Bats Northwest News

BNW IS A NON-PROFIT, ALL VOLUNTEER CONSERVATION ORGANIZATION

SPRING 2008

Bats and Humans: A Helping Hand

by Kathleen Bander

What amazing adaptation do bats and insects have in common? No, it isn't just that insects are food for bats. Nor is it that flight is the main mode of transportation for both.

The commonality is the ability, only lately witnessed by scientists, of both bats and insects to "hover" in one place. It's an aerodynamic mechanism produced by the bat or insect flapping its wings downwards, creating a tiny cyclone of air known as a "leading edge vortex" (LEV). This provides enough lift force to keep insects and bats airborne in one place. Though the trick has been seen before in insects, until now it has not been witnessed in larger, heavier animals.

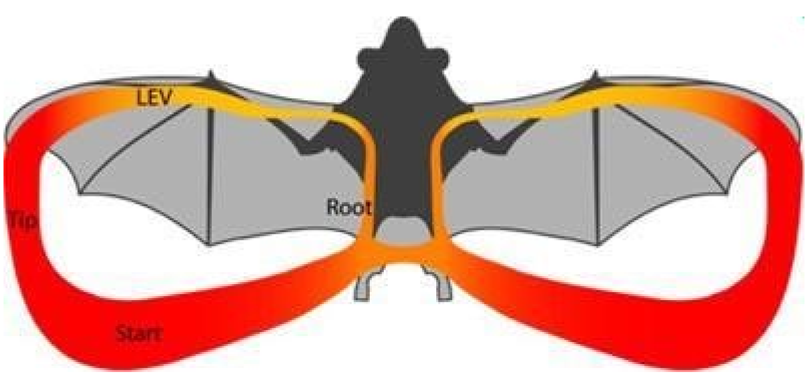
To test the observation, a joint Swedish and U.S. team set up feeding stations in a wind tunnel and then studied how the bats flew. They determined that leading edge vortices provide as much as 40% of the lift force that helped the bats stay aloft.

Bats go a step further by using their embedded thumbs and fingers as flaps like those on an airplane wing, to alter the curve of the wing and create the lift force needed to hover.

Scientists found that the reason bats are able to produce LEVs is because they can actively change the curvature of their wings using their elongaged fingers and muscle fibers unlike insects which rely on extreme speed.

So, why is this important? It's yet another reason that bats are important to humans: the findings lead researchers to ways to improve surveillance airplanes. "This shows we still have lots of engineering design inspiration to recover from nature," Anders Hedenstrom of Lund University said.

For those of us who follow all the research about bats, we find no surprise in that. If humans keep their minds open, and welcome new information from the natural world, there is no end to the benefits that can be found.



Graphic showing the LEVs that make bat flight and hovering possible.
Image courtesy of University of Southern California

Norma Fressel

Bats Northwest web site is waiting for you at:
www.batsnorthwest.org

Join our monthly BNW Meetings!

Second Tuesday, 6:30-8:30

Sand Point-Magnuson Park
Building 30 Conference Room

Bats Northwest
Envisions a Future

Where the Essential Role
of Bats is Understood

Where the Public Recognizes
the Vital Place of Bats In Our
Environment and Economy

Where All are Inspired by the
Remarkable Attributes and
Invaluable Contribution of
Bats to Our Natural Heritage

Board of Directors

Kathleen Bander
Heather Galvin
Meg Lunnum
Michelle Noe
Barb Ogaard

Technical Advisors

John Bassett
Curt Black
Russell Link
Sarah Schmidt

Newsletter Editor

Michelle Noe

Web Master

Michelle Noe

206.256.0406
www.batsnorthwest.org

Which Came First in Bats — Flight or Echolocation?

By John E. Bassett, Ph.D.

Science has always had to address questions which are known as conundrums. A good dictionary defines a “conundrum” as 1) a riddle whose answer is or involves a pun, 2) a question or problem having only a conjectural answer, or 3) an intricate and difficult problem.

A classic conundrum in evolutionary biology is whether the chicken or the egg came first. As it turns out, the egg actually did appear before the chicken when the first reptiles evolved the amniotic egg as an adaptation for life on land without the need of returning to water to reproduce. The chicken and the rest of the birds evolved from the reptiles later in the evolutionary history of the reptiles. The birds continued to use the amniotic egg to reproduce as they diversified during their subsequent evolutionary history. Thus the chicken or egg conundrum falls under the third definition listed above as “an intricate and difficult problem” because the answer, as currently understood, does not employ conjecture. The egg clearly appeared earlier in the evolutionary history of life than the chicken and the rest of the birds.

In the evolutionary history of mammals, scientists have recognized another conundrum involving the bats, the only true flying mammals. Debate has raged over whether the bats first evolved the ability to fly or the ability to echolocate (Speakman, 2008).

The “echolocation first” hypothesis proposes that small terrestrial or arboreal ancestors of the bats detected passing insects with ultrasound echolocation and then captured them by grabbing them from the air while remaining firmly planted on the ground or a branch. Such a foraging method would provide selective pressure for the evolution of longer forelimbs and the formation of inter-digit webbing which would provide a “catcher’s mitt” of sorts to aid in the capture of insect prey. The combination of elongated, webbed forelimbs and leaping behavior guided by echolocation to capture insects could select for true powered flight as an even more efficient way to snag an insect meal. In support of this hypothesis, 1) currently shrews (insectivores were once thought to be the closest living relatives of the bats) exist with primitive echolocation abilities, 2) primitive living bats use perch foraging where they hang from an exposed perch and briefly fly to catch passing insects detected by echolocation, and 3) biologists think it unlikely that bats would fly in the dark without the ability to orient themselves.

The opposing view, the “flight first” hypothesis, rests on the fact that echolocation is energetically much less costly when done while flying. A bat at rest must use energy to both breathe and produce ultrasound pulses for echolocation requiring substantial energy expenditure. In flight, however, there are minimal extra energetic costs to echolocate. Bats in flight take one breath with each wing beat and also send out a pulse of ultrasound all using one contraction of the same set of muscles. This multi-tasking physiology ultimately conserves energy. Adding echolocation to the ability to fly appears much easier to the proponents of the “flight first” hypothesis than the addition of flight to a pre-existing ability to echolocate.

All competing hypotheses proposed to answer a conundrum remain conjecture until data are collected which support one of the alternatives. Before early 2008, *Icaronycteris index,* the oldest fossil bat described at that time, failed to provide an answer to the conundrum. *Icaronycteris* was found in 1960 in the Fossil Butte member of the Green River Formation from Wyoming, USA (Jepsen, 1966). The fossil, which dates from the early Eocene approximately 52.5 million years ago, is considered to have consumed insects based on the teeth and to have been capable of powered flight based on the anatomy of the forelimbs and rib cage.

Icaronycteris and five other Eocene bats of younger age are also considered to have been capable of echolocation based on fossilized features of the ear, specifically the width of the cochlea of the inner ear relative to the width of the base of the skull and other characteristics of the middle and inner ear. The cochlea is a neural structure of the ear containing cells which convert the mechanical energy of sound into digital signals used by the nervous system to process information. Bats that echolocate must process large numbers of complex sounds reflected off of objects in the space they are entering. To deal with this large volume of information, they have evolved an enlarged "transducer", the cochlea, to convert these echoes into digital information for the brain to interpret. *Icaronycteris*, therefore, appears to date to an evolutionary stage in bats after the combination of powered flight and echolocation. Since this early bat was capable of both echolocation and powered flight, it did not help resolve the question of whether powered flight or echolocation evolved first.

Recently, a new bat from the early Eocene has been described which does provide information to resolve the conundrum of flight versus echolocation (Simmons, et al., 2008). The new bat, *Onychonycteris finneyi*, was found in 2003 also in the Fossil Butte member of the Green River Formation from Wyoming, USA. *Onychonycteris* is also considered to date to approximately 52.5 million years ago and to thus be a contemporary of *Icaronycteris*. This bat is considered to have been insectivorous based on its dentition and to also have been capable of powered flight based on the anatomy of the forelimbs and rib cage.

Even though *Onychonycteris* could fly, the forelimbs are considered more like those of terrestrial mammals than those of other early Eocene bats and thus to be more primitive than those of *Icaronycteris*. In addition, *Onychonycteris* had a claw on each of the five fingers in the wing while *Icaronycteris* had claws on the thumb and first finger only, a condition similar to that found in the megachiroptera today. Given these anatomic traits, *Onychonycteris* is now considered to be the most primitive bat known. When the size of the cochlea is compared to the size of the skull, *Onychonycteris* also appears to have been incapable of echolocation. The relative size of the cochlea was smaller than that in *Icaronycteris* and any of the other known Eocene bats, as well as being smaller than the cochlea in the insectivorous, echolocating bats living today. In fact, relative cochlear size in *Onychonycteris* matches that of currently living bats which do not echolocate, specifically the Old World fruit-eating megachiroptera.

When this new, primitive bat from the early Eocene is compared to previously described bats such as *Icaronycteris* and other known echolocating species, the answer to the conundrum of "powered flight first" versus "echolocation first" appears to come down on the side of powered flight having evolved first in bats with echolocation added sometime thereafter. As with any controversy in evolutionary biology which can be answered with fossils, the solution to this controversy may be revised again when the next fossil bat from the Eocene is recovered from the rocks and added to the history of life.

References

Jepsen, G. L. 1966. Early Eocene bat from Wyoming. Science, 154: 1333-1339.

Simmons, N. B., K. L. Seymour, J. Habersetzer, and G. F. Gunnell. 2008. Primitive early Eocene bat from Wyoming and the evolution of flight and echolocation. Nature, 451: 818-821.

Speakman, J. 2008. A first for bats. Nature, 451: 774-775.

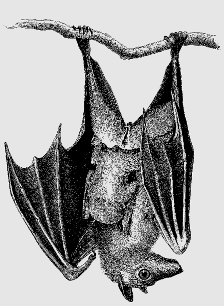
Our Mission

Bats Northwest Envisions a Future . . .
Where the Essential Role of Bats is Understood
Where the Public Recognizes the Vital Place of Bats In Our Environment and Economy
Where all are Inspired by the Remarkable Attributes and Invaluable Contribution of Bats to Our Natural Heritage

Many bat sites on the Web provide worthy information and great photos from around the world.

BATS NORTHWEST is focused on our regional bats, but there is so much to learn about bat conservation worldwide. You may enjoy visiting some of these sites.

www.batcon.org
www.wa.gov/wdfw/wildwatch
www.batsound.com
www.lubee.com
www.athertontablelands.com/bats
www.batbox.org
www.batworld.org
www.californiabats.com
www.batcrew.com
www.warksbats.co.uk



Bats in the Carpet

by Kathleen Bander

It isn't often that people come up with entirely new ways to build bat houses and find that they work. But observing what bats do naturally was what led one man to not only become a recycler extraordinaire, but to provide bats with choice housing.

A California man was in the habit of storing old burlap bags and carpet over the rafters in his small barn. One day he finally got around to cleaning up the barn, and discovered that bats were roosting in between the layers.

As the startled bats quickly flew away, it dawned on the man that if they had chosen to roost in the burlap bags and carpet scraps, then he could encourage them to roost in the same materials, only placed where he wanted to move them.

He used great ingenuity in constructing something that looked very much like a hanging file with folders. He used other rafters in his barn as the hangers. He found that six to twelve layers of carpet worked well, and that using only burlap bags didn't offer the bats enough insulation. The outmost layer should be something that really blocks drafts, like canvas or even plastic.

Using his research about bats, the man knew that they craved heat, so he placed his roost on the inside south and southwest walls, up high enough so the bats wouldn't be disturbed by his working in the barn. He likens his bat house to an "apartment" for bats, and believes it to be the most efficient and cheapest bat house around.

And around is exactly where he wants to keep his bats. He's impressed with how many insects they eat, and wants to keep his insect patrollers happy!

Burlap sack like those used in the bat house described.

White Nose Syndrome - Update

by Michelle Noe

White Nose Syndrome has spread further since Bat News first reported on it. Bats exhibiting symptoms have been found in New York, southwest Vermont, northwest Connecticut, western Massachusetts and possibly Pennsylvania. This is an additional 18 caves and mines in four states from the limited area of affect discovered in winter 2006/2007.

It is feared that the devastation from WNS this year could lead to many effects on humans. The syndrome itself does not appear to be infectious to cavers and researchers, but getting sick is not the main worry. Without the hundreds of thousands of bats (possibly as many as half a million animals may die) insect populations in the east may explode with the warmer weather. These insects unchecked could devastate crops and spread disease. The hibernacula with known WNS infection during 2006/2007 experienced 90% mortality. It won't be known until a 2009 census just how many bats died this winter.

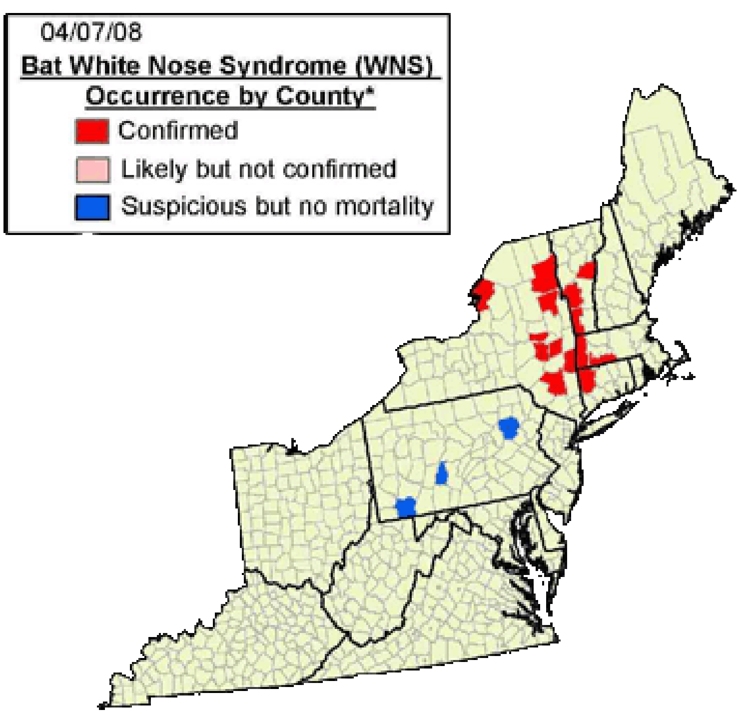
Indiana bat (ESA listed), little brown bats, northern long-eared, eastern pipistrelle, small-footed and others in the same caves have all been affected by WNS. Little brown bats have had the highest mortality.

A bat with visible fungus on muzzle and wings. Photo by Al Hicks

It is still not known what exactly is causing the syndrome. Gross necropsies have shown no effect to internal organs and there have been no specific viruses isolated in all cases according to Elizabeth Buckles, assistant professor of pathology, College of Veterinary Medicine, Cornell University, in an interview with NPR. The bats are basically starving to death. Both brown and white fat reserves are running out mid-winter. The brown fat reserves that bats depend upon to awaken in spring are not being found in the dead bats. Without the fat, some bats simply die where they hang without going out for that last ditch effort to find food above the snow.

Many theories for the cause of

Continued on pg 6



Map key: "Confirmed" = Mortality confirmed by state.
"Likely"=Mortality & fungus reported but not confirmed by state.
"Suspicious"= Fungus or other anomaly observed but no mortality at this time.
Map graphic: Cal Butchkoski

Keep up to date! Check out Bats Northwest's Website.

Watch our Events Page for news on upcoming presentations and field trips.

Continued from page 5

WNS have been put forward. In a Science Friday interview with NPR, Thomas H. Kunz, professor of biology and director of the Center for Ecology and Conservation Biology at Boston University, put forward the possibility that the bats simply may not have been able to put on enough fat before hibernation. This may have been caused by a lack of food due to pesticides or a pesticide in the insects blocking the ability to store the fat from the insects. So far there is not enough evidence to support any one theory put forth.

Other theories mentioned by Elizabeth Buckles include the possibility of an immuno-suppressive virus playing a role, but again, there has been no conclusive evidence and this possibility is thought unlikely. The initial toxicology tests for common pesticides and heavy metals have come back negative, but there are more toxicology tests to be run.

If WNS is being caused by a pathogen, it will likely take its toll without humans being able to intervene. After a pathogen has run its course then agencies will need to band together to try to strengthen remaining populations to rebuild what is lost. If WNS turns out to be caused by a toxin then it is important that we find the source as quickly as possible and work to control it before more damage is done.

The knowledge and available data on the WNS situation is constantly changing and new theories and possible causes are being discovered. To keep up-to-date visit the Bats Northwest website and click on the WNS links under Resources.

Bats at Elizabeth Mines in Vermont with WNS classic white muzzle.
Photo courtesy of the Herald of Randolph, VT

Bats in the snow.
Photo by Michael J Okoniewski.

South county student earns Eagle Scout

Eric Schmidt, 17, a home-schooled high school junior who attends Bellevue Community College as a Running Start student, recently earned the Eagle Scout rank. Schmidt is the son of Jim and Cindy Schmidt of south Snohomish County. He is a member of Boy Scout Troop No. 422 of North Lakes District.

Schmidt received the rank after completing his Eagle Scout project, which involved building eight bat houses that were placed at Woodinville's Woodin Creek Park, near the Sammamish Slough.

The project involved more than 60 hours of planning and a combined 240 volunteer hours, including research of the house design, meetings with a bat expert, and writing out a detailed project plan.

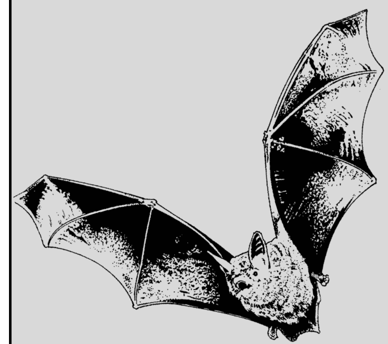
Schmidt successfully completed his project with the help of John Erdman, executive director of the Woodinville Chamber of Commerce, Brian Meyer with the city of Woodinville, McLendon Hardware, Ryan Erickson and Sunbelt Rentals, Bob Brodie and Matheus Lumber, and Dave Mullins and Greg Barr with Rinker Materials.

In addition to Scouting activities, Schmidt plays classical piano, is involved in theater and improvisation, practices archery, and is learning to speak Italian. He plans to apply to four-year universities in the fall.

Story from HeraldNet of Everett, WA
http://www.heraldnet.com/article/20080417/NEWS01/355916183

A Big Thank You to all of our wonderful Volunteers
who assisted at the
Northwest Flower & Garden Show 2008.

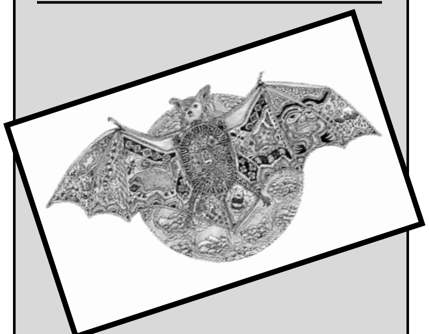
Thank you for helping Bats Northwest teach thousands
of gardeners about the benefits of bats.



Bats Northwest
206.256.0406
www.batsnorthwest.com

Bats Northwest Mailing Address:
P.O. Box 3026
Lynnwood, WA 98046
206.256.0406

Bats Northwest web site:
www.batsnorthwest.org



Become a Bats Northwest Member

Become a Bats Northwest Member.
Join us in the adventure to learn more about our bat neighbors!

Membership Options: ☐ $35 ☐ $50 ☐ $75 ☐ $100 ☐ Other $________________

Name:____

Address:____

____

Phone:____

Email:____

BATS NW T-SHIRTS

You'll look great in our Bats Northwest Long-Sleeved T-Shirt! It also makes a wonderful gift.
Heavyweight cotton, natural off-white, with a brightly colored bat graphic.

I WOULD LIKE TO ORDER ____ (QUANTITY) BATS NORTHWEST LONG-SLEEVED T-SHIRT(S) AT $22.00 EACH FOR A TOTAL OF $ ______ (AMOUNT).

SMALL__ MEDIUM__ LARGE__ X-LARGE__ 2X__

206.256.0406

Bats Northwest
P.O. Box 3026
Lynnwood, WA 98046