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To the Graduate Council:

I am submitting herewith a thesis written by Charles Edward Comiskey entitled "The Fishes of the Big South Fork of the Cumberland River System." I recommend that it be accepted for eighteen quarter hours credit in partial fulfillment of the requirements for the degree Master of Science, with a major in Zoology.

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THE FISHES OF THE BIG SOUTH FORK OF THE
CUMBERLAND RIVER SYSTEM

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

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

by
Charles Edward Comiskey
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ABSTRACT

This thesis reports the results of a survey of the fishes of the Big South Fork of the Cumberland River system in Tennessee and Kentucky. This system represents the southeasterly extension of the Cumberland River system.

The survey was conducted from June, 1968, to September, 1969, with the majority of the collecting being made in the summer months of both years. A variety of collecting techniques were employed. These included ten and twenty-foot small mesh seine nets, thirty and sixty-foot bag seines, gill nets and sodium cyanide.

A total of sixty-four collections are included, sixty-one made by the author, and three by other investigators. These yielded sixty-three species of fishes. Several additional species are included in the paper. These were reported in the literature as being taken at one time or another from the system, but were not taken in the present study, and thus may or may not be still present.

Contained in this thesis is a list of the species of fishes collected in the system, with notes on their habitat and distribution, both within the system, and in comparison with other systems. Included also is a literature survey and a description of the river system with notes on the current state of pollution in the system.

A discussion of the species distribution is included,

and possible reasons for the distribution are given. Results of the survey indicate a strong possibility for stream capture between the Big South Fork system and other parts of the Cumberland River system. However, more investigation is needed in this regard.

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CHAPTER I

INTRODUCTION

This paper represents an ichthyofaunal study of the Big South Fork of the Cumberland River system in Tennessee and Kentucky. The research included in this thesis was undertaken for several reasons. First of all, it was found that there has been surprisingly little research done on the fauna of this river system. This becomes especially evident when a literature survey is undertaken. Many papers which include drainage maps of the Kentucky and Tennessee areas reveal that data is present for most drainages except for the Big South Fork of the Cumberland River system. The reason for this lack of investigation may lie in the fact that many investigators feel that the system is too badly polluted to be of any value. Secondly, the research involves the unique position of this drainage. Because of its location with respect to the rest of the Cumberland River system, the Big South Fork River system could represent the Southeastern limit of the range of some of the species present in the system. A third, and possibly overriding reason for this study was that there was, and still is, a distinct possibility that the Big South Fork River could be impounded. Several attempts have been made to appropriate the necessary funds for the proposed Devil's Jump Dam project, and while these have, as of yet, failed, there is a chance

funds will become available in the near future. Impoundment would mean certain loss of the majority of the species of smaller fishes, especially the darters (Percidae) and many of the minnows (Cyprinidae) whose survival depends on a free-flowing environment. It is unfortunate that these are the species that are most interesting from the ichthyologist's standpoint. Thus, because there is a chance that this critically located drainage would be lost, and because there is little known about the ichthyofauna of the drainage, this study was undertaken. It is hoped that, if impoundment does occur, this research will provide a basis for a post-impoundment study of the inundated river system. It is also hoped that this study will reveal that, on the basis of its distinct fish fauna, the river is worth saving.

The survey extended from late June, 1968, to September, 1969. Included in this report are the fishes collected in the survey, with notes on the habitat of the more important and interesting of these species, and a discussion of the distribution of these species, both within the drainage, and in comparison with other drainages. Several collections made by other investigators are included since they yield information not otherwise available.

I. THE RIVER

The Big South Fork of the Cumberland River is formed

in North Central Tennessee by the confluence of the New and Clear Fork Rivers, and by North Whiteoak Creek one mile downstream of this confluence. Northward, the main river is joined by several smaller tributaries that empty directly into it. These include, on the west, Station Camp Creek and No Business Creek which empty into the main river in Tennessee, and Rock Creek and Little South Fork River, whose headwaters lie in Tennessee, but have their major portions in Kentucky. On the east is Roaring Paunch Creek, which also has its headwaters in Tennessee, but the main body of the stream is in Kentucky. The whole system drains an area of thirteen hundred and seventy square miles, with the main river system emptying into Lake Cumberland at Burnside, Kentucky.

Shoup (1940), in his study on the water chemistry of the Big South Fork system, gave a description of the physical and chemical qualities of the streams in the drainage. He described the presence of oil pollution in the Whiteoak Creek portion of the Clear Fork River drainage. At the time of the present study, no pollution was in evidence in this area. Bone Camp Creek, the stream into which the pollutant was deposited, appeared quite clear and clean. However, the pollution in the New River drainage was still quite in evidence throughout the period of the present study. Communications with local residents and fish and game officials revealed that periodic fish kills do still occur throughout the length

of the New River drainage. Montgomery Fork, which had been badly polluted, still lacked macroscopic aquatic organisms. The bottom of many tributaries, as well as the New River itself, was covered with a slippery reddish deposit (FeOH_3). Only here and there could one find a tributary stream that appeared free of the effects of this strip mine pollution. Coal deposits are in evidence along the banks of both the New River and its tributaries, and the Big South Fork River itself, although fish kills do not appear to extend downstream into the Big South Fork River. Even with this pollution, most of the streams making up the New River portion of the system maintain abundant fish populations. It appears that enough tributaries remain free of pollution so that, in times of fish kills, a residual population remains in the cleaner portions which can later repopulate the temporarily affected areas.

II. COLLECTING SITES, MATERIALS AND METHODS

Sixty-one collections were made during the study period, which extended from June 28, 1968 to September 21, 1969. Most collections were made during the summer period when the river was at low level. In addition to the collections already mentioned, three other collections, made by members of the Department of Zoology and Entomology at the University of Tennessee are included. All these collections,

including location, species collected, number of each species collected, and investigators involved in each collection are listed in Appendix A. The majority of the collecting was done in the Tennessee portion of the drainage since the major emphasis was on the fishes of the smaller streams rather than those of the main river. However, Little South Fork River, which has its headwaters in Tennessee, but empties into the Big South Fork River in Kentucky, was sampled quite extensively in the Kentucky portion of the stream. The reasons for this will be explained later in the paper. Most collecting was done where roads crossed the particular streams; however, lack of roads in certain areas necessitated either cross-country hiking or wading the stream to arrive at a suitable collecting site.

As mentioned previously, the majority of the collecting was done in the tributary streams, with only occasional sampling being done in the deeper waters of the main river. All of the major tributaries in Tennessee were sampled. Fifteen collections were made in New River and its tributaries. Clear Fork River drainage was sampled seventeen times. Four collections were taken from North Whiteoak Creek and its tributaries, eight collections from Little South Fork River, and eleven from Big South Fork River itself. Of these latter eleven collections, ten were made in Tennessee and one was taken in Kentucky. In addition, one collection from the main

river in Kentucky, and one collection from the Little South Fork River, not collected by the author, are included. Six collections were made from the smaller tributaries that empty directly into the Big South Fork River, with an additional collection from Perkins Creek, not made by the author, being included. A list of the species of fishes collected in each of the major drainages appears in Appendix B.

A variety of collecting materials and methods were utilized. Most collecting was done with 10- and 20-foot small-mesh seines being employed whenever possible. Thirty- and sixty-foot bag seines were also used in certain instances, but the rocky nature of the stream bottom in many areas precluded their use. In certain cases, such as in medium- and larger-sized pools of the larger streams, gill nets were employed. These sampled only larger fish such as suckers (*Catostomidae*) and catfish (*Ictaluridae*). Finally, in areas where no other method could be used effectively, sodium cyanide pellets were employed. The procedure usually involved one investigator dissolving the tablets in the stream above a riffle, while the other investigator or investigators waited along or below the riffle for signs of fish in distress. These fish were then captured in dip nets and those not needed were released upstream from the site of the cyanide application. If the cyanide is applied properly, most fish will recover from its effects. A seine was often used as a block

net at the foot of the riffle, and this captured many fish that would have otherwise escaped detection. The effectiveness of the cyanide varies with a great many factors, such as water temperature, water chemistry, species of fish, depth of water, velocity of current, amount of cyanide used, etc. Without this method, many habitats, especially some of the larger and deeper riffles and runs of the main river, would have gone unsampled. Because of the use of cyanide, certain species of fish were found to be abundant in the river system, whereas their presence had gone undetected by other investigators who did not have this means of sampling at their disposal. Ten percent formalin was used for the preservation of all specimens immediately after their capture.

Specimens collected by the author were identified by him, with the help of Dr. D. A. Etnier. Identifications of the three added collections were made by the collectors. Eddy (1969), Moore (1968), Hubbs and Lagler (1958) and Lachner and Jenkins (1967) were used as aids in identification of specimens. The scientific names of the species collected are in accordance with those given in American Fisheries Society Special Publication Number Two (1960).

The following abbreviations are used in this paper: U. T. B. S. F. means the University of Tennessee's Big South Fork Collection. U. T. denotes the University of Tennessee's catalogue collection.

CHAPTER II

FISHES OF THE RIVER SYSTEM

I. LITERATURE SURVEY

The earliest recorded collections in the area of the Big South Fork system were made by Rafinesque (1820), but the information he presented did not sufficiently delimit the areas of collection. Cope (1870) reported on a series of collections from the Big South Fork River system. He reported Etheostoma blennioides Rafinesque from the headwaters of the Cumberland River, Campbell County, Tennessee, Etheostoma maculatum Kirtland (as Poesilichthys sanguifluus) from the headwaters of South Fork of the Cumberland River, Tennessee, Etheostoma caeruleum Storer (as Poecilichthys coeruleus) from South Fork of the Cumberland River, Tennessee, and Percina caprodes (Rafinesque) from South Fork of the Cumberland River, Campbell County, Tennessee. Also Reported were Etheostoma camurum (Cope) (as Poecilichthys camurus) and a questionable record (as Hyostoma cymatogrammum) from the head of the Cumberland River, Tennessee. The latter two may or may not have been taken in the Big South Fork System.

Kirsch (1893) collected in the Big South Fork River system from September 4 to September 9, 1891. His localities were Canada (Kennedy) Creek, Wayne County, Kentucky, Little South Fork River, Wayne County, Kentucky, Rock Creek, McCreary

County, Kentucky, Big South Fork of Cumberland River, McCreary County, Kentucky, and Brimstone Creek and New River, Scott County, Tennessee. In the paper he listed thirty-seven species of fishes from the system. He listed Notropis heterodon (Cope) which was certainly a misidentification of another species (perhaps white-zone shiner), and Notropis megalops (Rafinesque) which was most probably Notropis chrysocephalus (Rafinesque). Other discrepancies included listing of Cottus bairdi Girard, which was undoubtedly Cottus carolinae (Gill), Etheostoma rufolineatum (Cope) which was probably Etheostoma maculatum Kirtland, and Notropis umbratilis cyanocephalus (Copeland) which was Notropis ardens (Cope). None of those above listed by Kirsch are known to occur now or to have been present in the system. Notropis whipplei (Girard) was also listed, but this was most likely Notropis spilopterus (Cope) since the two species were not differentiated by earlier ichthyologists, and Notropis whipplei Has not been collected in the drainage by later investigators. Kirsch also reported the occurrence of Hybopsis kentuckiensis (Rafinesque) from all localities he collected. Lachner and Jenkins (1967) discussed the distribution of the chubs of the Genus Nocomis. The specimens of Hybopsis kentuckiensis collected in Little South Fork River and Kennedy Creek were probably Nocomis effusus Lachner and Jenkins, while those in the Big South Fork River, New River, and Brimstone Creek were probably Nocomis micro-pogon (Cope). Reasons for this conclusion will be discussed

later. Most interesting is his listing of Lagochila lacera Jordan and Brayton from Little South Fork River and Canada Creek. This once widespread species is now believed extinct. Possible reasons for its demise were given in Trautman (1957) and Gilbert (1969). Etheostoma macrocephalum Cope (present name Percina macrocephala (Cope)) and Etheostoma simoterum atripinnis (Jordan) (present name Etheostoma atripinne (Jordan)) were also reported from the drainage. The significance of these latter two citations will be discussed later in the paper. Both Notropis ariommus (Cope) and Notropis telescopus (Cope) were reported, with the two being collected together in Rock Creek. Finally, Kirsch's listing of Percina caprodes (Rafinesque) (as Etheostoma caprodes (Rafinesque)) needs some clarification. R. E. Jenkins (personal communication) has located and examined one specimen from Kirsch's collections, that being Percina sp. (Henry Fowler's Percina caprodes burtoni) from Little South Fork River. The other specimens could not be located. The present survey yielded P. caprodes from Little South Fork River, but no P. sp. were taken. Both species probably persist there today.

Fowler (1906) gave an annotated list of some of the fish species in the collections of the Academy of Natural Sciences of Philadelphia. He listed Etheostoma blennioides Rafinesque (as Diplesion blennioides), Percina caprodes, Ammocrypta asprella (Jordan) (as Crystallaria asprella), Etheostoma maculatum (as Poecilichthys sanguifluus), and

Etheostoma caeruleum. All were contributed by E. D. Cope, and were presumed to have been from the collections cited in Cope (1870). Some question then arises as to the validity of the Ammocrypta asprella record. No date of collection is given, and it can only be assumed that the specimen was collected by Cope on the same trip as were the other specimens mentioned above. However, all other species listed by Fowler as being donated by E. D. Cope are also listed in Cope (1870), while Ammocrypta asprella was not mentioned in the paper. It is felt by this author that it is not unlikely that Ammocrypta asprella existed at one time, and may still exist, in the Big South Fork River system. Cope, having probably recognized the specimen as an undescribed species, most likely refrained from including the record in the 1870 publication, deferring its description to a later date. The species was described by Jordan (1878), probably before Cope had a chance to prepare his own description.

Evermann (1915-1916) reviews the literature up to that time concerning the publications which, at least in part, include collections from Tennessee and Kentucky. All the important papers concerning the Big South Fork system up to 1916 were included in this review.

Shoup and Peyton (1940) reported on, among other organisms, some fishes collected from the Big South Fork system in Tennessee. This collecting was done in conjunction

with Shoup's chemical study of the river system (Shoup 1940). Most of their collecting was done from June to September, 1938, with some entries from September, 1939. Thirty-four species of fish were listed along with localities and some distribution data. Of the thirty-four species listed, three were collected from areas outside the Big South Fork drainage. These included Etheostoma kennicotti (Putnam) (as Catonatus kennicottii cumberlandicus), Notropis chrysocephalus (as Notropis cornutus chrysocephalus), and Etheostoma nigrum Rafinesque (as Boleosoma nigrum susanae). A fourth, Pimephales notatus (Rafinesque) (as Hyborynchus notatus), was listed in one part of the paper as being collected from a stream outside the drainage and in another part as being taken from the Big South Fork River. Two species, Salmo gairdneri Richardson and Salvelinus fontinalis (Mitchill) were introduced by stocking. Notropis spectrunculus (Cope) was an obvious misidentification, and was most likely Notropis sp. (saw-fin shiner, a species not yet described), since both Notropis volucellus (Cope) and Notropis stramineus (Cope) were recognized by the authors. Notropis spectrunculus does not inhabit this system. The validity of the Notropis ariommus (as Notropis ariommus ariommus) and Notropis telescopus (as Notropis ariommus telescopus) records cannot be verified, and must remain questionable (Gilbert, 1969).

II. AN ANNOTATED LIST OF THE FISH SPECIES IN THE SYSTEM

Family Salmonidae

Salmo trutta Linnaeus--Brown trout. Found at only one locality in the system, the specimen was undoubtedly stocked in the stream by fish and game personnel. Shoup and Peyton (1940) reported Salvelinus fontinalis and Salmo gairdneri from Pickett Lake, a part of the Rock Creek drainage. These specimens were also the result of stocking, and are not known to occur naturally anywhere in the system. Rock Creek in Kentucky may now have a reproducing trout population, since much stocking has occurred, and the features of the stream might afford a suitable environment.

Family Catostomidae

Catostomus commersoni (Lacepede)--White sucker. This species was collected occasionally in both the New River and Clear Fork River drainages. It was found in the pool areas of moderate-sized streams.

Hypentelium nigricans (LeSueur)--Northern hog sucker. Very common throughout the system, inhabiting all sizes and types of streams except where the bottom was intensely silted. It was most common in riffles and runs, but was also found in pool areas.

Moxostoma breviceps (Cope)--Shorthead redhorse. Adults were taken only from the main river with the use of gill nets. The species inhabited the long, wide pools so

characteristic of the Big South Fork River. The bottoms of these pools were composed of large rocks over gravel and sand. The bottom was relatively silt-free, and a moderate current persisted in most of the pools.

Moxostoma duguesnei (LeSueur)--Black redhorse. Although this species was often taken in the Big South Fork River in a habitat similar or identical to that of M. breviceps, the black redhorse was more common in the medium-sized streams than was the shorthead redhorse. Adults were taken in shallow pool areas and runs in New River and Clear Fork River, as well as the main river. Many juveniles inhabited the clearer tributaries and main channel in both the New and Clear Fork Rivers, very often being found in pool areas with abundant rooted aquatic vegetation.

Moxostoma erythrurum (Rafinesque)--Golden redhorse. As far as the author could discern, the habitat of this species was just about identical to that of the black redhorse. The two species were often found together.

Family Cyprinidae

Campostoma anomalum (Rafinesque)--Stoneroller. Widely distributed throughout the system, in both shallow pool areas and in riffles.

Chrosomus erythrogaster Rafinesque--Southern Red-Bellied Dace. This species was restricted to certain headwaters where the waters were cold and clear. It was

frequently found near springs and where water emerged from caves.

Clinostomus funduloides Girard--Rosyside dace. Another headwater species, it was found in pool areas of cold, clear streams in mountainous areas.

Hybopsis dissimilis (Kirtland)--Streamline chub. Found only in the Little South Fork River. This species preferred the riffles of moderate size and depth, being especially abundant at the foot of these riffles in the pool areas, where siltation had not become a problem.

Hybopsis insignis Hubbs and Crowe--Blotched chub. This species was also collected only from the Little South Fork River in the system, in habitats similar to that of the streamline chub.

Nocomis effusus Lachner and Jenkins--Orangefin chub. Another species which appears to be restricted to the Little South Fork River in the system. It was found in riffles of moderate depth (one to two feet), and was of spotty occurrence, even in areas where it was known to be present.

Nocomis micropogon (Cope)--River chub. Lachner and Jenkins (1967) discussed the distribution of the chubs of the Genus Nocomis, including in their paper some mention of the situation in the Big South Fork system. The authors related the possibility that the two species of Nocomis that existed in the system might be sympatric in the Little South Fork

River. Nocomis micropogon was not taken in the present study from Little South Fork River, and the author doubts its occurrence in the stream, especially in areas away from the mouth of the stream (where it empties into the Big South Fork River). Nocomis micropogon showed a habitat preference different from that of Nocomis effusus, the former usually being found in larger bodies of water. Thus even if N. micropogon is present in the Little South Fork River near its mouth, it may not occur far enough upstream to invade the areas inhabited by Nocomis effusus. The apparent restriction of N. effusus to the Little South Fork River will be discussed later.

Pimephales notatus (Rafinesque)--Bluntnose minnow. Found in pool areas throughout the length of Little South Fork River, but not taken elsewhere in the system.

Pimephales promelas Rafinesque--Fathead minnow. This species was collected by C. R. Gilbert, D. A. Etnier, R. Bouchard and R. Stiles at one locality in the Little South Fork River. Trautman (1957) discussed the habitat of these two species of Pimephales. Data from the present study would appear to corroborate his statement that competition between the two results in the exclusion of P. promelas. In the one collection in which P. promelas was taken, P. notatus was also taken. Otherwise P. notatus was taken alone.

Rhinichthys atratulus (Hermann)--Blacknose dace.

Probably well distributed throughout the system since it was taken in widely separated parts of the drainage, this species was restricted to the smaller, cooler headwater streams of moderately high gradient. It occurred either in riffles or, where this habitat was not present, in pool areas, especially close to the bank of the stream.

Semotilus atromaculatus (Mitchill)--Creek chub. A very common species, it was a predominant inhabitant of the shallow pool areas of small- and medium-sized, cool-water streams, especially those whose banks were well-shaded.

Notropis sp.--White-zone shiner. This species, an ally of N. stramineus, is now being described by R. E. Jenkins of Roanoke College. It was found only in Little South Fork River where it occurred in areas of shallow water with a slow to moderately slow current, and in shallow pool areas. It was occasionally found in association with aquatic vegetation.

Notropis ardens (Cope)--Rosefin shiner. Widely distributed in the system, mainly being found in shallow pool areas, often at the foot or head of riffles, and in less severe riffles where siltation was absent or negligible, and the bottom was of gravel or bedrock.

Notropis ariommus (Cope)--Popeye shiner. This species was very spotty in its occurrence even in areas where it was known to occur. In the present study it was taken only in Little South Fork River, and here it seemed to be absent from

the smaller headwater areas. It was only found where the stream took on the characteristics of a larger body of water. Here the gravel bottom and pool and riffle habitat seemed to enhance the presence of the species. It was sympatric with its close relative N. telescopus in the Little South Fork River. (See Notropis telescopus notes for further discussion).

Notropis atheriniodes Rafinesque--Emerald shiner.

Although the author failed to collect this species, it was reported by Kirsch (1893) as being widely distributed in the Big South Fork system. The species was taken in one collection by C. R. Gilbert, D. A. Etnier, R. Bouchard, and R. Stiles, from the Big South Fork River at Hilltop, McCreary County, Kentucky, at state highway 92 bridge. The preference of this species for large bodies of water is widely acknowledged.

Notropis chrysocephalus (Rafinesque)--Striped shiner.

Found mainly in streams of low to moderate gradient in pool areas. In Whiteoak Creek and Buffalo Creek tributaries, turbidity and siltation were quite evident, but this did not seem to have adversely affected the population.

Notropis galacturus (Cope)--Whitetail shiner. Widely distributed in the clearer portions of the drainage. The species preferred shallow (one to two feet) runs with moderately fast current.

Notropis leuciodus (Cope)--Tennessee shiner. Found only in the Clear Fork River drainage and Little South Fork

River by the author, but reported by Shoup and Peyton (1940) from tributaries of New River. The species seemed to prefer mountain streams with high gradient.

Notropis photogenis (Cope)--Silver shiner. The absence of this species from all but the Little South Fork River is something of a puzzle. In general, the species prefers moderate to large rivers, and the boulder-strewn and swifter-flowing portions of the pools would seem a very likely habitat. Pollution may have adversely affected its occurrence in the main drainage, but other causes seem more feasible.

Notropis rubellus (Agassiz)--Rosyface shiner. An inhabitant of fast, moderately deep runs, mostly over gravel or bedrock, this species was widely distributed in the drainage wherever this habitat was available, except in those streams that showed signs of excessive siltation.

Notropis sp.--Sawfin shiner. This undescribed species now being described by Dr. John Ramsey of Auburn University preferred small to medium-sized cold, clear, unpolluted streams with moderate gradient. In the Big South Fork system, it appeared to be restricted to those western tributaries described earlier as emptying into the Big South Fork River in Tennessee. It was often taken in the same collection with N. telescopus. Although it was not taken in No Business Creek, it probably occurs there.

Notropis spilopterus (Cope)--Spotfin shiner. Its

preference for the larger streams in the system was clearly indicated. Here it inhabited quiet pool areas, especially those areas near the foot of riffles. Its tolerance to pollution was discussed by Trautman (1957).

Notropis stramineus (Cope)--Sand shiner. Although it was present in several localities in the larger waters of the system, it predominated in the small- to moderate-sized streams, here being most often found in and near shallow riffles, and in pools of little current, especially just below a riffle. It seemed to prefer sand and gravel bottoms, and was the most abundant shiner in those areas that were affected by mine pollution.

Notropis telescopus (Cope)--Telescope shiner. Unlike its relative, Notropis ariommus, this species was found to occur widely in the western tributaries of the drainage, from North Whiteoak Creek northward. It seemed to be less limited by stream size than was N. ariommus, being found in both headwaters and in the larger waters of the system. In most localities, N. telescopus preferred faster flowing habitats, being only occasionally found in pools. Gilbert (1969), in discussing the two species, related the effect of pollution on the distribution of N. ariommus. Since N. ariommus is both pollution intolerant, and at the same time prefers larger streams, its isolation in Little South Fork River could be due to elimination from the rest of the system. Notropis tele-

scopus, on the other hand, is more widespread, possibly because it inhabits smaller streams, some of which would surely avoid pollution. The Little South Fork River is one of the few areas where the two species have been known to occur sympatrically.

Notropis volucellus (Cope)--Mimic shiner. Occurred in streams of all sizes with moderate gradient, but seemed to be more prevalent in the medium- and larger-sized streams, being found in the smaller streams only near their entrance into larger bodies of water. It was collected most often in quiet water near the banks of streams with sand and gravel bottoms, and in moderately flowing pools between riffles.

Family Ictaluridae

Ictalurus natalis (LeSueur)--Yellow bullhead. Collected only in Whiteoak Creek, a tributary of Clear Fork River. At the time of collection, the stream was reduced to intermittent pools with almost no discernable flow between pools. Aquatic vegetation was abundant in Whiteoak Creek, and this may have something to do with the occurrence of the species in this part of the drainage (Trautman 1957).

Ictalurus punctatus (Rafinesque)--Channel catfish. Found only in the larger waters of the drainage, the adults were most often taken in the large pools similar to those in which the redhorse suckers (Moxostoma spp.) were common. The young were often present in riffles, runs and especially in

the shallow pools below the riffles.

Noturus flavus Rafinesque--Stonecat. This species was found only in the larger streams of the system, most often along the edges of the shallow riffles of the main river, in association with emergent aquatic vegetation.

Pylodictis olivaris (Rafinesque)--Flathead catfish. This is another inhabitant of only the largest waters of the drainage. No adults were taken, probably because the deep pool areas were not adequately sampled. The juveniles were often taken in the riffles and run areas, or in pools just below the riffles.

Family Cyprinodontidae

Fundulus catenatus (Storer)--Northern studfish. This is another of the species that was restricted to Little South Fork River, where it was quite abundant. It inhabited the pools, especially those which received the direct rays of the sun for much of the day.

Family Atherinidae

Labidesthes sicculus (Cope)--Brook silverside. Quite common in the Little South Fork River, but found at only one location in the rest of the system (Clear Fork River). Its absence in much of the system could be due to conditions similar to those projected for the decline of N. ariommus. The brook silverside prefers larger bodies of water, and, at the same time, seems intolerant of pollution. A discussion

of its changing status in Ohio was given by Trautman (1957).

Family Serranidae

Roccus chrysops (Rafinesque)--White bass. One specimen was taken in a gill net in one of the larger pools of the main river. The large pools of the main river may provide a suitable habitat for this lake-preferring species.

Family Centrarchidae

Ambloplites rupestris (Rafinesque)--Rockbass. Well-distributed throughout the system.

Micropterus dolomieu Lacepede--Smallmouth bass. Found in various localities throughout the system, the species preferred unpolluted, clear, cool streams of moderate to moderately fast gradient. It was most often captured from pools or runs with a rocky substrate.

Micropterus punctulatus (Rafinesque)--Spotted bass. This species was well-distributed throughout the system. It inhabited some of the same areas as M. dolomieu, but also occurred in the warmer, more turbid, sluggish areas where M. dolomieu was absent.

Lepomis macrochirus Rafinesque--Bluegill. Widely distributed in the system, this species was found in pool areas of streams of all sizes.

Lepomis megalotis (Rafinesque)--Longear sunfish. Distributed throughout the system, the longear sunfish was found in all types and sizes of streams, but showed some preference for headwater areas.

Family Percidae

Etheostoma blennioides Rafinesque--Greenside darter.

Widely distributed in the system, this species was taken in riffles of all sizes except the very small and very swift and deep.

Etheostoma caeruleum Storer--Rainbow darter. Of wide occurrence in the system, this species seems to have a somewhat wider range of habitats than most darters. It was found to be abundant in both headwaters and the main river. Although most prominent in the shallow riffles, it was also found in pools of shallow depth with a sand and/or gravel bottom.

Etheostoma camurum (Cope)--Bluebreast darter. Mainly an inhabitant of the larger deeper runs and riffles of the main river, it extended some distance up into the tributaries that empty directly into the Big South Fork River. The bottom of these riffles was composed of sand, gravel, and large rock. It was found under or alongside boulders in some of the deepest runs in the stream. The young were often found in less severe riffles, and often occupied areas similar to those occupied by E. caeruleum.

Etheostoma cinereum Storer--Ashy darter. This solitary and secretive darter was found to exist in rather substantial numbers in the Big South Fork River, being also found

in some of the larger tributaries. The species preferred fairly shallow (one to three feet) pool areas in which medium-sized rocks lie on gravel and sand. In such habitats, which abound in the main river, the species was found to be quite common. In areas where the pools flowed into riffles, the pool area just above the riffles and along the bank of the stream, where current was slight, seemed to be preferred habitats. Occasionally a specimen was found in the riffles, but this was rare. Often they were found in shallow pool areas at the foot of riffles. The location that would best afford an opportunity for an ecological study of this interesting species is Big South Fork River at the mouth of Station Camp Creek.

Etheostoma flabellare Rafinesque--Fantail darter.

Specimens of this species were taken only from Little South Fork River in small gravel riffles, and shallow pools with some current. Its absence in the rest of the system cannot be explained on the basis of siltation or pollution, since it is quite tolerant of these factors (Trautman 1957).

Etheostoma kennicottii (Putnam)--Stripetail darter.

This species was collected in only two localities, but these represented quite different situations. Specimens were collected in Perkins Creek (a branch of Roaring Paunch Creek) in the same pool in which Etheostoma sagitta was found. In the Big South Fork it was taken in several collections made at

one locality, that being the main river near the mouth of Station Camp Creek. Here it was taken in and near riffles of small to moderate size.

Etheostoma maculatum Kirtland--Spotted darter. In the main river, this species inhabited areas similar to that of E. camurum, but it did not extend up into the tributaries as frequently or as far as did the latter. This indicates its closer restriction to the very heavy riffles of the main river. Trautman (1957) stated that in riffles or rapid current flowing over a gravel and boulder-strewn bottom, E. maculatum was taken from the center of the riffle where the current was strongest.

Etheostoma obeyense Kirsch--Barcheek darter. Within the drainage, this species seems to be restricted to two western tributaries, Little South Fork River and Rock Creek. Here it was very common, most often being taken in sandy pool areas with moderate current, but also found in some smaller riffles.

Etheostoma sagitta (Jordan and Swain)--Arrow darter. Collected only in Perkins Creek, a tributary of Roaring Paunch Creek. At the time of collecting, the stream was reduced to a series of pools with almost no current connecting them. The darters were found under large rocks that were strewn along the sides of, and in, the pools. Bailey (1948) states that Etheostoma sagitta was collected in the deepest and fastest

riffles in the stream, so the occurrence in Perkins Creek may have been one of necessity, since no riffle habitats were available at the time of collecting. The arrow darter appears to be a headwater species, preferring small streams to larger bodies of water. The presence of E. sagitta in the Big South Fork system represents the first occurrence of this species below Cumberland Falls (Bailey 1948, Kuehne and Bailey 1961).

Etheostoma stigmaeum (Jordan)--Speckled darter. This species was collected only from the main river and from Station Camp Creek and Little South Fork River. It is felt by the author that the species does not occur in New or Clear Fork River or North Whiteoak Creek. It preferred riffles of moderate current and shallow depth as well as shallow pools with some current.

Etheostoma tippecanoe Jordan and Evermann--Tippecanoe darter. Observations made by the author in the Big South Fork system are in general agreement with those of Trautman (1957). The species is of extremely variable occurrence. In the one locality where it was collected, several previous collections (one year previous) yielded no specimens. The following year, at exactly the same spot, the species was found to be present. It was taken from moderately swift, shallow riffles of sand, gravel and rock. This location, Big South Fork River at the mouth of Station Camp Creek, is the most upstream locality for the occurrence of the species in the Cumberland River

system. It was previously reported from the Cumberland River drainage, only from Central Tennessee near Nashville in the East Fork of the Stones River and Harpeth River (Zorach 1969). The specimens from the Big South Fork system seem to be more closely related to the Cumberland River form than to the form that exists in the Upper Tennessee River system.

Etheostoma zonale (Cope)--Banded darter. This darter was taken from the riffles of the larger streams in the drainage, and seemed to be absent from the smaller tributaries, especially areas in these smaller streams much removed from larger water. It occupied the shallow portions of the same riffles as E. maculatum, being found more toward the edges of these rather than directly in the main current. It was also taken in shallower riffles in the main river.

Etheostoma (Ulocentra) sp.--Emerald darter. This is undoubtedly the same undescribed darter that was reported by Shoup and Peyton (1940) and is now being described by Dr. R. M. Bailey. The species also occurs in the Upper Cumberland system (above Cumberland Falls), and in the Upper Kentucky system, and in the Rockcastle River (below Cumberland Falls) (Kuehne and Bailey 1961). It was of wide occurrence in the Big South Fork system, being found in New and Clear Fork River at the mouth of Station Camp Creek. It was not found in Little South Fork River. The species inhabited the shallows of sandy, rock-strewn pools in smaller streams, and along the

quiet edges of shallow riffles in the main river, especially where emergent aquatic vegetation was present.

Percina caprodes (Rafinesque)--Logperch. Very common in all but the extremely small streams, this darter was taken from riffles, runs and from pool areas of moderate depth.

Percina copelandi (Jordan)--Channel darter. This species was most often taken in the larger rivers of the system on sand, sand on bedrock, or sand and gravel substrates. It was not a riffle fish, being most often found in moderately deep pools (one to three feet) with slow current, and along the edges of riffles (near shore) in quieter water.

Percina maculata (Girard)--Blackside darter. This darter was found in a similar habitat in small and large streams throughout the system. Generally it was found in areas where there was little, if any, current flow. These included larger pool areas of smaller streams, occurring especially among the rocks near the bank of the stream, and in the main river, in a habitat similar to that of E. cinereum. Trautman (1957) stated that this species is intolerant of mine waste pollution. There are thriving populations of this species all over the badly polluted New River drainage, so this point might be questioned.

Percina sciera (Swain)--Dusky darter. This species was found only at the Big South Fork River at Hilltop, McCreary County, Kentucky, at state highway 92 bridge. At

the time of collection, the stream was at an unusually low level, due to the lack of rain the previous spring and summer. P. sciera was taken from a deep, boulder-strewn channel area with moderate current.

Percina squamata (Gilbert and Swain)--Olive darter. This was the dominant inhabitant of the deeper, swifter moving waters of the main river. This species was taken from the deepest and fastest boulder-strewn runs of the river. Effective seining of these runs was impossible, so sodium cyanide was employed. P. squamata was found in this deep, fast water under or alongside boulders and also in a similar habitat where the current was somewhat lessened.

Stizostedion vitreum (Mitchill)--Walleye. Specimens were taken only from the main river. This species preferred the long pools of moderate depth which are so characteristic of the Big South Fork River. Occasionally the young are taken in shallow, boulder-strewn pool areas of smaller streams.

Family Cottidae

Cottus carolinae (Gill)--Banded sculpin. Collected only from Little South Fork River, this species occupied the shallow riffles, being especially abundant in the headwater areas.

The following are species that were not taken during the study period by the author, but whose occurrence in Big South Fork River system is documented in the literature, and

which may or may not still be present in the system.

Family Catostomidae

Lagochila lacera Jordan and Brayton--Harelip sucker. Kirsch (1893) reported the occurrence of this species in Little South Fork River and Kennedy Creek. It has not been taken since in the system, and has not been taken anywhere since 1900. Siltation of streams is given by most investigators as the explanation for the decline of the species.

Family Percidae

Ammocrypta asprella (Jordan)--Crystal darter. The only report of this species from the system was that of Fowler (1906), who listed this species as being collected by E. D. Cope in the Big South Fork system.

Percina sp.--Kirsch (1893) listed Percina caprodes (as Etheostoma caprodes) from Little South Fork River, Brimstone Creek, New River, and Big South Fork River. R. E. Jenkins (personal communication) has located one specimen from Little South Fork River, which was found to be P. sp., which corresponds to Henry Fowler's Percina caprodes burtoni, and will probably be recognized as a separate species. The present study has yielded P. caprodes from Little South Fork River, but no P. sp. Even so, it is felt that these two closely related species exist today sympatrically in the Little South Fork River.

Percina macrocephala (Cope)--Longhead darter.

Kirsch (1893) lists this species from Little South Fork River (as Etheostoma macrocephalum). Attempts to verify this record have, as of yet, failed, but it is not too unlikely that the species did at one time occur in the system.

Etheostoma atripinne (Jordan)--Cumberland snubnose darter. Kirsch (1893) lists this darter from Kennedy Creek. It seemed to be absent from the river system during the present study, and is a species more characteristic of more westerly portions of the Cumberland River system.

CHAPTER III

DISCUSSION AND CONCLUSIONS

Faunistically, the drainage of the Big South Fork of the Cumberland River does not represent, by any means, an homogenous unit. There are involved several more or less well-defined groupings of fishes within the system. Many species are, of course, distributed throughout the system, but certain species are quite restricted to one part of the drainage or another.

Although there are a few differences, the Clear Fork River drainage and the New River drainage have faunas that are quite similar. Notropis leuciodus was not taken in the New River drainage, but was probably present. Shoup and Peyton (1940) reported its capture in Smoky Fork of New River. Most other differences involved species that are occupants of larger rivers (Etheostoma maculata, Percina copelandi, Percina squamata, and Pylodictis olivaris), and were taken from Clear Fork River near its junction with New River. These species are undoubtedly present in the New River near its junction with Clear Fork River, and their absence in collections reflects lack of collection data for this part of New River. The other differences in the two drainages (Labidesthes sicculus, Ictalurus natalis and Chrosomus erythrogaster) deal with species that occur sporadically in collections and may

very well be present in New River. All in all, the two faunas are extremely similar.

A second faunistic unit represented in the sampling is that of the western tributaries that lie completely within the boundaries of Tennessee, and empty independently into the Big South Fork River. These include the drainages of North Whiteoak Creek, Station Camp Creek, and No Business Creek. While North Whiteoak Creek, being the largest by far of the three, has some species characteristic of the larger waters of the system, there is some data unifying the three streams. Most notable is the presence, in all three, of Notropis telescopus, and in Station Camp Creek and North Whiteoak Creek of sawfin shiner (Notropis sp.). It is the author's opinion that this undescribed species also exists in No Business Creek. Notropis telescopus was taken only in the Big South Fork River near the mouth of Station Camp Creek, and in the Little South Fork River, another western tributary. Sawfin shiner was taken nowhere else besides the localities listed above.

A third area is that of Roaring Paunch Creek. Although only one collection was made here, the results are quite revealing. Especially noteworthy is the presence of two species, Etheostoma sagitta and Etheostoma kennicotti. Etheostoma kennicotti was taken only in the Big South Fork River besides this locality. Etheostoma sagitta was restrict-

ed, in the Big South Fork system, to Roaring Paunch Creek. This fish is an occupant of small headwater streams (Bailey 1948, Kuehne and Bailey 1961) which characteristically undergo periods of drying out, at which time the situation is one of intermittent pools. At the time of collection, Perkins Creek, a tributary of Roaring Paunch Creek, was reduced to a series of intermittent pools with virtually no current present between the pools. The bottom was silt-covered and strewn with large rocks, under which the E. sagitta and E. kennicotti were taken. Before this report, E. sagitta had only been reported above Cumberland Falls, and was thought to be restricted to the Upper Cumberland River system above the falls. Therefore, this isolated population below the falls raises questions as to its means of entry into the Big South Fork system. Since it is a headwater species, its entry via the main river is unlikely. This leaves stream capture as the only feasible alternative answer. Collections by members of the Department of Zoology and Entomology at the University of Tennessee in the headwaters of Clear Fork or the Cumberland River (not the same Clear Fork River that heads the Big South Fork River) in Tennessee revealed the presence of E. kennicotti, E. sagitta, and Etheostoma (Ulocentra) sp. (U. T. 1968 collections, numbers 28 and 138). Clear Fork of the Cumberland River, whose headwaters drain the North-facing slopes of the same mountains that Roaring Paunch Creek drains, is part

of the upper Cumberland River system (it empties above Cumberland Falls). Kuehne and Bailey (1961) state that only four darters are present in the Upper Cumberland River system. In addition to the three already mentioned, Etheostoma nigrum susanae is also present. This last species was not taken in the Perkins Creek collections, nor was it taken in any of the tributaries of the Upper Cumberland River system sampled in Tennessee, but this does not preclude its existence in either of these areas. Its presence in Roaring Paunch Creek drainage would be further evidence for stream capture in this area. In addition to the evidence already presented, there is the fact that three species of darters characteristic of the Big South Fork system are present in the above mentioned Upper Cumberland River drainage in Tennessee. These are E. blennioides, P. caprodes and P. maculata (U. T. 1968 collections numbers 28 and 138; U. T. 1969 collections numbers 25, 26 and 27). In certain areas the drainage divide between Big South Fork River system (Roaring Paunch Creek) and Upper Cumberland River system (Clear Fork of Cumberland River drainage) is quite low, and at least affords the possibility of capture between the two. The area needs further study directed toward stream capture before any definitive statement can be made.

Comprising a fourth unit are those western tributaries, Little South Fork River and Rock Creek, whose headwaters lie in Tennessee, but empty into the Big South Fork

River in Kentucky. Rock Creek was sampled only in its headwaters, but the presence of Etheostoma obeyense is significant. This species was found only in Little South Fork River in addition to Rock Creek. Little South Fork was sampled extensively and yielded forty-one species of fishes, eleven of which were taken only from this stream in the system. These include Nocomis effusus, Fundulus catenatus, Etheostoma flabellare, Cottus carolinae, Hybopsis insignis, Hybopsis dissimilis, Notropis ariommus, Notropis sp. (white-zone shiner), Notropis photogenis, Pimephales promelas, and Pimephales notatus. The presence of these species in Rock Creek is not precluded since adequate sampling on the stream was not made. In addition to those species already mentioned, Kirsch (1893) reported Lagochila lacera, Percina macrocephala, and Etheostoma atripinne as being present in the Little South Fork drainage. It is clear from the data that the Little South Fork River, and probably Rock Creek have a fauna that is much more similar to that of streams entering the Cumberland River further downstream than to the rest of the Big South Fork system. Tributaries of Little South Fork River lie in close proximity to two of these streams, Wolf River, which drains into Dale Hollow Reservoir, and Beaver Creek, which drains into Lake Cumberland. Kirsch (1893) who collected in the Big South Fork system, also collected in Beaver Creek. He reported among other, Pimephales notatus, Fundulus

catenatus and Etheostoma obeyense from this drainage. Collections made by members of the Department of Zoology and Entomology at the University of Tennessee in the Wolf River drainage in Tennessee have yielded, among others, Etheostoma atripinne, Etheostoma flabellare, Cottus carolinae, Fundulus catenatus and Pimephales notatus (U. T. 1968 collections number 87; U. T. 1969 collections numbers 85 and 86). Also taken were Notropis telescopus and Etheostoma stigmaeum, two species that are restricted, in the Big South Fork system, to the western tributaries. These faunal similarities cannot be overlooked, and again point to stream capture as a means of entrance of these fishes into the Big South Fork system. One area that could quite possibly yield the answer is that of Elk Spring Valley (U. S. Geological Survey, quadrangle map, 1953 series) seen in the Monticello, Kentucky quadrangle. A number of headwater streams drain into this valley and go underground. No major stream occupies the valley. The drainage divide between Beaver Creek drainage to the west and Little South Fork drainage to the east (Kennedy Creek) is quite substantial, being composed of Elk Ridge. However, this divide is broken where Elk Spring Valley traverses the divide. At this point the divide between the two systems is virtually non-existent. It is hypothesized that any capture or connection between the two systems must have taken place at this point. Since all these headwater streams go underground in

this valley, the possibilities for a connection between the two systems at some time in the past is increased.

A further bit of evidence for stream capture is that of the distribution of Nocomis effusus and Nocomis micropogon. Nocomis effusus, in the Big South Fork system was captured only in Little South Fork drainage, while Nocomis micropogon is present in the larger waters of the rest of the drainage. The isolation of Nocomis effusus could be the result of the stream capture hypothesized above. Lachner and Jenkins (1967) discuss the distribution of these chubs, documenting the presence of Nocomis effusus in Wolf River and Eagle Creek.

The last faunal unit, and the least defined, is that of the Big South Fork River itself. The larger water of the main river provides a habitat for many species whose ecological requirements dictate their restriction to this type of water. This unit is not well defined because, where tributaries enter the main river, the larger river forms are often collected well up into the lesser stream. Making up this unit are such species as Etheostoma camurum and Etheostoma maculatum, which prefer fast flowing riffles of moderate depth. Of course, this habitat predominates in the main river, but is also present in smaller streams. Percina squamata, whose deep, fast flowing, boulder-strewn habitat is not approximated in any tributaries except near the mouth of Clear Fork River and North Whiteoak Creek, and possibly the

mouth of New River, seems to be quite restricted to the main body of water. Etheostoma cinereum, which prefers fairly shallow rock-strewn pools, is most abundant in the main river, although occasionally taken in a tributary. Percina copelandi was found most often along the banks of the main river in sandy pools, and Percina sciera was taken at only one locality in the drainage, this being a deep channel in the main river. Among the shiners, Notropis atherinoides and Notropis spilopterus showed a distinct preference for the larger waters. Other, more common, fish that showed preference for the larger waters were Ictalurus punctatus, Noturus flavus, Pylodictis olivaris, Roccus chrysops and Stizostedion vitreum. The red-horse suckers (Genus Moxostoma) ventured into the larger tributaries, but were still restricted to the larger parts of these. Lastly, Etheostoma tippecanoe was taken only in the main river, and seems to prefer this type of water.

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APPENDIXES

APPENDIX A

U. T. COLLECTIONS IN THE BIG SOUTH FORK OF THE CUMBERLAND RIVER SYSTEM

U. T. B. S. F. 1, Double Mill Creek, 1/3 mile from junction with New River, Anderson Co., Tenn., Sept. 6, 1969. R. Riggs, B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	6
<u>Catostomus commersoni</u>	2
<u>Notropis stramineus</u>	4
<u>Semotilus atromaculatus</u>	24

U. T. B. S. F. 2, Stallion Branch of New River at Hy. 116 bridge at Fork Mountain, Anderson Co., Tenn., Sept. 6, 1969. R. Riggs, B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	3
<u>Etheostoma caeruleum</u>	63
<u>Notropis stramineus</u>	17
<u>Rhinichthyes atratulus</u>	13
<u>Semotilus atromaculatus</u>	16

U. T. B. S. F. 3, New River, below junction of Laurel Fork, 1 mile South of Mooretown, Anderson Co., Tenn., Sept. 6, 1969. R. Riggs, B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	3
<u>Notropis ardens</u>	8
<u>Notropis stramineus</u>	105
<u>Rhinichthyes atratulus</u>	2

Semotilus atromaculatus 2

U. T. B. S. F. 4, Ligias Fork, 1/3 mile above junction of Carrol Branch, Anderson Co., Tenn., Sept. 6, 1969. R. Riggs, B. Hitch, C. Comiskey.

Campostoma anomalum 3

Etheostoma caeruleum 25

Hypentelium nigricans 1

Lepomis megalotis 1

Notropis ardens 4

Notropis galacturus 1

Notropis stramineus 62

Semotilus atromaculatus 1

U. T. B. S. F. 5, Ligias Fork, 1/4 mile downstream from Calvin Branch, Anderson Co., Tenn., Sept. 6, 1969. R. Riggs, B. Hitch, C. Comiskey.

Etheostoma blennioides 1

Etheostoma caeruleum 26

Etheostoma (Ulocentra) sp. 7

Hypentelium nigricans 1

Lepomis megalotis 1

Micropterus dolomieu 1

Moxostoma duquesnei 1

Notropis ardens 2

Notropis galacturus 4

Notropis rubellus 3

<u>Notropis stramineus</u>	93
<u>Percina caprodes</u>	1
<u>Percina maculata</u>	1

U. T. B. S. F. 6, New River at junction of Nick's Creek, Campbell Co., Tenn., Sept. 7, 1969. R. Riggs, S. Hitch, B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	4
<u>Etheostoma blennioides</u>	1
<u>Etheostoma caeruleum</u>	17
<u>Etheostoma camurum</u>	8
<u>Hypentelium nigricans</u>	1
<u>Ictalurus punctatus</u>	11
<u>Notropis ardens</u>	2
<u>Notropis rubellus</u>	6
<u>Notropis volucellus</u>	1
<u>Percina caprodes</u>	4
<u>Percina maculata</u>	2

U. T. B. S. F. 7, Stony Fork of New River, 1/2 mile above Clinchmore, Campbell Co., Tenn., Sept. 7, 1969. R. Riggs, S. Hitch, B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	9
<u>Catostomus commersoni</u>	1
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	17
<u>Hypentelium nigricans</u>	2

<u>Notropis stramineus</u>	81
<u>Percina maculata</u>	4
<u>Semotilus atromaculatus</u>	5

U. T. B. S. F. 8, Smokey Creek at Hembree Bridge, Scott Co., Tenn., Sept. 7, 1969. R. Riggs, S. Hitch, B. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	16
<u>Etheostoma blennioides</u>	6
<u>Etheostoma caeruleum</u>	90
<u>Etheostoma</u> (Ulocentra) <u>sp.</u>	10
<u>Hypentelium nigricans</u>	4
<u>Lepomis megalotis</u>	5
<u>Micropterus punctulatus</u>	1
<u>Moxostoma erythrurum</u>	3
<u>Notropis ardens</u>	7
<u>Notropis stramineus</u>	150
<u>Percina caprodes</u>	3
<u>Percina maculata</u>	5
<u>Semotilus atromaculatus</u>	2

U. T. B. S. F. 9, Brimstone Creek, at Walker Bridge, 3 miles east of Robbins, Scott Co., Tenn., Oct. 11, 1968. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	11
<u>Etheostoma blennioides</u>	6

<u>Etheostoma caeruleum</u>	65
<u>Hypentelium nigricans</u>	4
<u>Lepomis macrochiris</u>	1
<u>Lepomis megalotis</u>	1
<u>Micropterus punctulatus</u>	7
<u>Moxostoma duquesnei</u>	1
<u>Moxostoma erythrurum</u>	8
<u>Nocomis micropogon</u>	1
<u>Notropis ardens</u>	4
<u>Notropis stramineus</u>	18
<u>Percina caprodes</u>	7
<u>Percina maculata</u>	22
<u>Semotilus atromaculatus</u>	11

U. T. B. S. F. 10, Paint Rock Creek at Tenn. Hy. 63
bridge, Scott Co., Tenn., Oct. 11, 1968. B. Hitch, C.
Comiskey.

<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	21
<u>Hypentelium nigricans</u>	3
<u>Notropis ardens</u>	13
<u>Notropis stramineus</u>	2
<u>Semotilus atromaculatus</u>	4

U. T. B. S. F. 11, Stanley Branch of Buffalo Creek,
Scott Co., Tenn., Sept. 19, 1969. R. Riggs, C. Comiskey.

<u>Campostoma anomalum</u>	3
<u>Etheostoma caeruleum</u>	9
<u>Hypentelium nigricans</u>	1
<u>Notropis ardens</u>	20
<u>Notropis chrysocephalus</u>	2
<u>Notropis stramineus</u>	2
<u>Semotilus atromaculatus</u>	11

U. T. B. S. F. 12, Smith Creek, a branch of Buffalo Creek, 1/2 mile above New Salem at County rd. 2450 bridge, Scott Co., Tenn., July 27, 1969. F. Riggs, C. Comiskey.

<u>Campostoma anomalum</u>	7
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	16
<u>Hypentelium nigricans</u>	2
<u>Lepomis megalotis</u>	1
<u>Micropterus punctulatus</u>	1
<u>Moxostoma erythrurum</u>	5
<u>Notropis ardens</u>	10
<u>Notropis chrysocephalus</u>	5
<u>Notropis stramineus</u>	17
<u>Semotilus atromaculatus</u>	6

U. T. B. S. F. 13, Buffalo Creek, 1 1/2 mile upstream of junction of Rockhouse Fork, Scott Co., Tenn., July 27, 1969. F. Riggs, C. Comiskey.

<u>Ambloplites rupestris</u>	6
<u>Campostoma anomalum</u>	5

<u>Etheostoma blennioides</u>	34
<u>Etheostoma caeruleum</u>	38
<u>Etheostoma</u> (Ulocentra) <u>sp.</u>	1
<u>Hypentelium nigricans</u>	2
<u>Lepomis megalotis</u>	7
<u>Micropterus punctulatus</u>	1
<u>Notropis ardens</u>	20
<u>Notropis stramineus</u>	21
<u>Percina caprodes</u>	2
<u>Percina maculata</u>	1
<u>Semotilus atromaculatus</u>	1

U. T. B. S. F. 14, Buffalo Creek at Tenn. Hy. 63
bridge, Scott Co., Tenn., Oct. 11, 1968. B. Hitch, C.
Comiskey.

<u>Ambloplites rupestris</u>	2
<u>Campostoma anomalum</u>	1
<u>Etheostoma caeruleum</u>	2
<u>Hypentelium nigricans</u>	1
<u>Lepomis megalotis</u>	2
<u>Moxostoma duquesnei</u>	2
<u>Moxostoma erythrurum</u>	1
<u>Notropis ardens</u>	2
<u>Notropis stramineus</u>	2
<u>Semotilus atromaculatus</u>	1

U. T. B. S. F. 15, New River, 1 mile east of the town of New River, Scott Co., Tenn., Oct. 11, 1968. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	3
<u>Etheostoma blennioides</u>	3
<u>Etheostoma caeruleum</u>	10
<u>Hypentelium nigricans</u>	1
<u>Lepomis megalotis</u>	12
<u>Micropterus punctulatus</u>	4
<u>Nocomis micropogon</u>	1
<u>Notropis ardens</u>	166
<u>Notropis galacturus</u>	1
<u>Notropis rubellus</u>	14
<u>Notropis stramineus</u>	2
<u>Notropis volucellus</u>	15
<u>Percina maculata</u>	3
<u>Semotilus atromaculatus</u>	1

U. T. B. S. F. 16, Clear Fork Creek, north prong 1 mile east of Grimsley at Co. rd. 4242 bridge, Fentress Co., Tenn., July 16, 1969. B. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	1
<u>Hypentelium nigricans</u>	1
<u>Lepomis macrochirus</u>	2
<u>Micropterus punctulatus</u>	1

<u>Notropis ardens</u>	66
<u>Semotilus artomaculatus</u>	1

U. T. B. S. F. 17, Clear Fork Creek, north prong, at
Co. rd. 4450, 3 miles NNE of Banner Springs, Fentress Co.,
Tenn., July 26, 1969. F. Riggs, C. Comiskey.

<u>Campostoma anomalum</u>	12
<u>Etheostoma blennioides</u>	24
<u>Etheostoma caeruleum</u>	84
<u>Etheostoma camurum</u>	24
<u>Lepomis megalotis</u>	2
<u>Micropterus punctulatus</u>	1
<u>Moxostoma erythrurum</u>	1
<u>Nocomis micropogon</u>	1
<u>Notropis ardens</u>	23
<u>Notropis galacturus</u>	1
<u>Notropis leuciodus</u>	21
<u>Notropis rubellus</u>	29
<u>Notropis stramineus</u>	79
<u>Notropis volucellus</u>	6
<u>Percina caprodes</u>	1

U. T. B. S. F. 18, Clear Fork Creek, south prong, 2
air miles NNE of Roslin, Fentress Co., Tenn., July 26, 1969.
F. Riggs, C. Comiskey.

<u>Ambloplites rupestris</u>	6
<u>Campostoma anomalum</u>	2

<u>Etheostoma blennioides</u>	6
<u>Etheostoma caeruleum</u>	10
<u>Hypentelium nigricans</u>	7
<u>Lepomis macrochirus</u>	1
<u>Notropis ardens</u>	25
<u>Semotilus atromaculatus</u>	16

U. T. B. S. F. 19, Clear Fork Creek, at Gatewood bridge on Co. rd. 4425, 6 air miles WNW of Grimsley, on Morgan-Fentress Co. line, Tenn., July 26, 1969. F. Riggs, C. Comiskey.

<u>Ambloplites rupestris</u>	2
<u>Lepomis megalotis</u>	1
<u>Micropterus punctulatus</u>	1
<u>Moxostoma erythrurum</u>	12
<u>Notropis ardens</u>	16
<u>Notropis rubellus</u>	64
<u>Notropis volucellus</u>	5

U. T. B. S. F. 20, Crooked Creek, at Co. rd. 4240 bridge, at Cumberland Grove, Fentress Co., Tenn., July 16, 1969. B. Hitch, C. Comiskey.

<u>Chrosomus erythrogaster</u>	4
<u>Lepomis macrochirus</u>	2
<u>Micropterus punctulatus</u>	1
<u>Rhinichthys atratulus</u>	9
<u>Semotilus atromaculatus</u>	8

U. T. B. S. F. 21, Crooked Creek, on Co. rd. 4450
bridge, 2 miles south of Allardt, Fentress Co., Tenn., July
26, 1969. F. Riggs, C. Comiskey.

<u>Campostoma anomalum</u>	4
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	3
<u>Hypentelium nigricans</u>	3
<u>Lepomis macrochirus</u>	2
<u>Micropterus punctulatus</u>	5
<u>Notropis stramineus</u>	37
<u>Percina maculata</u>	6
<u>Semotilus atromaculatus</u>	2

U. T. B. S. F. 22, Crooked Creek, 100 yards above
the junction of Clear Fork River, 4 miles south of Armawaithe,
Fentress Co., Tenn., July 15, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	3
<u>Etheostoma caeruleum</u>	2
<u>Etheostoma camurum</u>	23
<u>Notropis ardens</u>	84
<u>Notropis galacturus</u>	65
<u>Notropis leuciodus</u>	5
<u>Notropis rubellus</u>	30
<u>Notropis stramineus</u>	12
<u>Notropis volucellus</u>	8

U. T. B. S. F. 23, Big Creek, tributary of Clear Fork River, 2 miles SW of Armawaithe, Fentress Co., Tenn., July 26, 1969. F. Riggs, C. Comiskey.

<u>Lepomis megalotis</u>	2
<u>Micropterus punctulatus</u>	1
<u>Semotilus atromaculatus</u>	3

U. T. B. S. F. 24, Clear Fork River, at junction of Crooked Creek, 4 air miles south of Armawaithe, on Morgan-Fentress Co. line, Tenn., July 15, 1969. B. Hitch, C. Comiskey.

<u>Labidesthes sicculus</u>	1
<u>Lepomis macrochirus</u>	2
<u>Notropis ardens</u>	50
<u>Notropis galacturus</u>	15

U. T. B. S. F. 25, Clear Fork River, at Brewster bridge on Tenn. Hy. 52, on Morgan-Fentress Co. line, June 28, 1968. Bouchard, Smythe, Etnier, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	3
<u>Etheostoma blennioides</u>	23
<u>Etheostoma caeruleum</u>	18
<u>Etheostoma camurum</u>	57
<u>Hypentelium nigricans</u>	4
<u>Lepomis megalotis</u>	3
<u>Nocomis micropogon</u>	9
<u>Notropis ardens</u>	6

<u>Notropis galacturus</u>	29
<u>Notropis rubellus</u>	62
<u>Notropis stramineus</u>	15
<u>Notropis volucellus</u>	183
<u>Percina squamata</u> (very small)	4

U. T. B. S. F. 26, Whiteoak Creek, 1 mile east of Hy. 27, just downstream of junction of Hall Branch, Morgan Co., Tenn., July 15, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	1
<u>Etheostoma caeruleum</u>	1
<u>Notropis ardens</u>	26
<u>Notropis chrysocephalus</u>	4
<u>Notropis stramineus</u>	10
<u>Semotilus atromaculatus</u>	4

U. T. B. S. F. 27, Whiteoak Creek, 1/2 mile east of Sunbright, Morgan Co., Tenn., Sept. 13, 1968. R. Stiles, D. Etnier, C. Comiskey.

<u>Campostoma anomalum</u>	1
<u>Catostomus commersoni</u>	1
<u>Etheostoma blennioides</u>	1
<u>Etheostoma caeruleum</u>	18
<u>Ictalurus natalis</u>	1
<u>Lepomis macrochirus</u>	2
<u>Notropis ardens</u>	19
<u>Notropis stramineus</u>	11

<u>Percina maculata</u>	9
<u>Semotilus atromaculatus</u>	34

U. T. B. S. F. 28, Whiteoak Creek, at Hambright bridge
on Rd. 2438, Morgan Co., Tenn., July 15, 1969. B. Hitch, C.
Comiskey.

<u>Ambloplites rupestris</u>	4
<u>Campostoma anomalum</u>	3
<u>Catostomus commersoni</u>	3
<u>Etheostoma blennioides</u>	8
<u>Etheostoma caeruleum</u>	24
<u>Etheostoma</u> (Ulocentra) <u>sp.</u>	3
<u>Hypentelium nigricans</u>	2
<u>Lepomis macrochirus</u>	1
<u>Lepomis megalotis</u>	3
<u>Notropis ardens</u>	54
<u>Notropis chrysocephalus</u>	5
<u>Notropis stramineus</u>	100
<u>Notropis volucellus</u>	20
<u>Percina caprodes</u>	1
<u>Percina maculata</u>	2
<u>Semotilus atromaculatus</u>	11

U. T. B. S. F. 29, Bone Camp Creek, at Co. rd. 2438
bridge, Morgan Co., Tenn., July 16, 1969. B. Hitch, C.
Comiskey.

<u>Ambloplites rupestris</u>	5
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<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	12
<u>Etheostoma caeruleum</u>	20
<u>Etheostoma</u> (Ulocentra) <u>sp.</u>	2
<u>Hypentelium nigricans</u>	2
<u>Lepomis megalotis</u>	7
<u>Nocomis micropogon</u>	5
<u>Notropis ardens</u>	50
<u>Notropis galacturus</u>	1
<u>Notropis leuciodus</u>	2
<u>Notropis rubellus</u>	4
<u>Notropis stramineus</u>	117
<u>Notropis volucellus</u>	124
<u>Percina caprodes</u>	1
<u>Percina maculata</u>	8

U. T. B. S. F. 30, Whiteoak Creek, at Hy. 52 bridge,
Morgan Co., Tenn., July 15, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	2
<u>Etheostoma blennioides</u>	9
<u>Etheostoma caeruleum</u>	3
<u>Etheostoma camurum</u>	32
<u>Hypentelium nigricans</u>	3
<u>Nocomis micropogon</u>	1
<u>Notropis ardens</u>	71
<u>Notropis galacturus</u>	10

<u>Notropis rubellus</u>	27
<u>Notropis volucellus</u>	145

U. T. B. S. F. 31, Clear Fork River, at Burnt Mill bridge, approx. 3 and 3/4 miles upstream from junction with New River, Scott Co., Tenn., July 24, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	6
<u>Campostoma anomalum</u>	4
<u>Etheostoma blennioides</u>	29
<u>Etheostoma caeruleum</u>	2
<u>Etheostoma camurum</u>	40
<u>Etheostoma maculatum</u>	20
<u>Hypentelium nigricans</u>	13
<u>Ictalurus punctatus</u>	2
<u>Lepomis megalotis</u>	5
<u>Micropterus dolomieu</u>	4
<u>Nocomis micropogon</u>	12
<u>Notropis ardens</u>	1
<u>Notropis galacturus</u>	26
<u>Notropis rubellus</u>	53
<u>Notropis volucellus</u>	2
<u>Percina copelandi</u>	37
<u>Percina squamata</u>	5
<u>Pylodictis olivaris</u>	1

U. T. B. S. F. 32, Clear Fork River, at Burnt Mill bridge, 3 and 1/2 air miles NW of Robbins, Scott. Co., Tenn.,

July 26, 1969. B. Hitch, C. Comiskey.

<u>Etheostoma blennioides</u>	5
<u>Etheostoma camurum</u>	1
<u>Etheostoma maculatum</u>	1
<u>Hypentelium nigricans</u>	1
<u>Notropis galacturus</u>	5
<u>Notropis rubellus</u>	19
<u>Notropis volucellus</u>	16
<u>Percina squamata</u>	1

U. T. B. S. F. 33, Pine Creek, along old Oneida and Western railroad bridge (abandoned), approx. 1 mile upstream from junction with Big South Fork, Scott Co., Tenn., July 5, 1968. Gnilka, Etnier, Comiskey.

<u>Campostoma anomalum</u>	1
<u>Lepomis macrochirus</u>	1
<u>Micropterus dolomieu</u>	2
<u>Semotilus atromaculatus</u>	2

U. T. B. S. F. 34, Big South Fork River, at old Oneida and Western railroad bridge, approx. 1 mile upstream from junction with North Whiteoak Creek, Scott Co., Tenn., July 5, 1968. Gnilka, Etnier, Comiskey.

<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	4
<u>Etheostoma camurum</u>	3
<u>Ictalurus punctatus</u>	22
<u>Micropterus dolomieu</u>	2

<u>Micropterus punctulatus</u>	1
<u>Notropis ardens</u>	6
<u>Notropis galacturus</u>	22
<u>Notropis rubellus</u>	257
<u>Notropis spilopterus</u>	3
<u>Notropis volucellus</u>	102
<u>Percina maculata</u>	1
<u>Percina squamata</u>	37
<u>Pylodictis olivaris</u>	100

U. T. B. S. F. 35, Camp Branch of North Whiteoak Creek, at Zenith, approx. one hundred yards above junction with North Whiteoak Creek, Fentress Co., Tenn., Sept. 6, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	3
<u>Etheostoma blennioides</u>	6
<u>Etheostoma caeruleum</u>	52
<u>Hypentelium nigricans</u>	3
<u>Micropterus punctulatus</u>	3
<u>Notropis sp.</u>	5
<u>Notropis rubellus</u>	2
<u>Notropis telescopus</u>	63
<u>Percina maculata</u>	2
<u>Semotilus atromaculatus</u>	12

U. T. B. S. F. 36, North Whiteoak Creek, at Zenith, Fentress Co., Tenn., Sept. 6, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	5
<u>Etheostoma blennioides</u>	38
<u>Etheostoma caeruleum</u>	26
<u>Etheostoma camurum</u>	26
<u>Etheostoma maculatum</u>	9
<u>Hypentelium nigricans</u>	1
<u>Notropis sp.</u>	37
<u>Notropis galacturus</u>	85
<u>Notropis rubellus</u>	46
<u>Notropis telescopus</u>	28
<u>Percina maculata</u>	2

U. T. B. S. F. 37, Laurel Fork of North Whiteoak Creek, on old Oneida and Western railroad (abandoned), approx. one hundred yards above junction with North Whiteoak Creek, Fentress Co., Tenn., Sept. 6, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	16
<u>Etheostoma blennioides</u>	6
<u>Etheostoma caeruleum</u>	10
<u>Etheostoma camurum</u>	9
<u>Etheostoma maculatum</u>	2
<u>Etheostoma zonale</u>	2
<u>Hypentelium nigricans</u>	4
<u>Micropterus dolomieu</u>	1
<u>Nocomis micropogon</u>	2

<u>Notropis</u> <u>sp.</u>	4
<u>Notropis</u> <u>ardens</u>	1
<u>Notropis</u> <u>galacturus</u>	3
<u>Notropis</u> <u>rubellus</u>	27
<u>Notropis</u> <u>telescopus</u>	22
<u>Percina</u> <u>squamata</u>	1
<u>Salmo</u> <u>trutta</u>	1

U. T. B. S. F. 38, North Whiteoak Creek, at old Oneida and Western Railroad bridge (abandoned), approx. 1/2 mile from junction with Big South Fork, Scott Co., Tenn., July 5, 1968. Gnilka, Etnier, Comiskey.

<u>Campostoma</u> <u>anomalum</u>	24
<u>Etheostoma</u> <u>blennioides</u>	54
<u>Etheostoma</u> <u>caeruleum</u>	18
<u>Etheostoma</u> <u>camurum</u>	33
<u>Etheostoma</u> <u>cinereum</u>	1
<u>Etheostoma</u> <u>maculatum</u>	8
<u>Etheostoma</u> <u>zonale</u>	2
<u>Hypentelium</u> <u>nigricans</u>	19
<u>Micropterus</u> <u>dolomieu</u>	1
<u>Notropis</u> <u>sp.</u>	1
<u>Notropis</u> <u>ardens</u>	2
<u>Notropis</u> <u>galacturus</u>	87
<u>Notropis</u> <u>rubellus</u>	113
<u>Notropis</u> <u>telescopus</u>	1
<u>Notropis</u> <u>volucellus</u>	36

<u>Noturus flavus</u>	8
<u>Percina caprodes</u>	4
<u>Percina copelandi</u>	12
<u>Percina squamata</u>	8

U. T. B. S. F. 39, Big South Fork River, at Leatherwood Ford, 11 miles east of Oneida, Scott Co., Tenn., July 17, 1968. Sayrs, Gnilka, Comiskey.

<u>Campostoma anomalum</u>	3
<u>Etheostoma blennioides</u>	16
<u>Etheostoma caeruleum</u>	7
<u>Etheostoma camurum</u>	169
<u>Etheostoma maculatum</u>	5
<u>Etheostoma zonale</u>	8
<u>Hypentelium nigricans</u>	12
<u>Ictalurus punctatus</u>	8
<u>Micropterus punctulatus</u>	2
<u>Nocomis micropogon</u>	39
<u>Notropis ardens</u>	2
<u>Notropis galacturus</u>	10
<u>Notropis rubellus</u>	111
<u>Notropis volucellus</u>	23
<u>Noturus flavus</u>	15
<u>Percina caprodes</u>	3
<u>Percina copelandi</u>	3
<u>Percina squamata</u>	23
<u>Pylodictis olivaris</u>	28

U. T. B. S. F. 40, Big South Fork River, at Leatherwood Ford, Scott Co., Tenn., Sept. 12, 1968. Stiles, Etnier, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	1
<u>Etheostoma caeruleum</u>	6
<u>Etheostoma camurum</u>	14
<u>Etheostoma cinereum</u>	2
<u>Hypentelium nigricans</u>	2
<u>Nocomis micropogon</u>	4
<u>Notropis stramineus</u>	20
<u>Percina caprodes</u>	1
<u>Percina copelandi</u>	8
<u>Percina squamata</u>	1
<u>Stizostedion vitreum</u>	4

U. T. B. S. F. 41, Big South Fork River, approx. 1/2 mile downstream from Leatherwood Ford, Scott Co., Tenn., August 30, 1968. Etnier, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Etheostoma caeruleum</u>	15
<u>Etheostoma camurum</u>	93
<u>Etheostoma cinereum</u>	1
<u>Etheostoma maculatum</u>	15
<u>Etheostoma zonale</u>	3
<u>Hypentelium nigricans</u>	2

<u>Ictalurus punctatus</u>	3
<u>Lepomis macrochiris</u>	7
<u>Lepomis megalotis</u>	38
<u>Micropterus punctulatus</u>	5
<u>Moxostoma duquesnei</u>	8
<u>Moxostoma erythrurum</u>	4
<u>Nocomis micropogon</u>	3
<u>Notropis ardens</u>	3
<u>Notropis galacturus</u>	28
<u>Notropis spilopterus</u>	12
<u>Notropis stramineus</u>	8
<u>Noturus flavus</u>	4
<u>Percina copelandi</u>	1
<u>Percina maculata</u>	1
<u>Percina squamata</u>	14
<u>Pylodictis olivaris</u>	1
<u>Stizostedion vitreum</u>	1

U. T. B. S. F. 42, Big South Fork River, approx. 1 mile downstream from Leatherwood Ford, Scott Co., Tenn., July 17, 1968. Sayrs, Gniska, Comiskey.

<u>Etheostoma camurum</u>	64
<u>Etheostoma zonale</u>	2
<u>Ictalurus punctatus</u>	7
<u>Micropterus dolomieu</u>	3
<u>Micropterus punctulatus</u>	4

<u>Nocomis micropogon</u>	14
<u>Notropis ardens</u>	2
<u>Notropis galacturus</u>	28
<u>Notropis rubellus</u>	49
<u>Notropis spilopterus</u>	2
<u>Notropis volucellus</u>	175
<u>Noturus flavus</u>	2
<u>Percina copelandi</u>	1
<u>Percina squamata</u>	17
<u>Pylodictis olivaris</u>	12
<u>Stizostedion vitreum</u>	1

U. T. B. S. F. 43, Big South Fork River, approx. 1 and 1/2 miles downstream from Leatherwood Ford, Scott Co., Tenn., July 24, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Etheostoma camurum</u>	15
<u>Etheostoma maculatum</u>	1
<u>Etheostoma zonale</u>	1
<u>Ictalurus punctatus</u>	5
<u>Micropterus punctulatus</u>	3
<u>Nocomis micropogon</u>	21
<u>Notropis ardens</u>	1
<u>Notropis galacturus</u>	7
<u>Notropis rubellus</u>	72
<u>Notropis spilopterus</u>	2
<u>Notropis volucellus</u>	13

<u>Percina squamata</u>	11
<u>Pylodictis olivaris</u>	3

U. T. B. S. F. 44, Big South Fork River, near Angel Falls, approx. 2 miles downstream from Leatherwood Ford, Scott Co., Tenn., Sept. 12, 1968. Stiles, Etnier, Comiskey.

<u>Ambloplites rupestris</u>	5
<u>Etheostoma blennioides</u>	10
<u>Etheostoma caeruleum</u>	6
<u>Etheostoma camurum</u>	73
<u>Etheostoma cinereum</u>	4
<u>Etheostoma stigmaeum</u>	4
<u>Etheostoma zonale</u>	3
<u>Ictalurus punctatus</u>	5
<u>Lepomis macrochiris</u>	10
<u>Lepomis megalotis</u>	26
<u>Micropterus punctulatus</u>	4
<u>Moxostoma breviceps</u>	7
<u>Moxostoma duquesnei</u>	3
<u>Notropis galacturus</u>	7
<u>Notropis volucellus</u>	2
<u>Noturus flavus</u>	1
<u>Percina caprodes</u>	1
<u>Percina copelandi</u>	4
<u>Percina maculata</u>	1
<u>Percina squamata</u>	19

<u>Pylodictis olivaris</u>	6
<u>Roccus chrysops</u>	1
<u>Stizostedion vitreum</u>	1

U. T. B. S. F. 45, Station Camp Creek, approx. 1/4 mile above junction with Big South Fork River, Scott Co., Tenn., Sept. 22, 1968. Sayrs, Reese, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	8
<u>Etheostoma caeruleum</u>	33
<u>Etheostoma camurum</u>	2
<u>Etheostoma stigmaeum</u>	7
<u>Etheostoma</u> (Ulocentra) <u>sp.</u>	1
<u>Hypentelium nigricans</u>	6
<u>Micropterus dolomieu</u>	1
<u>Notropis sp.</u>	1
<u>Notropis rubellus</u>	7
<u>Notropis telescopus</u>	3
<u>Percina caprodes</u>	1
<u>Percina copelandi</u>	7

U. T. B. S. F. 46, Big South Fork River, near junction with Station Camp Creek, Scott. Co., Tenn., Sept. 16, 1968. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	10
<u>Etheostoma blennioides</u>	11

<u>Etheostoma caeruleum</u>	21
<u>Etheostoma camurum</u>	26
<u>Etheostoma cinereum</u>	7
<u>Etheostoma kennicotti</u>	4
<u>Etheostoma maculatum</u>	18
<u>Etheostoma stigmaeum</u>	1
<u>Etheostoma zonale</u>	16
<u>Hypentelium nigricans</u>	6
<u>Lepomis megalotis</u>	1
<u>Moxostoma breviceps</u>	1
<u>Nocomis micropogon</u>	10
<u>Notropis rubellus</u>	46
<u>Percina caprodes</u>	12
<u>Percina copelandi</u>	4
<u>Pylodictis olivaris</u>	1
<u>Ulocentra sp.</u>	2

U. T. B. S. F. 47, Big South Fork River, near junction
with Station Camp Creek, Scott Co., Tenn., Sept. 22, 1968.
Sayrs, Reese, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	2
<u>Etheostoma blennioides</u>	17
<u>Etheostoma caeruleum</u>	127
<u>Etheostoma camurum</u>	71
<u>Etheostoma cinereum</u>	4

<u>Etheostoma kennicotti</u>	8
<u>Etheostoma maculatum</u>	55
<u>Etheostoma stigmaeum</u>	4
<u>Etheostoma zonale</u>	22
<u>Hypentelium nigricans</u>	1
<u>Ictalurus punctatus</u>	1
<u>Lepomis macrochiris</u>	1
<u>Lepomis megalotis</u>	1
<u>Nocomis micropogon</u>	2
<u>Notropis rubellus</u>	1400
<u>Noturus flavus</u>	12
<u>Percina caprodes</u>	10
<u>Percina copelandi</u>	19
<u>Ulocentra sp.</u>	6

U. T. B. S. F. 48, Big South Fork River, at mouth of
Station Camp Creek, Scott Co., Tenn., Sept. 8, 1969. B. Hitch,
S. Hitch, R. Riggs, C. Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Etheostoma blennioides</u>	8
<u>Etheostoma caeruleum</u>	29
<u>Etheostoma camurum</u>	74
<u>Etheostoma cinereum</u>	2
<u>Etheostoma maculatum</u>	32
<u>Etheostoma stigmaeum</u>	4
<u>Etheostoma tippecanoe</u>	2

<u>Etheostoma zonale</u>	12
<u>Hypentelium nigricans</u>	2
<u>Ictalurus punctatus</u>	1
<u>Lepomis megalotis</u>	12
<u>Micropterus dolomieu</u>	1
<u>Nocomis micropogon</u>	5
<u>Notropis galacturus</u>	11
<u>Notropis rubellus</u>	79
<u>Notropis spilopterus</u>	2
<u>Notropis telescopus</u>	2
<u>Notropis volucellus</u>	76
<u>Percina caprodes</u>	2
<u>Percina copelandi</u>	5
<u>Percina maculata</u>	1

U. T. B. S. F. 49, No Business Creek, near mouth of
Langfield Branch, Scott Co., Tenn., Sept. 8, 1969. R. Riggs,
C. Comiskey.

<u>Campostoma anomalum</u>	2
<u>Etheostoma blennioides</u>	10
<u>Etheostoma caeruleum</u>	50
<u>Etheostoma camurum</u>	2
<u>Etheostoma cinereum</u>	1
<u>Etheostoma maculatum</u>	1
<u>Hypentelium nigricans</u>	1
<u>Notropis ardens</u>	8

<u>Notropis rubellus</u>	17
<u>Notropis stramineus</u>	15
<u>Notropis telescopus</u>	66
<u>Percina caprodes</u>	4
<u>Semotilus atromaculatus</u>	2

U. T. B. S. F. 50, Perkins Creek (Upper branch of Roaring Paunch Creek), on U. S. Hy. 27, approx. 1 1/4 miles below the Tennessee-Kentucky state line, Scott Co., Tenn., Sept. 22, 1968. Sayrs, Reese, Comiskey.

<u>Etheostoma kennicotti</u>	73
<u>Etheostoma sagitta</u>	4
<u>Lepomis macrochiris</u>	2
<u>Micropterus punctulatus</u>	1
<u>Rhinichthys atratulus</u>	1
<u>Semotilus atromaculatus</u>	8

U. T. B. S. F. 51, Thompson Creek, a branch of Rock Creek, Pickett State Forest, Pickett Co., Tenn., Sept. 6, 1968. B. Hitch, S. Hitch, C. Comiskey.

<u>Hypentelium nigricans</u>	2
<u>Semotilus atromaculatus</u>	12

U. T. B. S. F. 52, Rock Creek, 2 air miles north of Pickett Lake, Pickett State Forest, Pickett Co., Tenn., Sept. 6, 1968. B. Hitch S. Hitch, C. Comiskey.

<u>Clinostomus funduloides</u>	15
<u>Etheostoma obeyense</u>	17
<u>Hypentelium nigricans</u>	10

<u>Semotilus atromaculatus</u>	12
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U. T. B. S. F. 53, Big South Fork River, at Hilltop, Kentucky Hy. 92, McCreary Co., Ky., Sept. 27, 1968. Jenkins, Jenkins, Etnier, Comiskey.

<u>Percina caprodes</u>	3
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<u>Percina sciera</u>	4
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U. T. B. S. F. 54, Little South Fork River, 2 air miles SW of Mt. Pisgah, Wayne Co., Ky., Sept. 21, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	8
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<u>Chrosomus erythrogaster</u>	125
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<u>Cottus carolinae</u>	3
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<u>Etheostoma caeruleum</u>	43
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<u>Etheostoma obeyense</u>	19
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<u>Notropis telescopus</u>	7
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<u>Notropis volucellus</u>	2
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<u>Semotilus atromaculatus</u>	20
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U. T. B. S. F. 55, Langham Branch of Little South Fork River, at Hy. 167 bridge, Wayne Co., Ky., July 21, 1969. B. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	1
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<u>Campostoma anomalum</u>	1
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<u>Cottus carolinae</u>	1
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<u>Etheostoma blennioides</u>	1
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<u>Etheostoma caeruleum</u>	10
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<u>Etheostoma flabellare</u>	18
<u>Etheostoma obeyense</u>	45
<u>Etheostoma stigmaeum</u>	1
<u>Fundulus catenatus</u>	1
<u>Hypentelium nigricans</u>	1
<u>Notropis ardens</u>	15
<u>Notropis chrysocephalus</u>	2
<u>Notropis telescopus</u>	105
<u>Notropis volucellus</u>	6
<u>Pimephales notatus</u>	22

U. T. B. S. F. 56, Little South Fork River, at Hy. 167
bridge, Wayne Co., Ky., Sept. 21, 1969. B. Hitch, C. Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	13
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	28
<u>Etheostoma flabellare</u>	1
<u>Etheostoma obeyense</u>	62
<u>Etheostoma stigmaeum</u>	7
<u>Fundulus catenatus</u>	6
<u>Hypentelium nigricans</u>	2
<u>Lepomis megalotis</u>	4
<u>Notropis ardens</u>	26
<u>Notropis chrysocephalus</u>	9
<u>Notropis telescopus</u>	91

<u>Notropis volucellus</u>	1
<u>Pimephales notatus</u>	18

U. T. B. S. F. 57, Little South Fork River, at Parmleyville, Wayne Co., Ky., Sept. 21, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	4
<u>Cottus carolinae</u>	1
<u>Etheostoma blennioides</u>	2
<u>Etheostoma caeruleum</u>	11
<u>Etheostoma obeyense</u>	7
<u>Etheostoma stigmaeum</u>	2
<u>Notropis sp.</u>	2
<u>Notropis telescopus</u>	200
<u>Notropis volucellus</u>	102
<u>Pimephales notatus</u>	3

U. T. B. S. F. 58, Little South Fork River, at the mouth of Kennedy Creek, Wayne Co., Ky., Sept. 27, 1968. Clay, Jenkins, Jenkins, Etnier, Comiskey.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	2
<u>Cottus carolinae</u>	3
<u>Etheostoma blennioides</u>	3
<u>Etheostoma caeruleum</u>	9
<u>Etheostoma obeyense</u>	7
<u>Etheostoma stigmaeum</u>	5
<u>Fundulus catenatus</u>	3

<u>Hybopsis dissimilis</u>	3
<u>Hypentelium nigricans</u>	2
<u>Ictalurus punctatus</u>	1
<u>Labidesthes sicculus</u>	20
<u>Lepomis megalotis</u>	1
<u>Micropterus dolomieu</u>	1
<u>Moxostoma duquesnei</u>	1
<u>Nocomis effusus</u>	1
<u>Notropis sp.</u>	10
<u>Notropis ardens</u>	80
<u>Notropis ariommus</u>	12
<u>Notropis chrysocephalus</u>	9
<u>Notropis galacturus</u>	4
<u>Notropis photogenis</u>	2
<u>Notropis rubellus</u>	5
<u>Notropis telescopus</u>	20
<u>Notropis volucellus</u>	13
<u>Pimephales notatus</u>	4

U. T. B. S. F. 59, Little South Fork River, 1/2 mile upstream of junction of Stone Dry Branch, Wayne Co., Ky., Sept. 21, 1969. B. Hitch, C. Comiskey.

<u>Campostoma anomalum</u>	1
<u>Etheostoma blennioides</u>	1
<u>Etheostoma caeruleum</u>	4
<u>Etheostoma camurum</u>	2
<u>Etheostoma obeyense</u>	2

<u>Etheostoma stigmaeum</u>	2
<u>Hybopsis insignis</u>	3
<u>Notropis telescopus</u>	16
<u>Notropis volucellus</u>	4

U. T. B. S. F. 60, Little South Fork River, 6.2 air miles EENE of Coopersville, at McCreary-Wayne Co. line, Ky., Sept. 28, 1968. Clay, Jenkins, Jenkins, Etnier, Comiskey, and U.T. students.

<u>Ambloplites rupestris</u>	3
<u>Campostoma anomalum</u>	2
<u>Cottus carolinae</u>	4
<u>Etheostoma blennioides</u>	34
<u>Etheostoma caeruleum</u>	142
<u>Etheostoma camurum</u>	20
<u>Etheostoma cinereum</u>	1
<u>Etheostoma flabellare</u>	18
<u>Etheostoma maculatum</u>	14
<u>Etheostoma obeyense</u>	56
<u>Etheostoma stigmaeum</u>	13
<u>Etheostoma zonale</u>	12
<u>Hypentelium nigricans</u>	1
<u>Labidesthes sicculus</u>	60
<u>Lepomis macrochirus</u>	6
<u>Lepomis megalotis</u>	17
<u>Micropterus punctulatus</u>	1
<u>Notropis sp.</u>	214

<u>Notropis ardens</u>	50
<u>Notropis ariommus</u>	9
<u>Notropis chrysocephalus</u>	7
<u>Notropis galacturus</u>	12
<u>Notropis photogenis</u>	9
<u>Notropis rubellus</u>	18
<u>Notropis telescopus</u>	77
<u>Noturus flavus</u>	1
<u>Percina caprodes</u>	13
<u>Pimephales notatus</u>	10
<u>Semotilus atromaculatus</u>	1

U. T. B. S. F. 61, Little South Fork River, at Rittner Ford, on Wayne-McCreary Co. line, Ky., Sept. 27, 1968. Clay, Jenkins, Jenkins, Etnier, Comiskey.

<u>Campostoma anomalum</u>	10
<u>Cottus carolinae</u>	1
<u>Etheostoma blennioides</u>	20
<u>Etheostoma caeruleum</u>	25
<u>Etheostoma camurum</u>	12
<u>Etheostoma flabellare</u>	1
<u>Etheostoma maculatum</u>	15
<u>Etheostoma obeyense</u>	15
<u>Etheostoma stigmaeum</u>	10
<u>Etheostoma zonale</u>	2
<u>Hypentelium nigricans</u>	7
<u>Hybopsis insignis</u>	9

<u>Ictalurus punctatus</u>	2
<u>Fundulus catenatus</u>	1
<u>Lepomis megalotis</u>	16
<u>Notropis sp.</u>	39
<u>Notropis ardens</u>	4
<u>Notropis ariommus</u>	3
<u>Notropis chrysocephalus</u>	4
<u>Notropis galacturus</u>	3
<u>Notropis rubellus</u>	14
<u>Notropis spilopterus</u>	2
<u>Notropis telescopus</u>	25
<u>Noturus flavus</u>	3
<u>Percina caprodes</u>	15

U. T. B. S. F. 62, Big South Fork River, at Kentucky Hy. 92, at Hilltop, McCreary Co., Ky., June 12, 1968. C.R. Gilbert, D. Etnier, R. Stiles, R. Bouchard.

<u>Campostoma anomalum</u>	4
<u>Lepomis megalotis</u>	7
<u>Moxostoma erythrurum</u>	1
<u>Notropis atherinoides</u>	10
<u>Percina caprodes</u>	15

U. T. B. S. F. 63, Perkins Creek, 1.2 miles south of Ky. state line, on US Hy. 27, Scott Co., Tenn., June 11, 1968. C. R. Gilbert, D. Etnier, R. Stiles, R. Bouchard.

<u>Etheostoma kennicotti</u>	6
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<u>Etheostoma sagitta</u>	9
<u>Lepomis macrochirus</u>	1
<u>Notropis stramineus</u>	61
<u>Semotilus atromaculatus</u>	many

U. T. B. S. F. 64, Little South Fork River, near Parmleysville, 6.7 miles off state Hy. 92, Wayne Co., Ky., June 11, 1968. C. R. Gilbert, D. Etnier, R. Stiles, R. Bouchard.

<u>Ambloplites rupestris</u>	1
<u>Campostoma anomalum</u>	5
<u>Etheostoma blennioides</u>	12
<u>Etheostoma caeruleum</u>	65
<u>Etheostoma camurum</u>	6
<u>Etheostoma obeyense</u>	23
<u>Etheostoma stigmaeum</u>	24
<u>Fundulus catenatus</u>	1
<u>Hybopsis dissimilis</u>	8
<u>Hypentelium nigricans</u>	1
<u>Lepomis megalotis</u>	1
<u>Micropterus dolomieu</u>	1
<u>Nocomis effusus</u>	3
<u>Notropis sp.</u>	6
<u>Notropis ardens</u>	203
<u>Notropis chrysocephalus</u>	98
<u>Notropis galacturus</u>	12
<u>Notropis leuciodus</u>	1

<u>Notropis telescopus</u>	237
<u>Notropis volucellus</u>	16
<u>Percina caprodes</u>	4
<u>Pimephales notatus</u>	4
<u>Pimephales promelas</u>	4

APPENDIX B

SPECIES COLLECTED IN THE MAJOR DRAINAGES OF THE SYSTEM

I. NEW RIVER DRAINAGE

Ambloplites rupestris

Campostoma anomalum

Catostomus commersoni

Etheostoma blennioides

Etheostoma caeruleum

Etheostoma canurum

Etheostoma (Ulocentra) sp.

Hypentelium nigricans

Ictalurus punctatus

Lepomis macrochirus

Lepomis megalotis

Micropterus dolomieu

Micropterus punctulatus

Moxostoma erythrurum

Moxostoma duquesnei

Nocomis micropogon

Notropis ardens

Notropis chrysocephalus

Notropis galacturus

Notropis leuciodus

Notropis rubellus

Notropis stramineus

Notropis volucellus

Percina caprodes

Percina maculata

Rhinichthys atratulus

Semotilus atromaculatus

II. CLEAR FORK DRAINAGE

Ambloplites rupestris

Campostoma anomalum

Chrosomus erythrogaster

Catostomus commersoni

Etheostoma blennioides

Etheostoma caeruleum

Etheostoma camurum

Etheostoma maculatum

Etheostoma (Ulocentra) sp.

Hypentelium nigricans

Ictalurus punctatus

Ictalurus natalis

Labidesthes sicculus

Lepomis macrochirus

Lepomis megalotis

Micropterus punctulatus

Micropterus dolomieu

Moxostoma erythrurum

Nocomis micropogon

Notropis ardens

Notropis chrysocephalus

Notropis galacturus

Notropis leuciodus

Notropis rubellus

Notropis stramineus

Notropis volucellus

Percina caprodes

Percina copelandi

Percina maculata

Percina squamata

Pylodictis olivaris

Rhinichthys atratulus

Semotilus atromaculatus

III. NORTH WHITEOAK CREEK DRAINAGE

Ambloplites rupestris

Campostoma anomalum

Etheostoma blennioides

Etheostoma caeruleum

Etheostoma camurum

Etheostoma cinereum

Etheostoma maculatum

Etheostoma zonale

Hypentelium nigricans

Micropterus dolomieu

Micropterus punctulatus

Nocomis micropogon

Notropis sp.

Notropis ardens

Notropis galacturus

Notropis rubellus

Notropis telescopus

Notropis volucellus

Noturus flavus

Percina caprodes

Percina copelandi

Percina maculata

Percina squamata

Salmo trutta

Semotilus atromaculatus

IV. LITTLE SOUTH FORK RIVER DRAINAGE

Ambloplites rupestris

Campostoma anomalum

Chrosomus erythrogaster

Cottus carolinae

Etheostoma blennioides

Etheostoma caeruleum
Etheostoma camurum
Etheostoma cinereum
Etheostoma flabellare
Etheostoma maculatum
Etheostoma obeyense
Etheostoma stigmaeum
Etheostoma zonale
Fundulus catenatus
Hybopsis dissimilis
Hybopsis insignis
Hypentelium nigricans
Ictalurus punctatus
Labidesthes sicculus
Lepomis macrochirus
Lepomis megalotis
Micropterus dolomieu
Micropterus punctulatus
Moxostoma duquesnei
Nocomis effusus
Notropis sp.
Notropis ardens
Notropis ariommus
Notropis Chrysocephalus
Notropis galacturus

Notropis leuciodus

Notropis photogenis

Notropis rubellus

Notropis spilopterus

Notropis telescopus

Notropis volucellus

Noturus flavus

Percina caprodes

Pimephales notatus

Pimephales promelas

Semotilus atromaculatus

V. BIG SOUTH FORK RIVER DRAINAGE

Ambloplites rupestris

Campostoma anomalum

Etheostoma blennioides

Etheostoma caeruleum

Etheostoma camurum

Etheostoma cinereum

Etheostoma kennicotti

Etheostoma maculatum

Etheostoma stigmaeum

Etheostoma tippecanoe

Etheostoma (Ulocentra) sp.

Etheostoma zonale

Hypentelium nigricans

Ictalurus punctatus

Lepomis macrochirus

Lepomis megalotis

Micropterus dolomieu

Micropterus punctulatus

Moxostoma breviceps

Moxostoma duquesnei

Moxostoma erythrurum

Nocomis micropogon

Notropis ardens

Notropis atherinoides

Notropis galacturus

Notropis rubellus

Notropis spilopterus

Notropis stramineus

Notropis telescopus

Noturus flavus

Percina caprodes

Percina copelandi

Percina maculata

Percina sciera

Percina squamata

Pylodictis olivaris

Roccus chrysops

Stizostedion vitreum

VITA

Charles Edward Comiskey was born in Newark, New Jersey on December 5, 1944. He lived, for most of his early life, in Hillside, New Jersey, where he attended the local elementary schools. He graduated from Hillside High School in June, 1962. The following September, he entered Seton Hall University and received the B. A. degree with a major in Biology in June, 1966. He enrolled in the University of Tennessee graduate school in September, 1966, and was a graduate assistant in the Department of Zoology and Entomology until September, 1968, at which time he accepted a University of Tennessee Non-Service Fellowship for the academic year 1968-1969. This fellowship was renewed the following year. In March, 1969, he resigned the Non-Service Fellowship, at the same time accepting a National Defense Education Act Title IV Fellowship, under which he is currently studying.