Southeastern Cave Bats: Reservoirs for Future Populations?

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Introduction

Since 2006, white-nose syndrome (WNS) has devastated bat populations across the Eastern United States. The US Fish and Wildlife Service estimates the loss at more than 5.7 million bats. WNS and/or the fungal causative agent, *Geomyces destructans*, has been found in 21 states and 4 Canadian provinces, including AL, KY, MO, NC, OK, and TN (See Figure 1). Several southern sites have confirmed the presence of *G. destructans*, without the manifestation of WNS. Consequently, many sites have not documented the high mortality found in the northeast US. Additionally, some southern species, such as the Virginia big-eared bat (*Corynorhinus townsendii virginianus*), a federally listed endangered species, have not displayed the pathogen mediated damage associated with WNS, despite their suspected vulnerability to infection and exposure to the fungus. Recent research has demonstrated that WNS impacts different species in different ways, and to different degrees (Langwig et al. 2012). This research suggests that habitat variables, such as temperature and humidity, and social behavior, such as clustering, may impact fungal growth, host immune function and spore transmission. Geographical variation in sociality and behavior size is well documented in bats (Barbour and Davis 1969). This, coupled with site-specific climactic variation, may produce areas of reduced WNS-caused fatality. As such, the southeastern US may provide areas of refuge from this disease; such sites need prioritized protection if they are to act as reservoirs for future populations. We sought to compile WNS fatality data from across the range of the disease to identify latitudinal trends in mortality. We also identify actions that resource managers can take to protect bats in light of this disease.

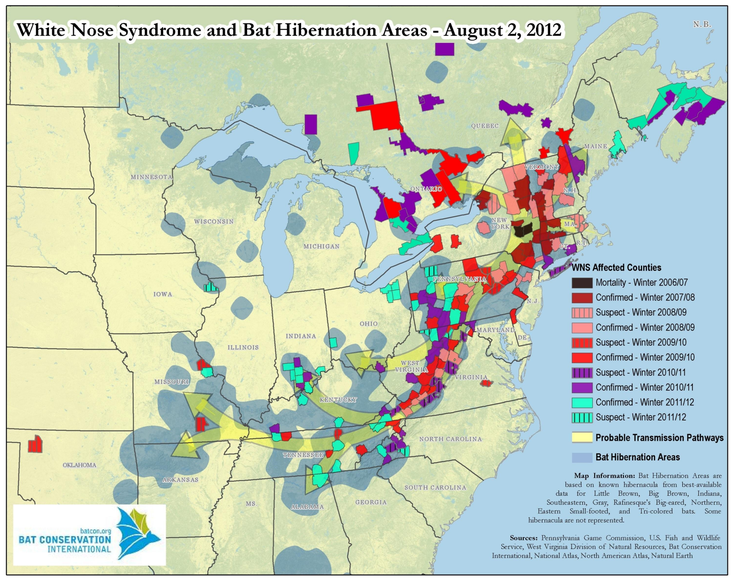


Figure 1. Current distribution of confirmed and suspect WNS sites in North America

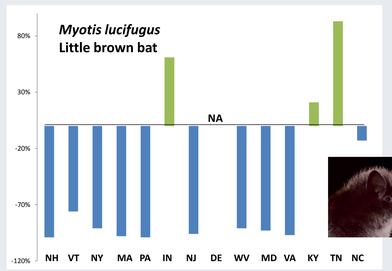
Methods

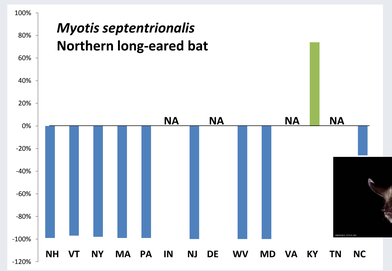
Bat Conservation International and the Southeastern Bat Diversity Network share similar missions which address bat conservation needs. As such, we partnered to collect, compile, synthesize and present the information below. We contacted state biologists in 17 of the 19 WNS-positive states. As WNS was new to Missouri and Alabama in 2012, we did not request mortality data from either of those states. From each state, we requested **1)** Pre-WNS roost estimates, by species, averaged across the states, **2)** Post-WNS roost estimates, by species, averaged across the state, and **3)** Percent decline, by species, averaged across the state.

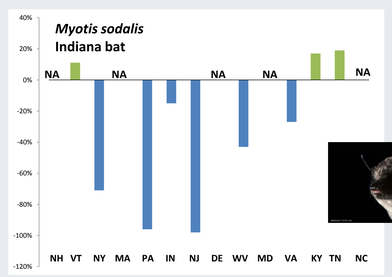
For data that was submitted, if raw numbers were provided, percent decline by species was calculated. All data was input into a master spreadsheet. Individual graphs were generated for each species to display percent decline. Within these graphs, states were arranged north to south to detect any trends by latitude.
Finally, as the collection of this data varied significantly among states, we collected a list of caveats associated with these data.

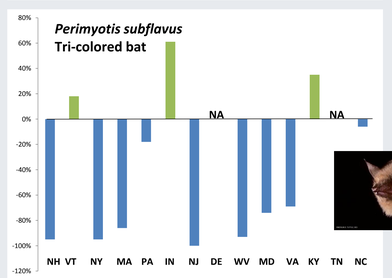
Results

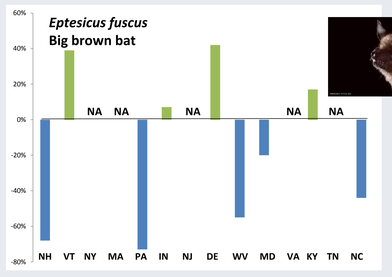
Data were collected from 14 of the 19 WNS-positive states: NH, VT, NY, MA, PA, IN, NJ, DE, WV, MD, VA, KY, TN, and NC. We were unable to obtain data from OH or ME. Data were collected for 6 species: *Myotis lucifugus, M. sodalis, M. septentrionalis, M. leibii, Eptesicus fuscus,* and *Perimyotis subflavus*. However, due to the broad geographic range of data collected, not every state had count data on each species. Data were most complete for *M. lucifugus* (10 of 14 states); the least-sampled species was *M. leibii* (5 of 14 states). Four species appear to have lower rates of decline at southerly latitudes: *M. lucifugus, M. septentrionalis, M. sodalis,* and *P. subflavus* (See figures below).

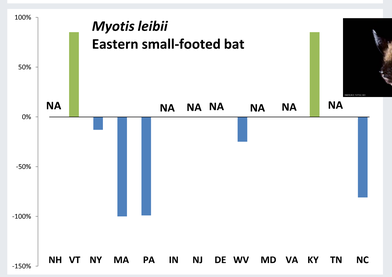












Discussion

This was the first compilation and examination of survey data for the six disease-impacted species across the range of WNS. Four species (*M. lucifugus, M. septentrionalis, M. sodalis,* and *P. subflavis*) appear to have lower rates of decline at southern latitudes. This is not uniform, however. Note that while some species are showing increases in some states (*M. lucifugus* and *M. sodalis* in KY), others states are showing declines that are comparable to the north (*M. sodalis* and *P. subflavis* in VA).
This data is preliminary and, was collated *a posteriori*, so caution must be taken. As several state biologists noted, data collection prior to WNS was opportunistic and may not be representative of population levels. Biologists in TN stated that pre-WNS estimates for *M. lucifigus* were based on counts at 3 sites, whereas post-WNS estimates were from 18 sites. A trend may appear due to low sample sizes, versus actual population decline. For example, pre-WNS counts were ≥ 100 individuals for *M. leibii* in 5 of the 7 reporting states (MA, PA, WV, MD, and KY). Additionally, NC warned that averaging percent decline diluted the mortality impacts at WNS-positive sites, where declines were as high as 81%. Finally, the latency period for WNS may be as high as 1-2 years; as such, the clinical signs of fatality may be underestimated, as WNS has only been present on the southern landscape for up to 3 years. Possibly, the rate of spread and/or severity of impacts in the south could be less due to milder winters and other factors, but that is yet to be determined. Although the data suggests reduced mortality at southern sites for 4 species – *M. lucifugus, M. sodalis, M. septentrionalis,* and *P. subflavis*, additional surveys and data collection is required to determine if southern sites provide a refugia from WNS.

Management Recommendations

WNS is a recently emergent wildlife disease. The novelty of WNS, coupled with the rapid spread, has left researchers with little time to develop new technologies to prevent bat-bat transmission or eradicate *G. destructans* from natural reservoirs. Current control strategies specifically target human-environmental transmission. It is imperative that southeastern resource managers take action to provide critical protections for bats. Individuals need to be as healthy as possible when facing the disease in the hibernating months.

- Minimize disturbance at hibernacula by regulating human entry
- Protect known hibernacula with bat-friendly gates
- Require USFWS-approved decontamination in scientific collection permits and underground survey efforts
- Identify and protect maternity roosts
- Where populations are roost limited, provide artificial roosting options
- Encourage safe exclusions and provide alternate roosts

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