

**A SURVEY OF THE FISHES OF THE
NORTHWESTERN HIGHLAND RIM WITH EMPHASIS
ON MONTGOMERY COUNTY, TENNESSEE**



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A SURVEY OF THE FISHES OF THE NORTHWESTERN
HIGHLAND RIM WITH EMPHASIS ON
MONTGOMERY COUNTY, TENNESSEE

An Abstract
Presented to
the Graduate Council of
Austin Peay State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
Byron Lee Woodruff

August, 1971

ABSTRACT

A taxonomic survey of the fishes of the Northwestern Highland Rim of Middle Tennessee was conducted between autumn of 1969 and spring of 1971. Primary emphasis was placed on Montgomery County, Tennessee.

Freshwater habitats investigated included large sluggish rivers, small swift-flowing streams, cold springs, subterranean streams, swamps, small farm ponds, and large lakes.

The fishes collected represent 21 families comprising 70 species. Collections of Lampetra lamottei, Lepisosteus oculatus, L. platostomus, Amia calva, Anguilla rostrata, Hiodon alosoides, Ictiobus bubalus, Ictalurus furcatus, Aphredoderus sayanus, Morone saxatilis, and Etheostoma chlorosomum contribute new distributional information concerning fishes from the Cumberland River drainage of Tennessee.

Previous available information fails to reveal the presence of Amia calva and Etheostoma chlorosomum in the Cumberland River drainage of Tennessee. This suggests a possible range extension for both species.

A description of the area, materials and methods used in the investigation, and an annotated checklist of species collected is

included.

**Permanent specimens were prepared and are housed in the
Austin Peay State University Museum of Zoology.**

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To the Graduate Council:

I am submitting herewith a Thesis written by Byron Lee Woodruff entitled "A Survey of the Fishes of the Northwestern Highland Rim with Emphasis on Montgomery County, Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Biology.

Marvin M. Provo
Major Professor

We have read this thesis and recommend its acceptance:

Floyd M. Ford
Second Committee Member

Edward W. Chester
Third Committee Member

Accepted for the Council:

Wayne E. Stamps
Dean of the Graduate School

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CHAPTER I

INTRODUCTION

Available information concerning the fishes of the northern portion of Middle Tennessee is inadequate when compared to that of East and West Tennessee. Much previous research has been concentrated on Reelfoot Lake, the Great Smoky Mountains, and the Tennessee and Mississippi River drainages. Much of the information pertaining to the Cumberland River system of Middle Tennessee has come largely from the Harpeth, Stones, Caney Fork, and Obey River drainages. It appears that much of the region northwest of the Harpeth River drainage has remained practically unworked.

Statement of the Problem

The purpose of this research was to: (1) conduct a survey of the ichthyofaunal resources of the Northwestern Highland Rim in Tennessee; (2) annotate the fish collection at Austin Peay State University; and (3) provide new distribution data concerning the fishes of Tennessee.

Importance of the Study

This study is important to both the student of local ichthyology and the researcher. It will aid the researcher by serving as a basis for later studies that might be conducted on fishes of Montgomery County or contiguous areas. To the student, it will serve as a reference source that deals with the local ichthyofauna.

Limitations of the Study

The study was conducted between the Autumn of 1969 and Spring of 1971. The study was confined to the Northwestern Highland Rim province of Middle Tennessee. Primary emphasis was placed on Montgomery County.

Nomenclature

Throughout this manuscript, scientific and common names of species follow those of the American Fisheries Society (1970), except with the subspecies Ulocentra (Etnier, 1969c).

Literature Review

Very little information concerning the fishes of northern Middle Tennessee is available. Much research has been directed at Reelfoot Lake (Baker, 1937, 1939a, 1939b; Baker and Parker, 1938) and the Great Smoky Mountains (Burrows, 1935; Holloway,

1945; Lennon, 1962). Among other previous research, some of which is not published, are those of Bailey (1959), Ball (1937), Etnier (1967a, 1967b, 1969a, 1969b, 1969c, 1970a, 1970b, 1970c, 1971a), Evermann (1915-1916), Evermann and Hildebrand (1914), Grant (1966), Henshall (1889), Howell (1968), Hubbs (1939), Jordan (1877, 1888), Jordan and Brayton (1878), Kirsch (1891), Khune (1939), Lachner and Jenkins (1967), Miller (1968), Ramsey (1964), Raney and Zorach (1966), Shoup, et al. (1941), Small (1971), Smith (1965), Stiles (1968), Taylor (1969), Zorach (1969), and Zorach and Raney (1966). In a number of studies only a certain genus or species was treated. However, an adequate representation of fishes from northern Middle Tennessee has not been previously indicated.

According to Gentry (1965) the first known list of fishes in Tennessee waters was compiled by the Tennessee Game and Fish Division (now the Tennessee Game and Fish Commission) and was published by Kuhne (1939). Later a checklist of the names of fishes was compiled from all known records of fishes collected in Tennessee (Gentry, 1965). However, the most accurate, complete, and current checklist of Tennessee fishes is that of Etnier (1970a).

CHAPTER II

DESCRIPTION OF THE STUDY AREA

Montgomery County, Tennessee, is located in the northwest section of Middle Tennessee and is bordered on the east by Cheatham and Robertson Counties, on the south by Houston and Dickson Counties, and on the west by Stewart County. To the north lies Christian and Todd County, Kentucky. Montgomery County is comprised of 347,502 acres (Scott, 1967). It has a humid, mesothermal climate with little or no water deficiency in any season (Thorntwaite, 1948).

Physiography

Montgomery County, Tennessee lies within the Northwestern Highland Rim province (Fenneman, 1938). The terrain is relatively flat, interspersed with rolling hills. Elevations range from 350 feet in the valley of the Cumberland River to 700 feet on the uplands (Smith, 1962). The average elevation of the county is 500 feet (Killebrew, 1870).

The outstanding geologic features of the county include outcrops and the overburden of the St. Louis limestone formation of

Mississippian Age (Smith, 1962). The massive gray St. Louis formation contains numerous solution channels, sinkholes, and some caves, the best known being Dunbar Cave, which is 2 miles northeast of Clarksville. The main artery of the cave is more than 200 feet in length (Smith, 1962).

Underlying the St. Louis limestone is the Warsaw limestone, which is exposed at lower elevations. The Fort Payne chert is exposed in many of the stream valleys (Smith, 1962). According to Hardeman, et al. (1966) the county is primarily underlain by St. Louis and Warsaw limestone, with some deposits of Ste. Genevieve limestone occurring in areas of the northern quarter.

Wilson (1958) describes Montgomery County as being covered with red soils and white chert plus alluvial deposits along the Cumberland and Red River that drain the region.

Drainage

The Tennessee and Cumberland River systems drain the Highland Rim. The Tennessee River forms the western boundary of the area (Smith, 1962). However, Montgomery County, Tennessee, is drained primarily by the Cumberland and Red Rivers (Figure 1).

The Cumberland River arises in the plateau section of eastern Kentucky and flows southward and westward through Clay and Jackson Counties into the Central Basin of Tennessee. The river meanders

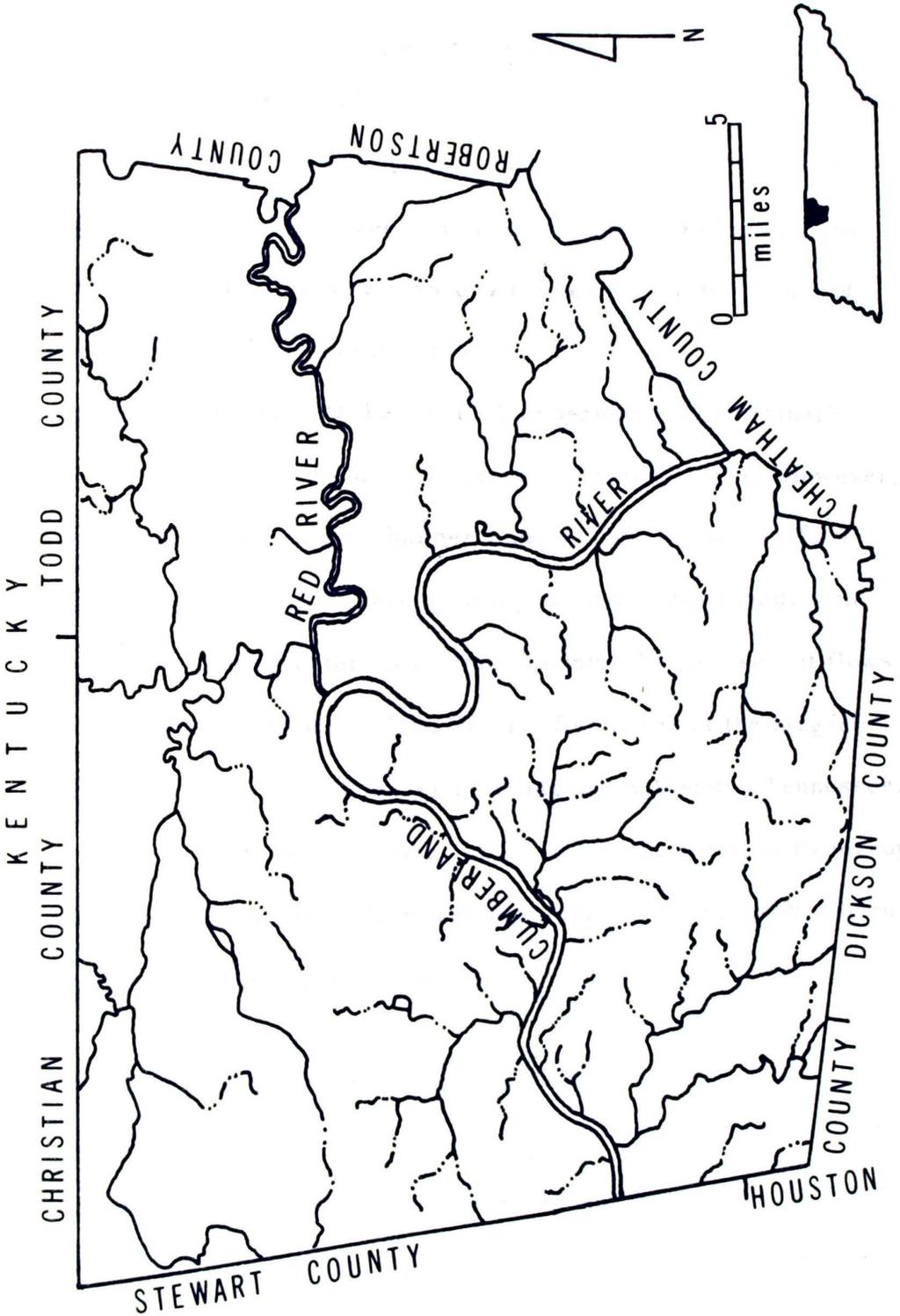


FIGURE 1. Montgomery County, Tennessee showing the major drainages.

westward through the Basin and then northwest through Davidson, Cheatham, Dickson, Montgomery, and Stewart Counties on the Highland Rim (Smith, 1962).

The Cumberland River parallels the Tennessee River in Stewart County, Tennessee, and in southwestern Kentucky, and empties into the Ohio River about 20 miles east of the mouth of the Tennessee River (Smith, 1962).

The Red River of the Lower Cumberland River drainage arises in Robertson County, Tennessee (Carter, 1970). However, a small portion arises in Sumner County, Tennessee. It flows approximately 30 miles through Simpson and Logan Counties in Kentucky, then re-enters Robertson County, Tennessee. It flows westward into the Cumberland River. Red River is the largest tributary to Cumberland River in Montgomery County, Tennessee.

The Red River watershed is located in the Western Pennyroyal physiographic region of Kentucky (Carter, 1970) and the Northern Highland Rim of Middle Tennessee.

Description of the Lentic and Lotic Habitats

Montgomery County, Tennessee, consists of three basic types of freshwater habitats. Two are of lentic nature; reservoirs and farm ponds. The other, streams, is of lotic nature. The latter is of primary interest in this study.

Barkely Reservoir is an impoundment of the Cumberland River. It enters Montgomery County from the southeastern corner, which borders Cheatham County, and extends approximately 37 river miles across the county into Stewart County, which lies on the western border (USDA-SCS, 1969).

Farm ponds are of two general types: (1) ponds having 5 acres and larger and (2) ponds having fewer than 5 acres. The former includes Dunbar Cave (Swan Lake) and Clarksville Lake. Swan Lake is about 15 acres in size and is located in the St. Bethlehem area in the northeast section of the county. Clarksville Lake consists of approximately 35 acres and is in the western portion of the county. It lies south of the Woodlawn area and northwest of the Dotsonville community. Lake Taal consists of around 31 acres and is located on the Fort Campbell Military Reservation in the northwest section of the county. The Bill Hudson farm pond is located near Port Royal in the eastern portion of the county and consists of approximately 12 acres. There are approximately 2,150 farm ponds of less than 5 acres scattered throughout Montgomery County (USDA-SCS, 1969).

As stated previously, Montgomery County, Tennessee, is drained primarily by the Cumberland and Red River. Since each river consists of several tributaries where many collections were made, a brief description of the tributary location follows. More

detailed information may be found in USDA-SCS (1969), which was the source of much descriptive material such as the extent of time streams were dry annually and the sizes of the impoundments.

Tributaries of Cumberland River

Eldridge Creek - occurs in the west section of the county south of the Oakwood community. It flows in a southeast direction into Blooming Grove Creek. Poplar Springs Road and Atkins Road cross the stream. It is dry an estimated 5 months per year.

Cooper Creek - located in the west section of the county southeast of the Oakwood area. The stream flows in a southeast direction into Blooming Grove Creek. Blooming Grove Road crosses the stream. The stream is dry approximately 4 months annually.

Blooming Grove Creek - situated in the west portion of the county west of Dotsonville. It enters the Cumberland River from the northwest. Poplar Springs Road and Pete Morrow Road bisect the stream.

Bartee Branch - established in the west section of the county northwest of Dotsonville and south of the Woodlawn community. The stream proceeds in a south to southwest direction into Dry Branch. It is intersected by Cunningham Lake Road.

Dry Branch - appears in the west fragment of Montgomery County northwest of the Dotsonville tract. The stream flows southwest into Blooming Grove Creek. York Road crosses the stream.

Outlaw Branch - occurs in the west section of the county southwest of the Dotsonville commonalty. Outlaw Branch flows southwest into Blooming Grove Creek. It is crossed by Outlaw Road. This stream is dry an estimated 8 months per year.

Sugar Creek - located in the west section of the county close to Dotsonville. Cumberland River receives this stream from the northwest. It has been estimated that this creek is dry 9 months per year.

Hog Branch - lies in the western part of the county, near the Dotsonville community. Its flow is southerly into Cumberland River and is dry approximately 9 months yearly.

Cummings Creek - occurs in the west section of the county east of Dotsonville. It flows in a southeast direction into Cumberland River. Dotsonville Road, Dailey Road, and Gip Manning Road cross the stream.

Sag Branch - located in the central portion of the county northeast of Dotsonville. The stream flows in a south direction into Cumberland River. It is estimated to be dry 9 months per year.

Donaldson Creek - situated in the central section of the county southwest of New Providence. It flows in a southeast direction into

Cumberland River and is dry an estimated 9 months per year.

Yellow Creek - established in the southwest fragment of the county just southwest of the Palmyra community. From Houston County it flows north into Cumberland River. Yellow Creek is intersected by McFall Road, Highway 13, and Riggins Road.

East Fork Yellow Creek - present in the southwest portion of the county west of Shiloh and southwest of Palmyra. It enters from Houston County and flows in a northwest direction into Yellow Creek. Wilson Chapel Road crosses the stream.

Thorn Hollow Branch - located in the southwestern part of the county southwest of the Shiloh community. It flows into Yellow Creek from the east. The stream is intersected by Thorn Hollow Road. It is dry an estimated 9 months per year.

Sullivan Branch - located in the southwest section of the county just south of Shiloh. It enters from Dickson County and flows in a northwest direction into East Fork Yellow Creek. Chambers Road and Highway 13 cross the stream.

Bagget Branch - exists in the southwest fraction of the county south to southeast of the Shiloh commonalty. The stream flows into East Fork Yellow Creek from the east. It is bisected by Bailey Cobb Road, Highway 13, Emery Road, and Moorefield Road.

Bryant Branch - occurs in the southwestern branch of the county. It is approximately southeast of Shiloh and north to northwest of the Marion community. From Dickson County the stream enters and flows in a northwest direction into Bagget Branch. Underwood Road crosses this tributary.

Burney Creek - appears in the southwestern division of the county north of Shiloh and south of Palmyra. It flows in a west direction into East Fork Yellow Creek. This waterway is intersected by Jarman Hollow Road. Burney Creek is estimated to be dry 9 months per year.

Bessie Branch - situated just west of Palmyra in the western section of the county. It flows in a northwest direction into Cumberland River. Corbandale Road crosses the stream. It is dry an estimated 9 months per annum.

Deason Creek - present in the southwest fraction of the county. It lies just south of Palmyra and flows north into Weaver Creek. The stream is crossed by Jarman Hollow Road and is estimated to be dry 9 months during the year.

Weaver Creek - established southeast of Palmyra in the southwest portion of the county. It empties into Cumberland River from the south and is bisected by Highway 149. Drought in this stream is approximately 9 months per year.

Goldenhorn Creek - occurs in the southwest sections of the county east to southeast of the Palmyra commonalty. It flows in a north direction into Cumberland River. The stream is dry an estimated 9 months yearly and is crossed by Highway 149.

Budds Creek - located in the west section of Montgomery County northeast of Palmyra. Its flow is in a northwest direction into Cumberland River. Budds Creek Road plus Highway 149 cross the stream.

Antioch Creek - situated northeast of Palmyra and west to southwest of the Orgains community in the west fraction of the county. From the east it flows into Budds Creek and is intersected by Hematite Road, Highway 149, Antioch Road, and Antioch Church Road.

Ussery Branch - appears in the west section of the county northeast of Palmyra and northwest of Orgains, near Hilltop. The branch flows in a west direction into Cumberland River. The stream is crossed by Ussery Road. It is dry an estimated 9 months per year.

Vernon Creek - exists in the southwest portion of Montgomery County west to northwest of the Lone Oak community. It flows northwest into Budds Creek. This tributary flows by Vernon Creek Road and Lem Davis Road.

Louise Creek - established in the south fragment of the county. It lies north to northeast of Marion and south to southwest of Southside. From the west it flows into Big Barton Creek. The following roads intersect this stream: Louise Creek Road, Highway 48, Akin Road, Batson Road, and Grays Chapel Road.

Rocky Ford Creek - occurs in the central portion of the county northeast of Orgains and west of the Salem community. The stream is dry an estimated 5 months per annum and is crossed by Bush Road, Edmondson Ferry Road, and Rocky Ford Road. It flows in a northeast direction into Cumberland River.

Camp Creek - found in the central section of the county northeast of Orgains and south of Salem. It enters Cumberland River from the west and is dry around 9 months a year. Seven Mile Ferry Road and Chapel Hill Road bisects the creek.

Hurricane Creek - located in the southeast section of the county southeast of Orgains, It flows east into Cumberland River. Freeman Road, Marthas Chapel Road, and Seven Mile Ferry Road cross the stream.

Sulfur Springs Branch - lies in the southeast portion of the county east of the Lone Oak community. Marthas Chapel Road crosses the stream. The branch flows northeast into Hurricane Creek and is dry approximately 9 months per year.

Dawson Creek - exists north of Southside in the southeast section of the county. It enters Cumberland River from the south. The creek is bisected by Liverworth Road and Dixie 'B' Road.

Frazier Branch - established northeast of Southside in the southeast portion of the county. It flows east into Cumberland River. For 9 months per year the stream is estimated to be dry.

Little Bartons Creek - appears in the southern region of the county south of Southside and east of Marion. The stream enters from Dickson County and flows east into Big Bartons Creek. Indian Mound Creek Road, Swift Lane, Old Highway 48, Sinks Road, and Batson Mill Road intersect it.

Big Bartons Creek - occurs in the southern section of the county south of Southside. It flows in a northeast direction into Cumberland River Watershed in Cheatham County, Tennessee. Batson Mill Road crosses the stream.

Wall Branch - found in the central section of the county west of the Excell community. It extends in a southwest direction into Cumberland River. Gratton Road bisects it. The stream is dry an estimated 9 months per year.

Big McAdoo Creek - located in the eastern fragment of the county south of Excell. From the east it flows into Cumberland

River. Among the roads that cross this stream are Point Road, Gholson Road, Highway 12, Shady Grove Road, and Gratton Road.

Little McAdoo Creek - established within the eastern portion of the county south of Excell and east of the Fredonia community. It flows west into Big McAdoo Creek. Point Road, Highway 12, Fredonia Road, and Iron Road cross this branch.

Muddy Branch - situated west of Hickory Point in the southeastern part of the county. It flows west into Cumberland River and is crossed by Muddy Branch Road and Gholson Road.

Sulfur Branch - exists in the southeastern region of the county south of Hickory Point. It is directed into Cumberland River from the northeast. The stream is crossed by Sulfur Springs Road.

Brush Creek - occurs south of Fredonia in the southeast section of the county. It flows southwest into Cumberland River and is bisected by Bearden Road, Highway 12, and the Old Clarksville Pike.

Marks' Slough - located in the southeastern section of the county near Lock B, Cumberland River. It consists of approximately 50 acres. The swamp is fed by several permanent springs and is transversed by a man-made ditch which empties into the Cumberland River. Before the advent of Barkley Dam the entire region was subjected to periodic flooding and now consists of a swampy river

bottomland thinly wooded in a few areas (Chester, 1970).

Tributaries of Red River

Big West Fork Creek - occurs in the northern section of the county. It flows south from Christian County, Kentucky into Red River. Boy Scout Road and Peachers Mill Road cross the stream.

Little West Fork Creek - located north of New Providence in the northern portion of the county. The stream runs east from the Fort Campbell Military Reservation into Big West Fork Creek. Peachers Mill Road, Highway 41-A, Boiling Springs Road, and Mabry Road bisect the tributary. The section of this stream crossing Highway 41-A is also referred to as Ringgold Creek.

Raccoon Branch - situated in the northwest area of the county north of Woodlawn. From the south it flows into Fletchers Fork Creek. LaFayette Road transects the stream. The majority of the stream occurs within the Fort Campbell Military Reservation and is estimated to be dry 11 months per year.

Fletchers Fork Creek - established in the northwest portion of the county north to northeast of Oakwood. It flows northeast into Little West Fork Creek. The larger portion of the tributary exists within the Fort Campbell Military Reservation. Highway 79, Boiling Springs Road, Mail Route Road, Woodlawn Road and Palmyra Road cross it.

Dry Fork Creek - appears in the northwest fragment of the county. In a southwest direction it flows into Little West Fork Creek. The creek enters the Fort Campbell Military Reservation from Christian County, Kentucky and is bisected by Mabry Road.

Dry Creek - found in the northwest portion of the county. It flows southward into Little West Fork Creek. Dry Creek enters the Fort Campbell Military Reservation from Christian County, Kentucky and is crossed by Palmyra Road and Mabry Road.

Piney Fork Creek - occurs in the northwest section of the county. It enters the Fort Campbell Military Reservation from Stewart County, Tennessee and flows east into Little West Fork Creek. The bulk of the tributary exists within the Fort Campbell Military Reservation. Mabry Road, Boiling Springs Road, Engineers Road, Palmyra Road, Grant Road, Ghost Corps Trail, and Jordan Springs Road cross the stream. It has been estimated to be dry 3 months per annum.

Little Creek - located within the Fort Campbell Military Reservation, in the northwest fragment of the county. It enters Piney Fork Creek from the west. Palmyra Road and Ghost Corps Trail transect the branch. It is dry an estimated 11 months per year.

Moss Creek - situated within the Fort Campbell Military Reservation in the northwest portion of the county. It flows east

into Jordan Creek. The stream is dry approximately 8 months yearly. Palmyra Road and Jordan Springs Road cross the stream.

Jordan Creek - established in the northwest section of the county within the Fort Campbell Military Reservation. It enters Piney Fork Creek from the west and is estimated dry 2 months a year. Among the roads that bisect this branch are Palmyra Road, Jordan Springs Road, and Pleasant Mill Road.

Elk Fork Creek - present in the northwest fraction of the county within Fort Campbell Military Reservation. It flows north into Piney Creek. Pleasant Mill Road crosses the stream. It is dry an estimated 8 months per year.

Spring Creek - occurs in the north section of the county northwest to northeast of the St. Bethlehem community and west of Hampton Station. It flows west into Big West Fork Creek. Needmore Road, Highway 48, Kennedy Road, Meriwether Road, Tylertown Road, Johnson Road, Highway 79, Port Royal Road, and Guthrie Road cross it.

Sulfur Fork Creek - located in the eastern fraction of the county near Port Royal. It enters from Robertson County and flows west into Red River.

Passenger Creek - situated in the east section of the county northeast of Sango and southwest of Port Royal. It enters from Robertson County and flows northwest into Red River. Grants

Chapel Road, Highway 76, Rosson Road, Trough Spring Road, and Sango Road cross the stream.

Coon Creek - established within the eastern portion of the county southwest of Port Royal and northeast of Sango. It immigrates Passenger Creek from the south and is estimated dry 6 months per year. Trough Spring Road and Dunbar Road transect the stream.

CHAPTER III

MATERIALS AND METHODS

Collecting

General collecting methods for fishes included the use of seines, gill nets, hoop nets, minnow traps, baited hooks, and electrical current. Seines were used primarily in springs, creeks, and ponds less than 4 feet in depth. Gill nets, hoop nets, and baited hooks were used in streams where the depth exceeded 4 feet. Minnow traps were used occasionally. An electric fish shocker (Morris, 1950) was constructed and tested, but not employed as a regular method of collection. In one instance a fine mesh insect net made of 1 mm sq. mesh was used to collect Typhilichthys subterraneus in a subterranean stream.

Killing, Fixing, and Preserving

Various methods were used to kill the fishes. Most of the specimens were immersed in 10 percent formalin. This method worked very well with smaller fishes since their fins became fixed

in an erect position. This aided in ray and spine counts and measurements. Other specimens were killed by freezing.

All specimens were fixed and preserved in 10 percent formalin. Fishes longer than 5 to 6 inches had either an incision cut in their abdomen using a scalpel or were injected with 10 percent formalin for adequate fixing. Several large specimens were bent in the desired position and fixed in this position to insure fitting into standard sized containers. Members of the family Lepisosteidae were identified and decapitated after body measurements were taken. Their heads were preserved in 10 percent formalin.

Data Recording

Once in permanent storage containers, the specimens were given permanent labels. These labels usually included the following information: (1) scientific and common name; (2) location (state, county); (3) collector's name; (4) date of collection; (5) habitat; and (6) specimen number. Additional information pertaining to measurements, etc. was added when it was of special interest.

CHAPTER IV

RESULTS

As a result of this research, 21 families comprising 70 species of fishes were collected from the Montgomery County, Tennessee area. Collections of Lampetra lamottei, Lepisosteus oculatus, L. platostomus, Amia calva, Anguilla rostrata, Hiodon alosoides, Ictiobus bubalus, Ictalurus furcatus, Aphredoderus sayanus, Morone saxatilis, and Etheostoma chlorosomum add concrete information to the check list of Tennessee fishes from the Cumberland River Drainage (Etnier, 1970a). A list of fishes of known and probable occurrence in the Cumberland River drainage appears in Table I. Previous available records do not reveal the presence of Amia calva and Etheostoma chlorosomum in the Cumberland River Drainage of Tennessee. This suggests a possible range extension for both species.

According to Eddy (1969) A. calva occurs in sluggish rivers and shallow lakes of the Mississippi drainage from Minnesota eastward through part of the Great Lakes and St. Lawrence drainage and south to the Gulf. It also ranges southward in the Atlantic drainage

TABLE I
 FISHES OF KNOWN AND PROBABLE OCCURRENCE
 IN THE CUMBERLAND RIVER DRAINAGE
 OF TENNESSEE

 Petromyzontidae

Ichthyomyzon bdellium
 I. castaneus*
 I. unicuspis
 Lampetra aepyptera
 L. lamottei*

Acipenseridae

Acipenser fulvescens

Polyodontidae

Polyodon spathula*

Lepisosteidae

Lepisosteus oculatus*
 L. osseus*
 L. platostomus*

Amiidae

Amia calva*

Anguillidae

Anguilla rostrata*

Clupeidae

Alosa chrysochloris
 Dorosoma cepedianum*
 D. petenense*

Hiodontidae

Hiodon alosoides*
 H. tergisus*

Salmonidae

Salmo gairdneri*
 S. trutta

Esocidae

Esox americanus
 vermiculatus*
 E. masquinongy

Cyprinidae

Campostoma anomalum*
 Carassius auratus*
 Clinostomus funduloides*
 Cyprinus carpio*
 Ericymba buccata
 Hemitrema flammea
 Hybognathus hayi
 H. nuchalis
 Hybopsis aestivalis
 H. amblops
 H. dissimilis
 H. insignis
 H. storeriana
 Nocomis effusus
 N. micropogon
 Notemigonus crysoleucas*
 Notropis amnis
 N. ardens*
 N. ariommus

* Species collected during this research.

TABLE I (continued)

<i>N. atherinoides</i>	<i>Minytrema melanops</i> *
<i>N. blennius</i>	<i>Moxoxotoma anisurum</i>
<i>N. boops</i>	<i>M. carinatum</i>
<i>N. buchanani</i>	<i>M. duquesnei</i> *
<i>N. chrysocephalus</i> *	<i>M. erythrurum</i> *
<i>N. emiliae</i>	<i>M. macrolepidotum</i>
<i>N. galacturus</i> *	
<i>N. heterolepis</i>	
<i>N. leuciodus</i>	Ictaluridae
<i>N. photogenis</i>	<i>Ictalurus furcatus</i> *
<i>N. rubellus</i>	<i>I. melas</i> *
<i>N. spilopterus</i> *	<i>I. natalis</i>
<i>N. stramineus</i>	<i>I. nebulosus</i>
<i>N. telescopus</i> *	<i>I. punctatus</i> *
<i>N. umbratilis</i>	<i>Noturus elegans</i>
<i>N. volucellus</i>	<i>N. eleutherus</i>
<i>N. whipplei</i> *	<i>N. exilis</i> *
<i>Phenacobius uranops</i>	<i>N. flavus</i>
<i>Phoxinus erythrogaster</i> *	<i>N. gyrinus</i>
<i>Pimephales notatus</i> *	<i>N. miurus</i>
<i>P. promelas</i> *	<i>N. munitus</i>
<i>P. vigilax</i> *	<i>N. stigmosus</i>
<i>Rhinichthys atratulus</i> *	
<i>R. cataractae</i>	Amblyopsidae
<i>Semotilus atromaculatus</i> *	<i>Chologaster agassizi</i> *
	<i>Typhlichthys subterraneus</i> *
Catostomidae	
<i>Carpiodes carpio</i>	Aphredoderidae
<i>C. cyprinus</i>	<i>Aphredoderus sayanus</i> *
<i>C. velifer</i>	
<i>Catostomus commersoni</i> *	
<i>Cycleptus elongatus</i>	Cyprinodontidae
<i>Erimyzon oblongus</i> *	<i>Fundulus catenatus</i> *
<i>E. sucetta</i>	<i>F. notatus</i>
<i>Hypentelium etowanum</i>	<i>F. olivaceus</i> *
<i>H. nigricans</i> *	
<i>Ictiobus bubalus</i> *	Poeciliidae
<i>I. cyprinellus</i>	<i>Gambusia affinis</i> *
<i>I. niger</i>	
<i>Lagochila lacera</i>	

TABLE I (continued)

Atherinidae	
<i>Labidesthes sicculus</i>	<i>E. rufilineatum</i>
	<i>E. sagitta</i>
	<i>E. spectabile</i> *
	<i>E. squamiceps</i> *
Percichthyidae	
<i>Morone chrysops</i>	<i>E. stigmaeum</i>
<i>M. mississippiensis</i> *	<i>E. tippecanoe</i>
<i>M. saxatilis</i> *	<i>E. (Ulocentra) sp. B</i>
	<i>E. (Ulocentra) sp. G.*</i>
	<i>E. virgatum</i> *
	<i>E. zonale</i>
Centrarchidae	
<i>Ambloplites rupestris</i> *	<i>Percina burtoni</i>
<i>Lepomis auritus</i>	<i>P. caprodes</i>
<i>L. cyanellus</i> *	<i>P. copelandi</i>
<i>L. gulosus</i> *	<i>P. evides</i>
<i>L. macrochirus</i> *	<i>P. macrocephala</i>
<i>L. megalotis</i> *	<i>P. maculata</i>
<i>Micropterus coosae</i>	<i>P. phoxocephala</i>
<i>M. dolomieu</i> *	<i>P. sciera</i>
<i>M. punctulatus</i> *	<i>P. sciera</i>
<i>M. salmoides</i> *	<i>P. squamata</i>
<i>Pomoxis annularis</i> *	<i>Stizostedion canadense</i> *
<i>P. nigromaculatus</i> *	<i>S. vitreum vitreum</i>
	Sciaenidae
Percidae	
<i>Ammocrypta asprella</i>	<i>Aplodinotus grunniens</i> *
<i>Etheostoma atripinne</i>	
<i>E. blennioides</i>	
<i>E. caeruleum</i> *	
<i>E. camurum</i>	
<i>E. (Catonotus) sp. C.</i>	
<i>E. chlorosomum</i> *	
<i>E. cinereum</i>	
<i>E. flabellare</i> *	
<i>E. kennicotti</i>	
<i>E. luteovinctum</i>	
<i>E. maculatum</i>	
<i>E. microlepidum</i>	
<i>E. nigrum</i>	
<i>E. obeyense</i>	
	Cottidae
	<i>Cottus bairdi</i>
	<i>C. carolinae</i> *

from Connecticut to Florida.

Etnier (1967b, 1970c) collected A. calva in Lake and Obion County in Tennessee. Sisk (1969) took this species in Graves and Hickman County in Kentucky. Page (1971) provides collection data from Ballard County, Kentucky and Obion County, Tennessee. All of the above collections were west of the Tennessee River. However, previous available records do not list it as occurring in the Cumberland River Drainage in Tennessee.

Etheostoma is one of the largest and most difficult genera of fishes in Tennessee. The reason for much of this difficulty is that the distribution of the species within the state has been rather poorly recorded in the literature, and that most species are extremely variable in the meristic characters (Etnier, 1969c).

Both Moore (1968) and Eddy (1969) list Etheostoma chlorosomum as being distributed from southern Minnesota and Indiana to Alabama and Texas. According to records provided by Bailey (1971) E. chlorosomum has been taken from Livingston County, Kentucky. Etnier (1967b) records it from Henderson County, Tennessee; (1969b) Hardeman, Hardin, and Henry Counties in Tennessee; (1970c) Carroll, Haywood, and Lauderdale Counties in Tennessee; and (1971a) Hardeman County, Tennessee. Sisk (1969) made a collection from Calloway County, Kentucky, and Smith and Sisk (1969) took this species in Fulton and Hickman County, Kentucky. Small (1971) offers

data from the University of Kentucky indicating a collection of this species from Ballard, Calloway, and Hickman Counties in Kentucky. Page (1971) provides collection data of it from Ballard, Leslie, and McCracken Counties in Kentucky and Hardeman County in Tennessee.

Etnier (1969b) recognizes this species as widespread in sluggish streams in the Mississippi River system of West Tennessee, and present but uncommon in streams entering the ascending arm of the Tennessee River from the west. Previous available records, however, do not list it as occurring in the Cumberland River Drainage in Tennessee.

Species of Probable Occurrence

The Cumberland River system drains much of Middle Tennessee via the Harpeth, Stones, Caney Fork, and Obey Rivers. Parts of northern East Tennessee drain into the Cumberland through the Big South Fork and a number of smaller tributaries (Etnier, 1970a).

Since much of the information pertaining to fishes of the Cumberland River system in Tennessee has been taken from the above streams, it can only be speculated that some of the species known to exist in the Cumberland River system occur in the Montgomery County area. I am following largely the observations of Dr. D. A. Etnier (1971b) in regard to possible and questionable

species occurring here. The following information includes those fishes not collected but thought to possibly occur in or near the immediate area.

Moore (1968) indicates that Ichthyomyzon bdellium is confined to the Ohio River and its tributaries. Bailey (1959) and Etnier (1970a) indicate the presence of this species in the Cumberland River drainage. Bailey (1959) made a collection of I. bdellium in the Cumberland River at Nashville, Tennessee.

Lampetra aepyptera is listed by Etnier (1970a) as occurring in the Cumberland River drainage. It has been collected in the Piney River near the boundary of Hickman and Dickson Counties.

Smith (1965) collected Alosa chrysochloris from Sycamore Creek in Cheatham County, Tennessee. Grant (1966) took this species from the Cumberland River in Old Hickory, Tennessee.

Ramsey (1965) lists Hybopsis amblops, H. dissimilis, and H. insignis as having been collected from the Harpeth River system in Cheatham County, Tennessee. Etnier (1967a) points out the presence of H. amblops in the Cumberland River drainage from the Obey River westward, but is absent from the Big South Fork eastward. He further mentions the occurrence of H. dissimilis from the Harpeth River eastward to the Obey River and H. insignis from the Harpeth River east to the Little South Fork. Carter (1970) has taken H. dissimilis from the Red River drainage in Logan County, Kentucky.

Nocomis effusus occurs in the Cumberland River drainage from the Little South Fork westward (Lachner and Jenkins, 1967). Etnier (1967a) lists N. micropogon occurring from the Caney Fork and Big South Fork River, but is more common to east Tennessee. Carter (1970) collected this species from the Red River drainage in Todd and Logan Counties in Kentucky. Lachner and Jenkins (1967) mention examining specimens from Spring Creek and Big West Fork Creek of the Red River drainage in Montgomery County as well as several surrounding counties in Kentucky and Tennessee.

Grant (1966) and Etnier (1967a) list Notropis antherinoides as occurring in the Cumberland River drainage. Notropis boops, N. leuciodes, and N. rubellus have been taken from the Harpeth River system by Ramsey (1964). According to Etnier (1967a) N. boops is confined to the middle and lower Cumberland River system and the Duck River portion of the Tennessee River. N. leuciodus is less common in the Cumberland system where it is known from the Big South Fork down to the Harpeth River.

The occurrence of Notropis photogenis in Montgomery County is questionable (Etnier, 1970a). However, it does occur in the Cumberland River drainage. Moore (1968) indicates the occurrence of this species from the northeast, south to the Little Tennessee River in North Carolina. Both Ramsey (1964) and

Etnier (1970a) indicate the presence of N. rubellus in the Harpeth River system.

Notropis umbratilis occurs in the Tennessee, Cumberland and Ohio River systems. It is said to replace N. ardens, which was collected in sandy streams of the Mississippi River drainage in West Tennessee (Etnier, 1967a). Although the presence of N. volucellus in the county is questionable, it is listed as common in the large streams of the Tennessee and Cumberland River system (Etnier, 1967a).

Carpiodes cyprinus, which is listed in the Cumberland River drainage (Etnier, 1970a), was not collected. However, local commercial fishermen have taken it in the past.

Both Ictiobus cyprinellus and I. niger are listed by Etnier (1970a) only as a probable occurrence in the Cumberland River drainage due to lack of reliable records.

Eddy (1969) indicates Ictalurus natalis occurring from North Dakota to the Hudson River and south to the Gulf and introduced elsewhere. Although its presence in the Tennessee River drainage is known, it is listed only as a probable occurrence in the Cumberland River drainage (Etnier 1970a).

Noturus eleutherus, N. flavus, and N. miurus are present in the Cumberland River drainage (Taylor, 1969; Etnier, 1970a).

Taylor (1969) collected N. eleutherus in the Harpeth River system. He states that the range of N. flavus extends through central and east Tennessee. In addition to his collection of N. miurus in the Cumberland River drainage, it was also taken from the Tennessee River drainage in Stewart County, Tennessee.

Etnier (1970a) list Fundulus notatus as occurring in the Cumberland River drainage, however, its presence in Montgomery County is questionable. Grant (1965) claims to have taken this species from the Cumberland River drainage at Old Hickory, Tennessee.

Morone chrysops is recorded as occurring in the Tennessee, Mississippi, and Cumberland River drainage (Etnier, 1970a). However, it was not taken from Montgomery County.

Ramsey (1964) collected Labidesthes sicculus in the Harpeth River System. Etnier (1970a) recognizes it as occurring in the Cumberland, Mississippi, and Tennessee River drainages. Clay (1962) lists it as occurring throughout Kentucky.

Etheostoma atripinne is recognized by Ramsey (1964) as occurring in the Harpeth River drainage. Moore (1968) mentions its occurrence in the Cumberland River drainage in general. Etnier (1969c), however, states that this species is restricted to the Cumberland River system from the Wolf River drainage in Pickett County west to the Harpeth River drainage in Dickson County,

Tennessee.

Ramsey (1964) and Etnier (1970a) list E. blennioides as being present in the Harpeth River drainage. Carter (1970) however, collected it from the Red River drainage in Logan, Simpson, and Todd Counties in Kentucky. While three nominal subspecies occur in Tennessee, E. b. newmanii is the form in the Cumberland River system and in most of the Tennessee River system (Miller, 1968).

The records of E. camurum in the Cumberland River drainage extends from the Nashville area east to the Big South Fork of the Cumberland (Etnier, 1969c). Although two distinct subspecies of E. maculatum occur in the state, E. m. sanguifluum is recognized as occupying the Cumberland River system (Zorach and Raney, 1966).

Etheostoma microlepidum has been taken from the Stones River in Nashville and Harpeth River in Cheatham County (Raney and Zorach, 1966). Ramsey (1964) and Etnier (1970a) list E. rufilineatum as occurring in the Tennessee and Cumberland River drainages. Moore (1968), however, mentions its presence in the Tennessee River system. Carter (1970) collected it in the Red River drainage at Logan and Simpson Counties in Kentucky. Etnier (1969c) states that in the Tennessee portion of the Cumberland drainage, this species is restricted to the area west of the Big South Fork. Zorach (1970) mentions examining specimens from Cheatham, Dickson, and Robertson Counties in Tennessee.

Howell (1968) lists E. stigmaeum as having been collected in the Red and Cumberland River drainage in Montgomery County. Ramsey (1964) and Etnier (1970a) recognize E. tippecanoe and E. zonale as occurring in the Cumberland River drainage. Tennessee records for E. tippecanoe are available for the Harpeth, Big South Fork, and Stones River of the Cumberland system (Etnier, 1969c; Zorach, 1969).

It is suspected by the author that Percina caprodes has been collected from the Montgomery County area. However, none was taken during this study. Etnier (1970a) lists it as occurring in the Cumberland River drainage and sure to be in this area. Carter (1970) lists it in his collections from the Red River drainage in Logan and Simpson Counties in Kentucky. Although P. maculata is listed as a Cumberland River species, its presence in Montgomery County is questionable. However, Carter (1970) indicates collecting it from the Red River drainage in Logan, Simpson, and Todd Counties in Kentucky. P. phoxocephala and P. sciera are listed as occurring in the Cumberland River drainage. However, the presence of P. phoxocephala in the Montgomery County area is doubtful. (Etnier, 1970a).

CHAPTER V

DISCUSSION AND CONCLUSIONS

Montgomery County, Tennessee contains a number of different aquatic habitats including large sluggish rivers, small swift-flowing streams, cold springs, subterranean streams, swamps, small farm ponds, and large lakes. In addition, the composition of the substratum varies from bedrock and gravel to a silty and mucky composition. The vegetation of these different habitats also varies.

The presence of numerous solution channels, sinkholes, and caves provides possible routes of migration for fishes. In addition, the Cumberland River, which drains much of Middle Tennessee, is now united with the Tennessee River via a man-made canal near Barkley Dam. This surely will provide another route for the migration of fishes from the Tennessee River System to the Cumberland River System. Further research will probably present new information pertaining to species listed as uncommon or absent to this area.

With regards to Amia calva and Etheostoma chlorosomum, it is possible that they have been present in the Cumberland River

Drainage of Tennessee for some time. They also may have migrated to the Cumberland River Drainage from the Mississippi River System via the Tennessee River or directly from the Mississippi River. If A. calva had been previously collected from this area, it was probably not recorded or merely treated as "another fish" by an unconcerned fisherman. It is possible that E. chlorosomum has been collected in this area and misidentified. However, this seems improbable due mainly to insufficient collecting.

CHAPTER VI

SUMMARY

A taxonomic survey of the fishes of the Northwestern Highland Rim of Middle Tennessee was conducted between Autumn of 1969 and Spring of 1971. Primary emphasis was placed on Montgomery County.

Freshwater habitats investigated included large sluggish rivers, small swift-flowing streams, cold springs, subterranean streams, swamps, small farm ponds, and large lakes.

The fishes collected represent 21 families comprising 70 species. Collections of Lampetra lamottei, Lepisosteus oculatus, L. platostomus, Amia calva, Anguilla rostrata, Hiodon alosoides, Ictiobus bubalus, Ictalurus furcatus, Aphredoderus sayanus, Morone saxatilis, and Etheostoma chlorosomum contribute new distributional information concerning fishes from the Cumberland River drainage of Tennessee.

Previous available information fails to reveal the presence of Amia calva and Etheostoma chlorosomum in the Cumberland River drainage of Tennessee. This suggests a possible range extension

LITERATURE CITED

- American Fisheries Society. 1970. A list of common and scientific names of fishes from the United States and Canada. Amer. Fish. Soc., Spec. Pub. No. 6. 150 p.
- Bailey, R. M. 1959. A collection record of Ichthyomyzon unicuspis Hubbs and Trautman. 105684 UMMZ. The University of Michigan, Ann Arbor, Michigan.
- Bailey, R. M. 1971. Curator of Fishes. Personal Communication. The University of Michigan, Ann Arbor, Michigan.
- Baker, C. L. 1937. The commercial, game, and rough fishes of Reelfoot Lake. J. Tenn. Acad. Sci. 12 (1): 9-54.
- _____. 1939a. Additional fishes of Reelfoot Lake. J. Tenn. Acad. Sci. 14 (1): 6-40.
- _____. 1939b. Key to Reelfoot Lake Fishes. J. Tenn. Acad. Sci. 14 (1): 41-45.
- _____ and M. V. Parker. 1938. The fishes of Reelfoot Lake. J. Tenn. Acad. Sci. 13 (2): 160-163
- Ball, M. 1937. Minnows of the Nashville region. Master's Thesis. Peabody College, Nashville, Tenn. 78 p.
- Burrows, Jr., Robert. 1935. A biological survey of streams in the Great Smoky Mountains National Park. U. S. Dept. Comm., Bu. of Fish. Mimeo. 33 p.
- Carter, J. P. 1970. Survey and classification of six Kentucky streams. Ky. Dept. Fish and Wildl. Reso., Ky. Div. Fish., Project f-35-2. p. 7-15.
- Chester, E. W. 1970. Some new vascular aquatic plants from Tennessee. J. Tenn. Acad. Sci. 45 (1): 6-7.
- Clay, W. M. 1962. A field manual of Kentucky fishes. Ky. Dept. Fish and Wildl. Reso., Frankfort, Ky. 147 p.

- Eddy, Samuel. 1969. How to know the freshwater fishes. 2nd ed. Wm. C. Brown Co. Publ., Dubuque, Iowa. 286 p.
- Etnier, D. A. 1967a. A key to the species of the genus Notropis occurring in Tennessee. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. p. 1-10.
- _____. 1967b. Fish collection notes. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 8 p.
- _____. 1969a. Family Cyprinidae: key to the genera and species of Tennessee Cyprinids. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 24 p.
- _____. 1969b. Summary of fish collections in Tennessee for the year 1968, made by the Department of Zoology, University of Tennessee. Unpublished manuscript. Univ. Tenn., Knoxville, Tennessee 11 p.
- _____. 1969c. The Tennessee species of the genus Etheostoma. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 21 p.
- _____. 1970a. A check list of fishes of Tennessee. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 8 p.
- _____. 1970b. Additional specimens of Etheostoma trisella (Percidae) from Tennessee. Copeia 1970(2): 356-358.
- _____. 1970c. Summary of fish collections in Tennessee for the year 1969. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 11 p.
- _____. 1971a. Summary of fish collections in Tennessee for 1970. Unpublished manuscript. Univ. Tenn., Knoxville, Tenn. 6 p.
- _____. 1971b. Professor of Zoology. Personal Communication. The University of Tennessee.
- Evermann, B. W. 1915-1916. The fishes of Kentucky and Tennessee: a distributional catalogue of the known species. Doc. No. 858. Bull. U. S. Bu. Fish. 35: 293-368.
- Evermann, B. W. and S. F. Hildebrand. 1914. Notes on the fishes of East Tennessee. Doc. No. 832. Bull. Bu. Fish. 34: 431-452.

- Gentry, Glenn. 1965. Common and scientific names of the fishes of Tennessee. Tenn. Game and Fish Comm., Nashville, Tenn. 16 p.
- Grant, Jr., R. R. Department of Limnology, The Academy of Natural Sciences of Philadelphia. Personal Communication to the Tennessee Game and Fish Commission. October 13, 1966.
- Henshall, J. A. 1889. On a collection of fishes from East Tennessee. J. Cincinnati Soc. Nat. Hist. 12 (1): 31-33.
- Holloway, A. D. 1945. Report on the fishes of the Great Smoky Mountains National Park. U. S. Fish and Wildl. Serv. (typewritten report to Nat. Park Serv.) 20 p.
- Howell, W. M. 1968. Taxonomy and distribution of the Percid fish Etheostoma stigmaeum (Jordan), with the validation and redescription of Etheostoma davisoni Hay. Unpublished Ph.D. dissertation. Univ. Ala. 113 p.
- Hubbs, C. L. 1939. List of the fishes of the Tennessee River System. Mimeo. 17 p.
- Jordan, D. S. 1877. A partial synopsis of the fishes of Upper Georgia: with supplementary papers on the fishes Tennessee, Kentucky, and Indiana. Annals N. Y. Lyc. Nat. Hist. 11: 307-377.
- _____. 1888. Report of explorations made during the summer and autumn of 1888, in the Alleghany Region of Virginia, North Carolina, and Tennessee, and in western Indiana, with an account of the fishes in each of the river basins of those regions. Bull. U. S. Fish Comm. 8: 97-173.
- _____ and A. W. Brayton. 1878. On the distribution of the fishes of the Alleghany Region of South Carolina, Georgia, and Tennessee, with description of new or little-known species. Bull. U. S. Natl. Mus., 12: 1-96.
- Killebrew, J. B. 1870. Montgomery County; Its Agriculture and Mineral Wealth; Its Topography and Geology; Its Healthfulness and Desirableness. Clarksville Tobacco Leaf Printing Office, Clarksville, Tenn. 61 p.

- Kirsh, P. H. 1891. Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee. Bull. U. S. Fish. Comm. 11: 257-265
- Knudsen, J. W. 1966. Biological techniques: collecting, preserving, and illustrating plants and animals. Harper and Row, New York. p. 318-345
- Kuhne, E. R. 1939. A guide to the fishes of Tennessee and the Mid-South. Tenn. Game and Fish Div., Nashville, Tenn. 124 p.
- Lachner, E. A. and R. E. Jenkins. 1967. Systematics, distribution, and evolution of the chub genus Nocomis (Cyprinidae) in the Southwestern Ohio River Basin, with the description of a new species. Copeia 1967(3): 557-580.
- Lennon, R. E. 1962. An annotated list of the fishes of the Great Smoky Mountains National Park. J. Tenn. Acad. Sci. 37(1): 5-7.
- Miller, R. V. 1968. A systematic study of the greenside darter, Etheostoma blennioides Rafinesque (Pisces: Percidae). Copeia 1968 (1): 1-40.
- Moore, G. A. 1968. Fishes, p. 21-165. In: W. F. Blair, et al., Vertebrates of the United States. McGraw-Hill Book Co., New York.
- Morris, R. W. 1950. An application of electricity to collection of fish. Prog. Fish-Cult. 12(1): 39-43.
- Page, L. M. Research Biologist. Personal Communication. Illinois Natural History Survey, July 12, 1971
- Pollock, C. W. Supervisor of Fisheries Research. Tennessee Game and Fish Commission, Nashville, Tennessee. Personal Communication, November 4, 1970.
- Ramsey, J. S. Professor of Biology. Auburn University, Auburn, Alabama. Personal Communication to the Tennessee Game and Fish Commission. 1964.

- Raney, E. C. and Timothy Zorach. 1966. Etheostoma microlepidum, a new Percid fish of the subgenus Nothonotus from the Cumberland and Tennessee River Systems. Am. Midl. Natl. 77(1): 93-103.
- Scott, A. F. 1967. A survey of the herpetofauna of Montgomery County, Tennessee. Unpublished Master's Thesis, Austin Peay State University. 65 p.
- Shoup, C. S., et al. 1941. A limited biological survey of the Obey River and adjacent streams in Tennessee. J. Tenn. Acad. Sci. 16(1): 48-76.
- Sisk, M. E. 1969. The fishes of West Kentucky. I. Fishes of Clark's River. Trans. Ky. Acad. Sci. 30 (3/4): 54-59.
- Small, Jr., J. W. Graduate Student, Department of Zoology, The University of Kentucky. Personal Communication, July 14, 1971.
- Smith, Jr., Ollie. 1962. Ground-water resources and municipal water supplies of the Highland Rim in Tennessee. Water Reso. Ser. No. 3., Tenn. Div. Water Reso. p. 1-168.
- Smith, P. L. and M. E. Sisk. 1969. The fishes of West Kentucky. II. Fishes of Obion Creek. Trans. Ky. Acad. Sci. 30(3/4): 60-68.
- Smith, P. W. Taxonomist, Illinois Natural History Survey. Personal Communication to the Tennessee Game and Fish Commission, 1965.
- Stiles, R. A. 1968. The fishes of the Conasauga River in Tennessee. Unpublished Master's Thesis. The University of Tennessee. 54 p.
- Taylor, W. R. 1969. A revision of the catfish genus Noturus Rafinesque with an analysis of the higher groups in the Ictaluridae. Smithsonian Institution, U. S. Nat. Mus., Washington, D. C. 315 p.
- Tennessee Game and Fish Commission. 1971. Tennessee fishing guide, 1971. Info.-Educ. Div., Nashville, Tenn. p. 18.

Thorntwaite, C. W. 1948. An approach toward a rational classification of climate. *Geog. Rev.* 38: 55-94.

United States Department of Agriculture Soil Conservation Service, et al. 1969. An appraisal of potentials for outdoor recreational developments in Montgomery County, Tennessee. U. S. D. A. - S. C. S. No. 4-29327 5-70, Fort Worth, Texas. 21 p.

Wilson, Jr., C. W. 1958. Guidebook to geology along Tennessee highways. State of Tenn., Dept. Geol., Rep. Invest. No. 5. 117 p.

Zorach, Timothy. 1969. Etheostoma jordani and E. tippecanoe, species of the subgenus Nothonotus (Pisces: Percidae). *Am. Midl. Natl.* 81(2): 412-434

_____. 1970. The systematics of the Percid fish Etheostoma rufilineatum (Cope). *Am. Midl. Natl.* 84(1): 208-225.

_____. and E. C. Raney. 1966. Systematics of the Percid fish, Etheostoma maculatum Kirkland, and related species of the subgenus Nothonotus. *Am. Midl. Natl.* 77(2): 296-322.

APPENDIX

AN ANNOTATED CHECKLIST OF THE FISHES OF MONTGOMERY COUNTY, TENNESSEE

This section consists of an annotated list of the fishes that were collected in the Montgomery County, Tennessee area. The specimen numbers are included. The nomenclature and order of the following information is that used by the American Fisheries Society in Special Publication No. 6, with the exception of the subgenus Ulocentra (Etnier, 1969c). Permanent specimens were prepared and are housed in the Museum of Zoology, Austin Peay State University

CLASS AGNATHA

ORDER PETROMYZONTIFORMES

Petromyzontidae - lampreys

Ichthyomyzon castaneus Girard. Chestnut lamprey. 26.

Two specimens were collected 2-10-70, at Lock B in Cumberland River, SE of Clarksville, from Ictiobus bubalus. Lampreys attached to buffalo, carp, and paddlefish are occasionally observed by local commercial fishermen.

Lampetra lamottei (Lesueur). American brook lamprey.
56. Collected in Montgomery County by field zoology students,
however, no location data was recorded.

CLASS OSTEICHTHYES

ORDER ACIPENSERIFORMES

Polyodontidae - paddlefishes

Polyodon spathula (Walbaum). Paddlefish. 16. One
collection was made at Cumberland River, approximately 5 miles
downstream from Clarksville. They have also been collected from
Red River. Several specimens were taken by gill nets. Paddlefish
exceeding 2 feet are occasionally collected by local commercial
fishermen.

ORDER SEMIONOTIFORMES

Lepisosteidae - gars

Lepisosteus oculatus (Winchell). Spotted gar. 20.
On 4-23-70, one specimen was collected approximately 1/4 - 1
mile downstream from Red River bridge on Highway 79.

Lepisosteus osseus (Linnaeus). Longnose gar. 18.
Several specimens were taken at Lock B, Cumberland River.
Both L. oculatus and L. osseus are frequently taken by local
commercial fishermen on baited hooks and gill nets.

Lepisosteus platostomus Rafinesque. Shortnose gar. 19. One specimen was collected 9-28-69, at Lock B, Cumberland River.

ORDER AMIIFORMES

Amiidae - bowfins

Amia calva Linnaeus. Bowfin. 22. One specimen was collected 10-24-69, approximately 1 mile downstream from Lock B, Cumberland River. Taken with hooks baited with shad. This specimen was a gravid female. According to local commercial fishermen, bowfins are very rarely seen in this area.

ORDER ANGUILLIFORMES

Anguillidae - freshwater eels

Anguilla rostrata (Lesueur). American eel. 34. Several specimens were collected 10-15-69, at Lock B, Cumberland River with baited hooks. Occasionally taken by local commercial fishermen.

ORDER CLUPEIFORMES

Clupeidae - herrings

Dorosoma cepedianum (Lesueur). Gizzard shad. 68. This species of herring is frequently seen in many of the small streams in the county. It seems to be very abundant. The following are some streams in which this species was either collected or observed:

Louise Creek, Blooming Grove Creek, Big McAdoo Creek, Big West Fork Creek, Little West Fork Creek, Spring Creek, Red River, Cumberland River, and a runoff stream from Swan Lake.

Dorosoma petenense (Günther). Threadfin Shad. 52. Several specimens were collected approximately 1/2 mile upstream from the mouth of Red River.

ORDER OSTEGLLOSSIFORMES (Open swamp of the

Hiodontidae - mooneyes

Hiodon alosoides (Rafinesque). Goldeye. 17. One specimen was collected at Lock B, Cumberland River by a gill net. However, local commercial fishermen occasionally take this species with baited hooks.

ORDER CYPRINIFORMES

Hiodon tergisus Lesueur. Mooneye. 48. One specimen was collected 10-9-70, approximately 1/2 mile upstream from the mouth of Red River.

ORDER SALMONIFORMES Blooming Grove Road,

Salmonidae - trouts

Salmo gairdneri Richardson. Rainbow trout. 30. This species has been introduced to this area by man. It was stocked in big McAdoo Creek several years ago by the Tennessee Game and Fish Commission. Fletchers Fork Creek, West Fork Creek,

and Piney Fork Creek, located on the Fort Campbell Military Reservation, have been stocked with this species within the last 2 years.

Esocidae - pikes

Esox americanus vermiculatus Lesueur. Grass pickerel. 2.
Frequently seen throughout the county in streams. The following include places where this species was collected: Blooming Grove Creek at Blooming Grove Road, Marks' Slough (Open swamp of the Cumberland River drainage) just east of Gholson Road and Nashville Railroad, Long Pond (locally named wooded swamp) west of Dotsonville near Gip Manning Road, and a runoff stream from Swan Lake on Dunbar Cave Road.

ORDER CYPRINIFORMES

Cyprinidae - minnows and carps

Campostoma anomalum (Rafinesque). Stoneroller. 12.
Frequently collected in clear streams. Sullivan Branch bridge on Highway 13, Blooming Grove Creek on Blooming Grove Road, Big McAdoo Creek on Highway 12, Hurricane Creek on Chapel Hill Road, East Fork Yellow Creek at the end of Hughs Griffin Blvd. on Tarsus Road, Passenger Creek on Highway 76 at bridge, Fletchers Fork Creek at south end of Lake Taal, tributary of Little West Fork Creek on Boiling Springs Road, and Cummings

Creek on Dailey Road are a few places where this species was collected. Seems to be very abundant in this area.

Carassius auratus (Linnaeus). Goldfish. 59. Collected

11-11-70, from a farm pond located on Hatcher Farm, approximately 1/4 mile from the residence of Mr. J. P. Hold, Lock B. Road, SE of Clarksville.

Clinostomus funduloides Girard. Rosyside dace. 45. Collected

at Sulphur Fork Creek on Highway 48 near the Montgomery and Dickson County line.

Cyprinus carpio Linnaeus. Carp. 69. A large specimen

(exceeding 2 feet) was collected at Marks' Slough but released.

This species has been collected in the Cumberland and Red River by baited hooks and nets. Seems to be very abundant in the larger streams of the county.

Notemigonus crysoleucas (Mitchill). Golden shiner. 41.

Collected 7-16-70, at Coon Creek on Rosson Road.

Notropis ardens (Cope). Rosefin shiner. 8. Collected in

the following streams: East Fork Yellow Creek at the end of Hughs Griffin Blvd. on Tarsus Road, SW of Clarksville; Big McAdoo Creek on Rosson Road; and a tributary of Little West Fork Creek on Boiling Springs Road.

Notropis chrysocephalus (Rafinesque) Striped shiner. 43.

Collected at Big McAdoo Creek on Highway 12, tributary of Little

West Fork Creek on Boiling Springs Road, Coon Creek at Rosson Road bridge, Passenger Creek on Highway 76 at the bridge, Louise Creek on Grays Chapel Road at the bridge, and Big McAdoo Creek at the bridge on Highway 12.

Notropis galacturus (Cope). Whitetail shiner. 49. Collected in Louise Creek at the bridge on Highway 48.

Notropis spilopterus (Cope). Spotfin shiner. 44. Taken from Louise Creek at the bridge on Highway 48.

Notropis telescopus (Cope). Telescope shiner. 11. Collected at Sullivan Branch, approximately 25 yards upstream from the bridge on Highway 13, Louise Creek on Grays Chapel Road, and Big McAdoo Creek on Highway 12 at the bridge.

Notropis whipplei (Girard). Steelcolor shiner. 67. Taken from Louise Creek at the bridge on Highway 48.

Phoxinus erythrogaster (Rafinesque). Southern redbelly dace. 7. Collected at the following locations: Louise Creek on Highway 48, Budds Creek on Highway 149, Cummings Creek at Dailey Road, and Big McAdoo Creek on Highway 12.

Pimephales notatus (Rafinesque). Bluntnose minnow. 42. This species was collected from the following streams: Big McAdoo Creek on Highway 12, Hurricane Creek on Chapel Hill Road, Fletchers Fork Creek on the south end of Lake Taal, a tributary of Little West Fork Creek on Boiling Springs Road, and Muddy

Branch on Gholson Road at the first bridge.

Pimephales promelas Rafinesque. Fathead minnow. 62.

Collected 11-11-70, at an old roadside pond in a slightly wooded area beside the Old Trenton Road before merging with Whitfield Road. Near Austin Peay State University Farm.

Pimephales vigilax (Baird and Girard). Bullhead minnow. 63.

Taken from Louise Creek at the bridge on Highway 48.

Rhinichthys atratulus (Hermann). Blacknose dace. 65.

Collected at Louise Creek on Grays Chapel Road and Thompson Road near the bridge, Big McAdoo Creek on Highway 12 at the bridge, and Cummings Creek on Dailey Road.

Semotilus atromaculatus (Mitchill). Creek chub. 37. This species seemed to be fairly abundant throughout the county. It was collected at the following streams: Big McAdoo Creek on Highway 12, Louise Creek on Highway 48, Passenger Creek on Highway 76 at the bridge, Jordan Creek on Jordan Springs Road, Fletchers Fork Creek on south end of Lake Taal, and Cummings Creek at the bridge on Dailey Road.

Catostomidae - suckers

Catostomus commersoni (Lacépède). White sucker. 40.

Several specimens were collected at Bartee Creek and the Clarksville Lake junction, Coon Creek at Rosson Road, and Muddy Branch at Gholson Road.

Erimyzon oblongus (Mitchill). Creek chubsucker. 61.

Specimens were collected at Moss Creek and a tributary of Little West Fork Creek on Boiling Springs Road. Both streams were located on the Fort Campbell Military Reservation.

Hypentelium nigricans (Lesueur). Northern hogsucker. 39.

This species seems to be very abundant throughout the county.

Specimens were collected at Sullivan Creek on Highway 13, Big McAdoo Creek, Louise Creek, Passenger Creek, Spring Creek, Big West Fork Creek, and Coon Creek.

Ictiobus bubalus (Rafinesque). Smallmouth buffalo. 21.

Although only a few specimens were collected from Cumberland River, Lock B area and Red River, they are frequently taken by local commercial fishermen.

Minytrema melanops (Rafinesque). Spotted sucker. 57.

A few specimens were collected from a runoff stream from Swan Lake.

Moxostoma duquesnei (Lesueur). Black redhorse. 3.

Specimens were collected at the Lock B area on Cumberland River and Big McAdoo Creek on Highway 12. This and related species are frequently collected by local commercial fishermen.

Moxostoma erythrurum (Rafinesque). Golden redhorse. 60.

Collected in Big McAdoo Creek at the bridge on Highway 12.

ORDER SILURIFORMES

Ictaluridae - freshwater catfishes

Ictalurus furcatus (Lesueur). Blue catfish. 54. This species was collected in Cumberland River near Seven Mile Ferry Road. Blue catfish are frequently taken by local commercial fishermen.

Ictalurus melas (Rafinesque). Black bullhead. 23. This species was taken on the Deason Creek side of Jarman Hollow Road at Palmyra, Highway 149 and in Muddy Branch on Gholson Road at the first bridge.

Ictalurus punctatus (Rafinesque). Channel catfish. 25. This fish was collected approximately 1 mile downstream from the Cunningham Bridge on Cumberland River. It is frequently taken with baited hooks, trammel nets, and gill nets by local commercial fishermen.

Noturus exilis Nelson. Slender madtom. 66. One specimen of this species was collected in Passenger Creek at the bridge on Sango Road approximately 1 mile east of Mt. Carmel Road. This specimen is housed in the collection at Northeast Louisiana State University, Monroe, Louisiana. Another specimen was collected in Montgomery County by field zoology students. However, the location data is questionable.

ORDER PERCOPSIFORMES

Amblyopsidae - cavefishes

Chologaster agassizi Putnam. Spring cavefish. 6. One specimen was collected approximately 100 yards downstream from Ussery Creek bridge on Seven Mile Ferry Road SW of Clarksville. The fish was taken at the intersection of a subterranean stream and the main stream. Another specimen was taken from a roadside spring approximately 50 yards west of Louise Creek on Batson Road. Additional specimens have been collected at Muddy Branch bridge on Gholson Road and Spring Creek at Webb Road and Louisville-Nashville Railroad.

Typhlichthys subterraneus Girard. Southern cavefish. 9. Collected from a sinkhole cave on Austin Peay State University farm.

Aphredoderidae - pirate perches

Aphredoderus sayanus (Gilliams). Pirate perch. 32. Most of the specimens were taken from sluggish water, however, a few were collected from moving streams. Collections were made at: Long Pond, Marks' Slough, Big McAdoo Creek, and Muddy Branch.

ORDER ATHERINIFORMES

Cyprinodontidae - killifishes

Fundulus catenatus (Storer). Northern studfish. 5. Several

collections were made of this specimen. It was collected at: Muddy Branch on Gholson Road, Big McAdoo Creek on Highway 12, Louise Creek, and a shoal area on Red River, approximately 8 miles upstream from the Red River bridge on Highway 79.

Fundulus olivaceus (Storer). Blackspotted topminnow. 14.

Collections at Budds Creek, Red River, Muddy Branch, and a runoff stream from Dunbar Cave (Swan Lake) yielded several specimens.

Poeciliidae - livebearers

Gambusia affinis (Baird and Girard). Mosquitofish. 31.

The majority of this species were collected from sluggish water, Marks' Slough and Long Pond. However, one series was taken from a moving stream, Blooming Grove Creek on Outlaw Road.

ORDER PERCIFORMES

Percichthyidae - temperate basses

Morone mississippiensis Jordan and Eigenmann. Yellow bass.

46. One specimen was taken from Cumberland River near the railroad bridge on Riverside Drive below Clarksville.

Morone saxatilis (Walbaum). Striped bass. 58. Two specimens were collected from Lock B on Cumberland River.

According to the Tennessee Game and Fish Commission (1971) the striped bass, which was discovered to be anadromous, was

established in Tennessee waters in 1958. Among the various reservoirs listed as being stocked with this species is Barkley Reservoir. Pollock (1970) indicated the name "rockfish" is used commonly along the Atlantic coast in reference to the striped bass. It is being used in Tennessee in an effort to avoid confusion between Morone saxatilis and the native white bass, Morone chrysops, which is referred to by laymen as the stripe or striped bass.

Centrarchidae - sunfishes

Ambloplites rupestris (Rafinesque). Rock bass. 36. One specimen was taken from Elk Fork Creek located on the Fort Campbell Military Reservation.

Lepomis cyanellus Rafinesque. Green sunfish. 53. Several collections were made of this species. It is frequently stocked in farm ponds as well as found in many streams throughout the county. Specimens were collected at Ussery Creek, Sulfur Fork Creek, Red River, Piney Fork Creek, Passenger Creek, and Muddy Branch.

Lepomis gulosus (Cuvier). Warmouth. 29. This fish was taken from Big McAdoo Creek and Marks' Slough.

Lepomis macrochirus Rafinesque. Bluegill. 27. This appears to be a fairly common species in the county. It is found in many farm ponds as well as in most of the streams through the county. A few collections were made at Big Mcadoo

Creek, Passenger Creek, Elk Fork Creek, a runoff stream of Swan Lake, Louise Creek, Sulfur Fork Creek, Red River, Cumberland River, Spring Creek, and Muddy Branch.

Lepomis megalotis (Rafinesque). Longear sunfish. 15. This species is another frequently occurring fish of the streams within the county. A few collections were made at Little West Fork Creek, Fletchers Fork Creek, Red River, and a runoff stream from Swan Lake.

Micripterus dolomieu Lacépède. Smallmouth bass. 47. One specimen was taken from Spring Creek on Highway 79, Red River drainage.

Micropterus punctulatus (Rafinesque). Spotted bass. 70. This species was collected approximately 8 miles upstream from the mouth of Red River at a shoal area.

Micropterus salmoides (Lacépède). Largemouth bass. 38. Collections were made at the junction of Bartee Branch and Clarksville Lake. This species may also be taken in many of the farm ponds in Montgomery County.

Pomoxis annularis Rafinesque. White crappie. 28. Several members of this species were taken from Lock B, Cumberland River and the Deason Creek side of Jarman Hollow Road in Palmyra.

Pomoxis nigromaculatus (Lesueur). Black crappie. 1. This species was collected from the Deason Creek side of Jarman Hollow Road, Palmyra, a runoff stream from Swan Lake, and Coon Creek at Rosson Road.

Percidae - perches

Etheostoma caeruleum Storer. Rainbow darter. 51. This darter seems to be fairly abundant throughout the county. Some collections were made at Big McAdoo Creek, Coon Creek, Fletchers Fork Creek, Louise Creek, Jordan Creek, a tributary of Little West Fork Creek on Boiling Springs Road, and Cummings Creek.

Etheostoma chlorosomum (Hay). Bluntnose darter. 13. This species was collected from the Deason Creek side of Jarman Hollow Road in Palmyra on Highway 149. Only one specimen was taken

Etheostoma flabellare Rafinesque. Fantail darter. 50. Several collections were made of this species. Some were made at Spring Creek on Highway 79, a tributary of Little West Fork Creek on the Fort Campbell Military Reservation, Louise Creek, and Fletchers Fork Creek as it enters Lake Taal in Fort Campbell.

Etheostoma spectabile (Agassiz). Orangethroat darter. 4. This darter seems to be fairly abundant in the streams throughout the county. Specimens were collected at Ussery Creek, Big McAdoo Creek, and Louise Creek.

Etheostoma squamiceps Jordan. Spottail darter. 64. Collected at Cummings Creek bridge on Dailey Road and Muddy Branch on Gholson Road at the bridge near the Louisville-Nashville Railroad.

Etheostoma virgatum (Jordan). Striped darter. 24. One specimen was taken from Blooming Grove Creek near the intersection of Blooming Grove Road and Cooper Creek Road.

Etheostoma (Ulocentra) sp. G. Golden snubnose darter. 10. There appears to be 8-10 darters with a subgenus of Ulocentra. According to Etnier (1969c) the extreme morphological similarity between the members of the subgenus has been responsible for much uncertainty in classification.

Stizostedion canadense (Smith). Sauger. 55. One specimen was collected from Cumberland River, just below the mouth of Red River.

Sciaenidae - drums

Aplodinotus grunniens Rafinesque. Freshwater drum. 35. Collections of this species were made at Lock B in Cumberland River.

Cottidae - sculpins

Cottus carolinae (Gill). Banded sculpin. 33. Many specimens of this species were taken throughout the county. A few collections were made at Ussery Creek, Muddy Branch, Big McAdoo Creek,

Louise Creek, an unnamed branch of West Fork Creek on Austin Peay State University farm, Coon Creek, Cummings Creek, Fletchers Fork Creek, Jordan Creek, and Spring Creek at Webb Road.