

Flyways of commuting vespertilionid bats at different background situations



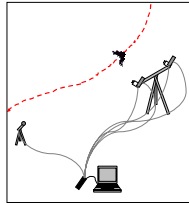
Introduction

Many bats follow stereotyped flight paths while commuting from roosts to foraging areas. Often the flight paths of individual bats are bundled to flyways which follow the contours of background structures such as vegetation and buildings.

To study the influence of background structures on the flyways we recorded the flight and echolocation behavior of *Myotis daubentonii* in different background situations.

At one of these sites we compared the behavior of *Myotis daubentonii* with the behavior of *Myotis brandtii* and *Pipistrellus pipistrellus*.

Methods



Recording of flight and echolocation behavior

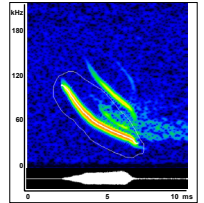
Two IR-video cameras, placed parallel to the flight path, recorded the flying bats. The scene was illuminated with IR strobe lights. Echolocation signals were recorded and synchronized with the video.

Three dimensional reconstruction of flight paths

Simi motion® software was used to reconstruct the flight routes of the bats. Accuracy of reconstruction: width (x) 1.7 %, depth (y) 2.7 %, height (z) 1.0 %

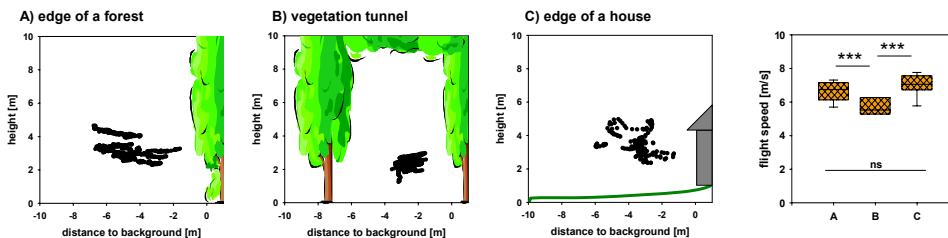
Sound analysis

A custom made program (selena) was used to analyze the echolocation signals (FFT of 256). Start-, peak- and end frequency of the first harmonic were measured and bandwidth, pulse duration and pulse interval calculated.

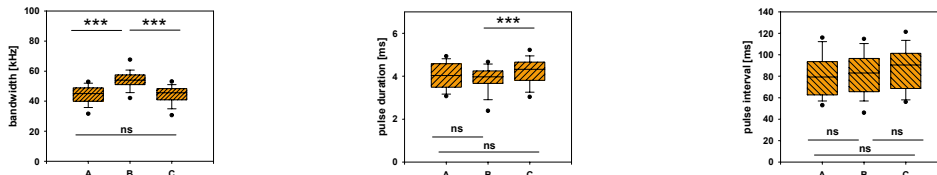


Results

Myotis daubentonii in different background situations



Along the edge of a forest (tree height 25 m) and a house (height 6 m) *M. daubentonii* used flyways ranging from 2 to 5 m height and from 2.5 to 7 m in horizontal distance to the background. Along a road bordered on both sides with dense vegetation (6 m width and 11 m height) the flyway was narrower ranging from 2 to 3 m height and 1.5 to 3.5 m distance to background. The flight speed did not differ ($p = 0.188$) at the two edge situations but was significantly lower ($p < 0.01$) in the vegetation tunnel.



The signal design at the two edge situation was rather similar. Pulse durations and pulse intervals were slightly longer at the edge of the house. In the vegetation tunnel the bandwidth was broader than in the other situations.

Conclusion

Flight behavior

• *M. daubentonii* in different situations

In edge situations the flyways were rather wide. In the vegetation tunnel the flyway was more narrow and closer to one side as to the other.

→ Narrow situations lead to a funnelling of flyways

• Three species at the same site

Within the vegetation tunnel the flyways of *M. brandtii* and *M. daubentonii* were rather similar. The flyway of *P. pipistrellus* was more extended.

→ Identical background situations lead to a similar flight behavior and flight speed

Echolocation behavior

• *M. daubentonii* in different situations

In the vegetation tunnel the bandwidth was higher and the pulse durations and pulse intervals were slightly shorter than in the edge situations. In situations with vegetation as background structure pulse durations were slightly shorter than at the homogenous background situation of the house.

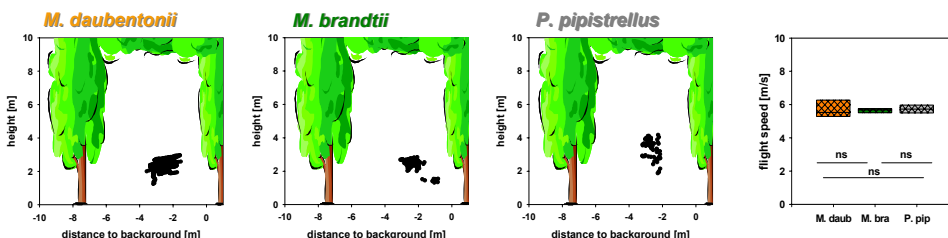
→ The narrower the space, the shorter the pulses and broader the bandwidth

• Three species at the same site

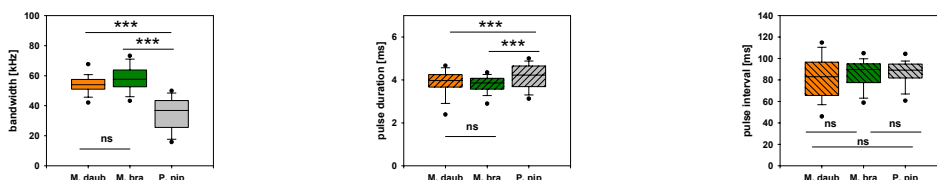
The two *Myotis* species showed a similar echolocation behavior which can not be compared with *P. pipistrellus* as this species is from another genus.

→ Similar background situations result in similar echolocation behavior in the two *Myotis* species

Comparison of three species at the same site



Within the vegetation tunnel the flyways of *M. brandtii* and *M. daubentonii* were rather similar ranging from 2 to 3 m height and 1.5 to 3.5 m in horizontal distance to background. The flyway of *P. pipistrellus* was more extended in vertical direction ranging from 2 to 4 m height. Within the vegetation tunnel the flight speed of all three species did not differ ($p = 0.836$).



M. brandtii and *M. daubentonii* showed a rather similar echolocation behavior. Signals of *P. pipistrellus* had a smaller bandwidth and a longer pulse duration. Pulse intervals did not differ.

Correspondence to:
andrea.schaub@uni-tuebingen.de



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