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Notes and Discussion

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Abstract.—A large emergence of bats from a roost tree or more commonly a cave, provide birds of prey, especially owls, with an improved opportunity to capture bats. Away from these concentrated bat communities, bats are thought to make up an insignificant portion of owl diets. However, little research has investigated if bats perceive owls as a potential predatory threat. We conducted acoustic bat surveys to assess if bat activity was altered by the presence of owl calls or ambient nocturnal noise. Our surveys found no difference in the level of bat activity recorded before or during broadcasted owl calls or nocturnal noise. It is possible bats do not respond to calling owls because bats do not perceive owls as a threat. Additional studies may elucidate the relationship (if any) between bats and owls.

Introduction

Owls are considered top predators in many ecosystems (Manley *et al.*, 2006), taking a variety of prey animals including bats (Ritchison and Cavanagh, 1992; Swengel and Swengel, 1992; Marti and Kochert, 1996). Owls may opportunistically take bats, but they make up an insignificant portion of owl diets (Fenton and Fleming, 1976; Duncan and Sidner, 1990; García *et al.*, 2005). Most reports of owls depredating bats have been observations made at roosts and caves when large swarms of bats exit (Twenty, 1954; Baker, 1962; Fenton *et al.*, 1994). These predators can wait for the bats to emerge in large numbers and this improves the predator's chances of capturing a bat. Nevertheless, Baker (1962) found owls, specifically Great Horned Owls (*Bubo virginianus*), to be one of the least effective avian predators near a cave in New Mexico. Because the owls could not outmaneuver the bats, they captured bats with their talons by flying into dense streams of bats exiting the cave (Baker, 1962). García *et al.* (2005) studied Long-eared Owls (*Asio otus*) in Europe and found bats made up approximately 2% of the owl's diets. However, they believe these bats were concentrated in an area when captured by the owls because the distribution of bats per pellet was aggregated.

Aggregations of bats could be an important food source for owls, but once bats are dispersed throughout their foraging area they appear to be a less common food source for birds of prey (Fenton and Fleming, 1976; Speakman, 1991; Garcia *et al.*, 2005). However, it is uncertain if bats perceive owls as a threat and alter their behavior when owls are present. Petrželková and Zukal (2001) found a predator model placed outside of a roost had no effect on bat emergence. Conversely, Baxter *et al.* (2006) found a decrease in bat activity in the presence of owl calls but could not distinguish if this decrease was in response to the owl calls or noise in general.

To better assess if bats alter their foraging behavior in the presence of owl calls, we conducted a study to measure the level of bat activity relative to owl calls and ambient nocturnal noises. To do this, we broadcast calls of a Great Horned Owl (*Bubo virginianus*), Barred Owl (*Strix varia*), Eastern Screech-owl (*Megascops asio*), and a mix of nocturnal noises [American Toads (*Bufo americanus*), Common Nighthawk (*Chordeiles minor*), and a train horn]. Based on personal observations and literature review, we predicted bat activity would be unaltered by calling owls. If owls do not pose a great enough risk to bats, then their foraging activity would not be significantly altered.

Methods

Our research took place in the Oak Openings Preserve (41″32–34′N × 83″50–51′W) located in Swanton, Ohio, U.S.A. This park is 1524 ha and is part of the 467,000-ha heterogeneous landscape of oak savanna, oak woodland, and wet prairies (Higgins, 2003; Brewer and Vankat, 2006) of the Oak Openings Region in northwest Ohio.

We surveyed eight sites, a minimum of 400 m apart, throughout the Oak Openings Preserve from 4 Sep. to 12 Sep. 2012. Our study followed summer bat surveys (Janos, 2013) where we observed that bats did not appear to alter their behavior when calling owls were heard in the area. Four sites were located in open grasslands, prairies, or savannas and three sites were located in forested areas. One site was located on the edge of a large recreational pond (walking paths around it and fishing access)

surrounded by forest. We selected this diverse range of habitats to increase the possibility of recording a wide range of bat species and to maximize the amount of bat activity recorded.

Surveys began a half hour after sunset and concluded within 3 h of sunset, which is when bat activity is at its highest (Hayes, 1997). During the first 10 min of sampling, we recorded bat activity with an Anabat^{TM} SDII acoustic detector (Titley Electronics, Ballina, NSW, Australia). This served as a control to monitor bat activity before treatments. After 10 min of recording, a treatment was randomly selected to be played through a boombox (Naxa NPB-250) located underneath the Anabat for 10 min. There were four possible treatments a site could be given: Great Horned Owl calls, Barred Owl calls, Eastern Screech-owl calls, or ambient nocturnal noise. The purpose of the noise treatment was to help distinguish if bats responded to a perceived predation risk or noise in general.

Treatments lasted 20 sec and were broadcasted once every minute for 10 min while the Anabat continued to record bat activity. The Anabat remained stationary, pointed in the direction with the least amount of clutter, whereas the boombox was pointed in a different cardinal direction every time a call was broadcast so as to uniformly distribute the calls/noises. Sites randomly received each treatment once and no more than one treatment on a given night.

The amount of bat activity at each site was quantified by the number of call sequences recorded by the Anabat (Hayes, 1997). We considered a call to be a single sound emission produced by a bat and a call sequence to be a series of calls separated by less than 1 s (Fenton, 1999). Files were 15 s in length, characteristic of the Anabat, and typically contained one call sequence.

The recorded files were loaded into AnalookW (version 3.8v, Chris Corben), a program that projects calls on a sonogram allowing an expert to view recorded bat calls and to measure call characteristics. Files were identified based on visual inspection of frequency, shape, and slope of the calls by the author and with the aid of call libraries and automated identification programs (Janos, 2013). Files containing a sequence of calls that could not be identified to species or a file that had fewer than three calls were labeled as ''unknown.'' All the files were identified then placed into one of the four treatment categories (Great Horned Owl, Barred Owl, Screech-owl, or noise) based on the time the calls were recorded.

Using the equation (t-c)/c, where ''t'' is the sum of bat activity recorded during a treatment and ''c'' is the sum of bat activity recorded during the corresponding control, a ratio was created of how much bat activity increased or decreased for a given survey at a site. Data were log-transformed to ensure normality and a two-way ANOVA was utilized, with site and treatment as model effects, to look for a difference in the ratio of bat files recorded during the four treatments. Additionally, a Student's *t*-test was utilized to determine if there was a difference in the amount of bat activity between the control and the corresponding noise treatments. These data were also log-transformed to ensure normality.

RESULTS

We recorded 637 files during our surveys (n = 32). Most of the bats recorded were Big Brown Bats (*Eptesicus fuscus*; 76.2% of all files). Few files were attributed to Silver-haired (*Lasionycteris noctivagans*; 9.4%), Eastern Red (*Lasiurus borealis*; 1.6%), Tri-colored (*Perimyotis subflavus*; 0.5%), *Myotis* species (0.5%) and Hoary Bats (*Lasiurus cinereus*; 0.2%). The remainder of the files (11.6%) could not be identified to species. These data were analyzed as a whole, not by individual species, because calls attributed to Big Brown Bats were the most prevalent.

We found no statistically significant effect in the ratio of bat files recorded verses treatment ($F_{(10, 21)} = 1.14$, P = 0.379). The average number of bat files recorded was highest during the Barred Owl treatment (16.75 +/− 12.85) and lowest for the Eastern Screech-Owl (7.75 +/− 10.39; Table 1). The average number of files recorded during all the owl treatments combined (10.96 +/− 10.77) was slightly higher than the control (9.22 +/− 10.84) and noise treatment (9.88 +/− 13.79). There was no difference between the control and noise treatment ($t = 1.068$, P = 0.304).

DISCUSSION

Few studies have examined bats' perception of predators. Baxter *et al.* (2006) conducted a similar study to ours and found bat activity decreased in the presence of an owl treatment but could not confidently conclude that bats were responding to perceived predation risk versus general auditory noise. We utilized a noise treatment in an attempt to avoid this issue and contrary to their findings, our

TABLE 1.—The average number of bat files recorded during the control and the three owl treatments (*Bubo virginianus, Strix varia,* and *Megascops asio*) and the ambient noise treatment recorded at the Oak Openings Preserve, Ohio, U.S.A from 4 Sep. to 12 Sep. 2012. There was no statistical difference between any of the treatments

Treatment	Average (+/− SD)
Control	9.22 (+/− 10.84)
Bubo virginianus	8.38 (+/− 7.09)
Strix varia	16.75 (+/− 12.85)
Megascops asio	7.75 (+/− 10.39)
Noise	9.88 (+/− 13.79)

study found bat activity to be unaltered during any owl treatment or the noise treatment. It does not appear that bats associate calling owls with a predator, possibly because owls do not regularly take bats as prey (Ritchison and Cavanagh, 1992; Swengel and Swengel, 1992; Marti and Kochert, 1996).

Another possible explanation for the lack of response by bats is, that like most predators, owls are quiet when they hunt. Owls actively call to establish and defend territories and to attract mates (Johnsgard, 1988; Duncan and Duncan, 1997). Bats potentially are accustomed to owl calls and may perceive them as a nonthreatening nocturnal noise, similar to other common ambient nocturnal sounds.

Furthermore, insectivorous bats are highly agile (Norberg and Rayner, 1987) and likely can outmaneuver owls. Most observations of owls taking bats as prey have occurred near large roosts when bats exit in large numbers and owls have a better chance of catching a bat (Twenty, 1954; Baker, 1962; Barclay *et al.*, 1982). Habitats associated with a predation risk may be more of a determining factor whether to forage or not than the actual presence of predator (Boinski *et al.*, 2003).

We cannot say if owl calls affect individual bat species differently because we had few bat files attributed to species other than Big Brown Bats. We recommend repeating this study during the summer months when bat species evenness is greater and when bats are tied to foraging areas in the proximity to their roost. However, the average number of bat files recorded was similar between treatments and the control. Given the lack of response by bats when owl calls were played and the lack of evidence of bats in owl diets (Ritchison and Cavanagh, 1992; Swengel and Swengel, 1992; Marti and Kochert, 1996), it is likely owls pose a small risk to bat populations unless they are at communal roosts or in large aggregations.

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LITERATURE CITED

BAKER, J. K. 1962. The manner and efficiency of raptor depredations on bats. *Condor*, **64**:500–504.

BARCLAY, R. M. R., C. E. THOMPSON, AND F. J. PHELAN. 1982. Screech owl, *Otus asio,* attempting to capture little brown bats, *Myotis lucifugus,* at a colony. *Can. Field Nat.*, **96**:205–206.

BAXTER, D. J. M., J. M. PSYLLAKIS, M. P. GILLINGHAM, AND E. L. O'BRIEN. 2006. Behavioural response of bats to perceived predation risk while foraging. *Ethology,* **112**:977–983.

BOINSKI, S., L. KAUFFMAN, A. WESTOLL, C. M. STICKLER, S. CROPP, AND E. EHMKE. 2003. Are vigilance, risk from avian predators and group size consequences of habitat structure? A comparison of three species of squirrel monkey (*Saimiri oerstedii, s. boliviensis,* and *S. sciureus*). *Behaviour,* **140**:1421–1467.

BREWER, L. G. AND J. L. VANKAT. 2006. Richness and diversity of oak savanna in northwestern Ohio: proximity to possible sources of propagules. *Am. Midl. Nat.*, **155**:1–10.

DUNCAN, J. R. AND P. A. DUNCAN. 1997. Increase in distribution records of owl species in Manitoba based on a volunteer nocturnal survey using boreal owl and great gray owl playback. *In:* Duncan, J. R., D. H. Johnson and T. H. Nicholls (eds.). Biology and conservation of owls of the northern hemisphere: 2 d International symposium; 1997 Feb. 5–9; Winnipeg, MB. Gen. Tech. Rep. NC-190. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 519–524.

DUNCAN, R. B. AND R. SIDNER. 1990. Bats in spotted owl pellets in southern Arizona. *Great Basin Nat.*, **50**:197–200.

FENTON, M. B. 1999. Describing the echolocation calls and behavior of bats. *Acta Chiropterol.*, **1**:127–136.

——— AND T. H. FLEMING. 1976. Ecological interactions between bats and nocturnal birds. *Biotropica*, **8**:104–110.

———, I. L. RAUTENBACH, S. E. SMITH, C. M. SWANPOEL, J. GROSELL, AND J. VAN JAARSVELD. 1994. Raptors and bats: threats and opportunities. *Anim. Behav.*, **48**:9–18.

GARCÍA, A. M., F. CERVERA, AND A. RODRÍGUEZ. 2005. Bat predation by Long-eared Owls in Mediterranean and temperate regions of southern Europe. *J. Raptor Res.*, **39**:445–453.

HAYES, J. P. 1997. Temporal variation in activity of bats and the design of echolocation-monitoring studies. *J. Mammal.*, **78**:514–524.

HIGGINS, J. B. 2003. Emergy analysis of the Oak Openings region. *Ecol. Eng.*, **21**:75–109.

JANOS, G. 2013. Utilizing acoustic methods to identify bat species, and to assess their habitat use and perception of owls. Thesis, Bowling Green State University, Bowling Green, U.S.A.

JOHNSGARD, P. A. 1988. North American owls, biology and natural history. Smithsonian Institution, Washington, D.C.

MANLEY, P. N., B. VAN HORNE, J. K. ROTH, W. I. ZIEHINSKI, M. M. MCKENZI, T. J. WELLER, F. W. WECKERLY, AND C. VOJTA. 2006. Multiple species inventory and monitoring technical guide. Gen. Tech. Rep. WO-73. Washington, D.C.: U.S. Department of Agriculture, Forest Service, Washington Office. 204 p.

MARTI, C. D. AND M. N. KOCHERT. 1996. Diet and trophic characteristics of Great Horned Owls in southwestern Idaho. *J. Field Ornithol.*, **67**:499–506.

NORBERG, U. M. AND J. M. RAYNER. 1987. Ecological morphology and flight in bats (Mammalia: Chiroptera): wing adaptations, flight performance, foraging strategy and echolocation. *Philos. T. Roy. Soc. B.*, **316**:335–427.

PETRŽELKOVÁ, K. AND J. ZUKAL. 2001. Emergence behaviour of the serotine bat (*Eptesicus serotinus*) under predation risk. *Neth. J. Zool.*, **51**:395–414.

RITCHISON, G. AND P. M. CAVANAGH. 1992. Prey use by Eastern Screech-owls: seasonal variation in central Kentucky and a review of previous studies. *J. Raptor Res.*, **26**:66–73.

SPEAKMAN, J. R. 1991. The impact of predation by birds on bat populations in the British Isles. *Mammal Rev.*, **21**:123–142.

SWENGEL, S. R. AND A. B. SWENGEL. 1992. Diet of Northern Saw-whet Owls in southern Wisconsin. *Condor*, **94**:707–711.

TWENTY, J. W. 1954. Predation on bats by hawks and owls. *Wilson Bull.*, **66**:135–136.

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