A COMPREHENSIVE AQUATIC FAUNA SURVEY OF THREE CREEKS IN STEELE CREEK PARK, BRISTOL, TENNESSEE, AND REINTRODUCTION OF NATIVE SPECIES.

Submitted to Kathy Laster
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By
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Introduction

Steele Creek Park was acquired by the City of Bristol, Tennessee, in the early 1960's and 1970's. Since then, natural history data has been collected on many aspects of the park's flora and fauna. The aquatic environment which Steele Creek Park Lake encompasses has previously been studied, however, that of the stream environments, until now, has not been studied. The park contains five streams which include: Mill Creek, Slagle Creek, Steele Creek above the dam (AD), Steele Creek below the dam (BD), and Trinkle Creek. Four of these streams, excluding Mill Creek, were surveyed through this study.

The objectives of this study were as follows:
1) Survey the aquatic life, including fish, crustaceans, and insects, of the four streams within boundaries of Steele Creek Park, Bristol, Tennessee, Sullivan County
2) Conclude why each creek contains different species of aquatic life
3) Determine the desired habitat of the Tennessee Dace *Phoxinus tennesseensis* and author a management plan for its survival in Trinkle and Slagle Creek
4) Reintroduce freshwater mussels into Steele Creek above and below the dam
5) Study the life history of the Snubnose darter *Etheostoma simoterum* and reintroduce the species into Steele Creek below the dam

Tennessee is known for having the richest freshwater fish fauna in the United States. The combination of many independent drainages, physiographic regions, and habitat types, along with the relative geological stability of the region, has provided a great diversity of habitats and ample time for species to radiate into these habitats. As a result, there are approximately 320 species of native fishes within Tennessee (Eager & Hatcher 1980).

Fish, as well as other aquatic organisms, are vulnerable to habitat alterations. This includes point source and non point source pollution, siltation, and agricultural pollutants. These changes have placed one-fourth of Tennessee's fish fauna into categories of endangered, threatened, and in need of management (Eager & Hatcher 1980). Within the Holston watershed, in which Steele Creek Park is included, there are at least twenty-one at-risk fish and mussel species (Master, Flack, & Stein 1998). Presently, the Tennessee Dace is the only fish species within the park that has been placed into a category in need of management and no species within the park have been deemed threatened or endangered.

Industrial pollution, as well as agricultural run off, may have drastic effects on the aquatic environments of Steele Creek both above and below the dam. Both types of pollution are due to run off and are non point source.

Pollution, however, of any sort, may reduce the number of species in a stream by eliminating organisms that are sensitive to change (Mitchell & Stapp 1995). The aquatic survey conducted on park streams established a basis for both the types and the amounts of aquatic organisms that are present. The survey also helped to establish how great an effect pollution is having on park streams by identifying how many of the species found are tolerant to poor water quality.

In order to determine why each creek contains different species of aquatic life, an evaluation of each habitat will be taken. This evaluation will document the relative quality and quantity of habitat available for fish. Habitat data is important because it can determine potential fish species composition, abundance, and size/age structure (Simonson, Lyons, & Kanehl 1984).

The stream environments in which the Tennessee Dace have been located were studied to determine the desired habitat of the fish. A management plan was written in order to maintain the health of the Dace's present stream habitats within the park.

No native mussel species have been found living within any of Steele Creek Park's stream environments, although, it is believed that, due to stream conditions, they were once present. The goal set by this study for mussel species was the reintroduction of the Rainbow mussel *Vilosa iris* and the Mountain Creek Shell mussel *Vilosa vanuxemensis* into both areas of Steele Creek.

No darter species have been found living within the aquatic environment of Steele Creek (BD). However, the habitat below the dam presents a suitable and healthy environment for the darter species. This environment is believed to have held the Snubnose darter *Etheostoma simoterum* prior to the building of the lake and dam. The goal set by this study for darter species was the reintroduction of the Snubnose darter into Steele Creek (BD).

Due to the very low average of rainfall, 7.57 inches from July to November, 1998, stream water levels, water quality, and species inhabiting the streams were altered.

Methods and Materials

This study was conducted on four streams within Steele Creek Park boundaries between 20 September 1998 and 9 April 1999. Field collections and tests were performed on the streams Monday through Friday at times between 1500 and 1700 hours. Only one stream could be visited daily.

In order to collect fish species, a scientific collection permit was obtained through the Tennessee Wildlife Resources Agency (Appendix A). Through the permit, collections were subject to the completion of an annual report of collections. The permit did not allow species listed as rare or endangered to be collected.

Fish were collected by a variety of techniques, depending on the stream being sampled. A small-meshed seine net was used to collect fish and crustaceans in Steele Creek (AD). This net has a mesh size of .004 meters, a length of 20 meters, and width of 2 meters. Seines are weighted with lead along the bottom edge to maintain contact with the substrate and have floats along the top edge to keep the net extended vertically (Etnier 1993). By kicking the substrate ahead of the seine, organisms are guided into moving downstream and into the net.

A kick net was used in all four streams to sample fish, crustaceans, and insects. This type of net is used for the collection of much smaller areas of aquatic environments. A kick net is constructed of a handle of .88 meters that has a rectangular shaped net connected to the end of the handle. Although this net is also made of mesh, the mesh size is .001 meters, the length of the net of the net is .45 meters, its width is .24 meters, and the depth of the net is .25 meters. Fish are collected with a kick net by holding its handle at the very top and placing the net on the substrate of the stream. The researcher then 'kicks' into the net and organisms are guided down stream and into the net. Also, if sampling a stream with a deep pool or undercut bank, the kick net can be swept from one edge of the water to the other in order to capture aquatic organisms.

The last method of sampling was electro-shocking. Shockers include a generator unit connected to electrodes which are placed in the water to produce an electric field. Fishes within the electric field are temporarily immobilized by electrotetanus. They float to the top of the water where they are then collected with a small mesh net and identified.

The water parameters of each creek were measured. The primary tests for water quality included dissolved oxygen (DO), by means of the *WINKLER METHOD*, and pH. Other habitat data collected included measurements of water

temperature, water velocity, bottom substrate types, and average riparian zone characteristics. Research was completed which would determine how the above aquatic environment factors affected the types and amounts of aquatic species living in its waters.

Levels of dissolved oxygen (DO) were tested for each stream. DO is important to aquatic organisms because it provides for all of their oxidative metabolic processes, which allows them to convert stored energy to power various bodily functions (Moyle & Cech 1988). Riffle areas in streams mix atmospheric oxygen with stream water. A minimum value of 5ppm DO is satisfactory for most stages of fish species (Alabaster & Lloyd 1984). Spring fed streams have a lower DO at the point of deposit of the spring water. DO varies from season to season and can be lowered by the effects of decaying leaves, pollutants, and ice covering the surface of the stream (Hynes 1979). This seasonal pattern in DO is related to differences in temperature, water level, forest growth, and decomposition cycles (Silsbee & Larson 1981).

Levels of pH were tested for each stream. Streams with pH values below 5 are considered acidic and streams with pH values above 8.5 are considered alkaline. The growth rate of fish in acid waters is less than that under alkaline conditions. The number of food organisms for fish consumption and the productivity of the water is also reduced in acid waters (Alabaster & Lloyd 1984). A factor that affects the levels of pH is acid rain. Acid rain originates mainly from automobile emissions. Another factor effecting pH levels is spring fed streams. Levels of pH may be higher in streams that are fed by springs due to their contact with limestone beds (Hynes 1979).

Water temperatures of each stream were taken throughout the study. The temperature is the most important abiotic factor of a stream because of its effect on chemical contents. Temperature has an inverse relation to DO contents of streams, the DO content decreases as the temperature rises and the DO content increases as the temperature lowers (Hamilton & Bergersen 1985). A temperature of 19 degrees Celsius is the optimum temperature in respect to oxygen relations (Alabaster & Lloyd 1984). Warmer water carries less silt than colder water and its flow rate is faster (Hynes 1979). The cutting down of trees that provide shade for streams, as well as human thermal pollution, will cause an increase in stream temperatures. The building of a dam can also increase the temperature regime of an out flowing stream (Hamilton & Bergerson 1985). Water temperature has a profound effect on the occurrence of many fishes due to their preferences and ranges of tolerance (Simonson, Lyons, & Kanehl 1984). However, most species of fish are adapted to living in waters with a range of temperature from 0 degrees Celsius to 30 degrees Celsius. Spring fed streams differ from normal streams in temperature readings in that they tend to have more uniform temperatures. In the summer, temperatures downstream of spring fed

streams will increase and during the winter the reverse occurs (Alabaster and Lloyd 1984).

The velocity of each creek was measured in meters per second. Velocity, by definition, is the speed at which the water is moving downstream, expressed as a distance per unit time. The velocity was estimated by the passage of a floating object, usually a leaf, over a meter of the stream's reach. The composition of a streambed can be defined by the capacity of the stream to move rock. With an increase in velocity, there is an increase of larger particles occupying the streambed and an increase in larger substrate that is left behind. With an increase in the stream's gradient, there is an increase in the percentage of larger size classes of substrate in the streambed (Silsbee & Larson 1981).

To document quantitative descriptions of substrate compositions in all four creeks, a *WOLMAN PEBBLE COUNT* was conducted for each. Substrate refers to the materials that make up the stream bed. Substrate is important because it provides cover and spawning habitat for many fish and benthic invertebrates (Simonson, Lyons, & Kanehl 1984). To conduct a pebble count, first the length of the creek must be measured. Next, the creek is divided into percentages of pool, riffle, and run areas. Pools are areas with deeper than the stream's average depths and little surface turbulence. Water velocities are always slow in pools. Riffle areas have shallower than average depths, obvious surface turbulence, and faster than average water velocities. Runs are areas with average depths and little or no surface turbulence. Water velocities may be fast or slow, but the water appears smooth in runs (Simonson, Lyons, & Kanehl 1984).

Once finished measuring, the collection and measurements of substrate are to be completed. The following categories are used to group and size substrate:

Bedrock - Solid, uniform rock bottom
Large Boulder - Rocks with a maximum length of >512mm
Small Boulder - Rocks with a maximum length of 256-512mm
Rubble/Cobble - Rocks with a maximum length of 64-256mm
Coarse Gravel - Rocks with a maximum length of 16-64mm
Fine Gravel - Rocks with a maximum length of 2-16mm
Sand - Maximum length of 0.062-2mm
Silt - Maximum length of 0.004-0.062mm
Clay - Maximum length of <0.004mm

In a pebble count, 100 particles of substrate are obtained and measured. The *percent* of pool, riffle, and run areas is correlated to how many pieces of substrate you retrieve from each area. For example, if 50 *percent* of the creek is pool, 50 pieces of your 100 particles of substrate must come from pool areas. If

25 *percent* of the creek is run and 25 Cyprinid minnows is riffle, 25 pieces of substrate must come from both riffle and run areas.

Pebble counts were intended to be random in point selection. The person sampling was to randomly chose substrate particles instead of 'looking' for specific pieces. When measuring a piece of substrate, the intermediate axis was measured. This was neither the longest nor shortest side of the substrate. During the count, data was written on a tally sheet and, once finished, it was compiled.

Riparian characteristics were determined for each stream. Among these characteristics, bank conditions have the most direct influence on the quality of aquatic habitat. Well-vegetated banks are stable and resistant to erosion. These types of banks provide shading, which minimizes thermal stress from solar radiation and serves as a source of wood debris, which provides shelter for aquatic organisms. The riparian land use is the amount of land use on the banks of a stream. Disturbed land use is not natural and can come into contact with human interactions. Undisturbed land uses are relatively unaltered natural vegetation and soils. Bank erosion is the degree to which the stream banks are susceptible to the loss of materials, particularly soil. Unstable banks supply sediment to the stream bed, provide poor conditions for plant growth, and provide little cover for fish (Simonson, Lyons, & Kanehl 1984).

In order to reintroduce mussel species, as well as the Snubnose darter, into creeks within park boundaries, the organisms had to be collected from an area of the Holston River watershed. In order to maintain genetic purity, the introduction of aquatic species must always involve moving species within the same watershed.

Before reintroducing freshwater mussels, the waters of Steele Creek were tested. Steele Creek (BD) contains the Asian clam *Corbicula fluminae* as well as freshwater snails. Steele Creek (AD), however, does not contain either species. In order to test the waters of Steele Creek (AD), to make certain that mussels would sustain life in their new environment, 200 freshwater snails were first introduced. The snails were collected from a portion of Steele Creek located outside park boundaries. The snails were transported in a cooler, with an ample supply of water, and introduced into Steele Creek (AD) in an area that was within park boundaries. The snails were then observed from 0800 hours to 1700 hours. Observations were made of the snails moving both up and down the stream. For the most part, snails moved upstream against the waters current and under an area of boulders, which served as a protective cover. After collecting more than twenty-five *percent* of the snails introduced, it was determined that the snails had survived and mussel reintroduction was initiated.

By using underwater viewing scopes, 28 specimens of the Rainbow mussel *Vilosa iris* and the Mountain Creek Shell *Vilosa vanuxemensis* were collected from the Holston River watershed. They were then transported in a small cooler, with an ample supply of water, to Steele Creek Park Nature Center. Here, each mussel was aged and measured. Each mussel was given a filed mark on its shell and then reintroduced into Steele Creek either above or below the dam. There were a total of 15 mussels reintroduced above the dam and 13 mussels reintroduced below the dam.

By electro-shocking Steele Creek (AD), 25 specimens of Snubnose darters were collected and then transported in a cooler, with an ample supply of water, to Steele Creek (BD). Here, the darters were reintroduced approximately 20 meters downstream from the spillway.

Study Areas

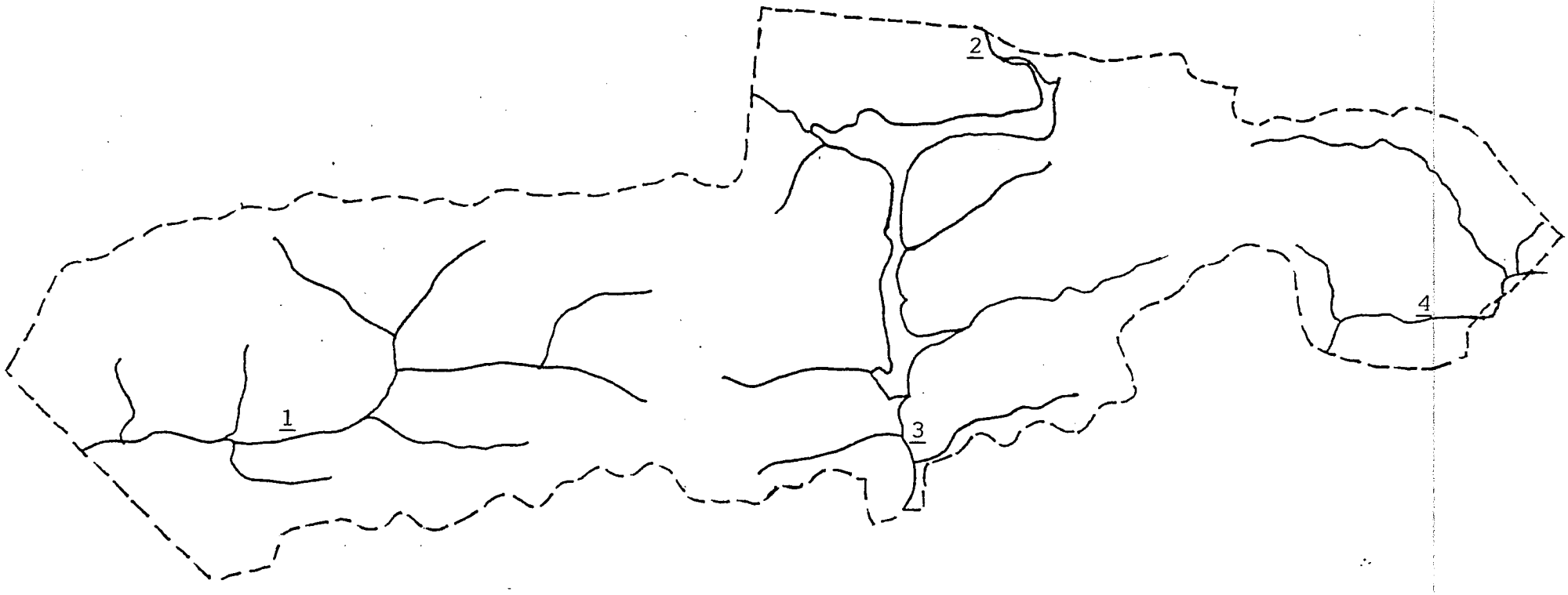
This study was conducted on four streams within the boundaries of Steele Creek Park.

Slagle Creek is located in the western corner of Steele Creek Park (Figure 1). Slagle Creek runs through what is known as Slagle Hollow and reaches over 3,499 meters of land (Table 1). Before Slagle Hollow was owned by the City of Bristol, much of the land was used for farming in the 1940's. Because of this, some of the land surrounding the stream, mainly down stream, does not provide the maximum cover that it once did. Slagle Creek has an average width of 6 meters and an average depth of .244 meters (Table 1). The percentage of pools in Slagle Creek makes up 31 *percent*, riffle areas make up 18 *percent*, and runs make up 51 *percent* (Table 2). Slagle Creek can be considered a meandering stream due to the fact that it contains many bends within its channels. The land surrounding the stream only comes into contact with human interaction in certain areas. Due to the prohibited us of off road vehicles riding through the park, siltation is being added into the creek as riders pass through. Another area of human interaction is located upstream of Slagle Creek where the creek comes into contact with a hiking trail. Cover for aquatic organisms, which visually isolates predators and gives shelter to prey, is composed of undercut banks, overhanging vegetation, woody debris, and boulders (Table 3). Due to the below average rainfall from July to November 1998, the water depths became so low in Slagle Creek that only ten to twelve small pools were left holding water. Aquatic organisms were confined to these pools during the period of drought. Water quality within each pool was very poor and hardly suitable for living organisms. Animal tracks, such as those of raccoons *Procyon lotor*, were observed around the pools during the drought. By December 1998, the rainfall average began to rise and the creek once again took full shape.

Steele Creek above the dam (AD) is located in the north-eastern section of the park. It forms a confluence with Mill Creek where it then flows into Steele Creek Park Lake (Figure 1). Steele Creek (AD), within park boundaries, covers 337 meters, has an average width of 7.7 meters, and an average depth of .279 meters (Table 1). The percentage of pools in Steele Creek (AD) makes up 20 *percent*, riffle areas make up 64 *percent*, and runs make up 16 *percent* (Table 2). Very few undercut banks are present in Steele Creek (AD). There is no overhanging vegetation or woody debris; however, boulders can commonly be found throughout the course of the creek (Table 3). Human interaction comes into contact with all areas of shoreline and fishing can commonly be observed at the base of the creek, before it enters the lake. Mallards, Belted kingfishers *Megaceryle alcyon*, and muskrats *Ondatra cibechicus* prey upon organisms living within Steele Creek (AD).

Figure 1

MAP SHOWING STEELE CREEK PARK BOUNDARIES AND THE FOUR STREAMS STUDIED



1 Slagle Creek
2 Steele Creek above the dam (AD)
3 Steele Creek below the dam (BD)
4 Trinkle Creek

Table 1 **Comparison of Creeks**

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Length	3499.0 m	37.0 m	559.0 m	1337.0 m
Average Width (9 samples taken)	1.6 m	7.7 m	1.8 m	1.8 m
Average Depth (11 samples taken)	.244 m	.279 m	.330 m	.326 m
Average Temp.	(8 samples taken)			
Fall	15.5 C	20.3 C	22.5 C	18.9 C
Spring	16.0 C	17.0 C	18.0 C	18.5 C
Average Velocity	(9 samples taken)			
Fall	1 m/ 0.0 sec	1 m/ 7.8 sec	1 m/ 6.0 sec	1 m/ 24.7 sec
Spring	1 m/ 6.0 sec	1 m/ 3.0 sec	1 m/ 8.0 sec	1 m/ 30.0 sec
Average pH	(11 samples taken)			
Fall	7.6	9.4	8.9	8.6
Spring	7.9	9.3	8.7	8.7
Average DO	(11 samples taken)			
Fall	3.1 ppm	8.3 ppm	7.5 ppm	6.3 ppm
Spring	9.6 ppm	8.6 ppm	7.8 ppm	8.4 ppm

Table 2 **Percentage of Pool, Riffle, and Run Areas**

	Pool	Riffle	Run
Slagle Creek	31%	18%	51%
Steele Creek(AD)	20%	64%	16%
Steele Creek(BD)	21%	41%	38%
Trinkle Creek	28%	17%	55%

Table 3 **Aquatic Organism Cover**

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Undercut Banks	X	X	X	X
Overhanging Vegetation	X			X
Boulders	X	X	X	X
Woody Debris	X			X
Total	4	2	2	4

Steele Creek (BD) is located in the southern section of the park (Figure 1). Steele Creek (BD) begins at the spill way of the dam and ends at a confluence with Beaver Creek. Steele Creek (BD) is 559 meters long, has an average width of 1.8 meters, and an average depth of .330 meters (Table 1). The percentage of pools in Steele Creek (BD) makes up 21 *percent*, riffle areas make up 41 *percent*, and runs make up 38 *percent* (Table 2). Steele Creek (BD), before the dam was built in the early 1960's, covered a larger area of land. When the dam was completed and a walking trail was built around the lake, part of Steele Creek (BD) was filled in. Presently, the slope of the banks range from 60 degrees to 80 degrees. A few areas of undercut banks and woody debris exist along and in the creek. No overhanging vegetation is present, and boulders are quite common throughout the creek (Table 3). Human interaction is very constant but only along side one of the banks of Steele Creek (BD). Muskrats *Ondatro cibechicus*, Belted, herons family Ardeidae, and raccoons all prey upon organisms living within Steele Creek (BD).

Trinkle Creek is located in the south-eastern corner of the park (Figure 1). Trinkle Creek is 1,337 meters long, has an average width of 1.8 meters, and an average depth of .326 meters (Table 1). This creek is considered a first order creek because it is a self contained watershed. The percentage of pools in Trinkle Creek makes up 28 *percent*, riffle areas make up 17 *percent*, and runs make up 53 *percent* (Table 2). Trinkle Creek, because of its bending channels, is considered a meandering stream. Many areas of undercut banks, overhanging vegetation, and woody debris exist along and in the creek (Table 3). Only a few boulders can be found in Trinkle Creek. Human interaction does not come into contact with Trinkle Creek. Animal tracks, including those of herons and raccoons, were observed and found to be very common on the banks of the creek.

Results

Through the aquatic survey conducted, data was collected on the diversity and amounts of fish, crustaceans, and insect populations of each creek. Water quality and general habitat characteristics were tested and determined.

Fish Populations

Slagle Creek supports eight species of fish: Central stoneroller *Campostoma anomalum*, Striped shiner *Luxilus chrysocephalus*, Tennessee dace *Phoxinus tennessensis*, Blacknose dace *Rhinichthys atratulus*, Creek chub *Semotilus atromaculatus*, White sucker *Catostomus commersoni*, Fantail darter *Etheostoma flabellare*, and Banded sculpin *Cottus carolinae* (Table 4).

Steele Creek (AD) supports twelve species of fish: Central stoneroller *Campostoma anomalum*, Blacknose dace *Rhinichthys atratulus*, Creek chub *Semotilus atromaculatus*, White sucker *Catostomus commersoni*, Snubnose darter *Etheostoma simoterum*, Banded sculpin *Cottus carolinae*, Northern hogsucker *Hyentelium nigricans*, Bluegill *Lepomis macrochirus*, Green sunfish *Lepomis cyanellus*, Redbreast sunfish *Lepomis auritus*, Yellow bullhead catfish *Ameiurus natalis*, and Largemouth bass *Micropterus salmoides* (Table 4).

Steele Creek (BD) supports nine species of fish: Central stoneroller *Campostoma anomalum*, Blacknose dace *Rhinichthys atratulus*, Creek chub *Semotilus atromaculatus*, Snubnose darter *Etheostoma simoterum* (introduced into creek through study), Banded sculpin *Cottus carolinae*, Bluegill *Lepomis macrochirus*, Redbreast sunfish *Lepomis auritus*, Warmouth sunfish *Lepomis gulosus*, and Largemouth bass *Micropterus salmoides* (Table 4).

Trinkle Creek supports three species of fish: Tennessee dace *Phoxinus tennessensis*, Blacknose dace *Rhinichthys atratulus*, and Creek chub *Semotilus atromaculatus* (Table 4).

Insect Populations

Slagle Creek has eight species of aquatic insects: Water strider *Gerris remigis*, Horse/Deer fly *Tabanus atratus*, Rolledwinged stonefly *Leuctra spp.*, Common stonefly *Acroneuria erolufa*, Northern casemaker *Limnephilus spp.*, Primitive minnow mayfly *Ameletus spp.*, Dobsonfly *Corydalus spp.*, and Cranefly *Tipula abdominalis* (Table 5).

Steele Creek (AD) has six species of aquatic insects: Common netspinner *Symphitopsyche slossanae*, Riffle beetle *Stenelmis spp.*, Flatheaded mayfly

Table 4 **Fish Diversity**

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Central stoneroller	X	X	X	
Striped shiner	X			
Tennessee dace	X			X
Blacknose dace	X	X	X	X
Creek chub	X	X	X	X
White sucker	X	X		
Faintail darter	X			
Snubnose darter		X	X	
Banded sculpin	X	X	X	
Northern hogsucker		X		
Bluegill		X	X	
Green sunfish		X		
Redbreast sunfish		X	X	
Warmouth sunfish			X	
Yellow bullhead		X		
Largemouth bass		X	X	
Total Species	8	12	9	3

Table 5 **Aquatic Insect Diversity**

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Water strider	X			X
Black fly			X	
Horse/Deer fly	X			
Rolledwinged stonefly	X			
Common stonefly	X			X
Northern casemaker	X			X
Common netspinner		X	X	X
Water penny				X
Riffle bettle		X		
Flatheaded mayfly		X	X	X
Primitive minnow mayfly	X	X	X	X
Dobsonfly	X	X	X	X
Damselfly				X
Cranefly	X			X
Dragonfly				X
Crawler larva				X
Planarian			X	
Midge		X	X	X
Total Species	8	6	7	13

Stenacron interpunctatum, Primitive minnow mayfly *Ameletus spp.*, Dobsonfly *Corydalus spp.*, and Chironomid midges (Table 5).

Steele Creek (BD) has seven species of aquatic insects: Black fly *Simulium vittatum*, Common netspinner *Symphitopsyche slossanae*, Flatheaded mayfly *Stenacron interpunctatum*, Primitive minnow mayfly *Ameletus spp.*, Dobsonfly *Corydalus spp.*, Planarian from the phylum Platyhemins (macroinvertebrate), and Chironomid midges (Table 5).

Trinkle Creek has thirteen species of aquatic insects: Water strider *Gerris remigis*, Common Stonefly *Gerris remigis*, Northern casemaker *Limnephilus spp.*, Common netspinner *Symphitopsyche slossanae*, Water penny *Psephenus herricki*, Flatheaded mayfly *Stenacron interpunctatum*, Primitive minnow mayfly *Ameletus spp.*, Dobsonfly *Corydalus spp.*, Damselfly *Odonata* order, Cranefly *Tipula abdominalis*, Dragonfly *Anax junius*, Tricorythidae Crawler larva, and Midge *Chironomidae.* (Table 5).

Crayfish Populations

Slagle Creek supports three species of freshwater crayfish: *Cambrus bartonii, Cambrus longirostris,* and *Cambrus dubius* (Table 6).

Steele Creek (AD) supports two species of freshwater crayfish: *Cambrus bartonii* and *Orconectes rusticus* (Table 6).

Steele Creek (BD) supports two species of freshwater crayfish: *Cambrus bartonii* and *Orconectes rusticus* (Table 6).

Trinkle Creek supports three species of freshwater crayfish: *Cambrus bartonii, Cambrus longirostris,* and *Cambrus dubius* (Table 6).

The park crayfish of the genus *Cambrus* are native. The crayfish *Orconectes rusticus* is an exotic species.

Water Quality

Both dissolved oxygen and pH reading were taken in the fall of 1998 as well as the spring of 1999. Ten to fifteen reading were taken for both and an average was produced for each.

In the fall of 1998, Slagle Creek had the lowest DO average (3.1ppm), Trinkle Creek had the second lowest (6.3 ppm), following with Steele Creek (BD) (7.5ppm) and Steele Creek (AD) (8.3ppm). In the spring of 1999, however, Steele Creek (BD) had the lowest DO average (7.8ppm), Trinkle Creek had the

Table 6 **Crayfish Diversity**

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Cambrus bartonii	X	X	X	X
Orconectes rusticus		X	X	
Cambrus longirostris	X			X
Cambrus dubius	X			X
Total Species	3	2	2	3

second lowest (8.4ppm), following with Steele Creek (AD) (8.6ppm) and Slagle Creek (9.6ppm) (Table 7).

In the fall of 1998, Slagle Creek had the lowest pH average (7.6), Trinkle Creek had the second lowest (8.1), following with Steele Creek (BD) (9.0) and Steele Creek (AD) (9.4). In the spring of 1999, Slagle Creek had the lowest pH average (7.9), Trinkle and Steele Creek (BD) the second lowest (8.7), and Steele Creek (AD) the highest average(9.3) (Table 8).

Habitat Characteristics

Temperature and velocity readings were taken in the fall of 1998 and the spring of 1999. Pebble counts were taken during the winter of 1998 and the data on creek riparian zones was taken throughout the study.

In the fall of 1998, Slagle Creek had the lowest temperature average (15.5C), Trinkle Creek had the second to lowest temperature average (18.9C), following with Steele Creek (AD) (20.3C) and Steele Creek (BD) (22.5C). In the spring of 1998, Slagle Creek had the lowest temperature average (16.0C), Steele Creek (AD) had the second lowest temperature average (17.0C), following with Steele Creek (BD) (18.0C) and Trinkle Creek (18.5C) (Table 1).

In the fall of 1998, the velocity reading of Slagle Creek was so low that it could not be obtained. Trinkle Creek had the second lowest average velocity (1meter/24.7sec), followed by Steele Creek (AD) (1meter/7.8sec), and Steele Creek (BD) (1meter/6.0sec). In the fall of 1998, Trinkle Creek had the lowest average velocity (1meter/30.0sec), Steele Creek (BD) had the second lowest (1meter/8.0sec), followed by Slagle Creek (1meter/6.0sec), and Steele Creek (AD) (1meter/3.0sec) (Table 1).

The results of each pebble count presented each creek as containing substrate that measures from the size of silt and clay to the size of bedrock formations. No specific substrate content of a stream is considered optimal for all aquatic life (such as mussels) (McMahon 1991).

In pool, riffle, and run areas of Slagle Creek, the largest *percent* of sediment is gravel. Slagle Creek contains 54 *percent* gravel in it's pool areas, 73 *percent* gravel in it's riffle areas, and 54 *percent* gravel in its run areas.

In pool areas of Steele Creek (AD), the largest *percent* of sediment is cobble. In riffle areas the largest percent of sediment is bedrock and in run areas gravel makes up the largest percent. Steele Creek (AD) contains 35 *percent* cobble in its pool areas, 56 *percent* bedrock in its riffle areas, and 63 *percent* gravel in its run areas.

Water Quality Factors of Each Stream

Table 7 Dissolved Oxygen Comparison (ppm)

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Fall 1998	3.1 ppm	8.3 ppm	7.5 ppm	6.3 ppm
Spring 1999	9.6 ppm	8.6 ppm	7.8 ppm	8.4 ppm

Table 8 pH Readings

	Slagle Creek	Steele Creek(AD)	Steele Creek(BD)	Trinkle Creek
Fall 1998	7.6	9.4	9.0	8.1
Spring 1999	7.9	9.3	8.7	8.7

In pool, riffle, and run areas of Steele Creek (BD), the largest *percent* of sediment is gravel. Steele Creek (BD) contains 50 *percent* gravel in its pool areas, 34 *percent* gravel in its riffle areas, and 27 *percent* gravel in its run areas.

In both pool and run areas of Trinkle Creek, the largest *percent* of sediment is silt and clay. However, in riffle areas, the largest percent of sediment is gravel. Trinkle Creek contains 54 *percent* silt and clay in it's pool areas, 78 *percent* gravel in it's riffle areas, and 51 *percent* silt and clay in it's run areas.

Riparian Zones

Trinkle Creek has the most beneficial riparian zone. The bank conditions of Trinkle Creek are well vegetated and stable. Thick amounts of vegetation are present along many parts of the creek. This provides shade and excellent protection for aquatic organisms. The riparian area of Trinkle is undisturbed and, for the most part, wild animals are the only living organisms altering vegetation and soils.

Slagle Creek has both well vegetated and stable banks. This creek may contain more shaded regions than Trinkle and, therefore, Slagle Creek has more thermal stress from solar radiation effecting the stream environment. The riparian land use of Slagle Creek is for the most part undisturbed, however, a small amount of human interaction affects certain sections of the stream.

Bank conditions of Steele Creek (AD) and Steele Creek (BD) are partially stable. Very little vegetation occurs on the banks of Steele Creek (AD). That which does exist consists of seeded grass that is kept trimmed. Half of Steele Creek (BD) has naturally vegetated banks, while the other half consists of seeded grass that is trimmed. Thermal stress plays a major role on Steele Creek (AD) because of its lack of cover. Steele Creek (BD), because of its partial tree coverage, is exposed to more solar radiation than Trinkle or Slagle, but less than that of Steele Creek (AD). The banks of Steele Creek (AD) and Steele Creek (BD) are considered disturbed because of their interaction with humans.

Reintroduction

Mussels

Mussels do not prefer water with low velocities. These filter feeders can become extirpated by the result of large quantities of industrial pollution, urban waste water outpourings, or silt and acid discharge. They favor waters with pH values above 7.0 and depths below 3-4 feet. Mussels can survive in water with temperatures between zero degrees Celsius and twenty-seven degrees Celsius (McMahon 1991).

Specifically, the Rainbow and Mountain creekshell mussels live in riffle areas with gravel and sand as substrate. They prefer strong currents. The Rainbow is hosted by the Largemouth bass and the Mountain creekshell is hosted by the Banded sculpin (Parmalee & Bogan 1998).

When reintroducing the Rainbow and Mountain creekshell mussels into Steele Creek (AD) and Steele Creek (BD), species were collected from areas inside the Holston River watershed. The reason for using species in the same watershed is to retain genetic purity.

With the help of TWRA, mussels were collected from Beech, Caney, and Big Creeks in Hawkins County, Tennessee. A total of eleven Rainbow and four Mountain creekshell mussels were reintroduced into Steele Creek (AD), and five Rainbow and eight Mountain creekshell mussels were reintroduced into Steele Creek (BD).

Snubnose darter

The Snubnose darter is found in gravel, as well as bedrock bottomed streams of small creeks and medium sized rivers. They prefer the shallow gravel-bedded riffle areas of streams. Most feed on midge and mayfly larvae (Etnier 1993). Steele Creek (BD) meets all of the above requirements for habitat usage of darters.

As in the reintroduction of mussels, the same requirement goes for the introduction of fish species. When the Snubnose darter was introduced into Steele Creek (BD), species were collected from the same watershed. More specifically, Snubnose darters were collected from Steele Creek (AD). With the assistance of TWRA, a total of twenty-five Snubnose darters were reintroduced into Steele Creek (BD).

Discussion

All streams are dynamic systems that involve a correlation between the organisms living in them and the physical and chemical conditions prevailing (Brown 1987). For this reason, the streams of Steele Creek Park can not be compared by rating one as the most proficient or another as the least. Nevertheless, the streams *can* be compared by relating one to another, discussing their differences, and then explaining why they differ.

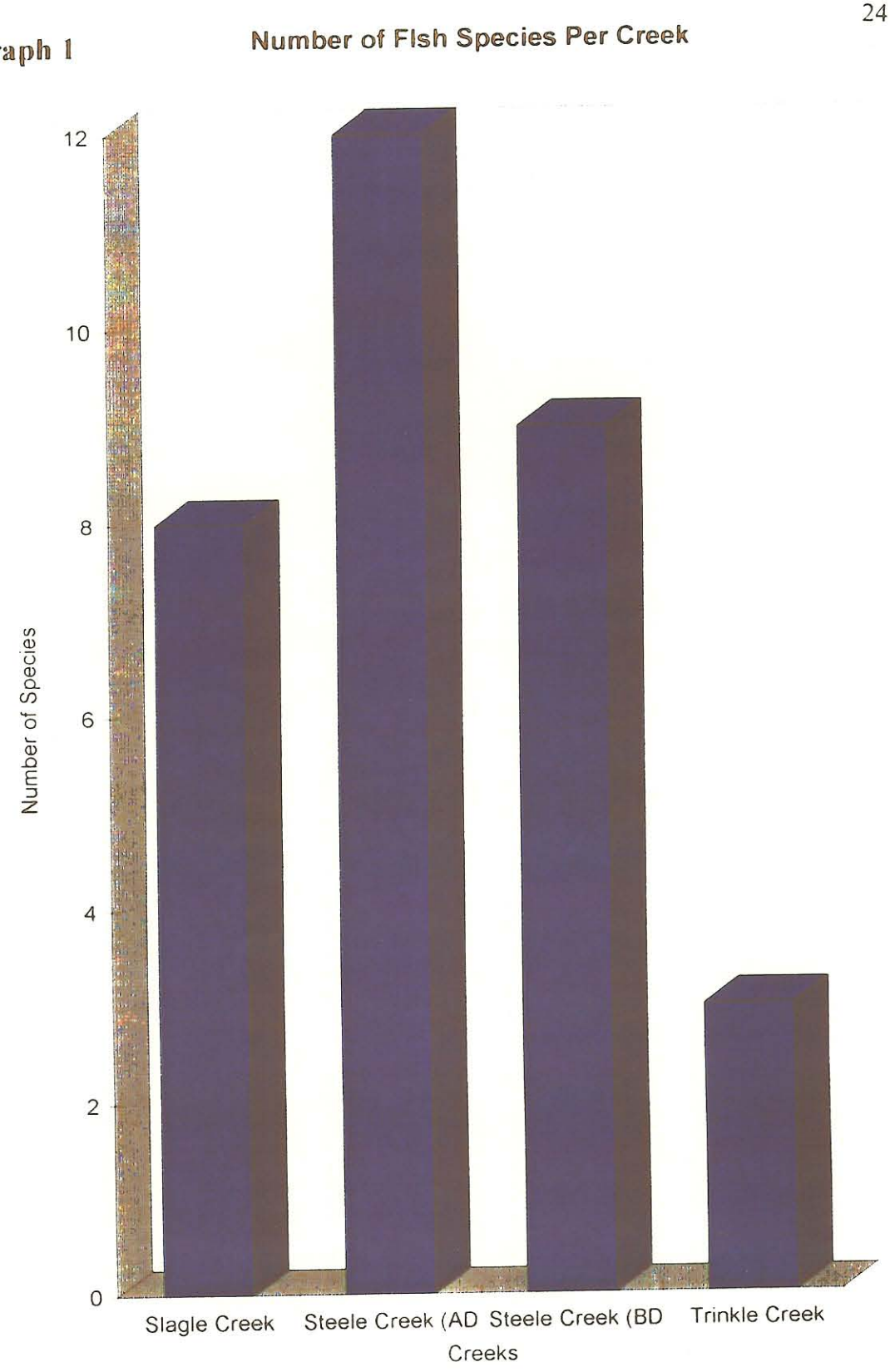
Slagle Creek, Steele Creek (AD), Steele Creek (BD), and Trinkle Creek vary by the number of fish and insect species (Graphs 1 & 2). This does not refer to the total number of individuals, but the actual species in each stream. This diversity is due to the physical environment of each creek and how tolerant each organism is to a change in habitat.

Although Steele Creek (AD) contains the largest number of fish species (Graph 1), almost 50 *percent* of these species are adapted to living in both stream and lake environments. Due to the presence of Steele Creek Lake, these species, adapted to both environments, are able to swim into Steele Creek (AD). Only 25 *percent* of Steele Creek's (AD) fish species are within the minnow family Cyprinidae. This can be compared to Slagle Creek's fish population that contains 63 *percent* fish from the minnow family, Steele Creek (BD)'s fish population that contains 33 *percent* fish from the minnow family, and Trinkle Creek's fish population which contains only species from the minnow family.

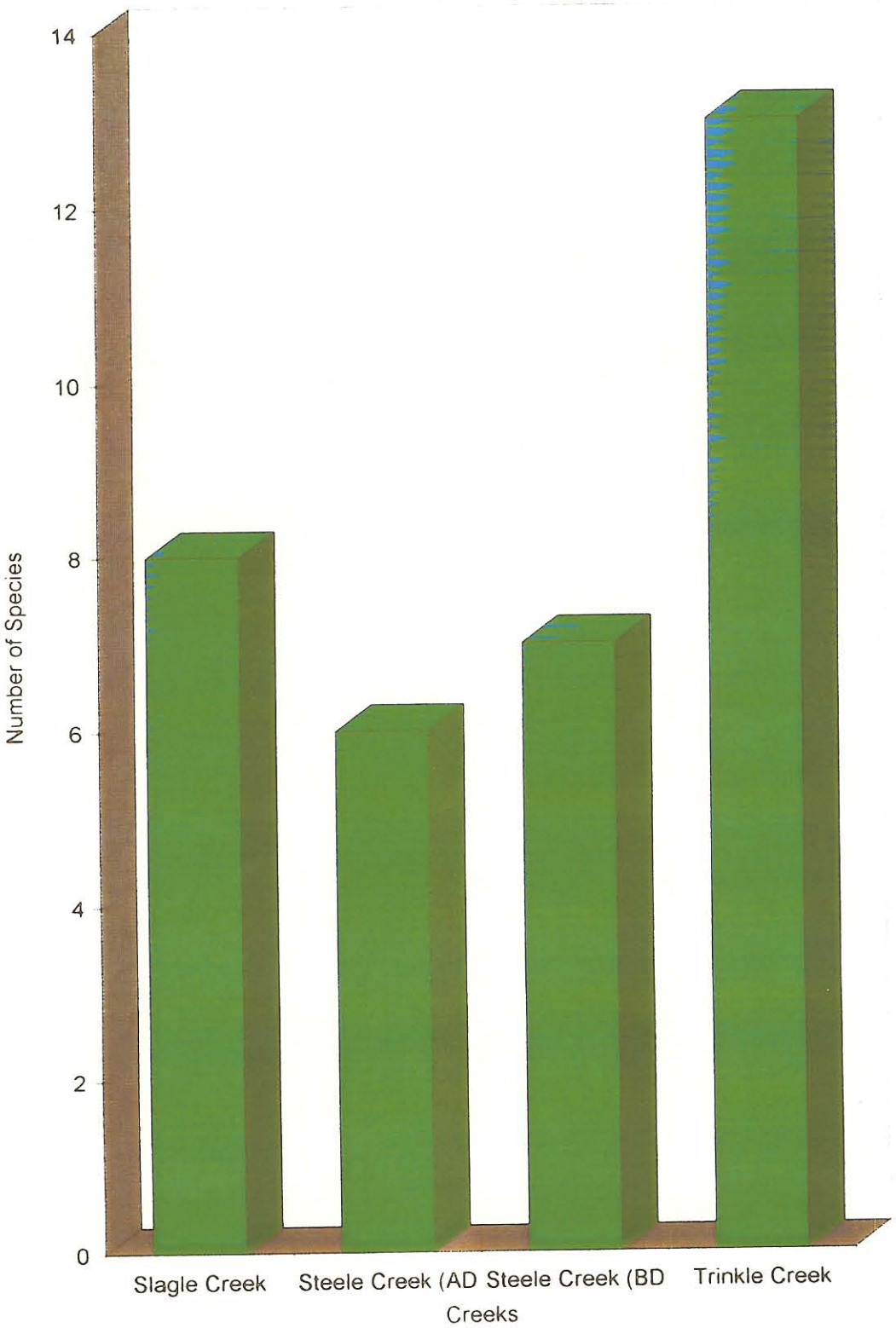
Like Steele Creek (AD), Steele Creek (BD)'s fish population contains fish species that are adapted to living in both stream and lake environments. Forty-four *percent* of the stream's fish population is made of these types of fish. Another factor effecting this streams population of aquatic species is it's channel morphology. In the early 1960's, Steele Creek (BD) was greatly effected by the building of the lake and dam. It's stream channel is now artificially straightened and therefore has less variety of habitats for aquatic organisms to hide and spawn.

Of all four creeks, Trinkle Creek contains the largest amount of insects (Graph 2). Fifty-four *percent* of the creek's insects are intolerant to change, sensitive to pollution, and are found primarily in streams with favorable water quality. Almost 50 *percent* of these types of insects were found only in Slagle and Trinkle Creeks. Insects are valid indicators of healthy environments because they have a certain range of physical and chemical conditions in which they can live. When comparing the number of insect species to the *percent* of Cyprinid minnows living in each creek, the largest number of insects were found in Trinkle Creek, which contains the largest percentage of Cyprinid minnows (Graph 3).

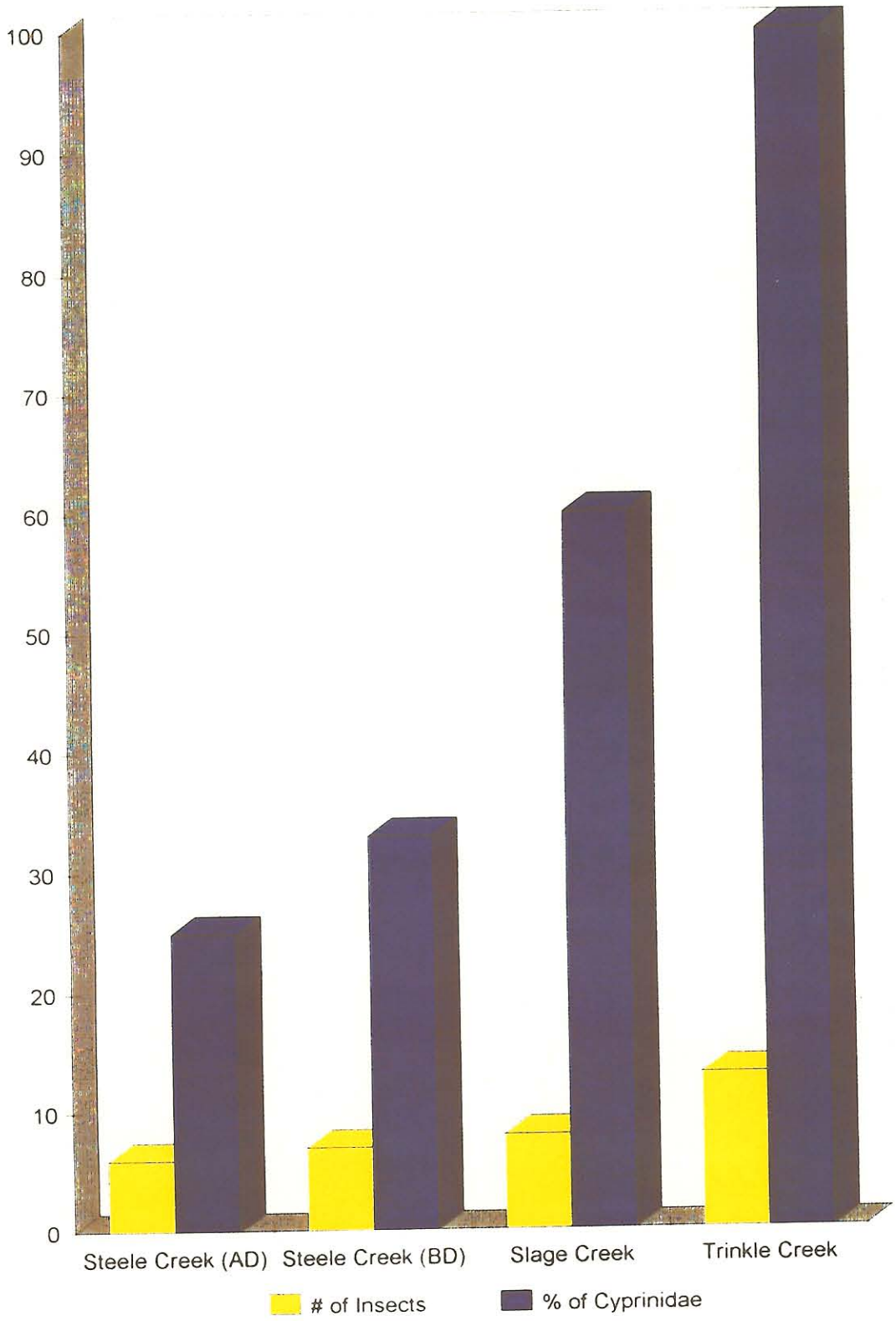
Graph 1


Number of Fish Species Per Creek
12
10
8
6
4
2
0
Number of Species
Slagle Creek
Steele Creek (AD
Steele Creek (BD
Trinkle Creek
Creeks

Graph 2 **Number of Insects Per Creek**



Graph 3 # of Insects vs % of Cyprinidae



Almost every type of freshwater stream in eastern North America is utilized by one or more species of crayfish (Crocker & Barr 1968). However, the more diverse species inhabit areas of well oxygenated waters, with a minimum of six parts per million (ppm), and streams with an optimum pH value of seven to nine (Groves 1985). Crayfish were found living in and around all streams of Steele Creek Park. Three species were identified living in Slagle and Trinkle Creeks, while only two were found in both portions of Steele Creek. The Rusty Crayfish *Oronectes rusticus*, an exotic invasive, was found living in Steele Creek (AD) and Steele Creek (BD), but did not inhabit Slagle and Trinkle Creeks. The exotic may have been carried in by fisherman using them as bait. There is no fishing in the other creeks.

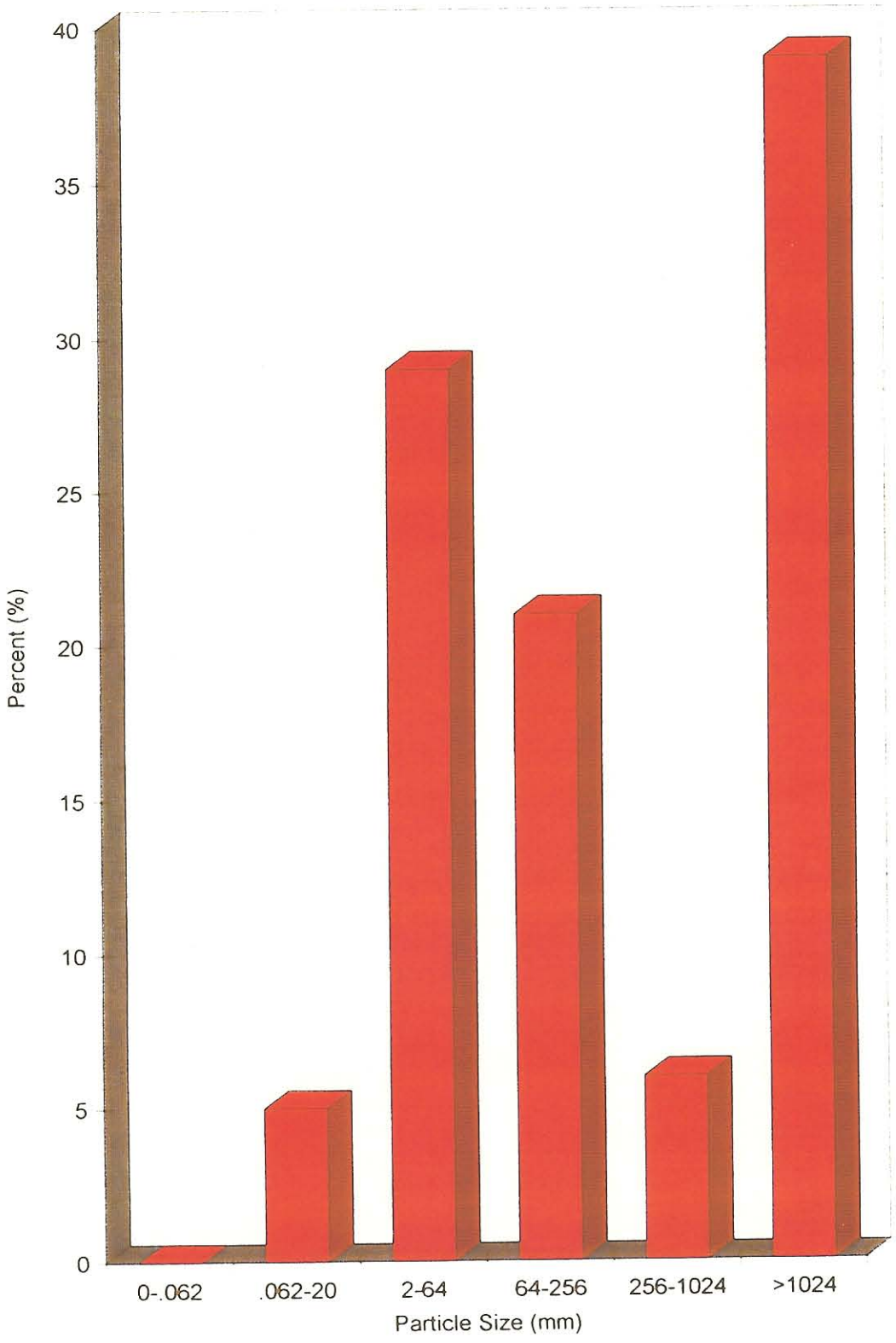
Sensitivity of fish to low concentrations of dissolved oxygen differs between species. The general pattern provides that, with the absence of poisons, a favorable minimum value of five ppm exists. Although the DO of Slagle Creek dropped below five ppm during the drought, many fish still survived. The average DO levels were highest in Steele Creek (AD) due to the large amount of surface area, an average width of 7.7 meters, and the large quantity of riffle areas, which make up 64 *percent* of the streams environment. DO is more abundant in riffle areas do to the mixing of atmospheric oxygen with the water.

There is no defined pH range where a fish is unharmed, but rather there is a decline in fish species as the pH values are removed from the non lethal levels of five to nine. Both Slagle and Trinkle had the smallest amount of fish diversity and the lowest pH readings.

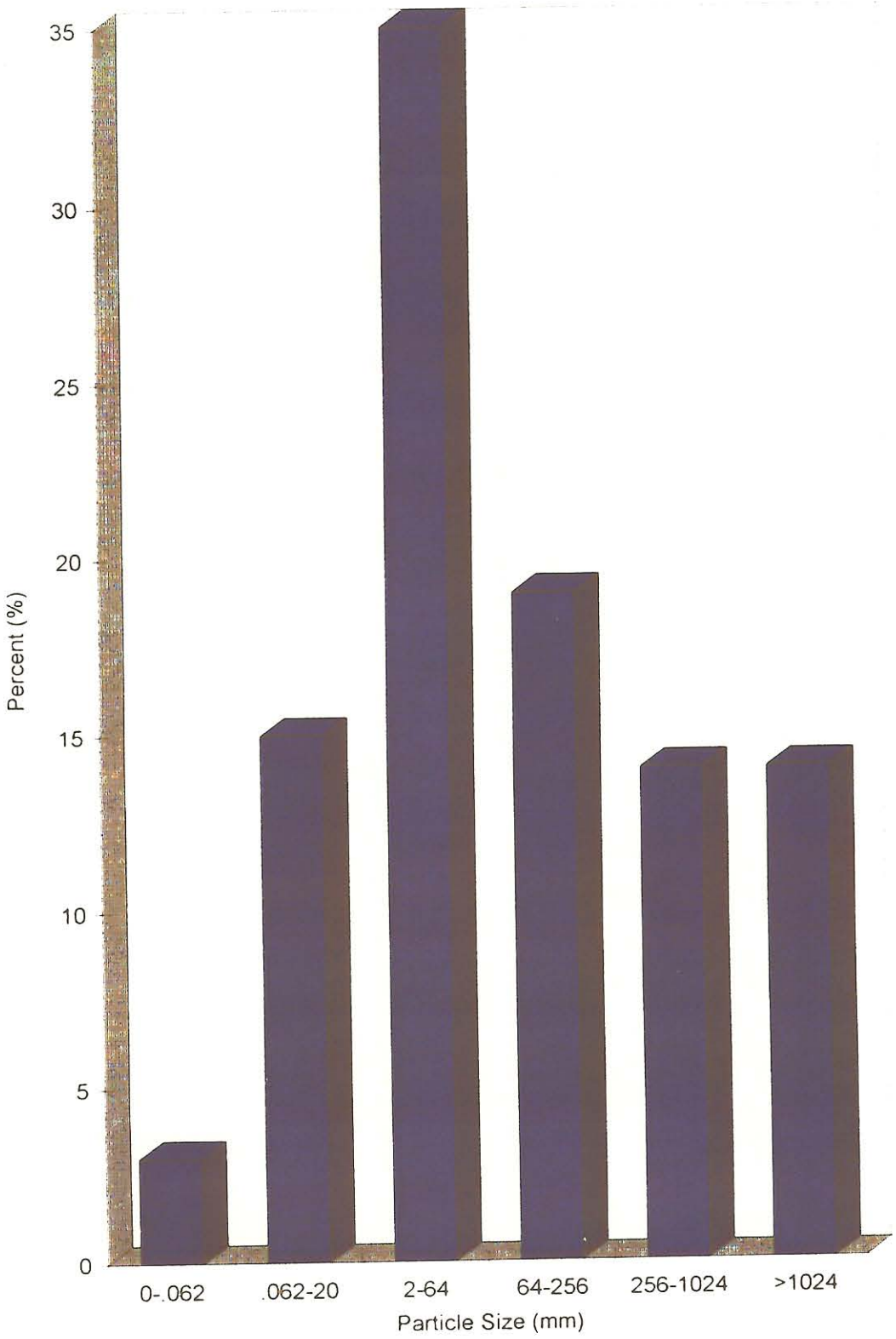
The temperature of a stream is mainly effected by the amount of thermal radiation the stream is exposed do. Both Slagle and Trinkle Creeks had the largest amount of shaded bank areas and the lowest temperatures. Lower water temperatures allows oxygen to dissolve more freely. Slagle Creek had the lowest DO content during the fall, but the highest amount of DO in the spring. All four streams did, however, contain a range of temperature which freshwater fish can survive in. Trinkle Creek contains the optimum temperature, which is nearest to 19 degrees Celsius.

With an increase in a streams velocity, there is an increase of larger particles occupying the streambed (Silsbee & Larson 1981). Steele Creek (AD) had the highest velocity of all four streams and therefore the largest percentage of cobble, boulder, and bedrock formations (Graph 4). Steele Creek (BD) had the second highest velocity of all four streams and the second largest percentage of cobble, boulder, and bedrock formations (Graph 5). Slagle Creek had the second slowest velocity of all four streams and the largest percentage of gravel substrate (Graph 6). Trinkle Creek had the lowest velocity and the largest amount of silt

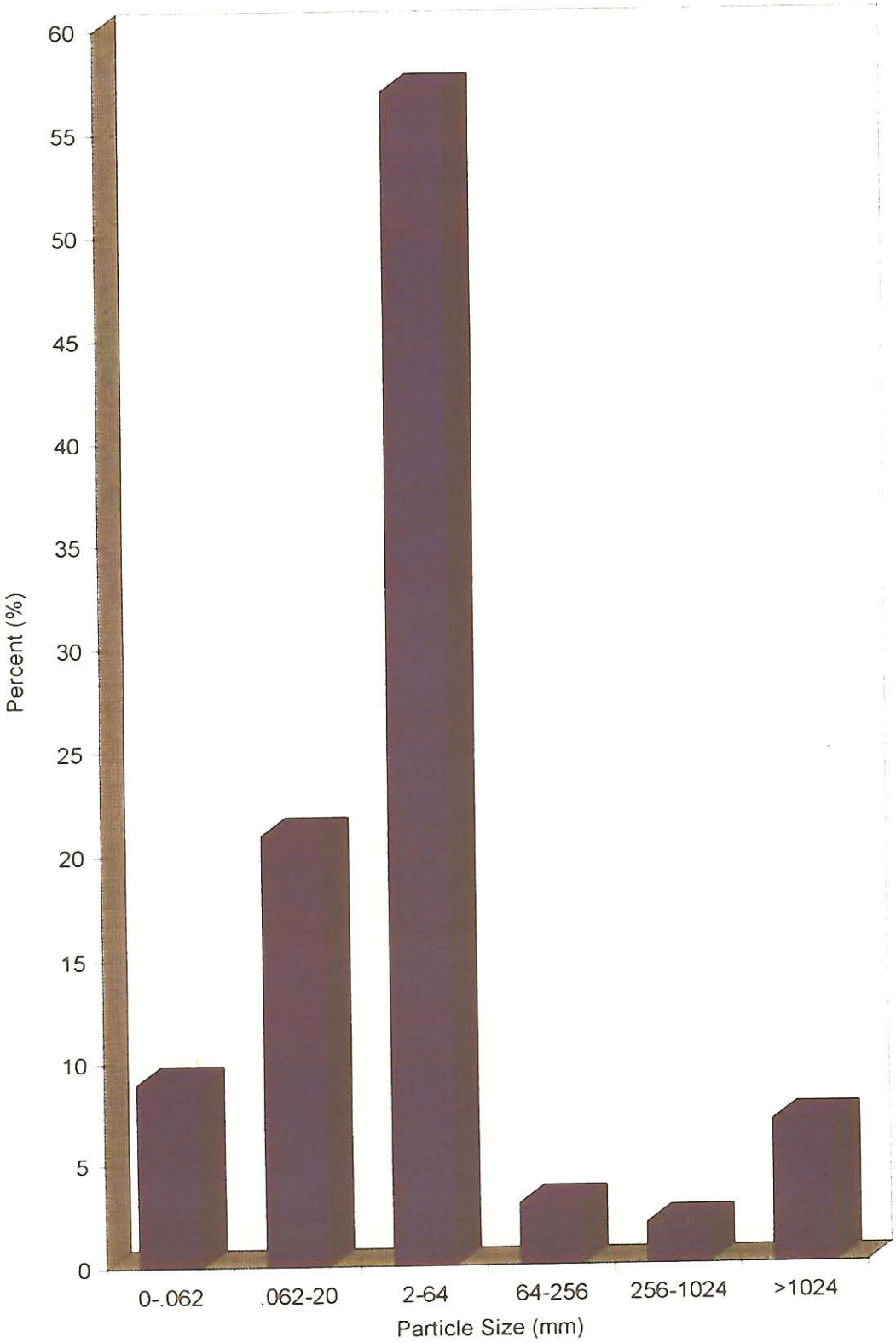
Graph 4 **Substrate Content of Steele Creek (AD)**



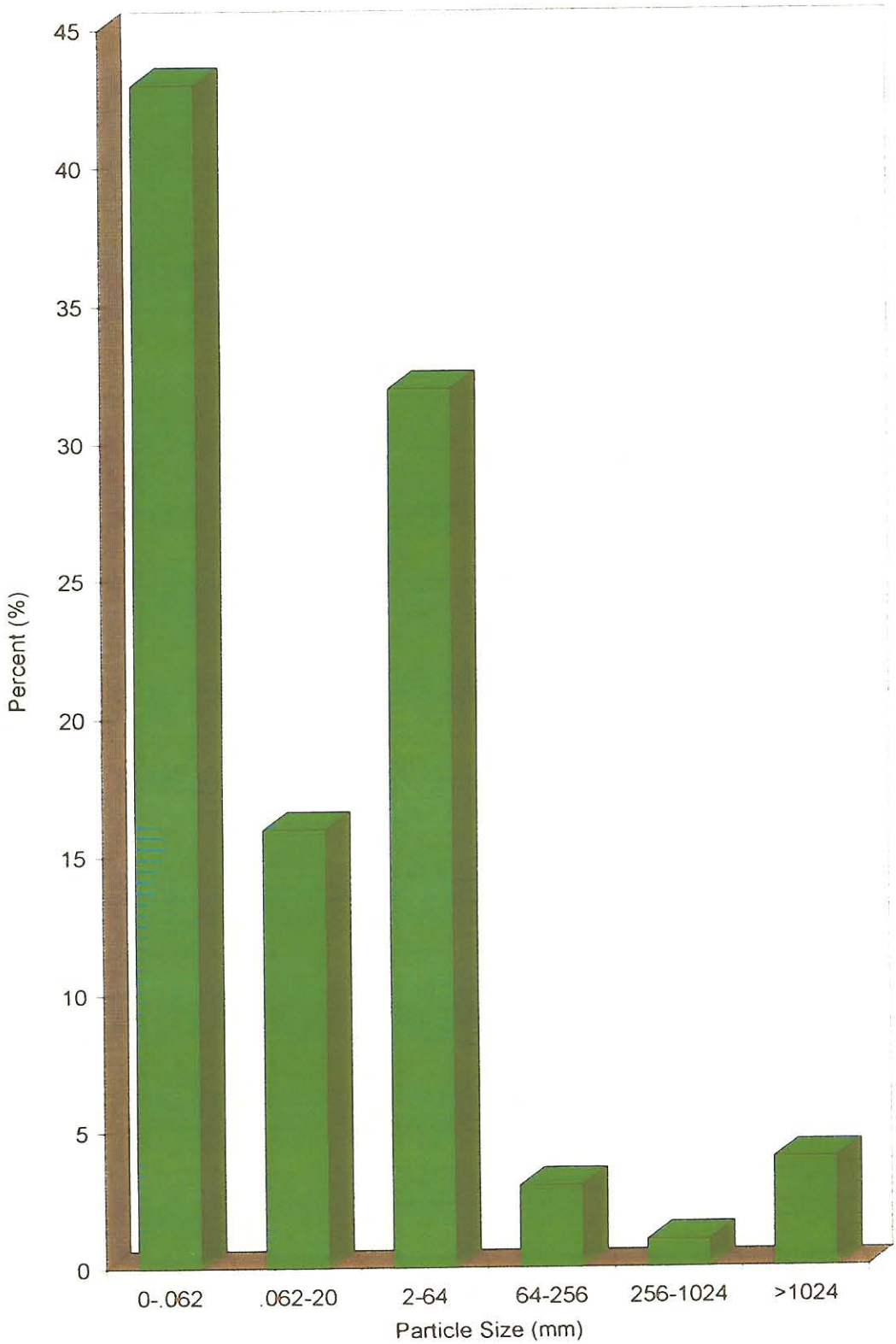
Graph 5 **Substrate Contents of Steele Creek (BD)**



Graph 6 **Substrate Contents of Slagle Creek**



Graph 7 **Substrate Contents of Trinkle Creek**



and clay sized particles (Graph 7). With a increase in each streams percentage of silt, clay, and sand sized substrate, there was also an increase in it's percentage of Cyprinid minnows (Graph 8).

Trinkle Creek and Slagle Creek, overall, have the most beneficial riparian zones and cover for aquatic organisms. This is due to their well vegetated and stable banks, small, if any, areas of human interaction, the presence of undercut banks, overhanging vegetation, boulders, and woody debris.

Because freshwater snails, in general, do not tolerate a great deal of pollution, chemical changes, or physical disturbance, their survival in Steele Creek (AD) is viewed as a success. Their threat to physical disturbance, however, is the most costly. The population of Mallard *Anas latyrhynchos* within Steele Creek park proposes a potential threat. After snails were introduced into Steele Creek (AD), the gizzard and stomach contents of one male Mallard, feeding in the stream, were examined. The contents of the drakes gizzard and stomach contained 100 *percent* vegetation.

The average amount of rain fall during 1998, within Steele Creek Park, from July to November, was 8.71 inches lower than in a normal year (Table 9). Because of this, the water levels of each stream dropped. Due to the fact that Steele Creek (AD), Steele Creek (BD), and Trinkle Creek are all effected in some way by springs, they contained water throughout the time of drought. Slagle Creek, however, is effected the most by precipitation. So, when the rain fall amounts dropped, so did the creek's water levels. Starting in July of 1998, the creek contained only a few pools of water that served as habitat for aquatic organisms. Most of these pools were electro-shocked to identify what was living in them. When the water level returned to normal, in January, the stream was once again shocked. All species of fish had survived, however, their numbers had greatly decreased.

Through this study, two populations of the Tennessee dace were discovered. Their desired habitat was evaluated and included in a management plan (Appendix B). The management plan also contains strategies that will hopefully keep both populations of the dace in healthy conditions.

Due to the fact that Steele Creek (AD) and Steele Creek (BD) contain water all year, have high velocities, pH values above 7, depths below four to ten feet, temperatures never below zero degrees Celsius or above 27 degrees Celsius, areas of silt that are three to five inches thick, and are able to host snails, they were categorized as potential environments for mussel reintroduction. The fact that Steele Creek (BD) already contains one type of mussel, as well as freshwater snails, are good indicators of native mussel survival.

Graph 8 % Silt,Clay,&Sand vs the % Cyprinidae

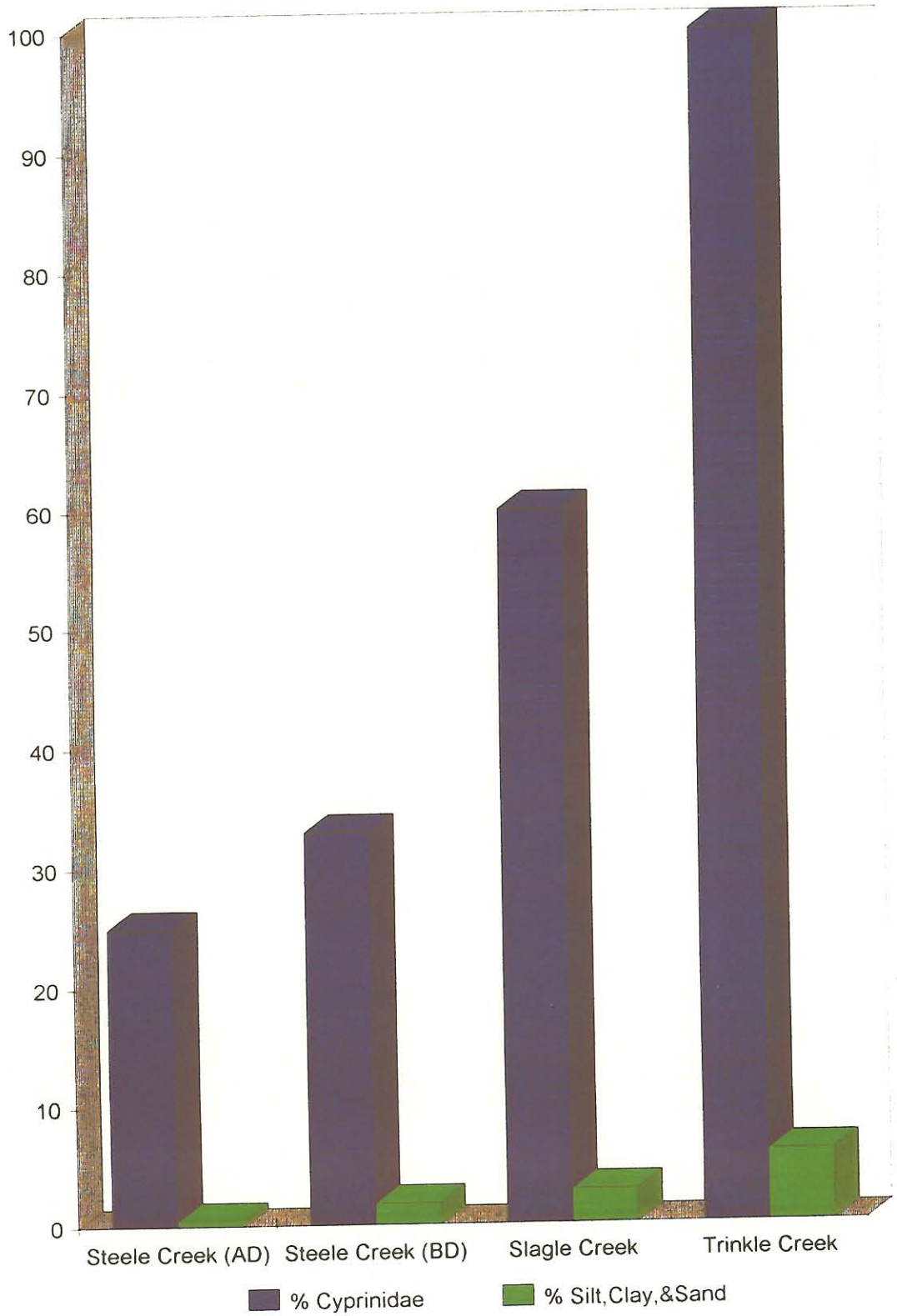


Table 9 **Average Rainfall**

	A 100 year average at Tri-Cities Airport*	During 1998 at Tri-Cities Airport*	During 1998 at Steele Creek Park
July	4.32 inches	1.97 inches	2.28 inches
August	3.17 inches	2.14 inches	2.29 inches
September	3.26 inches	0.90 inches	0.50 inches
October	2.59 inches	1.68 inches	1.00 inches
November	2.94 inches	1.44 inches	1.50 inches
Average	16.28 inches	8.13 inches	7.57 inches

*Tri-Cities Airport Average Rainfall is recorded by the National Weather Service in Morristown, Tennessee

With the help of TWRA, a total of 15 native mussels were introduced into Steele Creek (AD) and 13 native mussels were introduced into Steele Creek (BD). Areas of reintroduction were re-surveyed and many mussels were found living and none were found to have died. Up until this point, the survival of these mussels, in their new environments, has been successful.

Because Steele Creek's (BD) streambed is made up of around 35 *percent* gravel and 15 *percent* bedrock, contains 41 *percent* riffle areas, and holds the aquatic insects of midge and mayfly larvae, the stream presents the requirements needed for habitat usage of darters.

With the help of TWRA, 25 species of Snubnose darters were introduced into Steele Creek (BD). The stream was later surveyed and darters were found.

Conclusion

The objectives of this study were to survey aquatic life within streams of Steele Creek Park. This survey provided documentation of fish, crustaceans, and insects of Slagle Creek, Steele Creek above the dam (AD), Steele Creek below the dam (BD), and Trinkle Creek. Six species of fish were added to the park's list of freshwater fish. One of these fish, the Tennessee dace, was found as a species that is in need of management. The desired habitat of the dace was determined and a management plan was written to help preserve the Tennessee dace and it's habitat. The reintroduction of Rainbow and Mountain creekshell mussels was completed within two streams of the park. The Snubnose darter was reintroduced to one stream within the park.

Through surveying, four streams within the 2,200 acres of Steele Creek Park, a habitat description was determined for each. Each stream turned out to be it's own unique environment. Streams differed in amounts of dissolved oxygen and pH, velocity, average depth, length and width, as well as the number and diversity of aquatic species.

Slagle Creek had a total of eight fish species, eight aquatic insects, and three species of crayfish. The percentage of Cyprinid minnows, within Slagle Creek was around 60 *percent*. This creek, due to dry weather from July to November (Table 9), held only a few large pools until January1999. The rest of the creek channel was dry. During dry weather, Slagle Creek, compared to the other three, had the lowest temperature, lowest velocity, lowest pH, and lowest dissolved oxygen. By early water was flowing through its complete channel. Temperature, velocity, pH and dissolved oxygen had all increased by spring. Cover for aquatic organisms of Slagle Creek includes undercut banks, overhanging vegetation, boulders, and woody debris.

Steele Creek (AD) had 12 fish species, six aquatic insects, and two crayfish. The percentage of Cyprinid minnows with Steele Creek was 25 *percent*. This creek was affected by the dry weather, but water supplies were not depleted. Steele Creek (AD) had the second highest temperature in the fall and second lowest temperature in the spring. Overall, the velocity of Steele Creek (AD) is faster than that of the others, Steele Creek (AD) contacts limestone beds, which increases pH. The pH levels of this creek were the highest of all four during both the fall and spring. Steele Creek (AD) had the largest *percent* of riffle areas (64%). Dissolved Oxygen content was the highest in Steele Creek (AD) during the fall and second highest during the spring. The high amounts of DO in the creeks water is caused by large amount of riffle. Another factor which increased

the creeks DO content was the large surface area of the creek. Steele Creek, compared to the other four creeks, had the largest width of 7.7 meters. Due to human interaction with the shoreline of Steele Creek (AD), cover for aquatic organisms consists only of undercut banks and boulders.

Steele Creek (BD) had nine species of fish, seven species of aquatic insects, and two species of crayfish. Steele Creek (BD) is effected by the increase in temperature and filtration of silt by the dam built for Steele Creek Lake. Steele Creek had the highest average temperature, second fastest velocity, second highest pH levels, and second highest average of dissolved oxygen. Due to human influence of the width of the creek and of bank structures, Steele Creek (BD) had only two sources cover for aquatic organisms, undercut banks and boulders.

A major influence on Steele Creek (AD) and Steele Creek (BD) is the lake. Both creeks not only contain freshwater fish which have adapted to living in streams, and contain freshwater fish that are adapted to living in either streams or larger reservoirs such as lakes (ex: Green sunfish, Largemouth bass, and Bluegill). Because of these added freshwater fish species, Steele Creek (AD) and Steele Creek (BD) have a larger number of fish diversity than Slagle Creek and Trinkle Creek.

Trinkle Creek had three species of fish, thirteen species of aquatic insects, and three species of crayfish. Trinkle Creek is a first order stream that is fed by rain water and springs. Trinkle Creek had the second lowest temperatures, lowest velocity rates, second to lowest pH values, and second to lowest Dissolved Oxygen content. Because Trinkle Creek is not disturbed by humans and the direction of its channeling is natural, the creek has four sources of cover for aquatic organisms, undercut banks, overhanging vegetation, boulders, and woody debris.

The desired habitat for the Tennessee dace was determined by the evaluation of the two populations in Slagle and Trinkle Creeks. The management plan derived for the species will hopefully keep these populations of dace out of harm's way. Due the addition of these two populations, there are now 40 known functional populations of the Tennessee dace documented. Steele Creek Park presently holds five *percent* of the total population of Tennessee dace world wide.

The reintroduction of mussels and the Snubnose darter, up to this point, had proved to be successful. Re-evaluation of both Steele Creek (AD) and Steele Creek (BD) have shown all three reintroduced species as being able to sustain life in a new environment.

The importance of many overlooked areas with the park, as well as the species that inhabit these areas, were recognized through this study. The aquatic survey provided insights on new park aquatic species and their habitats, and established the differences between each creek environment. In addition to the survey, this project helped in maintaining the park's and state's biological diversity by providing a management plan for an in-need-of-management fish species and by the reintroduction species of three aquatic species into Steele Creek Park.

Appendix A
Scientific Collection Permit

TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

40

ientific Collection Permit : 1139 **Issue Date:** 9/20/98 **Expiration Date:** 9/20/99

Pursuant to authority of T.C.A. 70-2-213:

ıme : HAMED KEVIN
Organization: STEELE CREEK NATURE CENTER Phone: 423/989-5616
P.O. BOX 1189

BRISTOL TN 37621
Additional Permittees:
ARAH GARRETT

is granted permission to take, possess, and transport, for purely scientific purposes, the following species d numbers of wildlife:
ISHES (UP TO 10 OF EACH SPECIES)

stricted to the following locations:
TEELE CREEK STATE PARK - SLAGLE CREEK, TRINKLE CREEK, & STEELE CREEK

ing the following collection methods:
SEINES, KICKNETS, ELECTROFISHING

bject to the following rules: An annual report of collections will be sent to the Fish Management Division at the above address by permit expiration. No species listed as rare or endangered on either state or federal lists may be taken with this permit.

ways call the nearest TWRA Regional Office within one week prior to sampling:

Jackson: 1-800-372-3928 or 901-423-5725 Nashville: 1-800-624-7406 or 615-781-6622
Crossville: 1-800-262-6704 or 931-484-9571 Talbott: 1-800-332-0900 or 423-587-7037

Gary T. Myers By FLE
Executive Director, Tennessee Wildlife Resources Agency

9/20/98
Date

The State of Tennessee

AN EQUAL OPPORTUNITY EMPLOYER

Appendix B
Management Plan

Management Plan

Background

The Tennessee dace *Phoxinus tennessensis* has been given an S1 rating on the rare vertebrates list by the Tennessee Natural Heritage Program. This numeric rating means that the species is extremely rare and critically imperiled in Tennessee. The 50 noted historical occasions of the species are localized and most are disjust. Presently, there are 38 documented and functional populations. In Tennessee, the dace is recorded as being distributed in small tributaries of the upper Tennessee River drainage northeastward through the Holston and French Broad systems (Environmental Biology of Fishes).

Through an aquatic study, two populations of the Tennessee dace have been identified by TVA and TWRA. These newfound populations are living within Steele Creek Park boundaries. One population is located within Trinkle Creek, while the other is located within Slagle Creek. With the addition of these populations, there are 40 documented and functional populations of Tennessee dace.

Ecological Requirements

The Tennessee dace is most commonly present in small woodland first order tributaries with stream widths of two to five feet. These streams often have some degree of spring influence. The dace is usually found in pools of streams that are shaded by undercut banks, vegetation, and woody debris. Most Tennessee dace inhabit streams with substrate composed mostly of silt, clay, sand, and gravel. Their diet consists of diatoms and algae. They spawn in nests of other minnows (Environmental Biology of Fishes).

Threats

The populations of Tennessee dace found within the park are threatened by possible alterations of habitats. The introduction of nonnative fish species could hurt the populations by taking over their environment. The introduction of the Mountain redbelly dace *Phoxinus erythrogaster,* which is not at this time present in either creek, would also create a threat by taking over the Tennessee dace's habitat. Harvesting of timber, logging, the development of housing, and the building of park trails all pose threats to the Tennessee dace's habitat. If coverage of either stream is taken away, a significant source of protection for the fish species is then lost and an increase in thermal radiation is produced. If large amounts of bank erosion fall into the dace's stream it could result in a lack of available spawning cover for the nest-building minnows necessary for successful Tennessee dace reproduction. Specifically in Slagle Creek, the prohibited use of off road vehicles create a threat to the stream. Specifically in Trinkle Creek,

small-scale landscaping could easily degrade the spring-fed streams the dace inhabit. The withdrawal or reduction of water might reduce the flow in the streams and impact benthic habitats (Environmental Biology of Fishes).

Values of Species

The reason for management of the Tennessee dace is due to scientific value and for protection of the park's and state's biological diversity.

Management Strategy

To protect the habitat of Tennessee dace within Steele Creek Park the following strategies should be considered:

1) The acquisition of land around both Trinkle and Slagle Creeks. If development were to occur, work with developers to insure vegetation is maintained and that silt fences are erected and sustained.
2) Secure and retain creeks, plus surrounding land, from public use. Create a 40-50 foot buffer zone, in order that future trails would not be built in areas that harmed the creeks.
3) Stabilize areas that are already eroding.
4) Monitor water quality, such as dissolved oxygen content and pH levels, to insure a healthy environment for the dace.
5) Do not disturb woody debris that have formed/fallen, over/into creeks.
6) Prevent the introduction of any non-native fish species or the Mountain redbelly dace into either creek.
7) Arrange yearly monitoring of the Tennessee dace populations, by Nature Center naturalist. Keep records on the distribution and conditions of the dace.
8) *Specifically in Trinkle Creek:*
a-Work with the Bristol Tennessee Fire Department to direct fire hydrant tests away from Trinkle Creek.
b-Work with the Utility Department to insure that the waste pumping station, located near Trinkle Creek, has fail safe measures that avoid overflowing sewage into the creek
9) *Specifically in Slagle Creek:*
a-continue enforcing off road vehicles from entering park boundaries and crossing over Slagle Creek
10) INCREASE AWARENESS OF THE TENNESSEE DACE

Appendix C
Pictures of Study Areas

Trinkle Creek

Slagle Creek

Steele Creek (AD)

Steele Creek (BD)

Appendix D
Survey Sheets

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 1
Survey Site No.: 1

Date: 28 August 1998
Time: 1600

State: Tennessee
County: Sullivan

Locality: Trinkle Creek
Drainage: Holston

Width of stream: 8cm (max 91.4cm)
Bottom: Rock 50% Silt 50%
Air Temp: 32 C
Shore: Eroded banks with vegetation

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter/ 23 seconds
Depth of water: 20.3 cm

Depth captured: less than 20.3 cm
Method captured: Kick net

pH of Water: 7.5
DO of Water: 5.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 10 Blacknose Dace 15 mm
01 Blacknose Dace 35 mm
02 Creek Chub 15 mm
Dragon Fly Larvae

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 1
Survey Site No.: 2
State: Tennessee
County: Sullivan

Date: 28 August 1998
Time: 1630
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 2 meters
Bottom: 98% rock 2% silt
Air Temp: 32 C
Shore: Eroded banks with vegetation

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter / 6 seconds
Depth of water: 20.3 cm

Depth captured: less than 20.3 cm
Method captured: Kick net

pH of Water: 7.5
DO of Water: 5.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 03 Tennessee Dace 60mm
06 Blacknose Dace 40 mm
03 Crayfish 30 mm (1 collected)
01 Dusky Salamander
01 Snail

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 1
Survey Site No.: 3
State: Tennessee
County: Sullivan

Date: 28 August 1998
Time: 1700
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 2 meters
Bottom: Silt
Air Temp: 32 C
Shore: Eroded banks with vegetation

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter/ 26 seconds
Depth of water: 23 cm

Depth captured: less than 23 cm
Method captured: Kick net

pH of Water: 7.5
DO of Water: 5.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 15mm
05 Creek Chub 30mm
09 Blacknose Dace 15mm
01 Tennessee Dace 40mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 1
Survey Site No.: 4
State: Tennessee
County: Sullivan

Date: 28 August 1998
Time: 1730
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 1.2 cm
Bottom: Silt
Air Temp: 32 C
Shore: Eroded banks with vegetation

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter/ 26 seconds
Depth of water: 30.5 cm

Depth captured: less than 30.5 cm
Method captured: Kick net

pH of Water: 7.5
DO of Water: 5.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 15mm
01 Creek Chub 40mm
01 Creek Chub 60mm
01 Creek Chub 70mm
02 Creek Chub 90mm
01 Tennessee Dace 15mm
01 Tennessee Dace 40mm
01 Tennessee Dace 50mm
03 Blacknose Dace 15mm
01 Blacknose Dace 20mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 2
Survey Site No.: 5
State: Tennessee
County: Sullivan

Date: 31 August 1998
Time: 1530
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 13 meters
Bottom: 80% rock 20% silt
Air Temp: 33 C
Shore: Vegetated

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter/ 3 seconds
Depth of water: 50.8 cm

Depth captured: 50.8 cm
Method captured: Kick net/Seine net

pH of Water: 9.5
DO of Water: 7.6 ppm

Collected by: Sarah Garrett, Kevin Hamed, and Elizabeth Mitchel
Preservative: none
Remarks:
Species &length: 02 Central Stoneroller 20mm
05 Central Stoneroller 40mm
01 Central Stoneroller 60mm
01 Snubnose Darter 40mm (collected)
01 Snubnose Darter 50mm (collected)
02 Snubnose Darter 60mm (2 collected)
02 Crayfish 30mm
01 Crayfish 40mm (2 collected)
04 Crayfish 80mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 2
Survey Site No.: 6
State: Tennessee
County: Sullivan

Date: 31 August1998
Time: 1600
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 2.1 meters
Bottom: 5% rock 95% silt
Air Temp: 33.5 C
Shore: Vegetated

Vegetation: none
Water Temp: 23 C
Water Velocity: 1 meter/ 5 seconds
Depth of water: 17.8 cm

Depth captured: 10.1 cm
Method captured: Seine net

pH of Water: 9.5
DO of Water: 7.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 40mm
01 Creek Chub 52mm
04 Central Stoneroller 20mm
04 Central Stoneroller 30mm
34 Central Stoneroller 40mm
05 Central Stoneroller 50mm
01 Central Stoneroller 60mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 3
Survey Site No.: 7
State: Tennessee
County: Sullivan

Date: 3 September 1998
Time: 1630
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 4.5 meters
Bottom: 20% rock - 80% silt
Air Temp: 29 C
Shore: Vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 17 seconds
Depth of water: 25 cm

Depth captured: 1.7 cm
Method captured: Kick net

pH of Water: 9.7
DO of Water: 8.4 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Stoneroller 40 mm
Mayfly Larvae

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 3
Survey Site No.: 8
State: Tennessee
County: Sullivan

Date: 3 September 1998
Time: 1700
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 20 meters
Bottom: (riffles) 90% rock - 10% silt
Air Temp: 29 C
Shore: Vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 4 seconds
Depth of water: 22.8 cm

Depth captured: less than 22.8 cm
Method captured: Kick net

pH of Water: 9.7
DO of Water: 8.4 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 50mm
02 Central Stoneroller 35mm
04 Central Stoneroller 40mm
04 Central Stoneroller 45mm
05 Central Stoneroller 50mm
01 Central Stoneroller 55mm
01 Central Stoneroller 57mm
01 Central Stoneroller 60mm
02 Blacknose Dace 60mm
01 Blacknose Dace 65mm
02 Snubnose Darter 50mm
02 Crayfish 30mm
01 Crayfish 20mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 4
Survey Site No.: 9
State: Tennessee
County: Sullivan

Date: 4 September 1998
Time: 1630
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 5 meters
Bottom: (riffles) 98% rock - 02% silt
Air Temp: 30 C
Shore: Vegetated

Vegetation: none
Water Temp: 20 C
Water Velocity: 1 meter/ 4 seconds
Depth of water: 35.5 cm

Depth captured: 22.8 cm
Method captured: Kick net

pH of Water: 9.5
DO of Water: 8.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 45mm
01 Central Stoneroller 35mm
02 Central Stoneroller 40mm
01 Central Stoneroller 42mm
01 Central Stoneroller 43mm
04 Central Stoneroller 45mm
01 Central Stoneroller 46mm
01 Central Stoneroller 50mm
01 Central Stoneroller 55mm
01 Snubnose Darter 43mm
01 Banded Sculpin 95mm
01 Crayfish 24mm
01 Mayfly Larvae

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 4
Survey Site No.: 10
State: Tennessee
County: Sullivan

Date: 4 September 1998
Time: 1630
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 15 meters
Bottom: 95% rock - 05% silt
Air Temp: 30 C
Shore: Vegetated

Vegetation: none
Water Temp: 20 C
Water Velocity: l meter / 3 seconds
Depth of water: 20.3 cm

Depth captured: 7-10 cm
Method captured: Kick net

pH of Water: 9.5
DO of Water: 8.6 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 60mm
01 Central Stoneroller 20mm
01 Central Stoneroller 40mm
01 Central Stoneroller 45mm
01 Central Stoneroller 90mm
01 Central Stoneroller 140mm
01 Snubnose Darter 40mm
01 Crayfish 50mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 5
Survey Site No.: 11
State: Tennessee
County: Sullivan

Date: 11 September 1998
Time: 1530
Locality: Steele Creek (BD)
Drainage: Holston

Width of stream: 3 meters
Bottom: 90% rock - 10% silt
Air Temp: 30 C
Shore: Vegetated

Vegetation: none
Water Temp: 22 C
Water Velocity: 1 meter/ 4seconds
Depth of water: 35.5 cm

Depth captured: 17.7 cm
Method captured: Kick net

pH of Water: 9
DO of Water: 7.4ppm

Collected by: Sarah Garrett and Kevin Hammed
Preservative: none
Remarks:
Species &length: 01 Central Stoneroller 45mm
01 Central Stoneroller 60mm
09 Crayfish 45-60mm
01 Mayfly
01 Kingfisher

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 5
Survey Site No.: 12
State: Tennessee
County: Sullivan

Date: 11 September 1998
Time: 1615
Locality: Steele Creek (BD)
Drainage: Holston

Width of stream: 2 meters
Bottom: 50% rock - 50% silt
Air Temp: 30 C
Shore: Vegetated

Vegetation: none
Water Temp: 23 C
Water Velocity: 1 meter/ 6 seconds
Depth of water: 30.4 cm

Depth captured: 17.1 cm
Method captured: Kick net

pH of Water: 9
DO of Water: 7.4ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: Will need to be electro-shocked
Species &length: 02 Central Stoneroller 45mm
02 Crayfish 45mm
28 Crayfish 30-55mm
01 Dobsonfly
01 Water penny
01 Mayfly
01 Kingfisher

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 6
Survey Site No.: 13
State: Tennessee
County: Sullivan

Date: 12 September 1998
Time: 1500
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 7.6 meters
Bottom: 85% rock - 15% fine silt
Air Temp: 32 C
Shore: Vegetated

Vegetation: none
Water Temp: 20 C
Water Velocity: 1 meter/ 3 seconds
Depth of water: 20.3 cm

Depth captured: 10 cm
Method captured: Seine and Kick nets

pH of Water: 8.3
DO of Water: 8.6ppm

Collected by: Sarah Garrett and Virginia Intermont Students
Preservative:
Remarks:
Species &length: 01 Central Stoneroller 55 mm
01 Blacknose Dace 38mm
03 Crayfish 40mm
05 Crayfish 45mm
02 Crayfish 51mm
02 Crayfish 60mm
01 Crayfish 70mm
Insects found: Midge larvae, Cranefly larvae, Scuds,
Stonefly nymphs, Mayfly nymphs, hellgramohite, Caddisgly larvae

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 7
Survey Site No.: 14
State: Tennessee
County: Sullivan

Date: 14 September 1998
Time: 1500
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 1.5 meters
Bottom: 20% rock, 80% silt
Air Temp: 32 C
Shore: Vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 30 seconds
Depth of water: 5cm

Depth captured: 2 cm
Method captured: Kick net

pH of Water: 8
DO of Water: 7.2ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: Velocity low due to lack of ran. Many raccoon tracks present.

Species &length:

01 Creek Chub 20mm
01 Creek Chub 35mm
01 Creek Chub 45mm
01 Creek Chub 46mm
02 Creek Chub 53mm
01 Creek Chub 55mm
01 Blacknose Dace 19mm
01 Blacknose Dace 20mm
01 Blacknose Dace 22mm
01 Blacknose Dace 28mm
02 Blacknose Dace 40mm
01 Blacknose Dace 45mm
02 Tennessee Dace 15mm
03 Tennessee Dace 17mm
01 Tennessee Dace 20mm
03 Tennessee Dace 30mm
01 Tennessee Dace 37mm
01 Tennessee Dace 40mm
01 Tennessee Dace 43mm
01 Crayfish 45mm
01 Dusky Salamander
01 Two Lined Salamander
01 Snail (opens left)
02 Waterboat Men
10 Water Strider
03 Tennessee Dace 16mm
01 Tennessee Dace 19mm
02 Tennessee Dace 25mm
01 Tennessee Dace 32mm
02 Tennesse Dace 35mm
01 Tennessee Dace 42mm
03 Tennessee Dace 45mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 7
Date: 14 September 1998
Survey Site No.: 15
Time: 1600
State: Tennessee
Locality: Trinkle Creek
County: Sullivan
Drainage: Holston

Width of stream: 2 meters
Vegetation: none
Bottom: 20% rock - 80% silt
Water Temp: 19 C
Air Temp: 32 C
Water Velocity: not measurable
Shore: Vegetated
Depth of water: 11.4 cm

Depth captured: 5 cm
pH of Water: 8
Method captured: Kick net
DO of Water: 7.2ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: Observed a male Ruby Throated Hummingbird and more raccoon tracks
Species &length: 01 Creek Chub 30mm
01 Creek Chub 60mm
02 Blacknose Dace 15mm
05 Blacknose Dace 20mm
02 Blacknose Dace 32mm
02 Blacknose Dace 35mm
01 Blacknose Dace 36mm
01 Balcknose Dace 40mm
02 Tennessee Dace 20mm
04 Tennessee Dace 25mm
02 Tennessee Dace 30mm
01 Tennessee Dace 37mm
01 Tennessee Dace 45mm
01 Two Lined Salamander
01 Snail (opening on left)

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 7
Date: 14 September 1998
Survey Site No.: 16
Time: 1630
State: Tennessee
Locality: Trinkle Creek
County: Sullivan
Drainage: Holston

Width of stream: *
Vegetation: none
Bottom: *
Water Temp: *
Air Temp: 32 C
Water Velocity: *
Shore: vegetated
Depth of water: 17.7 cm

Depth captured: 10 cm
pH of Water: 7.5
Method captured: Kick net
DO of Water: 4.4ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: * Dry Creek with 4 shallow puddles. Largest puddle was sampled.
Species &length: 01 Creek Chub 90mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 8
Survey Site No.: 17
State: Tennessee
County: Sullivan

Date: 15 September 1998
Time: 1430
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 2 meters
Bottom: 15% rock - 85% silt
Air Temp: 34 C
Shore: Vegetated

Vegetation: areas of vegetated islands
Water Temp: 19 C
Water Velocity: 1 meter/ 40 seconds
Depth of water: 35.5 cm

Depth captured: 17.7 - 20.3 cm
Method captured: Kick net

pH of Water: 9
DO of Water: 6.5ppm

Collected by: Sarah Garrett, Kevin Hamed, and two NC volunteers
Preservative: none
Remarks: Cardinal flower was prevalent
Species &length: 02 Creek Chub 60mm
01 Creek Chub90mm
01 Blacknose Dace 09mm
07 Blacknose Dace 15mm
01 Blacknose Dace 17mm
02 Blacknose Dace 20mm
01 Blacknose Dace 21mm
01 Blacknose Dace 25mm
02 Blacknose Dace 30mm
01 Blacknose Dace 35mm
01 Blacknose Dace 40mm
01 Blacknose Dace 55mm
01 Blacknose Dace 60mm
01 Blacknose Dace 65mm
02 Tennessee Dace 14mm
01 Tennessee Dace 19mm
01 Tennessee Dace 21mm
02 Tennessee Dace 30mm
01 Tennessee Dace 42mm
01 Tennessee Dace 49mm
01 Dragonfly Larvae
01 Two lined Salmander
01 Dusky Salamander
01 Snail (opens left)
02 Crayfish 45mm
11 Tennessee Dace 16mm
01 Tennessee Dace 20mm
02 Tennessee Dace 25mm
03 Tennessee Dace 40mm
02 Tennessee Dace 45mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 9
Survey Site No.: 18
State: Tennessee
County: Sullivan

Date: 17 September 1998
Time: 1500
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 2 meters
Bottom: 15% rock - 85 % silt
Air Temp: 32 C
Shore: Vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 45 seconds
Depth of water: 14.2 cm

Depth captured: less than 15.2 cm
Method captured: Kick net

pH of Water: 9
DO of Water: 6.5ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 05 Creek Chub 15mm
01 Creek Chub 25mm
01 Creek Chub26mm
01 Creek Chub 60mm
01 Creek Chub 70mm
04 Blacknose Dace 15mm
07 Blacknose Dace 16mm
01 Blacknose Dace 20mm
01 Blacknose Dace 35mm
01 Blacknose Dace 40mm
01 Blacknose Dace 70mm
06 Tennessee Dace 16mm
02 Tennessee Dace 20mm
01 Tennessee Dace 22mm
03 Tennessee Dace 30mm
03 Tennessee Dace 40mm
01 Tennessee Dace 45mm
01 Tennessee Dace 50mm
02 Snails (open from left)
01 Dragonfly Larvae

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 9
Survey Site No.: 19
State: Tennessee
County: Sullivan

Date: 17 September 1998
Time: 1545
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 1 meter
Bottom: 50% rock - 50% silt
Air Temp: 32 C
Shore: vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 48 seconds
Depth of water: 15.2 cm

Depth captured: less than15.2 cm
Method captured: kick net

pH of Water: 9
DO of Water: 7.4ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:

Species &length: 05 Creek Chub 20mm
04 Creek Chub 25mm
01 Creek Chub 30mm
01 Creek Chub 35mm
03 Creek Chub 40mm
01 Creek Chub 44mm
01 Creek Chub 45mm
17 Blacknose Dace 16mm
05 Blacknose Dace 20mm
01 Blacknose Dace 30mm
02 Blacknose Dace 40mm
01 Blacknose Dace 60mm
02 Tennessee Dace 15mm
01 Tennessee Dace 16mm
01 Tennessee Dace 20mm
01 Tennessee Dace 24mm
01 Tennessee Dace 35mm
01 Tennessee Dace 40mm
03 Tennessee Dace 45mm
01 Tennessee Dace 50mm

01 Two Lines Salamander 40mm
01 Snail (opens left)

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 9
Survey Site No.: 20
State: Tennessee
County: Sullivan

Date: 17 September 1998
Time: 1615
Locality: Trinkle Creek
Drainage: Holston

Width of stream: 1 meter
Bottom: 50% rock - 50% silt
Air Temp: 90 F
Shore: Vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 34 seconds
Depth of water: 6 in

Depth captured: less than 6 in
Method captured: kick net

pH of Water: 8.5
DO of Water: 6.4ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Creek Chub 16mm
03 Creek Chub 20mm
01 Creek Chub 22mm
03 Creek Chub 25mm
01 Creek Chub 27mm
01 Creek Chub 30mm
03 Creek Chub 50mm
01 Creek Chub 55mm
01 Creek Chub 85mm
13 Blacknose Dace 16mm
02 Blacknose Dace 20mm
02 Blacknose Dace 21mm
01 Blacknose Dace 40mm
01 Blacknose Dace 50mm
01 Blacknose Dace 55mm
01 Tennessee Dace 25mm
01 Tennessee Dace 30mm
01 Tennessee Dace 35mm
01 Tennessee Dace 39mm
01 Tennessee Dace 40mm
01 Tennessee Dace 50mm
02 Snails (1 opens left; 1 opens right)
01 Dusky Salamander 20mm
01 Two Lined Salamander 15mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 10
Survey Site No.: 21
State: Tennessee
County: Sullivan

Date: 22 September 1998
Time: 1500
Locality: Slagle Creek
Drainage: Holston

Width of stream: 25.4 cm
Bottom: 50% rock - 50% fine silt
Air Temp: 29 C
Shore: 80% rock - 20% soil

Vegetation: none
Water Temp: 18 C
Water Velocity: not measurable
Depth of water: 10.1 cm

Depth captured: less than 10.1 cm
Method captured: elecroshocking

pH of Water: 7.5
DO of Water: 2.0ppm

Collected by: Sarah Garrett, Kevin Hamed, Dave Tomljanvoich
Preservative: none
Remarks: Dried Creek - due to weather - only shaded pool habitats could be sampled
Species &length: 01 Central Stoneroller
01 Blacknose Dace
01 Creek Chub
07 Striped Shiner *most abundant
01 White Sucker
01 Fantail Darter
01 Box Turtle

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 10
Survey Site No.: 22
State: Tennesse
County: Sullivan

Date: 22 September 1998
Time: 1530
Locality: Slagle Creek
Drainage: Holston

Width of stream: 1 meter
Bottom: silt
Air Temp: 29 C
Shore: rock

Vegetation: none
Water Temp: 18 C
Water Velocity: not measurable
Depth of water: 35.5 cm

Depth captured: less than 35.5
Method captured: Electro-shocking

pH of Water: 7
DO of Water: 1.8ppm

Collected by: Sarah Garrett, Kevin Hamed, Dave Tomljanvoich
Preservative: none
Remarks: One Wild Turkey and two Grouse observed
Species &length: 07 Central Stoneroller
05 Tennesse Dace
15 Creek Chub *most abundant
02 Fantail Darter

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 10
Survey Site No.: 23
State: Tennessee
County: Sullivan

Date: 22 September 1998
Time: 1550
Locality: Slagle Creek
Drainage: Holston

Width of stream: 3 meter
Bottom: pebbles
Air Temp: 29 C
Shore: 80% rock - 20% soil

Vegetation: none
Water Temp: 18 C
Water Velocity: not measurable
Depth of water: 35.5 cm

Depth captured: less than 35.5 cm
Method captured: Electro-shocking

pH of Water: 7.5
DO of Water: 3.0ppm

Collected by: Sarah Garrett, Kevin Hamed, Dave Tomljanvoich
Preservative: none
Remarks:
Species &length: 06 Tennessee Dace
15 Creek Chub *most abundant
08 Striped Shiner

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 10
Date: 22 September 1998
Survey Site No.: 24
Time: 1610
State: Tennesee
Locality: Slagle Creek
County: Sullivan
Drainage: Holston

Width of stream: 1.5 meter
Vegetation: none
Bottom: silt
Water Temp: 18 C
Air Temp: 29 C
Water Velocity: not measurable
Shore: 80% rock- 20% silt
Depth of water: 48.2 cm

Depth captured: less than 48.2 cm
pH of Water: 8
Method captured: Electro-shocking
DO of Water: 5.0ppm

Collected by: Sarah Garrett, Kevin Hamed, Dave Tomljanvoich
Preservative:
Remarks: In previous dried puddle we found one dried Fantail Darter
Species &length: 05 Central Stoneroller
01 Blacknose Dace
13 Tennessee Dace
30 Creek Chub *most abundant (max:137 mm)
02 Striped Shiner

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 10
Date: 22 September 1998
Survey Site No.: 25
Time: 1630
State: Tennessee
Locality: Slagle Creek
County: Sullivan
Drainage: Holston

Width of stream: 3 meters
Vegetation: none
Bottom: silt
Water Temp: 18 C
Air Temp: 29 C
Water Velocity: none
Shore: 60% rock - 40% vegetation
Depth of water: 30 cm

Depth captured: less than 30cm
pH of Water: 8
Method captured: Elecro-shocking
DO of Water: 3.8ppm

Collected by: Sarah Garrett, Kevin Hamed, Dave Tomljanvoich
Preservative:
Remarks:
Species &length: 15 Central Stoneroller
02 Blacknose Dace
04 Tennessee Dace
15+ Creek Chub *most abundant
15 Striped Shiner

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 11
Date: 30 September 1998
Survey Site No.: 26
Time: 1500
State: Tennessee
Locality: Trinkle Creek
County: Sullivan
Drainage: Holston

Width of stream: 3 meters
Vegetation: none
Bottom:
Water Temp: 19 C
Air Temp: 27 c
Water Velocity: 1 meter/ 18 sec
Shore: Vegetated
Depth of water: 62.9 cm

Depth captured: 5 cm
pH of Water: 9
Method captured: kick net
DO of Water: 6.0 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:

Species &length:
01 Creek Chub 16mm
01 Creek Chub 30mm
01 Creek Chub 40mm
02 Creek Chub 70mm
01 Creek Chub 75mm
03 Creek Chub 90mm
01 Creek Chub 150mm
01 Blacknose Dace 10mm
02 Blacknose Dace 15mm
14 Blacknose Dace 16mm
01 Blacknose Dace 20mm
03 Blacknose Dace 25mm
02 Blacknose Dace 30mm
01 Blacknose Dace 35mm
02 Blacknose Dace 40mm
01 Blacknose Dace 60mm
01 Blacknose Dace 90mm
08 Snails (open left)
02 Snails (open right)
27 Tennessee Dace 16mm
02 Tennessee Dace 20mm
05 Tennessee Dace 25mm
02 Tennessee Dace 30mm
03 Tennessee Dace 35mm
04 Tennessee Dace 40mm
09 Tennessee Dace 45mm
01 Tennessee Dace 50mm
01 Crayfish 16mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 11
Date: 30 September 1998
Survey Site No.: 27
Time: 1600
State: Tennessee
Locality: Trinkle Creek
County: Sullivan
Drainage: Holston

Width of stream: 3 meters
Vegetation: none
Bottom:
Water Temp: 19 C
Air Temp: 27 C
Water Velocity: not measurable
Shore: vegetated
Depth of water: 76.2 cm

Depth captured: 10.1 cm
pH of Water: 9
Method captured: kick net
DO of Water: 7.0 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: Horsetails found as vegetation on creek banks
Species &length: 01 Creek Chub 60mm
02 Creek Chub 50mm
04 Creek Chub 40mm
01 Creek Chub 20mm
01 Blacknose Dace 10mm
01 Blacknose Dace 15mm
03 Blacknose Dace 20mm
03 Blacknose Dace 25mm
02 Blacknose Dace 30mm
07 Blacknose Dace 40mm
01 Blacknose Dace 75mm
01 Tennessee Dace 10mm
33 Tennessee Dace 16mm
08 Tennessee Dace 20mm
03 Tennessee Dace 25mm
02 Tennessee Dace 30mm
05 Tennessee Dace 40mm
03 Tennessee Dace 45mm
02 Tennessee Dace 50mm
04 Dusky Salamanders

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 12 | Date: 01 October 1998

Survey Site No.: 28* | Time: 1500

State: Tennessee | Locality: Trinkle Creek

County: Sullivan | Drainage: Holston

Width of stream: * | Vegetation: *

Bottom: * | Water Temp: *

Air Temp: * | Water Velocity: *

Shore: * | Depth of water: *

Depth captured: * | pH of Water: *

Method captured: electroshocking | DO of Water: *

Collected by: 2 TWRA Biologists, 3 NC Volunteers, Sarah G., Kevin H.

Preservative: none

Remarks: * area of Trinkle Creek which had already been sampled with a kick net

Species &length: 55 Creek Chub
44 Blacknose Dace
38 Tennessee Dace
08 Crayfish

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 13
Survey Site No.: 29
State: Tennessee
County: Sullivan

Date: 07 October 1998
Time: 1515
Locality: Steele Creek (AD)
Drainage: Holston

Width of stream: 12 meters
Bottom:
Air Temp: 25 C
Shore: vegetated

Vegetation: none
Water Temp: 19 C
Water Velocity: 1 meter/ 6 sec
Depth of water: max 71.1 cm

Depth captured: less than 50cm
Method captured: kick net

pH of Water: 9.5
DO of Water: 8.2 ppm

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks:
Species &length: 01 Central Stoneroller 35mm
01 Northern Hogsucker
01 Bluegill 40mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 14 | Date: 12 October 1998

Survey Site No.: 30 | Time: 1530

State: Tennessee | Locality: Trinkle Creek

County: Sullivan | Drainage: Holston

Width of stream: 1 meter | Vegetation: none

Bottom: | Water Temp: 14 C

Air Temp: 22 C | Water Velocity: not measurable

Shore: vegetated | Depth of water: max 60mm

Depth captured: less than 30mm | pH of Water: 7.5

Method captured: kick net | DO of Water: 5.4 ppm

Collected by: Sarah Garrett and Kevin Hamed

Preservative: none

Remarks:

Species &length: 03 Creek Chub below 50mm
06 Creek Chub between 50mm-90mm
01 Creek Chub averaging 120mm
13 Blacknose Dace below 22mm
03 Blacknose Dace between 22mm-44mm
36 Tennessee Dace below 30mm
19 Tennessee Dace between 30mm-49mm
01 Tennessee Dace between 50mm-65mm
48 Snails (opens right)
01 Crayfish
03 Dusky Salamanders

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 15
Date: 20 October 1998
Survey Site No.: 31*
Time: 1038
State: Tennessee
Locality: Steele Creek (AD)
County: Sullivan
Drainage: Holston

Width of stream: *
Vegetation: *
Bottom: *
Water Temp: *
Air Temp: *
Water Velocity: *
Shore: *
Depth of water: *

Depth captured: *
pH of Water: *
Method captured: electroshocking
DO of Water: *

Collected by: TWRA Biologist and Kevin Hamed
Preservative: none
Remarks: * area already sampled with kick net and seine net
Species &length: 08 Central Stoneroller
01 Blacknose Dace
04 Banded Sculpin
02 Yellow Bullhead Catfish
04 Snubnose Darter
01 White Sucker
03 Redbreasted Sunfish
04 Northern Hogsucker
01 Bluegill

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 15 Date: 20 October 1998

Survey Site No.: 32* Time: 1200

State: Tennessee Locality: Trinkle Creek

County: Sullivan Drainage: Holston

Width of stream: * Vegetation: *

Bottom: * Water Temp: *

Air Temp: * Water Velocity: *

Shore: * Depth of water: *

Depth captured: * pH of Water: *

Method captured: electroshocking DO of Water: *

Collected by: TWRA Biologist and Kevin Hamed

Preservative: none

Remarks: * area electroshocked has previously been sampled with a kick net

Species &length: 21 Creek Chub
15 Blacknose Dace
08 Tennessee Dace

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 15 | Date: 20 October 1998

Survey Site No.: 33 | Time: 1345

State: Tennessee | Locality: Steele Creek (BD)

County: Sullivan | Drainage: Holston

Width of stream: * | Vegetation: *

Bottom: * | Water Temp: *

Air Temp: * | Water Velocity: *

Shore: * | Depth of water: *

Depth captured: * | pH of Water: *

Method captured: electroshocking | DO of Water: *

Collected by: TWRA Biologist and Kevin Hamed

Preservative: none

Remarks: * area electroshocked was previously sampled with a kick net

Species &length:

15 Blacknose Dace	40
Creek Chub	01
Redbreast Sunfish	01
Warmouth Sunfish	
01 Banded Sculpin	
01 Bluegill	
02 Largemouth bass	

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 16
Date: 28 October 1998
Survey Site No.: 34*
Time: 1500
State: Tennessee
Locality: Slagle Creek
County: Sullivan
Drainage: Holston

Width of stream: W-110cm L-150cm
Vegetation: none
Bottom: *
Water Temp: 13 C
Air Temp: 15 C
Water Velocity: not measurable
Shore: rock
Depth of water: max 10 cm

Depth captured: 6.4 cm
pH of Water: *
Method captured: kick net
DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: * re-evaluation of survey site no. 21 -- pH and DO readings not taken
Species &length: First year Tennessee Dace present in pool

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 16 | Date: 28 October 1998

Survey Site No.: 35* | Time: 1510

State: Tennessee | Locality: Slagle Creek

County: Sullivan | Drainage: Holston

Width of stream: W-1m L-200cm | Vegetation: none

Bottom: * | Water Temp: 13 C

Air Temp: 15 C | Water Velocity: not measurable

Shore: rock | Depth of water: max 17 cm

Depth captured: 10cm | pH of Water: *

Method captured: Kick net | DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed

Preservative: none

Remarks: * re-evaluation of survey site no. 22 -- pH and DO readings not taken

Species &length: Creek Chub present in pool

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 16 | Date: 28 October 1998

Survey Site No.: 36* | Time: 1520

State: Tennessee | Locality: Slagle Creek

County: Sullivan | Drainage: Holston

Width of stream: W-144cm L-340cm | Vegetation: none

Bottom: | Water Temp: 13 C

Air Temp: 15 C | Water Velocity: not measurable

Shore: 80% rock- 20% silt | Depth of water: max 14

Depth captured: 9.6 cm | pH of Water: *

Method captured: kick net | DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed

Preservative: none

Remarks: * re-evaluation of survey site no. 23 -- pH and DO readings not taken

Species &length: Creek Chub present in pool

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 16 | Date: 28 October 1998

Survey Site No.: 37* | Time: 1530

State: Tennessee | Locality: Slagle Creek

County: Sullivan | Drainage: Holston

Width of stream: W-150cm L-750vm | Vegetation: none

Bottom: * | Water Temp: 13 C

Air Temp: 15 C | Water Velocity: not measurable

Shore: 80% rock- 20% silt | Depth of water: max 20 cm

Depth captured: 18.8 cm | pH of Water: *

Method captured: kick net | DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed

Preservative: none

Remarks: * re-evaluation of survey site no. 24 -- pH and DO readings not taken

Species &length: Creek Chub present in pool

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 16
Date: 28 October 1998
Survey Site No.: 38*
Time: 1540
State: Tennessee
Locality: Slagle Creek
County: Sullivan
Drainage: Holston

Width of stream: W-260cm L-400cm
Vegetation: none
Bottom: *
Water Temp: 13 C
Air Temp: 15 C
Water Velocity: not measurable
Shore: 60% rock - 40% vegetation
Depth of water: max 24 cm

Depth captured: 15.9 cm
pH of Water: *
Method captured: kick net
DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed
Preservative: none
Remarks: * re-evaluation of survey site no. 25 -- pH and DO readings not taken
Species &length: Movement identified but no specific species caught.
The following areas of bed rock contained Faintail Darters. The bed rock area had a width of 1 meter and a length of 10 meters. The maximium depth was 14cm and the average depth was 1.9 cm.

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 17 | Date: 29 October 1998

Survey Site No.: 39 | Time: 1500

State: Tennessee | Locality: Trinkle Creek

County: Sullivan | Drainage: Holston

Width of stream: 1 meter | Vegetation: none

Bottom: | Water Temp: 11 C

Air Temp: 15 C | Water Velocity: not measurable

Shore: vegetated | Depth of water: 91.4 cm

Depth captured: less than 91.4 cm | pH of Water: 7

Method captured: kick net | DO of Water: 5.7 ppm

Collected by: Sarah Garrett and Kevin Hamed

Preservative: none

Remarks: One pool in this survey site that was 2m wide and 3m long.

Species &length: 05 Creek Chub below 50mm
01 Creek Chub between 50mm-90mm
01 Blacknose Dace below 22mm
11 Tennessee Dace below 30mm
11 Tennessee Dace between 30mm-49mm
02 Tennessee Dace between 50mm-65 mm
30 Snails (open right)
02 Dusky Salamanders

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 18 | Date: 17 December 1998

Survey Site No.: 40* | Time: 1100

State: Tennessee | Locality: Steele Creek (AD)

County: Sullivan | Drainage: Holston

Width of stream: * | Vegetation: *

Bottom: * | Water Temp: *

Air Temp: * | Water Velocity: *

Shore: * | Depth of water: *

Depth captured: * | pH of Water: *

Method captured: electroshocking | DO of Water: *

Collected by: TVA Biologist and Kevin Hamed

Preservative:

Remarks: * re-evaluation of Steele Creek (AD) -- no readings taken

Species &length: 14 Banded Sculpin
08 Blacknose Dace
02 Bluegill
199 Central Stoneroller
02 Creek Chub
01 Green Sunfish
02 Largemouth Bass
01 Northern Hog Sucker
01 Redbreasted Sunfish
09 Snubnose Darter
01 Yellow Bullhead

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 19 | Date: 19 February 1999

Survey Site No.: 41* | Time: 1300

State: Tennessee | Locality: Steele Creek (AD)

County: Sullivan | Drainage: Holston

Width of stream: * | Vegetation: *

Bottom: * | Water Temp: *

Air Temp: * | Water Velocity: *

Shore: * | Depth of water: *

Depth captured: * | pH of Water: *

Method captured: electoshocking | DO of Water: *

Collected by: TWRA Biologist Rick Bivens, Sarah G., and Kevin H.

Preservative:

Remarks: * re-evaluation of Steele Creek (AD) -- no readings taken

Species &length: 18 Banded Sculpin
20 Blacknose Dace
100 Central Stoneroller
01 Creek Chub
01 Green Sunfish
25 Snubnose Darter
01 Yellow Bullhead

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 19
Date: 19 February 1998
Survey Site No.: 42*
Time: 1445
State: Tennessee
Locality: Slagle Creek
County: Sullivan
Drainage: Holston

Width of stream: *
Vegetation: *
Bottom: *
Water Temp: *
Air Temp: *
Water Velocity: *
Shore: *
Depth of water: *

Depth captured: *
pH of Water: *
Method captured: electroshocking
DO of Water: *

Collected by: TWRA Biologist Rick Bivens, Sarah Garrett, and Kevin H.
Preservative:
Remarks: * re-evaluation of Slagle Creek -- no readings taken
Species &length: 04 Tennessee Dace 40mm-45mm
02 Tennessee Dace Last Year
06 Blacknose Dace
15 Striped Shiner
20 Central Stoneroller
06 Creek Chub

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 20 | Date: 15 March 1999

Survey Site No.: 43* | Time: 1500

State: Tennessee | Locality: Trinkle Creek

County: Sullivan | Drainage: Holston

Width of stream: * | Vegetation: *

Bottom: * | Water Temp: *

Air Temp: * | Water Velocity: *

Shore: * | Depth of water: *

Depth captured: * | pH of Water: *

Method captured: Kick Net | DO of Water: *

Collected by: Sarah Garrett

Preservative:

Remarks: * re-evaluation of Trinkle Creek -- no readings taken

Species &length:

01 Creek Chub 55mm
01 Creek Chub 80mm
01 Creek Chub 115mm
01 Blacknose Dace 20mm
02 Blacknose Dace 24mm
02 Blacknose Dace 27mm
01 Tennessee Dace 20mm
01 Tennessee Dace 21mm
01 Tennessee Dace 22mm
05 Tennessee Dace 25mm
03 Tennessee Dace 30mm
04 Tennessee Dace 35mm
01 Tennessee Dace 40mm
02 Tennessee Dace 45mm
03 Tennessee Dace 50mm
02 Tennessee Dace 52mm
11 Tennessee Dace 55mm
03 Tennessee Dace 60mm
01 Tennessee Dace 61mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 21
Survey Site No.: 44*
State: Tennessee
County: Sullivan

Date: 24 March 1999
Time: 1300
Locality: Trinkle Creek
Drainage: Holston

Width of stream: *
Bottom: *
Air Temp: *
Shore: *

Vegetation: *
Water Temp: *
Water Velocity: *
Depth of water: *

Depth captured: *
Method captured: Kick net

pH of Water: *
DO of Water: *

Collected by: Sarah Garrett and Kevin Hamed
Preservative:
Remarks: GPS Reading: N36degrees34'43.42" W82degrees12'17.39"

Species &length:

02 Creek Chub 50mm
01 Creek Chub 60mm
01 Creek Chub 70mm
01 Creek Chub 75mm
01 Creek Chub 90mm
01 Creek Chub 110mm
01 Creek Chub 115mm
01 Blacknose Dace 17mm
01 Blacknose Dace 20mm
01 Blacknose Dace 21mm
02 Blacknose Dace 22mm
01 Blacknose Dace 25mm
01 Blacknose Dace 30mm
01 Blacknose Dace 35mm
01 Blacknose Dace 43mm
01 Blacknose Dace 45mm
01 Tennessee Dace 60mm
02 Blacknose Dace 46mm
01 Blacknose Dace 47mm
01 Blacknose Dace 50mm
01 Blacknose Dace 65mm
01 Blacknose Dace 80mm
01 Blacknose Dace 85mm
01 Tennessee Dace 19mm
10 Tennessee Dace 20mm
04 Tennessee Dace 23mm
06 Tennessee Dace 24mm
12 Tennessee Dace 25mm
07 Tennessee Dace 30mm
04 Tennessee Dace 35mm
03 Tennessee Dace 40mm
05 Tennessee Dace 45mm
05 Tennessee Dace 54mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 22
Survey Site No.: 45*
State: Tennessee
County: Sullivan

Date: 31 March 1999
Time: 1500
Locality: Trinkle Creek
Drainage: Holston

Width of stream: *
Bottom: *
Air Temp: *
Shore: *

Vegetation: *
Water Temp: *
Water Velocity: *
Depth of water: *

Depth captured: *
Method captured: Kick net

pH of Water: *
DO of Water: *

Collected by: Sarah Garrett and Phil Gentry
Preservative:
Remarks: * re-evaluation of Trinkle Creek -- no readings taken

Species &length:
01 Creek Chub 60mm
01 Creek Chub 63mm
02 Creek Chub 65mm
01 Creek Chub 89mm
01 Creek Chub 90mm
01 Creek Chub 105mm
01 Blacknose Dace 20mm
01 Blacknose Dace 21mm
02 Blacknose Dace 30mm
01 Tennessee Dace 17mm
03 Tennessee Dace 22mm
01 Tennessee Dace 24mm
02 Tennessee Dace 25mm
04 Tennessee Dace 30mm
01 Tennessee Dace 34mm
02 Tennessee Dace 35mm
01 Tennessee Dace 36mm
01 Tennessee Dace 38mm
02 Tennessee Dace 40mm
01 Tennessee Dace 41mm
02 Tennessee Dace 44mm
01 Tennessee Dace 45mm
01 Tennessee Dace 48mm
01 Tennessee Dace 50mm
02 Tennessee Dace 51mm
01 Tennessee Dace 52mm
01 Tennessee Dace 65mm

Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 23
Survey Site No.: 46
State: Tennessee
County: Sullivan

Date: 9 April 1999
Time: 1500
Locality: Trinkle Creek
Drainage: Holston

Width of stream: *
Bottom: *
Air Temp: *
Shore: *

Vegetation: *
Water Temp: 18.5 C
Water Velocity: 1 meter/ 30 sec
Depth of water: *

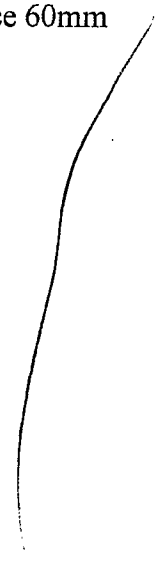
Depth captured: *
Method captured: Kick net

pH of Water: 8.7
DO of Water: 8.4ppm

Collected by: Sarah Garrett
Preservative:
Remarks: * re-evaluation of Trinkle Creek

Species &length:

01 Creek Chub 50mm
01 Creek Chub 62mm
01 Creek Chub 65mm
01 Creek Chub 70mm
01 Creek Chub 95mm
01 Creek Chub 110mm
02 Blacknose Dace 20mm
02 Blacknose Dace 21mm
03 Blacknose Dace 22mm
03 Blacknose Dace 25mm
04 Blacknose Dace 26mm
01 Blacknose Dace 27mm
01 Blacknose Dace 30mm
02 Blacknose Dace 43mm
02 Blacknose Dace 47mm
01 Blacknose Dace 65mm
02 Tennessee Dace 20mm
02 Tennessee Dace 21mm
10 Tennessee Dace 25mm
07 Tennessee Dace 30mm
01 Tennessee Dace 35mm
05 Tennessee Dace 40mm
01 Tennessee Dace 41mm
01 Tennessee Dace 42mm
03 Tennessee Dace 45mm
01 Tennessee Dace 50mm
01 Tennessee Dace 51mm
01 Tennessee Dace 52mm
02 Tennessee Dace 55mm
01 Tennessee Dace 56mm
01 Tennessee Dace 57mm
01 Tennessee Dace 60mm



Survey of Aquatic Environments within Steele Creek Park Boundaries

Trip No.: 24
Survey Site No.: 47*
State: Tennessee
County: Sullivan

Date: 10 April 1999
Time: 1800
Locality: Trinkle Creek
Drainage: Holston

Width of stream: *
Bottom: *
Air Temp: *
Shore: *

Vegetation: *
Water Temp: *
Water Velocity: *
Depth of water: *

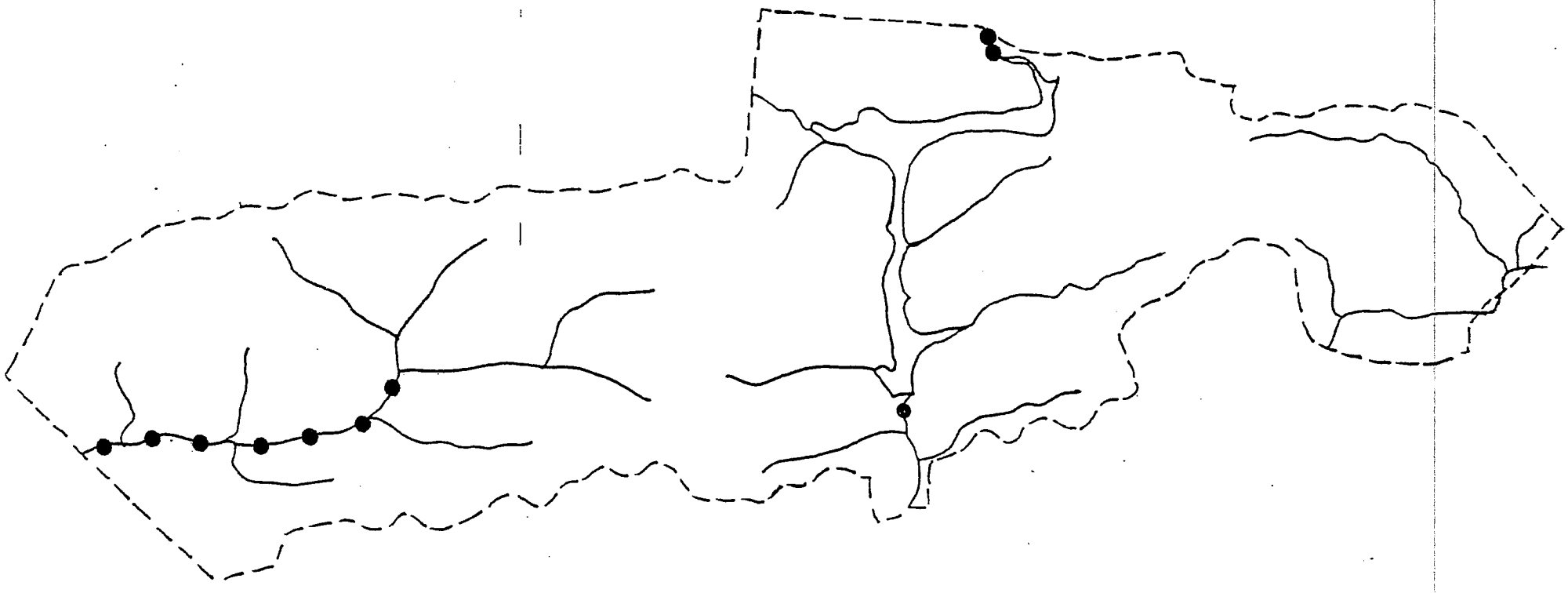
Depth captured: *
Method captured: Kick net

pH of Water: *
DO of Water: *

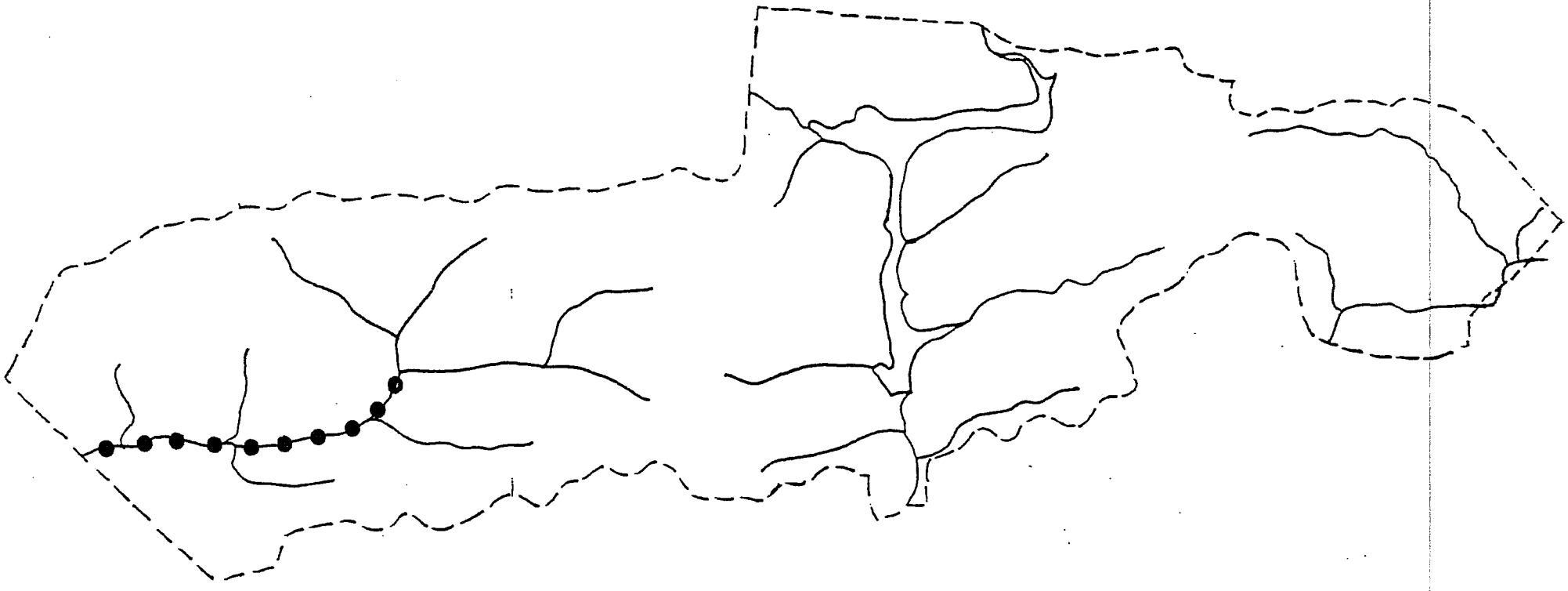
Collected by: Sarah Garrett and Mandi Hobbs
Preservative:
Remarks: * re-evaluation of Trinkle Creek

Species &length:
01 Creek Chub 30mm
01 Creek Chub 36mm
02 Creek Chub 40mm
01 Creek Chub 45mm
01 Creek Chub 57mm
01 Creek Chub 70mm
02 Creek Chub 75mm
02 Blacknose Dace 25mm
01 Blacknose Dace 29mm
04 Blacknose Dace 30mm
01 Blacknose Dace 35mm
02 Tennessee Dace 23mm
03 Tennessee Dace 25mm
01 Tennessee Dace 26mm
01 Tennessee Dace 29mm
01 Tennessee Dace 30mm
02 Tennessee Dace 31mm
02 Tennessee Dace 35mm
02 Tennessee Dace 40mm
01 Tennessee Dace 44mm
02 Tennessee Dace 45mm
03 Tennessee Dace 46mm
03 Tennessee Dace 50mm
01 Tennessee Dace 55mm
01 Tennessee Dace 56mm
01 Tennessee Dace 60mm

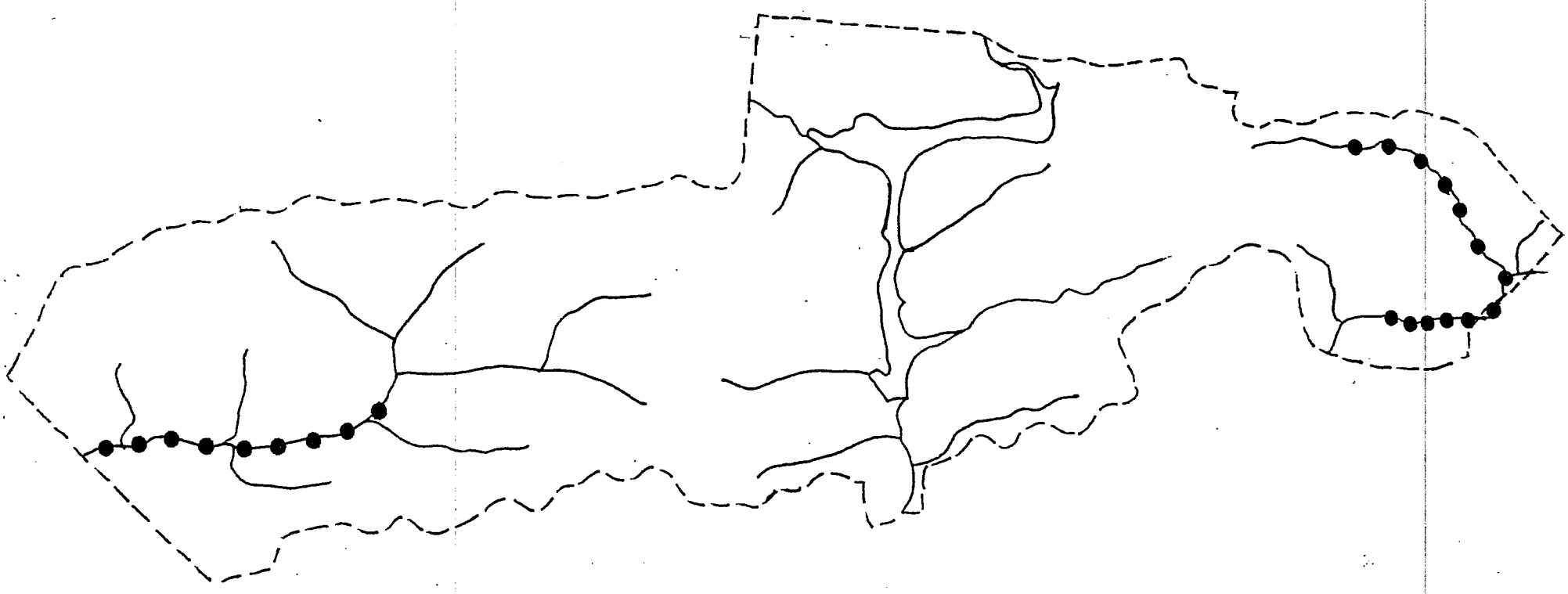
Appendix E
Maps of Location of Fish



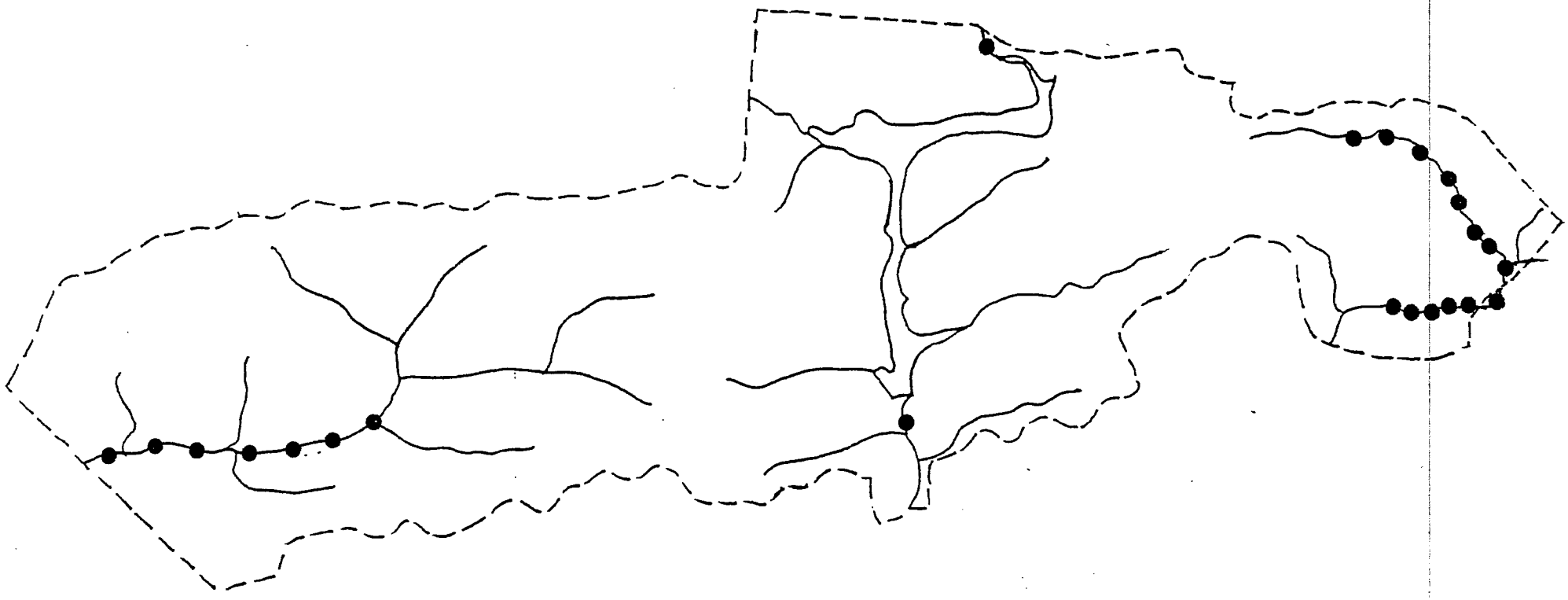
Central stoneroller
Campostoma anomalum



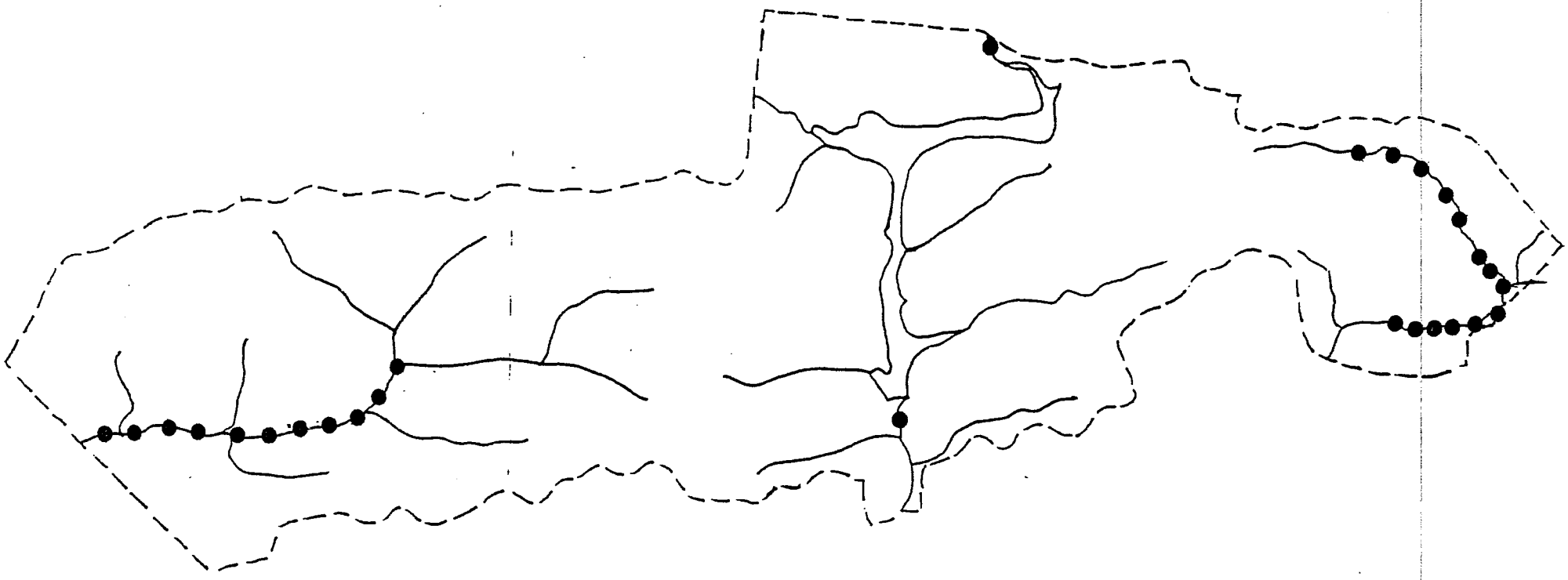
Striped shinner
Luxilus chrysocephalus



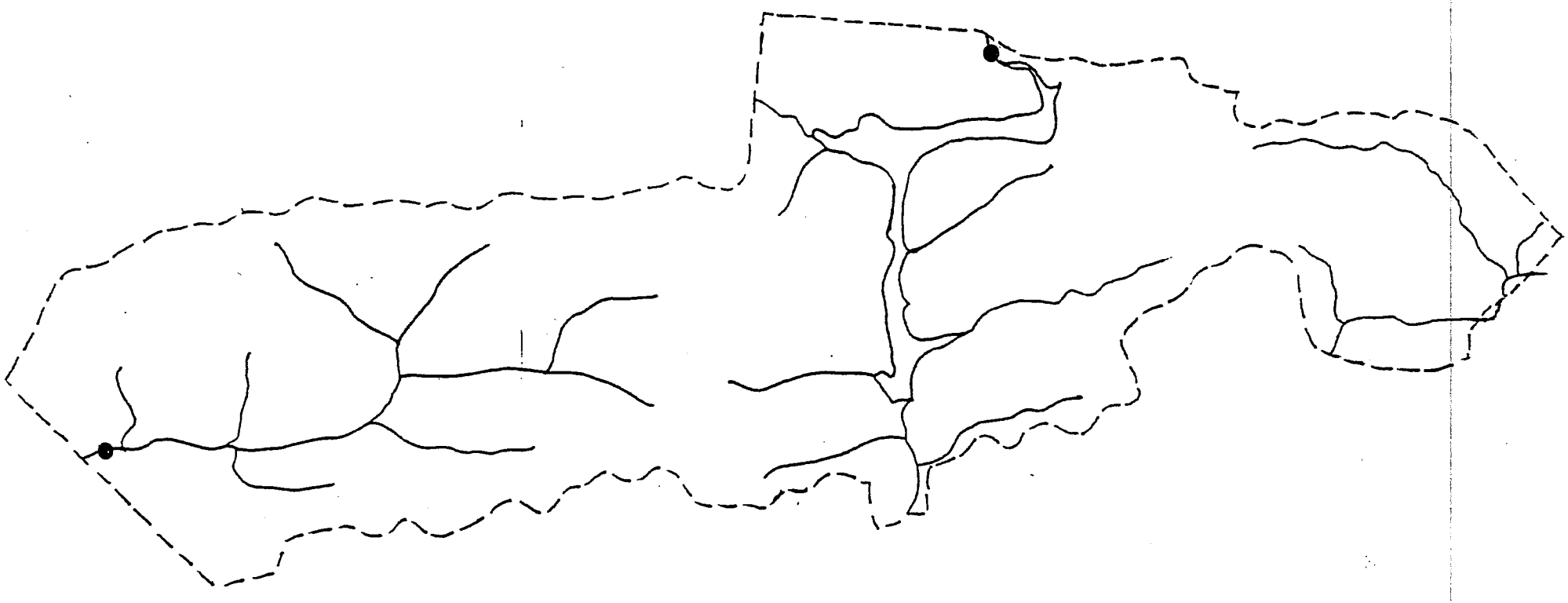
Tennessee Dace
Phoxinus tennesseensis



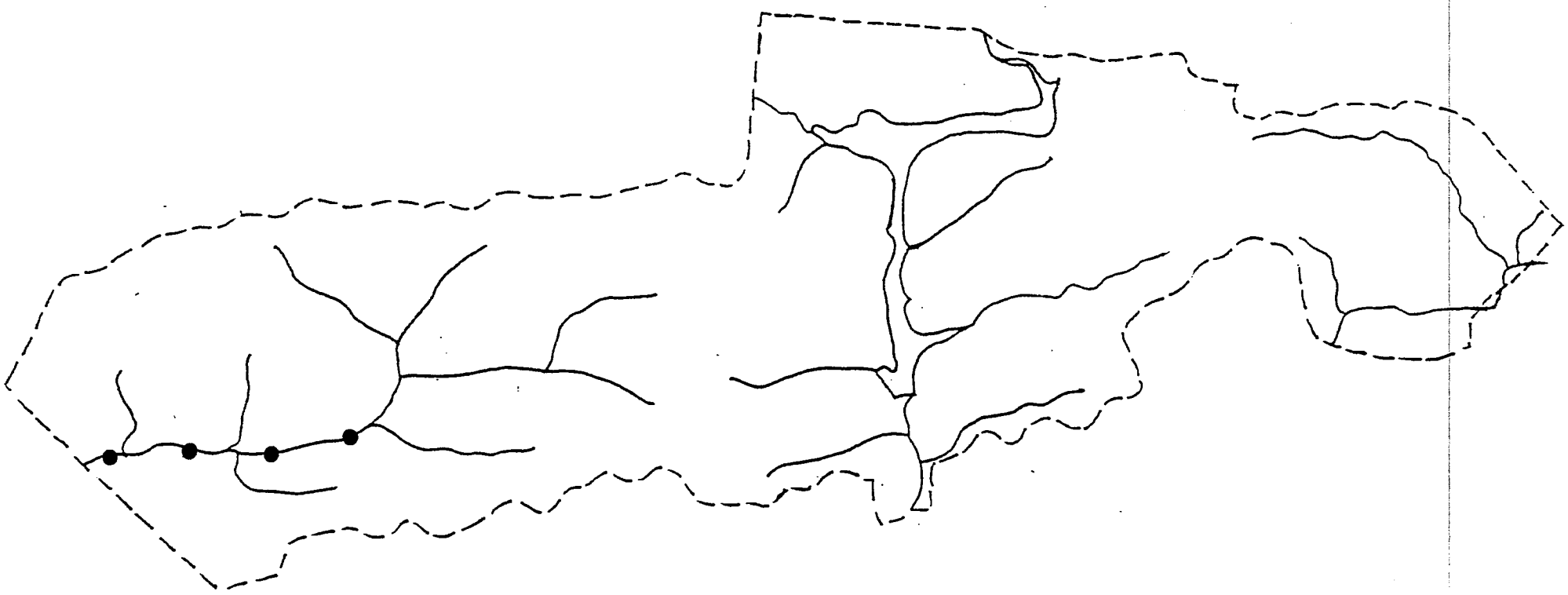
Blacknose Dace
Rhinichthys atratulus



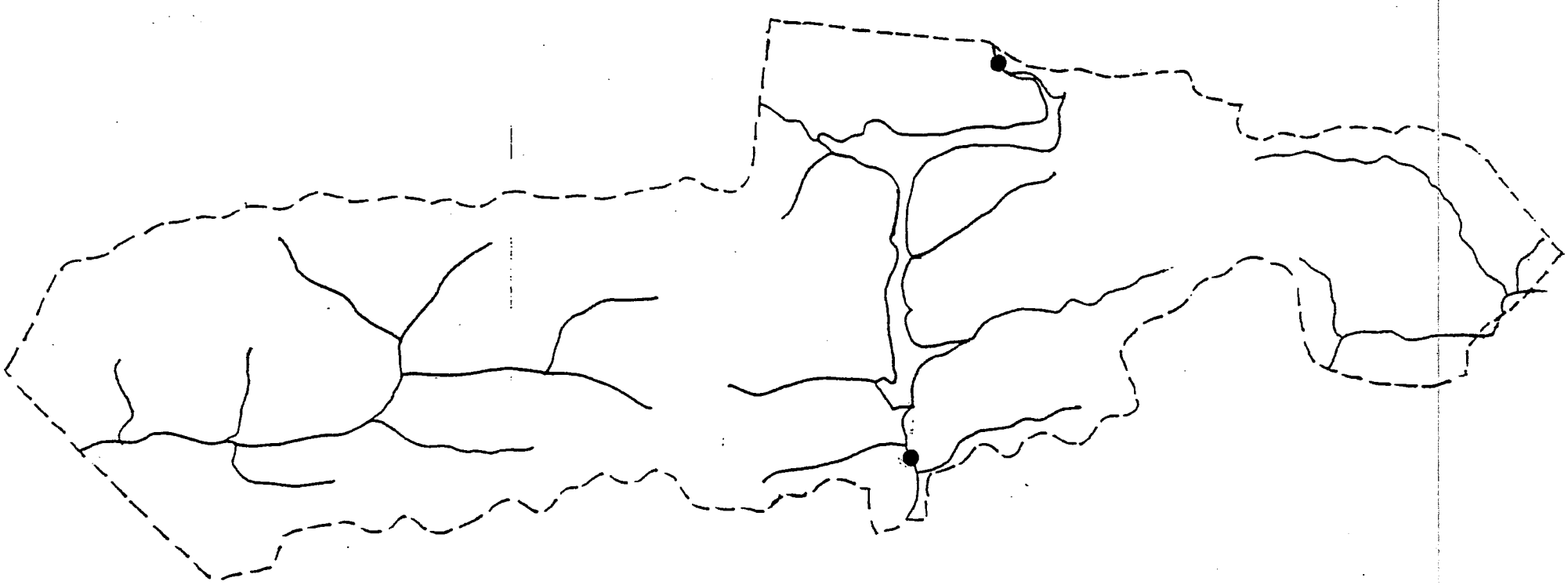
Creek Chub
Semotilus atromaculatus



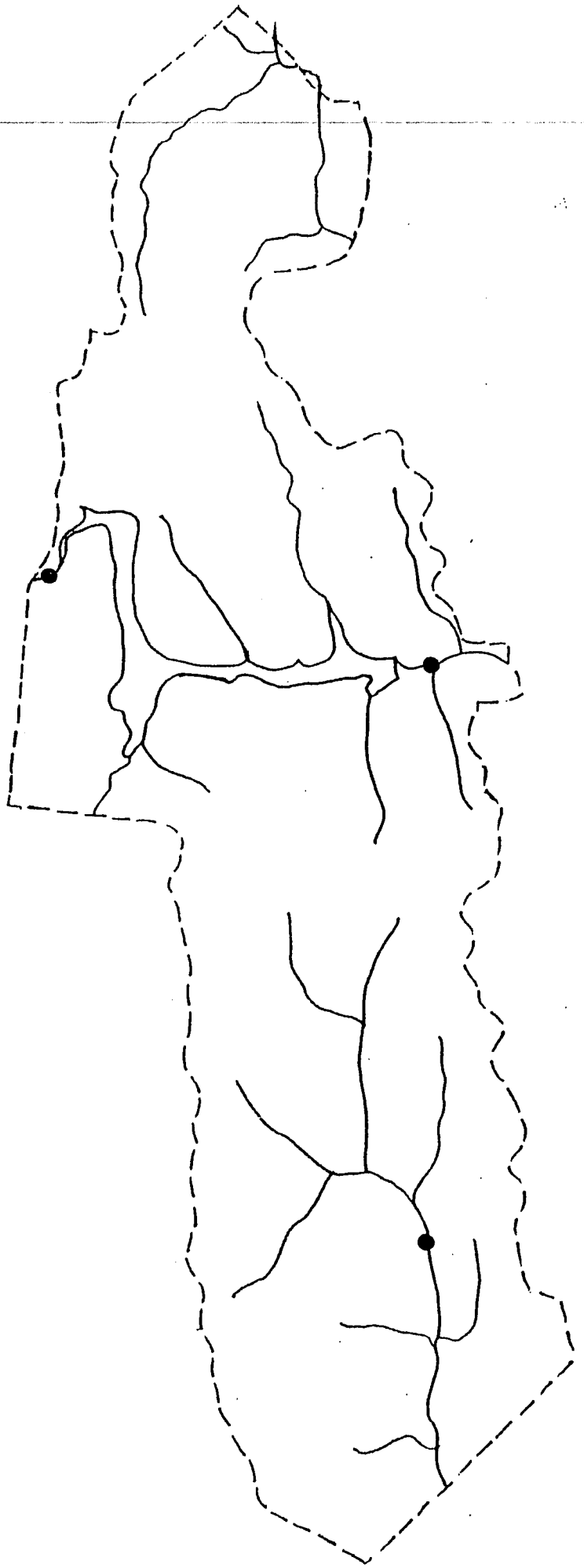
White sucker
Catostomus commersoni



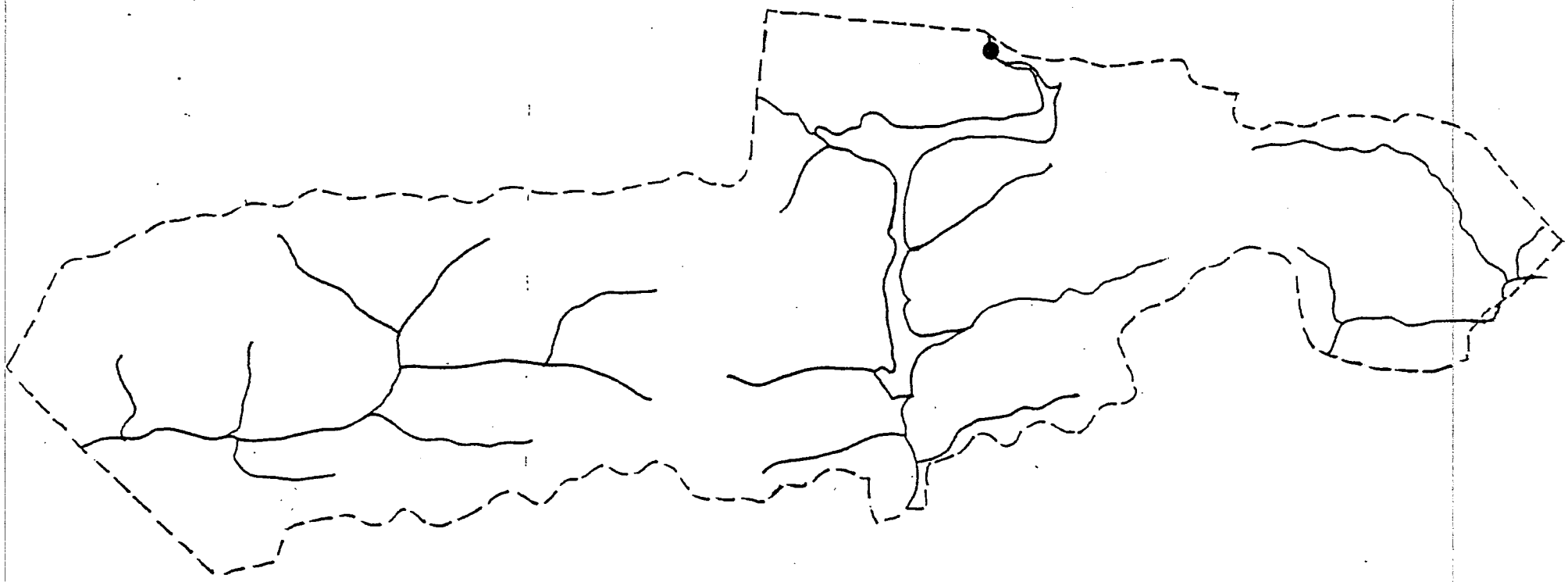
Fantail darter
Etheostoma flabellare



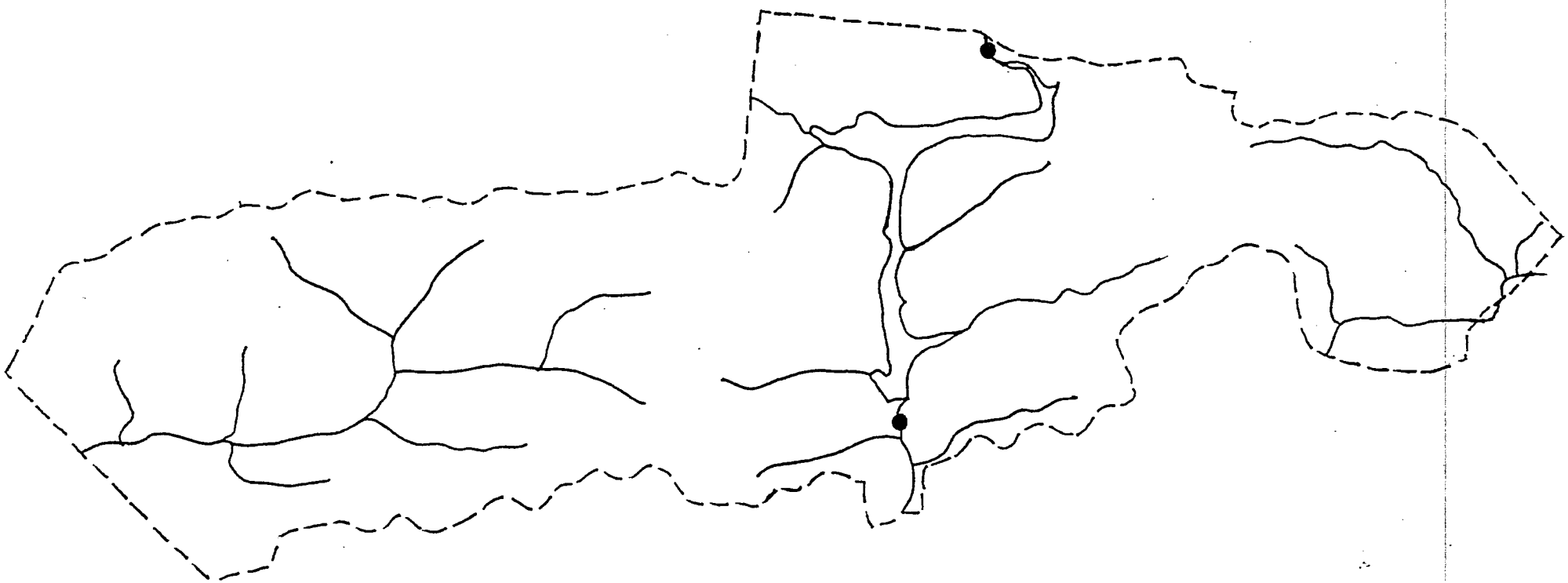
Snubnose darter
Etheostoma simoterum



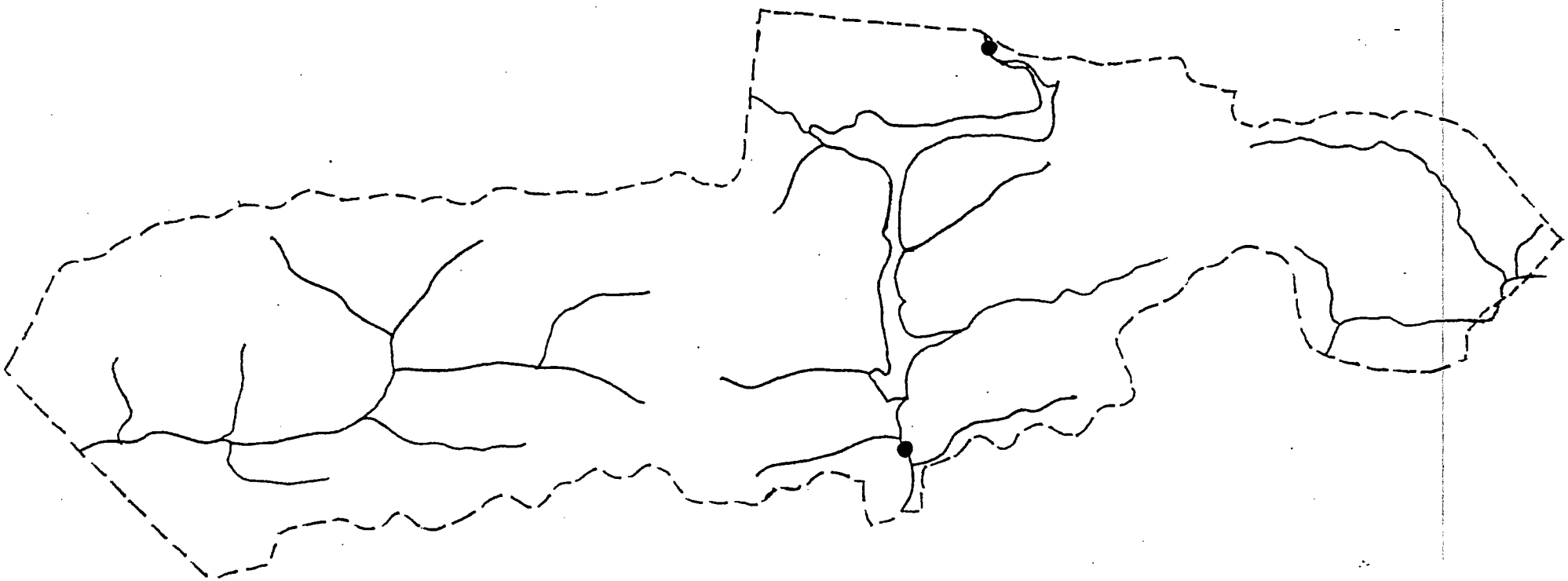
Banded sculpin
Cottus carolinae



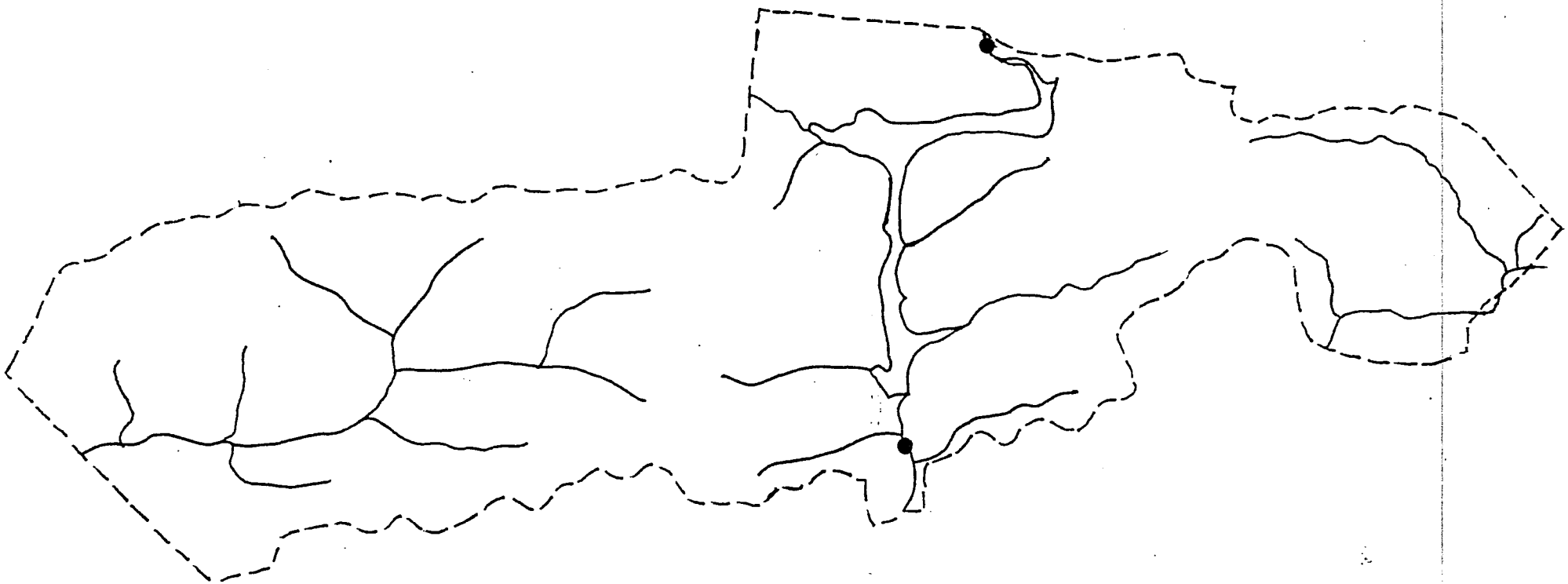
Northern hogsucker
Hypentelium nigricans



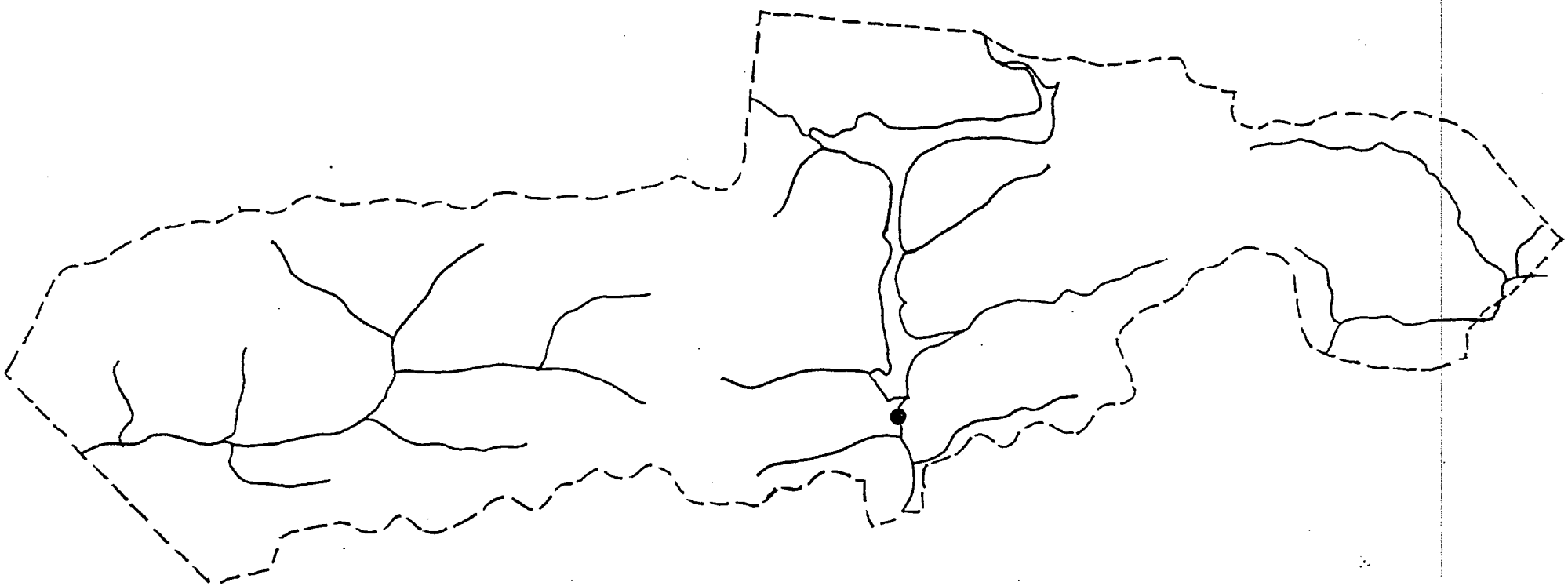
Bluegill
Lepomis macrochirus



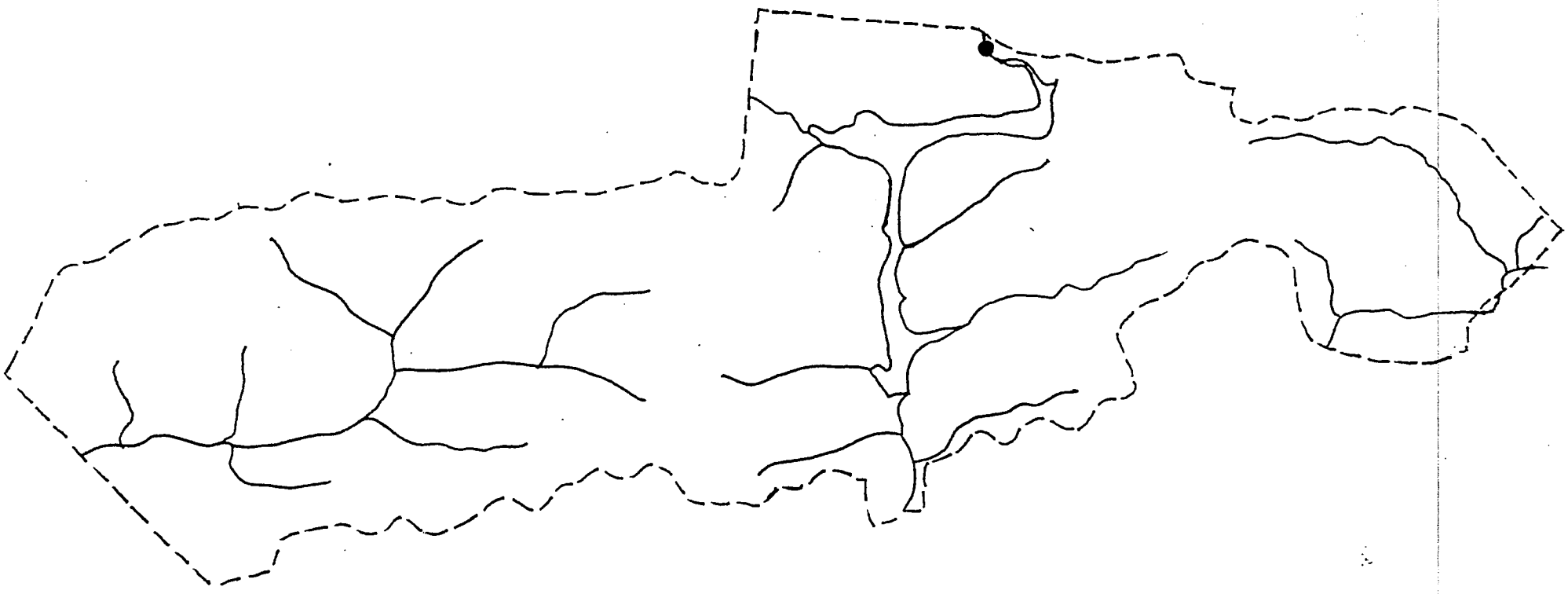
Green Sunfish
Lepomis cyanellus



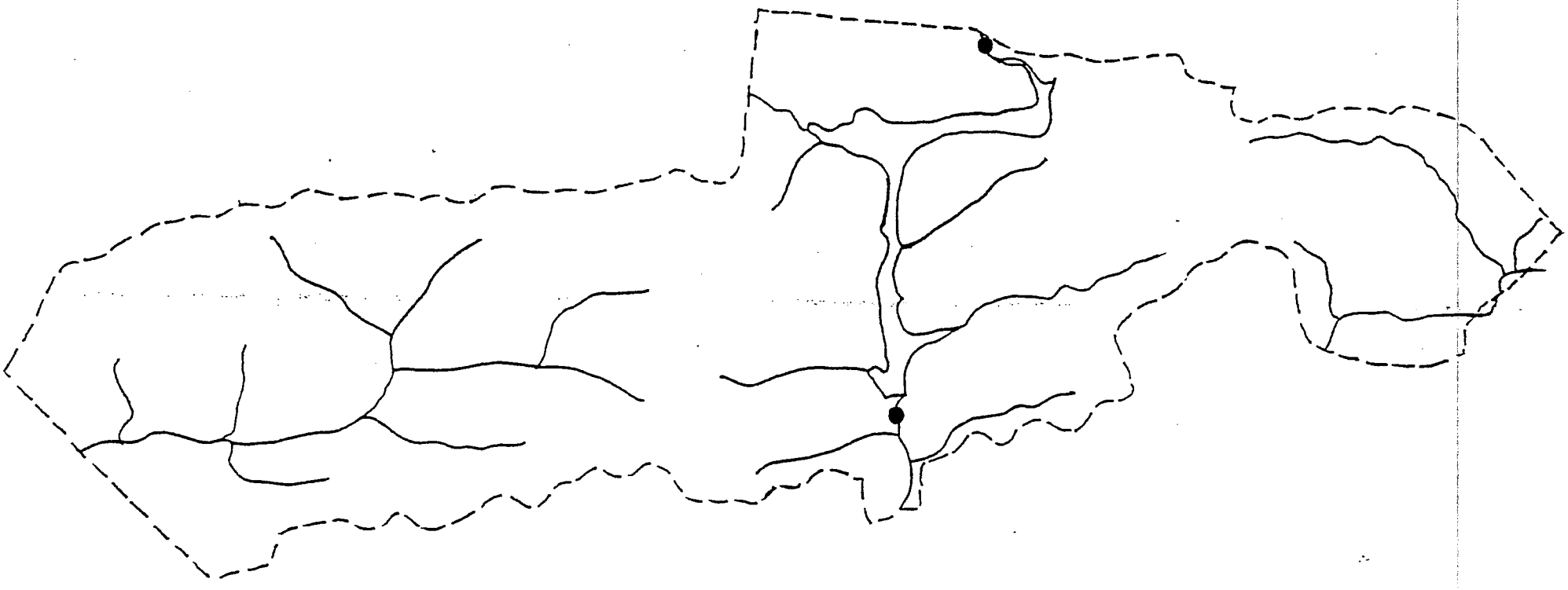
Redbreast sunfish
Lepomis auritus



Warmouth
Lepomis gulsus

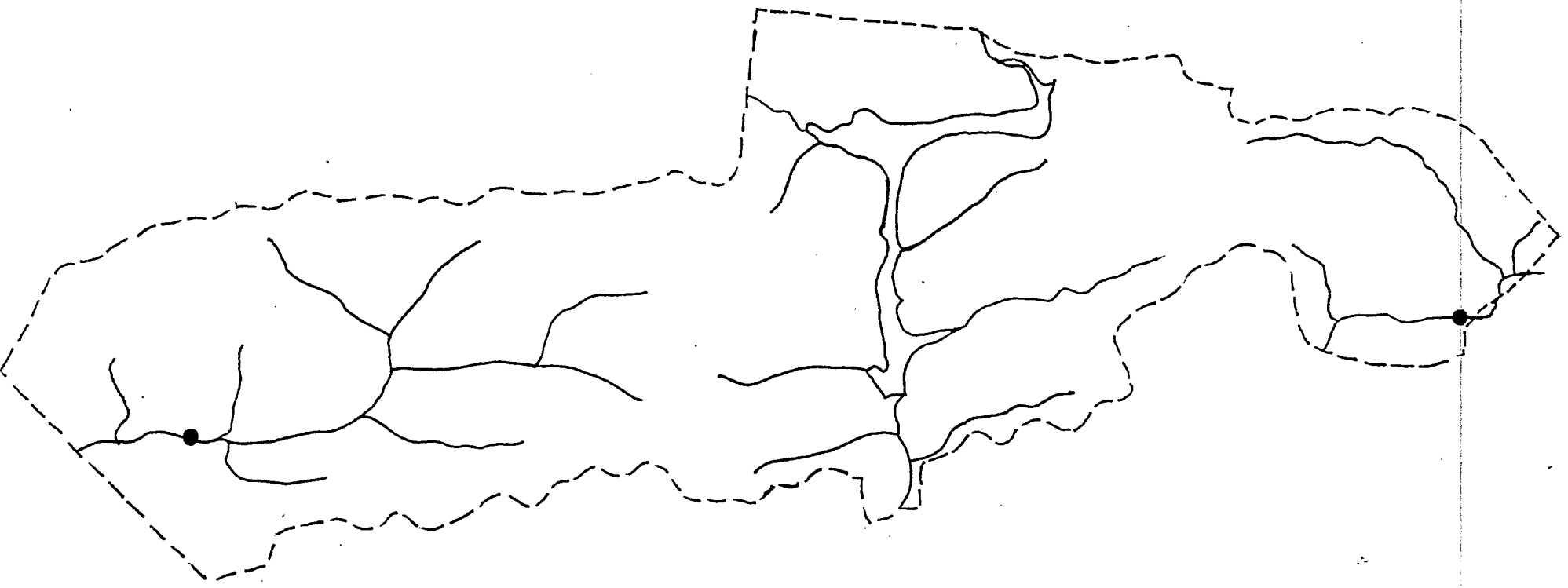


Yellow bullhead
Ameiurus natalis

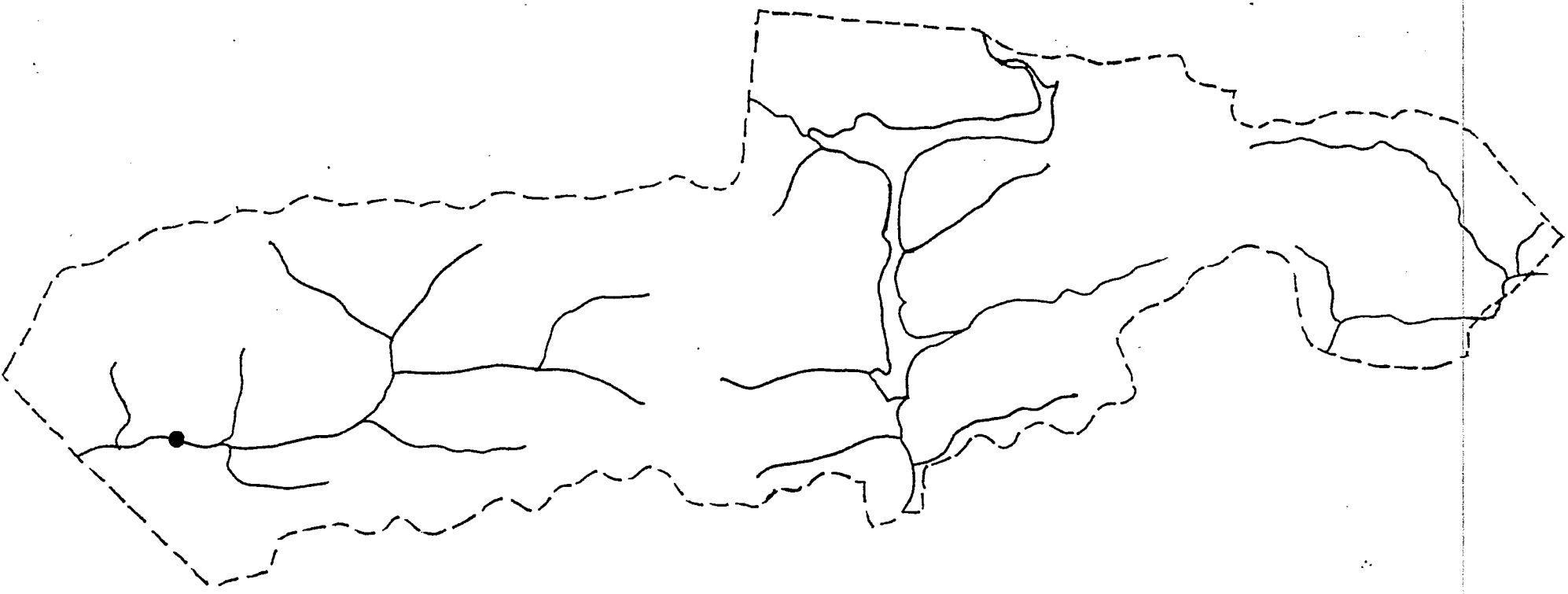


Largemouth bass
Micropterus salmoides

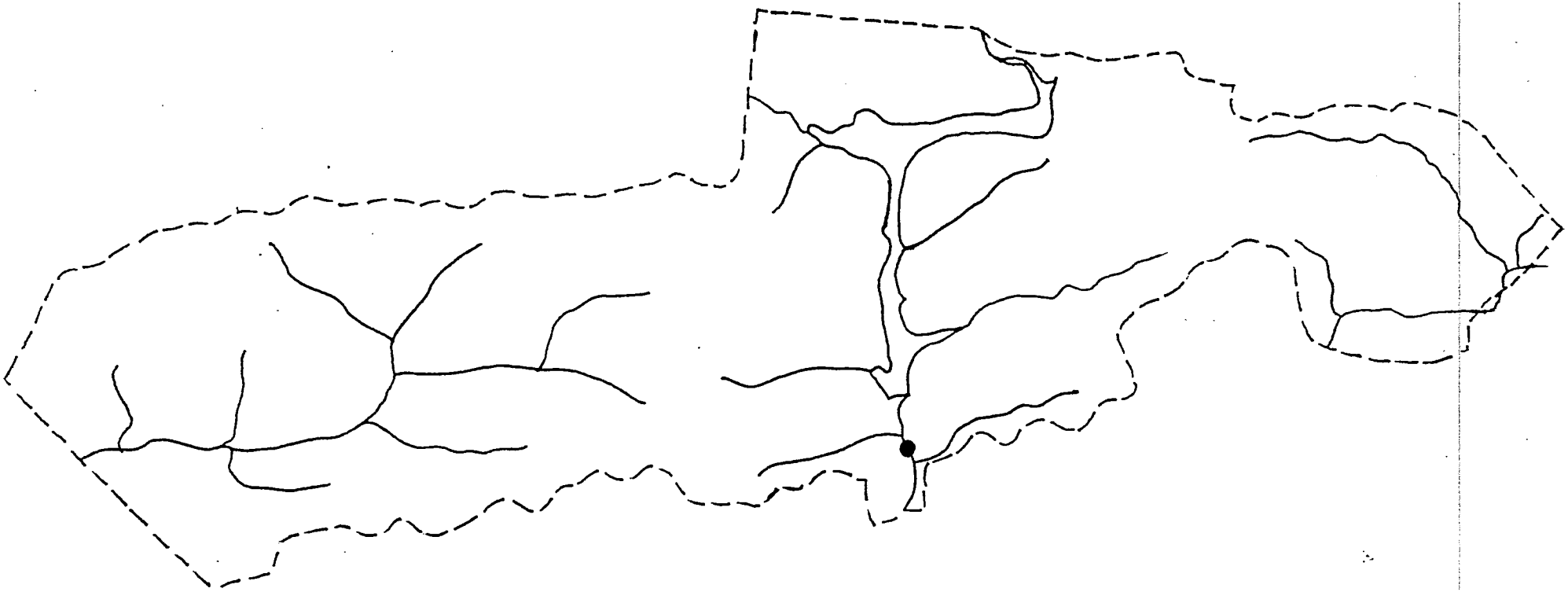
Appendix F
Maps of Location of Insects



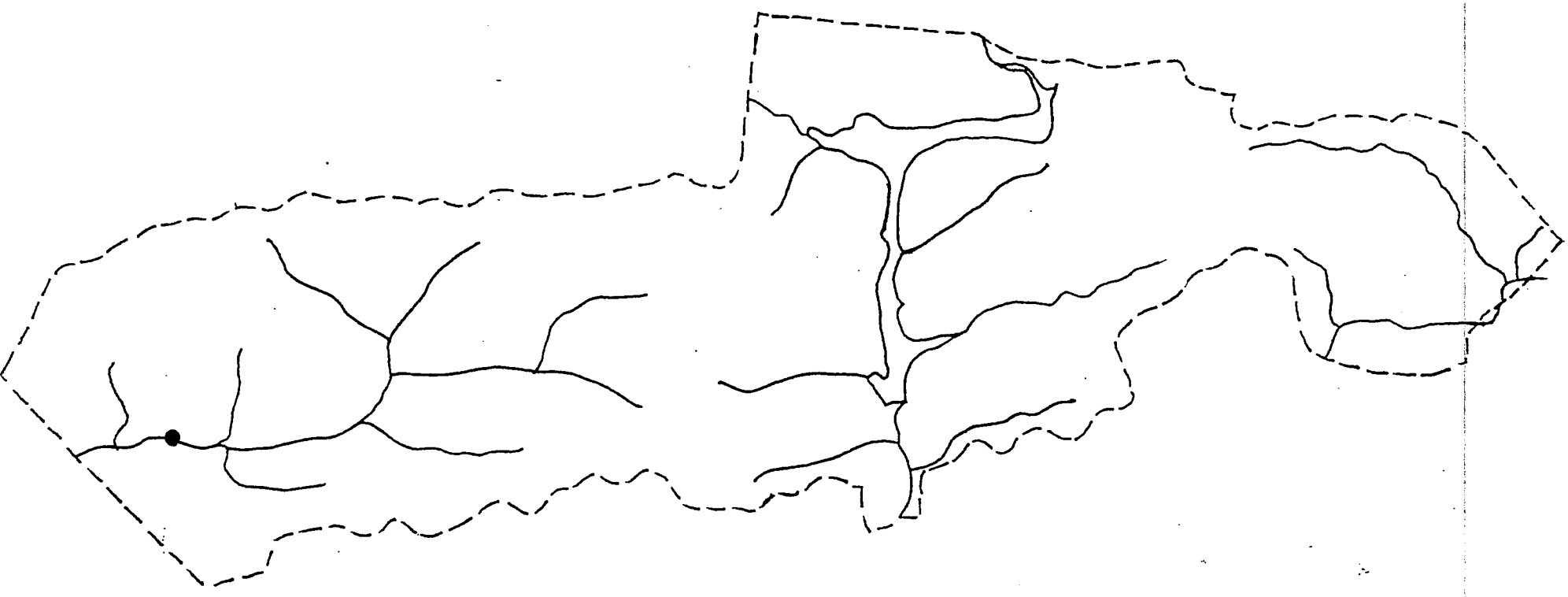
Water strider
Gerris vemigis



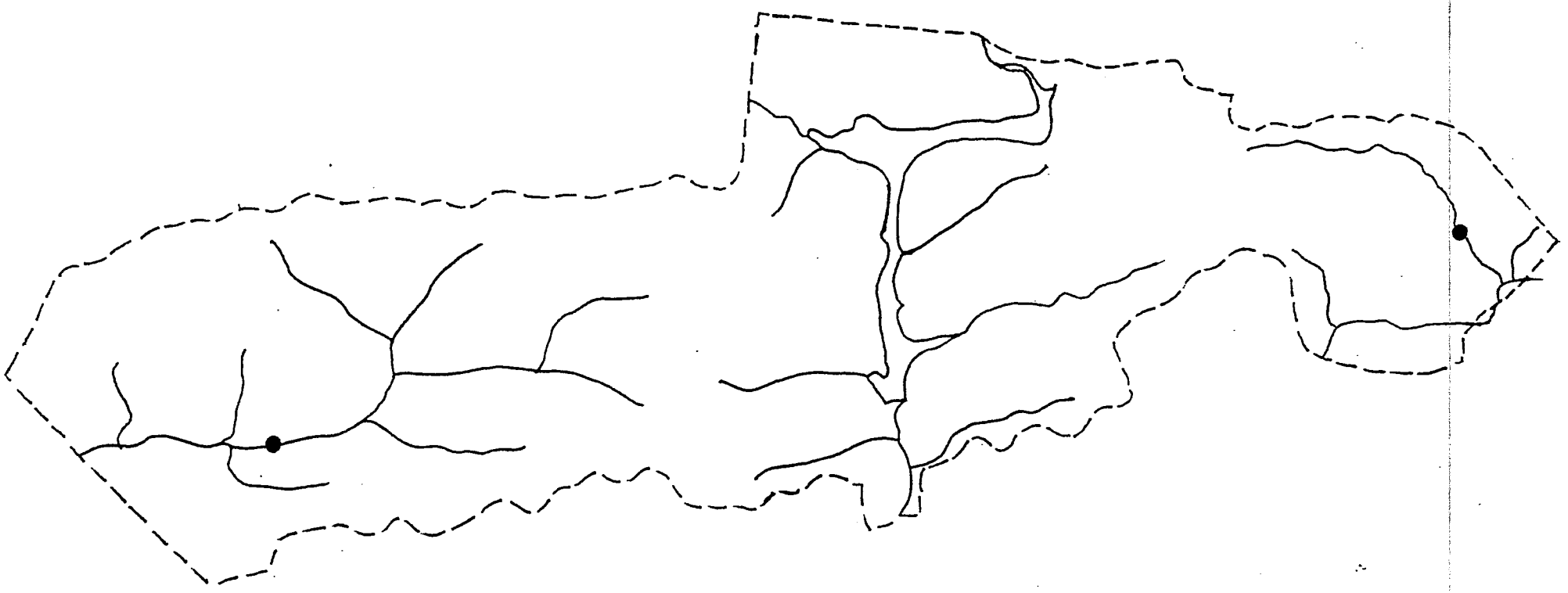
Horse/Deer fly
Tabanus atratus



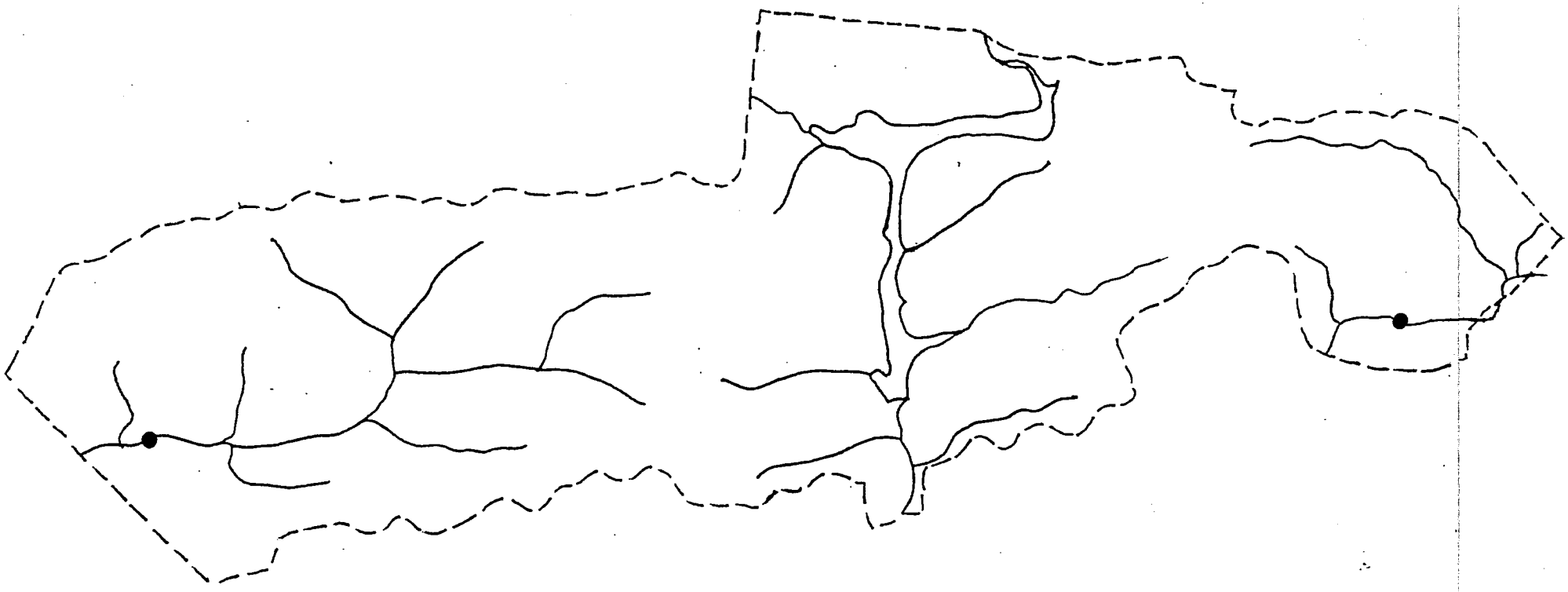
Black fly
Simulium vittatum



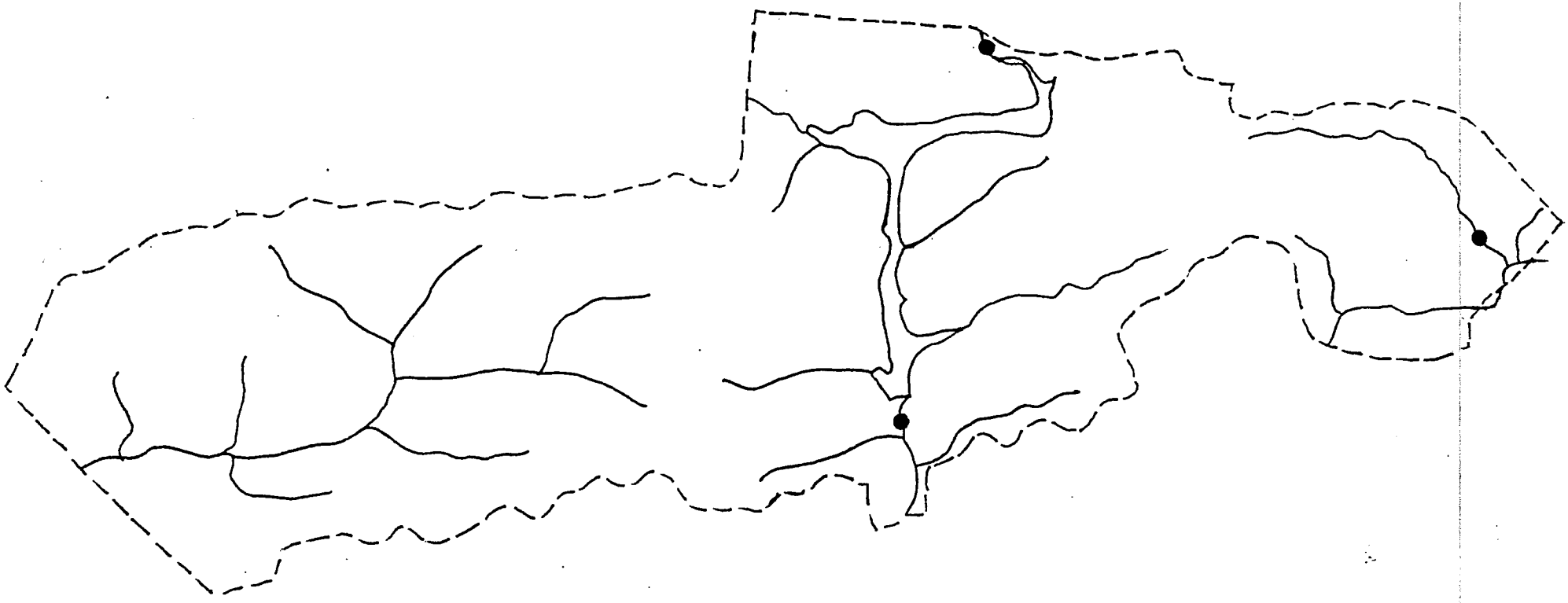
Rolledwinged stonefly
Leuctra spp.



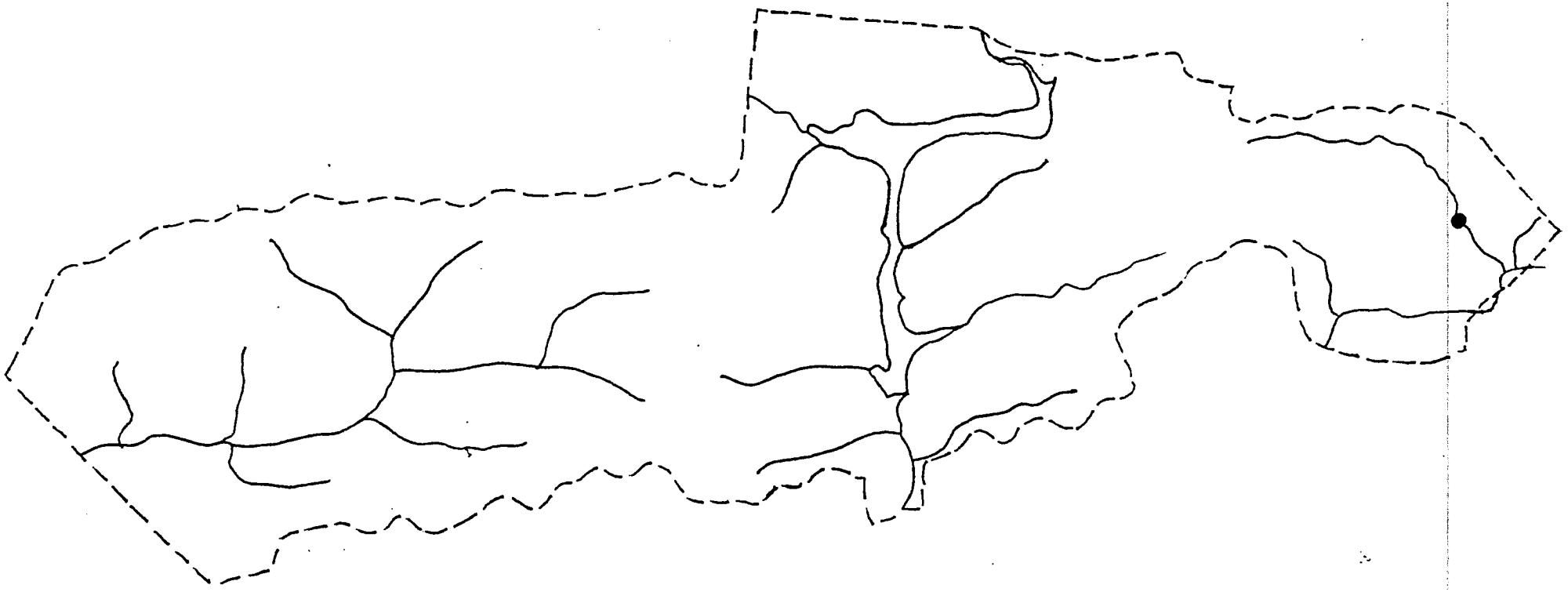
Common stonefly
Acroneuria eroluta



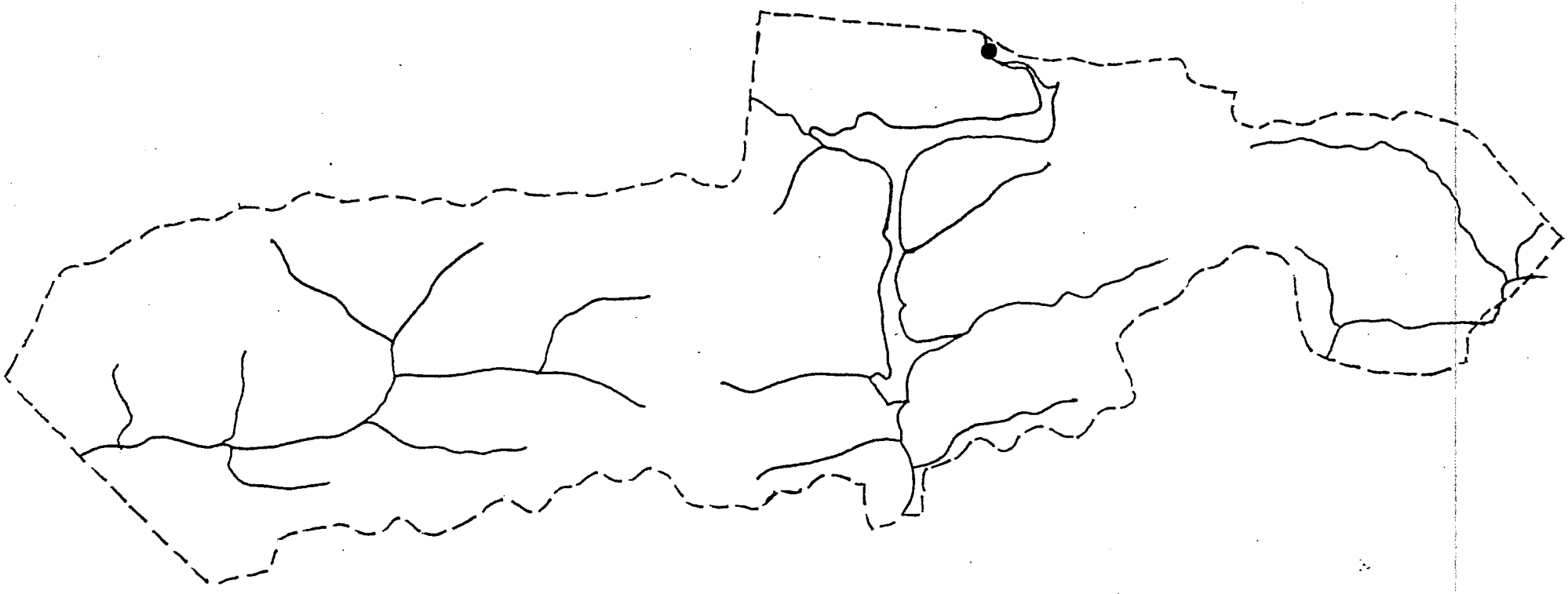
Northern Casemaker
Limnephilus spp.



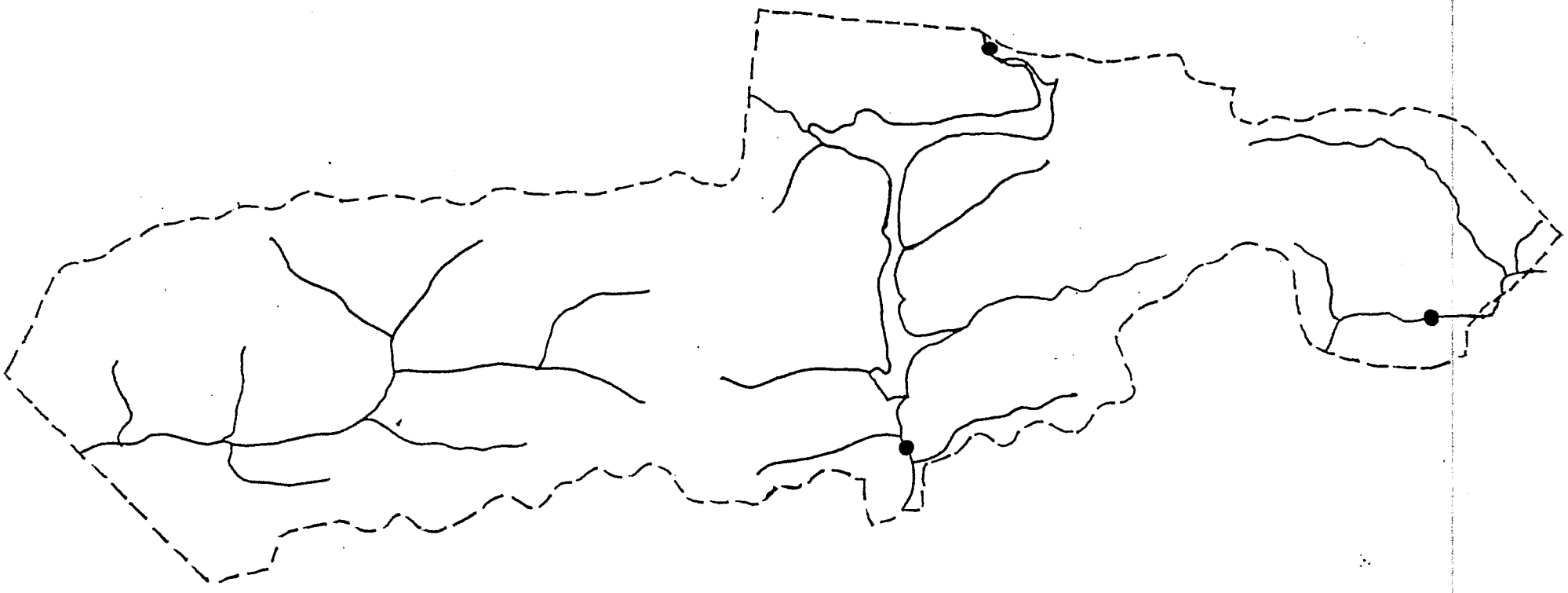
Common netspinner
Symphitopsyche slossanae



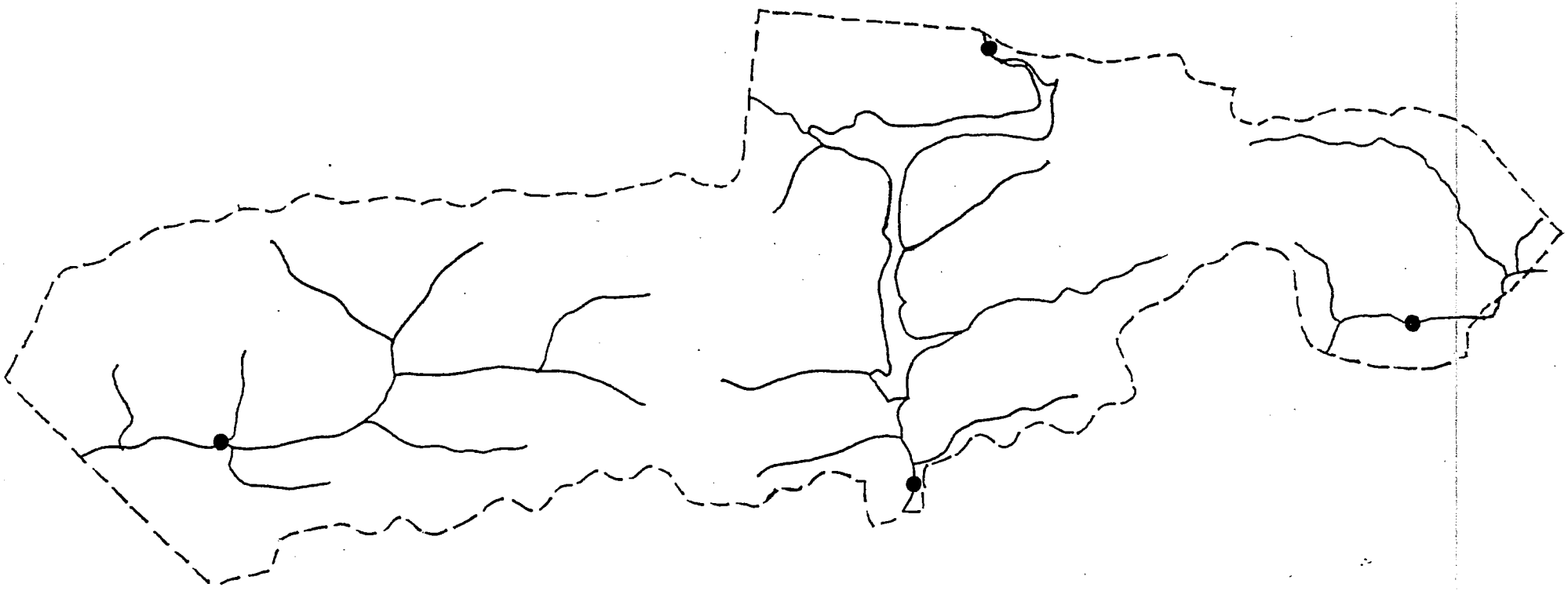
Water penny
Psephenus herricki



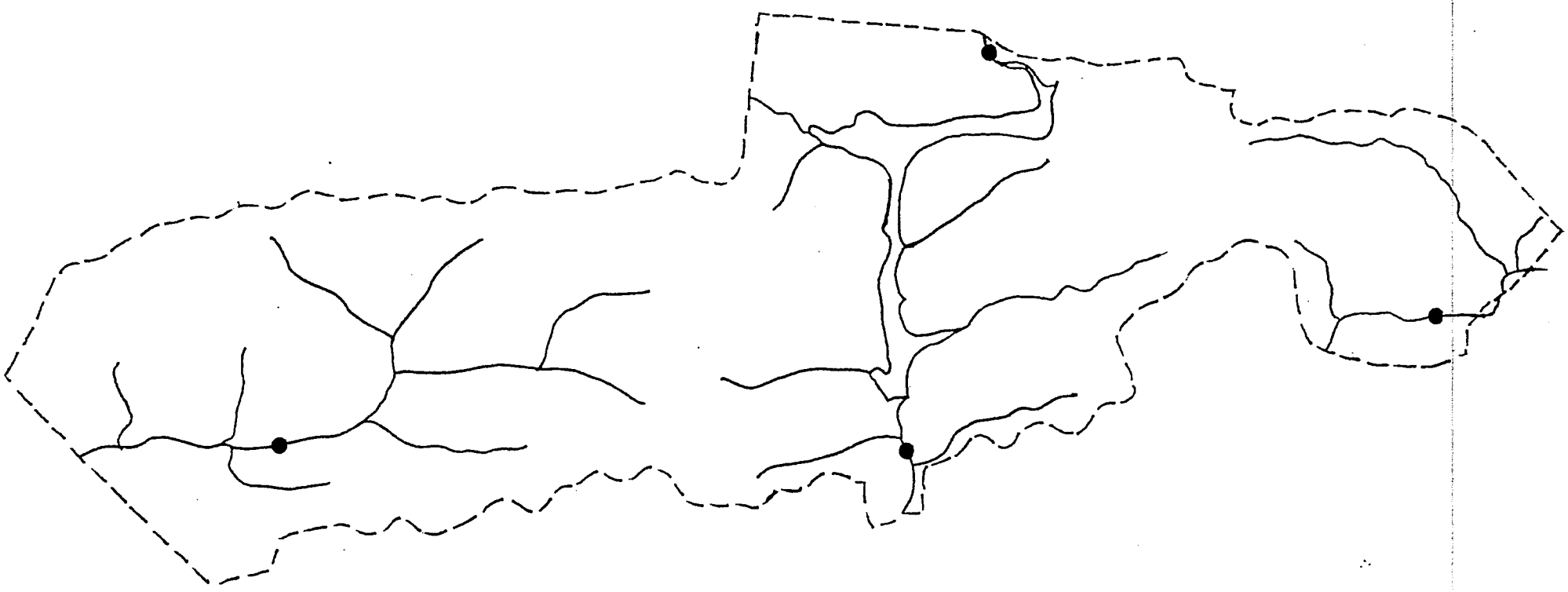
Riffle bettle
Stenelmis spp.



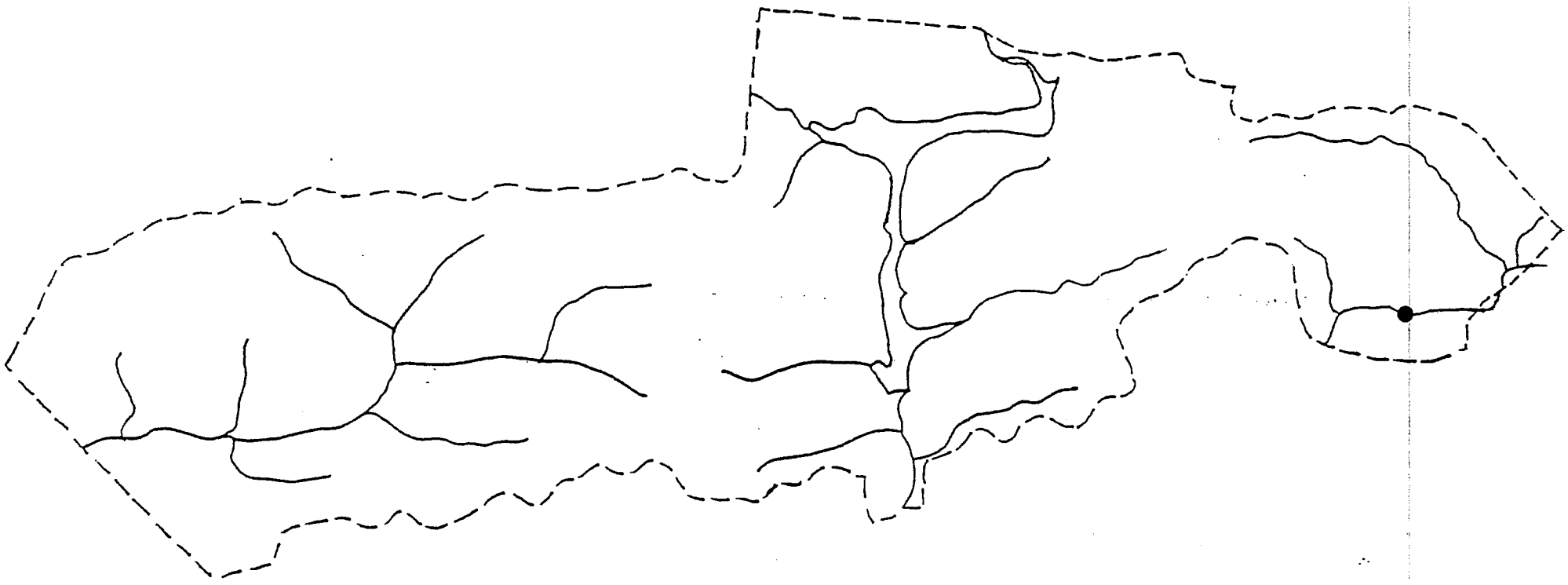
Flatheaded mayfly
Stenacron interpunctatum



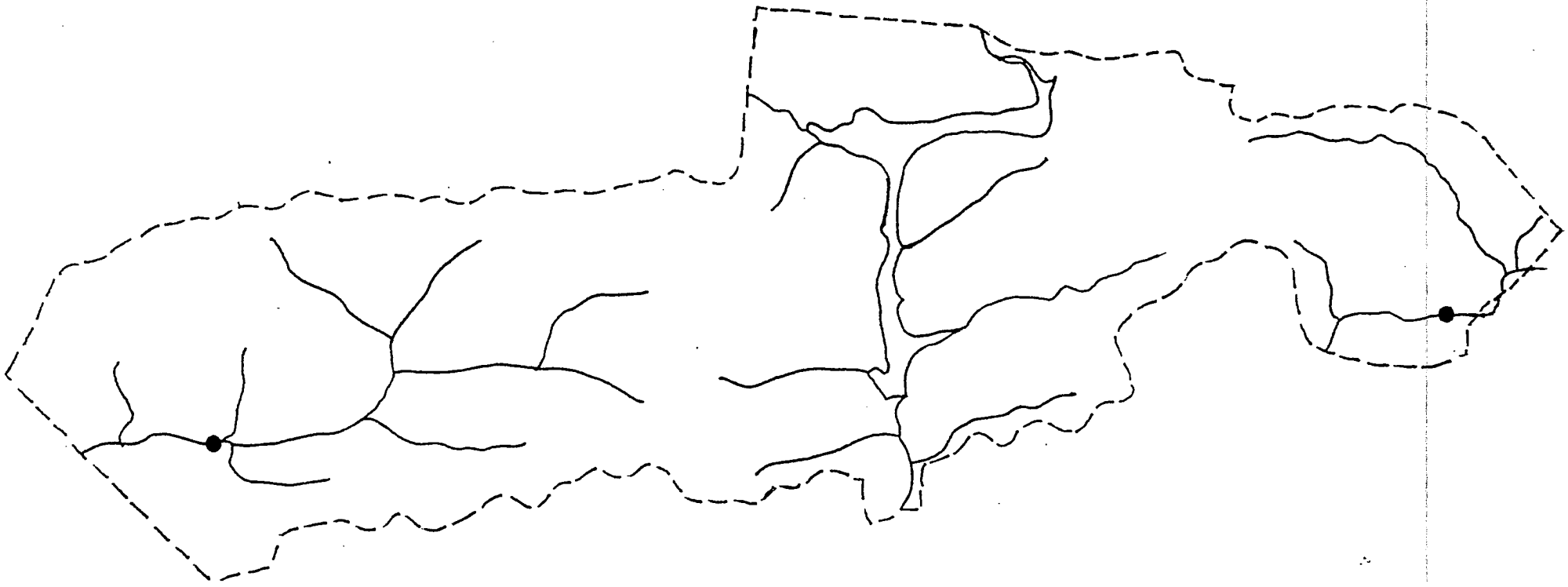
Primitive minnow mayfly
Ameletus spp.



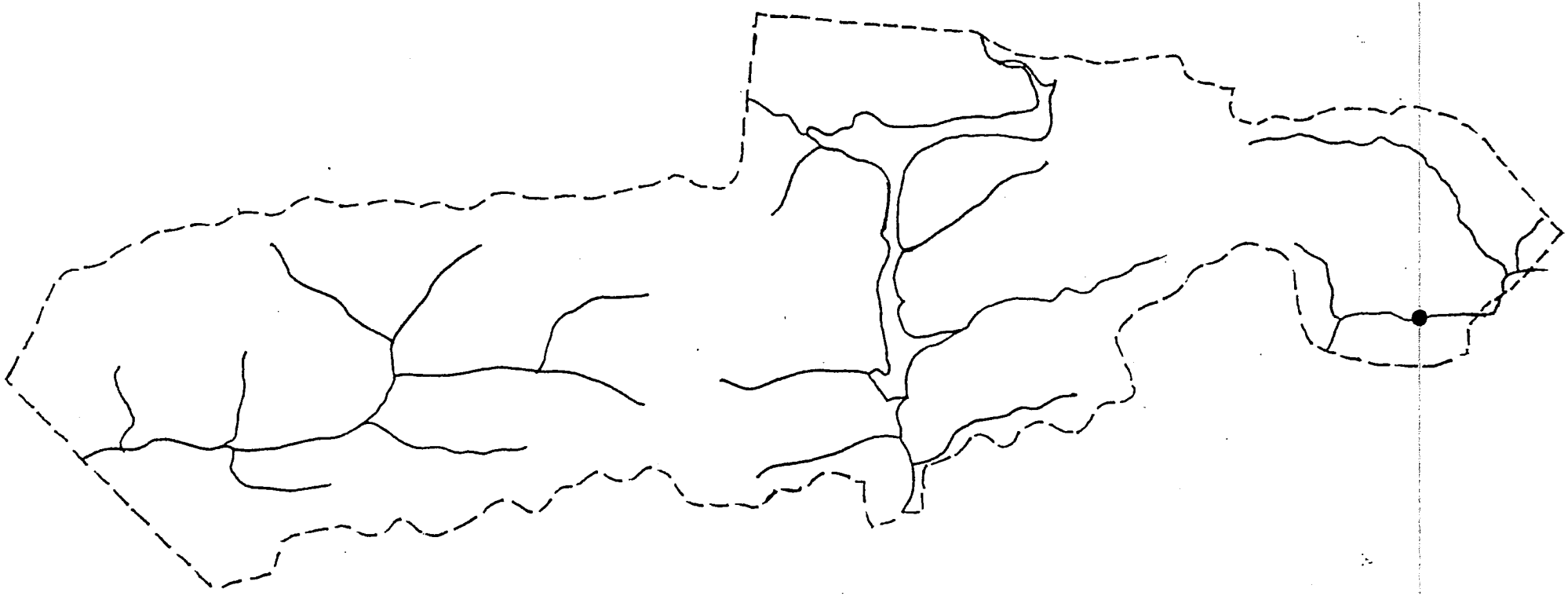
Dobsonfly
Corydalus spp.



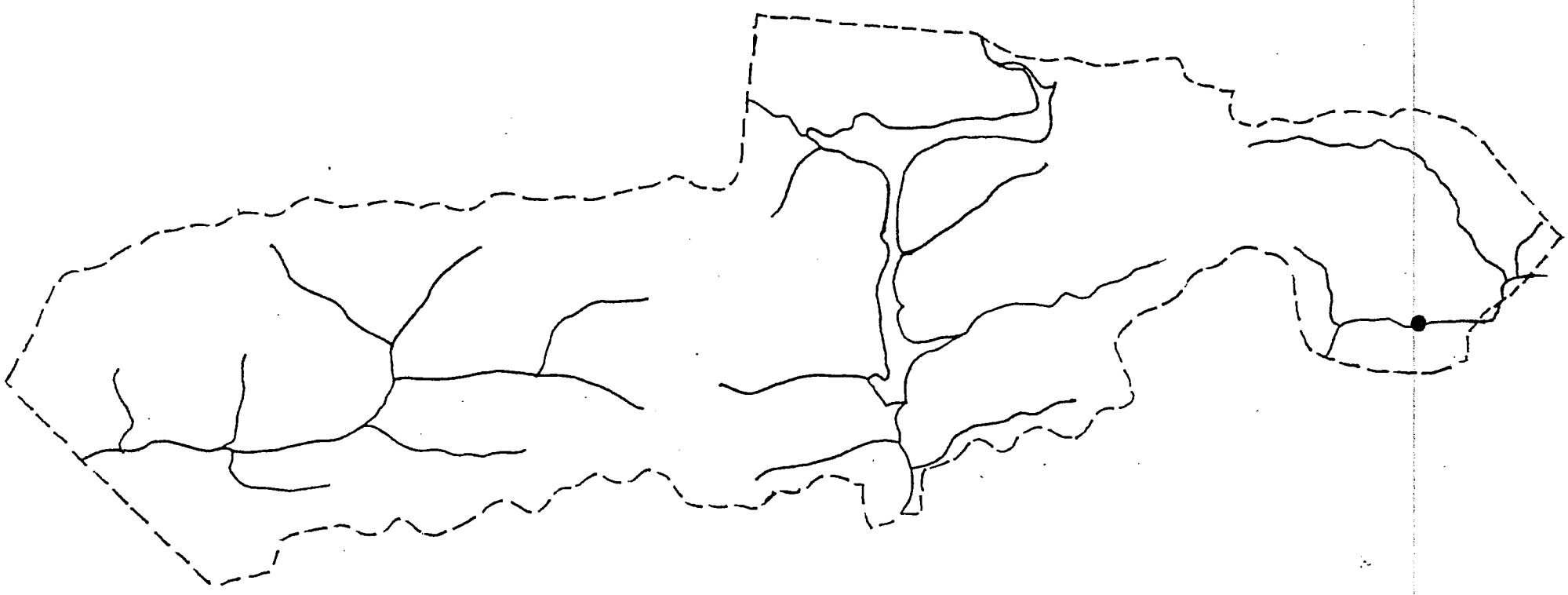
Damselfly
order *Odonata*



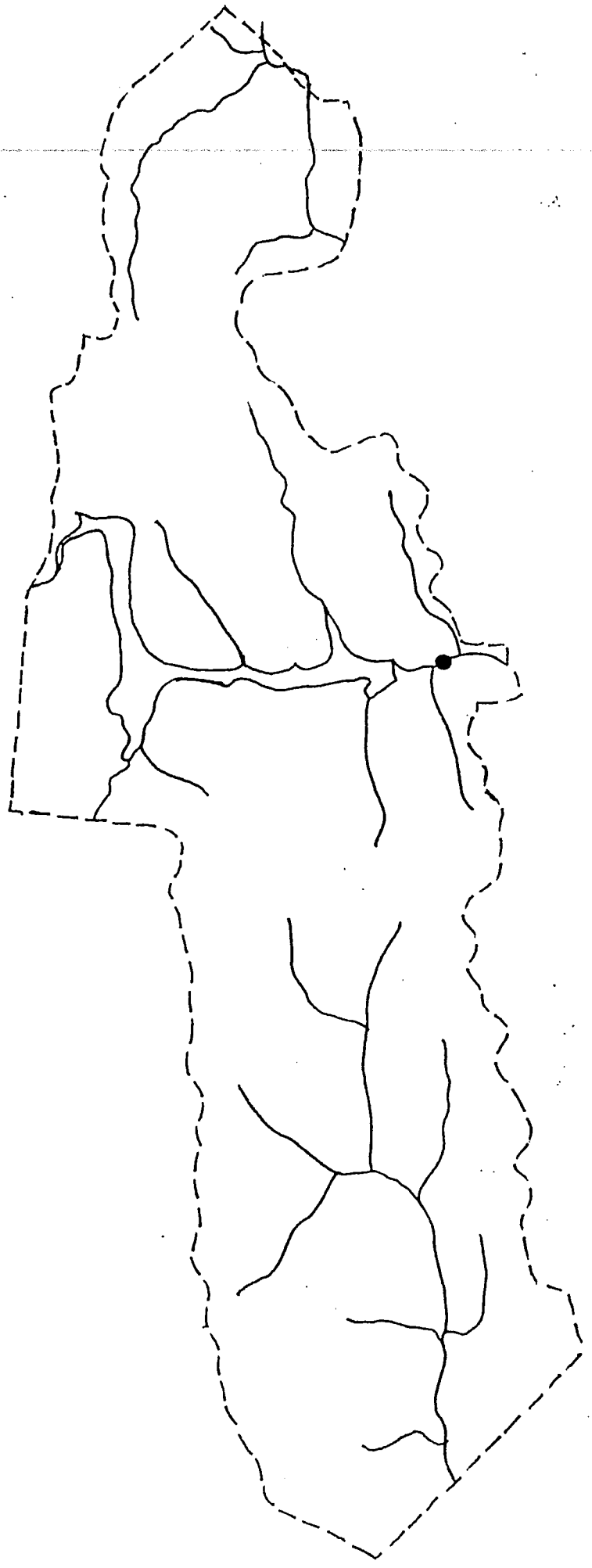
Cranefly
Tipula abdominalis



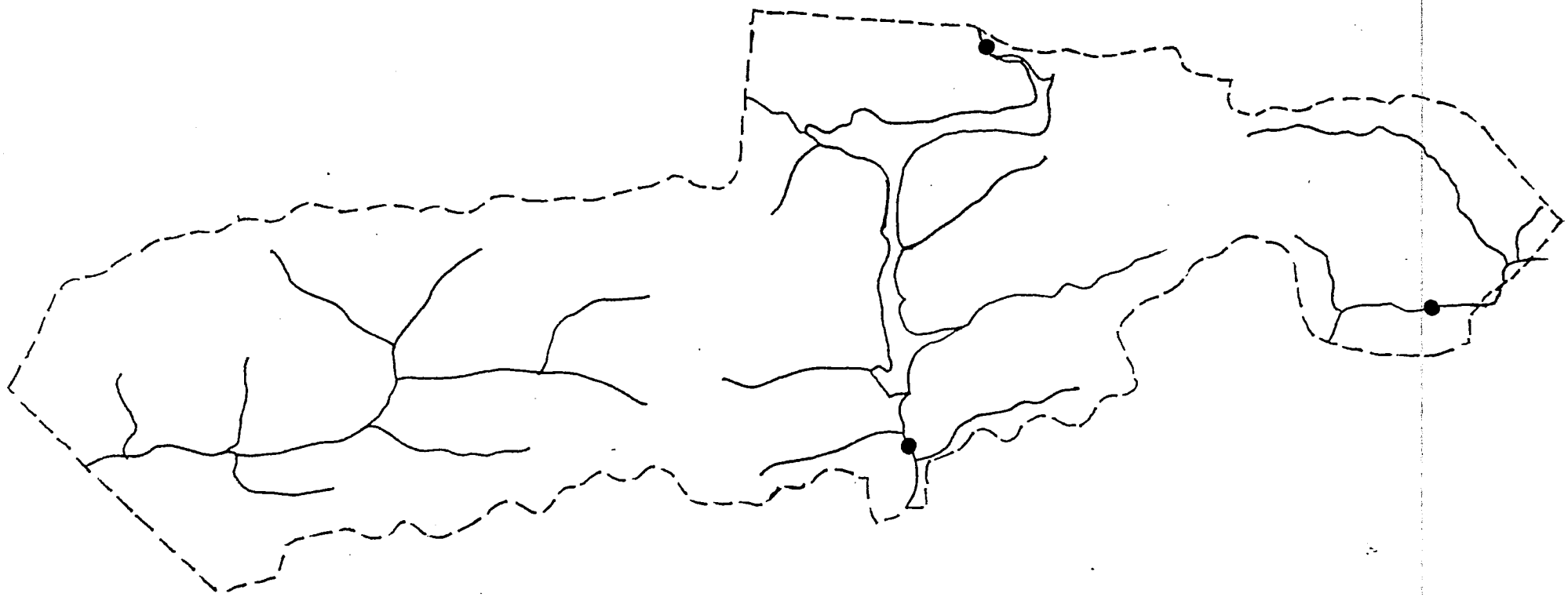
Dragonfly
Anax junius



Crawler larva
Tricorythidae fam.

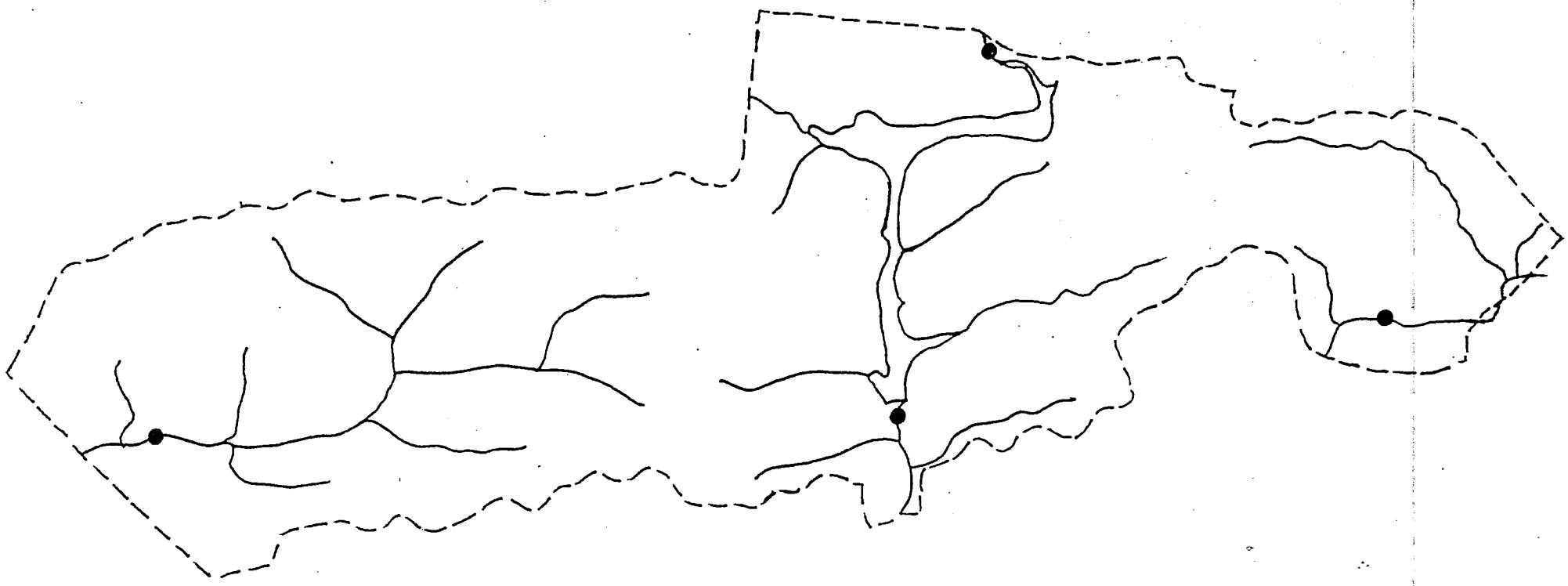


Planarian
Turbellaria

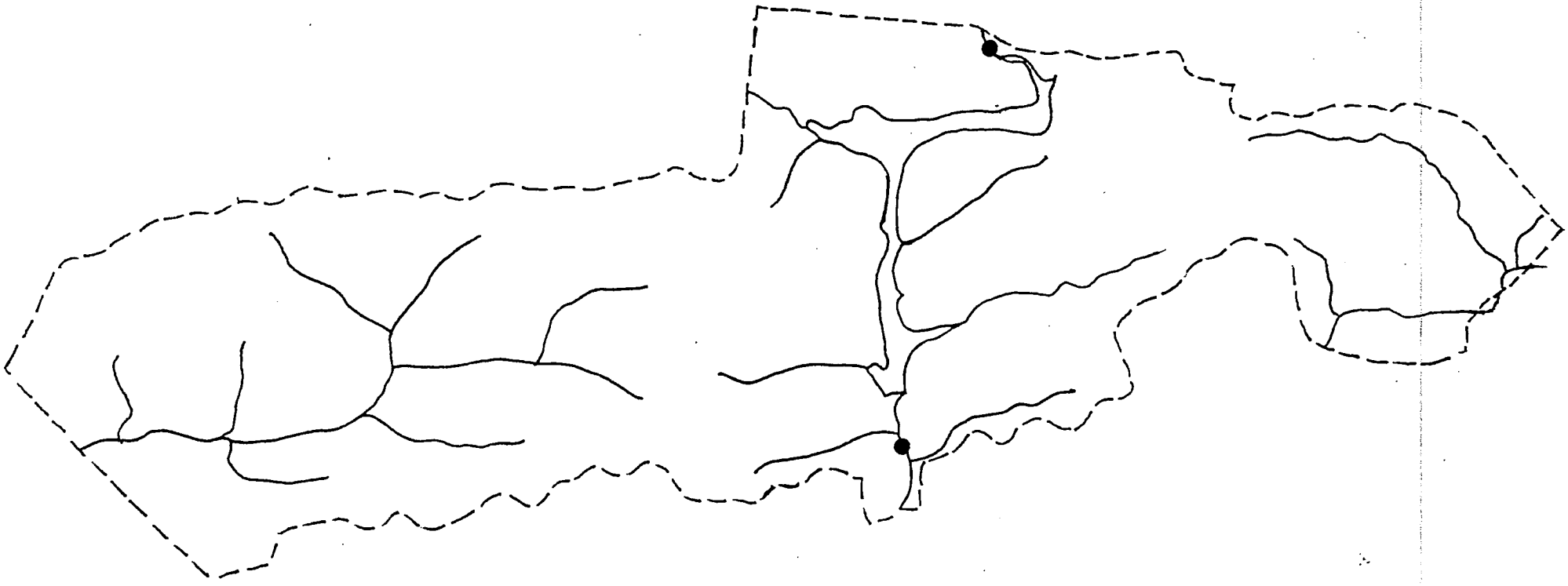


Midge fly
Podonominae

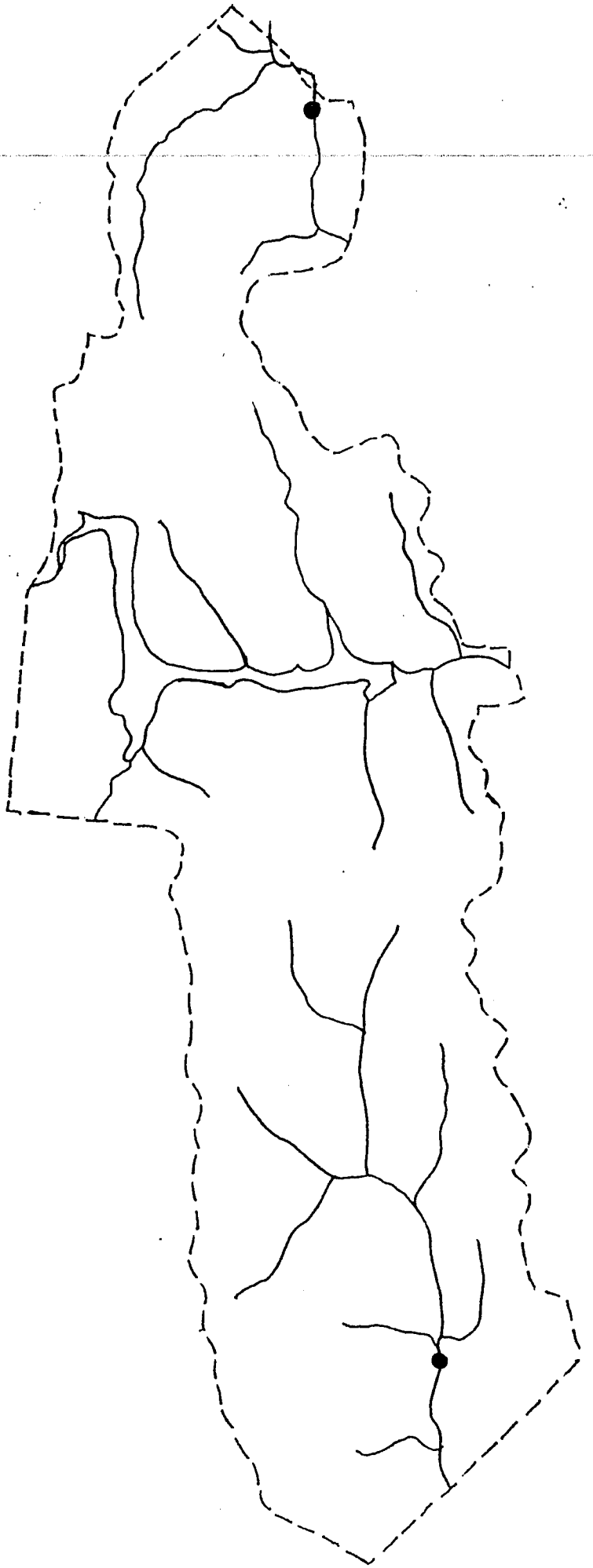
Appendix G
Maps of Location of Crayfish



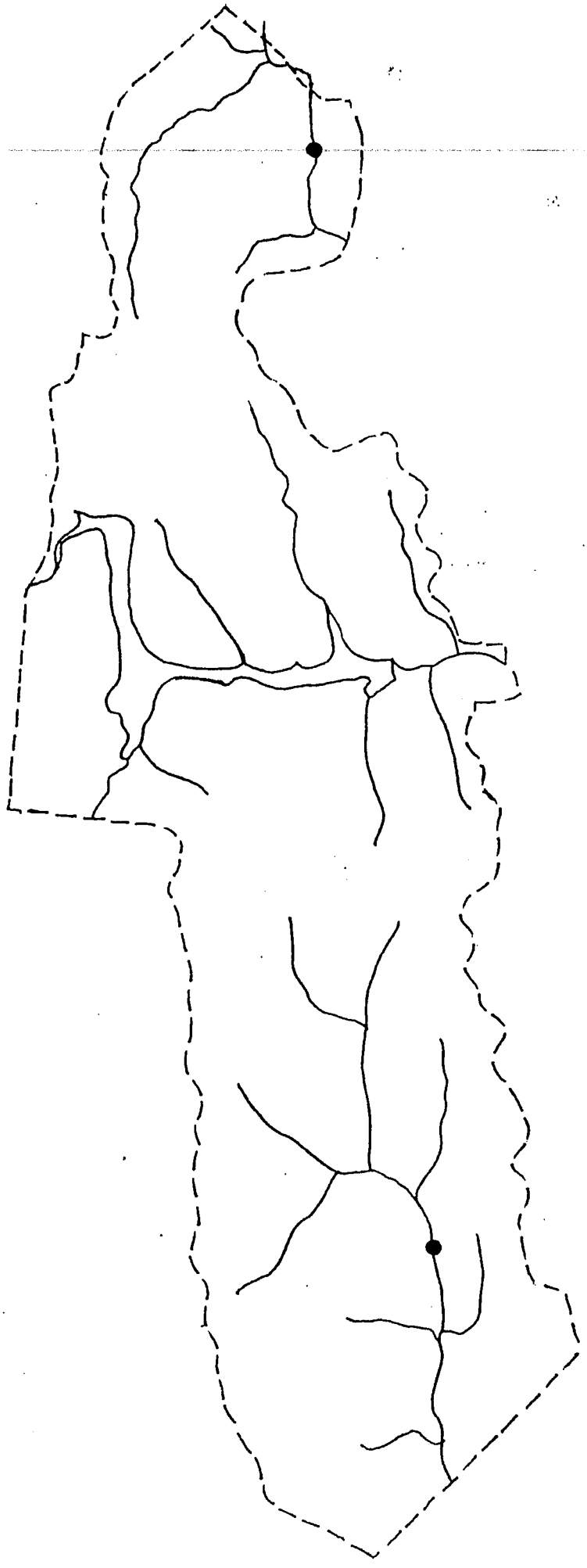
Appalachian brook crayfish
Cambrus bartonii



Rusty crayfish
Orconectes rusticus

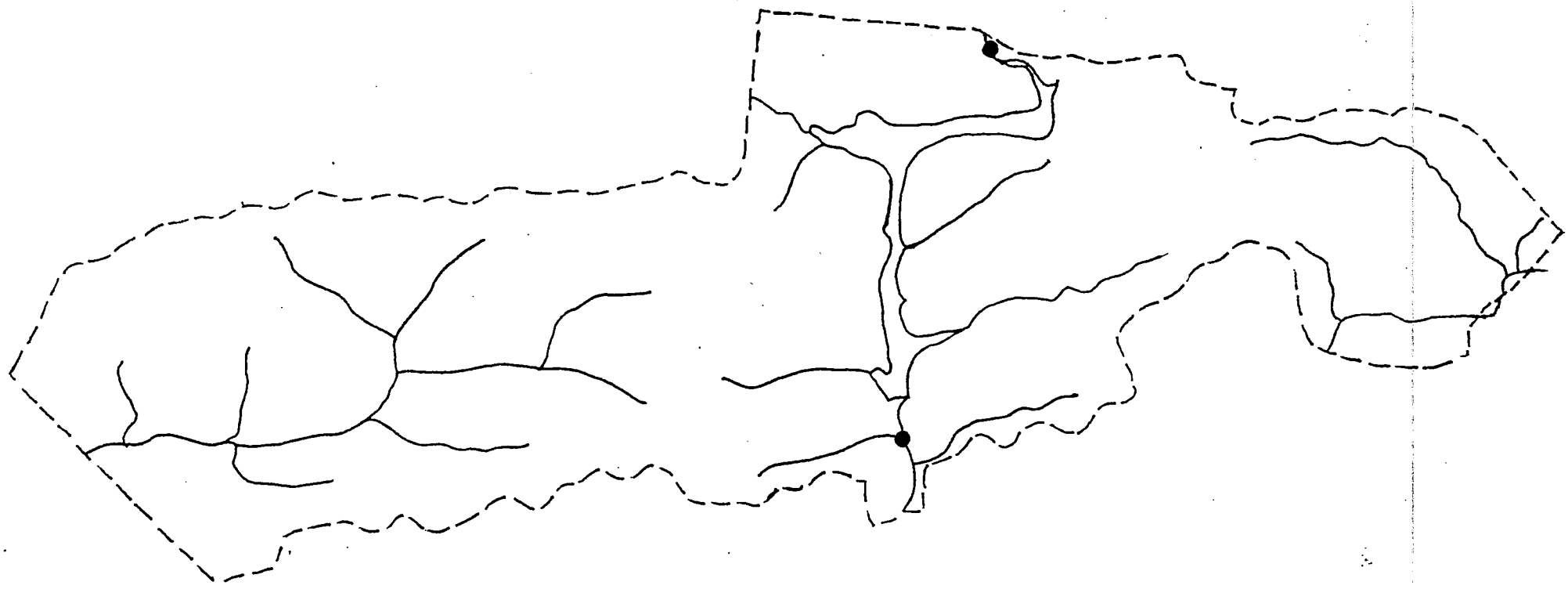


Cambrus longirostris

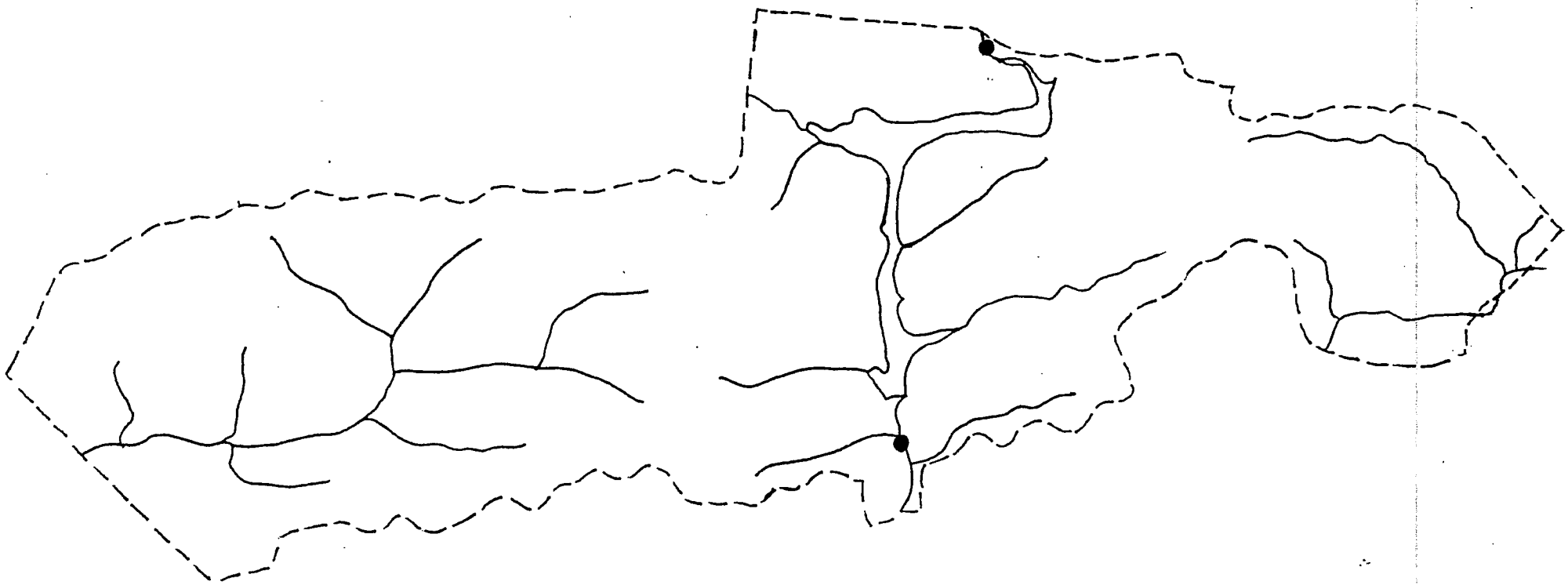


Cambrus dubius

Appendix H
Map of Location of Mussels



Rainbow shell
Vilosa iris



Mountain creek shell
Vilosa vanuxemensis

Appendix I
Pebble Count Data

Pebble Count Data - Holston River Watershed Stream Surveys

Stream: Steele Creek (AD) Quad: Date 14 Jan. 1999 Collector: Sarah Garrett

			Pool		%: 20		Riffle		%: 64		Run			%: 16	
	Particle	Millimeters	Count	Tot #	Item %	% Cum	Count	Tot #	Item %	% Cum	Millimeters	Count	Tot #	Item %	% Cum
	Silt/Clay	<.062									<.062				
S	Very Fine	.062 - .125									.062 - .125	2	2	13%	
A	Fine	.125 - .25									.125 - .25				
N	Medium	.25 - .5					1	1	2%		.25 - .5				
D	Coarse	.5 - 1.0									.5 - 1.0				
	Very Coarse	1.0 - 2.0									1.0 - 2.0	2	2	13%	
	Very Vine	2.0 - 4.0	1	1	5%		1	1	2%		2.0 - 4.0	2	2	13%	
G	Fine	4.0 - 6.0	1	1	5%		4	4	6%		4.0 - 6.0	2	2	13%	
R	Fine	6.0 - 8.0									6.0 - 8.0	1	1	6%	
A	Medium	8.0 - 12.0					1	1	2%		8.0 - 12.0	2	2	13%	
V	Medium	12.0 - 16.0					2	2	3%		12.0 - 16.0	1	1	6%	
E	Coarse	16.0 - 24.0					1	1	2%		16.0 - 24.0	1	1	6%	
L	Coarse	24 - 32	3	3	15%		1	1	2%		24 - 32				
	Very Coarse	32 - 48					2	2	3%		32 - 48	1	1	6%	
	Very Coarse	48 - 64					2	2	3%		48 - 64				
C	Small	64 - 96	1	1	5%		3	3	5%		64 - 96	1	1	6%	
O	Small	96 - 128	2	2	10%		4	4	6%		96 - 128				
B	Large	128 - 192	1	1	5%		4	4	6%		128 - 192				
L	Large	192 - 256	3	3	15%		2	2	3%		192 - 256				
B	Small	256 - 384	2	2	10%						256 - 384				
L	Small	384 - 512	3	3	15%						384 - 512				
D	Lrg-Vry Lrg	512 - 1024	1	1	5%						512 - 1024				
		Bedrock	2	2	10%		36	36	56%		Bedrock	1	1	6%	

Pebble Count Data - Holston River Watershed Stream Surveys

Stream: Steele Creek (BD) Quad: Date 28 Jan. 1999 Collector: Sarah Garrett

			Pool		%: 21		Riffle		%: 41			Run		%:38	
	Particle	Millimeters	Count	Tot #	Item %	% Cum	Count	Tot #	Item %	% Cum	Millimeters	Count	Tot #	Item %	% Cum
	Silt/Clay	<.062	1	1	5%						<.062	2	2	5%	
S	Very Fine	.062 - .125					1	1	2%		.062 - .125	3	3	8%	
A	Fine	.125 - .25									.125 - .25	1	1	3%	
N	Medium	.25 - .5	1	1	5%						.25 - .5	3	3	8%	
D	Coarse	.5 - 1.0	2	2	10%		1	1	2%		.5 - 1.0	1	1	3%	
	Very Coarse	1.0 - 2.0	1	1	5%		1	1	2%		1.0 - 2.0				
	Very Vine	2.0 - 4.0	1	1	5%		3	3	7%		2.0 - 4.0				
G	Fine	4.0 - 6.0	1	1	5%		1	1	2%		4.0 - 6.0	4	4	11%	
R	Fine	6.0 - 8.0	1	1	5%						6.0 - 8.0				
A	Medium	8.0 - 12.0					1	1	2%		8.0 - 12.0	3	3	8%	
V	Medium	12.0 - 16.0	1	1	5%		1	1	2%		12.0 - 16.0				
E	Coarse	16.0 - 24.0	2	2	10%						16.0 - 24.0	3	3	8%	
L	Coarse	24 - 32	2	2	10%		1	1	2%		24 - 32				
	Very Coarse	32 - 48					3	3	7%		32 - 48				
	Very Coarse	48 - 64	2	2	10%		5	5	12%		48 - 64				
C	Small	64 - 96	2	2	10%		5	5	12%		64 - 96	2	2	5%	
O	Small	96 - 128					3	3	7%		96 - 128	3	3	8%	
B	Large	128 - 192					1	1	2%		128 - 192	2	2	5%	
L	Large	192 - 256	1	1	5%						192 - 256				
B	Small	256 - 384	2	2	10%						256 - 384	2	2	5%	
L	Small	384 - 512					2	2	5%		384 - 512	2	2	5%	
D	Lrg-Vry Lrg	512 - 1024	1	1	5%		3	3	7%		512 - 1024	2	2	5%	
		Bedrock					9	9	22%		Bedrock	5	5	13%	

Pebble Count Data - Holston River Watershed Stream Surveys

Stream: Slagle Creek Quad: Date 29 Jan. 1999 Collector: Sarah Garrett

			Pool		%: 31		Riffle		%: 18			Run		%: 51	
	Particle	Millimeters	Count	Tot #	Item %	% Cum	Count	Tot #	Item %	% Cum	Millimeters	Count	Tot #	Item %	% Cum
	Silt/Clay	<.062	4	4	13%						<.062	5	5	10%	
S	Very Fine	.062 - .125	1	1	3%						.062 - .125	1	1	2%	
A	Fine	.125 - .25									.125 - .25	3	3	6%	
N	Medium	.25 - .5									.25 - .5	3	3	6%	
D	Coarse	.5 - 1.0	2	2	6%		2	2	11%		.5 - 1.0	3	3	6%	
	Very Coarse	1.0 - 2.0	2	2	6%						1.0 - 2.0	4	4	8%	
	Very Vine	2.0 - 4.0	6	6	19%		2	2	11%		2.0 - 4.0	3	3	6%	
G	Fine	4.0 - 6.0	4	4	13%						4.0 - 6.0	3	3	6%	
R	Fine	6.0 - 8.0									6.0 - 8.0	1	1	2%	
A	Medium	8.0 - 12.0									8.0 - 12.0	4	4	8%	
V	Medium	12.0 - 16.0	2	2	6%		3	3	17%		12.0 - 16.0	7	7	14%	
E	Coarse	16.0 - 24.0	1	1	3%		1	1	6%		16.0 - 24.0	5	5	10%	
L	Coarse	24 - 32					2	2	11%		24 - 32	2	2	4%	
	Very Coarse	32 - 48	4	4	13%		3	3	17%		32 - 48	1	1	2%	
	Very Coarse	48 - 64					2	2	11%		48 - 64	1	1	2%	
C	Small	64 - 96	1	1	3%		1	1	6%		64 - 96				
O	Small	96 - 128	1	1	3%						96 - 128				
B	Large	128 - 192									128 - 192				
L	Large	192 - 256									192 - 256				
B	Small	256 - 384									256 - 384				
L	Small	384 - 512	1	1	3%						384 - 512				
D	Lrg-Vry Lrg	512 - 1024	1	1	3%						512 - 1024				
		Bedrock					2	2	11%		Bedrock	5	5	10%	

Pebble Count Data - Holston River Watershed Stream Surveys

Stream: Trinkle Creek Quad: Date 31 Jan. 1999 Collector: Sarah Garrett

			Pool		%: 28		Riffle		%: 17		Run			%: 55	
	Particle	Millimeters	Count	Tot #	Item %	% Cum	Count	Tot #	Item %	% Cum	Millimeters	Count	Tot #	Item %	% Cum
	Silt/Clay	<.062	15	15	54%						<.062	28	28	51%	
S	Very Fine	.062 - .125	3	3	10%						.062 - .125	3	3	6%	
A	Fine	.125 - .25									.125 - .25	1	1	2%	
N	Medium	.25 - .5	2	2	7%						.25 - .5	1	1	2%	
D	Coarse	.5 - 1.0	1	1	4%		1	1	6%		.5 - 1.0				
	Very Coarse	1.0 - 2.0	2	2	7%						1.0 - 2.0	3	3	6%	
	Very Vine	2.0 - 4.0					1	1	6%		2.0 - 4.0	2	2	4%	
G	Fine	4.0 - 6.0					1	1	6%		4.0 - 6.0	3	3	6%	
R	Fine	6.0 - 8.0	2	2	7%						6.0 - 8.0				
A	Medium	8.0 - 12.0					4	4	24%		8.0 - 12.0	1	1	2%	
V	Medium	12.0 - 16.0	1	1	4%		1	1	6%		12.0 - 16.0	1	1	2%	
E	Coarse	16.0 - 24.0					2	2	12%		16.0 - 24.0	6	6	11%	
L	Coarse	24 - 32					2	2	12%		24 - 32	2	2	4%	
	Very Coarse	32 - 48					1	1	6%		32 - 48				
	Very Coarse	48 - 64					1	1	6%		48 - 64	1	1	2%	
C	Small	64 - 96					1	1	6%		64 - 96				
O	Small	96 - 128									96 - 128	1	1	2%	
B	Large	128 - 192									128 - 192	1	1	2%	
L	Large	192 - 256									192 - 256				
B	Small	256 - 384					1	1	6%		256 - 384				
L	Small	384 - 512									384 - 512				
D	Lrg-Vry Lrg	512 - 1024									512 - 1024				
		Bedrock	2	2	7%		1	1	6%		Bedrock	1	1	2%	

Appendix J
Mussel Collection Data

SITE Beech Creek **LOCATION** Hawkins County, Tennessee

DATE COLLECTED 30 March 1999 **COLLECTORS** Mark Fagg, Kevin Hamed, Phil Gentry, Sarah Garrett

DATE SORTED 30 March 1999 **SORTERS** Kevin Hamed, Phil Gentry, Sarah Garrett

	Species	Age	Size(mm) @ 1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30
#1	Vilosa iris/ 52.3 mm	14												XX					
#2	Vilosa iris/ 56.3 mm	9									XX								
#3	Vilosa iris/ 37.6 mm	4				XX													
#4	Vilosa iris/ 42.1 mm	5					XX												
#5	Vilosa iris/ 35.2 mm	5					XX												
#6	Vilosa iris/ 52.7 mm	11										X	X						
#7	Vilosa iris/ 40.1 mm	7							XX										
#8	Vilosa vanuxemensis/ 44.4 mm	10										XX							
#9	Vilosa vanuxemensis/ 37.9 mm	8								XX									

* ALL NINE MUSSELS WERE INTRODUCED INTO STEELE CREEK (AD) ON THE 30th OF MARCH 1999

SITE Caney Creek LOCATION Hawkins County, Tennessee

DATE COLLECTED 07 April 1999 COLLECTORS Mark Fagg, Kevin Hamed

DATE SORTED 07 April 1999 SORTERS Kevin Hamed, Sarah Garrett

	Species	Age	Size(mm) @ 1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30
#1	Vilosa vanuxemensis/ 37.0 mm	5					XX												
#2	Vilosa vanuxemensis/ 44.6 mm	8								XX									
#3	Vilosa vanuxemensis/ 39.1 mm	6						XX											
#4	Vilosa vanuxemensis/ 35.5 mm	5					XX												

* ALL FOUR MUSSELS WERE INTRODUCED INTO STEELE CREEK (BD) ON THE 7th OF APRIL 1999

SITE Big Creek LOCATION Hawkins County, Tennessee

DATE COLLECTED 08 April 1999 COLLECTORS Mark Fagg, Kevin Hamed

DATE SORTED 08 April 1999 SORTERS Kevin Hamed, Sarah Garrett

	Species	Age	Size(mm) @ 1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30
#1	Vilosa iris/ 40.0 mm	5					XX												
#2	Vilosa iris/ 45.2 mm	9									XX								
#3	Vilosa iris/ 38.6 mm	5					XX												
#4	Vilosa iris/ 50.1 mm	10										XX							
#5	Vilosa iris/ 38.3 mm	4				XX													
#6	Vilosa iris/ 39.0 mm	6						XX											
#7	Vilosa iris/ 40.5 mm	5					XX												
#8	Vilosa iris/ 38.4 mm	4				XX													
#9	Vilosa iris/ 36,9 mm	5					XX												
#10	Vilosa vanuxemensis/ 58.2 mm	11										XX							
#11	Vilosa vanuxemensis/ 40.7 mm	6						XX											
#12	Vilosa vanuxemensis/ 39.0 mm	3			XX														
#13	Vilosa vanuxemensis/ 59.5 mm	11										X	X						
#14	Vilosa vanuxemensis/ 46.2 mm	5					XX												
#15	Vilosa vanuxemensis/ 40.3 mm	4				XX													

* FOUR Vilosa iris AND TWO Vilosa vanuxemensis WERE INTRODUCED INTO STEELE CREEK (AD ON THE 8th OF APRIL 1999. FIVE Vilosa iris AND FOUR Vilosa vanuxemensis WERE INTRO DUCED INTO STEELE CREEK (BD) ON THE 8th OF APRIL 1999.

Appendix K
Log

INDEPENDENT STUDY TIME SHEETS

8/19/89 Met Kevin Hamed at The Nature Center to begin plans for an independent study. Along with Blair Cowen, a Tennessee High student and insect hobbyist, we hiked through Slagle Hollow, following Slagle Hollow Stream. Because of the dry weather, we were able to view the stream at what we believed to be its lowest levels. We collected several specimens, which were later placed in The Nature Center under suitable conditions. (11:A.M. - 5:00 P.M.)

8/20/98 Drove to The Nature Center, Steele Creek Park, where I was able to do research on Ichthyology and specimens collected the previous day. (2:14:P.M. to 4:45 P.M.)

8/21/98 Drove to Virginia Highlands Community College where I completed further research on the specimens collected. Found a freshwater fish field guide for future identification. (2:14 P.M. to 4:00 P.M.)

8/24/98 Drove to Steele Creek Park, where I met Kevin Hamed. We began the first stages of set-up for a darter aquarium. Also, we discussed my proposal and timeline for the project. (2:14 P.M. - 5:00 P.M.)

8/25/98 Drove to Steel Creeke Park, where Kevin Hamed and I hiked along Slagle Creek to acquire rocks for the darter aquarium. We completed further planning and work at The Nature Center on requirements and set-up for aquariums. Time was then spent on detailed work for the proposal. (12:30 P.M. - 4:45 P.M.)

8/26/98 Drove to Steele Creeke Park where Kevin Hamed and I collected more rocks for the darter Aquarium. The aquarium was filled with water and filters were ordered. A revision of proposal was also made. (12:30 P.M. - 5:30 P.M.)

8/27/98 Drove to The Nature Center at Steel Creek Park, where I finished construction of darter and Crayfish artificial environments. Work was also done on a data sheet for field identification and research. (2:14 P.M. - 5:00 P.M.)

8/28/98 On my way to meet Kevin Hamed, at Trinkle Hollow, I stopped by Walmart and purchased waders. Although I will not be using them today, I will need them for wading in Steele Creek, especially during the winter months. Kevin and I, once in Trinkle Hollow, hiked to the stream running through Trinkle Hollow. Here we surveyed four different sites using the data sheets as guidelines for written information. Once each of the four sites had been sampled, we returned to the Nature Center to put the fish and crayfish in their aquariums. (2:14 P.M. - 6:00 P.M.)

INDEPENDENT STUDY TIME SHEETS

8/30/98 I traveled to The Nature Center, where I used an enlarged Topo-Map of the park to label the areas in which Kevin and I had sampled on August 28. Future sampling areas will also be labeled on the map. (3:00 P.M. - 3:30 P.M.)

8/31/98 Drove to the Nature Center, where Kevin and I began samplings of Steele Creek. Two sites along Steele Creek were surveyed by Kevin Hamed, myself and a King College student, Elizabeth Mitchell. The final aquarium was finished once we returned to The Nature Center. Display sheets were prepared for all three aquariums. (2:14 P.M. - 5:45 P.M.)

9/1/98 Drove to The Nature Center, where Kevin and I tried contacting Tennessee Valley Authority and The Virginia Wildlife and Inland Fisheries Agency. Research, to be completed on certain fish species, was discussed. Aquariums were maintained. (2:14 P.M. - 4:45 P.M.)

9/3/98 Stayed at Abingdon High School to research information on fish species. (2:14 P.M. - 3:04 P.M.)

9/4/98 Drove to Steele Creek, where Kevin and I surveyed Steele Creek. (2:14 P.M. - 5:30 P.M.)

9/5/98 Using Etnier's book, The Fishes of Tennessee, I recorded all minnows, sculpins, and darters found in this region. I then began typing data collected from the stream survey into a data base. (1:30 P.M. - 3:00 P.M.)

9/6/98 Drove to Virginia Tech to research information on the Banded Sculpin, Snubnose Darter, Blacknose Dace, and Tennessee Dace in the Virginia Tech Library. Research was also done on fresh-water mussels and crayfish. (8:00 A.M. - 6:45 P.M.)

9/8/98 Drove to The Nature Center, where I used books and journal articles collected from Virginia Tech to research aquatic life. (2:14 P.M. - 4:15 P.M.)

9/9/98 Stayed at Abingdon High School, completing research using books and journal articles from Virginia Tech. (2:14 P.M.- 3:04 P.M.)

9/10/98 Stayed at Abingdon High School , researching books and journal articles from library at Virginia Tech. (2:14 P.M. - 3:04 P. M.)

INDEPENDENT STUDY TIME SHEETS

9/11/98	Drove to the Nature Center, where Kevin Hamed and I started sampling Steele Creek below the dam. (2:14 P.M. - 5:00 P.M.)
9/14/98	Met Kevin Hamed at Trinkle Hollow, where three sites were sampled. (12:34 P.M. - 5:00 P.M.)
9/15/98	Met Kevin Hamed at Trinkle Hollow, where one more site was sampled. (12:34 P.M. - 4:00 P.M.)
9/16/98	Drove to The Nature Center, where Kevin Hamed and I cleaned the darter and crayfish aquariums. We also discussed questions that I should ask Dave Tomljanvoich, T.V.A. fisheries Biologist. We called Leroy Koch to request information on freshwater mussels. (2:14 P.M. - 4:30 P.M.)
9/17/98	Met Kevin Hamed at Trinkle Hollow, where three sites were sampled. (2:14 P.M. - 5:30 P.M.)
9/18/98	Stayed at Abingdon High School, where I finished literature review due on September 21. (2:14 P.M. - 3:04 P.M.)
9/22/98	Drove to Steele Creel Lake, where I met Kevin Hamed and Dave Tomljanvoich, T.V.A. fisheries biologist. We drove to the opposite side of the park to electro-shock Slagle Hollow Creek. We found that most of the stream was dry, due to lack of rainfall. Five puddles of water were shocked, each containing an abundance of fish. (2:14 P.M. - 5:00 P.M.)
9/23/98	Drove to The Nature Center to meet Kevin Hamed. From there we drove to the opposite side of the park and ran water quality tests on sites previously electro-shocked. After all tests were completed, we hiked through Slagle Hollow, following the stream bed. The same dry conditions were found upstream. (2:14 P.M. - 4:45 P.M.)
9/28/98	Drove to The Nature Center where all aquariums were maintained. Along with Kevin Hamed I drove to Slage Hollow to view previously surveyed puddles. Because of the warm temperatures and dry weather the depth of water in each puddle was declining. We were able to relocated four Fantail Darters, six Tennessee Dace, and three Blacknose Dace to areas of Slagle Hollow that had water depths greater than three cm and held the right qualities to maintain life. (2:14 P.M. - 5:00 P.M.)

9/29/98 Drove to The Nature Center where Kevin Hamed and I looked over information Dave Tomljanovich had sent us. This information reviewed methods of conducting Pebble Counts. All tanks were maintained. (2:14 P.M.- 4:45 P.M.)

9/30/98 Drove to Trinkle Hollow where I met Kevin Hamed and Autumn, an intern from Virginia Intermont. We surveyed all downstream sites that had not previously been surveyed. (2:14 P.M. - 5:00 P.M.)

10/1/98 Drove to Trinkle Hollow where I met Kevin Hamed and TWRA Fisheries Biologists. We were able to electro-shock part of Trinkle Hollow and also receive information on native crayfish and mussel species. (2:14 P.M. - 4:45 P.M.)

10/3/98 Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

10/6/98 Drove to Steel Creek where I first fed all aquarium species and then proceeded to talk with Kevin Hamed about my project Timeline. (2:14 P.M. - 4:30 P.M.)

10/7/98 Drove to Steele Creek where Kevin H., Autumn, and I finished the sampling of Steele Creek above the dam. (2:14 P.M. - 4:30P.M.)

10/9/98 Stayed in Abingdon, Va., where I went to The Nature Conservatory and The US Fish and Wildlife Services to inquire about native mussel species. I received a journal article, poster, and magazine publication dealing with mussels. (2:14 P. M.- 3:30 P.M.)

10/10/98 Maintained all aquariums at The Nature Center.(12:00P.M. - 12:15 P.M.)

10/12/98 Drove to Steele Creek, where Kevin Hamed and I then drove to Trinkle Hollow to survey upstream of Trinkle Creek. It was then decided that only one more day was needed for the sampling of Trinkle Creek. (2:14 P.M. - 5:45 P.M.)

10/13/98 Drove to The Nature Center where I maintained all aquariums. Kevin Hamed and I then tried to contact TVA, TWRA, and US Fisheries and Wildlife Services. The mussel species found below the dam of Steele Creek was keyed out as an exotic species. (2:14 P.M. - 4:00 P.M.)

10/14/98 Stayed at Abingdon High School where I researched materials on mussel species found in this area. (2:14 P.M. - 4:00 P.M.)

10/16/98 Drove to the Abingdon Office of the US Fish and Wildlife services, where I met with Leroy Koch. We talked over the idea of reintroduction of native mussel species into Steele Creek. He also identified the Asian mussel found below the dam in Steele Creek. (2:14 P.M. - 4:00 P.M.)

10/17/98 Maintained all aquariums at The Nature Center. (12:00 P.M. - 12:15 P.M.)

10/20/98 TWRA Biologist, Carl Williams, along with Kevin Hamed and other TWRA Biologists, electro-shocked Steele Creek above and below the dam, as well as a section of Trinkle Creek. They completed their work while I was still in school, therefore I was unable to assist them in the electro-shocking procedures. Once I arrived at The Nature Center, Kevin informed me of the fish and crayfish species found from the sampling. (2:14 P.M. - 4:00 P.M.)

10/21/98 Drove to The Nature Center, where Kevin Hamed and I discussed the procedures for carrying out Pebble Counts. We read journal articles, material and method lists, and also looked at previous Pebble Count studies. We decided the means by which the creek beds must first be identified and then the counts carried out. (2:14 P.M. - 4:00 P.M.)

10/27/98 Drove to The Nature Center where Kevin Hamed and I maintained all of the aquariums. We discussed mussel reintroduction and also the history of the Snubnose Darter. (2:14 P.M. - 4:00 P.M.)

10/28/98 Drove to the Nature Center where Kevin, Autumn, and I drove to the other side of the park to re-sample Slagle Hollow. Also, on this visit, we classified the stream bed into pool, riffle, and run areas. The percentages of each will be used later in Pebble Counts. (2:14 P.M. - 5:15 P.M.)

10/29/98 Drove to Trinkle Hollow where I met Kevin Hamed and we finished the sampling of Trinkle Creek. (2:14 P.M. - 5:15 P.M.)

10/31/98 Maintenance of all aquariums. (12:00 P.M. - 12:15 P.M.)

11/2/98 Drove to Bristol where I met Kevin Hamed at Middlebrook Lake. From here sampled a stream running off of the lake for mussels. However, the only mussels found were the exotic, Asian species. These are identical to the mussels found in Steel Creek below the dam. (2:14 P.M. - 4:45 P.M.)

11/3/98 Drove to The Nature Center where I met Kevin Hamed. Here we cleaned all aquariums, fed all fish, and reviewed the creeks within the park that concontained rare fish species. (2:14 P.M. - 4:45 P.M.)

11/4/98 Spent time adding to data base which contains survey information. Also completed work on the second six weeks information folder for Mrs. Laster. (2:14 P.M. - 6:00 P.M.)

11/10/98 Drove to The Nature Center where I proceeded to feed all fish and crayfish. Kevin Hammed and I then began analyzing data by comparing the number of fish species in each creek to the DO and pH levels of each creek. (2:14 P.M. - 4:45 P.M.)

11/11/98 Drove to The Nature Center where Kevin Hammed and I copied maps which I had drawn of the park boundaries and the streams within them. On a series of maps, we plan to document as to which specific fish species have been found. (2:14 P.M. - 4:45 P.M.)

11/12/98 Drove to The Nature Center where everything was fed and maps were worked on. I contacted Leroy Koch, from The US Fisheries and Wildlife, about visiting the park in order to talk further about mussel reintroduction into Steele Creek. (2:14 P.M. - 4:45 P.M.)

11/15/98 Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

11/18/98 Stayed at Abingdon High School to read over mussel reintroduction material. (2:14 P.M. - 3:30 P.M.)

11/19/98 Drove to The Nature Center, where Kevin Hamed and I talked about the the article for the Bristol, TN, newsletter, that I needed to write. We went over what it should include and should not include. (2:14 P.M. - 3:30 P. M.)

11/20/98 Drove to The Nature Center, where everything was fed and I started on my article for the Bristol, TN, newsletter. (2:14 P.M. - 3:30 P.M.)

11/22/98 Maintained all aquariums at The Nature Center. (10:00 A.M. - 11:00 A.M.)

11/23/98 Kevin Hamed and I drove to the opposite side of the park which connects to Slagle Hollow. We began measurements of the creek that we will use for pebble counts. (2:14 P.M. - 4:45 P.M.)

11/24/98 Kevin Hamed and I returned to the opposite side of the park connecting to Slagle Hollow. We did further measuring of the creek. Measurements are broken into three divisions: pool, riffle, and run. (2:14 P.M. - 4:45 P.M.)

11/25/98 - 11/26/98 Thanksgiving break.

11/28/98 Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

11/30/98 Met Leroy Koch, of The US Fish and Wildlife Service, at his office. From there, we drove to Steele Creek Park, where we met with Kevin Hamed. The three of us drove to Steele Creek so that Leroy could evaluate the habitat in which we plan to reintroduce mussels. (2:14 P.M. -5:00P.M.)

12/1/98 Kevin Hamed and I drove to both sides of the park connecting Trinkle and Slagle Hollows. We collected snail specimens from Trinkle Creek. However, no snail specimens were found in Slagle Creek. (2:14 P.M. - 5:30 P.M.)

12/2/98 Began measurements of the stream running through Trinkle Hollow. Measurements will be used for further data concerning pebble counts. (2:14 P.M. - 4:30 P.M.)

12/3/98 Drove to The Nature Center, where I began working on a visual that contains information on my project. The visual will be set up in The Nature Center in order to inform visitors of my study. (2:14 PM. - 4:30P.M.)

12/4/98 Completed further work on the visual. (2:14 P.M. - 6:00 P.M.)

12/5/98 Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

12/7/98 Measured the length of Steele Creek, both above and below the dam. (2:14 P.M. - 4:45 P.M.)

12/8/98 Drove to The Nature Center, where Kevin Hamed and I contacted Bob Hatcher, a Biologist for TWRA. We talked with him about transferring snails from Trinkle Creek to Steele Creek. (2:14 P.M. - 4:00 P.M.)

12/9/98 Drove to Trinkle Hollow on the opposite side of the park from The Nature Center. Further measurements of the creek's length were made. (2:14 P.M. - 4:30 P.M.)

12/10/98 Further measurements of the length of Slagle Creek were achieved. (2:14 P.M. - 4:45 P.M.)

12/11/98 Further measurements of the length of Trinkle Creek were achieved. (2:14 P.M. - 4:45 P.M.)

12/12/98 Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

12/14/98 Further measurements on the length of Slagle Creek were completed. (2:14 P.M. - 5:00 P.M.)

12/15/98 - 12/18/98 EXAMS

12/19/98 - 01/04/99 Christmas break

12/23/98 - Drove to the Nature Center where I was to meet Kevin Hamed and Kathy Laster. Kevin and I first showed Mrs. Laster the tanks we had set up for darters, crayfish, and other species (which were found while sampling). From there, we drove to the opposite side of the park attaching to Slagle Hollow. We gave Mrs. Laster a "field view" of my project and what I was doing each afternoon when I drove to the park. We sampled areas of the stream, did both DO and pH tests, and walked upstream approximately one mile. We answered Mrs. Laster's questions and filled in gaps which can only be answered through hands on experience. (8:00 A.M. - 12:30 P.M.)

12/26/98 - Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

12/29/98 - Drove to Steele Creek, where Kevin Hammed and I finished measuring the length of Slagle Creek. After completing this, we drove around in the Bristol area tracing the watershed system of Steel Creek Lake. We looked for areas of the creek which would support snail species. (8:30 A.M. - 2:45 P.M.)

1/4/99 - Drove to the US Fish and Wildlife Services office, in Abingdon, Virginia, to speak with Leroy Koch. Although he was not there, I left a letter asking him if he had received results on the snail specimens that I had given him. I also asked for advice on the introduction process of the snails. (2:15 P.M. - 3:05 P.M.)

1/5/99 - Stayed at AHS, where I began filling out the Annual Report of Activities under scientific permits, submitted to The Fisheries Management Division and Wildlife Resources Agency. (2:15 P.M. - 3:05 P.M.)

1/6/99 and 1/7/99 - Out of school, due to snow.

1/10/99 - Maintained all aquariums. (12:00 P.M. - 12:30 P.M.)

1/11/99 - Worked on the Annual Report of Activities under scientific permits. This report tells T.W.R.A which species of fish I have caught, where I caught them, and how many I have caught and collected. (2:15P.M - 4:00 P.M.)

1/12/99 - Completed all work on Annual Reports. (2:15 P.M. - 4:00 P.M.)

1/13/99 - Completed data dealing with the length of each stream in my survey. I then averaged all the amounts of pool, riffle, and run area for each. These numbers will be needed in order to study the stream beds by means of a pebble count. (2:15 P.M. - 4:00 P.M.)

1/14/99 - Drove to The Nature Center where I conducted a pebble count survey on Steel Creek, above the dam. (2:15 P.M. - 5:00 P.M.)

1/18/99 - Drove to Steele Creek Park Nature Center, where Kevin Hammed and I began plans to reintroduce snails into Steel Creek. For advice on how to perform the procedure, we called Leroy Koch, of the US Fish and Wildlife Services, and Steve Awstead, of the USGS. Mr. Awstead advised that we begin immediately with the reintroduction of native mussel species. (2:15 P.M. - 4:30 P.M.)

1/19/99 - Drove to Steele Creek Park Nature Center. From there, Kevin Hammed and I drove to Rooster Front Park, which adjoins to the dam side of the lake. Here I began the pebble count of Steel Creek below the dam. (2:15 P.M. - 5:00 P.M.)

1/20/99 - Drove to Steele Creek Park Nature Center, where I maintained all aquariums. (2:15 P.M. - 4:00 P.M.)

1/23/99 - Maintained all aquariums. (12:00 P.M. - 12:00 P.M.)

1/25/99 - Drove to Steele Creek Park Nature Center, where I finished reading studies on Ichthyology, which I had found at the library at Virginia Tech. (2:15 P.M. - 4:00 P.M.)

1/26/99 - Drove to Steele Creek Park Nature Center. There Kevin Hamed and I worked on the filtering system for the darter tank. We proceeded to analyze collected data from the three creeks in the park. We discussed other data analysis, and further reintroduction procedures. (2:15 P.M. - 4:30 P.M.)

1/27/99 - Drove to Rooster Front Park, adjoining Steele Creek Park. Here I had access to Steele Creek below the dam. I completed the pebble count survey for the stream system. (2:15 P.M. - 5:00 P.M.)

1/28/99 - Drove to Steele Creek Park Nature Center, where Kevin Hamed and I proceeded to drive to the opposite side of the park, adjoining Slagle Hollow. Here we conducted a pebble count survey on Slagle Creek. (2:15 P.M. - 5:30P.M.)

1/30/99 - Maintained all aquariums. (12:00 P.M. - 12:15 P.M.)

1/31/99 - Drove to the opposite side of the park, from The Nature Center, which adjoins Trinkle Hollow. I hiked into the area where Trinkle Creek flows. Here I finished measuring the length of the creek and then completed the pebble count for the creek. (10:00 A.M. - 2:00 P.M.)

2/3/99 - Drove to Steele Creek Park where Kevin Hamed and I then drove upstream of Steele Creek .5 of a mile. Here we began collecting freshwater snails to introduce into Steele Creek located within park boundaries. (2:15 P.M. - 4:45 P.M.)

2/5/99 - Drove to Steele Creek Park where Kevin Hamed and I then drove back upstream of Steele Creek. We finished collecting snails and ended with a total of 215 individuals within three separate species. (2:15 P.M. - 5:00 P.M.)

2/6/99 - Drove to Steele Creek Park to introduce and observe collected sails. (8:00 A.M. - 5:00 P.M.)

2/7/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

2/8/99 - Drove to the Nature Center to resurveyed introduced snails. (2:15 P.M. - 4:00 P.M.)

2/9/99 - Drove to the Nature Center where I resurveyed introduced snails. (2:15 P.M. - 4:15 P.M.)

2/14/99 - Drove to the Virginia Tech Library to conduct further literature searches on stream environments, the Tennessee Dace *(Phoxinus tennesseensis)*, the Rainbow Mussel *(Vilosa iris)*, and other aquatic fish and snails. (8:00 A.M. - 6:00 P.M.)

2/15/99 - Drove to Steele Creek Park where I worked on information to be compiled for a fourth six-weeks notebook for Mrs. Laster. Kevin Hamed and I continued talking of plans for mussel reintroduction. (2:15 P.M. - 4:15 P.M.)

2/16/99 - Drove to the Nature Center and then to the opposite side of the park connecting to Trinkle Hollow. Here I collected a sample of Trinkle Creek water to be tested for algae. Drove back to the Nature Center where I began looking at the sample through a light microscope. (2:15 P.M. - 4:30 P.M.)

2/17/99 - Worked at Abingdon High School on water samples collected from Trinkle Creek. (2:15PM - 3:05PM)

2/18/99 - Drove to Steele Creek Park where I again resurveyed snails introduced into into Steele Creek (AD). (2:15pm - 3:30pm)

2/19/99 - Drove to Steele Creek Nature where I met Kevin Hamed and Rick Bivens. We electro-shocked both Steele Creek (AD) and Slagle Creek. Snubenose darters were collected from Steele Creek (AD) and introduced into Steele Creek (BD). (1pm - 6pm)

2/20/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

2/22/99 - Collected insects from Steele Creek above the dam. (2:15pm - 3:30pm)

2/23/99 - Began keying out the insects collected from Steele Creek (AD) (2:15pm - 5pm)

2/24/99 - Worked on keying out the insects collected from Steele Creek (AD) (2:15pm - 4pm)

2/25/99 - Finished keying out the insects collected from Steele Creek (AD) (2:15pm - 6pm)

2/26/99 - Collected insects from Trinkle Creek. (2:15pm - 3:30pm)

2/27/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

3/1/99 - Began keying out the insects collected from Trinkle Creek (2:15pm - 4pm)

3/2/99 - Worked on keying out the insects collected from Trinkle Creek(2:15pm - 5pm)

3/3/99 - Finished keying out the insects collected from Trinkle Creek (2:15pm - 6:15pm)

3/4/99 - Collected insects from Slagle Creek. (2:15pm - 3:45pm)

3/5/99 - Began keying out the insects collected from Slagle Creek (2:15pm - 4pm)

3/6/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

3/8/99 - Worked on keying out the insects collected from Slagle Creek(2:15pm - 5:15pm)

3/9/99 - Finished keying out the insects collected from Slagle Creek (2:15pm - 6pm)

3/10/99 - Collected insects from Steele Creek (BD). (2:15pm - 4:15pm)

3/11/99 - Began keying out the insects collected from Steele Creek (BD). (2:15pm - 4pm)

3/12/99 - Worked on keying out the insects collected from Steele Creek (2:15pm - 5pm)

3/13/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

3/15/99 - Began re-survey work on Trinkle Creek. (2:15pm - 4:30pm)

3/16/99 - Worked on keying out the insects collected from Steele Creek. (2:15pm - 5:30pm)

3/17/99 - Finished keying out Steele Creek (BD) insects. (2:15pm - 4pm)

3/18/99 - Began keying out insects from all creeks that could earlier not be determined. (2:15pm - 4:15pm).

3/19/99 - Worked on keying out insects from all creeks that could were not determined earlier. (2:15pm - 5pm)

3/20/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

3/22/99 - Worked on keying out insects from all creeks that could were not determined earlier. (2:15pm - 4:45pm)

3/23/99 - Finished keying out insects from all creeks that could were not determined earlier. (2:15pm-5pm)

3/24/99 - Worked on the re-surveying of Trinkle Creek. (2:15pm - 5pm)

3/29/99 - Researched the Rainbow and Mountain creekshell mussels. (2:15pm - 4pm)

3/30/99 - Kevin Hamed, Phil Gentry, Mark Fagg, and myself collected mussels from Hawkins County stream. (12pm-7pm)

3/31/99 - Worked on the re-surveying of Trinkle Creek. (2:15pm - 5pm)

4/1/99 - 4/6/99 - Spring Break

4/3/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)

4/7/99 - Introduced mussels into Steele Creek (AD) and (BD). (2:15pm-5pm)

4/8/99 - Introduced mussels into Steele Creek (AD) and (BD). (2:15pm-5pm)

4/9/99 - Worked on the re-surveying of Trinkle Creek. (2:15pm - 5pm)

4/10/99 - Maintained all aquariums (1:30 P.M. - 1:45 P.M.) and finished the re-surveying of Trinkle Creek. (6pm - 8pm)

4/11/99 - Drove to Virginia Tech to use their library for information needed to complete my study. (7am - 4pm)

4/12/99 - Collected DO and pH samples from Steele Creek (AD) and (BD). (2:15pm - 5pm)

4/13/99 - Collected DO and pH samples from Slagle Creek. (2:15pm - 4:15pm)
4/14/99 - Collected DO and pH samples from Trinkle Creek. (2:15pm - 4:30pm)

4/15/99 - Began working with research material and data for the published version (report) of this study. (2:15pm - 3:30 PM)

4/17/99 - Maintained all aquariums. (1:30 P.M. - 1:45 P.M.)
Worked on report. (10am - 1pm)

4/18/99 - Worked on report. (1pm -7pm)

4/19/99 - Worked on report. (2:15pm - 12am)

4/20/99 - Worked on report. (2pm-1am)

4/21/99 - Worked on report. (3:05pm - 2am)

4/22/99 - Worked on report. (2:15pm - 3am)

4/23/99 - Worked on report. (2:15pm - 6pm)

4/24/99 - Worked on report. (10am - 3pm)

4/25/99 - Worked on report. (12pm - 4:30pm)

4/26/99 - Worked on report. (2:15pm - 10pm)

4/27/99 - Worked on report. (2:15pm - 12am)

4/28/99 - Practice for presentation. (6:30pm - 8pm)

4/29/99 - Presentation at Steele Creek Park Nature Center. (7pm - 8:30pm)

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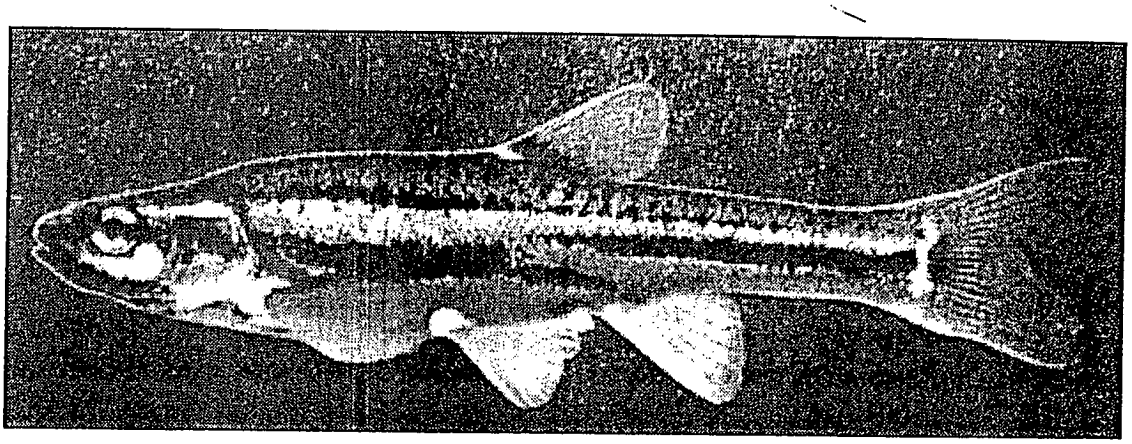
Rare aquatic species discovered in Steele Creek Park streams



There are fewer than 40 known populations of the rare and endangered Tennessee Dace. The species was found in two streams at Steele Creek Park.

While uncovering the mysteries found within the aquatic environments of Steele Creek Park, a new light was shed on two specific stream environments. What is so special about these two streams? Well, to begin with is their physical characteristics. Both streams are around one meter in width and 14 centimeters in water depth. The bottoms of each streambed are made of a conglomeration of gravel, sand, and silt. Each contain shallow to fairly deep pools of slow moving water and both are found in the woodland areas of the park. However, it is not only the streams themselves that are special, but the living creatures within their waters. It just so happens that located within these two streams is the Tennessee Dace (Phoxinus Tennessenisis).

The Tennessee Dace is found within the state in fewer than 40 known populations. The species was given a state endangered ranking of "S2" by the Tennessee Natural Heritage Program, which in turn means that it is rare and imperiled species within the state. General characteristics of the species include a broken stripe running along its side, a thin black stripe running parallel to the broken one, several small black spots along its back, and a display of bright silver areas at the base of each fin.

Now that the park knows of the endangered species living within its stream, what does it plan to do? Sarah Garrett, an Abingdon High School Student and intern working through Bristol Leisure Services at Steele Creek Park Nature Center, plans to author a management plan for the survival of the Tennessee Dace. Sarah who found and identified the species, will work along with the Tennessee Wildlife Resource Agency, TWRA, to devise a method in which the Tennessee Dace will live free from human interference and environmental harm.

From *The Shape of Things*
publication of the *Bristol Herald Courier*,
Winter 1999

Garrett studies aquatic life

by Cynthia Fields

Senior Sarah Garrett has an independent study with a lengthy name: "A comprehensive survey of aquatic life, utilizing Steele Creek, Slagle Creek, and Trinkle Creek as a habitat, within boundaries of Steele Creek Park, Bristol, Tennessee, Sullivan County; along with reintroduction of native park aquatic species into these aquatic environments." But because Garrett has so many activities involved with the project, it is aptly named.

During seventh period Garrett travels to Steele Creek Park, surveys and compares the aquatic life, including fish, crustacean, insects, and algae, of three creeks in Steele Creek Park in Bristol, Tennessee. She stays everyday for about two hours.

While studying the water life, she found and identified a species of fish called the Tennessee Dace (*Phoxinus Tennessenisis*). In Tennessee, the fish is known in less than forty populations and is considered a rare and imperiled species in the state.

Garrett also works as a naturalist with the Bristol Leisure Services at Steele Creek Park Nature Center during the summer and set up an aquarium to support another fish, the Snubnose darter (*Etheostoma simoterum*). By examining its characteristics, Garrett hopes to reintroduce the fish to a spot below Steele Creek Lake from the creek above the lake.

To do this, Garrett used electro-shock material to stun the fish so they would float to the surface of the water. Garrett then collected 22, put them in coolers, and then replaced them in a habitat below the lake. "If the Tennessee Dace can survive, it will give an indication of the water quality. It is the different number of species in an area, not the amount of each species, that determines water quality," said Garrett. "The healthier a habitat is, the broader number of species it can hold."

Although a habitat can hold a broad range of species, foreign species are not good for natural ones. The case with Steele Creek Park is that the Asian Clam, a foreign mussel, is dominating and multiplying quickly, making it hard for natural, local mussels. With the supervision of the Tennessee Valley Authority, Garrett hopes to also establish a species of Rainbow Mussel above the dam. The species probably existed there earlier but now only lives below the dam.

Photo by Kevin Hamed

Garrett sweeps the water with a net to catch fish. The fish will then be measured and identified.

Garrett enjoys the project. "I am able to gain experience from it. I am learning the field research process and about the environment. It is giving me a good background for something that I would like to go into later."

From the *TALON*
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March 24, 1999
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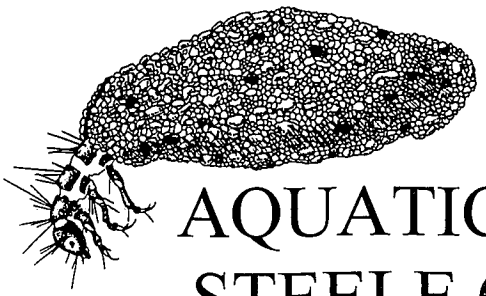
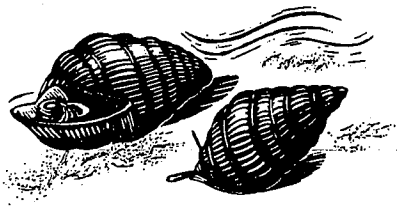
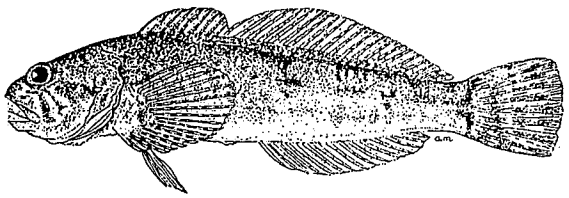




AQUATIC STUDIES AT STEELE CREEK PARK

FREE AND INFORMATIVE SEMINAR



April 29, 1999
7:00 P.M.

Presented by... **SARAH GARRETT,** Abingdon High School
Steele Creek Park Nature Center Bristol, Tennessee

For All Ages!
Have you ever wondered what lives in the creeks of Steele Creek Park? Now is the time to find out!

This year long project discovered several new park records, located two populations of the rare Tennessee Dace, reintroduced two species of mussels to Steele Creek, surveyed crayfish populations, identified aquatic insects, and monitored water quality of these creeks.

Why do some animals live in Slagle Creek and not Steele Creek?
How were mussels reintroduced?
Where were darters re-established?
All of these questions and many more will be answered!

BRISTOL TENNESSEE Leisure Services

BRISTOL TENNESSEE

Friends of Steele Creek Park

About
Sarah Garrett

Sarah Garrett is presently a senior attending Abingdon High School. She is an active member of the Fellowship of Christian Athletes, President of the AHS Latin Club, and Chaplain of the Student Council Association. She will graduate in the summer of 1999 in the top 10 of her Senior Class.

As a Junior, Sarah conducted a biological study on migratory waterbirds in the Bristol area. She plans to continue her study in Biology by majoring in the field while attending Virginia Polytechnic Institute.

For more information, please call Steele Creek Park Nature Center (423-989-5616) or Department of Leisure Service (423-764-4023)