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**Executive Summary Report**

Summer Ecology of Indiana Bats in Ohio

FHWA Report Number:	OH-2011/11
Report Publication Date:	May 2011
ODOT State Job Number:	134387
Project Duration:	36 months
Start Date:	April 15, 2008
Completion Date:	April 15, 2011
Total Project Funding:	\$192,009.00
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**For copies of this final report go to <http://www.dot.state.oh.us/research>.**

**Project Background**

The Indiana bat (*Myotis sodalis*) is a small, tree roosting species found throughout the eastern United States that is federally listed as endangered by the U.S. Fish and Wildlife Service. Although their major hibernacula are protected, information on summer foraging and roosting habitat of the Indiana bat is limited, particularly in Ohio. ODOT's roadway program is associated with several activities that may result in impacts to the bat. As a result, in accordance with the Endangered Species Act of 1973, ODOT must plan and implement its program in a manner that avoids or minimizes impacts to the Indiana bat. A more detailed understanding of summer roosting and foraging habitat for Indiana bats is needed for effective conservation and mitigation plans.

**Study Objectives**

The overall objective for the project is to provide information on the summer ecology of Indiana bats at a site where maternity roosts likely occur. Specific objectives include identifying characteristics of primary and secondary tree roosts, estimating home range size and location, identifying habitat selection, and documenting reproductive parameters for the local population.

**Description of Work**

Fieldwork was conducted on private land located along the Big Darby Creek in Pickaway County, Ohio. Indiana bats were captured during summer months during 2008-2010 using mist nets set across flight corridors and beneath forest canopies throughout the study area. We recorded various physical characteristics for each bat, and then banded them with unique numbers and attached radiotransmitters for monitoring. Radiotagged bats were located during the day to identify roost trees and radiotracked at night to estimate home ranges and habitat use. We also conducted emergence counts at selected roosts to identify potential maternity roosts.

**Research Findings & Conclusions**



We captured and tagged 55 Indiana bats during the study. We tracked 51 bats to 56 roost trees 474 times (bat roost days). Roosts were largely clustered in riparian woodland habitat along the Big Darby Creek. Roost trees were of 11 different species but two of the trees could not be identified. Eight of the trees were alive, two were declining, and the rest were dead or in a greater stage of decay. Roost trees were found relatively close to water, and tended to be dead or decaying, a high percentage of loose bark, and a dominant canopy class, when compared to other available trees. Bats did not use roost trees evenly, but showed strong preference for certain trees (i.e., primary roosts). Primary roosts were used by a large number of bats. The roost receiving the greatest use included 67% of the radiotagged bats using the tree, and emergence counts (the number of bats counted exiting the tree) approximated 100 each year. Secondary roosts received variable amounts of use from small numbers of bats. Although our quantitative analysis suggested a difference in characteristics between primary and secondary roosts, no single characteristic, or combination, emerged as reliably different. Nevertheless, some generalizations can be made for roosts used by Indiana bats in this study. Nearly all primary roosts were dead trees with DBH > 51 cm (20 in), > 90% loose bark, and associated with an emergent or dominant canopy and a surrounding canopy cover > 80%. Secondary roosts had more variable characteristics, but a similar DBH. Nearly all primary roosts, and most secondary roosts, were located near (< 100 m [328 ft]) from a stream.

We calculated 33 home ranges. Average home range size was  $210.5 \pm 130.6$  SD ha ( $0.84 \pm 0.52$  SD mi<sup>2</sup>) for fixed kernel and  $374.2 \pm 359.6$  SD ha ( $1.49 \pm 1.44$  SD mi<sup>2</sup>) for minimum convex polygon. Home ranges were clustered along the riparian areas and centered on roost locations. Bats selected for woodland and water habitats, and avoided cropland at multiple spatial scales. Although most foraging flights occurred within the riparian corridor, bats also moved outside the corridor to upland areas. For example, our radiotelemetry revealed that 95% of bat movements were within 4000 m (2.5 mi) of the nearest day roost location and 75% of all recorded movements were within 1200 m (0.75 mi).

The number of reproductive females (93% of females with evidence of producing young) captured at this site suggests this section of the Big Darby Creek has maternity roosts, which are likely the primary roosts described above. Females were documented returning to the area annually, including individuals likely born there. These results illustrate the important of riparian woodland habitat to Indiana bats during summer.

## Implementation Recommendations

Results from our study can be used to avoid or minimize impacts to bats by focusing survey efforts or guidance in interpreting maps, with respect to habitats preferred by Indiana bats during the summer in Ohio. Our results clearly illustrate the preferred use by bats of riparian woodland habitat for roosting and foraging. Our results can assist with the identification of potential roost trees, or sites where roost trees may be likely. Trees likely to be secondary or primary roosts should receive a high priority for conservation. Only 4 out of 56 roost trees (7%) had a DBH < 25 cm (10 in); guidelines currently focus on a minimum 20 cm (8 in) DBH, and nearly all primary roosts had a DBH > 51 cm (20 in). Typical characteristics of primary roost trees were dead, emergent or dominant trees with > 90% exfoliating or loose bark. Thus, trees with these characteristics near (< 100 m [328 ft]) water should be carefully managed as potential roost sites.

We provided more information regarding the seasonal window when Indiana bats are likely to occur on their summer grounds. Removal of potential roost trees or similar habitat alteration, if necessary, should take place outside this 'window'.

Likewise, our results provide a spatial scale with regard to the distance from a riparian corridor bats are likely to travel, which should assist in assessments of potential impact or mitigation. For example, our radiotelemetry revealed that 95% of bat movements were within 4000 m (2.5 mi) of the nearest day roost location and 75% of all recorded movements were within 1200 m (0.75 mi).

This project also highlights potential areas for future research, in the event that additional projects are required. These include radiotelemetry efforts to identify more large-scale movements and roosting, continued work on quantifying site fidelity and roost site dynamics, and the use of bridges as rest locations and potential roosts.