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Observations of a merlin (*Falco columbarius*) hunting northern bats (*Eptesicus nilssonii*) in midnight sun (Northern Norway)

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With 2 figures

Zusammenfassung

Beobachtungen über einen in Nord-Norwegen während der Periode mit Mitternachtssonne Nordfledermäuse (*Eptesicus nilssonii*) jagenden Merlin (*Falco columbarius*)

Nordfledermäuse (*Eptesicus nilssonii*) wurden 100 km südlich von Tromsø / N-Norwegen (etwa 69°00'N, 19°00'E) während der Sommer 2001-2011 studiert, indem ein teilweise großer Zeitaufwand in verschiedenen Sommern an zwei Quartieren investiert wurde, als dort Fledermäuse telemetriert worden sind. Die Zeitspanne mit Mitternachtssonne endet am 19. Juli und danach gibt es eine Periode mit Zwielicht (Dämmerungsphase), bis die Sonne mehr als 6° unter den Horizont sinkt. Raubtiere wurden hier bis vor kurzem niemals beim Jagen auf Fledermäuse gesehen, weder an den Quartieren noch anderswo, bis 2011. In diesem Sommer wurde ein Merlin (*Falco columbarius*) beobachtet, der mehrere Male an einem Quartier Fledermäuse jagte, obwohl das Töten eines Tieres nur einmal mit eigenen Augen gesehen werden konnten. Während der Periode vom 29. Juni bis zum 12. Juli 2011 besuchte ich dieses spezielle Quartier in 7 Nächten und beobachtete den Merlin dort 5mal, und zwar in einer Nacht bei jeweils 3, 0, 1, 1, 0, 5, 5 Gelegenheiten. Später, am 21. Juli 2011, verließ die erste Fledermaus das Quartier erst 9 Minuten vor Mitternacht, zwei Stunden später als im vorhergehenden Jahr, bei etwa gleichen Wetterbedingungen (bewölkt, trübe). Obwohl der Merlin in dieser Nacht nicht gesehen wurde, war das verspätete Ausfliegen wahrscheinlich das Ergebnis seiner früheren Jagdaktivität. In den dunkleren Nächten im August war der Merlin ebenfalls nicht zu sehen und die Fledermäuse zeigten dann wieder eine normale Aktivität. Raubtiere, die Fledermäuse jagen, werden dabei selten beobachtet, aber solche Ereignisse können Fledermäuse stark beeinflussen, indem sie ihre Zahl verkleinern und auch die Jagdperioden verkürzen. So wird das Überleben beeinflusst und möglicherweise auch der Reproduktionerfolg.

Abstract

Northern bats (*Eptesicus nilssonii*) were studied in Troms county, northern Norway (approximately 69°00'N, 19°00'E, about 100 km south of Tromsø,) during the summers of 2001-2011, with a particular large amount of time spent at two roosts in several summers when bats were radio-tracked. The period with midnight sun ends 19 July, after which there is a period of twilight until the sun drops more than 6° below the horizon. Predators were never seen hunting bats, neither at roosts nor elsewhere, until 2011. This summer a merlin (*Falco columbarius*) was seen hunting bats at one roost on numerous occasions, although only one kill was witnessed. During the period 29 June to 12 July 2011, I visited this particular roost on 7 nights, observing the merlin in 5 of these, on 3, 0, 1, 1, 0, 5, 5 occasions per night. On 21 July, the first bat did not emerge until 9 minutes before midnight, two hours later than in the previous year, under approximately identical weather conditions (cloudy). Although the merlin was not seen this night, the delayed exit was probably a result of its hunting activity. With darker nights in August, the merlin was not seen and the bats resumed normal activity. Predators hunting bats are rarely observed, but such events may also influence bats that survive, reducing their hunting periods and possibly reproductive success.

Keywords

Predators hunting bats. Merlin (*Falco columbarius*). Northern bat (*Eptesicus nilssonii*). Troms county. Northern Norway. North of Arctic Circle.

1 Introduction

Information about predators hunting bats are scanty (ALTRINGHAM 2011). Predators may be regular visitors at large roosts (tens of thousands +), and in these circumstances predation events have been frequently observed. For bats that live in small and scattered roosts little is known about predation rate and its effects. Bat populations do not tolerate high mortality, because all species have very low fecundity. Many animals may hunt bats, i. e. hawks, falcons, owls, mammals and snakes, but very few are specialized to do so. In a review of bird predation on British bats, SPEAKMAN (1991) found 11 species that occasionally fed on bats and 3 species of owls that fed on bats more

frequently. He estimated that avian predators accounted for minimum 11 % of the annual mortality in British bats, and that this may affect their population dynamics. Other studies have also revealed a multitude of avian predators on bats, either at roosts, when hunting or in hibernaculas (FENTON et al. 1994, GRIMSTAD & MICHAELSEN 2007, LESIŃSKI et al. 2009a, 2009b, SOMMER et al. 2009, STEVENS et al. 2009, ZHANG et al. 2009, ESTÓK et al. 2010, FISCHER et al. 2010). In Poland, as populations of bats increased in the last decades, so did the occurrence of bats in the diet of tawny owls (*Strix aluco*; LESIŃSKI 2010). In an experiment, stuffed predators had little or no effect on the evening emergence of bats (PETRZELKOVÁ & ZUKAL 2001).

Bats on predator-free islands may sometimes emerge to hunt in daytime hours, such as the Sao Tomé bat (*Hipposideros ruber*; RUSSO et al. 2011). The endemic Azores noctule (*Nyctalus azoreum*) may also hunt during daytime or emerge very early in the evening, presumable because there are few or no avian predators on these islands (MOORE 1975, SPEAKMAN & WEBB 1993). During the winter, one advantage may be higher temperatures in daytime hours (MOORE 1975). Clustered emergence in this species may be due to mammalian predators, as rats and cats were seen close to some exit holes (IRWIN & SPEAKMAN 2003).

The northern bat (*Eptesicus nilssonii*) is the only species regularly distributed north of the Arctic Circle in Norway (FRAFJORD 2001). At high latitudes the nights are particular bright with the sun shining 24 hours a day during the first part of summer, although it does descend behind mountains and hills in its lowest position. SPEAKMAN et al. (2000) studied northern bats in North Norway and concluded that although they did not witness any predation events, risk of predation was still a plausible factor to explain why bats were nocturnal under such conditions. Do northern bats experience higher predation risk in midnight sun?

2 Study area and method

I studied the northern bat in Troms county, northern Norway (approximately 69°00'N, 19°00'E) during the summers of 2001-2011, using different methods in various projects; locating roosts, counting numbers of bats, radio-tracking individual bats, etc. The known roosts were counted yearly around 20-25 July, before the young became volant. In several summers I spent much time at two particular roosts, from which bats were radio-tracked throughout the season. The habitat was boreal forest interspersed with farmland, sparsely populated.

3 Results

In most of these years predation was never witnessed, neither at roosts nor in other places, and no predators gathered at roosts at any time. However, in the summer 2011 a merlin (*Falco columbarius*) was hunting bats at one roost. A merlin was also seen minimum two times at the roost in 2010 by HANS OLAV LØVHAUG (pers. com.), but probably hunted bats less that summer. This roost included the largest numbers of bats of all ca. 8 known roosts until 2010, with around 100 adult females until 2007 (Fig. 1). The numbers were much reduced between 2007 and 2008 and between 2009 and 2010. This reduction may have resulted from two winters with severe frost that penetrated deep into the ground, possibly increasing mortality during hibernation. Roost switching does not appear to be prominent in this region, and other roosts showed basically the same reductions in numbers (with the exception of two roosts that increased in numbers the last two years).

During the period 29 June to 12 July 2011, I visited this particular roost on 7 nights, observing the merlin in 5 of these, on 3, 0, 1, 1, 0, 5, 5 different occasions per night. One night the merlin was seen chasing bats 5 times, but no kill was made. One bat fled into the foliage of a tree where the merlin did not follow, and others fled and took evasive actions with the

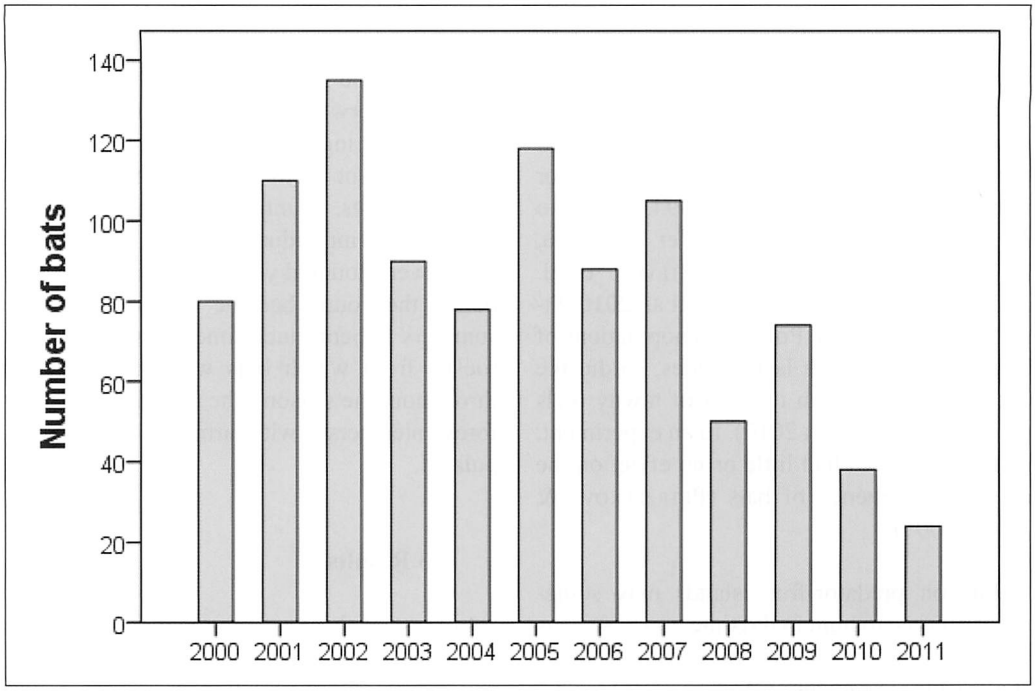

Figure 1. Numbers of northern bats in the roost during the years 2000-2011 (the estimate for 2000 may be a little too low). The bats were counted when emerging in the evening (using a bat-detector and being able to observe every bat).

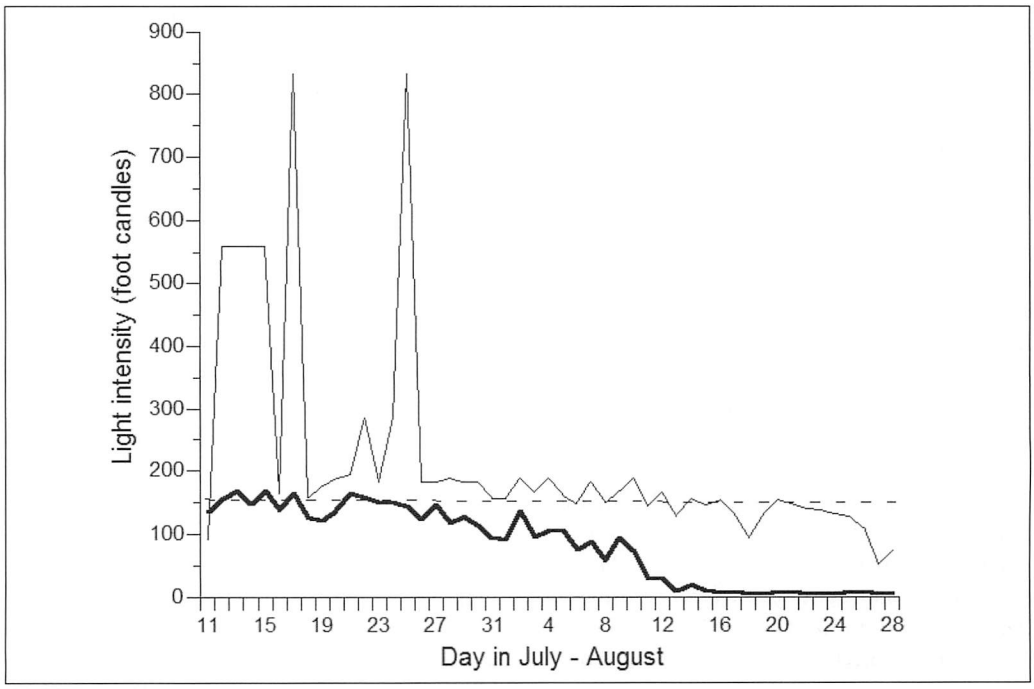

Figure 2. An example of light intensity (foot candles) measured by a datalogger with light sensor placed close to the colony during July and August, 2001, recorded at 21.00 hours (thin line) and 23.00 hours (thick line). The northern bat prefers to exit in levels below 160 foot candles (broken line).

raptor in hot pursuit. The bats were able to avoid the merlin if they spotted it early. On one occasions the merlin caught a bat just above my head and just meters away from the roost house, but got only one claw into its back so the bat managed to wriggle loose and fled straight into the house. I witnessed only one bat killed by the merlin, although the actual number probably was much higher as the merlin most likely also hunted farther away from the roost (and naturally also when I was not present). On 3 evenings the merlin arrived at the roost just before bats started to emerge, obviously having learnt their activity pattern, sitting in various trees. It is possible, that the merlin significantly contributed to the reduced number of bats in this roost in 2010-2011 (Fig. 1).

In the first nights about 8 bats used the roost, which had increased to 24 bats when I performed the yearly count 21 July. This night and later the merlin was not seen (I visited the roost on 5 nights during 15-24 August). The period with midnight sun ends 19 July, after which there is a period of twilight until the sun drops more than 6° below the horizon (Fig. 2). On 21 July, the first bat did not emerge until 9 minutes before midnight. This is two hours later than in the previous year, under approximately indentical weather conditions (cloudy). No other colony emerged that late in 2011. Normally, all adult bats leave the roost before midnight and the firsts start to return soon afterwards. Hence, it is likely that the delay was caused by the merlin's hunting activity at the roost. Such a large delay may have limited the bats' hunting period significantly. With darker nights in August, the bats resumed normal activity.

4 Discussion

I witnessed a similar incidence at Ponta Delgada on the Azores (Portugal) in the evening of 1 June 2011. During one hour at dusk, around 20-21 hours, a hobby (*Falco subbuteo*) caught and ate least four Azores noctules that foraged high in the sky above agricultural fields. Some bats successfully evaded the falcon, which just went after the next bat.

Risk of predation is probably the main reason why northern bats north of the Arctic Circle are active only in the middle of the "night" in July, although this reduces their hunting activity to just 1-2 hours when the sky is clear (sensu RYDELL et al. 1996). Predation events may be rare, but have serious consequences. A single raptor may possibly reduce both the number of bats in a colony and their hunting time, thus potentially influence both survival and reproductive success. The diversity of bats is highly dependent upon latitude, i. e. temperature and night length (KAUFMANN & WILLIG 1998, ULRICH et al. 2007), and the northern bat in Troms is at the northern distribution limit of any bat in the world. MICHAELSEN et al. (2011) concluded that temperature predicted the distribution of soprano pipistrelles (*Pipistrellus pygmaeus*) at their northern limit in Norway, and these bats took advantage of the dark side of valleys to emerge up to 2 hours earlier in the evening (sensu JONES & RYDELL 1994).

Living in large (summer) colonies may be an antipredator-startegy, if large numbers of bats emerge more or less simultaneously in the evening there will be "safety in numbers" (ALTRINGHAM 2011). Large roosts may attract more predators, which particularly gather around the roost at emergence time. Bats are particularly vulnerable to aerial predation as they leave the roost. If they emerge in large numbers over a relatively short period of time, the event can be predicted by predators. In many species the evening emergence is synchronized, they gather in large numbers before leaving the roost, and they leave along common fly-ways. Bats often prefer to leave the roost early, before it is pitch dark, to take advantage of a higher density of insects at the end of the day or an evening peak in insect abundance (JONES & RYDELL 1994, RYDELL et al. 1996). To reduce predation risk they may emerge later, emerge in clusters or switch roost (FENTON et al. 1994, ALTRINGHAM 2011). Of these alternatives, northern bats in Troms appeared to rely heavily on emerging later. This also implied leaving the roost more synchronously, i. e. a shorter duration before the entire colony had left. However, the merlin

was able to hunt even in the darkest part of the night in the first half of July, making the bats very vulnerable.

Literature

ALTRINGHAM, J. D. (2011): Bats: from evolution to conservation. Oxford University Press. Oxford, U. K.

ESTÓK, P., ZSEBOK, S., & SIEMERS, B. M. (2010): Great tits search for, capture, kill and eat hibernating bats. Biology Letters **6**(1), 59-62.

FENTON, M. B., RAUTENBACH, I. L., SMITH, S. E., SWANEPOEL, C. M., GROSELL, J., & JAARESVELD, J. V. (1994): Raptors and bats: threats and opportunities. Animal Behaviour **48**(1), 9-18.

FISCHER, E., MUNIN, R. L., LONGO, J. M., FISCHER, W., & DE SOUZA, P. R. (2010): Predation on bats by great kiskadees. J. Field Ornithol. **81**(1), 17-20.

FRAFJORD, K. (2001): Distribution of the northern bat *Eptesicus nilssonii* above the Arctic Circle in Norway (in Norwegian, summary in Engl.). Fauna **54**(4), 124-131.

GRIMSTAD, K. J., & MICHAELSEN, T. C. (2007): Gyrfalcon *Falco rusticolus* hunting bats (in Norwegian, summary in Engl.). Ibid. **60**(3-4), 289-291.

IRWIN, N. R., & SPEAKMAN, J. R. (2003): Azorean bats *Nyctalus azoreum*, cluster as they emerge from roosts, despite the lack of avian predators. Acta Chiropterologica **5**(2), 185-192.

JONES, G., & RYDELL, J. (1994): Foraging strategy and predation risk as factors influencing emergence time in echolocating bats. Phil. Trans. R. Soc., Lond., **B 346**, 445-455.

KAUFMAN, D. M., & WILLIG, M. R. (1998): Latitudinal patterns of mammalian species richness in the New World: the effects of sampling method and faunal group. J. Biogeography **25**, 795-805.

LESIŃKSKI, G. (2010): Long-term changes in abundance of bats as revealed by their frequency in tawny owl's diet. Biologia **65**(4), 749-753.

-, GRYZ, J., & KOWALSKI, M. (2009a): Bat predation by tawny owls *Strix aluco* in differently human-transformed habitats. It. J. Zool. **76**(4), 415-421.

-, IGNACZAK, M., & MANIAS, J. (2009b): Opportunistic predation on bats by the tawny owl *Strix aluco*. Animal Biol. **59**(3), 283-288.

MICHAELSEN, T. C., JENSEN, K. H., & HÖGSTEDT, G. (2011): Topography is a limiting distributional factor in the soprano pipistrelle at its latitudinal extreme. Mamm. Biol. **76**(3), 295-301.

MOORE, N. W. (1975): The diurnal flight of the Azorean bat (*Nyctalus azoreum*) and the avifauna of the Azores. J. Zool., Lond., **177**, 483-486.

PETRZELKOVÁ, K., & ZUKAL, J. (2001): Emergence behaviour of the serotine bat (*Eptesicus serotinus*) under predation risk. Neth. J. Zool. **51**(4), 395-414.

RUSSO, D., MAGLIO, G., RAINHO, A., MEYER, C. F. J., & PALMERIM, J. M. (2011): Out of the dark: diurnal activity in the bat *Hipposideros ruber* on Sao Tomé island (West Africa). Mamm. Biol. **76**, 701-708.

RYDELL, J., ENTWISTLE, A., & RACEY, P. A. (1996): Timing of foraging flights of three species of bats in relation to insect activity and predation risk. Oikos **76**(2), 243-252.

SOMMER, R. S., NIEDERLE, M., LABES, R., & ZOLLER, H. (2009): Bat predation by the barn owl *Tyto alba* in a hibernation site of bats. Folia Zool. **58**(1), 98-103.

SPEAKMAN, J. R. (1991): The impact of predation by birds on bat populations in the British Isles. Mammal. Rev. **21**(3), 123-142.

-, RYDELL, J., WEBB, P. I., HAYES, J. P., HAYES, G. C., HULBERT, I. A. R., & MCDEVITT, R. M. (2000): Activity patterns of insectivorous bats and birds in northern Scandinavia (69°N). Oikos **88**(1), 75-86.

-, & WEBB, P. I. (1993): Taxonomy, status and distribution of the Azorean bat (*Nyctalus azoreum*). J. Zool., Lond., **231**(1), 27-38.

STEVENS, L. E., BROWN, B. T., & ROWELL, K. (2009): Foraging ecology of peregrine falcons (*Falco peregrinus*) along the Colorado River, Grand Canyon, Arizona. Southwestern Naturalist **54**(3), 284-299.

ULRICH, W., SACHANOWICZ, K., & MICHALAK, M. (2007): Environmental correlates of species richness of European bats (*Mammalia: Chiroptera*). Acta Chiropterologica **9**(2), 347-360.

ZHANG, L.-J., WANG, A.-M., BAO, W.-D., & LI, X.-J. (2009): Food composition of wintering long-eared owls (*Asio otus*) in different habitats in Beijing. Ch. J. Ecol. **28**(8), 1664-1667.

Anmerkung

Im deutschsprachigen Schrifttum, darunter auch im NYCTALUS, sind in den letzten Jahren mehrmals zusammenfassende Arbeiten über das Erbeuten von Fledermäusen durch Greifvögel und andere Vogelarten erschienen:

HAENSEL, J. (1999): Fledermäuse und Vögel – Kontakte, Konflikte und andere Interaktionen zwischen den beiden einzigen aktiv fliegenden Wirbeltiergruppen. Mitt. naturwiss. Ver. Goslar **6**, 219-240.

- (2008): Vögel attackieren und erbeuten Fledermäuse, aber auch umgekehrt! Nyctalus (N. F.) **13**, 127-136.

-, & NICOLAI, B. (2007): Vögel machen Jagd auf Fledermäuse – Versuch einer Übersicht nach dem Schrifttum und anderen Quellen. Orn. Jber. Mus. Heineanum **25**, 51-70.

-, & SÖMMER, P. (2002): Taggreifvögel erbeuten Fledermäuse und Flughunde – Versuch einer Gesamtübersicht – und neueste Erkenntnisse zur Fledermausjagd der schnellsten Falken in Deutschland. Ibid. **20**, 99-141.

SÖMMER, P., & HAENSEL, J. (2003): Fledermäuse als Beute von Taggreifvögeln – überraschende neue Befunde besonders für die beiden schnellsten deutschen Falkenarten. Nyctalus (N. F.) **9**, 61-78.

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