

# **Herpetofauna Survey of Cumberland Gap National Historical Park**

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November 2003

Cooperative Agreement  
H5028 02 A424

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## v. Summary

This report summarizes results of an amphibian and reptile survey conducted in 2003 at Cumberland Gap National Historical Park. Previously selected random plots along with specialized habitats were searched for amphibians and reptiles. Specialized habitats included streams, floodplains, mountain meadows, caves, cliffs, bogs, and manmade structures. A total of 160 individual amphibians and reptiles (exclusive of large frog choruses), representing 35 species were recorded using area-constrained searches of random plots and specialized habitats, placement of artificial cover boards, night driving, and incidental observations. Observed species included 14 salamanders, 9 frogs and toads, 9 snakes, 2 lizards, and 1 turtle.

## vi. Acknowledgements

I would like to thank W. Olson and A. Smith of Third Rock Consultants, LLC for helping me with fieldwork for this study. I also would like to thank the staff at Cumberland Gap National Historical Park, especially J. Beeler and R. Collier for helping us locate access points for the park and for transporting us with all-terrain vehicles to distant plots.

## 1. Introduction

National parks of the United States represent unique, relatively undisturbed environments that support a diverse fauna. Accurate inventory information regarding the distribution, abundance, and habitat relationships of this fauna is essential for the management and protection of these natural resources. To this end, the National Park Service (NPS) has created inventory and monitoring networks to gather this necessary information, particularly as it relates to threatened and endangered species. These networks encompass parks with similar resources and management issues within a specific geographical area. The Cumberland Piedmont Network consists of 14 parks and includes Cumberland Gap National Historical Park (CGNHP). This report covers the results of a 12-month inventory study of the reptiles and amphibians of CGNHP.

Goals of this study were to document the occurrence of at least 90 percent of the reptile and amphibian species reasonably expected to occur in the park and describe this herpetofauna in terms of its distribution, habitat usage, and relative abundance. A comprehensive survey approach was used to encompass not only the extensive vegetation cover types but also minor habitats that contribute to species richness.

There is little available information regarding the herpetofauna of CGNHP. Burger (1958) provided the earliest documentation of herpetological specimens collected from CGNHP and surrounding areas. Twenty years later, Nicholson (1978) completed a thesis on the distribution patterns of amphibians in the park. He recorded 23 species from CGNHP, including 13 salamanders and 12 frogs and toads. The following year, Barbour *et al.* (1979) completed a

vertebrate survey for the park. This study provided useful species location information that was used as a starting point for species documentation for this survey.

## 2. Study Area

Cumberland Gap National Historical Park is situated along an approximate 15-mile segment of Cumberland Mountain, a northeast-southwest oriented ridge that creates a natural border between Bell and Harlan Counties, Kentucky and Lee County, Virginia. A portion of Claiborne County, Tennessee occupies the southwest corner of the park (Figure 1). The park was authorized by Congress in 1940 and encompasses 8,274 hectares (NPS 2002). Cumberland Gap, located at the southwestern end of the park, represents a rare break in the Cumberland Mountain. This natural pass through the mountains was first used as a game trail by migratory animals and later became an important transportation corridor for Native Americans and early settlers.

The trail through the pass eventually became US 25E, which linked the town of Middlesboro, Kentucky to Cumberland Gap, Tennessee. The wilderness trail was restored after the completion of the Cumberland Gap tunnel, a 4,600-foot long portal that passes under Cumberland Gap between Kentucky and Tennessee.

The park is located within the Cumberland Mountain Thrust Block ecoregion, which is characterized by high, steep ridges, hills, coves, narrow valleys, and the Pine Mountain Overthrust Fault (Woods 2002). Forests are usually more mesophytic than in the rest of the Appalachian Plateau but vary in composition based on aspect, slope, and past land use. Pennsylvanian sandstone, siltstone, shale, conglomerate, and coal underlie this area. Sedimentation from coal mining activities and logging have decreased the biological integrity and productivity of streams. Small streams are common, with high gradients, waterfalls,

frequent riffles, few pools, and cobble/boulder substrates. Streams tend to be less alkaline, less productive, and cooler than the Dissected Appalachian Plateau ecoregion located to the north.

The steep slopes of the park are covered in second or third growth forests dominated by mixed mesophytic species. The park contains over 20 caves, a number of streams and headwater tributaries, an historic settlement, rock outcrops, and several unique high elevation bogs. Elevations within the park range from approximately 1,100 feet along Little Yellow Creek to over 3,200 feet along the ridge trail near Hensley Settlement. The park occupies portions of five United States Geological Survey (USGS) 7.5 minute quadrangles: Ewing, Middlesboro North, Middlesboro South, Varilla, and Wheeler.

Cumberland Gap has hot and humid summers and moderately cold winters. The average summer (July) high temperature is 30.4°C, with overnight lows averaging 16.8°C. In January, the average high temperature is 7.0°C, with an average low of -4.4°C. Mean annual precipitation is 130.3 centimeter (cm) and is evenly distributed throughout the year (WKU 2003).

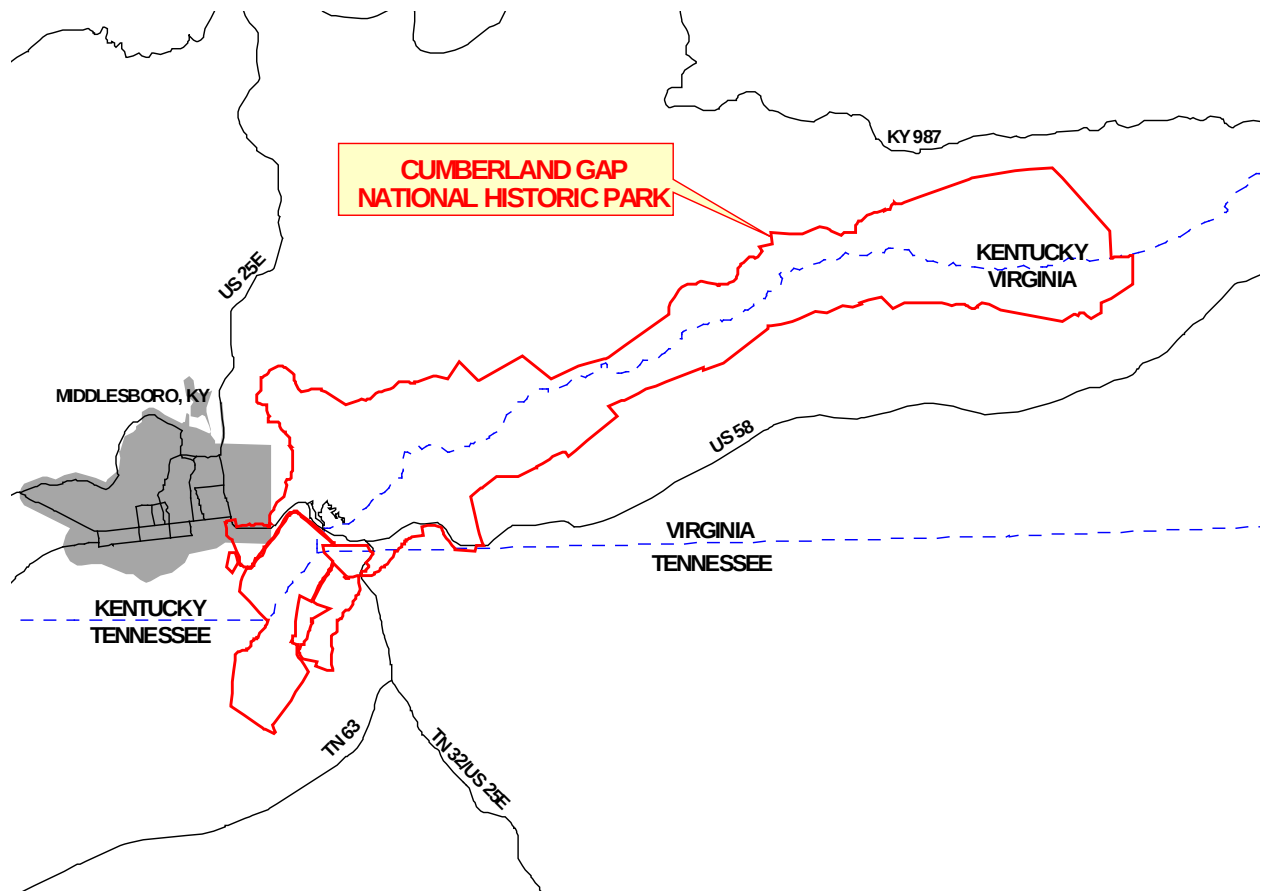


Figure 1. Outline map of Cumberland Gap National Historical Park

### 3. Methods

Prior to the field survey, a list of species thought to have a reasonable probability of occurring in the park was compiled from several sources (Appendix A). Species identified in Barbour *et al.* (1979) provided a preliminary list. Modifications to the list were derived from range maps from several sources: Barbour 1971, Conant and Collins 1991, MacGregor 2001, MacGregor 2003, Mitchell and Reay 1999, Petranka 1998, Petranka 2003, and Redmond and Scott 1996. Common and scientific names follow nomenclature listed in Collins and Taggart (2002).

An initial visit to the park was conducted in January 2003. During this initial visit, random plots were located, cover boards were placed in suitable habitats, and important roads and access points were surveyed by car. Sampling dates were spread across one annual cycle of herpetofauna activity – spring, summer, and fall.

In order to obtain a comprehensive survey of the park, circular, 1-hectare random plots previously established by the NPS as part of the networks vegetation mapping/plant inventory project were used as sampling sites for reptiles and amphibians. In addition to these random plots, specialized habitats not covered by the random plots were also searched (Figure 2).

Within the random plots and specialized habitats, one of two survey techniques was used. Area-constrained searches were used for plots located in upland forest; cover boards were placed in plots located either in open or floodplain environments. Area-constrained searches and cover boards were laid out in systematic clusters (Figure 3) as described by NPS (2002). A generalized search of the remainder of the plots was also performed.

Figure 2. Map of Cumberland Gap National Historical Park illustrating sampling plots

Figure 2b

Figure 2c

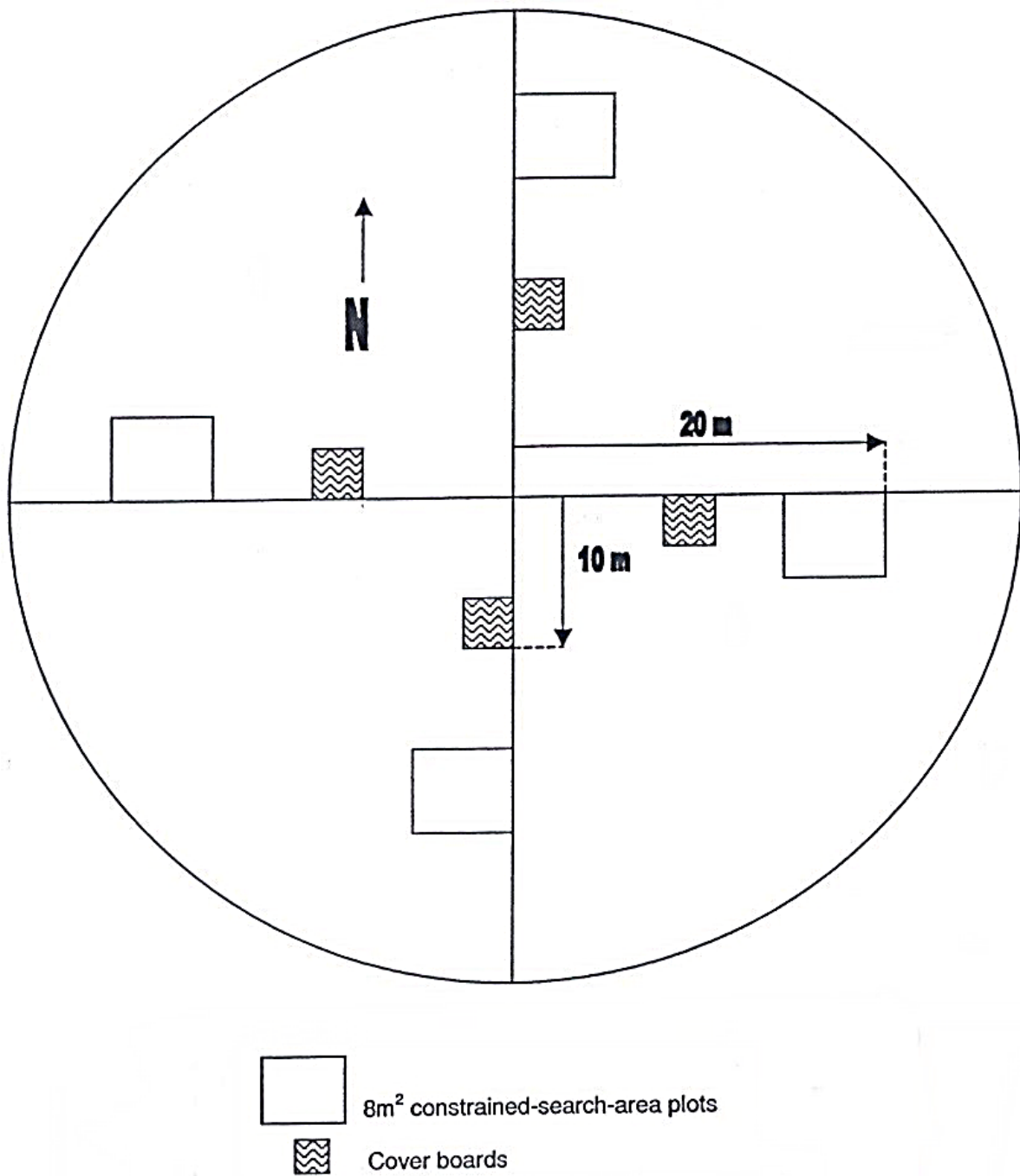


Figure 3. Random plot outline illustrating constrained area searches and cover board layouts

Thirty-five of the 53 random plots established by the NPS were sampled at least once during 2003. A random plot located in a mountain bog was not located, but two other mountain bogs were discovered in the same area and were documented as specialized habitats. The 17 remaining plots were not sampled due to the repetitiveness of the habitat in the random plots, their proximity to similar plots, or difficult access to repetitive plots. The unsampled plots and reasons for eliminating them are noted in Appendix B.

Specialized habitats searched within the park included streams, ponds, floodplains, mountain meadows, caves, cliffs/rock outcrops, bogs, and manmade structures. Cover board plots were placed in three habitats: floodplain, mountain meadow, and one of the bogs. In addition to cover boards, survey techniques included visual searches beneath rocks, logs, or clumps of moss, minnow traps, and hoop nets. In addition, flashlights were used to search caves and rock crevices.

Night driving surveys were conducted on the limited number of roads that exist within the park. Surveys were primarily conducted during or after a rain event and consisted of driving and sometimes walking paved and gravel roads. The primary route driven was Bartlett Park Road ending at the railroad tracks. Night driving surveys were completed at least once during each survey period: spring, summer, and fall.

Besides these specific sampling methods, data was also recorded from incidental observations during the course of traveling to and from survey plots. Additional observations were solicited from personnel working in the park, including NPS staff and campground hosts.

Digital photographs were taken of species captured for documentation and are located in Appendix C. No specimens were collected for preservation during this study. A photograph was not taken for three species documented in the park: mountain chorus frog (*Pseudacris brachyphona*), timber rattlesnake (*Crotalus horridus*), and Northern Water Snake (*Nerodia sipedon sipedon*).

#### 4. Results

A total of 160 individual amphibians and reptiles representing 35 species were captured or observed during the study. These included 14 salamanders, 9 frogs and toads, 9 snakes, 1 lizard, and 1 turtle (Table 1). No federal or state listed species were expected or observed during the course of this study. A timber rattlesnake was observed by park personnel during June 2003 and was included in the results. One of the stream sampling locations, an unnamed tributary of Shillalah Creek, was located outside of the park boundary along Shillalah Creek trail in Shillalah Creek Wildlife Management Area. Collections along the stream were indicated in the report because of its close proximity to the park and were also included in all results.

Habitats within the park were categorized into forest, floodplain/pond, mountain meadow, cave, cliff, bog, stream, and manmade structures. Table 2 shows the distribution of species within each habitat. Incidental observations and road cruising results are also included. Road cruising records were assigned a habitat based on the general habitat that existed along the road at the point of observation. A majority of the sampling plots were located in forest, floodplain, or stream habitats. Thirty-two of the 35 species present, representing approximately 80 percent of the captures or observations, were found in these habitats. Species with unique habitat requirements such as the green salamander (*Aneides aeneus*) and the cave salamander (*Eurycea lucifuga*) were only located in their respective specialized habitats, cliffs and caves.

Table 1. Amphibians and reptiles of Cumberland Gap National Historical Park based on an inventory study conducted in 2003. Common and scientific nomenclature follows Collins and Taggart (2002).

|                                                                               |
|-------------------------------------------------------------------------------|
| Salamanders                                                                   |
| Spotted Salamander ( <i>Ambystoma maculatum</i> )                             |
| Marbled Salamander ( <i>Ambystoma opacum</i> )                                |
| Green Salamander ( <i>Aneides aeneus</i> )                                    |
| Northern Dusky Salamander ( <i>Desmognathus fuscus</i> )                      |
| Seal Salamander ( <i>Desmognathus monticola</i> )                             |
| Black Mountain Salamander ( <i>Desmognathus welteri</i> )                     |
| Southern Two-Lined Salamander ( <i>Eurycea cirrigera</i> )                    |
| Cave Salamander ( <i>Eurycea lucifuga</i> )                                   |
| Kentucky Spring Salamander ( <i>Gyrinophilus porphyriticus duryi</i> )        |
| Four-Toed Salamander ( <i>Hemidactylium scutatum</i> )                        |
| Red-Spotted Newt ( <i>Notophthalmus viridescens viridescens</i> )             |
| Northern Slimy Salamander ( <i>Plethodon glutinosus</i> )                     |
| Cumberland Plateau Salamander ( <i>Plethodon kentucki</i> )                   |
| Southern Ravine Salamander ( <i>Plethodon richmondi</i> )                     |
| Frogs and Toads                                                               |
| Eastern American Toad ( <i>Bufo americanus americanus</i> )                   |
| Cope's Gray Treefrog ( <i>Hyla chrysoscelis</i> )                             |
| Mountain Chorus Frog ( <i>Pseudacris brachyphona</i> )                        |
| Northern Spring Peeper ( <i>Pseudacris crucifer crucifer</i> )                |
| Upland Chorus Frog ( <i>Pseudacris feriarum</i> )                             |
| Bullfrog ( <i>Rana catesbeiana</i> )                                          |
| Green Frog ( <i>Rana clamitans melanota</i> )                                 |
| Pickerel Frog ( <i>Rana palustris</i> )                                       |
| Wood Frog ( <i>Rana sylvatica</i> )                                           |
| Snakes                                                                        |
| Northern Copperhead ( <i>Agkistrodon contortix mokasen</i> )                  |
| Eastern Worm Snake ( <i>Carphophis amoenus amoenus</i> )                      |
| Northern Black Racer ( <i>Coluber constrictor constrictor</i> )               |
| Timber Rattlesnake ( <i>Crotalus horridus</i> )                               |
| Northern Ringneck Snake ( <i>Diadophis punctatus edwardsii</i> )              |
| Midland Rat Snake ( <i>Elaphe spiloides</i> )                                 |
| Northern Water Snake ( <i>Nerodia sipedon sipedon</i> )                       |
| Northern Redbelly Snake ( <i>Storeria occipitomaculata occipitomaculata</i> ) |
| Eastern Garter Snake ( <i>Thamnophis sirtalis sirtalis</i> )                  |
| Lizards                                                                       |
| Five-Lined Skink ( <i>Eumeces fasciatus</i> )                                 |
| Eastern Fence Lizard ( <i>Sceloporus undulatus</i> )                          |
| Turtles                                                                       |
| Eastern Box Turtle ( <i>Terrapene carolina carolina</i> )                     |

Table 2. Species captures and observations by habitat type at Cumberland Gap National Historical Park in 2003. Total salamander numbers for stream include two *Desmognathus* sp. individuals that were not identified to species level.

|                               | Forest    | Floodplain/<br>Pond | Mountain<br>Meadow | Cave     | Cliff    | Bog      | Manmade<br>structure | Stream    |
|-------------------------------|-----------|---------------------|--------------------|----------|----------|----------|----------------------|-----------|
| Spotted Salamander            | 1         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 0         |
| Marbled Salamander            | 0         | 1                   | 0                  | 0        | 0        | 0        | 0                    | 0         |
| Green Salamander              | 0         | 0                   | 0                  | 0        | 3        | 0        | 0                    | 0         |
| Northern Dusky Salamander     | 0         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 13        |
| Seal Salamander               | 0         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 9         |
| Black Mountain Salamander     | 0         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 1         |
| Southern Two-Lined Salamander | 0         | 0                   | 0                  | 0        | 0        | 1        | 0                    | 4         |
| Cave Salamander               | 0         | 0                   | 0                  | 3        | 0        | 0        | 0                    | 0         |
| Kentucky Spring Salamander    | 0         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 4         |
| Four-Toed Salamander          | 1         | 0                   | 0                  | 0        | 0        | 2        | 0                    | 0         |
| Red-Spotted Newt              | 9         | 5                   | 0                  | 0        | 0        | 0        | 0                    | 0         |
| Northern Slimy Salamander     | 0         | 2                   | 0                  | 0        | 0        | 0        | 0                    | 0         |
| Cumberland Plateau Salamander | 4         | 0                   | 0                  | 6        | 2        | 2        | 0                    | 0         |
| Southern Ravine Salamander    | 2         | 0                   | 0                  | 0        | 0        | 0        | 0                    | 0         |
| <b>Total Salamanders</b>      | <b>17</b> | <b>8</b>            | <b>0</b>           | <b>9</b> | <b>5</b> | <b>5</b> | <b>0</b>             | <b>33</b> |

Table 2. Species captures and observations by habitat type at Cumberland Gap National Historical Park in 2003. Total salamander numbers for stream include two *Desmognathus* sp. individuals that were not identified to species level (continued).

|                              | Forest    | Floodplain/<br>Pond | Mountain<br>Meadow | Cave      | Cliff     | Bog      | Manmade<br>structure | Stream    |
|------------------------------|-----------|---------------------|--------------------|-----------|-----------|----------|----------------------|-----------|
| Eastern American Toad        | 6         | 11                  | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Cope's Gray Treefrog         | 0         | 3                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Mountain Chorus Frog         | 0         | 2                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Northern Spring Peeper       | 2         | 4                   | 0                  | 0         | 0         | 0        | 0                    | 2         |
| Upland Chorus Frog           | 0         | 3                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Bullfrog                     | 0         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 2         |
| Green Frog                   | 0         | 3                   | 0                  | 0         | 0         | 0        | 0                    | 3         |
| Pickerel Frog                | 0         | 0                   | 0                  | 2         | 0         | 0        | 0                    | 0         |
| Wood Frog                    | 0         | 4                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| <b>Total Frogs and Toads</b> | <b>8</b>  | <b>30</b>           | <b>0</b>           | <b>2</b>  | <b>0</b>  | <b>0</b> | <b>0</b>             | <b>7</b>  |
| Northern Copperhead          | 1         | 0                   | 0                  | 0         | 2         | 0        | 0                    | 0         |
| Northern Black Racer         | 1         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Timber Rattlesnake           | 1         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Northern Ringneck Snake      | 1         | 2                   | 1                  | 0         | 0         | 0        | 0                    | 0         |
| Midland Rat Snake            | 2         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Northern Water Snake         | 0         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 3         |
| Northern Redbelly Snake      | 1         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 1         |
| Eastern Garter Snake         | 1         | 2                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| Eastern Worm Snake           | 1         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| <b>Total Snakes</b>          | <b>9</b>  | <b>4</b>            | <b>1</b>           | <b>0</b>  | <b>2</b>  | <b>0</b> | <b>0</b>             | <b>4</b>  |
| Five-Lined Skink             | 1         | 0                   | 0                  | 0         | 5         | 0        | 3                    | 0         |
| Eastern Fence Lizard         | 4         | 0                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| <b>Total Lizards</b>         | <b>5</b>  | <b>0</b>            | <b>0</b>           | <b>0</b>  | <b>5</b>  | <b>0</b> | <b>3</b>             | <b>0</b>  |
| Eastern Box Turtle           | 2         | 1                   | 0                  | 0         | 0         | 0        | 0                    | 0         |
| <b>Total Turtles</b>         | <b>2</b>  | <b>1</b>            | <b>0</b>           | <b>0</b>  | <b>0</b>  | <b>0</b> | <b>0</b>             | <b>0</b>  |
| <b>Total Numbers</b>         | <b>41</b> | <b>43</b>           | <b>1</b>           | <b>11</b> | <b>12</b> | <b>5</b> | <b>3</b>             | <b>44</b> |
| <b>Total Species</b>         | <b>18</b> | <b>13</b>           | <b>1</b>           | <b>3</b>  | <b>4</b>  | <b>3</b> | <b>1</b>             | <b>10</b> |

The different survey techniques used in this study varied widely in their effectiveness in documenting different species (Table 3). In general, a constrained search of specialized habitats was the most effective sampling method. A total of 75 individuals representing 18 species were captured or observed using this method. Although cover board plots only resulted in the capture of 13 individuals representing 7 different species, very few of the plots were sampled using this method due to park terrain. Of significance is the fact that only 16 individuals representing 10 different species of reptiles and amphibians were found in the constrained search of random plots.

Table 3. Comparison of capture and observation totals of different sampling methods at Cumberland Gap National Historical Park in 2003. Total number of individuals and number of species for each sampling method are listed for salamanders, frogs and toads, snakes, lizards, and turtles.

|                   |              | Random<br>plot<br>constrained<br>searches | Cover<br>Boards | Road<br>Cruising | Specialized<br>habitat<br>constrained<br>searches | Incidental<br>Observations |
|-------------------|--------------|-------------------------------------------|-----------------|------------------|---------------------------------------------------|----------------------------|
| Salamanders       | Total #      | 10                                        | 5               | 1                | 54                                                | 7                          |
|                   | #<br>Species | 4                                         | 3               | 1                | 10                                                | 3                          |
| Frogs &<br>Toads  | Total #      | 1                                         | 2               | 34               | 8                                                 | 2                          |
|                   | #<br>Species | 1                                         | 1               | 7                | 4                                                 | 2                          |
| Snakes            | Total #      | 4                                         | 5               | 1                | 5                                                 | 5                          |
|                   | #<br>Species | 4                                         | 2               | 1                | 3                                                 | 5                          |
| Lizards           | Total #      | 0                                         | 0               | 0                | 8                                                 | 5                          |
|                   | #<br>Species | 0                                         | 0               | 0                | 1                                                 | 2                          |
| Turtles           | Total #      | 1                                         | 1               | 0                | 0                                                 | 1                          |
|                   | #<br>Species | 1                                         | 1               | 0                | 0                                                 | 1                          |
| Individual Totals |              | 16                                        | 13              | 36               | 75                                                | 20                         |
| # Species Totals  |              | 10                                        | 7               | 9                | 18                                                | 13                         |

## 5. Discussion

The herpetofauna found in CGNHP is typical of the Cumberland Plateau region of eastern Kentucky. The major goal of this study was to document 90 percent of the herpetofauna species thought to be present. In this study, approximately 73 percent or 35 of the 48 species on the initial list were found. Barbour *et al.* (1979) described most of the species not found on the list as rare or uncommon. Bullfrogs were not observed by Barbour *et al.* (1979), but Nicholson (1978) reported this species from near the old environmental center and from Sugar Run. Adult bullfrogs were found in the beaver wetland created in Davis Branch during this study. The eastern spadefoot (*Scaphiopus holbrookii*) had not been listed by any previous study and was not observed in this study. Petranka (2003) has observed this species twice in the past 11 years in the wooded vernal pond located between the park offices and the railroad bridge. The Cumberland Plateau salamander (*Plethodon kentucki*) considered to be a junior synonym of *P. glutinosus*, was elevated to species level in 1983 (Highton and MacGregor, 1983). This salamander was one of the most commonly encountered terrestrial salamanders in the park at higher elevations. Some of the expected species not found during the present study included Fowler's toad and common musk turtle. Barbour *et al.* (1979) described Fowler's toad as rare in the park, only documenting them from Davis Branch. They also described the common musk turtle as being common in Little Yellow Creek. Fowler's toad and common musk turtle were not found during this survey, indicating that they may be rare or even extirpated from the park.

## 6. Conclusions

Although the primary goal of 90 percent of the expected species was not met, this study provides current species data and distribution for herpetofauna within CGNHP. The time and effort taken to visit and search the previously selected random plots was not beneficial in providing individual captures or new species not found elsewhere. The random plots only accounted for 16 of the 160 captures or observations (Table 3) and only two species not found elsewhere.

Although the random plots provided a way to sample dominant vegetative community types in the park, most of the plots provided little cover (*e.g.*, rocks, logs, etc.) for herpetofauna species. More time and effort could have been spent in areas likely to shelter reptiles and amphibians.

The use of cover boards was restricted in the park due to the rugged terrain. Cover boards were placed in only 6 areas of the park. The systematic clusters of cover boards accounted for 13 captures or observations of 7 different species (Table 3). Future surveys may benefit from an increase in the number of cover boards per plot, allowing more available cover, particularly for snakes.

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Appendix A. Expected amphibians and reptiles of Cumberland Gap National Historical Park. Common and scientific nomenclature follows Collins and Taggart (2002).

#### Salamanders

Spotted Salamander (*Ambystoma maculatum*)  
Marbled Salamander (*Ambystoma opacum*)  
Green Salamander (*Aneides aeneus*)  
Northern Dusky Salamander (*Desmognathus fuscus*)  
Seal Salamander (*Desmognathus monticola*)  
Black Mountain Salamander (*Desmognathus welteri*)  
Southern Two-Lined Salamander (*Eurycea cirrigera*)  
Longtail Salamander (*Eurycea longicauda longicauda*)  
Cave Salamander (*Eurycea lucifuga*)  
Kentucky Spring Salamander (*Gyrinophilus porphyriticus duryi*)  
Four-Toed Salamander (*Hemidactylium scutatum*)  
Red-Spotted Newt (*Notophthalmus viridescens viridescens*)  
Northern Slimy Salamander (*Plethodon glutinosus*)  
Cumberland Plateau Salamander (*Plethodon kentucki*)  
Southern Ravine Salamander (*Plethodon richmondi*)  
Midland Mud Salamander (*Pseudotriton diastictus*)  
Northern Red Salamander (*Pseudotriton ruber ruber*)

#### Frogs and Toads

Eastern American Toad (*Bufo americanus americanus*)  
Fowler's Toad (*Bufo fowleri*)  
Cope's Gray Treefrog (*Hyla chrysoscelis*)  
Mountain Chorus Frog (*Pseudacris brachyphona*)  
Northern Spring Peeper (*Pseudacris crucifer crucifer*)  
Upland Chorus Frog (*Pseudacris feriarum*)  
Bullfrog (*Rana catesbeiana*)  
Green Frog (*Rana clamitans melanota*)  
Pickerel Frog (*Rana palustris*)  
Wood Frog (*Rana sylvatica*)  
Eastern Spadefoot (*Scaphiopus holbrookii*)

#### Snakes

Northern Copperhead (*Agkistrodon contortix mokasen*)  
Eastern Worm Snake (*Carphophis amoenus amoenus*)  
Northern Black Racer (*Coluber constrictor constrictor*)  
Timber Rattlesnake (*Crotalus horridus*)  
Northern Ringneck Snake (*Diadophis punctatus edwardsii*)  
Midland Rat Snake (*Elaphe spiloides*)  
Black Kingsnake (*Lampropeltis getula nigra*)  
Eastern Milk Snake (*Lampropeltis triangulum triangulum*)  
Northern Water Snake (*Nerodia sipedon sipedon*)  
Rough Green Snake (*Opheodrys aestivus*)  
Northern Redbelly Snake (*Storeria occipitomaculata occipitomaculata*)

Appendix A. Expected amphibians and reptiles of Cumberland Gap National Historical Park.  
(continued)

Eastern Garter Snake (*Thamnophis sirtalis sirtalis*)

Eastern Earth Snake (*Virginia valeriae valeriae*)

Lizards

Five-Lined Skink (*Eumeces fasciatus*)

Eastern Fence Lizard (*Sceloporus undulatus*)

Ground Skink (*Scincella lateralis*)

Turtles

Common Snapping Turtle (*Chelydra serpentina serpentina*)

Common Musk Turtle (*Sternotherus odoratus*)

Eastern Box Turtle (*Terrapene carolina carolina*)

## Appendix B. Eliminated plots and reasoning

## Appendix B. Eliminated Plots and Reasoning

| Plot # | Reasoning                                                                       |
|--------|---------------------------------------------------------------------------------|
| 2      | Similar habitat to plot CTN2 and CTN1                                           |
| 3      | Similar habitat and close proximity to plot 46                                  |
| 6      | Difficult access, similar to other plots, no directions to centerpoint provided |
| 10     | Plot within briar/scrub brush slope. Tag tree could not be located              |
| 16     | Similar habitat and slope facing as plot 13                                     |
| 18     | Similar habitat and close proximity to plots 40 and 51                          |
| 22     | Difficult access and similar habitat to other sampling stations                 |
| 24     | Similar habitat and close proximity to plot 26, which is easier to access       |
| 26     | Access issues due to landowner, and similar habitat to other plots              |
| 29     | Difficult access and similar to habitats that were in easier locations          |
| 31     | Difficult access and similar to habitats that were in easier locations          |
| 33     | Difficult access and similar to habitats that were in easier locations          |
| 37     | Difficult access and similar habitat to other plots                             |
| 38     | Similar habitat and close proximity to plot 21                                  |
| 47     | Similar habitat and close proximity to plots 42, 50, and 53                     |
| 50     | Similar habitat and close proximity to plots 42, 47, and 53                     |
| 55     | Severe slope and cliffline within plot which is sampled elsewhere               |

Plots 9, 19, 20, 27, 40, 43, 45, 51, 52, 53, and CTN1 were only visited once during the survey due to their similar habitats to other nearby plots and the time involved in reaching them.

## Appendix C. Photographs of species

## Salamanders



Spotted salamander, *Ambystoma maculatum*  
Location captured: Plot 5



Marbled salamander, *Ambystoma opacum*  
Location captured: Bartlett Park Road (night driving)



Green salamander, *Aneides aeneus*  
Location captured: Plot CLIFF3



Northern dusky salamander, *Desmognathus fuscus*  
Location captured: Plot STRM2 (Station Creek)



Seal salamander, *Desmognathus monticola*  
Location captured: Plot STRM4 (Sugar Run)



Black mountain salamander, *Desmognathus welteri*  
Location captured: Plot STRM4 (Sugar Run)



Southern two-lined salamander, *Eurycea cirrigera*  
Location captured: Plot STRM4 (Sugar Run)



Cave salamander, *Eurycea lucifuga*  
Location captured: Gap Cave



Kentucky spring salamander, *Gyrinophilus porphyriticus duryi*  
Location captured: Plot STRM5 (Shillalah Creek)



Four-toed salamander, *Hemidactylium scutatum*  
Location captured: Plot BOG2



Red-spotted newt, *Notophthalmus viridescens viridescens*  
Location captured: Plot 35



Southern ravine salamander, *Plethodon richmondi*  
Location captured: Plot 1



Northern slimy salamander, *Plethodon glutinosus*  
Location captured: Plot FLDPLN2 (Station Creek)



Cumberland plateau salamander, *Plethodon kentucki*  
Location captured: Skylight Cave

## Frogs & Toads



Eastern American toad, *Bufo americanus americanus*  
Location captured: Bartlett Park Road  
(night driving)



Cope's gray treefrog, *Hyla chrysoscelis*  
Location captured: Bartlett Park Road  
(night driving)



Northern spring peeper, *Pseudacris crucifer crucifer*  
Location captured: Bartlett Park Road  
(night driving)



Upland chorus frog, *Pseudacris feriarum*  
Location captured: Bartlett Park Road  
(night driving)



Bullfrog, *Rana catesbeiana*  
Location captured: Plot STRM3 (Davis Branch)



Green frog, *Rana clamitans melanota*  
Location captured: Plot STRM5 (Shillalah Creek)



Pickerel frog, *Rana palustris*  
Location captured: Skylight Cave



Wood frog, *Rana sylvatica*  
Location captured: Bartlett Park Road  
(night driving)

## Snakes



Eastern worm snake, *Carphophis amoenus amoenus*  
Location captured: Plot 30



Northern copperhead, *Agkistrodon contortrix mokasen*  
Location captured: Incidental capture at  
Wilderness Road Trail culvert



Northern black racer, *Coluber constrictor constrictor*  
Location captured: Plot 35



Northern ringneck snake, *Diadophis punctatus edwardsii*  
Location captured: Plot FLDPLN1 (Davis Branch)



Midland rat snake, *Elaphe spiloides*  
Location captured: Incidental capture at  
Wilderness Road Campground



Northern redbelly snake, *Storeria occipitomaculata occipitomaculata*  
Location captured: Plot STRM1 (Little Yellow  
Creek)



Eastern garter snake, *Thamnophis sirtalis sirtalis*  
Location captured: Plot FLDPLN3

## Turtles & Lizards



Eastern box turtle, *Terrapene carolina carolina*  
Location captured: Incidental capture at Gibson Gap trailhead



Eastern fence lizard, *Sceloporus undulatus*  
Location captured: Incidental capture at Wilderness Road Trail



Five-lined skink, *Eumeces fasciatus*  
Location captured: Incidental capture from Ridge Trail

