

Assessing dietary specialization of Rafinesque's big-eared bats from a maternity colony at Mammoth Cave National Park

Luke E. Dodd^{1,2},
M.J. Lacki¹, & L.K. Rieske-Kinney²

University of Kentucky
Departments of Forestry¹ & Entomology²



Corynorhinus

- Plecotine bats, Family Vespertilionidae
- Distinct morphology



Photo by
Michael Baker

Morphology & Gleaning



Photo by
Joe Johnson

Morphology & Gleaning

- Echolocation & morphology of pinnae
 - Low frequency (~ 20 kHz) & intensity calls

Morphology & Gleaning

- Echolocation & morphology of pinnae
 - Low frequency (~20 kHz) & intensity calls
- Wing morphology & flight
 - Low wing loadings

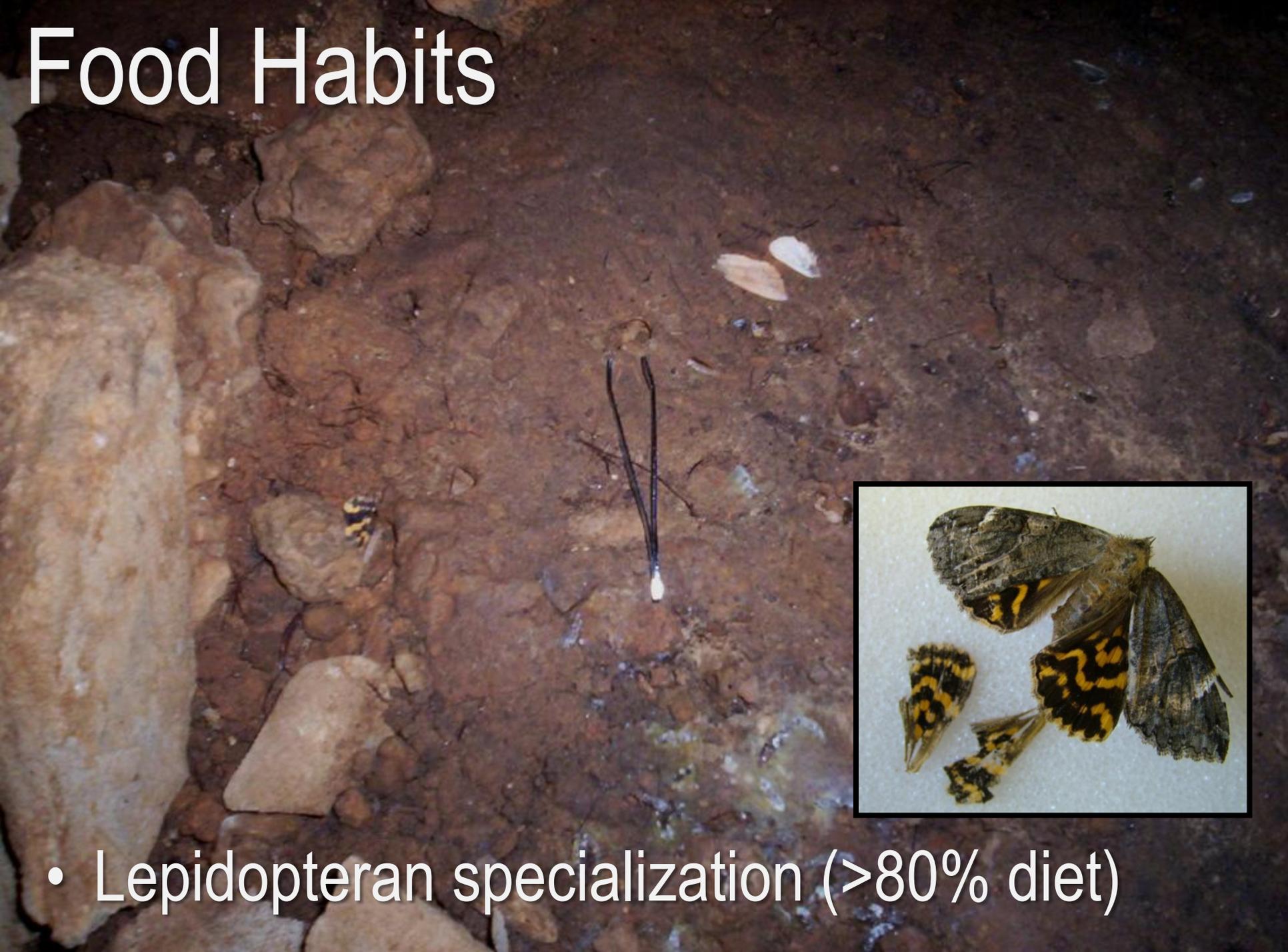
Morphology & Gleaning

- Advantages
 - Exploit “eared” prey
 - Handle larger prey

Food Habits



Food Habits



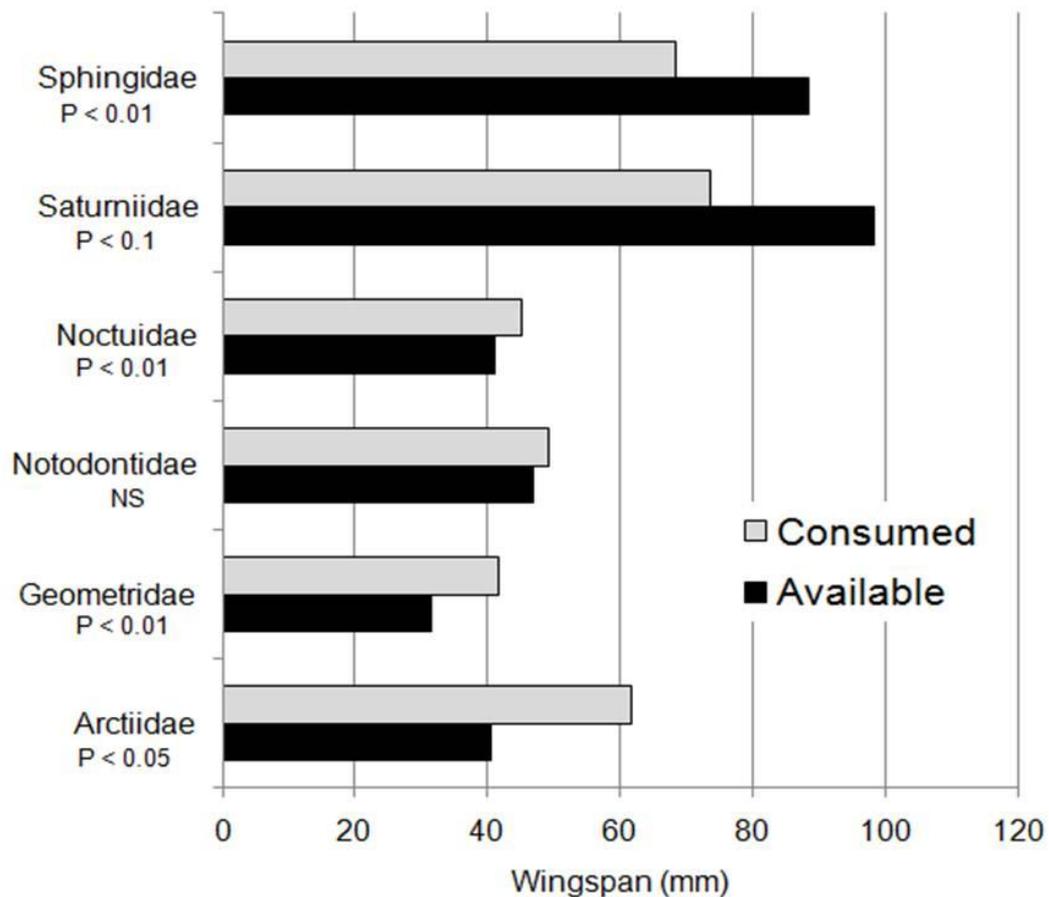
- Lepidopteran specialization (>80% diet)

Food Habits



- Feeding roosts
 - 114 species/genera across 11 families
- Prey sizes (wingspan)
 - All *Corynorhinus*: 47.0 (± 1.3) mm
 - *C. rafinesquii*: 51.2 (± 2.4) mm

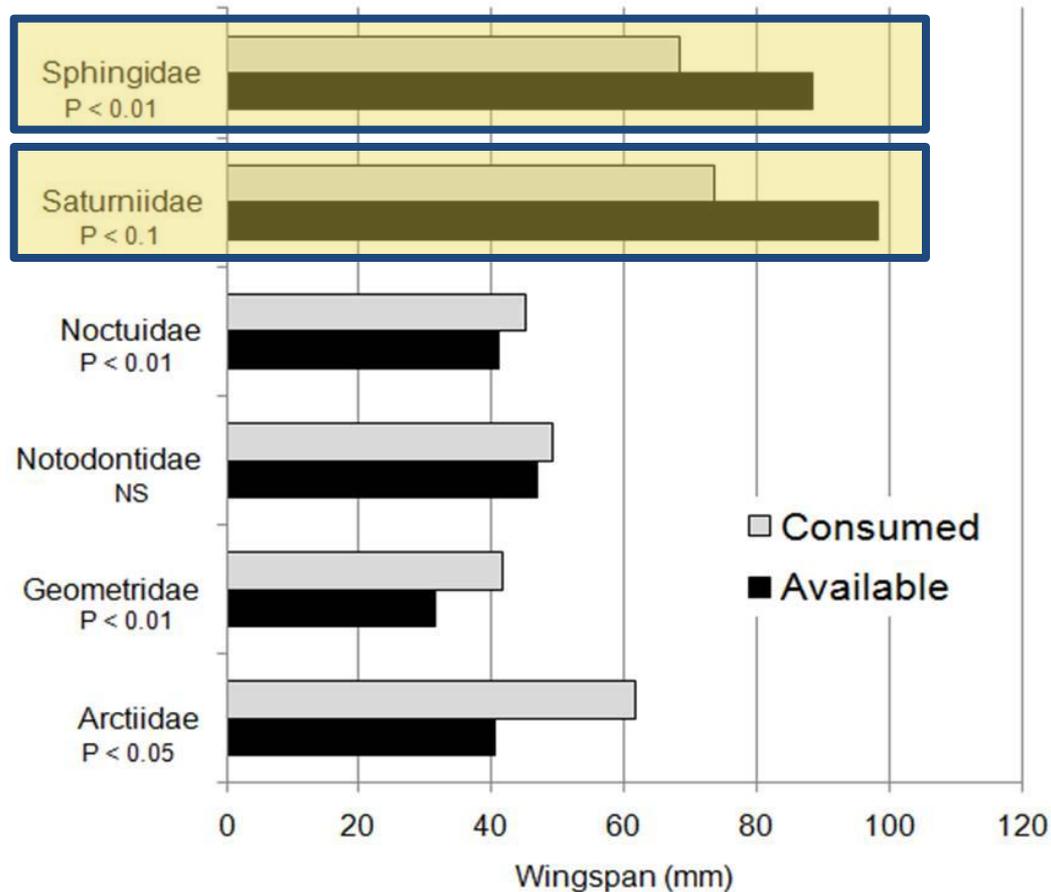
Food Habits



Citation for proceedings: Loeb, Susan C.; Lacki, Michael J.; Miller, Darren A., eds. 2011. Conservation and management of eastern big-eared bats: a symposium. Gen. Tech. Rep. SRS-145. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 157 p.

Source: Burford and Lacki (1998), Covell (1984), Dalton and others (1989), Dodd and Lacki (2007), Hurst and Lacki (1997), Lacki and LaDeur (2001), Sample and Whitmore (1993).

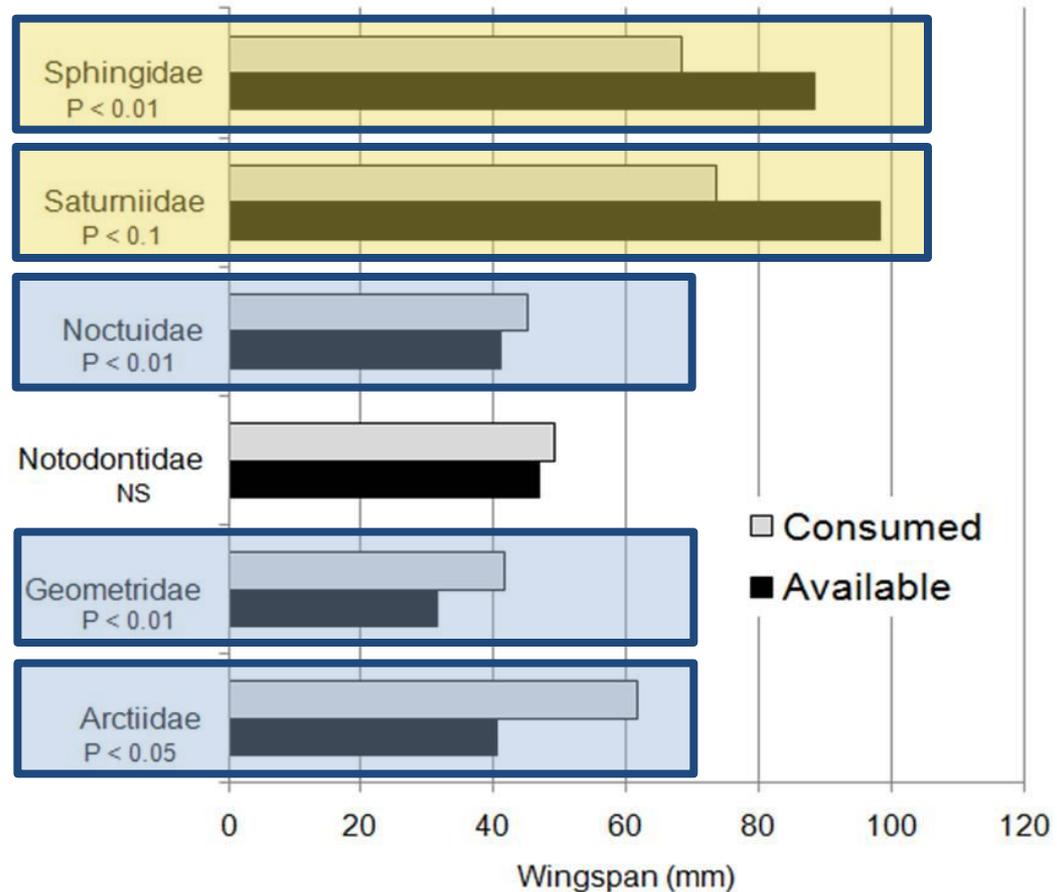
Food Habits



Citation for proceedings: Loeb, Susan C.; Lacki, Michael J.; Miller, Darren A., eds. 2011. Conservation and management of eastern big-eared bats: a symposium. Gen. Tech. Rep. SRS-145. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 157 p.

Source: Burford and Lacki (1998), Covell (1984), Dalton and others (1989), Dodd and Lacki (2007), Hurst and Lacki (1997), Lacki and LaDeur (2001), Sample and Whitmore (1993).

Food Habits



Citation for proceedings: Loeb, Susan C.; Lacki, Michael J.; Miller, Darren A., eds. 2011. Conservation and management of eastern big-eared bats: a symposium. Gen. Tech. Rep. SRS-145. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 157 p.

Source: Burford and Lacki (1998), Covell (1984), Dalton and others (1989), Dodd and Lacki (2007), Hurst and Lacki (1997), Lacki and LaDeur (2001), Sample and Whitmore (1993).

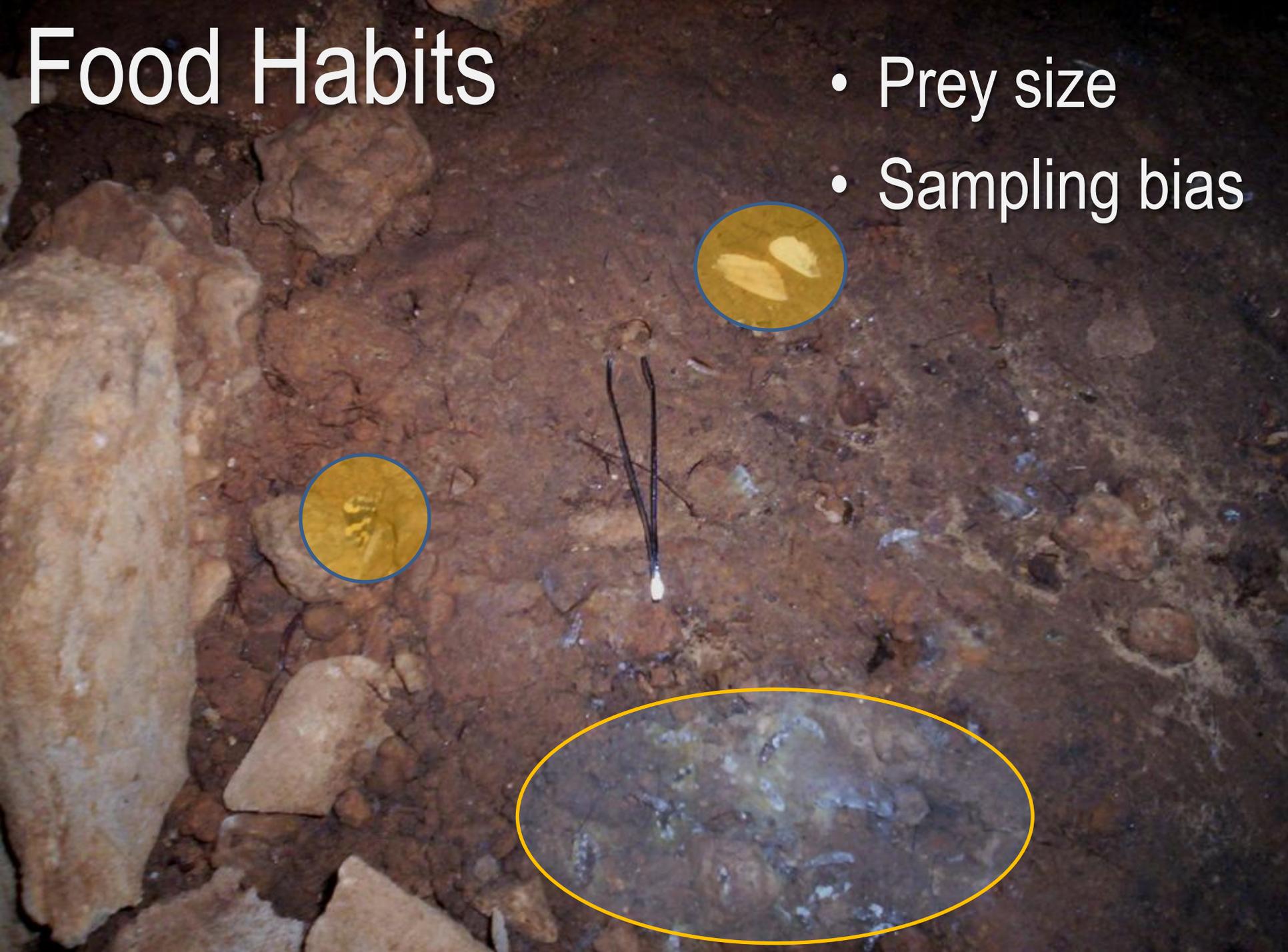
Food Habits

- Prey size
- Sampling bias



Food Habits

- Prey size
- Sampling bias



Objectives

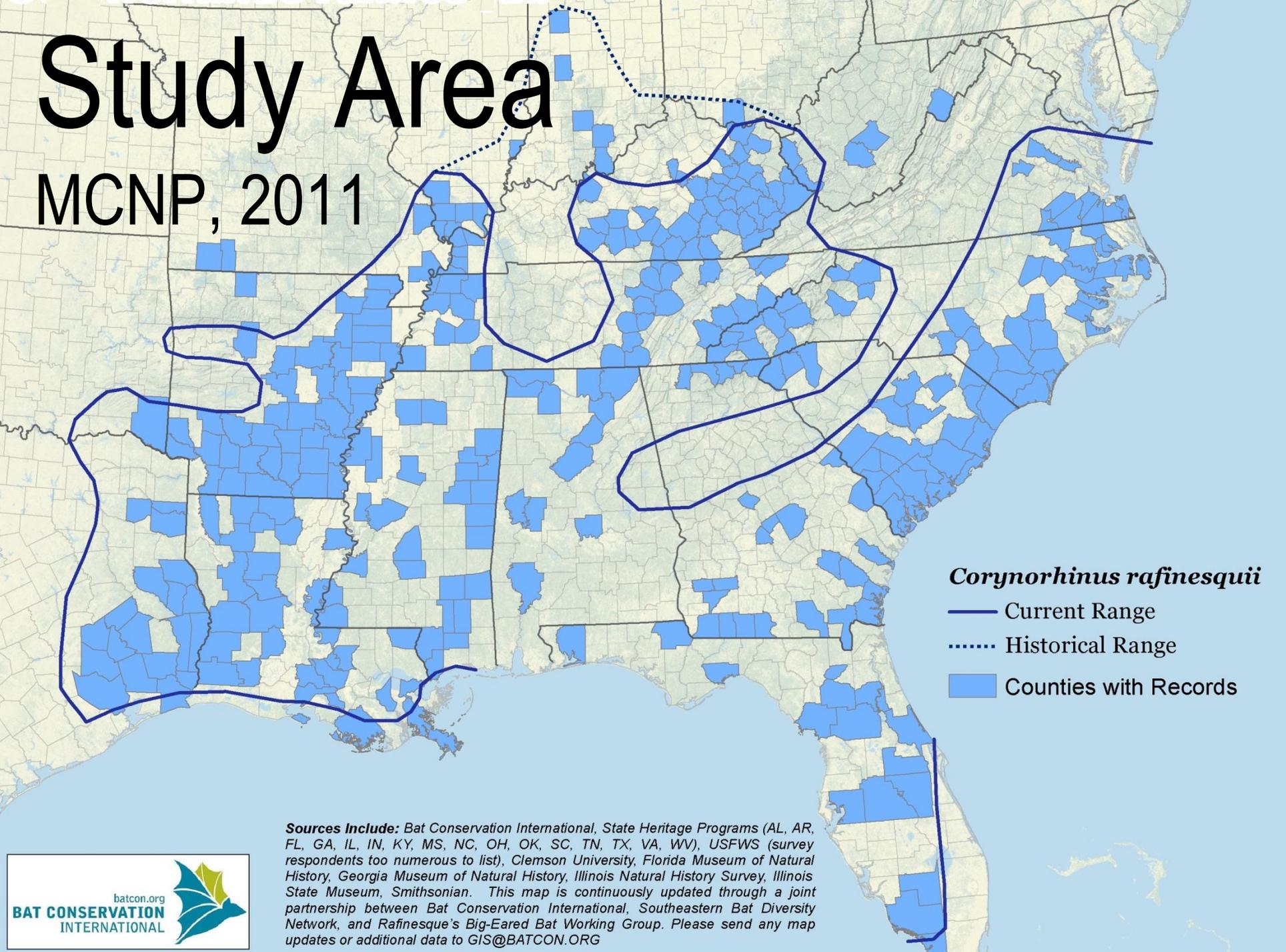
Assess consumption patterns
of *C. rafinesquii* in relation to...

- Prey availability
- Existing “culled wing” data
- DNA data for co-occurring species
- DNA data for old-world congener



Study Area

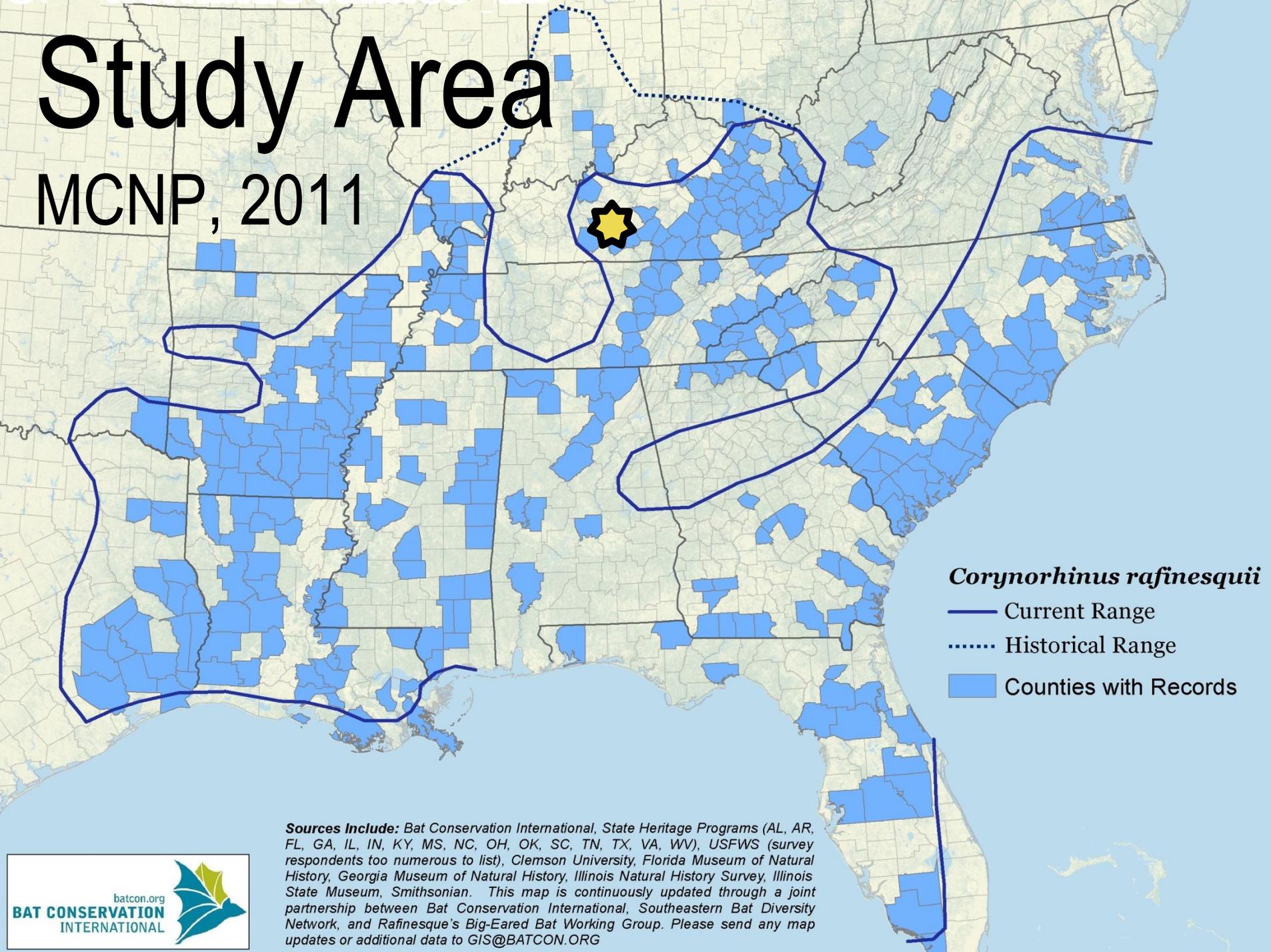
MCNP, 2011



Sources Include: Bat Conservation International, State Heritage Programs (AL, AR, FL, GA, IL, IN, KY, MS, NC, OH, OK, SC, TN, TX, VA, WV), USFWS (survey respondents too numerous to list), Clemson University, Florida Museum of Natural History, Georgia Museum of Natural History, Illinois Natural History Survey, Illinois State Museum, Smithsonian. This map is continuously updated through a joint partnership between Bat Conservation International, Southeastern Bat Diversity Network, and Rafinesque's Big-Eared Bat Working Group. Please send any map updates or additional data to GIS@BATCON.ORG

Study Area

MCNP, 2011



Sources Include: Bat Conservation International, State Heritage Programs (AL, AR, FL, GA, IL, IN, KY, MS, NC, OH, OK, SC, TN, TX, VA, WV), USFWS (survey respondents too numerous to list), Clemson University, Florida Museum of Natural History, Georgia Museum of Natural History, Illinois Natural History Survey, Illinois State Museum, Smithsonian. This map is continuously updated through a joint partnership between Bat Conservation International, Southeastern Bat Diversity Network, and Rafinesque's Big-Eared Bat Working Group. Please send any map updates or additional data to GIS@BATCON.ORG

Methods

Fecal Collection

MCNP, 2011

- Long-standing maternity colony at barn
- Fecal samples collected nightly (N = 6)
- August – October (juveniles volant)

Methods

Lepidopteran Occurrence

MCNP, 2011



Methods

DNA Extraction



- Fecal samples are impure; EtOH wash
- Pellet homogenized; Qiagen spin column kit

Identification of prey of *Myotis septentrionalis* using DNA-based techniques

Author(s): Luke E. Dodd, Eric G. Chapman, James D. Harwood, Michael J. Lacki, and Lynne K. Rieske
Source: Journal of Mammalogy, 93(4):1119-1128. 2012.

Methods

PCR & Sequencing



- Universal COI primers, general protocol, 50 cycles
- Sequenced bi-directionally at University of Kentucky



C1-J-1859: 5'-GGAACIGGATGAACAGTTTACCCICC-3'
C1-N-2191: 5'-CCCGGTA AAAATTA AAAATATAAACTTC-3'

Identification of prey of *Myotis septentrionalis* using DNA-based techniques

Author(s): Luke E. Dodd, Eric G. Chapman, James D. Harwood, Michael J. Lacki, and Lynne K. Rieske
Source: Journal of Mammalogy, 93(4):1119-1128. 2012.

Methods



DNA Identification & Analyses

- Unknown COI sequences
 - BOLD's ID Engine (December 2012)

Molecular Ecology (2009) 18, 2532–2542

Species on the menu of a generalist predator, the eastern red bat (*Lasiurus borealis*): using a molecular approach to detect arthropod prey

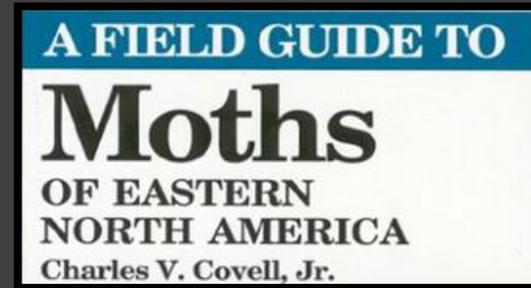
ELIZABETH L. CLARE,*ERIN E. FRASER,†HEATHER E. BRAID*, M. BROCK FENTON† and PAUL D. N. HEBERT*

Methods



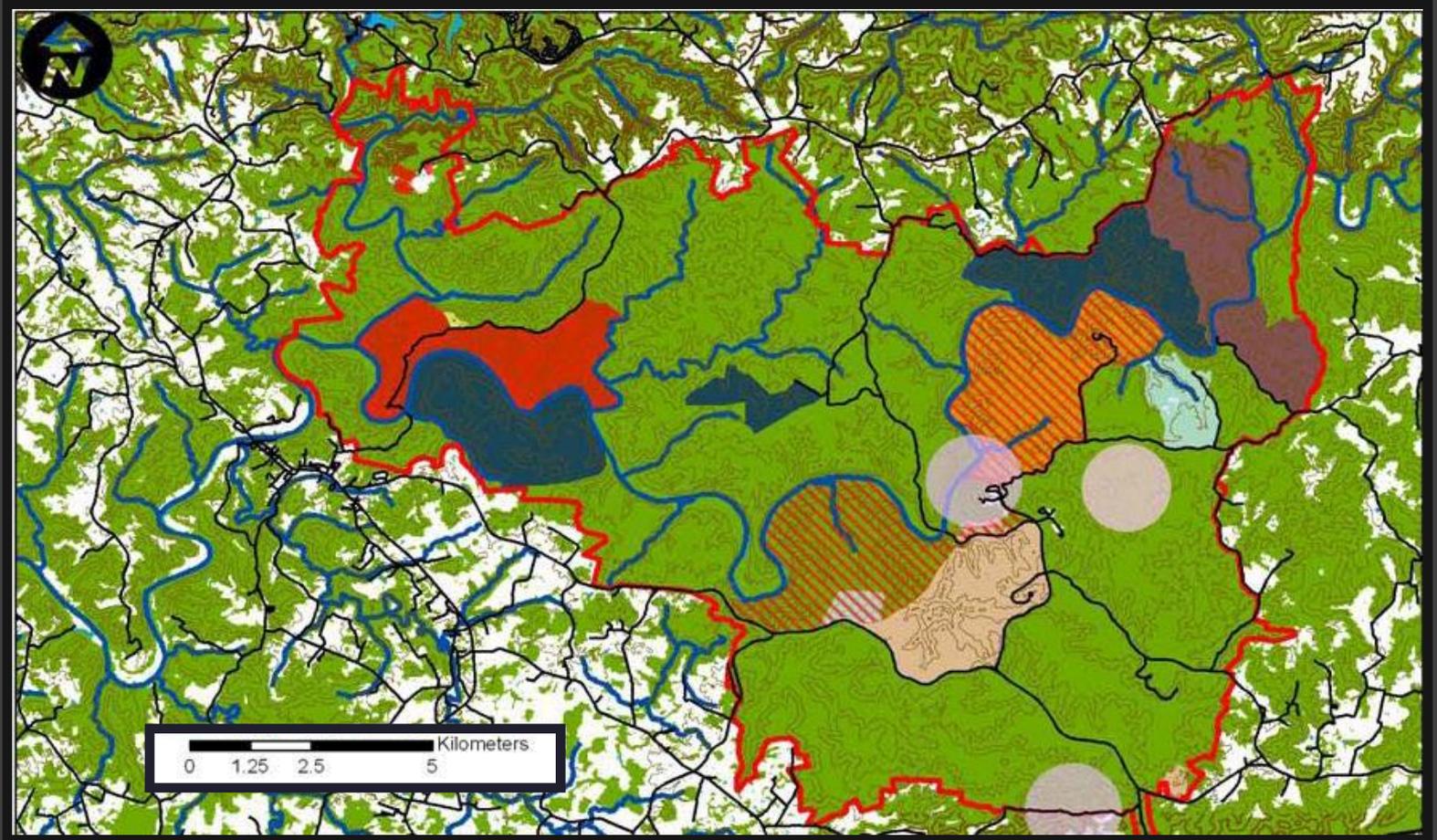
DNA Identification & Analyses

- Unknown COI sequences
 - BOLD's ID Engine (December 2012)
- Prey sizes; wingspan (mm)
 - Covell (2005) & Bug Guide (2013)
- One-way ANOVAs



Molecular Ecology (2009) 18, 2532–2542
Species on the menu of a generalist predator, the eastern red bat (*Lasiurus borealis*): using a molecular approach to detect arthropod prey
ELIZABETH L. CLARE,*ERIN E. FRASER,†HEATHER E. BRAID*, M. BROCK FENTON† and PAUL D. N. HEBERT*

Sampling Intensity



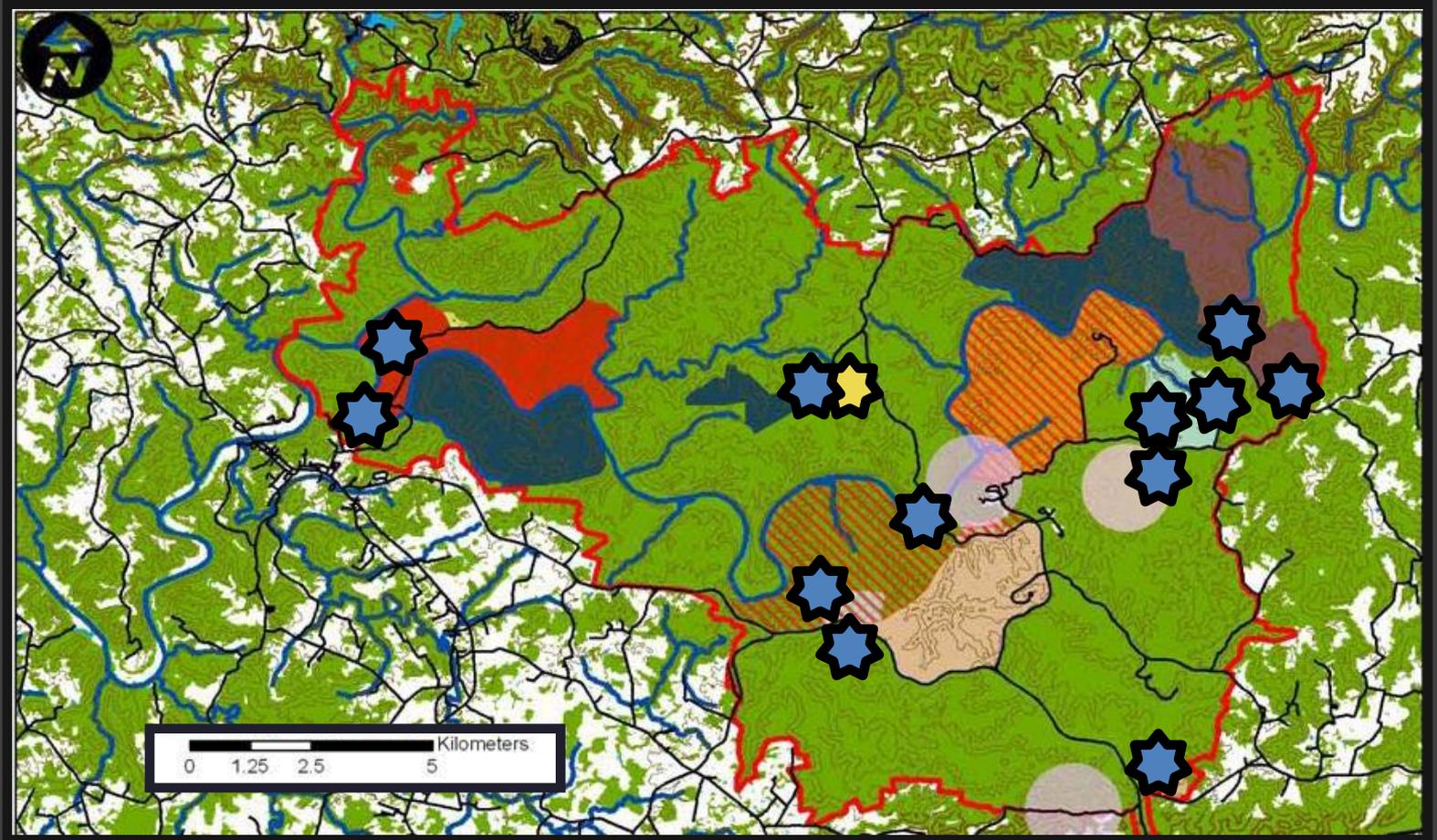
Sampling Intensity

All morphological dissections
>50% Lepidoptera



- Fecal collection (6 nights; 60 pellets)

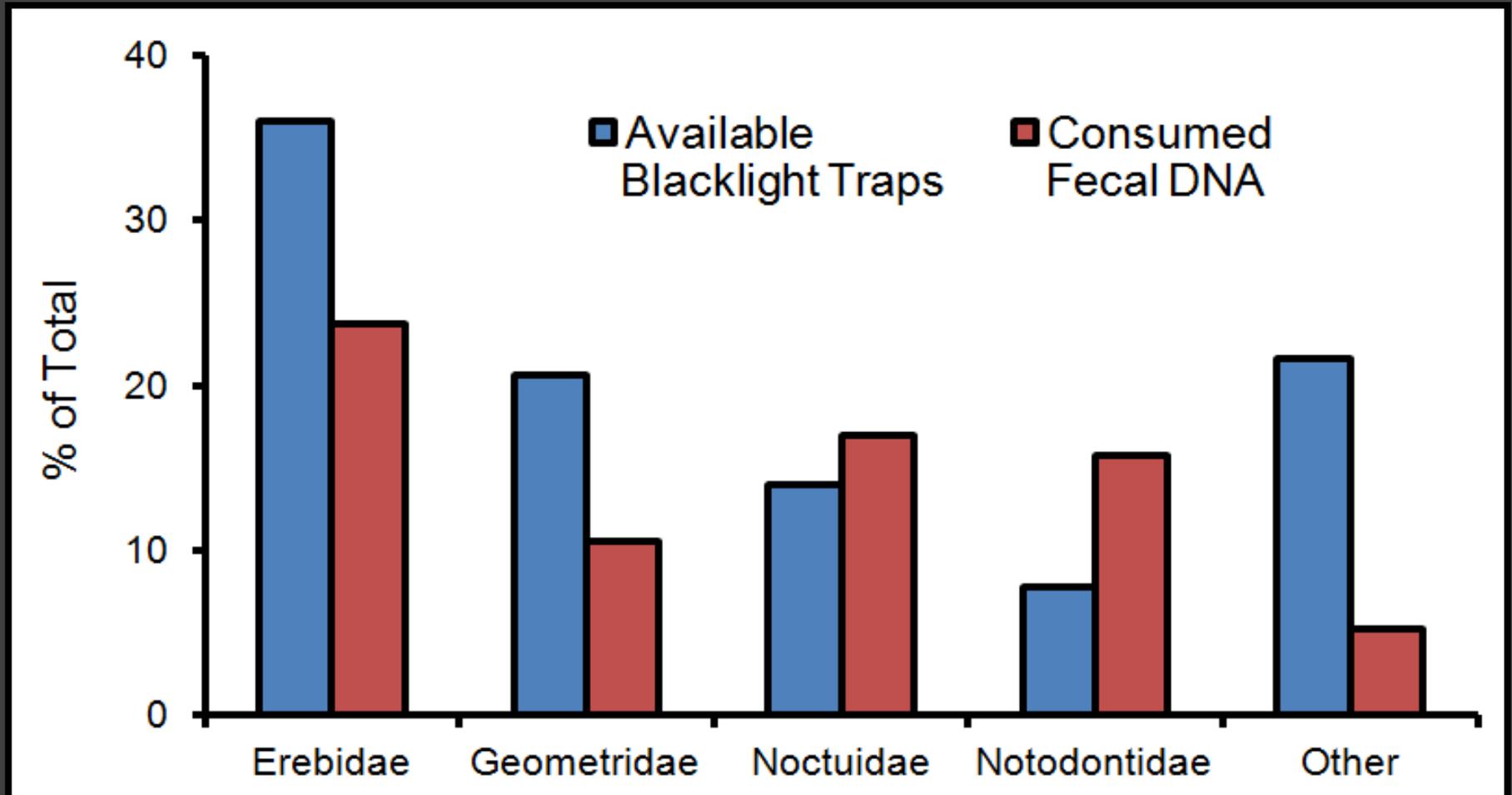
Sampling Intensity



- Fecal collection (6 nights; 60 pellets; 40 ID's)
- Prey assessment (6 nights; 48 traps)

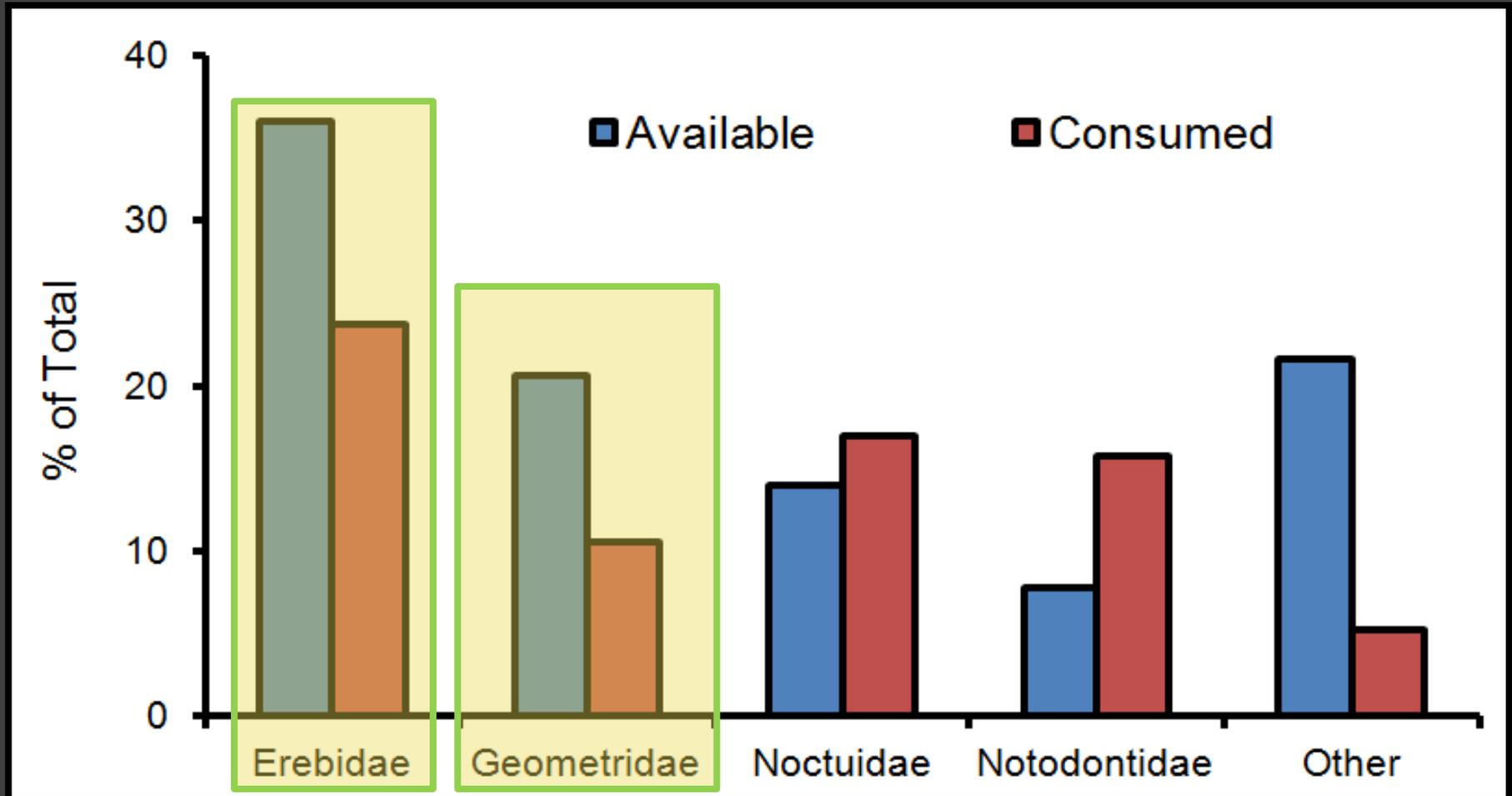
Results

Consumption vs. Availability



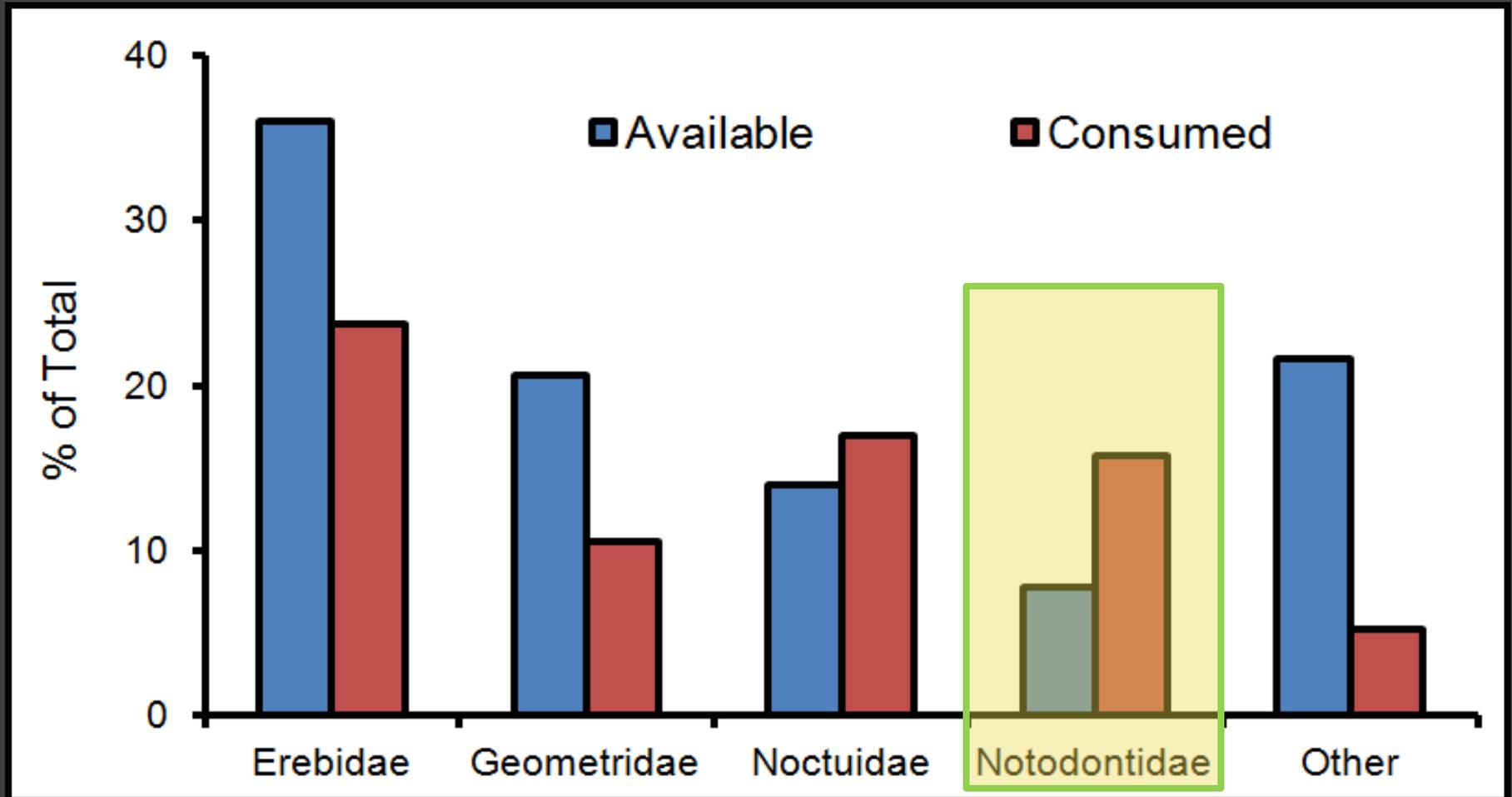
Results

Consumption vs. Availability



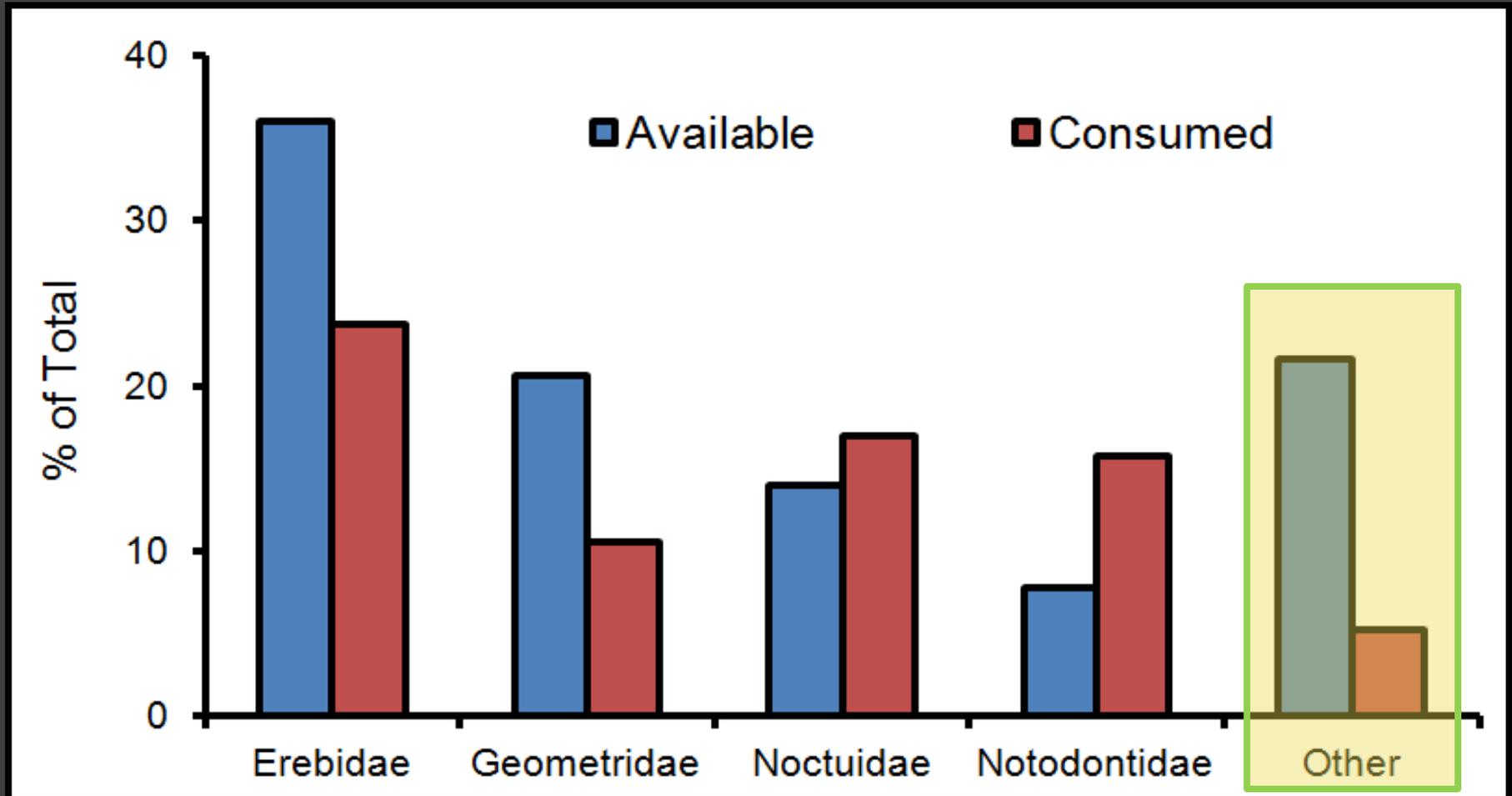
Results

Consumption vs. Availability



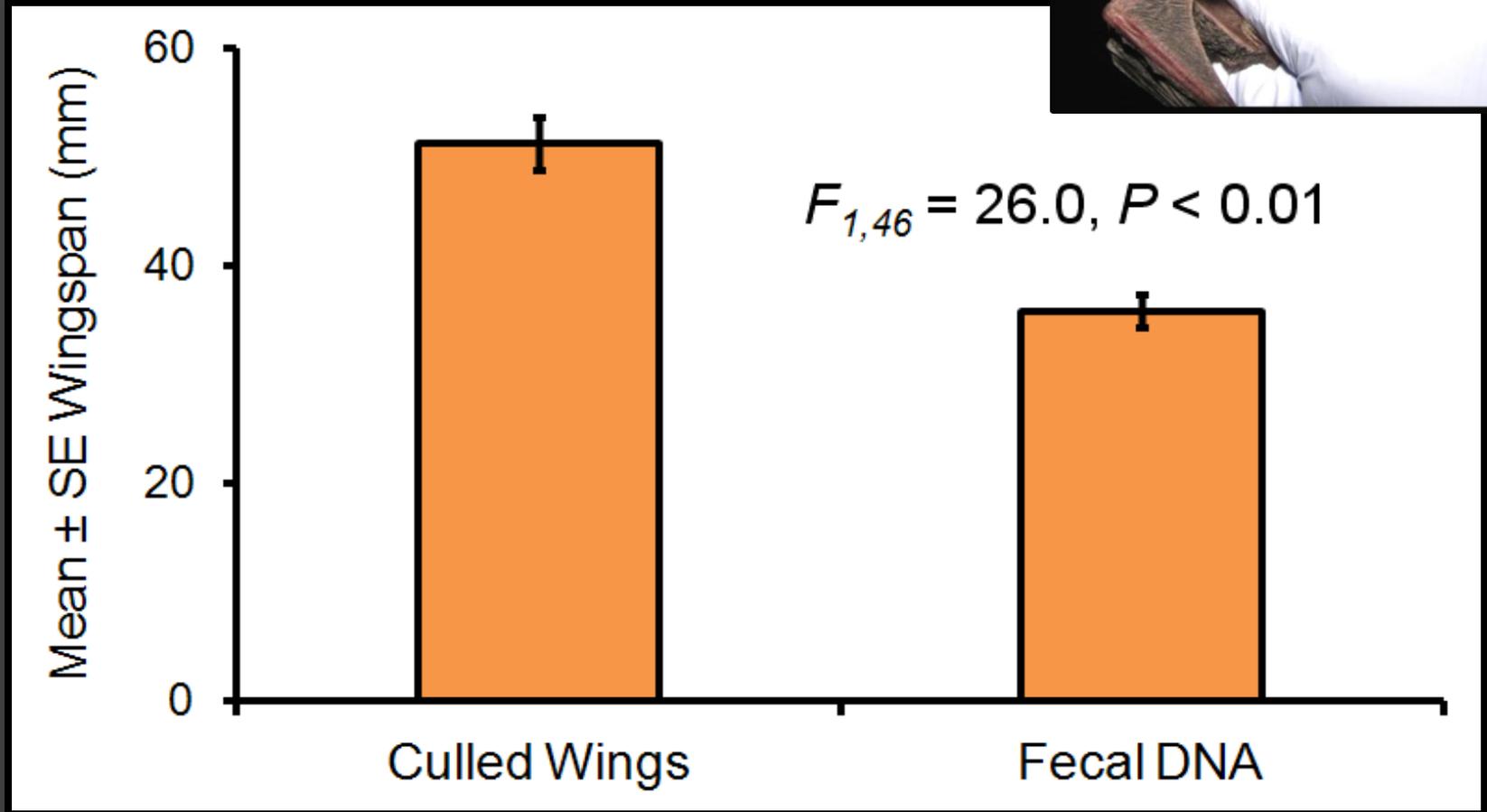
Results

Consumption vs. Availability



Results

Comparison of Methods



- What does this tell us about *Corynorhinus* behavior?

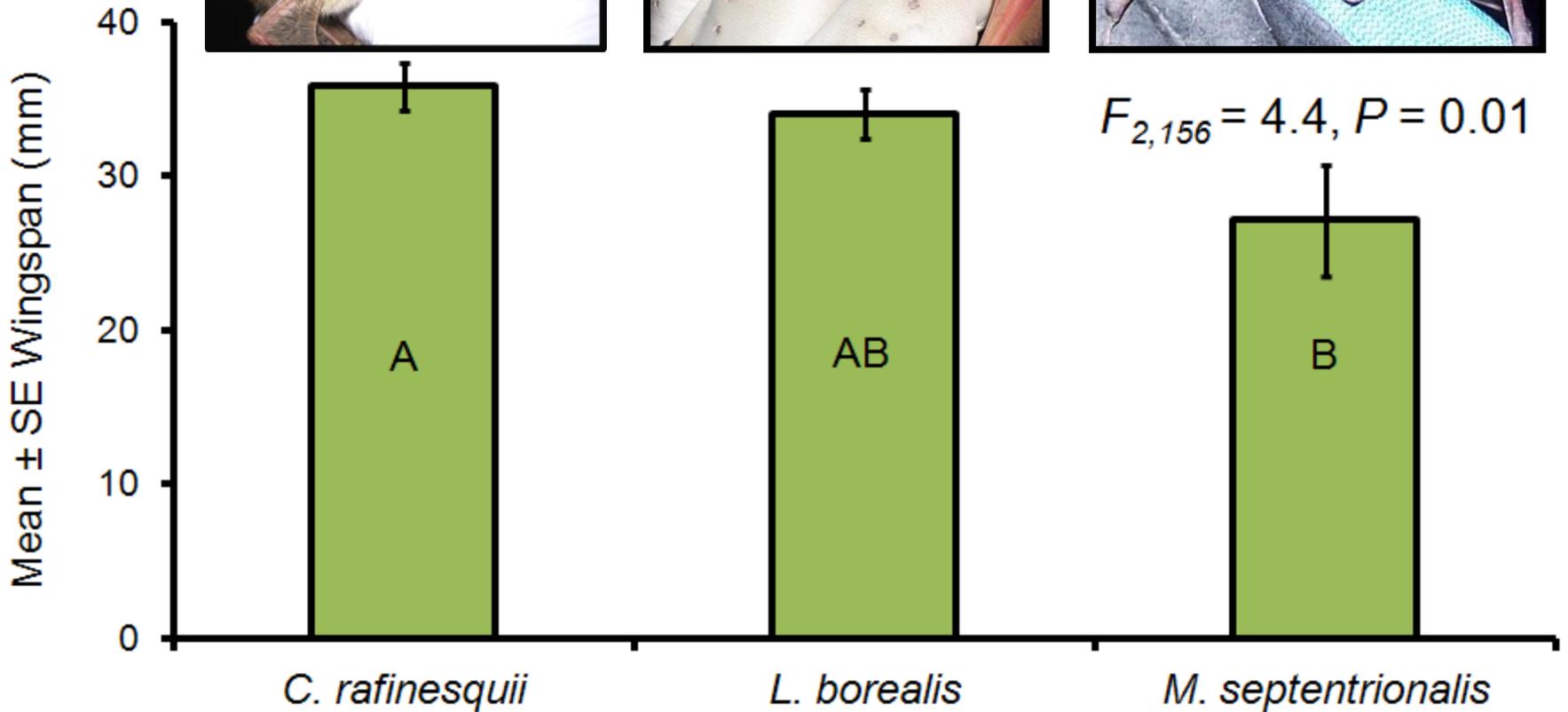
Comparison of Co-occurring Species

Results



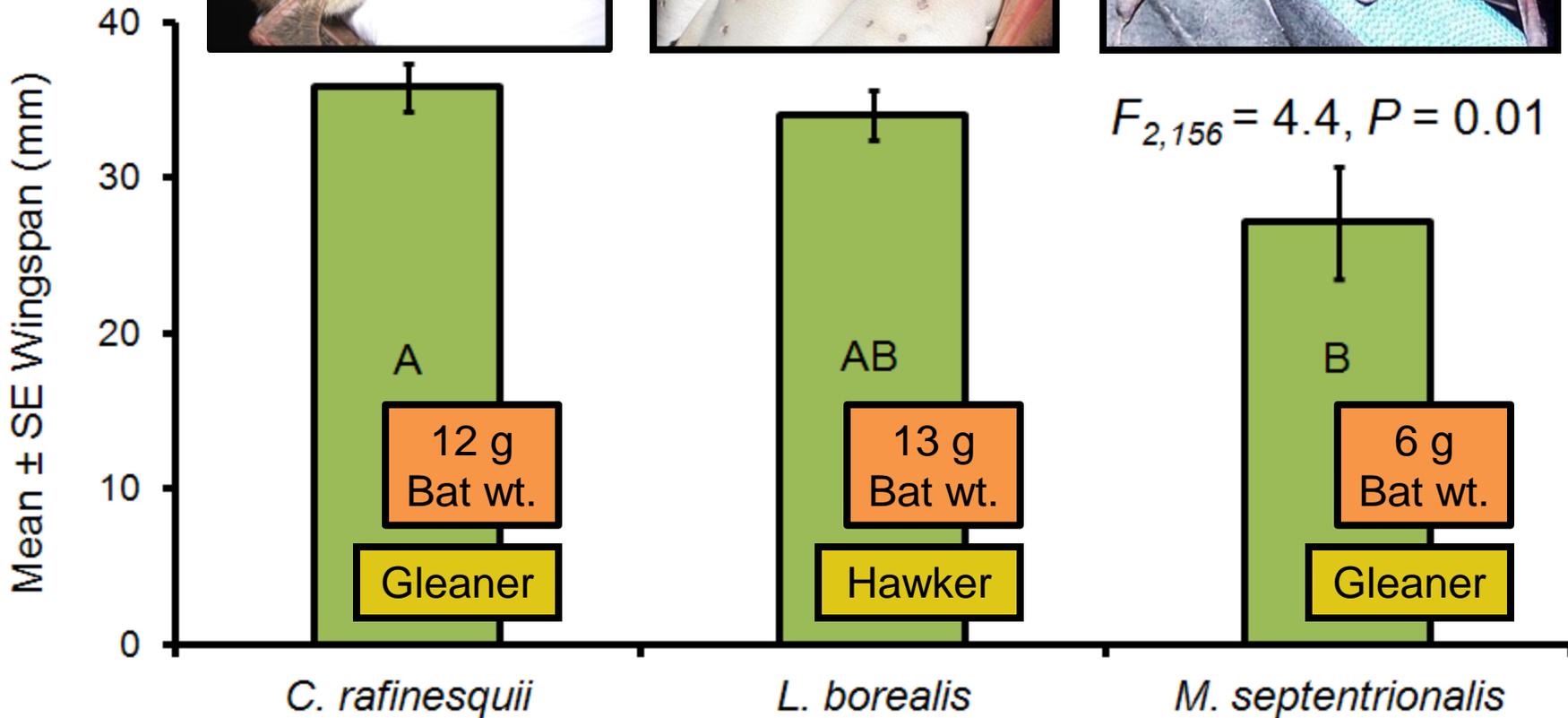
Comparison of Co-occurring Species

Results



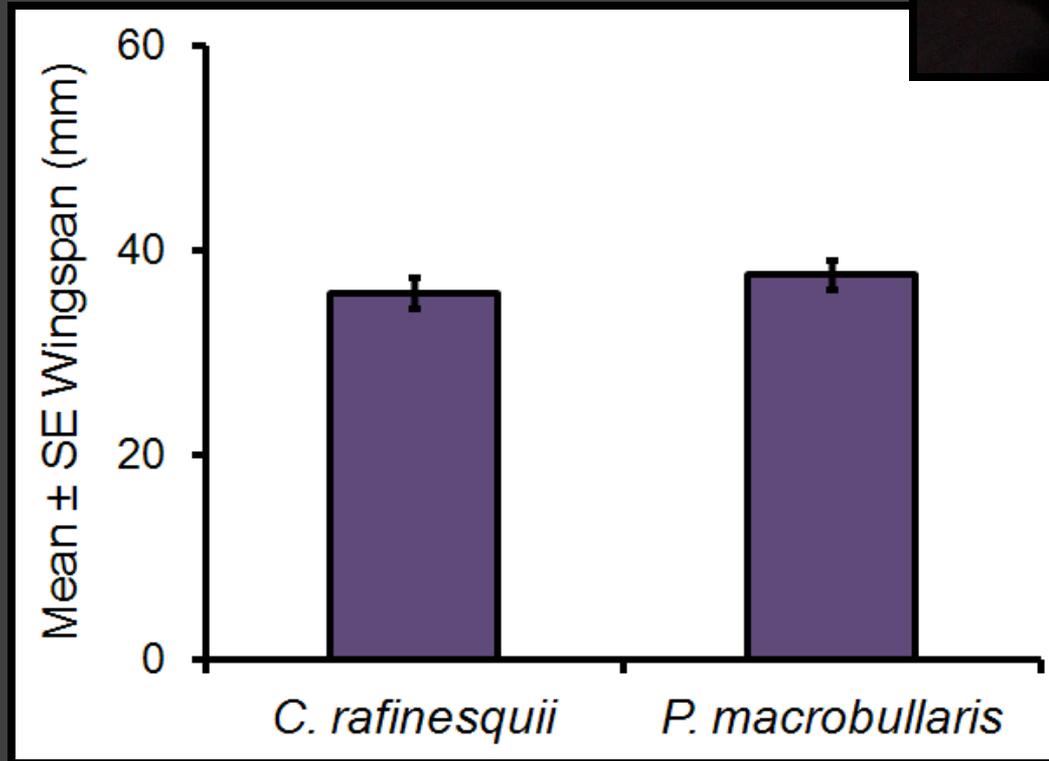
Comparison of Co-occurring Species

Results



Results

Comparison with Old-World Congener



Synthesis & Implications



Synthesis & Implications

- No particular prey taxa exploited
- Culled wing data & *Corynorhinus* behavior

Synthesis & Implications

- *C. rafinesquii* consumes larger prey than *M. septentrionalis*, a co-occurring gleaner

Synthesis & Implications

- Prey size in our study corroborates results for an old-world species using a different approach

Synthesis & Implications

- This study contributes to a global, expanding body of research for these interesting predators!

Acknowledgements

A close-up photograph of a person's hands holding a small, brown bat. The bat's wings are fully extended, showing the intricate structure of the wing membrane. The bat's body is covered in fine, brown fur, and its large, dark, leathery ears are prominent. The person holding the bat is wearing blue denim jeans, which are visible in the background. The lighting is soft, highlighting the texture of the bat's fur and the membrane of its wings.

- Funding
 - Joint Fire Sciences
- NPS Personnel
 - Dr. Rick Toomey
 - Steve Thomas
 - Shannon Trimboli
- Tech Support
 - Tracy Culbertson
 - Jennifer Winters