

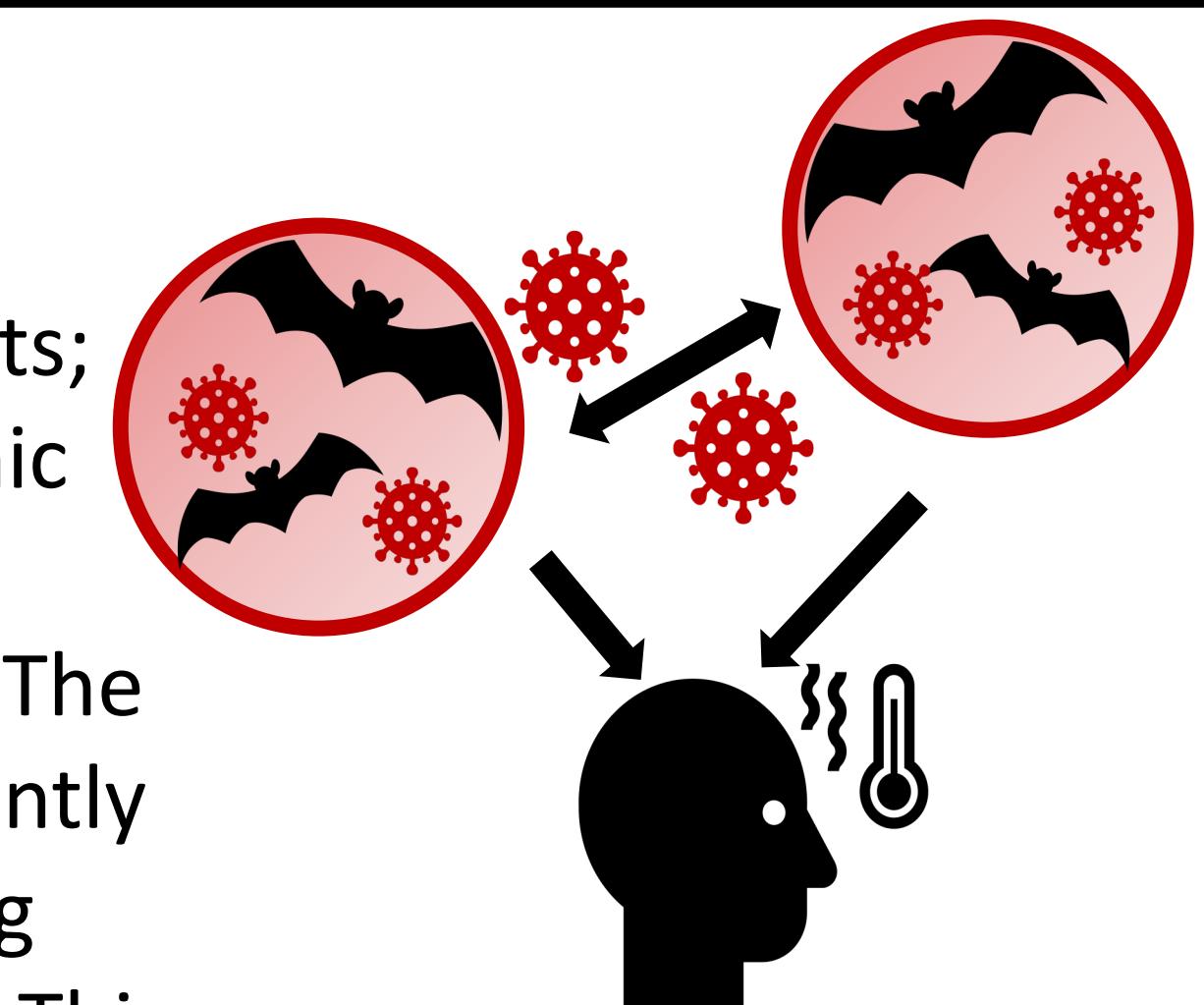
## Background

Bats are known reservoirs for the world's most virulent **emerging zoonoses**.

**Madagascar** is home to >40 species of bats; previous work has shown that the endemic fruit bats circulate potentially zoonotic henipavirus, filovirus, and coronaviruses. The largest fruit bat, *Pteropus rufus*, is frequently hunted for food across the island, creating frequent opportunities for **viral spillover**. This system is thus of great public health concern.

We can study **bat movement** can help us quantify zoonotic risk. We do this in two main ways:

1. Estimating **population connectivity**, or the amount that different populations interact, allows us to parameterize disease models that explore how pathogens persist across the landscape
2. Identifying **roosting and foraging locations** allows us to quantify human-bat proximity, a predictor of human-bat contact rates



## Objectives

1. Deploy GPS telemetry tags on representatives from bat populations of *Pteropus rufus*
2. Quantify population connectivity and identify roosting/foraging locations
3. Use metrics in a disease model to explore transmission dynamics and zoonotic risk

## Methods



### FIELD



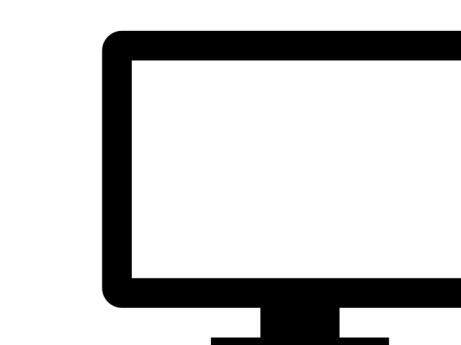
#### Tagging

We outfitted bats with a Lotek Inc. Argos/GPS transmitter attached to a lightweight, comfortable collar. Collars were sewn shut with vet-grade soluble thread.

To catch bats, we set up mist nets near roosts or in flyways. We monitor nets at dawn and dusk, as bats leave and return to their roost. Bats are removed from the net and processed immediately.



### COMPUTATIONAL



Data download from Argos web

R studio,  
Google Earth Pro

## Results

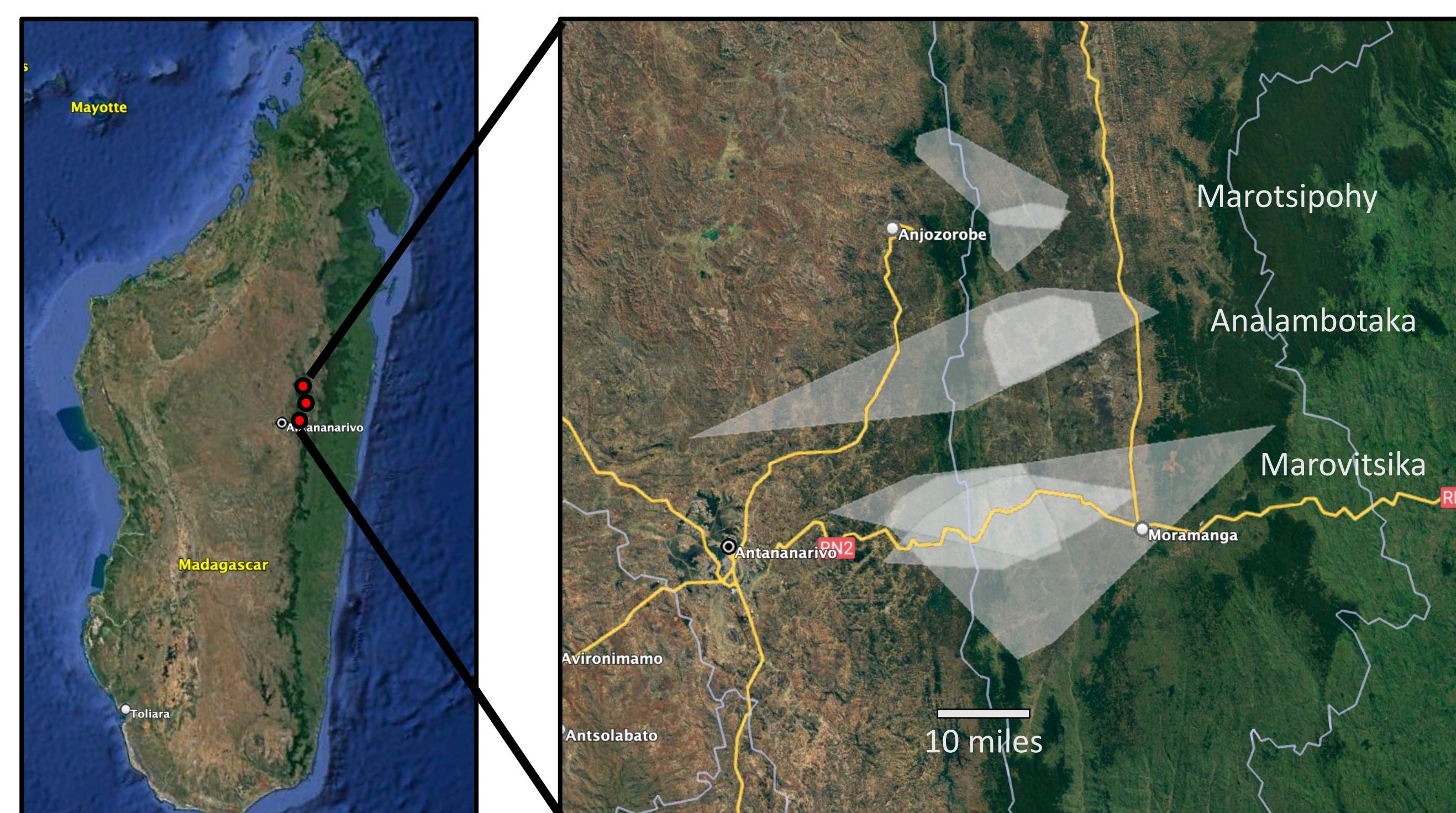
### Tagging



We tagged a total of 7 *Pteropus rufus* bats across three populations in the Moramanga area. Tags were programmed to take data every hour from 6pm – 6am, and once at 12pm.

| Date     | Site         | Sex    |
|----------|--------------|--------|
| 08/23/23 | Analambotaka | Male   |
| 08/23/23 | Analambotaka | Male   |
| 09/07/23 | Marotsipohy  | Male   |
| 09/08/23 | Marotsipohy  | Female |
| 09/11/23 | Marovitsika  | Female |
| 09/11/23 | Marovitsika  | Male   |
| 09/11/23 | Marovitsika  | Female |

### Population Connectivity



Map of Madagascar showing tagging locations in red circles. Home range analysis of telemetry data. Each white polygon represents the area of movement for a single bat.

#### Key takeaways:

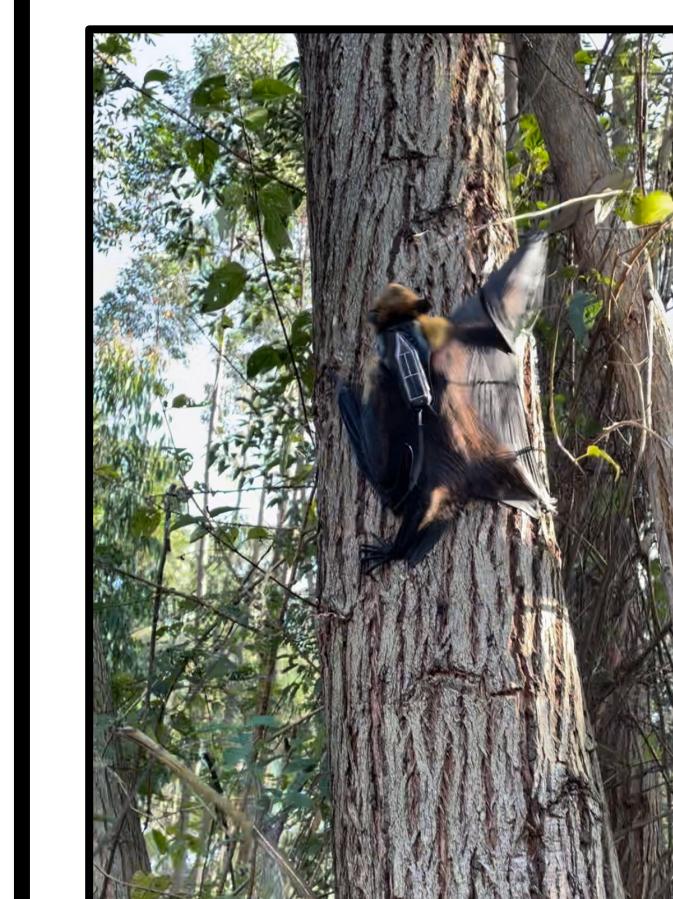
- Individual variation in home range size
- No evidence of population interaction
- Evidence of long-distance travel

### Roosting and Foraging Locations



Satellite image of a human settlement in the Moramanga area, with red circles indicating bat location data.

## Discussion



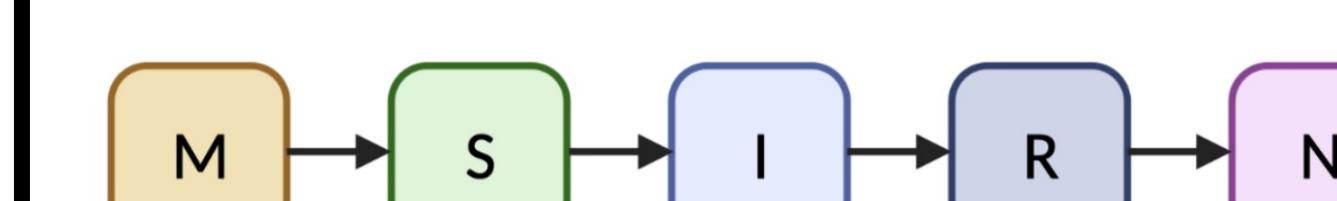
Although the telemetry data doesn't yet show direct evidence of population connectivity, the long distances traveled by some bats indicates the capability for interaction. The collars are intended to stay on the bats for up to one year, so it is possible that we will see evidence of connectivity in the coming months. Population interaction can promote pathogen existence by allowing for a continual influx of susceptible individuals.

The data does show that bats forage in extremely close proximity to humans, increasing the likelihood of human-bat interactions. Bats are hunted as a source of food across Madagascar, and it is likely this proximity makes such interactions more likely. This threatens both human health and bat conservation.

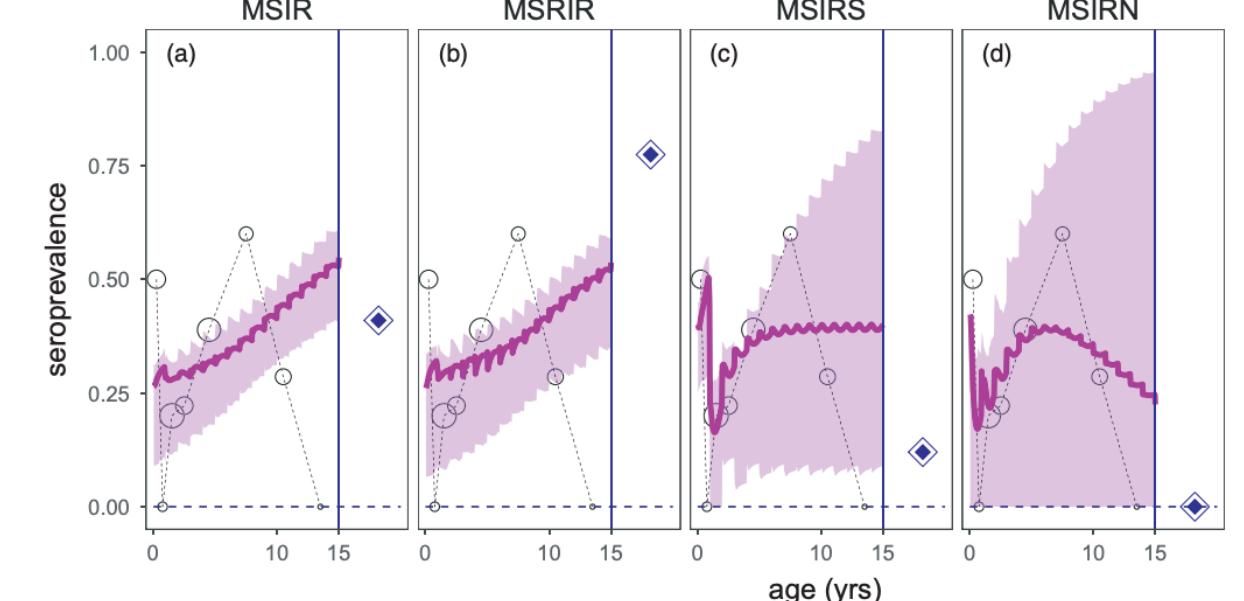
Notably, bat roosting and foraging changes with seasonal habitat and food availability. As the tags continue to gather data throughout the remainder of the year, we will be able to detect any important changes in these patterns.

## Next Steps

We will use estimates of population connectivity to parameterize a metapopulation disease model that explores how viruses persist in bat populations. Simulations from this model, along with estimates of human-bat contact, will allow us to predict areas of high zoonotic risk.



Brook et al 2019



## Conclusion



Results thus far demonstrate the potential for population connectivity, and close human-bat proximity. Given our understanding of the wide range of viruses hosted by these bats, this system warrants continued surveillance and study for the health of both human and bat communities.



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