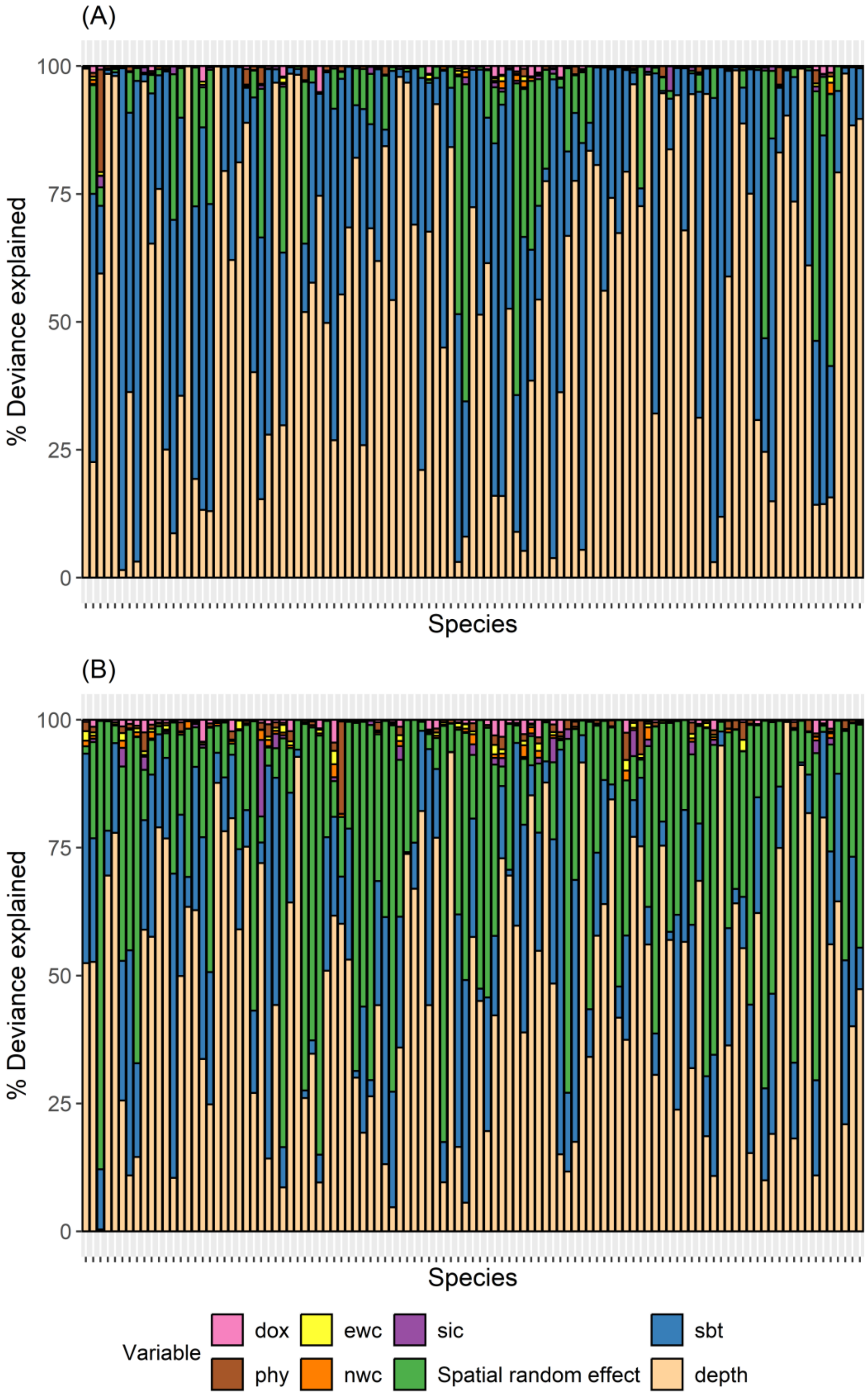
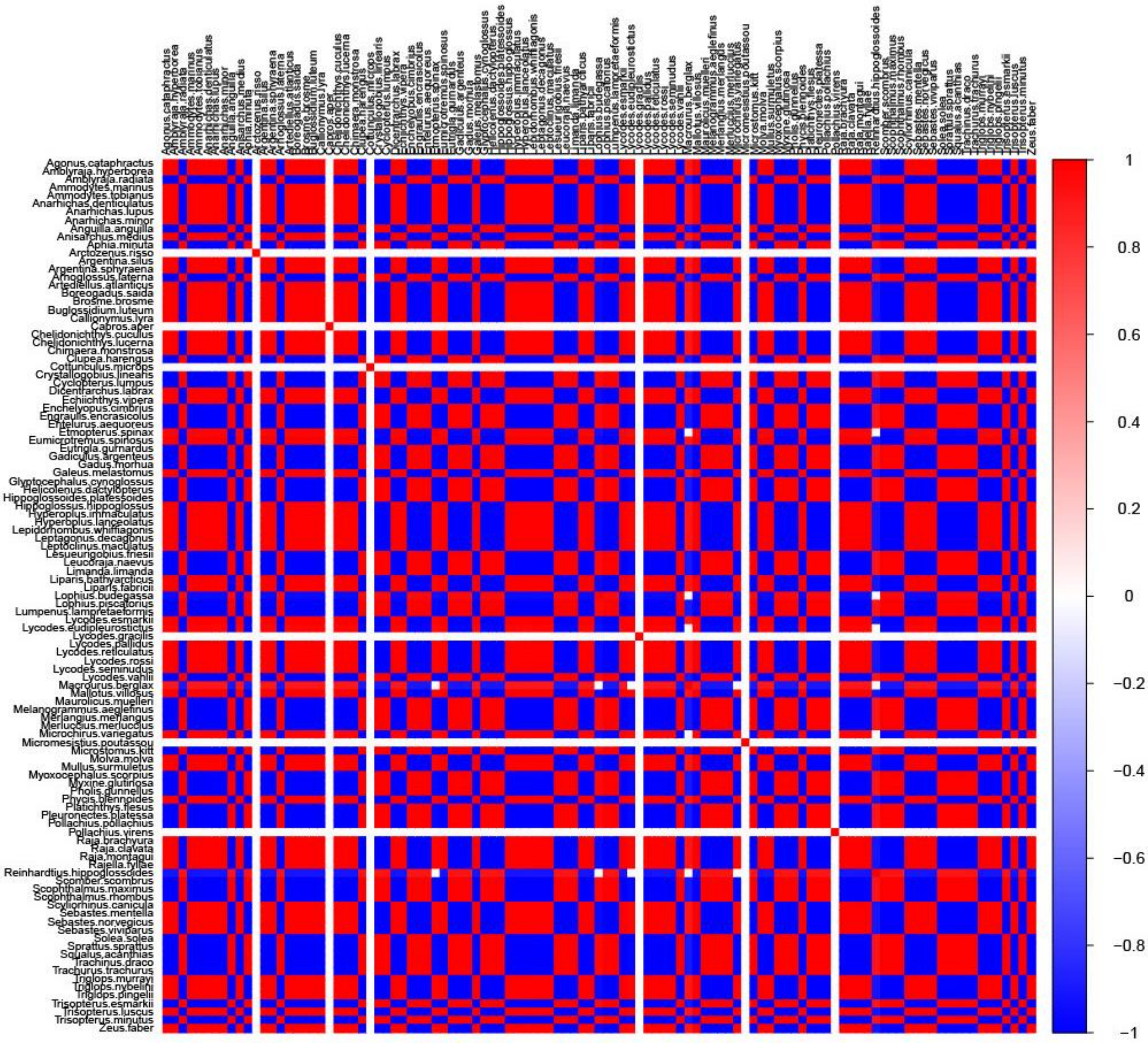
SUPPLEMENTARY INFORMATION

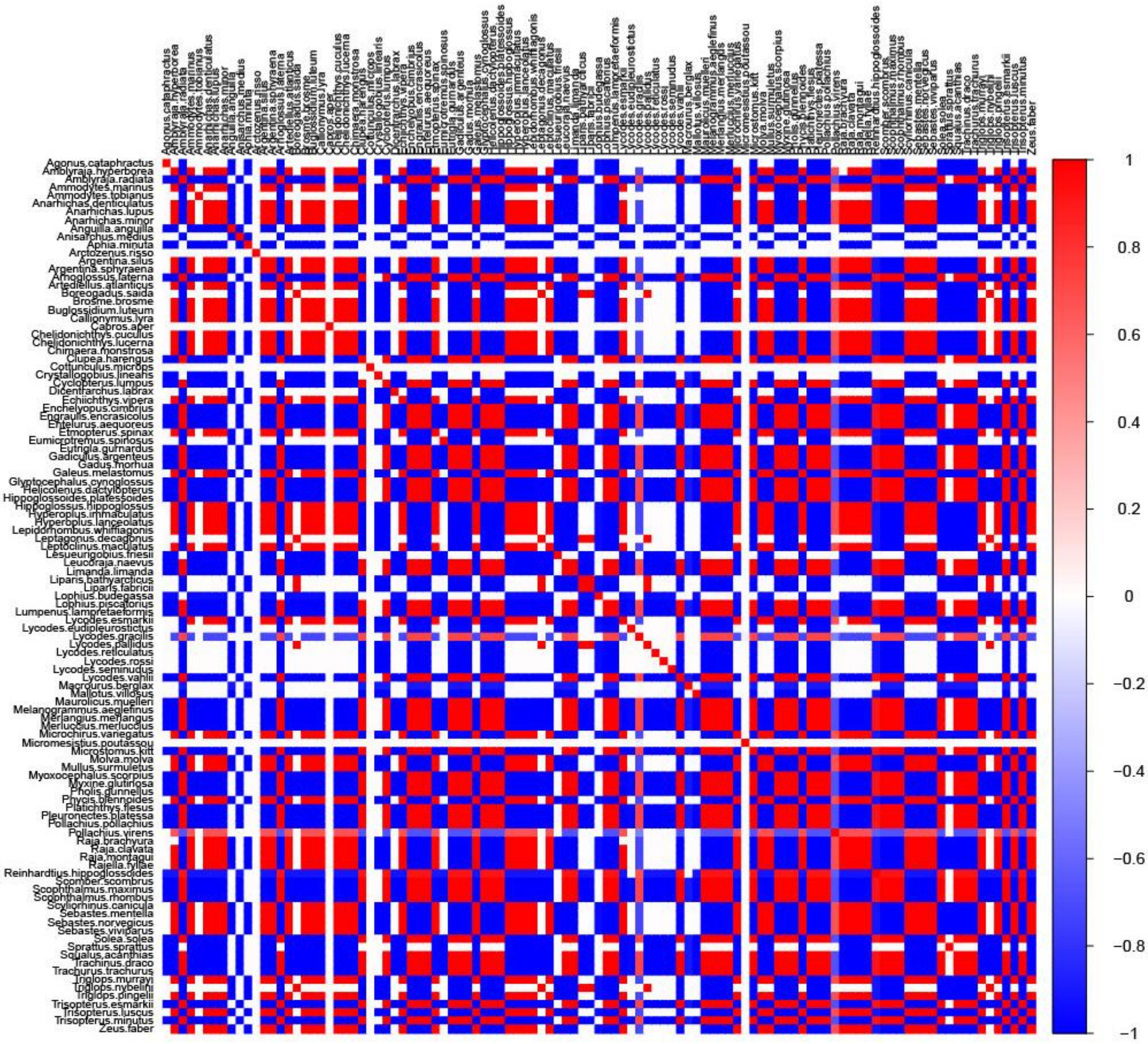
FIGURES



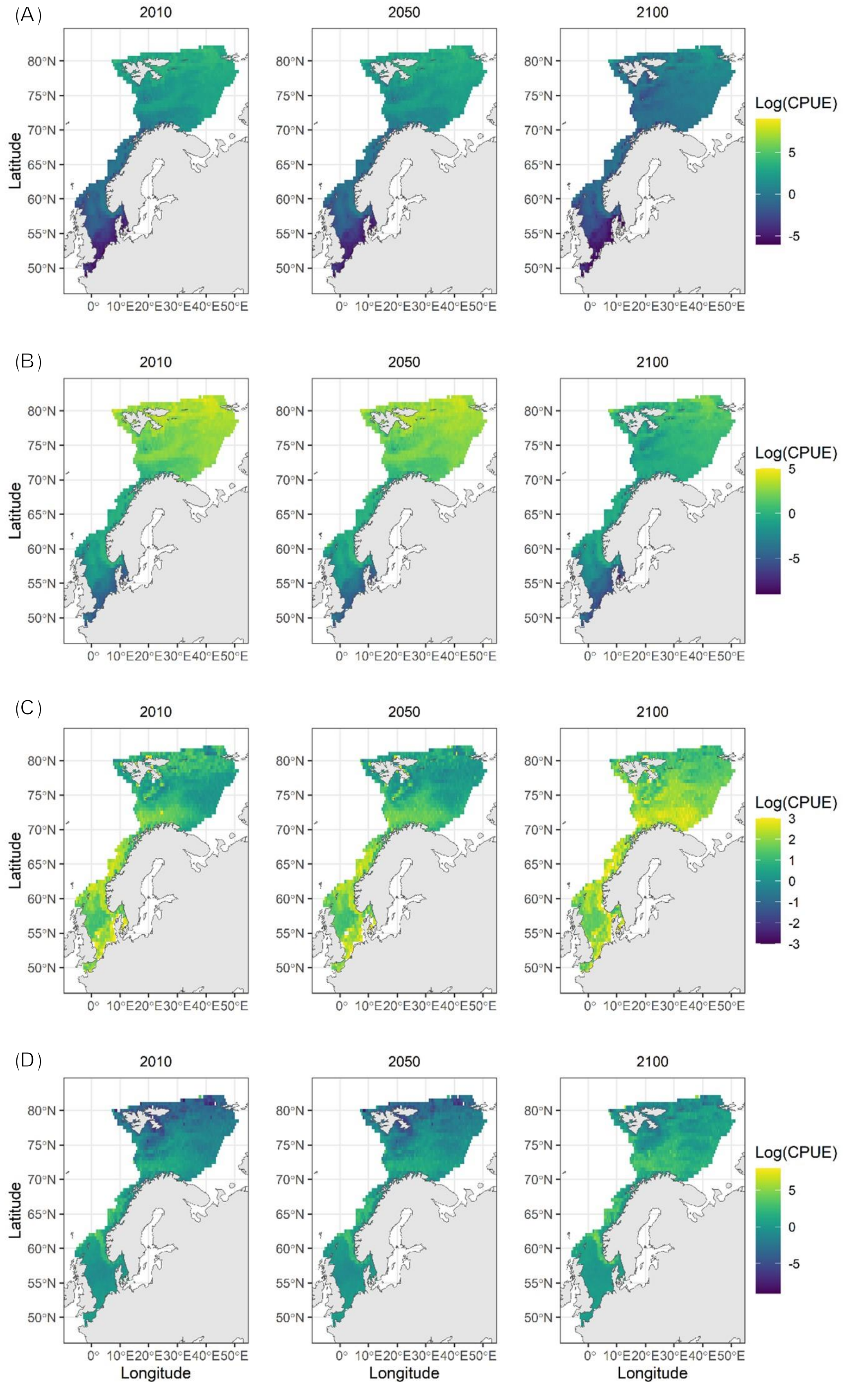
Supplementary Figure 1. Variance partitioning of (A) presence-absence model, and (B) biomass model, both components of the Hurdle model.



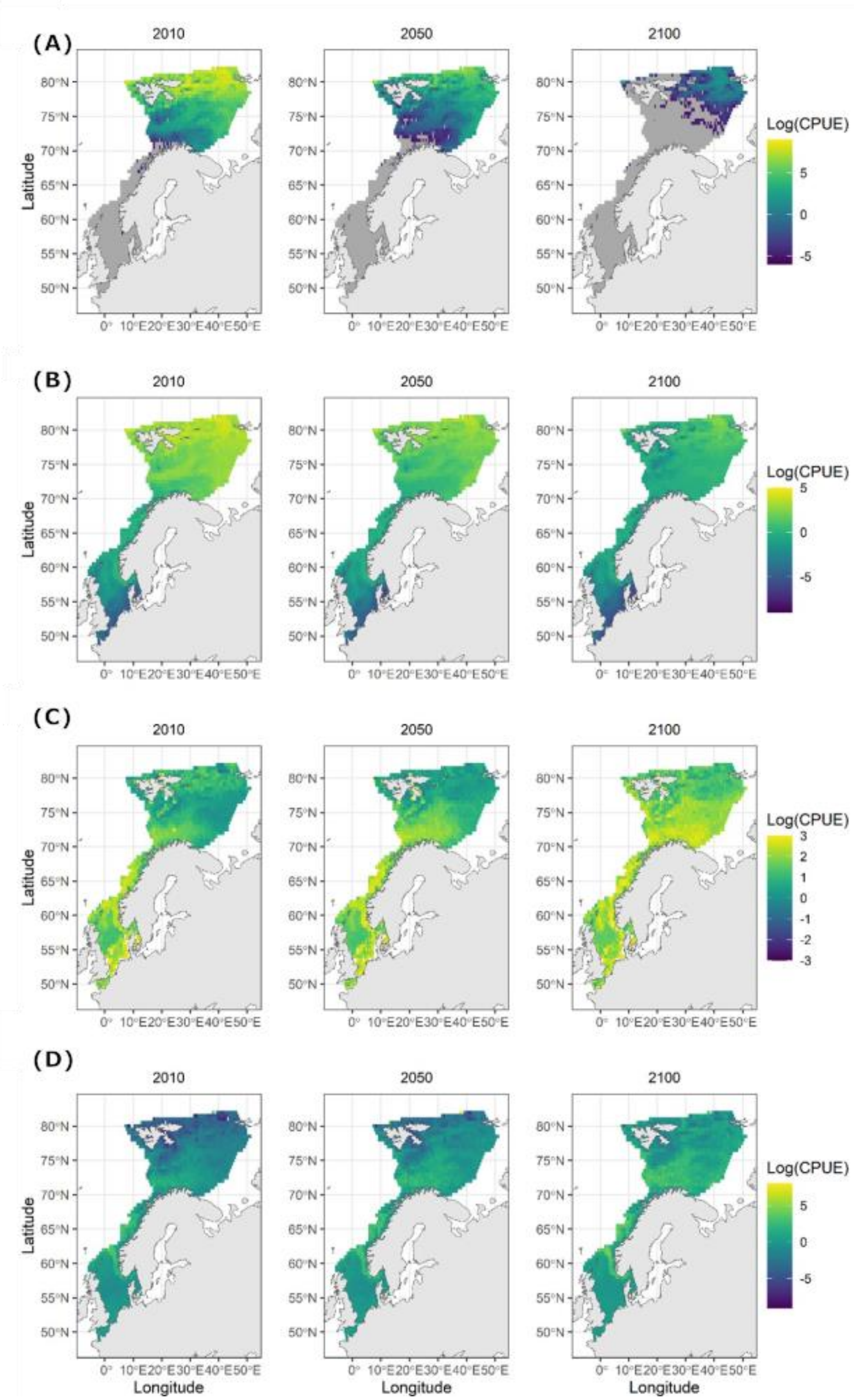
Supplementary Figure 2. Species co-occurrence patterns of the occurrence model.



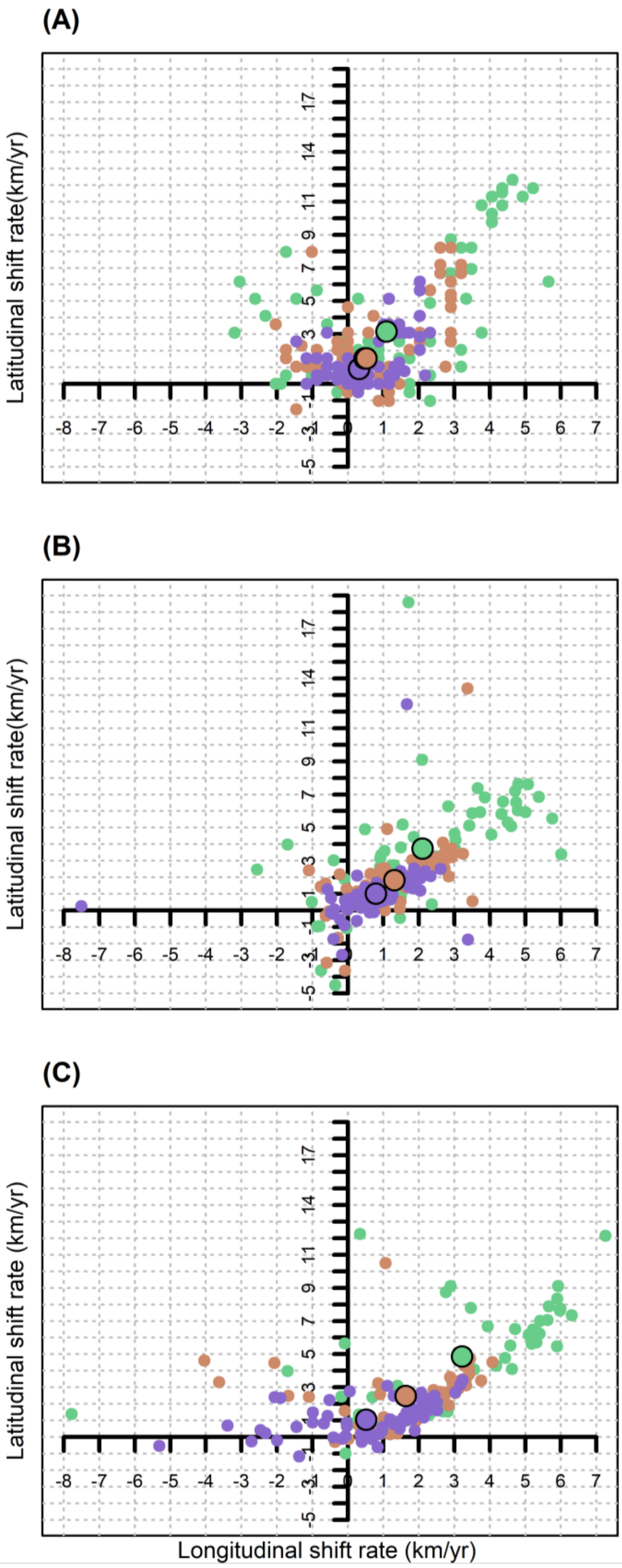
Supplementary Figure 3. Species co-occurrence patterns of the occurrence model.



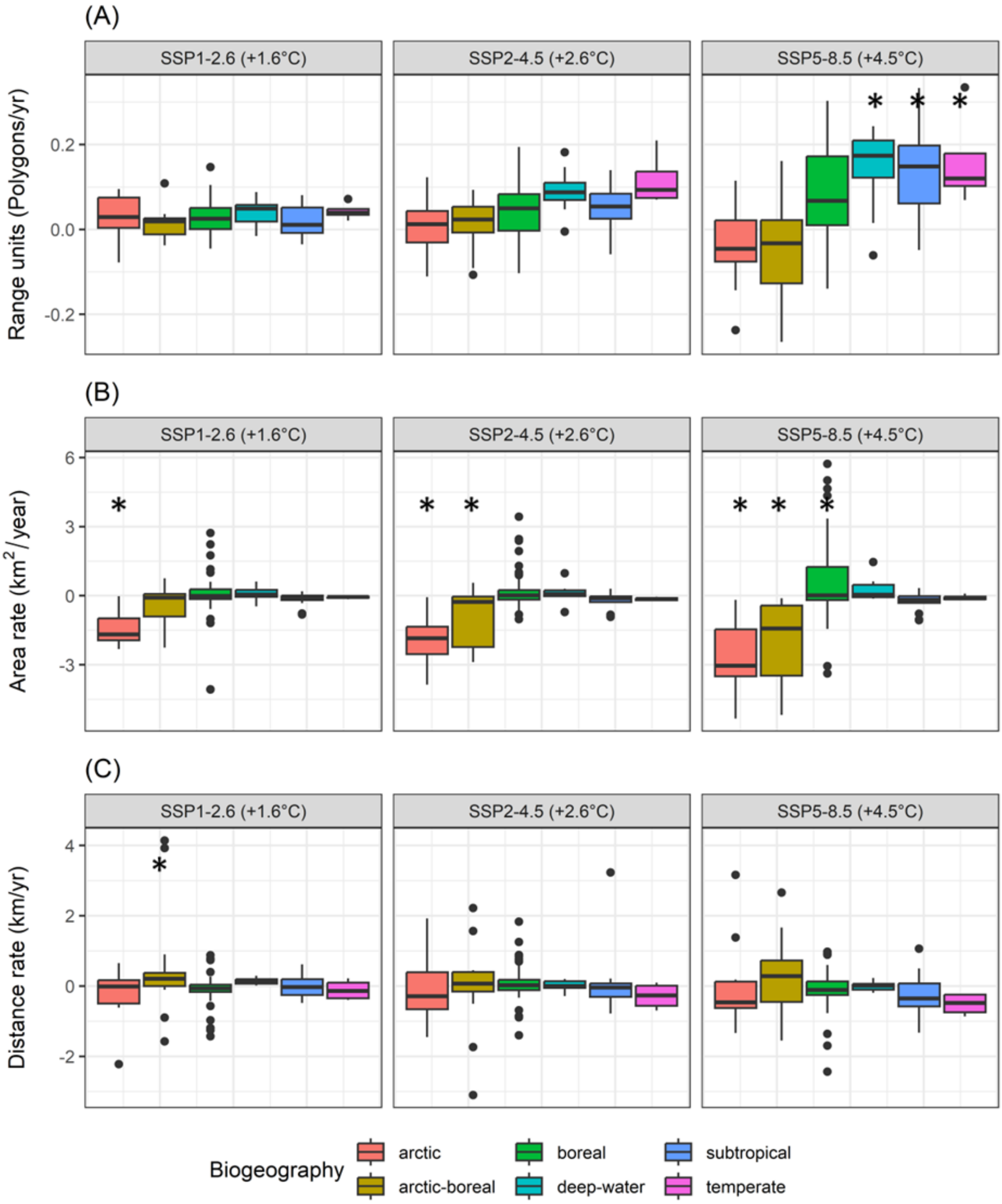
Supplementary Figure 4. Mean future biomass projections under SSP1-2.6 for (A) Arctic (n = 3), (B) Arctic-Boreal (n = 8), (C) Boreal (n = 40), and (D) Temperate and Subtropical (n = 5) species. Log CPUE corresponds to log of catch per unit effort (fish/min).



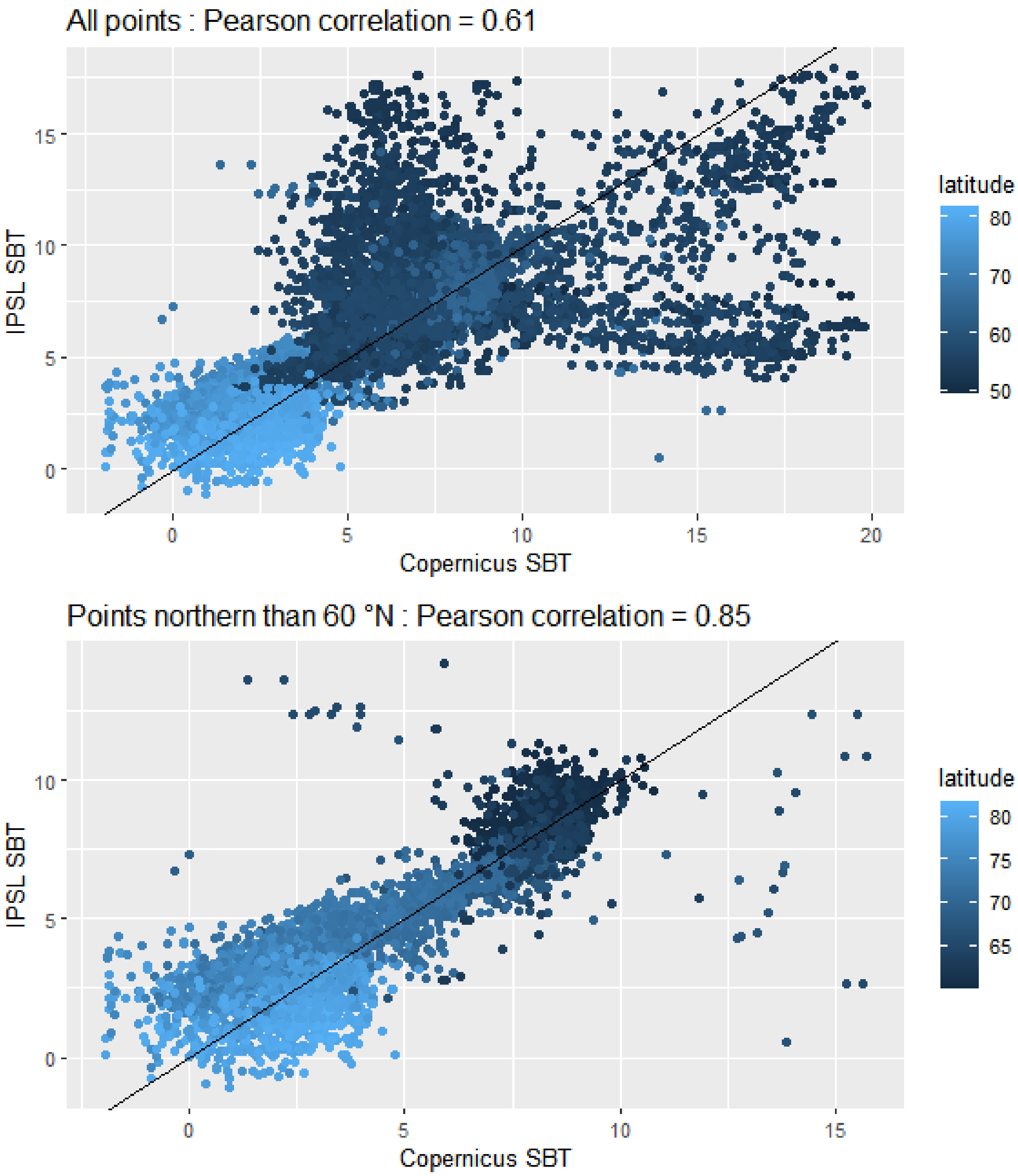
Supplementary Figure 5. Mean future biomass projections under SSP2-4.5 for (A) Arctic (n = 3), (B) Arctic-Boreal (n = 8), (C) Boreal (n = 40), and (D) Temperate and Subtropical (n = 5) species. Log CPUE corresponds to log of catch per unit effort (fish/min).



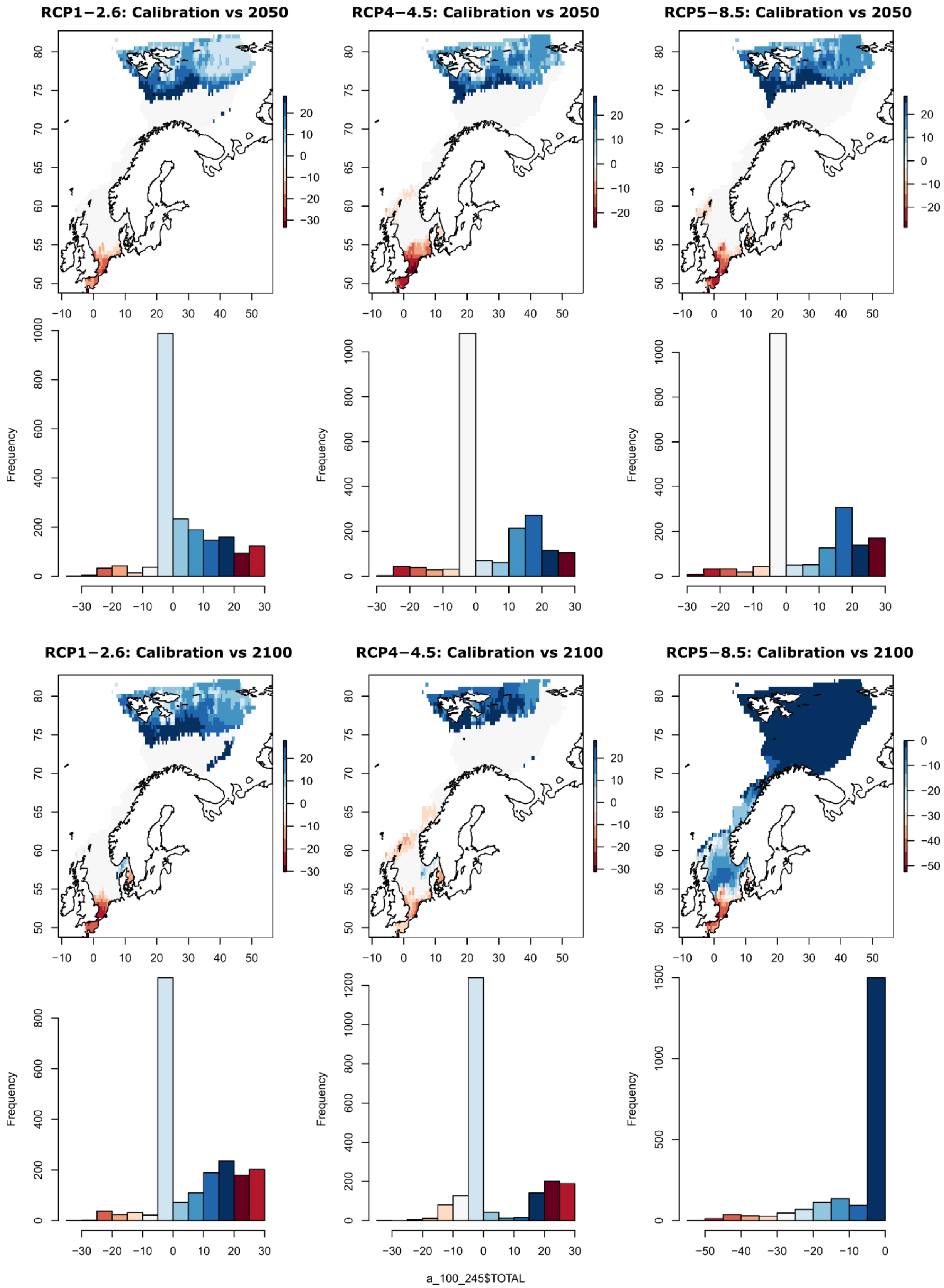
Supplementary Figure 6. Projected shift in distribution (km/yr) between 2010 and 2100 of (A) geographic range centroid (n = 107 species); (B) Biomass weighted mean geographic range centroid (n = 61 species), and (C) core range biomass weighted mean geographic centroid (61 species). Bigger points show the each climate scenario mean shift, weighted by the kernel density estimate (purple, SSP1 – 2.6; orange, SSP2 – 4.5; green, SSP5 – 8.5).



Supplementary Figure 7. Geographic range fragmentation change per zoogeograhpic class and shared socioeconomic pathway from 2010 to 2100. (A) Change in number of geographic range units; (B) change in mean area per geographic range unit, and (C) change in distance between geographic range units. Geographic range units are the individual polygons that compose a species' projected range. Whiskers correspond to maximum and minimum values, calculated as Q3 + 1.5xIQR and Q1 – 1.5xIQR, and points correspond to outliers. indicate significant effect of zoogeographic class (multiple linear regression $p < 0.05$).Sample sizes (arctic: n=11; arctic-boreal n = 13; boreal n = 57; deep-water n = 8, subtropical n = 14; temperate n = 4).



Supplementary Figure 8. Correlation analysis between monthly SBT from the copernicus analysis forecast, and the historical run of the CMIP6-IPSL global earth system model, for each of the sampling points between 2004 and 2014 (CMIP6-IPSL historical run only runs up to 2014)**,** with and without the North Sea (top and bottom respectively).



Supplementary Figure 9. MESS analysis including all environmental variables and comparing training data to 2050, and 2100 predictive data, in each of the three emission scenarios. Strongly negative values represent those sections of the environmental space poorly sampled during model calibration, and therefore projections in those areas are less reliable.

TABLES

Supplementary Table 1. Explanatory variables considered in fittng the Joint Species Distribution Models (JSDMs) and projecting them in the future.

Model fitting			
Variable	**Units**	**Resolution**	**Source**
Bathymetry	m	0.08 °	Bio Oracle
Bottom temperature	°C	0.08 °	Global Ocean Physics Reanalysis
Bottom dissolved oxygen	mmol/m3	0.25 °	Global Ocean Biogeochemistry Hindcast
Phytoplankton	mg/m3	0.25 °	Global Ocean Biogeochemistry Hindcast
Northward surface current	m/s	0.08 °	Global Ocean Physics Reanalysis
Eastward surface current	m/s	0.08 °	Global Ocean Physics Reanalysis
Sea ice concentration	fraction of 1	0.08 °	Global Ocean Physics Reanalysis
Future projections			
Variable	**Units**	**Resolution**	**Source**
Bathymetry	m	0.08 °	IPSL Global earth model
Bottom temperature	°C	0.08 °	IPSL Global earth model
Bottom dissolved oxygen	mmol/m3	0.25 °	IPSL Global earth model
Phytoplankton	mg/m3	0.25 °	IPSL Global earth model
Northward surface current	m/s	0.08 °	IPSL Global earth model
Eastward surface current	m/s	0.08 °	IPSL Global earth model
Sea ice concentration	fraction of 1	0.08 °	IPSL Global earth model