Uncertainties in ensemble projections of copepod species assemblages for the Mediterranean Sea

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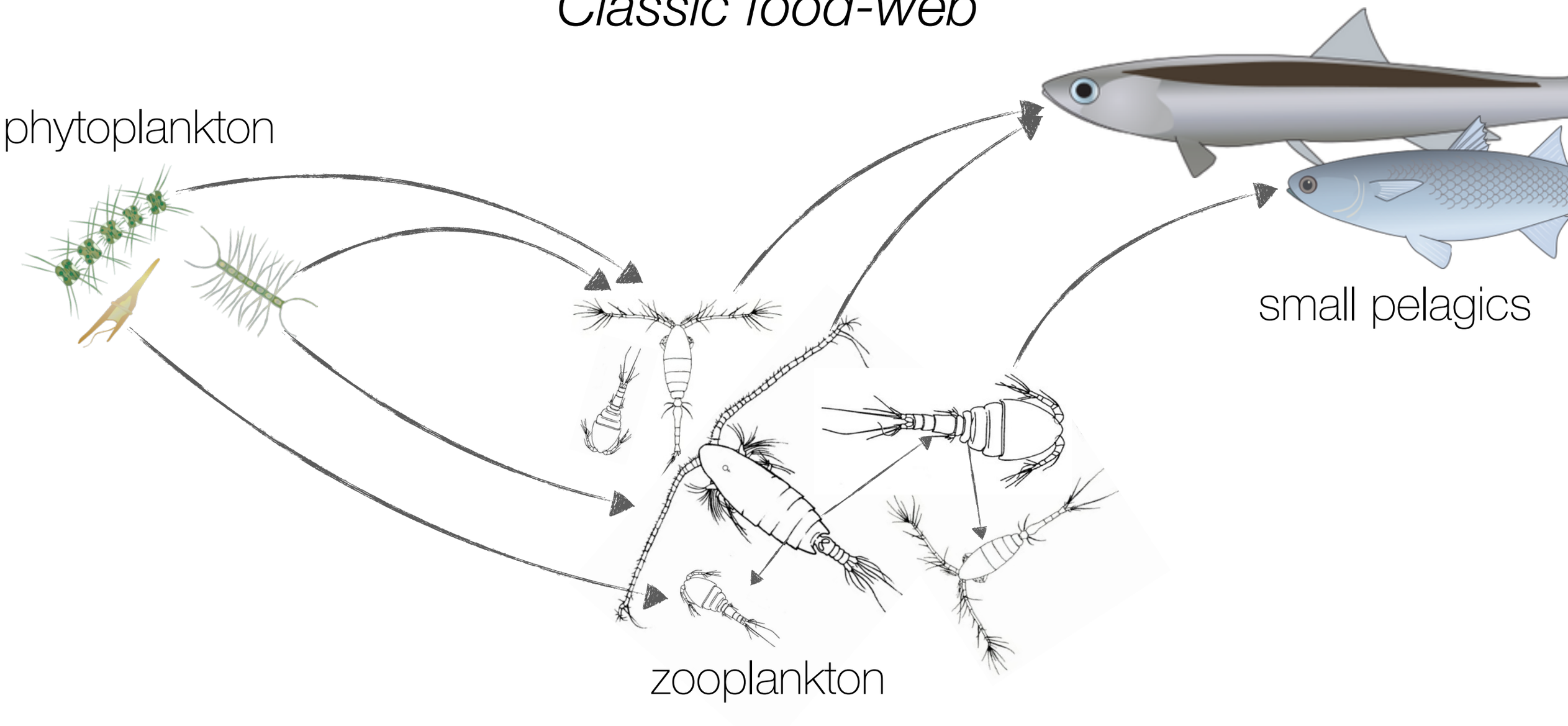
Introduction

One of PlankMed's main goal : assess the possible impact of climate change on the **Mediterranean planktonic community assemblages**.

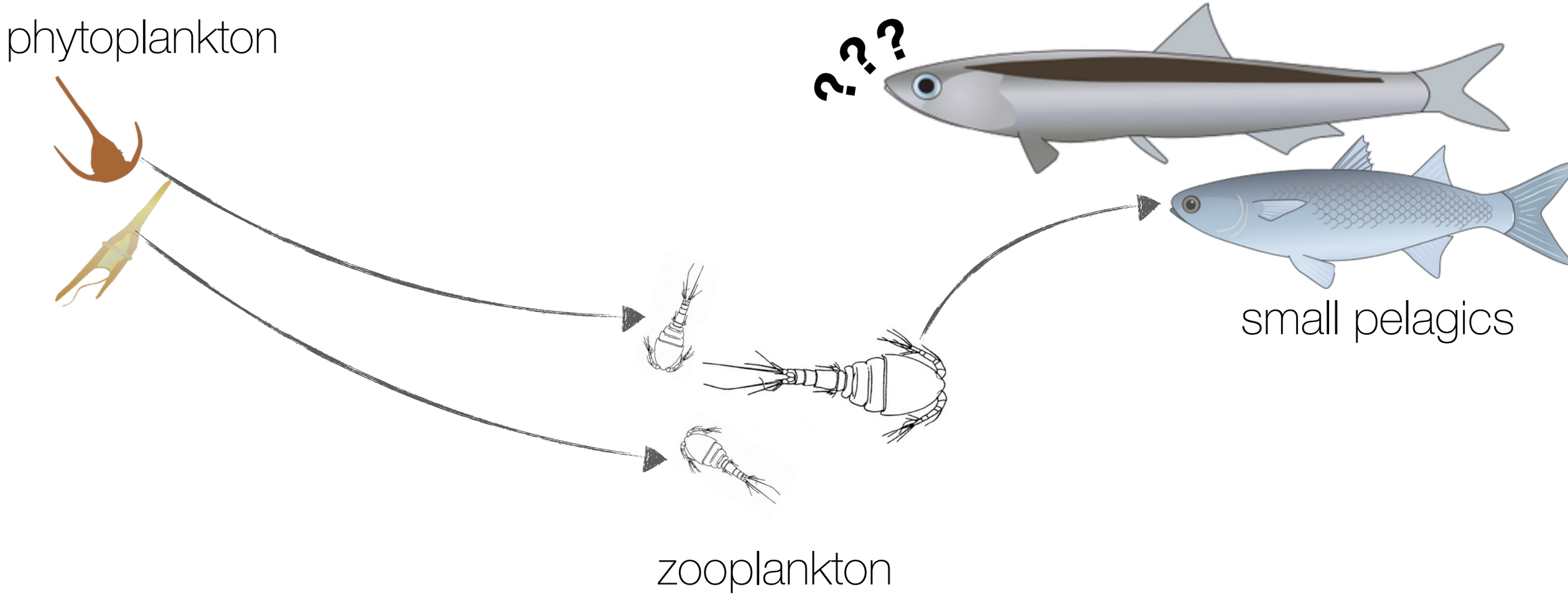
Classic food-web



Introduction

To identify regions where climate change has the major impact on **community composition**, and therefore **ecosystem functioning**

Climate change-impacted food-web



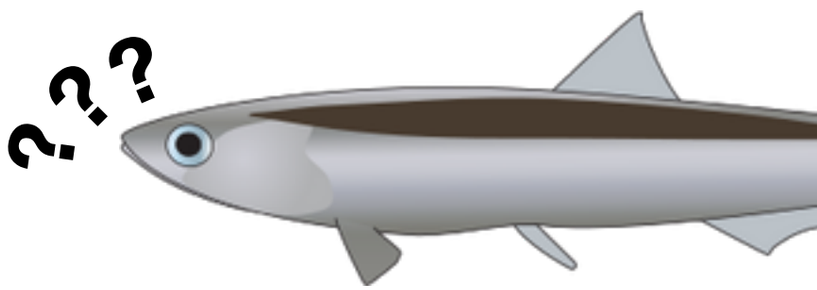
Introduction

How ?

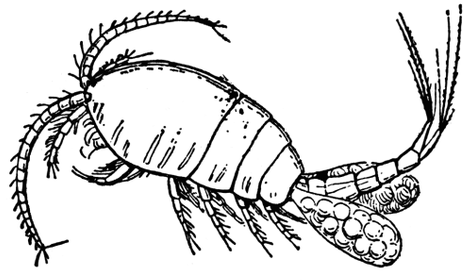
- **Habitat Suitability Index** (HSI) given by statistical niche models
- Climate change scenarios from **ocean regional climate model (ORCM)**

BUT many **uncertainties** related to **:**

- **Niche model** choice (GLM, GAM, BRT, ANN etc.)
- **ORCM configuration** (boundary forcings)
- **Emission scenario** (A2 vs. B1 vs. A1B)



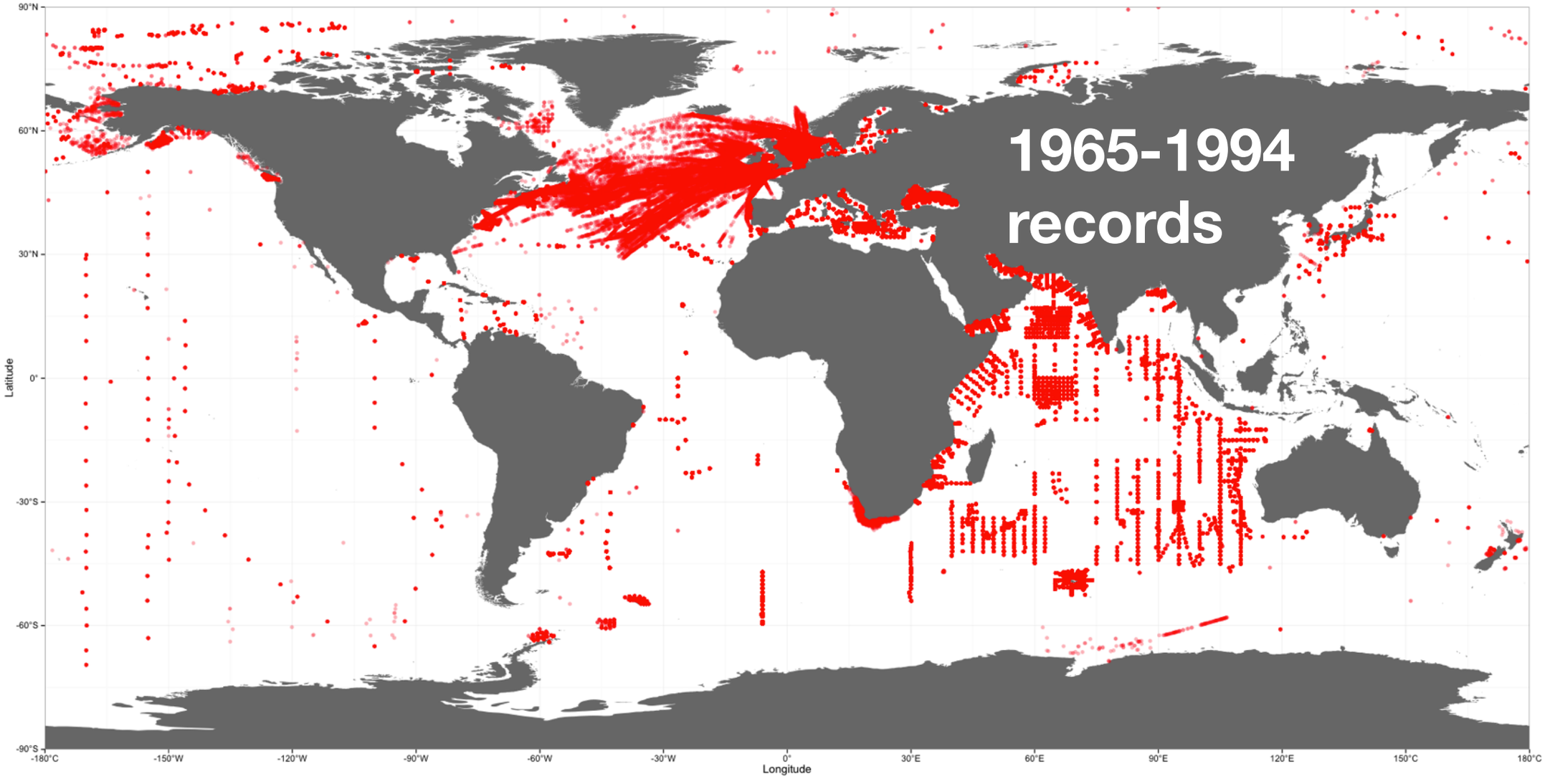
Modelling Strategy



Modelling Strategy

Species

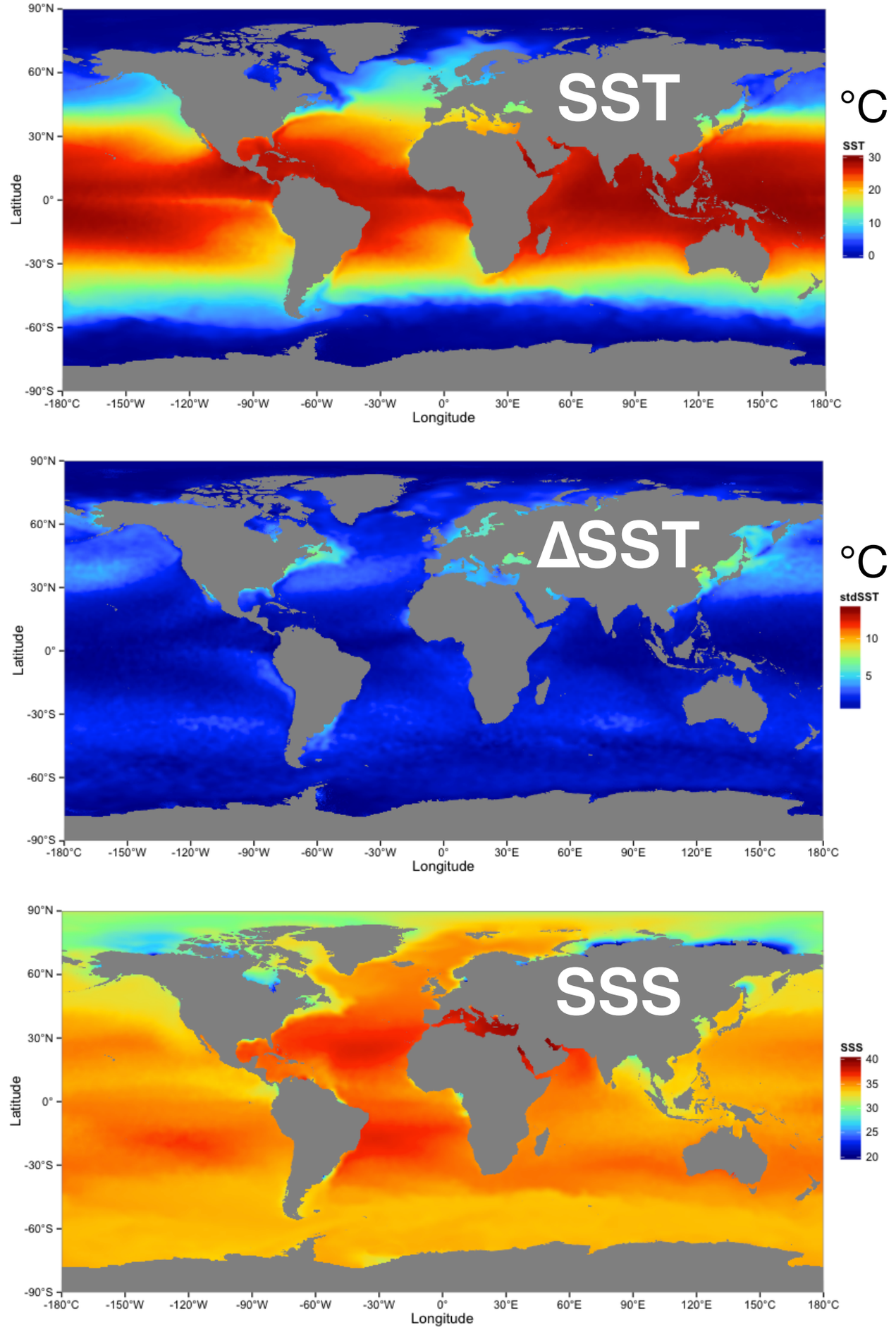
- **106** copepod species, most encountered in the Med Sea
- Small Calanoids, Cyclopoids, some temperate spp.
- Med Sea datasets + **OBIS** (worldwide ; map below)



Modelling Strategy

Predictors

- **Global**
- **1965-1994** baseline period
- Need to encompass records' period
- **Surface** obs.
- Structure spp. distribution
- **In situ** climatology (World Ocean Atlas 2013)



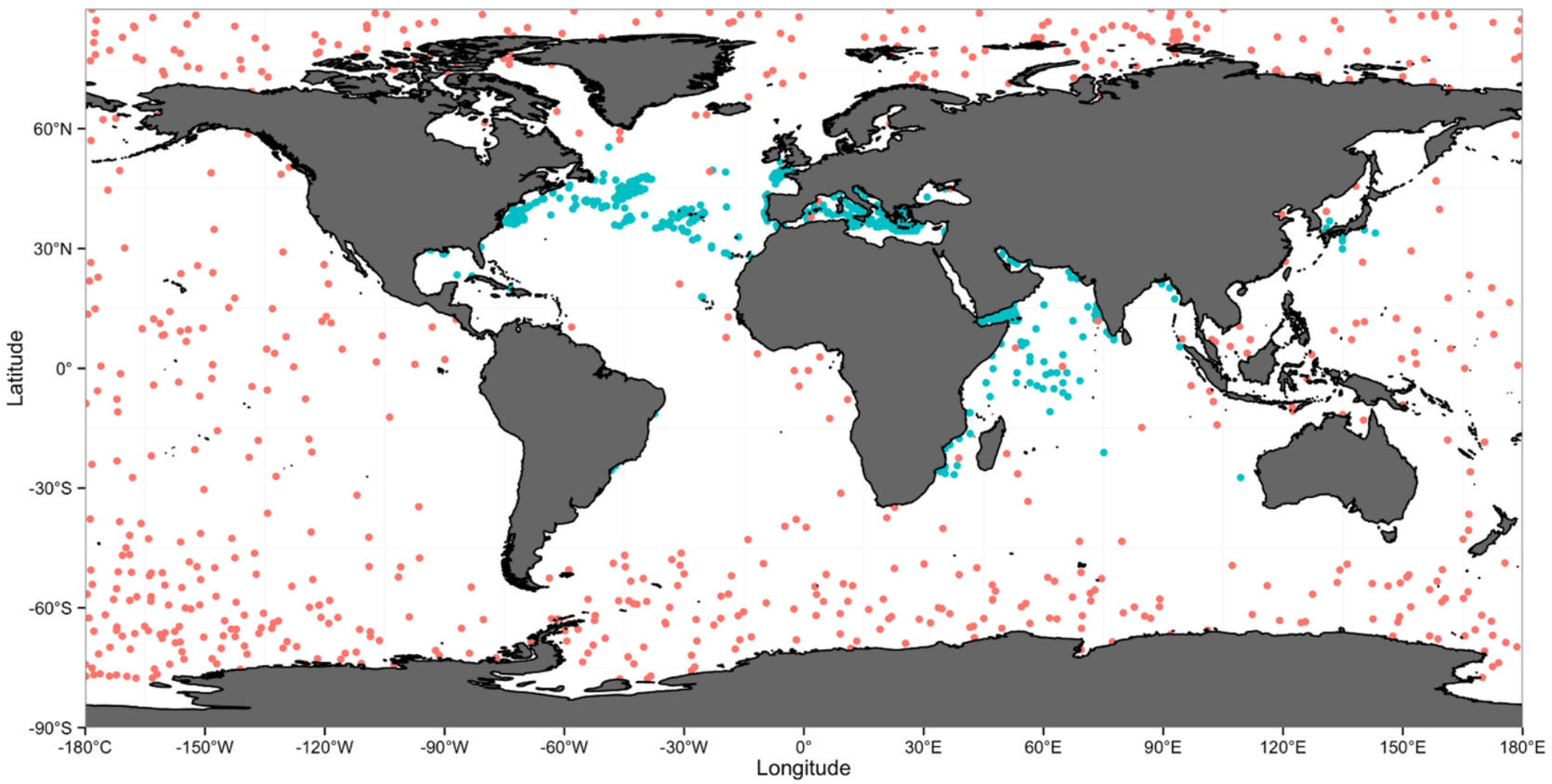
Modelling Strategy

Niche Models

- **10** commonly used **niche models** (SRE, GLM, GAM, ANN, RF, MAXENT…)
- '**biomod2**' R package
- Require both **presences** and **pseudo-absences**
- **Simulated** (x10) with environmental and spatial weighting

Temora stylifera

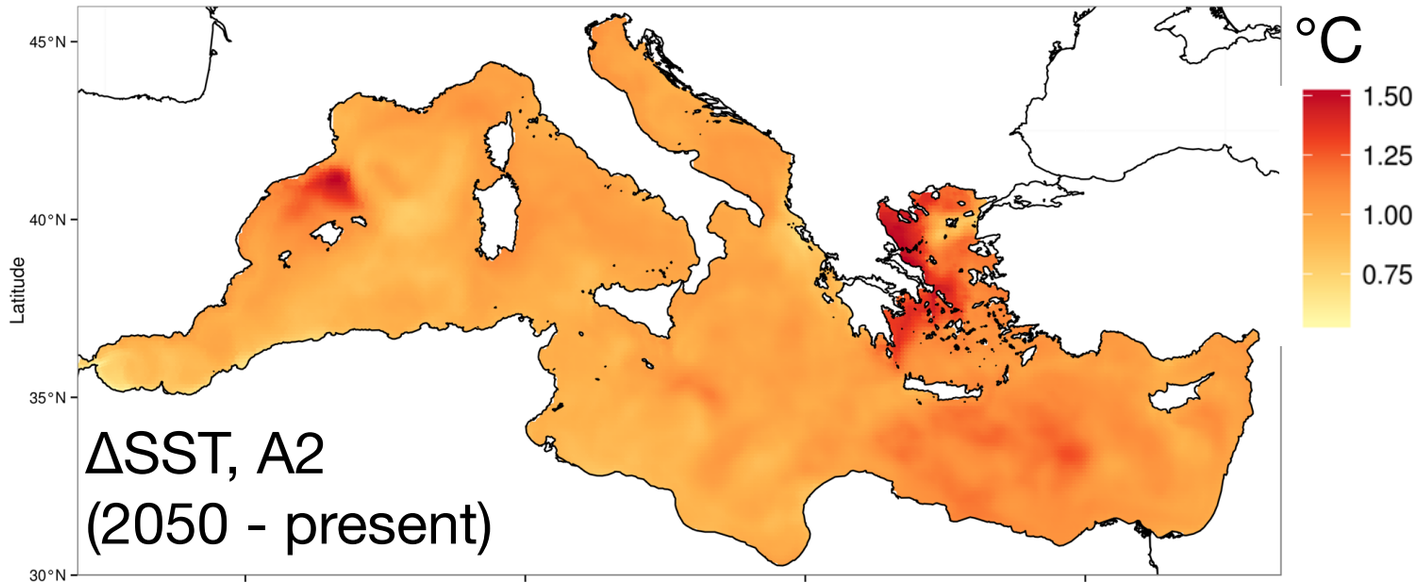
- Presences
- pseudo-Abs.



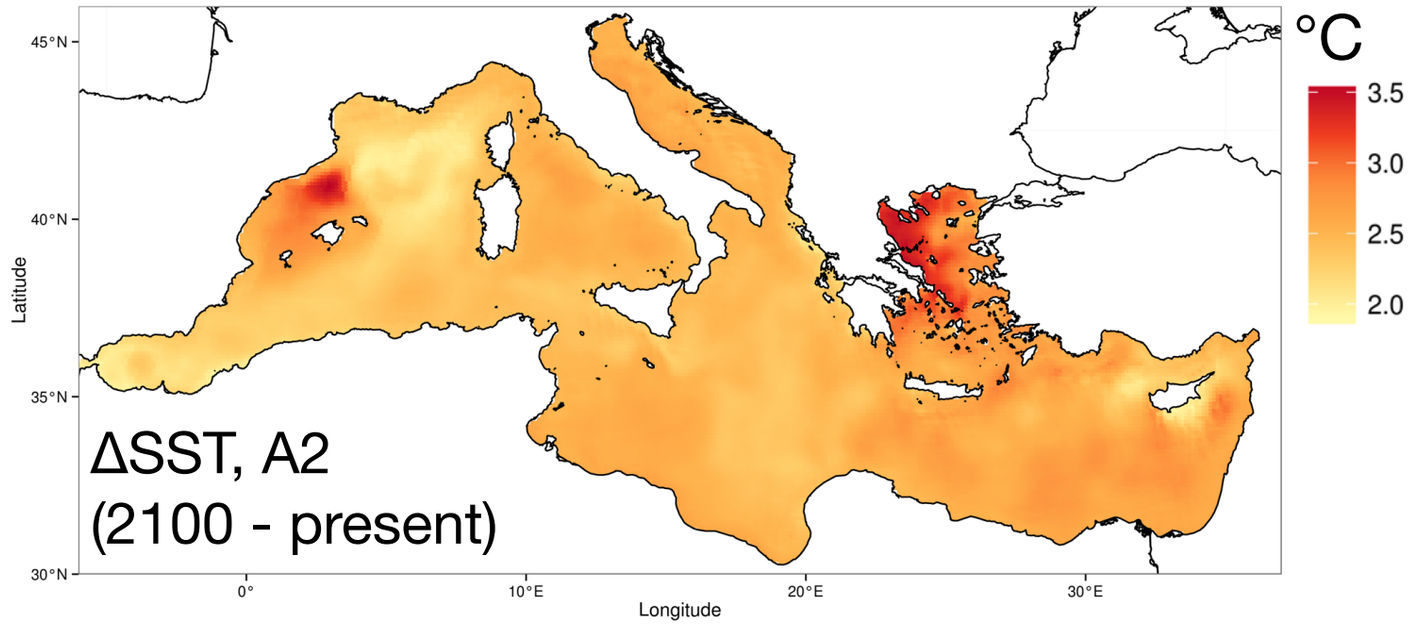
Modelling Strategy

Anomalies

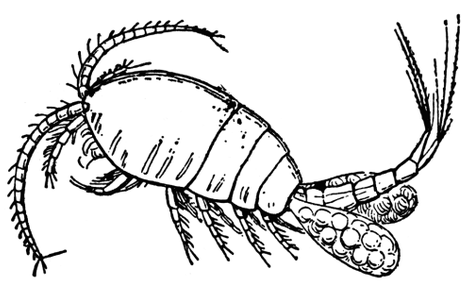
- Project on WOA13 (present)
- Predict on WOA13 + anomalies (2050, 2098)



- **30-year climatologies** calculated like WOA13 to aggregate **similar level of variability**
  - 2050 = 2020-2049
  - 2100 = 2069-2098



An example…

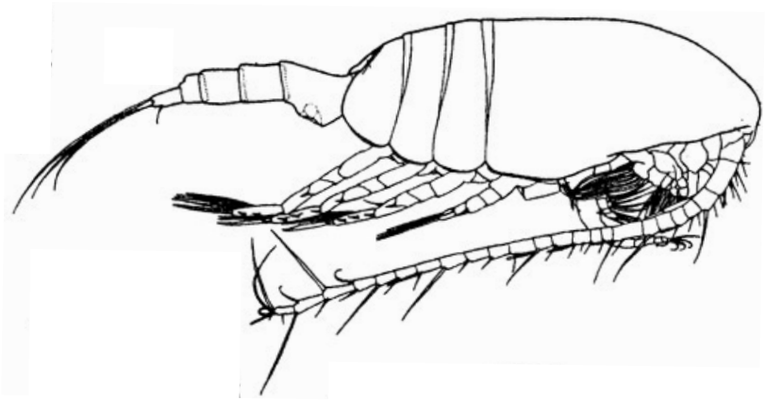


Example

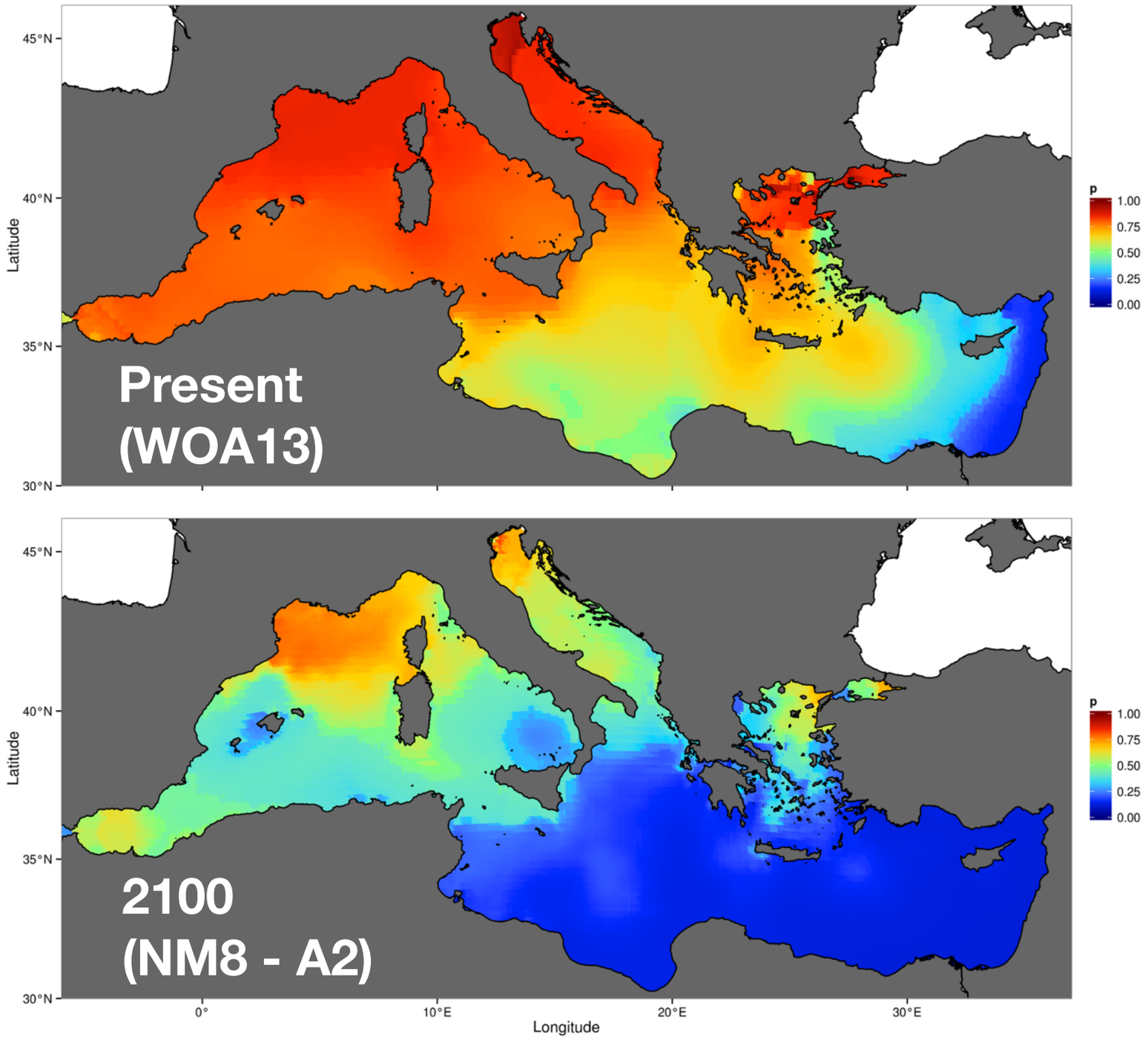
Pseudocalanus elongatus

Ensemble modelling (model averaging) of habitat suitability under A2 scenario

Shift northwards ?



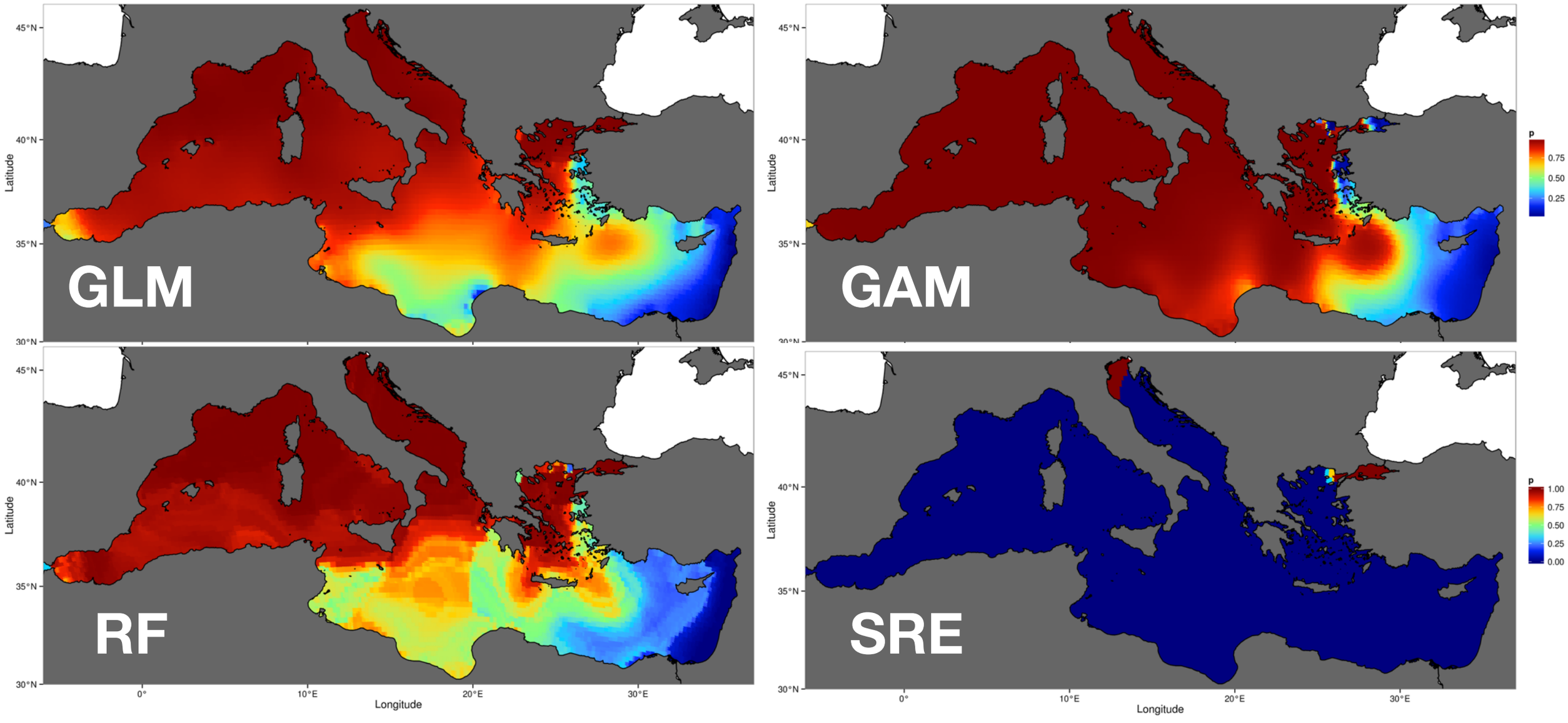
Habitat suitability maps



Example

Same species, same data, baseline period, but **different niche models** —> high **variability** !

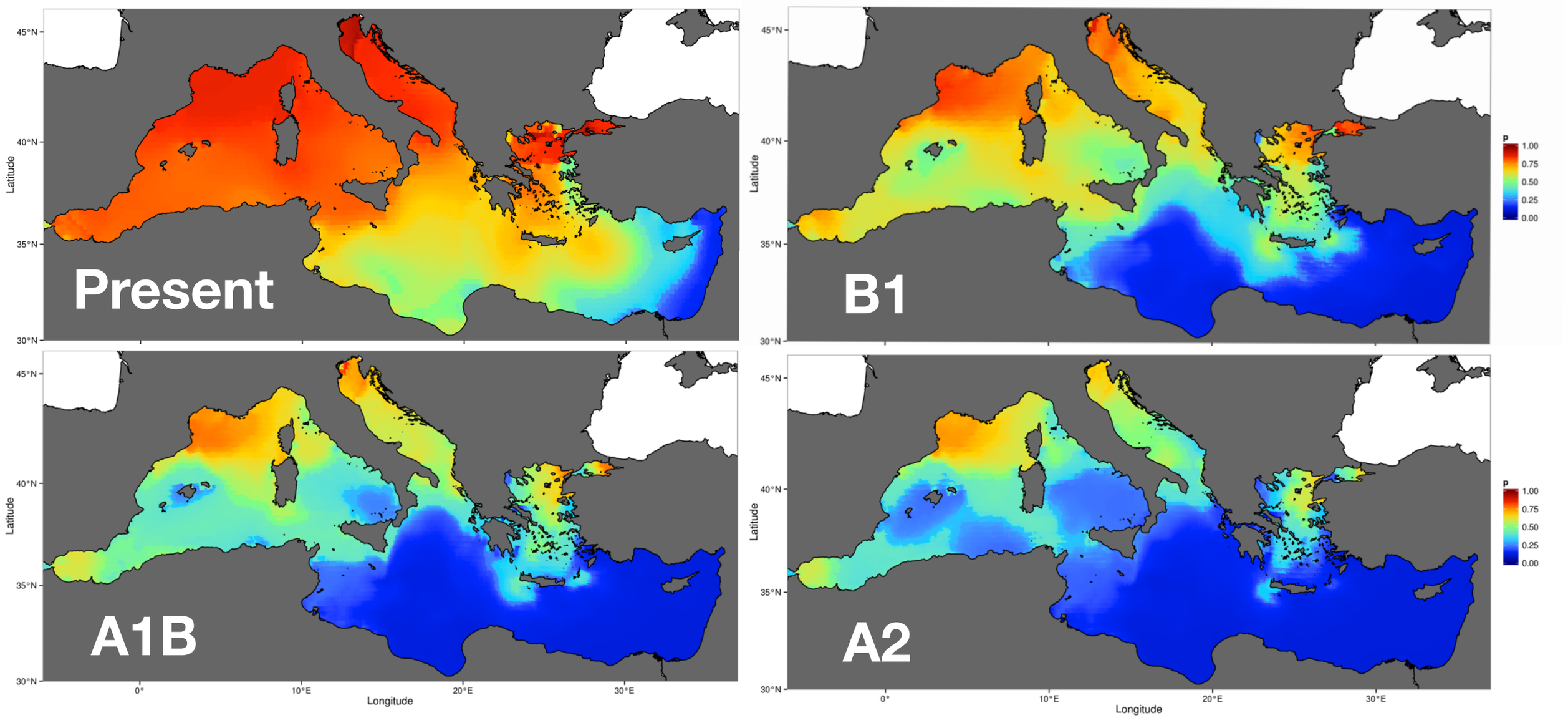
HS maps for **different models** and for the **present**



Example

Same species, same data, ensemble modelling, but **different scenarios** —> impact on shift amplitude

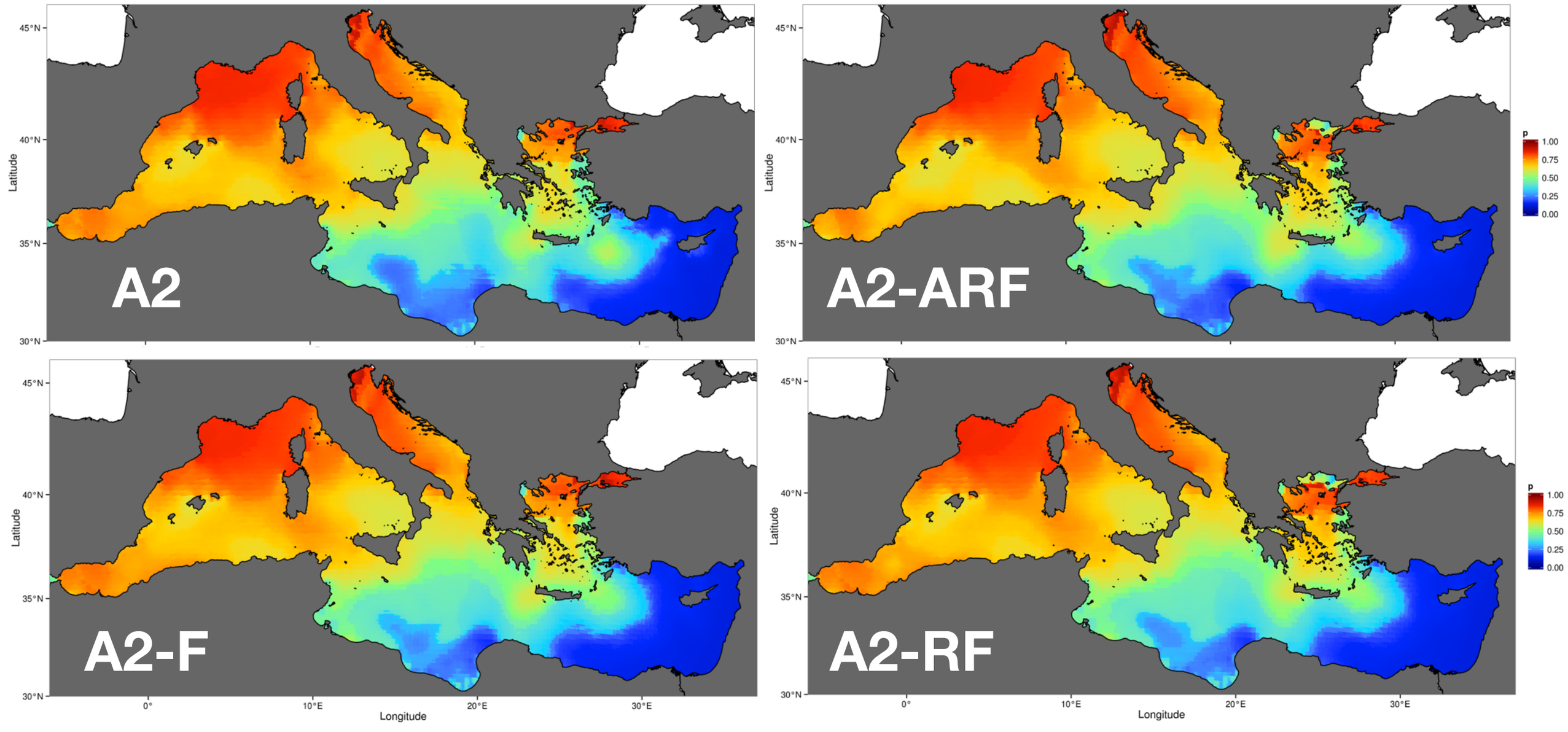
HS maps for **different scenarios** (2100)



Example

Same species, same data, same scenario, ensemble modelling, but **different boundary forcings**

HS maps for **different boundary forcings** (2100)



Next

- Compute **species turn-over** (Jaccard index) between 2100 and present :

$$\frac{G + L}{SR + G}$$

G = Gain
L = Loss
SR = Species Richness

- **Variance analysis** to assess major sources of uncertainties within each cell
- Analyze **emergent properties** of the mesozooplankton compartment : size structure, feeding habitats…

Thank you for your attention !