

Diurnal activity patterns and unusual habitat use and behaviour of whiskered bats (*Myotis mystacinus*) at northern latitudes in western Norway

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Abstract

The present study provides evidence of daytime flight and foraging behaviour of whiskered bats (*Myotis mystacinus*) in western Norway at 62° N. The bats were captured by mist netting and radio-tracked in late autumn. Whiskered bats hunted during daytime at several occasions which were not directly linked to temperature or weather conditions. They foraged in open habitats but were also observed to land on the ground, searching for prey. These bats returned to their roost at sunset. It is assumed that this daytime foraging behaviour is mainly used by immature bats which were born late in the season and must put on weight before winter.

Zusammenfassung

Tagesaktivitäten, Nutzung ungewöhnlicher Habitate und Verhalten der Kleinen Bartfledermaus (*Myotis mystacinus*) in den nördlichen Breiten von West-Norwegen.

Die vorliegende Studie beschreibt Tagesflüge und Jagdverhalten der Kleinen Bartfledermaus (*Myotis mystacinus*) in West-Norwegen in Höhe des 62. nördlichen Breitengrades. Die Fledermäuse werden im Spätherbst mit Japannetzen gefangen und anschließend telemetriert. Die Bartfledermäuse jagten mehrfach während des Tages und diese Aktivität war nicht temperatur- oder wetterabhängig. Sie jagten vorwiegend in offenen Lebensräumen. Landungen auf dem Boden und Suche nach Beute wurden aber auch beobachtet. Diese Fledermäuse kehrten bei Sonnenaufgang in ihre Quartiere zurück. Es wird angenommen, dass die Strategie der Tagesflüge vor allem von immaturren Bartfledermäusen angewendet wird, die spät im Jahre geboren wurden und vor dem Winter ein noch ausreichendes Gewicht erreichen müssen.

In general, European bats south of the Arctic Circle are nocturnal and this behaviour is interpreted as an anti-predator strategy (e. g. SPEAKMAN 1991, JONES & RYDELL 1994, DUVERGE et al. 2000). Except for some species, such as the noctule (*Nyctalus noctula*) and the soprano pi-

pistrelle (*Pipistrellus pygmaeus*), most species emerge after astronomical sunset (JONES & RYDELL 1994, DIETZ et al. 2007, MICHAELSEN et al. 2011, RUSSO et al. 2011). Bats of the *Myotis* family emerge late from their roosts (e. g. JONES & RYDELL 1994) and are not reported to frequent out during daytime.

During a radio telemetry study to search for roost sites for bats in late autumn and early winter in western Norway (62°N), 11 bats including four whiskered bats (*Myotis mystacinus*), were fitted with transmitters. The whiskered bat is a fairly common and widespread bat in western Norway (unpubl.). Data suggest that the whiskered bat is sedentary, but that at least some individuals will undertake shorter movements to the winter-mild sections where this study was carried out (MICHAELSEN 2011). All bats were trapped on their hunting grounds using a Sussex Autobat (HILL & GREENAWAY 2005) combined with puppet hair nets or captured using pole flicking (3 m mist net between telescope poles). The bats were tracked mainly during daytime to confirm roost site selection or in the evening, before expected departure (sometimes also after sunset to confirm nocturnal hunting bouts). When tracking bats fitted with transmitters, we simultaneously searched for small *Myotis* bats (*Myotis* sp.) using ultrasound detectors (Pettersson D240X/Tranquillity II).

Both northern bats (*Eptesicus nilssonii*, n = 6) and long eared bat (*Plecotus auritus*, n = 1) maintained a nocturnal activity pattern in autumn, but some emerged just before sunset. The activity patterns found in northern bats here fit our general impression as this easily detectable species has only been confirmed

hunting in daytime twice over a period of ten years (both in late autumn) in this area (unpubl. data). The whiskered bats also had nocturnal flights, but two (probably three) of these bats had strictly diurnal hunting bouts, returning to their roosts before sunset. These flights were all confirmed visually and in one area, the flight was recorded on video. A third bat probably hunted during daytime on one occasion. The signals shifted directions several times as heard on the receiver just after the observer arrived to track the bat. This was not confirmed through visual observations and after a few minutes, the signals were steady coming from its roost. Bats moving about inside crevices in rock walls can cause conflicting signals and this could, in theory, have lead the observer to believe that it was out flying, thus day-flight was not confirmed in this third bat. When trying to confirm day flight on a later date, the bat was not found and signals from the transmitter were never heard again. The fourth whiskered bat did not fly in daylight conditions during the few and short visits made to its roost. In addition to the whiskered bats tracked using telemetry, several small *Myotis* bats, *Myotis* sp. (all probably whiskered bats as Brandt's bat, *Myotis brandtii*, is not found in western Norway) were seen out hunting in daylight in two of the three areas as we tracked our bats. Diurnal flights were observed both during periods of cold weather when nightly temperatures dropped to around 0°C, but also on days preceded and followed by warm nights (>10°C).

Unlike in summer and during nocturnal flights, these whiskered bats also hunted in open habitats, such as along cliffs and large rock walls, over scree, and even above a fiord or around tree tops. When hunting in these habitats, the whiskered bats did not fly in its typical linear manner, but resembled more the flight patterns of soprano pipistrelles (*Pipistrellus pygmaeus*) when hunting along edges or rock walls and Daubenton's bats (*Myotis daubentonii*) when hunting just above the water surface of a marine Norwegian fiord. At close range, these bats could still be distinguished from soprano pipistrelles and

Daubenton's bats on speed, maneuverability and how the bat flapped its wings. It was not possible to confirm from direct observations or video recordings that this bat used gleaning to catch prey, but this cannot be excluded. One bat also used the typical linear hunting pattern when hunting along a trail in woodland during daytime (tunnel shaped tree cover), but also departed from the trail to hunt in dense woodland. On at least one occasion it landed on the trail and poked under leaves and twigs. Successful predation on invertebrates was not confirmed. It probably landed on the ground two more times, but this was not confirmed visually.

Although a small sample, this study suggest that whiskered bats will use a wide range of hunting habitats and hunting strategies in late autumn and further, that some bats of this species will undertake diurnal flights. We assume that this risk prone behaviour is related to time stress at northern latitudes, and further, that this behaviour is most likely to be found in young inexperienced bats born late in summer. Little data exists on time of reproduction in whiskered bats at 62°N, but hairless and newborn pups have been found as late as ultimo July/early August (unpubl.). These bats will, in their first year of life, have little time to put on weight and get ready for hibernation. The three female whiskered bats trapped in this study, none of which had previously reproduced (i. e. one or two years of age), weighed between 4.8 and 5.5 g, a low body mass in October around the time activity comes to a halt and winter sets in. Thus, high mortality of young whiskered bats is to be expected towards the species northern extreme.

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Literature

- DIETZ, C., VON HELVERSEN, O., & NILL, D. (2007): Handbuch der Fledermäuse Europas und Nordwestafrikas. Franckh-Kosmos GmbH & Co. KG. Stuttgart.
- DUVERGE, P. L., JONES, G., RYDELL, J., & RANSOME, R. D. (2000): Functional significance of emergence timing in bats. *Ecography* **23**, 32-40.
- HILL, D. A., & GREENAWAY, F. (2005): Effectiveness of an acoustic lure for surveying bats in British woodlands. *Mammal Rev.* **35**, 116-122.
- JONES, G., & RYDELL, J. (1994): Foraging strategy and predation risk as factors influencing emergence time in echolocating bats. *Philosophical Transactions of the Royal Society of London B Biological Sciences* **346**, 445-455.
- MICHAELSEN, T. C. (2011): Movements of bats in western Norway. *Fauna (Oslo)* **64**, 31-43 (engl. summary).
- , JENSEN, K. H., & HÖGSTEDT, G. (2011): Topography is a limiting distributional factor in the soprano pipistrelle at its latitudinal extreme. *Mammalian Biology* **76**, 295-301.
- RUSSO, D., CISTRONE, L., GARONNA, A. P., & JONES, G. (2011): The early bat catches the fly: Daylight foraging in soprano pipistrelles. *Ibid.* **76**, 87-89.
- SPEAKMAN, J. R. (1991): Why do insectivorous bats in Britain not fly in daylight more frequently? *Functional Ecology* **5**, 518-524.