

Preregistration

Preregistration: Bat Community Structure In the Cypress Hills pre/post White-Nose Syndrome

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Study Information

Title	Preregistration: Bat Community Structure In the Cypress Hills pre/post White-Nose Syndrome Effects of white-nose syndrome (WNS) on bat community structure in Cypress Hills, Saskatchewan, Canada.
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Description	White-nose syndrome (WNS) is an infectious fungal disease of bats that was first detected in New York City in the winter of 2006 Jachowski et al. (2014). Since its first detection it has affected and killed more than 6 million hibernating bats in eastern North America Jachowski et al. (2014). WNS affects bat species differentially with the little brown bat (<i>Myotis lucifugus</i>) being the most adversely affected
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species Frick et al. (2010), Hoyt, Kilpatrick, & Langwig (2021). Due to the differential gradient in the effect of WNS on different bat species, there is a dire need for community-level studies on bat populations and regional scale monitoring programs in order to mitigate adverse effects of WNS Hoyt, Kilpatrick, & Langwig (2021). The mitigation of WNS's effects can aid in ensuring effective ecosystem function through the maintenance of community structure, especially since bats play key roles in pollination and seed dispersal Hoyt, Kilpatrick, & Langwig (2021).

Instances of WNS in bats in Canada are In the predominately prairie province of Saskatchewan in Canada, bat populations have been studied since ca.XXXX (Citation). However, recently in ca. 2019, researchers identified instances of WNS in the Cypress Hills region in Saskatchewan, indicating a spread into central Canada (CITATION?). Thus, given the adverse nature of WNS on bats, our study aims to inform conservation efforts by compiling and comparing bat community data from before and after the introduction of WNS in Cypress Hills. In addition we also construct population projection models for each species in order to understand differences in species responses to WNS.

Hypotheses White nose syndrome may affect bat populations in Cypress hill region of Saskatchewan Province (See Figure 1).

Directional: We expect to see population **declines** in little brown bats (*Myotis lucifugus*) along with declines in most other bat species within an infected community.

Directional: We expect to see an **increase** in silver-haired bats (*Lasionycteris noctivagans*) (CITATION?).

Design Plan

Study type **Observational Study.** Data is collected from study subjects that are not randomly assigned to a treatment. This includes surveys, natural experiments, and regression discontinuity designs.

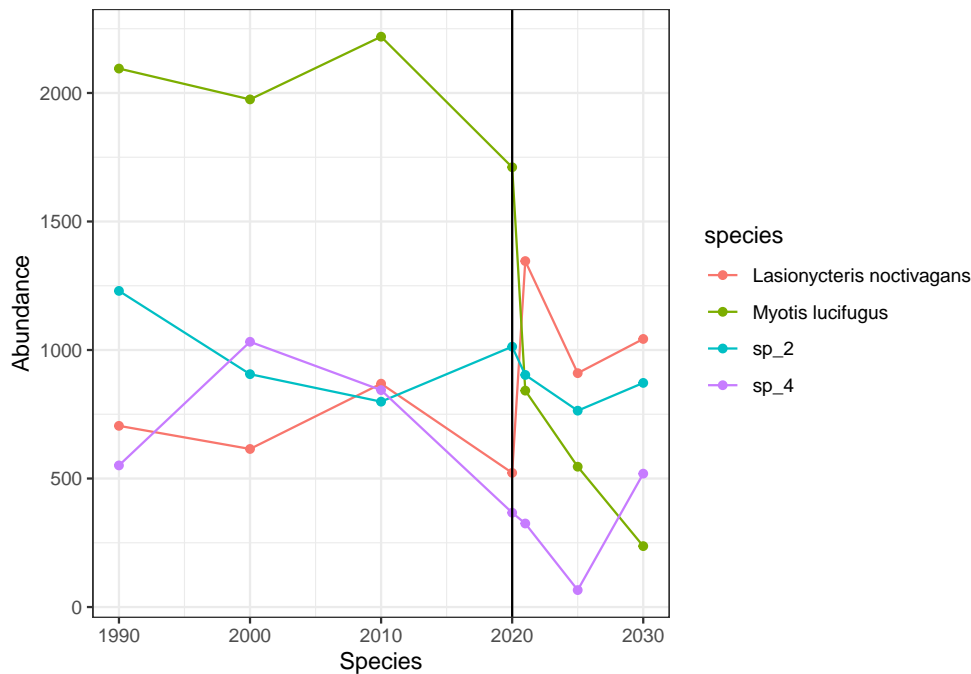


Figure 1: Expected changes in bat species frequencies after the introduction of white nose syndrome in 2019 the Cypress hill region of Saskatchewan Province.

Blinding	No blinding is involved in this study.
Study design	<p>Timing: The Bat Community in the Cypress Hills has been monitored since 1991, and we will continue to monitor the community until 2030. Monitoring will start around mid-June every year, depending upon permit permissions. Monitoring will finish in mid-August.</p> <p>Study sites: Researchers will place mist nets at various points along Battle Creek in the Cypress Hills West Block. We will choose these sites based on records from previous capture data. We will continue to return to these sites each year until 2030. We will also attempt to net at each site at similar dates each year.</p> <p>Field methods: We will raise 1-3 mist nets across Battle Creek at each net site. Number of nets will be chosen based on personnel, time, and previous net set-ups. Each mist net will be raised at last light and we will monitor net activity for three hours per night. Every hour we will record ambient temperature, cloud cover and wind speed. We will close nets if it is raining or wind speed is above 20 km/s.</p> <p>We will check the nets every 10 minutes for one hour after last light, and every 15 minutes for the two proceeding hours. If a bat is captured it will be extracted and moved away from the mist nets in order to reduce other bats being attracted to the distress call of the captured bat. We will take data on each captured bats species, age, sex, and mass. Bats will be released at most half an hour after capture.</p>

Explanation of existing data	<p>Capture data from bats in the Cypress Hills has been collected since 1991, and so we have data for this project from 1991 until now. The existing data was collected by other researchers and was used for many different studies over time. These researchers left their raw data available for others to use. Currently, only one of the project members has seen the original data. However, they have only seen the data from 1991-1992, and the 2019 dataset and they have not conducted any prior analyses or investigations of it. The other project members have not seen any of the existing data yet. Furthermore, this project assesses community structure changes before and after the detection of White-nose syndrome in Saskatchewan until 2030. We will not analyze the data until after 2030.</p>
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Data collection procedures	<p>Monitoring will start around mid-June every year, depending upon permit permissions. Monitoring will finish in mid-August. We will monitor community structure using the capture data we collect from mist nets.</p> <p>We will set up 1-3 mist nets at one site each night. Nets will be set up across Battle Creek. Nets will be at least 1m tall, and wide enough to cover the width of the creek. Nets will be set up at transition sites where the flyway above Battle Creek transitions from a cluttered environment with lots of debris to open sky. Nets will also be placed over calm sections of water, without ripples.</p> <p>Each mist net will be raised at last light and we will monitor net activity for three hours per night. Every hour we will record ambient temperature, cloud cover and wind speed. We will close nets if it is raining or wind speed is above 20 km/s.</p> <p>We will check the nets every 10 minutes for one hour after last light, and every 15 minutes for the two proceeding hours. If a bat is captured it will be extracted and moved away from the mist nets in order to reduce other bats being attracted to the distress call of the captured bat. We will take data on each captured bats species, age, sex, and mass. Bats will be released at most half an hour after capture.</p> <p>We will continue to return to these sites each year until 2030. We will also attempt to net at each site at similar dates each year.</p>
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Sample size	Our target sample size is 4000 individuals. However, we do not have a pre-determined count and cannot control the number of bats we capture each year.
Sample size rationale	We do not have control over how many bats we will capture a night. We are assuming based anecdotal knowledge and previous experience that in three months we will capture 100-200 bats, and after forty years of data collection we will collect around 4000 bats.
Stopping rule	<p>Data collection will end each year in mid-August. The field station where researchers live during the field season is owned by the University of Regina, who use the station for an undergraduate class during the last week of August. The field station is closed after that, so data collection will stop mid-August</p> <p>The project overall will end in 2030. White-Nose Syndrome was first detected in Saskatchewan in 2021. Ending the project 10 years after WNS was first detected allows us to observe bat community structure at the start of the disease, directly after it should have killed the largest number of bats, and ten years later when it should have become endemic to the population.</p>
Variables	
Manipulated variables	<i>TK</i> I'm assuming 'raw' abundance records will be transformed to some measure of frequency/ratio or otherwise 'extrapolated' to some measure of abundance?
Measured variables	We are going to be measuring the population size of the bat species in the Cypress Hills before and after the detection of White-nose Syndrome. We will measure this by counting how many bats of each we catch in mist nets each year.
Indices	Enter your response here.

Analysis Plan

Statistical models Enter your response here.

Transformations Enter your response here.

Inference criteria

Data exclusion Enter your response here.

Missing data We might expect bat records not to have a species identifier. As this is the data of interest these records will have to be removed as there is no feasible way to impute the missing data.

Exploratory analyses (optional) Enter your response here.

Other

Other (Optional) Enter your response here.

References

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- Frick, W. F., Pollock, J. F., Hicks, A. C., Langwig, K. E., Reynolds, D. S., Turner, G. G., . . . Kunz, T. H. (2010). An Emerging Disease Causes Regional Population Collapse of a Common North American Bat Species. *Science*, 329(5992), 679–682. doi:[10.1126/science.1188594](https://doi.org/10.1126/science.1188594)
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