

MATE



Fine spatial distribution and temporal activity patterns of three mesopredators: A case study from Greece

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Species with the same fundamental niche can either

- partition the limited resources and coexist
- or
- exclude one another through competition

Coexistence mechanisms

- Segregation [Spatial
Temporal
Trophic
- Differentiated habitat use
- Behavioral modifications

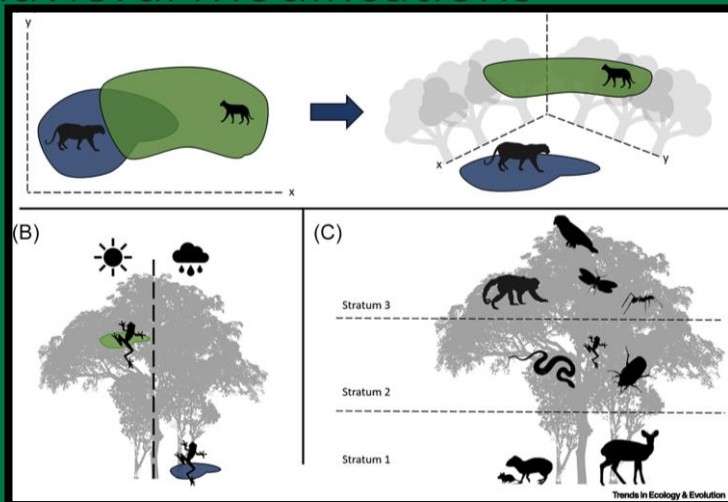


Image credit: Gamez & Harris, 2022

In carnivores

Interference influenced by

- differences in body size
- taxonomic similarity
- dietary overlap



The subordinate species modifies its realized niche to avoid/reduce aggression



Image credit: Isidora Kyriazi



Focus:

Golden jackal (*Canis aureus*)

Red fox (*Vulpes vulpes*)

Badger (*Meles meles*)

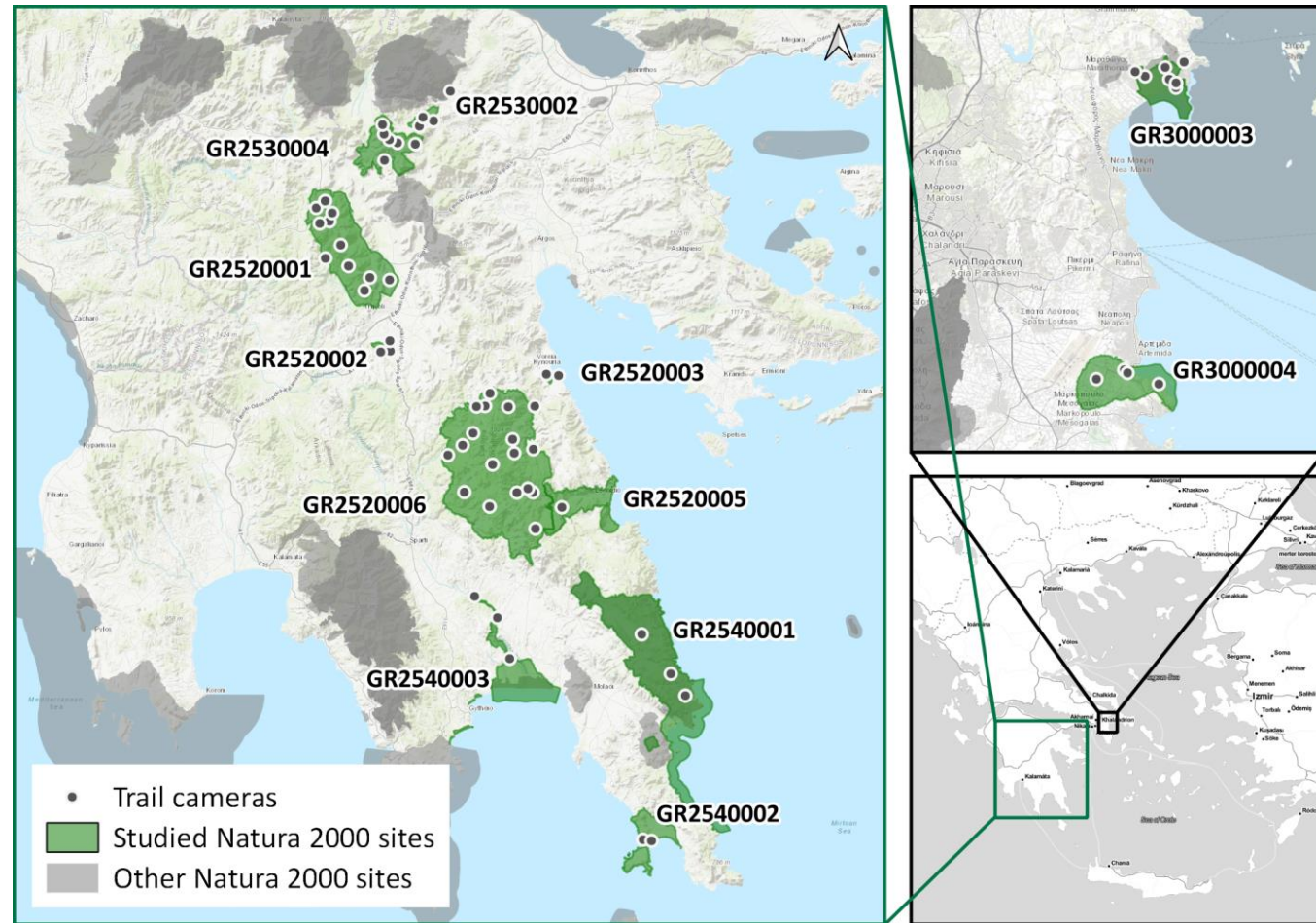
Explore:

- Fine-scale spatial distributional patterns
- Daily activity patterns
- Spatial & temporal overlap among species



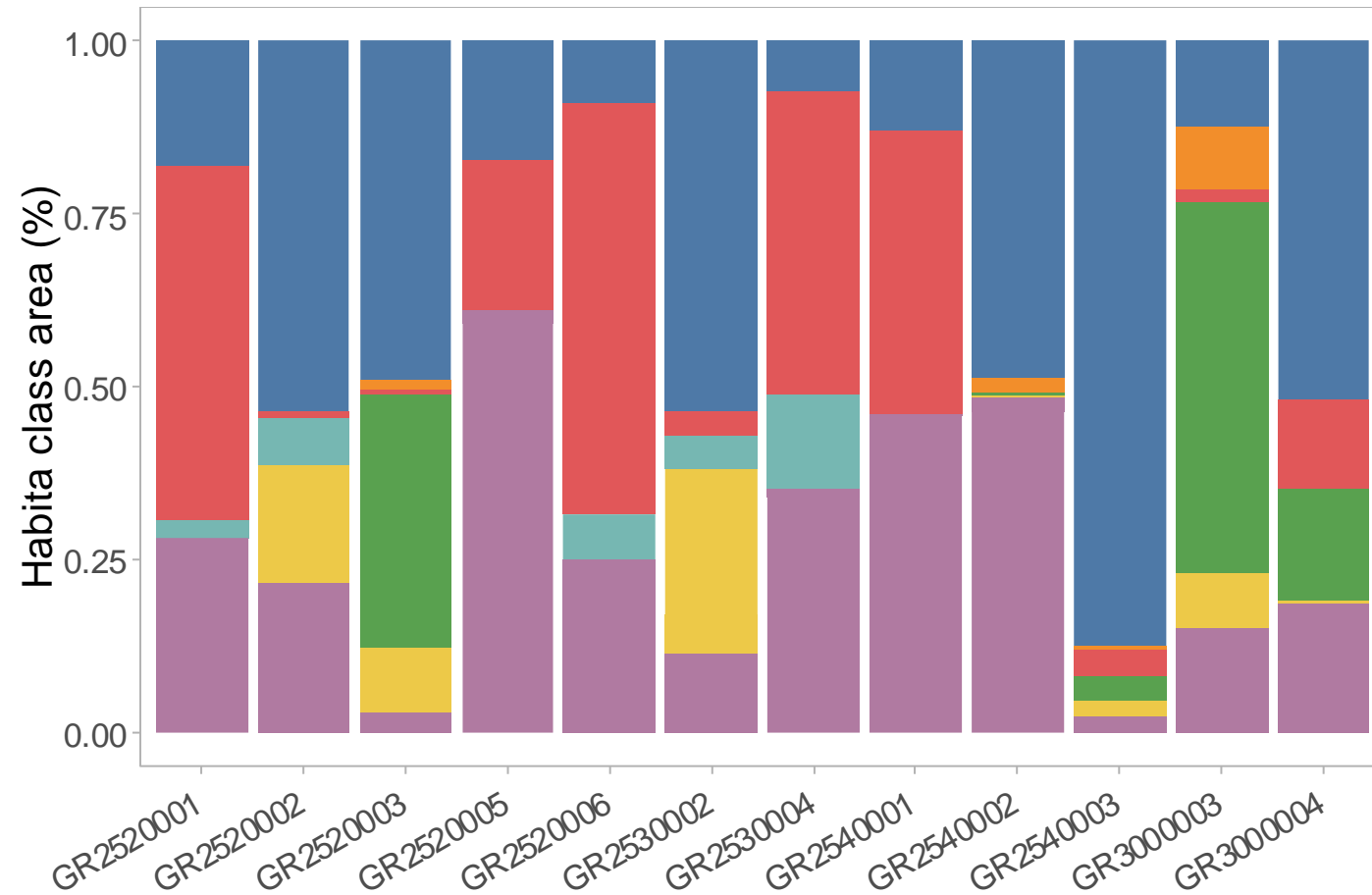
Study area

- 12 Natura 2000 sites (10 in Peloponnese, 2 in Attica)
- Total study area \approx 143080 ha
- 7 habitat classes
 - Anthropogenic habitats
 - Coastal dunes
 - Grasslands
 - Halophilous vegetation
 - Riparian vegetation
 - Scrubs – Phrygana
 - Forests



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Camera trap design

- 63 camera trap stations
- Cameras used
 - BUSHNELL Aggressor 24MP No-Glow (Attica)
 - RECONYX HF2X HyperFire 2 Covert IR (Peloponnese)
- Study area was divided in 5 km² grid
- Minimum distance between stations = 1 km
- Spring – Autumn 2020
- Minimum sampling days/site = 28
- Mean sampling days per station = 29.47 ± 7.44



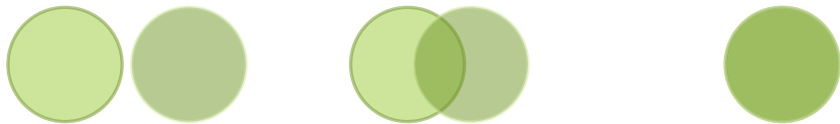
Analysis

Relative Abundance Index (RAI)

$$\frac{\text{Number of independent events}}{\text{Number of sampling days}} \times 100 \text{ for each species}$$

Spatial overlap

$0 \leq \text{Pianka's index} \leq 1$



$$\alpha = \frac{\sum (j_i \times x_i)}{(\sum j_i^2 \times \sum x_i^2)^{1/2}}$$

j_i = RAI of species j on camera site i

x_i = RAI of species x on camera site i

Daily activity

Probability density function using Kernel density estimation with 1000 bootstrapping iterations for CI estimation

Daily activity overlap

$0 \leq \Delta \text{ coefficient} \leq 1$



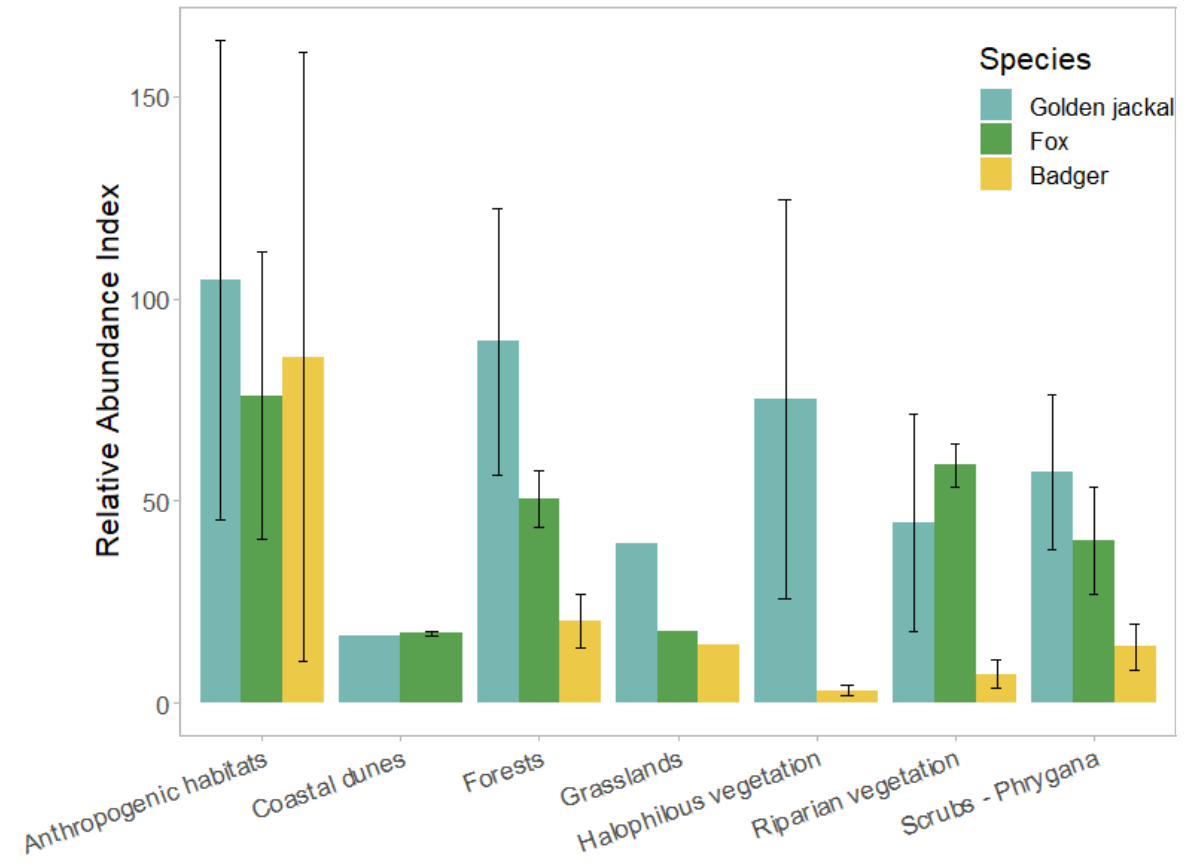
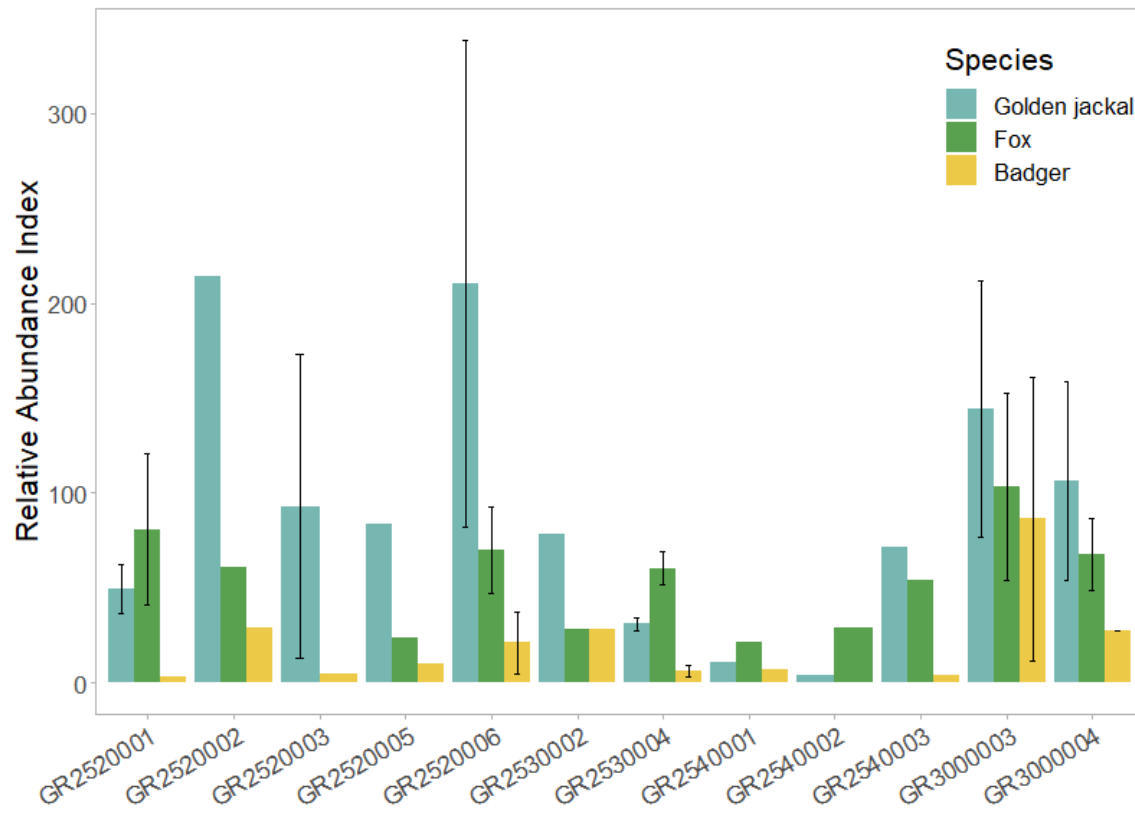
Species captured

12 species from 1768 trap days



Species	Number of independent events
Golden jackal	682
Red fox	456
Badger	158
Hare	156
Wild boar	145
Dog	86
Stone marten	68
Roe deer	20
Otter	14
Feral cat	12
Hedgehog	2
Wild cat	1

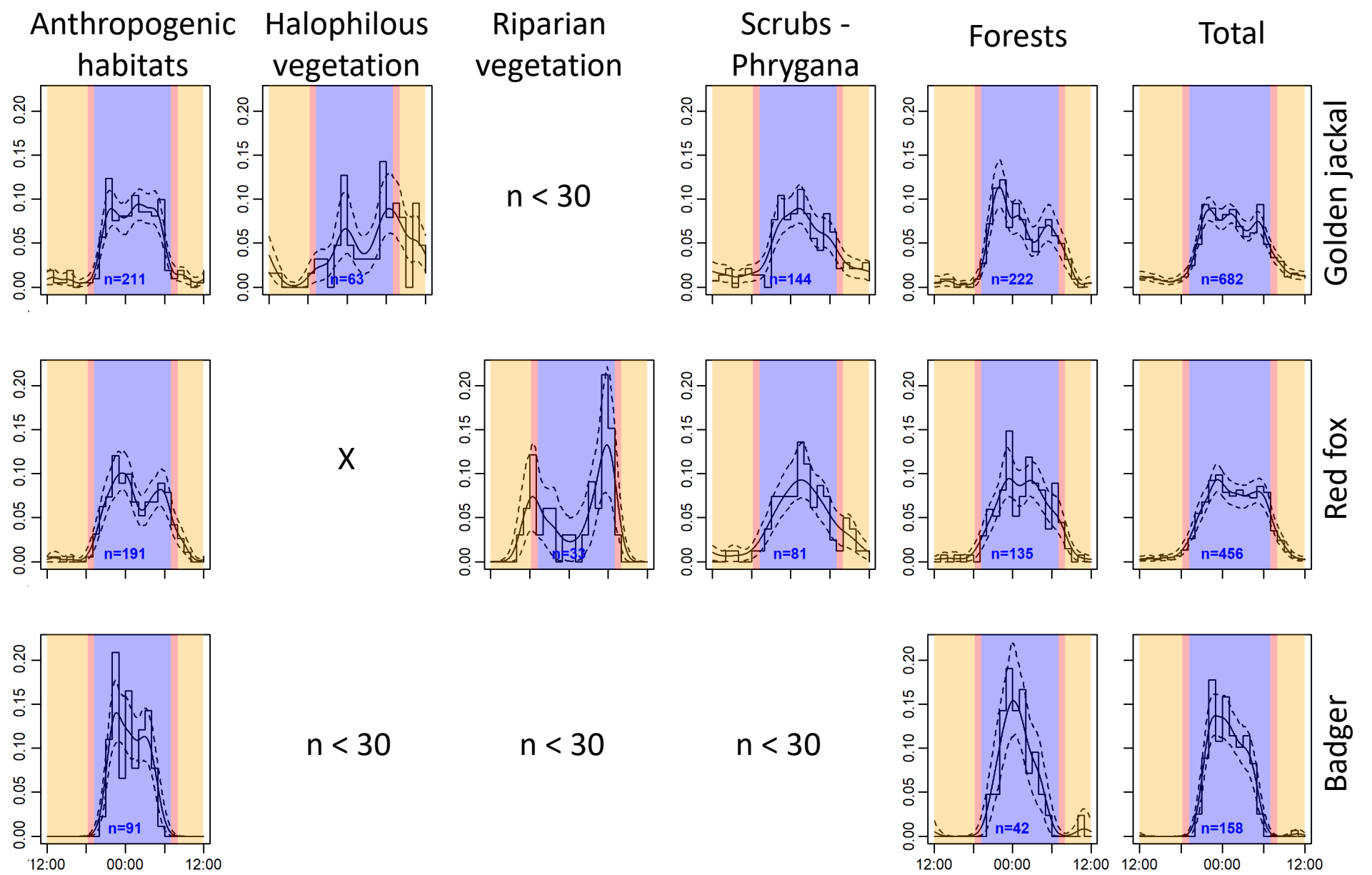
Relative Abundance Index per Natura 2000 site and habitat



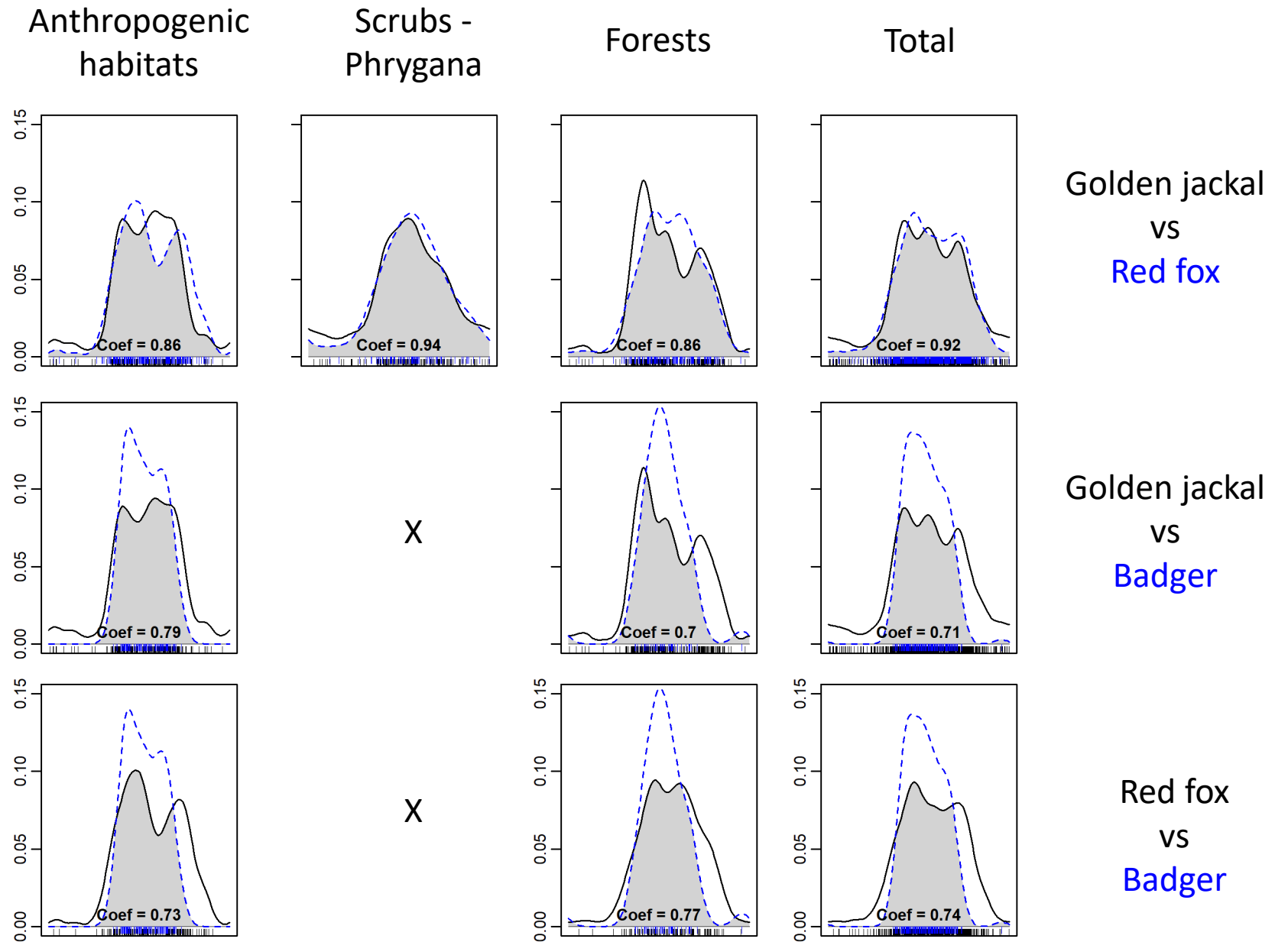
Spatial distribution overlap

	Anthropogenic habitats	Halophilous vegetation	Coastal dunes	Riparian vegetation	Scrubs - Phrygana	Forests	Total
Golden jackal vs Red fox	0.915	0	0.682	0.498	0.686	0.533	0.721
Golden jackal vs Badger	0.953	0.155	0	0.563	0.558	0.936	0.936
Red fox vs Badger	0.924	0	0	0.873	0.496	0.563	0.563

Daily activity



Daily activity overlap



Conclusions

- Jackals, as highly opportunistic species, show high densities even in Natura 2000 sites with >50% anthropogenic habitats in contrast with foxes and badgers
- Jackals thrive even in areas with relatively unfavorable conditions, like halophilous vegetation
- All species show greatest spatial overlap in anthropogenic habitats, followed by forests and lowest overlap in halophilous vegetation and coastal dunes
- All species modify their daily activity in anthropogenic habitats by extending the duration or intensity of nocturnal activity

Conclusions

- Badgers have similar fine-scale spatial distribution and activity pattern with jackals, perhaps due to another coexistence mechanism (probably low dietary overlap and taxonomic dissimilarity)
- Foxes and jackals show spatial segregation especially in areas of limited food resources
- Foxes don't seem to modify their activity at the areas of high jackal presence (eg. anthropogenic habitats) or extended their activity in areas of low spatial overlap (scrubs – phrygana)
- Foxes follow the same strategy to avoid interference with badgers



Thank you for your time!