

FROM LOW TO HIGH BAT MOBILITY: UNDERSTANDING THE SIZE AND HABITAT SELECTION

Ferreira A.^{1*}, Santos M.^{1, 2}, Braz L.³, Cabral J. A.² & Barros P.^{1,3}

1 - Fluvial and Terrestrial Ecology Laboratory of Innovation and Development Center, University Trás-os-Montes e Alto Douro (UTAD);

2 - CITAB/Inov4Agro-Centrer for Research and Technology of Agro-Environmental and Biological Sciences, University of Tras-os-Montes e Alto Douro;

3 - SECEMU

*anaipferreira@gmail.com

Introduction

The Baixo Sabor Valley displays typical Mediterranean characteristics, featuring shrublands, native forests, and extensive agricultural areas, such as olive groves, almond orchards, and rainfed crops in the plateau region ¹.

Bats exhibit great diversity, plasticity and specific ecological requirements, allowing them to occupy various ecological niches, which highlights their remarkable adaptability ². Habitat selection by bats is directly linked to their energy requirements and the availability of trophic resources in the area ³. Functionally, bats can be classified based on their home range into three groups: low mobility species (home range under 5 km), moderate mobility species (home range between 6 and 15 km), and highly mobility species (home range over 15 km). Consequently, the size and composition of landscape units play a critical role in shaping the activity patterns of these functional bat groups.



Study Area



Greater Horseshoe bat
(*Rhinolophus ferrumequinum*)
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Objectives

Mobility Functional Groups (MFG)

Low Mobility ³⁻¹⁵

Moderate Mobility ^{8, 16-19}

High Mobility ^{8, 20-23}

Landscape Units (LU)

100 Meter Buffer

1000 Meter Buffer

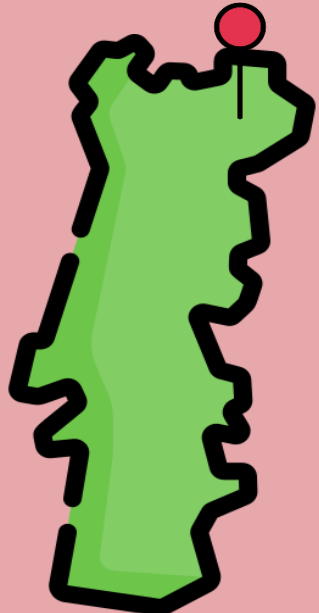
5000 Meter Buffer

Land Cover (LC)

Class	Acronym
Water Bodies	WB
Temporary Crops	TC
Mixed Forest	MF
Shrubs	SCRO
Olive Groves	OLIV
Pastures	PAST
Permanent Crops	PC
Agro-forestry Areas	AFA
Complex Cultivation Patterns	CCP
Artificial Surfaces	AS
Vineyards	VINE

What are the Landscape Units and Land Cover that best explain the activity of the different Mobility Functional Groups?

Methodology



The data was collected in **Baixo Sabor** between **2015 and 2022**



At **60 fixed listening points**, with **15-minute** sessions conducted monthly from **June to August**



The ultrasound recordings allow for the **identification of individuals** and the **detection number of bat passes** ('bat passes')



Ultrasound analysis is conducted using the **Kaleidoscope Pro v.4.5.5** software (Wildlife Acoustics Inc., USA)



Generalized Linear Mixed Models (GLMM) were employed

The monitoring sessions began 30 minutes after sunset and continued for up to 4 hours.

Results

Low Mobility												
LU	AIC	WB	TC	MF	SCRO	OLIV	PAST	PC	AFA	CCP	AS	VINE
100	3134.3	0.040 (< 0.001)				0.012 (< 0.001)				n.s		
1000	3200.6		-0.038 (< 0.001)									n.s
5000	3194.1	n.s			n.s	-0.027 (< 0.05)			n.s	0.225 (< 0.001)		n.s

The results of the analysis for the three considered LU buffers, regarding the activity 'bat passes' of the MFG with low mobility, revealed that the model with the lowest AIC was obtained at the LU_100 buffer. **The variables that significantly influenced the activity response of bats in this MFG were Water Bodies (WB) and Olive Groves (OLIV).**

High Mobility												
LU	AIC	WC	TC	MF	SCRO	OLIV	PAST	PC	AFA	CCP	AS	VINE
100	1182.4	0.059 (< 0.001)				n.s						
1000	1180.4	0.066 (< 0.05)	-0.056 (< 0.01)			-0.033 (< 0.01)	-0.217 (< 0.05)					
5000	1171.4			0.145 (< 0.001)	0.123 (< 0.001)			-0.143 (< 0.05)	2.268 (< 0.001)	0.407 (< 0.001)		

The results of the analysis of the three LU buffers regarding the activity 'bat passes' of the MFG with high mobility revealed that the model with the lowest AIC was obtained at the LU_5000 buffer. **The variables that significantly influenced the activity response of bats in this MFG were Mixed Forests (MF), Shrubs (SCRO), Agro-forestry areas (AFA), and Complex Cultivation Patterns (CCP). The results also demonstrated that Permanent Crops (PC) negatively influence the activity of this MFG.**

Moderate Mobility												
LU	AIC	WC	TC	MF	SCRO	OLIV	PAST	PC	AFA	CCP	AS	VINE
100	1137.5	0.061 (< 0.001)	0.019 (< 0.01)			0.011 (< 0.05)		-0.040 (< 0.05)		0.092 (< 0.001)		
1000	1157					n.s			-0.493 (< 0.05)	n.s	0.603 (< 0.001)	
5000	1166.6			0.075 (< 0.01)	0.086 (< 0.001)			0.089 (< 0.01)		0.008 (< 0.01)	-0.396 (< 0.05)	0.225 (< 0.001)

The results of the analysis of the three LU buffers regarding the activity 'bat passes' of the MFG with low mobility, revealed that the model with the lowest AIC was obtained at the LU_100 buffer. **The variables that significantly influenced the activity response of bats in this MFG were Water Bodies (WB), Temporary Crops (TC), Olive Groves (OLIV), and Complex Cultivation Patterns (CCP). The results also demonstrated that Permanente Crops (PC) negatively influence the activity of this MFG.**

Legend:
model selected with the lowest AIC;
positively significant variable;
negatively significant variable.

Conclusions

The findings indicated that the **100 m Landscape Unit buffer best fitted the activity patterns of the LOW and MODERATE MOBILE GROUPS** (based on the lowest Akaike Information Criterion model), while the **5000 m Landscape Unit buffer provided the best fit for the HIGH MOBILE GROUP**. The significant explanatory variables (land cover categories) varied depending on the Functional Groups.

The obtained results suggest that the most appropriate **Landscape Units for each Functional Groups could not only help in designing effective acoustic monitoring plans for bats, but also that bat mobility should be considered in habitat management and conservation planning, as Landscape Units can distinctly influence the different Functional Groups studied.**

