

# Unravelling diversity contrasts across families and regions in coral reef fishes

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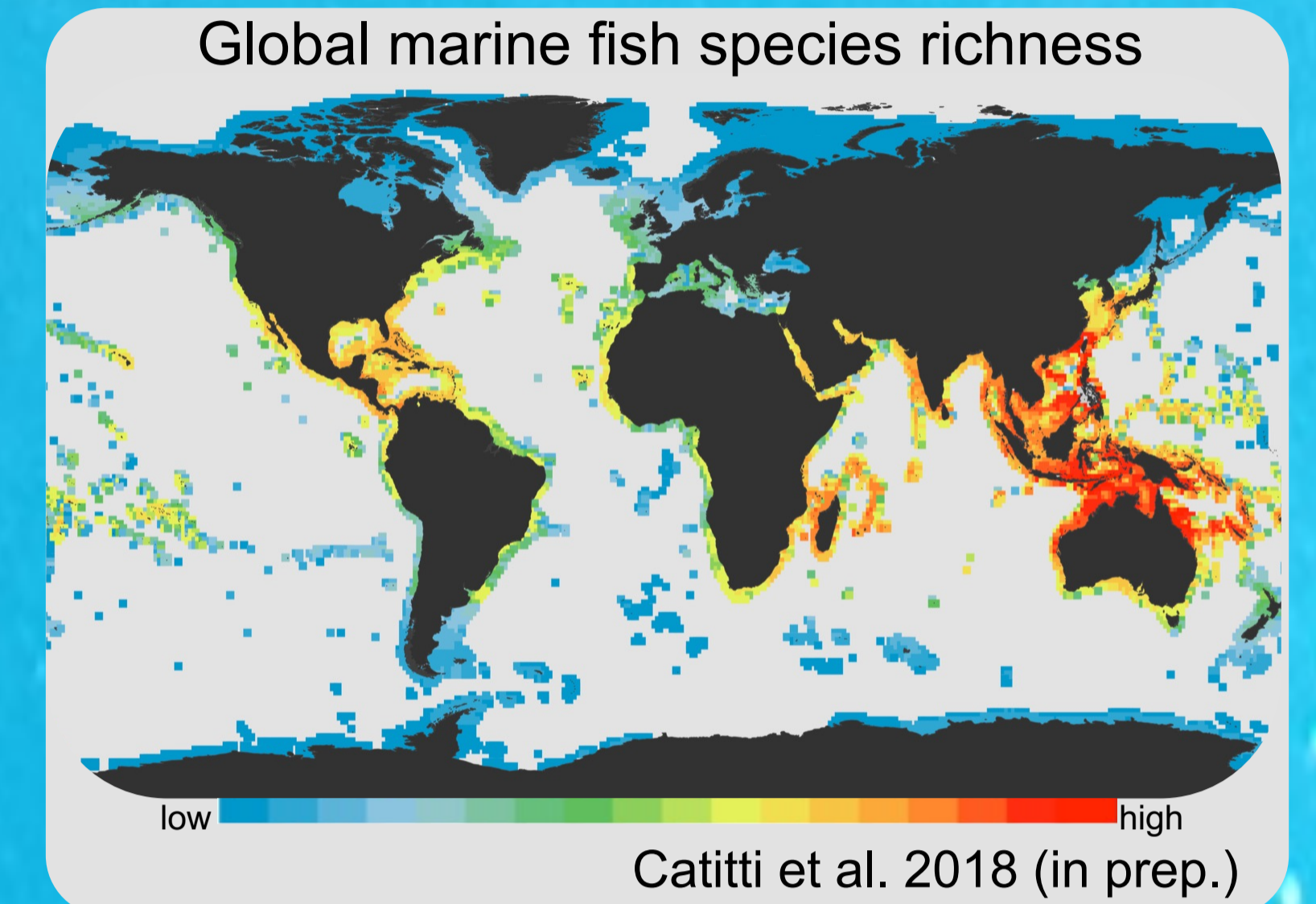
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Tropical reef fishes show over ten-fold differences in species richness among clades, but also among tropical regions.

Dispersal is a pervasive force modulating both the ecological and evolutionary processes shaping global patterns of biodiversity.

We examined whether species traits related to dispersal explain diversity contrasts across clades and regions using two complementary approaches.



## Phylogenetic-based species diversification model

**Data:** • Phylogenies • Dispersal-trait data • Time-calibrated phylogeny ray-finned fishes.

### Analytical steps:

1. Computed the net diversification rate:  $r = \lambda - \mu$  per clade (birth-death model, R package "RPANDA")<sup>1</sup>.
2. Computed mean (e.g. *body elongation*) or proportion of modalities (e.g. *home range*) for dispersal-related traits<sup>2,3</sup> (n=7) over 10 reef fish families.
3. Related 1. and 2. using phylogenetic generalized linear models (PGLS, R package "caper")<sup>4,5</sup>.

### Results:

Clades characterized by reduced body elongation and higher proportions of restricted home ranges were associated to higher diversification rates.

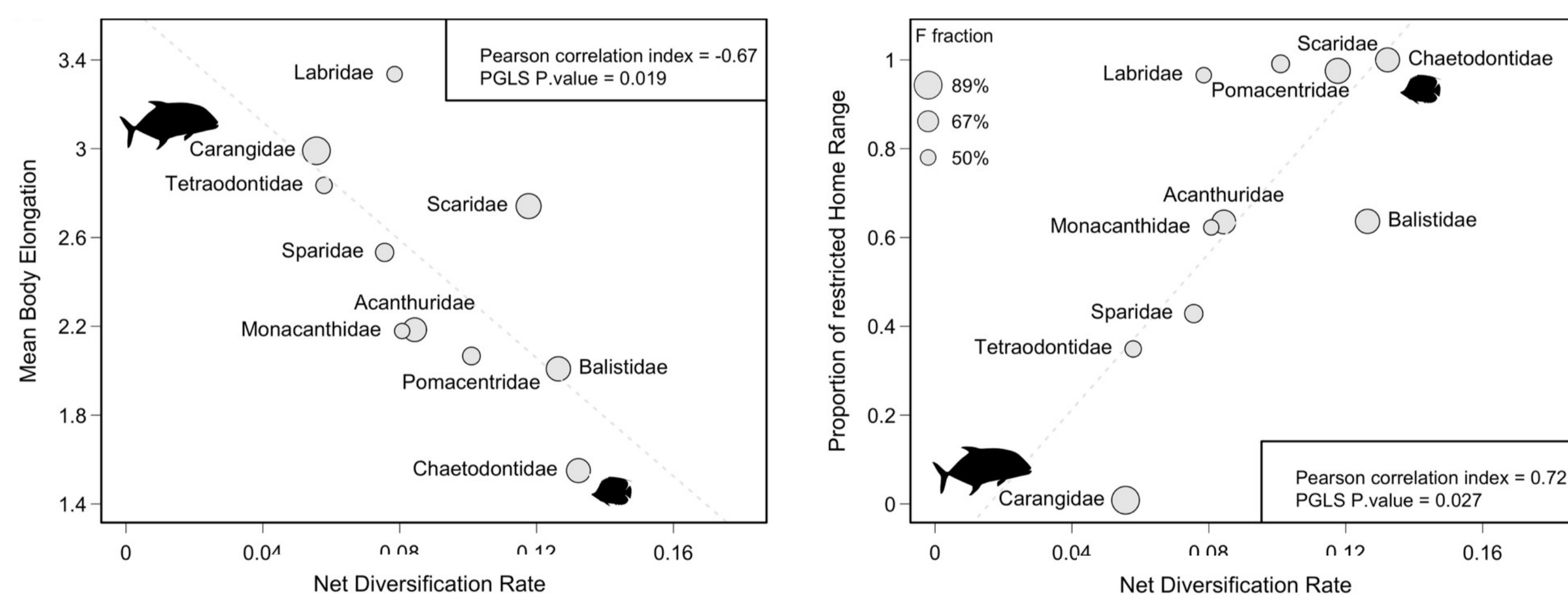


Figure 1: Simple linear regressions between net rate of diversifications and dispersal-related traits. The points' width relates to "F", i.e. fraction of extant species included in the phylogeny.

## Spatial sPeciation of Lineages through Time (SPLIT) model

**Data:** • Dispersal parameters • Dispersal-related trait occurrence data global scale  
• Plate motion model

### Analytical steps:

1. SPLIT<sup>6,7</sup> model simulations ( $d$  and  $d_s$ ).
2. Observed patterns of traits distributions.
3. Spatial congruence analysis<sup>8</sup>.

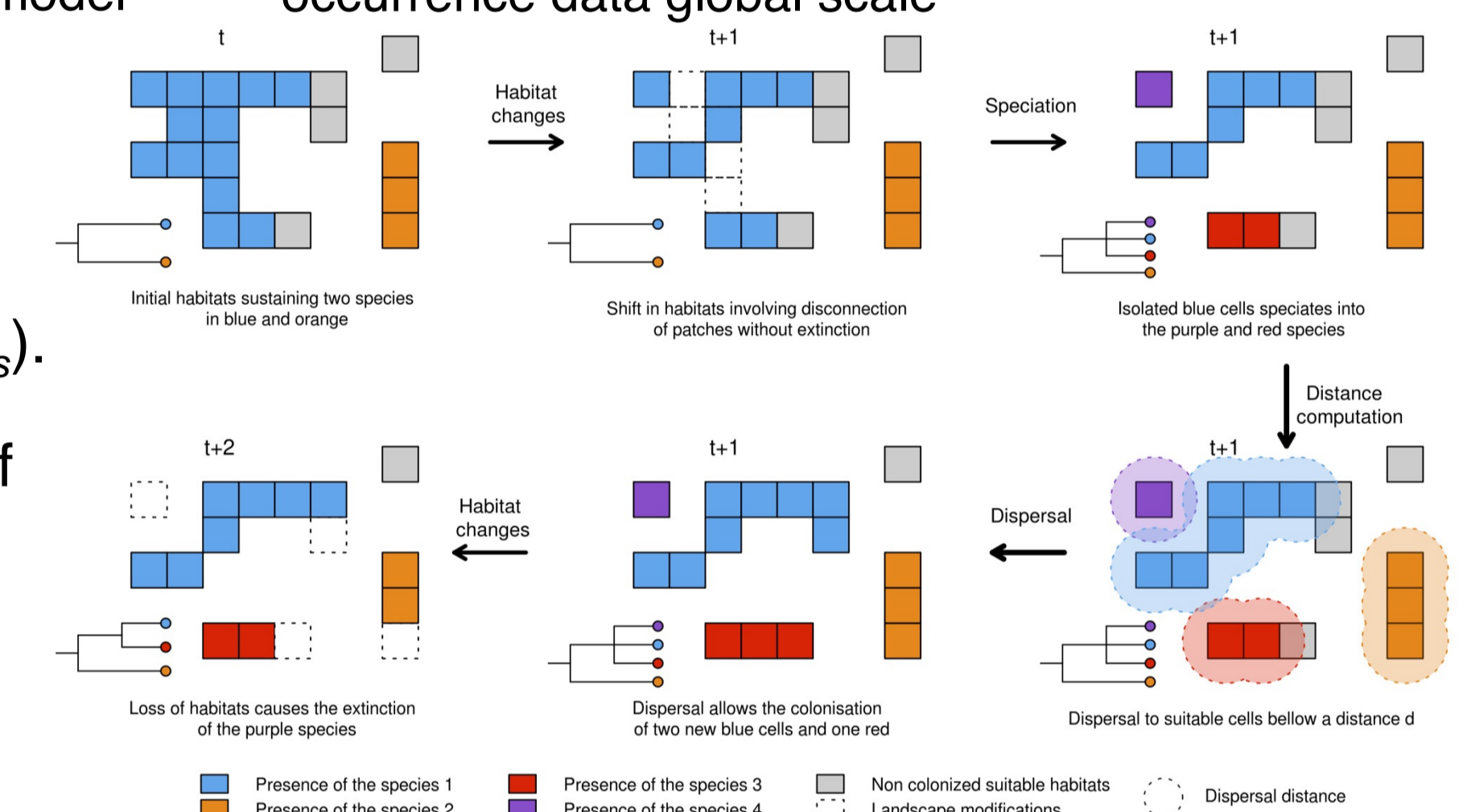


Figure 2: Description of the speciation, dispersal and extinction process implemented in the SPLIT model.

### Results:

The spatially-explicit simulations with low dispersal parameters spatially matched areas with a large proportion of species characterized by restricted home range and reduced adult body size.

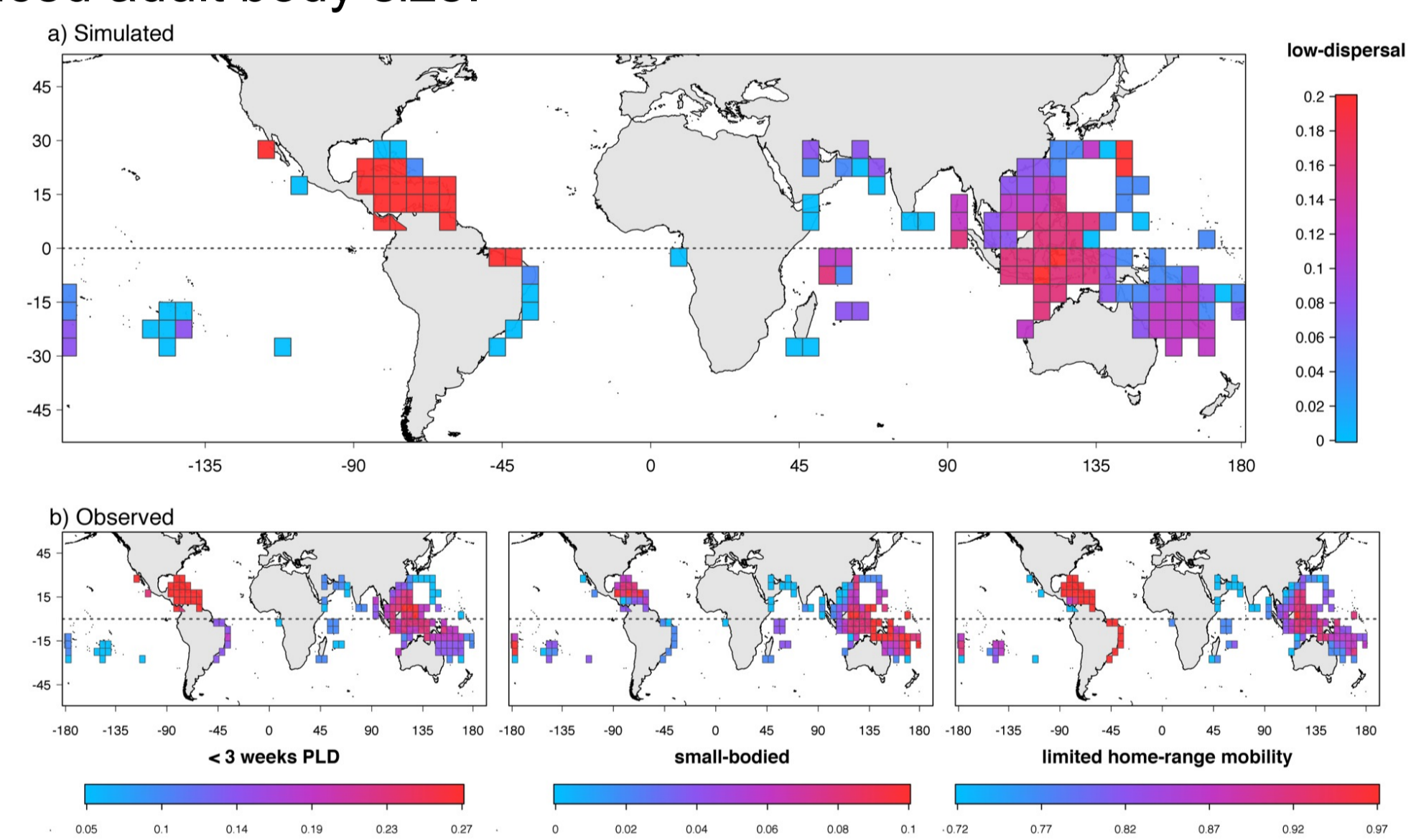


Figure 3: Global distribution maps showing proportions of species richness for (a) low-dispersal parameter SPLIT simulations and (b) observed traits: Pelagic Larval Duration (left), small Total Length (centre), home range (right).

## Take home message

Taken together, our findings suggest that a set of ecological and body-feature related traits, modulating dispersal, played a major role in shaping species diversification within clades, together with the spatial organization of coral reef fish assemblages worldwide.