Present and past ecological niche models for the Great Tit (*Parus major*)

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The Great Tit (*Parus major*) is a charismatic bird found in most of Eurasia. This widespread species is well known by birdwatchers and has been the subject of a plethora of research studies; however, its evolutionary history and systematics are still in debate. There are taxonomic authorities that recognize four species (Clements Checklist), while others suggest that the whole complex is formed by one taxon with 44 subspecies (HBW).

To understand some of the differentiation patterns recovered in a newly well-resolved multi-locus phylogeny (Song et al *in prep.*), we undertook an ecological niche modeling approach, exploring climatic changes since the Pleistocene along the distribution of the whole complex.

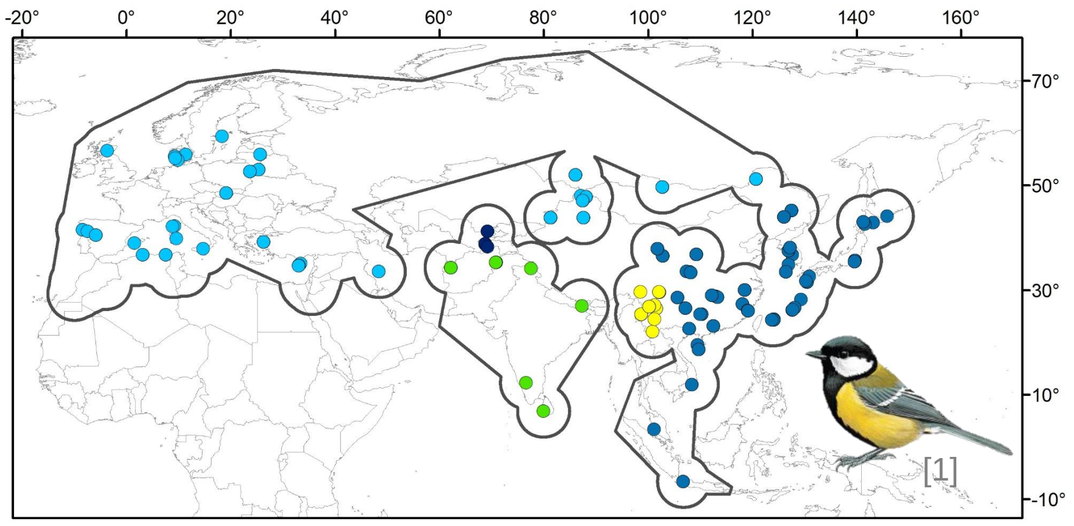

Fig 1. Distribution of *P. major* genotyped populations and calibration area for the models (dark gray contour).

METHODS

GBIF
121,041 records
Spatial filter (50 km) [2]
1,112 occurrences
train 50:50 test

15 bioclim. variables [3]
PCA
(99% explained variance)
7 hierarchical PC sets
present past [4]

Parameters
29 feature combinations and
17 regularization multipliers (β)
[4]
AICc
Omission rate (<7%)
Partial ROC (significance)
Selection criteria

3,451 explored models

RESULTS

The best models (n = 13) were significant and showed omission rates between 5.0 - 6.8%, generally using a small set of PCs. Most models (11) produced similar predictions; with northern areas being somewhat excluded from the potential distribution. The additional models were broader and consistent among each other, predicting most of Eurasia as suitable for the species, excluding the Arabic Peninsula, southeastern India, northeastern Siberia, and in some cases the Tibetan Plateau (Fig. 2). Finally, models showed greater environmental continuity and larger suitable areas in the LGM (Fig. 3). Most of the suitability loss occurred in the southern range of the study area, contrasting with northwestern regions in Eurasia.

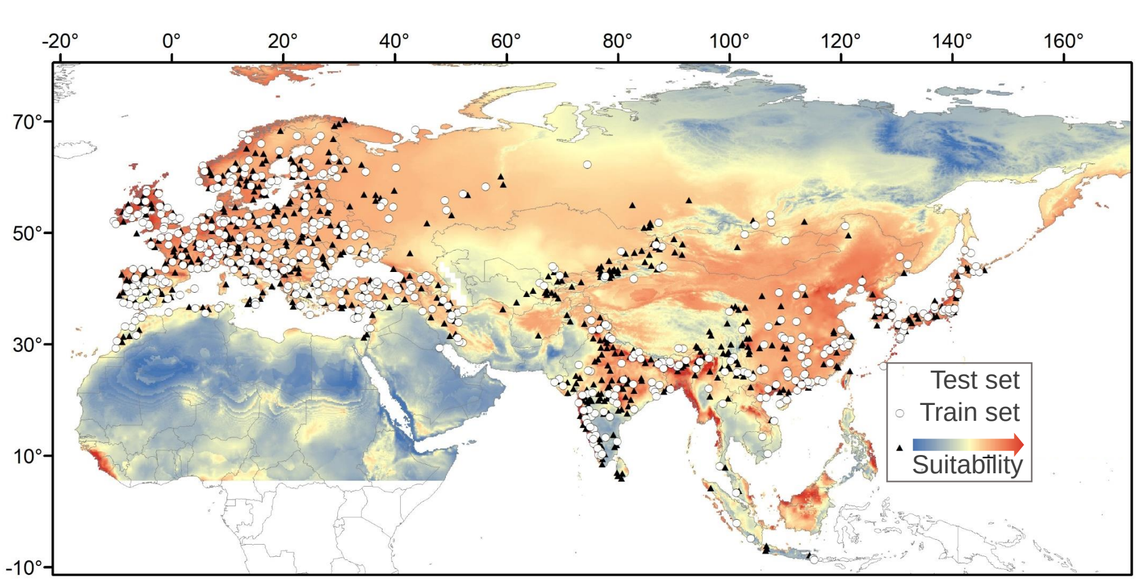

Fig 2. Ecological niche model for *P. major* with test and train records (q & p features, β = 1, 6 PCs, 6.5% omission).

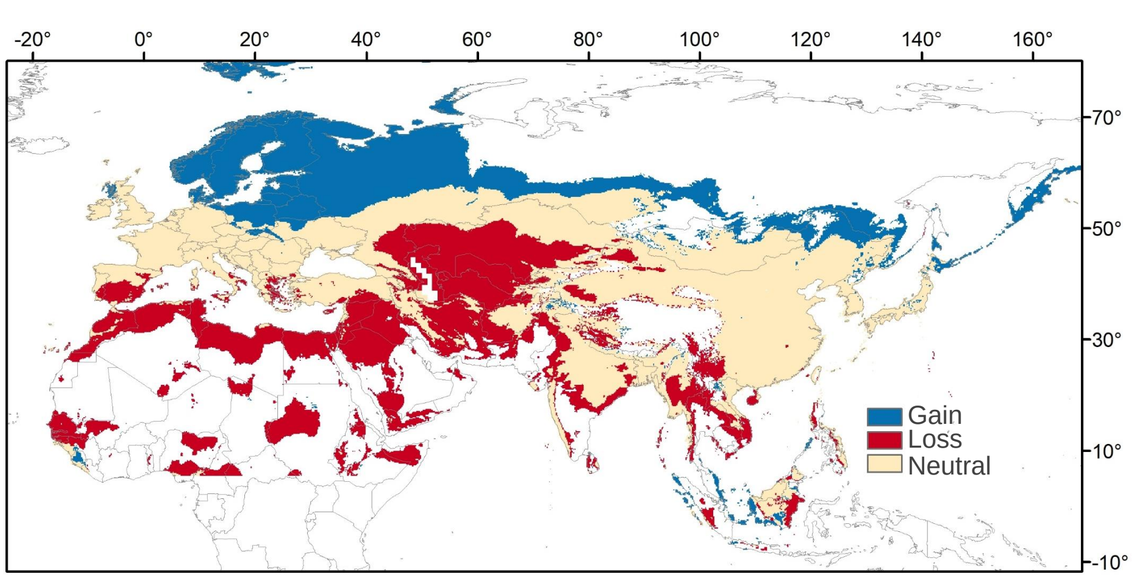

Fig 3. Climatic turnover from LGM to present along Eurasia and Africa.

CONCLUSIONS

- Climate change since the LGM might have influenced the current distributional patterns and the diversification of *Parus major.*

- At present, there is less suitable areas and a complex landscape.

- We aim to do new models with more samples from Siberia, considering also other past climatic scenarios such as the Last Interglacial.

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