

**An Inventory of the Salamander Species
of Steele Creek Park,
in Sullivan County, Tennessee,
with Notes on Their Distribution**

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Introduction

Salamanders and their habitats were studied in Steele Creek Park, in Sullivan County, Tennessee. This site was chosen because the last salamander inventory was done in 1972 and only included the Slagle Hollow area of the park. The primary study was an inventory of both aquatic and terrestrial species found within the park boundaries, including the Slagle Hollow and Trinkle Hollow areas. Individual salamanders ($n=92$) were caught, identified, measured, and released and notes on their habitats were recorded. Six different species were found, including three species undocumented in the 1972 study (Table 1). In areas of low populations ($n < 1/m^2$), water samples were taken to determine if water quality affects salamander population density (Table 4). Since all salamanders require moisture for respiration and reproduction, species distribution may be affected by pH, phosphate, dissolved oxygen, predatory fish populations, or physical domain.

Literature review

Salamanders, or "fire lizards", are members of the Order Caudata (Chordata: Amphibia). They rely on external moisture to maintain a proper internal water balance and to allow oxygen to move through their smooth, flexible skin (Halliday, 1986). Temperature and rainfall are primary factors that initiate breeding activities (Duellman and Trueb, 1986). Breeding can occur annually, in the spring, or biennially, in late summer and spring (Duellman and Trueb, 1986).

Steele Creek Park is a designated State Natural Area of Sullivan County, Tennessee. Steele Creek Park has an 11.8 mile perimeter surrounding 2,196 acres of wildlife sanctuary. It is divided into two halves: Slagle Hollow and Trinkle Hollow. The Slagle Hollow area encompasses 1,267 acres and 5.9 miles of boundary. The Trinkle Hollow area has a 4.5 mile perimeter with 740 acres. Two families and six species were found within the boundaries of Steele Creek Park.

The mole salamanders of the family Ambystomatidae remain under ground throughout the year except during breeding season (Noble, 1954; Maddison *et al*, 1998). They start their annual breeding migrations during spring rains when the temperature exceeds 10 degrees Celsius (Duellman and Trueb, 1986). They have internal fertilization and their larvae tend to mature in one to three years (Duellman and Trueb, 1986). This family has aquatic larvae that display broad heads, caudal fins, and long filamentous gills (Maddison *et al*, 1988). Some ambystomatids are perennibranchiate and retain the appearance and aquatic lifestyle of the larvae (Maddison *et al*, 1998). Many species of this family have skin secretions that serve as an antipredator mechanism (Salamander Chronicles, 1998). These secretions are produced by the granular glands of the skin and possess very strong adhesive properties and rapid bond rates (Salamander Chronicles, 1998).

Ambystoma maculatum, the spotted salamander, is a robust salamander that is black with two irregular rows of yellow spots down each side of its body. This large salamander is normally about 15 cm but can reach up to 24 cm (Conant and Collins, 1991). It normally resides underground where it feeds on earthworms and other invertebrates (Capula, 1989). In the spring, *A. maculatum* can be most easily seen during the mass migrations to woodland ponds, where the female attaches her egg masses to submerged vegetation (Conant and Collins, 1991).

The family Plethodontidae is the largest family of tailed amphibians, with over 300 extant species (Halliday, 1986). The most distinguishing feature of this family is absence of lungs in adults; 90 % of their respiration is cutaneous (Noble, 1954; Duellman and Trueb, 1986). They also use buccopharyngeal respiration which is accomplished by vascularization of the epithelium and an increased rate of throat vibrations to push oxygen over the epithelium (Noble, 1954). Another unique characteristic of plethodontids is the presence of nasolabial grooves which carry waterborne odors from the ground to the nose (Halliday, 1986). Most plethodontids are completely terrestrial, but others are biphasic or completely aquatic. In any of these cases, plethodontids must remain moist at all times to allow for proper gas exchange. They emerge typically only on wet nights to feed or mate. Most plethodontids reproduce biennially, generally in late summer and again in the spring (Duellman and Trueb, 1986). They generally lay small clutches of terrestrial eggs that the female attends until the eggs hatch (Duellman and Trueb, 1986). The larvae are either aquatic or develop directly without an aquatic stage (Duellman and Trueb, 1986). They have a very low metabolic rate so they are able to remain inactive for long periods of time. When they do feed they store much of what they eat as fat to preserve them through dry or inactive times (Halliday, 1986).

The family Plethodontidae is divided into two subfamilies that contain their own unique characteristics. The Desmognathinae are the dusky and the shovelnose salamanders that are almost constantly changing throughout development, making identification extraordinarily difficult. They can range from completely terrestrial to completely aquatic (Maddison *et al*, 1998). The most distinctive characteristic among the desmognathines is the pale diagonal line that extends from the eye down the angle of the jaw (Conant and Collins, 1991). The hind legs tend to be larger and more stout than the front (Conant and Collins, 1991). *Desmognathus fuscus*, the northern dusky salamander, is a highly variable aquatic species. It generally has a compressed tail with a sharp dorsal edge (Conant and Collins, 1991). It is most often gray or brown with five to seven pair of yellowish spots on the body and tail. It is generally found under rocks and debris in small, trickling streams. *Desmognathus fuscus* tend to remain in a home territory in the vicinity of running water and may become quite territorial (Barker, 1964). It tends to be aquatic through all stages of life (Duellman and Trueb, 1986). *Desmognathus ochrophaeus*, mountain dusky salamander, is very similar to *D. fuscus*. *Desmognathus ochrophaeus* has aquatic eggs and larvae, but the adults are generally terrestrial (Duellman and Trueb, 1986).

The subfamily Plethodontinae contains terrestrial woodland salamanders that have no aquatic larval stage (Maddison *et al*, 1998). Their eggs generally hatch into tiny replicas of their parents (Halliday, 1986). These salamanders require moisture but not necessarily standing water, so they tend to hide by day in moist burrows or under rotten logs and surface on wet nights to feed (Halliday, 1986). They differ from the desmognathines in that they lack the facial line and all the legs are of equal size. *Plethodon richmondi*, the ravine salamander, is black to brown dorsally with a plain dark belly and mottled chin (Conant and Collins, 1991). It is very long and slender giving it a "worm-like" appearance. *P. richmondi* can be found on slopes and ravines, particularly at higher elevations (Conant and Collins, 1991). *Plethodon glutinosus*, the slimy salamander, is a glossy black with silvery white spots sprinkled all over its body (Capula, 1989). The cylindrical tail is longer than the body. Its skin glands secrete a sticky mucus that makes it distasteful to most predators (Capula, 1989). It is mainly active at night after heavy rains and tend to remain dormant at all other times. *P. glutinosus* is generally found in shaded ravines or woodland banks (Capula, 1989).

The genus *Eurycea*, or brook salamanders, are found in small bodies of water where predatory fish are absent (Conant and Collins, 1991). They are aquatic through all stages of their life, with the female laying small clutches of eggs under rocks (Duellman and Trueb, 1986). They all tend to have yellowish undertones, especially on the bellies. This genus is confined to eastern and south central North America (Conant and Collins, 1991). *Eurycea wilderae*, the Blue Ridge two-lined salamander, is yellow with broad, black bands running the length of the body and breaking into dots at the tail (Conant and Collins, 1991). Its tail is generally longer than its body and its belly is solid, bright yellow. It can be found under rocks in streams and even in humid forests.

Salamanders are presumed to be excellent indicators of water quality and environmental conditions because of their total reliance on water (Maddison *et al*, 1998). They are also environmental indicators because of their fragile systems that cannot survive the various man-made pollutants (Salamander Chronicles, 1998). Damage to the ozone layer may also contribute to deformities and developmental abnormalities among salamanders (Sounder, 1997). Therefore, salamanders are a significant part of our ecosystem because of their sensitivity to foreign chemicals and their importance to the food web.

Location Areas

Steele Creek Park has an 11.8 mile perimeter surrounding 2,196 acres. It is divided into two halves by a 52 acre lake (Fig. 1). The Slagle Hollow side contains 5.9 miles of boundary and 1,267 acres. The Trinkle Hollow area has 740 acres of land and 4.5 miles of boundary. Eleven locations were selected from the park. Most of the locations followed creeks and encompassed 10-20 meters surrounding the creek banks.

Six locations were designated in the Slagle Hollow side of Steele Creek Park (Fig. 2). Location 3 included the creek and surrounding area along Hemlock Hollow trail (Fig. 3). The location started once the trail first crossed the creek and continued until the creek crossed the path again. The area surrounding the creek contained rotten and moss covered logs, rocks, and leaf litter. The creek had detritus throughout and was very rocky. Location 7 was the continuation of location 3. Location 7 started at the second crossing of Hemlock Hollow trail and continued along the Slagle Hollow trail until the trail crossed the creek (Fig. 3). The creek was very rocky with many fallen branches and trees crossing it. The surrounding area had many rotten logs, leaf litter, and rocks. Location 4 was the first 50 meters of the creek along Jewelweed Way trail. The creek was very rocky with artificially placed rocks along the sides. The banks were covered with rocks and leaf litter. Location 9 was the section of Slagle Hollow trail that went over the knoll into Slagle Hollow (Fig. 3). This location was completely terrestrial and contained many overturned trees, rocks, logs, and leaf litter. Once in Slagle Hollow, the trail crosses a small creek, which is the beginning of Location 10. This location followed the creek for approximately 100 meters. This area had many overturned trees, rocks, logs, thick vegetation, leaf litter, and detritus. Location 11 was the continuation of this creek running through Slagle Hollow. This location ended when other creeks joined. This habitat was similar to Location 10, with overturned trees, thick vegetation, and leaf litter (Fig. 3).

Trinkle Hollow is made up of 740 acres, four locations were used during this study. Location 1 was the main creek to the point the first branch entered (Fig. 4). The creek had scattered rocks and detritus. The surrounding area had rotten logs, rocks, overturned trees, and leaf litter. The area immediately around the creek was a marsh with rotten trees and leaves. Location 2 was the first branch entering the main creek. The creek was very rocky and the area around the creek had rocks and leaf litter. This creek flowed from the knoll and eventually ended. Location 5 was the continuation of the main creek for approximately 100 meters (Fig 4). This creek contained many rocks and had very steep, high banks. The area around the creek was steep and strewn with overturned trees, moss covered logs, and leaf litter. One section of location 5 was a very marshy area that was thick with vegetation, rotten logs, and detritus. Location 6 was the first permanent branch that entered location 5. The creek was very rocky and the sides had moss covered rocks and logs. This branch flowed from a knoll and eventually ended (Fig. 4).

Slagle Hollow

Trinkle Hollow



Figure 1. Map of Steele Creek Park, showing the two regions of the current study.



Figure 2. Map of the Slagle Hollow area with the six locations used during this study.

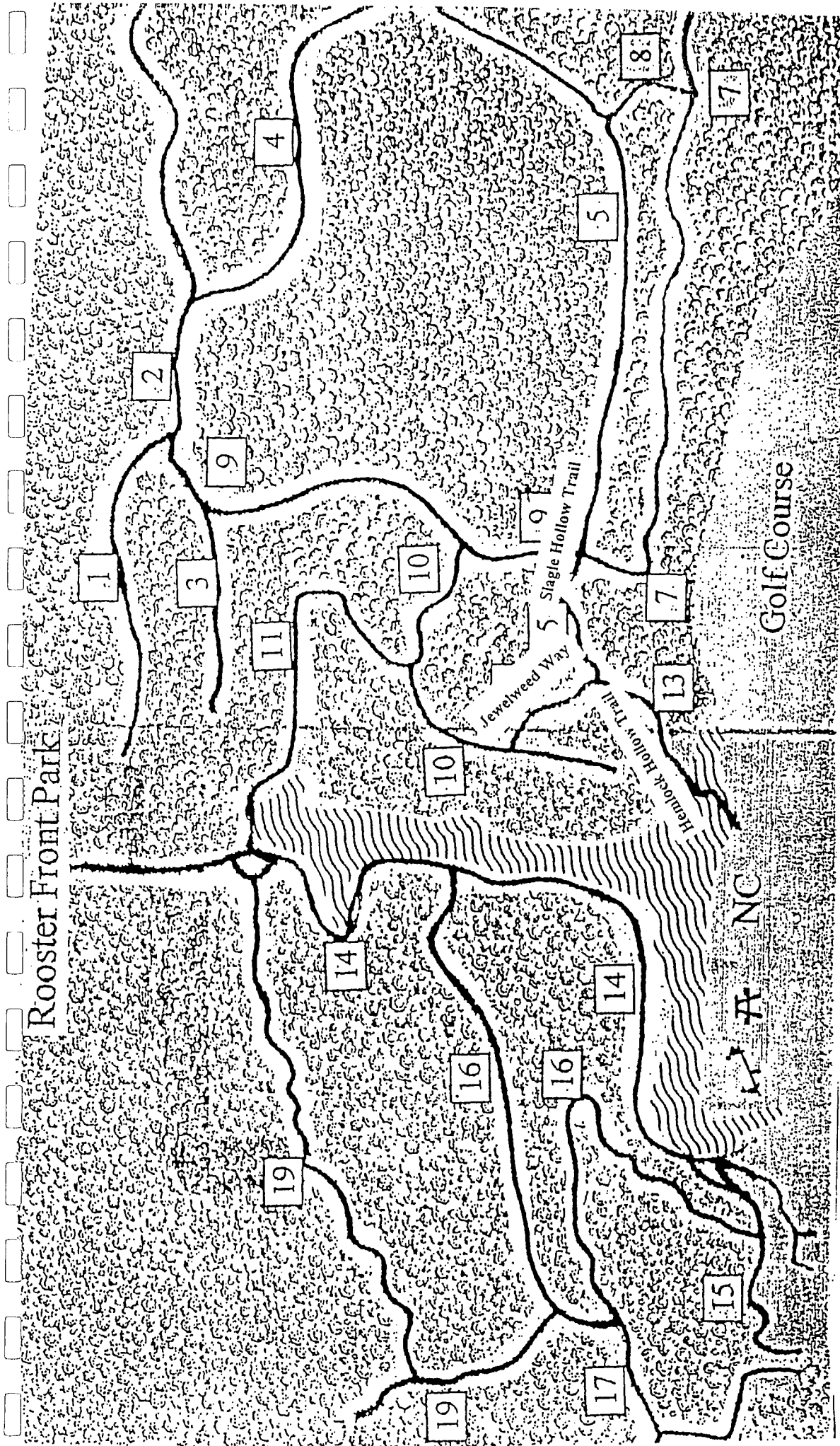


Figure 3. Trail map of Steele Creek Park with the trails used during this study in Slagle Hollow. Designated trails were not used in Trinkle Hollow.

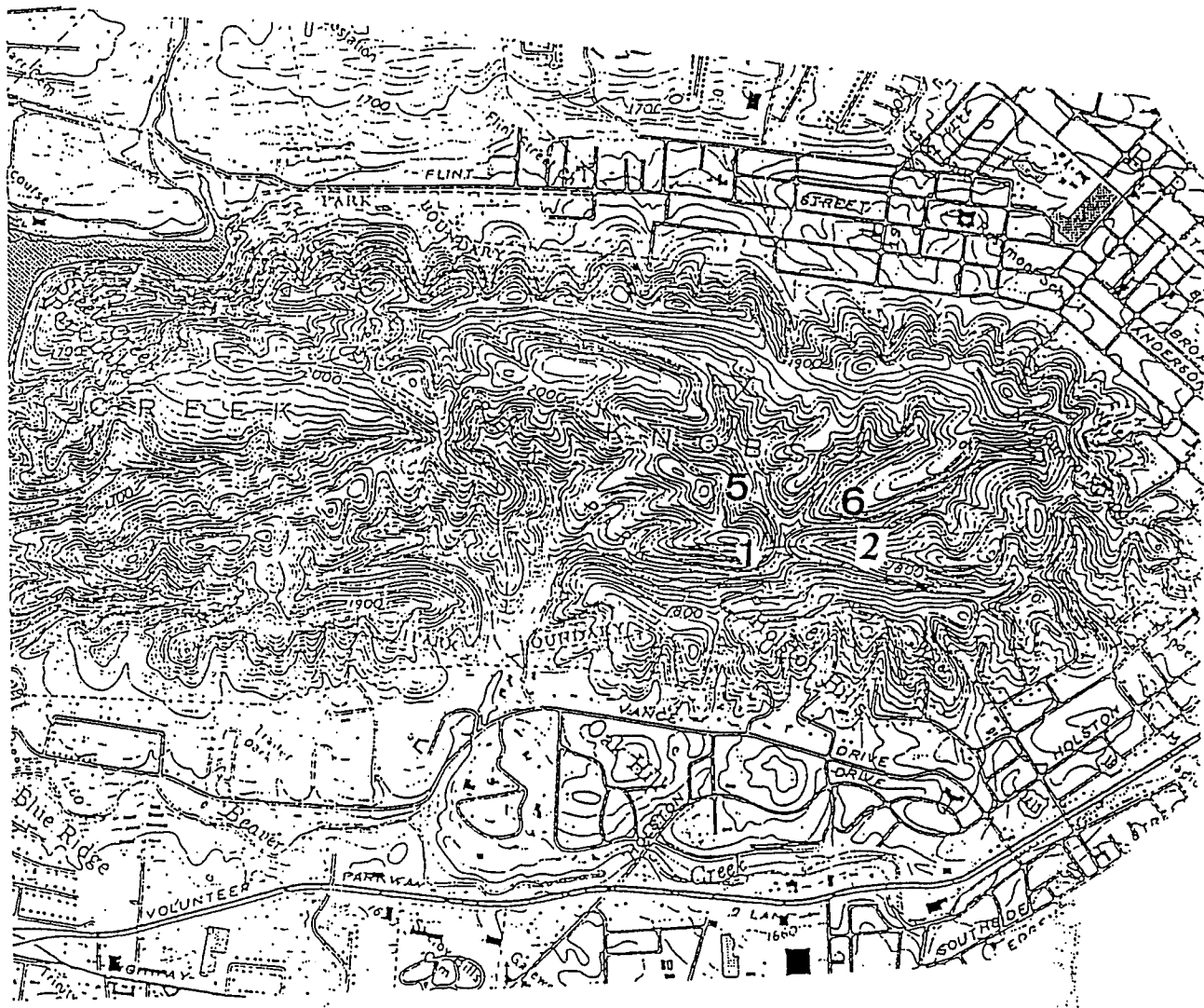


Figure 4. Map of Trinkle Hollow with the four locations used during this study.

Materials and Methods

This project was designed to determine the species richness in Steele Creek Park. A short-term sampling method was established by first identifying and defining specific locations. These locations were determined by choosing habitats suitable for salamanders. A location was generally a creek or the first 100 meters and the surrounding area. Creeks that contained many rocks, detritus, and logs were considered excellent salamander habitat. Terrestrial areas that had overturned trees, rocks, leaf debris, and rotten logs were also sampled. Location areas were marked with survey tape, numbered, and the vegetation, altitude, and general habitat descriptions were recorded on the location forms (Appendix A).

Random sampling methods were used to find the individual salamanders. The creeks and approximately 20 meters surrounding were sampled. Any rocks, logs, and large masses of leaf debris were overturned. Each salamander was caught and placed in a zip-lock bag. The species and location found were recorded in the field notebook and on observation forms (Appendix B). The snout-vent length (SVL) was then measured using calipers (Fig. 5). It was recorded if the salamander was gravid or around eggs. The salamander was then released where it was captured. Each section was done only once to prevent capturing the same salamanders repeatedly.

If an area seemed to have a low population ($n < 1/m^2$), then the water quality was tested. CHEMets test kits were used to test phosphate and dissolved oxygen content. Each test kit was used to test the pH. The water was tested in the creek with low population as well as the surrounding creeks for comparison. The results were compared to determine if water quality affected salamander populations. Physical domain and fish populations were also recorded as possible reasons for population decline.

The data was analyzed to determine if the species distribution was the same throughout the park. The number of individuals per species were calculated to figure the most abundant species, terrestrially and aquatically, within the park (Table 2), as well as to see if the distribution was equal in the Trinkle Hollow and Slagle Hollow (Table 3). Further analysis was done to determine age classes by snout-vent lengths (Tables 6,7, and 8).

Results

A total of six species were documented at Steele Creek Park during this survey. The survey done in 1972 found three species (Table 1). *Plethodon richmondi*, *Eurycea wilderae*, and *Ambystoma maculatum* were the new species found the current study. These three species, along with *Plethodon glutinosus*, *Desmognathus fuscus*, and *Desmognathus ochrophaeus* were distributed relatively evenly throughout the park (Table 2) as well as between Slagle Hollow and Trinkle Hollow (Table 3).

All six species were found in Slagle Hollow's locations 3, 4, 7, 9, 10, and 11 (Table 3; Appendix A). Location 3 yielded only aquatic species, *Desmognathus fuscus* and *Eurycea wilderae*, even though terrestrial habitats were available. Additionally, a gravid female *E. wilderae* was found. Location 4 also had only aquatic species but the *Desmognathines* tended to be dominant. Within location 7, *Plethodon richmondi*, *Desmognathus fuscus*, and *Desmognathus ochrophaeus* were found. This location yielded a low number of individuals, but this was mainly due to fallen logs and debris making finding individuals very difficult. Location 9 was completely terrestrial and very steep. *Plethodon richmondi* was found in this location, but as the terrain became steeper no salamanders could be found. Location 10 proved to hold an variety of salamanders, aquatic and terrestrial. This location had superior habitat for salamanders because of the fallen trees and debris from the January 1998 blizzard. *Plethodon richmondi*, *Ambystoma maculatum*, *Eurycea wilderae*, *Desmognathus fuscus*, and *Desmognathus ochrophaeus* were found here. Additionally, a gravid *E. wilderae* was found in this creek. Location 11 was a continuation of the same area in location 10, therefore location 11 was also a superior habitat. *Plethodon glutinosus*, *Plethodon richmondi*, and *Desmognathus fuscus* were found in abundance in this location (Appendix B).

Five of the six species were found in Trinkle Hollow's locations 1, 2, 5, and 6 (Table 3; Appendix A). Location 1 had an abundance of *Plethodon richmondi*, as well as *Desmognathus fuscus* and *Desmognathus ochrophaeus*. Location 2 had an abundance of the aquatic species with no documentation of terrestrial species. *Desmognathus fuscus* and *Eurycea wilderae* were found. Also found were eggs laid beneath a rock, presumable those of *Eurycea wilderae*, as a *E. wilderae* female was found guarding the eggs. Additionally, a gravid *E. wilderae* female was found within this creek as well. Location 5 had a variety of different habitats. Within the creek *D. fuscus*, *D. ochrophaeus*, and *E. wilderae* were found. There was also a marsh area approximately 10 meters from the creek that had *D. fuscus* and *D. ochrophaeus*. One *Plethodon glutinosus* was found dead in the creek. It is a terrestrial salamander and had presumable been caught in high water while breeding or egg-laying. No aquatic salamanders were found in the main creek of location five above the third branch. Water quality was tested (Table 4) and predatory fish were identified. The relatively low dissolved oxygen content and presence of *Rhinichthys atratulus*, the blacknose dace, were said to contribute to the low populations of aquatic salamanders in location 5. Location 6 had an abundance of *E. wilderae*, as well as dispersed *D. fuscus*. A gravid female *E. wilderae* was found within creek of location 6 (Appendix B). Once the salamanders were inventoried, their snout-vent lengths were graphed to determine if they could be divided into age classes (Fig. 6, 7, and 8).

Throughout the park, the most abundant aquatic species was *Eurycea wilderae* and the most prevalent terrestrial species was *Plethodon richmondi* (Table 2). The only gravid individuals or eggs found were in conjunction with *E. wilderae*. A total of 92 individuals were collected from two families, four genera, and six species. Finally, most of the creeks within Steele Creek Park should have excellent water quality because of the high populations of salamanders.

Discussion

The salamander inventory done in 1972 yielded only three species, whereas this inventory found six species. The addition of *Eurycea wilderae* may be explained through possible introduction from fisherman using them for bait. Individuals that escape could have reproduced and started a new population. The more probable explanation for the increase in salamander species is natural salamander succession. This is the replacement of one dominant species by another over time. Additionally, habitat changes that naturally occurred in the 26 years since the original study must be taken into account. As the habitat naturally changed, different salamander species would become more dominant as their niche became prevalent.

The low occurrence of certain species may also be because of season and breeding periods. The low number of ambystomatids found can also be explained by their fossorial lifestyles. Many other species of salamanders also stay underground or in hiding except during breeding season or after hard rains; therefore, timing is essential to capture these salamanders.

Salamanders are excellent indicators of water quality because of their reliance on water for respiration and breeding. In areas of low populations ($n < 1/m^2$), water quality was tested. The only location deemed as having a low population was a section of location 5. There were only 3 individuals found in this section. Dissolved oxygen, phosphate, and pH were tested in the field. The water quality of locations 2 and 6 were also tested as they were nearby and had adequate salamander populations. Location 2 and 6 had similar dissolved oxygen amounts (8 ppm and 7, ppm respectively), whereas location 5 had a lower content at 5 ppm. The pH was the exact same in locations 5 and 6 and slightly more alkaline in location 2. The phosphate levels were 0 ppm in all three locations (Table 4). Therefore, the only difference seen was the lower dissolved oxygen content. This could contribute to the low populations, but other explanations could be found. The presence of *Rhinichthys atratulus*, the blacknose dace, at location 5 and absence at locations 2 and 6, could better explain the low population of salamanders. These predatory fish tend to feed on all life stages of salamanders and can greatly diminish populations. Since other habitats were available without these predatory fish, salamanders migrated to the more suitable areas. Therefore, the water quality within the park is excellent and would support salamanders, but the presence of predatory fish limits the population to certain areas.

The three most abundant species were divided by SVL to determine age classes (Fig. 6, 7, and 8). The graph of SVL of *P. richmondi* showed a distinct division between the juveniles and the adults (Fig. 6). *Desmognathus fuscus* does not show such divisions because the high variability of aquatic desmognathines prevents their accurate identification and, therefore, they were not considered in this study (Fig. 7). This can be explained since *D. fuscus* has highly variable aquatic juveniles, they were not used in the inventory. *Eurycea wilderae* were all roughly the same size; however the females found with eggs or gravid were between 35-45 mm, suggesting there is a certain reproductively mature size (Fig. 8).

Conclusion

Steele Creek Park contains the habitat and water quality to support a variety of salamander species. More time and a greater number of individuals collected may prove that there are more species within the park than found in this survey. Species found greatly depends on season and exceptional timing. However, with time the species distribution will likely change again and different species will become dominant.

Appendix A

Location forms

Location Sheet

Location number: 1

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Christmas fern, Pines, Horsetail

Altitude: 494-500 meters

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X		X	
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Trinkle Hollow

Main creek to the where the first branch enters

Creek is rocky

Edges and surrounding woodland has rotten logs,
rocks, and leaf litter

Location Sheet

Location number: 2

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Christmas fern, Pines, Horsetail

Altitude: 494-500 meters

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X		X	
Ponds/Pool					
Lake					
Woodland	X			X	X

General Habitat Description: Trinkle Hollow
 First branch flowing into location 1
 Creek is very rocky
 Edges and surrounding woodland has rotten logs,
 rocks, and leaf litter

Location Sheet

Location number: 3

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Chestnut Oak, Red Oak, May Apple

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X		X	X
Ponds/Pools					
Lake					
Woodland	X				X

General Habitat Description: Slagle Hollow
 Creek that follows Hemlock Hollow trail
 Leaf litter in creek and along sides
 Many rocks along sides

General Habitat Description: Slagle Hollow
First 50 meters creek of Jewelweed Way
Leaf litter in creek and along sides
Many rocks along sides

Location Sheet

Location number: 5

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Christmas fern, Pines, Horsetail

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Trinkle Hollow
 Extension of Location 1 creek-approximately 100 meter
 Leaf litter and rocks within the creek
 Many overturned trees, rotten logs, moss covered rocks,
 and wet leaves

Location Sheet

Location number: 6

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Christmas fern, Pines, Horsetail

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Trinkle Hollow
 First permanent creek entering location 5
 Creek very rocky with moss and leaf litter along sides

Location Sheet

Location number: 7

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Chestnut Oak, Red Oak, May Apple

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Slagle Hollow
 Continuation of Location 3 creek
 Creek very rocky with fallen trees crossing it
 Rotten logs, rocks, and leaf litter along sides

Location number: 8

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Grass, small pines, Beech,

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools				X	
Lake					
Woodland	X			X	X

General Habitat Description: Rooster Front Park
Temporary creek that flows through forest and into field
Creek rocky with leaf litter
Rocks and leaf litter along sides

Location Sheet

Location number: 9

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Chestnut Oak, Red Oak, May Apple

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks					
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Slagle Hollow
 Slagle Hollow trail as it winds over the knoll
 Overturned trees, rotten logs, rocks, and leaf litter

Location Sheet

Location number: 10

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Chestnut Oak, Red Oak, May Apple

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Slagle Hollow
 First 100 meters of creek in Slagle Hollow that parallels Slagle Hollow trail
 Creek very rocky with leaf litter and rotten logs
 Many overturned trees, rotten logs, rocks, and leaf litter along sides

Location Sheet

Location number: 11

City: Bristol County: Sullivan State: Tennessee

Habitat Information:

Landscape: Natural Grazed Mowed Urban Other: _____

Dominant Vegetation: Beech, Chestnut Oak, Red Oak, May Apple

Altitude: 494-500

Distance to nearest water source: <5 meters 5-20 meters 20-100 meters >100 meters

Sample Areas:

	Under rocks	along sides	open water	among vegetation	under logs
Creeks	X	X	X	X	X
Ponds/Pools					
Lake					
Woodland	X			X	X

General Habitat Description: Slagle Hollow
Continuation of location 10 until the creek branches
Creek very rocky with leaf litter and rotten logs
Many overturned trees, rotten logs, rocks, and leaf litter along sides

Appendix B

Observation forms

OBSERVATION FORM

Location Number 1Date: 02 -19 -98

Begin Time: 1:00 PM

End Time: 4:00 PM

Begin Air Temp: 8.5 C

Begin Water Temp: 10.0 C

Begin Soil Temp: 9.0 C

End Air Temp: 7.5 C

End Water Temp: 11.0 C

End Soil Temp: 8.0 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Plethodon richmondi</i>	ravine salamander	under bark	44 mm		
<i>Plethodon richmondi</i>	ravine salamander	leaf litter	43 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	45 mm		
<i>Plethodon richmondi</i>	ravine salamander	under limb	52 mm		
<i>Plethodon richmondi</i>	ravine salamander	leaf litter	43 mm		

Comments:

OBSERVATION FORM

Location Number 1

Date: 03 -24 -98

Begin Time: 1:30 PM

End Time: 4:00 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 7.0 C

End Air Temp: 10.0 C

End Water Temp: 8.0 C

End Soil Temp: 7.0 C

Cloud Cover: 50 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus fuscus</i>	northern dusky	under log	33 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	under log	55 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	under log	48 mm		

Comments:

OBSERVATION FORM

Location Number 2Date: 02 -19 -98

Begin Time: 1:00 PM

End Time: 4:00 PM

Begin Air Temp: 8.5 C

Begin Water Temp: 10.0 C

Begin Soil Temp: 9.0 C

End Air Temp: 7.5 C

End Water Temp: 11.0 C

End Soil Temp: 8.0 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	38 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	49 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	45 mm	10 eggs ~ 2 mm	
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	46 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	45 mm		42 eggs under rock ~ 3 mm
<i>Desmognathus fuscus</i>	northern dusky	creek	28 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	25 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	27 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	49 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	40 mm		

Comments:

OBSERVATION FORM

Location Number 3Date: 02 -24 -98

Begin Time: 1:00 PM

End Time: 3:30 PM

Begin Air Temp: 6.0 C

Begin Water Temp: 6.5 C

Begin Soil Temp: 4.0 C

End Air Temp: 6.0 C

End Water Temp: 7.0 C

End Soil Temp: 6.0 C

Cloud Cover: 75 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus fuscus</i>	northern dusky	beside creek	23 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	26 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	33 mm	11 eggs ~ 2 mm	
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	30 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	32 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek (dead)	30 mm		

Comments:

OBSERVATION FORM

Location Number 4Date: 02 -24 -98

Begin Time: 1:00 PM

End Time: 3:30 PM

Begin Air Temp: 6.0 C

Begin Water Temp: 6.5 C

Begin Soil Temp: 4.0 C

End Air Temp: 6.0 C

End Water Temp: 7.0 C

End Soil Temp: 6.0 C

Cloud Cover: 75 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus ochrophaeus</i>	mountain dusky	beside creek	43 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	38 mm		

Comments:

OBSERVATION FORM

Location Number 5Date: 03 -3 -98

Begin Time: 1:00 PM

End Time: 3:30 PM

Begin Air Temp: 5.0 C

Begin Water Temp: 6.0 C

Begin Soil Temp: 6.0 C

End Air Temp: 0 C

End Water Temp: 6.0 C

End Soil Temp: 5.5 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus fuscus</i>	northern dusky	creek	32 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	26 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	32 mm		

Comments:

OBSERVATION FORM

Location Number 5Date: 03 -5 -98

Begin Time: 1:30 PM

End Time: 3:30 PM

Begin Air Temp: 14.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 11.0 C

End Water Temp: 8.0 C

End Soil Temp: 9.0 C

Cloud Cover: 75 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	41 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	21 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	18 mm		
<i>Plethodon glutinosus</i>	Slimy salamander	creek (dead)	80 mm		
<i>Plethodon richmondi</i>	ravine salamander	under rock	21 mm		

Comments: No aquatic salamanders found in creek above third branch. Water quality should be tested.

OBSERVATION FORM

Location Number 5Date: 03 -24 -98

Begin Time: 1:30 PM

End Time: 4:00 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 7.0 C

End Air Temp: 10.0 C

End Water Temp: 8.0 C

End Soil Temp: 7.0 C

Cloud Cover: 50 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus fuscus</i>	northern dusky	marsh	35 mm		
<i>Desmognathus ochrophaeus</i> *	mountain dusky	marsh	43 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	beside marsh	51 mm		
<i>Demognathus ochrophaeus</i>	mountain dusky	beside marsh	35 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	41 mm		

Comments: *large gash at base of tail, possible fighting with *D. fuscus* found nearby

OBSERVATION FORM

Location Number 6Date: 03 -3 -98

Begin Time: 1:00 PM

End Time: 3:30 PM

Begin Air Temp: 5.0 C

Begin Water Temp: 6.0 C

Begin Soil Temp: 6.0 C

End Air Temp: 0 C

End Water Temp: 6.0 C

End Soil Temp: 5.5 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	39 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	39 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	41 mm	19 eggs ~3 mm	
<i>Desmognathus fuscus</i>	northern dusky	creek	23 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	43 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	41 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	32 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	29 mm		

Comments:

OBSERVATION FORM

Location Number 6

Date: 03 -24 -98

Begin Time: 1:30 PM

End Time: 4:00 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 7.0 C

End Air Temp: 10.0 C

End Water Temp: 8.0 C

End Soil Temp: 7.0 C

Cloud Cover: 50 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	43 mm		

Comments:

OBSERVATION FORM

Location Number 7Date: 03 -17 -98

Begin Time: 2:00 PM

End Time: 4:00 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 7.0 C

End Air Temp: 6.0 C

End Water Temp: 7.0 C

End Soil Temp: 7.0 C

Cloud Cover: 90 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Plethodon richmondi</i>	ravine salamander	under bark	19 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	under rock	50 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	18 mm		

Comments:

OBSERVATION FORM

Location Number 8Date: 03 -31 -98

Begin Time: 2:30 PM

End Time: 3:00 PM

Begin Air Temp: 20.0 C

Begin Water Temp: 16.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 20.0 C

End Water Temp: 16.0 C

End Soil Temp: 10.0 C

Cloud Cover: 50 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus fuscus</i>	northern dusky	creek	31 mm		

Comments:

OBSERVATION FORM

Location Number 9

Date: 04 -02 -98

Begin Time: 1:00 PM

End Time: 4:00 PM

Begin Air Temp: 18.0 C

Begin Water Temp: 16.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 18.0 C

End Water Temp: 16.0 C

End Soil Temp: 10.0 C

Cloud Cover: 10 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Plethodon richmondi</i>	ravine salamander	under rock	45 mm		

Comments:

OBSERVATION FORM

Location Number 10Date: 04 -02 -98

Begin Time: 1:00 PM

End Time: 4:00 PM

Begin Air Temp: 18.0 C

Begin Water Temp: 16.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 18.0 C

End Water Temp: 16.0 C

End Soil Temp: 10.0 C

Cloud Cover: 10 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus ochrophaeus</i>	mountain dusky	under rock	51 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	under rock	47 mm		
<i>Desmognathus ochrophaeus</i>	mountain dusky	under rock	50 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	36 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	32 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	34 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	35 mm		15 eggs ~3 mm
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	31 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	28 mm		
<i>Plethodon richmondi</i>	ravine salamander	under rock	47 mm		

Comments:

OBSERVATION FORM

Location Number 10Date: 04 -07 -98

Begin Time: 4:30 PM

End Time: 8:30 PM

Begin Air Temp: 20.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 9.0 C

End Air Temp: 16.0 C

End Water Temp: 8.0 C

End Soil Temp: 9.0 C

Cloud Cover: 30 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Desmognathus ochrophaeus</i>	mountain dusky	under wet leaves	59 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	34 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	34 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	31 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	41 mm		
<i>Eurycea wilderae</i>	Blue Ridge two lined	creek	35 mm		

Comments:

OBSERVATION FORM

Location Number 10Date: 04 -09 -98

Begin Time: 1:00 PM

End Time: 4:30 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 8.0 C

End Water Temp: 8.0 C

End Soil Temp: 10.0 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Ambystoma maculatum</i>	spotted salamander	under log	85 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	51 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	41 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	49 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	40 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	19 mm		

Comments:

OBSERVATION FORM

Location Number 11Date: 04 -09 -98

Begin Time: 1:00 PM

End Time: 4:30 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 8.0 C

End Water Temp: 8.0 C

End Soil Temp: 10.0 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Plethodon richmondi</i>	ravine salamander	under log	38 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	21 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	17 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	49 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	50 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	41 mm		
<i>Desmognathus fuscus</i>	northern dusky	under rock	47 mm		
<i>Plethodon richmondi</i>	ravine salamander	under rock	47 mm		
<i>Plethodon glutinosus</i>	slimy salamander	under rock	43 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	49 mm		

Comments:

OBSERVATION FORM

Location Number 11Date: 04 -09 -98

Begin Time: 1:00 PM

End Time: 4:30 PM

Begin Air Temp: 10.0 C

Begin Water Temp: 8.0 C

Begin Soil Temp: 10.0 C

End Air Temp: 8.0 C

End Water Temp: 8.0 C

End Soil Temp: 10.0 C

Cloud Cover: 100 %

Wind: Calm Light Moderate Strong

Weather: Clear Light Rain Heavy Rain Partly Cloudy Mostly Cloudy Snow

Species Information

Scientific Name	Common Name	Where Found	SVL (mm)	Gravid	Eggs/Juveniles present
<i>Plethodon richmondi</i>	ravine salamander	under log	36 mm		
<i>Plethodon richmondi</i>	ravine salamander	under log	40 mm		
<i>Plethodon glutinosus</i>	slimy salamander	under log	59 mm		
<i>Plethodon glutinosus</i>	slimy salamander	under rock	68 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	49 mm		
<i>Desmognathus fuscus</i>	northern dusky	creek	59 mm		
<i>Plethodon glutinosus</i>	slimy salamander	under leaf litter	66 mm		

Comments:

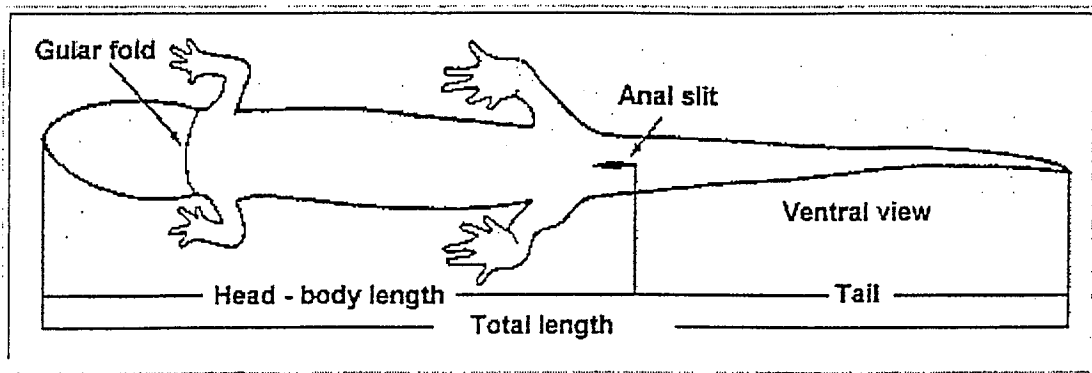


Figure 5. Measuring snout-vent length in salamanders. Tail measurements are not used because the tails are frequently damaged or missing.

P. richmondi

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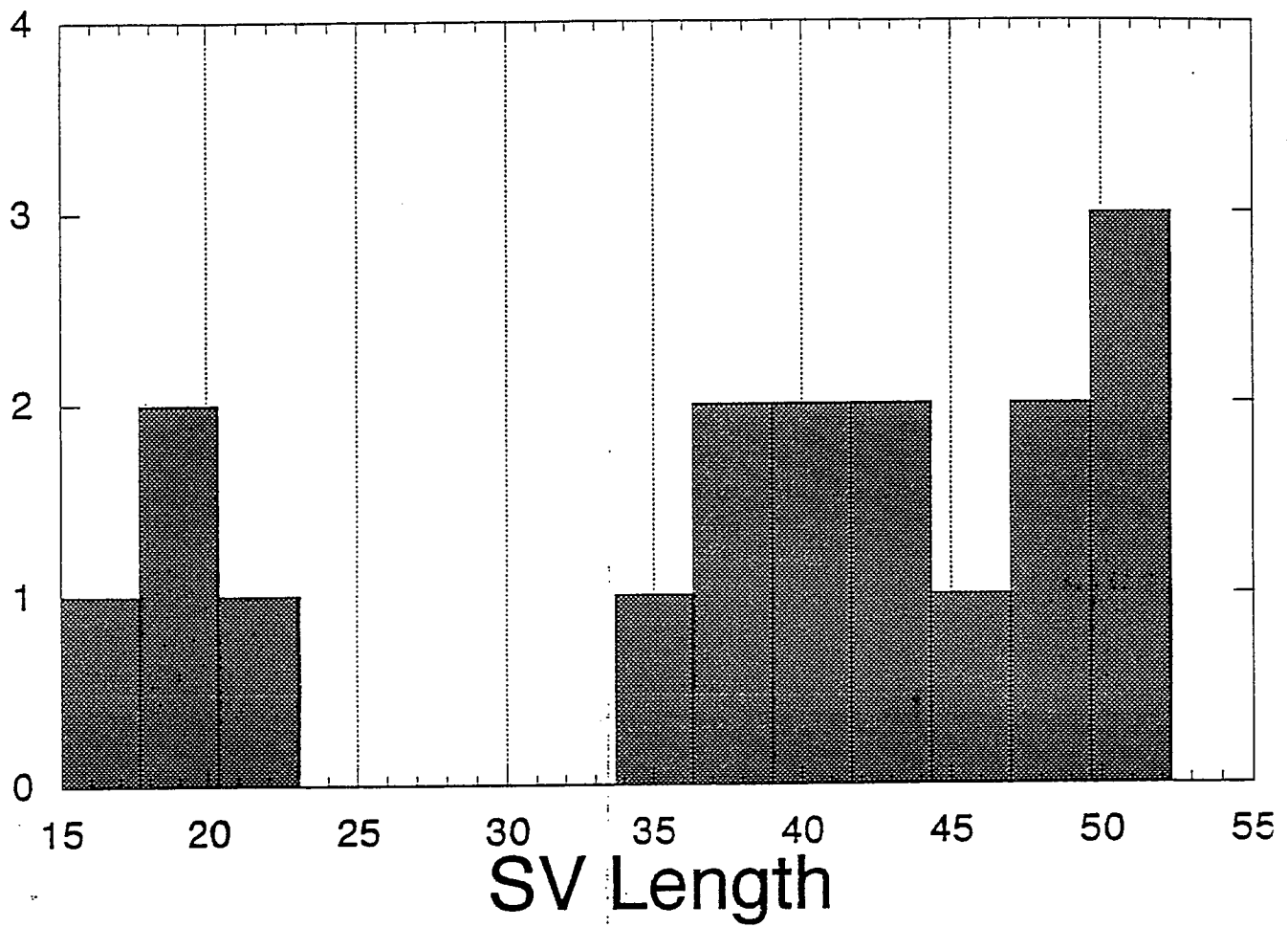


Figure 6. Number and size of *Plethodon richmondi* in the current study.

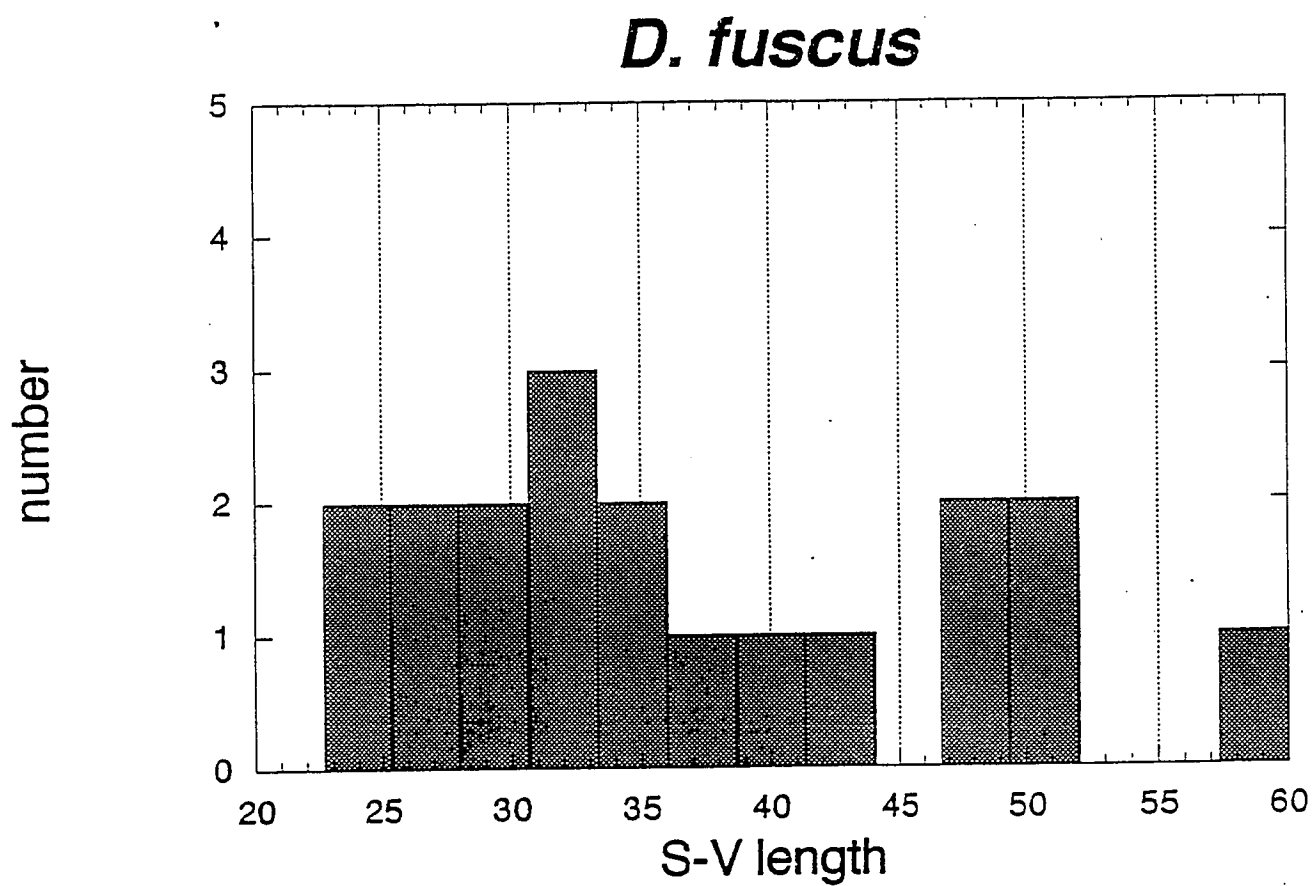


Figure 7. Number and size of *Desmognathus fuscus* in the current study.

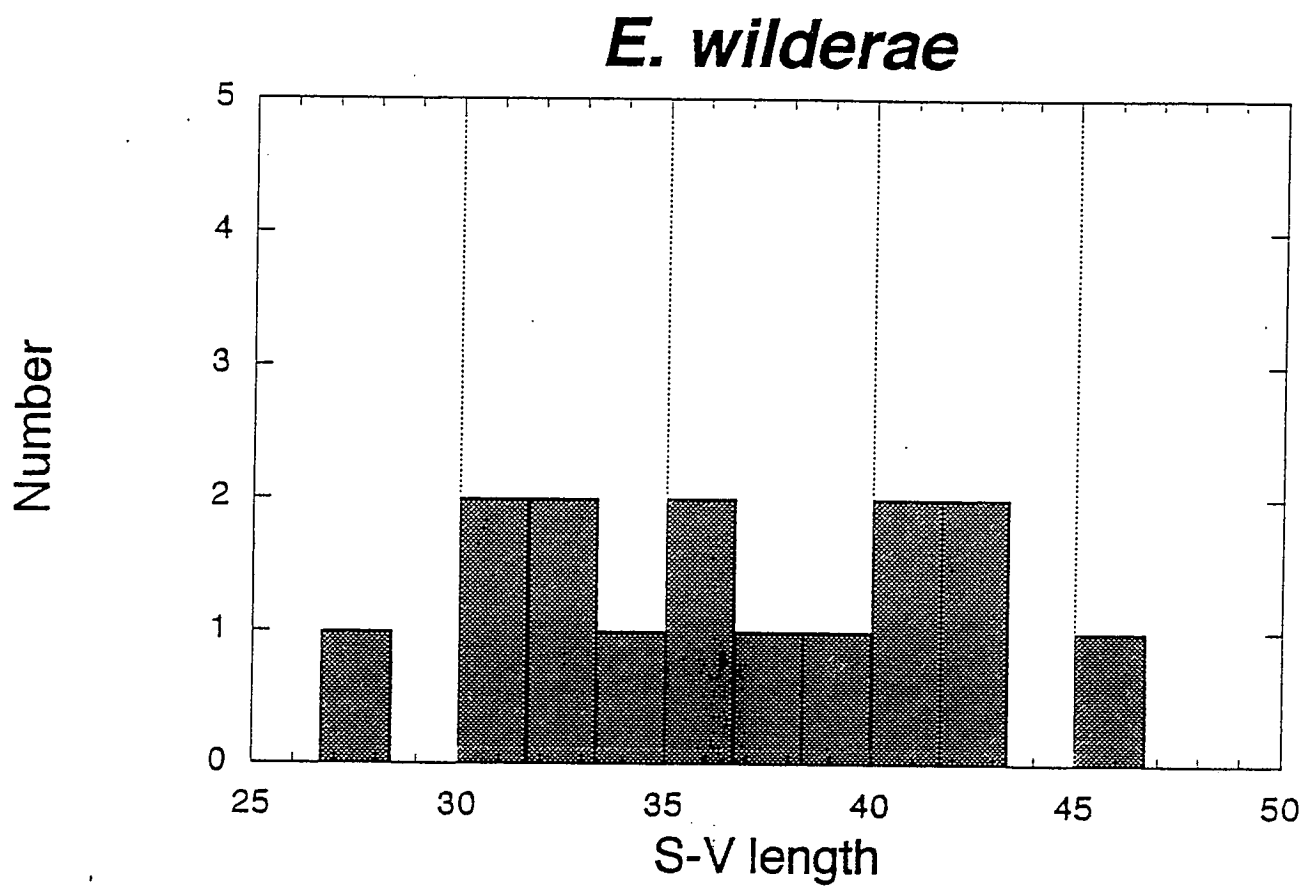


Figure 8. Number and size of *Eurycea wilderae* in the current study.

Table 1. Comparison of 1972 and 1998 salamander populations in Slagle Hollow.

	1972	1998
Slimy Salamander <i>Plethodon glutinosus</i>	X	X
Northern Dusky <i>Desmognathus fuscus</i>	X	X
Mountain Dusky <i>Desmognathus ochrophaeus</i>	X	X
Blue Ridge Two-Lined <i>Eurycea wilderae</i>		X
Ravine Salamander <i>Plethodon richmondi</i>		X
Spotted Salamander <i>Amystoma maculatum</i>		X

Table 2. Salamander species at Steele Creek Park.

	Number	Mean S-V Length	High Length	Low Length
<i>Ambystoma maculatum</i>	1	85 mm		
<i>Plethodon richmondi</i>	26	37.9 mm	52 mm	18 mm
<i>Eurycea wilderae</i>	28	35.8 mm	46 mm	28 mm
<i>Desmognathus fuscus</i>	21	35 mm	59 mm	23 mm
<i>Desmognathus ochrophaeus</i>	11--	48.3 mm	59 mm	35 mm
<i>Plethodon glutinosus</i>	5	63.2 mm	80 mm	43 mm

Table 3. Slagle Hollow species population compared to Trinkle Hollow species population.

Species found	Slagle Hollow Locations: 3,4,7,9,10,11	Trinkle Hollow Locations: 1,2,5,6
<i>Ambystoma maculatum</i>	1	0
<i>Plethodon richmondi</i>	19	8
<i>Eurycea wilderae</i>	14	13
<i>Desmognathus fuscus</i>	8	13
<i>Desmognathus ochrophaeus</i>	7	5
<i>Plethodon glutinosus</i>	4	1

Table 4. Water quality in selected creeks of Trinkle Hollow.

	Dissolved Oxygen	pH	Phosphate	Number of Individuals
Location 2	8 ppm	9	0 ppm	10
Location 5	5 ppm	7.5	0 ppm	3
Location 6	7 ppm	7.5	0 ppm	9

Literature Cited

- Barker, W. 1964. Familiar reptiles and amphibian of America. Boston: Harper Row Publishers.
- Breen, J. F. 1974. Encyclopedia of reptiles and amphibians. New Jersey: TFH Publications, Inc.
- Brunkow, P. E and J.P. Collins. 1996. Effects of individual variation in size on growth and development of larval salamanders. Ecology 77:1483-1500.
- Capula, M. 1989. Simon and Schuster's guide to reptiles and amphibians of the world. New York: Simon and Schuster Inc.
- Conant, R., and J. Collins. 1991. Peterson field guide of reptiles and amphibians of eastern/central North America. New York: Houghton Mifflin Company.
- Duellman, W. E., and L. Trueb. 1986. Biology of amphibians. Baltimore, Maryland: The Johns Hopkins University Press.
- Halliday, T. 1986. The encyclopedia of reptiles and amphibians. New York: Facts on File, Inc.
- Noble, G. K. 1954. The biology of amphibians. New York: Dover Publications, Inc.
- Maddison, D. R., *et al.* 1998. The tree of life.
<http://phylogeny.arizona.edu/tree/phylogeny.html>. (February-March 1998).
- Rowell, B. 1972. Natural history inventory. On file at Steele Creek Park Nature Center.
- Salamander Chronicles. 1998. <http://www.accent.net/~kaymur/salamr2a.htm>
- Souder, W. Dec. 15, 1997. Salamanders seem to suffer in sunlight. The Washington Post. Science Notebook. A02.

SALAMANDER STUDIES AT STEELE CREEK PARK

FREE AND ENTERTAINING

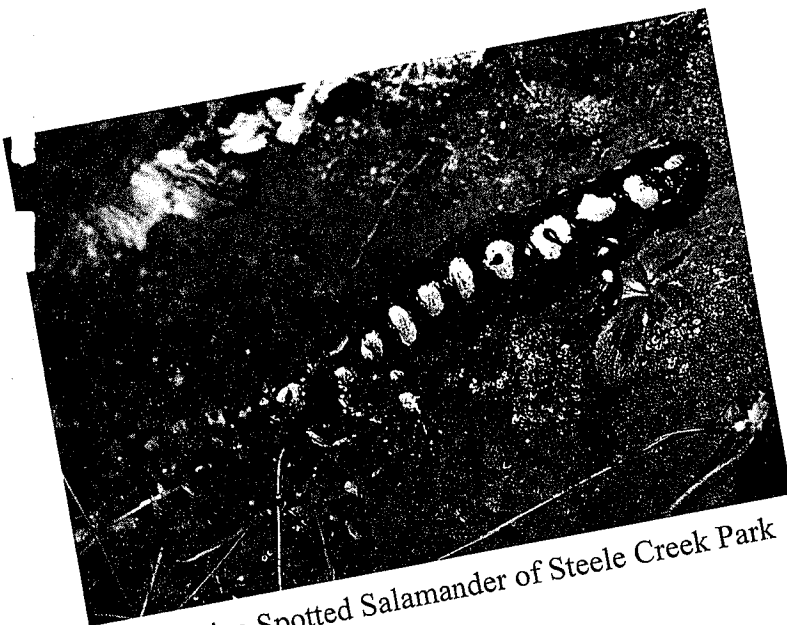
SEMINAR

Presented by...

KATRINA WILLIAMS

MAY 1, 1997

**Steele Creek Park
Nature Center
Bristol, Tennessee
7:00 P.M.**



The Elusive Spotted Salamander of Steele Creek Park

If you wish more information, please call
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Service

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For All Ages, For All Nature Enthusiasts

You will be amazed and entertained at this presentation of salamander studies at Steele Creek Park. During the early Spring of 1998, Katrina Williams conducted a comprehensive salamander study.

She spent more than 170 hours researching and conducting field work in the park. She identified two new species of salamanders and found only the second recorded specimen of a spotted salamander.

The research was conducted as an independent study course at Emory & Henry College and supervised by park staff and professor Greg McConnell.

About Katrina Williams

Katrina is a senior at Emory & Henry College majoring in Biology. She will be graduating with honors on May 16, 1998. She plans to continue her education for a Ph.D. in Animal Physiology or Mammalian Behavior.

At Emory, Katrina is pledgemaster of Alpha Phi Omega, a national community service co-ed fraternity and a member of Tri-Beta national biological society.

She is the daughter of Warren and Sue Williams of Franklin County, VA.

