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Luring Rafinesqueâ€™s Big-Eared Bats â€“ or Not
Striking discoveries from an experiment that didnâ€™t work
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Great ideas donâ€™t always pan out. In science, hypotheses, when tested through experiment, occasionally turn out to be wrong. But that doesnâ€™t necessarily mean the experiment was a failure: results can sometimes be valuable even when they are not at all what we expected. They can certainly point toward powerful new directions for research.

Such was the case with our efforts to lure rare and notoriously hard-to-capture Rafinesqueâ€™s big-eared bats (Corynorhinus rafinesquii) to mist nets by broadcasting recordings of their social calls. Not only were we unable to attract these bats, but the recordings seemed to repel them. Bats of other species, meanwhile, apparently were attracted by the recordings.

While this result wonâ€™t help us capture Rafinesqueâ€™s big-eared bats in our nets, it could help us better understand how bats choose foraging habitat, with potential for boosting conservation efforts.

Rafinesqueâ€™s big-eared bats are found throughout the southeastern United States, but they are very sparsely distributed throughout their range. Their population and conservation status is of great concern now. In the northern and mountainous areas of their range, these bats hibernate in caves and mines during winter. This means they may be threatened by White-nose Syndrome, which has been decimating bat populations in the eastern U.S. since 2006. In the southern and western parts of Rafinesqueâ€™s big-eared batsâ€™ range, they rely on large hollow trees in mature bottomland forests, where habitat loss and forest fragmentation take a toll.

Determining the status of Rafinesqueâ€™s big-eared bats and understanding the threats they face require intensive surveying and monitoring. But these bats are rare, widely dispersed and very adept at evading mist nets. They also have very soft echolocation calls. Neither mist nets nor bat detectors have been particularly effective for studying this species.

Our U.S. Forest Service team, bolstered by Eric Britzke of U.S. Army Research and Development Center and with support from a BCI North American Bat Conservation Fund grant, hoped to develop a new way to inventory these difficult bats.

Studies in Europe suggested we might be able to attract Rafinesqueâ€™s big-eared bats to our nets by using recordings of their social calls. Social calls are different from echolocation, which is used to locate prey. Bats use social calls to communicate among their colony mates or other members of their species about such things as foraging sites, roost sites, mating and potential danger. Social calls are usually louder and lower in frequency than echolocation calls so they can be heard over a greater distance. Researchers in England and Italy have been able to increase the capture rates of Bechsteinâ€™s myotis (Myotis bechsteinii) by broadcasting their social calls near mist nets. This bat is very similar in size, shape (especially their big ears) and ecology to Rafinesqueâ€™s big-eared

bats.

We recorded social calls of Rafinesqueâ€™s big-eared bats at two colonies in different parts of South Carolina. One colony inhabited an abandoned gold mine in the mountainous northwest corner of the state. The other roosted in a large black gum tree on the Savannah River Site in the Upper Coastal Plain, about 100 miles (160 kilometers) to the southeast. We were unable to record calls at our third site: Congaree National Park in central South Carolina. The park has the largest remaining tract of old-growth bottomland forest in the U.S. and is home to at least one large maternity colony of Rafinesqueâ€™s big-eared bats.

We also found hints of regional or colony dialects (somewhat akin to accents) â€“ small but distinct differences in the social calls of two colonies. Although the calls recorded in the mountain and Coastal Plain sites were generally similar in shape and frequency, there were differences. Studies of other bat species have found subtle but important variations in the social calls of bats from different colonies. These are usually attributed to genetic differences, learned call structures or environmental conditions at each roost.

It is not clear what caused the differences in social calls between the colonies we sampled, but we plan to record calls from several more colonies this coming year to determine whether the distinctions are due to regional, environmental (mine versus tree) or social factors.

We selected typical, high-quality calls from each site for playback, then returned to the field to test how bats would respond. At each site in turn, we set up two nets near known Rafinesqueâ€™s big-eared bat roosts. We designated one as the experimental net and placed an acoustic transmitter on either side of it. The other was our control, without playback. For an hour, we rotated between five minutes of broadcast and five minutes of silence. Then we moved our transmitters to what had been the control net and repeated the process for an hour, and so on. We ended the evening with two hours of broadcast calls at each net.

We monitored both nets continuously and removed bats as soon as they were captured. We conducted our experiments for one night at Congaree and four nights each at the other two sites.

Our results were surprising. We captured a total of 11 Rafinesqueâ€™s big-eared bats, but 10 of those were from control nets without calls. Rather than luring Rafinesqueâ€™s big-eared bats to the nets, the calls seemed to be repelling them. The results were the same regardless of where the calls were recorded.

On the other hand, the calls seemed to be attracting other bats. Thirteen of the 19 bats of other species that we captured â€“ big brown bats (Eptesicus fuscus), eastern red bats (Lasiurus borealis), Seminole bats (L. seminolus), southeastern myotis (Myotis austroriparius), northern myotis (M. septentrionalis) and tri-colored bats (Perimyotis subflavus) â€“ were taken at experimental nets.

Why might Rafinesqueâ€™s big-eared bats be repelled by the social calls of their own species? We suspect the answer lies in the way that Rafinesqueâ€™s big-eared bats forage. Most insect-eating bats in North America are aerial hawkers, which utilize echolocation to catch flying insects. Rafinesqueâ€™s big-eared bats, however, are primarily gleaners that snatch insects from the surface of vegetation. They listen for faint sounds generated by their prey and may avoid areas where the calls of other bats might interfere with their ability to

hear the insects. Or perhaps individual bats use social calls to establish their own foraging areas and keep others out.

The other species from our nets were all aerial hawkers, which often eavesdrop on the echolocation calls of other bats to find areas with abundant prey. These bats may have heard our playback calls and assumed they signaled abundant prey at the nets.

Although we were unable to lure Rafinesqueâ€™s big-eared bats to our mist nets, this research suggests that social communication may be very important in the lives of bats. It also suggests that largely unexpected factors may influence how bats choose and use habitat. If bats are attracted or repelled by bat calls, the presence of other bats may be as important in determining habitat use as landscape quality and prey abundance.

Although scientists have been studying echolocation for many decades, we have just begun to investigate social calls and communication within and among bat species. There is much to learn and the lessons will almost certainly be fascinating.

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