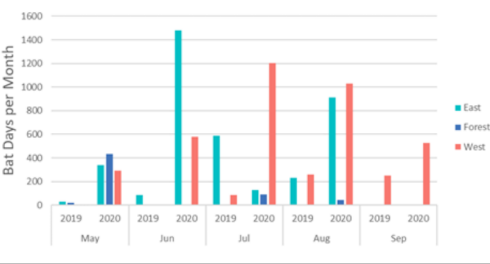
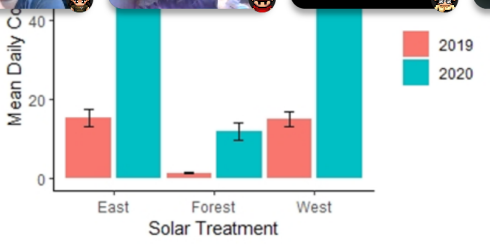


how Indiana bats acclimate to rocket boxes over time.

- **Research objectives:** Evaluate maternal Indiana bat roost use across varied landscape positions over multiple years.

Methods

- **Field site:** Veteran's Memorial Wildlife Management Area, Scott County, KY
- Constructed bat boxes of five designs.²
- Installed one of each design in clusters across four solar treatments in 2019:
 - Full solar exposure (Open)
 - Receives mostly eastern sun (East)
 - Receives mostly western sun (West)
 - Shaded in forest interior (Forest)
- Performed spotlight checks and exit counts 3-4 days a week in 2019 and 2020.^{2,3}



- Bats primarily used East and West clusters across years.
- Bats used the Forest cluster in the spring prior to the formation of the maternity colony.
- Bats never used the open cluster.

Conclusions

Increased box use in 2020 is likely due to time it took for bats to discover these novel roosts. However, additional factors could include bats developing search images for the roosts or assessing microclimates of roosts through trial and error.

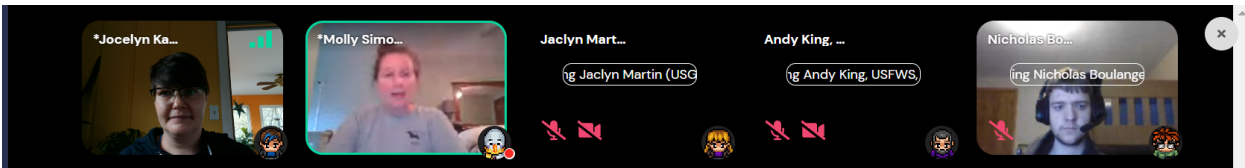
Acknowledgements

We are grateful to KDFWR for facilitating this research (particularly Zack Couch and Michaela Rogers). Further, we appreciate the help and support of the Dodd and O'Keefe lab groups (especially Jessa and Jesse). We thank EKV, its Graduate Student Association, and the Graduate Student Union for their economic and financial support. Funding was provided by the National Science Foundation (Award # F20AP00273).

Literature Cited

1. Hoeh et al. 2018. PLoS ONE 13: 1-16.
2. Crawford, R. 2020. M.S. thesis, Eastern Kentucky University, Richmond, KY.
3. Rogers, M. 2020. M.S. thesis, Eastern Kentucky University, Richmond, KY.





Big brown bats with chronic *Pseudogymnoascus destructans* exposure weigh less in northern latitudes compared to southern latitudes

Molly C. Simonis^{1,2}, Lynn K. Hartzler^{1,2}, Greg G. Turner³, Michael R. Scafani³, Joseph S. Johnson⁴ and Megan A. Rúa^{1,2}



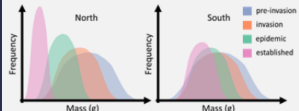
¹ Wright State University Environmental Sciences PhD Program, Dayton, OH 45435; ² Wright State University Department of Biological Sciences, Dayton, OH 45435; ³ Pennsylvania Game Commission Bureau of Wildlife Management, Harrisburg, PA 17110; ⁴ Ohio University Department of Biological Sciences, Athens, OH 45701



Introduction

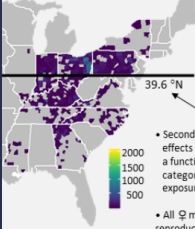
- Pathogen introductions cause host trait shifts
- *Pseudogymnoascus destructans* (*Pd*) was introduced in North America in 2006 and causes white-nose syndrome in temperate bats
- Highly susceptible bats surviving *Pd* invasion have increased fat stores (Cheng *et al.* 2019)
- How do traits shift in less susceptible bats with chronic *Pd* exposure over time and space?

Hypotheses:



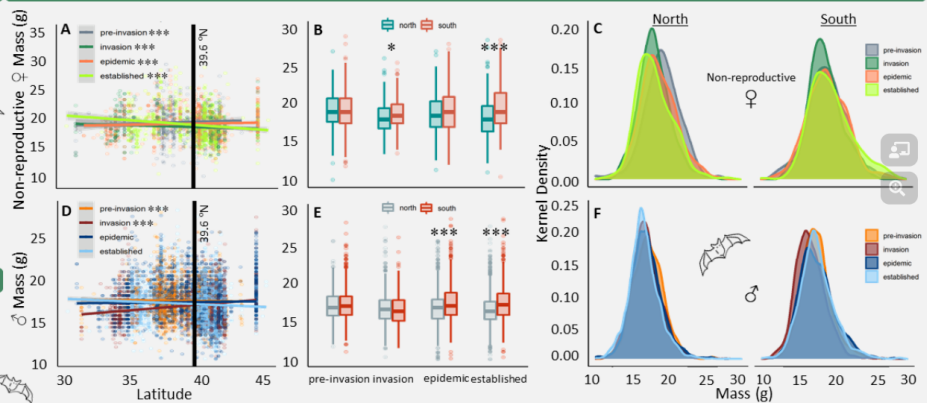
Methods

Big brown bat captures per county Spring-Fall, 1990-2020



- ♀ (n = 14,153)
- ♂ (n = 9,965)
- Initial linear mixed effects models for mass as a function of latitude, *Pd* exposure time and site.
- Identified latitudinal inflection point
- Secondary linear mixed effects models for mass as a function of latitudinal category (north/south), *Pd* exposure time and site
- All ♀ models included reproductive status

Results

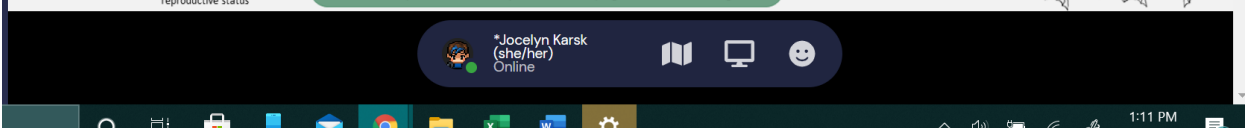


Adult big brown bats weigh less north of the latitudinal inflection point by *Pd* establishment compared to their southern counterparts. Shifts in mass north and south of the latitudinal inflection point over *Pd* exposure time for non-reproductive females (A & C) and males (D & F). Pre-invasion (< 0 yrs); invasion (0 - 1 yrs); epidemic (2 - 4 yrs); established (5 + yrs). Time factor adapted from Langwig *et al.* (2015). * P < 0.05, ** P < 0.01, *** P < 0.001.

Acknowledgements: Thank you to all those in the field who captured bats in the past 30 years! Thank you to data contributors: Andy King & IN USFWS; Carl Herzog & NY DEC; Dr. Tim Carter, Ball State University; Gary Jordan & NC USFWS; Gene Zirkle & Fort Campbell Directorate of Public Works; Josh Campbell & TN Wildlife Resource Agency; Kaitlin Cross & MS Museum of Natural History; Katherine Etchison & NC Wildlife Resources Commission; Rick Reynolds & VA DGIF; Sarah Stanakovich & OH DNR; Sunni Carr & KY USFWS; Trina Morris & GA DNR; Dr. Lisa Cooper, NEOMED. Thank you to the ES PhD program at WSU for funding.

Conclusions

- Chronic *Pd* exposure illuminates trait-shifts in less susceptible species
- Shifts likely confounded with environmental factors linked to latitude
- Spatial threshold may help focus management and conservation practices where *Pd* is established



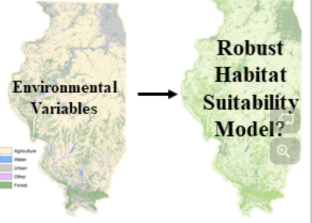
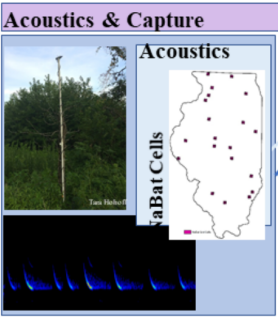
Participant names and video thumbnails: Jocelyn Ka..., Sarah Gaulk..., Bethany Str..., Tara Hohoff - INHS sh..., Nicholas Bou..., Lori Pruitt, Jean Menge...

- Bats need a variety of habitat patches and corridors and are impacted by change at all spatial scales
- Habitat suitability models can identify this critical habitat and provides species-specific information for forest management, conservation, and policy
- Bats are typically surveyed using two methods: capture and acoustic surveys
- Acoustic data is easier to collect, but identifying species based on the call alone is subjective and hard to confirm. Physical capture is time and labor intensive, but species can be definitively identified.
- NaBat, the North American acoustic monitoring program, is gaining momentum and data is being collected by the terabyte
- Little research has been done on the efficacy of different data types on habitat suitability modeling

Species names and photos: *Lasiurus borealis* (Jocelyn Karsk), *Lasiurus cinereus* (Tara Hohoff)

Forest Type	Cropland Data Cover
Aspect	National Elevation Dataset
Elevation	National Elevation Dataset
Amount of Water	National Hydrology Dataset
Distance to Water	National Hydrology Dataset
Distance to Roads	TIGER roads layer

DIFFERENT DATA SETS
One model for each data set per species



RESEARCH QUESTIONS

- What are the core habitats and its characteristics for the tricolored, hoary, and eastern red bat? Based on these preferences, where would we expect to find them across Illinois?
- Does data approach (mixed, acoustic-only, or physical capture-only) matter in developing robust habitat suitability models for our three focal taxa?
- Can NABat protocol acoustics yield robust habitat suitability models?

DATA SETS

- Data were acquired via data sharing agreement with Illinois Department of Natural Resources and the U.S. Fish and Wildlife Service from 2002-2021
- Additional data from Illinois Bat Conservation Program acoustic and capture surveys, and VertNet online database
- Capture data: mist netting surveys, carcass surveys at wind farms
- Acoustic data: 20 NaBat GRTS cells, additional long term and short-term acoustic surveys

DATA ANALYSIS

- Use false positive occupancy model to reduce error
- Calculate best spatial scale for each variable from a moving window scale on raster cells at 100m, 500m, and 1km
- Prevent correlated variables and promote variable suitability by running univariate models and choosing variables above 0.5 AUC
- Generate >15 presence-only models in MaxEnt
- Variables and model parameters remain the same between models
- ENMTools will calculate AIC and AUC values for candidate model evaluation
- Test model efficacy by measuring the omission rate by withholding 10% of data points
- Ensure the amount of suitability overlap between models for a comparison metric

Zoom controls and participant name: Jocelyn Karsk (she/her) Online

Joe Kath ...

*Bree McM...
ree McMurray-Missou

Shane Brod...
Ring Shane Brodnick

Megan Mart...
egan Martin (she/her)

Tara Hohoff ...
Tara Hohoff - INHS sh

MIDWEST BAT WORKING GROUP

Joe Kath - Illinois DNR

*Jocelyn Karsk (she/her)

Elisabeth Hartman

Shane BrodnickMurray-Missouri DOT

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Tara Hohoff - INHS she/her

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Gerda Nordquist, MNDNR (she/her)

Eric Schroder, AllStar Ecology

Lara Sviat, Galen Burrell

Bethany Straw

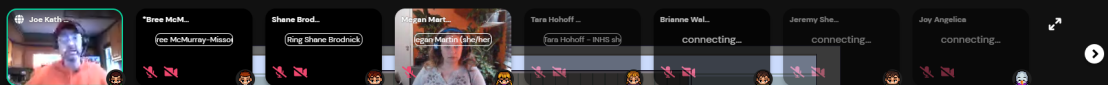
Clarissa Starbuck (she/her)

*Jocelyn Karsk (she/her) Online

s Chicago

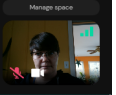
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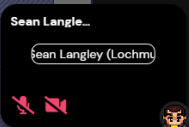
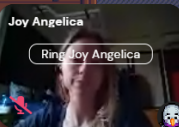
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MIDWEST BAT WORKING GROUP

Joe Kath - Illinois DNR
Jocelyn Karak (she/her)
Elisabeth Hartman
Shane Brodick Murray - Missouri DDT
Lisa Powers, PhD - U.S. Forest Service (she/her)
Brian Heeringa - USFS
Tara Hohoff - NRS (she/her)
Megan Martin (she/her) Mike Van Sloten, Prairie Land Conservancy Sarah Stankovich, Ohio DNR
Caroline Byrne, BSI
Brianna Waterstrom, Joy Angelica
Molly Simons (she/ers) Ash Cable
Sean Langley (Lochmueller) Ellen Hogrebe, CMT
Gerda Nordquist - MNDNR (she/her)
Eric Schroder, AllStar Ecology
Lara Svatko, Galen Burrell
Bethany Straw
Clarissa Starbuck (she/her)
Rachil Claudia Boothe - Urban Rivers Chicago
Katy Goodwin (she/her)
Kanya Pasa (she/ers) icon
Nicholas Boulanger
Sarah Gauke (she/ers)
Joel Flory (USFS) Rhina Michalson Hiawatha FS
Haley Price
Shannon Howe
Brian Bogaczky, Ka Nichole Laggan (she/her) VT
Bill Leogracyn Martin (USGS) Jeff Hubschman
Scott Bergeson (U of Wayne)
Elizabeth Belko (she/ Maria XM
Jocelyn Karak (she/her) Orono
Tara Hohoff (she/her) ch





MIDWEST BAT WORKING GROUP

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- Brian Heeringa - USFS
- Tara Hohoff - INHS (she/her)
- Megan Martin (she/ & Kate Van Sloten, Prairie Land Conservancy; Sarah Stankovich, Ohio DNR)
- Caroline Byrne_BRI
- Brianne Walters; rémy Shee & Joy Angelica
- *Molly Simonis (she/hers)
- Ash Cable
- Sean Langley (Lochmueller)
- Ellen Hogrebe, CMT
- Gerda Nördquist, MNDNR (she/her)
- Eric Schroder, AllStar Ecology
- Lara Sviatko
- Galen Burrell
- Bethany Straw
- Clarissa Starbuck (she/her)
- Rachael, Claudia Boothe; Urban Rivers Chicago
- Katy Goodwin (she/her)
- Kavya Parsa (she/hers) son
- Nicholas Boulanger
- Katrina Schultes Sarah Gaulke (she/hers)
- Joel Flory (USFS, Rhine & Michielsen Hiawatha FS)
- Haley Price
- Brian Bogaczyk; Ka; Nichole Laggan (she/her); VT
- Bill Leo; Jaclyn Martin (USGS)
- Jeff Huebschman
- Scott Bergeson (PU Ft Wayne)
- Jocelyn Karsk (she/her) Online
- Elizabeth; Shannon; Howe; M...
- Richard Tier, LPZ (she/her) ch

This screenshot shows a Zoom meeting grid with several participants. At the top, four large video thumbnails are visible: Joe Kath, Joy Angelica (with a 'Ring Joy Angelica' overlay), Jeremy She... (with a 'Ring Jeremy Sheets' overlay), and Megan Mart... (with a 'Megan Martin (she/her)' overlay). Below these are rows of smaller participant icons and names, many with muted microphones. The names include: Shane Brödnick - Missouri DOT, Lisa Powers, PhD - U.S. Forest Service (she/her), Brian Heering, Tara Hohoff - INHS (she/her), Megan Martin (she/her), Kate Van Sloten, Prairie Land Conservancy, Sarah Stankavich, Ohio DNR, Caroline Byrne_BRI, Brienne Walters, Jeremy Shee, Joy Angelica, Molly Simonis (she/hers), Ash Cable, Sean Langley (Lochmueller), Ellen Hogrebe, CMT, Gerda Nördquist, MNDNR (she/her), Eric Schroder, AllStar Ecology, Bethany Straw, Clarissa Starbuck (she/her), Rach... Claudia Boothe, Urban Rivers Chicago, Katy Goodwin (she/her), Debbie Johnson, Nicholas Boul..., Katrina Schultes Sarah C, Jocelyn Karsk (she/her) Online, liawatha FS, and Haley Pri... A 'Manage space' button is located in the bottom right corner. The bottom of the screen features a toolbar with icons for chat, gallery view, screen sharing, and a smiley face icon.

Participants visible in the grid:

- Joe Kath ...
- Joy Angelica (Ring Joy Angelica)
- Jeremy She... (Ring Jeremy Sheets)
- Megan Mart... (Megan Martin (she/her))
- Shane Brödnick - Missouri DOT
- Lisa Powers, PhD - U.S. Forest Service (she/her)
- Brian Heering
- Tara Hohoff - INHS (she/her)
- Megan Martin (she/her)
- Kate Van Sloten, Prairie Land Conservancy
- Sarah Stankavich, Ohio DNR
- Caroline Byrne_BRI
- Brienne Walters
- Jeremy Shee
- Joy Angelica
- Molly Simonis (she/hers)
- Ash Cable
- Sean Langley (Lochmueller)
- Ellen Hogrebe, CMT
- Gerda Nördquist, MNDNR (she/her)
- Eric Schroder, AllStar Ecology
- Bethany Straw
- Clarissa Starbuck (she/her)
- Rach... Claudia Boothe, Urban Rivers Chicago
- Katy Goodwin (she/her)
- Debbie Johnson
- Nicholas Boul...
- Katrina Schultes Sarah C
- Jocelyn Karsk (she/her) Online
- liawatha FS
- Haley Pri...

The screenshot shows a Zoom meeting interface. At the top, there are four active video windows:

- Joe Kath ...**: A man in an orange shirt.
- Joy Angelica**: A woman with blonde hair, with a sub-window labeled "Ring Joy Angelica".
- Jeremy She...**: A man with a beard, with a sub-window labeled "Ring Jeremy Sheets".
- Megan Mart...**: A woman with dark hair, with a sub-window labeled "Megan Martin (she/her)".

Below the video windows is a list of participants, many of whom are muted and have their video off (represented by icons):

- Shane Brödnick - Missouri DOT
- *Lisa Powers, PhD - U.S. Forest Service (she/her)
- Brian Heeringa
- Tara Hohoff - INHS (she/her)
- Megan Martin (she/her)
- Kate Van Sloten, Prairie Land Conservancy
- Sarah Stankavich, Ohio DNR
- Caroline Byrne_BRI
- Brianne Walters
- Shrèe Joy Angelica
- *Molly Simonis (she/hers)
- Ash Cable
- Sean Langley (Lochmueller)
- Ellen Hogrebe, CMT
- J Gerda Nordquist, MNDNR (she/her)
- Eric Schroder, AllStar Ecology
- Bethany Straw
- Clarissa Starbuck (she/her)
- Rach Claudia Boothe, Urban Rivers Chicago
- Katy Goodwin (she/her)
- Debbie Johnson
- Nicholas Boul...
- Katrina Schultes Sarah C
- *Jocelyn Karsk (she/her) Online
- liawatha FS
- Haley Pr...

At the bottom right, there is a "Manage space" button and a small video window showing a man's face.

The image shows a Zoom meeting interface. At the top, there are four large video windows for participants: Joe Kath, Joy Angelica, Jeremy Shee..., and Megan Mart... Each window has a name and a 'Ring' button. Below these are several smaller video windows for other participants, including Elisabeth Hartman, Shane Brödnick, Lisa Powers, Tara Hohoff, Megan Martin, Kate Van Sloten, Sarah Stankavich, Caroline Byrne, Brianne Walters, Jeremy Shee, Joy Angelica, Molly Simonis, Ash Cable, Sean Langley, Ellen Hogrebe, Gerda Nördquist, Eric Schroder, Bethany Straw, Clarissa Starbuck, Rach, Claudia Boothe, Katy Goodwin, Debbie Johnson, Nicholas Boul..., and Jocelyn Karsk. A 'Manage space' button is visible in the bottom right corner. The background of the meeting is a dark blue patterned wall with a bat silhouette.

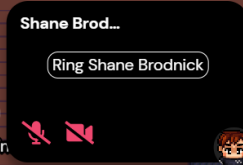


Joe Kath ...



Jeremy She...

Ring Jeremy Sheets



Shane Brod...

Ring Shane Brodnick



*Bree McM...

ree McMurray, Missou

MIDWEST
BAT WORKING
GROUP

MIDWEST
BAT WORKING
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Megan Martin (she/her), Káte Van Sloten, Prairie Land Conservancy, Sarah Stankavich, Ohio DNR

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Ellen Hogrebe, CMT

Gerda Nordquist, MNDNR (she/her)

Eric Schroder, AllStar Ecology

Bethany Straw

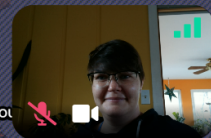
Clarissa Starbuck (she/her)

Rach, Claudia Boothe, Urban Rivers Chicago

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(she/her)
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Manage space

Joe Kath ...

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Midwest Bat Working Group

Midwest Bat Working Group

Joe Kath - *Molly Simonis (she/hers)

Shane Brödnick - Missouri DOT

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Clarissa Starbuck (she/her)

*Jocelyn Karsk (she/her) Online

Bethany Stra

Chicago

Manage space