ENVIRONMENTAL FACTORS INFLUENCING THE STATUS AND MANAGEMENT OF BATS UNDER GEORGIA (USA) BRIDGES

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ABSTRACT

More than half of the bat species found in the United States are endangered or declining in numbers due to various factors, including the recent devastating effects of White-nose Syndrome. Another critical factor affecting bat populations has been the disappearance of satisfactory habitat for bats, including their natural roosts.

As a consequence of natural roost loss, bridges and culverts are becoming increasingly important as roosting alternatives to bats. A preliminary study conducted by Bat Conservation International clearly illustrated that bridges and culverts used as roosts, particularly day roosts, must possess certain characteristics to attract bats, otherwise all bridges would support bat populations.
The purpose of this study was to determine roost selection preferences of bats utilizing Georgia bridges, specifically identifying those structures being utilized as bat roosts as well as the characteristics that make a bridge a suitable roost site.

During a period spanning August 2003 through April 2005, 540 randomly selected bridges located in 136 Georgia counties were surveyed. Within this sample, 55 bridges were identified as currently or previously occupied by roosting bats. Numerous bridge construction and surrounding habitat characteristics of roost and non-roost bridges were compared in an effort to identify bat roosting preferences. The data from this study suggest that bats prefer to roost in bridges primarily constructed of concrete materials with open crevices. Roost bridges were most frequently surrounded by woodland/riparian habitat, though some were also found surrounded by residential dwellings, commercial areas, open farms, and ranchlands.

INTRODUCTION

Numerous studies have demonstrated loss of suitable natural bat roosts (Kunz, 1982 and Altringham, 1996). Bridges have been shown to provide many bat species with important alternative roosts which, because of their structure, maintain the sun's heat well into night hours (Keeley and Tuttle, 1999). Aware of this, the Georgia Department of Transportation (DOT) sought information about bats under state bridges and requested a management plan to assist them, especially when faced with a need to repair or replace bridges with potential bat presence.

STUDY METHODS

Georgia is divided into seven Highway Districts (Fig.1). Using a random number generator, selection of general sites for bridge assessment across the state was made utilizing a state bridge GIS map. Exceptions were made to determine actual bridges surveyed. Each bridge selected was examined for evidence of bats and roosts visually and with a Peterson bat detector. Evidence of urine or guano staining or guano deposits were noted during the survey.

An evaluation of each bridge was made considering numerous structural design features, such as composition (concrete, steel, wood), age of the bridge, presence and condition of transverse and parallel expansion joints, GIS location and elevation. Surrounding habitat type was determined and recorded as residential/commercial, woodland, grassland, ranching or agricultural. The distance to the nearest water sources was determined if the bridge did not span water. A total of

540 Department of Transportation bridges (Fig.2) were surveyed for bat roosts in 136 of 159 counties in the state (Fig.1) between August 2003 and April 2005.

FIGURE 1 Counties surveyed in Georgia.

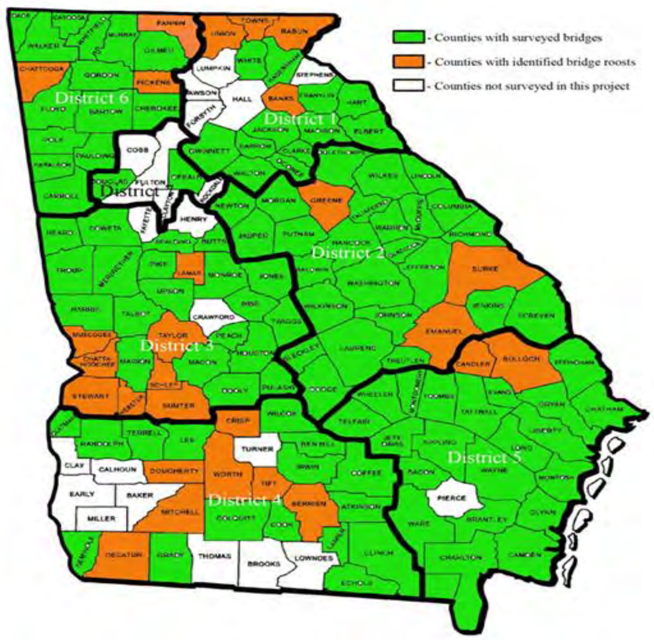
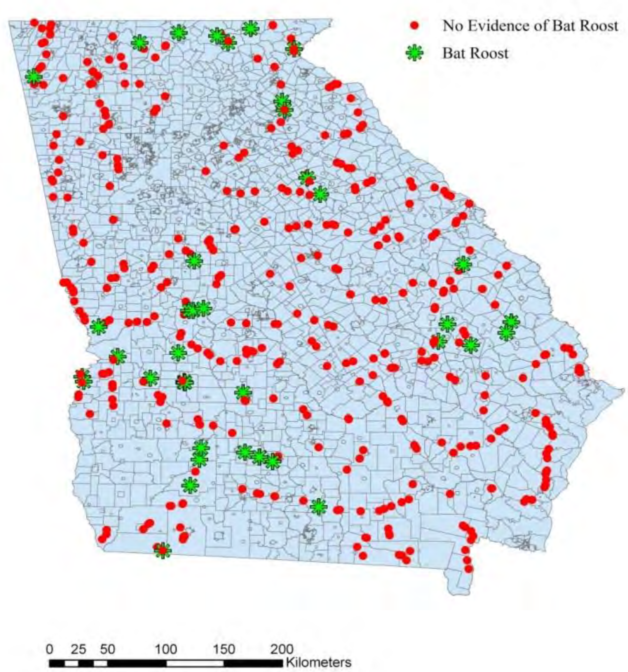


FIGURE 2 Location of Georgia DOT bridges surveyed.



RESULTS

It was determined that 55 of the 540 bridges examined in the study had bat roosts (Fig. 2). Construction materials (composition) varied (Figs. 3, 4, 5). Parallel and transverse crevices caused by bridge expansion joints provide sites for bat roosts. Bats were found in 78% (43 of 55 roost bridges) that had transverse crevices (Fig.6) while 7.2% (4 of 55 roost bridges) had parallel crevices with bats (Fig. 7). Only 7.2% (4 of 55 roost bridges) with bats had no crevices present (Fig.8). Bats were found in 7.2% (4 of 55 roost bridges) that had combinations of transverse and parallel crevices and downspout sites (Fig.9, 10).

FIGURE 3 Percentages of bat roosts found under various bridge types.

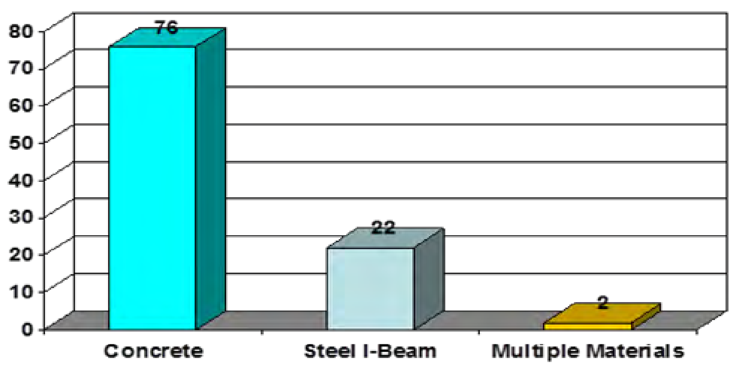


FIGURE 4 Numbers of roosts located with various types of "ceiling" composition.

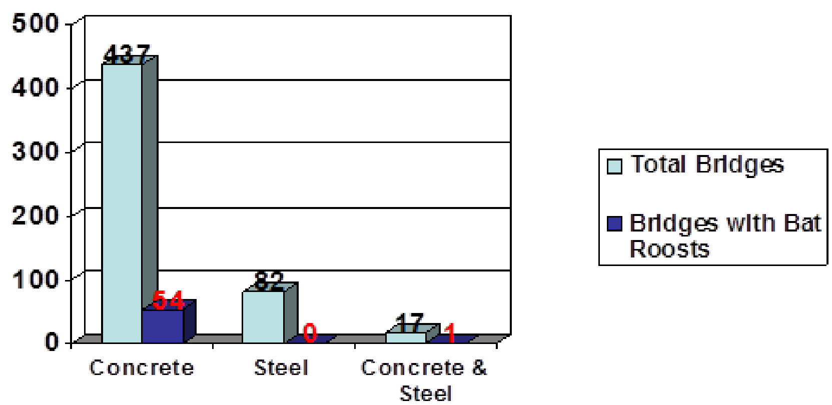


FIGURE 5 Metal under-ceiling bridge in Georgia.

FIGURE 6 Staining of crevices and transverse beam by guano and urine under bridge in Lamar County.

FIGURE 7 *Myotis lucifugus* emerging from a parallel crevice in Schley County.

FIGURE 8 Solid arched bridge in Jackson County with no crevices/no bats.

FIGURE 9 Roost for an estimated 2,000 *Tadarida brasiliensis* in Stewart County.

FIGURE 10 Bats roosting in concrete downspouts in Burke County.

This study demonstrated that the surrounding environment of the bridge had a definite influence on bat roost location. Forty four of the roost bridges spanned or were adjacent to water sources. Where the bridge roost spanned a highway or railroad, only 5 (each) provided a site for bats. Only one roost was located where the bridge spanned bare soil. No roosts were located if the highway had over four lanes. The maximum distance from any roost bridge to water was over one kilometer. Primary surrounding habitat type was woodlands/riparian (Fig.11) although both commercial and residential areas (Fig.12) were represented. Blockages of bat flyways, such as heavy vegetation (Fig.13), can limit bat occupation.

FIGURE 11 Woodlands/riparian environment.

FIGURE 12 Commercial area adjacent to a bridge in Dekalb County.

FIGURE 13 Bridge with ends blocked by vegetation, access at bridge center.

The age (year constructed) of the bridge inhabited by bats was noted. During construction expansion, materials fill transverse and parallel crevices but fail with time, providing new roosting access to bats (Fig.14). Non-roost bridges ranged in age from 1935 – 2004. The average age of non-roost bridges was 29.7 years. Forty three of the non-roost bridges were of unknown age. Roost bridges ranged in age from 1949 – 1996, although some of these had been expanded or modified since construction. The average age for roost bridges was 33.5 years.

FIGURE 14 Construction expansion materials fail with time, providing new roosting access to bats.

CONCLUSIONS AND OBSERVATIONS

1. Bats prefer roost bridges constructed of concrete with open crevices (supportive of previous studies (Keeley and Tuttle, 1999) and Florida DOT (personal comm., K. Studenroth)
2. Although the age of the bridge is not significant in itself, the deterioration of expansion materials with time provides an increased surface area for bat roosting.
3. Although no bridges were recorded as roosts in the greater Atlanta area, smaller Georgia towns such as Albany, Barnesville and Americus all had roost bridges within the town limits.
4. Ideal roost bridges have open crevices, concrete beams and deck or ceiling.
5. All bat roost bridges observed either spanned water or were within 1 km of water.
6. Roost bridges had open flyways with at least 2 m under their roost.

RECOMMENDATIONS

1. When activity at a bridge is planned and bat presence is suspected, departments of natural resources personnel should be informed to evaluate circumstances.
2. Every bridge should be checked for bat activity prior to any construction, major alteration or demolition. Even if bats are not observed, the evidence of their presence should be determined by checking for guano and urine guano/staining.
3. Maintenance activities should not be conducted during the months of March through August when bats are roosting under a bridge (depending upon the geographical location).
4. Any roost bridge demolition should be coordinated with state non-game wildlife personnel.
5. Ideally, bridges scheduled for demolition should be abandoned rather than demolished. If this is not possible, the new structure should possess the characteristics described for the ideal bridge or retrofitted as described by Keeley and Tuttle, 1999.

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BIOGRAPHICAL SKETCHES

Arthur G. Cleveland received Ph.D. and M.A. degrees in biology from the University of North Texas and a B.S. from the University of Texas at Arlington. His field research has been in the United States, Mexico, Central and South America and China, working with rodents and bats. He has made professional presentations and published in United States, Europe and China journals. A life member of the American Society of Mammalogists, he is currently a Professor of Environmental Sciences and a vice president at California Baptist University. He occupied an endowed chair at the University of the Incarnate Word, was dean of the College of Science at Columbus State University (Georgia), and mentored graduate students at several universities.

Jennifer G. Jackson received her B.S. in Environmental Biology from Utah State University (Logan). Her M.S. in Environmental Sciences from Columbus State University is in progress. She founded an environmental consulting firm in Georgia. Jennifer has several professional publications. She has been Regional Conservation Educator at the Idaho Department of Fish and Game (Pocatello) for over seven years.

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