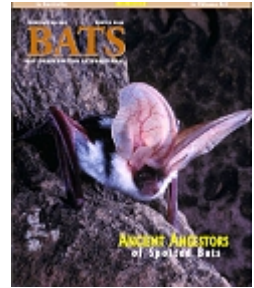


VOLUME 22, NO. 4 Winter 2004

Little Old Man

A tale of frogs, fish and amazing memories

Rachel Page



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The tropical night was filled with a cacophony of chorusing frogs. Gathered by the hundreds in forest puddles and ponds, these males endlessly shout their desire for mates. Naturally, a bat has evolved to tap this cornucopia of noisy protein. And that brought me to the Panama Canal. I was exploring the cues, flexibility and learning that fringe-lipped bats (*Trachops cirrhosus*) use to hunt these frogs. What I found was an astonishing feat of learning and memory in a battered bat we called Little Old Man.

BCI Founder Merlin Tuttle and Michael J. Ryan (now a Professor of Zoology at the University of Texas at Austin) found that the fringe-lipped bat of Central and South America feeds on frogs and uses their mating calls to find its prey. As a graduate student at UT-Austin, I went to Barro Colorado Island in Lake Gatun, in the Panama Canal, to study the behavior of this frog-eating bat.

I hiked through the wet, tropical forests of Barro Colorado to small streams and ponds and set mist nets each evening. Each time I caught a frog-eating bat, I would take it to an outdoor flight cage to conduct behavioral tests, measuring the bat's responses to different frog calls and other acoustic stimuli. After several days of testing, I marked each bat with a small PIT tag (a passive microchip inserted under the skin, similar to those used to identify pet dogs and cats). Then I released the bat in the same spot where I caught it.

Previous experience with these bats led me to suspect that they are extremely quick learners and very flexible in their foraging behavior. But I was unprepared for the feats of Little Old Man.

The tale goes like this: I was nearly finished with my fieldwork for the season, when my field assistants – Danielle Temple, Katy Klymus and Tida Beng – caught three *Trachops*. We marked all three with PIT tags and I began testing the first bat in the flight cage. We put the other bats in a flight tent on the other side of the field station. One of these bats was notable – by far the oldest *Trachops* I had ever seen. His teeth were yellowed and broken off, his wing and tail membranes were scarred and dry, he had a tear in his right ear, and his fur was a coarse, yellowish color. We named him Little Old Man.

While the bats were awaiting their tests, we took turns feeding them. There are several ways to feed a *Trachops* in captivity: You can catch it and feed it by hand; you can catch a small army of katydids and release them into the flight tent in hopes that the bat will catch them on its own; or you can throw prey such as katydids against dried leaves to make a rustling sound the bat will key in on and attack. (Allowing the bats to feed on captured frogs is not an option because frogs are protected at the Barro Colorado Island field station run by the Smithsonian Tropical Research Institute.)

The easiest approach is to teach the bat to come on call to snatch minnows from your hand. This can take hours, but once a bat learns the new taste and gets over its fear, the result is well worth the effort. This allows me to precisely monitor the bat's food intake and the bat is more likely to exhibit normal behavior. Plus, you don't have to run all over the island catching katydids all night long!

We buy small bait fish that I freeze, thaw and feed to the bats. Once trained, the bats readily

accept the fish. So that night in late June, we set to work training the bats to come to our hands on call. You walk very slowly and quietly up to the bat, with a thawed minnow in your hand. Usually, the bat flies away, so you approach again. And again. And again. But eventually, if you are lucky, the bat may take a small nibble of food before flying away. Then you're set. You need only to add a small noise, like making a clicking sound with your tongue, and soon the bat will learn to fly to your outstretched hand and delicately take the fish.

As I worked through my tests with the first bat, the other bats waited their turn in the flight tent. Danielle, Katy and Tida divided the night into feeding sessions, each taking a few hours so the bats would receive enough food. Soon all the bats would come quickly to our hands, including Little Old Man.

Our flight tent had been used previously to house Jamaican fruit-eating bats, *Artibeus jamaicensis*, which prefer figs. Like *Trachops* taking fish in lieu of frogs, this bat will readily eat bananas when figs aren't available, and some ba-nanas had been left in the tent. Unfortunately, another rain-forest denizen is also extremely fond of ba-nanas – the coati (*Nasua narica*).

Much like the northern raccoon, this scavenger made quick work of the flight tent, ripping large holes and ex-tracting the fruit. The bats were un-harmed and, amazingly, were still in the flight tent the next morning, despite the coati-sized holes. We spent many hours mending the holes with needle and thread – but apparently not well enough.

A few days later, we were very frustrated to find that Little Old Man had disappeared from the tent. Not only had we missed our chance to test him (and we were very interested in the foraging ability of such an old bat), but he would have to fly clear across the island to get back to his home. It's a small island, but it still took us a good hour to hike from the field station to his roost. Would he find his way home?

The rest of the testing went well, all the bats were returned, well-fed, to their homes, and I returned to Texas to analyze data and write up my results. A year passed. The following spring, I returned to Panama to continue my research. I had new nets, new questions and a new set of experiments. The weeks passed in their usual sleep-deprived blur.

One night toward the end of the season, my field assistant, Clark Jones, came rushing into the flight cage. He had caught a bat that he thought was a *Trachops*, but was unsure of his identification. I lifted the bat from the carrying bag and found that it was, indeed, a *Trachops* – and a most peculiar-looking one at that. Its fur was bleached, its membranes looked dry and scarred, its teeth were in terrible shape. And it had a little tear on one ear. I scanned it with the PIT tag reader and, sure enough, it was Little Old Man.

Now this was exciting in itself. Clark had set his nets and caught this bat in the exact spot we had caught him the year before. After escaping so ingeniously the previous spring, Little Old Man had found his way right back to where he belonged.

Knowing his tricks, we made doubly certain that all screens were secure, then released him into the flight cage. I first tested him on frog calls, playing a call and waiting to see if he would approach the speaker in search of a frog. There was no response. That's not unusual. Bats are often frightened during their first night; they have just been caught in a net, carried through the forest in a bag and released into a strange place. I try to treat them gently throughout the experiments, but I am especially careful the first night. If I can't get them to eat in captivity, I must take them back to where they were caught and let them go.

Little Old Man was hanging from a perch in the corner of the flight cage. I tried the frog call again. No response. I sighed, anticipating a night of catching katydids for his dinner. Just as I was leaving I had an idea. This bat had, after all, learned to approach our outstretched hands for food the year before. Would this bat remember his feeding experiences over the course of five nights in a flight tent a year ago?

I took a minnow and held it between thumb and forefinger. I did not approach the bat at all. Instead, I stood in the center of the flight cage and held out my hand. He watched me from his corner. Feeling a little foolish, and nearly certain I was wasting my time, I made the clicking noises. To my astonishment, Little Old Man took off from his perch, flew directly toward me and deftly plucked the minnow from my fingers.

He took no notice as I laughed, delighted. He flew back to his perch and promptly ate the fish. As soon as he finished, I got another minnow and tried again. Again he took it. And again. I ran to the field station and got my assistants. We watched in amazement as this wild bat, caught that very evening, flew to our hands without fear. What had been learned 12 months before, over the course of just a few days, and with no subsequent reinforcement, had been stored and remembered.

This has impressive implications for the role of learning and memory in foraging bats. Some researchers have speculated that *Trachops* must relearn the correct responses to frog calls each wet season, when the frogs become available, because they forget them over the dry season. A single incident in a single bat does not definitively prove anything about the foraging behavior of a species. Yet it is now clear that *Trachops* are far more capable of long-term memory than researchers had anticipated.

Taking Little Old Man back to his roost several days later, I released him with wonder. Would I catch this old bat again? And what would he remember of me in the meantime? As I study the foraging behavior of this species, it is clear to me that learning is going in both directions: I learn from the bats just as they learn from me.

Rachel Page is a Ph.D. candidate in Ecology, Evolution and Behavior at the University of Texas at Austin. Her first experience with bats came while helping Barbara French of BCI and George Pollak of the University of Texas investigate social communication calls of Mexican free-tailed bats. She is in her third year of doctoral studies and is returning to Panama this spring for another field season working with fringe-lipped bats.

The author thanks the fantastic field assistants who helped on this project: D. Bethel, M. K. Clark, N. Cooper, K. Gillies, C. Jones, K. Klymus, E. A. Snider, D. Marks, D. Temple and K. Sheldon. I am grateful to my funding sources: Smithsonian Tropical Research Institute, the National Science Foundation, the Theodore Roosevelt Memorial Fund of the American Museum of Natural History and the University of Texas at Austin; and to my advisors on this project: M. J. Ryan, M. D. Tuttle, E. K. V. Kalko and A. S. Rand.

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