FEATURES

1 8,000,000 Fruit Bats
   Africa’s best-kept wildlife secret
   by Paul Racey

6 A Bat’s Eye View of a Hidden World
   Ultraviolet vision helps bats find flowers
   by Robert Locke

8 Changing Island Attitudes
   How one BCI member creates a commitment to conservation
   by Elaine Acker

11 A Partnership for Bats & Mines
   BCI and U.S. Borax go to work in Death Valley
   by Michael Rauschkolb

DEPARTMENTS

14 News and Notes
   Carving out a home
   Protecting Romania’s bats
   Bats reseed lost forests
   The call of the wild – part 2
   Volunteers make the difference
   The wish list

COVER PHOTO: This straw-colored fruit bat (Eidolon helvum) is munching on a guava fruit, an introduced species that has gone wild in parts of Africa. The bats normally feed on native fruits, spreading countless seeds that are vital to keeping Africa’s forests healthy. (Story begins on page 1.)

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BATS
Volume 22, No. 1, Spring 2004

www.batcon.org
PO. Box 162603, Austin, Texas 78716
(512) 327-9721 • Fax (512) 327-9724

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BATS (ISSN 1049-0043) is published quarterly by Bat Conservation International, Inc., a nonprofit corporation supported by tax-deductible contributions used for public education, research, and conservation of threatened and endangered bats.

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Bat Conservation International is dedicated to conserving and restoring bat populations and habitats around the world. Using non-confidential methodologies, we educate people about the ecological and economic values of bats, advance scientific knowledge about bats and the ecosystems that rely on them, and preserve critical bat habitats through win-win solutions that benefit both humans and bats.

A subscription to BATS is included with BCI membership: Senior, Student or Educator $30; Basic $35; Friends of BCI $45; Supporting $60; Contributing $100; Patron $250; Sustaining $500; Founder’s Circle $1,000. Third-class postage paid at Austin, Texas. Send address changes to Bat Conservation International, P.O. Box 162603, Austin, TX 78716.

BATS is printed on a 50/20 chlorine-free recycled paper with a water-based coating on the cover.
One of the great wildlife wonders of the world unfolds in southern Africa near the end of each year. As the sun sets, up to eight million fruit bats unfurl wings that average three feet (a meter) across, release their grip on the sagging branches of their tree roosts and take to the sky. A few lead the way, soaring off gracefully on those big wings. Then more follow, and more still, until the sky is filled with bats flying off in every direction. Three thousand metric tons (6.6 million pounds) of mammals in flight create an amazing and beautiful spectacle.

When millions of straw-colored fruit bats begin emerging at sunset from a tiny patch of Zambia’s Kasanka National Park, the sight (top) is spectacular. The bats are so tightly packed in their tree roosts (above) that branches sometimes break under their weight.
The straw-colored fruit bats (*Eidolon helvum*) begin to arrive in Zambia's Kasanka National Park in late October. Their numbers grow rapidly until, by the last week of November, up to eight million are packed into less than 2½ acres (one hectare) of evergreen swamp forest (known locally as *mushito*).

Fruit bats often space themselves about a wingspread apart while roosting, but not the Kasanka bats. Their roosting behavior is so distinctive that from a distance they look like swarms of honeybees, their densely packed brown bodies hanging from every bole and branch of every tree and even from one another.

So heavy are these dense clusters that branches often break, dropping bats to the ground. Some are injured in the fall and promptly eaten by crocodiles, monitor lizards, black mambas, pythons, civets and the occasional leopard.

Bat numbers peak at Kasanka near the end of November, then begin falling rapidly. After a few weeks, by late December or early January, the patch of forest is empty of bats. Why do so many straw-colored fruit bats converge on such a small area year after year?

*Eidolon*, a migratory bat that is one of the most important players in regenerating Africa’s forests, forms large colonies in widely scattered locations across the central belt of Africa. Major roost sites are known at Jinja and KAMPALA in Uganda; Ile-Ife and Lagos in Nigeria; Accra and Wli Falls in Ghana; Abidjan in Ivory Coast; and Dar-es-Salaam in Tanzania. The number of bats in these large, vulnerable roosts is thought to have declined in recent decades. The primary threats include human hunting for food and the loss of habitat to expanding agriculture.

An *Eidolon* colony in western Kenya, for example, has been looked after by a local farmer on whose land they roost. His sons want to clear the roosting trees for farming, but Bat Conservation International, Fauna and Flora International and IUCN — The World Conservation Union are working with local bat biologist Paul Webala to prevent this.

Straw-colored fruit bats often roost in tall trees in busy villages and towns and on lake or river islands. The colonies typically are huge, conspicuous — and extremely vulnerable to human persecution. In parts of Africa, particularly West Africa, they are hunted for food.

These are migratory bats that seasonally move 600 miles (1,000 kilometers) or more up and down this central belt. They have even been reported 120 miles (200 kilometers) out to sea.

The major roosts favored by colonies of straw-colored fruit bats have been used for centuries, raising the possibility that the bats living in them may have become inbred. So it occurred to me that a possible reason that the bats converge on Kasanka might be to mate with members of different colonies.

That idea bit the dust, however, as soon as we examined a few of the Kasanka bats.

The females were either pregnant, with a fetus in mid to late pregnancy, or were carrying newborn pups. Pregnant females apparently travel to Kasanka, probably migrating over great distances, because the area’s abundant fruits support the increased energy demands of pregnancy and lactation. This underlines the importance of the forests of Kasanka as a food resource for the bats.

I have been in many tropical forests but never one with such a synchronized abundance of fruits, the main ones being wild loquat (*Uapaca kirkiana*), water berry (*Syzygium cordatum*) and red milkwood (*Mimusops xyber*).

The trees are laden with these fruits. While returning to Kasanka’s Wasa tourist camp after watching the spectacular dusk dispersal, we often saw bats feed-
The Kasanka fruit bats are critical to healthy forests. Each night, they eat up to 6,000 tons of wild fruit and scatter seeds as they travel up to 40 miles (65 kilometers) from their roosts.

Accommodations at its two camps, however, that secret is about to be shared with many more people around the world. We hope the attention and ecotourist dollars will help protect these bats.

Conserving straw-colored fruit bats is crucial to the health of vast stretches of African forests and to the continent’s timber industry. BCI biologist Dan Taylor, for example, determined that this foraging species accounts for more than 98 percent of seed dispersal for the inko tree – one of West Africa’s most important and threatened commercial hardwoods (BAT’S, Fall 2000).

Canadian researcher Donald Thomas calls fruit bats “the farmers of the tropics” because they are by far the most effective spreaders of viable seeds for many important tropical trees.

Not only do straw-colored fruit bats sow seeds during their long migrations, but they also venture 40 miles (65 kilometers) or more from their roosts on nightly foraging flights, scattering seeds in their feces along the way.

And they eat enormous quantities of seed-rich fruit: Thomas found that a straw-colored fruit bat can eat nearly twice its weight each night. The Kasanka bats thus consume nearly 6,000 tons of fruit per night – imagine their impact on the growth of forests!

We have not determined where the Kasanka bats come from, but they seem to represent several widely scattered colonies. Reproduction in each colony is believed to be highly synchronized, and since the Kasanka females we examined were in various stages of pregnancy or had already given birth, they were unlikely to have come from the same colony.

Kasanka is not only a special place because of its...
Amazing Southern Africa

A BCI Founder’s Circle trip to a magical place

by Fiona A. Reid

After witnessing the staggering spectacle of 8 million straw-colored fruit bats taking wing from just 2½ acres of African forest, BCI Science Advisor Paul Racey wanted to draw international attention to this incredible wildlife resource. So, upon his return from Zambia’s Kasanka National Park in December 2002, he urged BCI Founder Merlin Tuttle to come photograph the bats.

Bat Conservation International went even further, organizing a Founder’s Circle trip to southern Africa with a focus on the fruit bats of Kasanka. The trip, featuring Malawi and Botswana, as well as Zambia, promptly sold out, and last November Merlin and I set off with 12 participants on an unforgettable African adventure.

Our trip took us to Mvuu Camp on the Shire River in Malawi, where we had the novel – if somewhat disconcerting – experience of rescuing mist nets from errant hippos, but not before capturing a large slit-faced bat (Nycteris grandidis). The rewards for day and night drives, hikes and boat trips were up-close views of a great variety of big and small game at Mvuu.

We also visited a pair of luxurious game camps in Botswana’s Okavango Delta, where we watched cheetahs and African wild cats – and came almost too close to a pride of lions that had just killed a full-grown hippo. Private planes took us from camp to camp, where excellent local guides enhanced our journeys. By day, some of us focused on the colorful diversity of birds, while others sought out exotic plants or Africa’s legendary big game.

We all enjoyed evenings spent mist netting bats at isolated water holes or in patches of riparian forest. We caught 19 species of bats, including the rare Botswana long-eared bat (Loephotes botswanae) and the beautiful Rupell’s pipistrelle (Pipistrellus rueppelli). Each stop on our tour charmed us with its own special character and wildlife, but the undisputed highlight came when we arrived at Kasanka and visited the straw-colored fruit bat colony at its peak density.

Some notes from my field journal:

November 15, 2003, 2 p.m.: Heidi Richer, a biologist studying the flying foxes, accompanied us to the colony. From more than a kilometer away, bat sounds fill the air. Soon the shapes of numerous large bats on the wing can be seen. We pass through a patch of forest where many of the trees are dead – an older roost site, now abandoned for lack of shade – and then reach the active colony. The bats pile up several deep on every branch. The outermost bats stretch, groom, argue and take flight, then everyone resuffles, searching for shade or just a place to hang. Some end up roosting just a few feet above ground. I have never seen tree-roosting bats packed so densely or so active by day. There are two small blinds where we can be in the midst of the colony without disturbing them.

6:30 p.m.: Sunset. Standing in an open area by a small river, I turn 360° and each and every horizon is literally filled with bats. Some are flying low, directly overhead, flapping slowly and gracefully with their long thumbs extended. All are heading out to find fruit in the surrounding forests. We watch until it is too dark to see, but still bats are pouring past on all sides.

We spent our last night in Africa in a deluxe hotel above Victoria Falls, a fitting finale to our unique African adventure.

FIONA A. REID leads BCI trips and workshops to a variety of destinations. She hopes to return to Kasanka with another BCI members group.

For information on this and other BCI trips, contact Andy Moore at amoore@batcon.org or (512) 327-9721.
fruit bats. It is the first privately managed national park in Zambia. Although it was declared a national park in 1972, the area was not managed, poaching was rife and it was in danger of losing its national park status.

When former British colonial officer David Lloyd visited the park in 1985, he saw few game animals, but heard gunshots, suggesting that poachers were still active and thus there must still be antelope to shoot. He asked the Zambian government if he could manage the park, and a ten-year management agreement was signed in 1990. It was recently renewed. Lloyd established anti-poaching patrols and the number of game animals increased, particularly puku and the extraordinary swamp antelope, the sitatunga.

Today, Kasanka is managed by a not-for-profit organization, The Kasanka Trust, based in Lusaka with a parallel organization in London that helps raise money for major projects. Tourist accommodations have been built at two camps in Kasanka: Wasa, which overlooks a shallow lake that attracts hippos and many bird species, and Luwombwa, on a bank of a river that offers fishing for largemouth bream and tigerfish.

As tourism grows, officials hope Kasanka will become financially self-sufficient. And as attention focuses on this magnificent spectacle, the future of millions of straw-colored fruit bats at Kasanka — and perhaps elsewhere throughout their range — might finally become more secure.

Paul Racey is Regius Professor of Natural History at the University of Aberdeen, Scotland, and a member of BCI’s Scientific Advisory Board.

To learn more about Kasanka National Park, visit its website at www.kasanka.com.
Many bats and plants, forever bound by mutual needs, march together in their struggle for survival – the loss of one can mean the end of the other. So, like an old married couple, each side evolves special strategies to accommodate the other. The latest discovery: At least one nectar-eating bat uses some very unusual biology to see ultraviolet light and examine a world, invisible to humans, where many rain-forest flowers shine brightly.

Bats that feed on nectar typically have long muzzles and tongues that are well adapted for reaching deep into open flowers and lapping the sweet liquid inside. In the process, the bats’ faces are repeatedly dusted with pollen, which they spread from flower to flower, pollinating the plants so they can produce fruit and seeds – and new plants.

To keep the bats coming, plants have evolved a wide range of bat-friendly colors, shapes and other characteristics. For example, most plants that depend on bats for pollination open their flowers at night, when the bats are out. In 1999, Dagmar and Otto von Helversen of Germany’s Erlangen University found that the Mucuna boltonii vine of Central America features an “acoustic mirror.” The vine’s blossoms are shaped to reflect a unique pattern of echolocation signals that guide bats into the best position for a sip of nectar and a dusting of pollen.

Now, in a remarkable series of experiments, scientists in Germany and Guatemala have discovered that at least one nectar-eating bat in Central and South America – Pallas’ long-tongued bat (Glossophaga soricina) – can see ultraviolet light, an extremely rare ability among modern mammals.
Many birds, insects, fish and reptiles can see ultraviolet light. Plants that are pollinated by bees and butterflies are known to take advantage of that ability by presenting very bright, ultraviolet "nectar guides." Such plants, black-eyed Susans, for instance, display a high-contrast, ultraviolet bull's-eye — a dark center surrounded by bright petals — that helps the insect quickly find the nectar- and pollen-rich center of the flower. These patterns are invisible to human eyes, which cannot see ultraviolet light.

Some neotropical plants that are pollinated by bats also have violet blossoms that very strongly reflect ultraviolet light. This led York Winter of the University of Munich, Jorge Lopez of Guatemala's University of San Carlos and Otto von Helversen, coauthor of the "acoustic mirror" report, to wonder whether bats can exploit this visual feature of their food supply.

To explore that possibility, the researchers conducted a series of "psychophysical" experiments with four bats in a computer-controlled artificial environment. First, they taught the bats over several months that they could retrieve nectar only from artificial flowers that were lit by small signal lights. Once that lesson was learned, the wavelength and intensity of the signal lights were varied. The bats kept responding to the feeding lights — meaning they obviously could still see them — well into the ultraviolet range. They were, however, unable to discriminate among colors; these bats are colorblind.

To determine how bats see ultraviolet light, the team flooded the artificial environment with single-color background light, then gradually lowered the intensity of the signal lights on the flowers. This experiment, which let the researchers determine when the signal lights became too faint for the bats to see, was repeated with different colors of background light.

The bats lost the signal lights at roughly the same intensity, regardless of background color. This is the pattern you'd expect if only one photoreceptor is active in the eye.

These results, bolstered by additional research, lead to an intriguing conclusion. The retina of the human eye has two sets of light-sensitive structures that convert light into the electrochemical signals our brains process as vision. One set of these photoreceptors is called cones, and each cone is sensitive to different wavelengths of light. We enjoy full-color vision because human eyes (and those of other primates) have three cones; most other mammals have only two cones and limited color vision. A few mammals, such as rodents and marsupials, see ultraviolet light because of a cone tuned to UV wavelengths. Humans and other mammals also have photoreceptors called rods, which we use for black-and-white vision in low-light conditions.

Although all bats have working eyes, most of them, because they work at night, have a rather unusual visual system. They have no cones at all, using only a rod receptor for vision. The latest research shows that this receptor, at least in G. soricina, is sensitive to light wavelengths of 310 to 600 nanometers. Humans see visible light from about 400 to 700 nanometers, which spans the colors of the rainbow. UV light ranges from around 100 to 400 nanometers.

Pallas's long-tongued bat is an essential pollinator of many important rain-forest plants in Central and South America. This one is taking nectar (and pollen) from the tropical shrub Mabea occidentalis.

Another critical factor in bats' ultraviolet vision, the researchers report, is the absence of a UV filter from the lens over their eyes. A strong filter blocks the potentially damaging ultraviolet light from the eyes of humans and most other mammals.

Ultraviolet vision based on a single rod receptor was unknown in bats or other mammals before Winter and his colleagues reported it in the journal Nature last fall. They suggest that at least some bats evolved this unique UV ability to better locate nectar-rich flowers in the darkening evenings, when the waning light shifts toward the ultraviolet end of the spectrum.

Only additional research will determine whether other bat species, particularly nectar-feeders that are closely related to G. soricina in the tropics of the Americas, share this unusual adaptation.

Bats, with their incredibly precise echolocation and sometimes super-acute sense of hearing, "see" their environments far differently than other creatures. This new discovery adds yet another unexpected dimension to the unique world of bats.

ROBERT LOCKE is Director of Publications for Bat Conservation International.
Changing Island Attitudes

How one BCI member creates a commitment to conservation

by Elaine Acker

Lois Blumenthal strolls casually into the Cayman Islands Northward Prison workshop. Inmates greet her with a pleasant island lilt, “Good morning, Bat Lady.” Today, they are building houses for bats, and while they sometimes seem a bit amused at the idea, they are eager to help this enthusiastic woman who is changing island attitudes.
Blumenthal arrived on Grand Cayman, a British territory 480 miles (770 kilometers) south of Miami, in 1990, when her husband Jim retired. They packed up their two children, Janice and David (then 11 and 7), and turned their favorite vacation destination into their permanent home. A member of Bat Conservation International, she volunteers as BCI’s Caribbean Coordinator for Bat Conservation.

Her commitment to bats and BCI began a decade ago. She homeschooled her children and discovered the sad plight of Cayman Islands’ bats during science studies. “A pest-control company had a float in the Pirate’s Week Parade featuring rats, roaches and bats,” she recalls. “We didn’t know much about bats but thought they didn’t belong in the same category as non-native pests. We wrote for information from BCI. When the materials came and we read that bats have only one young per year and how important they are to ecosystems, we realized that this single pest-control company could do enormous damage.”

Blumenthal requested a BCI slide show and launched her first public-education campaign. Efforts to contact the pest-control company were met with hostility. “Here in the Cayman Islands, bats form colonies under people’s roofs, and this can be a serious nuisance,” she says. “When I first began working to conserve bats, they were all called ‘rat-bats,’ pest-control companies were poisoning them, and the Cayman Islands Health Depart-

ment was erroneously advising that bats be killed because of ‘disease.’ People were either living with the odors of bats or using drastic and usually ineffective methods to try to remove them.”

Things have changed since Blumenthal began working for bats. Now islanders usually call her first if they have a bat problem. Pest-control agencies use humane exclusion methods with one-way valves that let bats leave but block their return, and bats are not excluded during the summer birthing season. Blumenthal has created a Bats Study Guide for the Cayman Islands and gotten bat-educational materials in all island schools. The media portrait bats in a positive light, and most residents appreciate the ecological benefits of bats.

“The whole family has helped with bat counts, answered hundreds of phone calls, loaded and transported heavy bat houses and been very supportive in every way,” she says. Her kids once climbed into sweltering roof spaces, dripping sweat while roaches ran up their legs, to rescue a group of exceptionally stubborn bats that refused to use the exclusion device. “Only once, when David was 14 and I planned to sell bags of guano at the Agricultural Fair, did he beg me, ‘Mom, please don’t make me be the kid whose mom is selling bat poop at the fair.’ I had to honor this request, although now that he is grown and beyond the reach of peer pressure, I’m planning to sell bags of guano at the next fair in March.”

Blumenthal’s schedule rivals that of any full-time executive. On a typical day, she rises early to call a local hardware store to schedule a delivery of bat-house materials to the prison. By midmorning, she’s presenting an educational program at an elementary school. At noon, she meets with a homeowner who’s concerned about bats living in her roof. Then she dashes off to meet the staff of Caribbean Utilities Company Ltd. (CUC) – one of her most active partners.

Her efforts to install bat houses for excluded bats really took off when CUC agreed to donate and install utility poles for the houses. “CUC recognizes the

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*Image: White-shouldered bats (Phyllostomus hastatus), once thought to be extinct on Grand Cayman, were discovered by BCI member Annie Bond in the island’s Lower Valley Forest.*

*Image: Warden Leonard Jarvis watches Murph Powell and Randale Rankin build a new bat house to help conserve the island’s colonial species. Thanks to Lois Blumenthal, bat house building has become a popular pastime for these and other inmates of the Cayman Islands Northward Prison.*
B.CI member Lois Blumenthal (right) visits with Miss Hulda H, a Cayman Islands resident who is now excluding bats from her attic using humane methods. The pvc pipe placed beneath the eaves allows bats to escape, but keeps bats from reentering the attic.

While the news is mostly good from Cayman, Blumenthal worries about bats on other islands. “Though Caribbean islands share similar ecosystems and species,” she says, “communication among them is not easy. Travel to another island usually involves changing planes in the United States.” So she founded an Internet forum (*Caribbean-bats@yahoogroups.com*) that lets over 50 members around the Caribbean communicate instantly, ask questions and share ideas and resources.

Island environments highlight the challenges facing bats and other wildlife worldwide. Here the land is clearly finite, and almost all impacts are magnified. Grand Cayman, largest of the three Cayman Islands, is a limestone outcropping just 22 miles (35.4 kilometers) long and 8 miles (12.8 kilometers) across at its widest point. When non-native species threaten wildlife or companies plan to dredge sensitive estuaries, there is no doubt of the consequences.

“Our bat-conservation program here became a model for the Caribbean,” Blumenthal says. “The challenge now is to make it clear that bat houses are not the entire answer. We have other species of bats here that are cave dwellers or that live in dense vegetation. Saving habitat for these bats is my biggest challenge today – especially in the Lower Valley Forest.”

This small, beautiful forest is home to five rare bats, including the white-shouldered or fig-eating bat (*Phyllops falcatus*), a species shared only with Cuba and Haiti. It had not been seen in Cayman since 1932 – until BCI member Annie Band visited Blumenthal and discovered a colony surviving there. “This little bat is entirely dependent on a few patches of ancient *Ficus* forest – and this is imminently threatened by development,” Blumenthal says. “These bats are slow, clumsy fliers that don’t like to go out across cleared land. They don’t fly high and fast like the free tails, so they are essentially marooned in their tiny remaining habitats.”

The Lower Valley Forest is also home to cave systems used by Waterhouse’s leaf-nosed bats (*Macrotus waterhousii*), the Grand Cayman subspecies of big brown bats (*Epitesicus fuscus*), buffy flower bats (*Erophylla sezikornii*) and some Mexican free-tailed bats (*Tadarida brasiliensis*). The forest and cave systems are dominated by large *Ficus* trees, a critical food source for bats, birds and other wildlife because they produce fruit year round.

“My job now is to save the forest and cave habitats,” she says, “The land in the Lower Valley Forest is valued at millions of dollars, so we’ll need to find a large donor who wants to save a rare ecosystem, including these extremely rare bats, before this land is hopelessly subdivided and cleared for housing.”

Enthusiasm and persistence can make the impossible possible, and Blumenthal has both in abundance, whether the task is saving a threatened forest, changing pest-control attitudes or convincing power companies and prisoners to create innovative solutions for bats. Back at Northward Prison, she unveils a cake and cookies to express her gratitude for the inmates’ hard work. She gives them a broad, approving smile and a quick good-by. Then she’s off to tell another islander about the benefits of bats.

*ELAINE ACKER is Associate Executive Director of BCI.*

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Lois Blumenthal credits many companies and individuals for the bat-conservation successes on Grand Cayman. Among them: Bat Conservation International, Caribbean Utilities Company Ltd., Cayman Islands Department of Environment, Cayman Islands Department of Public Works, Cayman Islands Lion’s Club, Blanford Dixon, John Gray Recyclers, Ron Moser, National Trust for the Cayman Islands, Northward Prison (Frank Marshall, Assistant Director), Peter Paskold, Alan Patino and photographer Courtney Platt (www.courtneyplatt.com).

Joan Kelleher’s donation to BCI made many of these achievements possible, including Annie Band’s work with Lois Blumenthal in researching the island’s bat species and making critical conservation recommendations that have since been implemented.

If you’d like to help support BCI’s Global Grassroots Conservation Fund, which makes vital bat-conservation efforts like those of Lois Blumenthal possible around the world, please contact Nicole Daspit at ndaspit@batcon.org or (512) 327-9721. Or check out our Wish List on page 17 for a deserving project that needs support.
Johnny Sheridan was a Death Valley prospector of the old school. He lived in a manmade cave carved out of a volcanic ash bed and combed the hills above Shoshone, California. In 1925, he discovered a rich deposit of borate ore, the raw material of borax. That borate made Johnny a very rich man. He sold his claim to Pacific Coast Borax Company, but kept living in his cave.

U.S. Borax Inc. is a mining company of a new school. The deposit Sheridan discovered was mined until recently, but the mine’s upper reaches were abandoned decades ago. And it was in those uppermost workings that a colony of Townsend’s big-eared bats (Corynorhinus townsendii) discovered an ideal maternity roost. So U.S. Borax, the successor of Pacific Coast Borax, worked with engineers and wildlife biologists to design and install gates in 2001 that keep humans out of the abandoned mine while maintaining airflow and access for the bats. Two years after gating, the colony has grown by 24 percent.

Johnny Sheridan’s old home, by the way, is now occupied by pallid bats (Antrozous pallidus).
U.S. Borax has partnered with Bat Conservation International for about five years in protecting bats and the public at abandoned borate mines in and around Death Valley. The company’s active commitment to bat conservation traces to a BCI-sponsored Bats and Mines workshop in 1998. Borax has installed 11 bat-friendly gates at three mining sites since 2000 and plans nine more this year. The Death Valley area is home to at least 16 bat species, many of which use the old mines as roosts.

More than a century of mining for gold, silver and borax left this ruggedly beautiful area pockmarked with abandoned and deteriorating underground mines. These remnants of early ventures have become serious safety concerns as more and more people venture into the desert backcountry.

Old mines pose temptations to off-road adventurers and some have become popular—and potentially hazardous—destinations. Faced with risks to the incautious public, Borax has closed more than 400 mine openings by backfilling, plugging and capping. More recently, the company has been working with BCI, local bat biologist Patricia Brown and engineer James Cremer to identify old mines used by bats and close them to the public without barring the bats.

For example, when sampling at the Lila C Mine showed that all the ore had been extracted, Borax sponsored biological surveys that detected several bat species, including Townsend’s big-eared bat, using the mine. To close the mine, the company first stabilized four of its entrances by placing concrete sewer pipes, roughly 6 feet (1.8 meters) in diameter, in them. The pipes provided a strong base for the installation of bat-compatible gates.

These four openings connect to the extensive underground workings that offer both summer and winter habitat for bats. Other entrances, which weren’t used by bats, were capped. The surface was then re-contoured and the roads closed, making the reclaimed and gated sites safe for both bats and people.

Borax has developed a detailed procedure for closing and sealing abandoned mines. It begins by producing new maps of the mine workings, since old maps are not always accurate. Then biologists conduct internal or external surveys to determine current wildlife usage. Once wildlife needs and priorities are set, mining engineers design an appropriate closure method for each mine opening. Closures are done in the spring or fall, when bats will be least affected.

These efforts play an important role in developing new mine-closure technology. The sewer-pipe stabilization method, for example, was used at the abandoned Murphy Gold Mine in Nevada to protect a large colony of pallid bats.

With a long history of community involvement, Borax is now working with BCI and local residents to develop a volunteer-based, long-term monitoring program for gated bat habitats of the Amargosa Valley at the southern end of Death Valley. The study area includes three small towns (Shoshone, Death Valley Junction and Tecopa), two multi-

The author begins an abandoned-mine survey by recording external characteristics that will help determine habitat quality. The rocks at this entrance clearly show the white borates that have precipitated to the surface.

BCI’s Faith Watkins and U.S. Borax’s Mike Rauschkeid discuss the innovative use of concrete sewer pipes to stabilize old mine openings before bat-friendly gates are installed. This one’s at the Lower Biddy Mine in Death Valley. The inset shows a completed gate at the Lila C Mine. This technique, developed by Borax engineers, is now being used at abandoned mines elsewhere.
gated mine complexes and a recently rebuilt bat gate at Devil’s Hole Cave that protects a colony of Townsend’s big-eared bats. Borax provides night-vision video cameras, dataloggers and a bat detector. The program will help determine which species are using the gated mines and when and how they are using them. Pre- and post-gate monitoring will document how bats respond to protection measures.

Company mines along the Amargosa Valley are ideal study sites for Townsend’s big-eared bats. Outflights from the mine portals are easy to record with low-light video cameras, and roosts will be equipped with dataloggers that record temperature and relative humidity.

Such long-term studies will improve mine-reclamation projects on Borax properties and elsewhere. Society needs the products that mining industries pull from the ground, and environmental stewardship and reclamation are becoming critical components of mining company business plans.

MICHAEL RAUSCHKOLB, a certified professional landman with a master’s degree in geology, is the Principal Land Agent at U.S. Borax.

To volunteer for the Amargosa Valley bat studies, write to:
U.S. Borax Inc.
Attn: Michael Rauschkolb

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**Death Valley Roots**

U.S. Borax is deeply rooted in California’s Death Valley, where teams of 20 mules once hauled great wagon loads of borate ore across 165 miles (265 kilometers) of desert. The company began mining borates—amazingly useful minerals based on the element boron—in Death Valley in 1882.

The Death Valley region contains almost half of the known borate ore in North America, thanks to the same tectonic forces that produce California’s infamous earthquakes. Death Valley was created millions of years ago as the Pacific plate of the Earth’s crust began sliding inexorably past the North American plate. Volcanoes erupted along the boundary of those two plates, which we now call the San Andreas Fault, and borates crystallized in lakes fed by volcanic hot springs. When the lakes dried up, they left behind great deposits of borate.

Most people associate borax with a powder that cleans just about everything from dirty clothes to bathtub rings. Borate minerals are still used in soaps and detergents, but they’re also key ingredients for products as diverse as wood preservatives, fiberglass, ceramics and nutrients that increase crop yields.

In the early days, borate ore sat right on the surface of Death Valley’s dry lakebed. All the miners had to do was shovel it up, dissolve the ore in boiling water, decant the clear liquid into another tank and wait for morning to find pure borax crystallized on the bottom of the tank. When the surface ores began running out, however, miners had to go underground.

Pacific Coast Borax, a predecessor of U.S. Borax, began underground mining on the edge of Death Valley in 1907 at the Lila C Mine, which grew to more than 2,000 feet (600 meters) at depths of up to 300 feet (90 meters). The company mined borates in several mines in Death Valley until 1927, when an enormous deposit was discovered at what’s now Boron, California.

During those heady days around the turn of the century, Stephen Mather joined Pacific Coast Borax and quickly became director of advertising. Among many innovations, he introduced the famed Twenty Mule Team brand. Mather retired at age 37 and began traveling around the American West. Appalled by conditions at national parks of the time, he wrote a scathing letter to U.S. Interior Secretary Franklin Lane, describing them as a “federal disgrace.” Lane suggested that Mather come to Washington and run the parks himself.

Mather did just that in 1916, becoming the first director of the new National Park Service and beginning a process that led to Death Valley being declared a National Monument in 1933. Thus did a graduate of the borax business become the father of America’s national parks system.
Carving Out a Home
by Robert Hodgkinson

Several species of tropical bats build their own roosts by creating “tents” out of leaves. And recent studies also find roost-making bats building homes out of other plant parts, including stems, roots and even clusters of fruit. Now, research supported by the BCI scholarship fund has discovered yet another roost-making strategy in Malaysia: a fruit bat that carves its home out of the active, arboreal nests of ants and termites.

The spotted-winged fruit bat (Baliostomus maculatus), one of the smallest of Old World fruit bats at less than half an ounce (13.5 grams), creates smooth, bell-shaped cavities in the nests that can hold one male and up to nine females with their young. The construction technique has not been confirmed, but it’s likely that, as with other tent-making bats, spotted-winged fruit bat males use their teeth and jaws to hollow out the soft interior chambers of the insects’ treemounted nests.

We find similar roost cavities within the root masses of epiphytic plants (non-parasitic species that grow on the surface of other plants), including birds’ nest ferns and epiphytic wild ginger.

Researchers usually attribute bats’ tent making to males and associate the behavior with attracting females. The roosts created by spotted-winged fruit bats should provide males with all they need to protect their harems and offspring from wind, rain and sun and conceal them from predators. Whether reproductive success is linked to quality of the roost has not been determined. It is interesting to note, however, that males spend significantly more time around roost sites at night and are more faithful to a single roost site than females.

Spotted-winged fruit bats are found throughout Peninsular Malaysia and northern and western Borneo, with scattered records in southern Thailand and Sumatra. Females typically give birth to up to two single pups a year. In Malaysia, the spotted-winged fruit bat feeds on the fruits of at least 22 species of plants, nearly all of which are restricted to low-growth rain forests. This species is therefore likely to be severely threatened by deforestation and forest fragmentation.

Robert Hodgkinson, a BCI Scholar, conducted this research while at the University of Aberdeen in Scotland, in collaboration with Sharon Baling of Aberdeen, Tom Kurz of Boston University and Zubaid Akbar of the Universiti Kebangsaan Malaysia. This study was funded by the Lubee Bat Conservancy and

Bracken Members Nights!

Plan now to see the spectacular flight of the world’s largest bat colony at Bracken Cave at one of BCI’s Members-Only Nights this summer. These private visits give BCI members a chance to meet each other and BCI staff while watching 20 million Mexican free-tailed bats emerge from the cave near San Antonio, Texas.

Registration begins May 3, 2004. This year’s member nights (all Saturdays) are June 26, July 10 and 24, August 7, 21 and 28 and September 4 and 11. Send BCI your name and member number, address, phone number, email address, number of people attending and your first and second choices of dates. Email to bracken@batcon.org, fax to (512) 327-9724, ‘Attention Members Night Coordinator,’ or call BCI at (512) 327-9721 (7:30 a.m.-4:30 p.m. Central Time, Mon-Fri). Please try to limit your group to four family members. Immediate family only, and no pets. Space is limited to a total of 50 people each night, so make your reservations early – beginning May 3.
Protecting Romania’s Bats

Bats haven’t been much of a priority in Romania, so when a handful of dedicated bat conservationists organized a national group, they realized they first had to build a solid foundation of research and education. They turned to Bat Conservation International.

BCI’s Global Grassroots Conservation Fund gave the fledgling Romanian Bat Protection Association $1,500 to help get its ambitious programs under way.

The group’s National Bat Monitoring System has so far identified 22 bat species, five of them listed as vulnerable. Then the association enlisted support of the Romanian National Parks, which is including a focus on bats in a new monitoring program of flora and fauna.

But few park rangers and volunteers knew much about bats. BCI, with its long history of effective field workshops, lent its support for a series of workshops run by the Bat Protection Association for National Parks biologists and rangers.

The three workshops provided hands-on experience with bat detectors and mist nets, plus instruction on bat biology, ecology and monitoring.

The results of this initial work were presented at two international symposia and used as the basis for an educational CD that presented the general biology of bats, descriptions of echolocation and a species-identification key.

For the long term, the new Association now has a growing database of the nation’s bats and their needs and status. These crucial data are being shared with National Parks and other agencies as bat conservation takes hold in Romania.

You can help support bat conservation around the world by contributing to BCI’s Global Grassroots Conservation Fund. Contact Nicole Daspit at ndaspit@batcon.org or (512) 327-9721.

BCI Member Snapshots

This unique bat quilt was created by longtime BCI member and bat rehabilitator Dottie Barnes of San Marcos, Texas. When her collection of bat T-shirts outgrew her drawer space, she decided to make this quilt. Dottie worked on it off and on for more than a year, and it is sure to become a family heirloom.

Share a snapshot of your bat activities with your fellow members: Send it to Robert Locke, Bat Conservation International, PO Box 162603, Austin, TX, 78716.

Participants in a field workshop sponsored by the new Romanian Bat Protection Association explore the fine points of mist netting as they learn how to monitor bat populations in a nation that previously had shown little interest in bat conservation.
Bats Reseed Lost Forests

Every year, millions of acres of tropical rain forest are cleared for timber and agriculture in Central and South America. But efforts are increasing to reforest these barren lands, and bats and artificial roosts may play a vital role.

Detlev Kelm of Germany’s University of Erlangen-Nuremberg says that while the commitment to reforestation is growing throughout much of the tropics, we still lack practical and cost-efficient methods for kick-starting the process of forest regeneration. He used a Bat Conservation International research scholarship to explore and test some possibilities.

The first step in regrowth on open land is seed dispersal. In tropical environments, fast-growing, light- and heat-tolerant pioneer plant species play a dominant role in restoring vegetation. Fruits of such plants are the main food source of tropical bats that feed on the fruit and nectar and disperse seeds.

Although these bats still seem to be abundant in the New World tropics, their local distribution depends on the availability of suitable daytime roosts, and most of the relevant bat species prefer caves or, especially in lowland areas, hollow trees. But very few old trees become large and hollow enough to serve as day roosts. Since loggers typically remove the largest trees, many areas now lack sufficient natural roosts, so bat densities decline even though food sources could support many more bats.

Kelm’s project, begun in 2000, designed artificial bat roosts for fruit-eating bats that live in tree hollows. Then he installed the roosts in a lowland area of Costa Rica, where dominant land uses are ranching and farming. The roosts proved highly attractive to bats, which moved into most of them within a few weeks, and these roosts have been permanently occupied for over three years.

The main resident is the short-tailed fruit bat (Carollia perspicillata). But nectar-feeding bats such as the brown long-tongued bat (Glossophaga commissarisi), which is an important pollinator for a great number of plants, tiny common big-eared bats (Micronycteris microtis) and frog-eating bats (Trachops cirrhosus) have also been recorded.

An analysis of bat droppings collected from inside the roosts revealed seeds of more than 40 different plant species, most of them fast-growing pioneer plants. The study showed that, on average, 10 short-tailed fruit bats bring more than five grams of seeds into their roosts every night. That’s an average of more than 2,000 individual seeds! Since bats from these roosts defecate even more seeds while flying to and from feeding areas, their potential contributions to reforestation are enormous.

Bats clearly can be major players in launching the regrowth of tropical forests in cleared areas, and Kelm has shown that artificial roosts can be effective in helping bats to recolonize areas where natural roosts are scarce. The next step is to install these artificial roosts across fragmented tropical landscapes, thus encouraging bats to help us in our reforestation efforts.

For more information on these and other artificial bat roosts, contact BCI Bat House Research Coordinator Mark Kiser at mkiser@balcon.org.

You can support this kind of critical research while preparing talented young biologists for leadership roles. To contribute to BCI’s Student Scholarship Program, contact Nicole Daspit at ndaspit@balcon.org or (512) 327-9721.

‘The Call of the Wild’ — Part 2

When the Houston Zoo began a cell-phone recycling program to benefit Bat Conservation International (BATS, Winter 2003), BCI members responded like — well, like BCI members. “I am receiving phones by mail almost daily now from all over the United States from people who say they saw the ad in your member magazine,” says Carol Krieger, who’s coordinating the program.

About 200 phones have been received, including those from BCI members in Arizona, California, Florida, Illinois, Indiana, Massachusetts, Michigan, Missouri, Ohio, Virginia and Washington, she said. “I think this is a great response!” The first check to BCI, which receives all the money raised in the program, is due shortly.

The Wireless Foundation pays for every cell phone, battery or charger that’s donated, and the equipment will be refurbished and sold or safely recycled. The zoo’s appeal: “Answer the Call of the Wild — Be a Bat Crusader.”

The program continues at least through this September. A phone-recycling bin is located at the zoo’s gift shop or cell phones may be mailed to:

Houston Zoo Inc. • Cell Phone Recycle
1513 North MacGregor • Houston, TX 77030
Volunteers Make the Difference

by Amy Sugeno

Volunteers are the real stars in dispelling hurtful myths about bats, and the Texas Parks & Wildlife Department, a BCI partner, recently honored the volunteers who explain the benefits of bats to some 15,000 visitors a year at Old Tunnel Wildlife Management Area. The annual Volunteer Appreciation Lunch celebrated their achievements.

Located near Fredericksburg, Texas, about 75 miles (120 kilometers) west of Austin, the abandoned railroad tunnel shelters as many as 3 million Mexican freetailed bats (Tadarida brasiliensis), as well as several thousand cave myotis (Myotis velifer). The Texas Parks & Wildlife Department purchased this 920-foot (280-meter) tunnel and surrounding land in 1991 specifically to protect and manage the bats.

Thousands of people visit Old Tunnel each year, from May through October, to watch dense clouds of bats leave the tunnel for a night of hunting down insects. Visitors, after being wowed by the spectacular emergence, learn about bats through interpretive presentations and question-and-answer sessions. Group tours can be scheduled, and hiking and picnicking are encouraged.

Few of those opportunities for public education would be possible without dedicated volunteers, most of whom show up one night a week for six months – for a group total of 2,000 hours of service. The Texas Parks & Wildlife Department trains the volunteers as Certified Interpreters. They also are invited on special field trips, including a visit to BCI’s famous Bracken Bat Cave.


For more information about the Old Tunnel Wildlife Management Area, the bats or the volunteer program, contact Amy Sugeno at Amy.Sugeno@tpwd.state.tx.us or (830) 367-7923.

AMY SUGENO is Manager of the Old Tunnel Wildlife Management Area.
Countless bats are being protected around the world by people whose commitment to bat conservation was strengthened, empowered and often created at Bat Conservation International workshops.

Classroom instruction and hands-on field experience give everyone from biologists, wildlife managers and school-teachers to individual enthusiasts the knowledge and skills they need to develop, implement and improve bat conservation programs. We've been conducting these workshops for more than two decades, and our graduates install bat-friendly gates at caves and mines, maintain bat habitats on public and private forests, develop and build artificial roosts, focus many government agencies on bat conservation, teach youngsters and other professionals about the benefits and needs of bats, and so much more.

BCI offers full and partial scholarships to deserving workshop participants who can make major contributions to bat conservation in their states or countries.

The payoff can be huge. A scholarship allowed Luis Aguirre of Bolivia to attend an Arizona workshop six years ago. Soon afterward, he founded the Program for the Conservation of Bolivian Bats, now a powerful force for bat conservation throughout his country. There are many more success stories like this one.

Help us get the tools and knowledge of bat conservation to people who will put them to use. Scholarships range from $500 to $1,000 depending on the workshop. Please contribute to the BCI Workshop Scholarship Fund.

For information, contact Nicole Daspit at (512) 327-9721 or ndaspit@batcon.org. Or send your donation to:
Nicole Daspit, Acting Director of Development
Bat Conservation International
PO Box 162603
Austin, TX 78716