

The Wild Times

A Newsletter from Wild Things Sanctuary • vol. 2, no. 1, Autumn/Winter 2011

White Nose Syndrome: The mystery fungus killing our bats

The speed at which this problem has spread and the degree of impact on the bat numbers is, well its really beyond what anyone would have imagined. I don't think that it's an exaggeration to say, even in the field of wildlife study, there are few examples of disease issues that have been so virulent & complete in their impact. -Carl Herzog, NYSDEC

Unless you've been living in a cave these last few years you will have heard about the killer fungus that causes White Nose Syndrome and it's deadly march across the Eastern United States. But wait, if you'd been living in a cave, you might well be dead. *Geomyces destructans*, the fungus that causes White Nose Syndrome (WNS) is possibly the most deadly disease to hit wildlife in the United States and is causing one of the most precipitous wildlife declines in recorded history. WNS has killed millions of bats and every year pushes westwards leaving thousands more dead in its wake. The Little Brown Bat, once the most populous predator in the United States, is now threatened with extinction in perhaps as little as a decade if WNS is not stopped. And so far, five years after its appearance, no one knows how to stop this fungus and how to help the bats affected and threatened by its virulence.

The appearance and unrelenting march of WNS

In March 2007, New York biologists were surveying a cave near Albany when they came upon an eerie sight. "There are dead bats everywhere," they reported. In 2008 a 2006 photograph taken by a spelunker clearly showed a white-nose-afflicted bat in Howe Caverns, NY.

This became the first evidence of WNS in the US.

By the time the fungus was officially identified as a new species of cold-loving fungus in 2009, and



*The classic appearance of White Nose Syndrome on a Little Brown Bat
Photo Credit: Ryan von Linden/NY Department of Environmental Conservation)*

named *Geomyces destructans*, WNS had plowed through northeastern caves and had spread as far south as Virginia.

Since its deadly appearance, just 5 years ago, WNS has caused losses of up to 100% in some NE bat hibernacula (a place where bats gather to hibernate, e.g., caves and mines) and it is not uncommon to have loses of up to 60-70% in once healthy populations. Scientists have entered caves that once housed thousands of bats to discover only 20-30 sick individuals unlikely to recover. In an old graphite mine near Lake George, N.Y., where the bats once hung by the thousands in grape-like bunches, the number of bats plunged from 185,000 to 2,000 in three years. About 90 percent of affected populations along the East Coast have died. "Our bats are almost gone" reports Al Hicks, who was the first scientist to encounter WNS. And after only 5 years of WNS' appearance in Howe Caverns, one NY state biologist predicts that "Losing bats altogether from New York in the foreseeable future is a very real possibility" (Carl Herzog, NYSDEC biologist).

For the last few years, biologists have watched thousands of bats fly into their caves and mines for

hibernation, knowing that tens of thousands probably won't fly back out. "The worry is great, tremendous," says Greg Turner, a Pennsylvania researcher specializing in endangered mammals. By late winter the reports start coming in of the latest areas with confirmed WNS cases. It's a horrible feeling waiting and every few days hearing of yet another colony of bats that has disappeared or another state that has been infected. In 2011, cases of the mysterious disease were confirmed for the first time in Ohio, Indiana, North Carolina and Kentucky and in the Canadian provinces of New Brunswick and in Nova Scotia. So far, a total of 18 states, mostly in the eastern U.S., and four Canadian Provinces have been confirmed as infected.

What is WNS? How does WNS relate to Geomyces destructans? Why bats?

"White nose syndrome" describes the white fuzz that develops on the ears, nose and/or wings of hibernating bats infected by *G. destructans*. The fungus has also been known to completely cover the animal, attaching the victim to the cave's surface.

G. destructans can be thought of as a cave disease that uses bats as a kind of substrate on which to grow. It is a pathogen that can persist in a cave environment without the need for "host organisms" to stay alive; but the fungus *does* need a host in order to grow, and for *G. destructans*, the preferred host appears to be bats. It is possible that other species may contract spores of *G. destructans*, but these other animals do not provide a proper substrate for the fungus to proliferate and are therefore not vulnerable to WNS. Why are bats a good substrate for *G. destructans*? The fungus is "cold-loving" and thrives between 41-50°F. It is very unusual for a fungal infection to cause a warm-blooded animal to become sick, but the fungus strikes during the cold months when the bats are in their hibernacula in a state of torpor with lowered body temperatures.

What species get WNS?

At least six species are affected: the Little Brown Bat, Big Brown Bat, Tri-colored Bat, Northern Long-eared bat, Small-footed Bat, Virginia Big-Eared Bat and the Indiana Bat (the latter two are listed as endangered). Though the fungus seems to prefer the 25 species of hibernating bats, each of the 45 species of bats in the United States and Canada may be susceptible to WNS. The Little Brown Bat, the most abundant species in the regions currently affected by WNS, has experienced particularly dramatic population losses.

How did G. destructans appear in Howe Caverns?

The fungus appears to live in European caves without affecting bats. It is possible that the fungus was inadvertently carried on the clothes of a European tourist who went for a tour of the caves and may have brushed against a cave wall, depositing and leaving fungal spores behind. Support for this hypothesis is the finding that the fungus cannot be killed by simply washing clothes.

Letter from the President

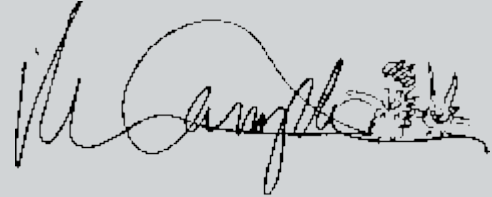
Dear Wild Time readers!

This issue of the Wild Times is dedicated to bats. Bats in the United States are facing one of the most deadly epidemics experienced by any species in recorded history. We need to be aware of what is happening to them and why they are an essential part of our ecosystem. Bats need our help!

As one of the few facilities in the area licensed to rehabilitate bats, Wild Things Sanctuary has had the pleasure to look after several of these amazing animals who can form life-long friendships in the same way as humans.

In other news, 2011 has proved an incredibly busy year for WTS as more and more people in the community reach out for help when they come across wildlife in trouble. At press time, I am very proud to report that this year has seen 68% of all incoming patients successfully released- far higher than the 50% average success rate of wildlife rehabilitation in the US. Many thanks to all the supporters and volunteers to help support our increasing patient load!

We wish you all a great holiday season, and remember to be aware of the wildlife around you!



Victoria Campbell, *President & Founder*

Mission Statement

Wild Things Sanctuary (WTS) is dedicated to helping native wildlife through rescuing and rehabilitating debilitated and orphaned/displaced animals until they are ready for release back into the wild. Eventually, WTS is also aiming to provide a sanctuary for non-releasable native animals.

WTS is also committed to improving the well-being of wildlife through public education; focusing on how humans can safely and peacefully coexist with native wildlife, and on wildlife's importance to man and the environment.

Become a friend of Wild Things Sanctuary

Here are 3 things you can do if you enjoy hearing about Wild Things Sanctuary and its patients:

- 1) Become a Friend of Wild Things and receive the monthly e-Newsletters. Each e-Newsletter has a story on one of our patients, wildlife tips, and information about any Wild Things events coming up.
- 2) Find Wild Things Sanctuary on Facebook for the latest pictures and news tidbits.
- 3) Follow WildThingsNY on Twitter

See www.wildthingsanctuary.org for more information!

How does WNS kill bats?

WNS causes cellular changes that affect the function of the skin on a bat's face and wing and tail membranes; research suggests that this may affect the bats in two deadly ways.

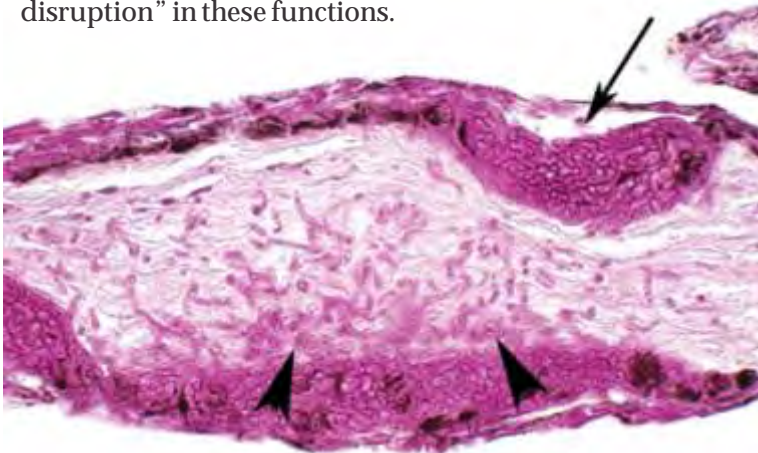
Theory #1: Hunger

Initial research indicated that the fungus may irritate the bat's skin, rousing the animal from torpor. As much energy as 30 days of hibernation is consumed each time the bat wakes up. In order to redress this energy need, the bat moves towards the entrance of the cave to look for food, but they find that it is still winter and there is no food, and no warmth. The bat dies of starvation and cold.

Theory #2: Thirst

But new research has demonstrated that it may be thirst and not hunger that is causing infected bats to wake up and move towards the entrance of their hibernaculum. Though the white muzzle of infected bats is the most obvious sign of the disease, it's actually the wings that appear to be particularly susceptible to the invasive fungus. Scientists believe that the way *G. destructans* invades bats' wing skin is unlike any known skin fungal pathogen in land mammals. The fungus digests, erodes and invades the skin by sending its tentacles through dead surface skin and into living dermis tissue - dissolving that tissue and using the liquid to feed itself.

But this does more than limit a bats ability to fly. Apart from enabling bats to perform amazing aerial feats, the bat's wings are also involved in many roles of homeostasis, such as regulating body temperature, blood pressure, water balance and blood and gas circulation and exchange. *G. destructans* interferes with the physiological functions performed by the bat's skin causing a "catastrophic disruption" in these functions.



A cross-section of a bat wing infected with *G. destructans*. This picture shows characteristic cup-like epidermal erosions filled with fungal hyphae (the long, branching filamentous structure of a fungus, that are the fungi's main mode of vegetative growth), as well as ulceration and the invasion of underlying connective tissue. In this case, the fungal invasion spans the full thickness of the wing membrane. Fungal hyphae can also fill hair follicles and destroy skin glands and local connective tissue.

Bat wings provide a large surface area for the fungi to colonize and grow, and once the wing is infected there may be a catastrophic disruption of homeostasis during hibernation, leading to the death of the infected bat.

From Blehart et al. (2011), *Microbe Magazine*, June 2011

Healthy wing membranes are critical in maintaining water balance in bats. During hibernation, bats are susceptible to dehydration due to their large lungs and exposed wing membranes; evaporative water loss from the skin can result in as much as 99% of total water loss in healthy hibernating bats. Bats counter this dehydration by selecting more



Pennsylvania Game Commission Biologist Greg Turner checks dead bats outside an abandoned coal mine. Photo Credit: Kevin Wenner/PGC 2009, PA

humid roosting spots, licking condensation off of fur and taking short flights to drink water (rehydration is hypothesized to be one reason behind the arousals in hibernating bats). But in infected bats, the fungus digests the delicate wing tissues, possibly causing unsustainable dehydration and triggering frequent arousals. And when the bats wake up to look for water, they are instead faced with a cold winter and limited resources, resulting in the premature depletion of fat stores. Bats have been observed leaving hibernacula affected by WNS and drinking from water surfaces or even eating snow—anecdotal evidence to corroborate the "dehydration hypothesis".

Why are hibernating bats particularly susceptible to G. destructans?

1) The body temperature of hibernating bats is in the range of maximal growth of the fungus.

2) During hibernation the drop in a bat's body temperature causes the immune system to also be in a torpor like state, inhibiting the immune response. Hibernating bats are not immunocompromised, but appear to have a suppressed immune system, which is a characteristic of the physiology of hibernation.

3) Behavioral strategies and adaptations that have evolved to maximize survival during hibernation, such as dense clustering in humid areas of a cave, may also enhance fungal growth and increase the infection rate.

Why does WNS result in such a severe mortality rate?

1) As outlined above, whether the bats wake up during torpor because of hunger or thirst, constant arousal during the winter months when there are limited resources is a death sentence.

2) *G. destructans* also destroys hair follicles, and sebaceous and apocrine glands. This disrupts protective secretions that moisturize and waterproof skin, and may provide a protective barrier against harmful microorganisms. Additionally, the secretions may supply nutrients to symbiotic, and possibly protective, micro-organisms.

3) *G. destructans* may also disrupt blood circulation, affecting core body temperature. Warmed blood could quickly lose heat through infected wings, and this means that the bat must use even more energy rewarming during arousals, which depletes even more fat reserves. In this way, wing damage creates an unsustainable cycle of energy loss.

4) Cutaneous respiration may also be impaired by *G. destructans*. During torpor this kind of passive gas exchange may be critically important when respiration rates are low. If this ability is impaired, compensation may occur by increased respiration by the lungs, leading to additional water loss.

Why do some species appear more susceptible to WNS than others?

Species of bats with a higher mortality rates due to WNS, such as the Little Brown Bat, Eastern Pipistrelle, and Northern Longed-Eared Bats, are often observed with condensation on their fur during hibernation. This suggests that these species are more susceptible to evaporative water loss. To compensate for water loss, these species choose more humid areas of hibernacula and cluster together: ideal conditions for the spread and contraction of WNS (which, in turn, causes them to become even more dehydrated). Species such as the Big Brown Bat, Small Footed Bat and the Indiana Bat are rarely observed covered in condensation and usually select drier areas of hibernacula. These species have a lower WNS mortality rate and more variable declines due to the disease.



The ground is littered with bat bones. There are so many of them- thousands upon thousands - that you can't take a step without crunching the underfoot."

-Elizabeth Kolbert describing the scene in the Aeolus Cave in Vermont.

Can bats survive WNS?

Despite exhaustive efforts by American wildlife rehabilitators and veterinarians, most bats who contract WNS do not recover. Even when the wings don't look too bad to the naked eye, a look under the microscope often reveals deadly damage already starting to take hold. This suggests that bats may be suffering more than we currently appreciate.

And if a bat does survive WNS, will it be OK? It is possible that injured wings, even if healed, may result in decreased flight ability and efficiency. Compromised wing structure and muscles may make wings unstable and harder to control in flight. Damaged sensory nerves may diminish the ability to sense airflow across the wing's surfaces, resulting in a decreased ability to control flight. (See box, "Wildlife Rehabilitation & WNS").

Are humans at risk?

No worries here! White-nose syndrome does not affect people. The fungus would never grow on human skin, it is too warm. Bat's are at risk because when in torpor, their body temperature will drop to within a degree or two of the cave's temperature, which brings the bats within the fungi's ideal temperature growth range.

Why are bats important to humans?

Bats may be the most underappreciated mammal on the planet. As a top predator of flying insects and as pollinators, bats serve an important role in the ecosystem. These little animals are voracious predators, consuming up to their body weight a night in flying insects. These insects include many human, agricultural and forest pests such as mosquitoes, moths and beetles. By reducing the numbers of pests, bats help reduce crop damage and the use of insecticides. Bats also serve as pollinators and seed disseminators for our crops. Without bats we face significant environmental and economic consequences.

As bats numbers dwindle towards extinction, farmers may start finding themselves without a major ally in the war against pests. Several species of bats can eat up to 1,200 insects an hour, or about 3000-7000 insects a night. One researcher compares this to a human eating 50 pizzas a day! The loss of the one million bats in the Northeast over the last 5 years means that there are between 660 and 1320 metric tons of insects that are no longer being eaten each year by bats in this region.

This appetite for insects may make bats the most overlooked non-domestic economically important animal in North America. Bats enable organic farmers to grow food successfully without chemicals. But even nonorganic farmers save millions of dollars every year by the bats' pest control services. In the U.S. alone it has been estimated that the pest

control service provided by bats to agriculture range from a low of \$3.7 billion to a high of \$53 billion a year. As increasing numbers of bats succumb to WNS, scientists have predicted that within 4 to 5 years noticeable economic losses could occur to North American agriculture.

This may be particularly true in the Northern Regions of the US, where agriculture is a multi-billion dollar industry, accounting for about 20% of all jobs across North Dakota, Montana and Idaho, and cold winters make it a perfect place for the fungus to take hold. In these areas, the estimated annual value of bats is nearly \$2.7 billion (nearly one-third of the market value of crops sold in these states). For these economic reasons, the USDA Forest Service is considering closing caves in North Dakota, Montana, north Idaho, and northwest South Dakota. As one regional forester comments, "I don't believe we can approach this issue with a wait-and-see attitude, once one cave in the region is affected, the likelihood increases for a more rapid spread among the bat population" (Leslie Weldon, U.S. Forest Service).

Apart from agriculture, bats play a pivotal role in keeping us healthy. The U.S. Forest Service has estimated that in the U.S. there are already 2.4million more pounds of insects each year due to bats who have succumbed to WNS, and that this number will grow exponentially each year. As the distributions of insects carrying diseases like West Nile virus, malaria and dengue fever continue to grow, our health is already at risk. But now, not only are there more insects carrying more diseases, but because of WNS there are fewer bats to eat them, and this could precipitate a major health crisis in the human population.

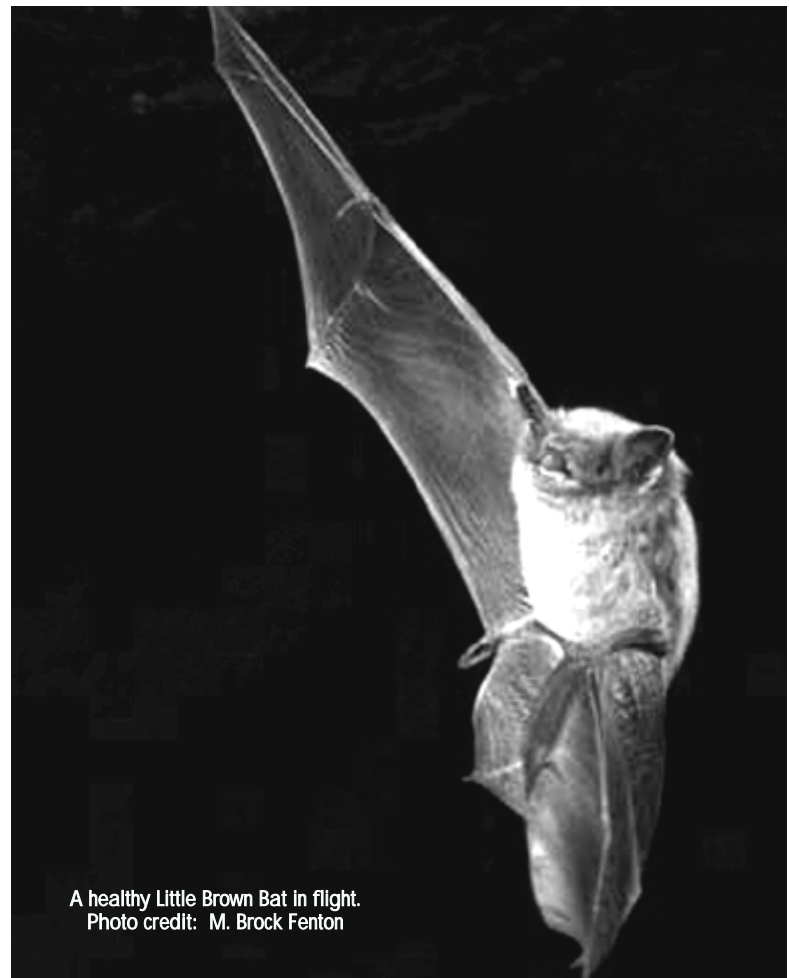
What are the scientists doing?

WNS is something entirely new; a fungus that kills a mammal and moves through a population and across geographic locations with great speed. The illness is sweeping across America so quickly that scientists are struggling to understand the fungus and counter its destruction before all of the bats are gone.

Here is what scientists have found out so far:

1) Bats are at high risk of being infected with *G. destructans* during the winter then their bodies are in torpor. At this time their immune systems are suppressed and their bodies do not fight off the fungus. Scientists examining infected tissue find that there is no inflammatory response to the infection. Though the lack of response may occur when the immune system is repressed it can also occur when the body does not recognize the infection as a foreign agent.

2) It appears that WNS is primarily transmitted from bat to bat, but fungal spores may be inadvertently carried to caves by humans on clothing and caving gear. It is unclear whether



A healthy Little Brown Bat in flight.
Photo credit: M. Brock Fenton



A Little Brown Bat hanging in its hibernacula and showing signs of White Nose Syndrome
Photo credit: from WV Department of Natural resources website

bats are still infective during the summer or if it is possible that the disease will spread to tree bats. If transmissible during the summer months, it is very possible that maternity roosts, where large numbers of bats gather during the warmer months, are a primary target for WNS infection. This might also account for the spread of the disease as bats who spend the summer in one state, but winter in another, can carry the fungus to their winter hibernacula initiating the spread of WNS in a previously unaffected area.

3) There appear to be similarities between *G. destructans* and the deadly fungus infecting and killing frogs worldwide at an alarming rate. Like *G. destructans*, *Batrachochytrium dendrobatidis* appeared suddenly, infects only the skin, and does not require a host organism for survival. In both frogs and bats, the skin serves physiological purposes that, when interrupted, can lead to death. Unlike other disease organisms (i.e., bacteria and viruses), fungi rarely cause death in afflicted organisms. What causes *G. destructans* and *B. dendrobatidis* to become deadly? While most pathogens have an evolutionary history with their host, these fungi may have become virulent alone, living in the water and soil without needing a host to survive, and only by chance growing upon (i.e., “infecting”) certain species and individuals (a process known as “accidental virulence”). This means that WNS will stay alive in deserted caves, ready to attack any bat that arrives for hibernation. *G. destructans* is able to drive a species to extinction because it survives without a host, laying in wait to infect the last remaining members of a species.

Similarities between the two fungi also suggest that it may be difficult for American bats to evolve a resistance to WNS. Though some researchers believe that evolving a resistance to the fungi is the best hope for American bats, like *B. dendrobatidis*, *G. destructans* may work too fast for evolution to save bat species from WNS. Bats normally live over 20 years and have only one offspring per year, which means that it will take a long time for bats to evolve resistance to this rapidly killing fungus and even longer for bat populations to recover. Over 200 species of frogs have declined or gone extinct; this is the greatest rate of loss due to

disease in recorded history. We can only hope WNS does not follow a similar pattern.

What's the plan to understand and tackle WNS?

It is incredibly challenging to tackle a disease in free-ranging wildlife species. A biologist writing on WNS states:

Mitigating diseases in free-ranging wildlife populations requires very different approaches from those applied in agriculture for domestic animals. Once established, diseases in free-ranging wildlife are rarely, if ever, eradicated. Biologists trying to manage WNS within bat populations face multiple challenges, including the need to deal with numerous host species, long-distance migrations of infected hosts, poor access to some host populations, impracticalities associated with treating individual wild animals, infected hosts that are sensitive to being disturbed and that inhabit fragile ecosystems, and environmental persistence of the pathogen. (Blerhart et al., 2011, *Microbe Magazine*)

Taking down WNS is going to be a great challenge over the coming years. Here are some steps that have already been put into motion:

1) As the deadly fungus spreads across the United States, collaboration is essential in order to mount a collective response to save the bat species from decimation. There are another 19 species of bats in the US who are obligate hibernators, and therefore have an increased risk of infection by *G. destructans*. In May 2011 The US Fish & Wildlife Service implemented a national management plan to address the threat posed by WNS. The national plan provides a framework for coordinating and investigating the cause of the WNS and is a cooperative effort with state and federal agencies, researchers, tribal land management agencies, universities and non-government organizations. Working together, sharing resources and information, the plan offers guidance to agencies as they make decisions related to managing their response to WNS. It also outlines the actions necessary for state, federal, and tribal coordination, and provides overall strategy for investigating the cause of WNS and for finding ways to prevent and manage the spread of the disease. Additionally the national plan aims to create an adaptive implementation plan to identify more specific actions needed, the entities responsible for implementation of each action, and cost estimates. The plan is designed to be a “dynamic document” that can be quickly modified in response to new information. “This is an issue that will take the efforts of all state, federal and tribal land management working together with partners, researchers and those in the recreational caving community,” says one official. “With everyone's assistance we hope to slow the spread of this disease” (Leslie Weldon, U.S. Forest Service).

Though the Interior Department has invested more than \$10.8 million towards investigating WNS since 2007, with more than \$3 million in research and support of ongoing research projects looking for methods to control or cure the disease, the restrictions, and site closures are the options currently available for managing the spread of WNS; these procedures will be reviewed as indicated by additional scientific findings.”

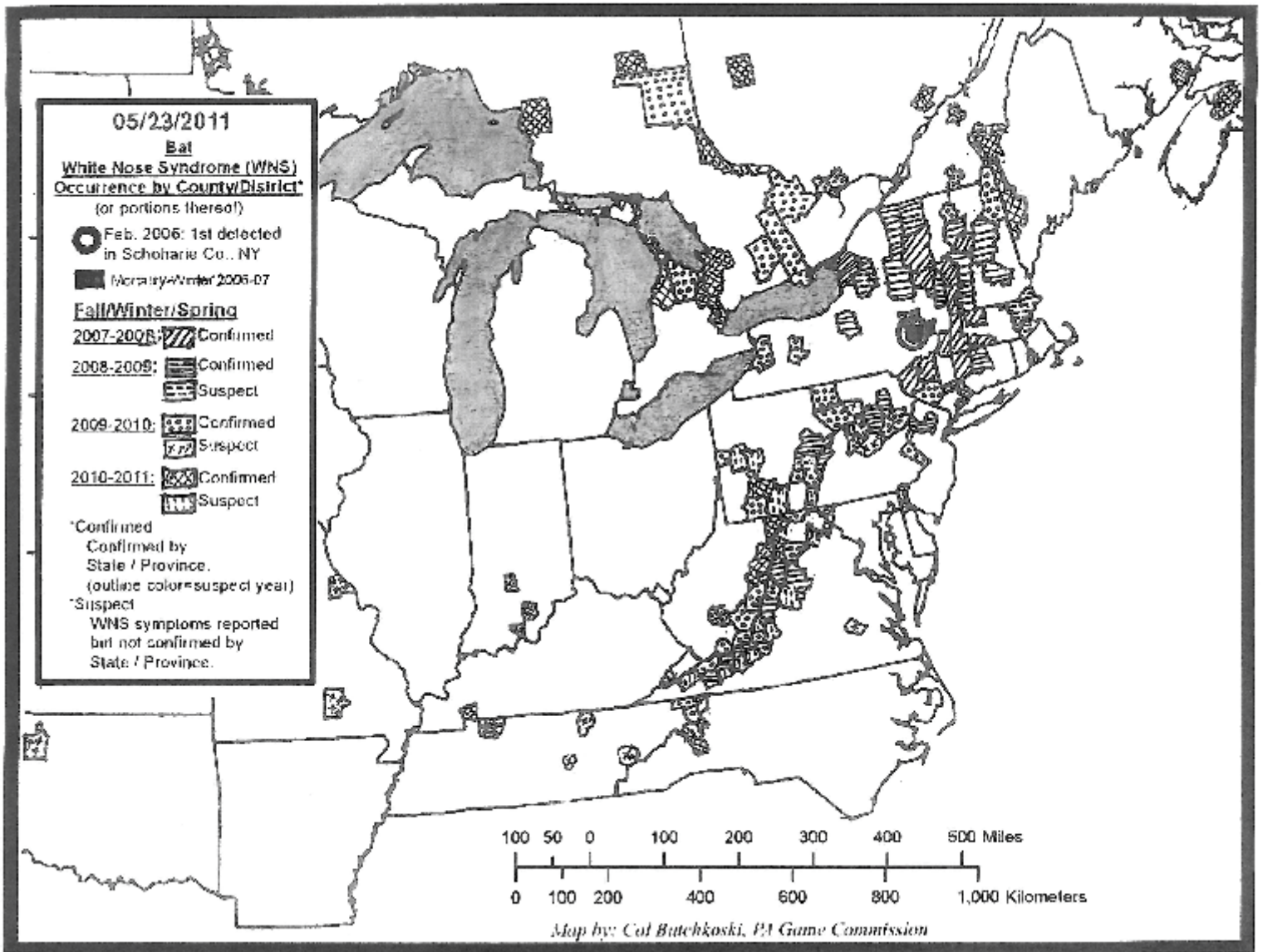
US Fish & Wildlife's national plan does not currently have any funding associated with it, though having it in place may help secure some federal money for research. At press time, they announced that this year, up to \$1 million will be available for high priority research projects related directly to the investigation and management of white-nose syndrome (WNS).

The full plan and additional WNS information available is at: www.fws.gov/WhiteNoseSyndrome/

2) There is evidence for human assisted spread of *G. destructans* in N. America. Apart from being the strongest hypothesis for why *G. destructans* arrived in New York in 2006, there have been long distance jumps of the fungus that exceed the known natural migratory distances of hibernating bats in North



The geographic range of the Little Brown Bat, taken from Fenton & Barclay (1980). By looking at this map, it is clear that if *G. destructans* continues on its devastating path, many more bats will succumb to WNS.



Since its first appearance White Nose Syndrome has spread in all directions at a frightening speed.

Map modified from US Fish & Wildlife Service website: <http://www.fws.gov/WhiteNoseSyndrome>

America suggesting that humans have helped spread the fungus. The U.S. Fish & Wildlife Service has taken a proactive stance to limit potential inadvertent human movement of the disease. These measures include cave closures on private, state and federal lands, increased surveillance, monitoring and education on decontamination procedures. As one bat expert writes,

We cannot yet rapidly screen sites for the presence of WNS fungus when visibly infected bats are absent, we cannot safely and effectively treat wild bats for WNS, we cannot decontaminate fragile cave ecosystems upon which bats rely, nor can we limit the natural movements of bats. Modifying human activity by implementing decontamination procedures, equipment restrictions, and site closures are the options currently available for managing the spread of WNS; these procedures will be reviewed as indicated by additional scientific findings (Jonathan Sleeman, USGS National Wildlife Health Center).

3) In America, bats appear to be a perfect host for *G. destructans*, providing nutrients, an ideal environment and offering virtually no resistance to the fungus. But *G. destructans* exists in Europe and does not appear to infect European bats. By comparing European bats and N.American bats, scientists hope to find out why N.American bats are so susceptible to the fungus and why the fungus is so “amazingly destructive” in this part of the world. European bats may have differences in behaviors, immune responses, susceptibility to water loss, skin secretions or symbiotic organisms that make them more resistant to WNS. European bats are also larger than their U.S. cousins; and as *G. destructans* depletes the fat stores in the small U.S. bats, larger bats with increased body mass may have greater ability to survive fungal infection. Additional research may also reveal that the American fungal species has subtle variations that make it more virulent than the *G. destructans* found in Europe. Or perhaps there are subtle temperature and humidity differences between American and European hibernacula that

patient news



Chippy Chipmunk

Chippy Chipmunk was a baby when she came to Wild Things last summer. She had been caught by a cat and was injured and separated from her mother. Because cats have such deadly bacteria in their saliva, she was put on antibiotics right away and survived the attack. After a few weeks of formula she was weaned, and once she learned to stuff her cheeks (as shown here), we knew she was good to go!

The Flying Sisters

These Southern Flying Squirrels were under an ounce when they arrived at Wild Things. They came from a litter of 4 quite close to WTS. A lady was sitting at home when her cat came in 4 times delivering these little tiny bundles one after another. When they came to WTS they were all injured and dehydrated and had to be put on medication to fight infection. Sadly, the brother didn't make it, but the sisters took off: literally! As they arrived late in the season they were not ready for release until October/November of last year, and by then it was too cold. Flyers do not hibernate, but nest with up to 50 individuals in one nest to stay warm. I was unsure that these little girls would find enough buddies to stay with over winter. So they stayed at Wild Things and had lots of practice flying and climbing. This spring they were successfully released into the woods.



Muskrat Trouble!

Early in the spring, WTS hosted its two first muskrats for several months. Both had been hit by cars and amazingly had not been killed. They both had head injuries, concussions, and only a few other little scrapes. The little girl pictured here had lost an eye and arrived so subdued from her head injury that I was unsure whether she would be able to be released; in fact her finder wasn't sure if she was still alive when she saw her on the road. But as her anti-inflammatory medication started working and easing the swelling on her brain, she recovered and resorted to busy little muskrat behavior and would jump in the air if touched unexpectedly. They both gained a lot of weight and enjoyed their donated fresh fish, and had lots of swims in my bathtub. Both were successfully released where they were found in time to enjoy the spring! Many thanks to the people who stopped for them and gave them a 2nd chance!



The Duck with half a beak

What happens when you are a lonely little duck with an injured beak? Apparently, you follow people around and look for help! This little mallard kept following different people home in a nearby town. They would put him back outside, and then he would follow someone else home. Eventually he was brought to Wild Things. Half of his top beak had been bitten off, and she was clearly missing quite a bit of feathers, probably from the same attack, but amazingly they were several week old injuries, and this little 4-5 week mallard had obviously been still able to eat to some extent. I didn't feel comfortable releasing him to the wild, and in fact was not entirely sure whether he was a wild or domestic mallard. But Farm Sanctuary in Watkins Glen generously extended an invitation for him to live out his life with them at their wonderful Sanctuary for rescued and abused farm animals. Many thanks to everyone who helped this lonely little guy find a home!



The "lost python"

When I got a call that there was a python in someone's barn I was intrigued! The finders caught it and brought it to me. Wild Things is not in the business of dealing with exotic animals, but I thought I might be able to find it a home. Well, imagine my surprise when I opened up the box to find this little Milk Snake! These little snakes are native to our area, and this little guy was probably just minding his own business catching mice in his barn home. I brought him back to where he was found and released him to back to his snakey home.

One strike & you're out!

Imagine you are trapped in someone's home trying to find way out. That is what happened to this Big Brown Bat ("big" but still under an ounce in weight!). Unfortunately instead of opening a window and letting him find his way out, they tried "ushering" him out with a hockey stick. One smack, and down he came. At least they made a good decision in bringing him to Wild Things! Though I set his broken wing the best I could, it did not align well enough to enable him to be the aerial predator that he had to be in order to successfully live in the wild. Lucky for him, he was taken in to a bat sanctuary. He has lots of friends there, but is apparently a bit bossy!



influence the virulence of *G. destructans*. As researchers find out more about *G. destructans*, they hope to find a “weak link” of the fungus that can be targeted in order to stop the infection and decimation of American bats.

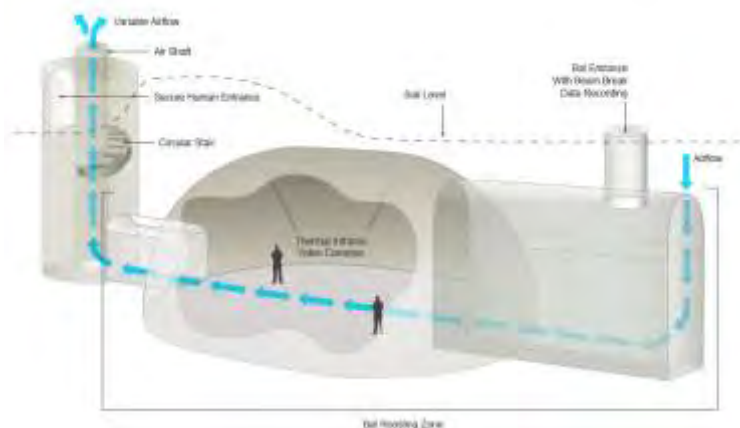
4) Videos are being made of bats in affected caves to study to study how the fungus may cause fatal changes in behavior.

5) Additional studies are looking at placing heaters in caves, studying bats' genetic susceptibility to the syndrome, and investigating ways to decontaminate caving gear, so that the fungus is not carried from cave to cave by spelunkers.

6) Scientists are testing fungicides that might rid caves of *G. destructans*. However, there is a fear that fungicides may kill other microbes in caves, perhaps setting off a chain of unintended consequences.

7) In Tennessee, the Nature Conservancy, Bat Conservation International and the University of Tennessee Knoxville are building an artificial cave free from fungus in an effort to entice bats from nearby colonies to switch homes. If successful it is possible that artificial caves could be located in areas with badly infected natural caves. The infected caves could be closed until researchers learn more about managing the fungus, and in the meantime the bats would have a healthy place to live (see picture below).

8) Many states as well as the U.S. Fish & Wildlife Service are considering extending endangered species protection to the species of bats most at risk of WNS. Though the listing will not necessarily address or solve the biggest threat to these bats, namely the disease itself, species listed as endangered may receive more funding for research. Additionally, listing a species as endangered is often followed by the development of a recovery plan and the designation of critical habitat for the species. Endangered species protection also gives these species “a voice” in the U.S. political and legal systems and increases public awareness and support.



The Nature Conservancy in Tennessee's proposed artificial bat cave, <http://www.nature.org/ourinitiatives/regions/northamerica/usa/tennessee/artificialbatcave.xml>

9) On the political end, U.S. Senator Frank R. Lautenberg (D-NJ) introduced legislation to create a federal plan for responding to wildlife disease emergencies. This bill is supported by several wildlife advocacy groups as it will give scientists more tools and funds to mount a response to devastating wildlife diseases like WNS. Senator Lautenberg also helped WNS research receive an essential \$1.6 million in federal support last year. This year, the US Fish & Wildlife Service recently announced that they anticipate up to \$1 million will be available for research projects related to the investigation and management of WNS.

How can humans help?

Our little insectivorous heroes patrol the night skies making us more comfortable and helping to provide food for our tables. And now, faced with a devastating sickness, these animals need, in fact they deserve, our help! WNS is the gravest threat ever faced by North American

bats and answers are elusive. Though we are not yet able to protect our little bat heroes from WNS, there are still measures we can take to help surviving bats. For example:

1) If you find a bat flying in your house, do not use violent measures to evict her. Bats can get in any tiny opening in your house and may get disorientated, desperately flying around to find a way out. Open a window and the bat will usually find her way out on her own. You may also, very carefully for everyone's safety, catch the bat in a towel and release it outside, or cover it with a container, slide on a cover and let her go outside.

2) Put up a bat house on your property to ensure that these animals have a safe place to live and raise young.

3) If you find a bat using your house for hibernation and it is not in the way of human activity, let him sleep if possible. Disturbing his hibernation could be fatal. Come spring, he will find his way out the way he got in. Once he is out, make sure you take measures to seal up any entrances in your house.

4) Stay out of bat caves. Until we discover how the fungus is being spread we need to be very careful about being accidental carriers of the pathogen.

5) If you observe more than six dead bats or large numbers of bats flying outside in the winter report those observations to the organization in your state in charge of Wildlife or to the US Fish & Wildlife Service. In New York state you can contact the Department of Environmental Conservation (DEC) in Albany at 518-402-8924 or fwwildlf@gw.dec.state.ny.us. Do not pick up sick or dead bats.

6) Support legislation that funds bat and WNS research.

In conclusion

I hope that this article makes you appreciate that we need to care about bats! As WNS spreads, scientists fear for the enormous hibernation caves in Kentucky and Tennessee where a million or more bats may hibernate in a single cave. Already, states to the west and south of the epidemic are putting precautions into place. In Wisconsin the Big Brown Bat, Little Brown Bat, Eastern Pipistrelle, and Northern Long Eared bat will be added to the state's threatened species list this year in order to provide protection to the bats in the face of the imminent threat of white-nose syndrome. Bats face one of the most significant disease threats to wildlife in history and as scientists race to solve WNS's deadly riddle, let's support our unsung bat heroes!



For more information and videos, take a look at:

Bat Conservation International, www.batcon.org

Bat World Sanctuary, www.batworld.org

US Fish & Wildlife Service, WNS page:
www.fws.gov/whitenosesyndrome

This Eastern Small Footed Bat arrived at Wild Things in October 2011. She was found on the ground in the middle of a city, moved to a nearby tree, and was still there after 36 hours. Something was wrong.

She came to Wild Things and appears healthy. Once warmed and fed, she flew beautifully and has been given a large enclosure to allow her to stretch her wings and fly. However, this little bat belongs to one of the species most effected by White Nose Syndrome; with cold weather approaching fast and not knowing whether her hibernacula may have been disturbed or whether she had had trouble during a migratory flight, it was decided that she would overwinter at Wild Things and be released close to where she was found in the early spring of 2012.

Thank you to the kind people who looked after her and made sure she ended up in a safe place with lots of delicious mealworms!

What are Wildlife Rehabilitators doing about White Nose Syndrome?

Wildlife rehabilitators in the Northeast have been working closely with wildlife agencies to care for bats and to research effective treatments for bats infected with WNS.

So far rehabilitators have noticed that some individuals may have more “mild” cases of WNS. It is hypothesized that those with more mild cases are the individuals who are able to stay in their hibernacula until spring, possibly using cave and mine resources to meet their hydration and nutritional needs. Alternatively, it is possible that the fungus grows in a specific area of the cave and once infected bats from that area die, new bats take their places. These new bats will not be hibernating in that area for as long as the previous inhabitants, so they are not as exposed to the fungus and end up with a more mild case of WNS. Only research will help explore these ideas.

If a bat has a mild case, or is found before the fungus takes a strong hold on its body, “good rehabilitation” with close attention to nutrition and changes in the infected individual may be able to reverse the fungus and allow the bats to get better, though this can take many months. A diluted vinegar solution applied a few times a day to infected wings has also appeared to halt the progress of wing damage and allow the wings to heal. Whether the vinegar has a direct effect on *G. destructans*, or affects harmful bacteria related to the fungus is unclear. In cases where the animals have severe lesions or holes in their skin an effective treatment has proved elusive.

Observations about a bat's immune response during hibernation (see main article) led researchers and rehabilitators to the discovery that if infected bats are artificially removed from hibernation and given food, water and warmth in a disease-free environment, they are able to recover. Obviously keeping millions of bats from hibernating is implausible, but right now, with our limited knowledge of *G. destructans*, the best way to save some of the most hard-hit populations of NE bats may be to let them settle into their hibernacula, remove them, hibernate them in a clean environment with careful monitoring, and then place them back in the hibernacula in the spring so that they can “wake up” in their natural setting and fly off to their summer roosts.

Is *Geomyces destructans* the Underlying Cause of White Nose Syndrome?

By Dr. June Kasminoff

Introduction: The Wild Times is lucky to have bat expert Dr. June Kasminoff weigh in on the cause of White Nose Syndrome. Dr. Kasminoff has been at the forefront of recording and rehabilitating bats in New York State for many years. With her great understanding of bat biology and the immune system she has come up with a hitherto unknown theory about why bats are getting sick. Read on!

In case you have been living in total isolation for the last five years let me explain to you what has been exterminating our bat population- it's a fungus that was first discovered in the caves and mines in New York State in 2006. It grows on them while they are hibernating in caves and mines. It digests them alive causing them to wake up early, dying from thirst and hunger-as their skin is being eaten away by this fungus. That is the theory....

My name is Dr. June Kasminoff. I am New York State's leading bat rehabilitator on the front lines fighting the effects of this fungus. I have a doctorate in podiatric medicine, and I teach chemistry with a special interest in bioengineering. My theory on why the bats are succumbing to this fungus infection is a little different, and you should be very concerned!

There are two facts that stand out to me concerning WNS infecting the bats. To begin with, this fungus, *Geomyces destructans* had never been found in New York, or even the United States; it is a foreign invader. *G. destructans* is similar to the fungus that causes wheat blight, and this fungus loves the cold. So the reasons why we refrigerate our food to keep mold and fungus away do not apply here. Where did *G. destructans* come from and how did it get here? Secondly, fungi are opportunistic organisms, only taking over when there is an obvious entry point or in an immunocompromised host. This means that the bats may well have weak immune systems for some reason. So, these are two unusual occurrences: a previously unknown fungus killing what we thought were healthy bat populations.

So why should you care? Can any facts about this bat tragedy be linked to human activity? First line responders and health care workers were all briefed after 9/11 on the indicators of a possible biological agent release. Two of the hallmarks of such a release are massive animal illnesses and/or die offs concentrated in one area. For me, the decimation of bat populations by WNS definitely meets this criteria.

The second area of concern, especially if you live in New York, is why and how would WNS start in New York? According to Richard Preston, author of *The Hot Zone*, in the 1980's the government released *Aspergillus* fungus into the New York subway system and the streets to test their biological tracking equipment.

Aspergillus was considered benign, only to be shown to cause infection in immunocompromised people. This made

me start wondering whether *G. destructans* could be one of those tests? Or was something else released to weaken the bats and make them more susceptible to this killer fungus? Wait, there's more.

What, besides hibernation, can be immuno-compromising bats? If we look at the European model of similar events, the horrible die-offs also occurred in Europe after the introduction of the new class of pesticides targeting the nicotine receptors on insect nerve cells. Bats eat three times their body weight in insects each night. By biomagnification the bats are consuming the pesticides as well. Is this immunocompromising them? Millions of bees are dead, and now bats: massive animal die-offs. This brings us back to the warning signs of a possible biological agent release. Could the culprit behind the WNS infections possibly be a biological agent designed to be a pesticide and thought to be harmless to people and animals?

Finally, ask yourself, why New York? Several other diseases have originated in or close to New York, such as Dutch duck plague (1967), Lyme Disease (1975) and West Nile virus (2000). What is it about New York? Can the origins of these diseases all be connected somehow? One mile off of Connecticut and the Northeastern end of Long Island sits Plum Island, home to the Plum Island Animal Disease Center (PIADC), a US federal research facility. After these diseases were discovered, stories were released from this facility claiming no connection to their animal testing activity. Yet, if you look at the epidemiology maps of Lyme Disease and West Nile (www.cdc.gov), and then compare them to the epidemiology map of WNS (www.fws.gov), you will be shocked at the similarities. Could it be possible that these diseases are a result of experiments gone wrong?

It doesn't matter whether or not you like bats; you need to appreciate their role in the ecosystem. They are intelligent, social, shy creatures who are now our canaries in the coal mine sending us a grave warning. Their immune systems are compromised, possibly at the hands of scientists, and that is the ultimate cause of why they are getting sick. If it wasn't *G. destructans*, another illness may well have targeted them. We need to be more aware of what our government is doing and we need to stop contaminating our environment with all these chemicals. Biological agents and pesticides should make us very concerned! These chemicals may well be killing the bats, and paradoxically, without bats we will be more dependent on chemicals and pesticides. In this vicious circle, we will wind up killing ourselves in the end.

If you want to help bats, please write to your government officials and ask them to support the WNS research, and encourage facilities to only turn wild bats over to professional bat care specialists who have years of experience in caring for these amazing creatures. By helping them you are helping you and your family live a healthy life

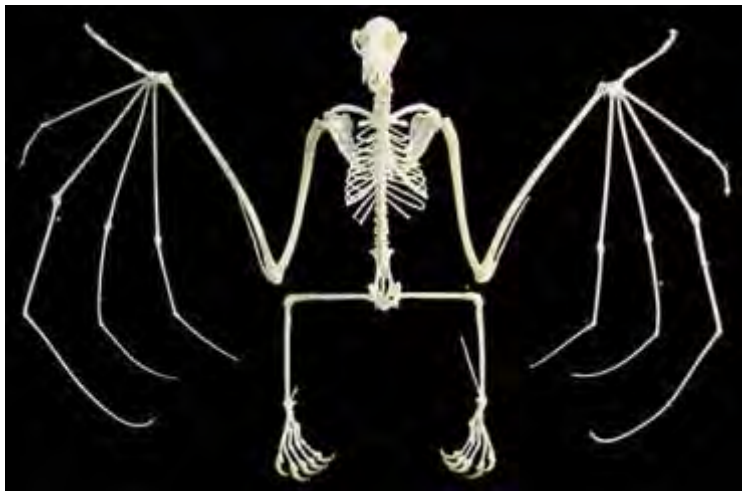
Species Highlight: Bats

By Adrian Williams

Bats, despite being much maligned in human folklore and superstition, are amazing creatures and are in fact beneficial to people. There are about 1,100 different species of bats, and they represent the second largest order of mammals, the Chiroptera, which is surpassed only by rodents. In fact, 20% of all mammals are bats, and these winged mammals thrive everywhere on the planet except the North and South Poles.

Bats are unique among mammals for their ability to fly (while flying squirrels also take to the air, they only glide short distances), and their wings consist of a long forearm, four fingers with thin, pliable skin stretched between, and a thumb reduced to a claw. Their young are born live and often cling to their mother as she flies in search of food, until in a mere 3-4 weeks they are ready to fly on their own. Bats are divided into two groups- "Microchiroptera" and "Megachiroptera". The latter, also known as "Megabats," and "Flying foxes" are nectar and fruit eaters and can be large, possessing wingspans up to 6 feet. Megabats play an important role in pollination. The former, "Microbats," consist of 70% of all bat species and are insect eaters. Microbats can be as small as just over an inch in length. A few of the microbats are carnivorous, including the vampire bats.

As if being able to fly were not amazing enough, insectivorous bats possess another wondrous adaptation: echolocation. The expression "blind as a bat" is not accurate but does hint at their generally poor eyesight. Bats in fact can see—some quite well—but most species have small eyes and poorly developed vision. They make up for their poor vision with a highly developed hearing and sonar ability. Whereas some nocturnal predators such as owls rely on large eyes to move about and locate prey, bats use



Bats may look a lot different from other mammals, but when you examine their skeletons one can see the similarities. They almost look like primate skeletons, with really long fingers!

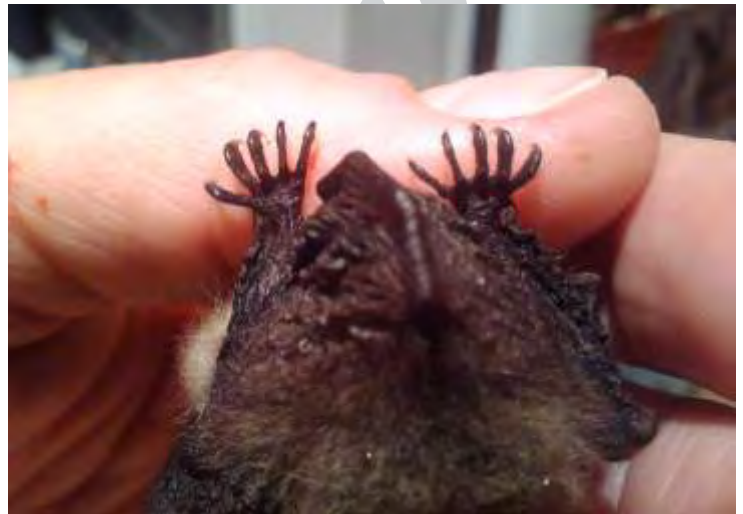
Photo credit: Google Images



This Little Brown Bat was found on the sidewalk on a cold March morning. When it came to WTS I thought it was dead...but a little movement and a lot of fluids later it revived and did very well, eventually released to the wild.

their prominent ears and a call-and-response system called echolocation. They emit high-pitched calls (clicks) and then listen to the intensity of the echoes, which indicates the size and proximity of objects in front of them. They are able to detect surrounding objects as far away as sixty feet or as close as half a millimeter, and use these echoes to navigate and to find food. Echolocation is used to determine the size, shape, direction, distance and motion of insects; its precision may be more accurate than 20/20 vision and can detect objects as fine as human hair and us used to catch insects the size of gnats. Some scientists believe that the principles of echolocation will help blind people find sight. This sonar system is far more complex than any invented by humans. If the bat's clicks were at a frequency detectable by the human ear, they would sound like a blaring fire alarm next to your head.

About ten species of bats are native to the Finger Lakes, but good luck distinguishing them! They can be difficult to



The feet of this Eastern Small Footed bat, are...well...small! But they are incredibly good at clinging onto just about anything- be it cave walls, towels or fingers as seen here! You can also see this bat's tail between its feet. Many species of Microchiroptera have a thin layer of skin extending from their body and running between their ankles to the tip of the tail, as seen here. This becomes a kind of "pocket" that can be used to help scoop insects out of the sky when hunting and/or to keep hold of a newly caught insect. In rehabilitation, bats will scoop this membrane up towards their bellies even when eating mealworms from a plate.

identify due to their fluttering airborne tendencies and nocturnal habits. Our most common species is the Little Brown Bat (*Myotis lucifugus*), which, with its 8-inch wingspan, can often be seen flying in open areas at dusk and into the night.

There is considerable diversity among bat species found in our area. Some roost in caves, some rest openly on tree branches where they resemble dead leaves. Some are solitary, others colonial. Some migrate south for the winter, but all can hibernate or go into torpor (bats are true hibernators along with jumping mice and woodchucks). All bats found in our region rely on insects for food, and so perform an important service for us by reducing the number of damaging crop pests and, to some extent, mosquitoes. While bats can carry rabies, this disease is actually quite rare in them and is of little concern provided we do not try to handle them. Statistics show that a person is more likely to be struck and killed by lightning than get rabies from a bat.

Recent research has shown that bats bond closely with family and friends and nurture lifelong friendships. They may have several social groups and even after long periods of separation they will remember each other. Bats also have a keen memory of their environment and may create and retain mental images of spaces, a prerequisite for future-planning.



Xrays revealed no broken bones, but in the dark circle the severe soft tissue swelling is clearly evident. Thank you Tanya Jackson of Eastview Veterinary Clinic in PennYan for helping with her Xrays, examination & medication!



To get the increasingly inflamed soft tissue injury under control she was given two kinds of antibiotics, a painkiller/anti-inflammatory medication and given a 2-3 times a day wing soaks in a special solution. She was amazingly good during all of these procedures.

~A Wild Things Bat Story~



Some of the Wild Times readers may have already heard the story about the Big Brown Bat trapped in a shutter. But for those who haven't...This "BBB" was trapped for over a day before she was rescued. She amazingly sustained no broken bones, but had severe soft tissue injuries. For over a month it was uncertain whether the nerve and blood supply to her injured wrist joint was healthy enough to allow the wing to recover...



She also gets a great diet while at Wild Things. This may look like just a plain delicious mealworm but she is munching upon, but in fact, all mealworms that are given to bats must be fed special foods themselves so that they are full of all of the right nutrients. The mealworms are also lightly dusted with vitamin powders and other power-boosters to help keep all Wild Things bat patients healthy and happy! Hopefully next spring will find this little girl back in the wild with her buddies!

Recently, this Eastern Small Footed Bat arrived at Wild Things after being displaced from her hibernacula. Her species is one of the smallest in North America and weighs about 6-7g...though after a big meal can get up to 7-8g! As you can see, she has a lovely soft coat.

Some of the smaller American bats are under 3 inches long and may only weigh 4g. That means it would take 112 bats of that size to weigh 1 pound! Despite getting parasites like any other animal, bats are very clean mammals and always groom their very soft fur. Different species can be distinguished by appearance, but also by the frequency of the pulses that they use in echolocation. They are fairly quiet animals, but will emit high frequency chirps and squeaks if bothered or communicating with conspecifics and other animals. Many species of bats have twins and, like other mammals, nurse their babies until they are weaned.





Dear Wild One,
 One evening I was following a particularly juicy sounding insect through the sky and found myself on a roof of someone's house. As I crawled around looking for my morsel it started to rain and I took shelter in a little pace I found. When I woke up I got confused and ended up in the house. I didn't want to be there and was scared! I flew around trying to find a way out. Suddenly someone started shouting "Rabies!" and hit me. When I came-to I was outside and flew away. Why did they hit me?

Signed,
 Hugo Bat


Dear Hugo,
 A lot of people are scared of bats. Why? Because people don't know that much about them. Though quite difficult to contract, rabies can be a deadly disease to all animals. However, only a very small number of bats actually have rabies, about 0.5%, the same percent as other mammals. In 2010 only 2.5% of bats tested for rabies in New York State actually had the virus (compare this to other species tested: 3.2% of cats, 8.5% of cows, 5% of horses and 7.7 % of sheep!), which means that many bats were needlessly killed for testing. Also, bats do not swoop down to attack people, but are more likely swooping down to pick tiny insects out of the air. A tiny animal is not likely to start a fight with a giant

confused as to why you were greeted negatively! Humans, if a bat gets in your house, open the window and let the bat find its way out on its own. Hugo, you were lucky not to be permanently injured. If the bat is injured call a wildlife rehabilitator. And know that bats love crawling under siding, or loose roof trim and can get through a ¼ -½" space and, so fix any openings in your home. Though bats provide a huge service to the ecosystem, human comfort and agricultural productivity, they are largely unappreciated by most humans. Learn about bats, how special they are and what you can do to help them!
 All the best,
 The Wild One

Stella's Corner
 Everyone can be a guardian angel to

Not to hurt our humble brethren in fur, feather or fin, is our first duty to them, but to stop there is not enough. We have a higher mission: to be of service to them whenever they require

~St. Francis of



I'd like to help Wild Things Sanctuary!

Enclosed is my tax-deductible gift of \$ _____

Name: _____

Address: _____

Please make cheques payable to Wild Things Sanctuary and send to:
 Wild Things Sanctuary, P.O. Box 713, Ithaca, NY 14851

You can also donate with a credit card online
 For this option see: www.wildthingsanctuary.org



The Chirp, Chatter & Growl

Dear Wild Times,
One night I was happily flying around eating lots of insects when suddenly I hit something and instantly I couldn't move! The more I tried to move the worse I became stuck. I was so scared. The next day a human found me. He brought me to a place called a rehabilitation center. They poked and prodded me and put all sorts of things on me. I didn't like it at all, but I got unstuck from the creepy thing! It took a long time but one day I was allowed to fly away and hope there are no more of these sticky monsters out there! What are they and why did they grab me?

Sincerely,
B. Batty

Dear Mr. Batty,
It sounds like you got trapped in a called "fly trap". These are strips of sticky goo designed to catch insects, but sadly make bats and birds can get stuck in them too. You were lucky that a human found you otherwise you may have starved to death. Humans, if you have to use a fly strip, consider wrapping the strip with chicken wire or hardware cloth so the insects go in, but other animals are protected. Take care!
The Wild One

For more information on all of these topics, see
www.wildthingsanctuary.org
or call *Wild Things Sanctuary*: (607) 200 4100



Wild Things Sanctuary
P.O. Box 713
Ithaca, NY 14850

