INTRODUCTION

Bat conservation has become a wildlife management issue throughout North America and Europe due to studies indicating significant population declines caused by habitat disturbance and destruction, and pesticide poisoning (Geluso et. al. 1976; McCracken 1986; Thomas et. al. 1990; Clawson 1991; Vaughan 1996). In North Carolina, eight bat species are legally protected as Rare Animals, and two more are on the Animal Watch List (LeGrand and Hall 1999; Table 1). Yet, because bat occurrence records for North Carolina are fragmentary, the state distributions of indigenous bat species are, to varying extends, uncertain. Statewide bat surveys are necessary to define species distributions and to provide reference data for future comparisons.

In 1999, a review of NC state park biological inventory data by the Division of Parks and Recreation (DPR) noted a lack of significant bat data throughout the park system. NC state parks were considered optimal sites for conducting a statewide bat survey because they incorporate large tracts of natural habitats, especially the mature hardwood forests, swamp forests, and riparian habitats used by bats for foraging and roosting. A 1999-2000 bat inventory of NC state parks was planned as a collaborative effort by the DPR and the North Carolina State Museum of Natural Sciences (NCSM). On September 22, 1999, the Natural Heritage Trust Board granted funds sufficient to survey bats at six to nine parks deemed to be of the highest priority. On September 28, 2000, a second grant was awarded from the Natural Heritage Trust Fund to continue the inventory through 2001.

The inventory project was conducted by NCSM mammalogy staff and a DPR biologist. DPR field staff at surveyed parks aided with equipment and logistical support.

TABLE 1. North Carolina Bat Species

Scientific Name	Common Name	NC Status	Federal Status
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	Special Concern (Proposed Threatened)	Species of Concern
Corynorhinus townsendii	Townsend's Big-eared Bat	Endangered	Endangered
Eptesicus fuscus	Big Brown Bat	-	-
Lasionycteris noctivagans	Silver-haired Bat	-	-
Lasiurus borealis	Eastern Red Bat	-	-
Lasiurus cinereus	Hoary Bat	-	-
Lasiurus intermedius	Northern Yellow Bat	(New NC occurrence)	-
Lasiurus seminolus	Seminole Bat	Watch List	-
Myotis austroriparius	Southeastern Bat	Special Concern	Species of Concern
Myotis grisescens	Gray Bat	Endangered	Endangered
Myotis leibii	Eastern Small-footed Bat	Special Concern	Species of Concern
Myotis lucifugus	Little Brown Bat	Watch List	-
Myotis septentrionalis	Northern Long-eared Bat	Special Concern	-
Myotis sodalis	Indiana Bat	Endangered	Endangered
Nycticeius humeralis	Evening Bat	-	-
Pipistrellus subflavus	Eastern Pipistrelle	-	-
Tadarida brasiliensis	Brazilian Free-tailed Bat	Special Concern (Proposed De-listed)	-

METHODOLOGY

Sites

Sixteen NC state parks and natural areas were selected for the survey based on their particular natural communities: Boone's Cave State Park, Eno River State Park, Goose Creek State Park, Gorges State Park, Hanging Rock State Park, Lake Waccamaw State Park, Lumber River State Park, Merchant's Millpond State Park, Morrow Mountain State Park, Mount Mitchell State Park, New River State Park, Pettigrew State Park, Raven Rock State Park, South Mountains State Park, Stone Mountain State Park, and the Weymouth Woods Sandhills Nature Preserve. (Figure 1)

Mist-netting

Mist nets were used to live-capture specimens in flight. The mist nets used were large (2.6 meters tall, 6-18 meters wide), tiered, small mesh (28-38 mm) nets constructed of ultra-fine, black nylon thread. Bats that flew into a net usually became entangled and were then removed by hand for close inspection and measurements. Mist-netting is an effective means of capture that, when conducted by well-trained operators, rarely results in physical injury to captured specimens.

Echolocating bats can detect the presence of the mist nets, with some species being especially sensitive. Therefore, a random placement of mist nets without consideration of the surrounding environment cannot be expected to produce good results. In this study, mist nets were set across what were determined to be potential bat flyways. These flyways were places where bats were expected to be accustomed to an open flight path and were therefore probably flying faster and less observantly than usual. Streams under low forest canopies, and roads and jeep trails through forests, were often suspected as flyways because they offered open paths through otherwise cluttered areas. It was preferred for the flight path to be netted to have a low and close forest canopy such that the effect was roughly tunnel-like. Under such circumstances, an appropriately sized mist net could fully cover the flight path and thereby prevent bats from dodging the net at the last moment. In this survey, a canopy net (a 20-25' tall, pulley-operated, two-net stacked array) was used to efficiently net large flyways.

Setting nets across streams and ponds was also a preferred strategy because of the tendency of bats to drink water (which they accomplish on the wing) after emerging from their hot daytime roosts. When a net was to be placed across water, a position was selected where a long stretch of calm, unobstructed water would provide an adequate space for a bat to dip down and drink while flying. Nets set over water were kept low but not so low that they would get wet and give up their location or cause a low-netted bat to drown. When a net was set across deep water, waders or canoes were used to erect the net and to reach and remove captured bats.

Approximate mist net locations and configurations were determined in advance during daytime reconnaissance of the study area. The nets were arranged and erected late in the afternoon, and in

most instances, all mist nets were up and operating by sunset. The nets were checked and tended regularly (approximately every 10 minutes) for captures to avoid excessive tangling and stress of netted animals. The nets were kept clean of debris and flying insects throughout the night. The nets were generally operated from dusk to around 2:00 A.M. The nets were then closed and dismantled in order to be erected again at a new site the following night.

Roost Searches

Roosting bats were searched for during the day, in tree cavities, in the interior and on the exterior of man-made structures, and inside small caves. Flashlights and binoculars were used in checking the contents of very tall tree cavities.

Echolocation Monitoring

The Anabat bat detection system, manufactured by Titley Electronics Proprietary Ltd., was employed to record high frequency bat vocalizations near some mist net arrays and in locations where open conditions prohibited mist-netting. Future analysis of the recorded vocalizations may allow for confident species identification.

Measurements

Captured bats were identified to species and sex, weighed using a Pesola 30g spring scale, and measured for forearm length. Females were examined for signs of pregnancy by palpating the abdomen, and males were checked for sexual maturity usually indicated by descended testicles. Also recorded was the time of capture of each specimen, the direction it was traveling when caught, and the height at which it was caught in the net. After measurements were recorded, each bat was released.

PARK-SPECIFIC RESULTS

Boone's Cave State Park Survey

Boone's Cave State Park covers 100 acres on the east side of the Yadkin River in Davidson County.

The terrestrial natural communities present include Dry Oak–Hickory Forest, Dry-Mesic Oak–Hickory Forest, Mesic Mixed Hardwood Forest (Piedmont Subtype), Piedmont/Mountain Bottomland Forest, Piedmont/Mountain Levee Forest, Piedmont/Mountain Swamp Forest, Successional Pine Forest, and an 80' long, granite-gneiss, fracture-formed cave.

Methods

Boone's Cave, also known as Devil's Den, was surveyed midday on 10/13/2000, 11/4/2000, and 8/23/2001. (Figure 2)

Table 2. Boone's Cave State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	not handled	8/23/2001	Beam-joint of picnic shelter (Site 2)	Oak–Hickory Forest	S. Lambiase
(3x) *P. subflavus*	not handled	10/13/2000	Devil's Den at farthest SE end (Site 1)	Cave	S. Lambiase
(4x) *P. subflavus*	not handled	11/4/2000	Devil's Den at farthest SE end (Site 1)	Cave	S. Lambiase
No observations	-	8/23/2001	Devil's Den	Cave	-

Total # of bats observed and identified to species: 8, but probably only 5 different individuals.
Total # of species: 2

Conclusions

This small park unit has several features favorable for bats: a stretch of river, mature hardwood forests, and a small cave. The majority of the cave is a straight shaft descending down from a small domed room at the entrance. At its southeastern terminus (where the Eastern Pipistrelles were observed), the cave shaft is very confined, and very humid/damp. This tunnel-like cave is probably a cold air sump that is sufficiently low and stable in temperature at the bottom to suit Eastern Pipistrelles as a hibernaculum. Eastern Pipistrelles are believed to be more adaptable to small caves than other species (Whitaker and Hamilton 1998), so they may be the only bat species able to use this cave in winter. No bats were observed during a summer inspection, perhaps because this cave appears (as measured from trash, and graffiti) to suffer ample visitor disturbance. There are several small spurs of the cave that could hide a small number of roosting bats, but are too tight to inspect.

Eno River State Park Survey

Eno River State Park is comprised of 2,635 acres in Durham and Orange Counties. The park property is largely distributed as a corridor along both sides of the Eno River.

The major terrestrial natural communities in the park are Dry-Mesic Oak–Hickory Forest, Mesic Mixed Hardwood Forest (Piedmont Subtype), Piedmont/Coastal Plain Acidic Cliff, Piedmont/Coastal Plain Heath Bluff, and Piedmont/Low Mountain Alluvial Forest.

Methods

The night of 6/19/2001, three short nets were set across the river about 100 meters downriver of Buckquarter Creek (Sites 1-3). Two additional nets (Sites 4, 5) were set across Buckquarter Creek. (Figure 3)

On 6/20/2001, a survey area was chosen off Pump Station Trail where a long island divides the river into two channels. Two nets were set across the river south of the island (Sites 6, 7), and one net (Site 8) was set across the river north of the island. A fourth net (Site 9) was set across Pump Station Trail. (Figure 3)

On 6/21/2001, a canopy net (Site 10) and two short nets (Sites 11, 12) were set across the river off of Cole Mill Trail. (Figure 3)

Four abandoned structures (Sites 13-16) were searched on 7/16/2001. (Figure 3)

Table 3. Eno River State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	male, non-scrotal	6/21/2001 22:05 hrs.	Eno River off Cole Mill Trail (Site 12)	Piedmont/Low Mountain Alluvial Forest	J. Beaty, S. Beaty, L. Gatens, S. Lambiase, D. Olschner, R. Lew
L. borealis	adult, female, lactating	6/19/2001 22:05 hrs.	Buckquarter Creek (Site 4)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
L. borealis	male, escaped net	6/19/2001 22:15 hrs.	Eno River off Buckquarter Creek Trail (Site 2)	Piedmont/Low Mountain Alluvial Forest	L. Gatens
L. borealis	male	6/19/2001 22:45 hrs.	Eno River off Buckquarter Creek Trail (Site 3)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
L. borealis	adult, female, lactating	6/19/2001 22:50 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
L. borealis	female	6/19/2001 23:25 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
L. borealis	female	6/19/2001 23:30 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace

Table 3. Eno River State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female	6/20/2001 02:15 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, S. Lambiase
L. borealis	adult, female, lactating	6/21/2001 22:00 hrs.	Eno River off Cole Mill Trail (Site 11)	Piedmont/Low Mountain Alluvial Forest	J. Beaty, S. Beaty, L. Gatens, S. Lambiase, R. Lew
P. subflavus	adult, female, pregnant	6/19/2001 21:15 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
P. subflavus	adult, female, pregnant	6/19/2001 21:35 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	M.K. Clark, L. Gatens, S. Lambiase, A. Wallace
P. subflavus	adult, female, pregnant	6/20/2001 01:10 hrs.	Eno River off Buckquarter Creek Trail (Site 1)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, S. Lambiase
No captures	-	6/20/2001	Eno River off Pump Station Trail (Sites 6-8)	Piedmont/Low Mountain Alluvial Forest	-
No observations	-	7/16/2001	Sites 13-16	Abandoned buildings	-

Total # of bats observed and identified to species: 12
Total # of species: 3

Conclusions

Water quality monitoring on the Eno River has consistently reported healthy aquatic macroinvertebrate communities. Presumably then, the river should support an abundance and high diversity of the aquatic insect larvae that mature into potential bat prey. Large diameter trees with cavities were not commonly observed, but definitely present (especially river-edge sycamores scarred from past flooding or beaver activity). Eno River State Park seems to possess a choice environment for bats.

The species captured (Big Brown Bat, Eastern Red Bat, and Eastern Pipistrelle) are common and expected for the Piedmont of North Carolina. There is a historical record of a colony of the much rarer Southeastern Bat occurring in nearby Wake County, and so this species was considered a possibility at this park. The Southeastern Bat forages over water and favors roosting near water in tree cavities and buildings (Webster et al. 1985) – all features that Eno River State Park possesses. There is also an April 1, 1992 record of a dead Silver-haired Bat having been found at the park (S. Hartley and F. Williams).

This survey captured fewer bats than one might expect from a good quality habitat. However, the low capture total was not entirely unforeseen given the difficulty of using mist nets to effectively sample over a wide river. This consideration, plus the quantity of river not represented, suggests that additional surveys (especially in different seasons) would likely add at least one or two new species to the bat checklist for this park. In particular, Evening Bats and Little Brown Bats are liable to be present.

Goose Creek State Park Survey

Goose Creek State Park is located in central Beaufort County. The park is roughly defined by its borders with Goose Creek to the west, Mallard Creek to the east, and the Pamlico River to the south. The park encompasses a total of 1,596 acres.

Goose Creek State Park includes a variety of natural communities, including Coastal Plain Small Stream Swamp Forest (Blackwater Subtype), Nonriverine Swamp Forest, Tidal Cypress--Gum Swamp Forest, Coastal Fringe Evergreen Forest, Estuarine Fringe Loblolly Pine Forest, Mesic Pine Flatwoods, Nonriverine Wet Hardwood Forest, and Tidal Freshwater Marsh (Oligohaline Variant).

Methods

Mist netting efforts in the park began on 9/7/99. That night, a mist net was operated over a 12 meter by 30 meter pond (Site 1), and another mist net was set across a narrow jeep trail through a pine woods (Site 2). (Figure 4)

On 9/8/99, Goose Creek was canoed upstream through Tidal Cypress--Gum Swamp Forest in a search for suitable mist net sites, from approximately the mouth of Flatty Creek up the right fork to the bridge at State Road 1334. That night, two mist nets were operated across upper Goose Creek (Sites 3, 4). (Figure 4)

Goose Creek was mist-netted again on 9/6/2000. Two nets were set across the driveways to a ranger residence and a superintendent residence (Sites 5, 6). A third net was set across a forested road at the edge of a field (Site 7), and a fourth was set at roughly Site 2. (Figure 4)

On 7/18/2001, a mist net was set before the campground dock (Site 8). (Figure 4)

Table 4. Goose Creek State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female	9/7/99 22:09 hrs.	Old drainage pond - "Bat Pond" (Site 1)	Regenerating mixed hardwood--pine forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
L. borealis	adult, female	9/8/99 20:54 hrs.	Upper Goose Creek near S.R. 1334 (Site 3)	Coastal Plain Small Stream Swamp Forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
L. borealis	adult, male	9/7/2000 00:30 hrs.	Superintendent's driveway (Site 6)	Regenerating mixed hardwood--pine forest	J. Benkusky, L. Gatens, J. Harrill, J. Greenwood, S. Lambiase
Lasiurus spp.	escaped net	9/7/99 21:35 hrs.	Old drainage pond - "Bat Pond" (Site 1)	Regenerating mixed hardwood--pine forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
Lasiurus spp.	escaped net	9/7/99 22:58 hrs.	Old drainage pond - "Bat Pond" (Site 1)	Regenerating mixed hardwood--pine forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
N. humeralis	adult, male,	9/7/99	Old drainage pond -	Regenerating mixed	J. Benkusky, M.K.

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
	descended testicles	**20:29 hrs.**	**“Bat Pond” (Site 1)**	**hardwood--pine forest**	**Clark, J. Greenwood, S. Lambiase**

Table 4. Goose Creek State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
N. humeralis	adult, male, descended testicles	9/7/99 21:01 hrs.	Old drainage pond - "Bat Pond" (Site 1)	Regenerating mixed hardwood--pine forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
N. humeralis	adult, female	9/8/99 20:40 hrs.	Upper Goose Creek near S.R. 1334 (Site 4)	Coastal Plain Small Stream Swamp Forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
Unknown	escaped net	9/8/99 19:58 hrs.	Upper Goose Creek near S.R. 1334 (Site 4)	Coastal Plain Small Stream Swamp Forest	J. Benkusky, M.K. Clark, J. Greenwood, S. Lambiase
No captures	-	9/7/99	Forest road between Bat Pond and field (Site 2)	Plantation pine forest	-
No captures	-	9/6/2000	Forest road between Bat Pond and field (Sites 2,7)	Plantation pine forest	-
No captures	-	9/6/2000	Ranger/superintendent driveway. (Site 6)	Regenerating mixed hardwood--pine forest	-
No captures	-	7/18/2001	Near campground dock (Site 8)	-	-

Total # of bats observed and identified to species: 6
Total # of species: 2

Conclusions

The abundance of swamp and riparian environments at Goose Creek State Park appears to offer excellent foraging habitat for a number of bat species. Roost habitat may be limited by the young age of the forests.

Fragments of older Tidal Cypress--Gum Swamp Forest can be seen along the banks of mid and lower Goose Creek, but the creek is too wide at that point for mist-netting across the water. Mist netting is possible where the creek narrows upstream, but in this area the Coastal Plain Small Stream Swamp Forest is fairly young. The Nonriverine Swamp just southeast of the visitor center has been logged probably in the last 30-50 years, with the mode d.b.h. of trees appearing to be at or below 12". Bald cypress and black gum are present in the swamp, but are on average too small to possess the basal cavities used by Rafinesque's Big-eared Bat and the Southeastern Bat.

The Red Bat and Evening Bat captured in this survey are both common species in North Carolina. Red Bats favor roosting in tree foliage and Spanish moss, and Evening Bats are generalists that may roost in buildings, Spanish moss, tree cavities (including woodpecker cavities), and exfoliating bark (Whitaker and Hamilton 1998). The park possesses abundant Spanish moss, and undoubtedly many trees with loose bark. It is the scarcity of old growth and associated cavities that decreases the probability of Goose Creek State Park supporting important Rafinesque's Big-eared Bat and the Southeastern Bat populations at the present time.

However, for natural resource management purposes, Goose Creek State Park should operate under the assumption that some number of Rafinesque's Big-eared Bats and Southeastern Bats could be foraging and roosting somewhere within the confines of the park. Pro-bat natural resource management of Goose Creek State Park should entail conservation of cavity trees and hollow snags within the park as much as possible, with removal occurring only when no reasonable alternatives are available. As the abundance of roost habitat may be the major factor limiting bat abundance and/or diversity within the park, erecting properly designed and located bat houses could be very successful. Also, thinning sweet gum and red maple from the Nonriverine Swamp, especially around larger trees with cavities, might increase the value of this habitat for bats.

Gorges State Park Survey

Gorges State Park is located in Transylvania County and encompasses an estimated 7,092-acre portion of the Jocassee Gorges.

The major terrestrial natural communities present are Acidic Cove Forest, Rich Cove Forest, Canada Hemlock Forest, White Pine Forest, Chestnut Oak Forest, Montane Oak--Hickory Forest, and Pine--Oak/Heath Forest.

In late July of 1999, federally Endangered Indiana Bats, *Myotis sodalis*, were discovered in the Nantahala National Forest of western North Carolina. As a result, a freeze was placed on national forest lumbering activities as far east as Macon County, the center of which is only 30 miles from Gorges State Park.

Methods

Bat survey work in Gorges State Park began on 7/8/2000. Two nets were erected across Bearwallow Creek in the vicinity of Bearwallow Fields, where the creek flows wide under a tall Hemlock Forest canopy (Sites 1, 2). (Figure 5)

On the night of 7/9/2000, a canopy net was operated across Bearwallow Creek at the Auger Hole Road ford (Site 3). The ford area was deemed a suitable net site because it was an intersection of two potential flyways, the road and the creek, in the midst of dense Acidic Cove Forest. Also, the openness and lack of obstructions in the water at the ford (the creek bed there is largely a sheet of smooth concrete) made it seem appealing as a drinking area. (Figure 5)

The canopy net was again operated at Site 3 on the night of 7/10/2000. An additional net (Site 4) was set across Auger Hole Road, about 15 meters east of the creek crossing, and another net (Site 5) was set in a forest gap about 20 meters from the creek. (Figure 5)

On 7/11/2000, a net (Site 6) was set across the Toxaway River, approximately 30 meters upstream from the Auger Hole Road ford, and another net (Site 7) was set across a closely forested section of the Auger Hole Road approximately 25 meters west from the river crossing. A third net (Site 8) was set in the Hemlock Forest at Bearwallow Fields, roughly 10 meters back from the creek and parallel to it. A fourth net (Site 9) was also set in the Hemlock Forest at Bearwallow Fields over a small spring that drains into Bearwallow Creek. (Figure 5)

On 7/14/2000, one net was set across Auger Hole Road on the east side of the river crossing (Site 10), and another across the jeep trail to the Bearwallow Fields campground (Site 11). (Figure 5)

An additional night of netting was attempted on 9/14/2000, at Sites 6, 7, and 10. (Figure 5)

On 6/25/2001, four nets (Sites 12-14) were set further up river on the Toxaway, close to an old

campsite.

Table 5. Gorges State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	adult, male, descended testicles	7/10/2000 23:20 hrs.	Auger Hole Road close to Bearwallow Creek (Site 4)	Acidic Cove Forest	L. Gatens, K. Kilburn, S. Lambiase, M. Teer, M. Traugott
E. fuscus	adult, male, descended testicles	7/11/2000 22:50 hrs.	Auger Hole Road, just west of the Toxaway River ford (Site 7)	Acidic Cove Forest	L. Gatens, K. Kilburn, M. Lambert, S. Lambiase, M. Teer, M. Traugott
E. fuscus	adult, male	6/25/2001 22:35 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J.
L. borealis	adult, male, undescended testicles	9/14/2000 20:20 hrs.	Auger Hole Road, just west of the Toxaway River ford (Site 7)	Acidic Cove Forest	L. Gatens, S. Lambiase
L. borealis	adult, male, undescended testicles	9/14/2000 21:05 hrs.	Toxaway River close to Auger Hole Road ford (Site 6)	Acidic Cove Forest	L. Gatens, S. Lambiase
L. borealis	adult, male, undescended testicles	9/14/2000 21:20 hrs.	Toxaway River close to Auger Hole Road ford (Site 6)	Acidic Cove Forest	L. Gatens, S. Lambiase

Table 5. Gorges State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, male, undescended testicles	9/14/2000 22:15 hrs.	Auger Hole Road, just west of the Toxaway River ford (Site 7)	Acidic Cove Forest	L. Gatens, S. Lambiase
L. borealis	adult, male	6/25/2001 21:45 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J. Hammett
L. borealis	adult, male	6/25/2001 22:20 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J. Hammett
L. borealis	adult, male	6/25/2001 22:45 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J. Hammett
L. borealis	adult, male	6/25/2001 23:35 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J. Hammett
L. borealis	male	6/26/2001 00:15 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, M. Lambert, S. Lambiase, R. Rathbone, J. Hammett
M. lucifugus	adult, female	7/10/2000 22:50 hrs.	Bearwallow Creek at Auger Hole Road	Acidic Cove Forest	L.Gatens, K. Kilburn, S. Lambiase, M. Teer,

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
			ford (Site 3)		M.Traugott

Table 5. Gorges State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. septentrionalis	adult, male, undescended testicles	7/11/2000 21:30 hrs.	Bearwallow Fields close to Bearwallow Creek (Site 8)	Hemlock Forest	L. Gatens, K. Kilburn, M. Lambert, S. Lambiase, M. Teer, M.Traugott
P. subflavus	adult, female	7/8/2000 21:15 hrs.	Bearwallow Creek at Bearwallow Fields (Site 2)	Hemlock Forest	L.Gatens, K. Kilburn, S.Lambiase, M. Teer, M.Traugott
P. subflavus	adult, female, pregnant	7/8/2000 22:50 hrs.	Bearwallow Creek at Bearwallow Fields (Site 2)	Hemlock Forest	L.Gatens, K. Kilburn, S. Lambiase, M. Teer, M.Traugott
P. subflavus	adult, male, descended testicles	7/10/2000 21:45 hrs.	Bearwallow Creek at Auger Hole Road ford (Site 3)	Acidic Cove Forest	L.Gatens, K. Kilburn, S. Lambiase, M. Teer, M.Traugott
P. subflavus	male	6/25/2001 21:15 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Rathbone, J. Hammett

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	escaped	6/25/2001 21:30 hrs.	Upper Toxaway River near old campsite (Site 12)	Acidic Cove Forest	L. Gatens, S. Lambiase

Table 5. Gorges State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
Unknown	escaped net	7/9/2000	Bearwallow Creek at Auger Hole Road ford (Site 3)	Acidic Cove Forest	L. Gatens, K. Kilburn, S. Lambiase
No captures	-	7/11/2000	Toxaway River close to Auger Hole Road ford (Site 6)	Acidic Cove Forest	-
No captures	-	7/14/2000	Auger Hole Road, east of the Toxaway River ford (Site 10)	Acidic Cove Forest	-
No captures	-	7/14/2000	Bearwallow Fields (Site 11)	Hemlock Forest	-
No captures	-	9/14/2000	Auger Hole Road, east of the Toxaway River ford (Site 10)	Acidic Cove Forest	-
No captures	-	9/25/2001	Upper Toxaway River (Sites 13, 14)	Acidic Cove Forest	-

Total # of bats observed and identified to species: 19
Total # of species: 5

Conclusions

Two of the species captured at Gorges State Park are uncommon; the Northern Long-eared Bat is a species of state Special Concern, and the Little Brown Bat is a Watch List species. Both of these *Myotis* are long-lived (15+ yrs.) and may use tree cavities, loose bark, caves, and man-made structures as roosts (Whitaker and Hamilton 1998; Foster and Kurta 1999).

Our survey efforts were concentrated in a fairly localized area, and all nets were set in either Acidic Cove or Hemlock Forest. There remains plenty of opportunity for additional mist-netting in the Toxaway River and Bearwallow Creek gorges. A previous mammal survey of the Toxaway River Gorge (Paul and Quay 1963) collected seven Eastern Pipistrelles and an Evening Bat, a species not encountered at our lower-gorge survey sites. The Hoary Bat, Indiana Bat, Rafinesque's Big-eared Bat, Silver-haired Bat, and Eastern Small-footed Bat, all remain possible occurrences in the park.

Gorges State Park has not yet fully developed facilities, trails, and campgrounds. With regards to bat habitat protection, older forest stands will tend to have more hollow snags and trees with cavities and/or sheets of loose bark. Facilities placement should avoid disturbing older forest stands. Remnant large trees can be found in younger forests and should also be carefully preserved. Any new hiking trails should be established away from cavity bearing trees and hollow snags to avoid having to one day remove them for safety purposes.

The Jocassee Gorges contain an abundance of rock outcrops. There is a possibility that bats may be roosting in micro-caves or large fissures in some of the larger outcrops. Visitor disturbance of rock outcrops with this potential should be prevented by discouraging climbing on them and by locating hiking trails and campgrounds away from such sites.

Hanging Rock State Park Survey

Hanging Rock State Park is located in Stokes County, where it covers 6,682 acres and includes a concentration of monadnocks (Cook's Wall, Flat Shoals, Hanging Rock, Moore's Knob, and Wolf Rock).

The major terrestrial natural communities present are Carolina Hemlock Bluff, Chestnut Oak Forest, Dry Oak–Hickory Forest, Low Elevation Rocky Summit, Montane Acidic Cliff, and Pine–Oak Heath. A few small caves have been identified in this rocky terrain.

Methods

On 11/13/2000, two micro-caves and one small cave (approx. 150' long, 40' high) were located on the ridge top of Flat Shoals Mountain and searched for bats (Sites 1-3). (Figure 6)

On 6/6/2001, a canopy net and a short net were set at a jeep trail ford of Indian Creek, near S.R. 1487 (Site 4). A third net was set further upstream across a pool on Indian Creek (Site 5). (Figure 6)

During the day of 6/7/2001, the abandoned house off S.R. 2012 near Cascade Creek was searched, as was Tory's Den, and the boathouse and bathhouse by the lake. That night, an 18 meter short net and a 9 meter short net were set side by side across the Dan River about 75 meters east of the boat launch (Site 6). An additional pair of nets (a 12 meter short net and a 9 meter short net) was set side by side across the river about 5 meters west of the boat launch (Site 7). (Figure 6)

During the day of 6/8/2001, an old tobacco barn north of S.R. 1001 by Indian Creek was examined, as were two deep rock fissures near Window Falls. That night three short nets were set perpendicular to the boathouse across the small inlet of the lake (Sites 8-10). (Figure 6)

On 7/21/2001, the three small Flat Shoals Mountain caves (Sites 1-3) were again searched for bats. (Figure 6)

Table 6. Hanging Rock State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female, pregnant	6/7/2001 23:10 hrs.	Dan River (Site 7)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
L. borealis	adult, male	6/7/2001 23:15 hrs.	Dan River (Site 6)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
L. borealis	adult, female, well developed mammae	6/8/2001 00:45 hrs.	Dan River (Site 6)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
L. borealis	adult, female, pregnant	6/8/2001 00:50 hrs.	Dan River (Site 7)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
L. borealis	adult, male, non-scrotal	6/8/2001 23:00 hrs.	Boathouse (Site 9)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, lactating	6/8/2001 21:15 hrs.	Boathouse (Sites 8-10)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, well developed mammae	6/8/2001 21:20 hrs.	Boathouse (Sites 8-10)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, male, non-scrotal	6/8/2001 21:20 hrs.	Boathouse (Site 8)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, well developed mammae	6/8/2001 21:25 hrs.	Boathouse (Sites 8-10)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase

Table 6. Hanging Rock State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. lucifugus	adult, female	6/8/2001 21:30 hrs.	Boathouse (Sites 8-10)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	escaped while handling	6/8/2001 22:55 hrs.	Boathouse (Site 8)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, post-partem	6/8/2001 22:55 hrs.	Boathouse (Site 8)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, well developed mammae	6/8/2001 23:35 hrs.	Boathouse (Site 8)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, well developed mammae	6/8/2001 24:00 hrs.	Boathouse (Site 8)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
M. lucifugus	adult, female, well developed mammae	6/9/2001 01:05 hrs.	Boathouse (Site 9)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase
P. subflavus	adult, female, pregnant	6/7/2001 22:30 hrs.	Dan River (Site 6)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
P. subflavus	adult, female, pregnant	6/7/2001 23:00 hrs.	Dan River (Site 6)	Mesic Mixed Hardwood Forest	M.K. Clark, L. Gatens, S. Lambiase
P. subflavus	adult, male, non-scrotal, very fat	6/8/2001 23:55 hrs.	Boathouse (Site 10)	Artificial structure on man-made lake	L. Gatens, A. Lambiase, J. Lambiase, S. Lambiase

Table 6. Hanging Rock State Park Results (continued)

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
(8x) *P. subflavus*	observed at a distance	11/13/2000	Bat Cave (Site 3)	Cave	L. Gatens, S. Lambiase
Unknown	too high to positively identify, but not a *P. subflavus*	11/13/2000	Bat Cave (Site 3)	Cave	L. Gatens, S. Lambiase
No observations	-	6/6/2001	Indian Creek (Site 4)	Chestnut Oak Forest	-
No observations	-	6/6/2001	Indian Creek (Site 5)	Chestnut Oak Forest	-
No observations	-	7/21/2001	Bat Cave (Site 3)	Cave	-
No observations	-	11/13/2000, 7/21/2001	Micro-cave 1 (Site 1)	Micro-cave	-
No observations	-	11/13/2000, 7/21/2001	Black Vulture Cave (Site 2)	Micro-cave	-

Total # of bats observed and identified to species: 26
Total # of species: 3

Conclusions

Hanging Rock State Park has a wealth of potential roost sites in the form of rock crevices. The park is well interspersed with water sources, although most streams were too small and/or confined for mist-netting. The ridge top of Flat Shoals Mountain may have more small caves that are yet undiscovered.

The two micro-caves (Site 1 and Site 2) on Flat Shoals Mountain are probably too small for hibernacula; their size preventing critical moisture retention and temperature stability. However, these caves could occasionally serve as summer roosts. Site 3 is a much larger cave that does retain a high humidity, and probably does offer some thermal stability through the winter. The Eastern Pipistrelles observed in November, 2001, presumably overwintered in the cave. Eastern Pipistrelles are believed to be more adaptable to small caves than other species (Whitaker and Hamilton 1998). It was somewhat surprising that no bats were observed in Site 3 in late July. Human disturbance may be to blame, as conveniently dated graffiti, and piles of trash and fire residue, show that this cave experiences significant visitor intrusions. If this cave (Site 3) is ever gated, it possesses enough bat roost merit to warrant a bat-friendly gate design.

Little Brown Bats are a N.C. Watch List species. Current data suggests that their range in N.C. is limited to the western and northernmost portions of the state (Whitaker and Hamilton 1998). Within this range, Little Brown Bats appear to be patchily distributed as they have been uncommonly captured during this state park survey. The roost in the park boathouse is therefore notable for its decent size (estimated at $\geq$ 25 bats) and that it is being used as a nursery roost. There are also many bats (estimated at $\geq$ 50) roosting under the roof of the swim area bathhouse. Overwhelming activity at the boathouse mist nets caused us to abandon netting in the bathhouse, but our observations of the emerging bats suggested to us that these bats were also mostly Little Brown Bats. These roosts may include inhabitants of other species, such as Big Brown Bats, Eastern Pipistrelles, Evening Bats, and perhaps even Northern Long-eared Bats. The bat roosts in these buildings should be considered significant natural resources and appropriately valued as such. Any undertakings that might negatively affect these roosts should be carefully considered and done under consultation with the DPR Resource Management Program.

Lake Waccamaw State Park Survey

Lake Waccamaw State Park is located in Columbus County. The park includes the 8,938 acre bay lake and 1,732 acres of upland habitat along the southeastern shore of the lake.

The terrestrial natural communities present are Natural Lake Shoreline, High Pocosin, Coastal Fringe Sandhill, Pond Pine Woodland, disturbed Pine Savanna, Cypress--Gum Swamp, Coastal Plain Levee Forest (Blackwater Subtype), and various forms of plantation pine forests and regenerating clearcuts.

The NCSM Mammal Collection has a July 7, 1989 record of a Rafinesque's Big-eared Bat located in an abandoned building near Lake Waccamaw. This record and the presence of extensive swamps bordering the lake (River Swamp and Lake Swamp to the south and Green Swamp to the northeast) made Rafinesque's Big-eared Bat and the Southeastern Bat the rare species targets of this survey.

Methods

The survey of Lake Waccamaw State Park began on 5/9/2000. Mist-netting in the Coastal Plain Levee Forest by the Waccamaw River dam would have the potential to capture bats traveling up the Waccamaw River from Cypress--Gum Swamps deeper inside River Swamp and Lake Swamp. However, a loud party of locals was, by loose standards, "fishing" in the area through the afternoon and was not expected to leave by the time nets would need to be set up. Logging roads through forests along the southern edge of the park were also determined to have mist-netting potential, but probably not for rare species. Mist-netting on 5/9/2000 was instead attempted across a boardwalk that cuts through the High Pocosin to the lake (Site 1). A net was also set across an old jeep trail through a Pine Savanna on the sandy ridge (Site 2). The Anabat bat detection system was operated from the main park road, from a deck at the edge of the lake, and on a small trail located approximately 10 meters in from the lake shoreline. (Figure 7)

Daytime reconnaissance of sample sites continued on 5/10/2000. Big Creek was canoed upstream into the Green Swamp from the bridge at Bella Coola Road until wading became necessary at approximately one kilometer upstream. Beyond this point the vegetation became too closed-in to allow for mist-netting. Cypress--Gum Swamp with some large trees was observed along the creek. That night two nets were operated over the water approximately 0.75 kilometers upstream from the road and 50 meters apart (Sites 3, 4). The Anabat bat detection system was used at the downstream net until it began to malfunction and was turned off. (Figure 7)

On the night of 5/11/2000, one net was set across an overgrown jeep trail through young, mixed pine--hardwood forest along the west side of Big Creek, less then 100 meters from the union of the creek and the lake (Site 5). The Anabat unit was operated from the shore of the lake near the mouth of Big Creek, and from a canoe on Big Creek from the bridge at Bella Coola Road to the lake. (Figure 7)

Table 7. Lake Waccamaw State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female, pregnant, non-lactating	5/10/2000 20:35 hrs.	Big Creek (Site 3)	Cypress--Gum Swamp Forest	M.K. Clark, H. Fraser
L. seminolus	adult, female, pregnant, non-lactating	5/10/2000 21:09 hrs.	Big Creek (Site 3)	Cypress--Gum Swamp Forest	M.K. Clark, H. Fraser
Lasiurus spp.	escaped net	5/10/2000 22:10 hrs.	Big Creek (Site 3)	Cypress--Gum Swamp Forest	M.K. Clark, H. Fraser.
M. austroriparius	adult, female, pregnant, non-lactating	5/10/2000 20:20 hrs.	Big Creek (Site 3)	Cypress--Gum Swamp Forest	M.K. Clark, H. Fraser
N. humeralis	adult, male, undescended testicles	5/10/2000 21:00 hrs.	Big Creek (Site 4)	Cypress--Gum Swamp Forest	L. Gatens, S. Lambiase
E. Screech Owl	-	5/9/2000	Boardwalk (Site 1)	High Pocosin	S. Lambiase
No captures	-	5/9/2000	Near park office (Site 2)	Pine Savanna	-
No captures	-	5/11/2000	Near lake junction with Big Creek (Site 5)	Mixed hardwood--pine forest	-

Total # of bats observed and identified to species: 4
Total # of species: 4

Conclusions

Within Lake Waccamaw State Park boundaries, the River Swamp and Lake Swamp property along the Waccamaw River likely contain the most significant habitat for bats. Bats could be roosting in the large remnant cypresses occurring in patches along the lake shore, but evening or night-vision aided surveillance of these cypresses would be necessary to settle this question as the environment is not suited to mist-netting. The lack of success of one night of mist-netting in the Pine Savanna and High Pocosin does not offer strong conclusions about the use of these natural communities by bats.

A park ranger had described bat activity as typically high along the perimeter of the lake. During the course of our survey, limited bat foraging activity was observed or recorded at the perimeter of the lake. However, it should be noted that during our travel around the lake on 5/11/2000, it was noticed that a substantial mayfly hatch was occurring exclusively along the north rim of the lake. It is possible that on the nights we attempted to survey the lake perimeter, certain events were attracting the bats elsewhere. Future analysis of the Anabat data could reveal the specific diversity of the calls that were recorded.

Big Creek did yield a favorable diversity of bats (four species) in only one night of sampling. Most notable was the Southeastern Bat, which is a species of state Special Concern and a Federal Species of Concern. In North Carolina, the Southeastern Bat roosts in hollow trees or buildings, preferably with water underneath or close by, and forages for insects over permanent bodies of water (Webster et al. 1985). Big Creek upstream of Bella Coola Road lies within a section of the Green Swamp owned by the N.C. Wildlife Resources Commission.

The Southeastern Bat was captured less than a kilometer from the lake. This bat could certainly range in its nightly foraging down Big Creek to the lake itself. For natural resource management purposes, Lake Waccamaw should operate under the credible assumption that Rafinesque's Big-eared Bat and the Southeastern Bat are foraging and roosting within the confines of the park. Abandoned structures should be examined for the presence of roosting bats before they are demolished, and potential roost trees should be conscientiously preserved.

Lumber River State Park Survey

Lumber River State Park property is distributed in Columbus, Robeson, and Scotland Counties, and encompasses 4,602 acres and 115 miles of a National Wild and Scenic River.

A wide diversity of natural communities are present, including Blackwater River, Sand and Mud Bar, Coastal Plain Levee Forest, Cypress–Gum Swamp (Blackwater Subtype), Coastal Plain Bottomland Hardwoods, Coastal Plain Small Stream Swamp (Blackwater Subtype), Small Depression Pond, Oxbow Lake, Wet Pine Flatwoods, Coastal Fringe Sandhill, Coastal Fringe Evergreen Forest, Xeric Sandhill Scrub, and Pine Savanna.

Methods

A daytime site reconnaissance trip to Lumber River State Park was made on 5/11/2000. The Stevens House (Site 1), an abandoned structure several hundred meters behind the park office, was searched as was the Green House (Site 2), the former park office. Afterwards, four small bodies of water located in forests west of the river were evaluated for future mist-netting. (Figure 8)

A daytime examination of potential net sites was resumed on 5/23/2000. An Oxbow Lake known as "the Millpond" was viewed but rejected based on a dirty film covering nearly the entire surface of the water. A Small Depression Pond, optimistically christened "Bat Lake" by park staff, was observed to be well canopied by surrounding forest, and sufficiently deep (>2 meters in areas) to indicate permanence and reliability as a water source for nearby bats. That night a 40' wide canopy net was operated across Bat Lake (Site 3). (Figure 8)

On 5/24/2000, a stretch of the Lumber River was toured via motorboat. Cypress and tupelo cavities observed between the river and an Oxbow Lake named Old Field Lake were searched on foot with flashlights. Later in the day, a number of abandoned buildings were visited in a search for roosting Rafinesque's Big-eared Bats. The Stevens House, the Green House, an old tobacco barn, several dilapidated sheds, and an abandoned home called the "Chihuahua Lady House" (Site 4) were all investigated. Mist-netting for the night was attempted at Old Field Lake (Site 5), with a canopy net and a short net set across the water, and a third net set in a forest gap perpendicular to the north end of the canopy net. A fourth net was set across a nearby forest road (Site 6). (Figure 8)

On 5/25/2000, a 40' canopy net was erected across Wildcat Lake (Site 7), but was never operated due to a strong thunderstorm that blew in. A short net was hastily set across a nearby forest road and operated as long as possible until the rain became heavy and the net had to be dismantled. (Figure 8)

Table 5. Lumber River State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
C. rafinesquii	observed only	5/11/2000	Kitchen cabinet inside Stevens House (Site 1)	Abandoned artificial structure	M.K. Clark, L. Gatens, C. Norris, C. Gause, S. Lambiase
C. rafinesquii	observed only	5/11/2000	Crawl space under Green House (Site 2)	Abandoned artificial structure	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
C. rafinesquii	adult, male	5/23/2000 23:12 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
C. rafinesquii	male	5/24/2000 00:50 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, S. Lambiase
C. rafinesquii	adult, male	5/24/2000	Crawl space under Green House (Site 2)	Abandoned artificial structure	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
C. rafinesquii	adult, male	5/24/2000	Inside a room of the Chihuahua Lady House (Site 4)	Abandoned artificial structure	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
L. borealis	juvenile, male	5/23/2000 17:08 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, J. Sessoms, S. Lambiase
L. borealis	adult, female, pregnant, non-lactating	5/23/2000 17:25 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, S. Lambiase

Table 5. Lumber River State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female, pregnant, non-lactating	5/24/2000	Forest road near Old Field Lake (Site 6)	Regenerating mixed-hardwood forest	M.K. Clark, L. Gatens, C. Gause, C. Norris, S. Lambiase, J. Sessoms
M. austroriparius	adult, male	5/23/2000 22:58 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
P. subflavus	male	5/23/2000 23:25 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
P. subflavus	male	5/23/2000 23:50 hrs.	Bat Lake (Site 3)	Cypress–Gum Swamp	M.K. Clark, L. Gatens, C. Norris, S. Lambiase
No captures	-	5/24/2000	Old Field Lake (Site 5)	Oxbow Lake	-
No captures (rained out)	-	5/25/2000	Wildcat Lake (Site 7)	Oxbow Lake	-

Total # of bats observed and identified to species: 12
Total # of species: 4

Conclusions

Natural and man-made habitats within Lumber River State Park are being utilized by a variety of bat species. Four species were captured, including two Federal Species of Concern, Rafinesque's Big-eared Bat and the Southeastern Bat.

Lumber River State Park contains a considerable variety and quantity of floodplain forests, and a number of permanent water bodies. Quality habitat for bat foraging appears to be abundant. However, suitable roosting habitat for cavity roosting species is limited by the youth of these forests. While reconnoitering the Lumber River, large cypresses, gums, and oaks with cavity potential were observed only sporadically. Significant stands of old-growth Cypress--Gum Swamp Forest were not observed during this survey.

Undoubtedly, there are remnant old-growth trees being used by Rafinesque's Big-eared Bats and Southeastern Bats that are protected within the park. However, our investigation of abandoned buildings on park property revealed that such structures are also being utilized by Rafinesque's Big-eared Bats in this area. Abandoned buildings are not an unusual landscape feature in the region around the park, and the loss of a small number of them may be tolerable at any one time. However, these old, abandoned structures are collectively approaching the end of their lifespans while the recruitment of new abandoned structures is likely to decrease. It is uncertain that a sufficient quantity of these surrogate habitats will survive to support the area's Rafinesque's Big-eared Bat populations for the length of time needed for the area's natural communities to mature an abundance of large, cavity-bearing trees.

As the DPR obtains more property along the Lumber River corridor, any unwanted structures that are acquired should be investigated for bat occupation before they are destroyed. Maternal roost sites are of critical importance, and the discovery of a structure occupied by Rafinesque's Big-eared Bats should result in the notification of the NCSM and the DPR Resource Management Program for careful evaluation before the demolition of the structure. In order to provide substitutes for two buildings scheduled for demolition, Lumber River State Park is erecting two experimental cement roosts (donated by Bat Conservation International), that are uniquely designed for Rafinesque's Big-eared Bat and the Southeastern Bat. Now that it is aware of their presence, the DPR should be very sensitive to the habitat needs of these rare species at Lumber River State Park.

Merchant's Millpond State Park Survey

Merchant's Millpond State Park is located in Gates County and encompasses 3,252 acres.

Merchant's Millpond is an unusual combination of a large Coastal Plain Semipermanent Impoundment and Cypress--Gum Swamp Forest. Lassiter Swamp, at the east end of the millpond, is a Coastal Plain Small Stream Swamp Forest. Bennett's Creek also forms a Coastal Plain Small Stream Swamp Forest downstream of the millpond dam. The slopes around Merchant's Millpond and Lassiter Swamp are covered with Coastal Plain Mesic Mixed Hardwood Forest. Loblolly pine forest and other disturbed forest communities are also present in the park.

Methods

On 2/9/2000, Bennett's Creek was explored from Lassiter Swamp at the eastern limits of park property to the canoe launch at the bottom of Merchant's Millpond. Lassiter Swamp contains remnants of virgin or near-virgin forest, and was identified as the top priority area for surveys in the park. This winter canoe trip allowed for the inspection of the forest while high winter water levels permitted easier canoe passage. Trees with suitable large cavities were inspected with flashlights and flagged for future monitoring. The locations of areas with high densities of potential roosts were recorded for possible mist-netting in the spring. (Figure 9b)

On the night of 5/15/2000, a 40' wide canopy net was operated on Bennett's Creek in the eastern portion of Lassiter Swamp (Site 1). (Figure 9a)

On 5/16/2000, tree cavities were again checked in Lassiter Swamp in the area of "Lassiter's Cave", an ancient cypress with an enormous basal cavity. That night a 40' canopy net was operated across Bennett's Creek, with an additional short net set diagonally from the northern end of the canopy net (Site 2). (Figure 9a)

Two rangers arrived from Goose Creek State Park to assist on 5/17/2000. During the afternoon, tree cavities were investigated in the Coastal Plain Small Stream Swamp Forest below the Merchant's Millpond dam. That night the 40' canopy net was operated across Bennett's Creek approximately 100-125 meters below the dam (Site 3). An additional net was set across a very small branch of the creek (Site 4), and another net was set across a forest gap (Site 5). (Figure 9a)

The millpond was revisited on 9/7/2000 to search tree cavities in Lassiter Swamp (Figure 9b) and for additional mist-netting. Two nets were erected across a temporary pool located in Coastal Plain Mesic Mixed Hardwood Forest (Site 6). A third net was set over a jeep trail at the edge of the forest (Site 7), and a fourth was set further down the trail closer to the swamp (Site 8). (Figure 9a)

Table 6. Merchant's Millpond State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
C. rafinesquii	presumed male	5/16/2000	Inside "Lassiter Cave", a giant *Taxodium distichum* (MEMI 002, Fig. 9b)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
C. rafinesquii	male	5/16/2000 22:47 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
C. rafinesquii (1st of two)	presumed male	5/17/2000	Bennett's Creek below the millpond, inside a *Nyssa aquatica* cavity (MEMI 001, Fig. 9b)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, J. Greenwood, S. Lambiase, F.Williams
C. rafinesquii (2nd of two)	presumed male	5/17/2000	Bennett's Creek below the millpond, inside a *Nyssa aquatica* cavity (MEMI 001, Fig. 9b)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, J. Greenwood, S. Lambiase, F.Williams
C. rafinesquii	male	5/17/2000	Bennett's Creek	C.P. Small Stream	J. Benkusky,

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
		22:27 hrs.	**below the millpond (Site 4)**	**Swamp Forest**	**L. Gatens, J. Greenwood, S. Lambiase, F.Williams**

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
C. rafinesquii	male	5/17/2000 23:23 hrs.	Bennett's Creek below the millpond (Site 4)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, J. Greenwood, S. Lambiase, F.Williams
C. rafinesquii	unknown	9/7/2000	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 004, Fig. 9b)	C.P. Small Stream Swamp Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, S. Williams
C. rafinesquii	female?	9/7/2000	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 005, Fig. 9b)	C.P. Small Stream Swamp Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, S. Williams
C. rafinesquii	juvenile?	9/7/2000	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 005, Fig. 9b)	C.P. Small Stream Swamp Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, S. Williams
C. rafinesquii	adult, male, descended testicles	9/8/2000 1:10 hrs.	Forest road access to Lassiter Swamp (Site 8)	Coastal Plain Mesic Mixed Hardwood Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, B. Strong
E. fuscus	adult, female, pregnant, non-lactating	5/15/2000 21:00 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	adult, female, pregnant, non-lactating	5/15/2000 23:15 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams
E. fuscus	adult, male, descended testicles	9/7/2000 20:20 hrs.	Forest road access to Lassiter Swamp (Site 7)	Edge of Coastal Plain Mesic Mixed Hardwood Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, B. Strong
L. borealis	adult, female, pregnant, non-lactating	5/16/2000 20:47 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
L. seminolus	-	5/15/2000 21:20 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams
M. austroriparius	adult, female, pregnant	5/15/2000 21:57 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams
M. austroriparius	female, escaped while examining	5/16/2000 21:03 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
M. austroriparius	adult, male	9/7/2000	Forest road access to Lassiter	Edge of Coastal Plain Mesic Mixed	L. Gatens, J. Harrill, S,

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
		20:20 hrs.	**Swamp (Site 7)**	**Hardwood Forest**	**Lambiase, F. Williams, B. Strong**

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. austroriparius	adult, male	9/7/2000 23:25 hrs.	Forest road access to Lassiter Swamp (Site 8)	Coastal Plain Mesic Mixed Hardwood Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, B. Strong
M. lucifugus	male	5/17/2000 20:55 hrs.	Bennett's Creek below the millpond (Site 4)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/15/2000 21:02 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams
N. humeralis	-	5/15/2000 21:02 hrs.	Lassiter Swamp (Site 1)	C.P. Small Stream Swamp Forest	M.K. Clark, K. Marsh, F.Williams
N. humeralis	adult, female, pregnant, non-lactating	5/16/2000 20:20 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
N. humeralis	juvenile, male	5/16/2000 20:47 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
N. humeralis	adult, female, pregnant, non-lactating	5/16/2000 21:25 hrs.	Lassiter Swamp (Site 2)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens, S. Lambiase, K. Marsh, F.Williams
N. humeralis	adult, male, undescended testicles	5/17/2000 20:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 20:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	male	5/17/2000 20:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 21:27 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 21:30 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 21:30 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 21:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 22:35 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 22:35 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 22:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase

Table 6. Merchant's Millpond State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 22:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 23:00 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 23:20 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	male	5/17/2000 23:25 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
N. humeralis	adult, female, pregnant, non-lactating	5/17/2000 23:34 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
(8x) *P. subflavus*	observed at a distance	3/9/2001	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 005, Fig. 9b)	C.P. Small Stream Swamp Forest	L. Gatens, S. Lambiase, F. Williams, S. Williams

Table 6. Merchant's Millpond State Park Results (continued)

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
P. subflavus	adult, female, pregnant, non-lactating	5/17/2000 20:45 hrs.	Bennett's Creek below the millpond (Site 3)	C.P. Small Stream Swamp Forest	J. Benkusky, L. Gatens, F. Williams, J. Greenwood, S. Lambiase
P. subflavus ?	too far up tree cavity to accurately identify	2/9/2000	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 005, Fig. 5b)	C.P. Small Stream Swamp Forest	M.K. Clark, L. Gatens
Unknown	too far up tree cavity to accurately identify	9/7/2000	Lassiter Swamp inside a *Nyssa aquatica* cavity (MEMI 003, Fig. 5b)	C.P. Small Stream Swamp Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, S. Williams
Southern Flying Squirrel	-	9/7/2000 21:00 hrs.	Temporary pool close to access road to Lassiter Swamp (Site 6)	Coastal Plain Mesic Mixed Hardwood Forest	L. Gatens, J. Harrill, S, Lambiase, F. Williams, B. Strong

Total # of bats observed and identified to species: 50
Total # of species: 8

Five active bat roost trees were identified (MEMI 001-005, on Figure 9b)

Conclusions

Our survey indicates that an exceptional diversity of bats is present at Merchant's Millpond State Park. Of the eight species encountered, two are Federal Species of Concern, Rafinesque's Big-eared Bat and the Southeastern Bat, and two are state Watch List species, the Little Brown Bat and the Seminole Bat.

Previous research conducted in South Carolina (Clark et al. 1997; Clark et al. 1998) indicates that Coastal Plain populations of Rafinesque's Big-eared Bat are largely dependent upon mature Cypress--Gum Swamp Forest for roosting sites (mature Coastal Plain Small Stream Swamp Forest is an equivalent habitat). Old-growth bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), swamp tupelo (*Nyssa biflora*), and black gum (*Nyssa sylvatica*), tend to develop large cavities that are the favored natural roosts of Coastal Plain populations of Rafinesque's Big-eared Bat and the Southeastern Bat.

Ideal tree cavity characteristics for Rafinesque's Big-eared Bats are: the cavity opening is basal; the cavity opening is large enough not to be blocked by typical flood levels; the cavity is spacious and terminates at its ceiling in a broad dome -- high narrow chimneys and open tops are less suitable; and the cavity is smooth-walled to deter snake predation (Clark et al. 1998).

The abundance of trees with suitable basal cavities found in Lassiter Swamp, Bennett's Creek below the dam, and in parts of the millpond proper, is highly significant. Six Rafinesque's Big-eared Bats and nine Eastern Pipistrelles were observed roosting inside tree cavities, confirming their importance. All Rafinesque's Big-eared Bats captured in mist nets were male, and all the solitary Rafinesque's Big-eared Bats observed roosting are presumed to be the same. Locating tree cavities used by female *Corynorhinus* as maternal roosts would be a very valuable achievement that would enable future population monitoring by park staff.

Merchant's Millpond State Park is clearly a special refuge for bats in North Carolina, particularly for two protected species. This bat habitat element should be appreciated when making natural resource management decisions for the park. The importance of the basal tree cavities of Lassiter Swamp needs to be considered when the environmental assessment of the new millpond dam structure is conducted. The prolonged blockage of cavity openings is a threat to roosting bat populations that might be unacceptably increased if the water level of the millpond is elevated. Also, Rafinesque's Big-eared Bats are known to be Lepidoptera specialists (Clark 1991; Hurst and Lacki 1997). Gypsy moth (*Lymantria dispar*) control measures that result in broad impacts on Lepidoptera would likely cause negative effects on the food base of this rare species. Finally, the high bat habitat value of the Coastal Plain Small Stream Swamp Forest along Bennett's Creek should be recognized when appraising land acquisition opportunities in this area.

Morrow Mountain State Park

Morrow Mountain State Park covers 4,693 acres of Stanly County. The park is bounded to the east by the Pee Dee River and the Uwharrie National Forest.

The major terrestrial natural communities in the park are Basic Oak–Hickory Forest, Dry-Mesic Oak–Hickory Forest, Dry Oak–Hickory Forest, Mesic Mixed Hardwood Forest (Piedmont Subtype), Piedmont/Coastal Plain Heath Bluff, Piedmont/Low Mountain Alluvial Forest, Piedmont Monadnock Forest, Upland Depression Swamp Forest, Upland Pools, and various disturbed communities.

Methods

On 5/22/2001, three nets were set across a drainage area between the group campground road and the Yadkin River (Sites 1-3). Two more nets were set parallel to the drainage (Sites 4,5), and another net was set across the road (Site 6). (Figure 10)

On 5/23/2001, three nets were set across Mountain Creek (Sites 7-9), and two additional nets were set across the nearby Mountain Creek Pond (Sites 10, 11). (Figure 10)

Table 7. Morrow Mountain State Park Results

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
L. borealis	female	5/22/2001 23:55 hrs.	Drainage off group camping road (Site 1)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, J. Harrill, S. Lambiase, R. Lew
L. cinereus	adult, female, pregnant	5/24/2001 00:50 hrs.	Mountain Creek (Site 7)	Piedmont/Low Mountain Alluvial Forest	R. Adnundson, L. Gatens, T. Howard, L. Hyde, S. Lambiase, R. Lew, W. Stubbs
Southern Flying Squirrel	-	5/22/2001	Drainage off group camping road (Site 4)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, S. Lambiase
Louisiana Waterthrush	male	5/23/2001	Mountain Creek (Site 7)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, T. Howard, W. Stubbs
No captures	-	5/23/2001	Mountain Creek Pond (Sites 10, 11)	Upland Pool	-

Total # of bats observed and identified to species: 2
Total # of species: 2

Conclusions

Morrow Mountain State Park was challenging to mist-net due to mostly open forests and minimally sized streams. Mountain Creek is appropriately sized (averaging 6-9 meters wide) and amenable to mist-netting. The Upland Depression Swamp Forest and several other Upland Pools located in the park would probably be very effective net sites, but they were unusually dry at the time of our visit.

Any capture of a Hoary Bat is noteworthy. According to prevailing theory (Whitaker and Hamilton 1998; Findley and Jones 1964), this pregnant female was probably on her way north for the summer, at least to the southern Appalachians. Red Bats were expected as would be Big Brown Bats, Eastern Pipistrelles, Evening Bats, and Seminole Bats. Little Brown Bats and Northern Long-eared Bats are possible residents.

Park staff reported bats roosting in the rafters of the bathhouse during the summer, but none were present during the survey. Bats have traditionally occupied the attic of one of the ranger residences near the horse-trailer parking, but they have not been seen this year. Feces were observed in this attic and in a nearby utility building, but no other buildings showed any sign of occupation.

Morrow Mountain State Park has interesting bat potential. As the efforts of this survey were not very enlightening, this park should be re-visited for additional mist-netting.

Mount Mitchell State Park Survey

Mount Mitchell State Park, located in Yancey County, consists of 1,835 acres of the highest ridge system in the eastern United States.

Fraser Fir Forest is present above 6,400', and Red Spruce--Fraser Fir Forest is the dominant natural community from 6,000-6,400'. Below 6,000', Northern Hardwood Forests and Grassy Balds are encountered. Within the park there is also a headwater stretch of Lower Creek, and scattered High Elevation Rocky Summits.

Methods

On 8/22/2000, the attic of the park barracks was searched for live and/or dead bat specimens (Site 1). Bats had been observed emerging from the attic earlier in the year, and batbugs (*Cimex* spp.) had apparently become a problem for the seasonal employees bunking in the barracks. As a result, openings in the building had been sealed by park staff after all bats were believed to have exited. (Figure 11)

On the night of 8/22/2000, a canopy net was placed across a very small (≤ 4 meters^2), seep-fed pool set at the edge of a jeep trail (Site 2). Two additional nets were placed at closed-canopied portions of the jeep trail (Sites 3, 4). (Figure 11)

An abandoned shed behind the ranger residences was checked on 8/23/2000, and, on the advice of a park ranger, the wooden siding of the park maintenance shed was also investigated for roosting bats. Several bats were heard vocalizing, and the hind portions of a small bat was observed under one of the wood slats. That night a triangular configuration of three nets was erected right in front of the inhabited wood siding (Site 5). Just around the corner of the building, an additional canopy set was placed in front of a tall outdoor light that had been seen to attract a number of foraging bats the previous night (Site 6) Finally, a series of three nets were erected along an extended forest gap adjacent to the tent camping area (Sites 7-9). (Figure 11)

On the night of 8/24/2000, a net was set across a pool on Lower Creek (Site 10). Another net was set parallel to the stream (Site 11), and a third was set at the edge of a grassy clearing (Site 12). (Figure 11)

On 9/12/2000, another attempt was made at Sites 10 and 11. A third net was set across a low-canopied portion of the Commissary Shelter Trail (Site 13). (Figure 11)

Table 7. Mount Mitchell State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	adult, male, descended testicles	8/23/2000 20:30 hrs.	Park maintenance building (Site 5)	Artificial – loose wood siding on building	L. Gatens, J. Harrill, S. Lambiase, M. Morales
L. borealis	adult, male	8/22/2000 22:15 hrs.	North flank of Mt. Gibbes at 6,000' (Site 2)	High Elevation Seep between Northern Hardwood Forest/ Red Spruce – Fraser Fir Forest	M.K. Clark, S. Lambiase, M. Morales
L. borealis	escaped net	9/12/2000 20:30 hrs.	Lower Creek (Site 10)	Grassy Bald and Northern Hardwood Forest	J. Amoroso
M. leibii	adult, male	8/22/2000 21:50 hrs.	North flank of Mt. Gibbes at 6,000' (Site 2)	High Elevation Seep between Northern Hardwood Forest/ Red Spruce – Fraser Fir Forest	M.K. Clark, S. Lambiase, M. Morales
M. leibii	adult, male	9/12/2000 21:30 hrs.	Commissary Shelter Trail (Site 13)	Northern Hardwood Forest	J. Amoroso, M. Ellis, S. Lambiase, B. Strong
P. subflavus	adult, male, descended testicles	8/23/2000 23:50 hrs.	Park maintenance building (Site 5)	Artificial – loose wood siding on building	L. Gatens, J. Harrill, S. Lambiase, M. Morales
P. subflavus	adult, male, descended testicles	8/23/2000 23:57 hrs.	Park maintenance building (Site 5)	Artificial – loose wood siding on building	L. Gatens, J. Harrill, S. Lambiase, M. Morales

Table 7. Mount Mitchell State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
Only feces observed	**-**	**8/22/2000**	**Park barracks (Site 1)**	**Artificial – attic**	**M.K. Clark**
No captures	**-**	**8/22/2000**	**North flank of Mt. Gibbes at 6,000' (Sites 3, 4)**	**Northern Hardwood Forest/ Red Spruce – Fraser Fir Forest**	**-**
No observations	**-**	**8/23/2000**	**Shed behind ranger residences**	**Abandoned artificial structure**	**-**
No captures	**-**	**8/23/2000**	**Park maintenance building (Site 6)**	**Artificial – high wattage outdoor light**	**-**
No captures	**-**	**8/23/2000**	**West side of tent camping area (Sites 7-9)**	**Red Spruce – Fraser Fir Forest**	**-**
No captures	**-**	**8/24/2000**	**Lower Creek in the vicinity of the Commissary Shelter Trail crossing (Sites 10-12)**	**Grassy Bald and Northern Hardwood Forest**	**-**

Total # of bats observed and identified to species: 7
Total # of species: 4

Conclusions

Mount Mitchell offers a challenging environment for a mist-net survey of bat diversity. The Red Spruce–Fraser Fir Forest canopy is quite short, and so open flyways through the forest are probably less traveled because bats can fly above the canopy with little effort. Streams and pools are usually choice net sites, but significant open water is very rare on the high ridge line. When decent net sites were located, poor weather was a problem. High winds vexed our netting efforts, blowing down an elaborate, and seemingly sturdy, canopy set around the outdoor light after less than ten minutes of operation. The strong winds probably discouraged bat foraging and, even if bats were out, the billowing of the mist nets in the wind made their mesh much more detectable by echolocation. A heavy mist on the 23rd and 24th caused condensation to form on the net threads, further increasing the conspicuousness of the nets. In short, a considerable number of survey nights would be required in order to be confident of having compiled a complete species list for this park.

Four species were eventually captured in this boreal environment. The most significant observation was that of the Eastern Small-footed Bat. This is a rare, little understood bat listed as state Special Concern and a Federal Species of Concern. The Eastern Small-footed Bat exhibits unusual life history characters that seem relatively well suited to the Mount Mitchell environment, including a favoring of mountain habitats, an exceptional tolerance of low temperatures, and a capacity for roosting under stones and in rock crevices (Whitaker and Hamilton 1998). This bat is believed to favor roosting in caves during the winter, but the nature of summer roosts is poorly known. Where and when Eastern Small-footed Bats are roosting on Mount Mitchell (in deep rock outcrop crevices/fissures, unknown small caves, tree cavities, artificial structures?) remain open and intriguing questions.

Bat roost sites are the primary management concern for Mount Mitchell State Park. Bat removal from certain park facilities may become necessary again in the future. However, because a rare species is now known to occur in the area, staff of the NCSM Mammal Collections or the DPR Resource Management Program should be consulted to identify the bat species involved in a potential roost removal or exclusion project, and to ensure that an appropriate methodology is used. Large cavity-bearing trees or hollow snags should also be investigated for bat occupancy before they are considered for removal for any reason (e.g., facilities placement, new trails, visitor safety). For pro-active bat management, Mount Mitchell State Park has good potential to show results from bat house introductions that are sited and designed following the latest research.

New River State Park

Located in Ashe County, New River State Park consists of several units of land (over 1,000 acres total) distributed along 22 miles of the South Fork of the New River and 4.5 miles of the New River. This 26.5 mile portion of the river (from Dog Creek to the VA border) is designated as both a National Wild and Scenic River and a State Scenic River.

The natural communities present along the river include Montane Oak–Hickory Forest, Rich Cove Forest, and Low Elevation Rocky Summit. A considerable portion of the land in the scenic corridor is in agricultural use. On average, the level land along the river is cultivated, the moderate slopes are pastures, and the steepest slopes and ridge tops are forested. Housing developments are evident throughout, and are increasing in density in the area.

Methods

The park was visited on 9/18/2001. Park staff had reported substantial bat urine and feces accumulating under the picnic shelter at the Wagoner Road Access Area. The shelter was tightly surrounded with mist nets (Site 1) in order to intercept any bats leaving their roosts to forage. (Figure 12)

On 9/19/2001, a large bat house was visited to identify the bat species occupying it. The bat house was located on Mr. Lon P. Coulter, Jr.'s private property close to the Wagoner Road Access Area. Also, the US 221 Access Area was reconnaissanced for future mist-netting, and the picnic shelter on top of Mount Jefferson was inspected for signs of bats roosting.

Table 10. New River State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	female	9/18/2001 20:05 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
E. fuscus	female	9/18/2001 20:25 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
E. fuscus	male	9/18/2001 20:25 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
E. fuscus	female	9/18/2001 20:25 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
E. fuscus	female	9/18/2001 20:25 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
E. fuscus	male	9/18/2001 20:50 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase, J. Wild
E. fuscus	female	9/18/2001 20:50 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase, J. Wild
E. fuscus	female	9/18/2001 21:00 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase, J. Wild

Table 10. New River State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	female	9/18/2001 22:15 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	M.K. Clark, L. Gatens, S. Lambiase
M. septentrionalis	adult, female	9/18/2001 19:50 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
M. septentrionalis	male	9/18/2001 19:50 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
M. septentrionalis	female	9/18/2001 19:55 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase
M. septentrionalis	female	9/18/2001 20:55 hrs.	Wagoner Rd. Access picnic shelter (Site 1)	Montane Oak–Hickory Forest	P. Bailey, M.K. Clark, L. Gatens, S. Lambiase, J. Wild

Total # of bats observed and identified to species: 13
Total # of species: 3

Conclusions

The portion of the New River corridor in question encompasses a heterogenous mix of forests, fields and pastures, as well as an excellent water source. In terms of foraging, the natural resources are in place to support healthy bat populations. However, the abundance of natural roosting structures may be limited. Artificial structures, such as the park's picnic shelter and the bat house in Mr. Coulter's shed, likely offer valuable roosting opportunities. Mr. Coulter's bat house had approximately 80-100 *Myotis* spp. bats inside, and he estimated that to be one third of the peak population.

The survey at New River State Park occurred late in the season. The number, and perhaps even the diversity, of bats captured using the picnic shelter is probably lower than a mid-summer survey would have indicated. Still, the Northern Long-eared Bats captured are a notably rare species (state Special Concern). The Big Brown Bats appear to use the shelter mainly as a night roost (for resting and digesting).

The park intends to replace the roof of the picnic shelter because of defects in its design. It would be best to do so during the winter when the bats have vacated the shelter. The worst timing would be in June or July, in case the shelter is used as a maternity roost. When the shelter roof is replaced, good wildlife stewardship would be to have a nearby bat house available to accommodate displaced bats (or to give the bats a better alternative to roosting in the new shelter roof). Any bat houses purchased or donated should be of Bat Conservation International approved design, and erected in an appropriately sunny location (the clearing between the parking area and the river is a prime location). The larger-sized bat houses, like Mr. Coulter's, tend to have the best acceptance rates.

Pettigrew State Park Survey

Pettigrew State Park is located in Washington and Tyrrell Counties, and includes about 1,233 acres of land and the 16,600 acre Lake Phelps.

The natural communities of the park include Natural Lake Shoreline, Mesic Pine Flatwoods, Nonriverine Wet Hardwood Forest, Nonriverine Swamp Forest, Mesic Mixed Hardwood Forest (Coastal Plain Subtype), Pond Pine Woodland, Bay Forest, High Pocosin, Peatland Atlantic White Cedar Forest, and various disturbed communities.

Methods

Pettigrew State Park was visited briefly on 9/8/99. A number of large trees with basal cavities (mostly sycamores and bald cypress) were investigated along the Bee Tree Trail.

On 7/21/2000, the park was again visited for a quick survey of cavity-bearing trees along the Bee Tree Trail. (Figure 13)

On 9/5/2000, the park was revisited to check tree cavities and to execute a night of mist-netting. Four nets were set along the Moccasin Trail (Sites 2-5). (Figure 13)

Tree cavities were searched and mist-netting again attempted on 4/24/2001. Tree cavities were investigated from the Bee Tree Trail between the group camp and Bee Tree Overlook, and from the Moccasin Trail between Weston Road and Moccasin Overlook. A mist net was set in Moccasin Canal not far from Lake Phelps (Site 7). (Figure 13)

Table 11. Pettigrew State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
(3x) *C. rafinesquii*	observed at a distance	7/21/2000	Inside a *Platanus occidentalis* cavity beside the Bee Tree Trail (Site 1)	Nonriverine Wet Hardwood Forest	J. Lambiase, S. Lambiase
(4x) *C. rafinesquii*	observed at a distance	9/5/2000	Inside a *Platanus occidentalis* cavity beside the Bee Tree Trail (Site 1)	Nonriverine Wet Hardwood Forest	L. Gatens, J. Harrill, S. Lambiase
(10x) *C. rafinesquii*	observed at a distance	4/24/2001	Inside a *Platanus occidentalis* cavity beside the Bee Tree Trail (Site 1)	Nonriverine Wet Hardwood Forest	J. Benkusky, J. Greenwood, M. Johnston
L. borealis	female	4/24/2001 20:06 hrs.	Moccasin Canal (Site 7)	Nonriverine Wet Hardwood Forest	J. Benkusky, J. Greenwood, M. Johnston
L. borealis	escaped before measuring	4/24/2001 20:30 hrs.	Moccasin Canal (Site 7)	Nonriverine Wet Hardwood Forest	J. Benkusky, J. Greenwood, M. Johnston
L. borealis	female	4/24/2001 20:30 hrs.	Moccasin Canal (Site 7)	Nonriverine Wet Hardwood Forest	J. Benkusky, J. Greenwood, M. Johnston

Table 11. Pettigrew State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
Lasiurus spp.	observed at a distance	4/24/2001	Inside a *Platanus occidentalis* cavity beside the Bee Tree Trail (Site 6)	Nonriverine Wet Hardwood Forest	J. Benkusky, J. Greenwood, M. Johnston
None observed	-	9/8/99	Large tree cavities along the Bee Tree Trail	Nonriverine Wet Hardwood Forest	-
No captures (poor weather)	-	9/5/2000	Moccasin Trail (Sites 2-5)	Nonriverine Wet Hardwood Forest	-

Total # of bats observed and identified to species: 20, but probably only 13 different individuals
Total # of species: 2

Conclusions

There is an abundance of very large trees of various species at Pettigrew State Park, including cavity-prone bald cypresses and sycamores. The park has a diverse Lepidopteran assemblage of at least 347 species (Hall 1999) and an abundance of water in the form of the second largest natural lake in the state. The presence of such high quality roosting and foraging habitat suggest that Pettigrew State Park could be a significant refuge for Rafinesque's Big-eared Bats and other species.

There are several bat conservation related resource management considerations for the park. First, any construction of new trails or campgrounds should avoid bringing visitors in direct contact with trees possessing the large basal cavities ideal for bat habitation. Currently, a number of ideal but uninhabited trees are located along the edges of trails and within camp sites. These trees are undoubtedly subject to frequent disturbance from visitors crawling inside. Several trees within the camp sites even appear to have had fires set in them -- certainly very discouraging of bat roosting. Second, the park has a clear problem with the invasive exotic, Japanese honeysuckle (*Lonicera japonica*). Heavy growth of Japanese honeysuckle and other viney plants (English ivy, poison ivy, greenbrier) is threatening bat access to some basal tree cavities. Trees with inhabited cavities or high quality uninhabited cavities should be monitored and kept clear of blockages. Third, like Merchant's Millpond, Pettigrew State Park will likely experience a gypsy moth invasion in the near future. The potential effects of broad-spectrum pesticides on the food base of Rafinesque's Big-eared Bat should be carefully considered.

Raven Rock State Park Survey

Raven Rock State Park occupies 3,549 acres of Harnett County. The park property lies on both sides of the Fall Zone of the Cape Fear River.

Terrestrial natural communities found in the park include Basic Mesic Forest (Piedmont Subtype), Dry Oak–Hickory Forest, Dry-Mesic Oak–Hickory Forest, Floodplain Pool, Granitic Flatrock, Mesic Mixed Hardwood Forest (Piedmont Subtype), Piedmont Longleaf Pine Forest, Piedmont/Coastal Plain Acidic Cliff, Piedmont/Coastal Plain Heath Bluff, Piedmont/Low Mountain Alluvial Forest, Piedmont/Mountain Bottomland Forest, Piedmont/Mountain Levee Forest, and Successional Pine–Mixed Hardwood Forest.

Methods

On February 23, 1993, a William Bussey reported observing nine *P. subflavus* hibernating in a rock fissure within the park. On 11/16/2000, granitic rock outcrops along the south bank of the river were searched for fissures containing roosting bats. Ranger Eric Folk later located the fissure (Site 1). (Figure 14)

Mist-netting began at the park on 8/27/2001, over Avents Creek. A canopy net and short net were paired and set across a large pool just upstream of S.R. 1418 (Site 2). Two short nets were set across the creek downstream of the road (Sites 3,4). (Figure 14)

Lower Campbell Creek down to the Cape Fear River was mist-netted on 8/28/2001 (Sites 5-8). (Figure 14)

Avents Creek was mist-netted again on 9/11/2001 (Sites 9-11). (Figure 14)

Table 12. Raven Rock State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	male	8/28/2001 23:00 hrs.	Avents Creek (Site 3)	Piedmont/Low Mountain Alluvial Forest	E. Folk, L. Gatens, S. Lambiase
N. humeralis	female	8/28/2001 20:40 hrs.	Avents Creek (Site 2)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, S. Lambiase
N. humeralis	male	8/28/2001 21:15 hrs.	Avents Creek (Site 2)	Piedmont/Low Mountain Alluvial Forest	E. Folk, L. Gatens, S. Lambiase
N. humeralis	male	8/29/2001 21:20 hrs.	Campbell Creek (Site 7)	Piedmont/Low Mountain Alluvial Forest	T. Howard, S. Lambiase
N. humeralis	male	9/11/2001 21:05 hrs.	Avents Creek (Site 9)	Piedmont/Low Mountain Alluvial Forest	E. Folk, S. Lambiase
P. subflavus	female	8/28/2001 20:40 hrs.	Avents Creek (Site 2)	Piedmont/Low Mountain Alluvial Forest	L. Gatens, S. Lambiase
P. subflavus	male	8/29/2001 20:50 hrs.	Campbell Creek at Cape Fear River (Site 8)	Piedmont/Low Mountain Alluvial Forest	T. Howard, S. Lambiase
Belted Kingfisher	-	9/11/2001 20:30 hrs.	Avents Creek (Site 9)	Piedmont/Low Mountain Alluvial Forest	S. Lambiase

Total # of bats observed and identified to species: 7

Total # of species: 3

Conclusions

Avents Creek and Campbell Creek both generally fluctuate between 6-9 meters wide, and both exhibit reliable flows. The narrow corridor of Alluvial Forest along both creeks grades into drier Oak–Hickory Forests upslope. Snags, and large diameter trees with cavities were observed but uncommonly.

The Cape Fear River, and the Bottomland and Levee Forests beside it, are probably the areas of the park with the greatest bat activity. However, the Cape Fear River is too wide to effectively mist-net. Future mist-netting over Avents Creek in the Bottomland Forest where it joins the Cape Fear River might be fruitful. Searching for cavity trees (particularly sycamores) in the Bottomland and Levee Forests would be time-consuming but might luck into an inhabited roost.

Big Brown Bats, Evening Bats, and Eastern Pipistrelles were expected species and were all observed. Although none were captured during this survey, Red Bats should also be expected in this habitat. Park Superintendent Paul Hart has documented several encounters with Red Bats in upland areas of the park.

The Southeastern Bat is the rarest species with a decent potential for inhabiting the park. The Southeastern Bat is known to favor foraging over water, and prefers roosting near water in hollow trees (Webster et al. 1985). The Seminole Bat and the Brazilian Free-tailed Bat (a high altitude flier that is unlikely to turn up in a mist net) are two other species with a likelihood of inhabiting the park; Hoary Bats and Silver-haired Bats may make transitory visits.

South Mountains State Park Survey

South Mountains State Park is located in Burke County, and encompasses 16,664 acres. The park contains two Significant Natural Heritage Areas, the Jacob Fork Watershed and the Henry Fork Watershed.

The natural communities present include Chestnut Oak Forest, Montane Oak--Hickory Forest, Acidic Cove Forest, Rich Cove Forest, Pine--Oak Heath, and numerous mountain streams.

Methods

Bat surveys at South Mountains State Park began on 8/8/2000. An abandoned structure named the Hildebrand House was searched (Site 1), and three nets were set over sequential pools on Jacob Fork (Sites 3-5). Two more nets were set downstream on lower Jacob Fork over a large pool (Site 2). A canopy net was also set in a clearing adjacent to the pool (Site 6). (Figure 15a)

On 8/9/2000, survey efforts were concentrated along Henry Fork downstream of the reservoir. Four short nets and two canopy nets were set across points along Henry Fork (Sites 7-10, 12). One net was set across a jeep trail running above and adjacent to the stream (Site 11). (Figure 15b)

A small cave on the east side of High Shoals Falls (Site 13) was investigated on 8/10/2000. Six nets were set across Jacob Fork: one a short distance upstream of the Shinny Creek confluence (Site 14), another a short distance downstream of the Shinny Creek confluence (Site 15), and a series of four nets downstream across from the park office (Sites 17-20). A canopy net was set across H.Q. Trail at its junction with High Shoals Falls Trail and S.R. 1904 (Site 16). (Figure 15a)

The High Shoals Falls cave (Site 13) was inspected again on 3/8/2001 and 3/17/2001. (Figure 15a)

Sites 17 and 20 on the Jacob Fork were re-sampled on 5/2/2001, 5/10/2001, 5/26/2001, 6/28/2001, 7/11/2001, and 8/10/2001. Site 19 was also re-sampled on 5/10/2001 and 7/11/2001, and also on 7/11/2001, a new site was set across Short Trail by the park office (Site 32). (Figure 15a)

On 5/17/2001, two mist nets were set on Shinny Creek (Sites 21, 22). Sites 21 and 22 were re-sampled on 7/10/2001. Also on 7/10/2001, a net was run across the end of the bridge (Site 30), and a third net was set across Shinny Creek (Site 31). (Figure 15a)

On 5/29/2001, two mist nets were set across Clear Creek (Sites 23, 24), and five nets were set across and around a tributary of the Little River, just upstream of Little River Falls (Sites 25-29). (Figure 15a)

Table 13. South Mountains State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
C. rafinesquii	observed at a distance	8/8/2000	Hildebrand House (Site 1)	Weedy field	M.K. Clark, J. Harrill, S. Lambiase, A. Rogers
C. rafinesquii	adult, female, post-lactating	8/9/2000 21:35 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L. Gatens, J. Harrill, S. Lambiase, A. Rogers, M. Traugott
C. rafinesquii	escaped net	8/10/2000 20:40 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	S. Lambiase
C. rafinesquii	escaped net	8/10/2000 23:45 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens
C. rafinesquii (1st of two)	male?	9/12/2000	Hildebrand House (Site 1)	Weedy field	J. Harrill
C. rafinesquii (2nd of two)	female?	9/12/2000	Hildebrand House (Site 1)	Weedy field	J. Harrill
C. rafinesquii	adult, male	8/10/2001 21:27 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill
E. fuscus	adult, female	8/8/2000 22:40 hrs.	Jacob Fork (Site 5)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	adult, female	8/8/2000 23:45 hrs.	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
E. fuscus	adult, female, non-pregnant	8/9/2000 20:55 hrs.	Henry Fork (Site 12)	Rich Cove Forest	A. Berner, L. Gatens, S. Lambiase, M. Traugott
E. fuscus	male	8/9/2000 21:20 hrs.	Henry Fork (Site 9)	Rich Cove Forest	M.K. Clark, J. Harrill, S. Lambiase, M. Teer, A. Rogers
E. fuscus	adult, male, descended testicles	8/9/2000 22:20 hrs.	Henry Fork (Site 12)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
E. fuscus	male	5/2/2001 21:30 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
E. fuscus	male	5/17/2001 22:10 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
E. fuscus	male	5/17/2001 23:12 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
E. fuscus	male	5/18/2001 00:17 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	male	5/30/2001 00:05 hrs.	Little River tributary (Site 29)	Montane Oak–Hickory Forest	S. Lambiase, A. Rogers
E. fuscus	adult, female, non-lactating	7/11/2001 23:17 hrs.	Short Trail (Site 32)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
E. fuscus	adult, female, non-lactating	8/10/2001 23:20 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	D. Campbell, J. Harrill
L. noctivagans	male	5/2/2001 20:45 hrs.	Jacob Fork (Site 19)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. noctivagans	male	5/2/2001 23:30 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. noctivagans	male	5/2/2001 23:45 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. noctivagans	male	5/17/2001 21:40	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
		hrs.			
L. noctivagans	**male**	**5/17/2001 23:00 hrs.**	**Shinny Creek (Site 21)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill**
L. noctivagans	**male**	**5/17/2001 23:45 hrs.**	**Shinny Creek (Site 22)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill**

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. noctivagans	male	5/18/2001 01:45 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
L. borealis	juvenile, male	8/8/2000 20:50 hrs.	Cate's Hole on Jacob Fork (Site 2)	Acidic Cove Forest	M.K. Clark, J. Harrill, S. Lambiase, A. Rogers, C. Shelton
L. borealis	juvenile, male	8/8/2000 21:18 hrs.	Jacob Fork (Site 5)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
L. borealis	adult, male, descended testicles	8/8/2000 23:47 hrs.	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
L. borealis	adult, male	8/8/2000 23:50 hrs.	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
L. borealis	adult, male, descended testicles	8/9/2000 00:12 hrs.	Jacob Fork (Site 5)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
L. borealis	escaped	8/9/2000 01:00	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A.

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
		hrs.			**Rogers, M. Traugott**

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	female, escaped during handling	8/9/2000 01:35 hrs.	Jacob Fork	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
L. borealis	juvenile, male	8/9/2000 20:40 hrs.	Jeep trail beside Henry Fork (Site 11)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
L. borealis	juvenile, male	8/9/2000 20:45 hrs.	Jeep trail beside Henry Fork (Site 11)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
L. borealis	juvenile, male, undescended testicles	8/9/2000 20:45 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L.Gatens, S. Lambiase, M. Traugott
L. borealis	juvenile, male, partially descended testicles	8/9/2000 20:45 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L.Gatens, S. Lambiase, M. Traugott
L. borealis	juvenile, male	8/9/2000 21:00 hrs.	Jeep trail beside Henry Fork (Site 11)	Rich Cove Forest	A. Berner, L.Gatens, S. Lambiase, M. Traugott
L. borealis	escaped net	8/9/2000 21:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer, A. Rogers

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	escaped net	8/9/2000 21:30 hrs.	Henry Fork (Site 8)	Rich Cove Forest	M.K. Clark, M. Teer, A. Rogers
L. borealis	adult, female	8/9/2000 21:35 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L. Gatens, J. Harrill, S. Lambiase, A. Rogers, M. Traugott
L. borealis	juvenile, male	8/9/2000 21:35 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L. Gatens, J. Harrill, S. Lambiase, A. Rogers, M. Traugott
L. borealis	escaped net	8/9/2000	Henry Fork (Site 9)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	female	8/9/2000 23:00 hrs.	Jeep trail beside Henry Fork (Site 11)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
L. borealis	juvenile, male	8/9/2000 23:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	escaped net	8/9/2000 23:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	escaped net	8/9/2000 23:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	escaped net	8/9/2000 23:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	female, escaped	8/10/2000 01:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	adult, male, partially descended testicles	8/10/2000 01:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	adult, male, partially descended testicles	8/10/2000 01:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
L. borealis	adult, male	8/10/2000 21:00 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
L. borealis	escaped net	8/10/2000 21:00 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark
L. borealis	escaped net	8/10/2000 21:00 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark
L. borealis	adult, male	8/10/2000 21:30 hrs.	Jacob Fork (Site 18)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, male, descended testicles	8/10/2000 21:40 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
L. borealis	male, partially descended testicles	8/10/2000 22:25 hrs.	Headquarters Trail/ High Shoals Falls Loop Trail junction (Site 16)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
L. borealis	male, descended testicles	8/10/2000 22:27 hrs.	Jacob Fork (Site 18)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
L. borealis	adult, female, non-lactating	8/10/2000 23:05 hrs.	Jacob Fork below Shinny Creek confluence (Site 15)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
L. borealis	juvenile, male	8/10/2000 23:20 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
L. borealis	adult, male	8/10/2000 24:00 hrs.	Jacob Fork (Site 18)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
L. borealis	adult, male, descended testicles	8/11/2000 00:35 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, female	8/11/2000 00:35 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
L. borealis	adult, male	8/11/2000 01:10 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
L. borealis	male	5/2/2001 21:00 hrs.	Jacob Fork (Site 19)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. borealis	female	5/11/2001 00:14 hrs.	Jacob Fork (Site 19)	Acidic Cove Forest	D. Campbell, J. Harrill
L. borealis	male	5/17/2001 23:47 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
L. borealis	male	5/26/2001 21:00 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
L. borealis	male	5/26/2001 21:35 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
L. borealis	adult, male	6/28/2001 21:36 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers, D. Stephens
L. borealis	adult, male	6/28/2001 21:47 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers, D. Stephens

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, male	7/10/2001 21:09 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. borealis	adult, male	7/10/2001 21:10 hrs.	Shinny Creek (Site 30)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. borealis	adult, male	7/10/2001 21:52 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. borealis	escaped	7/10/2001 23:03 hrs.	Shinny Creek (Site 30)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. borealis	adult, male	7/10/2001 -	Shinny Creek (Site 31)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
L. borealis	adult, female, lactating	7/11/2001 21:10 hrs.	Short Trail (Site 32)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
L. borealis	adult, male	7/11/2001 23:25 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
L. borealis	adult, male	7/11/2001 -	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
L. borealis	escaped	7/11/2001 21:40 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	adult, male	7/12/2001 00:10 hrs.	Jacob Fork (Site 19)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
L. borealis	male	8/10/2001 21:14 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	D. Campbell, J. Harrill
L. cinereus	adult, male	8/9/2000 23:32 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	A. Berner, L. Gatens, J. Harrill, S. Lambiase, A. Rogers, M. Traugott
L. cinereus	escaped net	8/11/2000 02:00 hrs.	Jacob Fork below Shinny Creek confluence (Site15)	Acidic Cove Forest	M.K. Clark
L. cinereus	female	5/2/2001 23:50 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. cinereus	female	5/10/2001 21:37 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill
L. cinereus	male	5/17/2001 22:20 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
L. cinereus	juvenile, female	6/29/2001 01:50 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers, D. Stephens

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. lucifugus	male	5/17/2001 21:07 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill
M. septentrionalis	adult, male, undescended testicles	8/9/2000 01:00 hrs.	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
M. septentrionalis	adult, male	8/9/2000 01:35 hrs.	Jacob Fork (Site 3)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
M. septentrionalis	escaped	8/10/2000 00:35 hrs.	Henry Fork (Site 12)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
M. septentrionalis	adult, male, descended testicles	8/10/2000 01:14 hrs.	Jeep trail beside Henry Fork (Site 11)	Rich Cove Forest	A. Berner, L. Gatens, S. Lambiase, M. Traugott
M. septentrionalis	adult, male	8/10/2000 01:30 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
M. septentrionalis	adult, male	8/10/2000 02:15 hrs.	Henry Fork/ He Creek confluence (Site 10)	Rich Cove Forest	L. Gatens, M. Traugott
M. septentrionalis	adult, male, undescended	8/10/2000 21:10 hrs.	Jacob Fork (Site 19)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
	testicles				

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. septentrionalis	adult, male	8/10/2000 21:30 hrs.	Junction of Headquarters Trail/ High Shoals Falls Loop Trail (Site 16)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
M. septentrionalis	adult, male, descended testicles	8/11/2000 01:10 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
M. septentrionalis	female	5/26/2001 22:43 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
M. septentrionalis	female, pregnant	5/29/2001 23:15 hrs.	Clear Creek (Site 24)	-	D. Campbell, J. Harrill, T. Johnson, D. Stephens
M. septentrionalis	female, pregnant	5/29/2001 21:12 hrs.	Road near tributary to Little River (Site 29)	Montane Oak–Hickory Forest	S. Lambiase, A. Rogers
M. septentrionalis	male	5/30/2001 00:05 hrs.	Road near tributary to Little River (Site 29)	Montane Oak–Hickory Forest	S. Lambiase, A. Rogers
M. septentrionalis	female, pregnant	5/30/2001 00:45 hrs.	Tributary to Little River (Site 28)	Montane Oak–Hickory Forest	S. Lambiase, A. Rogers

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
M. septentrionalis	adult, male	6/28/2001 22:42 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers, D. Stephens
M. septentrionalis	adult, male	7/10/2001 23:00 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill, L. Gatens, S. Lambiase, R. Lew
M. septentrionalis	adult, male	7/10/2001 -	Shinny Creek (Site 22)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
M. septentrionalis	adult, female, non-lactating	7/11/2001 23:17 hrs.	Short Trail (Site 32)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
M. septentrionalis	adult, male	7/11/2001 21:20 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
N. humeralis	male	5/17/2001 21:40 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	adult, male	8/8/2000 21:25 hrs.	Jacob Fork (Site 5)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott
P. subflavus	adult, female	8/8/2000 23:00 hrs.	Jacob Fork (Site 4)	Acidic Cove Forest	A. Berner, L. Gatens, J. Harrill, M. Teer, A. Rogers, M. Traugott

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	juvenile, female	8/9/2000 21:00 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer, A. Rogers
P. subflavus	juvenile, female	8/9/2000 21:10 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer, A. Rogers
P. subflavus	juvenile, male	8/9/2000 21:20 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer, A. Rogers
P. subflavus	adult?, female	8/10/2000 00:10 hrs.	Henry Fork (Site 12)	Rich Cove Forest	A. Berner, L. Gatens, M. Traugott
P. subflavus	-	8/10/2000 00:55 hrs.	Henry Fork (Site 7)	Rich Cove Forest	M.K. Clark, M. Teer
P. subflavus	adult, male	8/10/2000 20:30 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton
P. subflavus	adult, male	8/10/2000 20:50 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
P. subflavus	adult, male	8/10/2000 21:00 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott
P. subflavus	juvenile, female	8/10/2000 21:08 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	L. Gatens, S. Lambiase, M. Traugott

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	adult, male	8/10/2000 21:10 hrs.	Jacob Fork (Site 14)	Acidic Cove Forest	M.K. Clark, M. Teer, A. Rogers, C. Shelton, J. Harrill
P. subflavus	escaped net	8/10/2000 21:45 hrs.	Jacob Fork below Shinny Creek confluence (Site 15)	Acidic Cove Forest	M.K. Clark
P. subflavus	male	5/17/2001 22:20 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	observed from a distance	3/8/2001 3/17/2001	West side of High Shoals Falls (Site 13)	Small cave	S. Lambiase J. Harrill
P. subflavus	female	5/2/2001 22:50 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
P. subflavus	male	5/2/2001 23:10 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
P. subflavus	male	5/17/2001 21:40 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	male	5/17/2001 21:40 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	male	5/17/2001 22:20 hrs.	Shinny Creek (Site 22)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	male	5/17/2001 23:00 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	male	5/18/2001 01:30 hrs.	Shinny Creek (Site 21)	Acidic Cove Forest	D. Campbell, J. Harrill
P. subflavus	male	5/26/2001 21:05 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	J. Harrill, B. Schmit
P. subflavus	male	5/26/2001 21:05 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
P. subflavus	male	5/26/2001 21:45 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
P. subflavus	male	5/26/2001 22:44 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	J. Harrill, B. Schmit
P. subflavus	escaped	5/26/2001 23:15 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit
P. subflavus	male	5/26/2001 23:15 hrs.	Jacob Fork (Site 20)	Acidic Cove Forest	J. Harrill, B. Schmit

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	**adult, male**	**6/28/2001 21:20 hrs.**	**Jacob Fork (Site 20)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**adult, male**	**6/28/2001 21:20 hrs.**	**Jacob Fork (Site 20)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**adult, male**	**6/28/2001 21:35 hrs.**	**Jacob Fork (Site 20)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**adult, male**	**6/28/2001 21:35 hrs.**	**Jacob Fork (Site 20)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**escaped**	**6/28/2001 21:56 hrs.**	**Jacob Fork (Site 17)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**adult, male**	**6/28/2001 23:44 hrs.**	**Jacob Fork (Site 20)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers, D. Stephens**
P. subflavus	**adult, male**	**7/10/2001 21:25 hrs.**	**Shinny Creek (Site 21)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers**

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
P. subflavus	**adult, male**	**7/10/2001 21:37 hrs.**	**Shinny Creek (Site 21)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers**
P. subflavus	**adult, male**	**7/10/2001 21:52 hrs.**	**Shinny Creek (Site 30)**	**Acidic Cove Forest**	**D. Campbell, J. Harrill, A. Rogers**

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	adult, male	7/10/2001 23:25 hrs.	Shinny Creek (Site 30)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
P. subflavus	escaped	7/10/2001 23:25 hrs.	Shinny Creek (Site 30)	Acidic Cove Forest	D. Campbell, J. Harrill, A. Rogers
P. subflavus	adult, male	7/10/2001 -	Shinny Creek (Site 22)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
P. subflavus	adult, male	7/10/2001 -	Shinny Creek (Site 22)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
P. subflavus	adult, male	7/10/2001 -	Shinny Creek (Site 31)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
P. subflavus	adult, male	7/10/2001 -	Shinny Creek (Site 22)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew
P. subflavus	adult, male	7/11/2001 21:00 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
P. subflavus	escaped	7/11/2001 21:12 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	J. Harrill, L. Huss, D. Stephens
P. subflavus	-	7/11/2001 21:30 hrs.	Jacob Fork (Site 17)	Acidic Cove Forest	L. Gatens, S. Lambiase, R. Lew

Table 13. South Mountains State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
No observations	-	8/9/2000	West side of High Shoals Falls (Site 13)	Small cave	-

Total # of bats observed and identified to species: 155
Total # of species: 9

Conclusions

South Mountains State Park incorporates large tracts of forest, including two whole and undeveloped watersheds drained by streams rated as Outstanding Resource Waters. It is probably no coincidence that surveys have revealed a very high abundance and diversity of bats residing in the park.

Still, Rafinesque's Big-eared Bat and the Northern Long-eared Bat were captured in the park with surprising frequency. Cavities usually associated with mature, large-diameter trees are the natural roost habitat for both species, although the Northern Long-eared Bat will also roost under loose bark. These species were therefore expected to be somewhat rare, as the forests of the park are not especially old, having been logged probably up into the 1940's or even later in certain locations. The topography of the South Mountains is, however, very rugged, and large remnant trees have survived in scattered inaccessible areas. There are also remnant patches of old-growth forest in the greater South Mountains outside the park boundaries that could conceivably support robust bat populations. More surveys and telemetry studies in the South Mountains could produce some important discoveries.

Although present, sizeable tree cavities and other natural roost structures have a low density within South Mountains State Park, and may be the key limiting resource for resident bats. Because of their high value to many bat species, cavity bearing trees and hollow snags should only be disturbed if no other alternative is available. Any future trail and facilities development in the western portion of the park should take care not to disturb potential bat roosts.

The observation of Rafinesque's Big-eared Bats in an abandoned house on park property demonstrates both a demand for supplemental roost habitat, and the need for park staff to investigate such structures before they are demolished. Specially designed bat houses were erected at South Mountains State Park on 6/12/2001, and will hopefully prove to be a productive management effort for Rafinesque's Big-eared Bat. The number of natural roosts available for other bat species (such as the Northern Long-eared Bat) could be supplemented with crevice-style bat houses that are available from Bat Conservation International and other select manufacturers.

The small cave on the west side of High Shoals Falls appears to have some potential as a hibernaculum for Eastern Pipistrelles. A slight amount of trash on the floor indicates that the cave sees some visitor traffic, but it's tall, narrow shape probably keeps roosting bats well hidden and out of reach. There is a possibility that there are other small caves in the South Mountains that would have a potential for bat occupancy.

Both Rafinesque's Big-eared Bat and the Northern Long-eared Bat are believed to be moth specialists (Clark 1991; Hurst and Lacki 1997; Whitaker and Hamilton 1998). Moths also are a staple prey for the Hoary Bat (Ross 1967; Barclay 1985), a widely distributed but uncommonly encountered species. Often during our survey, we did casually observe an abundance of moths at

night, both around the nets and captured in them. There may be an important link between the moth resources of the South Mountains and the presence of some uncommon bat species.

Stone Mountain State Park Survey

Stone Mountain State Park covers 13,747 acres in Alleghany and Wilkes Counties. The park is bordered to the north by the Blue Ridge Parkway, and to the west by the Thurmond Chatham Game Lands.

The park possesses a diversity of terrestrial natural communities including Acidic Cove Forest, Chestnut Oak Forest, Dry-Mesic Oak–Hickory Forest, Dry Oak–Hickory Forest, Low Elevation Granitic Dome, Low Elevation Rocky Summit, Montane Oak–Hickory Forest, Pine–Oak/Heath, and Rich Cove Forest. Several creeks of superior water quality are sheltered in the park.

Methods

The survey of Stone Mountain State Park began on 7/30/2001. An abandoned homestead south of the picnicking area was searched (Site 1), and the East Prong Roaring River was scouted for mist net sites. Later that night, three short nets and one canopy net were set over the river a short distance downstream of the Garden Creek confluence (Sites 2-5). (Figure 16)

On 7/31/2001, two short nets and one canopy net were set over the East Prong Roaring River a short distance downstream of the Bullhead Creek confluence (Sites 6-8). (Figure 16)

On 8/1/2001, an abandoned barn east of the campground was searched (Site 9). Bullhead Creek and Widow's Creek were evaluated for mist-netting. That night five mist nets were set across Bullhead Creek (Sites 10-14). (Figure 16)

Garden Creek was prospected for mist-netting on 8/2/2001, as were additional sections of the East Prong Roaring River. Big Sandy Creek was evaluated above Little Falls and at the old homestead east of the campground. That night four mist nets were operated on Widow's Creek (Sites 15-18). (Figure 16)

The buildings of the Hutchinson Homestead (Site 19) were searched for roosting bats on 8/3/2001. (Figure 16)

Table 14. Stone Mountain State Park Results

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
E. fuscus	adult, male	7/30/2001 22:15 hrs.	East Prong Roaring River (Site 5)	Acidic Cove Forest	J. Beaty, M.K. Clark, J. Duggins, S. Lambiase
E. fuscus	adult, male	7/31/2001 21:35 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
E. fuscus	adult, male, testicles descended	7/31/2001 22:45 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
E. fuscus	adult, female	8/1/2001 00:15 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
E. fuscus	-	8/1/2001 01:05 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	S. Lambiase
E. fuscus	male	8/2/2001 00:50 hrs.	Bullhead Creek and Rich Mountain Creek confluence (Site 13)	Acidic Cove Forest	L. Gatens, S. Lambiase
E. fuscus	adult, male, testicles descended	8/2/2001 22:10 hrs.	Widow's Creek (Site 16)	Acidic Cove Forest	J. Beaty, M.K. Clark, L. Gatens, S. Lambiase
L. borealis	juvenile, male	7/30/2001 21:40 hrs.	East Prong Roaring River (Site 3)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	juvenile, female	7/30/2001 22:15 hrs.	East Prong Roaring River (Site 4)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase

Table 14. Stone Mountain State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	juvenile, male	7/31/2001 20:45 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	male	7/31/2001 21:40 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	S. Lambiase
L. borealis	juvenile, male	7/31/2001 22:25 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	escaped	7/31/2001 22:25 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark,
L. borealis	escaped	7/31/2001 22:30 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark,
L. borealis	adult, female, post-lactating	8/1/2001 24:00 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	adult, male	8/1/2001 00:25 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	juvenile, female	8/1/2001 00:45 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	female	8/1/2001 01:15 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase

Table 14. Stone Mountain State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
L. borealis	female	8/1/2001 01:25 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
L. borealis	adult, male	8/1/2001 21:07 hrs.	Bullhead Creek (Site 11)	Acidic Cove Forest	J. Beaty, M.K. Clark
L. borealis	male, descended testicles	8/1/2001 21:10 hrs.	Bullhead Creek (Site 12)	Acidic Cove Forest	L. Gatens, S. Lambiase
L. borealis	escaped	8/1/2001 22:20 hrs.	Bullhead Creek (Site 12)	Acidic Cove Forest	L. Gatens, S. Lambiase
L. cinereus	male, escaped	8/1/2001 22:15 hrs.	Bullhead Creek (Site 10)	Acidic Cove Forest	J. Beaty, M.K. Clark
M. leibii	adult, female, mammae inconspicuous	8/1/2001 21:00 hrs.	Bullhead Creek (Site 11)	Acidic Cove Forest	J. Beaty, M.K. Clark
M. leibii	adult, female	8/1/2001 21:20 hrs.	Bullhead Creek and Rich Mountain Creek confluence (Site 13)	Acidic Cove Forest	L. Gatens, S. Lambiase
M. lucifugus	adult, male	7/30/2001 21:40 hrs.	East Prong Roaring River (Site 2)	Acidic Cove Forest	J. Beaty, M.K. Clark, J. Duggins, S. Lambiase
M. septentrionalis	juvenile?, male	8/1/2001 21:30 hrs.	Bullhead Creek (Site 10)	Acidic Cove Forest	J. Beaty, M.K. Clark

Table 14. Stone Mountain State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	adult, male	7/30/2001 21:00 hrs.	East Prong Roaring River (Site 2)	Acidic Cove Forest	J. Beaty, M.K. Clark, J. Duggins, S. Lambiase
P. subflavus	adult, male	7/30/2001 21:00 hrs.	East Prong Roaring River (Site 3)	Acidic Cove Forest	J. Beaty, M.K. Clark, J. Duggins, S. Lambiase
P. subflavus	escaped net	7/30/2001 21:00 hrs.	East Prong Roaring River (Site 2)	Acidic Cove Forest	M.K. Clark
P. subflavus	adult, male	7/31/2001 20:20 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	adult, male	7/31/2001 20:25 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	adult, female, post-lactating	7/31/2001 20:45 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	adult, male	7/31/2001 20:45 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	adult, male	7/31/2001 21:50 hrs.	East Prong Roaring River (Site 6)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	male	8/1/2001 01:10 hrs.	East Prong Roaring River (Site 8)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase

Table 14. Stone Mountain State Park Results (continued)

Species	Age/Sex/Reproductive Condition	Time of Capture	Locality	Natural Community	Observers
P. subflavus	male	8/1/2001 01:30 hrs.	East Prong Roaring River (Site 7)	Acidic Cove Forest	J. Beaty, M.K. Clark, S. Lambiase
P. subflavus	adult, male	8/2/2001 00:45 hrs.	Bullhead Creek (Site 10)	Acidic Cove Forest	J. Beaty, M.K. Clark
P. subflavus	male	8/2/2001 01:00 hrs.	Bullhead Creek (Site 10)	Acidic Cove Forest	J. Beaty, M.K. Clark

Total # of bats observed and identified to species: 39
Total # of species: 7

Conclusions

The East Prong Roaring River and Bullhead Creek are of moderate width, with sheltering forest canopies and intermittent pools. Our survey observed a good quantity and diversity of bat traffic over the East Prong Roaring River, and also a high species diversity over Bullhead Creek. Widow's Creek was the smallest waterway surveyed, but it is still of sufficient size to act as a flyway and to provide drinking pools. The lack of capture success at the Widow's Creek sites was surprising, but only reflects the result of one night of sampling.

The assemblage of species captured over the escarpment creeks was quite different in composition than the assemblage of species captured over the river. More mist-netting would be necessary to ascertain if these differences are more than coincidental. Future mist-netting could also capture the two remaining species with potential to be present in the park: the Silver-haired Bat and Rafinesque's Big-eared Bat.

The Eastern Small-footed and Northern Long-eared Bats captured over Bullhead Creek are new records for Wilkes County and, being protected species, are the most significant finds of the survey. These Myotis' are likely using tree cavities for roosting. However, both species, and especially the Eastern Small-footed Bats, may also be roosting in the deep crevices of rock outcrops found along the escarpment. On the afternoon of 9/26/2001, an Eastern Small-footed Bat was observed roosting in a narrow crevice of a rock outcrop on the north roadside of the Blue Ridge Parkway, about 0.4 kilometers west of the Devil's Garden Overlook (less than 0.5 kilometers north of the park's Garden Creek watershed).

A number of old homes used to reside in the park but have since been demolished. An investigation of the remaining abandoned buildings was unsuccessful in finding any roosting bats. A small amount of bat feces was observed in the attic of the log cabin at the Hutchinson homestead. The Garden Creek Church was never searched. Investigating the inside of the church would require permission, and alerting the congregation to the possibility of bats living in the attic would be unwise.

Weymouth Woods Sandhills Nature Preserve

The Weymouth Woods Sandhills Nature Preserve is located on 898 acres of Moore County.

Terrestrial natural communities found within the preserve include Coastal Plain Small Stream Swamp (Blackwater Subtype), Pine/Scrub Oak Sandhill, Streamhead Pocosin, and Xeric Sandhill Scrub.

Methods

On the night of 5/15/2001, four nets were set across Pine Island Trail (Sites 1-4). (Figure 17)

The next night, 5/16/2001, three nets were set across James Creek near Valhalla Road (Sites 5-7), and a canopy net was set across a power line break close to James Creek (Site 8). (Figure 17)

Sites 5-8 were attempted again on 5/17/2001. (Figure 17)

Table 15. Weymouth Woods Sandhills Nature Preserve Results

Species	**Age/Sex/Reproductive Condition**	**Time of Capture**	**Locality**	**Natural Community**	**Observers**
L. borealis	adult, female, pregnant	5/15/2001 21:55 hrs.	Pine Island Trail (Site 1).	Streamhead Pocosin	L. Gatens, C. Helms, K. Hyre, S. Lambiase
L. borealis	frozen road-kill from park freezer	-	-	-	collected by S. Hartley
L. seminolus	frozen road-kill from park freezer	-	-	-	collected by S. Hartley
N. humeralis	frozen road-kill from park freezer	-	-	-	collected by S. Hartley
No captures	-	5/16/2001	James Creek and Valhalla Rd. (Sites 5-8)	Coastal Plain Small Stream Swamp	-
No captures	-	5/17/2001	James Creek and Valhalla Rd. (Sites 5-8)	Coastal Plain Small Stream Swamp	-

Total # of (live) bats observed and identified to species: 1
Total # of species: 3

Conclusions

The openness of the forests at Weymouth Woods State Nature Preserve made it difficult to find appropriate flyways for mist-netting. Consequently, mist-netting was only attempted in the Streamhead Pocosin and Coastal Plain Small Stream Swamp associated with James Creek. Cold and rainy weather during the survey week was a further impediment to mist-netting.

Fortunately, road-kill specimens collected by the park superintendent provided a decent depiction of the species present in the area. Rarer Coastal Plain species were never accounted for and are not particularly expected. The Southeastern Bat and Rafinesque's Big-eared Bat are more anticipated in areas with Cypress–Gum Swamp Forests and more substantial sources of water.

Interestingly, the park has also accumulated records of bats (presumed to be all Lasiurids) flying up from the litter layer during controlled burns (most recent observations made on 2/8/2001 and 3/1/2001).

OVERALL RESULTS

A total of 371 bats were captured or otherwise positively identified during the course of this survey. 12 species were represented, including: Rafinesque's Big-eared Bat (state Special Concern, Federal Species of Concern), Big Brown Bat, Silver-haired Bat, Eastern Red Bat, Hoary Bat, Seminole Bat (Watch List), Southeastern Bat (state Special Concern, Federal Species of Concern), Eastern Small-footed Bat (state Special Concern, Federal Species of Concern), Little Brown Bat (Watch List), Northern Long-eared Bat (state Special Concern), Evening Bat, and Eastern Pipistrelle. One or more protected species were encountered in nine of the sixteen parks visited.

For each park, we investigated a range of natural and man-made habitats that, along with a species list derived from mist-netting, enabled us to make specific natural resource management recommendations that would protect that park's bat populations.

OVERALL CONCLUSIONS

Most bat species in the Southeast produce only one or two offspring per year, although the Lasiurids may produce up to four (Whitaker and Hamilton 1998). This low annual reproduction is offset by a high survivorship; bat banding studies have revealed that lifespans in excess of 10 years are typical (Hall et al. 1957; Paradiso and Greenhall 1967; Davis 1986; Whitaker and Hamilton 1998). One Little Brown Bat that was banded as an adult was recaptured 33 years later (Davis and Hitchcock 1995). Any mortality or lost reproduction caused by the destruction of roost habitat has significant population consequences for an animal with such a slow capacity for population growth.

The protection of bat roost habitat is the most common bat management issue for those state parks visited during this survey. Many of the parks preserve considerable acreage of forest; however, the majority of the forests are of a younger age class, and so mature or dead trees with large cavities, loose bark, or other roosting structures are rare. These scarce cavity trees and snags should be recognized for their importance to bats and given special consideration and protection. Hazardous tree removal in parks should be delayed until a tree or snag with bat roost potential is inspected. If a 'hazard' tree is occupied by roosting bats, serious consideration should be given to alternatives to removal of the tree. Also, new trails should be constructed away from cavity trees and snags to prevent disturbance to any inhabitants and to avoid future hazard tree conflicts. Additional bat telemetry studies would benefit parks by locating bat roost trees so that they could be monitored and protected.

Because roost habitat is currently scarce in many parks, and possibly population limiting, habitat augmentation has great potential. Most parks could benefit their bat populations by introducing bat houses. It would be critical to design and place the bat houses based on the latest research in order to maximize the chances for bat acceptance. Interested parks should consult either the DPR Resource Management Program, the NC State Museum of Natural Sciences, or the Bat Conservation International website for advice on erecting bat houses.

The Rafinesque's Big-eared Bat's use of abandoned structures on park properties was a significant discovery. Abandoned buildings in the state parks are generally considered unsafe and unattractive and are therefore demolished. Survey observations indicate that this practice is eliminating critical habitat for a rare and protected animal. Abandoned structures slated for demolition need to be searched and, if found to house bats, the DPR Resource Management Program should be contacted to identify the species and number of bats involved. Depending on the rarity and size of the bat colonies involved, the structure should either be repaired/converted and left standing, or otherwise spared temporarily until an appropriately designed and sited bat house is ready to offer to the displaced bats.

Finally, the Division of Parks and Recreation's response to Gypsy Moth (*Lymantria dispar*) invasions of state parks should take into consideration the potential impacts on resident bat populations. Any environmental assessment of Bt (Bacillus thuringiensis) or other pesticide use in NC state parks should carefully evaluate the consequences for bats species that are specialist predators on Lepidoptera.

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