

# ECOLOGICAL DIVERSITY AND ITS VALUE IN THE HUMANIZED LANDSCAPE OF BAIXO VOUGA LAGUNAR



universidade de aveiro  
departamento de biologia



3<sup>ème</sup> Séminaire annuel du Labex DRIIHM 8  
et 9 juin 2015, Aix en Provence

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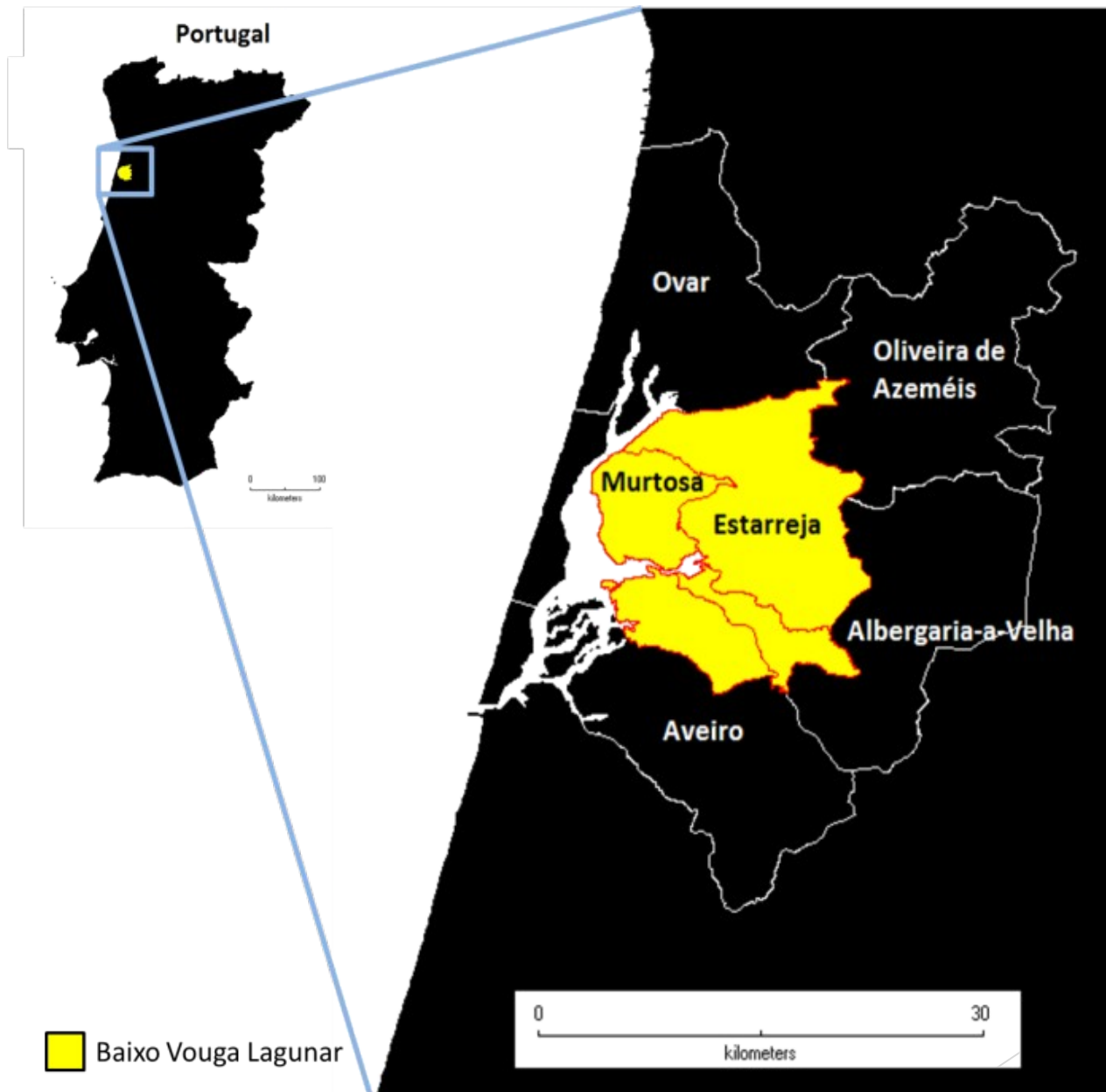


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Included in Baixo Vouga Lagunar and Ria de Aveiro wetland landscape.

Partially included in Zona de Proteção Especial da Ria de Aveiro (Birds Directive, 79/409/CEE) and Site Natura 2000 (PTCON0061)







- Patches and corridors are imbedded in the matrix, which is usually the most extensive and connected landscape element present
- Mosaic of natural and humanized habitats

- Investigate spatial and temporal patterns of species (mammals, amphibians and insects) diversity in habitat patches
- evaluate prey availability (small mammals) for large scale species (carnivores and birds of prey) and insects for amphibians (fine scale species)
- identify the main factors affecting those patterns (biotic, abiotic and anthropogenic)



bats

Species with **large** home-range at landscape level

carnivores

Landscape features at **matrix** level

Amphibians

Species with **small** home-range at landscape level

Small mammals

Landscape features at **patch** level







Three replicate sampling points in seven *habitats*: *Bocage*, rice fields, maize fields, reedbeds, marshland, rushes, forests (*Eucalyptus*)





# Field Methods



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- Nocturnal insects were sampled using light traps, twice a month in each sampling point, and stored in 70% ethanol for posterior identification;
- All specimens were identified to the taxonomic level of order and are currently being identified to the family and species level.





- Two sampling periods each month, during one year (October 2012 to September 2013);
- Several sampling methods were used in a standardized way: line-transects, pitfalls, pipetraps, funnel traps; sampling of water bodies and courses.
- Identification of adult and larval specimens.





- ▶ **Sherman™ live trap:**
  - ▶ 30 placed 10 m apart /trap-line
  - ▶ Five consecutive nights
  - ▶ Every two months



- ▶ **Capture-mark-recapture**
  - ▶ Identified based on external morphology, sexed and weighed
  - ▶ Marked with individual ear tags and later released at the capture site



- Grid with 84 cells of 1x1 km (standard sampling unit size)
- Two non invasive complementary methodologies:

### Signs of presence

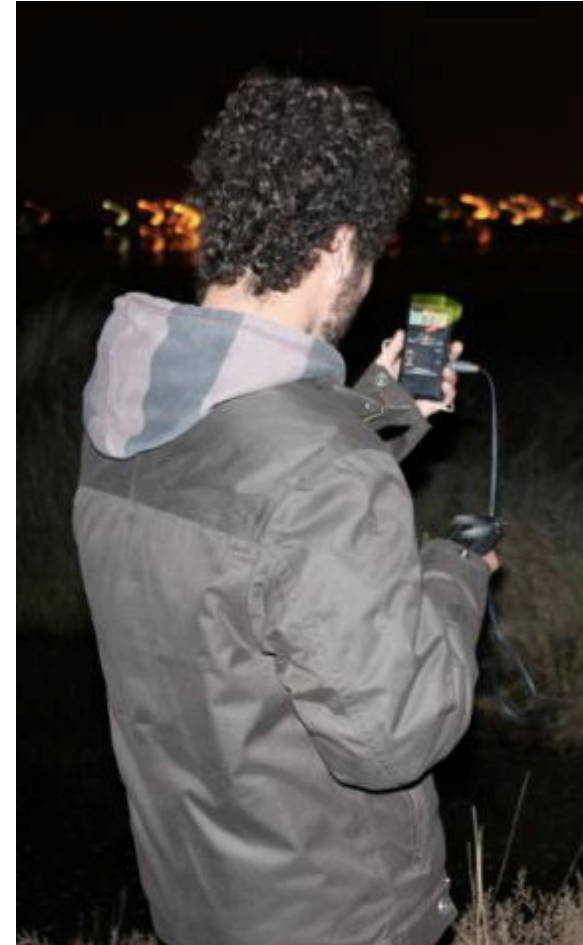
- 500 m long diurnal transect/30 minutes, for every 1 km<sup>2</sup> sampling unit

### Photo trapping

- 1 camera/ 15 consecutive nights, in each cell

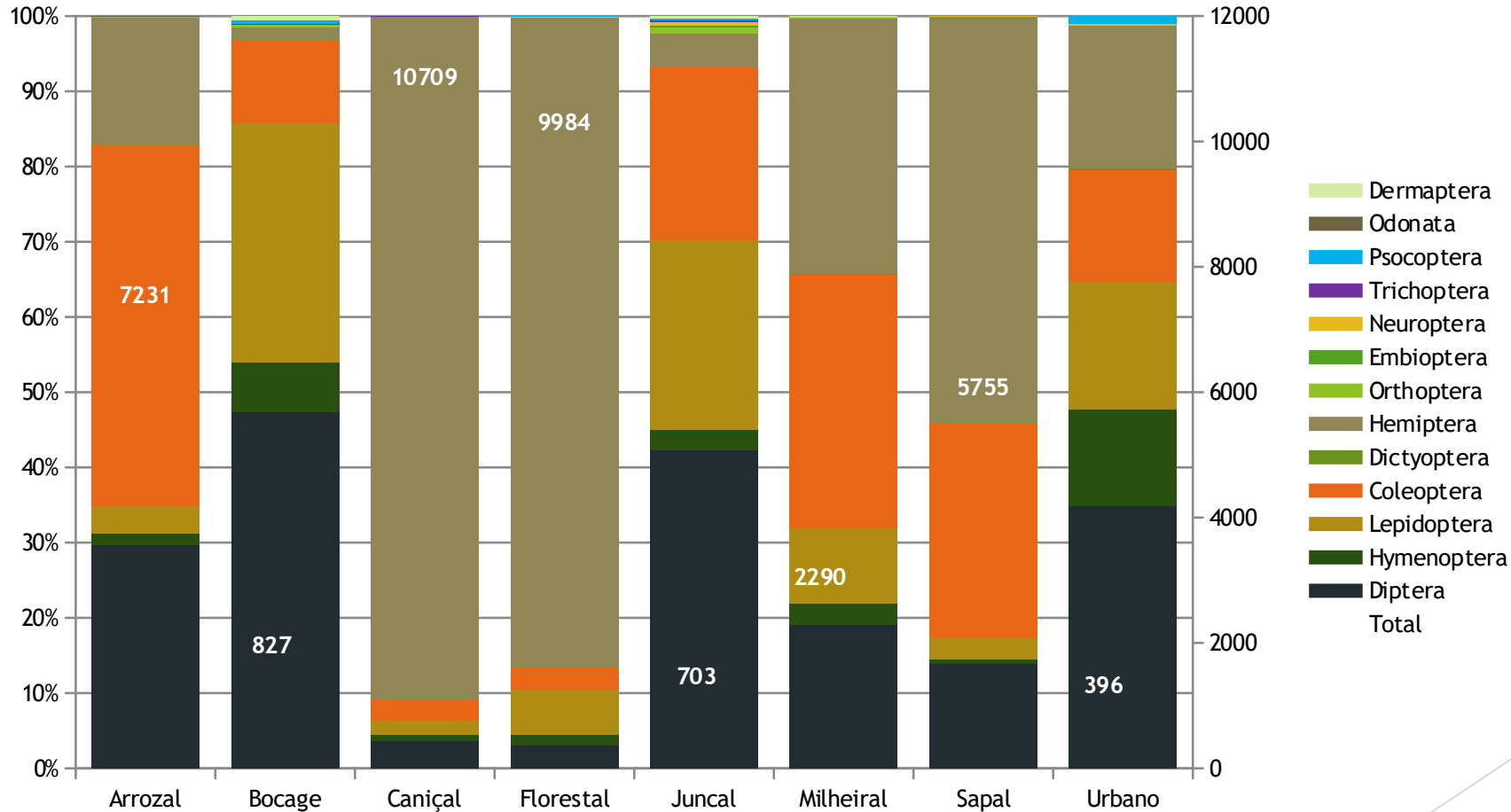


- ▶ **Acoustic sampling of bats**
  - ▶ Walking surveys of 15min (ca. 500m)
  - ▶ Ultra-sound detector and audio recorder
  
- ▶ **Creation of buffers of 1.5, 3 and 6km radii using ArcGIS**
  - ▶ 12 landscape variables
  - ▶ 12 local variables

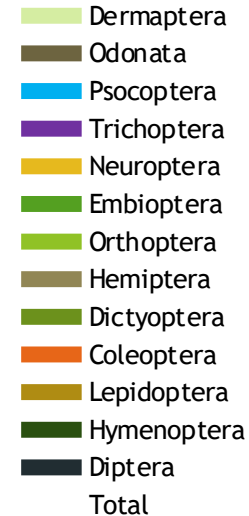




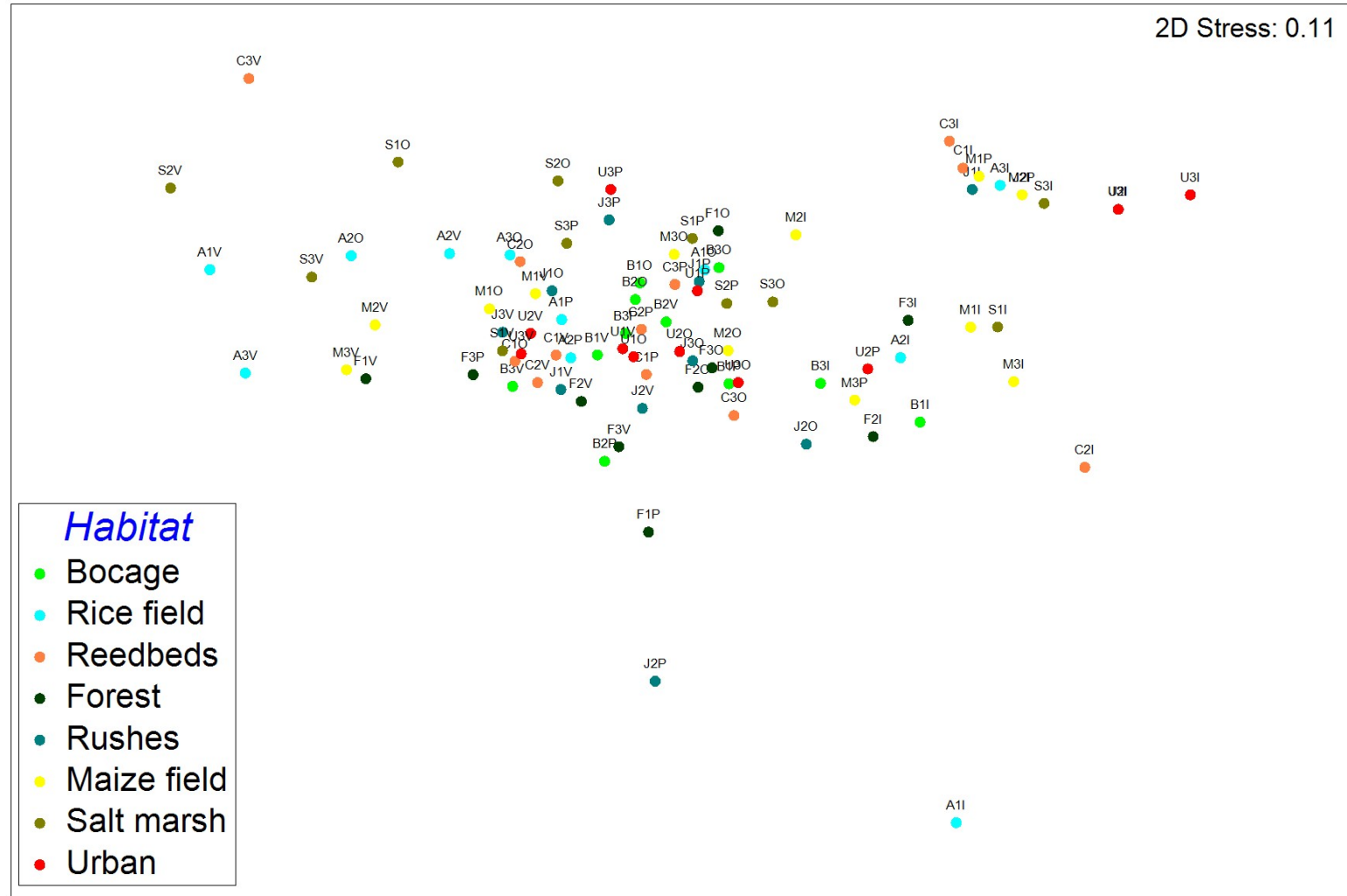
- **37895** individuals captured and identified to the level of order.
- Around **100** insect families already listed for the area.



Total numbers of insects captured per habitat, divided by order

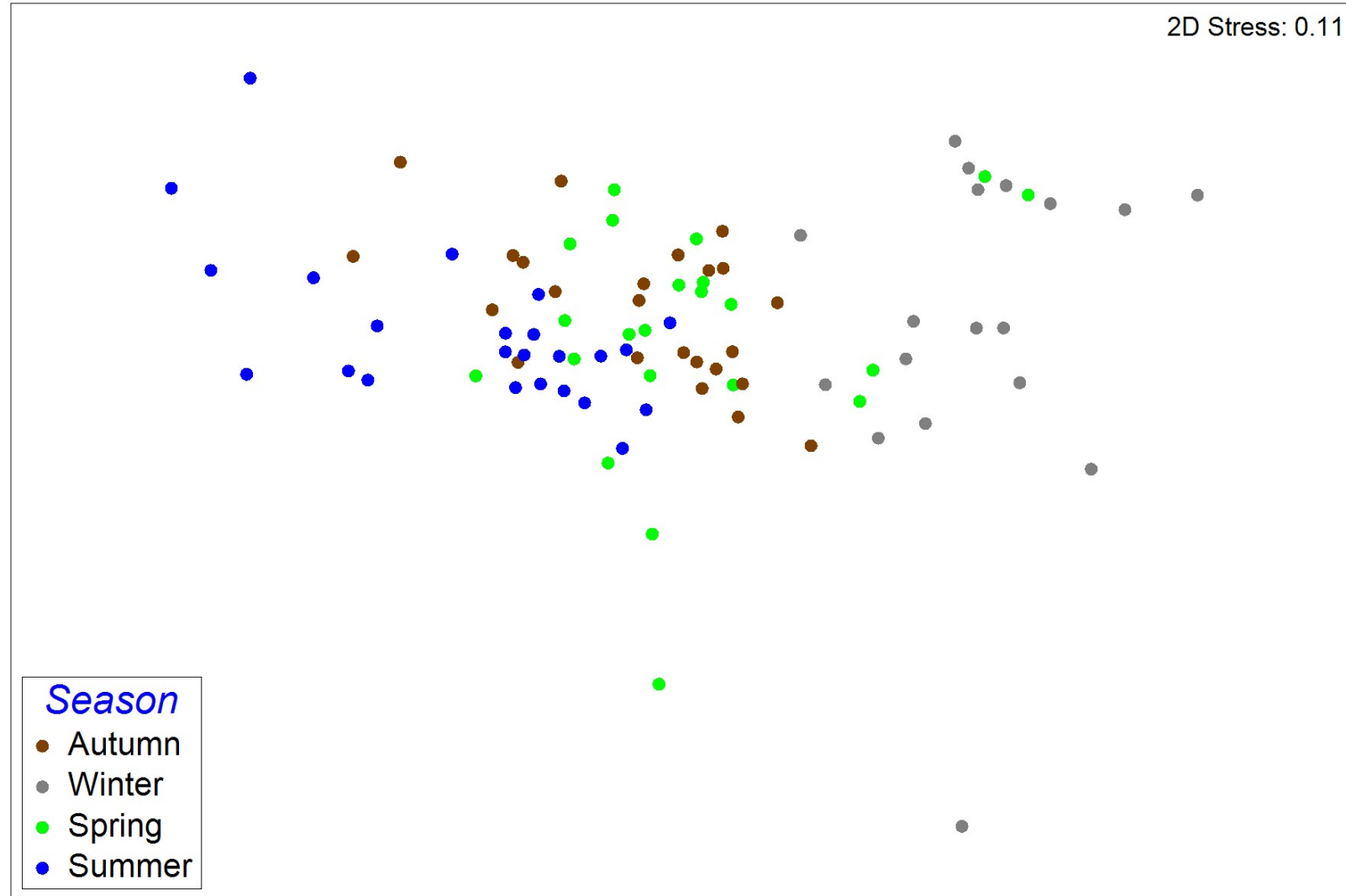


- At the taxonomic level of order, we found no significant differences in the composition of nocturnal insects assemblage among habitats;

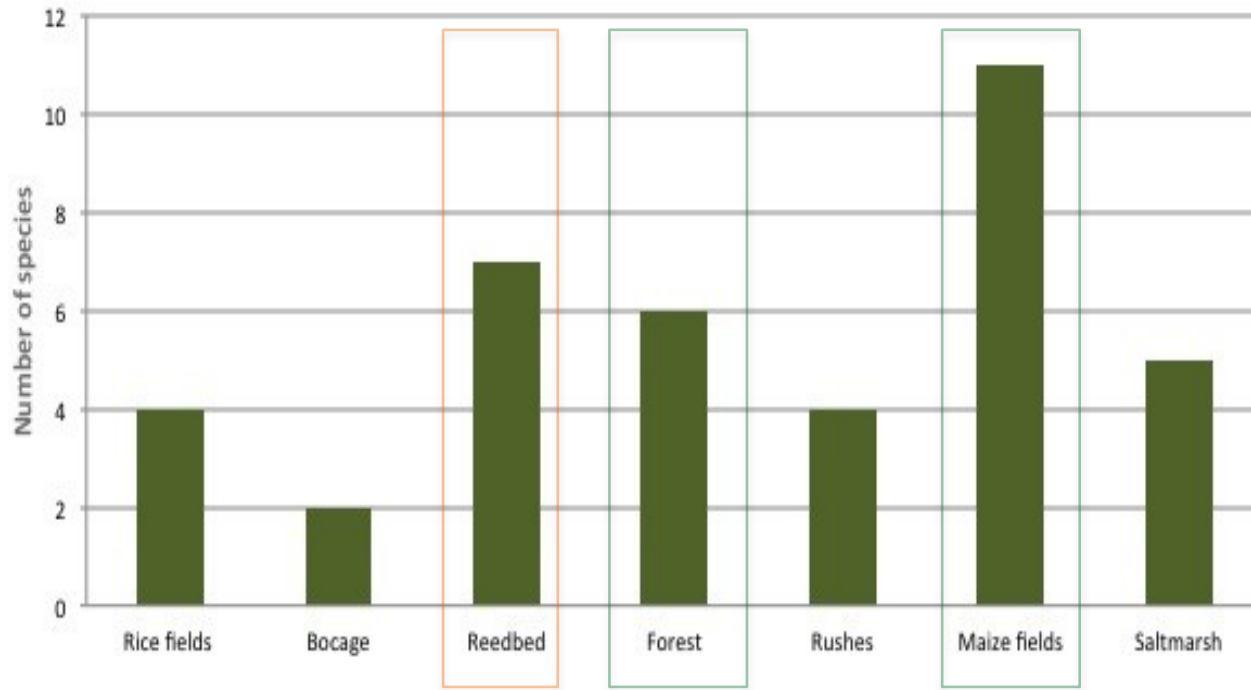




- There were however, differences in insect assemblage composition across seasons, with winter and summer assemblages being the most distinct;



Species richness per habitat



- During the sampling, about 1500 individuals were captured, including about 550 larvae.
- 13 species were recorded and one species, *Rana iberica*, was a new record for the area
- Species richness
- Maize fields with the highest number of species
- Bocage with lowest number of species

Agriculture habitat - Maize fields with the highest number of species



Model	AICc	$\Delta$ AICc	$\omega_i$
<i>Distance to nearest well</i>	76,61	0,00	0,14
<i>Distance to nearest well + Temporary water</i>	76,76	0,15	0,13
<i>Temporary water + Maize + Bocage</i>	77,69	1,08	0,08
<i>Distance to nearest well + Insect abundance</i>	77,74	1,13	0,08
<i>Temporary water</i>	78,6	1,99	0,05

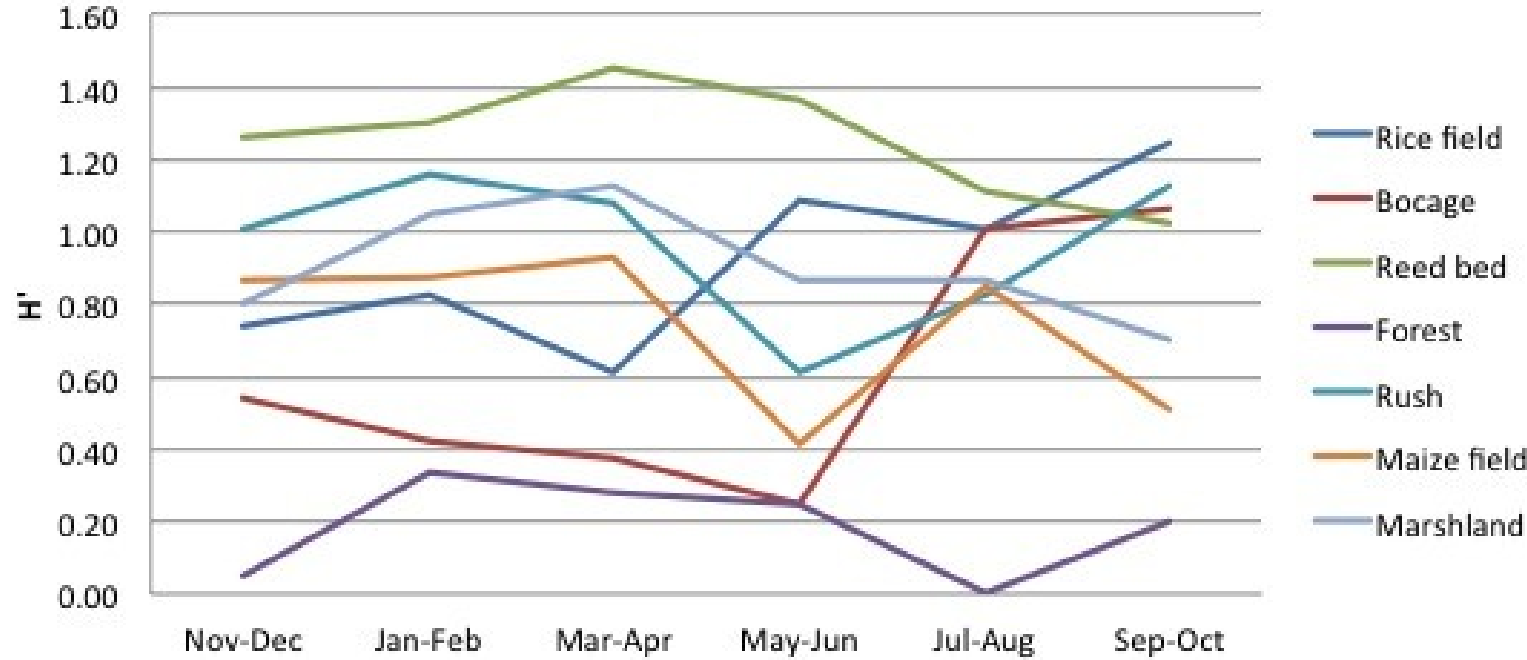
- The distance to the nearest well was the variable that, alone, better explained the pattern in species richness
- Temporary water bodies and insect abundance were also important predictors.

Variables that better support the variation of amphibian richness in this area were variables related to fresh water (distance to the nearest well and temporary water bodies) and food availability (insect abundance).



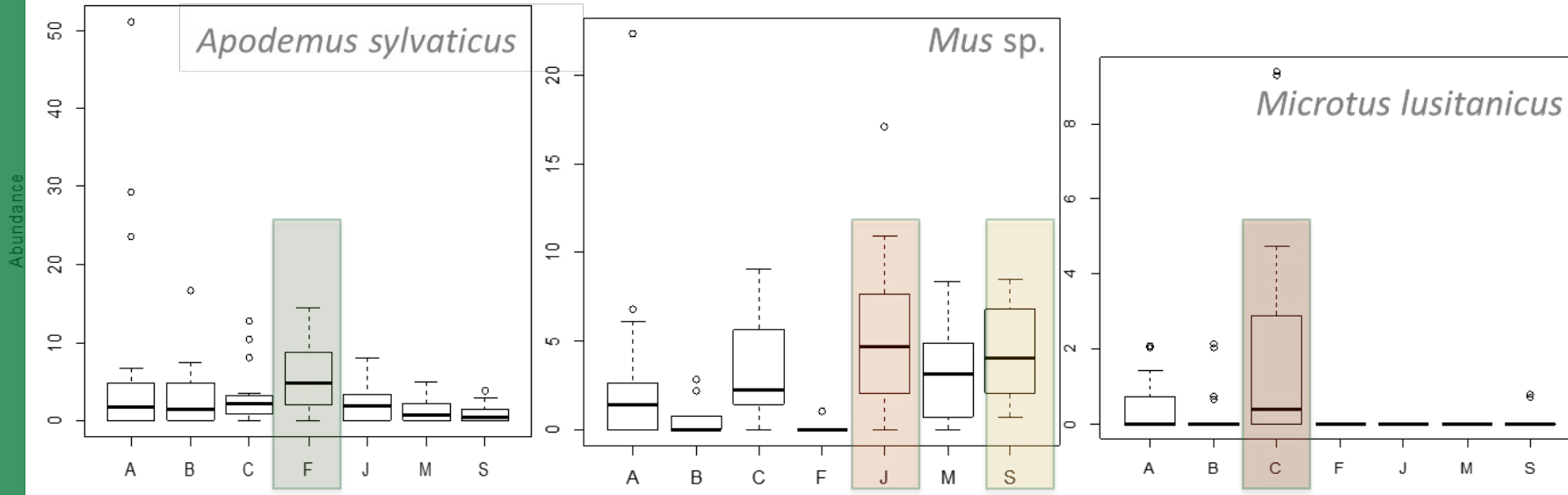


Shannon-Wiener ( $H'$ ) diversity index



- 1698 individuals of small mammals were captured
- 8 rodent species and 2 insectivore species
- Shannon-Wiener ( $H'$ ) diversity index  
 Reedbeds highest values  
 Forest areas lowest values

Temporal and spatial fluctuations in diversity index



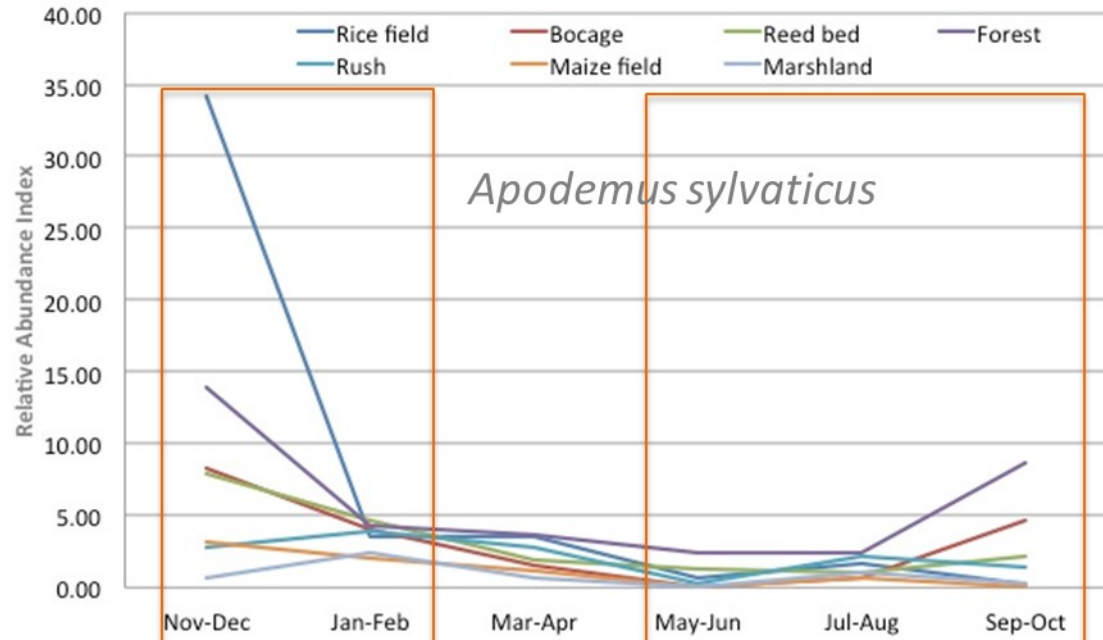
A – Rice field B – Bocage C – Reedbed F – Florest J – Murshes M –Maize fields S – Marshland

Most abundant Small mammals species available in **several habitats**

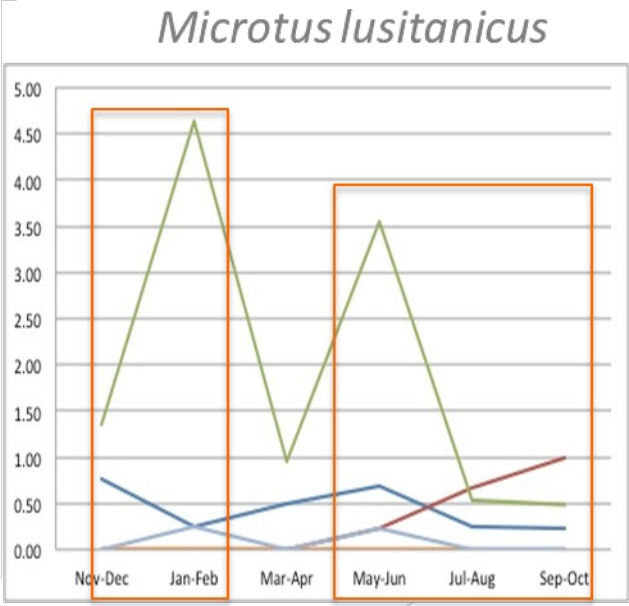
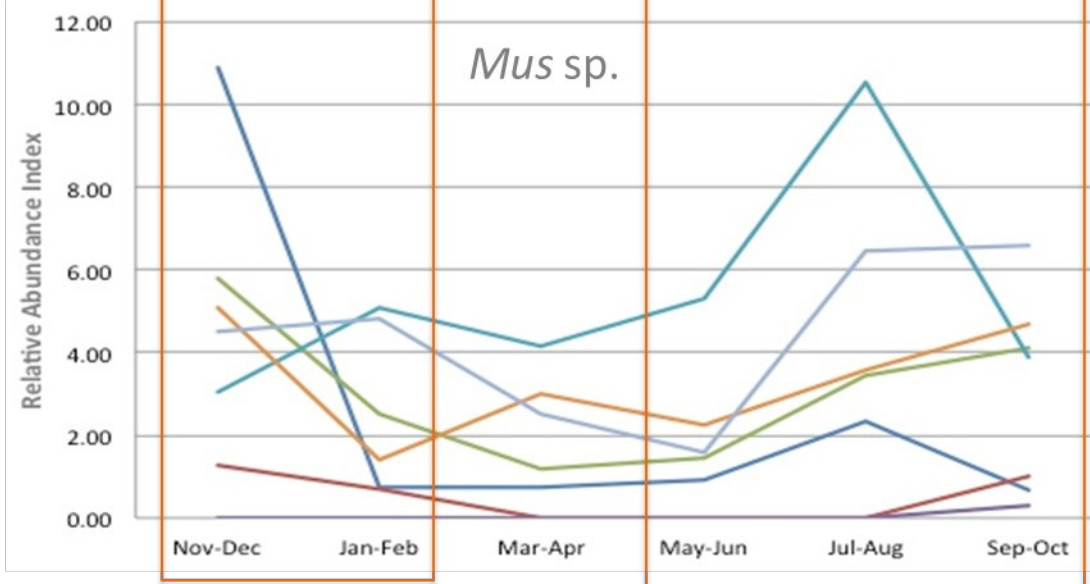
Most abundante species

- Apodemus sylvaticus* (first)----- Forest
- Mus sp* (second)----- Murshes; Marshland
- Microtus lusitanicus* (third)----- Reedbed





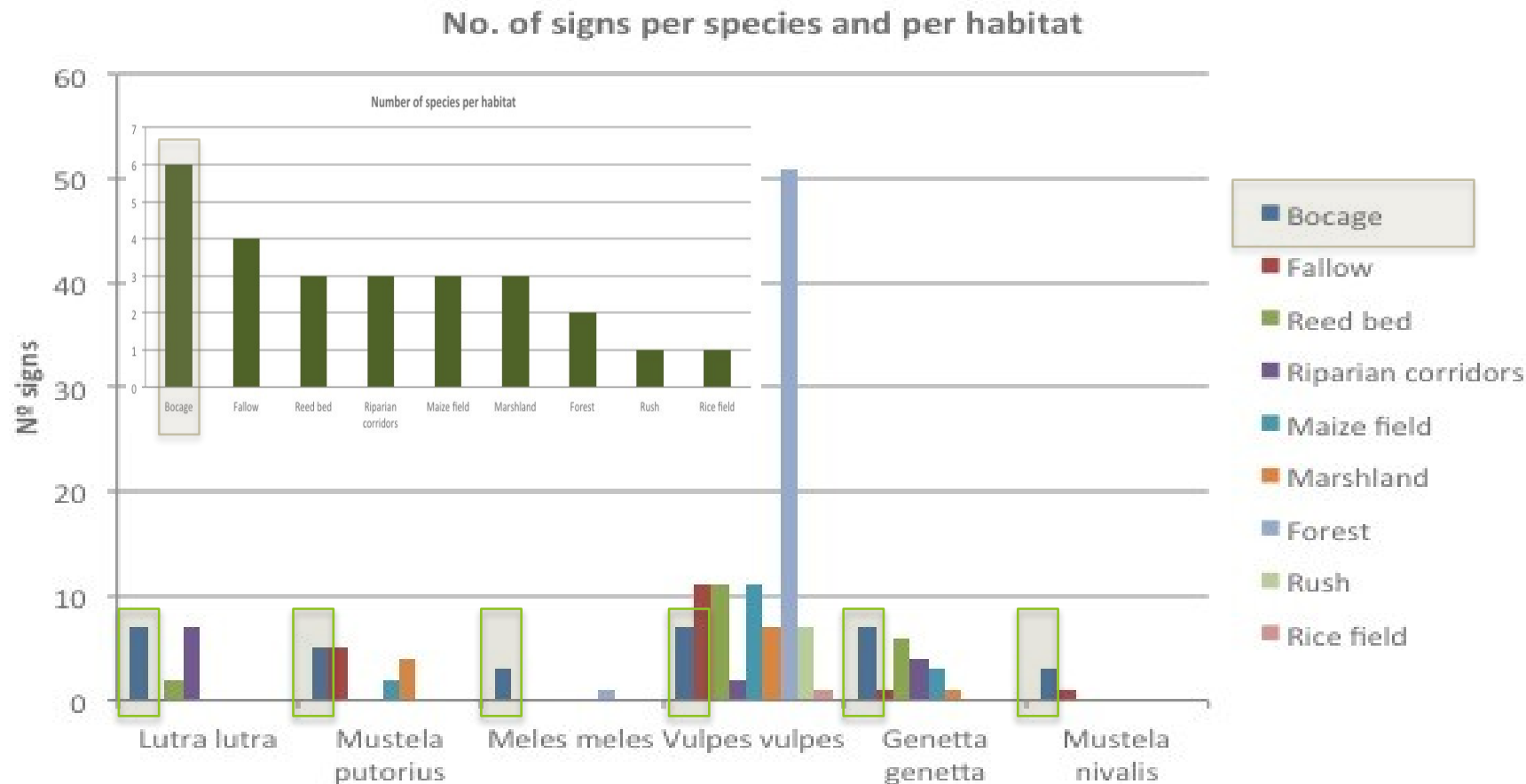
Seasonality Lag between species abundance peaks



# Positive value of landscape heterogeneity (mosaic of habitats) to small mammal fauna







- Recorded a total of 6 carnivore species
- Bocage was the most used habitat for all species (except *Vulpes vulpes*)
- Bocage with highest number of carnivore species

Bocage the most important habitat

## Length of freshwater lines (+)

Water availability

Riparian vegetation provides shelter and also promotes landscape connectivity

## Edge length (-)

Habitat fragmentation may cause disruption of key biological processes and resource dispersion

## Forest (-)

Eucalyptus monocultures do not promote biodiversity (greatly simplified habitat)

## Prey availability (?)

Spatially wide availability of food resources (small mammals), throughout the landscape matrix

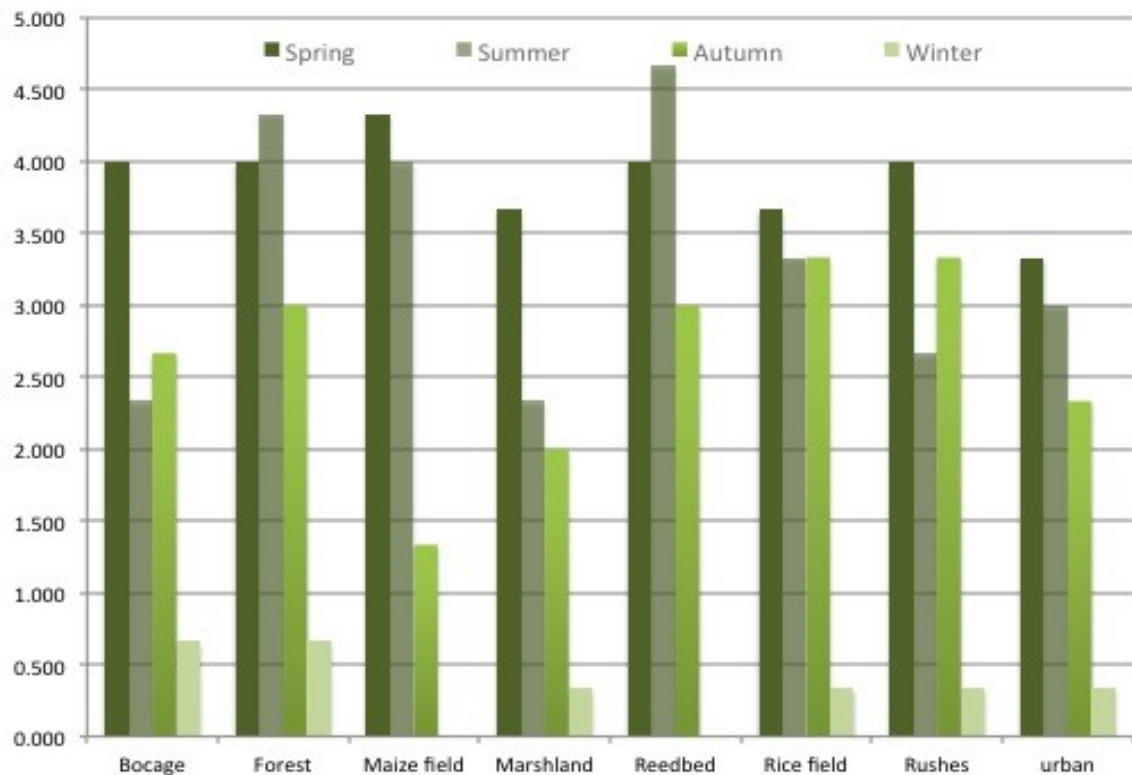


Watercourses and riparian vegetation associated - “keystone structures” to mammalian carnivores

Negative effect of landscape heterogeneity and fragmentation to carnivore richness, since the landscape is mainly composed by open habitats



## Species richness



- Recorded a total of 1366 bat passes
- Minimum of 12 species (more are probable but due to the impossibility to distinguish at least 4 pairs of species)
- Bocage and urban areas most used by bats

Bats use all habitats without high significant differences

Bats seem to respond to different factors, from wider scales where landscape structure variables are the most influencing ones, to a finer scale where keystone habitats and vital resources are the limiting factors

Site selection is not mainly limited by land cover type, but rather by prey abundance and weather conditions





Marsh harrier



© Howard Booty

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Habitat patches, depending on the degree of differentiation from the matrix, can add few or many elements to the species pool of a particular landscape

Prey abundance

Diversity patterns for different groups

ex:

Small mammals



carnivores

Baixo Vouga Lagunar

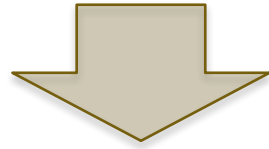
What is Known

The importance of landscape matrix to biodiversity is particularly relevant in areas with complex landscapes, where natural, naturalized, or managed habitats are interspersed by small patches of habitat types with very different biophysical characteristics

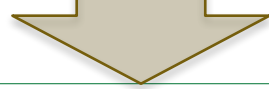
Since the matrix itself is important in maintaining diversity, influences the effectiveness of reserves, and controls landscape connectivity



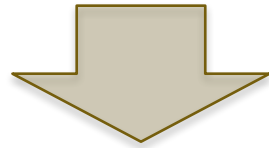
identify the main factors affecting species diversity and distribution



**Understanding and appropriately manipulating the landscape matrix**



**Use research outputs in Conservation proposals**



**Involve local people in conservation efforts**



# Integrate different scientific backgrounds

**BIODIVERSITY**

health  
risks

vertebrate  
ecology

**ECOTOXICOLOGY**

Environmental  
dynamics

Environmental  
pollution and  
contamination

Human  
health

Social  
perception

geodynamics

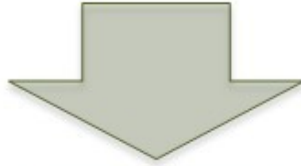
# Involve local people in conservation efforts

## SUSTAINABILITY APPROACH



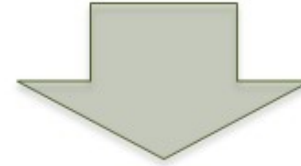
### Environment

- Scholar program
- Exhibitions
- Documentaries
- Conservation programme
- Stakeholders



### Social

- Citizen science
- Inclusion
- Relaunch traditions
- Respect the locals
- Public awareness



### Economics

- "New" products
- Valuing natural values
- Ecotourism
- Agrotourism
- Products certification
- Green jobs





**MERCI POUR  
VOTRE  
ATTENTION!!!**

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