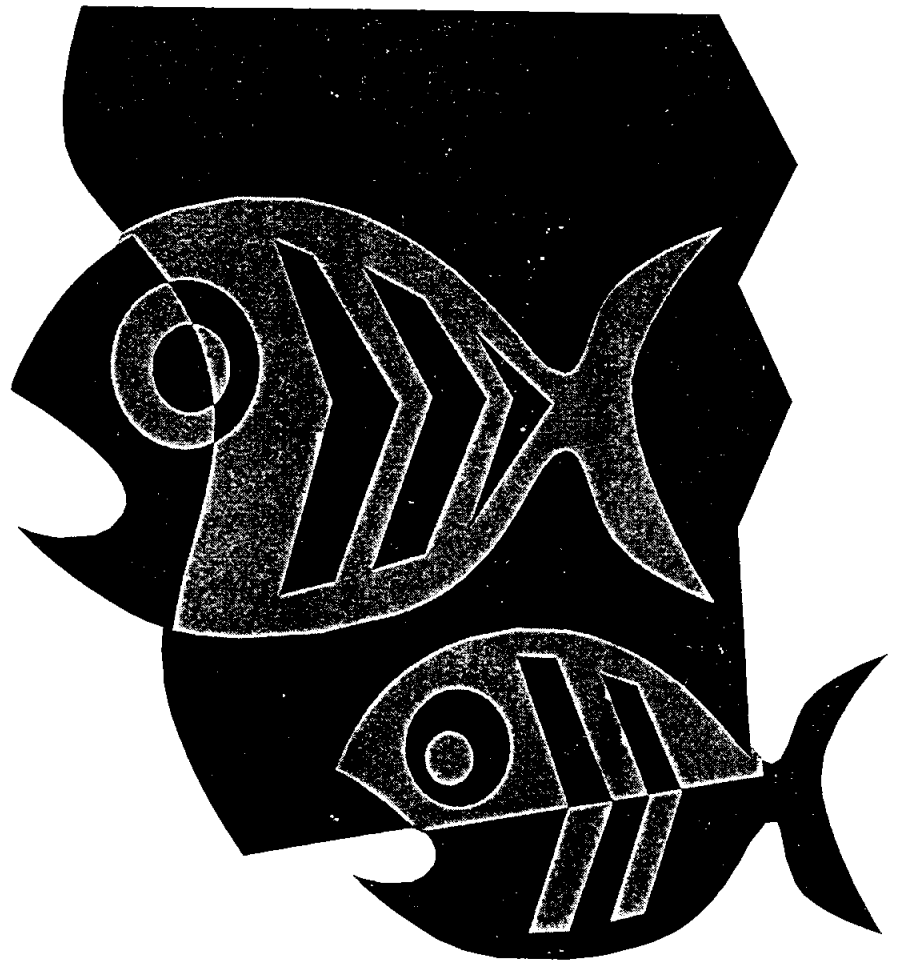


2/28/2000

# MISSOURI STATE PARKS FISH FAUNAL SURVEY

University of Missouri-Columbia  
Department of Fisheries and Wildlife Sciences

Jason C. Vokoun and Douglas B. Noltie



---

302 Anheuser-Busch Natural Resources Building  
Columbia, Missouri 65211-7240

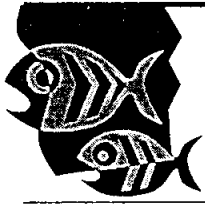
---

Phone: 573-882-3436  
Fax: 573-884-5070  
Email: [jasonvokoun@hotmail.com](mailto:jasonvokoun@hotmail.com)

1

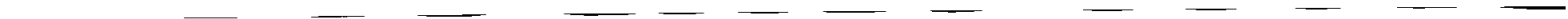
Please Cite:

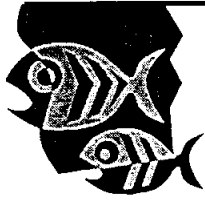
Vokoun, J. C. and D. B. Noltie. 2000. Missouri state parks fish faunal survey. University of Missouri, Department of Fisheries and Wildlife Sciences. Completion Report. Columbia, Missouri. 169 pp.



## TABLE OF CONTENTS

Executive Summary	3
Introduction	5
Ozark Faunal Region, Neosho Division	9
Big Sugar Creek	11
Ozark Faunal Region, White Division	17
Roaring River	19
Ozark Faunal Region, Black Division	27
Montauk	29
Johnson's Shut-Ins	39
Taum Sauk Mountain	45
Ozark Faunal Region, Southeast Division	49
Sam A. Baker	51
Ozark Faunal Region, Mississippi Division	63
St. Francois	65
Hawn	77
Washington	85
Meramec	93
Ozark Faunal Region, Missouri Division	97
Graham Cave	99
Ha-Ha Tonka	107
Bennett Spring	115
Prairie Faunal Region, Mississippi Division	121
Civre River	123
Prairie Faunal Region, Lower Missouri Division	133
Rock Bridge Memorial	135
Prairie Faunal Region, Osage Division	147
Prairie	149
References	157
Appendix 1	159
Appendix 2	165





## EXECUTIVE SUMMARY

The fish fauna of sixteen Missouri state parks was sampled during 1999 to provide baseline data on the species present, relative numbers, and habitat types used. For many of the parks this was the first comprehensive survey undertaken. The survey also identified crayfish species and collected relic mussel shells when encountered.

The survey centered on state parks with headwaters, creeks, and small rivers flowing through or bordering the park. We did not sample large rivers such as the Meramec and Niangua. Parks surveyed were chosen by Department of Natural Resources personnel. Considerable effort was expended to provide coverage throughout each park. Fish and crayfish were identified on site and released live whenever possible.

When possible, comparisons were made with historic samples in or near the parks. The historic samples were obtained from the Missouri Department of Conservation and the Department of Natural Resources.

This report is formatted to follow the aquatic community classification system developed by Dr. William Pflieger (1989a, 1989b). Pflieger's aquatic faunal regions are separated into four main cate-

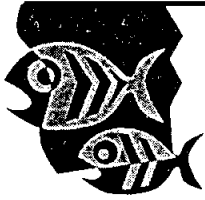
gories, big river, lowland, Ozark, and prairie. These four regions are further broken down into divisions which are delineated by a typical suite of species. No parks with flowing water resources are found in the Lowland Aquatic Faunal Region. Our survey methods were inappropriate for the Big River Aquatic Faunal Region. As a result, parks in this report are only from the Prairie and Ozark Aquatic Faunal Regions.

Presented in table form are the numbers of individuals captured for each fish species for each stream in a given park, including the corresponding species richness and Shannon-Wiener diversity index. The fish assemblage is also presented by habitat type, with fish being recorded as being captured in either riffle, run, pool, or backwater habitat types. The relative abundance of fish species within this habitat types is presented as a percent composition.

No fish species of special conservation concern were found during the survey. Of the 22 species of fish globally restricted in range to the Ozark uplift (Missouri-Arkansas, and portions of neighboring states), 11 occurred in the state park system. Two of the four fish species endemic to the state of Missouri were represented in state parks, the brook darter, and Missouri saddled darter. Four endemic crayfish species were found in state park waters, the woodland crayfish,

---

St. Francis River crayfish, saddlebacked crayfish, and belted crayfish. Two of these species, the Belted and St. Francis River crayfish are listed as being of conservation concern in Missouri. William's crayfish, known from Roaring River State Park, is also listed as being of conservation concern in Missouri, albeit not endemic to the state.



## INTRODUCTION

The fish fauna of sixteen Missouri state parks was sampled during 1999 to provide baseline data on the species present, relative numbers, and habitat types used. For many of the parks this was the first comprehensive survey done. The survey also identified crayfish species and collected relic mussel shells when encountered.

The survey centered on state parks with headwaters, creeks, and small rivers flowing through or bordering the park. We did not sample large rivers such as the Meramec and Niangua. Parks surveyed were chosen by Department of Natural Resources personnel.

When possible, comparisons were made with historic samples in or near the parks. The historic samples were obtained from the Missouri Department of Conservation and the Department of Natural Resources.

### **Methods**

Parks were surveyed using three sampling methods; seine (drag and kick), visual identification, and backpack electrofishing. All three methods were not appropriate at each locale. Seine and visual identification were used more often than the backpack electrofisher. Sample sites were typically 250 m lengths of stream,

but varied based on site-specific logistic considerations. The length of stream and continuous sampling time were recorded for each sample. Appendix 2 displays sample-specific parameters to allow for future comparison and repetition. Sampling was conducted at multiple sites within each park. Park naturalists and staff were questioned about the variety of habitats in the park, and particular sites of interest they would like to have sampled. Considerable effort was expended to provide coverage throughout each park.

Fish and crayfish were identified on site and released live whenever possible. Some species are difficult to identify in the field, and limited numbers had to be retained for lab identification under a microscope. These specimens will be used in the University of Missouri teaching collection. Specimens that were difficult to identify were compared to specimens in the University of Missouri Fish Museum and were examined by Dr. Matthew Winston of the Missouri Department of Conservation.

### **Format**

This report is formatted to follow the aquatic community classification system developed by Dr. William Pflieger (1989a, 1989b). These aquatic faunal regions follow rather closely the ecoregions of Missouri as defined by Omernik (1987). Pflieger's aquatic faunal regions are separated into four main categories,

big river, lowland, Ozark, and prairie. These four regions are further broken down into divisions which are delineated by a typical suite of species. These divisions and the state parks we surveyed which occur within them are listed in Table 0.1. State parks do occur in other divisions, but they were not sampled because the parks either had very limited flowing water resources, had been recently sampled, or were adjacent to big rivers that required more sampling effort than the scope of this survey allowed.

The fish community information has been organized into three levels. First, a species list with total numbers captured for each stream surveyed in a park is included. Species richness and Shannon-Wiener diversity indices are included for each stream. Second, species are also listed by habitat type. We recorded fish captures as coming from four stream habitat types generally accepted in the stream literature and which are readily distinguishable. They are pool, riffle, run, and backwater. We further distinguished backwaters as being connected or non-connected. Non-connected backwaters are those which occur away from the main channel, and do not have a surface water connection with the main channel except at elevated flows. Thirdly, the relative abundance of the species found in a stream are presented as percent composition within habitat types, allowing inter-

**Table 0.1.** State Parks sampled, arranged by the associated Aquatic Faunal Region and Division as described by Pflieger (1989a).

Aquatic Faunal Region	Division	State Parks sampled
Big River	Missouri River	
	Upper Mississippi River	
	Middle Mississippi River	
	Lower Mississippi River	
Lowland	Flowing Waters	
	Standing Waters	
	Crowley's Ridge Creeks	
Ozark	Neosho	Big Sugar Creek
	White	Roaring River
	Black	Montauk
		Johnson's Shut-Ins
		Taum Sauk Mountain
	Southeast	Sam A. Baker
	Mississippi	St. Francois
		Hawn
		Washington
		Meramec
Prairie	Missouri	Graham Cave
		Ha-Ha Tonka
		Bennet Spring
	Mississippi	Cuivre River
	Lower Missouri	Rockbridge Memorial
	Upper Missouri	
	Osage	Priarie
Neosho		



---

pretation of rare, common, and abundant status.

Crayfish and discovered relic mussels are presented as a species list for each stream sampled. We examined all crayfish encountered during our sampling, but did not specifically target crayfish species that burrow or are difficult to capture with fish sampling gears.

Fish and crayfish species are referred to in the text by common name, however the latin binomial for species found in the parks are listed in the tables found throughout the report.

### **Interpretation**

This information reveals several aspects of fish biodiversity in Missouri state parks. First, stream-specific species lists are representative of alpha diversity, or within habitat diversity (Whittaker 1972, Karr 1976). Streams within the same drainage or in a homogeneous region can be expected to have similar species richness and composition. For example, two headwater streams in the Ozark Mississippi division were sampled, Connville Creek and Beaver Creek. These two streams contained 16 and 19 species, respectively, and had 12 species in common.

This survey also provides diversity information at a larger scale. By comparing communities across diverse environmental gradients, we are measuring beta diversity. Probably the most important

gradient influencing stream fishes at the beta diversity level is stream size. Species diversity and composition change as streams travel from headwaters through creeks and small rivers until they ultimately become part of a large river. State park holdings include communities through a range of stream size. It becomes increasingly difficult to protect or manage stream habitat as stream size increases, because a stream exists in balance with its valley and is impacted by land use both upstream and down (Hynes 1975). The drainage basin of the Niangua River, for example, is easily tenfold the size of the state parks within it. On the other end of the spectrum, several state parks encompass in total or large percentages of headwater and small creek valleys, and by doing so exhibit a substantial amount of management potential.

Gamma diversity is addressed when species are considered at a regional and global level. This report addresses gamma diversity by placing the parks into the Aquatic Faunal Regions and Divisions developed for the State of Missouri. We have also highlighted species that are endemic, restricted in range, or are of conservation concern in North America.

Genetic diversity is often considered an important conservation goal beyond the previous alpha, beta, and gamma concepts which focus on species composition and richness. The variety of habits,

---

behaviors, and ecosystem functions of the fish species found in the state park system are all rooted in genetic code. Appendix 1 addresses the known variety of trophic function and reproductive diversity found in the fish species surveyed during this project.

It is our hope that the Department of Natural Resources can use this report to begin to monitor, continue to protect, and provide aquatic biodiversity for the public trust and heritage of Missouri.

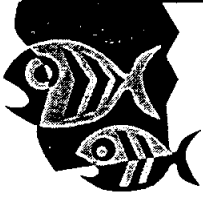
#### **Acknowledgements**

We wish to thank the Missouri Department of Natural Resources, which provided major funding. Mike Currier, with the Department of Natural Resources was the impetus for this survey and functioned as a liaison. There are far too many people to name individually, but the park naturalists, superintendents, and staff who assisted us on location are a wonderful group of people with a passion for the resources they are given in trust. Dr. Matthew Winston, of the Missouri Department of Conservation, graciously lent his time to share with us his knowledge of community fish sampling and field work. Doug Dieterman, Kim Stork, and Brett Redwine assisted in the field on occasion. Charles Rabeni provided editorial comments as well as support and advice throughout the project.

This is a contribution of the Missouri Cooperative Fish and Wildlife Re-

search Unit (USGS Biological Resources Division, Missouri Department of Conservation, University of Missouri, and the Wildlife Management Institute cooperating). Support in part also came from the University of Missouri Agricultural Experiment Station, Department of Fisheries and Wildlife Sciences, and the School of Natural Resources.

Last but certainly not least, Heather Heitz assisted with every field collection made during this survey, sorted and assisted with the identification of preserved specimens, and entered all raw data into the project database. While Heather returned to classwork during the writing of this report, she is to be included in the "we" found throughout this document.



## PRAIRIE

Prairie State Park is considered part of the Prairie Aquatic Faunal Region, Osage Division by Pflieger (1989a). The Prairie Osage Division is underlain by the Prairie Osage physiographic region, which is composed of beds of shale, sandstone, and limestone. Local relief is low, giving rise to a gently rolling landscape. Prairie State Park is the largest contiguous prairie found in Missouri, and its streams are perhaps the most pristine remaining examples of prairie headwaters. Most prairie headwaters in this region are degraded from agricultural activities. The streams of the park are highly vegetated (water willow and cordgrass) and when undisturbed run clear. Beaver have built cattail/earthen dams which create deep pool habitat in first and second order streams.

No fish species are restricted to this division and species diversity is lower than in most other divisions. The fish assemblage is composed mainly of widespread generalist species. Some predominantly Ozark species are found here as well, including the greenside darter.

### Physical characteristics

Aspects of the physical habitat present in Prairie State Park were measured/estimated and are reported in table 16.1. No obvious degradation to the

physical habitat of the stream channels was observed. The small portion of West Drywood Creek that flows through the park has evidence of downcutting, which has exposed raw soil along the banks. However, it appeared at the time of our survey that woody vegetation was reclaiming some of the eroded areas. East and Middle Drywood Creeks exhibit no perceptible erosion.

### Aquatic Biota

Fish surveys in Prairie State Park were accomplished during daylight hours. Samples 1001 and 1002 were conducted on July 21, 1999 using kick and drag seine. Sample 1003 used a backpack electrofisher on July 22, 1999. Samples 1004, 1005, 1006, and 1007 also took place on July 22, but used kick and drag seine. Sample locations are displayed in Figure 16.1.

Fish species results are presented in Table 16.2. Tables 16.4, 16.5, and 16.6 display the fish community relative abundance as percent composition by habitat type for East Drywood, Middle Drywood, and West Drywood Creeks, respectively. No formal fish surveys were conducted historically on the streams found in Prairie State Park. Crayfish species are reported in Table 16.3. One mussel species was identified from relict shells collected in West Drywood Creek, giant floater *Pyganodon grandis* (Cummings and Mayer 1992).

Twenty-four species of fish were surveyed in the park. The headwater streams found in the park contain no species restricted in range or threatened either globally or within the state of Missouri. The streams do however, contain above average species richness for the Prairie

Osage division. Headwaters in this division averaged 9.5 species, and ranged from 2 to 20. Small rivers in this division averaged 14.4 species, suggesting that the streams in Prairie State Park are in quite good condition.

Our capture of golden crayfish is

**Table 16.1.** Selected physical characteristics for sample sites 1001, 1002, and 1004 at East Drywood Creek, 1003 and 1007 at Middle Drywood Creek, and 1005 at West Drywood Creek, all in Barton county.

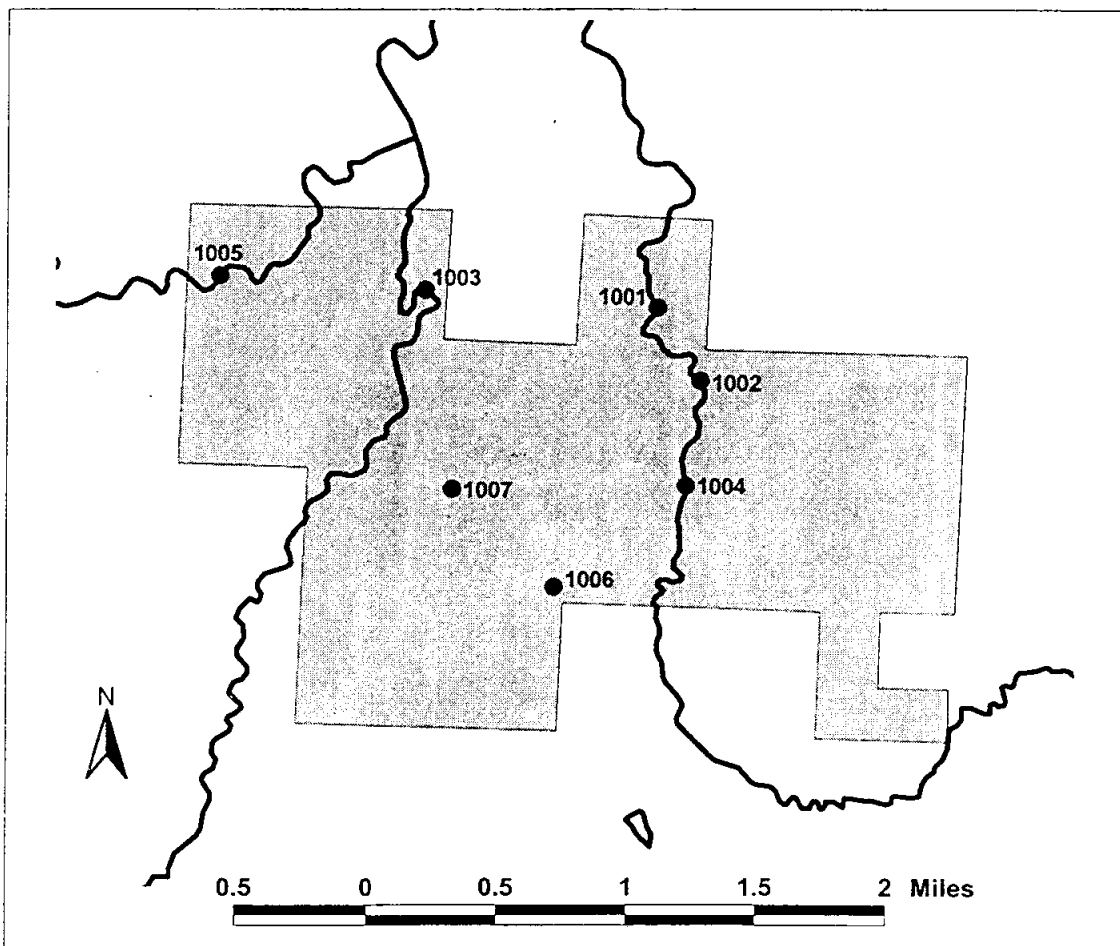
	1001	1002	1004	1003	1007	1005
<i>Channel</i>						
Est. width (m)	4	4	2	3	2	5
Est. depth riffle (m)				0.02		0.08
Est. depth run (m)				0.05		0.15
Est. depth pool (m)	1.25	1.5	1	0.6	1	1
<i>Water Quality</i>						
Stream temp (C)	31.6	31.1	31.5	26.6	32.3	29.1
Stream pH	9.9	10.7	11.7	11.6	11.5	11.6
Conductivity ( $\mu$ S)	125	126	194	1942	1354	1830
Dissolved oxygen (mg/L)						
<i>Substrate</i>						
Est. % bedrock	25	50	50	40	20	15
Est. % boulder	5	5	15		5	5
Est. % cobble	20	5	15	20	5	
Est. % gravel				5		50
Est. % sand	20	30		10	25	15
Est. % silt	25				25	
Est. % clay				20		10
Est. % detritus	5	5	15	5	10	5
Est. % muck-mud		5	5		10	
Est. % marl						
<i>Watershed</i>						
Riparian vegetation width	>18	>18	>18	6-12	>18	>18
Bank erosion	None	None	None	Moderate	Moderate	Moderate
Sediment deposits	Sand	Sand	Sand	Sand	Sand	Sand

**Table 16.2.** Total number captured per species, species richness and Shannon-Wiener diversity index for samples 1001, 1002, and 1004 at East Drywood Creek, 1003, 1006, and 1007 at Middle Drywood Creek, 1005 at West Drywood Creek, all in Barton County.

		1001	1002	1004	1003	1006	1007	1005
Common name	Scientific name							
central stoneroller	<i>Campostoma anomalum</i>			1	8	17		9
red shiner	<i>Cyprinella lutrensis</i>							9
redfin shiner	<i>Lythrurus umbratilis</i>							20
golden shiner	<i>Notemigonus crysoleucas</i>	5		24				
sand shiner	<i>Notropis stramineus</i>							3
suckermouth minnow	<i>Phenacobius mirabilis</i>							4
creek chub	<i>Semotilus atromaculatus</i>				8	5		3
white sucker	<i>Catostomus commersoni</i>		1					
golden redhorse	<i>Moxostoma erythrurum</i>		3					
black bullhead	<i>Ameiurus melas</i>					2		
yellow bullhead	<i>Ameiurus natalis</i>		2	10	1		1	1
channel catfish	<i>Ictalurus punctatus</i>							1
slender madtom	<i>Noturus exilis</i>				10			3
blackstriped topminnow	<i>Fundulus notatus</i>	13		20	1	6	7	
mosquitofish	<i>Gambusia affinis</i>	1						1
brook silverside	<i>Labidesthes sicculus</i>	17	14	42				7
green sunfish	<i>Lepomis cyanellus</i>		1	2	7	1	3	1
warmouth	<i>Lepomis gulosus</i>			1		1		1
orangespotted sunfish	<i>Lepomis humilis</i>				1			
bluegill	<i>Lepomis macrochirus</i>	13	12	4		1	4	2
longear sunfish	<i>Lepomis megalotis</i>	2	6	3	1		12	11
largemouth bass	<i>Micropterus salmoides</i>	3	1	10		8	2	2
greenside darter	<i>Etheostoma blenniodes</i>							1
orangethroat darter	<i>Etheostoma spectabile</i>	1		1	14			12
<b>Shannon-Wiener Diversity Index</b>			1.957			2.281		2.451
<b>Species Richness</b>			14			13		18

**Table 16.3.** Crayfish species encountered for sample sites 1001, 1002, and 1004 at East Drywood Creek, 1003, 1006, and 1007 at Middle Drywood Creek, and 1005 at West Drywood Creek, all in Barton County.

		1001	1002	1004	1003	1006	1007	1005
common	scientific							
golden crayfish	<i>Orconectes luteus</i>				X			
Northern crayfish	<i>Orconectes virilis</i>		X	X	X	X	X	X



**Figure 16.1.** Site map for Prairie State Park.

**Table 16.4.** Total species number, percent composition, and numerical range by habitat type for samples 1001, 1002, and 1004 at East Drywood Creek, Barton county.

Common name	Scientific name	Pool		
		total	%	range n=11
central stoneroller	<i>Campostoma anomalum</i>	1	0.5	0-1
golden shiner	<i>Notemigonous crysoleucas</i>	29	13.6	0-19
white sucker	<i>Catostomus commersoni</i>	1	0.5	0-1
golden redhorse	<i>Moxostoma erythrurum</i>	3	1.4	0-3
yellow bullhead	<i>Ameiurus natalis</i>	12	5.6	0-9
blackstriped topminnow	<i>Fundulus notatus</i>	33	15.5	0-9
mosquitofish	<i>Gambusia affinis</i>	1	0.5	0-1
brook silverside	<i>Labidesthes sicculus</i>	73	34.3	0-15
green sunfish	<i>Lepomis cyanellus</i>	3	1.4	0-1
warmouth	<i>Lepomis gulosus</i>	1	0.5	0-1
bluegill	<i>Lepomis macrochirus</i>	29	13.6	0-12
longear sunfish	<i>Lepomis megalotis</i>	11	5.2	0-6
largemouth bass	<i>Micropterus salmoides</i>	14	6.6	0-5
orangethroat darter	<i>Etheostoma spectabile</i>	2	0.9	0-1

the western most recent record for this species in Missouri (Pflieger 1996).

**Table 16.5.** Total species number, percent composition, and numerical range by habitat type for samples 1003, 1006, and 1007 at Middle Drywood Creek, Barton county.

Common name	Scientific name	Pool			Riffle		
		total	%	range N=10	total	%	range n=4
central stoneroller	<i>Campostoma anomalum</i>	17	18.1	0-17	8	29.6	0-5
creek chub	<i>Semotilus atromaculatus</i>	11	11.7	0-5	2	7.4	0-1
black bullhead	<i>Ameiurus melas</i>	2	2.1	0-2			
yellow bullhead	<i>Ameiurus natalis</i>	2	2.1	0-1			
slender madtom	<i>Noturus exilis</i>	7	7.4	0-4	3	11.1	0-2
blackstriped topminnow	<i>Fundulus notatus</i>	14	14.9	0-6			
green sunfish	<i>Lepomis cyanellus</i>	10	10.6	0-2	1	3.7	0-1
warmouth	<i>Lepomis gulosus</i>	1	1.1	0-1			
orangespotted sunfish	<i>Lepomis humilis</i>	1	1.1	0-1			
bluegill	<i>Lepomis macrochirus</i>	5	5.3	0-3			
longear sunfish	<i>Lepomis megalotis</i>	13	13.8	0-11			
largemouth bass	<i>Micropterus salmoides</i>	10	10.6	0-8			
orangethroat darter	<i>Etheostoma spectabile</i>	1	1.1	0-1	13	48.1	0-7



**Table 16.6.** Total species number, percent composition, and numerical range by habitat type for samples 1005 at West Drywood Creek, Barton county.

Common name	Scientific name	Pool			Riffle			Run		
		total	%	range n=5	total	%	range n=5	total	%	range n=1
central stoneroller	<i>Campostoma</i>	2	3.9	0-2	4	13.8	0-2	3	27.3	
red shiner	<i>Cyprinella lutrensis</i>	4	7.8	0-4	5	17.2	0-3			
redfin shiner	<i>Lythrurus umbratilis</i>	16	31.4	0-11				4	36.4	
sand shiner	<i>Notropis stramineus</i>				2	6.9	0-2	1	9.1	
suckermouth	<i>Phenacobius mirabilis</i>				2	6.9	0-2	2	18.2	
creek chub	<i>Semotilus</i>	3	5.9	0-3						
yellow bullhead	<i>Ameiurus natalis</i>	1	2.0	0-1						
channel catfish	<i>Ictalurus punctatus</i>	1	2.0	0-1						
slender madtom	<i>Noturus exilis</i>				3	10.3	0-2			
mosquitofish	<i>Gambusia affinis</i>				1	3.4	0-1			
brook silverside	<i>Labidesthes sicculus</i>	7	13.7	0-4						
green sunfish	<i>Lepomis cyanellus</i>	1	2.0	0-1						
warmouth	<i>Lepomis gulosus</i>	1	2.0	0-1						
bluegill	<i>Lepomis macrochirus</i>	2	3.9	0-2						
longear sunfish	<i>Lepomis megalotis</i>	10	19.6	0-10	1	3.4	0-1			
largemouth bass	<i>Micropterus salmoides</i>	2	3.9	0-2						
greenside darter	<i>Etheostoma</i>				1	3.4	0-1			
orangethroat darter	<i>Etheostoma spectabile</i>	1	2.0	0-1	10	34.5	1-3	1	9.1	

Appendix Table 2.1 continued

Sample	Stream	State Park	Date	Gear	Site Length	Effort (hrs)
701	Big Sugar	Big Sugar Creek	7/8/99	Kick and Drag Seine	250	2.5
702	Big Sugar Creek	Big Sugar Creek	7/8/99	Kick and Drag Seine	150	1.75
801	Sugar Creek	Cuivre River	7/13/99	Backpack Electrofishing	50	0.75
802	Sugar Creek	Cuivre River	7/13/99	Kick and Drag Seine	250	3
803	Sugar Creek	Cuivre River	7/13/99	Kick and Drag Seine	100	1
804	Sugar Creek	Cuivre River	7/14/99	Kick and Drag Seine	200	2.5
805	Sugar Creek	Cuivre River	7/14/99	Kick and Drag Seine	300	3
806	Cuivre River	Cuivre River	7/15/99	Kick and Drag Seine	150	1.5
901	Loutre River	Graham Cave	7/20/99	Kick and Drag Seine	75	0.75
902	Loutre River	Graham Cave	7/20/99	Kick and Drag Seine	75	1
903	Loutre River	Graham Cave	7/20/99	Kick and Drag Seine	75	1
1001	East Drywood Creek	Prairie	7/21/99	Kick and Drag Seine	100	1
1002	East Drywood Creek	Prairie	7/21/99	Kick and Drag Seine	50	0.75
1003	Middle Drywood Creek	Prairie	7/22/99	Backpack Electrofishing	150	1.67
1004	East Drywood Creek	Prairie	7/22/99	Kick and Drag Seine	400	3
1005	West Drywood Creek	Prairie	7/22/99	Kick and Drag Seine	250	2.5
1006	Middle Drywood Creek	Prairie	7/22/99	Kick and Drag Seine	25	0.5
1007	Middle Drywood Creek	Prairie	7/22/99	Kick and Drag Seine	100	0.8
1101	East Fork Black River	Johnson's Shut-Ins	7/27/99	Kick and Drag Seine	200	2