DISTRIBUTION OF FISHES IN REFERENCE STREAMS WITHIN ARKANSAS' ECOREGIONS

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ABSTRACT

The State of Arkansas has been subdivided into six ecoregions based on the homogeneity of land surface forms, potential natural vegetation, soil types and land uses. Reference streams of various sizes, excluding the large rivers, and with the least amount of point source and non-point source disturbances were selected for intensive physical, chemical and biological sampling. This data is to be used to characterize the streams and establish water quality criteria which will protect all stream uses. Fish populations of the reference streams are distinctively different among the ecoregions and can easily be used to characterize the waters of different ecoregions. Although composed of different species, the composition of trophic feeding levels of the fish populations is very similar among the ecoregions. The average number of species collected per sample site is similar among the ecoregions; however, the Arkansas River Valley and the Gulf Coastal ecoregions have the greatest species richness and the Delta ecoregion is the lowest in species richness. Species of fish sensitive to environmental change comprise near 50% or more of the population relative abundance in the Boston Mountains, Ozark Highlands and Ouachita Mountains ecoregions. Delta ecoregion fish populations contain less than 1% sensitive species. Comparisons of the ten most abundant species from each ecoregion by use of a similarity index shows very little similarity among the ecoregions. The Ouachita Mountains and Boston Mountains populations are most similar and the Ozark Highlands versus Delta and Ozark Highlands versus Gulf Coastal are least similar.

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INTRODUCTION

The delineation of regions that are distinctly homogeneous has been done by resource managers for decades in an effort to more efficiently manage a variety of natural resources. Many of the early attempts established physiographic regions based on geographic characteristics, regions of similar vegetation type and regions of various land use patterns. These were all single character classifications with specific needs in mind. Later, in an attempt to characterize ecological relationships, several workers incorporated various combinations of multiple characteristics such as soils, climate, water resource, vegetation, land uses and others into ecoregions classifications (USDA Soil Conservation Service, 1981; Bailey, 1976; Warren, 1979).

Most recently, Hughes and Omernik (1981) and Omernik et al. (1982) proposed methods for development and uses for ecoregions. The potential uses of these ecoregions include: (1) comparisons of land/water relationships within a region; (2) establish realistic water quality standards for regional rather than a large scale application; (3) location of monitoring and reference sites; (4) extrapolate from site specific studies; and (5) predict effects and monitor environmental changes resulting from pollution control activities (Omernik and Gallant, 1986).

The ecoregions of Omernik and Hughes are developed from four small-scale maps of interrelated land characteristics. These include: land uses, land surface forms, potential natural vegetation and soil types. The regions are delineated as the areas of greatest homogeneity. Within each region, the areas which share all of the characteristics that typify the ecoregion are distinguished as the most typical area. Areas which share most but not all of the similar characteristics are designated as generally typical of the region.

The ecoregions within Arkansas and surrounding areas were developed by Hughes and Omernik for the U.S. Environmental Protection Agency, Region VI, Dallas and for the Arkansas Department of Pollution Control and Ecology to assist with Arkansas' stream reclassification project. Their ecoregions in Arkansas include six distinct regions: (1) Ozark Highlands; (2) Boston Mountains; (3) Arkansas River Valley; (4) Ouachita Mountains; (5) ~~West Gulf Coastal Plains~~ South Central Plains; and (6) Mississippi Alluvial Plain (Delta). These regions are very similar to the natural divisions and sub-divisions of Arkansas as described in Arkansas Natural Area Plan (Foti, 1974) and further refined by Pell (1983). The natural divisions of Foti were developed from factors such as: primary vegetation, topography, surface geology, soils and surface hydrology.

Ground reconnaissance and field investigations have resulted in a slight modification of the western segment of the ecoregion boundary between the Arkansas River Valley and the Ouachita Mountains from that purposed by Hughes and Omernik.

MATERIALS AND METHODS

In order to characterize the physical, chemical and biological features of the biotic environments within each of Arkansas' ecoregions, the Arkansas Department of Pollution Control and Ecology selected a series of streams of varying sizes within each ecoregion for detailed investigation. These reference streams were selected, where possible, within the most typical area of the ecoregion, and only streams with the least amount of point and non-point source disturbances were chosen. A sample site on each stream was established, and both low-flow, high-temperature summertime and steady-state flow, springtime sampling was done. The sampling included detailed measurements of the physical features of the stream, analysis of 18 water quality parameters, a 72-hour continuous record of dissolved oxygen and water temperature, intensive sampling of the stream macroinvertebrate population and a comprehensive fish population sample.

The summer fish population sampling was done with the fish toxicant rotenone or with electrofishing devices. Most of the spring sampling was done with trammel nets of mesh sizes from 2.5 to 8.9 cm. Spring fish sampling was to identify migratory fishes in the area and verify fish spawning activities. The summer sampling identified the total resident fish population and established the relative abundance of each species.

Sample sites with very small or no flow, with reduced visibility into the water and with numerous instream obstructions were sampled with rotenone. If flow existed at these sites, a block net was utilized at the downstream limit of the sample area and the rotenone was detoxified with potassium permanganate below the sample area. Sample sizes ranged from about 0.1 to 0.4 ha.

Electrofishing gear was used at sites which had substantial flow, high visibility into the water and where much of the stream could be waded by workers in chest-waders. A gasoline powered generator with 3500 watt A.C. output was used as a power source. The electrodes were energized directly from the generator. Swift flowing riffle areas were blocked with a seine and stunned fish were allowed to drift into the seine. Sampling was done in an upstream direction and the sample areas were usually from 0.4 to 1.6 km in length. All areas that could be efficiently worked were sampled until it became apparent that all existing habitats had been sampled and the fish species and their relative abundance was well established by the sample.

All fishes possible were dipped from the water and preserved in 10% formalin for later identification and enumeration. When large numbers of the same species were observed while electrofishing, only an occasional "dip" sub-sample was made but notes on the species abundance were recorded. Each fish species from all summer samples was given a relative abundance value as described in Table 1. These values were determined from the number of fish in each species size

Table 1. Criteria for assigning relative abundance values to species and age group of fishes collected

VALUE

4 - Abundant - Species or age group collected easily in a variety of habitats where species expected; numerous individuals seen with consideration of sampling gear limitations and expected abundance of such species; a dominant species ~~of~~ of the species group.

3.5 - Common to Abundant

3 - Common - Species or age group collected in most areas where such species would exist; individuals frequently seen and apparently well established in the population; one of the more frequent species of the species group.

2.5 - Present to common

2 - Present - Species or age group collected with enough frequency to indicate the likely presence of an established population but definitely a subordinate species in the species group.

1.5 - Rare to Present

1 - Rare - Species or age group represented by only one or very few individuals in the population; more than likely a remnant, migrant or a displaced species.

Values are assigned to the adult, intermediate and young age group of each species; therefore, the maximum value for a species is 12 and the minimum is 1.

group, field observations of fishes which were not collected, general knowledge of fish species life history, selectivity of the sample gear and limitations existing at the sample site. Extensive efforts were not made to determine an accurate separation of the young and intermediate age groups of each species. These determinations were based on the presence or absence of a variety of distinctive size groups. All calculations of percent of the total population were made with the relative abundance values.

add paragraph about Sensitive species.

RESULTS AND DISCUSSION

General location of each sample site on the selected reference streams within Arkansas' six ecoregions are shown in Figure 1. A list of the reference streams with the size of the watershed and the stream gradient at the sample site is given in Table 2. Also included are the stream flows which existed during the spring and summer sample periods. The range of watershed sizes among all sites is from 44.2 to 1367.6 km^2. Stream gradients are from 0.095 to 7.6 m/km.

Fish habitat was measured at each site during the summer sampling along numerous stream transects. Instream fish cover such as brush, logs, debris, undercut banks, aquatic vegetation and low-overhanging vegetation was measured directly along each transect and converted to percent of stream width. Stream substrate was also measured along each transect, however a value relative to the value of different type of substrates as fish cover was applied to the percent of each substrate type. These

Figure 1. Map of Arkansas' Ecoregions with locations of sample sites on reference streams.

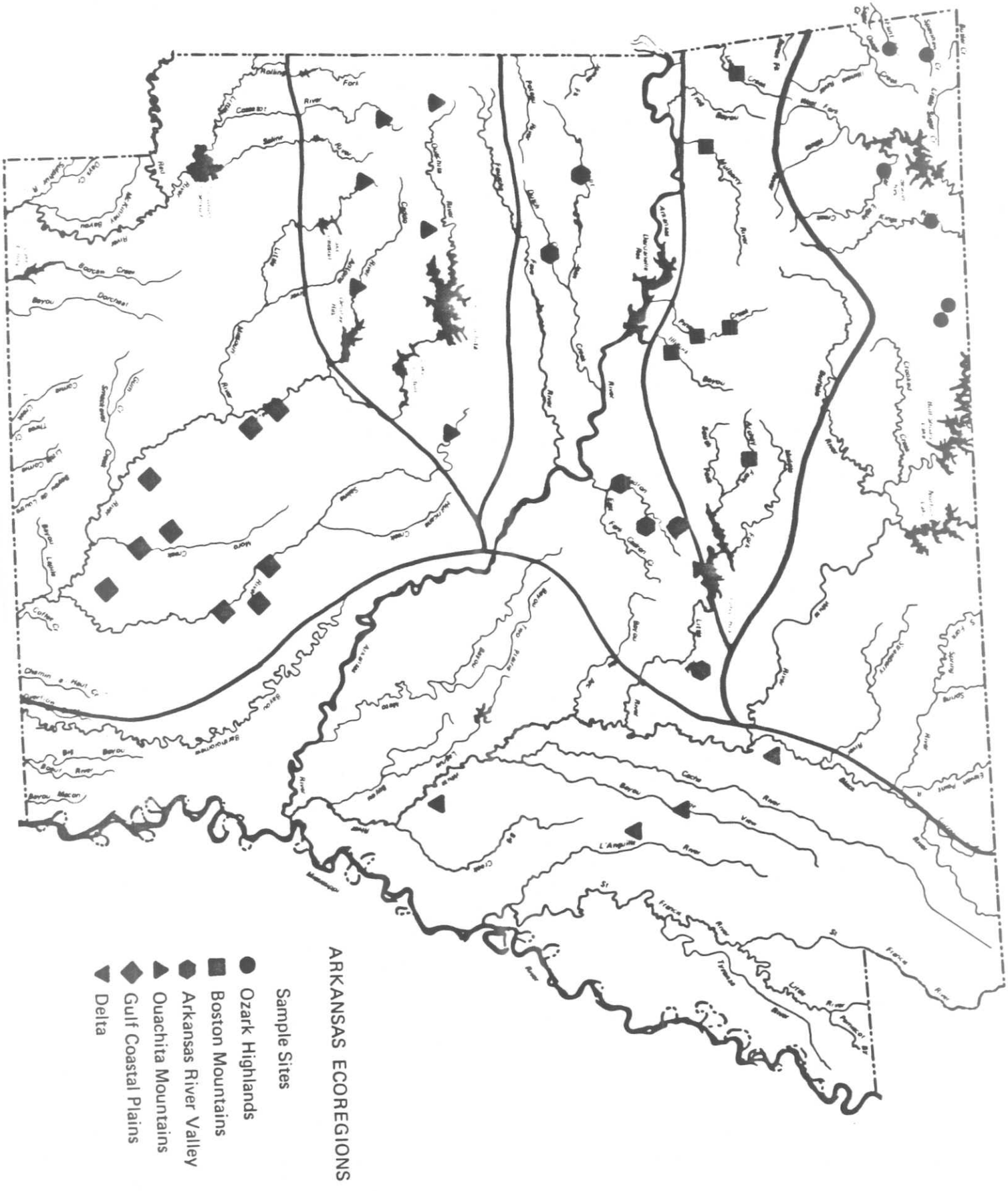


Table 2. List of reference streams within each ecoregion with watershed size, stream gradient and flows at sample sites.

Stream	Watershed Size(km^2)	Stream Gradient(m/km)	Summer Flow(cfs)	Spring Flow(cfs)
OZARK HIGHLAND ECOREGION				
South Fork Spavinaw	46.8	4.8	1.4	17
Flint Creek	49.4	3.7	4.5	27
Yocum Creek	143.0	3.4	5.3	162
Long Creek	478.4	1.3	9.5	183
War Eagle Creek	683.8	0.8	25.1	102
Kings River	1367.6	0.9	48.8	252
BOSTON MOUNTAINS ECOREGION				
Indian Creek	122.2	6.1	0.1	19
Hurricane Creek	130.0	6.3	0.1	30
Archey Creek	278.2	2.7	0.6	122
Illinois Bayou	325.0	2.4	1.0	147
Lee Creek	436.8	2.9	3.5	300*
Mulberry River	969.8	2.6	6.4	300*
ARKANSAS RIVER VALLEY ECOREGION				
Mill Creek	44.2	2.6	0	10
No. Cadron Creek	54.6	1.9	0.1	10
Ten Mile Creek	127.4	1.5	0.2	105
Dutch Creek	286.0	0.7	0.5	70
Petit Jean River	626.6	0.7	0.3	300*
Cadron Creek	800.8	0.1	15.0	500*

Table 2 (cont.)

OUACHITA MOUNTAINS ECOREGION				
Board Camp Creek	49.4	5.3	2.7	19.7
Little Missouri River	78.0	5.5	3.9	25.8
South Fork Ouachita	119.6	1.3	6.7	33.7
Cossatot River	312.0	7.6	17.4	97.4
Caddo River	756.6	2.5	134.0	500*
Saline River	938.6	0.8	53.0	400*
GULF COASTAL ECOREGION				
E. Fork Tulip Creek	119.6	0.7	5.2	56.0
Cypress Creek	189.8	0.8	10.8	150.0
Whitewater Creek	59.8	0.5	0	2.3
Big Creek	153.4	0.5	0	0.5
Derrieusseaux Creek	384.8	0.7	0	200.0
Freeo Creek	405.6	0.6	0	16.1
Hudgins Creek	486.2	0.3	0	300.0
L'Aigle Creek	603.2	0.5	0	188.7
Moro Creek	1172.6	0.3	0	350.0
DELTA ECOREGION				
Boat Gunwale Slash	59.8	0.1	2.9	230.0
Second Creek	156.0	0.2	7.5	165.0
Village Creek	504.4	0.1	133.5	35.0
Bayou DeView	1196.0	0.1	191.0	500.0*

*Flow estimated

values are as follows: mud/silt, sand and bedrock = 0; gravel = 0.5; rubble, boulder and large boulder = 1. Figure 2 demonstrates the different fish habitat within the ecoregions. Both the Delta and Gulf Coastal ecoregions are dominated by instream fish habitat such as brush, logs and debris. The Arkansas River Valley is highly variable in the type of fish habitat; however, from all sample sites, approximately 30% of the fish habitat is similar to that of the Delta and Gulf Coastal region and about 70% is dominated by substrate types which provide desirable fish cover. The Boston Mountain, Ozark Highlands and Ouachita Mountain ecoregion streams are heavily dominated by fish habitat provided by substrate. These differences in fish habitat among the ecoregions produce distinctly different fish populations.

The distribution of fishes within the five major fish families of the State are shown for each ecoregion in Figure 3. The Delta and Gulf Coastal ecoregions are distinctively dominated by the Centrarchidae. The Arkansas River Valley is also dominated by Centrarchidae but Cyprinidae is only slightly sub-dominant. Percidae dominates the Boston Mountain fishes but are followed closely by Cyprinidae and Centrarchidae. The Ozark Highlands are strongly dominated by Cyprinidae followed by Centrarchidae and Percidae. Similarly the Ouachita Mountains populations are dominated by Cyprinidae although not as distinctively as in the Ozark Highlands populations.

Figure 2. Fish habitat in ecoregion reference streams composed of instream cover (brush, logs, debris, etc.) or substrate types which offer valuable fish cover (rubble, boulder, large boulder, etc.).

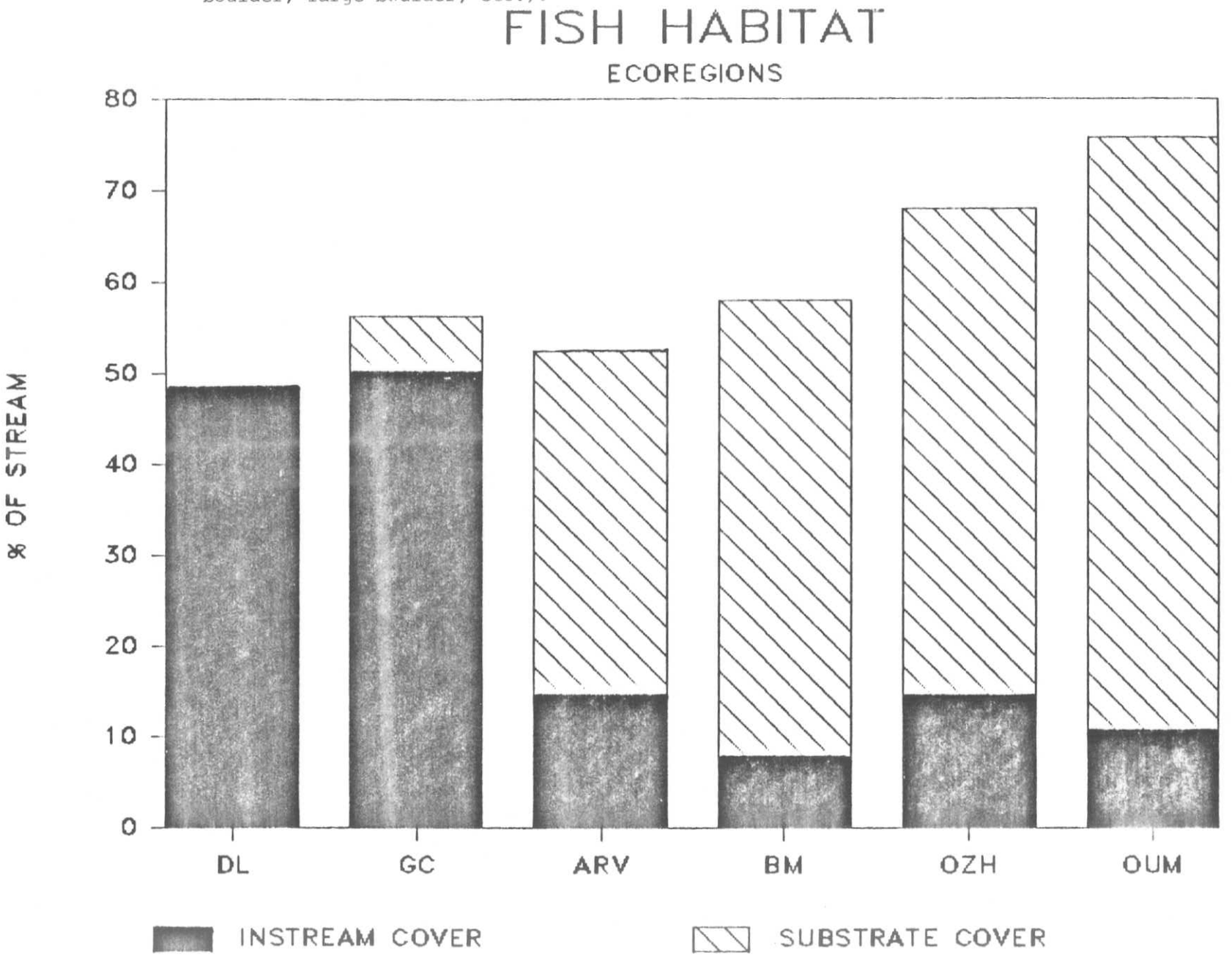
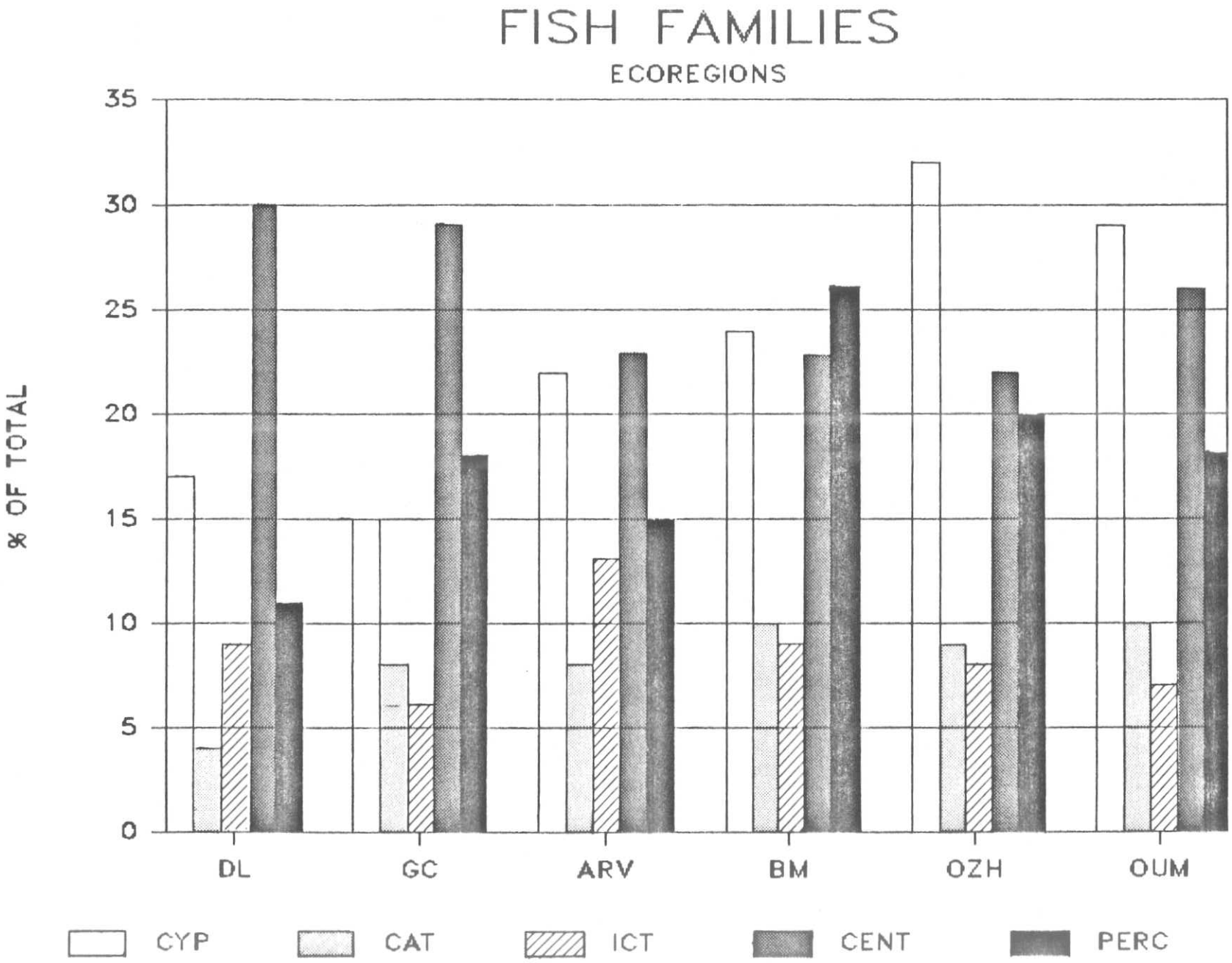


Figure 3. Distribution of fishes within Cyprinidae (CYP), Catostomidae (CAT), Ictaluridae (ICT), Centrarchidae (CENT) and Percidae (PERC) for each ecoregion.



The secondary trophic feeding level (marcroinvertebrate feeding fishes) dominates the fish populations of all regions (Figure 4). Primary feeding fishes are least abundant in the Gulf Coastal ecoregion where two samples contained no primary feeding fishes. Primary feeders are most abundant in the Ozark Highlands. This region also contains the highest levels of nitrogen in the water of the reference streams.

Sensitive fish species make up less than 0.2% of the relative abundance value of all Delta ecoregion populations (Figure 5). Gulf Coastal and Arkansas River Valley fish populations contain approximately 10 to 15% sensitive species. In contrast, sensitive species make up about 50% or more of the populations in the Ozark Highlands, Boston Mountains and Ouachita Mountains ecoregions. Over 66% of the Ozark Highlands fishes are sensitive species.

The average number of species collected per site is very similar among the ecoregions. However, the total number of species collected per ecoregion shows some variation (Figure 6). The greatest number of species was collected from Arkansas River Valley streams followed closely by Gulf Coastal streams. The Delta ecoregion is lowest in species richness. Although it is realized that not all species present within each ecoregion were collected, it is felt that the majority of the more common species within the least-disturbed streams were identified. Areas inadequately sampled within the ecoregions were the large rivers.

Figure 4. Distribution of fishes within the trophic feeding levels for reference streams within each ecoregion.

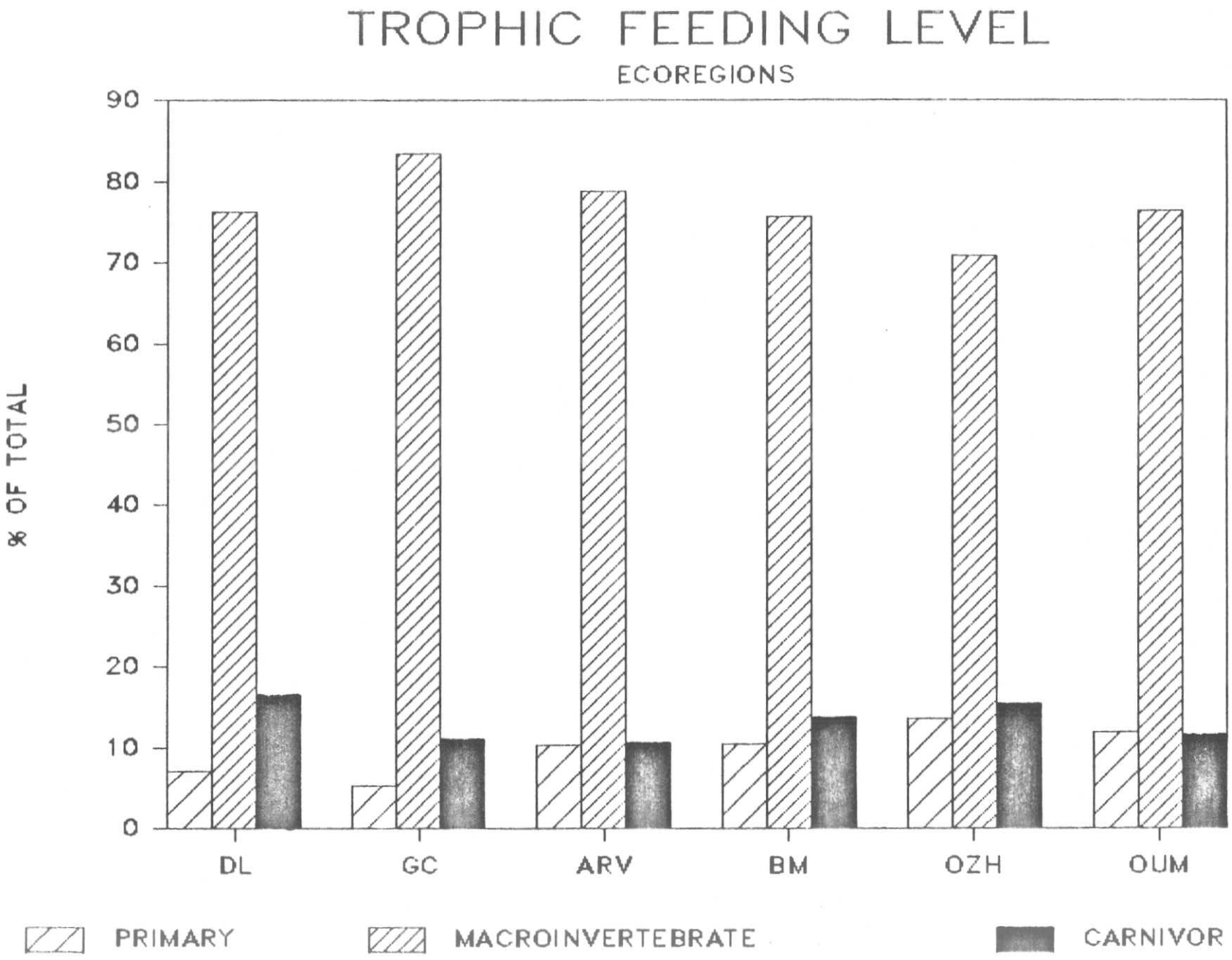


Figure 5. Composition of sensitive fish species from reference streams within each ecoregion.

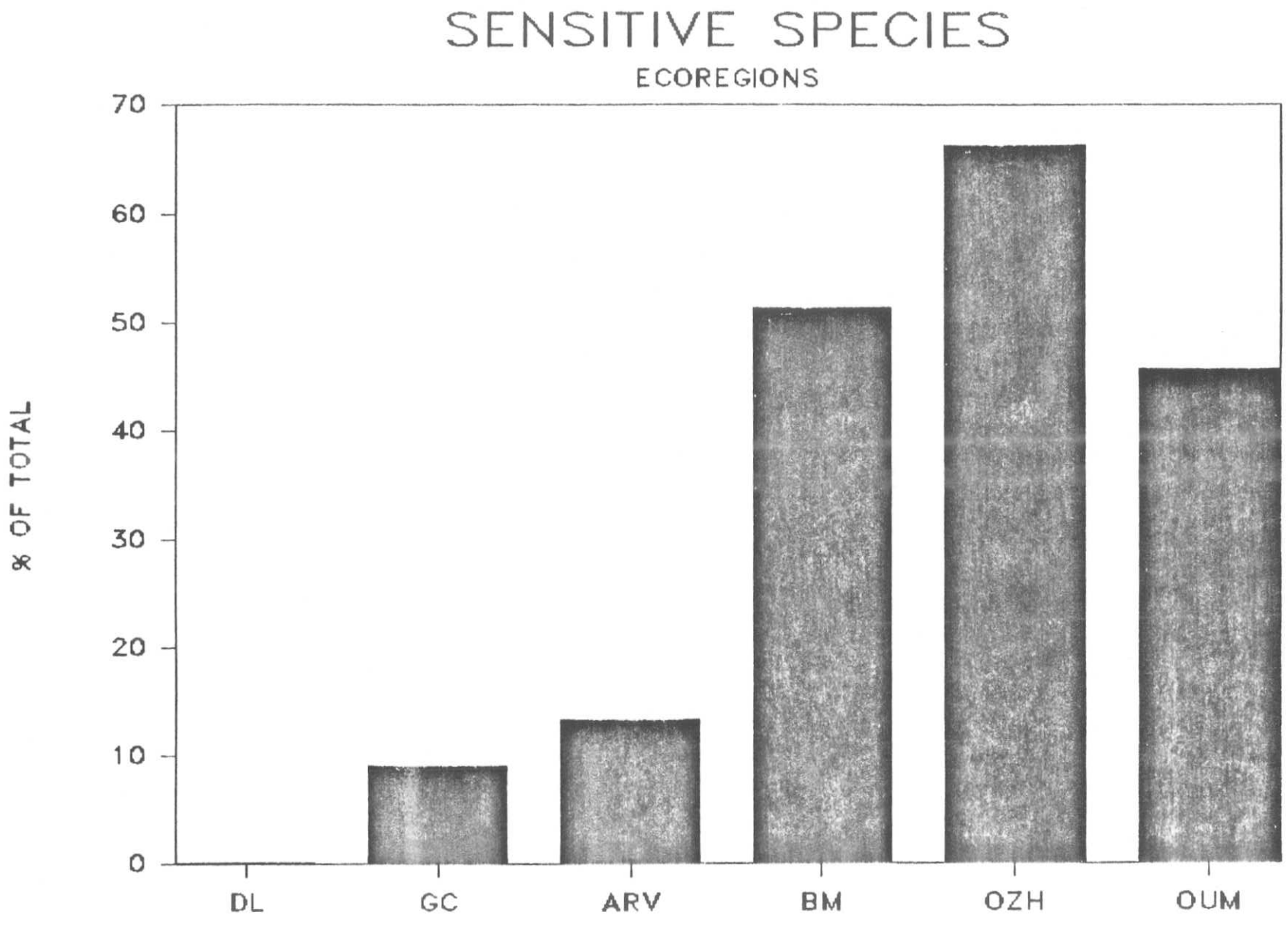
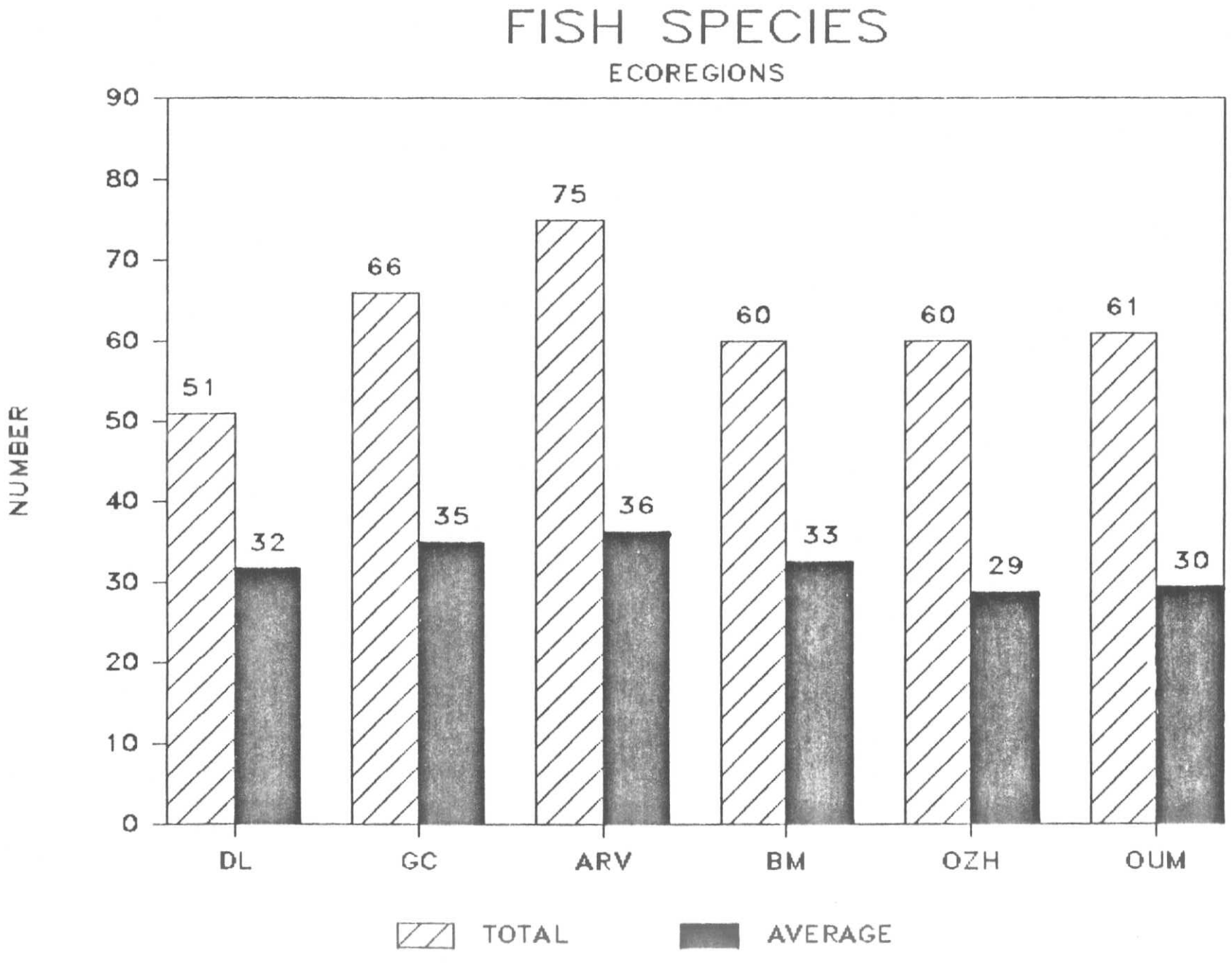


Figure 6. Average and total number of fish species collected from all reference streams within each ecoregion.



Tables 3 through 8 list all species collected within each ecoregion by sample site. The relative abundance value for each species is given for all sites where the species was collected. The species are listed in descending order of abundance within all reference streams of the ecoregion. The duskystripe shiner, Notropis pilsbryi, identified from the Flint Creek, South Fork Spavinaw and Lee Creek samples is currently being described as a distinct, new species.

A similarity index, modified from Odum (1971), was used to compare the 10 most abundant species within each ecoregion. Odum's index compares the number of species common in two populations with the total number of species from each population. This index was modified to use relative abundance values of the species as follows:

$$SI = \frac{C}{A+B+D} \times 100$$

SI = similarity index (range from 0 to 100; 100= identical populations)

A = total relative abundance value of sample A

B = total relative abundance value of sample B

C = sum of relative abundance values of species common to both samples

D = sum of difference in relative abundance values of species common to both samples

Table 3. Relative abundance values of fish species from Ozark Highlands Ecoregion reference streams.

FISH	SPECIES	SPAV.CR.	FLINT CR	YOCUM CR	LONG CR	WAR EGLE	KINGS	SUM
*(Notropis pilsbryi)	Duskystripe shiner	12.0	12.0	12.0	12.0	12.0	10.5	70.5
(Campostoma anomalum)	Stoneroller	10.5	12.0	12.0	12.0	12.0	12.0	70.5
*(Hypentelium nigricans)	Northern hogsucker	2.0	9.0	12.0	12.0	10.5	9.0	54.5
*(Cottus carolinae)	Banded sculpin	12.0	10.5	12.0	9.0	7.5		51.0
*(Etheostoma caeruleum)	Rainbow darter			10.5	12.0	12.0	12.0	46.5
(Lepomis megalotis)	Longear		9.0	8.0	9.0	10.5	9.0	45.5
*(Noturus exilis)	Slender madtom	12.0	10.5	9.0	6.0	3.0		40.5
*(Ambloplites constellatus)	Ozark bass			12.0	9.5	9.0	9.0	39.5
*(Micropterus dolomieui)	Smallmouth bass	2.0	10.5	8.5	4.0	1.0	10.5	36.5
(Notropis nubilus)	Ozark minnow		6.0	1.0	10.5	12.0	7.0	36.5
(Micropterus punctulatus)	Spotted bass				12.0	12.0	12.0	36.0
*(Noturus albater)	Ozark madtom			4.0	12.0	9.0	8.0	33.0
*(Etheostoma juliae)	Yoke darter				12.0	12.0	9.0	33.0
(Lepomis cyanellus)	Green sunfish	1.5	7.5	6.0	4.0	5.0	7.0	31.0
*(Moxostoma duquesnei)	Black redhorse				10.5	8.0	12.0	30.5
(Percina caprodes)	Logperch			1.0	12.0	2.0	12.0	27.0
(Etheostoma spectabile)	Orangethroat darter	9.0	12.0	6.0	S			27.0
*(Etheostoma zonale)	Banded darter				9.0	4.5	12.0	25.5
*(Notropis rubellus)	Rosyface shiner	S	1.5		6.0	9.0	7.5	24.0
*(Etheostoma flabellare)	Fantail darter	12.0		12.0				24.0
*(Etheostoma blennioides)	Greenside darter			S	9.0	6.0	9.0	24.0
*(Phoxinus erythrogaster)	Southern redbelly dace	12.0	9.0	S				21.0
*(Nocomis asper)	Redspot chub	9.0	12.0					21.0
*(Ambloplites rupestris)	Rock bass	9.0	12.0					21.0
*(Nocomis biguttatus)	Hornyhead chub			10.5	9.0			19.5
(Lepomis macrochirus)	Bluegill		1.0	6.0	3.0	2.0	6.5	18.5
(Moxostoma erythrurum)	Golden redhorse				1.0	8.0	8.0	17.0
*(Semotilus atromaculatus)	Creek chub	10.5	6.0					16.5
(Fundulus olivaceus)	Blackspotted topminnow		6.0	4.0		4.0	1.0	15.0
*(Moxostoma carinatum)	River Redhorse				4.0	1.0	9.0	14.0
*(Hybopsis dissimilis)	Streamline chub				6.0		8.0	14.0
*(Fundulus catenatus)	Northern studfish		4.5	8.0	1.0			13.5
(Notropis chrysocephalus)	Striped shiner				6.0	5.5	2.0	13.5
*(Notropis boops)	Bigeye shiner				4.5	4.0	4.0	12.5
(Ictalurus punctatus)	Channel catfish				4.5	S	8.0	12.5
*(Etheostoma euzonum)	Arkansas saddled darter						12.0	12.0
(Gambusia affinis)	Mosquitofish		10.5					10.5
(Pimephales notatus)	Bluntnose minnow				7.5	1.0	1.0	9.5
*(Etheostoma punctulatum)	Stippled darter	S	9.0					9.0
*(Notropis galacturus)	Whitetail shiner				6.0	1.0	1.0	8.0
(Dorosoma cepedianum)	Gizzard shad				1.5		6.0	7.5
(Micropterus salmoides)	Largemouth bass			1.0	1.0	1.0	4.0	7.0
*(Notropis whipplei)	Steelcolor shiner					4.0	1.0	5.0
(Pylodictis olivaris)	Flathead catfish					S	4.0	4.0
(Cyprinus carpio)	Carp				1.0	S	2.0	3.0
*(Notropis greenei)	Wedgespot shiner						2.0	2.0
*(Hybopsis amblops)	Bigeye chub						2.0	2.0
*(Etheostoma stigmaeum)	Speckled darter					2.0		2.0
(Labidesthes sicculus)	Brook silversides				1.0	1.0		2.0
*(Noturus flavater)	Checkered madtom					1.0		1.0
*(Notropis telescopus)	Telescope shiner					1.0		1.0
(Lepomis hybrid)	Hybrid sunfish	1.0						1.0
(Catostomus commersoni)	White sucker		1.0					1.0
*(Stizostedion vitreum)	Walleye						S	0.0
(Lepisosteus osseus)	Longnose gar					S		0.0
(Lepisosteus oculatus)	Spotted gar						S	0.0
(Ictalurus natalis)	Yellow bullhead				S			0.0
(Ictalurus melas)	Black bullhead						S	0.0
(Carpiodes velifer)	Highfin carpsucker					S	S	0.0
(Carpiodes cyprinus)	Quillback carpsucker					S		0.0
	NUMBER OF SPECIES=	16	21	22	36	39	39	60.0

* - SENSITIVE SPECIES
S - SPRING COLLECTION ONLY

Table 4. Relative abundance values of fish species from Boston Mountains Ecoregion reference streams.

FISH SPECIES		INDIAN	HURR	ARCHEY	ILL. BY.	LEE CR.	MULBRY	SUM
(Campostoma anomalum)	Stoneroller	12.0	12.0	9.0	12.0	12.0	12.0	69.0
*(Notropis boops)	Bigeye shiner	12.0	12.0	9.0	10.5	12.0	12.0	67.5
(Lepomis megalotis)	Longear	11.0	12.0	10.5	12.0	10.0	12.0	67.5
*(Noturus exilis)	Slender madtom	10.5	10.5	12.0	10.5	10.5	12.0	66.0
*(Etheostoma blennioides)	Greenside darter	10.5	12.0	12.0	9.0	7.5	9.0	60.0
(Lepomis cyanellus)	Green sunfish	8.0	10.5	10.0	12.0	6.0	10.5	57.0
*(Micropterus dolomieui)	Smallmouth bass	9.0	9.0	8.5	11.5	10.5	4.0	52.5
(Micropterus punctulatus)	Spotted bass	7.0	6.5	9.0	10.5	9.5	9.0	51.5
*(Etheostoma zonale)	Banded darter	7.5	10.5	7.5	9.0	6.0	9.0	49.5
*(Moxostoma duquesnei)	Black redhorse	11.0	9.0	10.0	10.5	7.5		48.0
(Pimephales notatus)	Bluntnose minnow	9.0	1.0	10.5	9.0	5.0	9.0	43.5
(Labidesthes sicculus)	Brook silversides	12.0	6.0	9.0	10.5	4.0	2.0	43.5
(Fundulus olivaceus)	Blackspotted topminnow	10.5	8.0	9.0	6.0	4.0	5.0	42.5
*(Hypentelium nigricans)	Northern hogsucker	9.0	6.0	6.5	7.5	4.0	8.5	41.5
*(Notropis greenei)	Wedgespot shiner		6.0	9.0	9.0	7.5	9.0	40.5
(Etheostoma spectabile)	Orangethroat darter	12.0	10.5		12.0	1.0	S	35.5
*(Etheostoma flabellare)	Fantail darter	4.5	6.0			12.0	12.0	34.5
(Etheostoma whipplei)	Redfin darter	12.0		6.0	12.0	2.0	2.0	34.0
*(Notropis whipplei)	Steelcolor shiner	2.5	1.5	7.0	9.0	6.0	7.5	33.5
(Moxostoma erythrurum)	Golden redhorse	9.0	4.5	6.0	1.0	9.0	3.0	32.5
*(Percina nasuta)	Longnose darter			6.5	7.5	5.0	6.0	25.0
*(Etheostoma punctulatum)	Stippled darter	4.5		3.0	12.0	4.0		23.5
(Percina caprodes)	Logperch	1.5		9.5		4.0	7.5	22.5
(Ictalurus punctatus)	Channel catfish	9.0	3.0	1.0		S	7.0	20.0
*(Ambloplites ariommus)	Shadow bass		1.0	10.5	6.0			17.5
(Micropterus salmoides)	Largemouth bass				2.5	6.0	6.0	14.5
(Lepomis macrochirus)	Bluegill	1.0		3.5	2.0	5.0	2.0	13.5
*(Notropis pilsbryi)	Duskystripe shiner					12.0		12.0
*(Etheostoma caeruleum)	Rainbow darter			12.0				12.0
*(Noturus albater)	Ozark madtom			9.0				9.0
*(Hybopsis dissimilis)	Streamline chub			9.0				9.0
*(Etheostoma moorei)	Yellowcheek darter			9.0				9.0
(Notropis nubilus	Ozark minnow					9.0		9.0
*(Etheostoma stigmaeum)	Speckled darter			7.5		1.0		8.5
(Ictalurus natalis)	Yellow bullhead		S	2.0	6.5			8.5
*(Etheostoma euzonum)	Arkansas saddled darter			8.0				8.0
(Pylodictis olivaris)	Flathead catfish			6.0	1.0		1.0	8.0
*(Pimephales tenellus)	Slim minnow			6.0				6.0
*(Percina maculata)	Blackside darter	1.0	S			2.5	2.0	5.5
(Esox americanus)	Grass pickerel	1.0			4.5			5.5
(Cyprinus carpio)	Carp	1.5				2.0	2.0	5.5
(Aplodinotus grunniens)	Freshwater drum	2.0		2.0			1.0	5.0
*(Fundulus catenatus)	Northern studfish					4.0		4.0
(Fundulus notatus)	Blackstripe topminnow			2.0		1.0		3.0
(Lepomis gulosus)	Warmouth			1.0			1.0	2.0
*(Semotilus atromaculatus)	Creek chub			1.0				1.0
*(Percina copelandi)	Channel darter						1.0	1.0
(Noturus miurus)	Brindled madtom			1.0				1.0
(Morone chrysops)	White bass			1.0				1.0
(Lepomis hybrid)	Hybrid sunfish				1.0			1.0
(Lepomis humilis)	Orangespotted sunfish					1.0		1.0
(Lepisosteus osseus)	Longnose gar					1.0	S	1.0
(Ichthyomyzon sp.)	Lamprey larvae		S	1.0				1.0
(Dorosoma cepedianum)	Gizzard shad			1.0	S			1.0
*(Stizostedion vitreum)	Walleye			S				0.0
*(Moxostoma carinatum)	River Redhorse				S	S	S	0.0
(Notropis emiliae)	Pugnose minnow		S					0.0
(Lepisosteus oculatus)	Spotted gar			S		S		0.0
(Ictiobus bubalus)	Smallmouth buffalo						S	0.0
(Carpiodes carpio)	River carpsucker						S	0.0
	NUMBER OF SPECIES=	27	25	43	30	37	34	60.0

* - SENSITIVE SPECIES

S - SPRING COLLECTIION ONLY

Table 5. Relative abundance values of fish species from Arkansas River Valley Ecoregion reference streams.

FISH	SPECIES	MILL CR.	N.FK.CAD	TEN MI.	DUTCH	PET	JEAN	CADRON	SUM
(Lepomis megalotis)	Longear	10.5	10.5	12.0	12.0	12.0	6.0		63.0
(Pimephales notatus)	Bluntnose minnow	12.0	9.0	12.0	12.0	12.0	4.0		61.0
(Etheostoma whipplei)	Redfin darter	12.0	12.0	9.0	12.0	12.0			57.0
(Fundulus olivaceus)	Blackspotted topminnow	9.0	12.0	9.0	9.0	9.0	7.5		55.5
(Lepomis cyanellus)	Green sunfish	12.0	10.5	7.5	10.5	9.0	2.0		51.5
(Micropterus punctulatus)	Spotted bass	9.0	7.5	7.5	8.0	9.0	8.0		49.0
(Ictalurus natalis)	Yellow bullhead	10.5	12.0	12.0	12.0	2.0			48.5
(Lepomis macrochirus)	Bluegill	9.0	6.0	7.5	7.5	6.0	12.0		48.0
*(Noturus exilis)	Slender madtom	9.0	12.0	9.0	5.5	12.0			47.5
(Labidesthes sicculus)	Brook silversides	9.0	4.5	9.0	9.0	9.0	6.0		46.5
(Campostoma anomalum)	Stoneroller	S	12.0	6.0	10.5	9.0			37.5
(Notropis umbratilis)	Redfin shiner	9.0	9.0	6.0	4.0	6.0	2.0		36.0
(Moxostoma erythrurum)	Golden redhorse	10.5	9.0	2.0	2.0	9.0	1.0		33.5
*(Notropis boops)	Bigeye shiner	9.0	9.0	9.0	6.0				33.0
(Erimyzon oblongus)	Creek chubsucker	5.0	12.0	9.0	2.0				28.0
(Esox americanus)	Grass pickerel	9.0	7.5		10.0	1.0			27.5
(Etheostoma spectabile)	Orangethroat darter		9.0		10.5	7.5			27.0
(Minytrema melanops)	Spotted sucker	9.0	7.5	2.0	2.0	2.0	4.0		26.5
(Dorosoma cepedianum)	Gizzard shad	10.5				4.0	12.0		26.5
(Notropis emiliae)	Pugnose minnow	S		1.0	9.0	6.0	9.0		25.0
(Noturus gyrinus)	Tadpole madtom			7.5	9.0		7.5		24.0
(Micropterus salmoides)	Largemouth bass	1.5	7.5	8.0	1.0	2.0	4.0		24.0
(Aphredoderus sayanus)	Pirate perch	1.5	4.0	9.0	6.0		2.0		22.5
(Noturus miurus)	Brindled madtom				9.0	12.0			21.0
(Notropis fumeus)	Ribbon shiner				9.0	7.5	4.5		21.0
(Fundulus notatus)	Blackstripe topminnow			9.0	12.0				21.0
(Aplodinotus grunniens)	Freshwater drum	3.0				6.0	12.0		21.0
(Lepomis gulosus)	Warmouth	4.0		4.0	5.0	1.0	6.0		20.0
(Pimephales vigilax)	Bullhead minnow	S				7.5	12.0		19.5
(Percina caprodes)	Logperch	4.0	1.0		7.0	7.0			19.0
*(Notropis whipplei)	Steelcolor shiner		1.0		8.5	4.5	4.0		18.0
(Ictalurus punctatus)	Channel catfish				4.0	4.0	9.0		17.0
(Noturus nocturnus)	Freckled madtom				7.5	9.0			16.5
*(Percina sciera)	Dusky darter				6.0	6.0	4.0		16.0
(Lepomis humilis)	Orangespotted sunfish					9.0	6.0		15.0
(Lepomis punctatus)	Spotted sunfish	1.0	6.0		6.0		1.0		14.0
*(Etheostoma stigmaeum)	Speckled darter				6.0	7.5			13.5
(Gambusia affinis)	Mosquitofish					9.0	4.0		13.0
(Notropis volucellus)	Mimic shiner						12.0		12.0
(Etheostoma gracile)	Slough darter				9.0		1.0		10.0
*(Percina copelandi)	Channel darter					7.5	2.0		9.5
*(Etheostoma punctulatum)	Stippled darter			9.0					9.0
(Notropis atherinoides)	Emerald shiner						9.0		9.0
*(Etheostoma caeruleum)	Rainbow darter			7.5					7.5
(Notropis chrysocephalus)	Striped shiner			7.5					7.5
(Etheostoma proeliare)	Cypress darter			7.5					7.5
*(Etheostoma flabellare)	Fantail darter		7.0						7.0
(Notropis venustus)	Blacktail shiner					1.0	6.0		7.0
*(Percina maculata)	Blackside darter	3.0	1.5	1.0	1.0				6.5
*(Etheostoma blennioides)	Greenside darter			6.0					6.0
(Etheostoma chlorosomum)	Bluntnose darter			6.0					6.0
(Pomoxis annularis)	White crappie				1.0		4.5		5.5
(Ictiobus bubalus)	Smallmouth buffalo					4.0	1.0		5.0
(Lepomis microlophus)	Redear	4.0							4.0
(Elassoma zonatum)	Banded pygmy sunfish						4.0		4.0
(Amia calva)	Bowfin	3.0					1.0		4.0
(Notemigonus crysoleucas)	Golden shiner		1.0	1.5	1.0				3.5
*(Hypentelium nigricans)	Northern hogsucker	1.0	1.0	1.0					3.0
(Pylodictis olivaris)	Flathead catfish					2.0	1.0		3.0
(Morone chrysops)	White bass					2.0	1.0		3.0
(Lepomis hybrid)	Hybrid sunfish			1.0	2.0				3.0
(Etheostoma asprigene)	Mud darter						3.0		3.0
(Lepisosteus oculatus)	Spotted gar				1.5	1.0			2.5
(Carpiodes carpio)	River carpsucker				S		2.5		2.5
(Ictalurus melas)	Black bullhead	S		2.0					2.0
(Esox niger)	Chain pickerel	1.0		1.0					2.0
(Pomoxis nigromaculatus)	Black crappie	1.5							1.5
*(Semotilus atromaculatus)	Creek chub			1.0					1.0
*(Etheostoma histrio)	Harlequin darter					1.0			1.0
(Ichthyomyzon sp.)	Lamprey larvae				1.0				1.0
*(Pimephales tenellus)	Slim minnow				S				0.0
*(Moxostoma carinatum)	River Redhorse					S			0.0
(Moxostoma macrolepidotum)	Shorthead redhorse				S				0.0
(Lepisosteus osseus)	Longnose gar					S			0.0
(Cyprinus carpio)	Carp				S				0.0
	NUMBER OF SPECIES=	33	27	35	44	41	38		75.0

* - SENSITIVE SPECIES
S - SPRING COLLECTION ONLY

Table 6. Relative abundance values of fish species from Ouachita Mountains Ecoregion reference streams.

FISH SPECIES		BRD.CAMP	L.MD.	S.FK.OUA	COSSAT.	CADDO	SALINE	SUM
(Campostoma anomalum)	Stoneroller	12.0	12.0	12.0	12.0	12.0	12.0	72.0
(Lepomis megalotis)	Longear	10.5	12.0	12.0	12.0	12.0	9.5	68.0
*(Notropis boops)	Bigeye shiner	9.5	12.0	12.0	7.0	12.0	10.0	62.5
*(Etheostoma radiosum)	Orangebelly darter	12.0	12.0	12.0	12.0	12.0		60.0
*(Etheostoma blennioides)	Greenside darter	6.5	12.0	10.5		10.5	11.0	50.5
*(Micropterus dolomieui)	Smallmouth bass	4.0	9.5	10.5	8.0	6.0	7.0	45.0
(Noturus nocturnus)	Freckled madtom	9.0	2.0	9.0		10.5	12.0	42.5
(Lepomis cyanellus)	Green sunfish	9.0	6.0	9.0	6.0	9.0	2.0	41.0
(Notropis chrysocephalus)	Striped shiner	7.0	9.0	12.0		6.0	6.0	40.0
*(Fundulus catenatus)	Northern studfish	6.5	6.0	9.0	8.0	9.0		38.5
*(Hypentelium nigricans)	Northern hogsucker	7.0	9.0	9.0		5.0	6.5	36.5
(Pimephales notatus)	Bluntnose minnow	S	12.0	10.5		7.5	6.0	36.0
(Moxostoma erythrurum)	Golden redhorse	S		9.0	7.0	7.0	7.5	30.5
*(Etheostoma zonale)	Banded darter		1.0	7.5		9.0	12.0	29.5
(Percina caprodes)	Logperch		6.0	10.5	S	11.0	1.0	28.5
(Micropterus punctulatus)	Spotted bass			10.5		9.0	9.0	28.5
(Fundulus olivaceus)	Blackspotted topminnow	1.0	6.0	7.5	6.0	6.0	2.0	28.5
*(Moxostoma duquesnei)	Black redhorse		S	8.5	7.0	4.0	7.5	27.0
*(Ambloplites ariommus)	Shadow bass		7.5	8.0	2.0	4.5	5.0	27.0
*(Hybopsis x-punctata)	Gravel Chub					10.5	12.0	22.5
(Lepomis macrochirus)	Bluegill	4.0	1.0	6.0		7.0	2.0	20.0
*(Notropis whipplei)	Steelcolor shiner			7.5	1.0	6.0	4.0	18.5
(Ictalurus natalis)	Yellow bullhead	2.0	6.0	5.5	2.0			15.5
(Micropterus salmoides)	Largemouth bass		1.0	6.5	1.0	6.0		14.5
(Etheostoma whipplei)	Redfin darter						12.0	12.0
(Labidesthes sicculus)	Brook silversides	1.0	7.5			1.0	2.0	11.5
*(Nocomis asper)	Redspot chub			9.0				9.0
(Minytrema melanops)	Spotted sucker			6.0		3.0		9.0
(Lepomis microlophus)	Redear			6.0		2.0	1.0	9.0
*(Notropis snelsoni)	Ouachita Mt. shiner				8.5			8.5
(Esox americanus)	Grass pickerel			6.0			2.0	8.0
(Notropis umbratilis)	Redfin shiner		6.0	S			1.0	7.0
(Dorosoma cepedianum)	Gizzard shad					2.0	4.5	6.5
*(Noturus eleutherus)	Mountain madtom					6.0		6.0
*(Etheostoma collettei)	Creole darter						5.0	5.0
(Notropis atherinoides)	Emerald shiner			5.0				5.0
(Lepomis gulosus)	Warmouth			S		4.0	1.0	5.0
(Fundulus notatus)	Blackstripe topminnow					4.5	S	4.5
*(Noturus taylori)	Caddo madtom			1.0		2.0		3.0
(Ichthyomyzon sp.)	Lamprey larvae			2.0		1.0		3.0
(Lepomis hybrid)	Hybrid sunfish	1.5				1.0		2.5
*(Pimephales tenellus)	Slim minnow	2.0						2.0
(Pylodictis olivaris)	Flathead catfish				2.0			2.0
(Noturus miurus)	Brindled madtom						2.0	2.0
(Notropis fumeus)	Ribbon shiner		1.0			1.0		2.0
(Erimyzon oblongus)	Creek chubsucker	1.0		S		1.0		2.0
*(Semotilus atromaculatus)	Creek chub		1.0					1.0
*(Percina copelandi)	Channel darter						1.0	1.0
*(Etheostoma histrio)	Harlequin darter						1.0	1.0
(Lepomis punctatus)	Spotted sunfish						1.0	1.0
(Ichthyomyzon castaneus)	Chestnut lamprey						1.0	1.0
(Etheostoma chlorosomum)	Bluntnose darter			1.0				1.0
(Aphredoderus sayanus)	Pirate perch			S		1.0		1.0
*(Salmo gairdneri)	Rainbow trout		S					0.0
*(Noturus lachneri)	Ouachita madtom						S	0.0
*(Moxostoma carinatum)	River Redhorse					S	S	0.0
(Pomoxis nigromaculatus)	Black crappie					S		0.0
(Lepisosteus osseus)	Longnose gar				S	S		0.0
(Ictalurus punctatus)	Channel catfish					S	S	0.0
(Ictalurus melas)	Black bullhead	S						0.0
(Ichthyomyzon gagei)	Southern brook lamprey			S				0.0
	NUMBER OF SPECIES=	21	25	36	18	40	37	61.0

* - SENSITIVE SPECIES

S - SPRING COLLECTION ONLY

Table 7. Relative abundance values of fish species from Gulf Coastal Ecoregion reference streams.

FISH SPECIES		TULIP	CYPRS	W.WTR	BIG	DERSX	FREED	HDGNS	L'AGL	MORO	SUM
(Aphredoderus sayanus)	Pirate perch	9.0	10.5	10.0	12.0	9.0	12.0	12.0	9.0	10.5	94.0
(Lepomis gulosus)	Warmouth	6.5	9.0	12.0	7.0	12.0	7.0	10.0	10.5	10.0	84.0
(Lepomis megalotis)	Longear	12.0	12.0	9.0	5.5	10.5	10.0	6.0	6.0	6.5	77.5
(Fundulus olivaceus)	Blackspotted topminnow	7.5	9.0	7.5	6.0	9.0	10.5	11.0	9.0	8.0	77.5
(Centrarchus macropterus)	Flier	4.5	9.0	12.0	10.0	12.0	6.0	8.0	10.5	5.0	77.0
(Esox americanus)	Grass pickerel	9.0	9.0	9.0	9.0	9.0	9.0	3.0	12.0	7.0	76.0
(Minytrema melanops)	Spotted sucker	2.0	7.0	9.0	1.0	11.0	3.0	12.0	12.0	12.0	69.0
(Ictalurus natalis)	Yellow bullhead	6.0	12.0	1.0	2.0	12.0	6.0	8.0	12.0	9.0	68.0
(Gambusia affinis)	Mosquitofish	4.5	4.5	9.0	9.0	6.5	7.5	9.0	9.0	7.5	66.5
(Etheostoma gracile)	Slough darter	7.5	4.5	9.0	9.0	10.0	2.0	12.0	7.0	4.0	65.0
(Notropis umbratilis)	Redfin shiner	12.0	12.0	6.0	6.0	9.0	10.5	6.5		2.0	64.0
(Lepomis macrochirus)	Bluegill	4.5		4.0	5.5	7.5	3.0	9.0	12.0	9.0	54.5
(Lepomis cyanellus)	Green sunfish	6.5	9.0	6.0	6.5	5.0	4.0	4.0	6.0	4.0	51.0
(Etheostoma whipplei)	Redfin darter	6.0	9.0	4.0	2.0	6.0	7.0	3.0	6.0	7.5	50.5
(Elassoma zonatum)	Banded pygmy sunfish	9.0	6.0	9.0	9.0	4.0	4.0	2.0	1.0	4.0	48.0
*(Etheostoma collettei)	Creole darter	9.0	7.5	1.0	S	1.0	9.0	2.0	7.0	11.0	47.5
(Lepomis punctatus)	Spotted sunfish	5.0	6.0	5.0		5.0	9.0	3.0	9.0	4.5	46.5
*(Percina maculata)	Blackside darter	6.0	6.0		7.0	5.5	8.0	5.5		5.0	43.0
(Etheostoma chlorosomum)	Bluntnose darter		1.0	1.0	2.0	6.0	6.0	12.0	4.5	9.0	41.5
(Micropterus salmoides)	Largemouth bass	7.5	2.0	1.0		4.0	2.0	9.0	7.5	7.0	40.0
*(Percina sciera)	Dusky darter	6.5	8.0		1.0	4.0	7.0		1.0	9.0	36.5
(Fundulus notatus)	Blackstripe topminnow	9.0	7.5	4.0				4.0	6.0	6.0	36.5
(Amia calva)	Bowfin	3.0	7.0	3.0		6.0	1.0	7.0	2.5	6.5	36.0
(Esox niger)	Chain pickerel		10.5	S		4.0		4.5	10.0	6.0	35.0
(Notropis chrysocephalus)	Striped shiner	9.0	7.5		6.0	2.0	1.0	4.0		5.0	34.5
(Notropis emiliae)	Pugnose minnow	6.0	6.0		1.0	3.0	2.0	6.0	2.0	7.0	33.0
(Hybognathus nuchalus)	Silvery minnow	1.5			2.0	7.0		12.0		9.0	31.5
(Erimyzon oblongus)	Creek chubsucker	2.0		6.0	8.0	5.0	5.0	1.0	2.0	2.5	31.5
*(Moxostoma poecilurum)	Blacktail redhorse	12.0	7.5			7.0	2.0	S		2.0	30.5
(Hybognathus hayi)	Cypress minnow					6.0		9.0	4.0	9.0	28.0
(Notropis fumeus)	Ribbon shiner					6.0		2.0	6.0	12.0	26.0
(Noturus nocturnus)	Freckled madtom	10.5	12.0							3.0	25.5
(Etheostoma proeliare)	Cypress darter		1.0	9.0			6.0		4.5	4.0	24.5
(Noturus gyrinus)	Tadpole madtom		6.0			4.0	9.0	2.0	1.0	2.0	24.0
(Notemigonus crysoleucas)	Golden shiner		1.0		9.0	8.0			2.0	4.0	24.0
(Notropis texanus)	Weed shiner					4.0			2.0	12.0	18.0
(Micropterus punctulatus)	Spotted bass	6.0	7.5					2.0			15.5
(Moxostoma erythrurum)	Golden redhorse	6.5	6.0							1.0	13.5
(Pomoxis nigromaculatus)	Black crappie		1.0			1.0		2.0	2.0	7.0	13.0
*(Ammocrypta vivax)	Scaly sand darter	9.0	1.0							2.0	12.0
(Noturus miurus)	Brindled madtom	10.5									10.5
(Percina caprodes)	Logperch							1.0		9.0	10.0
(Labidesthes sicculus)	Brook silversides		1.5			2.0	1.0		1.0	4.0	9.5
(Notropis atherinoides)	Emerald shiner						4.5		4.0		8.5
(Pimephales notatus)	Bluntnose minnow	7.5									7.5
(Aplodinotus grunniens)	Freshwater drum									5.0	5.0
(Pimephales vigilax)	Bullhead minnow									4.0	4.0
(Ichthyomyzon gagei)	Southern brook lamprey	3.0	1.0								4.0
(Campostoma anomalum)	Stoneroller	1.0	3.0								4.0
(Lepomis symmetricus)	Bantam sunfish			3.0							3.0
(Lepomis hybrid)	Hybrid sunfish					1.0	1.0	1.0			3.0
(Anguilla rostrata)	American eel		3.0								3.0
*(Percina ouachitae)	Saddleback darter									2.5	2.5
*(Etheostoma stigmaeum)	Speckled darter	1.5	1.0								2.5
*(Etheostoma parvipinne)	Goldstripe darter		1.0				1.0				2.0
(Percina shumardi)	River darter									2.0	2.0
(Cyprinus carpio)	Carp									2.0	2.0
*(Notropis amnis)	Pallid shiner									1.0	1.0
*(Hypentelium nigricans)	Northern hogsucker		1.0								1.0
*(Fundulus catenatus)	Northern studfish		1.0								1.0
*(Ammocrypta asprella)	Crystal darter									1.0	1.0
(Notropis venustus)	Blacktail shiner									1.0	1.0
(Lepomis microlophus)	Redear							1.0			1.0
(Lepisosteus oculatus)	Spotted gar							1.0			1.0
(Pomoxis annularis)	White crappie									S	0.0
(Ichthyomyzon castaneus)	Chestnut lamprey		S								0.0
	NUMBER OF SPECIES=	36	43	25	24	36	32	37	33	50	66.0

* - SENSITIVE SPECIES

S - SPRING COLLECTION ONLY

Table 8. Relative abundance values of fish species from Delta Ecoregion reference streams.

FISH SPECIES		BOAT G	SECOND VILGE	CR.BY	DeVIEW	SUM
(Gambusia affinis)	Mosquitofish	12.0	10.5	12.0	9.0	43.5
(Aphredoderus sayanus)	Pirate perch	10.0	12.0	12.0	8.0	42.0
(Lepomis macrochirus)	Bluegill	6.5	12.0	8.0	7.5	34.0
(Fundulus olivaceus)	Blackspotted topminnow	8.5	9.0	10.5	1.0	29.0
(Lepomis punctatus)	Spotted sunfish	7.5	9.0	6.0	4.0	26.5
(Lepomis megalotis)	Longear	6.0	10.5	8.0	1.0	25.5
(Lepomis gulosus)	Warmouth	9.0	9.0	5.5		23.5
(Micropterus salmoides)	Largemouth bass	6.5	12.0	2.0	2.0	22.5
(Ictalurus natalis)	Yellow bullhead	8.5	9.0	1.0	3.0	21.5
(Etheostoma chlorosomum)	Bluntnose darter	2.0	12.0	7.5		21.5
(Pomoxis nigromaculatus)	Black crappie	1.0	9.0	3.0	7.5	20.5
(Notropis emiliae)	Pugnose minnow		7.5	5.5	6.0	19.0
(Etheostoma asprigene)	Mud darter		9.0		9.0	18.0
(Elassoma zonatum)	Banded pygmy sunfish	12.0	2.0	4.0		18.0
(Notropis atherinoides)	Emerald shiner		7.5		10.0	17.5
(Etheostoma gracile)	Slough darter	9.0	2.0	5.0		16.0
(Lepisosteus oculatus)	Spotted gar	2.5	7.0	6.0		15.5
(Notemigonus crysoleucas)	Golden shiner	12.0	1.0	2.0		15.0
(Lepomis cyanellus)	Green sunfish	6.0	4.0	5.0		15.0
(Etheostoma proeliare)	Cypress darter	6.0	9.0			15.0
(Ictalurus punctatus)	Channel catfish		2.5		12.0	14.5
(Aplodinotus grunniens)	Freshwater drum		4.5	2.0	8.0	14.5
(Notropis fumeus)	Ribbon shiner	1.0	8.0	5.0		14.0
(Noturus gyrinus)	Tadpole madtom	6.0	6.0	1.0		13.0
(Pimephales vigilax)	Bullhead minnow				12.0	12.0
(Esox americanus)	Grass pickerel	9.0		2.0		11.0
(Amia calva)	Bowfin	10.0	S	1.0	S	11.0
(Fundulus notatus)	Blackstripe topminnow		9.0		1.0	10.0
(Notropis venustus)	Blacktail shiner		2.0		7.5	9.5
(Erimyzon sucetta)	Lake chubsucker	9.5				9.5
(Notropis texanus)	Weed shiner	6.0		3.0		9.0
(Dorosoma cepedianum)	Gizzard shad		3.0	4.0	2.0	9.0
(Centrarchus macropterus)	Flier	9.0				9.0
(Pylodictis olivaris)	Flathead catfish				8.0	8.0
(Ictiobus niger)	Black buffalo		2.0		6.0	8.0
(Hybognathus hayi)	Cypress minnow	5.5	1.0			6.5
*(Percina maculata)	Blackside darter				6.0	6.0
(Minytrema melanops)	Spotted sucker	1.5		2.0	2.0	5.5
(Micropterus punctulatus)	Spotted bass		1.0		3.5	4.5
(Cyprinus carpio)	Carp	S	1.5	S	3.0	4.5
(Lepomis symmetricus)	Bantam sunfish	1.5	1.0			2.5
(Hybognathus nuchalus)	Silvery minnow	1.5		1.0		2.5
(Ictiobus bubalus)	Smallmouth buffalo		2.0	S	S	2.0
(Pomoxis annularis)	White crappie	S	1.5			1.5
(Lepomis microlophus)	Redear	S	1.5			1.5
(Notropis maculatus)	Taillight shiner	1.0				1.0
(Labidesthes sicculus)	Brook silversides	1.0				1.0
(Ictalurus melas)	Black bullhead	1.0				1.0
(Lepisosteus platostomus)	Shortnose gar	S				0.0
(Ictiobus cyprinellus)	Bigmouth buffalo	S				0.0
(Esox niger)	Chain pickerel	S				0.0
	NUMBER OF SPECIES=	37	36	28	26	51.0

* - SENSITIVE SPECIES
S - SPRING COLLECTION ONLY

All possible comparisons among the six ecoregions were made using this modified similarity index and the 10 most abundant species of each ecoregion. The results are shown in Table 9. The greatest similarity exist between the Ouachita Mountains and the Boston Mountains fishes. The least similarity is between the Ozark Highlands versus Gulf Coastal and between the Ozark Highlands versus Delta fishes. It is apparent from the similarity indices that there is very little similarity of the 10 most abundant fishes from each of the six ecoregions within the State. This substantiates the distinctiveness of these ecoregions as reflected in the fish populations of the least-disturbed streams.

add paragraph concerning ecoregion fishery definitions

Table 10 - Reg #2 definitions

Table 9. Similarity indices from comparisons of relative abundance values of the ten most abundance fish species of all ecoregions.

	ECOREGIONS				
	BOSTON MTNS.	OZARK HIGHLAND	AR RIVER VALLEY	DELTA	GULF COASTAL PLAINS
OUACHITA MTNS.	62	32	21	11	11
BOSTON MTNS.		39	40	10	10
OZARK HIGHLAND			19	9	9
AR RIVER VALLEY				36	29
DELTA					58

Add

Acknowledgements:

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