Mammal Study 30: 69–71 (2005)

Luring bats to the camera — A new technique for bat surveys

Hirofumi Hirakawa

Forestry and Forest Products Research Institute, Hitsujigaoka, Toyohira, Sapporo 062-8516, Japan

Despite the worldwide concern about bat conservation, the status and distribution of many bat species are poorly known (Racey and Entwistle 2003). This is especially the case for forest bats that roost solitarily or in small groups under the bark, leaves, or in cavities of trees. Survey techniques are limited and include netting and acoustic monitoring (Kunz et al. 1996). Given this situation, it would be worth developing some new techniques for bat surveys.

While monitoring wildlife using cameras with infrared sensors, I found that bats in forests were often photographed (Hirakawa 2004). This suggested that automatic photography could be applied to bat surveys. However, because bats were photographed only by chance when they happened to pass in front of the cameras, the photographic rates were too low for the purpose and most of the bat images obtained were very poor. The photographed bats were often too near to the camera and images were too bright or out of focus, or they were too far and their images were too small. Also often, only parts of their bodies, such as tails and wing tips, were visible in the photographs.

To increase the rate and quality of bat photographs, and thereby to effectively apply automatic photography to bat surveys, I have devised a technique to lure bats to the front of the camera. In this paper, I will introduce the technique and report on its effectiveness.

Materials and methods

The technique used a simple device composed of a thin, straight steel music wire (ca. 90 cm in length and 0.8 mm in gauge) and a small piece of rubber eraser (ca. 12 mm in length, 5 mm in diameter, and 0.3–0.4 g), which was fixed to one end of the wire. The other end of the wire was attached to the back of the sensor camera, which was set on the trunk of a tree with a depression angle, so that the wire hung over the sensor camera with the eraser suspended around 50–60 cm away from the lens of the camera (Fig. 1). I expected this to work the way an anglerfish lures its prey. If bats were deceived and mistook the eraser as a prey insect, they would try to approach and capture it.

Fig. 1. The sensor camera and the lure.

I have used the sensor camera that I have developed on my own (now commercially available as "YoyShot" from Umezawamusendenki Co. Ltd.). This is a combination of a commercially available compact camera and a sensor circuit that I have designed. The camera has a built-in flash and a date/time stamp function. The sensor circuit can adjust sensitivity and select either 24-hour or night-only operation mode.

I tested the effect of the device by comparing the bat photographic rates between the sensor cameras with the device and those without the device (Table 1). The tests were conducted twice, each time for two weeks, in Oku-Jozankei forest, Sapporo, Hokkaido, Japan (141°10'E,

E-mail: hiroh@affrc.go.jp

Table 1. The summary of test methods and results.

year	2002				2004	
test period	24 July–7th August				3rd–17th September	
detection sensitivity	low	low	high	high	—	—
luring device	without	with	without	with	without	with
no. of sensor-cameras used	5	5	5	5	10	10
valid camera-nights	68	70	66	65	131	131
valid camera-night hours	641	660	621	611	1471	1471
no. bat photographs taken	2	6	0	16	4	25
photographic rate per 100 camera-night hours						
average	0.31	0.91	0.00	2.61	0.27	1.70
95% Poisson confidence interval	0.04–1.13	0.33–1.98	0.00–0.48	1.49–4.25	0.07–0.70	1.10–2.51

42°52'N), from 24 July to 7th August in 2002 and from 3rd to 17th September in 2004. The sensor cameras were set on the trunks of trees standing along forest roads at about 150 cm in height and 37 degrees in depression angle.

In 2002, I used two sets of 10 sensor cameras with different detection sensitivities (low or high). I put the device on five of the 10 sensor cameras of both sets for the first week, and then switched the device to the other five for the second week. The sensor cameras were set at least 50 m apart. In 2004, I used 20 sensor cameras of the same sensitivity in pairs and put the device on one of each pair. The sensor cameras of each pair were set within 5 m from each other and the pairs were set at least 50 m apart.

Assuming poisson process for the photographic event, I estimated the bat photographic rates per 100 camera-night hours and their 95% exact confidence intervals. The night (sunset to sunrise) hours for the area were obtained from the website "http://www1.kaiho.mlit.go.jp/KOHO/automail/sun_form3.htm" provided by Hydrographic and Oceanographic Department of Japan Coast Guard.

Results

From the low sensitivity set in 2002, I obtained six bat photos for 70 camera-nights (namely, 5 cameras × 7 nights/week × 2 weeks) with the device and two bat photos for 68 camera-nights without the device (Table 1). Two camera-nights were missing in the latter because of film depletion during the test. From the high sensitivity set, I obtained 16 bat photos for 65 camera-nights with the device and none for 66 camera-nights without it. Five camera-nights in the former and four in the latter were missing because of film depletion.

As for the paired test in 2004, I obtained 25 bat photos with the device and four without it for 131 paired-camera-nights (Table 1). I have excluded nine paired-camera-nights as invalid for comparison, because both sensor cameras of a pair did not work for a whole night. However, no bats were photographed during the excluded periods.

The photographic rates per 100 night-hours were much higher in those with the device than those without the device and the difference was significant except for the low sensitivity set in 2002 (Table 1). The obtained photographs also showed that the device helped to produce better images. It was obvious that bats were deceived and mistook the piece of eraser as prey because some bats were actually seen biting it in the photos (Fig. 2).

Discussion

The results showed that the device was highly effective in luring bats to the front of the cameras to photograph. They also showed that the detection sensitivity could notably affect the photographic rate of bats.

It is well known that the bat *Pipistrellus abramus*, which is commonly seen in some urban areas, is attracted to pebbles that children throw up in the air. Some people also observe while driving in forests that bats are attracted to the tip of the swaying rod antenna fixed to the car. Barclay and Brigham (1994) also observed that insectivorous bats attack any moving target of an appropriate size without making detailed discrimination for target shape and texture. Bats are thus apparently lured to some small objects hanging in the air.

This device could be a useful tool for bat surveys

Fig. 2. Lured and photographed bats.

using automatic photography. In fact, my colleagues and I have successfully monitored bat activities in forests using automatic photography with this technique for 140, 209, 210 consecutive nights in 2002, 2003, and 2004, respectively. The technique might also be used in combination with some other survey methods such as acoustic monitoring. However, we must be aware that different bat species might have different reactions to the luring device.

Initially, I tested several other materials as fake prey, such as aluminum foil, Styrofoam and feather. The aluminum foil was shaped to easily catch the wind or was made into a wad. Also, I used a short length of thread to attach those materials to the tip of the wire because I had expected that things that were easily blown about by a light wind would work better. However, I abandoned it later because threads tangled up easily making them difficult to handle when the device was not in use. Although I have not made a rigorous test, all the materials seemed to lure successfully bats. I adopted the eraser fixed to the tip of the wire only because it was the easiest to handle.

Intriguingly, not only bats but birds were also found to be lured to the device; for example, a nuthatch *Sitta europaea* and a Japanese pygmy woodpecker *Dendrocopos kizuki*, were actually seen biting the eraser, while the Siberian bluechat *Tarsiger cyanurus* was photographed several times apparently approaching it. Other bird species photographed might also have been attracted to the fake prey.

I thank Professor Kishio Maeda for his encouragement and help in this study. Gratitude is also due to Naoko Sasaki for her help in the field work and Dr. Kohji Yamamura for his help in statistics.

References

Barclay, R. M. R. and Brigham, R. M. 1994. Constraints on optimal foraging: a field test of prey discrimination by echolocating insectivorous bats. Animal Behaviour 48: 1013–1021.

Hirakawa, H. 2004. The status of middle- to large-sized mammals in Nakagawa Research Forest. In (M. Noda, ed.) Study of the Natural Environment in the Nakagawa Research Forest. The Reports for the 2001–2002 Fiscal Year. Pp. 3–11. Field Science Center for the Northern Biosphere, Hokkaido Univ., Nakagawa (in Japanese).

Kunz, T. H., Tidemann, C. R. and Richards, G. C. 1996. Chapter 8: Capturing Mammals. (Small volant mammals). In (D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudwan, and M. S. Foster, eds.) Measuring and Monitoring Biological Diversity — Standard Method for Mammals. Pp. 122–146. Smithsonian Institution Press, Washington and London.

Racey, P. A. and Entwistle, A. C. 2003. Chapter 15: Conservation ecology of bats. In (T. H. Kunz and M. B. Fenton, eds.) Bat Ecology. Pp. 680–743. Univ. Chicago Press, Chicago and London.

Received 1 November 2004. Accepted 24 January 2005.