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Fishes of The Mammoth Cave Region

John Sterling Jackson

FISHES OF THE MAMMOTH CAVE REGION

(A PRELIMINARY SURVEY)

BY

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Approved:-

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INTRODUCTION

Extensive surveys of the ichthyological fauna have been made for states bordering Kentucky. An investigation of the literature pertaining to the ichthyology of Kentucky discloses the fact that no detailed investigation has been made of fish life in this state, especially of western Kentucky. No record is available of any survey having been made in the section known as the Mammoth Cave Region.

PURPOSE OF THE STUDY

The purpose of this survey was to make a species and ecological study of the fishes of the Mammoth Cave Region. Extensive opportunity for ecological studies exists in this region, but only the most important factors were included in this study. A study was made of the species distribution as affected by altitude; the type of water, i.e., whether the water was a river, a lake, a pond, or a sink; and the type of current, i.e., whether a rapidly moving stream, a stream of moderate movement, a still but clear body of water, or stagnant water. Most of the large lakes are of the clear type, while the ponds are of the stagnant type. As the region is naturally divided by Green River into two regions of different geological formations, a study of the species distribution both north and south of the river was made..

REVIEW OF THE LITERATURE

Evermann[1] has made an exhaustive review of the literature on the ichthyology of Kentucky. A study of his report shows that Constantine Samuel Rafinesque was the first person to collect and study the fishes of Kentucky.[2] Rafinesque was located at Transylvania University, as professor of botany and natural history for eight years, and while located there, he made numerous collecting trips throughout the state. However, a definite record was not given of the exact location of all collections. He published several articles on the fish life of Kentucky in current magazines. Later these articles were combined and reissued by Rafinesque under the title "Ichthyologia Ohiensis."

Putnam[3] published an article in which he referred to two species of cave fishes found in the Mammoth Cave. These were Typhlichthys subterraneus and Amblyopsis spelaeus.

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1 Evermann, B. W., "The Fishes of Kentucky and Tennessee: A Distributional Catalogue of the Known Species," Bulletin U. S. Bureau of Fisheries, Washington, Vol. XXXV, 1915-1916.

2 Refinesque, Constantine Samuel, Ichthyologia Ohiensis (Lexington, Kentucky, W. G. Hunt, 1820).

3 Putnam, F. W. "The Blind Fishes of Mammoth Cave and Their Allies," American Naturalist, Vol. VI, No. I, (Jan. 1872), pp. 6-30.

David Starr Jordan[4] and assistants made several trips into Kentucky between 1876 and 1888 for the purpose of studying the fish life in the eastern part of the state. However, the records disclose no studies of the fishes of western Kentucky.

Gilbert[5] made collections of fishes in the eastern part of Kentucky in 1884.

Evermann[6] states that Woolman, Monical, and Chambers examined several streams in Kentucky in 1890. Some of the waters of the western part of the state were sampled, a collection having been made near Bowling Green, Kentucky. This is probably the nearest point to the Mammoth Cave Region where a collection has been made.

Evermann[7] accompanied David Starr Jordan on some of his trips into Kentucky. Evermann later spent several days at Louisville, Kentucky, studying the species of fishes of the Ohio River.

For a more detailed description of the literature on the ichthology of Kentucky the reader is referred to the "Fishes of Kentucky and Tennessee, by Evermann.[8]"

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4 Jordan, David Starr, "A Partial Synopsis of the Fishes of Upper Georgia: with supplementary papers on Fishes of Tennessee, Kentucky and Indiana," Ann, N. Y. Lyc. Nat. Hist.,Vol. XI, (June 1877), pp. 307-377.

5 Gilbert, C. H., "Descriptions of New and Little Known Ethcostomids." Proc. U. S. Nat. Mus., Vol. X, (May 17, 1877), pp. 47-64.

6 Evermann, B. W., op. cit., pp. 293-368.

7 Ibid.,pp. 297-298.

8 Ibid., pp. 293-368.

THE GEOLOGY AND PHYSIOGRAPHY OF THE MAMMOTH CAVE REGION

The area included in the Mammoth Cave Region is traversed by the gorge of Green River, which divides it into two regions. The northern region is a rugged, hilly country with but few sinks except near Green River; consequently, only a few lakes or sinks with water are to be found. The Pottsville Sandstone caps the hills and ridges in this northern region while underlying formations are exposed only in a few of the stream beds and gorges of the larger streams. The streams are more numerous and are swifter in the northern than in the southern region. They follow well defined valleys. During some seasons many of them are dry. Some of the creeks are sand-locked at their mouths. The waters of the northern region are cold because these streams are fed by many springs.

Sink holes, valley sinks, and caves are very numerous in the southern region. Flat-topped plateaus make up a large portion of this region, although sinks and depressions now occupy over one-half of the original plateaus. Very few streams are found in this southern section because most of the drainage of the region sinks below the surface and flows off through underground channels. The slow solution of the underlying Mississippian limestone rock with the resulting development of drainage channels and caverns has gradually developed a vast underground drainage system. The ponds and lakes which are found in the depressions, or valley sinks, are formed by the clogging of the outlets at the bottom of the sink with silt from the sides. Some of these sinks, such as Cedar Sink, do not have clogged outlets but connect with some stream; therefore the water

level in the sink rises and falls with that of the connecting stream.

METHOD OF STUDY

A topographic map[9] of the region was used in locating the different waters and in making a study of the altitudes. Collections of fishes were made by the use of a seine, from all important streams, lakes, and a few ponds, during August, 1932, and June, 1933. A few fishes were caught in Green River with hand-lines and trot-lines and a few species were collected in the region at other dates. Each collection was tied in a gauze bag, together with a label, to designate the collecting point. All bags were placed in a common container in a ten percent solution of formaldehyde. Later, each collection was placed in a separate container with a label designating the collecting point. All species were classified according to the system given in Manual of the Vertebrate Animals.[10] A binocular microscope was used to study detailed structures of the fishes. Representative species from each collecting point have been placed in the zoology laboratory of the Western State Teachers College.

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[9] Topographic Maps of Kentucky, United States Geological Survey, Washington, D. C., 1924.

[10] Jordan, David Starr, and Evermann, Barton Warren, Manual of the Vertebrate Animals of the Northeastern United States Inclusive of Marine Species (New York, World Book Co., 1929).

TABLE I

GENERAL DISTRIBUTION OF THE FISHES OF THE MAMMOTH CAVE REGION

Species	Collecting Points																			Frequency of Occurrence
	Green River (Glenmore) 16*	Green River (Woodbury) 23	Green River (Echo River Outlet) 10	Green River (Y.M.C.A. Spring) 11	Green River (Near Crystal Cave) 8	Alexander Creek 1	Beaver Dam Creek 2	Wet Prong of Buffalo Creek 3	Bylew Creek 4	Dog Creek 5	Cub Run Creek 9	Ugly Creek 17	Woolsie Hollow Lake No. 1 12	Woolsie Hollow Lake No. 2 18	New Entrance Mammoth Cave Lake 13	McCombs Lake 14	Crooked Creek Lake 15	First Creek Lake 6	Tibbs Pond 20	Alexander Pond 21	Mammoth Cave Pond 22	Sugar Sink 19	Cedar Sink 7	Miscellaneous Caves 24	
Petromyzonidae																									
Lampetra lamottenii	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Polyodontidae																									
Polydon spathula---	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Hiodontidae																									
Hiodon tergisus----	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Dorosomidae																									
Dorosoma cepedianum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	X	--	--	--	--	--	--	3
Anguillidae																									
Anguilla Bostoniensis	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Catostomidae																									
Megastomatobus cyprinella----------	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Catostomus commersonnii----------	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Hypentelium nigricans----------	--	--	--	--	X	--	--	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Minytreme melanops-	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

Polyodon spathula---	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Hiodontidae																											
Hiodon tergisus----	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Dorosomidae																											
Dorosoma cepedianum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	X	--	--	--	--	--	--	--	--	2
Anguillidae																											
Anguilla Bostoniensis	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Catostomidae																											
Megastomatobus cyprinella----------	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Catostomus commersonnii----------	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Hypentelium nigricans----------	--	--	--	--	X	--	--	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Minytrema melanops-	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Moxostoma aureolum-	--	--	--	--	X	--	X	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Cyprinidae																											
Chrosomus erythrogaster----------	--	--	--	--	--	X	--	X	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Notemigonus crysoleucas----------	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	X	--	--	--	--	--	2
Semotilus atromaculatus----------	--	--	--	--	--	X	X	X	X	X	X	X	--	--	--	--	--	--	--	--	--	--	X	--	--	--	8
Cyprinella whipplii	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Notropis telescopus	--	--	X	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Notropis rubrifrons	X	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Hybopsis nocomis---	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Hyborhynchus notatus	--	--	--	X	X	X	X	--	X	X	--	--	--	--	--	X	--	X	--	--	--	--	--	--	--	--	8
Campostoma anomalum	--	--	--	--	X	--	X	--	X	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6
Cyprinus carpio----	--	--	--	--	--	--	--	--	--	--	--	--	X	--	X	--	--	--	--	--	--	--	--	--	--	--	2
Hybognathus nuchalis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	1
Notropis ardens lythrurus----------	--	--	--	--	--	X	--	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Hybopsis volucellus	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

* The number following each collecting point refers to a position on the map of the region.

TABLE I (Continued)
GENERAL DISTRIBUTION OF THE FISHES OF THE MAMMOTH CAVE REGION

Species	Collecting Points																							Frequency of Occurrence
	Green River (Glenmore) 16	Green River (Woodbury) 23	Green River (Echo River Outlet) 10	Green River (Y.M.C.A. Spring) 11	Green River (Near Crystal Cave) 8	Alexander Creek 1	Beaver Dam Creek 2	Wet Prong of Buffalo Creek 3	Bylew Creek 4	Dog Creek 5	Cub Run Creek 9	Ugly Creek 17	Woolsie Hollow Lake No. 1 12	Woolsie Hollow Lake No. 2 18	New Entrance Mammoth Cave Lake 13	McCombs Lake 14	Crooked Creek Lake 15	First Creek Lake 6	Tibbs Pond 20	Alexander Pond 21	Mammoth Cave Pond 22	Sugar Sink 19	Cedar Sink 7	Miscellaneous Caves 24	
Cyprinidae (Cont.)																								
Opsopoedus emiliae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	2
Notropis photogenis	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ameiuridae																								
Ictalurus furcatus	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ictalurus punctatus	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ameiurus natalis	--	--	--	--	--	--	--	--	--	X	--	--	--	X	--	--	--	--	--	X	X	X	--	5
Ameiurus nebulosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	1
Ameiurus melas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	1
Opladelus olivaris	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Rabida miurus	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Esocidae																								
Esox vermiculatus	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Amblyopsidae																								
Typhlichthys subterraneus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	
Typhlichthys wyandotte	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	
Forbesichthys agassizii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	

Cyprinidae (Cont.)																									
Opsopoedus emiliae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	--	2
Notropis photogenis	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ameiuridae																									
Ictalurus furcatus	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ictalurus punctatus	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ameiurus natalis	--	--	--	--	--	--	--	--	--	X	--	--	--	X	--	--	--	--	--	X	--	X	X	--	5
Ameiurus nebulosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	1
Ameiurus melas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	1
Opladelus olivaris	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Rabida miurus	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Esocidae																									
Esox vermiculatus	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.
Amblyopsidae																									
Typhlichthys subterraneus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	
Typhlichthys wyandotte	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	
Forbesichthys agassizii	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	X	
Atherinidae																									
Labidesthes sicculus	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	X	X	--	--	--	--	--	--	3
Cyprinodontidae																									
Zygonectes notatus	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	X	X	X	--	--	--	--	--	--	4
Etheostomidae																									
Boleosoma nigrum	--	--	--	X	X	--	X	--	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5
Etheostoma blennioides	--	--	--	--	--	X	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Percina caprodes	--	--	X	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Ulocentra sp.	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Nanostoma zonale	--	--	--	--	--	X	X	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Claricola whipplii	--	--	--	--	--	--	--	X	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Catonotus flabellaris	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Hypohomus nianguae	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Poecilichthys coeruleus	--	--	--	--	X	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Poecilichthys virgatus	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

TABLE I (Continued)
GENERAL DISTRIBUTION OF THE FISHES OF TH

Species	Collecting Points													
	Green River (Glenmore) 16	Green River (Woodbury) 23	Green River (Echo River Outlet) 10	Green River (Y.M.C.A. Spring) 11	Green River (Near Crystal Cave) 8	Alexander Creek 1	Beaver Dam Creek 2	Wet Prong of Buffalo Creek 3	Bylew Creek 4	Dog Creek 5	Cub Run Creek 9	Ugly Creek 17	Woolsie Hollow Lake No. 1 12	Woolsie Hollow Lake No. 2 18
Etheostomidae (Continued)														
Hadropterus phoxocephalus	--	--	--	--	X	--	--	--	--	--	--	--	--	--
Percidae														
Stizostedion vitreum	X	--	--	--	--	--	--	--	--	--	--	--	--	--
Moronidae														
Roccus saxatilis	X	--	--	--	--	--	--	--	--	--	--	--	--	--
Sciaenidae														
Aplodinotus grunniens	X	X	--	--	X	--	--	--	--	--	--	--	--	--
Cottidae														
Cottus bairdii	--	--	--	--	X	--	--	X	--	X	--	--	--	--
Centrarchidae														
Huro salmoides	X	X	X	--	X	--	X	--	--	--	--	--	--	--
Micropterus pseudaplites	--	--	--	--	X	--	X	--	X	--	--	--	--	--
Micropterus dolomieu	--	--	--	--	--	--	X	--	--	--	--	--	--	--
Xenotis megalotis	X	--	--	X	X	--	--	--	--	X	--	--	--	--
Helioperca incisor	--	--	--	--	X	--	--	--	--	X	--	--	--	--
Eupomotis gibbosus	--	--	--	--	--	X	X	--	--	X	--	--	--	--
Chaenobryttus gulosus	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ambloplites rupestris	--	--	--	--	X	--	X	--	X	X	--	--	--	--
Pomoxis sparoides	--	--	X	--	--	--	--	--	--	--	--	--	--	--
Pomoxis annularis	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Number of species	9	7	4	4	19	7	15	4	11	22	4	1	2	1

	(Near Crystal Cave) 18	Alexandor Creek 1	Beaver Dam Creek 2	Wet Prong of Buffalo Creek 3	Bylew Creek 4	Dog Creek 5	Cub Run Creek 9	Ugly Creek 17	Woolsie Hollow Lake No. 1 12	Woolsie Hollow Lake No. 2 16	New Entrance Mammoth Cave Lake 13	McCombs Lake 14	Crooked Creek Lake 15	First Creek Lake 6	Tibbs Pond 20	Alexandor Pond 21	Mammoth Cave Pond 22	Sugar Sink 19	Cedar Sink 7	Miscellaneous Caves 23	Frequency of Occurrence
Collecting Points																					
	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	6	--	--	--	X	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	1
	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	22	--	X	--	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
	4	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	4
	1	--	X	--	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6
	3	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	4
	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	8	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	--	4
	5	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	--	4
	10	--	--	--	--	--	--	--	--	--	--	--	--	X	--	--	--	--	--	--	4
	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2
	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4
	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4
	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3

TABLE II

GENERAL DISTRIBUTION OF THE FISHES OF THE MAMMOTH CAVE REGION BASED ON CERTAIN ECOLOGICAL FACTORS

Species	River				Creeks					Lakes Sinks and Ponds		Altitude				Geographical Location		
	Current		Bottom		Current			Bottom										
	Swift	Moderate	Mud	Gravel	Swift	Moderate	Mud	Gravel	Rock & Sand	Clear	Stagnant	400-500 ft	500-600 ft	600-700 ft	700-800 ft	North of Green River	South of Green River	In Green River
Petromyzonidae																		
Lampetra lamottenii----	--	--	--	--	1*	--	--	--	1	--	--	--	1	--	--	1	--	--
Polyodontidae																		
Polyodon spathula------	--	1	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Hiodontidae																		
Hiodon tergisus--------	2	--	--	2	--	--	--	--	--	--	--	2	--	--	--	--	--	2
Dorosomidae																		
Dorosoma cepedianum----	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	2	--	--
Anguillidae																		
Anguilla bostoniensis--	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomidae																		
Megastomatobus cyprinella----------	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomus commersonnii	--	--	--	--	2	--	--	--	2	--	--	1	1	--	--	2	--	--
Hypentelium nigricans--	--	1	--	1	2	1	--	--	2	--	--	2	1	--	--	2	--	1
Minytrema melanops-----	--	--	--	--	1	--	--	--	1	--	--	--	1	--	--	1	--	--
Moxostoma aureolum-----	--	1	--	1	--	2	1	1	--	--	--	3	--	--	--	1	1	1

TABLE II

GENERAL DISTRIBUTION OF THE FISHES OF THE MAMMOTH CAVE REGION BASED ON CERTAIN ECOLOGICAL FACTORS

Species	River				Creeks					Lakes Sinks and Ponds		Altitude				Geographical Location		
	Current		Bottom		Current			Bottom										
	Swift	Moderate	Mud	Gravel	Swift	Moderate	Mud	Gravel	Rock & Sand	Clear	Stagnant	400-500 ft	500-600 ft	600-700 ft	700-800 ft	North of Green River	South of Green River	In Green River
Petromyzonidae																		
Lampetra lamottenii----	--	--	--	--	1*	--	--	--	1	--	--	--	1	--	--	1	--	--
Polyodontidae																		
Polyodon spathula------	--	1	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Hiodontidae																		
Hiodon tergisus--------	2	--	--	2	--	--	--	--	--	--	--	2	--	--	--	--	--	2
Dorosomidae																		
Dorosoma cepedianum----	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	2	--	--
Anguillidae																		
Anguilla bostoniensis--	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomidae																		
Megastomatobus cyprinella----------	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomus commersonnii	--	--	--	--	2	--	--	--	2	--	--	1	1	--	--	2	--	--
Hypentelium nigricans--	--	1	--	1	2	1	--	--	2	--	--	2	1	--	--	2	--	1
Minytrema melanops-----	--	--	--	--	1	--	--	--	1	--	--	--	1	--	--	1	--	--
Moxostoma aureolum-----	--	1	--	1	--	2	1	1	--	--	--	3	--	--	--	1	1	1

Lampetra lamottenii----	--	--	--	--	1*	--	--	--	1	--	--	--	1	--	--	1	--	--
Polyodontidae																			
Polyodon spathula------	--	1	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Hiodontidae																			
Hiodon tergisus--------	2	--	--	2	--	--	--	--	--	--	--	2	--	--	--	--	--	2
Dorosomidae																			
Dorosoma cepedianum----	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	2	--	--
Anguillidae																			
Anguilla bostoniensis--	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomidae																			
Megastomatobus cypri---																			
nella------------------	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Catostomus commersonnii	--	--	--	--	2	--	--	--	2	--	--	1	1	--	--	2	--	--
Hypentelium nigricans--	--	1	--	1	2	1	--	--	2	--	--	2	1	--	--	2	--	1
Minytrema melanops-----	--	--	--	--	1	--	--	--	1	--	--	--	1	--	--	1	--	--
Moxostoma aureolum-----	--	1	--	1	--	2	1	1	--	--	--	3	--	--	--	1	1	1
Cyprinidae																			
Chrosomus erythrogaster	--	--	--	--	3	--	--	--	3	--	--	2	1	--	--	2	1	--
Notemigonus crysoleucas	--	--	--	--	--	--	--	--	--	1	1	--	--	1	1	--	2	--
Semotilus atromaculatus	--	--	--	--	5	2	1	1	5	1	--	5	3	--	--	5	3	--
Cyprinella whipplii----	--	--	--	--	--	1	1	--	--	--	--	1	--	--	--	--	1	--
Notropis telescopus----	--	2	1	1	--	--	--	--	--	--	--	2	--	--	--	--	--	2
Notropis rubrifrons----	1	1	--	2	--	--	--	--	--	--	--	2	--	--	--	--	--	2
Hybopsis nocomis-------	--	--	--	--	1	--	--	--	1	--	--	--	1	--	--	1	--	--
Hyborhynchus notatus---	--	2	1	1	3	1	1	--	3	2	--	7	1	--	--	4	2	2
Campostoma anomalum----	--	1	--	1	2	2	1	1	2	--	--	4	1	--	--	3	1	1
Cyprinus carpio--------	--	--	--	--	--	--	--	--	--	2	--	--	--	2	--	--	2	--
Hybognathus nuchalis---	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--	1	--	--
Notropis ardens lythru-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
rus--------------------	--	--	--	--	3	--	--	--	3	--	--	2	1	--	--	2	1	--
Hybopsis volucellus----	--	1	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Opsopoedus emiliae-----	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	2	--	--
Notropis photogenis----	--	--	--	--	--	1	1	--	--	--	--	1	--	--	--	--	1	--

* The numeral indicates frequency of occurrence.

TABLE II (Continued)
GENERAL DISTRIBUTION OF THE FISHES OF THE MAMMOTH CAVE REGION BASED ON CERTAIN ECOLOGICAL FACTORS

Species	River				Creeks					Lakes Sinks and Ponds		Altitude				Geographical Location		
	Current																	
	Swift	Moderate	Mud	Gravel	Swift	Moderate	Mud	Gravel	Rock & Sand	Clear	Stagnant	400-500 ft.	500-600 ft.	600-700 ft.	700-800 ft.	North of Green River	South of Green River	In Green River
Moronidae																		
Roccus saxatilis	1	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Sciaenidae																		
Aplodinotus grunniens	2	1	--	3	--	--	--	--	--	--	--	3	--	--	--	--	--	3
Cottidae																		
Cottus bairdii	--	1	--	1	2	--	--	--	2	1	--	3	1	--	--	3	--	1
Centrarchidae																		
Huro salmoides	2	2	1	3	--	1	1	--	--	1	--	6	--	--	--	1	1	4
Micropterus pseudaplites	--	1	--	1	1	1	1	--	1	1	--	4	--	--	--	2	1	1
Micropterus dolomieu	--	--	--	--	--	1	1	--	--	--	--	1	--	--	--	--	1	--
Zenotis megalotis	1	2	1	2	1	--	--	--	1	--	--	3	1	--	--	1	--	3
Helioperca incisor	--	1	--	1	1	--	--	--	1	2	--	3	1	--	--	3	--	1
Eupomotis gibbosus	--	--	--	--	2	1	1	--	2	1	--	3	1	--	--	2	2	--
Chaenobryttus gulosus	--	--	--	--	--	--	--	--	--	2	--	2	--	--	--	2	--	--
Ambloplites rupestris	--	1	--	1	2	1	1	--	2	--	--	3	1	--	--	2	1	1
Pomoxis sparoides	--	1	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Pomoxis annularis	--	--	--	--	--	--	--	--	--	3	--	3	--	--	--	3	--	--

DISCUSSION

The results of collection studies, ecological observations, and classification of species of fishes studied are given in Tables I and II. The Map shows all collecting points. An analysis of the various ecological factors considered in this study sheds considerable light on the question of the distribution of the species of fishes. Probably other factors than those studied exert considerable influence on species distribution.

A total of sixty-three species of fishes, belonging to eighteen different families, were found in the Mammoth Cave Region. Three of these eighteen families embracing three species were found only in the northern region, and one family embracing three species was found only in the southern region. Six families embracing six species were found only in Green River. Eight families embracing fifty-one species were not limited to either region or to Green River. Eleven species belonging to these latter eight families were found only in the northern region; ten species only in the southern region; ten species only in Green River; seven species in the northern region and in Green River; one species in the southern region and in Green River; five species in the southern and northern regions and in Green River; seven species in the northern and southern regions.

The distribution of both families and species of fishes is much more general north of Green River than south of this stream. Table II shows that three families, Petromyzonidae, Dorosomidae, and Esocidae, were limited to the northern region. A study of

Dog Creek, a characteristic stream of this northern region, explains the greater distribution found north of Green River. Dog Creek affords a wide range of ecological conditions, chief among which are a swift current resulting from a stream flowing out of an elevated region; clear waters due to rock and sand bed; very cold water, originating in springs, which is well oxygenated due to the stream flowing over much bed rock as shallows and rapids where the water becomes well aerated. These ecological conditions are very favorable to species of the Cyprinidae and Etheostomidae families and are preferred by many species of other families. These conditions are not found in the southern region. As a greater number of the species collected prefer this type of stream, a large number of the species are limited to the northern region. A greater number of species were found in Dog Creek than in any other stream in this northern region. Twenty-two species belonging to seven different families were found in this stream. Twelve of these species belong to the Cyprinidae and Etheostomidae families.

The Amblyopsidae or cave fish family is the only family limited to the southern region. The absence of caves north of Green River limits the Amblyopsidae to this southern region. Fishes belonging to other families have never been found in the caves of this region. Four species of the Cyprinidae family, three of the Ameiuridae, one specie of the Centrarchidae, one specie of the Etheostomidae, and three species of the Amblyopsidae make a total of the twelve species which are limited to the southern region. The species of these last five families show

a preference for the sluggish type of streams with mud bottoms, or mud and sand. This, therefore, limits them to the southern section because lakes, sinks, ponds, and slow moving streams are characteristic of the region south of Green River.

Table II shows that six families, Polyodontidae, Hiodontidae, Anguillidae, Percidae, Moronidae, and Sciaenidae, are limited to Green River. The explanation for this fact is that the larger streams are the natural habitat of these families. Species belonging to each of these families are rarely found except in large bodies of water.

Table II shows that five species belonging to three families, Cyprinidae, Etheostomidae, and Centrarchidae, are not limited to either region or to Green River. These species indicate no special preference for a definite type of current, type of stream bed, or specific altitude. Therefore, they are widely distributed.

The members of the Ameiuridae family, excepting the species confined to Green River, are found mostly in ponds and lakes of the southern region. Only one species, Ameiurus natalis, was found north of Green River. The natural habitat of a great many of the species of the Ameiuridae family is sluggish water with a mud bottom. Therefore, they find favorable conditions in the southern region which are not found in the northern region.

The members of the Etheostomidae family were found more frequently in the swifter types of water. They also showed a preference for stream beds of rock and sand. These two factors explain the more frequent occurence of the darters in the northern than

in the southern region. Boleosoma nigrum showed the widest distribution of all the darters, as it was found both in the northern and southern region, and in Green River.

The species of the Centrarchidae family are rather widely distributed as shown in Table I. However, fewer species of this family were found in ponds and lakes than would be expected. The ponds and lakes of the southern region are landlocked and evidently have not been stocked with many species of fishes.

The minnow, Hyborhynchus notatus, showed the widest distribution of all the minnows studied. The frequency of occurrence, given in Table I, shows that Hyborhynchus notatus occurred in 8 collections. This minnow was found in all types of waters except ponds. Hyborhynchus notatus showed no preference for a definite type of current, stream bed, or specific altitude. The minnow, Semotilus Atromaculatus, showed a strong preference for the creeks, as it was found in all creeks examined, but was not found in Green River, in ponds, or in sinks.

One new species of fish belonging to the genus Ulocentra was found in Dog Creek. This was authenticated by Dr. Carl L. Hubbs, of the University of Michigan.

Ugly Creek, a stream of the northern region, was practically lacking in fish life. Only two fish were taken in a distance of a mile or more, and both of these were of the species Semotilus atromaculatus. Wet Prong of Buffalo, also a northern stream, was lacking in number of species as only four species were collected from its water. Both streams are very shallow with few deep pools and are

not fed by many springs. As a result these streams are dry, or almost dry, at certain seasons of the year. These conditions are not favorable to fishes in general.

SUMMARY

This investigation was conducted for the purpose of determining the species distribution of fishes and the related ecological factors in the Mammoth Cave Region. A review of the literature pertaining to the ichthyology of Kentucky discloses the fact that no detailed investigation had been made of fish life in the Mammoth Cave Region and very little in the state of Kentucky in general.

The Mammoth Cave Region is divided into two almost equal regions by Green River. The northern region is characterized by its very rugged and hilly nature, with many cold and swiftly flowing streams. Flat-topped plateaus, sink holes, valley sinks, and numerous caves characterize the southern region, which has very little surface drainage.

Collections of fishes were made in all important streams, lakes, sinks, and in a few ponds in the Mammoth Cave Region, during August, 1932 and June 1933. A few species were collected at other dates. Most of the fishes were taken with a seine. Others were caught with hand lines and trot lines. Collections were properly labeled and preserved in a 10 per-cent solution of formaldehyde. All species were classified according to the system given in the Manual of Vertebrate Animals, by Jordan and Evermann.

Tables I and II show the results of collection studies, ecolog-

ical observations, and classification of species of fishes. A total of sixty-three species of fishes belonging to eighteen different families were found in the Mammoth Cave Region. Three of these eighteen families embracing three species were found only in the northern region and one family embracing three species was found only in the southern region. Six families embracing six species were found only in Green River. Eight families embracing fifty-one species were found not to be limited to either region or to Green River. Eleven species belonging to these latter eight families were found only in the northern region; nine species only in the southern region; nine species only in Green River; eight species in the northern region and in Green River; five species in the southern and northern regions and in Green River; seven species in the northern and southern regions.

The distribution of both families and species of fishes is much more general north of Green River than south of this stream. Twenty-two species belonging to seven different families were found in Dog Creek, a characteristic stream of the northern region. Twelve of these species belonged to the Cyprinidae and Etheostomidae families.

Three species of the Amblyopsidae or cave fish family were found only in the southern cave region. Nine other species belonging to the Cyprinidae, Ameiuridae, Centrarchidae, and Etheostomidae families were also limited to this southern region.

Six families, Polyodontidae, Hiodontidae, Anguillidae, Percidae, Moronidae, and Sciaenidae, are limited to Green River because species belonging to these families are typical inhabitants of

the larger streams.

Five species belonging to three families, Cyprinidae, Etheostomidae, and Centrarchidae are not limited to either region or to Green River because they show no special preference for type of current, type of stream bed, or specific altitude.

The members of the Ameiuridae family, excepting the species confined to Green River are found mostly in the ponds and lakes of the southern region. Only one species of this family, Ameiurius natalis was found north of Green River. The southern region furnishes a preferred habitat for species of the Ameiuridae family.

The members of the Etheostomidae or darter family were found more frequently in the swifter types of streams with rock and sand beds. These conditions limited them more often to the northern region. Boleosoma nigrum showed the widest distribution of all the darters.

Fewer species of the Centrarchidae family were found than was expected, although they showed a rather wide distribution. This was because the ponds and sinks of the southern region are land-locked and evidently have not been stocked.

The minnow, Hyborhynchus notatus, with a frequency of occurrence of 8 showed the widest distribution of all the minnows studied because of the lack of preference for distinct types of current, stream bed, or altitude. Semotilus atromaculatus was found in all creeks examined, but was not found in ponds, lakes or in Green River.

One new species of fish, belonging to the genus Ulocentra, was found in Dog Creek. This was authenticated by Dr. Carl L.

Hubbs, of the University of Michigan.

Ugly Creek, a stream of the northern region, was practically lacking in fish life, due to the fact that it receives only surface drainage and therefore becomes dry,or almost dry, at certain seasons. Only two fish, of the genus and species of Semotilus atromaculatus, were found in this stream in a distance of over one mile. Wet Prong of Buffalo Creek, also of the northern region, contained only four species. This stream becomes dry at certain seasons except for small pools of water.

Several of the streams of the Mammoth Cave Region offer a natural habitat for species of game fishes while others do not. The writer believes that it is desirable to study closely the various ecological factors affecting species distribution of fishes before any stream is stocked with game fish.

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