

TRADITIONALLY CULTIVATED WETLAND MEADOWS AS FORAGING HABITATS OF THE GRASS-GLEANING LESSER MOUSE-EARED BAT (*MYOTIS BLYTHII*)

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Abstract: In 1994, three female *Myotis blythii* from a nursery colony in the Rhine valley (eastern Switzerland) were marked with radiotransmitters to locate their foraging areas. The aim of our work was to get a first insight into the feeding ecology of the Lesser Mouse-eared bat in a man-made landscape. As our study area is strongly dominated by intensively cultivated farming areas, we expected therefore that hunting individuals of *M. blythii* should select more traditionally managed grasslands which usually offer a higher abundance of large insects than intensively cultivated meadows.

In fact the bats demonstrated a pronounced selection for intact or not completely degraded wetland meadows (e.g. *Molinion*, *Filipendulion*). The bats predominantly hunted on unmown meadows with a vegetation height of at least 50 cm (eight foraging grounds). Only rarely have they been observed on shortgrass patches (two foraging grounds). We observed some short sequences of hunting *M. blythii* revealing a relatively slow search flight over the grass vegetation. The bats caught their prey by gleaning it from the blades of grass. In one case we observed a bat landing in the grass vegetation.

In the study area, wetland and wetlandlike grasslands are the most prominent habitats among traditionally cultivated meadows. Nowadays they are really endangered habitats in the whole study area. The pronounced selection for these particular grasslands by hunting bats makes the local population of *M. blythii* extremely vulnerable to further habitat destruction.

Key words: Austria, bat conservation, gleaning, habitat selection, hunting behaviour, *Myotis blythii*, radio tracking, Switzerland, wetland meadows.

Introduction

It was a complete surprise when in 1993 in the alpine Rhine valley (eastern Switzerland, cantons of Grisons and St. Gall) colonies of the very rare Lesser Mouse-eared bat (*Myotis blythii*), till now not ascertained north of the main alpine crest, were discovered. Together with its sibling species, the Greater Mouse-eared bat (*M. myotis*), the Lesser Mouse-eared bat forms here mixed colonies (Arlettaz et al. 1993). Meanwhile, 11 mixed colonies of the two Mouse-eared species have become known in Switzerland, seven of them being in the alpine Rhine valley. On account of its rareness the Lesser Mouse-eared bat is considered as «strongly endangered» in Switzerland (Duelli 1994).

Particularly in the northern Rhine valley it was not expected to encounter the Lesser Mouse-eared bat. Radiotransmitter studies in the Valais (south-western Switzerland) had shown that the Lesser Mouse-eared bats hunt exclusively in open areas for large insects - mainly bushcrickets (*Tettigoniidae*) - and prefer above all natural steppes and traditionally managed meadows as hunting grounds (Arlettaz 1995). In the northern Rhine valley there are today virtually none of those natural or traditionally managed

grasslands left. This leads inevitably to the question as to the habitats in which the Lesser Mouse-eared bat can still find abundant food in this landscape characterized by large-scale intensive agriculture. To answer this question, a pilot study has been performed in 1994. Four Lesser Mouse-eared bats were provided with radiotransmitters with the purpose of obtaining a first insight as to how the hunting Lesser Mouse-eared bats exploit their habitats in this intensively cultivated man-made landscape.

Material and methods

The nursery roost of the investigated colony is in the roof truss of the Protestant church in the community of Eichberg, 530 metres above sea level. In the transalpine area, it is the northernmost colony site in the alpine Rhine valley. In the region investigated the borderline between Austria (Vorarlberg) and Switzerland (canton of St. Gall) follows the course of the Rhine.

A pregnant and three lactating females have been selected for the radio tracking tests. The intention was to perform one test in each of three nights in the months of May, June, July and August. The May test failed on account of malfunction of the transmitter and the August test had to be interrupted prematurely after a successful night because of bad weather conditions. For this reason the present report takes into account merely the data of three animals collected in seven nights (June, July, August).

Locating of the hunting bats was done by two mobile teams communicating with each other by radio link. Division of the foraging grounds into lots was performed by way of the „homing-in on the animal“ technique (White & Garrott 1990) and additional direct watching by means of a low-light-level amplifier (WILD BIG 2). Direct watching of hunting animals provided valuable qualitative information as regards the prey search and catch behaviour. An evaluation of the time of activity in the foraging grounds was dispensed with since in the few test nights it had not been possible to pursue any of the three bats without interruption. The present survey takes into account merely those foraging grounds which were visited for at least 15 minutes during a night of observation.

Tab. 1: List of the located foraging grounds.

INDIVIDUAL BAT <i>(period of radiotracking)</i>	FORAGING HABITAT	FARMING INTENSITY <i>(scale: low, moderate, medium, high)</i>
female 1 <i>(June, three nights)</i>	• degraded wetland meadow: hay meadow with humidity indicators	moderate
	• degraded wetland meadow: hay meadow with humidity indicators	medium
	• degraded wetland meadow: hay meadow with humidity indicators	moderate
	• lawn area in suburban one-family-house settlement	
female 2 <i>(July, three nights)</i>	• wetland meadow <i>(Magnocaricion-Filipendulion)</i>	low
	• wetland meadow <i>(Molinion-Filipendulion)</i>	low
	• wetland meadow <i>(Molinion-Filipendulion)</i>	low
	• wetland meadow <i>(Molinion-Filipendulion)</i>	low
	• hay meadow and pasture (combined cultivation)	medium
female 3 <i>(August, one night)</i>	• degraded wetland meadow: pasture with wetland relicts	medium

Results

Habitat types (macrohabitat selection)

Apart from one exception all foraging habitats ascertained were more or less intact wetland meadows as well as areas still recognizable as former wetland in spite of intensive cultivation (Table 1). Based on their flora and the time of the first cut, these foraging habitats are checked for their farming intensity (method according to **Dietl** 1992). Four meadows belonged to the class of low farming intensity (one to two cuts, no fertilizing), two showed moderate intensity (two to three cuts) and only two hay meadows as well as a pasture were in the category of medium intensity (three to four cuts). One night one of the animals hunted in a lawn area in a suburban one-family-house settlement. Unfortunately it has not been possible to make detailed observations as regards the habitat exploitation in this area.

Habitat structure (microhabitat selection)

All meadows had in common that, in contrast to the adjoining areas, they were not yet mown at the time of observation in June and July. They showed knee to breast-high grass and herbage vegetation (Figures 1 and 2). On a hay meadow, definitely mown or pastured once in the early year, the grass was still 30 centimetres high. Only a permanent pasture used as foraging habitat showed more or less short grass, except for some small areas (Figure 3).



Fig. 1: Traditionally cultivated wetland meadow.

High vegetation generally seemed to be an important characteristic for the foraging habitats of the Lesser Mouse-eared bat, as demonstrated by the following observation: In the night of 29/30 June 1994, female 1 flew over a degraded wetland meadow during



Fig. 2: Hay meadow with humidity indicators (degraded wetland meadow).



Fig. 3: Pasture with wetland relicts (ancient wetland meadow).

a total time of 39 minutes. This meadow was mown in the following morning. The next night the same Mouse-eared bat at the beginning still flew over this meadow for two minutes, but then abandoned it for the rest of the night. On the other hand, this night it used a directly adjoining but unmown meadow of similar type for at least 16 minutes. (Moreover, another two Mouse-eared bats have been observed flying closely above the high-grass vegetation of this meadow.) This spontaneous abandonment of a meadow gives rise to the suspicion that the suitability of meadows for Lesser Mouse-eared bats is possibly diminished by a cut at short terms.

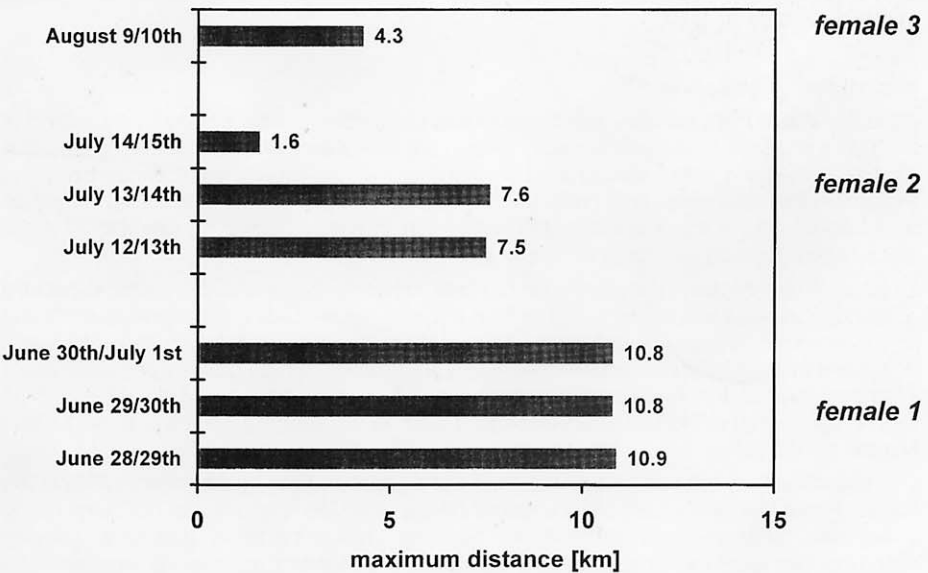
Hunting behaviour

In some foraging habitats it has been possible to observe the hunting activities of the radiocollared Lesser Mouse-eared bats by means of noctovision equipment. These observations clearly showed how masterly the Lesser Mouse-eared bats catch their prey in the dense grass vegetation. The animals mostly flew in comparatively slow search flight at low level directly above the meadow vegetation. At regular intervals the search flight was interrupted by a short hovering sequence. In one case a bat was observed landing in the grass. After a few seconds it flew up again and left the hunting ground. These observations indicate that the Lesser Mouse-eared bats often glean their prey from the blades of grass or pick it up from the vegetation by short landings in the grass.

Distance between nursery roost and hunting grounds

On their hunting flights some of the Lesser Mouse-eared bats went over ten kilometres away from their day-time roost (Figure 4). The individual foraging areas sometimes differed from night to night, an indication that some bats visited various areas within a few days. The hunting grounds were in the plane of the Rhine valley as well as on the adjoining

Fig. 4: Maximum distances between day roost and foraging grounds in different nights.



sloping sites. Since there are only very few wetland meadows left on the Swiss side in the plane of the Rhine valley it was no surprise that the bats with radio tracking (female 1 and female 2) visited such habitats in the plane merely on the Austrian side of the Rhine. When doing so they covered distances from 7.5 to 11 kilometres between daytime roost and hunting grounds. On the Swiss side wetland meadows and former wetland used as pasture were visited only on the sloping sites (female 2 and female 3), at a distance of 1.5 to 4.5 kilometres from the nursery roost.

Discussion

Microhabitat selection

In spite of their pilot character the preliminary results of our study disclose some obvious tendencies in foraging habitat selection by individual Lesser Mouse-eared bats. As in the Valais (see **Arlettaz** 1996) it is the same in our study area - the Lesser Mouse-eared bats mostly hunt in high-grass meadows where they catch their prey by grass-gleaning. Our observations have shown that they glean their prey from the vegetation by way of hovering or pick it up by short landings in the dense grass. It is not yet clear whether this habitat preference of the Lesser Mouse-eared bat must be attributed merely to the vegetation structure favourable to grass-gleaning bats or likewise to the comparatively wide range of prey available in such habitats.

In **Arlettaz'** as well as in our study hunting bats now and then also visited short-grass meadows and pastures. According to **Arlettaz** the Lesser Mouse-eared bats caught their prey in such habitats by way of ground-gleaning, a typical feature especially of the closely related Greater Mouse-eared bat (**Arlettaz** 1996, **Güttinger** 1997). In August one of our bats with radio tracking hunted on a short-grass pasture that was, however, still traditionally cultivated. It is presumably for this reason that, in comparison to the surrounding areas, it had a high density of grasshoppers (female 3, Table 1; Figure 3). In the study area there is hardly any unmown grassland at this time of the year so that the Lesser Mouse-eared bats probably have no other choice than to search for prey on short-grass land as well.

Macrohabitat selection

As in the Valais the bats with radiotransmitters for hunting mainly preferred grassland of low and moderate cultivation intensity also in our study area. A striking feature was that almost all foraging areas ascertained were intact wetland meadows or ancient wetland drained in the meantime. This preference for wetland and wetlandlike grassland may be ascribed chiefly to the still moderate cultivation intensity (fertilizing, number of cuts) since the vegetation is not cut till late in summer.

Qualitative observations showed that in the foraging areas the density of insects, especially grasshoppers, was substantially higher than that of the surrounding meadows. In particular in the unmown wetland meadows with a high and dense vegetation the intact and degraded areas distinguished themselves by a remarkably high density of bushcrickets (*Tettigoniidae*). In the study area (**Lustenberger & Güttinger**, in preparation) as well as in the Valais bushcrickets are an important item in the feeding ecology of the Lesser Mouse-eared bat.

Our preliminary results essentially confirm the patterns found by **Arlettaz** (1995) in the Valais. However, the Lesser Mouse-eared bats in the Valais and in the northern Rhine valley use different macrohabitats for hunting. This is certainly due to a differing macrohabitat availability: among the traditionally cultivated grasslands only wetland

meadows are still quite frequent in the northern Rhine valley, mainly on the Austrian side. Other traditionally cultivated meadows with possibly comparable insect biomass have diminished in such a way that, for quantitative reasons, they are of no significance as foraging habitats for the Lesser Mouse-eared bats.

Commuting distance and availability of foraging habitats

In the course of our field work it was always impressive to see how purposely the Lesser Mouse-eared bats visited the widely spread and small-sized wetland meadows for hunting and easily covered distances of over ten kilometres from their day-time roosts. Contrasting to the calculated mean of 6.3 kilometres in our study area, **Arlettaz** (1995) ascertained in the Valais an average commuting distance of merely four kilometres. These geographical differences in the commuting distances give rise to the supposition that in the Valais the number of suitable macrohabitats is clearly higher and the distance between favourable macrohabitat patches shorter than in the northern Rhine valley. Intact or not completely degraded wetland meadows still exist here merely in the form of small (some featuring less than 1 hectare) and scattered relicts of formerly large-scale wetland (**Broggi et al.** 1991, **Schlegel et al.** 1997).

Consequences for the protection of foraging habitats

Even if the foraging habitats ascertained no longer represent completely intact wetland meadows, these and the still traditionally cultivated wetland meadows are considered as genuine biotopes in the man-made landscape of the Rhine valley on account of their wealth of bushcrickets (biomass) and their vegetation structure (late first cut). Conservation and furtherance of such habitats are therefore a must if one wants to preserve or improve the living conditions of the Lesser Mouse-eared bat.

At present in the whole alpine Rhine valley seven nursery colonies are known on the Swiss side (**Arlettaz et al.** 1993 and own observations). In the course of our study another colony was discovered on the Austrian side of the Rhine valley (community of Sulz). Although there are no detailed investigations into the foraging ecology of the Lesser Mouse-eared in the alpine Rhine valley, the findings of **Arlettaz** (1995) and the few observations of our own permit to draw first conclusions as to population-related protective measures concerning the whole alpine Rhine valley. In the southern, central-alpine region (canton of Grisons) the landscape is still dominated (**Lutz**, personal communication) by large-scale grass farming of low to moderate intensity (at the most three cuts a year). Here the situation for the Lesser Mouse-eared bat most likely corresponds to that of the Valais - both regions are intra-alpine dry valleys - so that survival is presumably a matter of preserving the traditional meadow cultivation and of protecting the natural grassland habitats (e.g. steppes; see **Hegg et al.** 1993). Towards the northern border (canton of St. Gall, Vorarlberg) farming becomes more and more intensive on large-scale basis. According to our observations nothing but the conservation of the last wetland meadows will guarantee survival of the Lesser Mouse-eared bat in this region.

With their cross-border activity the Lesser Mouse-eared bats have clearly demonstrated in the course of our observations that large wildlife conservation projects in the Rhine valley must be coordinated on transnational basis. The alpine Rhine valley involves three European countries: Austria, Principality of Liechtenstein and Switzerland. In this area efforts for protecting the Lesser Mouse-eared bat must by all means be integrated into international protection concepts. In the northern Rhine valley, for example, survival of the Lesser Mouse-eared bat will presumably depend primarily on the success in protecting the wetland areas on the Austrian side (see above). The Lesser Mouse-eared bats show us in their own way that the Rhine valley still is a natural integrated whole in spite of the Rhine and national boundaries.

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Zusammenfassung

Extensiv bewirtschaftete Feuchtwiesen als Jagdhabitats des Kleinen Mausohrs (*Myotis blythii*):

1994 wurden aus einer Wochenstubenkolonie im Rheintal (Ostschweiz) drei weibliche Kleine Mausohren (*Myotis blythii*) telemetriert mit der Absicht, den Tieren auf ihren nächtlichen Jagdflügen bis in die Jagdgebiete zu folgen. Der Zweck dieser Pilotstudie war es, einen ersten Einblick in die Jagdhabitatswahl des Kleinen Mausohrs in der Kulturlandschaft des nördlichen Alpenrheintals zu gewinnen. Im Untersuchungsgebiet wird grossflächig intensive Landwirtschaft betrieben. Daher hegten wir die Erwartung, daß die jagenden Kleinen Mausohren ihre Beute gezielt auf extensiv bewirtschafteten Wiesen suchen sollten, weil diese im Vergleich zu intensiv bewirtschafteten Wiesen gewöhnlich ein höheres Beuteangebot aufweisen.

Tatsächlich zeigten die Fledermäuse eine auffällige Bevorzugung für intakte sowie noch nicht vollständig zerstörte Ried- und Streuwiesen (zum Beispiel *Molinion, Filipendulion*). Die Tiere jagten nahezu ausschliesslich auf ungemähten Wiesen mit meist über 50 cm hoher Vegetation (acht Jagdgebiete). Je einmal wurde ein telemetriertes Mausohr jagend auf einer kurzgrasigen Weide sowie auf einer Rasenfläche inmitten einer Einfamilienhaussiedlung nachgewiesen. Qualitative Beobachtungen mit Hilfe eines Restlichtverstärkers liessen erkennen, wie die jagenden Kleinen Mausohren dicht über der Wiesenvegetation relativ langsam hin- und herflogen. Regelmässig wurde der Flug von kurzen Rüttelsequenzen unterbrochen, wobei die Tiere wahrscheinlich Beutetiere von Grashalmen abpickten. Einmal beobachteten wir, wie ein telemetriertes Kleines Mausohr während des Suchflugs plötzlich im hohen Gras landete und nach wenigen Sekunden wieder aufflog.

Im nördlichen Alpenrheintal nehmen die nach wie vor intakten sowie noch nicht völlig zerstörten Feuchtwiesen innerhalb der „Extensiv-Wiesen“ den weitaus grössten Flächenanteil ein. Sie sind heute im ganzen Gebiet stark gefährdet. Die deutliche Bevorzugung dieser Wiesen als Jagdhabitats macht die lokale Population des Kleinen Mausohrs äusserst anfällig auf die Zerstörung der letzten noch vorhandenen Feuchtwiesen.

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