersed with hardwoods, which are more common along the lowland reaches (Williams et al., 2005). Historically, prior to human prescribed fire intervention, the longleaf pine climax community was maintained by seasonal lightning strikes, causing wild fires (Bridges and Orzell, 1989). Because longleaf pine is part of a ‘fire climax’ community, the army conducts a regulatory prescribed burn cycle, on a 2-3 year rotation.

The U.S. Army has maintained a military presence at Fort Polk from the Louisiana Maneuvers of 1939 until the present. This region was chosen because the historic logging left the landscape resembling European battlefields during WWI and facilitated the testing of new fast moving cavalry maneuvers. Prior to the establishment of Fort Polk as a military base, various logging companies placed a small number of stream crossings during the course of timber harvesting activities. The early bridges were all wood constructions with support timbers driven into the stream bottom; however, during the establishment and modernization of Fort Polk, major surfaced roadways were constructed that brought about the need for durable bridges capable of handling the heavy loads associated with military traffic (Grubh, 2006).

Culverts are one of the most numerous crossing types on Fort Polk and vary according to the size and purpose of the crossing. Round single culverts from 30 inches to 6 feet are the most common. At intermittent stream crossings, the bed area is excavated and replaced with washed gravel. The culvert is then placed at the stream grade and backfilled prior to overtopping with road material. Box culverts are also used to great extent because of their ease of placement and high weight capacities. Larger box culvert crossings utilize culverts that are 4’-6’ height by 10’ width, arranged in a stack or ‘shotgun’ fashion. Ford crossing designs have seen the most innovation at Fort Polk. Fords are the most cost effective, feasible, and least intrusive bridge construction method used. Original designs called for bed excavation at the crossing site, followed by the placement of a wire wrapped packet of gravel. Recent attempts to minimize impacts to natural hydrology have resulted in the construction of arch culverts and modified placement techniques for box type culverts. Stream crossing design at Fort Polk is evolving and the design for each crossing is predicated on the capability of handling heavy military traffic. Environmental considerations in design seek to minimize stream impacts while still focusing on mission support. The end result is a team approach that involves military planners, engineers, and scientists coming together to accomplish a common goal (Grubh, 2006).

In addition to culvert redesign, both the PRTA and JRTC have undergone multiple improvements to their facility. In 2003, timber harvesting started in the upper reaches of the PRTA watershed for constructing a range complex to facilitate combined arms training that is a part of Digital Multipurpose Battle Area Course (DMPBAC). The upper reaches of this region were clear-cut in late 2003 for creating firing lanes, road systems, and numerous stream crossings to allow transport of large equipment (Table 1). The military primarily uses this region for live fire exercises and troop maneuvers using heavy-duty vehicles (e.g. tanks). Vegetation along the stream riparian zone was completely removed without leaving any buffer along the firing lanes, and new roads were constructed. In addition to the DMPBAC installation, improvements have been made to their water treatment plant and waste disposal practices. In 2013, the Army spent five million dollars replacing the old trickling filter treatment unit with a modern forced-aeration activated sludge system, increasing oxygen levels of Bundick Creek (Cline et al., 2014).

Bayou Zourie, Big Brushy, Birds, Bundick, Comrade, Drakes, East Fork, Little Brushy, West Fork, and Whiskey Creek drain into the Calcasieu River drainage basin. The Calcasieu River originates in Vernon Parish, north of Leesville, passing through the Kisatchie National Forest, eventually draining southward to the Gulf of Mexico. The Calcasieu River is approximately 200 miles long, passing through areas intensive in petroleum refining and other industries (USGS, 2017). The Calcasieu and Sabine drainages share common physiography, geologic origin (lowland coastal plains), and species composition (Douglas, 1974). Anacoco, Dowden, and Martin Creek drain into the Sabine River drainage basin. The Sabine River is 510 miles long, travelling from northeast Texas to southern Louisiana, eventually draining into the Gulf of Mexico (USGS, 2017). The Sabine River flows through an area of abundant rainfall and discharges the largest volume of any river in Texas. Like the Calcasieu River, the Sabine River also flows through a petroleum-producing region; the lower region of the river near the Gulf is among the most industrialized areas of the southeastern United States (Long, 2017).

The streams of the Red River basin are fairly high gradient, and have loamy to sandy soils. Although the Red River drainage to the north differs in physiography and geology (upland drainage) from the other two drainages, it has a similar fish species composition (Williams et al., 2005). Little Sandy, Lyles, Odom, and Tiger Creek drain into the Red River drainage basin. The Red River is the second largest river basin in the southern Great Plains; it rises in two forks in the Texas panhandle and flows east, travelling through Arkansas and flowing into Louisiana. The Red River is approximately 1,300 miles long with a mean flow of over 57,000 cubic feet per second (Tyson, 1981).

Methods

Sampling methods

Macroinvertebrate and fish assemblage samples were collected in the summers of 2001-2004, 2012, and 2014-2016 in nineteen streams (Anacoco, Bayou Zourie, Big Brushy, Birds, Bundick, Comrade, Dowden, Drakes, East Fork, Indian, Little Brushy, Little Sandy, Lyles, Martin, Odom, Prairie, Tiger, West Fork, and Whiskey Chitto), with the exception that fish assemblage data were not collected in 2003 and 2004 due to decrease in funding. The gap in sampling corresponds to lack of funding related to foreign wars.

All data collection took place during the late spring and summer because there is a peak in diversity of both fish and macroinvertebrates during the summer months (Williams et al., 2007). Apart from 2015, yearly sampling between sites was completed within one week in an attempt to prevent seasonal biases. In 2015, sites on PRTA were sampled as normal, but a significant rain prevented data collection from the JRTC sites until three weeks later. The first samples were taken in 2001 with a field crew of three people. Funding levels increased from 2002-2004, allowing for a larger field crew. Crew size remained relatively consistent, with around four to six members, from 2012 to 2016. For each stream, collection sites were located near the PRTA or JRTC boundaries, apart from Lyles Creek, which was based on accessibility. All nineteen streams are first order and originate on U.S. Army managed property. Each site consisted of a minimum 100-meter section of stream that contained mesohabitats (such as runs, riffles, and pools), substrate, and woody debris in similar proportions to those of the overall stream reach; therefore, each site was considered representative of the conditions within each stream. Each stream was sampled at the closest accessible point where it leaves Army property. For example, south flowing streams were sampled along the southern border of the base. This type of site selection gave the most useful data on how the additive effects of management practices in the base are affecting headwater streams as they leave the base to eventually converge with higher order streams in the Red, Sabine, and Calcasieu River drainage basins.

Fish assemblages were sampled with backpack electroshockers and dip nets, using a two-pass depletion method to determine species richness (Kimmel and Argent, 2006). In 2001 and 2002, fish were identified to species, enumerated, and released (except for voucher specimens). In 2012 and 2014-2016, fish were anesthetized with tricaine methanesulfonate and preserved in 10% formalin solution; the specimens were later rinsed, identified to species, enumerated, and preserved in 70% ethanol and are maintained at The University of Texas at Tyler or at Fort Polk military base.

Macroinvertebrates were collected from each stream along the same reaches sampled for fishes. D-frame kick nets (twenty kicks per 100 meter reach) were used to sample all available microhabitats in the reach. Additionally, from 2001-2004, a 5-minute Surber sample was taken at each locality in an effort to capture more benthic taxa that might have been missed with kick-nets. Because riffle habitats were a minor component of these streams, the 5-minute Surber sample was deemed adequate to cover this habitat type. Surber sampling is particularly useful in streams where sampling has not occurred to detect rare taxa that may not otherwise be represented (Storey et al., 1991). Macroinvertebrates from Surber sampling and dip net sampling were used in the calculation of Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) from 2001-2004; however, because Surber samples were not taken after 2004, only macroinvertebrates collected by dip nets were included in 2012-2016 calculations (TCEQ, 2016). Macroinvertebrate samples were preserved in the field with 95% ethanol and transported to the laboratory for identification and enumeration. The macroinvertebrates were identified to the family level (genus when possible), and families were used for all statistical analyses (Bowman and Bailey, 1997). Habitat data also were collected, but these data were excluded from analysis because of inconsistent collection methodology.

Statistical methods

The Texas Commission on Environmental Quality (TCEQ) guidelines for northeastern Texas (ecoregion 35) were used to assign Index of Biotic Integrity (IBI) and Benthic Index of Biotic Integrity (B-IBI) metric scores to each stream for fish diversity and benthic macroinvertebrate diversity, respectively (TCEQ, 2016). These biological indices were used to quantify the long-term effects of military land management practices on headwater stream biodiversity in Fort Polk. Although the streams are located in western Louisiana, TCEQ metrics were used because Louisiana lacks a bioassessment metric system. Using the B-

IBI and IBI allowed for the standardization of sampling results among different habitat types and community compositions. The associations between these bioassessment metrics, river drainage, and year were analyzed using a two-way analysis of variance (ANOVA) calculated by MyStat (SYSTAT Software, San Jose, CA).

Additionally, multivariate techniques were used to measure changes in fish and macroinvertebrate assemblages over time. Similarities and dissimilarities between fish and macroinvertebrate assemblage structure by site and species were assessed with non-metric multidimensional scaling (NMS) calculated by PCORD (Whittaker, 1987). NMS is a non-parametric ordination technique that takes multivariate data and projects it into two dimensions; in this case, the coordinates were based on dissimilarities in taxa structure by site per year. In order to quantify NMS results, the NMS coordinates associated with the edges of the envelope (grouped by year, drainage basin, and stream) were analyzed using multi-response permutation procedures (MRPP) in PCORD (McCune and Mefford, 2011). MRPP provides a nonparametric test of whether there is a significant difference between two or more groups of sampling units.

Results

Covering a span of 16 years, 19 streams from the Calcasieu, Red, and Sabine River drainages were sampled for fish and macroinvertebrate assemblages. Over 15,000 macroinvertebrates were collected, encompassing 26 different orders and over 100 different families. Additionally, over 3,000 fish were collected, encompassing over 50 species.

Biological Indices

The majority of the streams scored intermediate (intermediate: 22-28 for B-IBI, 36-41 for IBI) or above for aquatic life use ranges for macroinvertebrate and fish assemblages with only nine instances of scores in the Limited range (limited: <22 for B-IBI, <36 for IBI; Tables 2, 3, 4, and 5). According to TCEQ standards, limited scores do not meet the requirements to maintain a healthy headwater stream ecosystem; stream reaches on Anacoco, Bayou Zourie, Comrade, Little Brushy, Little Sandy, and Lyles Creek all had one or more metric score below the maximum value for Limited aquatic life use (TCEQ, 2016). Apart from 2015, fish and macroinvertebrate assemblages followed similar trends (Figure 2). When all streams were averaged, B-IBI scores overall increased from 2001 to 2002, then decreased in 2003 (with a large deviation), then increased again in 2004. B-IBI scores stayed stable from 2012 to 2014, with an increase in 2015, then a decrease in 2016. Similarly, IBI scores overall increased from 2001 to 2002, with little change from 2012 to 2014; however, IBI scores decreased significantly in 2015, then increased in 2016.

Two-way ANOVA results showed statistically insignificant differences ($p=0.103$; $F=1.620$) in macroinvertebrate metric scores yearly across the Calcasieu, Red, and Sabine River drainage basins (Figure 3). B-IBI scores increased from 2001 to 2002, then decreased in 2012 in all three river drainage systems. B-IBI scores in the Calcasieu River drainage then decreased in 2014, increased in 2015, and then decreased in 2016. An increase in B-IBI scores in the Red River drainage was found from 2012 to 2015, followed by a decrease in B-IBI scores in 2016. B-IBI scores in the Sabine River drainage increased in 2015 and 2016. Two-way ANOVA results showed statistically significant differences ($p=0.049$; $F=2.025$) in fish metric scores yearly across the Calcasieu, Red, and Sabine River drainage basins (Figure 4). Relatively constant IBI scores were found in all three river drainage systems from 2001 to 2012. IBI scores in the Calcasieu River drainage then decreased in 2014 and 2015, and then increased in 2016. An increase in IBI scores in the Red River drainage were found from 2012 to 2015 and from 2015 to 2016. IBI scores in the Sabine River drainage decreased in 2015 and then increased in 2016.

Multivariate Analysis

Using the coordinates from non-metric multidimensional scaling (NMS) associating macroinvertebrate familial abundances, by site, per year, MRPP results showed statistically significant differences ($p=0.008$) between the NMS output by year (Figure 5). Although envelope overlap does occur between years, the multivariate data points are relatively clustered by year (as shown by the MRPP results). The smallest envelopes occur in the 2003, 2004, and 2014 datasets; the largest envelope occurs in the 2012 dataset. Using the same coordinates from NMS, MRPP results showed statistically insignificant differences ($p=0.962$) between the NMS output and different river drainages (Figure 6). The envelopes for the Calcasieu, Red, and Sabine River drainage basins overlap significantly, highlighting the lack of differentiation in macroinvertebrate assemblage structure yearly between drainages. Using the same coordinates from NMS, MRPP results showed statistically significant differences ($p=0.035$) between the NMS output and streams within the Calcasieu River drainage (Figure 7). The envelopes for streams within the Calcasieu River drainage rarely overlap, emphasizing the difference in macroinvertebrate assemblage composition between streams. Using the same coordinates from NMS, MRPP results showed statistically insignificant differences ($p=0.682$) between the NMS output and streams within the Red River drainage (Figure 8). Little overlap is seen between Odom Creek and other streams in the Red River drainage; however, the envelopes for Little Sandy Creek and Tiger Creek overlap significantly. Using the same coordinates from NMS, MRPP results showed statistically insignificant differences ($p=0.169$) between the NMS output and streams within the Sabine River drainage (Figure 9). Overlap is present when comparing the macroinvertebrate assemblages of Dowden and Martin Creeks. However, the Anacoco Creek envelope is isolated in the top right corner of the grid, highlighting the difference in Anacoco Creek's assemblage structure compared to Dowden and Martin Creeks.

Using the coordinates from NMS associating fish species' abundances, by site, per year, MRPP results showed statistically significant differences (p=0.012) between the NMS output per year (Figure 10). Although envelope overlap does occur between years, the multivariate data points are relatively clustered by year (as shown by the MRPP results). The smallest envelopes occur in the 2002 and 2014 datasets; the largest envelopes occur in the 2012 and 2015 datasets. Using the same coordinates from NMS, MRPP results showed statistically significant differences (p=0.017) between the NMS output and different river drainage basins (Figure 11). While the envelopes do indeed overlap between river drainages, the multivariate data points are relatively clustered by drainage (as shown by the MRPP results). Using the same coordinates from NMS, MRPP results showed statistically significant differences (p=0.022) between the NMS output and streams within the Calcasieu River drainage (Figure 12). The envelopes for streams within the Calcasieu River drainage rarely overlap, emphasizing the difference in fish assemblage structure between streams. Using the same coordinates from NMS, MRPP results showed statistically insignificant differences (p=0.179) between the NMS output and streams within the Red River drainage (Figure 13). Odom Creek portrays the largest envelope, exhibiting great diversity in fish assemblage structure for that stream. Conversely, the envelope for Tiger Creek is much smaller, highlighting the similarity in fish assemblage structure over the years at Tiger Creek. Using the same coordinates from NMS, MRPP results showed statistically insignificant differences (p=0.846) between the NMS output and streams within the Sabine River drainage (Figure 14). Envelopes for different streams within the Sabine River drainage overlap significantly, highlighting the lack of yearly differentiation in macroinvertebrate assemblage structure between streams.

Discussion

Streams can be extremely complex and variable environments, and this variability contributes to the dynamic nature of their fish and macroinvertebrate assemblages (Lancaster et al., 1990). At the stream reach scale, environmental variability is important in structuring stream biota (Gorman and Karr, 1978; Matthews et al., 1988; Lancaster et al., 1990; Richards and Host, 1994; Clenaghan et al., 1998; Lonzarich et al., 1998; Taylor and Warren, 2001). However, species assembly at smaller spatial scales is also influenced by regional and historical processes, and knowledge of these regional and historical influences is critical for refining hypotheses of community assembly and organization for stream biota (Hugueny, 1997; Ricklefs et al., 1999; Brooks and McLennan, 1993; Caley and Schluter, 1997; Angermeier and Winston, 1998). Large scale influences provide a physical and biogeographic framework for stream systems within which local processes must operate (Tabacchi et al., 1998). Thus, it is important to understand the role of history and large scale environmental effects on the abundance and distribution of regional faunas.

Multivaritate analysis showed statistically significant differences by year for both fish and macroinvertebrate assemblages. These results highlight the impact of yearly, large scale environmental gradients on the freshwater biota in this region. Because 2002, 2003, and 2004 had the smallest sample sizes, it is understandable as to why these envelopes would be the smallest in ordination space. Because 2012 has the largest sample size (17 sites), it is also understandable that the 2012 envelopes are larger in ordination space for both macroinvertebrate and fish assemblages.

An increase in both TCEQ B-IBI and IBI was shown from 2001 to 2002. Ten sites were sampled for macroinvertebrates and fish in 2001, nine sites were sampled for macroinvertebrates in 2002, and two sites were sampled for fish in 2002. Because sites sampled for macroinvertebrates did not increase from

2001 to 2002, sample size bias is an unlikely factor in this phenomenon. But it is possible that the small sample size for fish in 2002 was misrepresentative of the fish assemblage structure. Additionally, the same streams were sampled in both 2001 and 2002; therefore, other external factors may have caused a shift in the structure of the macroinvertebrate assemblages. A likely explanation of the increase in both community metrics and TCEQ scores lies in sampling procedure. The first time this field crew performed this type of sampling was in 2001, with outdated electrofishing equipment and a small field crew. Conversely, after 2001, new equipment was purchased and the field crew was extended. This alteration in sampling procedure could explain the positive shift in bioassessment scores.

B-IBI scores increased in 2015. A possible explanation for the increase in scores could be the upgrade in the Ft. Polk wastewater treatment facility, which improved the water quality of the plant's discharge into the stream (Broadbent, 2016). Recently, the Army has replaced the old trickling filter treatment unit with a modern forced-aeration activated sludge system. This enhancement increased oxygen levels of Bundick Creek (Cline et al., 2014). The increased oxygen levels could account for the improved quantity and diversity of fish species as well as the increased vegetation noted along the banks of Bundick Creek. Differing from macroinvertebrates, a significant decrease in richness, evenness, and diversity of fish assemblage composition and a decrease in IBI scores were reported in 2015. Vast amounts of rainfall in 2015 possibly skewed the attainment status or trends in bioassessment scores. The Principal Investigator (Dr. Williams) was present on both 2012 and 2015 field trips, and the electrofishing equipment was identical (and received regular servicing); thus, equipment malfunction and user error can be ruled out for the low fish IBI scores. When high volumes of water enter headwater streams, fish are pushed downstream (Williams et al., 2015). After sampling sites on PRTA in 2015, it rained significantly, and the high water levels caused a delay in sampling JRTC sites because of lack of accessibility. Once the water levels finally decreased, the JRTC sites were sampled directly following the displacement of fish caused by flooding, which is supported by the relationship between B-IBI and IBI scores.

Because insects at different life history stages can choose breeding sites based on environmental conditions at a stream locality and have the potential to cross drainage basin boundaries, it was anticipated that macroinvertebrate assemblages would not vary statistically between drainages (Anderson and Wallace, 1995). As predicted, statistically insignificant differences in B-IBI scores yearly across different river drainage basins were found, and ordination analysis showed statistically insignificant differences by drainage. Therefore, macroinvertebrates were associated with large scale environmental gradients regardless of drainage, generally responding more to local environmental conditions that vary across a larger geographic region (Williams, 2003b). Because most fish species are constrained to their historically defined drainage basins, it was predicted that environmental factors relating to both year and drainage would affect fish assemblage composition (Williams, 2003b). Statistically significant differences in IBI scores yearly across different river drainages were found, and ordination analysis showed statistically significant differences by drainage, supporting the hypothesis that fish species would be influenced more by spatially structured environmental factors unique to the drainage basin that contain them (Lammert and Allan, 1999).

In both fish and macroinvertebrate assemblages, multivariate analysis showed statistically significant differences by stream within the Calcasieu River drainage basin. In contrast, for both fish and macroinvertebrate assemblages, ordination analysis showed statistically insignificant differences by streams within the Red and Sabine River drainage basins. The increased diversity between streams within the Calcasieu River drainage is most likely a by product of the wider geographic scope of the Calcasieu sites; streams sampled within the Calcasieu drainage spread from JRTC to PRTA and the New

Lands, up to 60 km apart (Figure 1). Conversely, sites sampled from the Red and Sabine River drainage basins are all close in proximity to one another.

In summary, when the trends across years are examined, community structure of fish and macroinvertebrates in these streams are quite stable. The water quality indicators, B-IBI and IBI scores, are almost the same in 2001 and 2016. Fort Polk is one of the largest blocks of managed forest in the southeastern United States, which is why it has the largest remaining population of the federally endangered Red-cockaded Woodpecker (*Picoides borealis*; USFWS, 2003). Most notably, Tiger and Odom Creeks seem to have recovered from the large disturbance of their watersheds.

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Tables

Table 1. Description of location affected by clear-cutting and new roads following the year of timber harvest disturbance (2004).			
	Little Sandy	Odom	Tiger
Disturbance extent			
Total area (hectares)	1015.87	1377.58	224.21
Clear-cut area (hectares)	0	266.8	4.84
Thinned area (hectares)	0	504.98	129.44
New roads constructed	0	34.13	4.08
Percent disturbed	0	58.5	61.7
Stream characteristics			
Floodplain width (m)	12	16	9
Bankfull width (m)	10	9	5
Mean water depth (m)	0.27	0.23	0.25
Maximum depth (m)	0.039	0.029	0.041
Hydraulic radius	2.5	2.1	2.1
D50 (mm)	0.4	0.28	41
D84 (mm)	0.66	0.41	58
Tractive force (kg force/m2)	4.86	6.67	11.75
Geomorphological features			
Entrenchment ratio	1.23	1.68	1.6
Width to depth ratio	12.1	13.3	6.4
Sinuosity	1.1	1.8	2
Bed slope	0.18	0.29	0.47

Figures

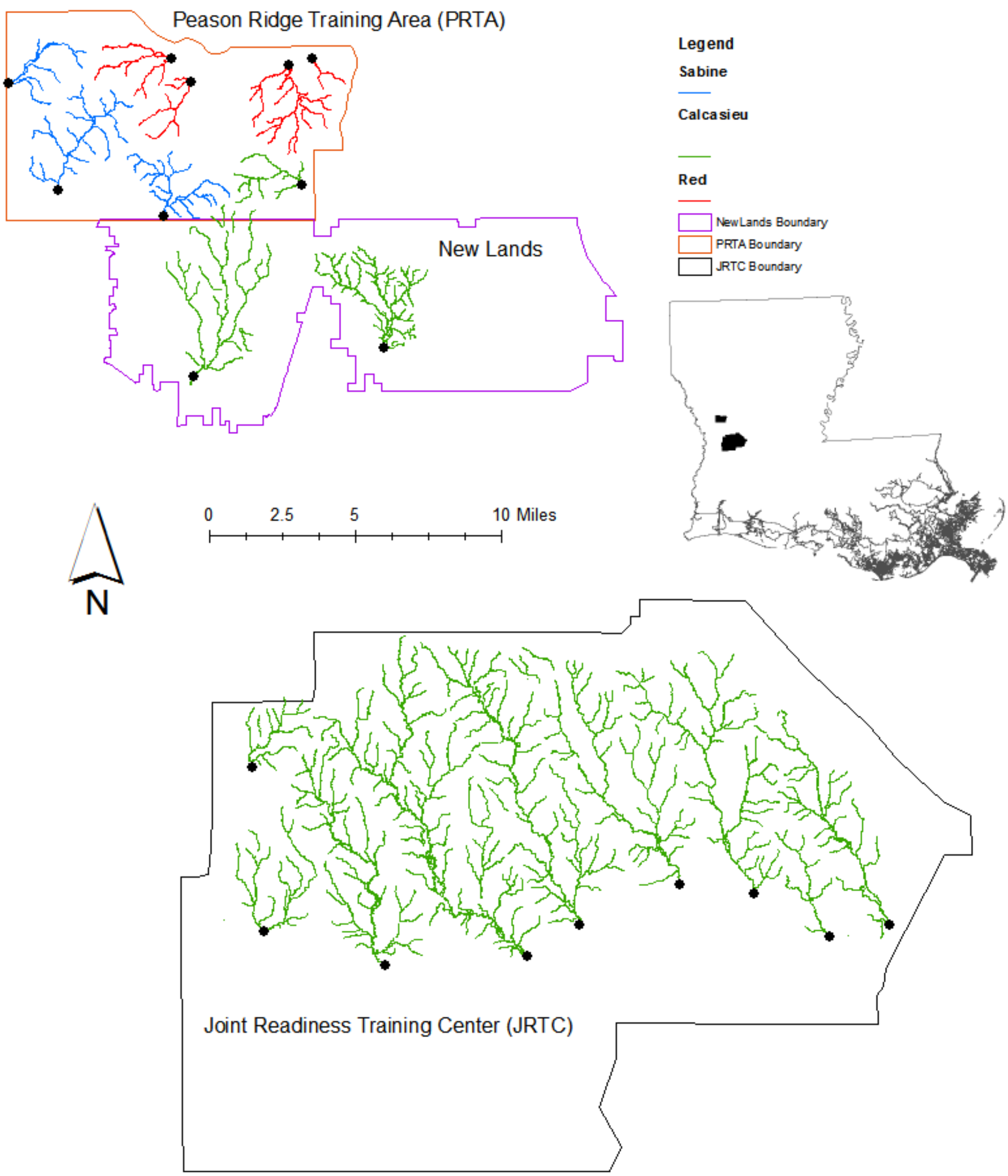
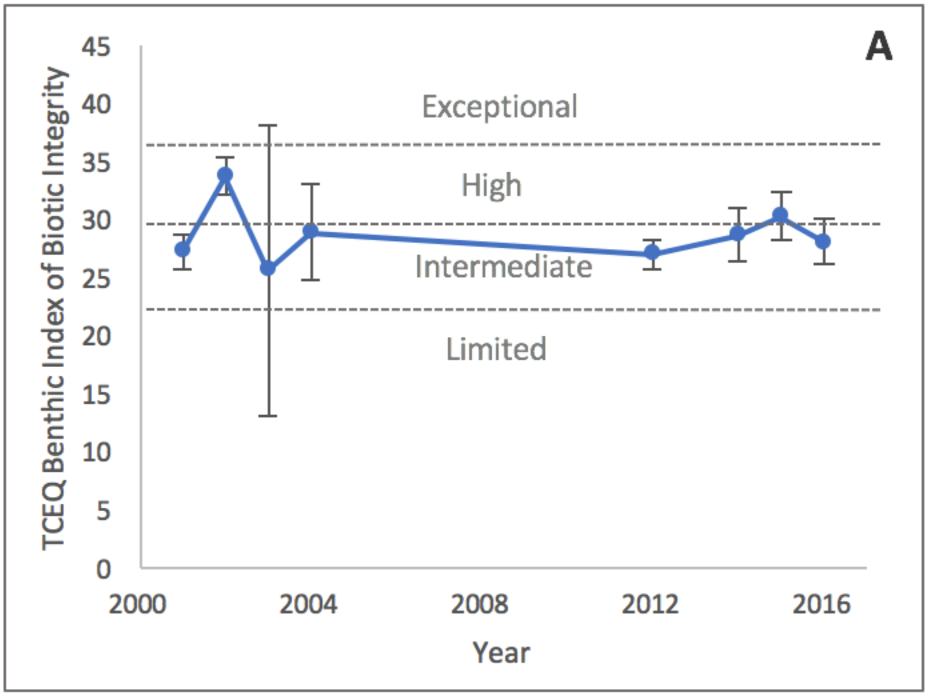


Figure 1. Map of Fort Polk, Louisiana



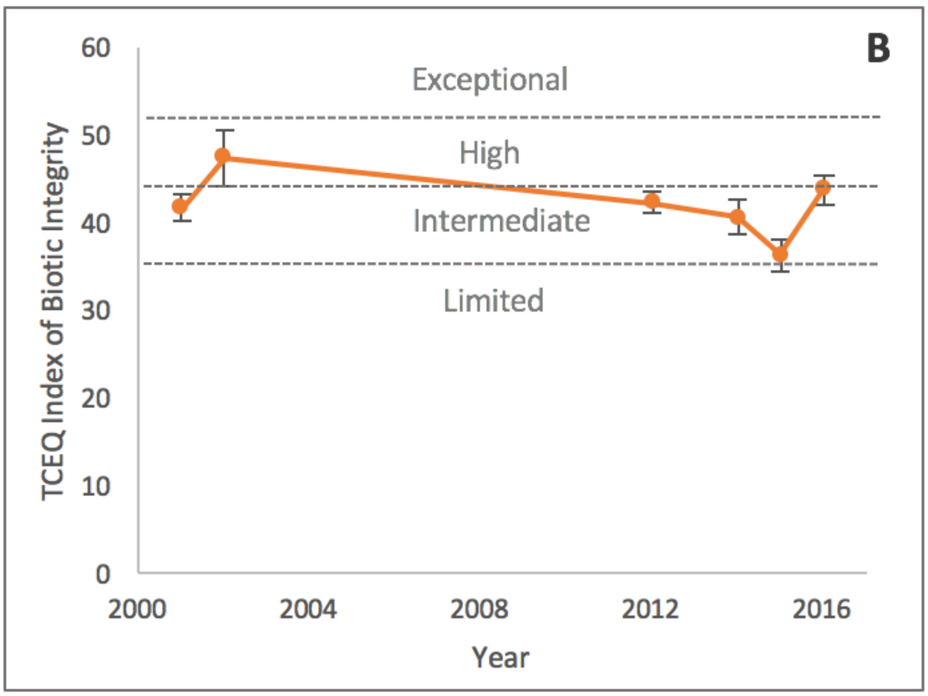


Figure 2. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate (**A**) and fish (**B**) assemblages, respectively. B-IBI and IBI values plotted by year quantitatively express changes in the structure of the biologic communities.

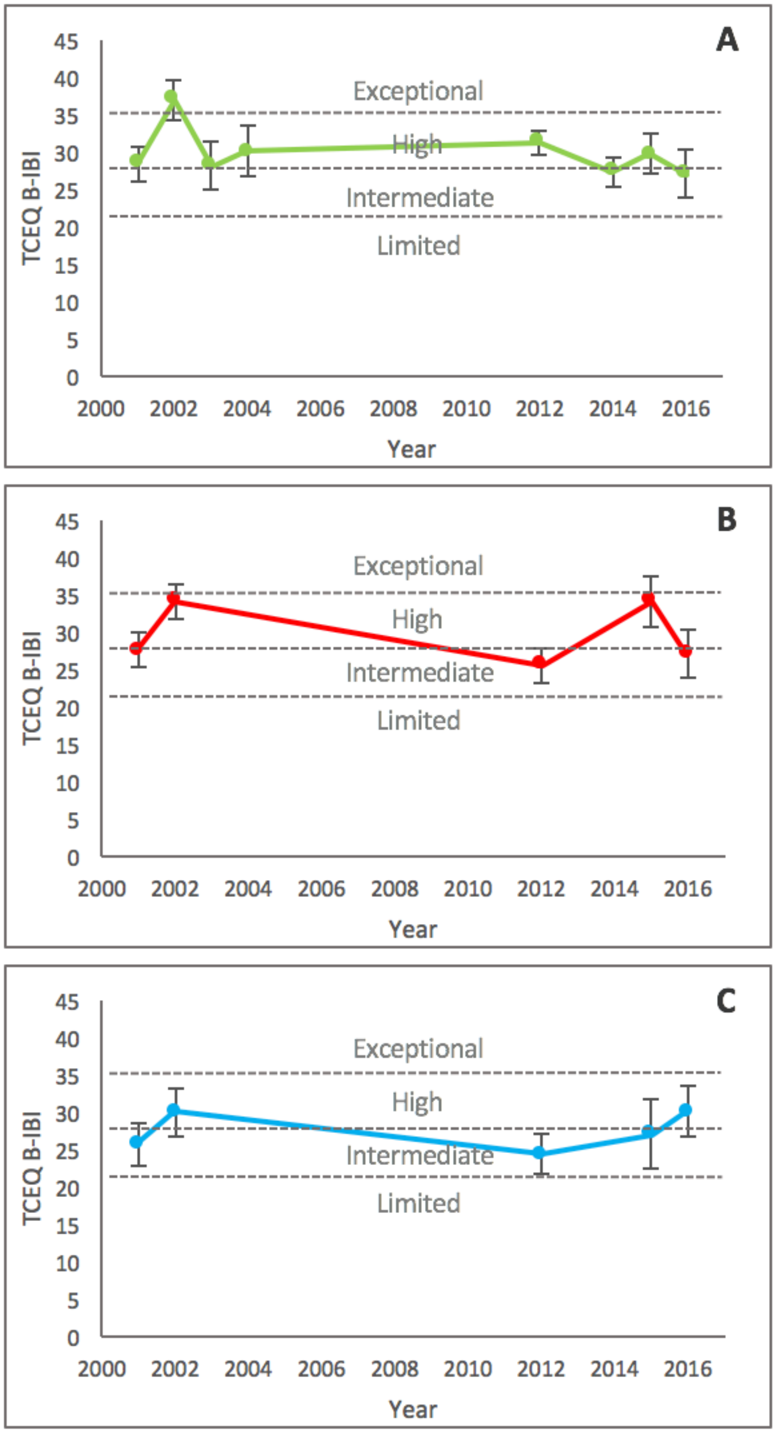


Figure 3. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) for macroinvertebrate assemblages in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show marginally statistically insignificant differences in B-IBI community scores yearly across the different river drainages ($p=0.103$; $F=1.620$).

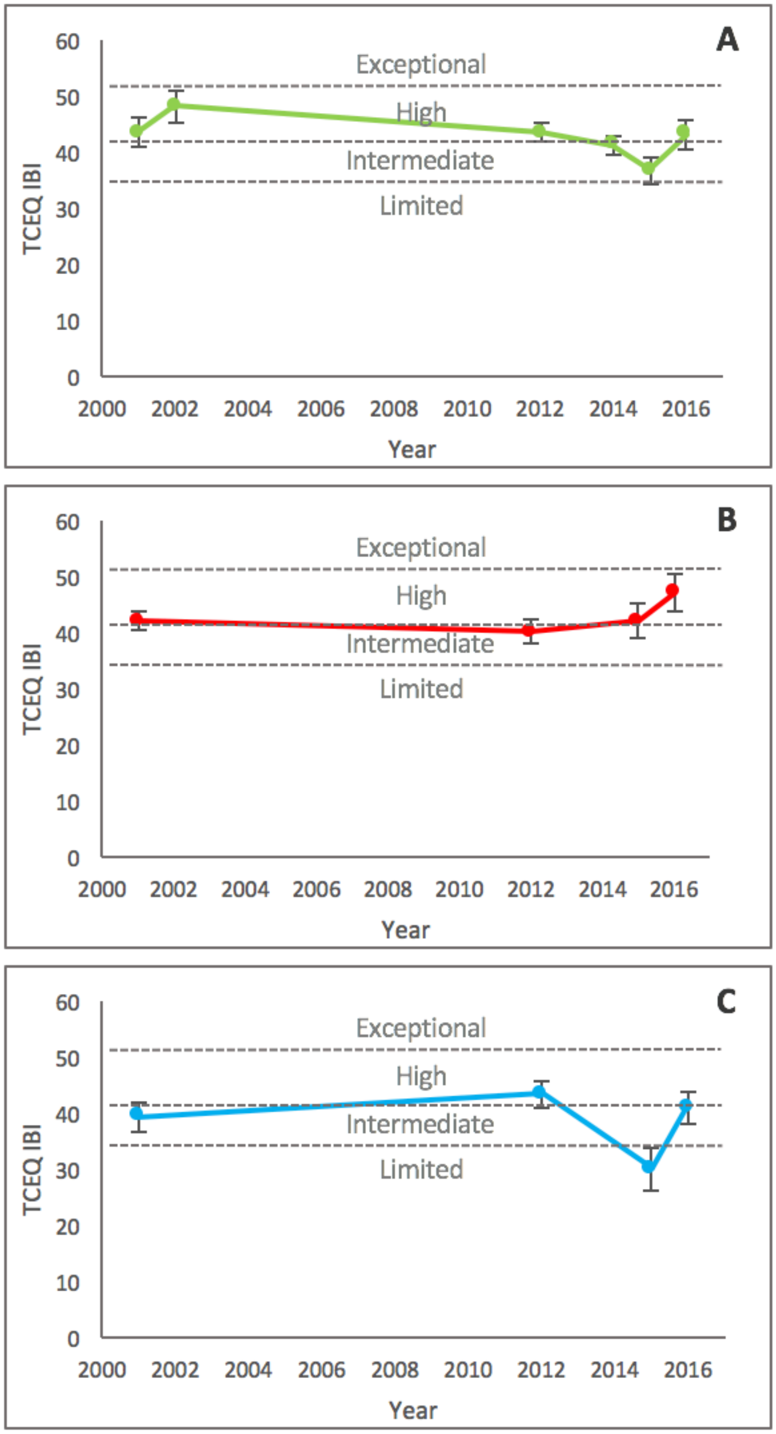


Figure 4. Texas Commission on Environmental Quality (TCEQ) Index of Biotic Integrity (IBI) scores for fish assemblages in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in IBI community scores yearly across the different river drainages ($p=0.049$; $F=2.025$).

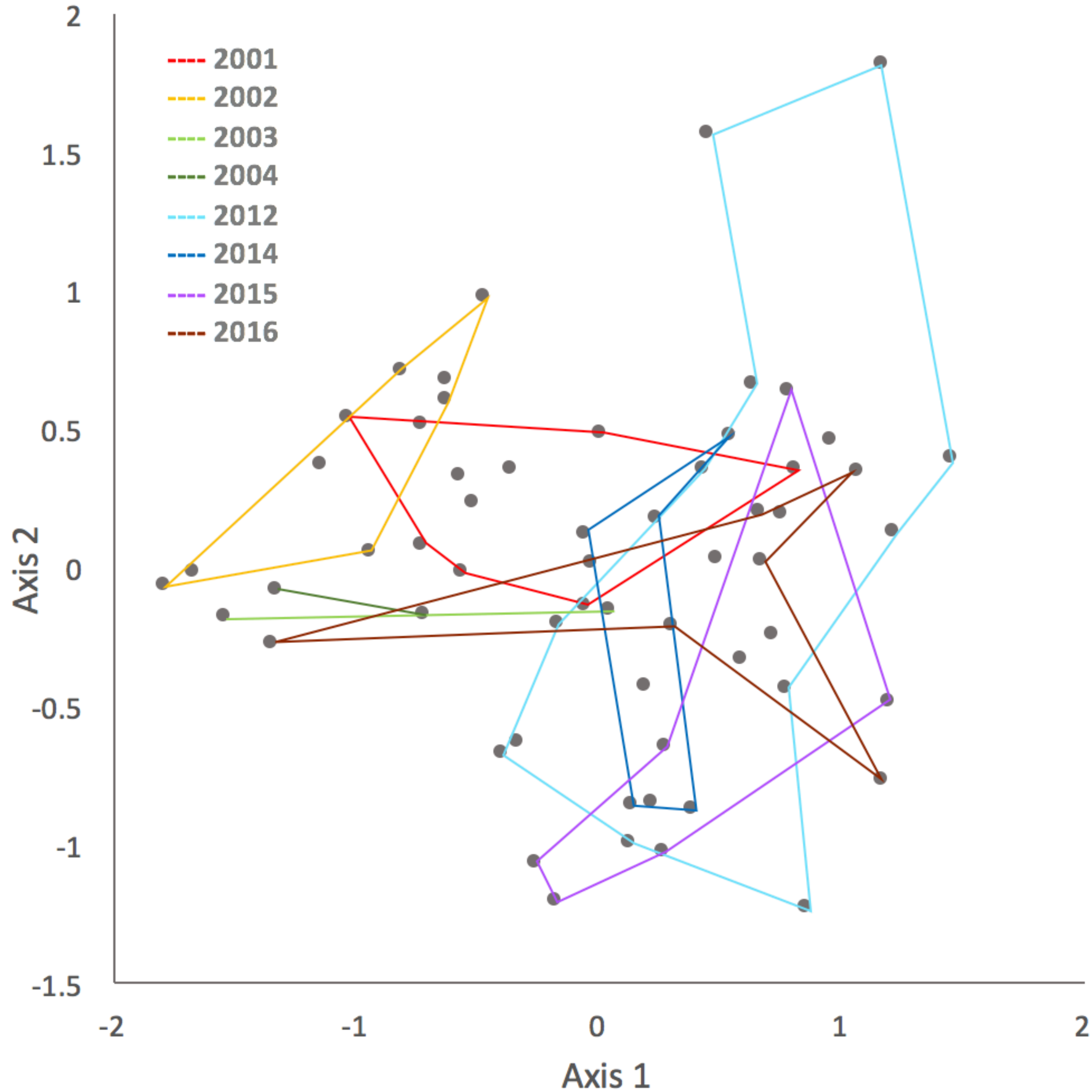


Figure 5. Similarities/dissimilarities of macroinvertebrate assemblage composition by site per year (NMS). Multivariate points were grouped by year, with MRPP results showing statistically significant differences between years (p=0.008).

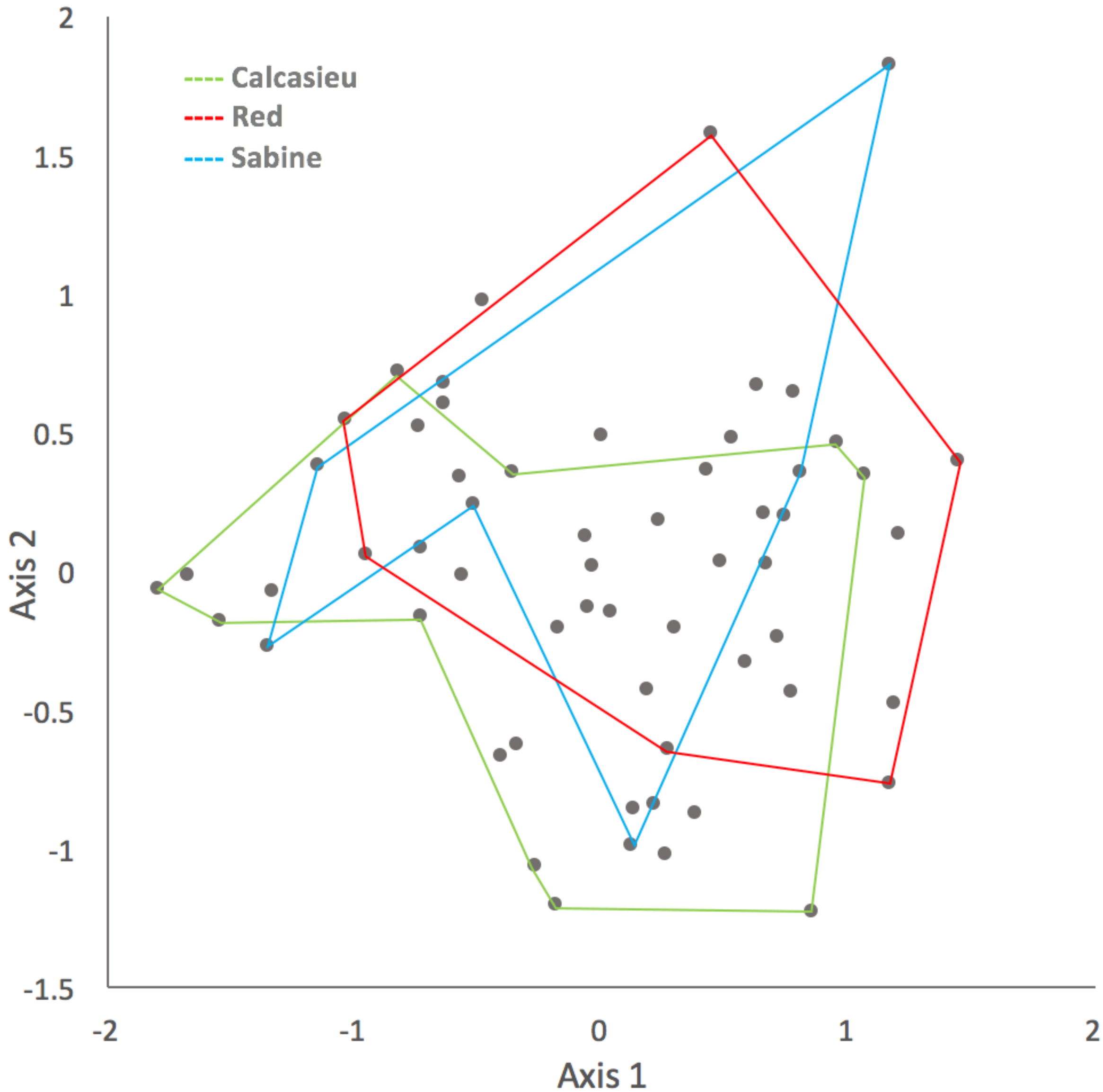


Figure 6. Similarities/dissimilarities of macroinvertebrate assemblage composition by site per year (NMS). Multivariate points were grouped by drainage, with MRPP results showing statistically insignificant differences between drainages (p=0.962).

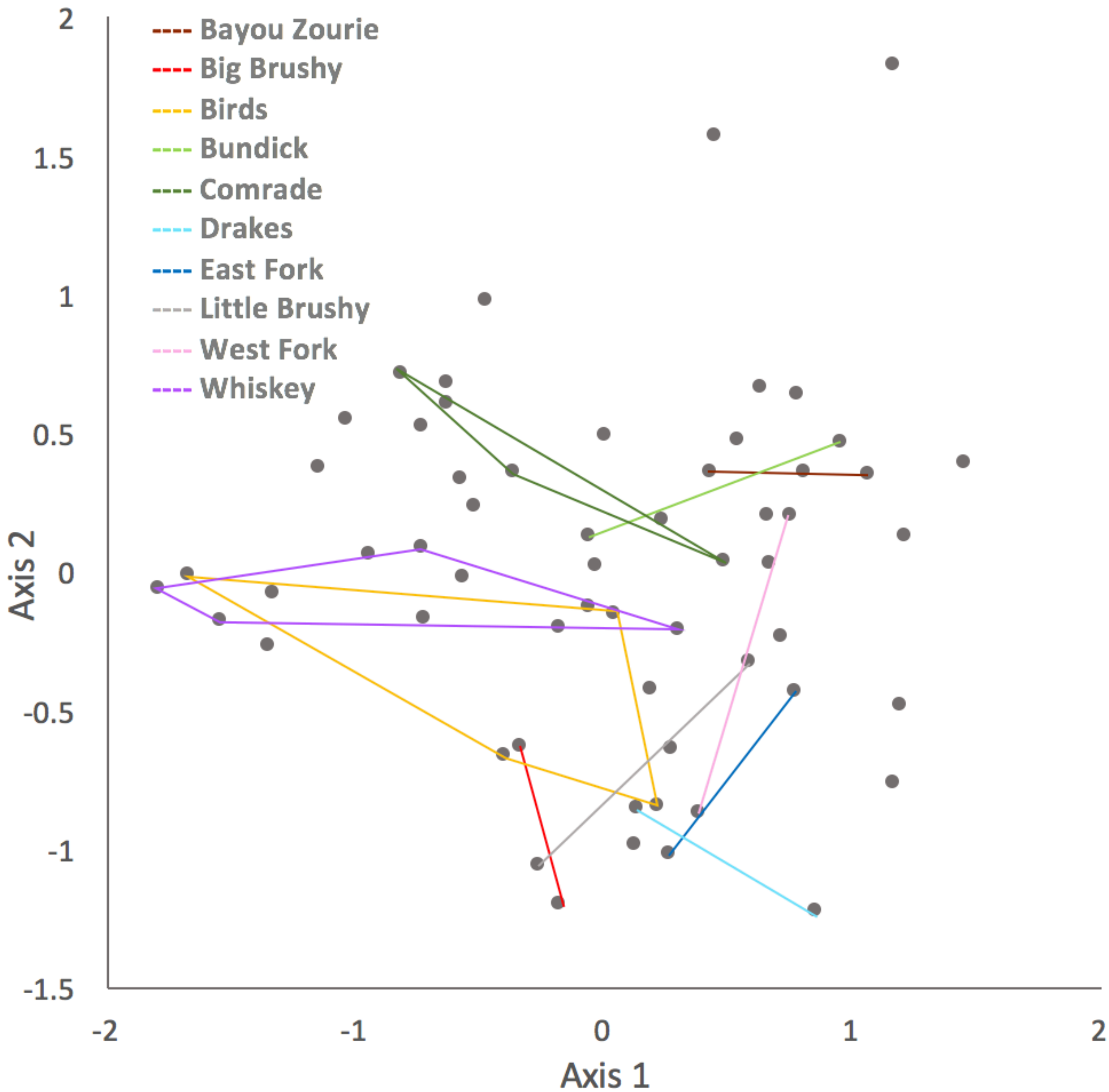


Figure 7. Similarities/dissimilarities of macroinvertebrate assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Calcasieu River drainage, with MRPP results showing statistically significant differences between streams (p=0.035).

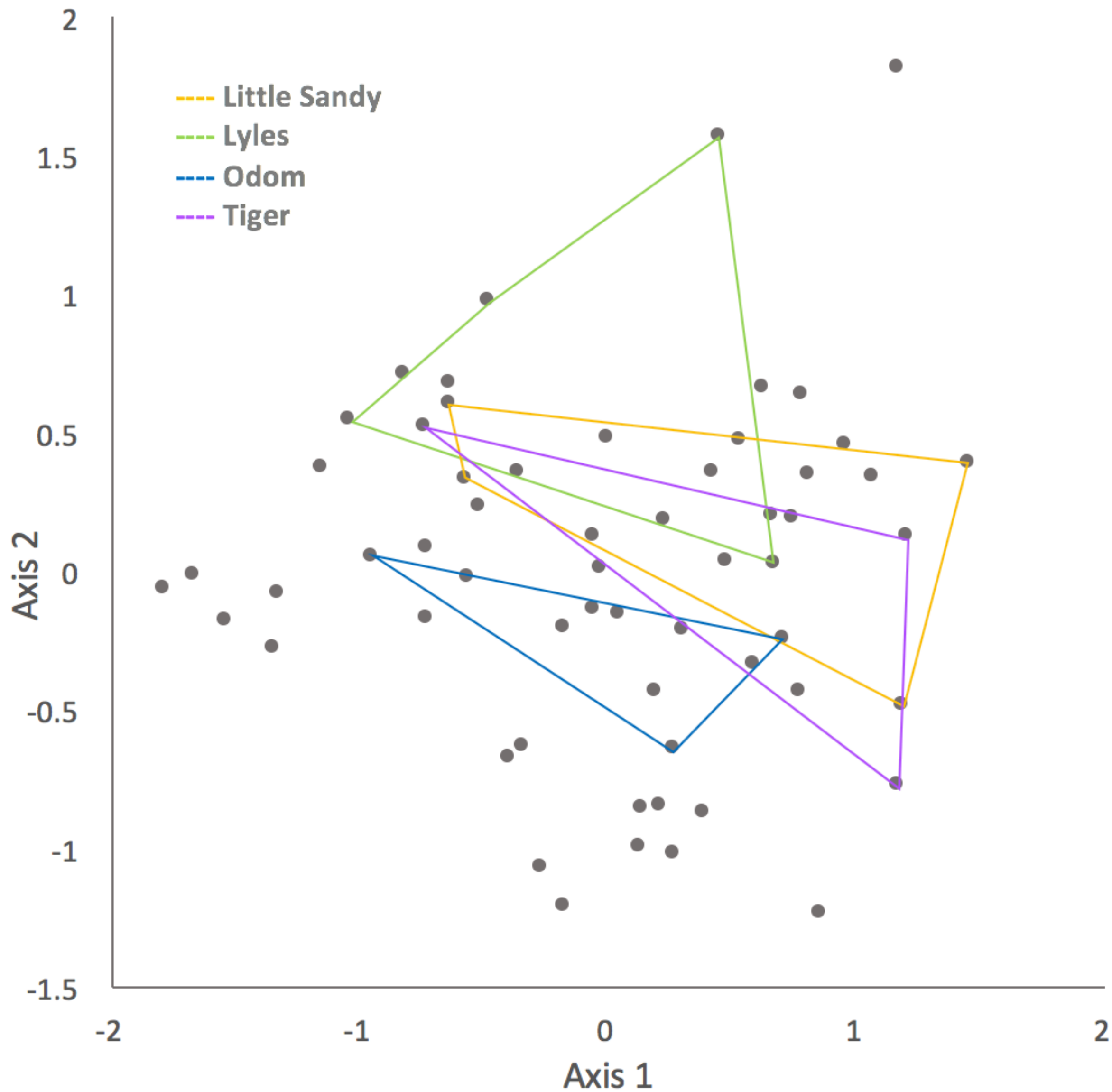


Figure 8. Similarities/dissimilarities of macroinvertebrate assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Red River drainage, with MRPP results showing statistically insignificant differences between streams (p=0.682).

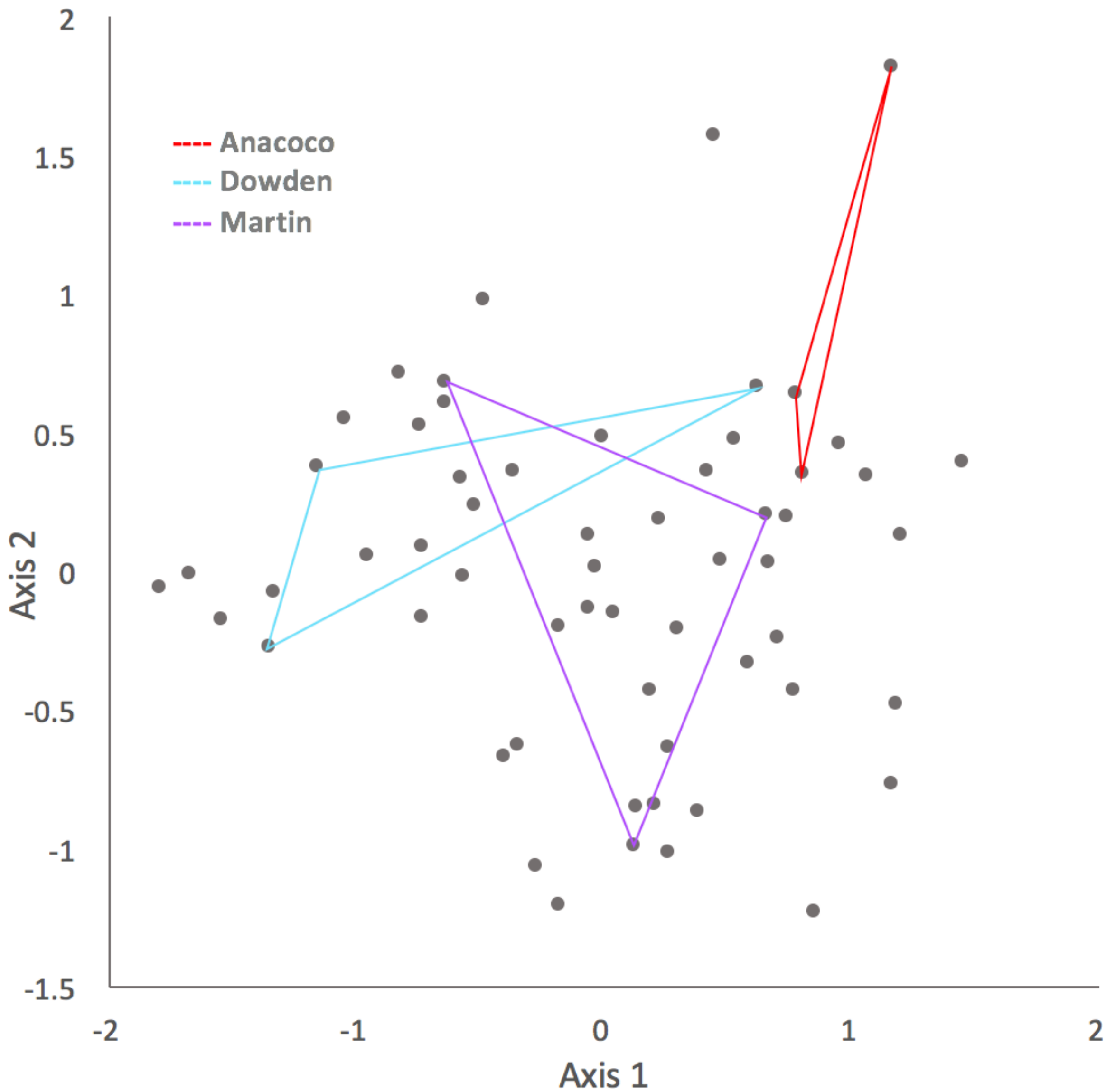


Figure 9. Similarities/dissimilarities of macroinvertebrate assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Sabine River drainage, with MRPP results showing statistically insignificant differences between streams (p=0.169).

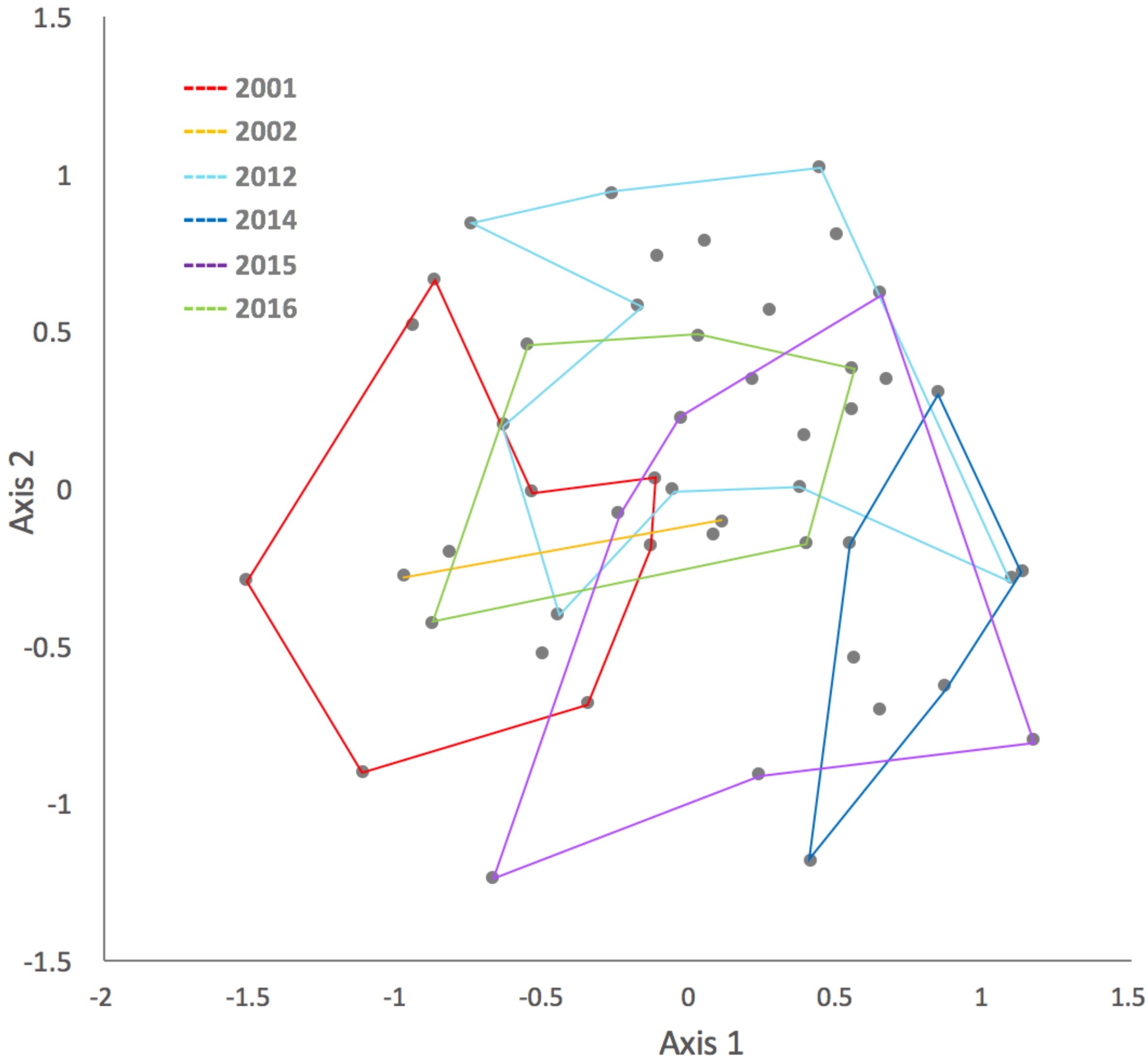


Figure 10. Similarities/dissimilarities of fish assemblage composition by site per year (NMS). Multivariate points were grouped by year, with MRPP results showing statistically significant differences between years ($p=0.012$).

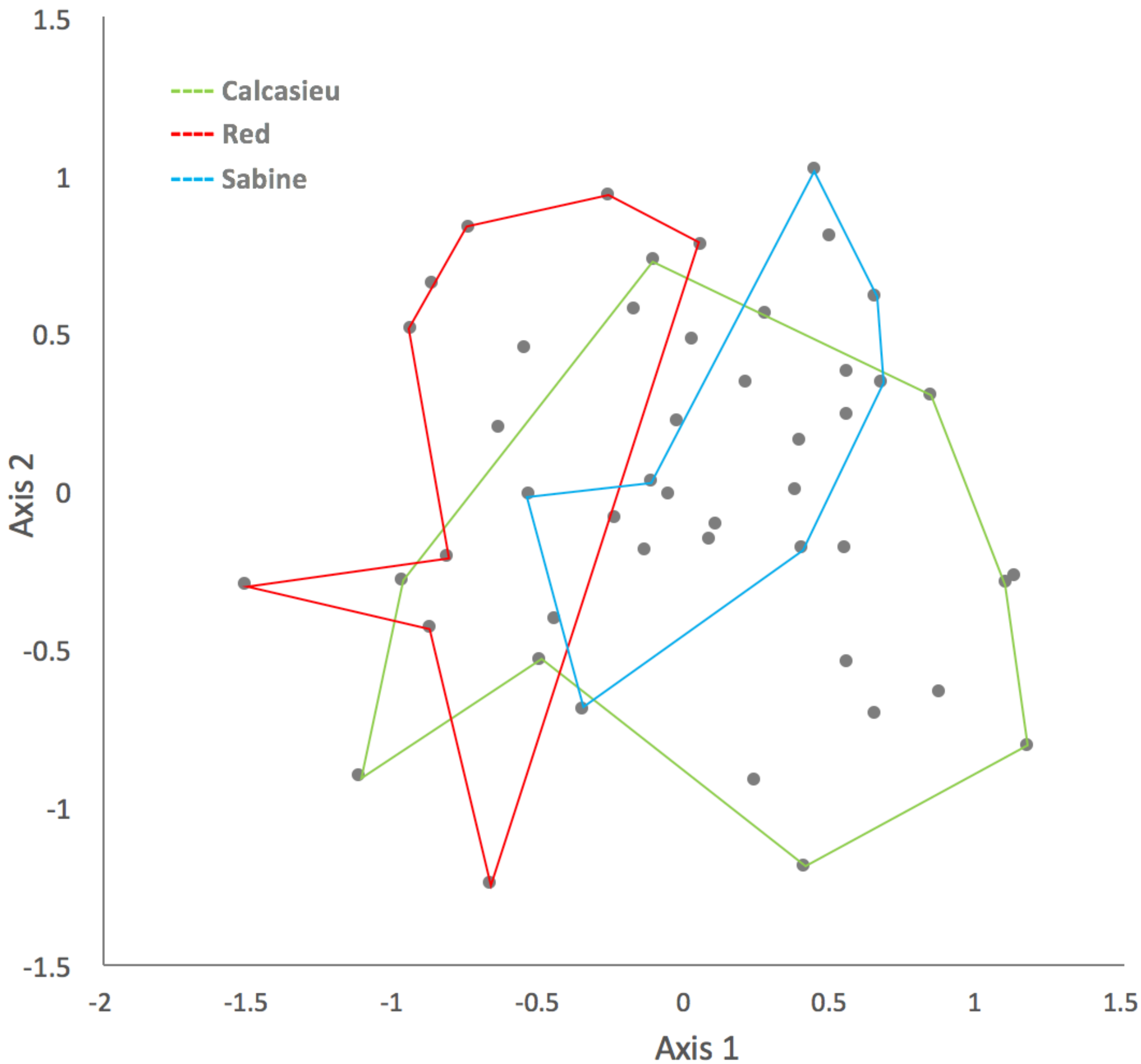


Figure 11. Similarities/dissimilarities of fish assemblage composition by site per year (NMS). Multivariate points were grouped by drainage, with MRPP results showing statistically significant differences between drainages (p=0.017).

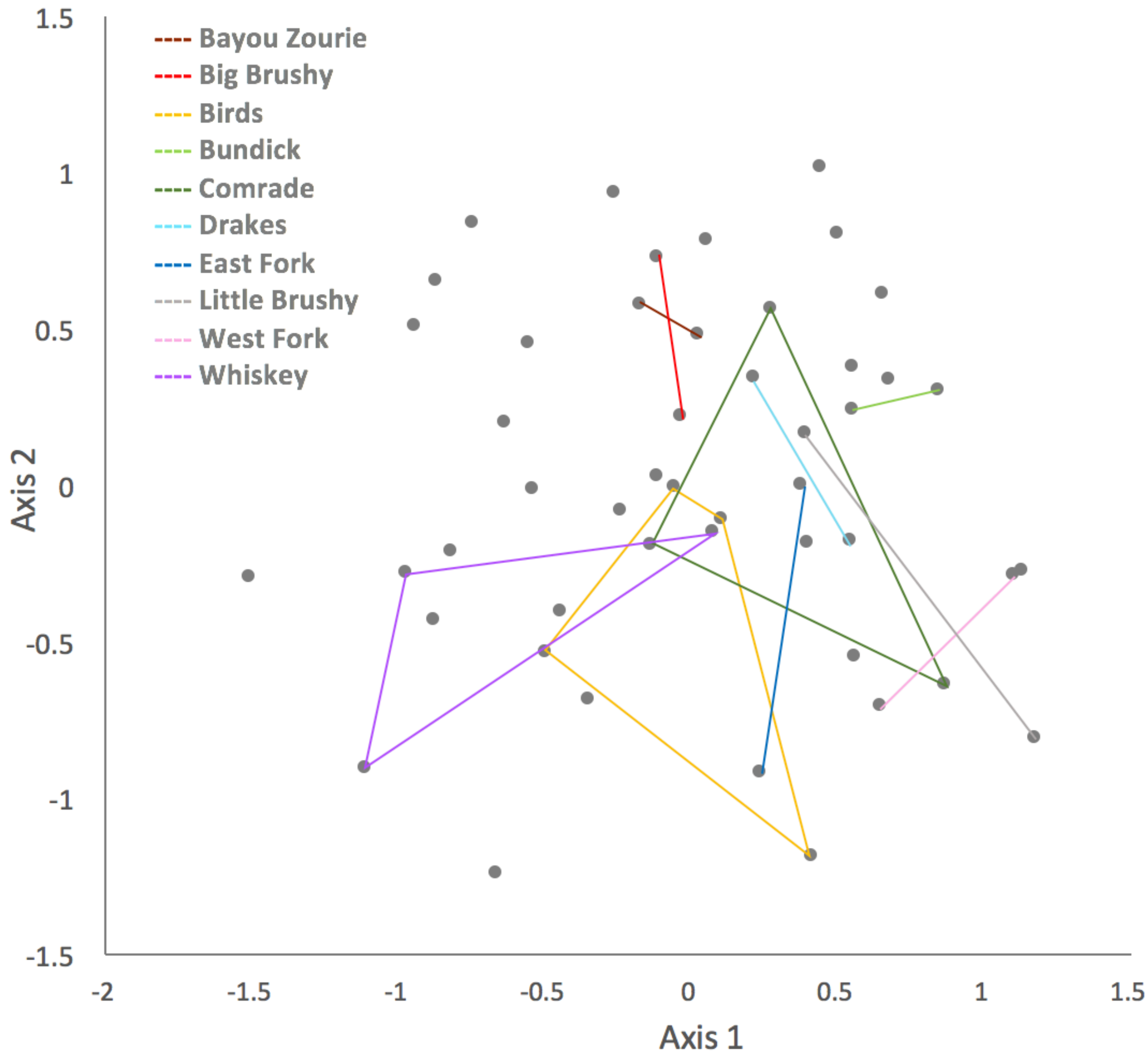


Figure 12. Similarities/dissimilarities of fish assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Calcasieu River drainage, with MRPP results showing statistically significant differences between streams (p=0.022).

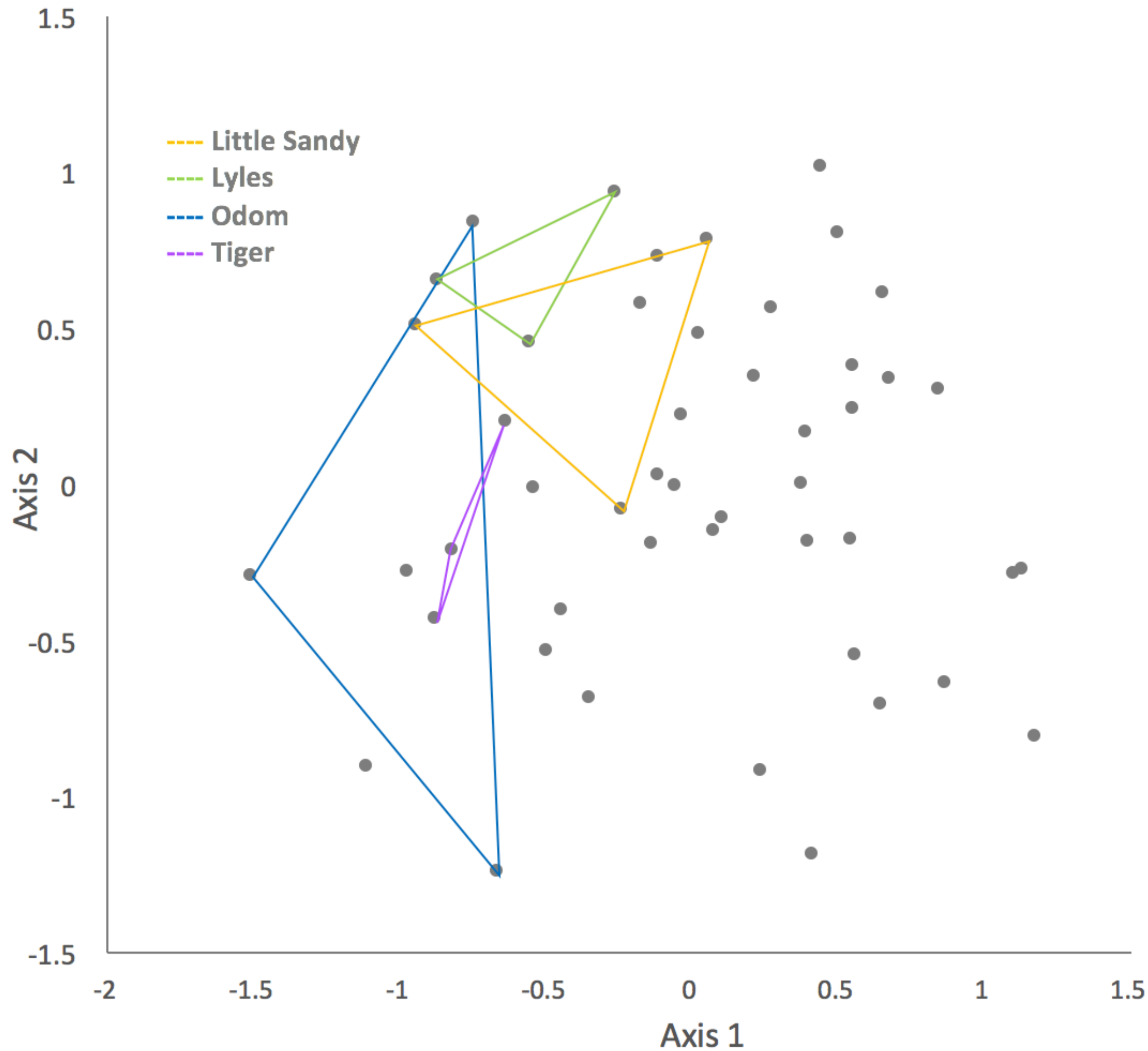


Figure 13. Similarities/dissimilarities of fish assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Red River drainage, with MRPP results showing statistically insignificant differences between streams ($p=0.179$).

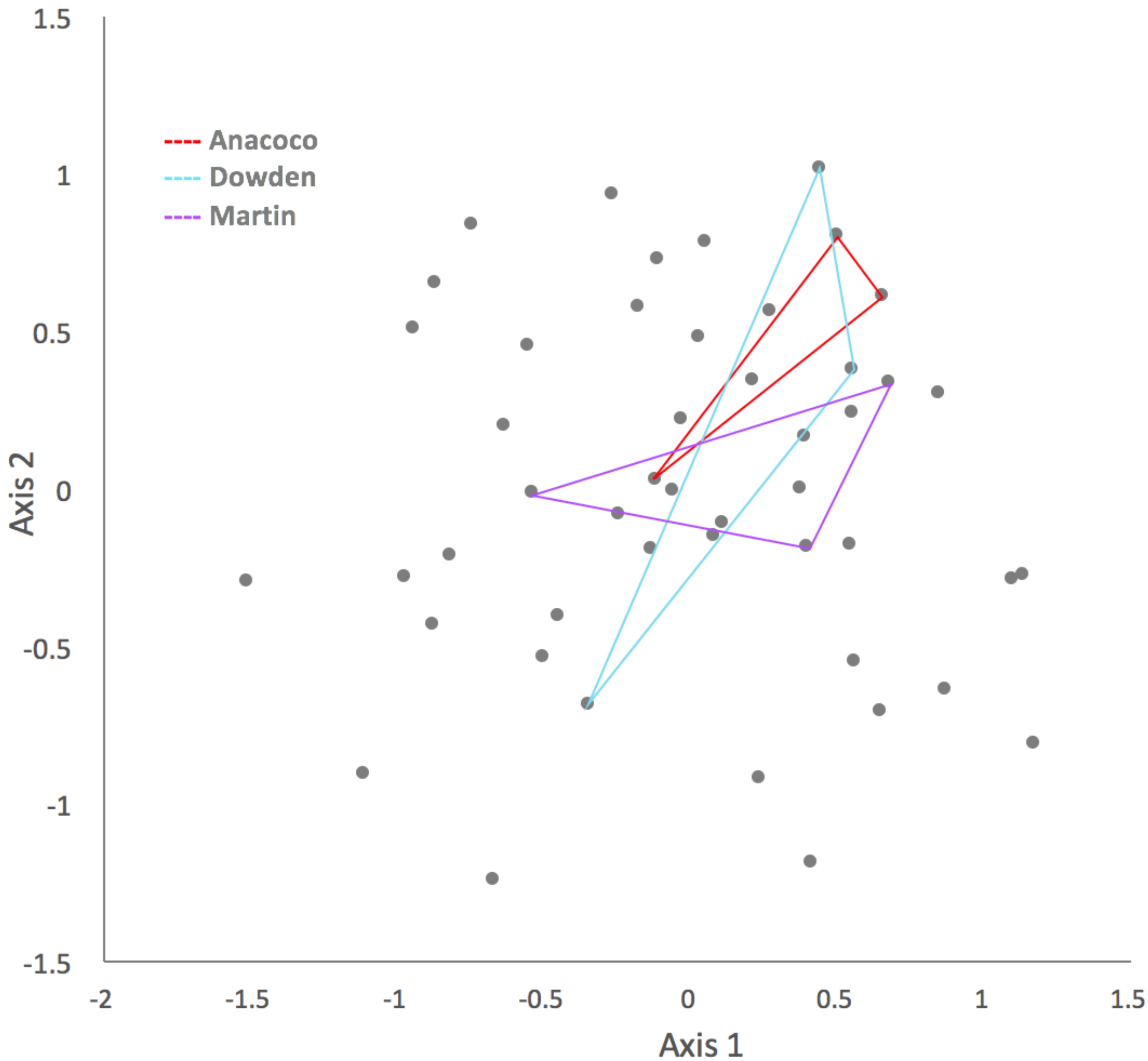


Figure 14. Similarities/dissimilarities of fish assemblage composition by site per year (NMS). Multivariate points were grouped by streams within the Sabine River drainage, with MRPP results showing statistically insignificant differences between streams (p=0.846).

Appendices

Figure A1. Longleaf pines

Figure A2. Bundick creek culvert design

Figure A3. DMPBAC culvert

Figure A4. DMPBAC

Figure A5. Little Brushy Creek

Figure A6. Prairie Creek

Figure A7. Little Sandy Creek

Figure A8. Dowden Creek

Table B1. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) metrics for ecoregions 33, 34, and 35.

	Scoring Criteria		
	5	3	1
Total Taxa	> 30	17-30	< 17
Diptera Taxa	> 10	6-10	< 6
Ephemeroptera Taxa	(*b*)	> 3	3
Intolerant Taxa	> 4	2-4	< 2
% EPT Taxa	> 18.9	10.8-18.9	< 10.8
% Chironomidae	(*a*)	< 40.2	≥ 40.2
% Tolerant Taxa	< 16	16-24.3	> 24.3
% Grazers (SCR, SHR)	> 9	5.2-9	< 5.2
% Gatherers(CG)	> 12.5	7.3-12.5	< 7.3
% Filterers(FC)	(*a*)	> 16.3	≤ 16.3
% Dominance (3 Taxa)	< 57.7	57.7-71.6	> 71.6

*Aquatic life score: > 36 exceptional, 29-36 high, 22-28 intermediate, < 22 limited
(*a*) The discriminatory power was less than optimal for this bioregion, so the metric was assigned only two scoring categories.
(*b*) The median value for this bioregion was less than the metric-selection criterion (< 5.5 for taxa richness metrics; < 12 for percentage metrics expected to decrease with disturbance), so the metric was assigned only two categories.

Table B2. Texas Commission on Environmental Quality (TCEQ) Index of Biotic Integrity (IBI) metrics for ecoregions 33 and 35.

	Scoring Criteria		
	5	3	1
Total number of Fish Species	> 20	7-20	< 7
Number of Native Cyprinid Species	> 4	2-4	< 2
Number of Benthic Invertevore Species	> 4	3-4	< 3
Number of Sunfish Species	> 4	3-4	< 3
Number of Intolerant Species	> 3	2-3	< 2
Percent of Individuals as Tolerant Species (Excluding Gambusia)	< 26	26-50	> 50
Percent of Individuals as Omnivores	< 9	9-16	>16
Percent of Individuals as Invertivores	> 65	33-65	< 33
Percent of Individuals as Piscivores	> 9	5-9	< 5
Number of Individuals	> 28	14-28	< 14
Percent of Individuals as Non-Native Species	< 1.4	1.4-2.7	< 2.7
Percent of Individuals with disease or anomaly	< 0.6	0.6-1	> 1

**Aquatic life use: ≥ 52 exceptional, 42-51 high, 36-41 intermediate, <36 limited

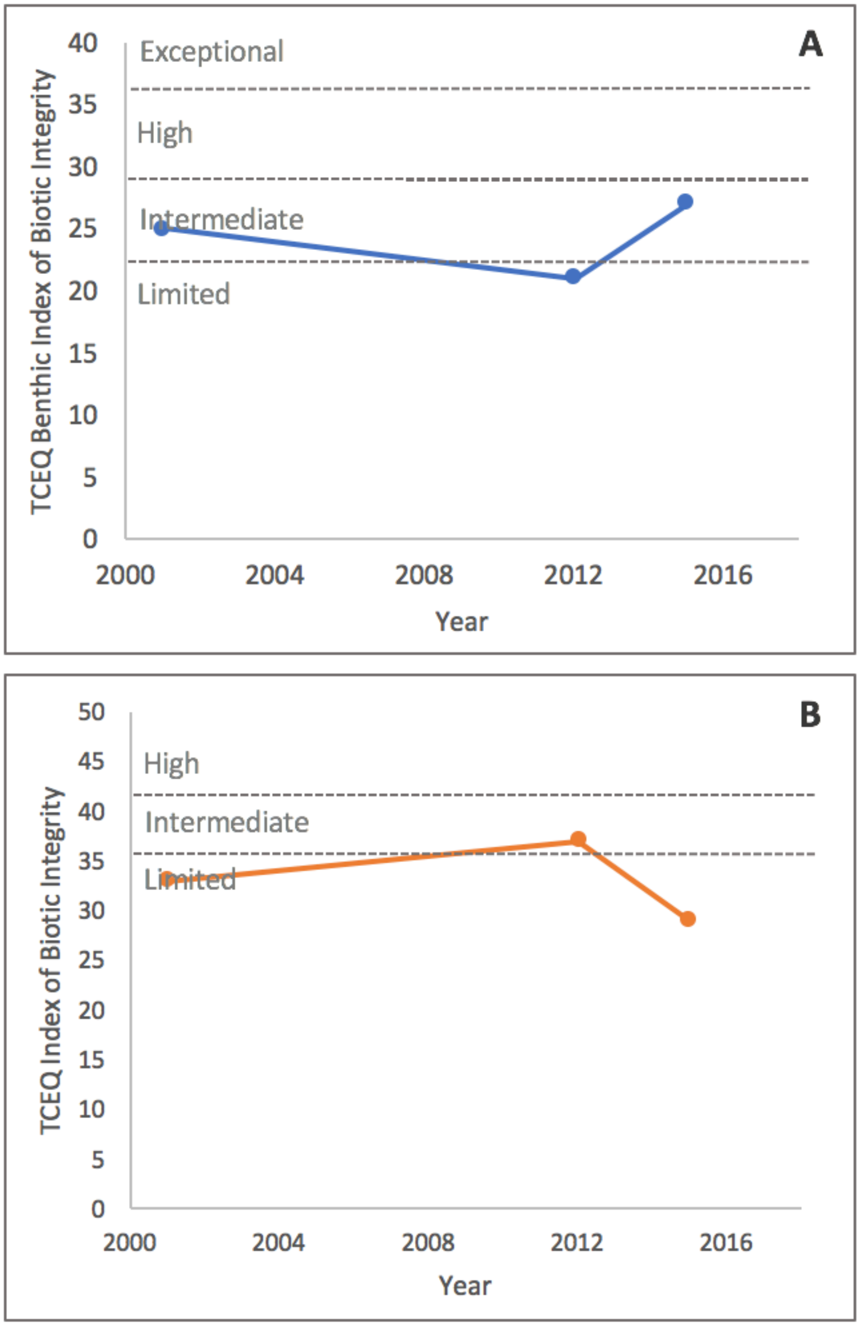


Figure C1. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Anacoco**.

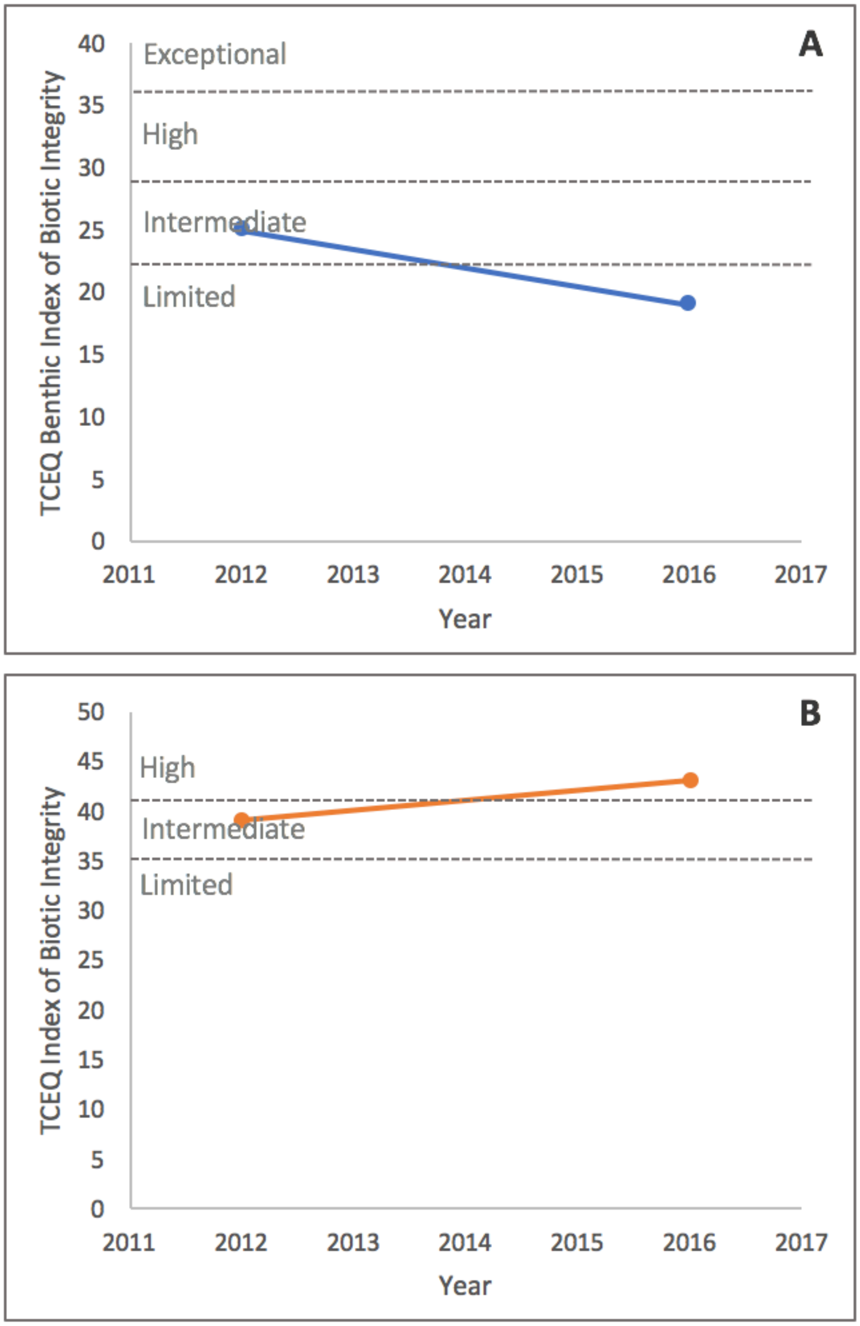


Figure C2. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Bayou Zourie.**

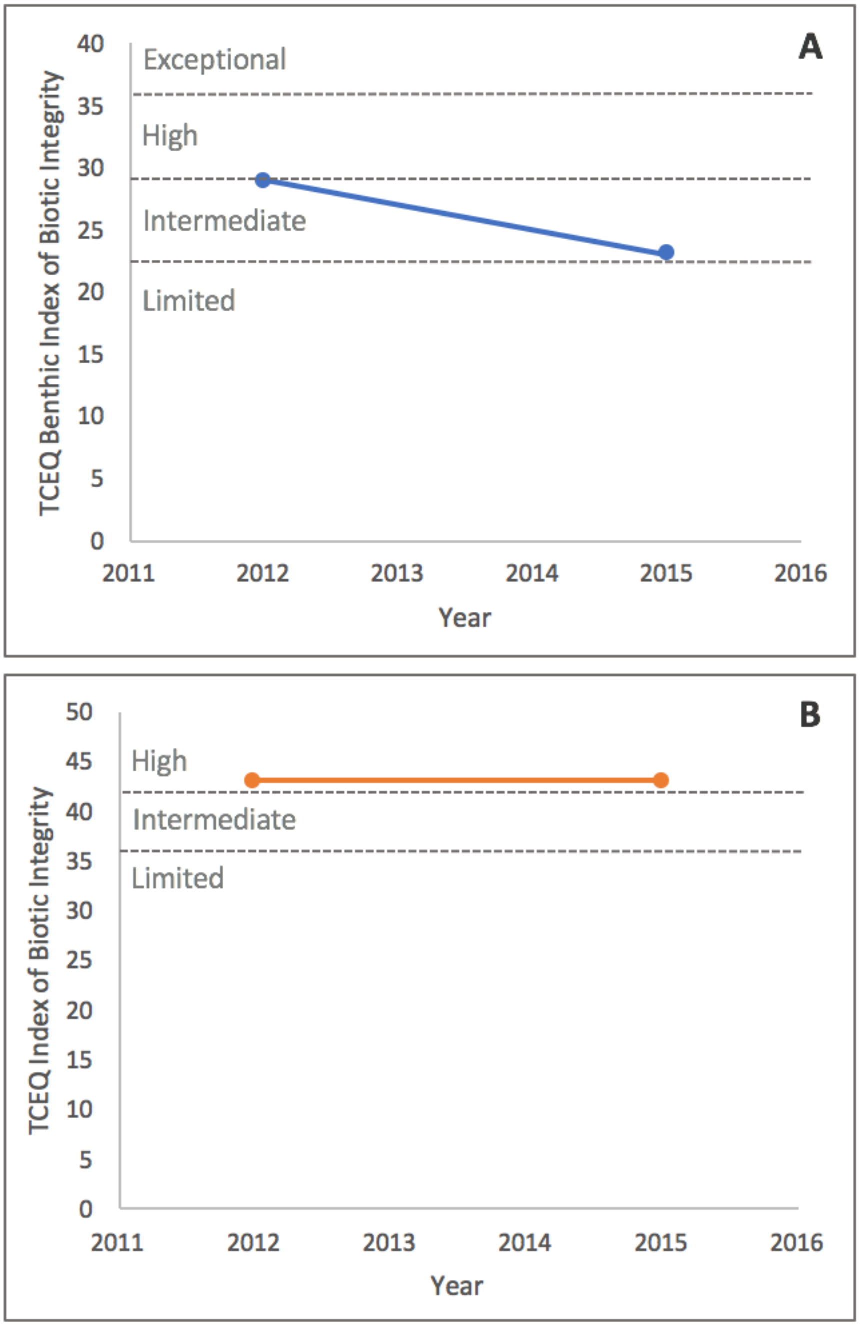


Figure C3. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Big Brushy**.

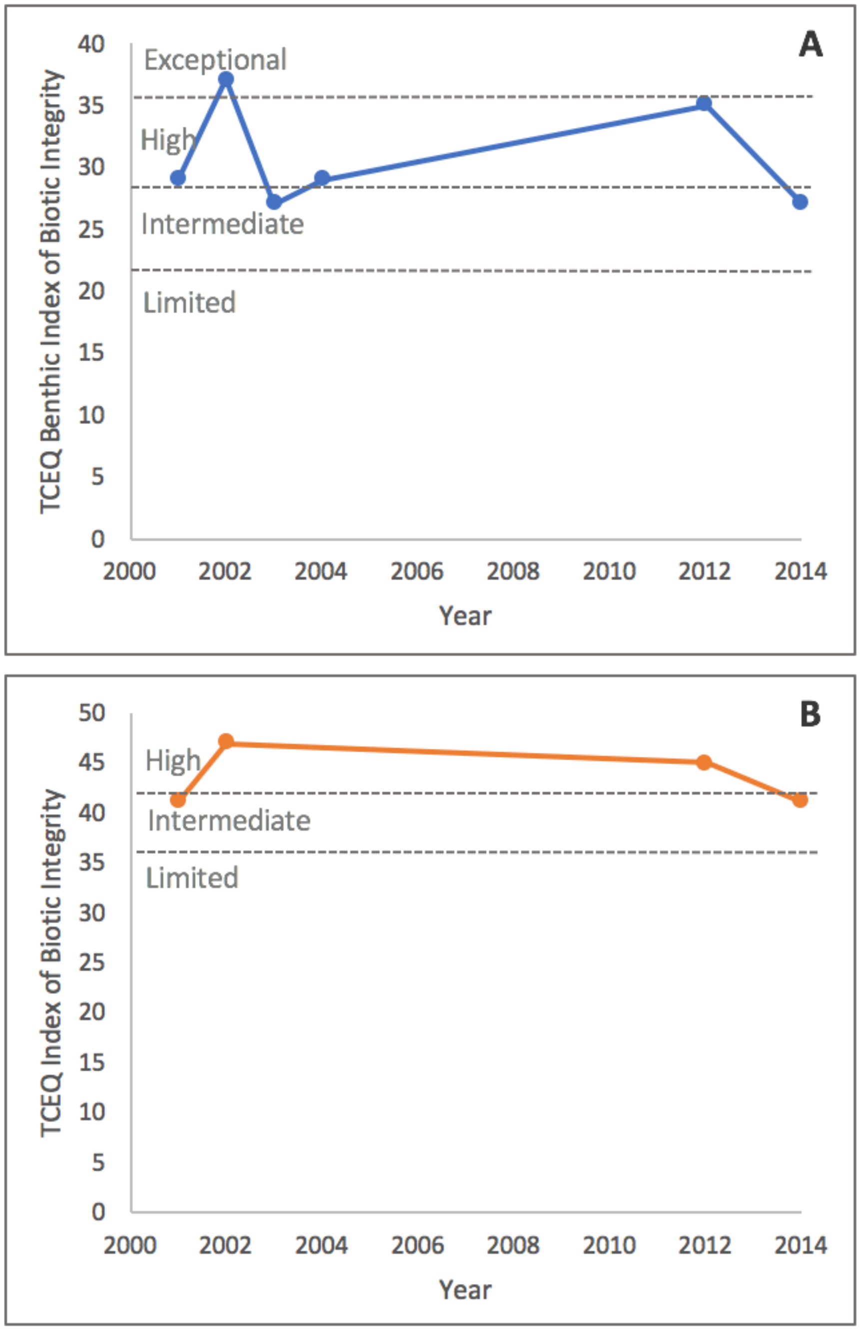


Figure C4. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Birds.**

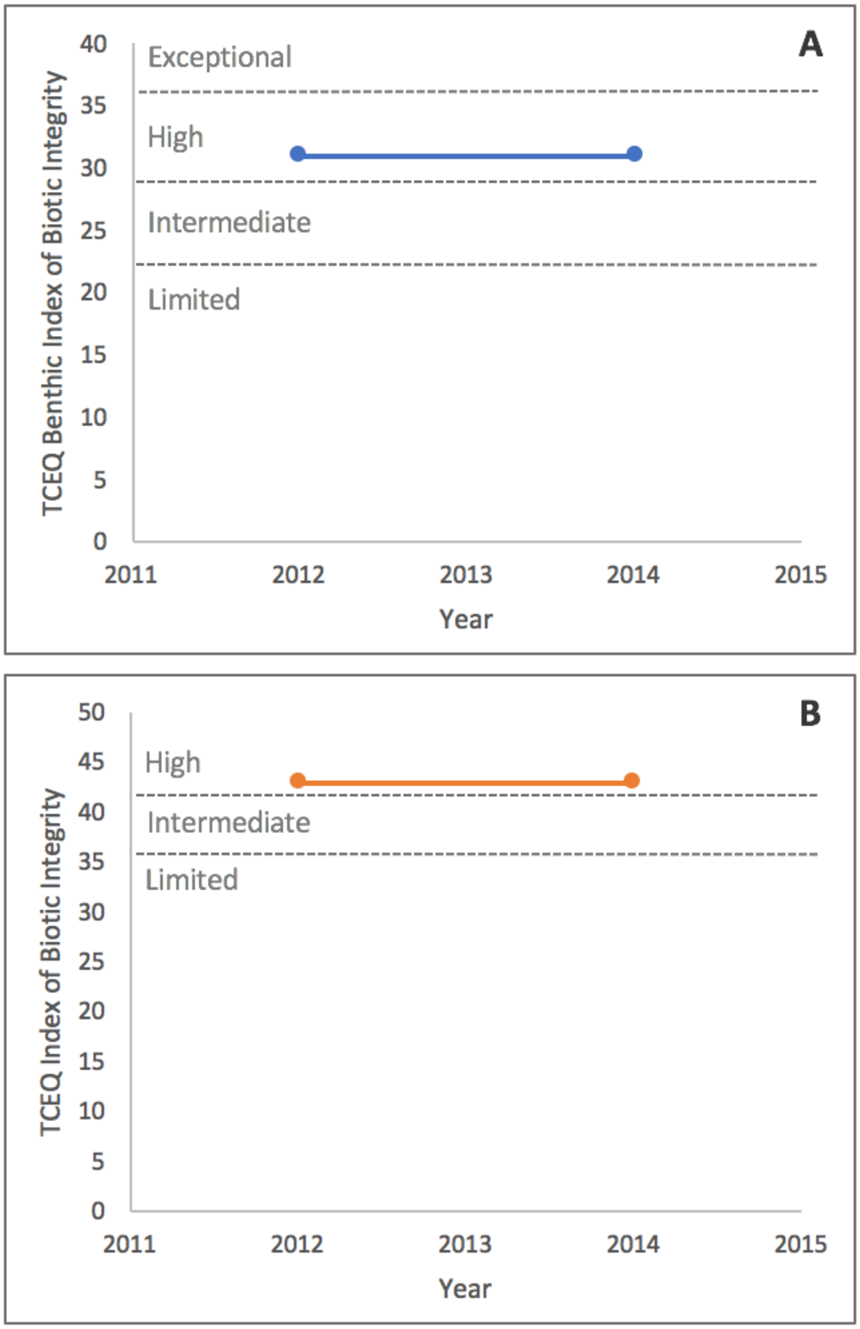


Figure C5. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Bundick**.

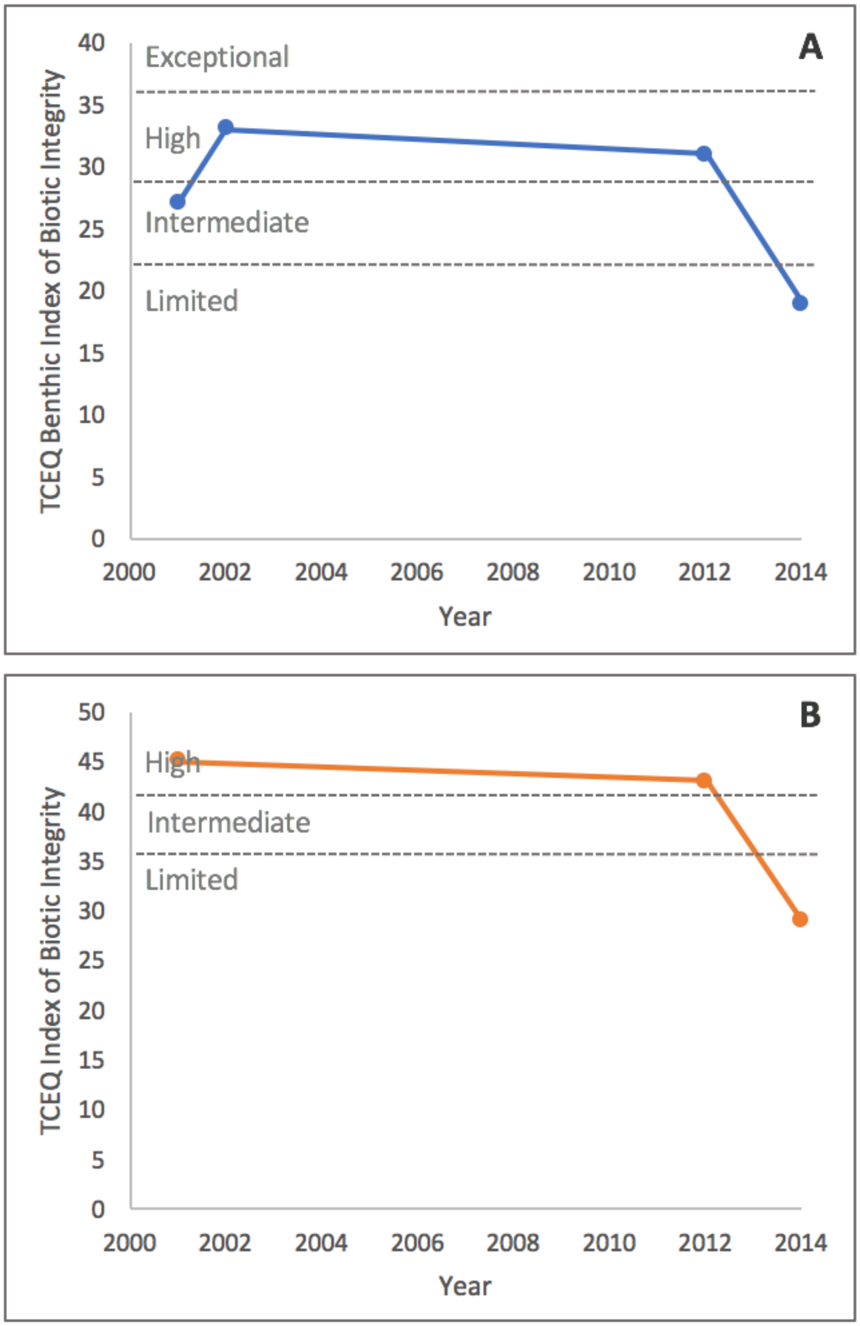


Figure C6. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Comrade.**

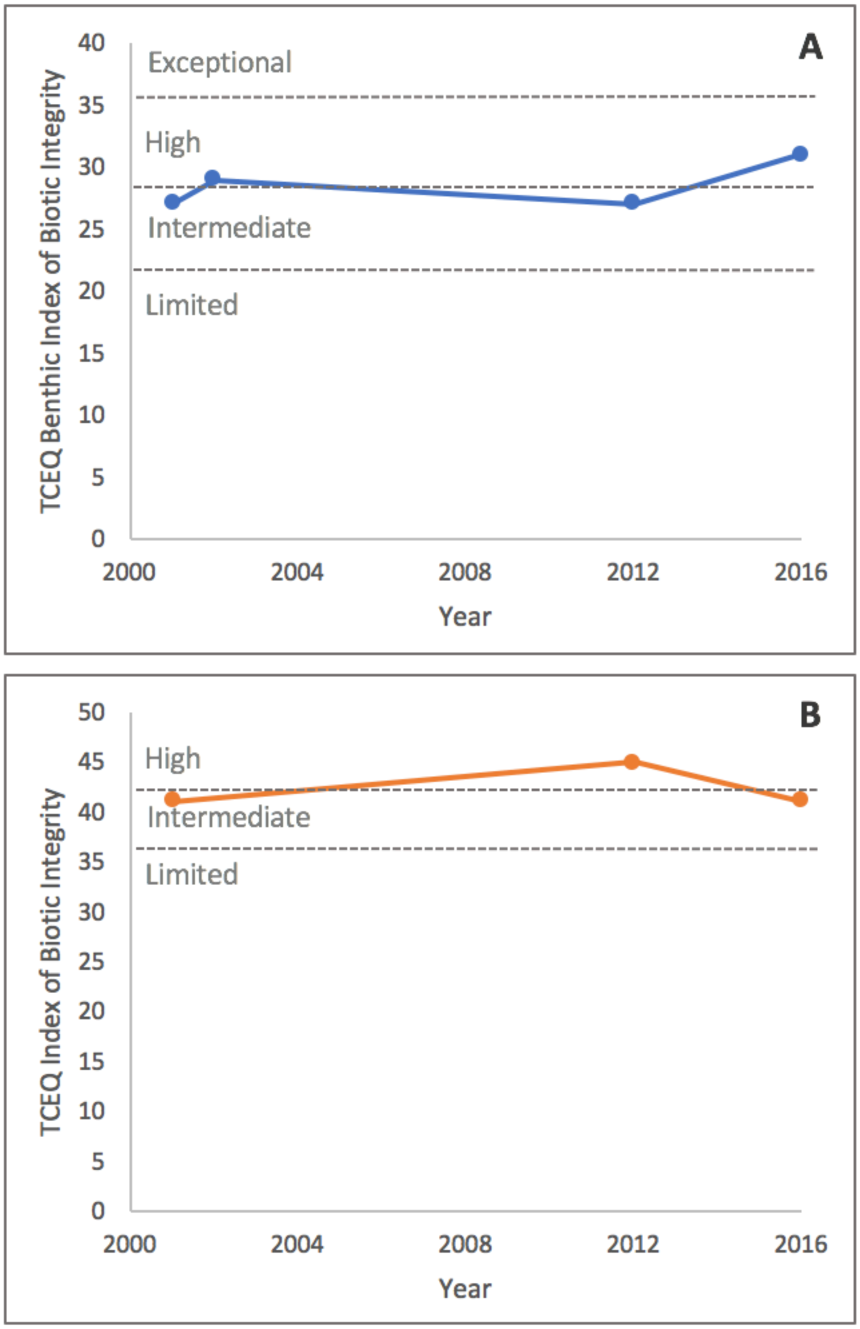


Figure C7. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Dowden.**

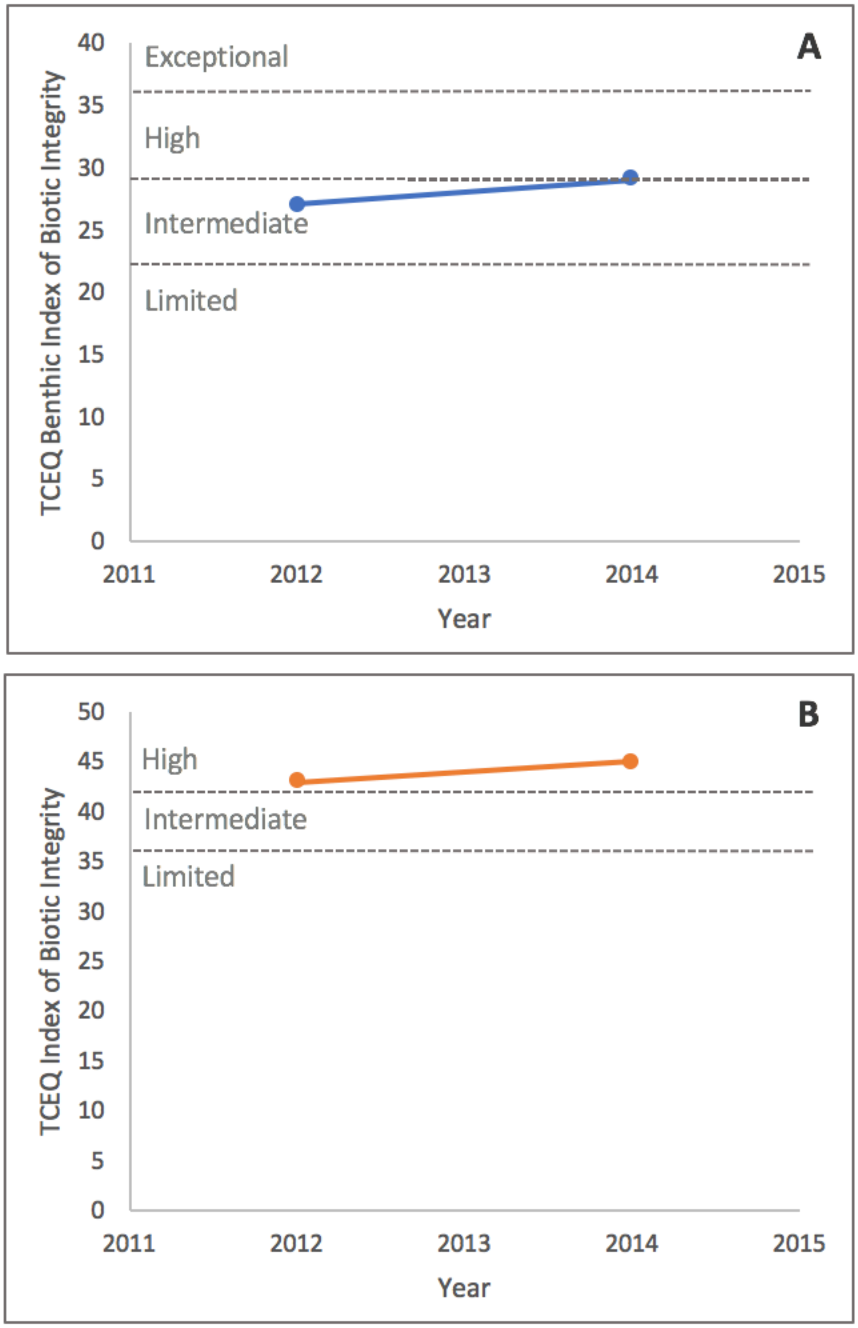


Figure C8. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Drakes.**

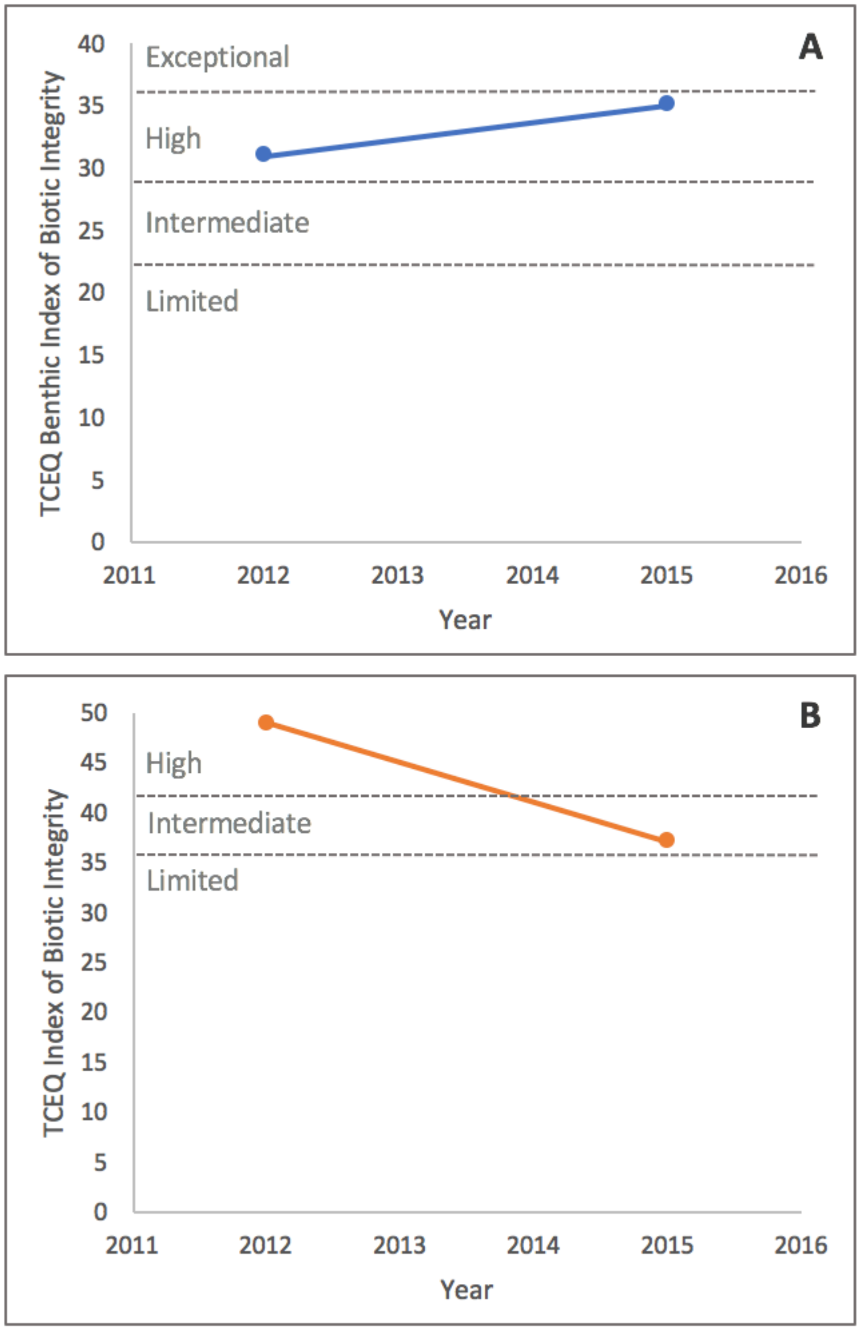


Figure C9. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **East Fork.**

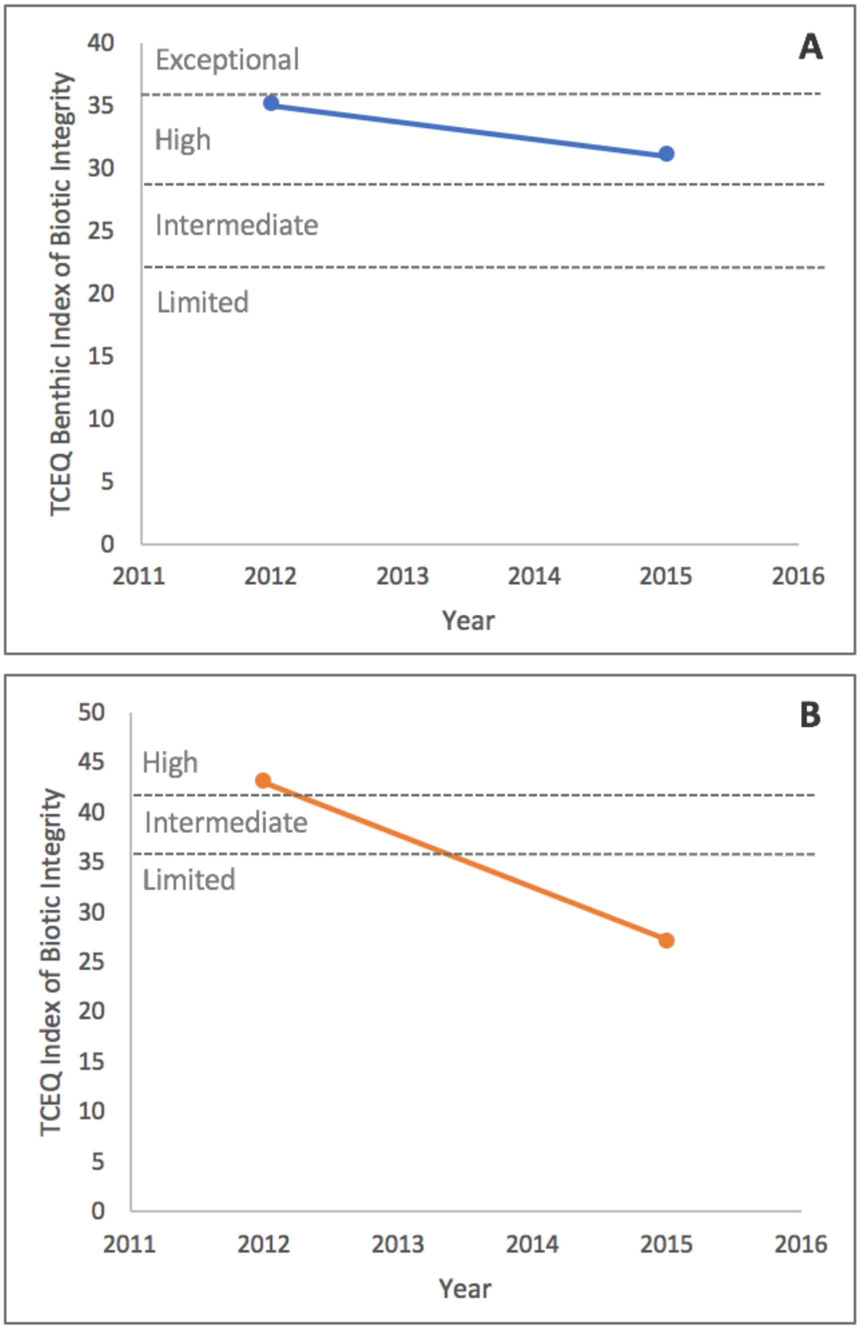
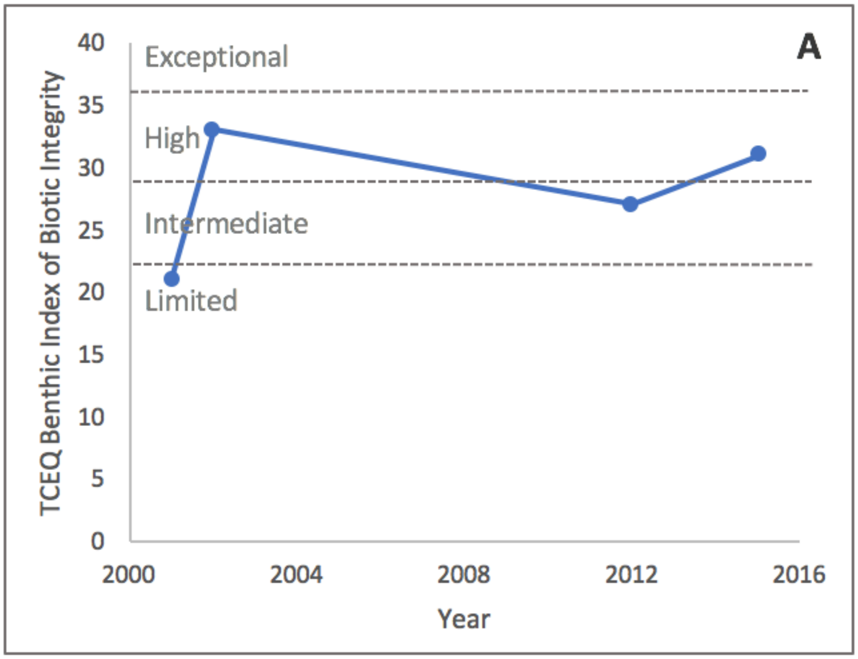


Figure C10. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Little Brushy.**



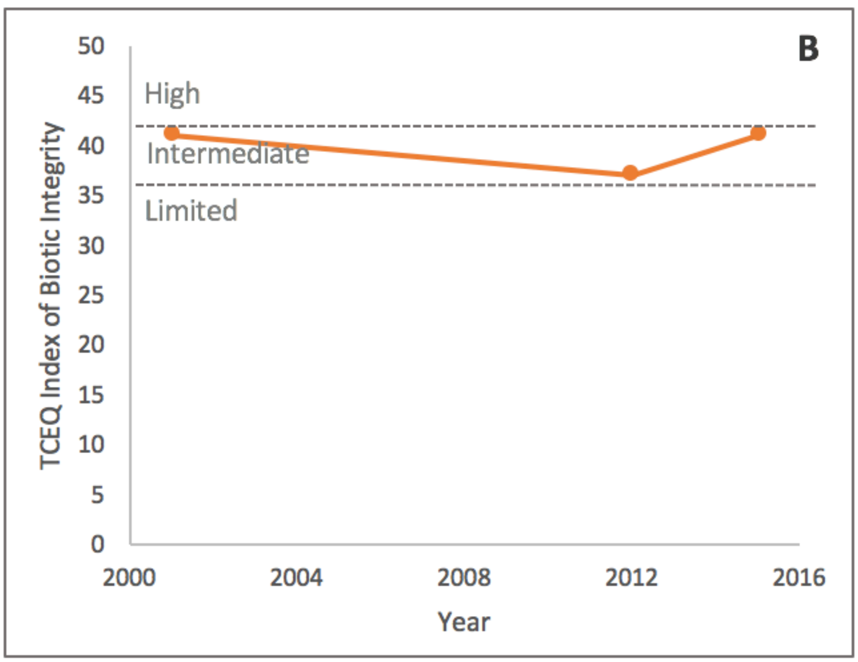


Figure C11. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Little Sandy.**

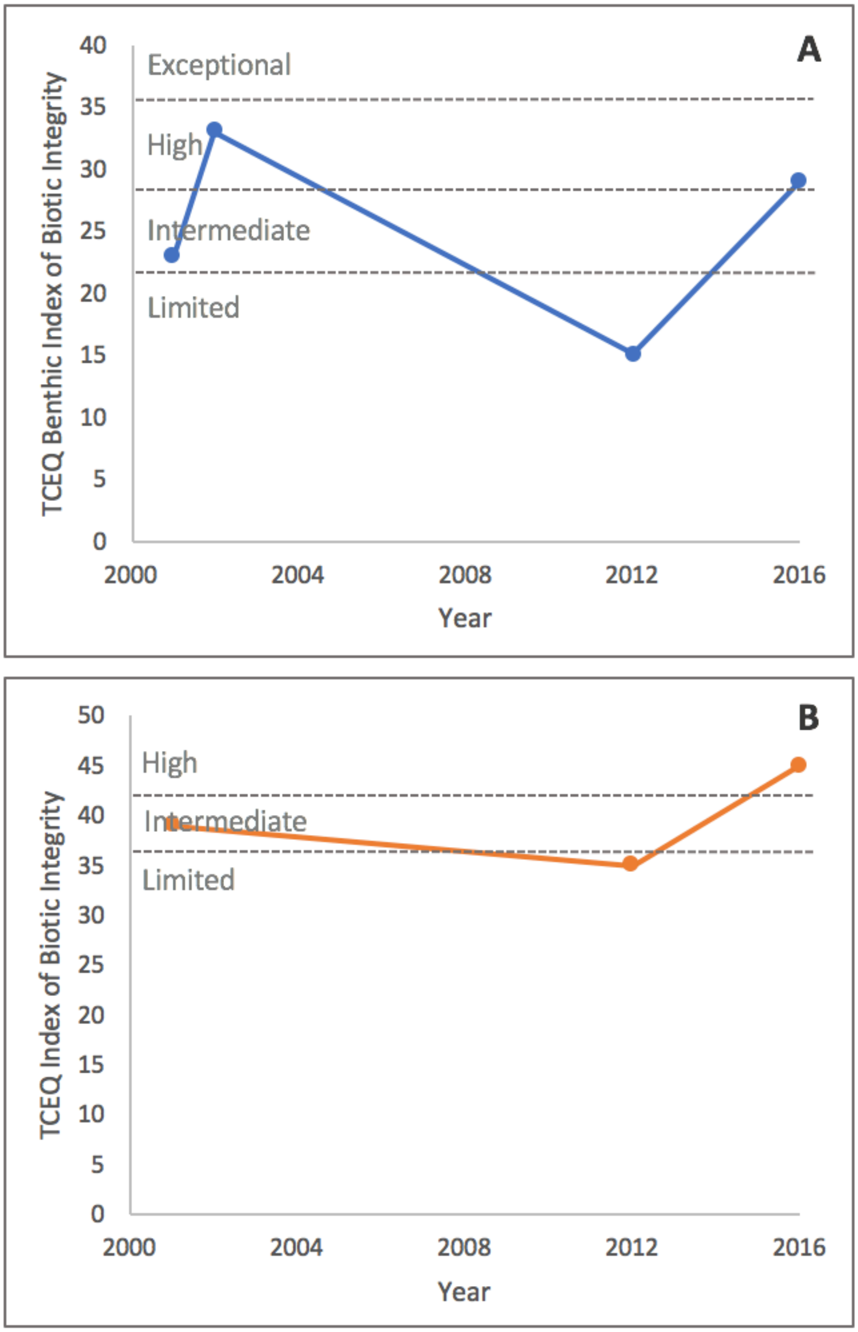


Figure C12. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Lyles.**

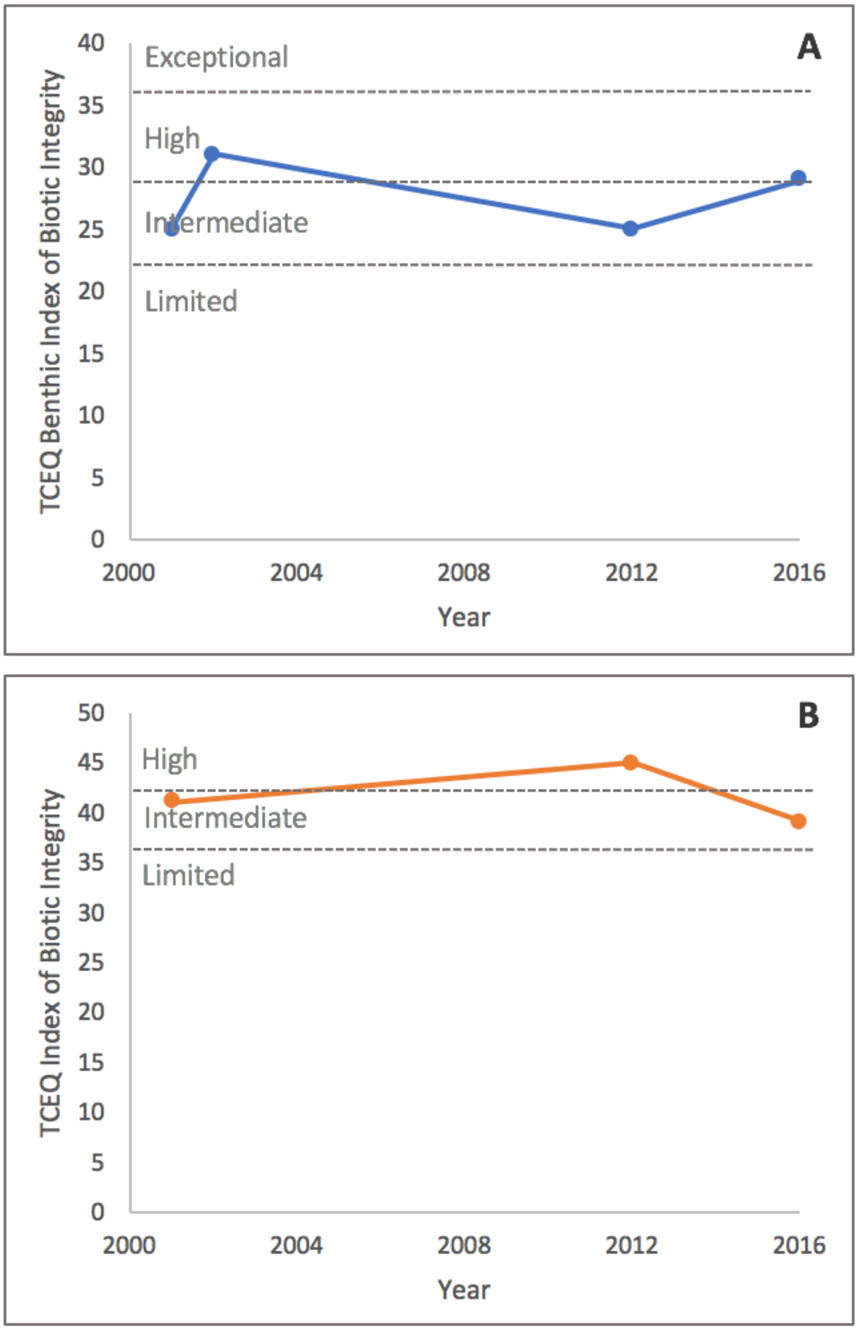


Figure C13. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Martin.**

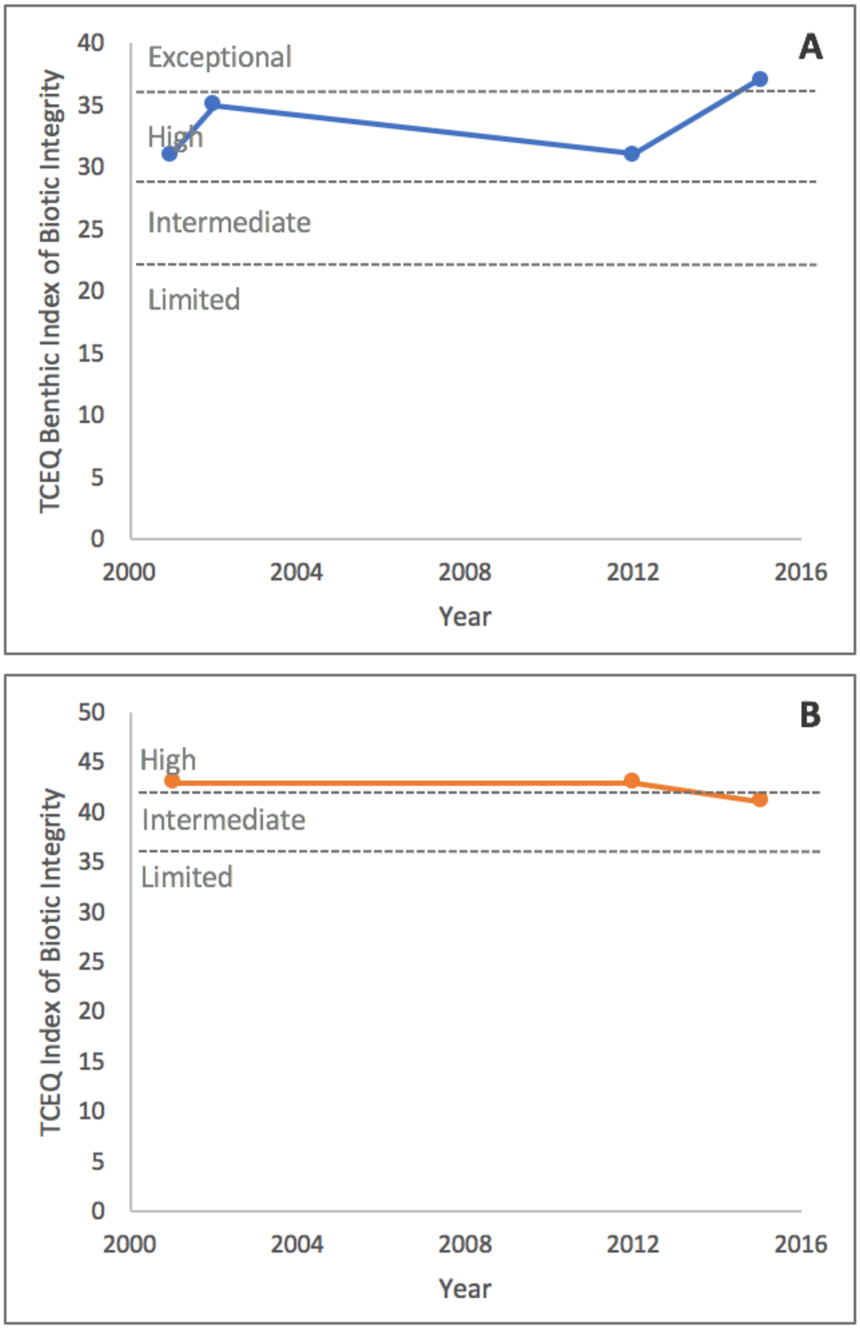


Figure C14. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Odom.**

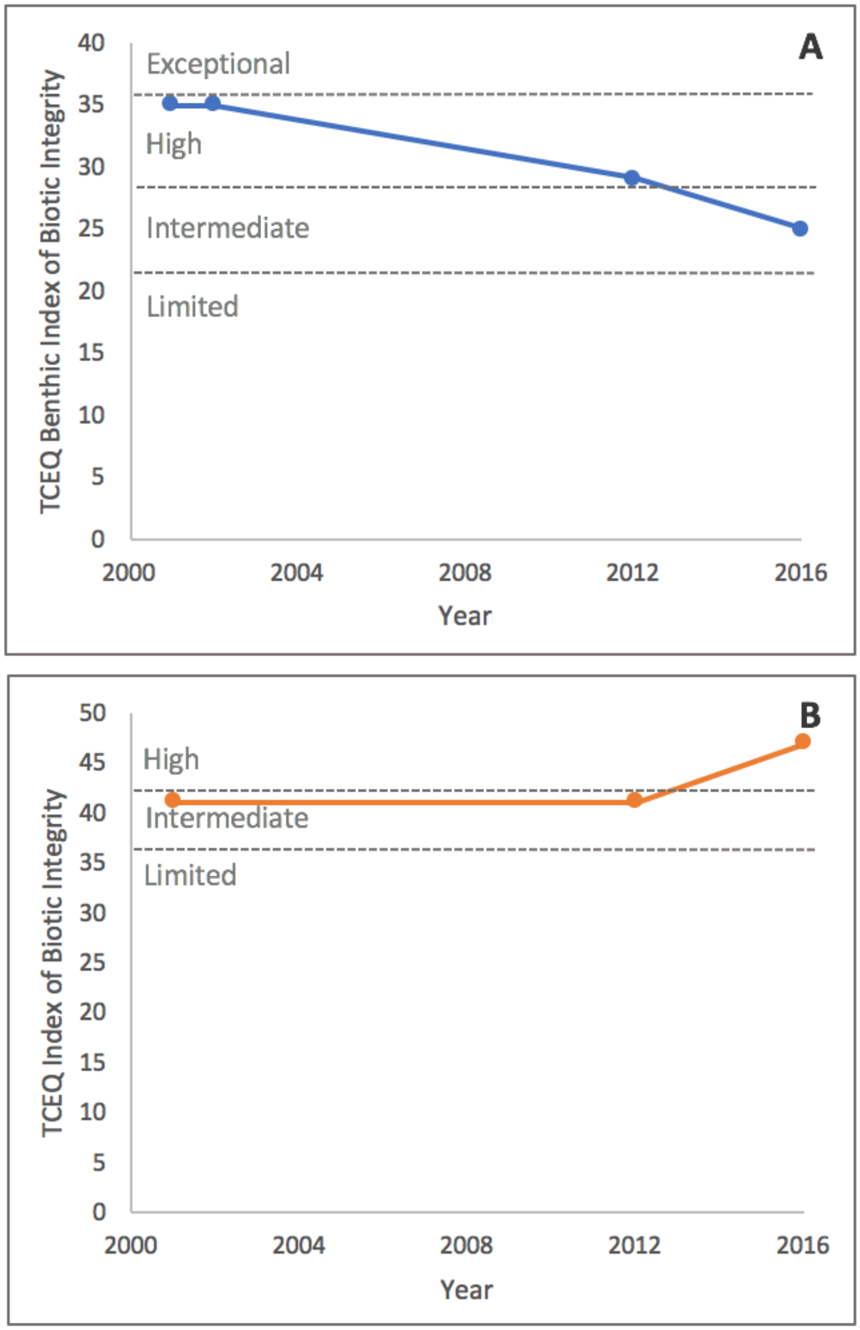


Figure C15. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Tiger.**

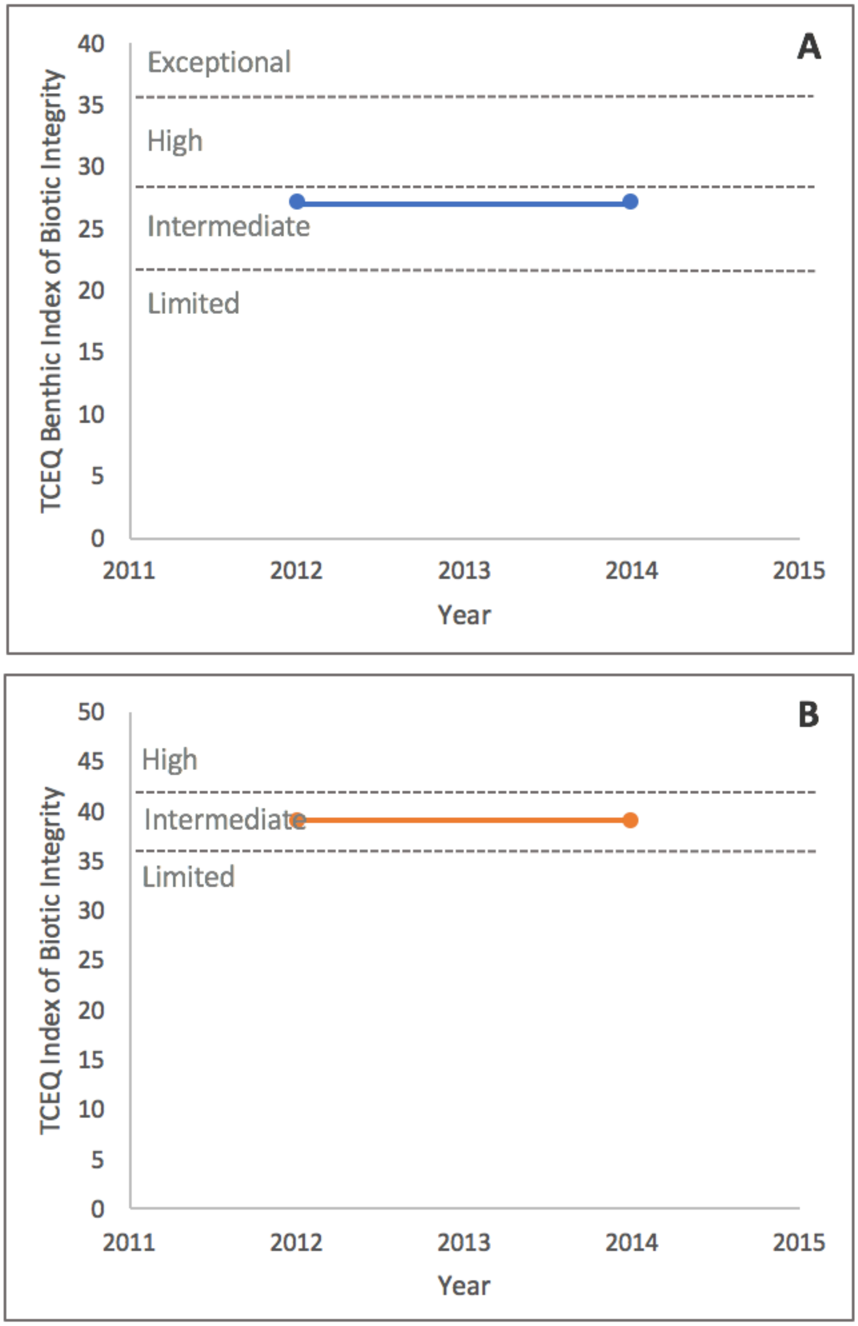


Figure C16. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **West Fork.**

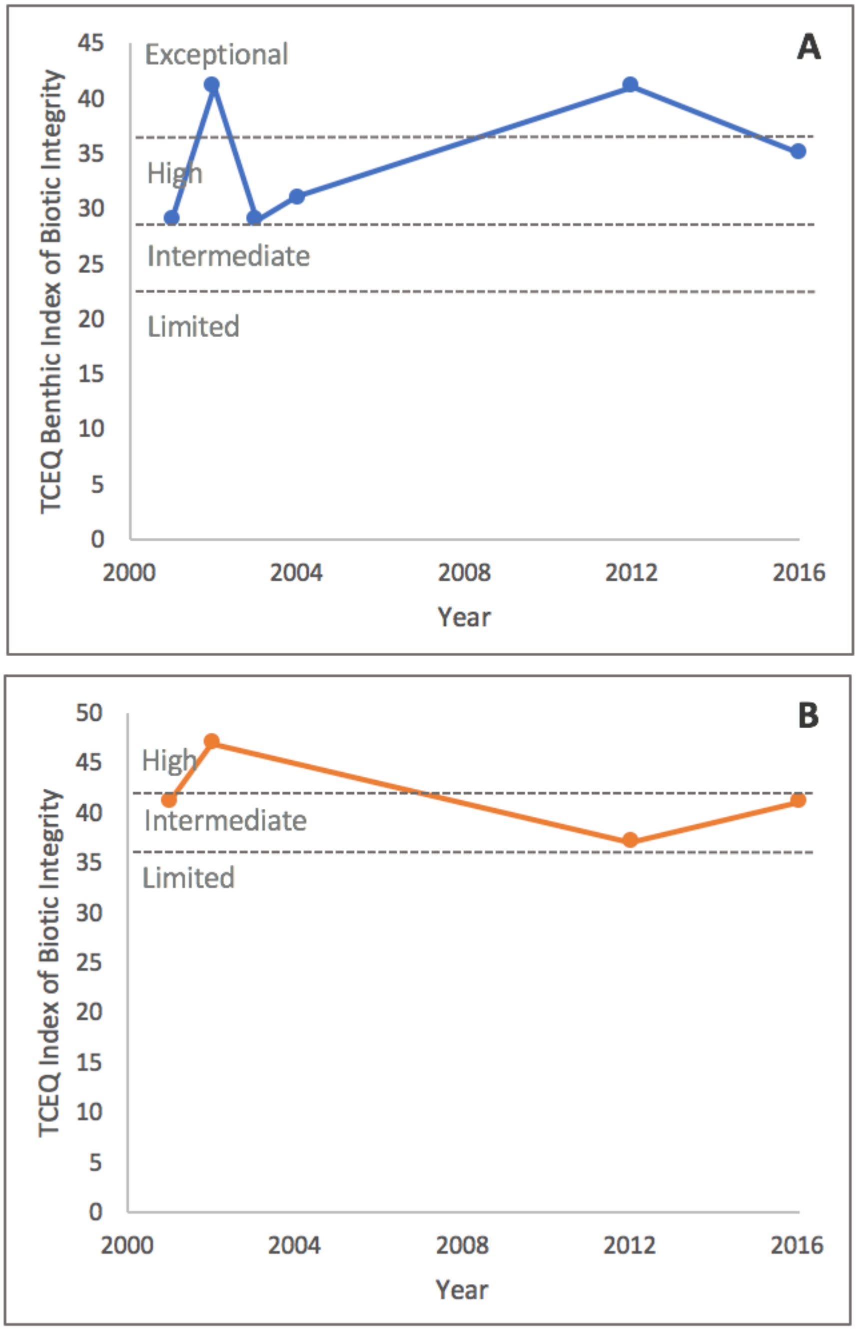


Figure C17. Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI) and Index of Biotic Integrity (IBI) for macroinvertebrate assemblages (**A**) and fish communities (**B**), respectively. B-IBI and IBI values plotted by year quantitatively express changes in the composition of the biologic communities of **Whiskey.**

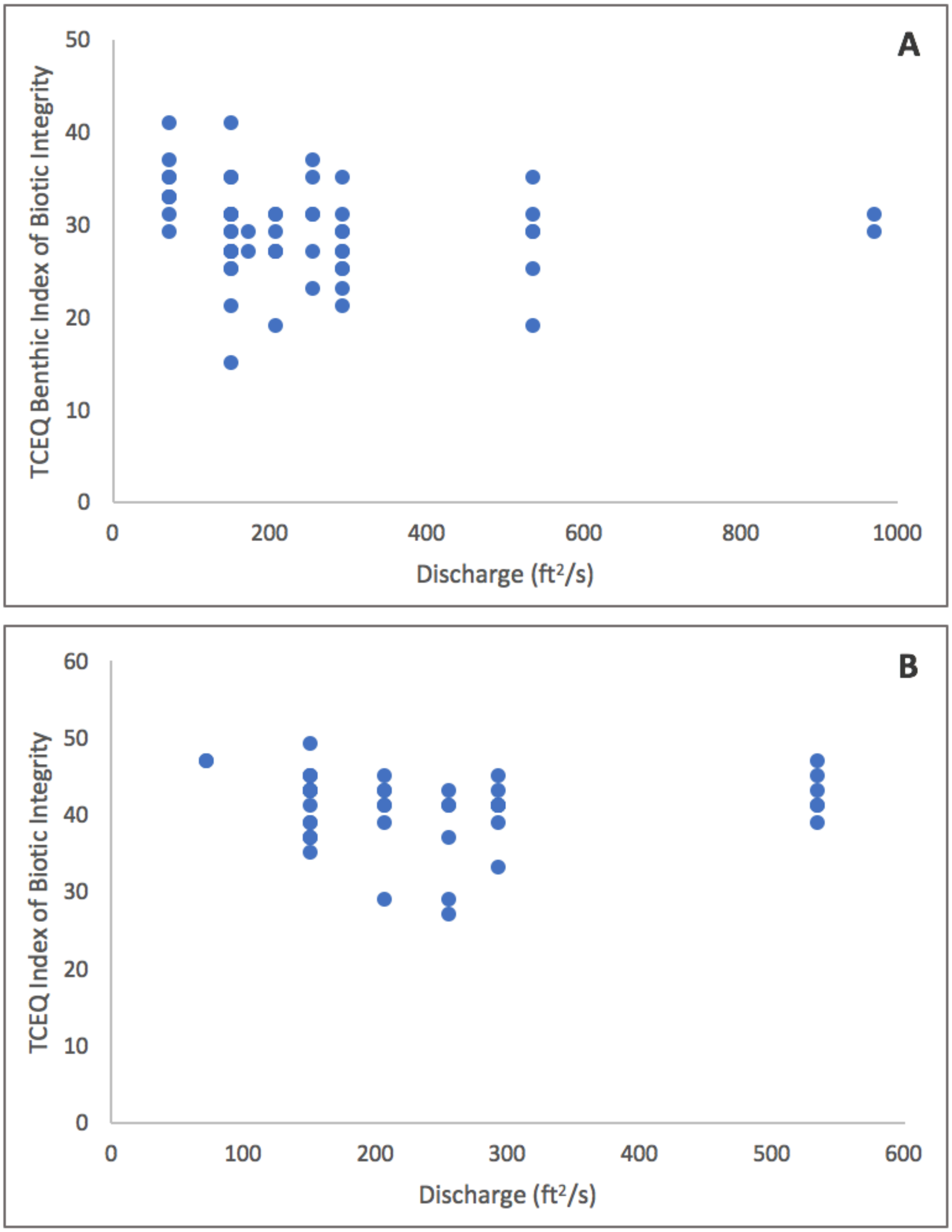


Figure D1. Relationship between discharge and Texas Commission on Environmental Quality (TCEQ) Benthic Index of Biotic Integrity (B-IBI; r= -0.144) and Index of Biotic Integrity (IBI; r= -0.014) for macroinvertebrate (**A**) and fish (**B**) assemblages, respectively.

Table E1. Macroinvertebrate community metrics for streams in Fort Polk, Louisisana							
Year	Area	Drainage	Stream	Richness	Evenness	Diversity	TCEQ B-IBI
2001	PRTA	Sabine	Anacoco	4	0.688	0.953	25
2001	JRTC	Calcasieu	Birds	12	0.753	1.871	29
2001	PRTA	Calcasieu	Comrade	18	0.667	1.929	27
2001	PRTA	Sabine	Dowden	17	0.582	1.649	27
2001	PRTA	Red River	Little Sandy	8	0.272	0.565	21
2001	PRTA	Red River	Lyles	13	0.301	0.772	23
2001	PRTA	Sabine	Martin	11	0.528	1.267	25
2001	PRTA	Red River	Odom	22	0.632	1.955	31
2001	PRTA	Red River	Tiger	18	0.72	2.08	35
2001	JRTC	Calcasieu	Whiskey	17	0.585	1.658	29
2002	JRTC	Calcasieu	Birds	36	0.691	2.477	37
2002	PRTA	Calcasieu	Comrade	25	0.636	2.048	33
2002	PRTA	Sabine	Dowden	27	0.668	2.202	29
2002	PRTA	Red River	Little Sandy	27	0.687	2.264	33
2002	PRTA	Red River	Lyles	22	0.477	1.475	33
2002	PRTA	Sabine	Martin	21	0.62	1.889	31
2002	PRTA	Red River	Odom	30	0.679	2.31	35
2002	PRTA	Red River	Tiger	30	0.685	2.331	35
2002	JRTC	Calcasieu	Whiskey	37	0.651	2.35	41
2003	JRTC	Calcasieu	Birds	12	0.783	1.946	27
2003	JRTC	Calcasieu	Whiskey	26	0.436	1.421	29
2004	JRTC	Calcasieu	Birds	15	0.619	1.678	29
2004	JRTC	Calcasieu	Whiskey	20	0.588	1.761	31
2012	PRTA	Sabine	Anacoco	8	0.888	1.847	21
2012	JRTC	Calcasieu	Bayou Zourie	10	0.827	1.904	25
2012	JRTC	Calcasieu	Big Brushy	10	0.67	1.542	29
2012	JRTC	Calcasieu	Birds	18	0.717	2.073	35
2012	JRTC	Calcasieu	Bundick	10	0.946	2.178	31
2012	PRTA	Calcasieu	Comrade	8	0.843	1.753	31
2012	PRTA	Sabine	Dowden	11	0.773	1.854	27
2012	JRTC	Calcasieu	Drakes	8	0.897	1.866	27
2012	JRTC	Calcasieu	East Fork	10	0.906	2.086	31
2012	JRTC	Calcasieu	Little Brushy	13	0.887	2.274	35
2012	PRTA	Red River	Little Sandy	10	0.835	1.922	27
2012	PRTA	Red River	Lyles	8	0.478	0.995	15
2012	PRTA	Sabine	Martin	11	0.81	1.943	25
2012	PRTA	Red River	Odom	10	0.895	2.06	31
2012	PRTA	Red River	Tiger	8	0.895	1.861	29
2012	JRTC	Calcasieu	West Fork	5	0.762	1.226	27
2012	JRTC	Calcasieu	Whiskey	23	0.856	2.684	41
2014	JRTC	Calcasieu	Birds	11	0.874	2.095	27
2014	JRTC	Calcasieu	Bundick	12	0.757	1.882	31
2014	PRTA	Calcasieu	Comrade	10	0.727	1.674	19
2014	JRTC	Calcasieu	Drakes	7	0.769	1.497	29

2014	New Lands	Calcasieu	Indian	8	0.697	1.449	27
2014	New Lands	Calcasieu	Prairie	10	0.883	2.033	31
2014	JRTC	Calcasieu	West Fork	9	0.901	1.98	27
2015	PRTA	Sabine	Anacoco	15	0.941	2.548	27
2015	JRTC	Calcasieu	Big Brushy	10	0.757	1.742	23
2015	JRTC	Calcasieu	East Fork	18	0.87	2.514	35
2015	JRTC	Calcasieu	Little Brushy	18	0.814	2.353	31
2015	PRTA	Red River	Little Sandy	16	0.847	2.349	31
2015	PRTA	Red River	Odom	19	0.909	2.675	37
2016	JRTC	Calcasieu	Bayou Zourie	5	0.804	1.295	19
2016	PRTA	Sabine	Dowden	25	0.449	1.446	31
2016	PRTA	Red River	Lyles	10	0.837	1.927	29
2016	PRTA	Sabine	Martin	10	0.815	1.877	29
2016	PRTA	Red River	Tiger	6	0.787	1.411	25
2016	JRTC	Calcasieu	Whiskey	13	0.894	2.292	35

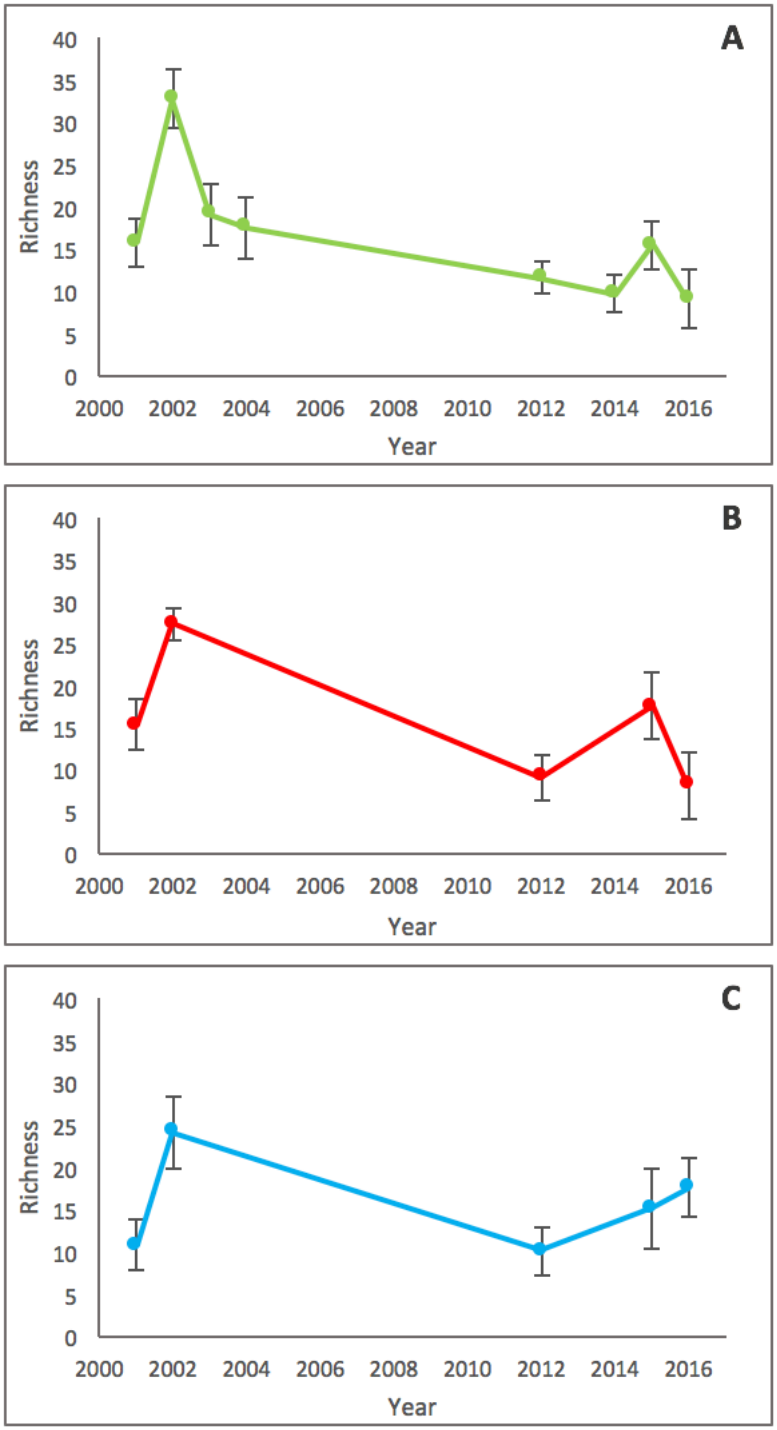


Figure E1. Macroinvertebrate community richness in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in the richness of macroinvertebrate communities yearly across the different river drainages ($p<0.001$; $F=6.418$).

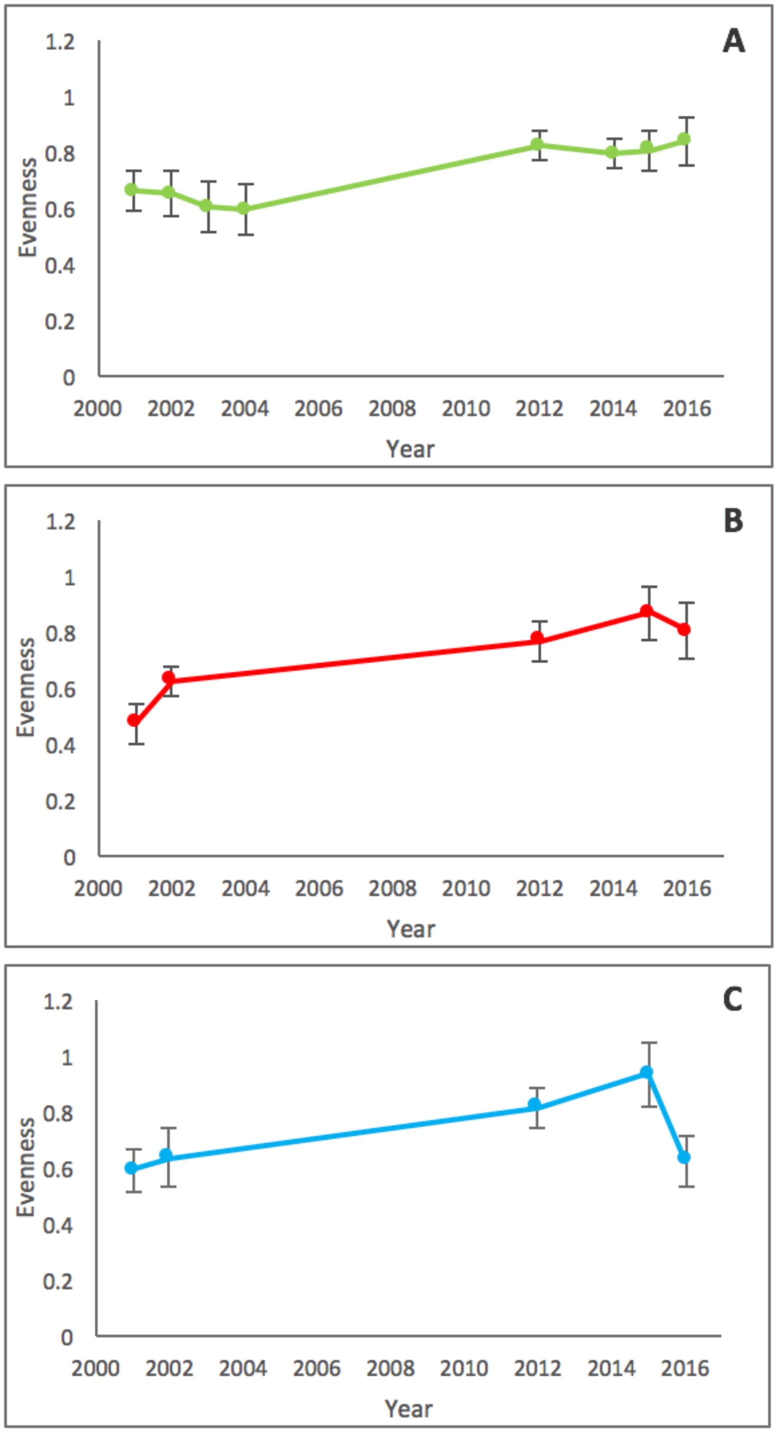


Figure E2. Macroinvertebrate community evenness in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in the evenness of macroinvertebrate communities yearly across the different river drainages ($p<0.001$; $F=3.148$).

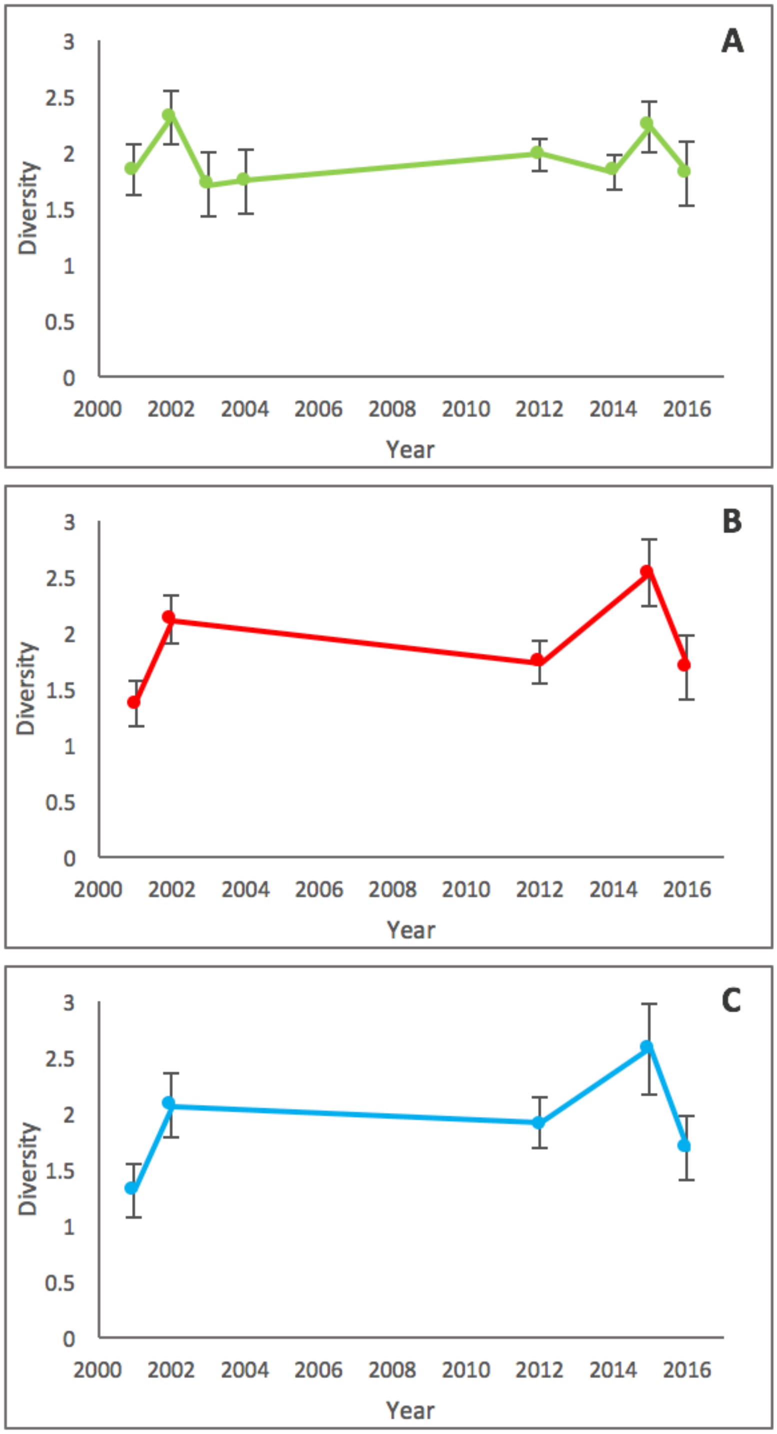


Figure E3. Macroinvertebrate community diversity in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show marginally significant differences in the diversity of macroinvertebrate communities yearly across the different river drainages ($p=0.056$; $F=1.837$).

Table E2. Fish community metrics for streams in Fort Polk, Louisiana

Year	Area	Drainage	Stream	Richness	Evenness	Diversity	TCEQ IBI
2001	PRTA	Sabine	Anacoco	9	0.789	1.735	33
2001	JRTC	Calcasieu	Birds	9	0.793	1.743	41
2001	PRTA	Calcasieu	Comrade	10	0.722	1.664	45
2001	PRTA	Sabine	Dowden	12	0.635	1.579	41
2001	PRTA	Red River	Little Sandy	13	0.86	2.206	41
2001	PRTA	Red River	Lyles	13	0.753	1.933	39
2001	PRTA	Sabine	Martin	13	0.702	1.8	41
2001	PRTA	Red River	Odom	14	0.865	2.283	43
2001	PRTA	Red River	Tiger	12	0.717	1.781	41
2001	JRTC	Calcasieu	Whiskey	9	0.499	1.095	41
2002	JRTC	Calcasieu	Birds	12	0.888	2.207	47
2002	JRTC	Calcasieu	Whiskey	20	0.798	2.391	47
2012	PRTA	Sabine	Anacoco	11	0.916	2.196	37
2012	JRTC	Calcasieu	Bayou Zourie	11	0.877	2.104	39
2012	JRTC	Calcasieu	Big Brushy	14	0.801	2.114	43
2012	JRTC	Calcasieu	Birds	13	0.903	2.315	45
2012	JRTC	Calcasieu	Bundick	13	0.93	2.387	43
2012	PRTA	Calcasieu	Comrade	8	0.859	1.787	43
2012	PRTA	Sabine	Dowden	13	0.89	2.284	45
2012	JRTC	Calcasieu	Drakes	10	0.884	2.035	43
2012	JRTC	Calcasieu	East Fork	14	0.907	2.395	49
2012	JRTC	Calcasieu	Little Brushy	11	0.725	1.74	43
2012	PRTA	Red River	Little Sandy	11	0.945	2.266	37
2012	PRTA	Red River	Lyles	11	0.841	2.017	35
2012	PRTA	Sabine	Martin	9	0.891	1.958	45
2012	PRTA	Red River	Odom	13	0.85	2.181	43
2012	PRTA	Red River	Tiger	9	0.792	1.74	41
2012	JRTC	Calcasieu	West Fork	7	0.918	1.787	39
2012	JRTC	Calcasieu	Whiskey	15	0.861	2.332	37
2014	JRTC	Calcasieu	Birds	8	0.918	1.909	41
2014	JRTC	Calcasieu	Bundick	9	0.792	1.741	43
2014	PRTA	Calcasieu	Comrade	4	0.912	1.264	29
2014	JRTC	Calcasieu	Drakes	11	0.937	2.246	45
2014	New Lands	Calcasieu	Indian	8	0.909	1.89	41
2014	New Lands	Calcasieu	Prairie	10	0.785	1.807	43
2014	JRTC	Calcasieu	West Fork	8	0.973	2.023	39
2015	PRTA	Sabine	Anacoco	6	0.912	1.635	29
2015	JRTC	Calcasieu	Big Brushy	9	0.929	2.041	43
2015	JRTC	Calcasieu	East Fork	13	0.745	1.911	37
2015	JRTC	Calcasieu	Little Brushy	8	0.926	1.925	27
2015	PRTA	Red River	Little Sandy	4	0.959	1.33	41
2015	PRTA	Red River	Odom	14	0.909	2.399	41
2016	JRTC	Calcasieu	Bayou Zourie	18	0.785	2.27	43
2016	PRTA	Sabine	Dowden	12	0.834	2.073	41

2016	PRTA	Red River	Lyles	19	0.871	2.565	45
2016	PRTA	Sabine	Martin	7	0.874	1.7	39
2016	PRTA	Red River	Tiger	16	0.908	2.518	47
2016	JRTC	Calcasieu	Whiskey	10	0.898	2.067	41

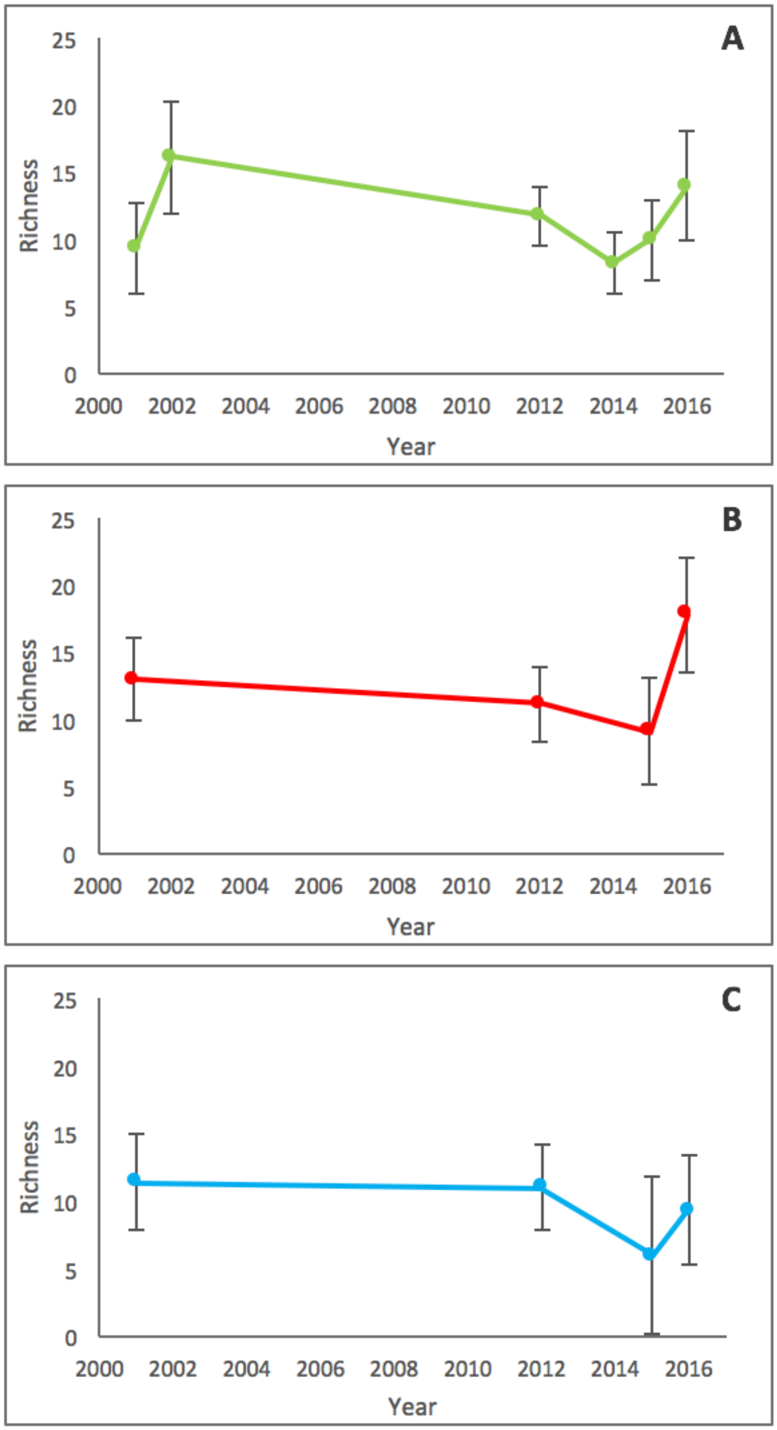


Figure E4. Fish community richness in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in the richness of fish communities yearly across the different river drainages ($p=0.011$; $F=2.676$).

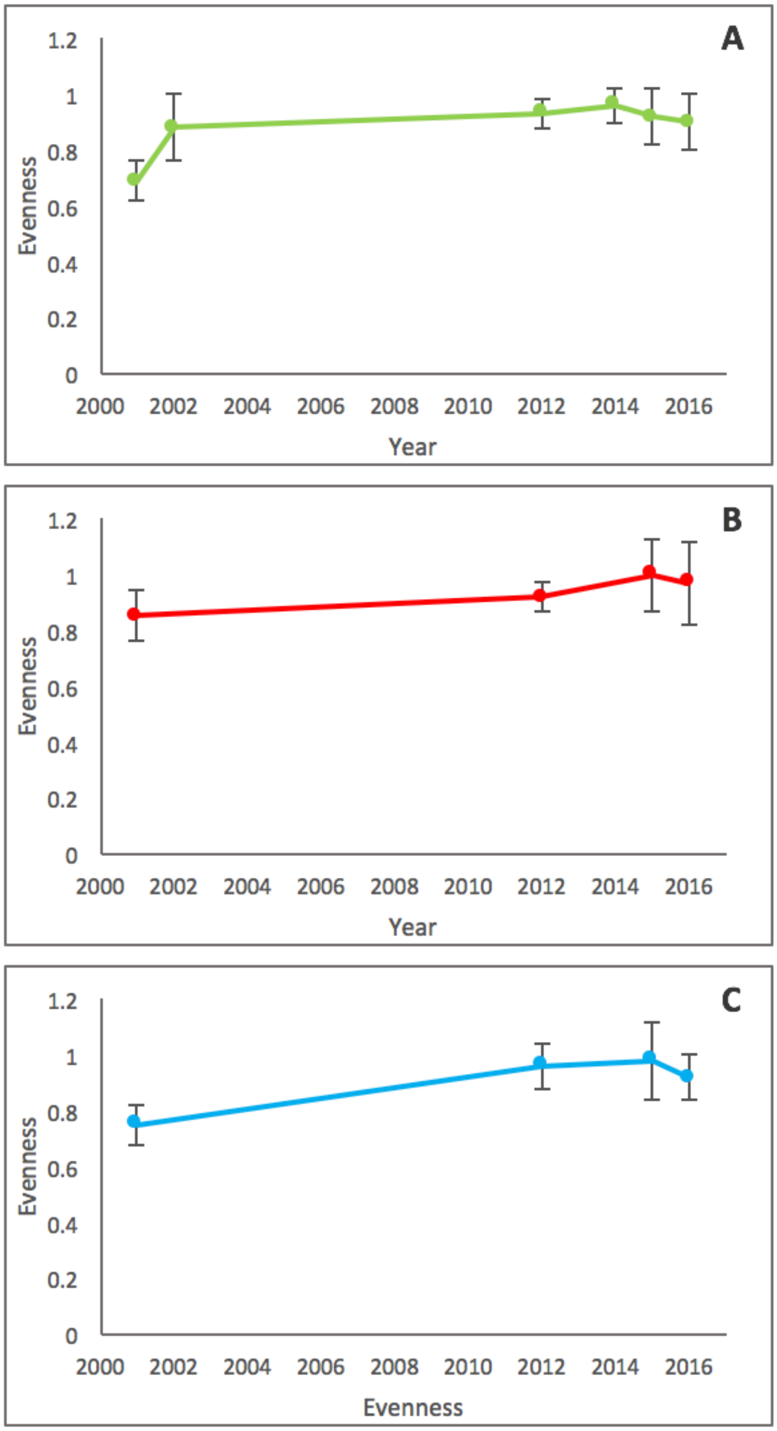


Figure E5. Fish community evenness in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in the evenness of fish communities yearly across the different river drainages ($p=0.007$; $F=2.872$).

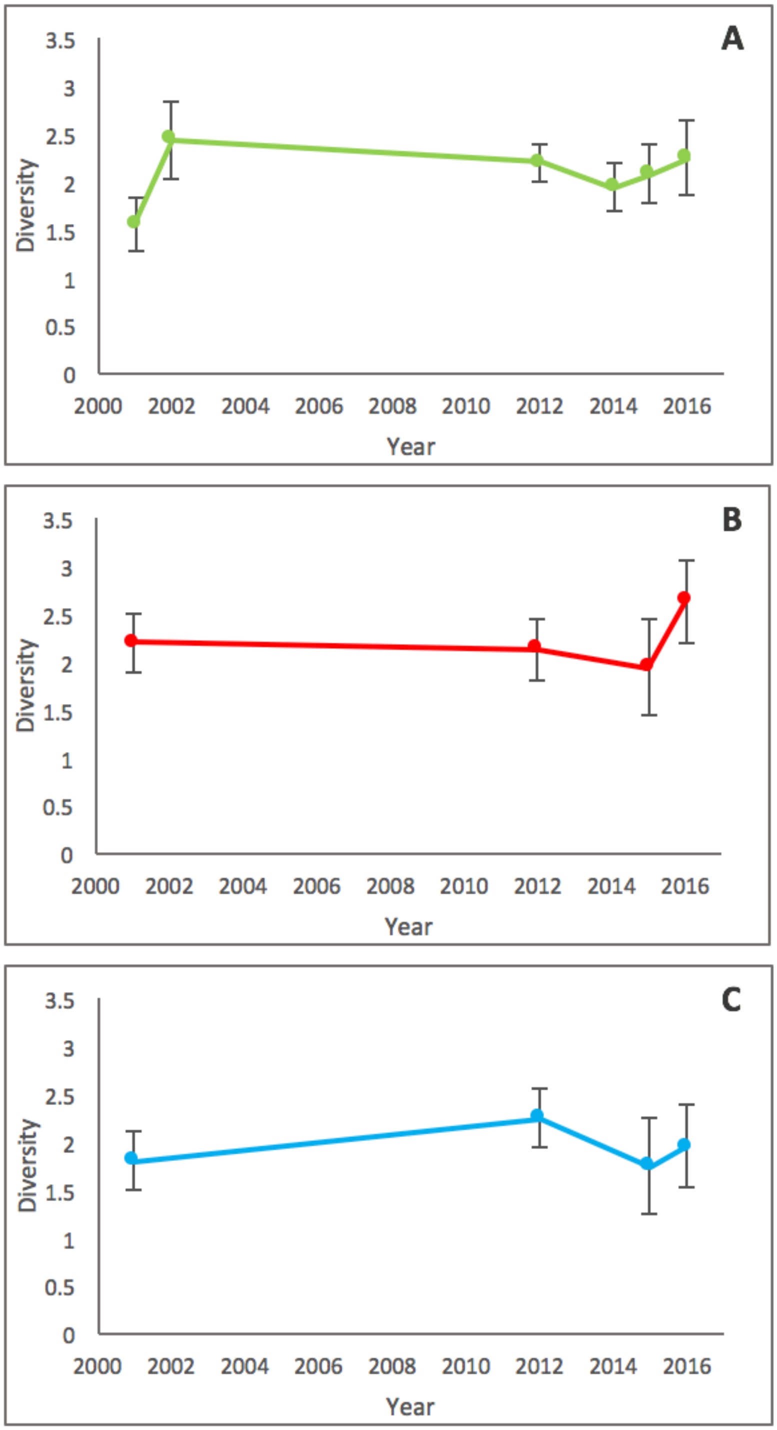
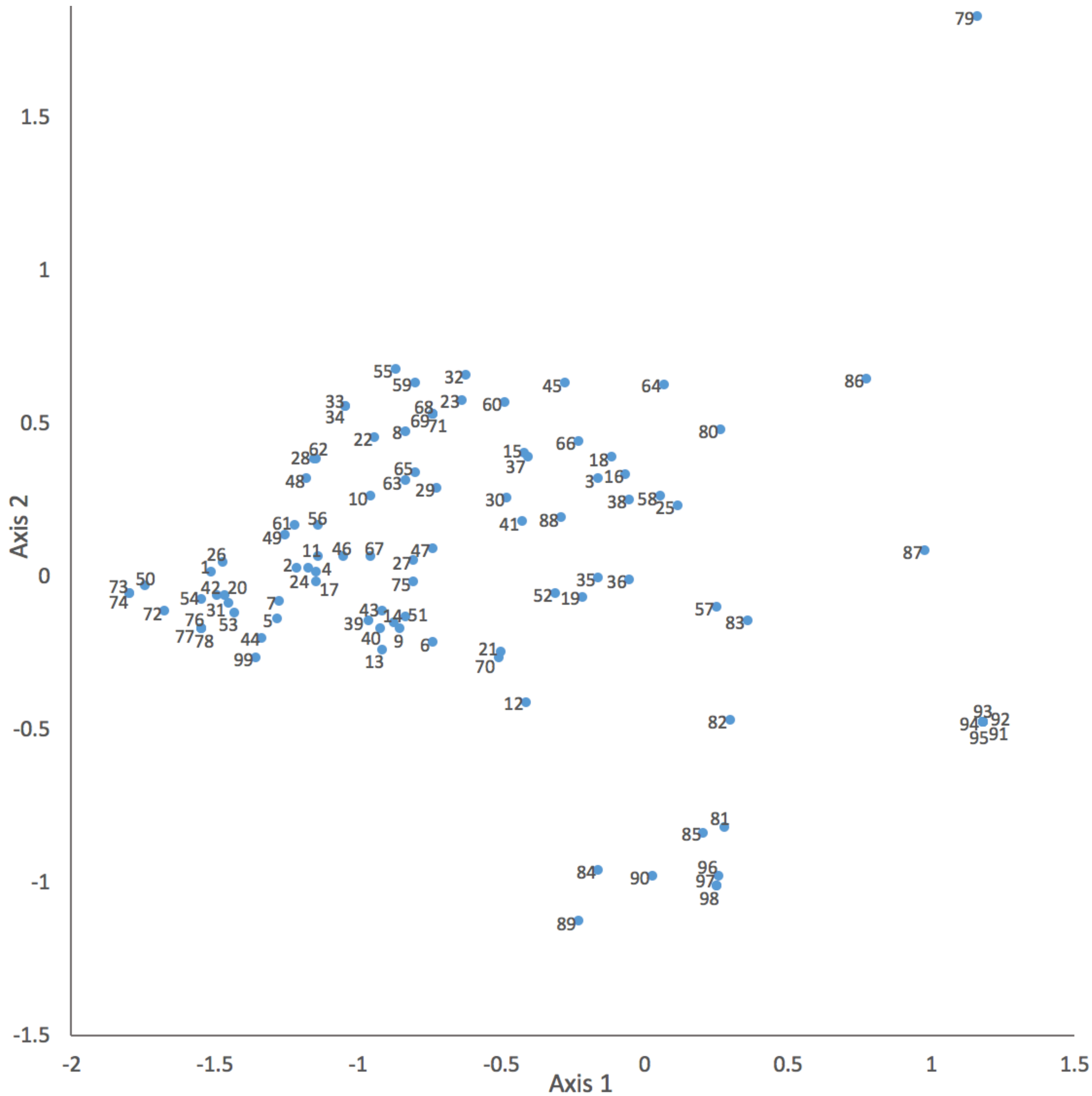


Figure E6. Fish community diversity in the Calcasieu (**A**), Red (**B**), and Sabine (**C**) River drainages. Two-way ANOVA results show statistically significant differences in the diversity of fish communities yearly across the different river drainages (p=0.016; F=2.502).


Axis 1
Axis 2
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86
87
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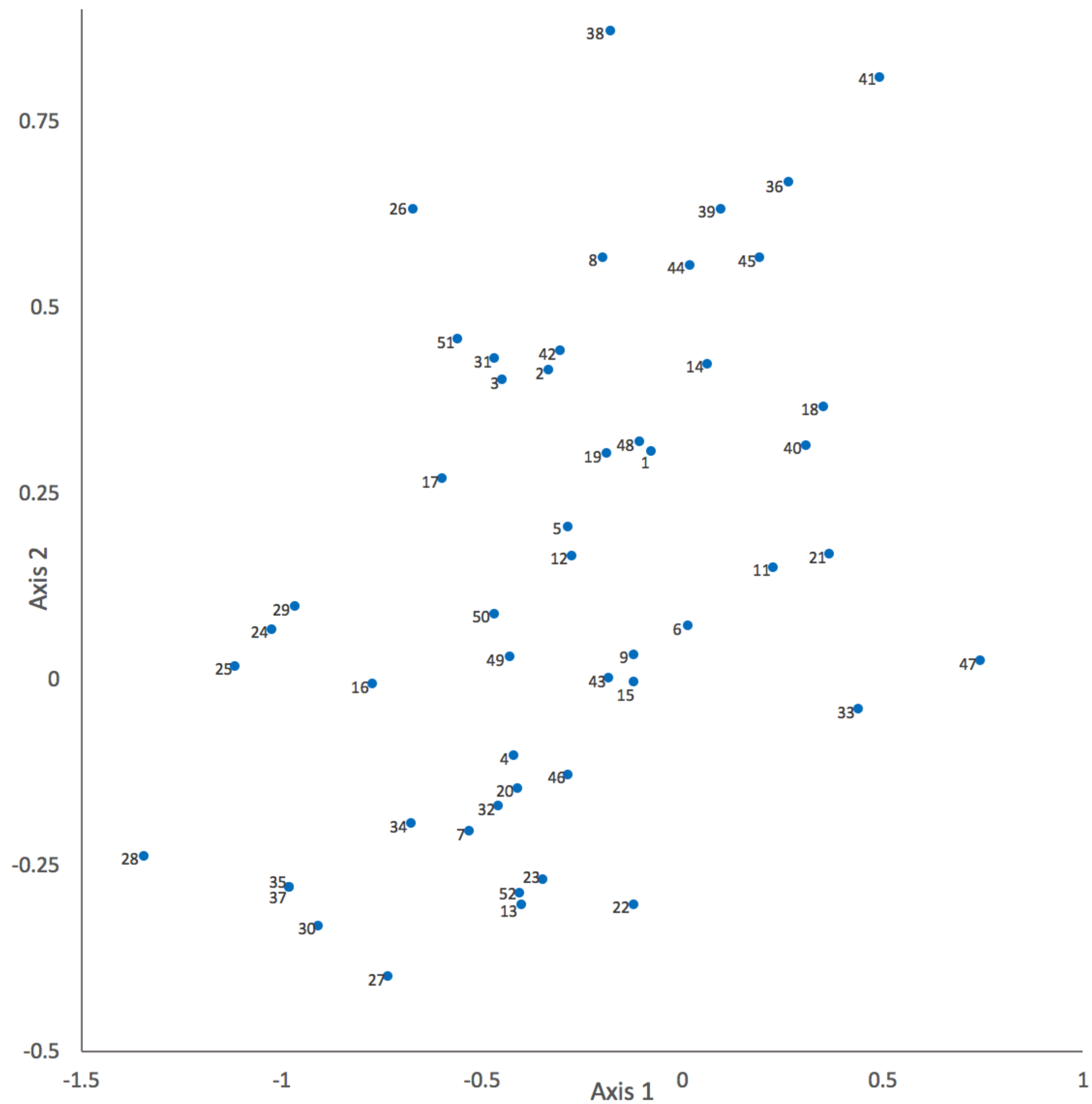
89

Key

	(Order, Family)	25	Amphipoda, Gammaridae	50	Diptera, Athericidae	75	Lepidoptera, Pyralidae
1	Diptera, Ceratopogonidae	26	Decapoda, Palaemonidae	51	Diptera, Ephydridae	76	Neuroptera, Sisyridae
2	Diptera, Chironomidae	27	Ephemeroptera, Leptophlebiidae	52	Diptera, Psychodidae	77	Orthoptera, Gryllidae
3	Diptera, Culicidae	28	Megaloptera, Sialidae	53	Ephemeroptera, Isonychiidae	78	Trichoptera, Calamoceratidae
4	Ephemeroptera, Baetidae	29	Mysidacea, Mysidae	54	Trichoptera, Odontoceridae	79	Diptera, Dolichopodidae
5	Coleoptera, Elmidae	30	Trichoptera, Limnephilidae	55	Amphipoda, Hyalellidae	80	Diptera, Syrphidae
6	Coleoptera, Gyrinidae	31	Hemiptera, Veliidae	56	Araneae, Pisauridae	81	Trichoptera, Rhyacophilidae
7	Diptera, Tipulidae	32	Hemiptera, Gerridae	57	Coleoptera, Dryopidae	82	Ephemeroptera, Siphlonuridae
8	Ephemeroptera, Caenidae	33	Hydroida, Hydridae	58	Coleoptera, Haliplidae	83	Ephemeroptera, Ameletidae
9	Ephemeroptera, Heptageniidae	34	Orthoptera, Gryllotalpidae	59	Coleoptera, Scirtidae	84	Plecoptera, Chloroperlidae
10	Odonata, Corduliidae	35	Coleoptera, Hydrophilidae	60	Diptera, Chaoboridae	85	Diptera, Limoniinae
11	Odonata, Gomphidae	36	Hemiptera, Belostomatidae	61	Trichoptera, Molannidae	86	Diptera, Brachycera
12	Plecoptera, Perlidae	37	Hemiptera, Hydrometridae	62	Trichoptera, Psychomyiidae	87	Hemiptera, Mesoveliidae
13	Trichoptera, Philopotamidae	38	Odonata, Cordulegastridae	63	Ephemeroptera, Baetiscidae	88	Odonata, Macromiidae
14	Trichoptera, Polycentropodidae	39	Diptera, Empididae	64	Hemiptera, Notonectidae	89	Coleoptera, Limnichidae
15	Anomopoda, Daphniidae	40	Diptera, Simuliidae	65	Hemiptera, Saldidae	90	Diptera, Thaumaleidae
16	Coleoptera, Dytiscidae	41	Ephemeroptera, Ephemerellidae	66	Lepidoptera, Nepticulidae	91	Coleoptera, Noteridae
17	Diptera, Tabanidae	42	Ephemeroptera, Tricorythidae	67	Plecoptera, Nemouridae	92	Ephemeroptera, Polymitarcyidae
18	Hemiptera, Corixidae	43	Odonata, Calopterygidae	68	Diptera, Dixidae	93	Ephemeroptera, Potamahthidae
19	Isopoda, Asellidae	44	Trichoptera, Hydropsychidae	69	Gastropoda, Ancylidae	94	Hemiptera, Pleidae
20	Megaloptera, Corydalidae	45	Coleoptera, Hydrochidae	70	Hemiptera, Nepidae	95	Plecoptera, Taeniopterygidae
21	Odonata, Aeschnidae	46	Ephemeroptera, Ephemeridae	71	Trichoptera, Phryganeidae	96	Trichoptera, Helicopsychidae
22	Odonata, Coenagrionidae	47	Trichoptera, Brachycentridae	72	Araneae, Tetragnathidae	97	Ephemeroptera, Bahningiidae
23	Odonata, Libellulidae	48	Trichoptera, Leptoceridae	73	Hemiptera, Hebridae	98	Plecoptera, Perlodidae
24	Trichoptera, Hydroptilidae	49	Coleoptera, Psephenidae	74	Lepidoptera, Tortricidae	99	Plecoptera, Capniidae

Figure F1. Similarities/dissimilarities of species compositon of macroinvertebrate assemblages in two dimensions (NMS).



Key

1	Aphredoderus sayanus	14	Lepomis megalotis	27	Notropis volucellus	40	Labidesthes sicculus
2	Erimyzon oblongus	15	Micropterus punctulatus	28	Noturus gyrinus	41	Pomoxis annularis
3	Etheostoma chlorosoma	16	Noturus phaeus	29	Semotilus atromaculatus	42	Ameiurus natalis
4	Etheostoma gracile	17	Lepomis cyanellus	30	Ammocrypta vivax	43	Cyprinella lutrensis
5	Gambusia affinis	18	Lepomis gulosus	31	Notropis texanus	44	Noturus nocturnus
6	Lepomis macrochirus	19	Lepomis marginatus	32	Percina sciera	45	Micropterus salmoides
7	Lythrurus umbratilis	20	Lepomis punctatus	33	Lepomis miniatus	46	Hybognathus nuchalis
8	Notropis atrocaudalis	21	Elassoma zonatum	34	Moxostoma poecilurum	47	Esox niger
9	Opsopedus emiliae	22	Lythrurus fumeus	35	Hybopsis amnis	48	Ameiurus melas
10	Cyprinella venusta	23	Minytrema melanops	36	Notropis sabinae	49	Percina maculata
11	Esox americanus	24	Etheostoma whipplei	37	Pimephales vigilax	50	Etheostoma artesiae
12	Fundulus olivaceus	25	Luxilus chrysocephalus	38	Erimyzon sucetta	51	Fundulus notatus
13	Icthyomyzon gagei	26	Notemigonus crysoleucas	39	Icthyomyzon fossor	52	Hybognathus hayi

Figure F2. Similarities/dissimilarities species composition of fish assemblages in two dimensions (NMS).

Table G1. Abundances of macroinvertebrates by year, site, and taxa classification.				
Year	**Stream Name**	**Order**	**Family**	**Abundance**
2001	Anacoco	Diptera	Ceratopogonidae	1
2001	Anacoco	Diptera	Chironomidae	10
2001	Anacoco	Diptera	Culicidae	3
2001	Anacoco	Ephemeroptera	Baetidae	1
2001	Anacoco	Oligochaeta		27
2001	Birds	Coleoptera	Elmidae	5
2001	Birds	Coleoptera	Gyrinidae	2
2001	Birds	Diptera	Ceratopogonidae	1
2001	Birds	Diptera	Chironomidae	29
2001	Birds	Diptera	Tipulidae	1
2001	Birds	Diptera		1
2001	Birds	Ephemeroptera	Caenidae	3
2001	Birds	Ephemeroptera	Heptageniidae	16
2001	Birds	Ephemeroptera		5
2001	Birds	Hydrachnida		6
2001	Birds	Nematoda		1
2001	Birds	Odonata	Corduliidae	1
2001	Birds	Odonata	Gomphidae	8
2001	Birds	Odonata		1
2001	Birds	Oligochaete		27
2001	Birds	Plecoptera	Perlidae	2
2001	Birds	Plecoptera		1
2001	Birds	Trichoptera	Philopotamidae	1
2001	Birds	Trichoptera	Polycentropodidae	6
2001	Comrade	Anomopoda	Daphniidae	16
2001	Comrade	Coleoptera	Dytiscidae	1
2001	Comrade	Coleoptera	Gyrinidae	1
2001	Comrade	Diptera	Ceratopogonidae	2
2001	Comrade	Diptera	Chironomidae	70
2001	Comrade	Diptera	Culicidae	18
2001	Comrade	Diptera	Tabanidae	3
2001	Comrade	Ephemeroptera	Baetidae	2
2001	Comrade	Ephemeroptera	Caenidae	5
2001	Comrade	Ephemeroptera	Heptageniidae	6
2001	Comrade	Hemiptera	Corixidae	5
2001	Comrade	Isopoda	Asellidae	1
2001	Comrade	Megaloptera	Corydalidae	2
2001	Comrade	Odonata	Aeshnidae	2
2001	Comrade	Odonata	Coenagrionidae	4
2001	Comrade	Odonata	Corduliidae	4
2001	Comrade	Odonata	Libellulidae	2
2001	Comrade	Oligochaeta		8
2001	Comrade	Trichoptera	Hydroptilidae	1

2001	Dowden	Acariformes		4
2001	Dowden	Amphipoda	Gammaridae	2
2001	Dowden	Coleoptera	Elmidae	2
2001	Dowden	Coleoptera	Gyrinidae	1
2001	Dowden	Decapoda	Palaemonidae	3
2001	Dowden	Diptera	Ceratopogonidae	2
2001	Dowden	Diptera	Chironomidae	97
2001	Dowden	Ephemeroptera	Heptageniidae	9
2001	Dowden	Ephemeroptera	Leptophlebiidae	2
2001	Dowden	Gastropoda		1
2001	Dowden	Hemiptera	Corixidae	3
2001	Dowden	Megaloptera	Sialidae	1
2001	Dowden	Mysidacea	Mysidae	11
2001	Dowden	Odonata	Coenagrionidae	5
2001	Dowden	Odonata	Corduliidae	4
2001	Dowden	Odonata	Gomphidae	5
2001	Dowden	Odonata	Libellulidae	1
2001	Dowden	Trichoptera	Limnephilidae	13
2001	Dowden	Trichoptera	Polycentropodidae	1
2001	Little Sandy	Coleoptera	Dytiscidae	1
2001	Little Sandy	Diptera	Ceratopogonidae	3
2001	Little Sandy	Diptera	Chironomidae	114
2001	Little Sandy	Ephemeroptera	Baetidae	1
2001	Little Sandy	Ephemeroptera	Caenidae	1
2001	Little Sandy	Ephemeroptera	Heptageniidae	2
2001	Little Sandy	Hemiptera	Veliidae	5
2001	Little Sandy	Hymenoptera		1
2001	Little Sandy	Odonata	Gomphidae	2
2001	Little Sandy	Oligochaeta		3
2001	Lyles	Coleoptera	Dytiscidae	4
2001	Lyles	Diptera	Ceratopogonidae	7
2001	Lyles	Diptera	Chironomidae	286
2001	Lyles	Diptera	Culicidae	2
2001	Lyles	Diptera	Tabanidae	1
2001	Lyles	Ephemeroptera	Baetidae	15
2001	Lyles	Ephemeroptera	Caenidae	10
2001	Lyles	Ephemeroptera	Heptageniidae	1
2001	Lyles	Hemiptera	Gerridae	12
2001	Lyles	Hemiptera	Veliidae	1
2001	Lyles	Hydroida	Hydridae	1
2001	Lyles	Odonata	Gomphidae	1
2001	Lyles	Oligochaeta		7
2001	Lyles	Orthoptera	Gryllotalpidae	1
2001	Martin	Coleoptera	Dytiscidae	2
2001	Martin	Coleoptera	Hydrophilidae	3
2001	Martin	Diptera	Chironomidae	39

2001	Martin	Ephemeroptera	Baetidae	4
2001	Martin	Ephemeroptera	Heptageniidae	1
2001	Martin	Hemiptera	Belostomatidae	2
2001	Martin	Hemiptera	Hydrometridae	1
2001	Martin	Isopoda	Asellidae	1
2001	Martin	Odonata	Coenagrionidae	1
2001	Martin	Odonata	Cordulegastridae	1
2001	Martin	Odonata	Corduliidae	1
2001	Martin	Oligochaeta		12
2001	Odom	Acariformes		1
2001	Odom	Coleoptera	Dytiscidae	1
2001	Odom	Coleoptera	Elmidae	3
2001	Odom	Coleoptera	Gyrinidae	1
2001	Odom	Diptera	Ceratopogonidae	7
2001	Odom	Diptera	Chironomidae	99
2001	Odom	Diptera	Empididae	1
2001	Odom	Diptera	Simuliidae	10
2001	Odom	Diptera	Tipulidae	3
2001	Odom	Ephemeroptera	Caenidae	17
2001	Odom	Ephemeroptera	Ephemerellidae	1
2001	Odom	Ephemeroptera	Heptageniidae	2
2001	Odom	Ephemeroptera	Tricorythidae	1
2001	Odom	Hemiptera	Hydrometridae	1
2001	Odom	Hemiptera	Veliidae	3
2001	Odom	Megaloptera	Corydalidae	1
2001	Odom	Odonata	Aeshnidae	6
2001	Odom	Odonata	Calopterygidae	1
2001	Odom	Odonata	Gomphidae	10
2001	Odom	Oligochaeta		5
2001	Odom	Plecoptera	Perlidae	1
2001	Odom	Trichoptera	Hydropsychidae	21
2001	Odom	Trichoptera	Hydroptilidae	5
2001	Odom	Trichoptera	Philopotamidae	3
2001	Tiger	Acariformes		1
2001	Tiger	Amphipoda	Gammaridae	1
2001	Tiger	Coleoptera	Dytiscidae	3
2001	Tiger	Coleoptera	Elmidae	2
2001	Tiger	Coleoptera	Hydrochidae	1
2001	Tiger	Diptera	Ceratopogonidae	1
2001	Tiger	Diptera	Chironomidae	15
2001	Tiger	Diptera	Tabanidae	1
2001	Tiger	Ephemeroptera	Baetidae	2
2001	Tiger	Ephemeroptera	Caenidae	9
2001	Tiger	Ephemeroptera	Ephemerellidae	1
2001	Tiger	Ephemeroptera	Heptageniidae	39
2001	Tiger	Ephemeroptera	Tricorythidae	1

2001	Tiger	Hemiptera	Veliidae	1
2001	Tiger	Nematoda		1
2001	Tiger	Odonata	Calopterygidae	3
2001	Tiger	Odonata	Cordulegastridae	2
2001	Tiger	Odonata	Corduliidae	3
2001	Tiger	Odonata	Gomphidae	9
2001	Tiger	Plecoptera	Perlidae	2
2001	Whiskey	Coleoptera	Elmidae	5
2001	Whiskey	Coleoptera	Gyrinidae	2
2001	Whiskey	Decapoda	Palaemonidae	1
2001	Whiskey	Diptera	Ceratopogonidae	76
2001	Whiskey	Diptera	Chironomidae	112
2001	Whiskey	Diptera	Empididae	1
2001	Whiskey	Diptera		2
2001	Whiskey	Ephemeroptera	Baetidae	5
2001	Whiskey	Ephemeroptera	Caenidae	12
2001	Whiskey	Ephemeroptera	Ephemerellidae	2
2001	Whiskey	Ephemeroptera	Ephemeridae	1
2001	Whiskey	Ephemeroptera	Heptageniidae	6
2001	Whiskey	Ephemeroptera	Tricorythidae	4
2001	Whiskey	Ephemeroptera		1
2001	Whiskey	Hirudinea		1
2001	Whiskey	Odonata	Aeshnidae	1
2001	Whiskey	Odonata	Corduliidae	1
2001	Whiskey	Odonata	Gomphidae	19
2001	Whiskey	Oligochaete		19
2001	Whiskey	Trichoptera	Brachycentridae	2
2001	Whiskey	Trichoptera	Hydropsychidae	4
2001	Whiskey	Trichoptera	Leptoceridae	1
2002	Birds	Bivalves		62
2002	Birds	Coleoptera	Elmidae	400
2002	Birds	Coleoptera	Gyrinidae	31
2002	Birds	Coleoptera	Psephenidae	12
2002	Birds	Copepoda		1
2002	Birds	Decapoda	Palaemonidae	53
2002	Birds	Diptera	Athericidae	1
2002	Birds	Diptera	Ceratopogonidae	379
2002	Birds	Diptera	Chironomidae	595
2002	Birds	Diptera	Empididae	4
2002	Birds	Diptera	Ephydridae	2
2002	Birds	Diptera	Psychodidae	3
2002	Birds	Diptera	Simuliidae	9
2002	Birds	Diptera	Tabanidae	14
2002	Birds	Diptera	Tipulidae	97
2002	Birds	Diptera		26
2002	Birds	Ephemeroptera	Baetidae	42

2002	Birds	Ephemeroptera	Caenidae	68
2002	Birds	Ephemeroptera	Ephemeridae	6
2002	Birds	Ephemeroptera	Heptageniidae	46
2002	Birds	Ephemeroptera	Isonychiidae	39
2002	Birds	Ephemeroptera	Leptophlebiidae	12
2002	Birds	Ephemeroptera	Tricorythidae	26
2002	Birds	Ephemeroptera		3
2002	Birds	Gastropoda		3
2002	Birds	Hemiptera	Gerridae	23
2002	Birds	Hemiptera	Veliidae	28
2002	Birds	Hydrachnida		12
2002	Birds	Megaloptera	Corydalidae	24
2002	Birds	Megaloptera	Sialidae	6
2002	Birds	Nematoda		1
2002	Birds	Odonata	Aeshnidae	5
2002	Birds	Odonata	Calopterygidae	4
2002	Birds	Odonata	Coenagrionidae	26
2002	Birds	Odonata	Corduliidae	13
2002	Birds	Odonata	Gomphidae	130
2002	Birds	Odonata		1
2002	Birds	Oligochaete		33
2002	Birds	Plecoptera	Perlidae	10
2002	Birds	Trichoptera	Hydropsychidae	38
2002	Birds	Trichoptera	Hydroptilidae	2
2002	Birds	Trichoptera	Leptoceridae	20
2002	Birds	Trichoptera	Odontoceridae	3
2002	Birds	Trichoptera	Philopotamidae	44
2002	Birds	Trichoptera	Polycentropodidae	6
2002	Birds	Trichoptera		21
2002	Comrade	Amphipoda	Hyalellidae	13
2002	Comrade	Anomopoda	Daphniidae	2
2002	Comrade	Arachnida	Pisauridae	1
2002	Comrade	Coleoptera	Dryopidae	1
2002	Comrade	Coleoptera	Dytiscidae	5
2002	Comrade	Coleoptera	Haliplidae	1
2002	Comrade	Coleoptera	Hydrochidae	2
2002	Comrade	Coleoptera	Scirtidae	4
2002	Comrade	Diptera	Ceratopogonidae	7
2002	Comrade	Diptera	Chaoboridae	8
2002	Comrade	Diptera	Chironomidae	82
2002	Comrade	Diptera	Culicidae	2
2002	Comrade	Ephemeroptera	Baetidae	3
2002	Comrade	Ephemeroptera	Caenidae	180
2002	Comrade	Ephemeroptera	Ephemerellidae	1
2002	Comrade	Ephemeroptera	Heptageniidae	10
2002	Comrade	Gastropoda	Ancylidae	1

2002	Comrade	Hemiptera	Corixidae	9
2002	Comrade	Hemiptera	Gerridae	11
2002	Comrade	Lepidoptera		3
2002	Comrade	Megaloptera	Sialidae	2
2002	Comrade	Odonata	Aeshnidae	2
2002	Comrade	Odonata	Coenagrionidae	57
2002	Comrade	Odonata	Corduliidae	12
2002	Comrade	Odonata	Gomphidae	4
2002	Comrade	Odonata	Libellulidae	18
2002	Comrade	Oligochaeta		10
2002	Comrade	Trichoptera	Leptoceridae	2
2002	Dowden	Acariformes		6
2002	Dowden	Amphipoda	Gammaridae	1
2002	Dowden	Amphipoda	Hyalellidae	2
2002	Dowden	Coleoptera	Dytiscidae	1
2002	Dowden	Coleoptera	Elmidae	40
2002	Dowden	Coleoptera	Scirtidae	1
2002	Dowden	Decapoda	Palaemonidae	10
2002	Dowden	Diptera	Ceratopogonidae	21
2002	Dowden	Diptera	Chaoboridae	1
2002	Dowden	Diptera	Chironomidae	246
2002	Dowden	Ephemeroptera	Baetidae	1
2002	Dowden	Ephemeroptera	Heptageniidae	7
2002	Dowden	Ephemeroptera	Leptophlebiidae	9
2002	Dowden	Hemiptera	Corixidae	22
2002	Dowden	Hemiptera	Gerridae	31
2002	Dowden	Megaloptera	Corydalidae	1
2002	Dowden	Megaloptera	Sialidae	35
2002	Dowden	Mysidacea	Mysidae	5
2002	Dowden	Odonata	Aeshnidae	1
2002	Dowden	Odonata	Coenagrionidae	78
2002	Dowden	Odonata	Corduliidae	7
2002	Dowden	Odonata	Gomphidae	15
2002	Dowden	Odonata	Libellulidae	16
2002	Dowden	Oligochaeta		8
2002	Dowden	Trichoptera	Leptoceridae	61
2002	Dowden	Trichoptera	Limnephilidae	1
2002	Dowden	Trichoptera	Molannidae	2
2002	Dowden	Trichoptera	Polycentropodidae	6
2002	Dowden	Trichoptera	Psychomyiidae	1
2002	Little Sandy	Amphipoda	Gammaridae	4
2002	Little Sandy	Arachnida	Pisauridae	1
2002	Little Sandy	Coleoptera	Dytiscidae	3
2002	Little Sandy	Coleoptera	Elmidae	4
2002	Little Sandy	Coleoptera	Hydrochidae	3
2002	Little Sandy	Diptera	Ceratopogonidae	10

2002	Little Sandy	Diptera	Chaoboridae	24
2002	Little Sandy	Diptera	Chironomidae	65
2002	Little Sandy	Ephemeroptera	Baetidae	10
2002	Little Sandy	Ephemeroptera	Baetiscidae	1
2002	Little Sandy	Ephemeroptera	Caenidae	92
2002	Little Sandy	Ephemeroptera	Ephemerellidae	10
2002	Little Sandy	Ephemeroptera	Ephemeridae	1
2002	Little Sandy	Ephemeroptera	Heptageniidae	2
2002	Little Sandy	Hemiptera	Gerridae	35
2002	Little Sandy	Hemiptera	Notonectidae	1
2002	Little Sandy	Hemiptera	Saldidae	2
2002	Little Sandy	Hemiptera	Veliidae	2
2002	Little Sandy	Megaloptera	Sialidae	1
2002	Little Sandy	Odonata	Aeshnidae	1
2002	Little Sandy	Odonata	Calopterygidae	4
2002	Little Sandy	Odonata	Coenagrionidae	3
2002	Little Sandy	Odonata	Corduliidae	1
2002	Little Sandy	Odonata	Gomphidae	31
2002	Little Sandy	Plecoptera	Perlidae	1
2002	Little Sandy	Trichoptera	Hydroptilidae	1
2002	Little Sandy	Trichoptera	Leptoceridae	1
2002	Lyles	Acariformes		1
2002	Lyles	Coleoptera	Dytiscidae	2
2002	Lyles	Coleoptera	Elmidae	1
2002	Lyles	Coleoptera	Gyrinidae	1
2002	Lyles	Coleoptera	Hydrochidae	4
2002	Lyles	Coleoptera	Psephenidae	1
2002	Lyles	Diptera	Ceratopogonidae	2
2002	Lyles	Diptera	Chironomidae	9
2002	Lyles	Diptera	Tabanidae	1
2002	Lyles	Ephemeroptera	Baetidae	7
2002	Lyles	Ephemeroptera	Caenidae	186
2002	Lyles	Ephemeroptera	Ephemerellidae	1
2002	Lyles	Ephemeroptera	Ephemeridae	1
2002	Lyles	Ephemeroptera	Heptageniidae	6
2002	Lyles	Hemiptera	Corixidae	2
2002	Lyles	Hemiptera	Gerridae	41
2002	Lyles	Megaloptera	Sialidae	2
2002	Lyles	Odonata	Aeshnidae	1
2002	Lyles	Odonata	Coenagrionidae	10
2002	Lyles	Odonata	Corduliidae	1
2002	Lyles	Odonata	Gomphidae	10
2002	Lyles	Odonata	Libellulidae	2
2002	Lyles	Oligochaeta		3
2002	Lyles	Trichoptera	Limnephilidae	1
2002	Martin	Arachnida	Pisauridae	4

2002	Martin	Coleoptera	Dytiscidae	2
2002	Martin	Coleoptera	Elmidae	2
2002	Martin	Coleoptera	Hydrochidae	1
2002	Martin	Coleoptera	Hydrophilidae	2
2002	Martin	Coleoptera	Scirtidae	2
2002	Martin	Diptera	Chaoboridae	2
2002	Martin	Diptera	Chironomidae	85
2002	Martin	Diptera	Tabanidae	2
2002	Martin	Ephemeroptera	Baetidae	1
2002	Martin	Ephemeroptera	Caenidae	68
2002	Martin	Hemiptera	Corixidae	1
2002	Martin	Hemiptera	Gerridae	6
2002	Martin	Hemiptera	Hydrometridae	1
2002	Martin	Hemiptera	Veliidae	1
2002	Martin	Megaloptera	Sialidae	1
2002	Martin	Odonata	Coenagrionidae	27
2002	Martin	Odonata	Gomphidae	2
2002	Martin	Odonata	Libellulidae	16
2002	Martin	Oligochaeta		10
2002	Martin	Trichoptera	Hydropsychidae	1
2002	Martin	Trichoptera	Leptoceridae	9
2002	Odom	Acariformes		16
2002	Odom	Arachnida	Pisauridae	5
2002	Odom	Coleoptera	Dytiscidae	5
2002	Odom	Coleoptera	Elmidae	29
2002	Odom	Coleoptera	Gyrinidae	1
2002	Odom	Coleoptera	Hydrochidae	1
2002	Odom	Coleoptera	Psephenidae	5
2002	Odom	Diptera	Ceratopogonidae	8
2002	Odom	Diptera	Chironomidae	186
2002	Odom	Diptera	Simuliidae	18
2002	Odom	Diptera	Tipulidae	3
2002	Odom	Ephemeroptera	Baetidae	44
2002	Odom	Ephemeroptera	Baetiscidae	3
2002	Odom	Ephemeroptera	Caenidae	20
2002	Odom	Ephemeroptera	Heptageniidae	6
2002	Odom	Ephemeroptera	Isonychiidae	1
2002	Odom	Ephemeroptera	Tricorythidae	25
2002	Odom	Hemiptera	Gerridae	2
2002	Odom	Hemiptera	Saldidae	2
2002	Odom	Hemiptera	Veliidae	1
2002	Odom	Lepidoptera	Nepticulidae	2
2002	Odom	Megaloptera	Corydalidae	22
2002	Odom	Odonata	Aeshnidae	2
2002	Odom	Odonata	Coenagrionidae	7
2002	Odom	Odonata	Cordulegastridae	1

2002	Odom	Odonata	Corduliidae	2
2002	Odom	Odonata	Gomphidae	13
2002	Odom	Plecoptera	Nemouridae	1
2002	Odom	Plecoptera	Perlidae	2
2002	Odom	Trichoptera	Hydropsychidae	4
2002	Odom	Trichoptera	Hydroptilidae	49
2002	Tiger	Arachnida	Pisauridae	3
2002	Tiger	Coleoptera	Dytiscidae	1
2002	Tiger	Coleoptera	Elmidae	1
2002	Tiger	Coleoptera	Hydrochidae	4
2002	Tiger	Coleoptera	Psephenidae	6
2002	Tiger	Coleoptera	Scirtidae	2
2002	Tiger	Diptera	Ceratopogonidae	9
2002	Tiger	Diptera	Chaoboridae	3
2002	Tiger	Diptera	Chironomidae	55
2002	Tiger	Diptera	Dixidae	3
2002	Tiger	Diptera	Simuliidae	2
2002	Tiger	Ephemeroptera	Baetidae	12
2002	Tiger	Ephemeroptera	Baetiscidae	2
2002	Tiger	Ephemeroptera	Caenidae	127
2002	Tiger	Ephemeroptera	Ephemerellidae	5
2002	Tiger	Ephemeroptera	Ephemeridae	4
2002	Tiger	Ephemeroptera	Heptageniidae	19
2002	Tiger	Ephemeroptera	Tricorythidae	1
2002	Tiger	Gastropoda	Ancylidae	5
2002	Tiger	Hemiptera	Gerridae	21
2002	Tiger	Hemiptera	Nepidae	1
2002	Tiger	Odonata	Calopterygidae	1
2002	Tiger	Odonata	Coenagrionidae	2
2002	Tiger	Odonata	Corduliidae	9
2002	Tiger	Odonata	Gomphidae	5
2002	Tiger	Oligochaeta		3
2002	Tiger	Trichoptera	Hydroptilidae	2
2002	Tiger	Trichoptera	Leptoceridae	12
2002	Tiger	Trichoptera	Limnephilidae	5
2002	Tiger	Trichoptera	Phryganeidae	1
2002	Tiger	Trichoptera	Polycentropodidae	4
2002	Whiskey	Araneae	Pisauridae	10
2002	Whiskey	Araneae	Tetragnathidae	1
2002	Whiskey	Bivalves		38
2002	Whiskey	Coleoptera	Dryopidae	3
2002	Whiskey	Coleoptera	Dytiscidae	1
2002	Whiskey	Coleoptera	Elmidae	342
2002	Whiskey	Coleoptera	Gyrinidae	7
2002	Whiskey	Coleoptera	Haliplidae	1
2002	Whiskey	Decapoda	Palaemonidae	3

2002	Whiskey	Diptera	Athericidae	1
2002	Whiskey	Diptera	Ceratopogonidae	288
2002	Whiskey	Diptera	Chironomidae	774
2002	Whiskey	Diptera	Empididae	5
2002	Whiskey	Diptera	Ephydridae	3
2002	Whiskey	Diptera	Simuliidae	4
2002	Whiskey	Diptera	Tabanidae	8
2002	Whiskey	Diptera	Tipulidae	36
2002	Whiskey	Diptera		167
2002	Whiskey	Ephemeroptera	Baetidae	105
2002	Whiskey	Ephemeroptera	Caenidae	64
2002	Whiskey	Ephemeroptera	Heptageniidae	87
2002	Whiskey	Ephemeroptera	Isonychiidae	99
2002	Whiskey	Ephemeroptera	Tricorythidae	117
2002	Whiskey	Ephemeroptera		13
2002	Whiskey	Gastropoda		5
2002	Whiskey	Hemiptera	Gerridae	16
2002	Whiskey	Hemiptera	Hebridae	1
2002	Whiskey	Hemiptera	Veliidae	108
2002	Whiskey	Hemiptera		2
2002	Whiskey	Hydrachnida		30
2002	Whiskey	Lepidoptera	Tortricidae	3
2002	Whiskey	Lepidoptera		7
2002	Whiskey	Megaloptera	Corydalidae	69
2002	Whiskey	Nematoda		2
2002	Whiskey	Nematomorpha		1
2002	Whiskey	Odonata	Aeshnidae	2
2002	Whiskey	Odonata	Calopterygidae	4
2002	Whiskey	Odonata	Coenagrionidae	2
2002	Whiskey	Odonata	Corduliidae	17
2002	Whiskey	Odonata	Gomphidae	50
2002	Whiskey	Odonata		3
2002	Whiskey	Oligochaete		15
2002	Whiskey	Plecoptera	Perlidae	13
2002	Whiskey	Trichoptera	Hydropsychidae	568
2002	Whiskey	Trichoptera	Hydroptilidae	28
2002	Whiskey	Trichoptera	Leptoceridae	9
2002	Whiskey	Trichoptera	Philopotamidae	1
2002	Whiskey	Trichoptera	Polycentropodidae	1
2002	Whiskey	Trichoptera		23
2003	Birds	Bivalves		4
2003	Birds	Coleoptera	Elmidae	14
2003	Birds	Decapoda	Palaemonidae	4
2003	Birds	Diptera	Chironomidae	22
2003	Birds	Diptera	Simuliidae	4
2003	Birds	Ephemeroptera	Caenidae	1

2003	Birds	Ephemeroptera	Heptageniidae	3
2003	Birds	Ephemeroptera	Tricorythidae	3
2003	Birds	Gastropoda		1
2003	Birds	Hemiptera	Veliidae	2
2003	Birds	Odonata	Calopterygidae	1
2003	Birds	Odonata	Coenagrionidae	1
2003	Birds	Odonata	Corduliidae	1
2003	Birds	Trichoptera	Limnephilidae	5
2003	Whiskey	Araneae	Pisauridae	1
2003	Whiskey	Araneae	Tetragnathidae	1
2003	Whiskey	Coleoptera	Elmidae	47
2003	Whiskey	Coleoptera	Hydrophilidae	1
2003	Whiskey	Diptera	Ceratopogonidae	19
2003	Whiskey	Diptera	Chironomidae	869
2003	Whiskey	Diptera	Empididae	3
2003	Whiskey	Diptera	Tabanidae	1
2003	Whiskey	Diptera	Tipulidae	13
2003	Whiskey	Ephemeroptera	Baetidae	13
2003	Whiskey	Ephemeroptera	Caenidae	37
2003	Whiskey	Ephemeroptera	Heptageniidae	58
2003	Whiskey	Ephemeroptera	Isonychiidae	57
2003	Whiskey	Ephemeroptera	Tricorythidae	47
2003	Whiskey	Hemiptera	Veliidae	14
2003	Whiskey	Hydrachnida		1
2003	Whiskey	Lepidoptera	Pyralidae	1
2003	Whiskey	Megaloptera	Corydalidae	1
2003	Whiskey	Neuroptera	Sisyridae	1
2003	Whiskey	Odonata	Aeshnidae	1
2003	Whiskey	Odonata	Calopterygidae	1
2003	Whiskey	Odonata	Calopterygidae	1
2003	Whiskey	Odonata	Gomphidae	2
2003	Whiskey	Oligochaeta		31
2003	Whiskey	Orthoptera	Gryllidae	1
2003	Whiskey	Trichoptera	Calamoceratidae	2
2003	Whiskey	Trichoptera	Hydropsychidae	131
2003	Whiskey	Trichoptera	Leptoceridae	2
2003	Whiskey	Trichoptera	Odontoceridae	2
2004	Birds	Bivalves		5
2004	Birds	Coleoptera	Dryopidae	4
2004	Birds	Coleoptera	Elmidae	101
2004	Birds	Diptera	Ceratopogonidae	19
2004	Birds	Diptera	Chironomidae	100
2004	Birds	Diptera	Culicidae	1
2004	Birds	Diptera	Simuliidae	1
2004	Birds	Ephemeroptera	Baetidae	3
2004	Birds	Ephemeroptera	Caenidae	3

2004	Birds	Ephemeroptera	Heptageniidae	9
2004	Birds	Ephemeroptera	Isonychiidae	19
2004	Birds	Ephemeroptera	Tricorythidae	1
2004	Birds	Hydrachnida		2
2004	Birds	Odonata	Coenagrionidae	1
2004	Birds	Odonata	Gomphidae	7
2004	Birds	Oligochaeta		16
2004	Birds	Plecoptera	Perlidae	3
2004	Birds	Trichoptera	Hydropsychidae	6
2004	Whiskey	Amphipoda		2
2004	Whiskey	Araneae	Pisauridae	1
2004	Whiskey	Bivalves		37
2004	Whiskey	Coleoptera	Dryopidae	1
2004	Whiskey	Coleoptera	Elmidae	219
2004	Whiskey	Coleoptera	Gyrinidae	2
2004	Whiskey	Diptera	Ceratopogonidae	17
2004	Whiskey	Diptera	Chironomidae	372
2004	Whiskey	Diptera	Culicidae	1
2004	Whiskey	Ephemeroptera	Baetidae	6
2004	Whiskey	Ephemeroptera	Caenidae	55
2004	Whiskey	Ephemeroptera	Heptageniidae	18
2004	Whiskey	Ephemeroptera	Isonychiidae	39
2004	Whiskey	Ephemeroptera	Tricorythidae	111
2004	Whiskey	Hemiptera	Veliidae	4
2004	Whiskey	Hydrachnida		3
2004	Whiskey	Megaloptera		2
2004	Whiskey	Odonata	Calopterygidae	1
2004	Whiskey	Odonata	Coenagrionidae	3
2004	Whiskey	Odonata	Gomphidae	7
2004	Whiskey	Oligochaeta		13
2004	Whiskey	Plecoptera	Perlidae	1
2004	Whiskey	Spider		1
2004	Whiskey	Trichoptera	Hydropsychidae	47
2004	Whiskey	Trichoptera	Odontoceridae	2
2004	Whiskey	Trichoptera	Philopotamidae	1
2012	Anacoco	Amphipoda	Gammaridae	1
2012	Anacoco	Coleoptera	Dytiscidae	4
2012	Anacoco	Diptera	Chaoboridae	1
2012	Anacoco	Diptera	Dolichopodidae	4
2012	Anacoco	Diptera	Syrphidae	1
2012	Anacoco	Hemiptera	Belostomatidae	1
2012	Anacoco	Lepidoptera	Nepticulidae	1
2012	Anacoco	Odonata	Libellulidae	1
2012	Bayou Zourie	Amphipoda	Gammaridae	2
2012	Bayou Zourie	Diptera	Ceratopogonidae	3
2012	Bayou Zourie	Diptera	Chironomidae	14

2012	Bayou Zourie	Diptera	Psychodidae	3
2012	Bayou Zourie	Diptera	Tipulidae	1
2012	Bayou Zourie	Ephemeroptera	Caenidae	3
2012	Bayou Zourie	Ephemeroptera	Heptageniidae	2
2012	Bayou Zourie	Hemiptera	Corixidae	1
2012	Bayou Zourie	Hemiptera	Gerridae	4
2012	Bayou Zourie	Oligochaeta		3
2012	Bayou Zourie	Trichoptera	Rhyacophilidae	1
2012	Big Brushy	Coleoptera	Elmidae	30
2012	Big Brushy	Coleoptera	Gyrinidae	1
2012	Big Brushy	Diptera	Chironomidae	17
2012	Big Brushy	Diptera	Simuliidae	2
2012	Big Brushy	Diptera	Tipulidae	4
2012	Big Brushy	Ephemeroptera	Heptageniidae	7
2012	Big Brushy	Ephemeroptera	Siphlonuridae	1
2012	Big Brushy	Odonata	Libellulidae	1
2012	Big Brushy	Oligochaeta		1
2012	Big Brushy	Plecoptera	Perlidae	17
2012	Big Brushy	Trichoptera	Hydropsychidae	75
2012	Birds	Amphipoda	Gammaridae	12
2012	Birds	Coleoptera	Elmidae	89
2012	Birds	Coleoptera	Gyrinidae	4
2012	Birds	Diptera	Ceratopogonidae	4
2012	Birds	Diptera	Chironomidae	9
2012	Birds	Diptera	Tabanidae	4
2012	Birds	Diptera	Tipulidae	6
2012	Birds	Ephemeroptera	Ameletidae	3
2012	Birds	Ephemeroptera	Caenidae	1
2012	Birds	Ephemeroptera	Heptageniidae	24
2012	Birds	Ephemeroptera	Isonychiidae	2
2012	Birds	Megaloptera	Corydalidae	2
2012	Birds	Odonata	Aeshnidae	8
2012	Birds	Odonata	Gomphidae	5
2012	Birds	Plecoptera	Perlidae	7
2012	Birds	Trichoptera	Hydropsychidae	28
2012	Birds	Trichoptera	Philopotamidae	2
2012	Birds	Trichoptera	Polycentropodidae	1
2012	Bundick	Coleoptera	Dytiscidae	3
2012	Bundick	Coleoptera	Gyrinidae	2
2012	Bundick	Diptera	Chironomidae	3
2012	Bundick	Ephemeroptera	Caenidae	3
2012	Bundick	Ephemeroptera	Heptageniidae	1
2012	Bundick	Hemiptera	Belostomatidae	1
2012	Bundick	Hemiptera	Corixidae	1
2012	Bundick	Hemiptera	Gerridae	1
2012	Bundick	Odonata	Gomphidae	1

2012	Bundick	Odonata	Libellulidae	3
2012	Comrade	Coleoptera	Elmidae	2
2012	Comrade	Diptera	Chironomidae	12
2012	Comrade	Diptera	Simuliidae	2
2012	Comrade	Ephemeroptera	Ameletidae	3
2012	Comrade	Ephemeroptera	Baetidae	1
2012	Comrade	Ephemeroptera	Caenidae	4
2012	Comrade	Ephemeroptera	Isonychiidae	2
2012	Comrade	Oligochaeta		2
2012	Comrade	Trichoptera	Hydropsychidae	2
2012	Dowden	Amphipoda	Gammaridae	5
2012	Dowden	Coleoptera	Gyrinidae	1
2012	Dowden	Diptera	Chaoboridae	1
2012	Dowden	Diptera	Chironomidae	6
2012	Dowden	Diptera	Tipulidae	4
2012	Dowden	Ephemeroptera	Ameletidae	3
2012	Dowden	Ephemeroptera	Baetidae	3
2012	Dowden	Ephemeroptera	Caenidae	1
2012	Dowden	Hemiptera	Corixidae	20
2012	Dowden	Odonata	Coenagrionidae	1
2012	Dowden	Odonata	Libellulidae	1
2012	Drakes	Amphipoda	Gammaridae	1
2012	Drakes	Coleoptera	Dryopidae	1
2012	Drakes	Coleoptera	Gyrinidae	2
2012	Drakes	Ephemeroptera	Heptageniidae	2
2012	Drakes	Ephemeroptera	Leptophlebiidae	1
2012	Drakes	Megaloptera	Corydalidae	1
2012	Drakes	Trichoptera	Hydropsychidae	5
2012	Drakes	Trichoptera	Philopotamidae	1
2012	East Fork	Amphipoda	Gammaridae	3
2012	East Fork	Coleoptera	Dryopidae	5
2012	East Fork	Coleoptera	Elmidae	4
2012	East Fork	Diptera	Chironomidae	5
2012	East Fork	Diptera	Tabanidae	1
2012	East Fork	Ephemeroptera	Ameletidae	4
2012	East Fork	Ephemeroptera	Heptageniidae	3
2012	East Fork	Megaloptera	Corydalidae	1
2012	East Fork	Trichoptera	Hydropsychidae	2
2012	East Fork	Trichoptera	Philopotamidae	11
2012	Little Brushy	Coleoptera	Hydrophilidae	1
2012	Little Brushy	Diptera	Ceratopogonidae	2
2012	Little Brushy	Diptera	Chironomidae	8
2012	Little Brushy	Diptera	Psychodidae	1
2012	Little Brushy	Diptera	Tipulidae	3
2012	Little Brushy	Ephemeroptera	Ameletidae	3
2012	Little Brushy	Ephemeroptera	Heptageniidae	2

2012	Little Brushy	Megaloptera	Corydalidae	1
2012	Little Brushy	Odonata	Calopterygidae	1
2012	Little Brushy	Odonata	Coenagrionidae	1
2012	Little Brushy	Plecoptera	Chloroperlidae	2
2012	Little Brushy	Trichoptera	Hydropsychidae	6
2012	Little Brushy	Trichoptera	Polycentropodidae	1
2012	Little Sandy	Amphipoda	Gammaridae	1
2012	Little Sandy	Coleoptera	Dryopidae	4
2012	Little Sandy	Coleoptera	Elmidae	1
2012	Little Sandy	Coleoptera	Hydrochidae	2
2012	Little Sandy	Diptera	Chironomidae	1
2012	Little Sandy	Diptera	Culicidae	1
2012	Little Sandy	Ephemeroptera	Caenidae	1
2012	Little Sandy	Ephemeroptera	Leptophlebiidae	1
2012	Little Sandy	Hemiptera	Gerridae	8
2012	Little Sandy	Oligochaeta		1
2012	Little Sandy	Plecoptera	Perlidae	1
2012	Lyles	Amphipoda	Gammaridae	7
2012	Lyles	Coleoptera	Dytiscidae	1
2012	Lyles	Coleoptera	Elmidae	1
2012	Lyles	Coleoptera	Hydrochidae	1
2012	Lyles	Diptera	Chironomidae	1
2012	Lyles	Hemiptera	Corixidae	1
2012	Lyles	Hemiptera	Gerridae	35
2012	Lyles	Odonata	Libellulidae	1
2012	Martin	Amphipoda	Gammaridae	1
2012	Martin	Coleoptera	Elmidae	13
2012	Martin	Coleoptera	Gyrinidae	12
2012	Martin	Diptera	Chironomidae	2
2012	Martin	Diptera	Tabanidae	1
2012	Martin	Diptera	Tipulidae	1
2012	Martin	Ephemeroptera	Heptageniidae	14
2012	Martin	Megaloptera	Corydalidae	2
2012	Martin	Plecoptera	Perlidae	3
2012	Martin	Trichoptera	Philopotamidae	8
2012	Martin	Trichoptera	Polycentropodidae	1
2012	Odom	Coleoptera	Dryopidae	5
2012	Odom	Coleoptera	Gyrinidae	4
2012	Odom	Diptera	Chironomidae	9
2012	Odom	Diptera	Empididae	4
2012	Odom	Diptera	Tipulidae	1
2012	Odom	Ephemeroptera	Ameletidae	2
2012	Odom	Ephemeroptera	Heptageniidae	2
2012	Odom	Odonata	Aeshnidae	1
2012	Odom	Trichoptera	Hydropsychidae	3
2012	Odom	Trichoptera	Polycentropodidae	1

2012	Tiger	Amphipoda	Gammaridae	1
2012	Tiger	Coleoptera	Dryopidae	5
2012	Tiger	Coleoptera	Hydrochidae	1
2012	Tiger	Diptera	Chironomidae	5
2012	Tiger	Ephemeroptera	Ameletidae	3
2012	Tiger	Ephemeroptera	Caenidae	1
2012	Tiger	Ephemeroptera	Leptophlebiidae	3
2012	Tiger	Trichoptera	Hydropsychidae	1
2012	West Fork	Coleoptera	Gyrinidae	1
2012	West Fork	Diptera	Chironomidae	10
2012	West Fork	Diptera	Culicidae	2
2012	West Fork	Diptera	Tabanidae	1
2012	West Fork	Ephemeroptera	Baetidae	4
2012	West Fork	Oligochaeta		8
2012	Whiskey	Coleoptera	Dryopidae	5
2012	Whiskey	Coleoptera	Dytiscidae	10
2012	Whiskey	Coleoptera	Elmidae	2
2012	Whiskey	Coleoptera	Gyrinidae	4
2012	Whiskey	Coleoptera	Hydrophilidae	10
2012	Whiskey	Diptera	Chaoboridae	5
2012	Whiskey	Diptera	Chironomidae	24
2012	Whiskey	Diptera	Empididae	1
2012	Whiskey	Diptera	Ephydridae	7
2012	Whiskey	Diptera	Psychodidae	8
2012	Whiskey	Diptera	Syrphidae	2
2012	Whiskey	Diptera	Tipulidae	3
2012	Whiskey	Ephemeroptera	Ameletidae	8
2012	Whiskey	Ephemeroptera	Baetidae	1
2012	Whiskey	Ephemeroptera	Caenidae	8
2012	Whiskey	Ephemeroptera	Heptageniidae	4
2012	Whiskey	Ephemeroptera	Isonychiidae	2
2012	Whiskey	Hemiptera	Belostomatidae	18
2012	Whiskey	Lepidoptera	Nepticulidae	1
2012	Whiskey	Odonata	Aeshnidae	3
2012	Whiskey	Odonata	Gomphidae	1
2012	Whiskey	Trichoptera	Hydropsychidae	28
2012	Whiskey	Trichoptera	Polycentropodidae	1
2014	Birds	Coleoptera	Elmidae	9
2014	Birds	Diptera	Chironomidae	2
2014	Birds	Diptera	Limoniinae	1
2014	Birds	Ephemeroptera	Baetidae	1
2014	Birds	Ephemeroptera	Ephemerellidae	6
2014	Birds	Ephemeroptera	Heptageniidae	6
2014	Birds	Megaloptera	Corydalidae	1
2014	Birds	Odonata	Gomphidae	3
2014	Birds	Plecoptera	Perlidae	5

2014	Birds	Trichoptera	Hydropsychidae	10
2014	Birds	Trichoptera	Polycentropodidae	1
2014	Bundick	Coleoptera	Elmidae	1
2014	Bundick	Diptera	Chironomidae	32
2014	Bundick	Odonata	Coenagrionidae	1
2014	Bundick	Diptera	Culicidae	1
2014	Bundick	Ephemeroptera	Baetidae	11
2014	Bundick	Ephemeroptera	Caenidae	13
2014	Bundick	Ephemeroptera	Heptageniidae	5
2014	Bundick	Hemiptera	Corixidae	9
2014	Bundick	Lepidoptera	Pyralidae	1
2014	Bundick	Odonata	Libellulidae	2
2014	Bundick	Plecoptera	Perlidae	1
2014	Bundick	Trichoptera	Hydropsychidae	6
2014	Comrade	Coleoptera	Dytiscidae	2
2014	Comrade	Coleoptera	Elmidae	1
2014	Comrade	Coleoptera	Gyrinidae	6
2014	Comrade	Coleoptera	Haliplidae	1
2014	Comrade	Diptera	Chironomidae	24
2014	Comrade	Diptera	Culicidae	2
2014	Comrade	Ephemeroptera	Heptageniidae	1
2014	Comrade	Hemiptera	Corixidae	11
2014	Comrade	Odonata	Corduliidae	1
2014	Comrade	Trichoptera	Hydropsychidae	4
2014	Drakes	Coleoptera	Elmidae	15
2014	Drakes	Diptera	Chironomidae	3
2014	Drakes	Diptera	Tipulidae	3
2014	Drakes	Ephemeroptera	Baetidae	3
2014	Drakes	Ephemeroptera	Heptageniidae	2
2014	Drakes	Hemiptera	Veliidae	1
2014	Drakes	Trichoptera	Hydropsychidae	18
2014	Indian	Amphipoda	Gammaridae	1
2014	Indian	Coleoptera	Dytiscidae	2
2014	Indian	Coleoptera	Elmidae	1
2014	Indian	Coleoptera	Haliplidae	3
2014	Indian	Diptera	Chironomidae	10
2014	Indian	Ephemeroptera	Heptageniidae	3
2014	Indian	Hemiptera	Corixidae	25
2014	Indian	Trichoptera	Leptoceridae	2
2014	Prairie	Coleoptera	Elmidae	10
2014	Prairie	Diptera	Chironomidae	8
2014	Prairie	Ephemeroptera	Heptageniidae	13
2014	Prairie	Hemiptera	Corixidae	5
2014	Prairie	Odonata	Coenagrionidae	1
2014	Prairie	Odonata	Corduliidae	1
2014	Prairie	Odonata	Gomphidae	6

2014	Prairie	Platyhelminthes	Turbellaria	1
2014	Prairie	Plecoptera	Perlidae	10
2014	Prairie	Trichoptera	Hydropsychidae	2
2014	Prairie	Trichoptera	Polycentropodidae	2
2014	West Fork	Coleoptera	Elmidae	8
2014	West Fork	Coleoptera	Gyrinidae	2
2014	West Fork	Diptera	Chironomidae	1
2014	West Fork	Ephemeroptera	Baetidae	1
2014	West Fork	Ephemeroptera	Heptageniidae	5
2014	West Fork	Odonata	Gomphidae	3
2014	West Fork	Plecoptera	Perlidae	8
2014	West Fork	Trichoptera	Hydropsychidae	3
2014	West Fork	Trichoptera	Polycentropodidae	3
2015	Anacoco	Coleoptera	Dytiscidae	4
2015	Anacoco	Coleoptera	Gyrinidae	3
2015	Anacoco	Diptera	Brachycera	3
2015	Anacoco	Diptera	Chaoboridae	3
2015	Anacoco	Diptera	Chironomidae	6
2015	Anacoco	Ephemeroptera	Caenidae	2
2015	Anacoco	Ephemeroptera	Siphlonuridae	2
2015	Anacoco	Hemiptera	Gerridae	2
2015	Anacoco	Hemiptera	Mesoveliidae	1
2015	Anacoco	Hemiptera	Notonectidae	1
2015	Anacoco	Odonata	Coenagrionidae	1
2015	Anacoco	Odonata	Cordulegastridae	1
2015	Anacoco	Odonata	Corduliidae	4
2015	Anacoco	Odonata	Macromiidae	1
2015	Anacoco	Trichoptera	Philopotamidae	2
2015	Big Brushy	Coleoptera	Elmidae	11
2015	Big Brushy	Coleoptera	Gyrinidae	1
2015	Big Brushy	Coleoptera	Limnichidae	1
2015	Big Brushy	Diptera	Simuliidae	2
2015	Big Brushy	Diptera	Thaumaleidae	23
2015	Big Brushy	Ephemeroptera	Baetidae	2
2015	Big Brushy	Ephemeroptera	Heptageniidae	13
2015	Big Brushy	Odonata	Calopterygidae	1
2015	Big Brushy	Plecoptera	Perlidae	1
2015	Big Brushy	Trichoptera	Hydropsychidae	16
2015	East Fork	Coleoptera	Elmidae	1
2015	East Fork	Coleoptera	Gyrinidae	2
2015	East Fork	Diptera	Chironomidae	2
2015	East Fork	Diptera	Thaumaleidae	1
2015	East Fork	Diptera	Tipulidae	1
2015	East Fork	Ephemeroptera	Bahningiidae	4
2015	East Fork	Ephemeroptera	Ephemeridae	1
2015	East Fork	Ephemeroptera	Heptageniidae	13

2015	East Fork	Ephemeroptera	Leptophlebiidae	1
2015	East Fork	Ephemeroptera	Siphlonuridae	2
2015	East Fork	Hemiptera	Corixidae	1
2015	East Fork	Hemiptera	Veliidae	8
2015	East Fork	Odonata	Aeshnidae	3
2015	East Fork	Plecoptera	Perlidae	9
2015	East Fork	Plecoptera	Perlodidae	1
2015	East Fork	Trichoptera	Helicopsychidae	9
2015	East Fork	Trichoptera	Hydropsychidae	7
2015	East Fork	Trichoptera	Rhyacophilidae	6
2015	Little Brushy	Coleoptera	Elmidae	20
2015	Little Brushy	Coleoptera	Gyrinidae	1
2015	Little Brushy	Coleoptera	Limnichidae	1
2015	Little Brushy	Diptera	Chironomidae	1
2015	Little Brushy	Diptera	Empididae	1
2015	Little Brushy	Diptera	Simuliidae	5
2015	Little Brushy	Diptera	Thaumaleidae	24
2015	Little Brushy	Ephemeroptera	Baetidae	4
2015	Little Brushy	Ephemeroptera	Heptageniidae	10
2015	Little Brushy	Hemiptera	Nepidae	1
2015	Little Brushy	Isopoda	Asellidae	1
2015	Little Brushy	Odonata	Aeshnidae	4
2015	Little Brushy	Odonata	Calopterygidae	3
2015	Little Brushy	Odonata	Gomphidae	2
2015	Little Brushy	Plecoptera	Chloroperlidae	13
2015	Little Brushy	Trichoptera	Hydropsychidae	10
2015	Little Brushy	Trichoptera	Hydroptilidae	1
2015	Little Brushy	Trichoptera	Philopotamidae	4
2015	Little Sandy	Coleoptera	Dytiscidae	3
2015	Little Sandy	Coleoptera	Gyrinidae	1
2015	Little Sandy	Coleoptera	Haliplidae	1
2015	Little Sandy	Coleoptera	Hydrophilidae	1
2015	Little Sandy	Coleoptera	Noteridae	2
2015	Little Sandy	Diptera	Chironomidae	2
2015	Little Sandy	Diptera	Culicidae	1
2015	Little Sandy	Diptera	Thaumaleidae	11
2015	Little Sandy	Diptera	Tipulidae	1
2015	Little Sandy	Ephemeroptera	Heptageniidae	3
2015	Little Sandy	Ephemeroptera	Polymitarcyidae	1
2015	Little Sandy	Ephemeroptera	Potamahthidae	1
2015	Little Sandy	Hemiptera	Mesoveliidae	1
2015	Little Sandy	Hemiptera	Pleidae	1
2015	Little Sandy	Hemiptera	Veliidae	1
2015	Little Sandy	Plecoptera	Taeniopterygidae	1
2015	Odom	Coleoptera	Dytiscidae	2
2015	Odom	Coleoptera	Elmidae	1

2015	Odom	Diptera	Chironomidae	1
2015	Odom	Diptera	Simuliidae	1
2015	Odom	Diptera	Thaumaleidae	2
2015	Odom	Ephemeroptera	Baetidae	9
2015	Odom	Ephemeroptera	Caenidae	5
2015	Odom	Ephemeroptera	Ephemerellidae	1
2015	Odom	Ephemeroptera	Heptageniidae	1
2015	Odom	Ephemeroptera	Isonychiidae	5
2015	Odom	Ephemeroptera	Leptophlebiidae	1
2015	Odom	Ephemeroptera	Siphlonuridae	6
2015	Odom	Ephemeroptera	Tricorythidae	1
2015	Odom	Hemiptera	Veliidae	2
2015	Odom	Odonata	Aeshnidae	4
2015	Odom	Odonata	Gomphidae	5
2015	Odom	Plecoptera	Perlidae	4
2015	Odom	Trichoptera	Helicopsychidae	1
2015	Odom	Trichoptera	Hydropsychidae	5
2016	Bayou Zourie	Diptera	Chironomidae	6
2016	Bayou Zourie	Hemiptera	Gerridae	1
2016	Bayou Zourie	Hemiptera	Veliidae	1
2016	Bayou Zourie	Odonata	Coenagrionidae	2
2016	Bayou Zourie	Odonata	Gomphidae	1
2016	Dowden	Amphipoda		4
2016	Dowden	Coleoptera	Dytiscidae	1
2016	Dowden	Coleoptera	Elmidae	16
2016	Dowden	Coleoptera	Gyrinidae	18
2016	Dowden	Coleoptera	Psephenidae	3
2016	Dowden	Diptera	Ceratopogonidae	3
2016	Dowden	Diptera	Chironomidae	675
2016	Dowden	Diptera	Simuliidae	18
2016	Dowden	Diptera	Thaumaleidae	1
2016	Dowden	Diptera	Tipulidae	3
2016	Dowden	Ephemeroptera	Baetidae	32
2016	Dowden	Ephemeroptera	Caenidae	1
2016	Dowden	Ephemeroptera	Ephemeridae	6
2016	Dowden	Ephemeroptera	Heptageniidae	48
2016	Dowden	Ephemeroptera	Isonychiidae	30
2016	Dowden	Hemiptera	Corixidae	5
2016	Dowden	Odonata	Aeshnidae	3
2016	Dowden	Odonata	Calopterygidae	4
2016	Dowden	Odonata	Libellulidae	1
2016	Dowden	Odonata	Macromiidae	1
2016	Dowden	Oligochaeta		14
2016	Dowden	Plecoptera	Capniidae	5
2016	Dowden	Plecoptera	Perlidae	20
2016	Dowden	Trichoptera	Hydropsychidae	82

2016	Dowden	Trichoptera	Molannidae	1
2016	Dowden	Trichoptera	Philopotamidae	5
2016	Dowden	Trichoptera	Polycentropodidae	22
2016	Lyles	Coleoptera	Dytiscidae	6
2016	Lyles	Diptera	Chironomidae	8
2016	Lyles	Diptera	Tipulidae	10
2016	Lyles	Ephemeroptera	Heptageniidae	3
2016	Lyles	Hemiptera	Gerridae	1
2016	Lyles	Odonata	Aeshnidae	1
2016	Lyles	Odonata	Coenagrionidae	1
2016	Lyles	Odonata	Corduliidae	1
2016	Lyles	Oligochaeta		2
2016	Lyles	Plecoptera	Perlidae	3
2016	Lyles	Trichoptera	Hydroptilidae	1
2016	Martin	Coleoptera	Dytiscidae	1
2016	Martin	Coleoptera	Elmidae	1
2016	Martin	Diptera	Chironomidae	9
2016	Martin	Ephemeroptera	Baetidae	1
2016	Martin	Ephemeroptera	Caenidae	2
2016	Martin	Ephemeroptera	Ephemeridae	1
2016	Martin	Ephemeroptera	Isonychiidae	1
2016	Martin	Odonata	Aeshnidae	1
2016	Martin	Odonata	LIbellulidae	1
2016	Martin	Oligochaeta		12
2016	Martin	Plecoptera	Perlidae	4
2016	Martin	Turbellaria		1
2016	Tiger	Aranea	Piscuridae	1
2016	Tiger	Diptera	Chironomidae	2
2016	Tiger	Ephemeroptera	Heptageniidae	1
2016	Tiger	Hemiptera	Veliidae	1
2016	Tiger	Odonata	Aeshnidae	1
2016	Tiger	Plecoptera	Perlidae	7
2016	Whiskey	Coleoptera	Elmidae	2
2016	Whiskey	Diptera	Chironomidae	11
2016	Whiskey	Diptera	Simuliidae	1
2016	Whiskey	Ephemeroptera	Baetidae	7
2016	Whiskey	Ephemeroptera	Caenidae	3
2016	Whiskey	Ephemeroptera	Heptageniidae	4
2016	Whiskey	Ephemeroptera	Isonychiidae	8
2016	Whiskey	Ephemeroptera	Leptophlebiidae	1
2016	Whiskey	Hemiptera	Veliidae	2
2016	Whiskey	Odonata	Aeshnidae	2
2016	Whiskey	Odonata	Gomphidae	3
2016	Whiskey	Plecoptera	Perlidae	5
2016	Whiskey	Trichoptera	Hydropsychidae	1

Table G2. Abundances of fish by year, site, and taxa classification.			
Year	Stream	*Genus species*	Abundance
2001	Anacoco	*Aphredoderus sayanus*	1
2001	Anacoco	*Erimyzon oblongus*	13
2001	Anacoco	*Etheostoma chlorosoma*	1
2001	Anacoco	*Etheostoma gracile*	1
2001	Anacoco	*Gambusia affinis*	6
2001	Anacoco	*Lepomis macrochirus*	3
2001	Anacoco	*Lepomis sp.*	1
2001	Anacoco	*Lythrurus umbratilis*	6
2001	Anacoco	*Notemigonus crysoleucas*	1
2001	Anacoco	*Opsopedus emiliae*	1
2001	Birds	*Aphredoderus sayanus*	3
2001	Birds	*Cyprinella venusta*	22
2001	Birds	*Esox americanus*	1
2001	Birds	*Fundulus olivaceus*	8
2001	Birds	*Ichthyomyzon gagei*	3
2001	Birds	*Lepomis megalotis*	3
2001	Birds	*Lythrurus umbratilis*	18
2001	Birds	*Micropterus punctulatus*	2
2001	Birds	*Notropis volucellus*	3
2001	Comrade	*Aphredoderus sayanus*	1
2001	Comrade	*Erimyzon oblongus*	1
2001	Comrade	*Esox americanus*	3
2001	Comrade	*Fundulus olivaceus*	1
2001	Comrade	*Lepomis cyanellus*	2
2001	Comrade	*Lepomis gulosus*	1
2001	Comrade	*Lepomis marginatus*	12
2001	Comrade	*Lepomis punctatus*	2
2001	Comrade	*Lythrurus umbratilis*	17
2001	Comrade	*Notemigonus crysoleucas*	1
2001	Dowden	*Aphredoderus sayanus*	4
2001	Dowden	*Cyprinella venusta*	2
2001	Dowden	*Elassoma zonatum*	1
2001	Dowden	*Etheostoma gracile*	1
2001	Dowden	*Fundulus olivaceus*	1
2001	Dowden	*Lepomis cyanellus*	1
2001	Dowden	*Lepomis macrochirus*	2
2001	Dowden	*Lepomis marginatus*	2
2001	Dowden	*Lythrurus fumeus*	36
2001	Dowden	*Lythrurus umbratilis*	21
2001	Dowden	*Micropterus punctulatus*	2
2001	Dowden	*Minytrema melanops*	2
2001	Little Sandy	*Aphredoderus sayanus*	1
2001	Little Sandy	*Erimyzon oblongus*	14
2001	Little Sandy	*Etheostoma whipplei*	10

2001	Little Sandy	*Fundulus olivaceus*	11
2001	Little Sandy	*Ichthyomyzon gagei*	2
2001	Little Sandy	*Lepomis cyanellus*	10
2001	Little Sandy	*Lepomis marginatus*	5
2001	Little Sandy	*Luxilus chrysocephalus*	5
2001	Little Sandy	*Lythrurus umbratilis*	1
2001	Little Sandy	*Micropterus punctulatus*	1
2001	Little Sandy	*Notropis atrocaudalis*	23
2001	Little Sandy	*Notropis sabinae*	1
2001	Little Sandy	*Noturus phaeus*	8
2001	Little Sandy	*Semotilus atromaculatus*	8
2001	Lyles	*Aphredoderus sayanus*	11
2001	Lyles	*Erimyzon oblongus*	24
2001	Lyles	*Esox americanus*	3
2001	Lyles	*Etheostoma chlorosoma*	11
2001	Lyles	*Etheostoma whipplei*	4
2001	Lyles	*Fundulus olivaceus*	40
2001	Lyles	*Gambusia affinis*	3
2001	Lyles	*Lepomis cyanellus*	7
2001	Lyles	*Lepomis marginatus*	6
2001	Lyles	*Luxilus chrysocephalus*	24
2001	Lyles	*Lythrurus umbratilis*	8
2001	Lyles	*Notropis atrocaudalis*	31
2001	Lyles	*Noturus phaeus*	2
2001	Martin	*Aphredoderus sayanus*	2
2001	Martin	*Cyprinella venusta*	5
2001	Martin	*Erimyzon oblongus*	1
2001	Martin	*Etheostoma chlorosoma*	1
2001	Martin	*Etheostoma gracile*	1
2001	Martin	*Fundulus olivaceus*	13
2001	Martin	*Gambusia affinis*	2
2001	Martin	*Lepomis macrochirus*	6
2001	Martin	*Lepomis marginatus*	12
2001	Martin	*Lepomis megalotis*	1
2001	Martin	*Lepomis punctatus*	1
2001	Martin	*Lythrurus umbratilis*	31
2001	Martin	*Notropis atrocaudalis*	5
2001	Odom	*Cyprinella venusta*	37
2001	Odom	*Etheostoma whipplei*	13
2001	Odom	*Fundulus olivaceus*	12
2001	Odom	*Ichthyomyzon gagei*	5
2001	Odom	*Lepomis cyanellus*	3
2001	Odom	*Lepomis marginatus*	4
2001	Odom	*Luxilus chrysocephalus*	47
2001	Odom	*Lythrurus umbratilis*	12
2001	Odom	*Micropterus punctulatus*	1

2001	Odom	*Notropis atrocaudalis*	3
2001	Odom	*Notropis sabinae*	109
2001	Odom	*Noturus phaeus*	7
2001	Odom	*Semotilus atromaculatus*	2
2001	Tiger	*Erimyzon oblongus*	2
2001	Tiger	*Etheostoma chlorosoma*	1
2001	Tiger	*Fundulus olivaceus*	6
2001	Tiger	*Ichthyomyzon gagei*	1
2001	Tiger	*Lepomis marginatus*	3
2001	Tiger	*Lepomis punctatus*	1
2001	Tiger	*Luxilus chrysocephalus*	15
2001	Tiger	*Lythrurus umbratilis*	26
2001	Tiger	*Notropis atrocaudalis*	2
2001	Tiger	*Notropis sabinae*	3
2001	Tiger	*Noturus phaeus*	1
2001	Tiger	*Semotilus atromaculatus*	1
2001	Whiskey	*Ammocrypta vivax*	3
2001	Whiskey	*Cyprinella venusta*	78
2001	Whiskey	*Fundulus olivaceus*	4
2001	Whiskey	*Gambusia affinis*	3
2001	Whiskey	*Lythrurus umbratilis*	7
2001	Whiskey	*Micropterus punctulatus*	1
2001	Whiskey	*Notropis volucellus*	11
2001	Whiskey	*Noturus nocturnus*	1
2001	Whiskey	*Percina sciera*	1
2002	Birds	*Aphredoderus sayanus*	1
2002	Birds	*Cyprinella venusta*	2
2002	Birds	*Esox americanus*	3
2002	Birds	*Fundulus olivaceus*	10
2002	Birds	*Ichthyomyzon gagei*	5
2002	Birds	*Lepomis marginatus*	7
2002	Birds	*Lepomis megalotis*	6
2002	Birds	*Lepomis miniatus*	2
2002	Birds	*Lythrurus umbratilis*	2
2002	Birds	*Micropterus punctulatus*	1
2002	Birds	*Moxostoma poecilurum*	2
2002	Birds	*Noturus nocturnus*	1
2002	Whiskey	*Ammocrypta vivax*	2
2002	Whiskey	*Cyprinella venusta*	64
2002	Whiskey	*Esox americanus*	1
2002	Whiskey	*Fundulus olivaceus*	14
2002	Whiskey	*Gambusia affinis*	8
2002	Whiskey	*Hybognathus nuchalis*	12
2002	Whiskey	*Lepomis marginatus*	2
2002	Whiskey	*Lepomis megalotis*	11
2002	Whiskey	*Lepomis miniatus*	2

2002	Whiskey	*Lythrurus fumeus*	4
2002	Whiskey	*Lythrurus umbratilis*	7
2002	Whiskey	*Micropterus punctulatus*	7
2002	Whiskey	*Minytrema melanops*	6
2002	Whiskey	*Moxostoma poecilurum*	32
2002	Whiskey	*Notropis sabinae*	22
2002	Whiskey	*Notropis volucellus*	4
2002	Whiskey	*Noturus gyrinus*	1
2002	Whiskey	*Noturus nocturnus*	1
2002	Whiskey	*Percina sciera*	8
2002	Whiskey	*Pimephales vigilax*	5
2012	Anacoco	*Erimyzon oblongus*	4
2012	Anacoco	*Erimyzon sucetta*	1
2012	Anacoco	*Esox americanus*	7
2012	Anacoco	*Gambusia affinis*	6
2012	Anacoco	*Ichthyomyzon fossor*	4
2012	Anacoco	*Labidesthes sicculus*	4
2012	Anacoco	*Lepomis gulosus*	1
2012	Anacoco	*Lepomis marginatus*	5
2012	Anacoco	*Lepomis megalotis*	3
2012	Anacoco	*Micropterus punctulatus*	1
2012	Anacoco	*Pomoxis annularis*	1
2012	Bayou Zuri	*Ameiurus natalis*	4
2012	Bayou Zuri	*Aphredoderus sayanus*	8
2012	Bayou Zuri	*Etheostoma gracile*	3
2012	Bayou Zuri	*Fundulus olivaceus*	12
2012	Bayou Zuri	*Gambusia affinis*	9
2012	Bayou Zuri	*Lepomis gulosus*	1
2012	Bayou Zuri	*Lepomis macrochirus*	1
2012	Bayou Zuri	*Lepomis marginatus*	8
2012	Bayou Zuri	*Lepomis megalotis*	16
2012	Bayou Zuri	*Notropis atrocaudalis*	3
2012	Bayou Zuri	*Percina sciera*	2
2012	Big Brushy	*Aphredoderus sayanus*	6
2012	Big Brushy	*Cyprinella lutrensis*	2
2012	Big Brushy	*Cyprinella venusta*	1
2012	Big Brushy	*Erimyzon sucetta*	8
2012	Big Brushy	*Esox americanus*	2
2012	Big Brushy	*Fundulus olivaceus*	8
2012	Big Brushy	*Gambusia affinis*	2
2012	Big Brushy	*Lepomis cyanellus*	1
2012	Big Brushy	*Lepomis gulosus*	3
2012	Big Brushy	*Lepomis marginatus*	13
2012	Big Brushy	*Lepomis megalotis*	28
2012	Big Brushy	*Notemigonus crysoleucas*	1
2012	Big Brushy	*Notropis atrocaudalis*	9

2012	Big Brushy	*Notropis texanus*	1
2012	Birds	*Aphredoderus sayanus*	4
2012	Birds	*Cyprinella venusta*	3
2012	Birds	*Esox americanus*	3
2012	Birds	*Etheostoma chlorosoma*	1
2012	Birds	*Fundulus olivaceus*	9
2012	Birds	*Lepomis marginatus*	5
2012	Birds	*Lepomis megalotis*	2
2012	Birds	*Micropterus salmoides*	1
2012	Birds	*Moxostoma poecilurum*	1
2012	Birds	*Notropis texanus*	1
2012	Birds	*Notropis volucellus*	3
2012	Birds	*Noturus phaeus*	3
2012	Birds	*Percina sciera*	1
2012	Bundick	*Aphredoderus sayanus*	4
2012	Bundick	*Cyprinella lutrensis*	1
2012	Bundick	*Erimyzon oblongus*	4
2012	Bundick	*Esox americanus*	3
2012	Bundick	*Fundulus olivaceus*	1
2012	Bundick	*Ichthyomyzon fossor*	4
2012	Bundick	*Lepomis macrochirus*	3
2012	Bundick	*Lepomis marginatus*	6
2012	Bundick	*Lepomis miniatus*	2
2012	Bundick	*Micropterus punctulatus*	1
2012	Bundick	*Moxostoma poecilurum*	1
2012	Bundick	*Notropis atrocaudalis*	1
2012	Bundick	*Notropis texanus*	4
2012	Comrade	*Aphredoderus sayanus*	3
2012	Comrade	*Esox americanus*	7
2012	Comrade	*Fundulus olivaceus*	7
2012	Comrade	*Lepomis gulosus*	2
2012	Comrade	*Lepomis marginatus*	17
2012	Comrade	*Lepomis megalotis*	9
2012	Comrade	*Moxostoma poecilurum*	1
2012	Comrade	*Notropis texanus*	3
2012	Dowden	*Ameiurus natalis*	1
2012	Dowden	*Aphredoderus sayanus*	2
2012	Dowden	*Erimyzon oblongus*	1
2012	Dowden	*Fundulus olivaceus*	1
2012	Dowden	*Hybognathus hayi*	5
2012	Dowden	*Labidesthes sicculus*	2
2012	Dowden	*Lepomis cyanellus*	1
2012	Dowden	*Lepomis marginatus*	4
2012	Dowden	*Lepomis megalotis*	9
2012	Dowden	*Micropterus punctulatus*	6
2012	Dowden	*Micropterus salmoides*	2

2012	Dowden	*Notropis texanus*	9
2012	Dowden	*Noturus gyrinus*	6
2012	Drakes	*Aphredoderus sayanus*	6
2012	Drakes	*Cyprinella lutrensis*	2
2012	Drakes	*Esox americanus*	2
2012	Drakes	*Fundulus olivaceus*	11
2012	Drakes	*Lepomis marginatus*	13
2012	Drakes	*Lepomis megalotis*	6
2012	Drakes	*Lepomis miniatus*	3
2012	Drakes	*Micropterus punctulatus*	1
2012	Drakes	*Moxostoma poecilurum*	2
2012	Drakes	*Notropis texanus*	5
2012	East Fork	*Aphredoderus sayanus*	4
2012	East Fork	*Cyprinella venusta*	5
2012	East Fork	*Esox americanus*	3
2012	East Fork	*Fundulus olivaceus*	5
2012	East Fork	*Lepomis cyanellus*	1
2012	East Fork	*Lepomis macrochirus*	4
2012	East Fork	*Lepomis marginatus*	1
2012	East Fork	*Lepomis megalotis*	6
2012	East Fork	*Lepomis miniatus*	8
2012	East Fork	*Micropterus punctulatus*	1
2012	East Fork	*Minytrema melanops*	3
2012	East Fork	*Notropis texanus*	9
2012	East Fork	*Noturus gyrinus*	1
2012	East Fork	*Noturus phaeus*	1
2012	Little Brushy	*Ameiurus natalis*	1
2012	Little Brushy	*Aphredoderus sayanus*	3
2012	Little Brushy	*Erimyzon oblongus*	1
2012	Little Brushy	*Esox americanus*	4
2012	Little Brushy	*Fundulus olivaceus*	18
2012	Little Brushy	*Lepomis cyanellus*	1
2012	Little Brushy	*Lepomis megalotis*	2
2012	Little Brushy	*Lepomis miniatus*	17
2012	Little Brushy	*Moxostoma poecilurum*	1
2012	Little Brushy	*Notropis texanus*	2
2012	Little Brushy	*Noturus gyrinus*	1
2012	Little Sandy	*Aphredoderus sayanus*	3
2012	Little Sandy	*Erimyzon oblongus*	7
2012	Little Sandy	*Erimyzon sucetta*	4
2012	Little Sandy	*Etheostoma chlorosoma*	4
2012	Little Sandy	*Fundulus olivaceus*	5
2012	Little Sandy	*Gambusia affinis*	1
2012	Little Sandy	*Labidesthes sicculus*	4
2012	Little Sandy	*Lepomis cyanellus*	4
2012	Little Sandy	*Lepomis megalotis*	8

2012	Little Sandy	*Notropis atrocaudalis*	4
2012	Little Sandy	*Noturus nocturnus*	1
2012	Lyles	*Ameiurus natalis*	1
2012	Lyles	*Aphredoderus sayanus*	14
2012	Lyles	*Erimyzon sucetta*	22
2012	Lyles	*Fundulus olivaceus*	11
2012	Lyles	*Gambusia affinis*	1
2012	Lyles	*Lepomis cyanellus*	3
2012	Lyles	*Lepomis megalotis*	23
2012	Lyles	*Notemigonus crysoleucas*	3
2012	Lyles	*Notropis atrocaudalis*	13
2012	Lyles	*Notropis texanus*	12
2012	Lyles	*Percina sciera*	1
2012	Martin	*Aphredoderus sayanus*	5
2012	Martin	*Esox americanus*	1
2012	Martin	*Fundulus olivaceus*	1
2012	Martin	*Lepomis gulosus*	2
2012	Martin	*Lepomis macrochirus*	3
2012	Martin	*Lepomis marginatus*	4
2012	Martin	*Lepomis megalotis*	10
2012	Martin	*Lepomis miniatus*	2
2012	Martin	*Micropterus punctulatus*	4
2012	Odom	*Ameiurus natalis*	3
2012	Odom	*Fundulus olivaceus*	6
2012	Odom	*Ichthyomyzon fossor*	4
2012	Odom	*Lepomis cyanellus*	1
2012	Odom	*Lepomis marginatus*	5
2012	Odom	*Lepomis megalotis*	5
2012	Odom	*Micropterus punctulatus*	1
2012	Odom	*Notropis atrocaudalis*	28
2012	Odom	*Notropis sabinae*	9
2012	Odom	*Notropis texanus*	11
2012	Odom	*Notropis volucellus*	12
2012	Odom	*Noturus nocturnus*	16
2012	Odom	*Percina sciera*	1
2012	Tiger	*Ameiurus natalis*	1
2012	Tiger	*Ammocrypta vivax*	3
2012	Tiger	*Fundulus olivaceus*	11
2012	Tiger	*Gambusia affinis*	1
2012	Tiger	*Lepomis cyanellus*	1
2012	Tiger	*Lepomis marginatus*	2
2012	Tiger	*Notropis sabinae*	1
2012	Tiger	*Notropis volucellus*	11
2012	Tiger	*Noturus nocturnus*	3
2012	West Fork	*Aphredoderus sayanus*	1
2012	West Fork	*Cyprinella venusta*	1

2012	West Fork	*Labidesthes sicculus*	4
2012	West Fork	*Lepomis macrochirus*	3
2012	West Fork	*Lepomis marginatus*	2
2012	West Fork	*Lepomis miniatus*	4
2012	West Fork	*Notropis texanus*	1
2012	Whiskey	*Ameiurus natalis*	1
2012	Whiskey	*Aphredoderus sayanus*	7
2012	Whiskey	*Cyprinella lutrensis*	6
2012	Whiskey	*Cyprinella venusta*	12
2012	Whiskey	*Etheostoma chlorosoma*	2
2012	Whiskey	*Fundulus olivaceus*	5
2012	Whiskey	*Gambusia affinis*	2
2012	Whiskey	*Hybognathus hayi*	21
2012	Whiskey	*Labidesthes sicculus*	4
2012	Whiskey	*Lepomis cyanellus*	1
2012	Whiskey	*Lepomis macrochirus*	5
2012	Whiskey	*Micropterus punctulatus*	6
2012	Whiskey	*Minytrema melanops*	1
2012	Whiskey	*Notropis texanus*	1
2012	Whiskey	*Percina sciera*	6
2014	Birds	*Cyprinella venusta*	3
2014	Birds	*Esox americanus*	1
2014	Birds	*Ichthyomyzon gagei*	1
2014	Birds	*Lepomis macrochirus*	1
2014	Birds	*Lepomis miniatus*	2
2014	Birds	*Lythrurus umbratilis*	4
2014	Birds	*Micropterus punctulatus*	1
2014	Birds	*Noturus nocturnus*	1
2014	Bundick	*Aphredoderus sayanus*	6
2014	Bundick	*Esox americanus*	2
2014	Bundick	*Esox niger*	2
2014	Bundick	*Fundulus olivaceus*	1
2014	Bundick	*Gambusia affinis*	1
2014	Bundick	*Lepomis gulosus*	1
2014	Bundick	*Lepomis marginatus*	1
2014	Bundick	*Lepomis megalotis*	8
2014	Bundick	*Lepomis miniatus*	13
2014	Comrade	*Esox americanus*	4
2014	Comrade	*Fundulus olivaceus*	4
2014	Comrade	*Lepomis miniatus*	2
2014	Comrade	*Micropterus punctulatus*	1
2014	Drakes	*Aphredoderus sayanus*	3
2014	Drakes	*Esox americanus*	1
2014	Drakes	*Fundulus olivaceus*	3
2014	Drakes	*Lepomis macrochirus*	2
2014	Drakes	*Lepomis megalotis*	7

2014	Drakes	*Lepomis miniatus*	4
2014	Drakes	*Lythrurus fumeus*	2
2014	Drakes	*Lythrurus umbratilis*	5
2014	Drakes	*Micropterus punctulatus*	3
2014	Drakes	*Minytrema melanops*	2
2014	Drakes	*Moxostoma poecilurum*	1
2014	Indian	*Ameiurus melas*	1
2014	Indian	*Esox americanus*	3
2014	Indian	*Fundulus olivaceus*	2
2014	Indian	*Gambusia affinis*	2
2014	Indian	*Lepomis gulosus*	1
2014	Indian	*Lepomis megalotis*	1
2014	Indian	*Lepomis miniatus*	5
2014	Indian	*Lythrurus fumeus*	1
2014	Prairie	*Esox americanus*	3
2014	Prairie	*Esox niger*	1
2014	Prairie	*Fundulus olivaceus*	6
2014	Prairie	*Ichthyomyzon gagei*	1
2014	Prairie	*Lepomis gulosus*	1
2014	Prairie	*Lepomis miniatus*	12
2014	Prairie	*Lythrurus fumeus*	1
2014	Prairie	*Lythrurus umbratilis*	2
2014	Prairie	*Micropterus punctulatus*	1
2014	Prairie	*Moxostoma poecilurum*	1
2014	West Fork	*Aphredoderus sayanus*	2
2014	West Fork	*Cyprinella venusta*	1
2014	West Fork	*Esox americanus*	2
2014	West Fork	*Fundulus olivaceus*	2
2014	West Fork	*Lepomis megalotis*	1
2014	West Fork	*Lepomis miniatus*	1
2014	West Fork	*Lythrurus umbratilis*	2
2014	West Fork	*Percina sciera*	1
2015	Anacoco	*Erimyzon oblongus*	6
2015	Anacoco	*Etheostoma chlorosoma*	2
2015	Anacoco	*Lepomis macrochirus*	2
2015	Anacoco	*Lepomis marginatus*	1
2015	Anacoco	*Lepomis megalotis*	3
2015	Anacoco	*Lythrurus fumeus*	2
2015	Big Brushy	*Aphredoderus sayanus*	9
2015	Big Brushy	*Erimyzon oblongus*	5
2015	Big Brushy	*Esox americanus*	6
2015	Big Brushy	*Etheostoma chlorosoma*	1
2015	Big Brushy	*Etheostoma gracile*	5
2015	Big Brushy	*Fundulus olivaceus*	11
2015	Big Brushy	*Gambusia affinis*	1
2015	Big Brushy	*Lepomis marginatus*	12

2015	Big Brushy	*Lepomis miniatus*	10
2015	Big Brushy	*Lythrurus fumeus*	5
2015	Big Brushy	*Lythrurus umbratilis*	3
2015	Big Brushy	*MIcropterus salmoides*	1
2015	Big Brushy	*Noturus nocturnus*	10
2015	Big Brushy	*Percina sciera*	2
2015	East Fork	*Aphredoderus sayanus*	2
2015	East Fork	*Cyprinella venusta*	1
2015	East Fork	*Fundulus olivaceus*	4
2015	East Fork	*Ichthyomyzon gagei*	1
2015	East Fork	*Lepomis macrochirus*	1
2015	East Fork	*Lythrurus umbratilis*	2
2015	East Fork	*Notropis texanus*	1
2015	East Fork	*Percina sciera*	1
2015	Little Brushy	*Erimyzon oblongus*	1
2015	Little Brushy	*Esox americanus*	1
2015	Little Brushy	*Fundulus olivaceus*	2
2015	Little Brushy	*Lepomis miniatus*	2
2015	Little Sandy	*Aphredoderus sayanus*	7
2015	Little Sandy	*Erimyzon oblongus*	4
2015	Little Sandy	*Etheostoma whipplei*	6
2015	Little Sandy	*Fundulus olivaceus*	9
2015	Little Sandy	*Ichthyomyzon gagei*	5
2015	Little Sandy	*Lepomis cyanellus*	5
2015	Little Sandy	*Lepomis marginatus*	2
2015	Little Sandy	*Lepomis miniatus*	1
2015	Little Sandy	*Lythrurus umbratilis*	2
2015	Odom	*Ameiurus natalis*	1
2015	Odom	*Cyprinella venusta*	9
2015	Odom	*Erimyzon oblongus*	1
2015	Odom	*Etheostoma gracile*	2
2015	Odom	*Etheostoma whipplei*	1
2015	Odom	*Fundulus olivaceus*	1
2015	Odom	*Ichthyomyzon gagei*	5
2015	Odom	*Lepomis cyanellus*	1
2015	Odom	*Lepomis miniatus*	1
2015	Odom	*Lythrurus umbratilis*	2
2015	Odom	*Notropis sabinae*	4
2015	Odom	*Noturus phaeus*	21
2015	Odom	*Percina sciera*	1
2016	Bayou Zuri	*Ameiurus melas*	1
2016	Bayou Zuri	*Ameiurus natalis*	3
2016	Bayou Zuri	*Aphredoderus sayanus*	7
2016	Bayou Zuri	*Erimyzon oblongus*	2
2016	Bayou Zuri	*Esox americanus*	1
2016	Bayou Zuri	*Etheostoma gracile*	2

2016	Bayou Zuri	*Fundulus olivaceus*	19
2016	Bayou Zuri	*Gambusia affinis*	2
2016	Bayou Zuri	*Lepomis macrochirus*	20
2016	Bayou Zuri	*Lepomis megalotis*	21
2016	Bayou Zuri	*Lepomis miniatus*	2
2016	Bayou Zuri	*Lepomis spp.*	1
2016	Bayou Zuri	*Lythrurus fumeus*	8
2016	Bayou Zuri	*Micropterus punctulatus*	1
2016	Bayou Zuri	*Notropis atrocaudalis*	1
2016	Bayou Zuri	*Notropis texanus*	3
2016	Bayou Zuri	*Noturus phaeus*	2
2016	Bayou Zuri	*Percina maculata*	1
2016	Bayou Zuri	*Percina sciera*	1
2016	Dowden	*Aphredoderus sayanus*	10
2016	Dowden	*Elassoma zonatum*	4
2016	Dowden	*Erimyzon oblongus*	2
2016	Dowden	*Esox americanus*	2
2016	Dowden	*Etheostoma artesiae*	1
2016	Dowden	*Fundulus olivaceus*	4
2016	Dowden	*Gambusia affinis*	1
2016	Dowden	*Lepomis gulosus*	2
2016	Dowden	*Lepomis megalotis*	16
2016	Dowden	*Lepomis miniatus*	7
2016	Dowden	*Lepomis spp.*	1
2016	Dowden	*Lythrurus fumeus*	1
2016	Dowden	*Noturus phaeus*	2
2016	Lyles	*Ameiurus melas*	3
2016	Lyles	*Ameiurus natalis*	3
2016	Lyles	*Aphredoderus sayanus*	24
2016	Lyles	*Erimyzon oblongus*	12
2016	Lyles	*Esox americanus*	6
2016	Lyles	*Etheostoma artesiae*	2
2016	Lyles	*Etheostoma chlorosoma*	2
2016	Lyles	*Fundulus hybrid*	9
2016	Lyles	*Fundulus notatus*	5
2016	Lyles	*Fundulus olivaceus*	3
2016	Lyles	*Gambusia affinis*	2
2016	Lyles	*Ichthyomyzon gagei*	3
2016	Lyles	*Lepomis cyanellus*	9
2016	Lyles	*Lepomis hybrid*	1
2016	Lyles	*Lepomis marginatus*	24
2016	Lyles	*Lepomis megalotis*	6
2016	Lyles	*Luxilus chrysocephalus*	10
2016	Lyles	*Lythrurus umbratilis*	22
2016	Lyles	*Notropis atrocaudalis*	8
2016	Lyles	*Noturus phaeus*	3

2016	Lyles	*Semotilus atromaculatus*	1
2016	Martin	*Cyprinella venusta*	1
2016	Martin	*Fundulus olivaceus*	8
2016	Martin	*Ichthyomyzon gagei*	2
2016	Martin	*Lepomis macrochirus*	1
2016	Martin	*Lepomis megalotis*	7
2016	Martin	*Lepomis miniatus*	3
2016	Martin	*Lythrurus fumeus*	6
2016	Tiger	*Cyprinella venusta*	11
2016	Tiger	*Etheostoma artesiae*	2
2016	Tiger	*Etheostoma chlorosoma*	1
2016	Tiger	*Etheostoma gracile*	7
2016	Tiger	*Fundulus olivaceus*	4
2016	Tiger	*Gambusia affinis*	2
2016	Tiger	*Hybopsis amnis*	1
2016	Tiger	*Ichthyomyzon gagei*	1
2016	Tiger	*Lepomis cyanellus*	7
2016	Tiger	*Lepomis macrochirus*	5
2016	Tiger	*Lepomis marginatus*	5
2016	Tiger	*Luxilus chrysocephalus*	10
2016	Tiger	*Lythrurus umbratilis*	3
2016	Tiger	*Noturus phaeus*	9
2016	Tiger	*Percina maculata*	1
2016	Tiger	*Semotilus atromaculatus*	5
2016	Whiskey	*Aphredoderus sayanus*	3
2016	Whiskey	*Cyprinella venusta*	8
2016	Whiskey	*Etheostoma chlorosoma*	1
2016	Whiskey	*Fundulus olivaceus*	8
2016	Whiskey	*Hybopsis amnis*	1
2016	Whiskey	*Ichthyomyzon gagei*	5
2016	Whiskey	*Lepomis megalotis*	12
2016	Whiskey	*Lepomis miniatus*	10
2016	Whiskey	*Lythrurus fumeus*	9
2016	Whiskey	*Percina sciera*	2