

Supplementary Information

Diversification in small mammals is associated with climatic specialisation, whereas species accumulation reflects evolutionary time

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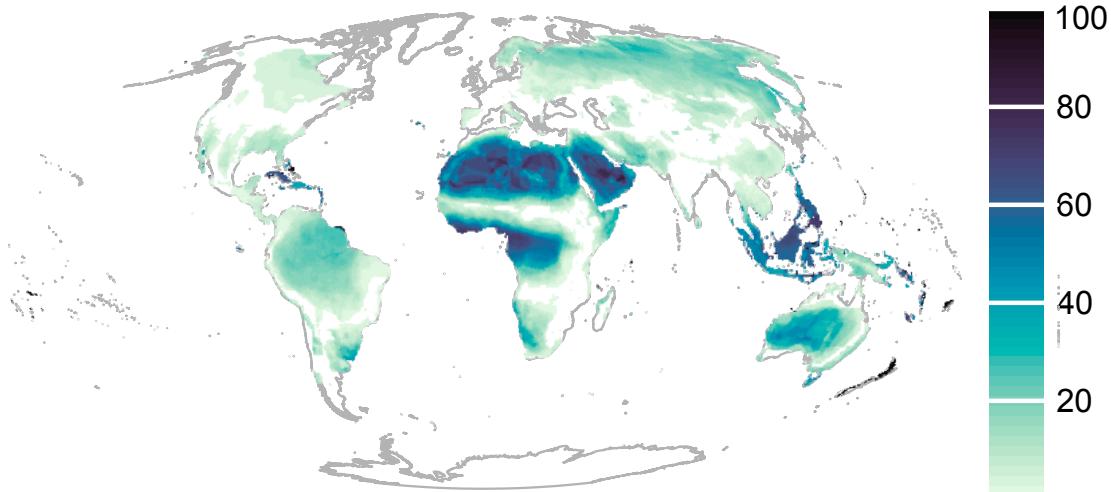
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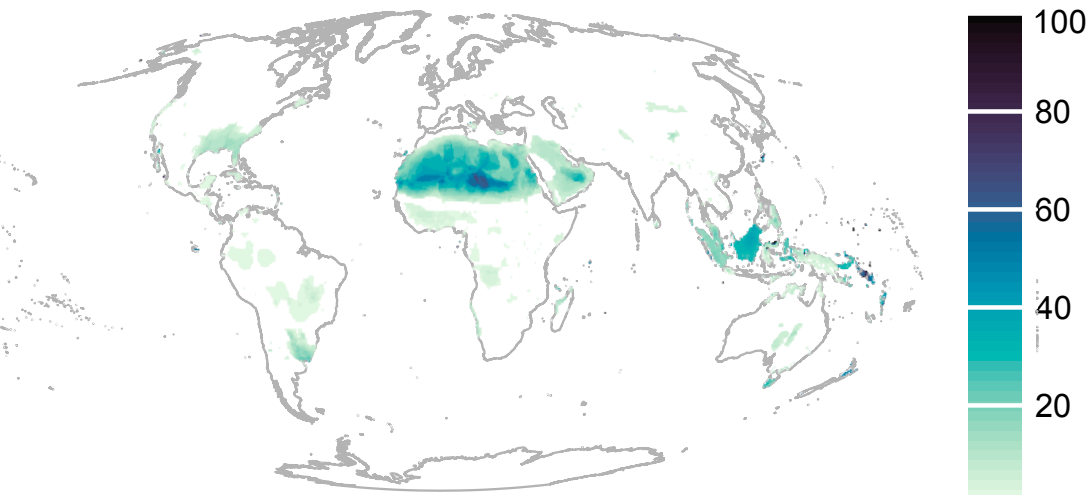
This PDF file includes:

Supplementary Figures 1 to 7

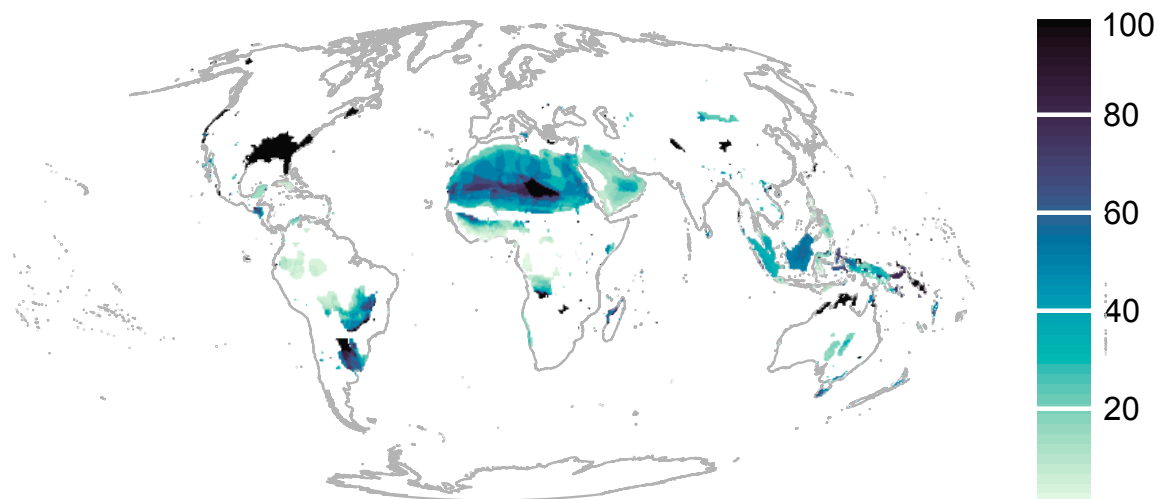
a Specialist / total



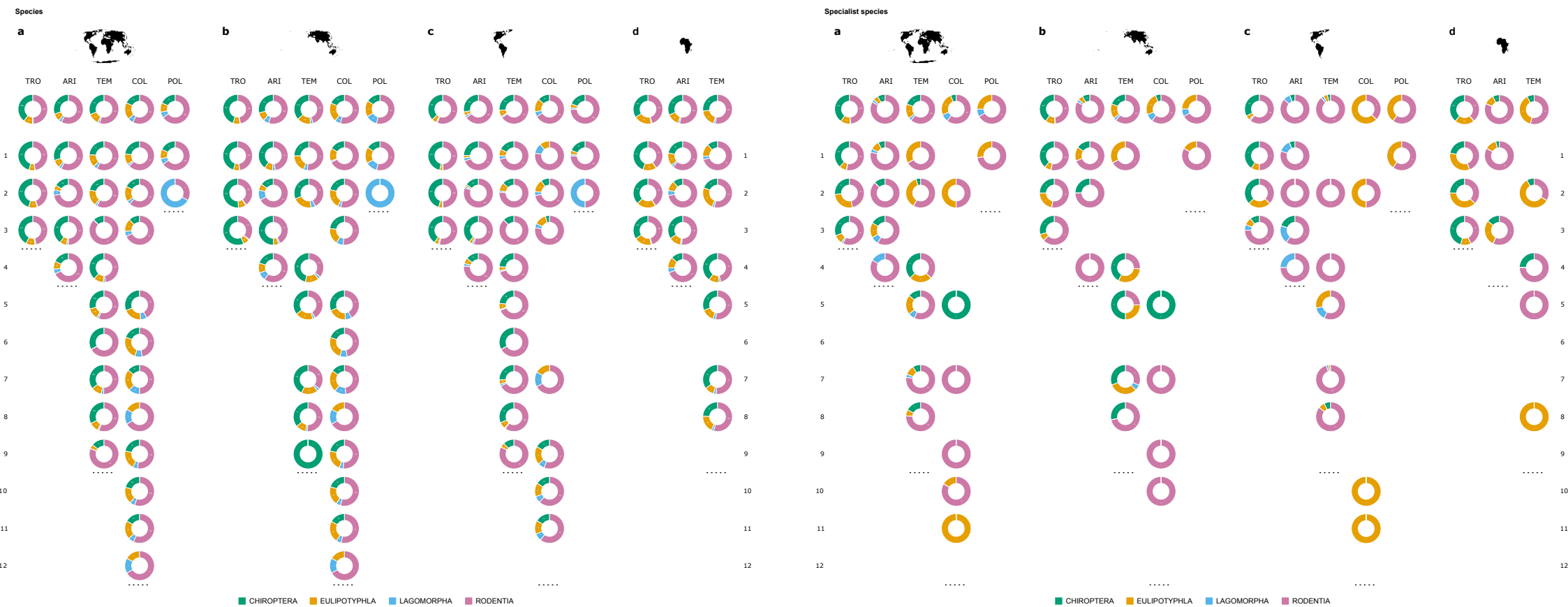
b Superspecialist / total



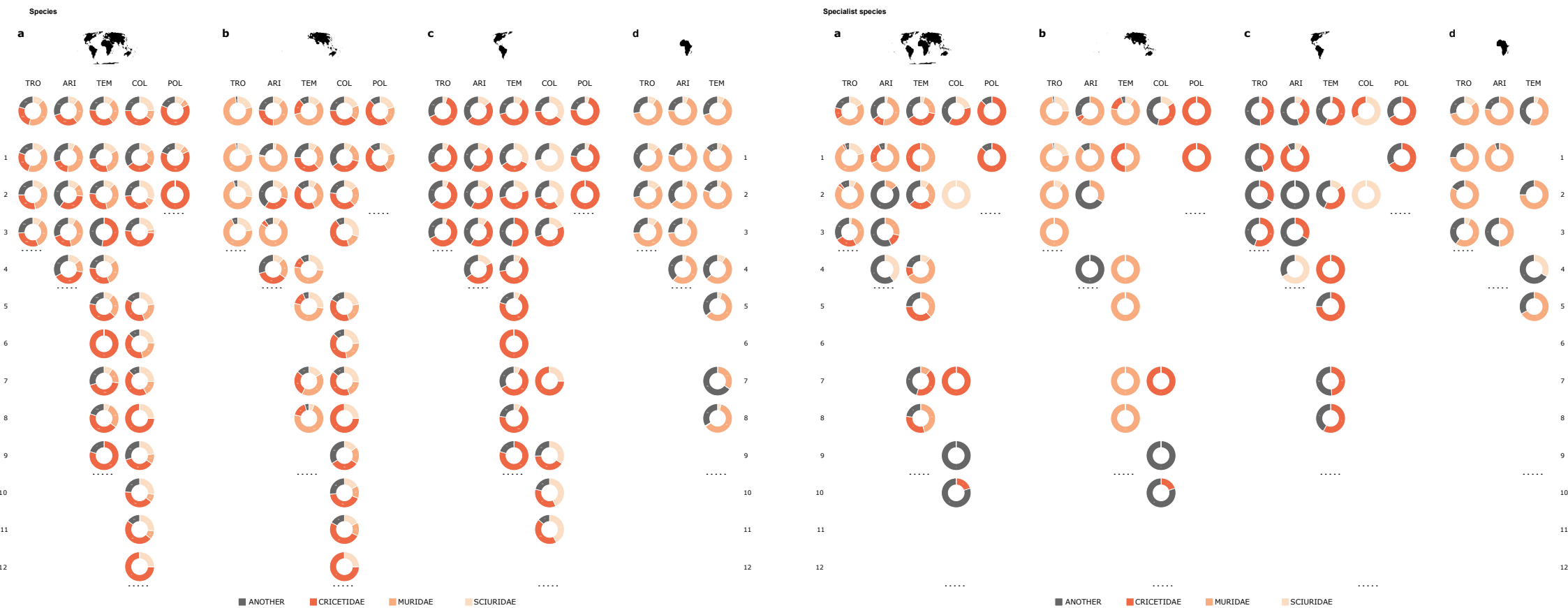
c Superspecialist / Specialist



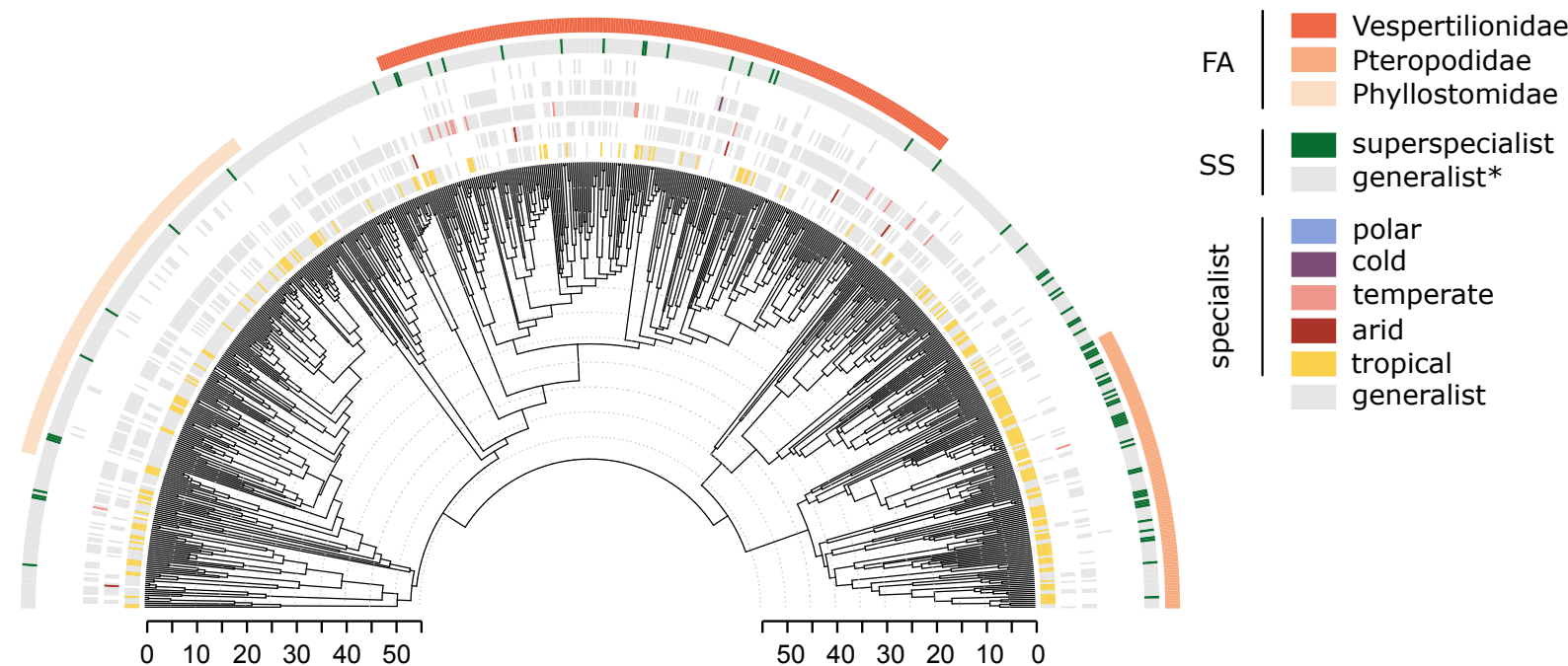
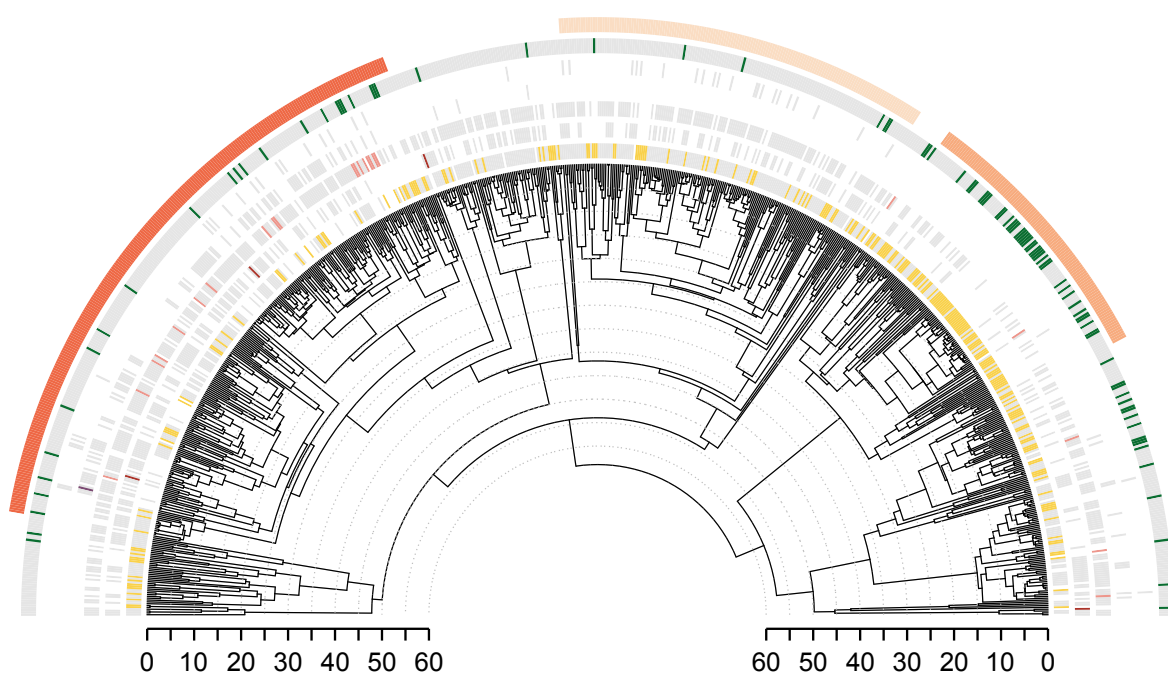
Supplementary Fig. 1: Proportional patterns of climatic specialisation. Maps showing a, the proportion of specialist species relative to total species richness, b, the proportion of superspecialist species relative to total richness, and c, the proportion of superspecialists among specialists. These representations allow comparing the geographic patterns of climatic specialisation independently of absolute species richness.



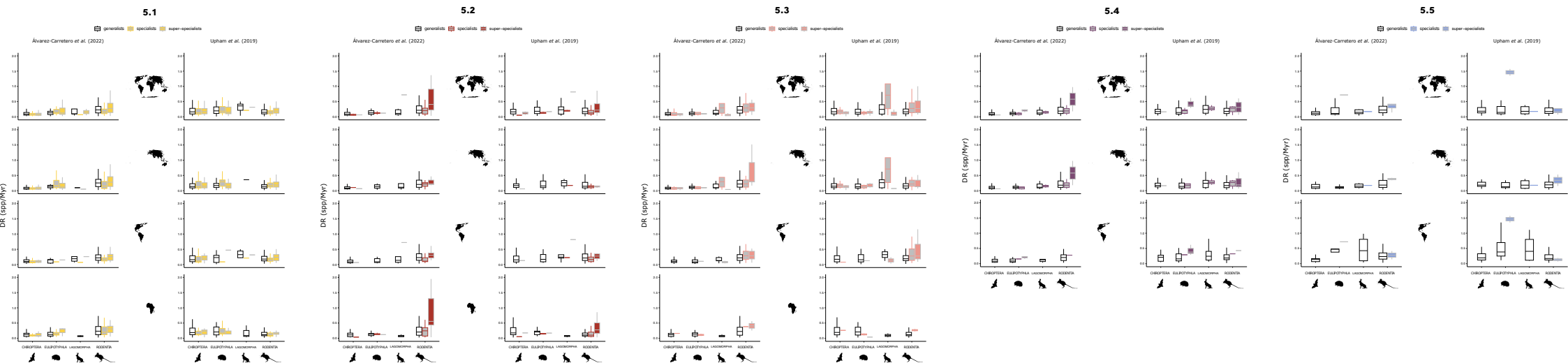
Supplementary Fig. 2: Distribution of total species (left) and specialist categories (right) by small mammal order and climatic zone, at the global scale (a) and across Eurasia-Oceania (b), America (c), and Africa (d). Pie charts represent the relative proportion of each order by zone. The upper row corresponds to the five main climatic zones: TRO - Tropical, ARI - Arid, TEM - Temperate, COL - cold, POL - polar, with climatic sub-zones indicated on below columns. Numbers on the margins (1 - 12) show the ordering of sub-zones within each zone, following Köppen-Geiger climate classification. Within Tropical, 1: Af - Rainforest, 2: Am - Monsoon, 3: Aw - Savanna. Within Arid, 1: BWh - Desert Hot, 2: BWk - Desert Cold, 3: Bsh - Semi-arid Hot, 4: Bsk - Semi-arid Cold. Within Temperate, 1: Csa - Dry Summer Hot Summer, 2: Csb - Dry Summer Warm Summer, 3: Csc - Dry Summer Cold Summer, 4: Cwa - Dry Winter Hot Summer, 5: Cwb - Dry Winter Warm Summer, 6: Cwc - Dry Winter Cold Summer, 7: Cfa - No Dry Season Hot Summer, 8: Cfb - No Dry Season Warm Summer, 9: Cfc - No Dry Season Cold Summer. Within Cold, 1: Dsa - Dry Summer Hot Summer, 2: Dsb - Dry Summer Warm Summer, 3: Dsc - Dry Summer Cold Summer, 4: Dsd - Dry Summer Very Cold Winter, 5: Dwa - Dry Winter Hot Summer, 6: Dwb - Dry Winter Warm Summer, 7: Dwc - Dry Winter Cold Summer, 8: Dwd - Dry Winter Very Cold Winter, 9: Dfa - No Dry Season Hot Summer, 10: Dfb - No Dry Season Warm Summer, 11: Dfc - No Dry Season Cold Summer, 12: Dfd - No Dry Season Very Cold Winter. Within Polar, 1: ET - Tundra, 2: EF - Ice Cap.



Supplementary Fig. 3: Distribution of total species (left) and specialist categories (right) by major rodent family and climatic zone, at the global scale (a) and across Eurasia-Oceania (b), America (c), and Africa (d). Pie charts represent the relative proportion of each family by zone. The upper row corresponds to the five main climatic zones: TRO - Tropical, ARI - Arid, TEM - Temperate, COL - cold, POL - polar, with climatic sub-zones indicated on below columns. Numbers on the margins show the ordering of sub-zones within each zone, following Köppen-Geiger climate classification. Within Tropical, 1: Af - Rainforest, 2: Am - Monsoon, 3: Aw - Savanna. Within Arid, 1: BWh - Desert Hot, 2: BWk - Desert Cold, 3: Bsh - Semi-arid Hot, 4: Bsk - Semi-arid Cold. Within Temperate, 1: Csa - Dry Summer Hot Summer, 2: Csb - Dry Summer Warm Summer, 3: Csc - Dry Summer Cold Summer, 4: Cwa - Dry Winter Hot Summer, 5: Cwb - Dry Winter Warm Summer, 6: Cwc - Dry Winter Cold Summer, 7: Cfa - No Dry Season Hot Summer, 8: Cfb - No Dry Season Warm Summer, 9: Cfc - No Dry Season Cold Summer. Within Cold, 1: Dsa - Dry Summer Hot Summer, 2: Dsb - Dry Summer Warm Summer, 3: Dsc - Dry Summer Cold Summer, 4: Dsd - Dry Summer Very Cold Winter, 5: Dwa - Dry Winter Hot Summer, 6: Dwb - Dry Winter Warm Summer, 7: Dwc - Dry Winter Cold Summer, 8: Dwd - Dry Summer Very Cold Winter, 9: Dfa - No Dry Season Hot Summer, 10: Dfb - No Dry Season Warm Summer, 11: Dfc - No Dry Season Cold Summer, 12: Dfd - No Dry Season Very Cold Winter. Within Polar, 1: ET - Tundra, 2: EF - Ice Cap.

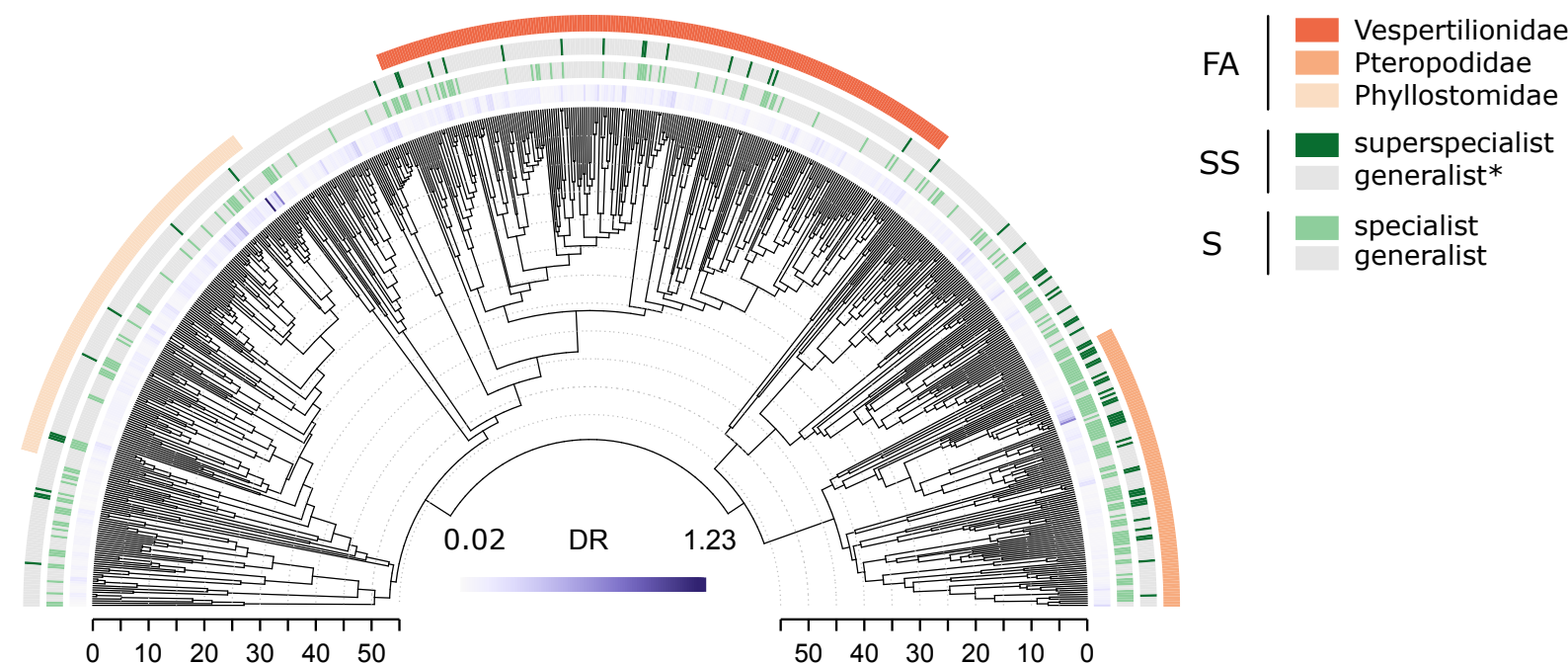
aÁlvarez-Carretero *et al.* (2022)**b**Upham *et al.* (2019)

Supplementary Fig. 4: Climatic specialisation and superspecialisation across Chiroptera, highlighting major families. Arcs, from outer to inner, correspond to family codes (FA), superspecialisation binary index over climatic zones (SS, where generalist* includes all species classified as non-superspecialists), and specialisation binary index (specialist) by climatic zone (polar, cold, temperate, arid, and tropical). Results are shown on top of the two considered phylogenies, Álvarez-Carretero *et al.* (AC-tree, a) and Upham *et al.* (Upham-tree, b), for all bats together. Bottom timescales are indicated in millions of years before present. Patterns reveal a predominance of tropical specialisation and a near absence of cold- and polar-adapted species.

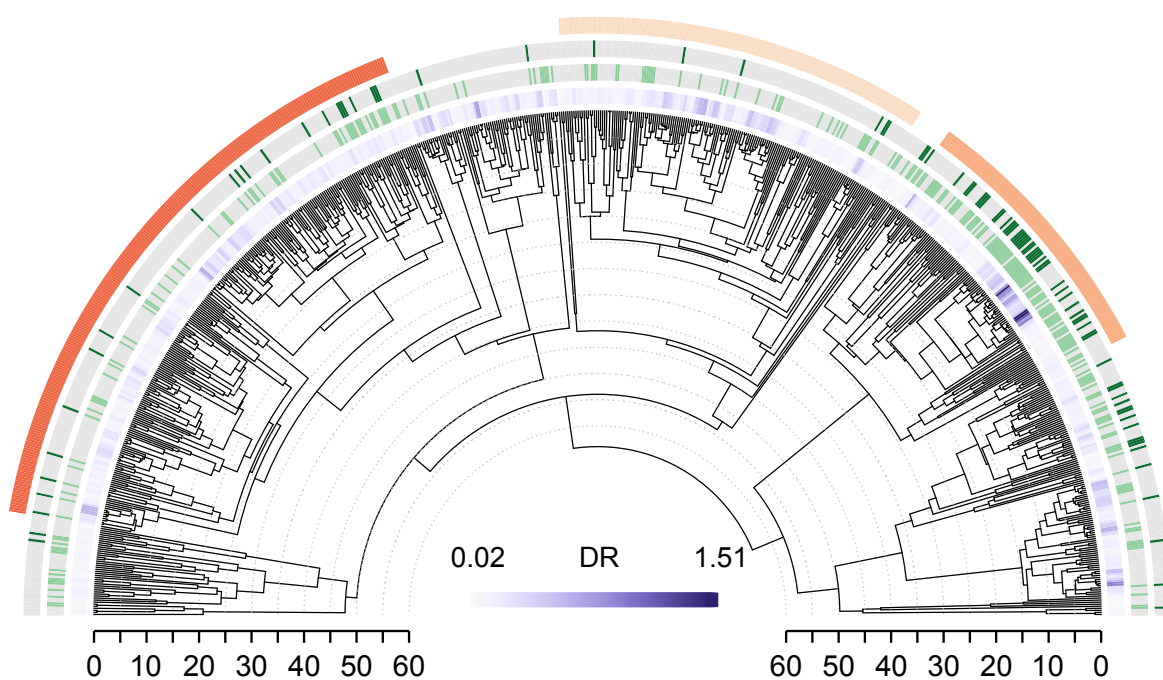


Supplementary Fig. 5.1-5.6: Tip diversification rates (DR) by small mammal order and climatic specialization category across climatic zones, according to AC-tree and Upham-tree phylogenies (left to right), at the global scale and across Eurasia+Oceania, America, and Africa (top to bottom). Panels correspond to the five main climatic zones: altogether (Fig. 5.1, in green), Tropical (Fig. 5.2, in yellow), Arid (Fig. 5.3, in red), Temperate (Fig. 5.4, in pink), Cold (Fig. 5.5, in purple), Polar (Fig. 5.6, in blue). Cold and polar zones are not present in Africa. Species silhouettes, under public domain dedication license, were downloaded from PhyloPic (<https://www.phylopic.org>).

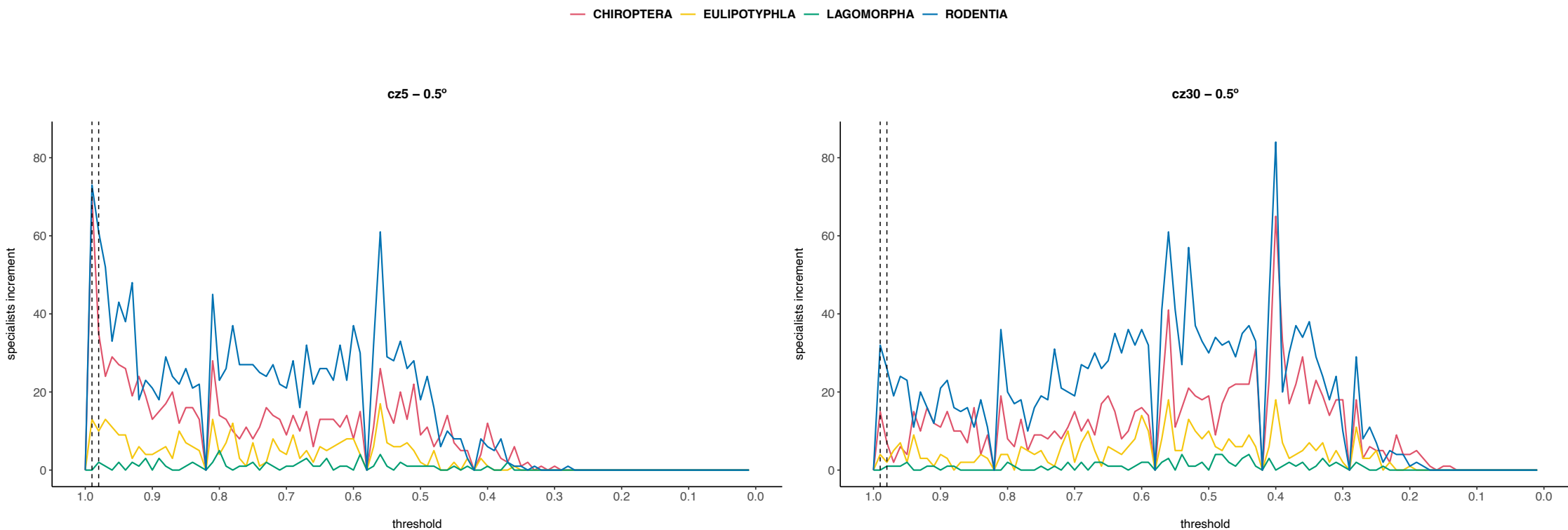
a

Álvarez-Carretero *et al.* (2022)

b

Upham *et al.* (2019)

Supplementary Fig. 6: Climatic specialisation and tip-diversification rates (DR) in Chiroptera, highlighting major bat families. Arcs, from outer to inner, correspond to family codes (FA), superspecialisation (SS, where generalists* include all species classified as non-superspecialists) and specialisation (S) binary indexes over climatic zones, and tip diversification rates (DR). Results are shown according to the two considered phylogenies, AC-tree (a) and Upham-tree(b), for all bats together. Bottom timescales are indicated in millions of years. Patterns indicate a weak or absent association between climatic specialisation and diversification across major bat families.



Supplementary Fig. 7: Climatic specialisation thresholds. Each threshold indicates the proportion of the geographic range of a given species overlapping with a climatic zone to be considered restricted to that zone (i.e., climatic specialist). Sensitivity analyses show how the number of species classified as climatic specialists changes across threshold values, as the increase with respect to the preceding value, for each small mammal order (Chiroptera, Eulipotyphla, Lagomorpha and Rodentia). Analyses were conducted for the five main Köppen-Geiger climatic zones (cz5, left) and for the 30 climatic sub-types (cz30, right), using species distributions at 0.5° spatial resolution. Results show that classification is relatively stable across nearby cutoff values and support the use of a conservative threshold of ≥ 0.98 of the species' range within a single climatic zone to define climatic specialists.