

Proposal Title

Determining the Naturally Occurring Wing Damage of *Myotis velifer* in Oklahoma

Project Summary

White-nose Syndrome (WNS) is currently spreading across the U.S. killing millions of bats. WNS is caused by fungus, *Geomyces destructans*, which damages the tissue of the wing membranes of bats. The purpose of this research project is to determine the normal amount of wing damage found on bats located in Oklahoma. Once this baseline is determined it can be used to assess the amount of damage that is produced by *G. destructans*.

Project Narrative

Between 2006 and 2007, White-nose Syndrome (WNS), a deadly fungal disease of bats, was discovered in the United States in an upstate New York cave (Cryan, P.M *et al.* 2010). It has rapidly spread north to Canada, south through eastern United States and west toward Oklahoma, reaching 16 states by the end of 2011 (Raloff, J. 2012). WNS has been found in nine bat species, including two endangered species (Nijhuis, M. 2012). The mortality rate in the caves where bats hibernate (hibernacula) has ranged from 75-95% (Cryan, P.M. *et al.* 2010). It has resulted in the most devastating loss of bats on record and could cause species extinctions if left unchecked. According to a January 2012 U.S. Fish & Wildlife press release, nearly 7 million bats have died as a result of exposure to the fungus, *Geomyces destructans*, which causes WNS.



Geomyces destructans thrives in the cold, humid conditions of hibernacula (Weir, K. 2012). It grows most efficiently at temperatures from 1-15°C (Cryan, P.M. *et al.* 2010) and appears as a white powdery growth on the muzzle, ears, and wings of bats (Rogall, G.M. 2012). The fungus is capable of destroying wing tissue and invading other living tissue, which is an uncommon characteristic of a cutaneous fungal pathogen of endothermic animals (Cryan, P.M. *et al.* 2010).

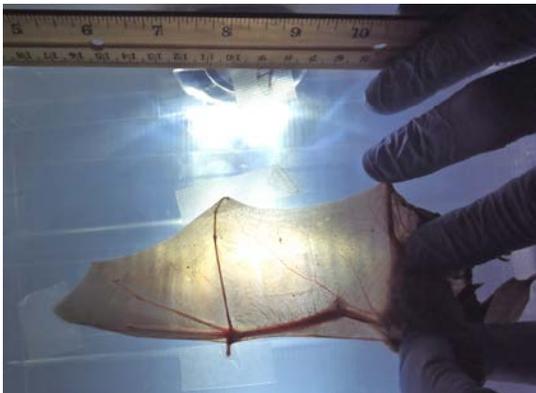
A recent study, in which bats with WNS were exposed to other healthy bats demonstrated that the fungus is spread within hibernacula by bat to bat contact exposure and proved for the first time that it is transmissible (Lorch, J.M. *et al.* 2011). Natural contact probably occurs during hibernation when the bats cluster together to conserve fat and to reduce water loss. During hibernation the fungus spreads and begins growing on the new host's skin. The majority of the skin exposed to *G. destructans* is found on the wing membranes (patagia) of the bat. That skin loses elasticity, tears easily, and suffers functional impairment (Cryan, P.M. *et al.* 2010). The wing damage results in the bat having excessive water loss through the skin, which normally helps to maintain water balance in the body (Nijhuis, M. 2012). This in turn causes the early and repeated awakening of the bat, which seeks water to avoid dehydration. Healthy hibernating bats wake once or twice a month. However, infected bats wake every four to five days

(Nijhuis, M. 2012). The infected bat burns its fat reserves during the extra activity, which leads to emaciation and death (Lubeck, M. *et al.* 2011).

Bats play crucial eco-service roles in ecosystems. They consume as much as half their weight in insects a night (Nijhuis, M. 2012). A million bats can eliminate 3.6 metric tons of insects per night (Weir, K. 2012). This reduces the number of disease spreading and agricultural pests that effect people, animals, and crops (Wibbelt, G. 2010). Insectivore bats in the United States save crop farmers at least \$3 billion a year by reducing the need for pesticides (Nijhuis, M. 2012). This emphasizes the importance of protecting bats from the deadly effects of this fungus.

Goals of the project -- The purpose of my research is to gain a better understanding of the role that wing damage might play in the death of bats infected with *G. destructans*. I will establish a baseline of the extent of wing damage that occurs in bats that are not affected by WNS.

Methods -- I will examine the wings of living and preserved species of bats native to Oklahoma to determine the amount of wing damage that occurs in these bats due to factors other than infection of *G. destructans*. *Myotis velifer*, the cave myotis, will be focused on because one individual of this species was reported to have *G. destructans*. To



make this determination I will construct a portable light table that will backlight the wing during examination for wing damage inside the caves and in the lab. The backlight will make areas of damage more visible so that I will be able to photograph the wing

with a digital camera. The images and image software obtained from the National Institute of Health will be used to determine the percentage of wing damage that is present. Another picture will be taken using UV light (365nm), which will also illuminate areas of damage and any fungal growth that might not normally be detected by the naked eye. Percentage of wing damage will be calculated for each region of the patagium (e.g. Plagiopatagium, dactylopatagium major, dactylopatagium medius, dactylopatagium minus, dactylopatagium brevis, uropatagium). Basic descriptive statistics will be used to describe the extent of wing damage found on the various regions of the wing, as well as the total wing. I will use bats from



multiple hibernacula in Oklahoma in order to represent the extent of variation from environmentally caused wing damage and to gather data from a variety of bat species. This process should allow us to determine and report a baseline for wing damage in *M. velifer* and other species and determine if there is significant difference amongst the various species.

Contributions to the field -- The baseline of natural wing damage will be available for comparison to the additional wing damage that might be caused by *G. destructans* and WNS. Wing damage and excessive water loss might then be shown to be the cause of frequent awakening during torpor, the depletion of fat reserves, and death of the bat. This can help to better understand WNS and the effects that it has on the various bat species of North America and hopefully assist in finding a way to prevent the extinction of species.

Citations/References

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Detailed Budget and Budget Justification

I am requesting \$500.00 for my 2015-2016 RCSA budget. The budget will allow me to purchase necessary equipment and to make the required trips to obtain data from the caves located at UCO's Selman Living Lab. I have described the need for this requested budget in detail below.

- Longwave UV Mini Light Source - S99187 Sirchie Finger Print Laboratories No.:CUV100T \$50.40 - This light will be used to illuminate damage of the patagium and to detect the presence of *Geomyces destructans*.
- Travel to and from UCO's Selman Living Lab - (352 mi x \$0.55) x 3 trips = \$580. I will be asking for \$449.60 for travel in order to not exceed the maximum \$500 total.