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Survey and Assessment of Man-made Structures Used by Rafinesque's Big-eared Bats (*Corynorhinus rafinesquii*) in Southeastern Virginia

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ABSTRACT

The distribution and abundance of Rafinesque's Big-eared Bat, a state-endangered species in Virginia, were investigated in 2008 by surveying previously documented and undocumented man-made structures. Of the 94 previously documented sites or structures inhabited by this species, 23 were confirmed to be in good status and 15 of these had bats present. Fourteen structures had been destroyed since 2002, 29 structures were known to have been destroyed prior to 2002, the status of seven structures was deemed vulnerable and the fate of 21 sites or structures was unknown,. Four active nursery colonies, each containing 30 to 50 females and their young, and 11 solitary roosts were documented during this study. Approximately 200 individuals were observed, mostly in Southampton and Sussex counties and the City of Virginia Beach. The overall population status in Virginia is unknown. Continued publicity and education are needed to enlist landowner cooperation and to locate other bat roosts.

Key words: Rafinesque's Big-eared Bat, distribution, Virginia.

INTRODUCTION

Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) is classified as a state endangered species (as *C. rafinesquii macrotis*, the Eastern Big-eared Bat) in the Commonwealth of Virginia (VDGIF, 2005). The Virginia Department of Game and Inland Fisheries' (VDGIF) Comprehensive Wildlife Conservation Strategy ranks *C. rafinesquii* as a Tier I Species of Greatest Conservation Need (VDGIF, 2005). The Virginia Endangered Species Recovery Plan for the Eastern Big-Eared Bat outlines many recovery needs and strategies for this species (Schwab et al., 1990). The first goal of the Recovery Plan is to determine the distribution of *C. rafinesquii* in Virginia by searching man-made and natural roost sites for day-roosting

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adults. In Virginia, this nocturnal species has been found roosting inside the hollows of Black Gum (*Nyssa sylvatica*) (Terwilliger Consulting, Inc., 2001), Water Tupelo (*Nyssa aquatica*) (Hobson, 1998), and Bald Cypress (*Taxodium distichum*) (Handley & Schwab 1991; Terwilliger Consulting, Inc., 2001) trees. However, most *C. rafinesquii* records in Virginia are from man-made, abandoned structures (VAFWIS, 2008). During the summer, females and their young form groups known as maternity or nursery colonies, but no nursery colonies have been discovered in tree roosts in Virginia (Carpenter, 2008). The second goal of the Recovery Plan is to identify essential habitat such as nursery colonies, hibernacula, and roosts of solitary bats. Once these sites have been identified, goals three and four recommend investigations into their natural history and developing a plan to monitor population trends (Schwab et al., 1990). The fifth goal of the Recovery Plan is to protect roost sites and other habitat from adverse modifications by enlisting the assistance of landowners.

There are only five records of *C. rafinesquii* in Virginia from 1897 to 1991 (Handley 1979; Handley & Schwab, 1991). Surveys by VDGIF began in 1993, with the most comprehensive study conducted in 1997 and 1998 by Brian Saunders and Donald Schwab. They reported 81 abandoned buildings in the counties of Greensville, Hanover, New Kent, Southampton, and Sussex, and the cities of Chesapeake and Suffolk that served as roost sites for Rafinesque's Big-eared Bats, including 12 nursery colonies (Garrett, 2001). The sum of the maximum number of bats observed at each site during that study was 471. Structure surveys in 2001 revealed that half of the previously documented nursery colony sites had been abandoned or destroyed (Garrett, 2001). In 2000, a radio-telemetry study tracked eight *C. rafinesquii* individuals to roosts in the vicinity of First Landing State Park (Terwilliger Consulting, Inc. 2001). In 2006, new sites were documented in the City of Suffolk and Isle of Wight County and the first hibernaculum was documented in Virginia (Carpenter, 2008). The present study was undertaken to document the continued presence and viability of *C. rafinesquii* in southeastern Virginia.

MATERIALS AND METHODS

To address the first goal of the Recovery Plan, surveys of potential man-made roost sites were conducted during 2008 by revisiting previously documented sites and road cruising for additional structures. Buildings were visually surveyed during the day from June to September 2008. Accessible rooms, closets, and attics of each structure were searched for bats, guano or other signs of use. Following the protocol from previous surveys, a management profile was established for each structure inhabited by *C. rafinesquii*, containing data on the number and behavior of bats, GPS location and address, and building characteristics (e.g., number of rooms, stories and type of roof). Newly discovered structures that looked suitable but did not have bats were recorded as null sites. Landowner contacts were updated by phone interviews or written correspondence to acquire permission to access structures and discuss building status. The status of previously occupied structures was assessed as 'good,' 'vulnerable,' 'destroyed,' or 'unknown.' Unknown status was assigned to a structure if permission from the landowner was not granted or the structure could not be located. Additional records of *C. rafinesquii* were also entered into the Virginia Fish and Wildlife Information System (VAFWIS) database. Natural roost sites (i.e., tree hollows) were not included in this survey due to inaccessibility.

RESULTS AND DISCUSSION

From 1993 to 2008, there were 94 records of *C. rafinesquii* in 10 counties and municipalities in southeastern Virginia, with most observations obtained in Southhampton County (Table 1). We documented a total of 15 structures inhabited by *C. rafinesquii*, including 11 solitary roosts and four nursery colonies (Table 1). The structures were abandoned two-story houses where the bats utilized attics, interior hallways, and closets. A barn, an abandoned one-room schoolhouse, an old country store, and two concrete bunkers also were used. Solitary roosts in Virginia were also observed under a bridge (Carpenter 2008) and inside a large hollow tree (Hobson, 1998). The sum of the maximum number of bats observed at each site during this study was 165. We confirmed the destruction of 14 structures previously known to be used by *C. rafinesquii*. Landowners cited natural decomposition, hurricanes and storms, property development, and property upkeep as reasons for collapsing or destroyed structures.

To monitor population trends, four previously known nursery colonies were revisited in Southampton and Sussex counties and the City of Virginia Beach. In 2008, each of these colonies consisted of 30 to 50 bats (Table 2), indicating stable population trends at these sites compared to previous counts in 1997 and 1998. One site (SO42) was documented as being used as a nursery colony three times in 10 years, the longest data set available for this species in Virginia. No new nursery colonies were discovered during this study, but other colonies from previous surveys were destroyed or

Table 1. The Status of Rafinesque's Big-eared Bat Structures or Sites in Southeastern Virginia

County or City	Total Structures or Sites Reported 1993-2008	Structure/Site in Good Status, 2008	Structure/Site in Good Status and Bats Present, 2006-2008	Structure/Site in Vulnerable Status, 2008	Structure/Site in Unknown Status, 2008	Structure/Site Destroyed 2002-2008	Structure/Site Destroyed Before 2002	Active Nursery Colonies 2006-2008
Chesapeake	3	0	0	0	1	0	2	0
Greensville	7	0	0	2	2	1	2	0
Hanover	1	0	0	0	1	0	0	0
Isle of Wight	2	1	1	0	0	1	0	0
New Kent	1	0	0	0	0	1	0	0
Powhatan	1	0	0	0	1	0	0	0
Southampton	51	14	7	3	13	8	13	2
Suffolk	15	4	3	2	1	1	7	0
Sussex	11	2	2	0	2	2	5	1
Virginia Beach	2	2	2	0	0	0	0	1
Total	94	23	15	7	21	14	29	4

Table 2. Annual Estimates of Rafinesque's Big-eared Bat Nursery Colonies in Southeastern Virginia.

County or City	VDGIF Site Profile	Range observed 2008	Range observed previous years	First year documented	Structure Type	Surrounding Habitat	Ownership
Southampton	SO48	30-40	30-70	2005	2-story wooden country store	hardwood forest and lake	VDGIF
Southampton	SO42	40-50	35-60	1997	2-story wooden farm house	active agricultural fields	Private
Sussex	SU10	30-45	30-40	2002	1-room wooden school house	active agricultural fields	Private with conservation easement
Virginia Beach	VB221	30	20-50	2000	concrete bunker	cypress-black gum swamp	US Navy

of unknown status. Also, in 2009 two additional nursery colonies were observed, one previously surveyed and the other newly discovered, though specific data are not included here. The nursery colonies were consistently dark rooms with minimal human activity inside the buildings; three of the structures had metal roofs.

Due to the recent trend in destruction of known roost structures, an emphasis was placed on surveying new areas. Consequently, Charles City, Prince George, and Surry counties were targeted for road cruising because these areas are considered likely to be within the range of *C. rafinesquii*, but they lack historical records (VAFWIS 2008). Road cruising in these counties and the City of Suffolk yielded approximately 80 structures with potential as bat roosts and landowner contacts were undertaken. No *C. rafinesquii* were found in structures searched in Charles City, Prince George, or Surry counties, or the City of Petersburg. Throughout southeastern Virginia, we documented 15 null sites, structures that looked suitable but had no bats present.

During this study, one newly discovered solitary roost was secured with a padlock and nursery colony sites were evaluated for structural integrity. One of the nursery colonies (VB221) is not protected from trespassers and spray paint inside the concrete bunker indicated occasional human activity there (Terwilliger Consulting, Inc. 2001). In an effort to develop and maintain landowner and public support for species protection, approximately 100 information letters were sent to landowners. We met with and discussed the status of structures and *C. rafinesquii* protection with two landowners. Furthermore, three newspaper articles were published (Virginian-Pilot, Progress-Index, and Hopewell News), an educational pamphlet (Carpenter, 2007) was written, and a children's coloring sheet (Defenders of Wildlife, 2008) was distributed to disseminate public information. Continued publicity and education are needed to enlist landowner cooperation and to locate other bat roosts.

Surveys conducted during this study yielded three new solitary bat roosts and updated VDGIF site management profiles for many previously documented nursery and solitary bat roosts. We believe fewer individuals were observed during this survey (165, versus 471 in 1997/1998) because of less intensive relative survey effort rather than a population decline. Survey information showed stable populations at the four nursery sites over consecutive years and three sites are protected and actively managed by the landowners (Table 2). Two other maternity colonies not included in this survey are protected within Great Dismal Swamp National Wildlife Refuge (D. J. Schwab, pers. comm. 2009). Surveys indicated high nursery site fidelity over many years, as large fragrant guano accumulations were observed. We believe that *C. rafinesquii* is viable in southeastern Virginia although the overall population status in Virginia is unknown. We believe that this Tier I state endangered bat species is not in current danger of extirpation, as was suggested in the Recovery Plan (Schwab et al., 1990).

It is unclear what proportion of the population uses natural roost sites versus man-made structures because of the lack of surveys and difficulty accessing roosts in tree hollows in swamps; a previous survey of 40 trees yielded only a single specimen (Hobson 1998). Threats to *C. rafinesquii* include conversion of farmland to residential development, razing of old barns and abandoned houses, and disease. Survey information will assist in revising the Recovery Plan for *C. rafinesquii* and was also sent to the U.S. Fish and Wildlife Service in response to their 2009 efforts to conduct a status review of this species. Future studies could focus on areas where no surveys have been conducted, such as Chesterfield, Henrico, and Powhatan counties. Surveys of historically occupied structures are incomplete, because there are currently 21 such structures with an unknown status. There is a great need for revisiting previously documented sites and searching for potential new structures.

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