

Filling the urban niche: assessing Darwin's Naturalization Conundrum on invaded Italian bird communities

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1 Introduction

- The debate about the mechanisms that drive **non-native species establishment** lead to two opposing predictions that form **Darwin's Naturalization Conundrum**: that established species are closely related to local native species (**environmental filtering**), or that established species are distantly related to local native residents (**limiting similarity**)
- For birds, both establishment mechanisms have been shown to occur more frequently in human-disturbed habitats (e.g. urban areas) than in more natural habitats

Which of Darwin's predictions has driven the establishment of non-native bird species in Italian urban areas?

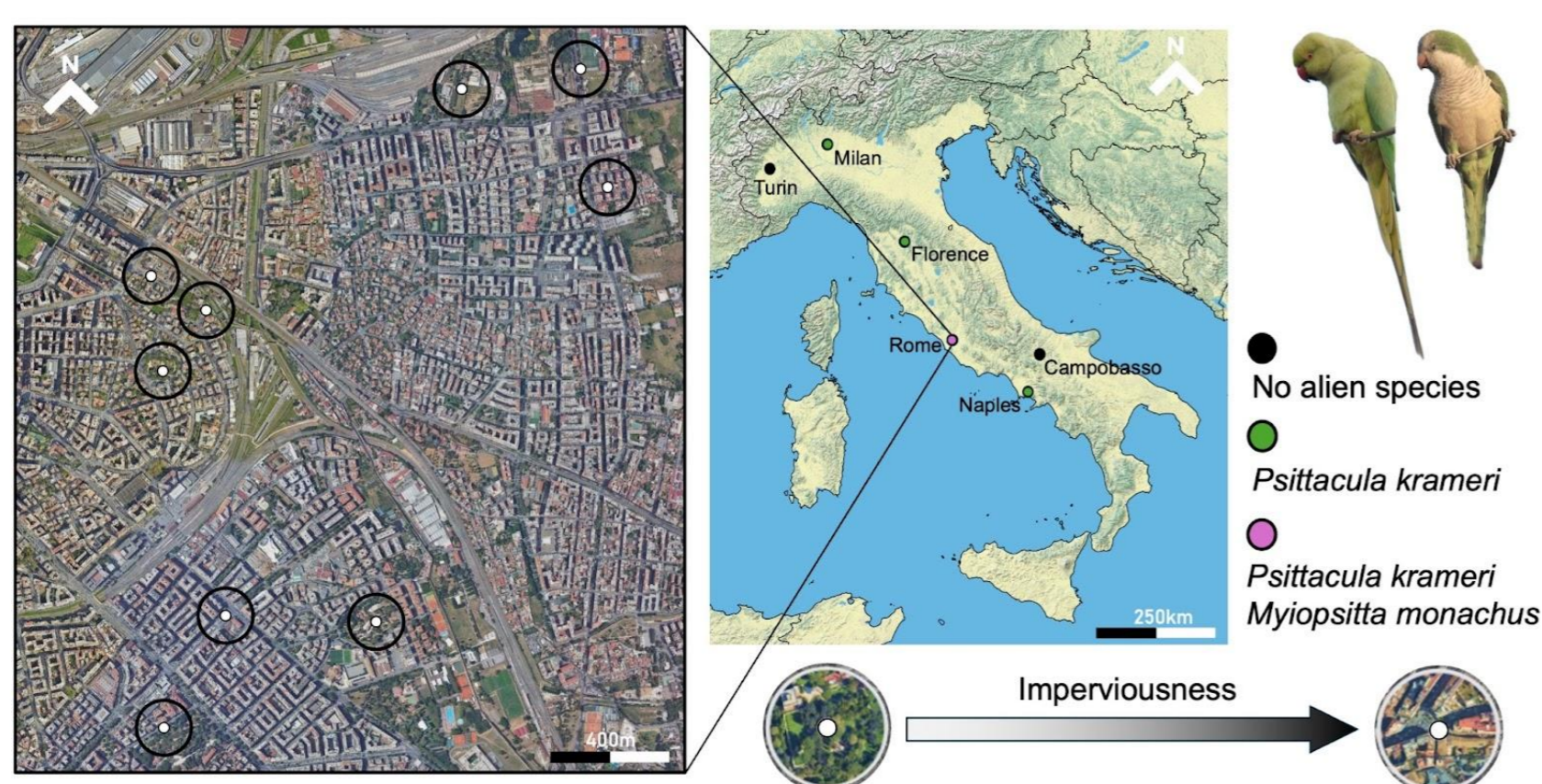


Fig. 1 Location of the six cities surveyed in the Italian peninsula (right) represented by different colours depending on the presence (green and purple dot) or absence (black dot) of non-native parakeet species. An example of the study design (left) with point counts (white dots) and the 100 m buffer (dark circle) with different urbanisation levels (imperviousness) is presented from the city of Rome.

2 Methods

- 220 points** in the urban matrix of 6 Italian cities (Fig 1)
- Bird and habitat surveys in **breeding and wintering seasons**
- Imperviousness gradient** (% Impervious Surface Area)
- 10 functional traits**
- SES functional dispersion and contribution** (Null-models)
- LMMs

3 Results

- Invaded communities** (i.e. parakeet species present) showed a marked overdispersion (**limiting similarity**) in both surveyed periods for functional dispersion (Fig 2)
- Higher SES values in **breeding** than in **wintering** periods (i.e. higher overdispersion both for non-invaded and invaded communities), increasing with the **imperviousness gradient** (Fig 2)
- The **functional contribution** of non-native parakeets was always **overdispersed**, with monk parakeet located in the right-end of the distribution curve for the city of Rome (Fig 3)

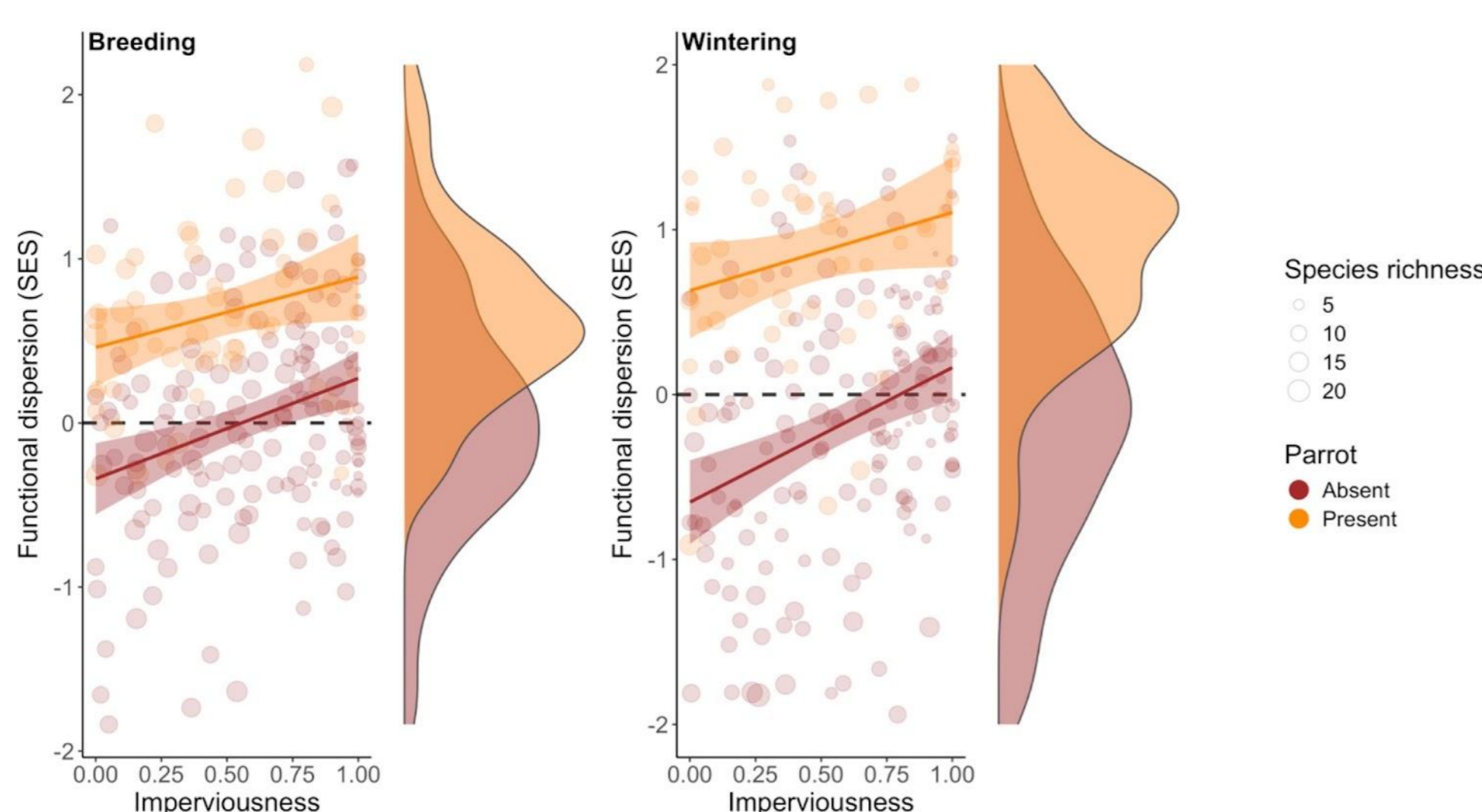


Fig. 2 Response of SES values for Functional dispersion to the gradient of urbanisation (i.e. Imperviousness) in both periods. Points represent the communities with increasing size correlated to the increasing number of species. **Brown** colour represents the non-invaded communities (i.e. no non-native species were found in all visits); **Orange** colour represents the invaded communities (i.e. at least one non-native species was found in at least one visit).

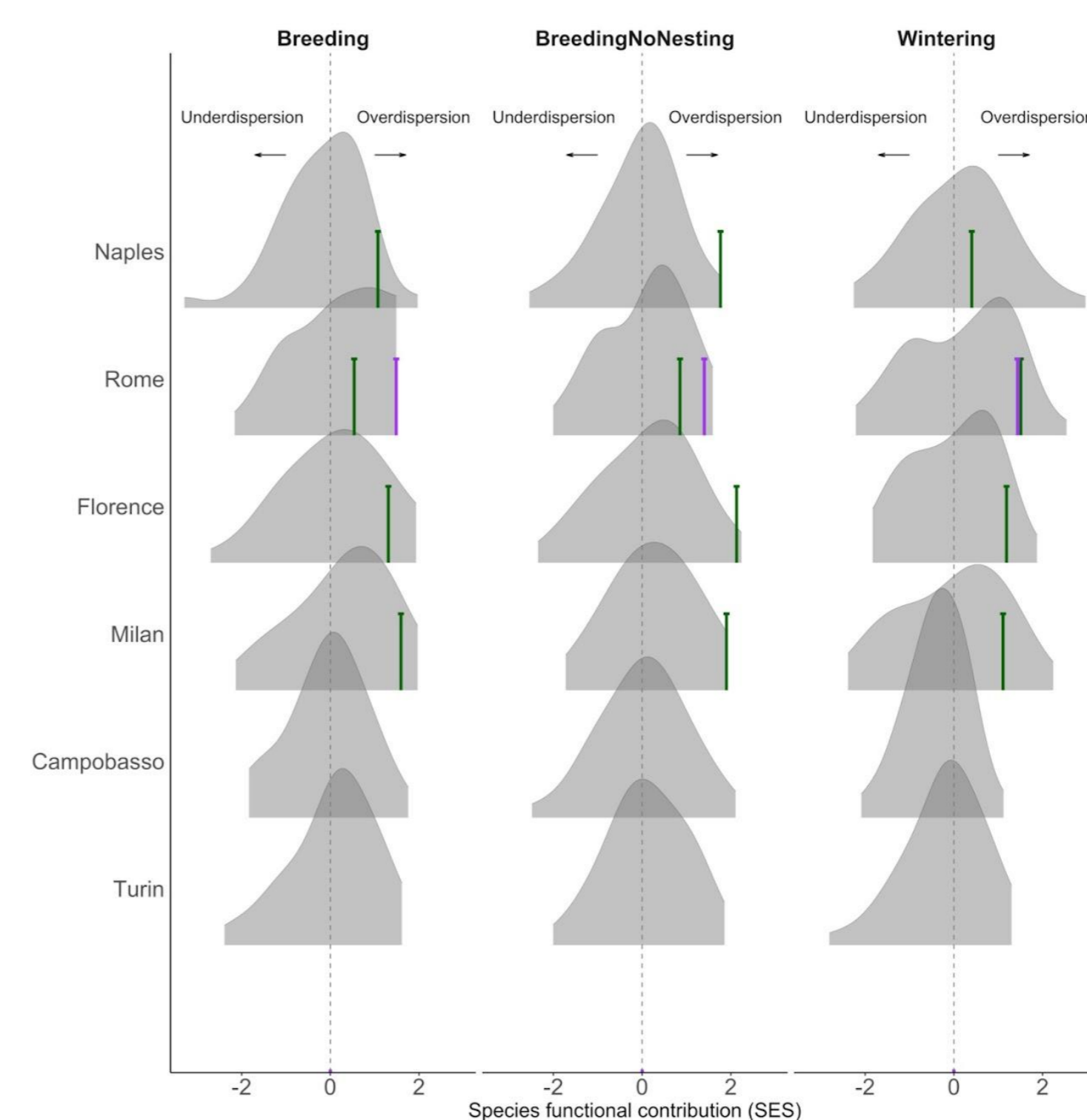


Fig. 3 Distribution of SES values for Functional contribution in all periods for each city, including the comparison in which the breeding period functional contribution was analysed without the nesting traits. **Purple** colour (*Myiopsitta monachus*) and **green** (*Psittacula krameri*) lines represent the functional contribution of the non-native parakeets to the overall bird communities.

4 Conclusions

Communities invaded by non-native species were characterised by limiting similarity due to their intrinsic high disturbance and low species richness, thus urban environments offer novel niches that are occupied by non-native bird species. Promoting 'environmental filtering' should be considered as a conservation objective for the future planning of urban areas.

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