

Final Report

Non-volant Mammals of Kings Mountain National Military Park

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Introduction

In accordance with the National Park Service mandate to conduct biological inventories on all parks, this report is presented as an inventory of non-volant mammals (the bats were surveyed by other researchers) at Kings Mountain National Military Park. This report summarizes the procedures and results of a two-year survey, establishes a baseline of mammal species occurrence data, and makes recommendations for future research, preservation, and management.

Kings Mountain National Military Park (KIMO) is located in northwestern York County and northeastern Cherokee County, South Carolina, or approximately 21km northwest of York, South Carolina. Over 1596 hectares (3945 acres) of land are included with the park boundaries. While most of the park consists of upland dry deciduous forests, smaller habitat associations are found within this large ecosystem. Based on surveys conducted by parks ecologists, the habitat associations are labeled as follows: disturbed, dry deciduous forest, wet deciduous forest, evergreen forest, dry mixed forest, and dry mixed woodland.

Non-volant mammal species expected to occur at Kings Mountain National Military Park

A preliminary survey of the literature and museum records indicated that at least 33 species of non-volant mammals are known from within a 25-mile radius of KIMO. The following pages provide a detailed account of those mammal species known to occur in the vicinity of KIMO. Taxonomy and phylogenetic sequence follow Baker et al. (2003) with species arranged alphabetically within genera.

Within each chart, headings denote whether the occurrence was documented in a museum collection (C) or in the literature or an unpublished record (L/R). The **source** of the record (the name of a museum, reporting organization, or title of publication or article) is given next, followed by the **reference** (museum catalog number, if known, or literature citation – author and year). Finally, the **state**, **county** and **date** of occurrence or collection, if known, are given.

ORDER DIDELPHIMORPHIA

Family Didelphidae

Didelphis virginiana (Virginia opossum)

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1991
L/R	SCDNR	unpublished	SC	Cherokee	
L/R	SCDNR	unpublished	SC	York	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

ORDER INSECTIVORA

Family Soricidae

Sorex longirostris (southeastern shrew)

C or L/R	Source	Reference	State	County	Date
L/R		Cloninger et al. 1977	SC	York	1974-76

***Blarina brevicauda* (northern short-tailed shrew) and
Blarina carolinensis (southern short-tailed shrew)**

C or L/R	Source	Reference	State	County	Date
L/R		Cloninger et al. 1977	SC	York	1974-76
C	Clemson University	2549	SC	York	01 Apr 1993
C	Clemson University	2592	SC	York	01 Apr 1993
L/R	KIMO	unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	94.5.12	SC	York	10-Mar-94
C	Museum of York Co.	94.5.14	SC	York	Oct-92
C	Museum of York Co.	94.5.16	SC	York	24-Mar-94
C	Museum of York Co.	94.5.2	SC	York	
L/R		Fields 2000	SC	York	

***Cryptotis parva* (least shrew)**

C or L/R	Source	Reference	State	County	Date
C	Clemson University	2593	SC	York	01 Apr 1993
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Family Talpidae

***Scalopus aquaticus* (eastern mole)**

C or L/R	Source	Reference	State	County	Date
C	Field Museum	7772	SC	York	14 Nov 1899
C	Field Museum	7773	SC	York	14 Nov 1899
C	MUSEUM OF YORK CO.	94.5.13	SC	York	
L/R	SC Mammals	Golley 1966	SC	York	
L/R	KIMO	unpublished	SC	York/Cherokee	1994

ORDER LAGOMORPHA

Family Leporidae

***Sylvilagus floridanus* (eastern cottontail)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	94.5.8	SC	York	22-Mar-94
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

ORDER RODENTIA

Family Sciuridae

***Tamias striatus* (eastern chipmunk)**

C or L/R	Source	Reference	State	County	Date
C	Museum of York Co.	97.1.26	SC	York	15-Aug-96
C	NC State Museum		NC	Gaston	22-May-1975
C	NC State Museum		NC	Cleveland	11-May-1968
C	NC State Museum		NC	Gaston	1-Jan-1955
C	NC State Museum		NC	Cleveland	
C	NC State Museum		NC	Gaston	
L/R		Lee et.al. 1982	NC	Cleveland	
L/R		Lee et.al. 1982	NC	Gaston	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

***Marmota monax* (woodchuck)**

C or L/R	Source	Reference	State	County	Date
C	NC State Museum		NC	Gaston	00 Aug 1956
C	NC State Museum		NC	Gaston	
L/R		Lee et.al. 1982	NC	Gaston	
L/R		Fields 2000	SC	York	

***Sciurus carolinensis* (eastern gray squirrel)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	Unpublished	SC	York/Cherokee	1994
L/R	S. Fields	Unpublished	SC	York	1997
L/R	SCDNR	Unpublished	SC	Cherokee	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

***Glaucmys volans* (southern flying squirrel)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	Unpublished	SC	York/Cherokee	1999
L/R		Fields 2000	SC	York	

Family Castoridae

***Castor canadensis* (American beaver)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1999
L/R		Fields 2000	SC	York	
C	Museum of York Co.	97.1.27	SC	York	11-Aug-93

Family Muridae

***Oryzomys palustris* (marsh rice rat)**

C or L/R	Source	Reference	State	County	Date
C	Museum of York Co.	95.4.3	SC	York	22-Jun-95
C	Museum of York Co.	95.4.8	SC	York	11-Mar-95
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

***Reithrodontomys humulis* (eastern harvest mouse)**

C or L/R	Source	Reference	State	County	Date
L/R		Cloninger et al. 1977	SC	York	1974-76
L/R	Matthews	Unpublished	SC	York	Mar-2003

***Peromyscus leucopus* (white-footed mouse)**

C or L/R	Source	Reference	State	County	Date
C	Charleston Museum		SC	York	21-Aug-1928
C	Charleston Museum		SC	York	22-Aug-1928
C	Clemson University	2668	SC	York	12 May 1995
C	Clemson University	2669	SC	York	06 Jun 1995
C	Field Museum	7989	SC	York	16 Nov 1899
C	Field Museum	7990	SC	York	14 Nov 1899
L/R	KIMO	Unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	94.5.4	SC	York	4-May-94
C	Museum of York Co.	95.4.9	SC	York	12-Jul-95
C	Museum of York Co.	97.1.20	SC	York	5-Mar-97
C	NC State Museum		NC	Cleveland	16-Jan-1977
L/R		Lee et.al. 1982	NC	Cleveland	
L/R		Golley 1966	SC	York	
L/R		Fields 2000	SC	York	

Peromyscus polionotus (oldfield mouse)

C or L/R	Source	Reference	State	County	Date
C	Clemson University	2666	SC	York	18 Mar 1995
C	Clemson University	2667	SC	York	18 Mar 1995
C	Museum of York Co.	94.5.3	SC	York	
C	Museum of York Co.	94.5.5	SC	York	7-Mar-94
C	Museum of York Co.	94.5.6	SC	York	16-Mar-94
L/R	S. Fields	unpublished	SC	York	1996
L/R		Fields 2000	SC	York	

Ochrotomys nuttalli (Golden mouse)

C or L/R	Source	Reference	State	County	Date
C	Charleston Museum		SC	York	22-Aug-1928
L/R		Golley 1966	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Sigmodon hispidus (hispid cotton rat)

C or L/R	Source	Reference	State	County	Date
C	Charleston Museum		SC	York	23-Aug-1928
L/R	KIMO	unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	95.4.1	SC	York	11-Aug-94
C	Museum of York Co.	95.4.2	SC	York	2-Sep-94
C	Museum of York Co.	97.1.25	SC	York	19-Aug-94
L/R	S. Fields	unpublished	SC	York	1996
L/R		Golley 1966	SC	York	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Neotoma floridana (eastern woodrat)

C or L/R	Source	Reference	State	County	Date
L/R		Dowda et al. 1981	SC	York	

Rattus rattus (black or house rat)

C or L/R	Source	Reference	State	County	Date
C	Charleston Museum		SC	York	23-Aug-1928
C	Charleston Museum		SC	York	24-Aug-1928
L/R		Golley 1966	SC	York	

Mus musculus (house mouse)

C or L/R	Source	Reference	State	County	Date
L/R	S. Fields	unpublished	SC	York	1996
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76
C	Charleston Museum		SC	York	15-Jun-1927
C	Museum of York Co.	95.4.14	SC	York	22-Jun-95
C	Museum of York Co.	95.4.15	SC	York	22-Jun-95
C	Museum of York Co.	95.4.16	SC	York	18-Jul-95
C	Museum of York Co.	96.2.2	SC	York	9-Aug-96
L/R		Golley 1966	SC	York	

Microtus pennsylvanicus (meadow vole)

C or L/R	Source	Reference	State	County	Date
C	Museum of York Co.	94.5.11	SC	York	1-Aug-94
C	Museum of York Co.	97.1.24	SC	York	24-Apr-97
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

***Microtus pinetorum* (woodland vole)**

C or L/R	Source	Reference	State	County	Date
C	Charleston Museum		SC	York	20-Aug-1927
C	Museum of York Co.	96.2.3	SC	York	18-Mar-96
C	NC State Museum		NC	Cleveland	
L/R		Golley 1966	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76
C	Field Museum	8152	SC	York	14 Nov 1899

***Ondatra zibethicus* (common muskrat)**

C or L/R	Source	Reference	State	County	Date
C	Museum of York Co.	84.21.4	SC	York	1983
C	Museum of York Co.	84.21.5	SC	York	1983
L/R	SCDNR	unpublished	SC	Cherokee	1985-93
L/R		Golley 1966	SC	York	
L/R		Fields 2000	SC	York	

ORDER CARNIVORA

Family Canidae

***Canis latrans* (coyote)**

C or L/R	Source	Reference	State	County	Date
L/R	SCDNR	Unpublished	SC	York	
C	Museum Of York Co.	Uncataloged specimen	SC	York	2003

***Vulpes vulpes* (red fox)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1993
C	Museum of York Co.	94.5.10	SC	York	5-Oct-94
C	Museum of York Co.	95.4.6	SC	York	29-May-95
L/R	SCDNR	unpublished	SC	Cherokee	1985-93
L/R	SCDNR	unpublished	SC	York	1985-93
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

***Urocyon cinereoargenteus* (common gray fox)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	84.21.1	SC	York	9-Mar-84
C	Museum of York Co.	94.5.9	SC	York	17-Jan-91
C	Museum of York Co.	95.4.5	SC	York	21-Feb-95
C	Museum of York Co.	92.9.16	SC	York	30-Sep-92
L/R	SCDNR	unpublished	SC	Cherokee	1985-93
L/R	SCDNR	unpublished	SC	York	1985-93
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Family Procyonidae

***Procyon lotor* (northern raccoon)**

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	Unpublished	SC	York/Cherokee	1998
L/R	SCDNR	Unpublished	SC	York	1985-93
L/R		Golley 1966	SC	York	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Family Mustelidae

Mustela frenata (long-tailed weasel)

C or L/R	Source	Reference	State	County	Date
L/R		Hall 1981	SC	York	

Mustela vison (American mink)

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	unpublished	SC	York/Cherokee	1999
C	Museum of York Co.	94.5.15	SC	York	25-May-94
L/R	SCDNR	unpublished	SC	Cherokee	
L/R	SCDNR	unpublished	SC	York	
L/R		Golley 1966	SC	York	
L/R		Fields 2000	SC	York	

Lontra canadensis (northern river otter)

C or L/R	Source	Reference	State	County	Date
L/R	SCDNR	Unpublished	SC	Cherokee	1985-93
L/R	SCDNR	Unpublished	SC	York	1985-93

Family Mephitidae

Mephitis mephitis (striped skunk)

C or L/R	Source	Reference	State	County	Date
L/R	SCDNR	Unpublished	SC	Cherokee	
L/R	SCDNR	Unpublished	SC	York	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Family Felidae

Lynx rufus (bobcat)

C or L/R	Source	Reference	State	County	Date
L/R	SCDNR	Unpublished	SC	Cherokee	1985-93
L/R	SCDNR	Unpublished	SC	York	1985-93
L/R		Fields 2000	SC	York	

ORDER ARTIODACTYLA

Family Cervidae

Odocoileus virginianus (white-tailed deer)

C or L/R	Source	Reference	State	County	Date
L/R	KIMO	Unpublished	SC	York/Cherokee	1998
L/R	SCDNR	Unpublished	SC	Cherokee	
L/R		Fields 2000	SC	York	
L/R		Cloninger et al. 1977	SC	York	1974-76

Methods

Some of the data in this report was taken from Sewall (unpublished), a previous species occurrence inventory at KIMO conducted by Brent Sewall, a Student Conservation Association Resource Assistant – November 17, 1998 to February 17, 1999. Otherwise, I used several methods for trapping and detecting mammals (Wilson et al. 1996) including Sherman live traps, pitfall traps (4-liter to 19-liter), discarded bottle surveys (Benedict and Billeter 2004, Pagels and French 1987), carnivore scent station surveys (SCDNR 2003a), and remote-trip cameras (Wemmer et al. 1996). During most field sessions, I was accompanied by other individuals. From March 2004 through October 2005, I recorded over 200 person-hours in the field. Additionally, I recorded 3257 trap nights.

Results

For the total of 3257 trap nights, there were 98 “captures,” including mammals taken in traps and tracks at scent stations and other places around the park, resulting in a 3.01% success rate. I documented 108 occurrences presenting 21 species of non-volant mammals at KIMO. All occurrence data are summarized in Appendix 1. Specimens that died in traps and were salvageable were prepared as voucher specimens and placed in the mammal collections of the Museum York County (MYCO), an agency of the York County Culture and Heritage Museums.

Discussion

Compared to the 33 species known to occur within a 25-mile radius of KIMO, at least 21 species were actually documented; at most 23 species were documented. This represents 64 – 70% documentation of “expected” species occurrence. However, because the majority of land at KIMO is forested (primarily dry deciduous forest) all 33 species listed in the introduction of this report should not actually be expected to occur within the park boundaries. For example, several rodent species, including *Microtus pennsylvanicus*, *Sigmodon hispidus*, and *Peromyscus polionotus* prefer open fields instead of forests (Reich 1981, Cameron and Spencer 1981, Whitaker and Hamilton 1998). The occurrence of such open habitat at KIMO is rare and patchy, at best. As a result, none of these three species were documented within the park during my two-year study, although their presence is verified within the region. Similarly, other species may not have the proper habitat requirements at KIMO and, therefore, are not present.

**Non-volant mammal species documented at
Kings Mountain National Military Park**

ORDER DIDELPHIMORPHIA

Family Didelphidae

Didelphis virginiana (**Virginia opossum**). This species has been previously documented at KIMO (ironically, along Opossum Trot Road) through scent station surveys conducted by the South Carolina Department of Natural Resources in October 1991. I recorded a digital image of opossum tracks along the bank of Kings Creek in April 2004 (see Appendix 2; page 2-2). An opossum was also trapped and at KIMO during a mammal survey in January 1999 (Sewall, unpublished).

ORDER INSECTIVORA

Family Soricidae

Blarina carolinensis (**southern short-tailed shrew**). This species has been well documented throughout York County (Cloninger et al. 1977, Fields 2000) and has been previously reported at KIMO during a mammal survey in January 1999 (Sewall, unpublished).

The southern short-tailed shrew is located throughout the southeastern United States, except in the southern Appalachians (Whitaker and Hamilton 1998). While some authors, including Hall (1981) listed this shrew as a subspecies of its northern counterpart *B. brevicauda*, Wilson and Reeder (1993) clearly recognized the two distinct species *B. brevicauda* and *B. carolinensis*. The question of sympatricity remains under study in parts of the Carolinas, but in York County and the region around KIMO, any short-tailed shrews are referable to *B. carolinensis* (D. Webster, pers. comm.).

Voucher specimens were taken during the recent survey and are housed at MYCO under the accession number 2004.001. Individual numbers: SEF-KIMO-021, 024. Additionally, digital images were taken (see Appendix 2; page 2-1).

Cryptotis parva (**least shrew**). The least shrew inhabits the central and southeastern portions of the United States (Whitaker 1974), including North and South Carolina (Webster et al. 1985). This was the most commonly trapped shrew at KIMO, especially at plots 8 & 12. I have taken least shrews in other parts of York County (Fields 2000), as did Cloninger et al (1977).

Voucher specimens were prepared primarily as skulls and are housed at MYCO under the accession number 2004.001. Individual numbers: SEF-KIMO-016, 017, 018, 019, 020, 023, 026, 027, 028, 029.

Family Talpidae

Scalopus aquaticus (**eastern mole**).) The eastern mole ranges throughout the central and southeastern United States (Brown 1997, Hall 1981). However, Whitaker and Hamilton (1998) indicated an absence in the Appalachian Mountains. My field notes (March 1994) recorded moles at KIMO by the presence of tunnels, especially along the grassy roadsides and lawn of the park headquarters moles. A voucher specimen was

taken during the recent survey and will be placed at MYCO under the accession number 2004.001. Individual number: SEF-KIMO-012.

Order Lagomorpha

Family Leporidae

Sylvilagus floridanus (**eastern cottontail**). This is the most widespread species of *Sylvilagus* in North America and occurs across the continent. (Chapman et al. 1980, Hall 1981, Whitaker and Hamilton 1998). All recent records of this species at KIMO were visual sightings by park visitors and staff, including Sewall (unpublished) in January 1999. No images or voucher specimens were taken.

Sylvilagus sp. (**undetermined cottontail**). Sewall (unpublished) also trapped and released a specimen that he tentatively identified as *Sylvilagus transitionalis*. Although Sewall clearly indicated in his report that his identification was questionable, he did not indicate the characters by which he made the identification. If, indeed, a species other than *S. floridanus* resided at KIMO, it might be more accurately described as *S. obscurus*. Whitaker and Hamilton (1998) reported research that recognized two races, and possibly two species of cottontails. The northern *S. transitionalis*, by this classification, lives in the New England region of the United States. The southern *S. obscurus* inhabits the Appalachian Mountains of the Carolinas, Virginia, West Virginia, and Pennsylvania. Still, the range and habitat reported by Whitaker and Hamilton (1998) for *S. obscurus* do not completely agree with Sewall's specimen. Without a voucher or more information, the only reasonable designation for the record is *Sylvilagus* sp.

ORDER RODENTIA

Family Sciuridae

Tamias striatus (**eastern chipmunk**). The eastern chipmunk is distributed over most of the eastern United States, though absent from the coastal plain of the Carolinas, Georgia, and the state of Florida (Snyder 1982, Whitaker and Hamilton 1998). This species is abundant throughout its range in the Carolinas (Webster et al. 1985). This species was reported twice at KIMO during the two-year study, and, unfortunately, neither record has an image or voucher specimen. Still, I am confident in the observation I made April 22, 2004 along Piedmont Road. Also, a field technician reported a dead specimen in a Sherman trap near the intersection of Yorkville-Shelbyville Road and the Main Park Drive July 12, 2004. Not realizing the need for a voucher specimen, he disposed of the animal.

Sciurus carolinensis (**eastern gray squirrel**). While it is not surprising to find gray squirrels in the region, it is in keeping with the purpose of this paper that I report at least 14 visual sightings, as well as Sewall (unpublished) for previous records of this species at KIMO. No images or voucher specimens were taken for this species.

Glaucomys volans (**southern flying squirrel**). *Glaucomys volans* is found throughout the eastern United States (Dolan and Carter 1977, Hall 1981, Whitaker and Hamilton 1998) including all of North and South Carolina (Brown 1997, Webster et al. 1985). Due to its nocturnal habits and secretive nature, the southern flying squirrel is not

frequently encountered. Still, the presence of this rodent has been well established in York County (Fields 2000). Sewall (unpublished) trapped this species at KIMO in February 1999. There is a single digital image (see Appendix 2; page 2-7) on file from March 2004, representing the only official record of this species at KIMO.

Family Castoridae

Castor canadensis (**American beaver**). This large semi-aquatic rodent ranges across North America, having been nearly extirpated before 1900, but reintroduced throughout the eastern United States (Hall 1981, Whitaker and Hamilton 1998). This pattern was also noted on a regional level within the Carolinas (Webster et al. 1985, Shipes and Rainey 1986). I observed an immature beaver at Kings Creek October 28, 2004 and took a digital image (see Appendix 2; page 2-2). Sewall (unpublished) also noted beavers at KIMO in January 1999 by the presence of gnawed tree stumps along Kings Creek.

Family Muridae

Reithrodontomys humulis (**eastern harvest mouse**). This small mouse ranges throughout the southeastern United States (Brown 1997, Hall 1981, Stalling 1997), including all of North and South Carolina (Webster et al. 1985). While Sewall (unpublished) reported the harvest mouse at KIMO in February 1999, he acknowledged the uncertainty of his identification. Again, he did not describe the characters by which he made the determination, only that the specimen was trapped and released in a power line right-of-way (see Cloninger et al. 1977). *R. humulis* is easily confused with the house mouse (*Mus musculus*) and occasionally with mice of the genus *Peromyscus*. However, only the harvest mouse has grooved upper incisors (Whitaker and Hamilton 1998). Because Sewall (unpublished) also recognized and reported *Peromyscus* from KIMO, it seems likely that any mistaken identifications would turn out to be *Mus musculus*. I have collected *Mus* in habitats similar to that of *Reithrodontomys*, and only by inspecting the incisors could I make a proper diagnosis of species. Therefore, I report the findings of Sewall (unpublished) with some reservation and list his two occurrences (Appendix 1) as questionable.

Peromyscus leucopus (**white-footed mouse**). This mouse is a common resident throughout most of the eastern United States, but is absent from the coastal plain of Alabama, Georgia, South Carolina, and all of Florida (Brown 1997, Hall 1981, Lackey et al. 1985). Sewall (unpublished) reported *P. leucopus* from several sites around the park in 1999. This was the most commonly documented species in the park during the recent survey with at least 29 occurrences (see Appendix 1). Most identifications were made from external measurements. Immature specimens were identified by habitat. The only other species of *Peromyscus* in the region is the smaller *P. polionotus*, whose habitat preference is reflected in the common name of the species – the oldfield mouse. Virtually all occurrences of *Peromyscus* at KIMO were in forested areas, the preferred habitat of *P. leucopus*. Voucher specimens taken during the survey are housed at MYCO under the accession number 2004.001. Individual numbers: SEF-KIMO-001, 004, and 022. Additionally, voucher images were taken and recorded (see Appendix 2; page 2-5).

***Sigmodon hispidus* (hispid cotton rat).** This species is a common resident throughout the southeastern United States (Brown 1997, Whitaker and Hamilton 1998), and the range extends into the south central United States, Mexico, and Central America (Cameron and Spencer 1981, Hall 1981). Sewall (unpublished) trapped this species at KIMO in 1999. I found no other evidence of this species. However, this species prefers open fields instead of forests, and Sewall's single record was from a power line right-of-way.

***Ochrotomys nuttalli* (golden mouse).** This mouse occurs throughout the southeastern United States (Hall 1981, Linzey and Packard 1977, Whitaker and Hamilton 1998) including all of North and South Carolina (Webster et al. 1985). I captured a single specimen, representing the only documented occurrence of the species as KIMO during this survey. However, Sewall (unpublished) collected and released a single specimen in 1999. The specimen I collected will be prepared as a voucher specimen and placed at MYCO under the accession number 2004.001. Individual number: SEF-KIMO-022.

***Ondatra zibethicus* (muskrat).** The muskrat is widely distributed across the United States and Canada, though it is absent from the coastal plains of Georgia and South Carolina and all of Florida (Hall 1981, Whitaker and Hamilton 1998). While the occurrence of the muskrat at KIMO is plausible, I present this single record with some reservation. Species occurrence was documented by the presence of tracks (see Appendix 2; page 2-3) along Kings Creek, the identification of which I referred to Dr. Julie Weston of the University of South Carolina. My slight skepticism stems from the fact that there were no other records of this species, and subsequently the presence an immature beaver (*Castor canadensis*) was unquestionably verified (see Appendix 2; page 2-2). It is possible that the tracks pictured in Appendix 2 are from this or another young beaver. However, I will defer to Dr. Weston's identification with my caution duly expressed.

ORDER CARNIVORA

Family Procyonidae

***Procyon lotor* (northern raccoon).** The raccoon is a common resident with a widespread range across the United States (Hall 1981, Whitaker and Hamilton 1998), including all of North and South Carolina (Brown 1997, Webster et al. 1985). Sewall (unpublished) reported this species at KIMO in 1999. C. McNeilly trapped a raccoon in a Havahart trap at the Visitor's Center and relocated the specimen to another part of the park. We further documented this species by tracks at scent stations and other locations (see Appendix 2; page 2-6).

Family Mustelidae

***Mustela vison* (American mink).** The mink is found throughout North America and parts of northern Europe and Asia (Lariviere 1999). The species ranges across the southeastern United States, including both Carolinas (Brown 1997, Webster et al. 1985). While I found no evidence of this elusive mammal, Sewall (unpublished) documented tracks along Kings Creek in 1999.

Family Mephitidae

***Mephitis mephitis* (striped skunk).** The striped skunk ranges most of the United States, southern Canada, and northern Mexico (Hall 1981, Smith and Verts 1982) and is distributed across the southeast and North and South Carolina (Brown 1997, Webster et al. 1985). While I recorded only one occurrence of the striped skunk at KIMO, there were other times when the presence a skunk was quite obvious. The skunk is truly one mammal that can be documented by smell. However, because there is the remote possibility of the spotted skunk (*Spilogale putoris*) in the region (Webster et al. 1985, Whitaker and Hamilton 1998), I chose not to document species by smell alone.

Family Canidae

***Vulpes vulpes* (red fox).** While the current range of the red fox is well established, the historic and prehistoric distribution is more tenuous. Furthermore, North American red foxes were once regarded as a separate species (*V. fulva*) from the Old World (*V. vulpes*). This is reflected in some references cited (Cloninger et al. 1977) and some museum specimens (FURM). However, the North American and Old World species are now widely recognized as the same species *V. vulpes* (Hall 1981, Whitaker and Hamilton 1998). Moreover, at least some populations in the eastern United States were brought from Europe during colonial times for fox hunting (Webster et al. 1985, Whitaker and Hamilton 1998). SCDNR recorded the presence of red fox by scent station surveys along Opossum Trot Rd. at KIMO September 23, 1993. Sewell (unpublished) also reported *V. vulpes* at KIMO in February 1999.

***Urocyon cinereoargenteus* (common gray fox).** The range of the gray fox includes most of the United States except the northern Plains states (Fritzell and Haroldson 1982, Hall 1981). While relatively common throughout the Carolinas, this fox is less abundant in higher elevations (Brown 1997, Webster et al. 1985). Aside from visual sightings, the presence of this species was documented by tracks and digital images recorded (see Appendix 2: page 2-7).

Family Felidae

***Lynx rufus* (bobcat).** The bobcat is still a resident throughout most of its historical range, which includes most of the United States and northern Mexico (Lariviere and Walton 1997, Whitaker and Hamilton 1998). The secretive and nocturnal nature of the bobcat was played out during this survey. While no doubt present in larger numbers than indicated at the park, I only documented a single occurrence at a scent station and recorded an image of its tracks (see Appendix 2; page 2-3).

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Family Cervidae

***Odocoileus virginianus* (white-tailed deer).** The white-tailed deer is common throughout most of North America and absent primarily from the southwestern United States (Smith 1991, Whitaker and Hamilton 1998). The species is abundant throughout the southeastern United States (Brown 1997, Webster et al. 1985). This species was documented at least 14 times at KIMO and voucher images from casual observations, stealth cameras, and tracks throughout the park were retained (see Appendix 2; page 2-4).

Conclusion and Recommendations

While this survey documented up to 70% of the expected non-volant mammal species diversity at Kings Mountain National Military Park, it did little to assess relative or absolute abundance any individual species. As such, there is little evidence to support statements about the seeming lack of abundance noted during this two-year study. In effect, I base such a statement on the observation that there were study plots in which traps were set for several nights with no capture success. Indeed, the overall success rate for “captures,” which included tracks left at scent stations, was only 3.01%. While many factors can influence trap success, I feel somewhat confident in my assessment of low mammal abundance because similar results were obtained in the bird species inventory for the park (Dr. W. Rogers, personal communication, September 2005).

One factor that may have a negative impact on species abundance and distribution is the controlled burn program at KIMO. Although the detrimental effects of fire are questionable (Ford et al. 1999), it seems that burning during late spring and early summer would at least have short-term effects on mammal populations. However, comparative studies should be designed and executed to properly address this issue. One such study is already in progress by a graduate student of Winthrop University to assess the effects of fire on the avian diversity of Kings Mountain National and State Parks (Dr. W. Rogers, personal communication).

At the very least, relative abundance studies should be conducted to facilitate proper management of mammal populations at KIMO. The data provided by this report can serve as the baseline of information upon other studies can be constructed. With the occurrences of individual species verified at specific locations within the park, abundance studies can be immediately initiated so that more time can be spent monitoring populations and the factors that influence them over space and time. Such monitoring and subsequent management can assure the future of the mammal communities and other irreplaceable natural treasures of Kings Mountain National Military Park.

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