SCIENCES
SORBONNE
UNIVERSITÉ

BORÉA
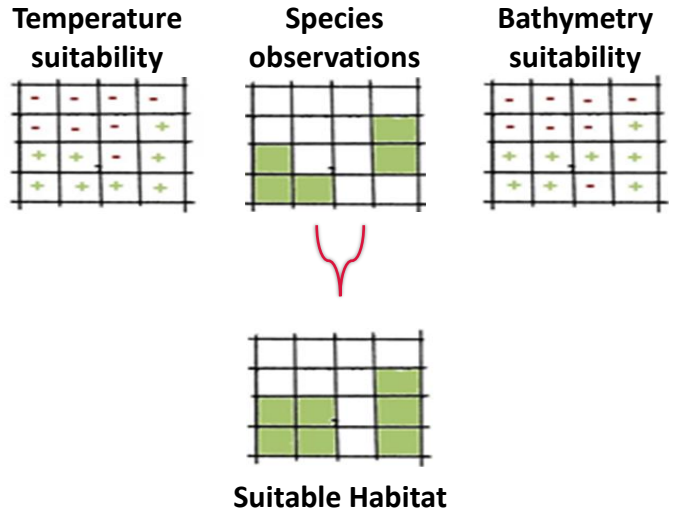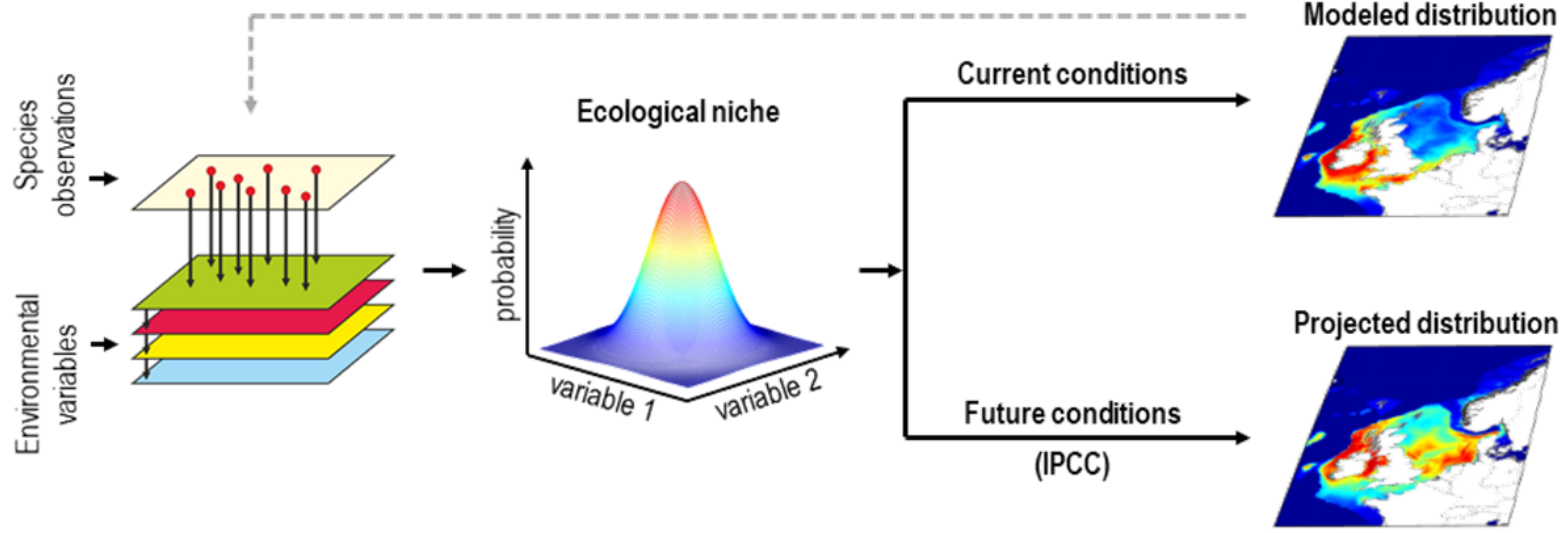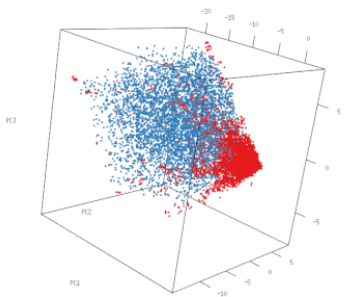Biologie des organismes et écosystèmes aquatiques

Unlocking the past to predict the future
Enhancing species distribution modelling
with long-term data

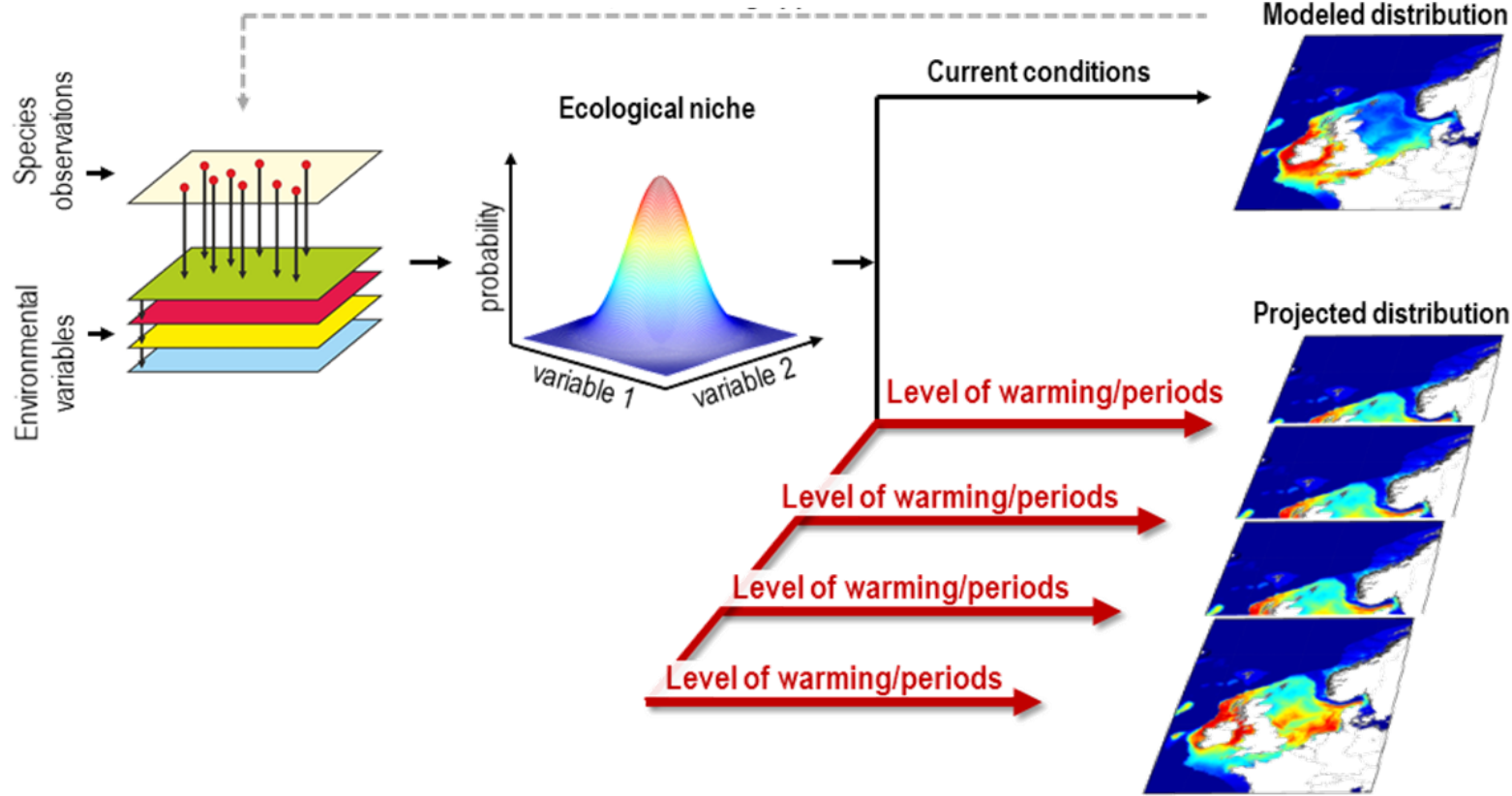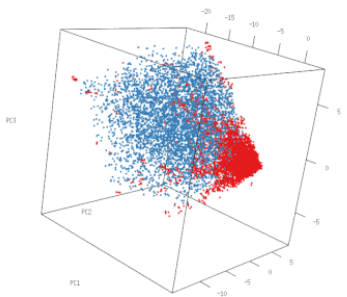### Eric Goberville

eric.goberville@sorbonne-universite.fr
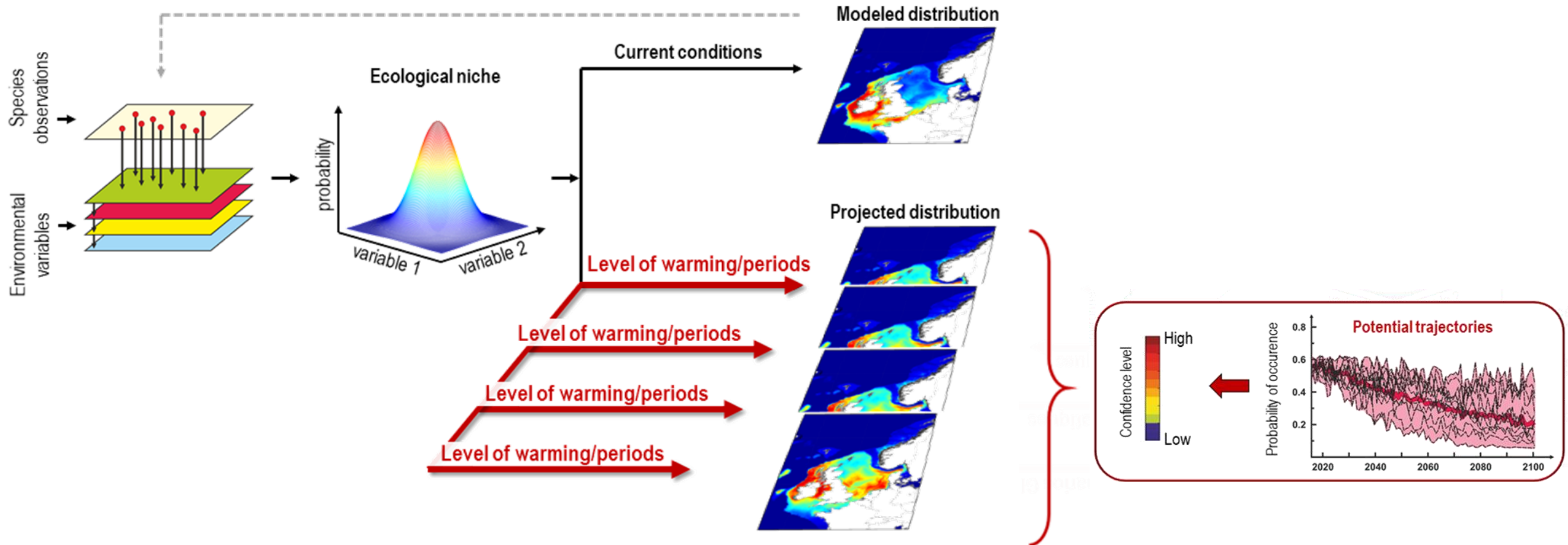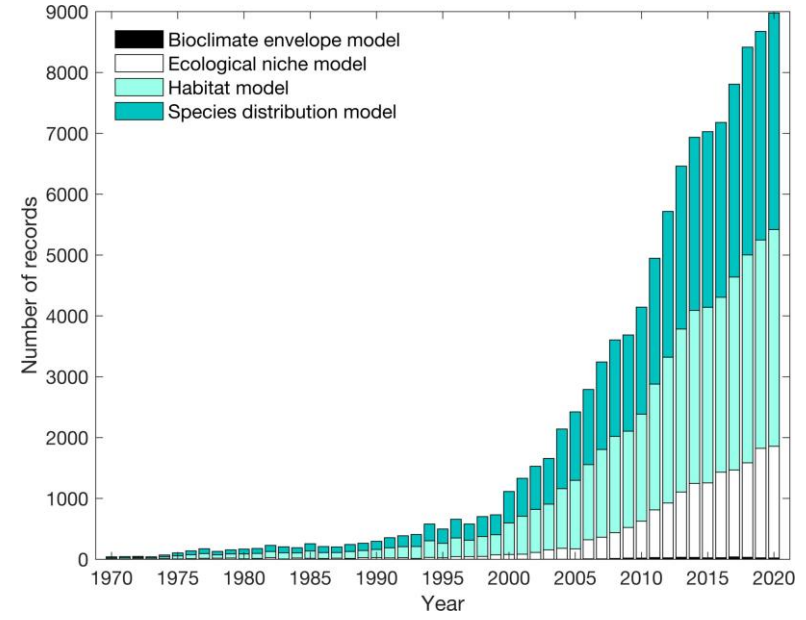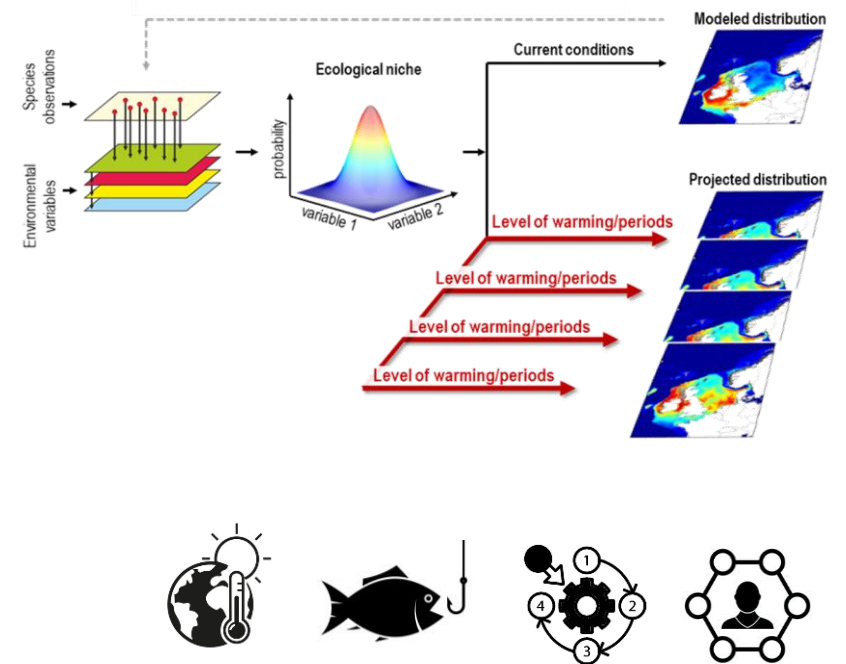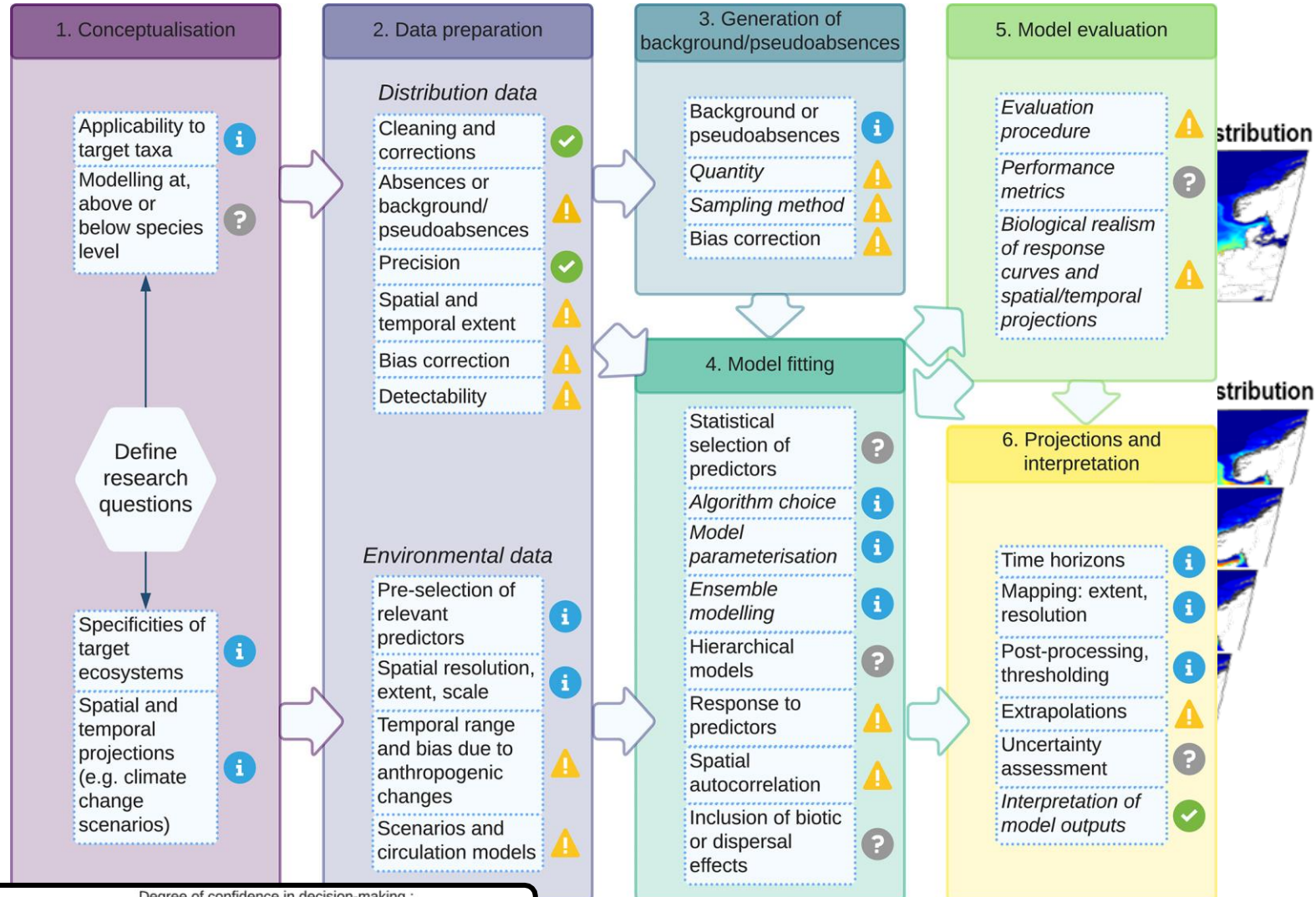
From species occurrences to niche modelling and biogeographical distributions

From species occurrences to niche modelling and biogeographical distributions
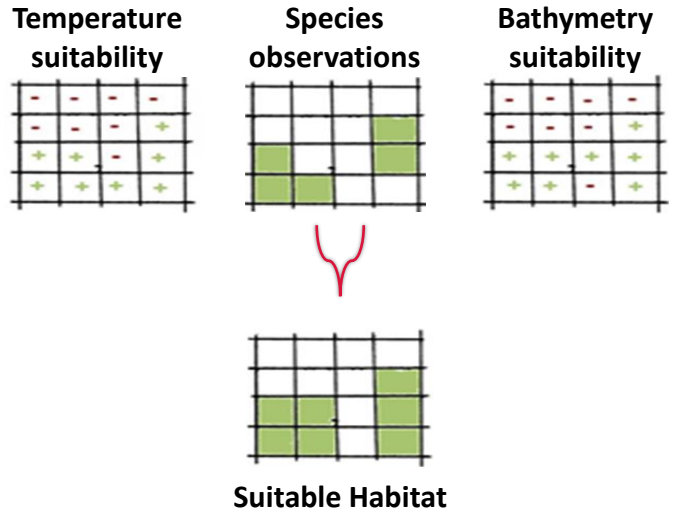
From species occurrences to niche modelling and biogeographical distributions

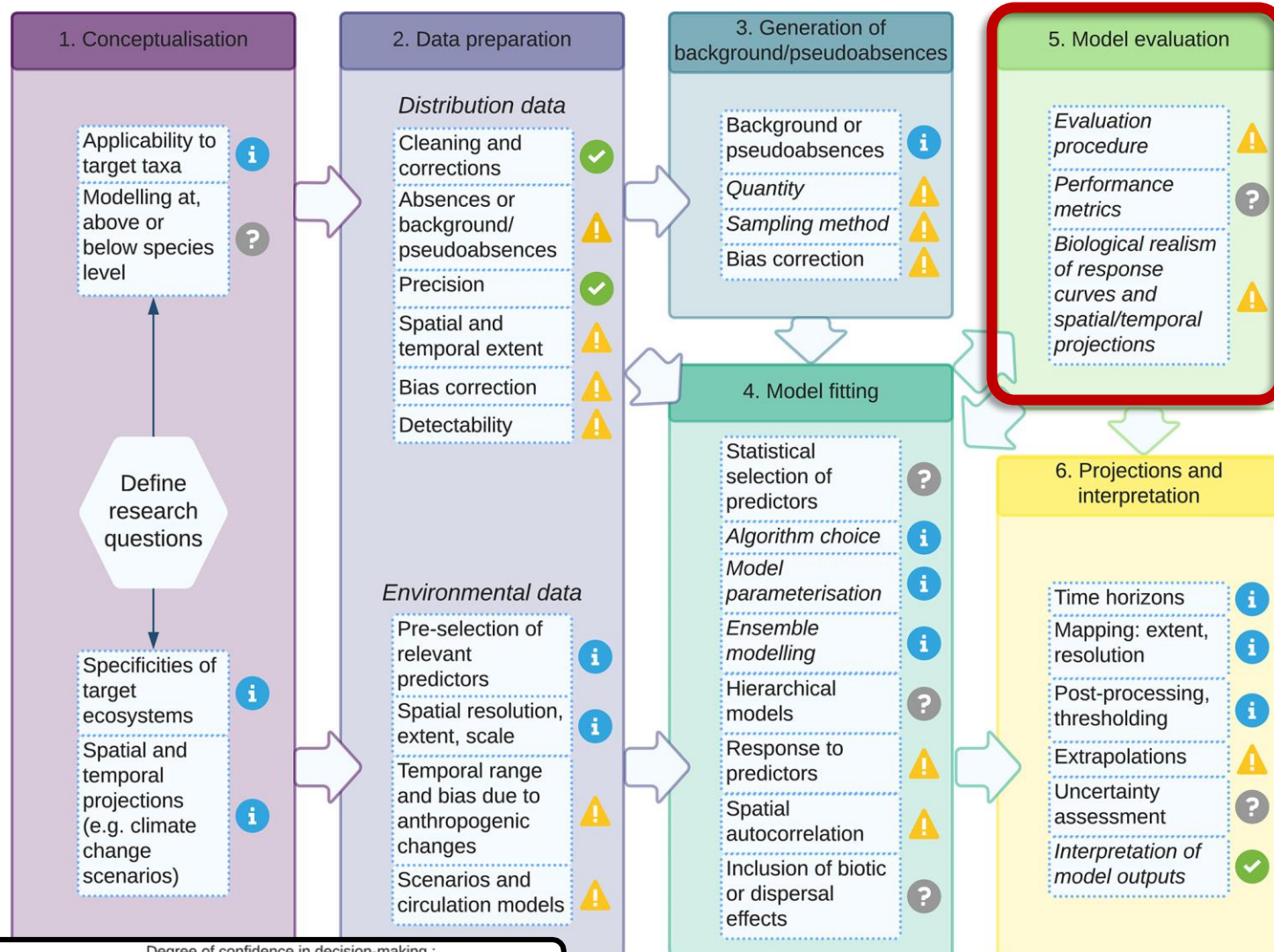# The major uncertain steps in the construction of Species Distribution Model

Asch et al. 2022; Leroy et al. 2023

The major uncertain steps in the construction of Species Distribution Model

Leroy et al. 2023

ECOLOGICAL SOUNDING

AUC: a misleading measure of the performance of predictive distribution models

Jorge M. Lobo[1*], Alberto Jiménez-Valverde[1] and Raimundo Real[2]

PERSPECTIVE

WILEY Journal of Biogeography

Without quality presence–absence data, discrimination metrics such as TSS can be misleading measures of model performance

Selecting thresholds of occurrence in the prediction of species distributions

Canran Liu, Pam M. Berry, Terence P. Dawson and Richard G. Pearson

Presence-only species distribution models are sensitive to sample prevalence: Evaluating models using spatial prediction stability and accuracy metrics

Liam Grimmett[a,b,*], Rachel Whitsed[a,b], Ana Horta[a,b]

[a] School of Environmental Sciences, Charles Sturt University, Albury, Australia
[b] Institute for Land, Water and Society, Charles Sturt University, Albury, Australia
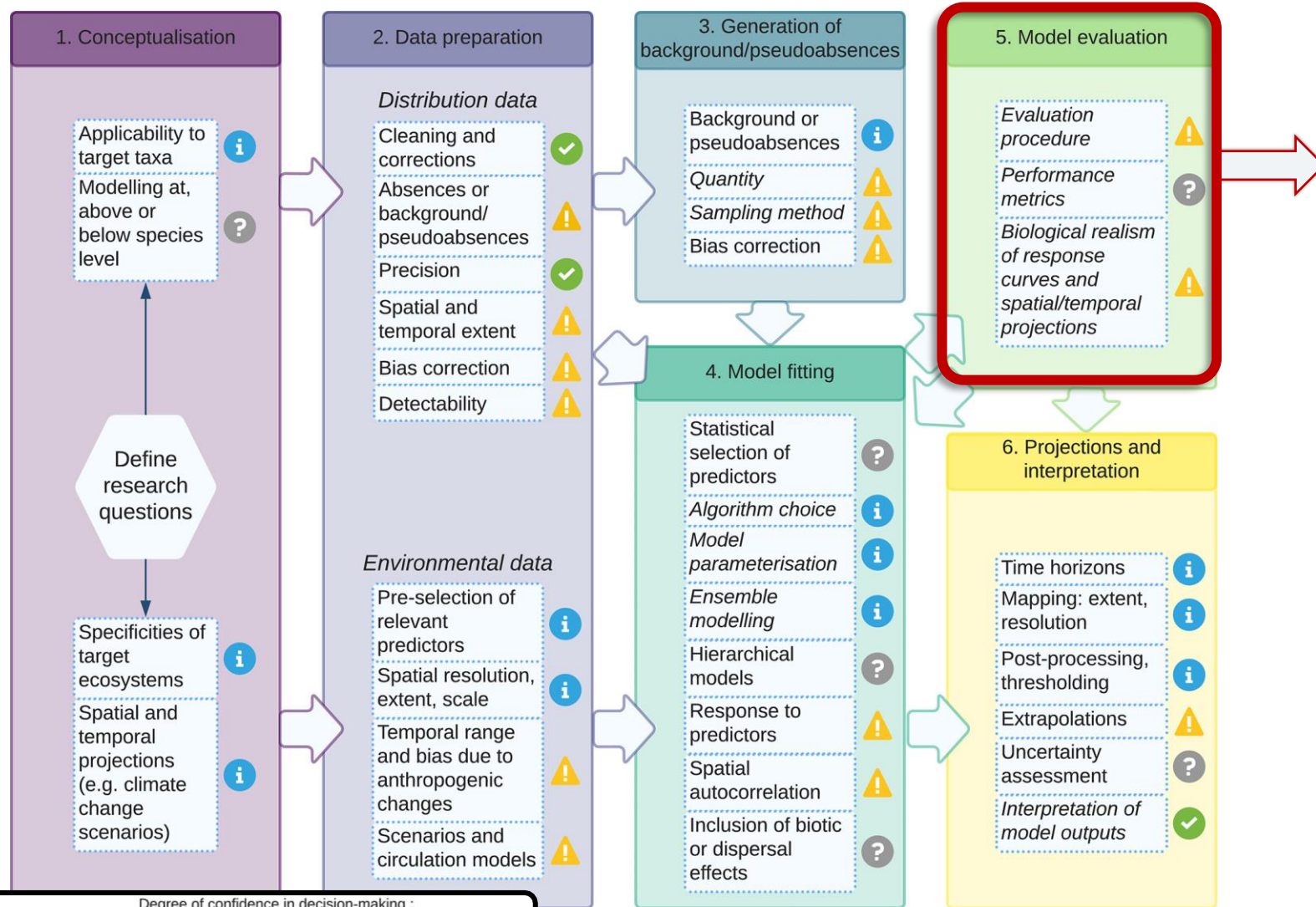
BIODIVERSITY REVIEW

WILEY Diversity and Distributions

A review of evidence about use and performance of species distribution modelling ensembles like BIOMOD

Tianxiao Hao | Jane Elith | Gurutzeta Guillera-Arroita | José J. Lahoz-Monfort

And much more...

The major uncertain steps in the construction of Species Distribution Model

How can long-term time series be used for the evaluation of niche modelling?
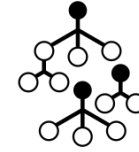
Leroy et al. 2023

Using long-term time series to model species distribution
Calanus finmarchicus, "The Rolls Royce of zooplankton©"

13 environmental parameters reflecting monthly thermohaline conditions, primary production, stratification, oceanic/atmospheric circulation, from 1958 onwards

Using long-term time series to model species distribution

Calanus finmarchicus, "The Rolls Royce of zooplankton©"

Observations

Abundances (log X+1)
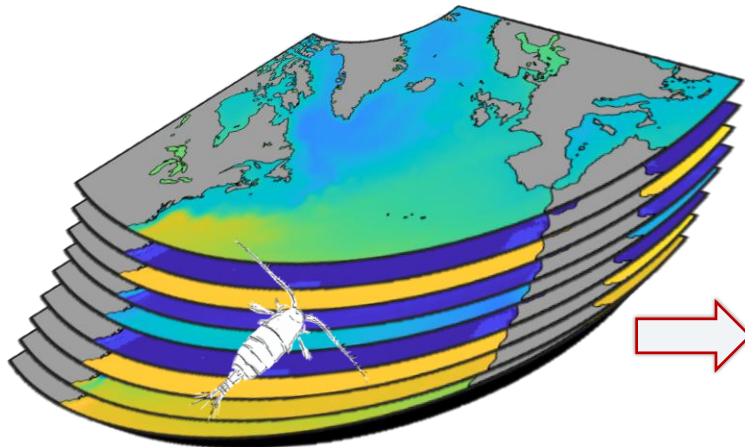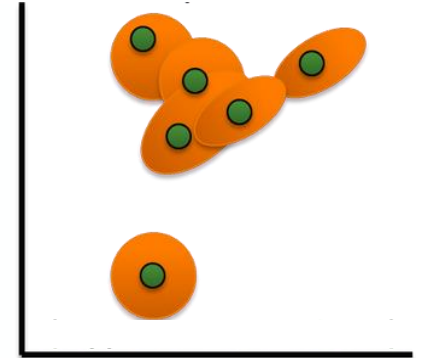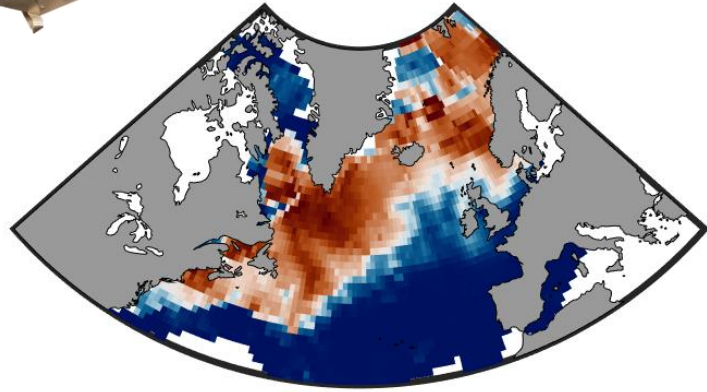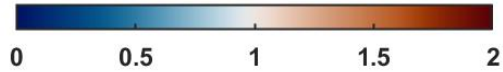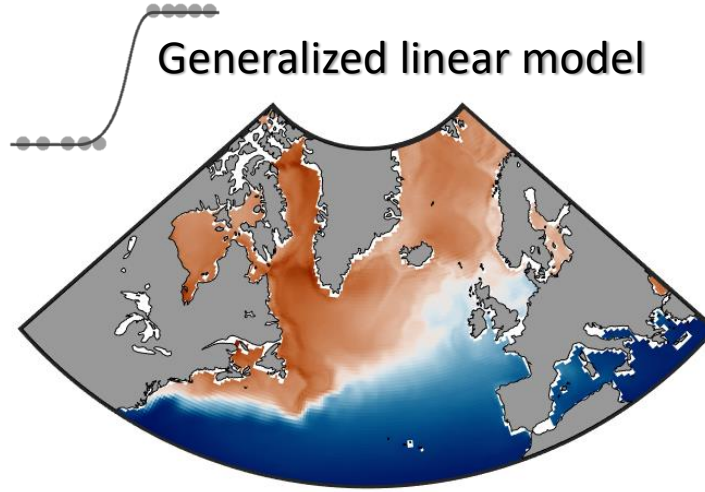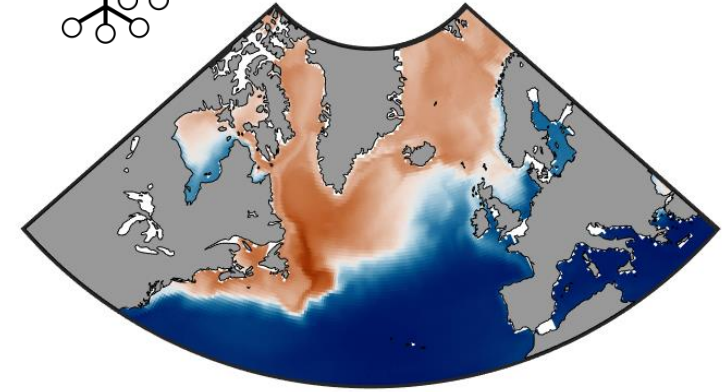
0   0.5   1   1.5   2
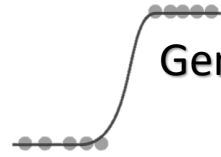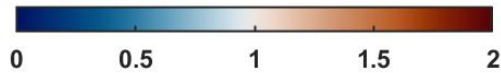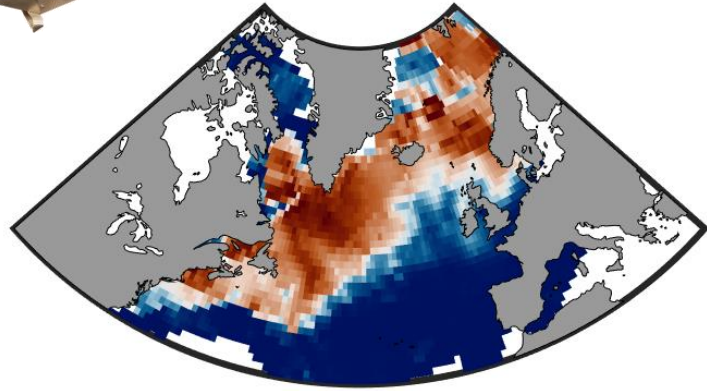
Generalized linear model

Environmental suitability
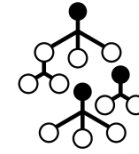
0   0.2   0.4   0.6   0.8   1

Random Forest

Environmental suitability

0   0.2   0.4   0.6   0.8   1
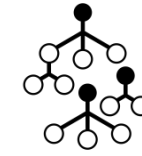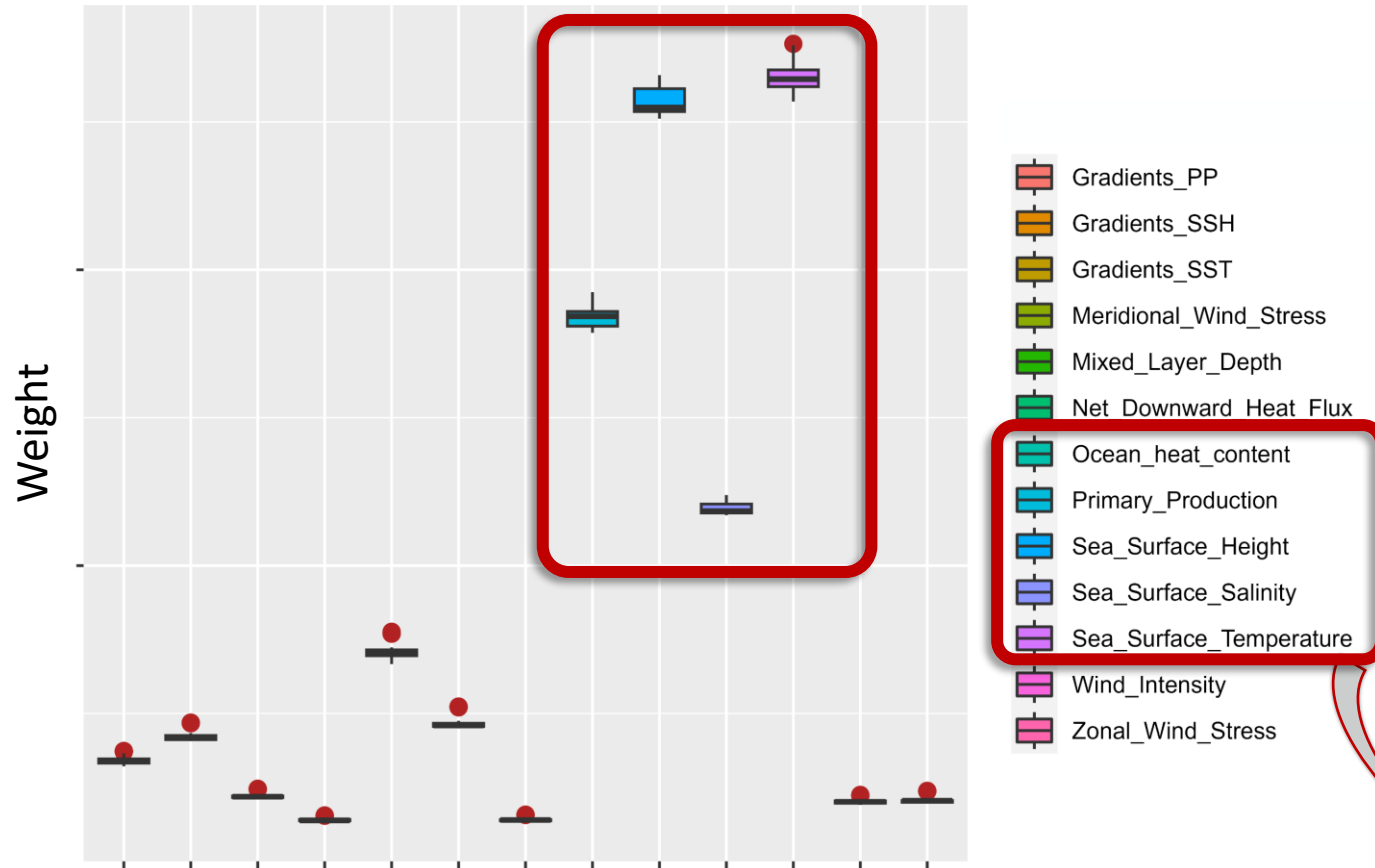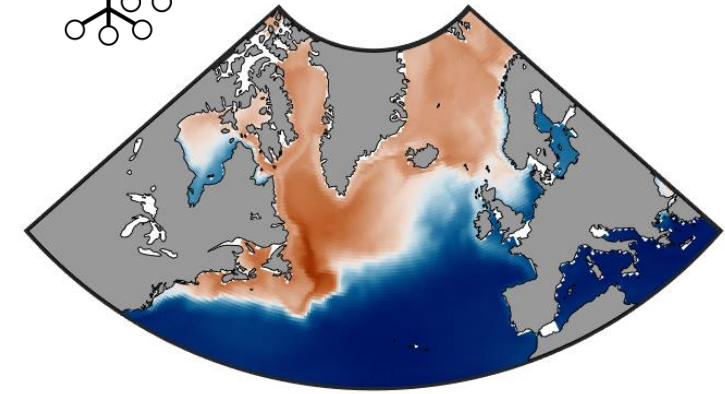
Using long-term time series to model species distribution

Calanus finmarchicus, "The Rolls Royce of zooplankton©"

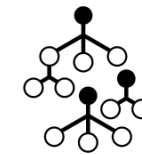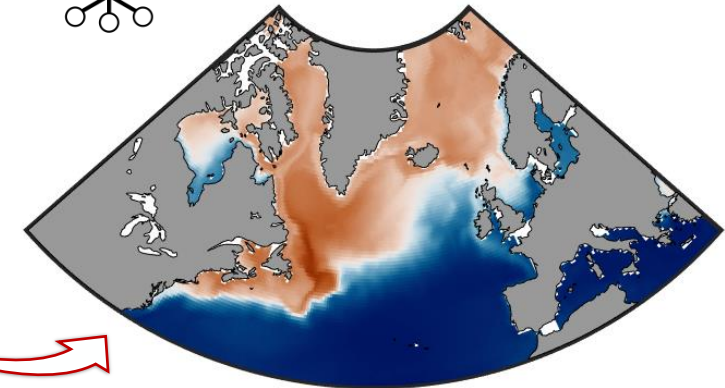Relative importance of explanatory variables

Weight

Gradients_PP
Gradients_SSH
Gradients_SST
Meridional_Wind_Stress
Mixed_Layer_Depth
Net_Downward_Heat_Flux
Ocean_heat_content
Primary_Production
Sea_Surface_Height
Sea_Surface_Salinity
Sea_Surface_Temperature
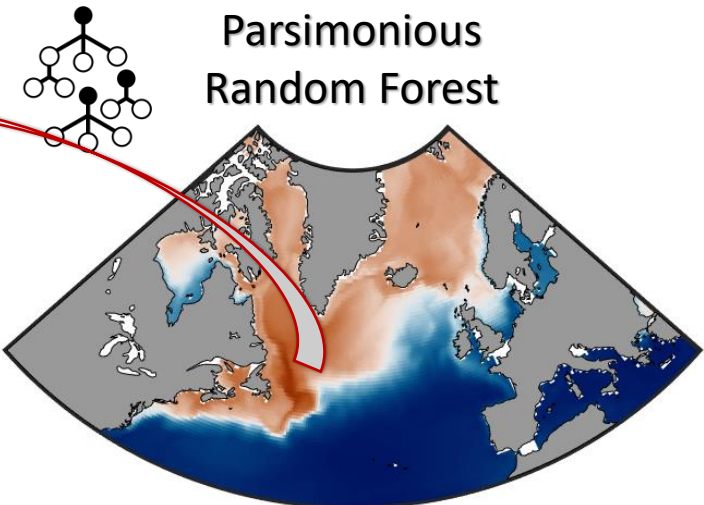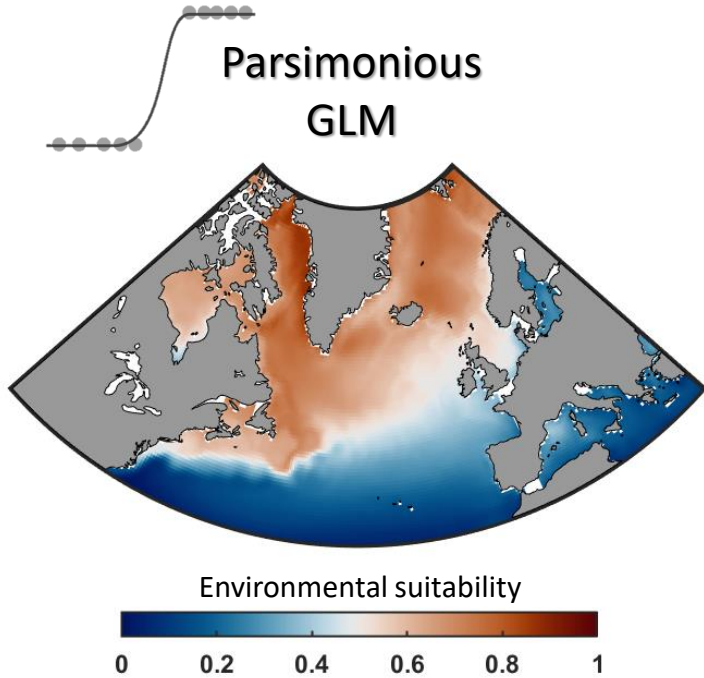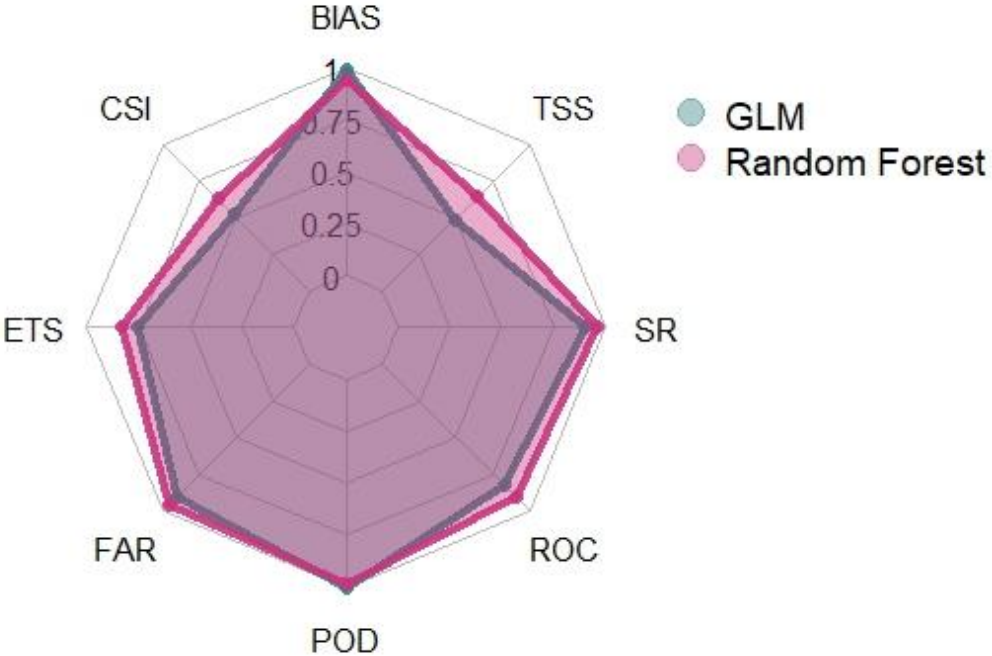Wind_Intensity
Zonal_Wind_Stress

Random Forest

Environmental suitability

0   0.2   0.4   0.6   0.8   1

Parsimonious Random Forest

Assessing the robustness of models using classical evaluation metrics

Parsimonious GLM

Environmental suitability

0   0.2   0.4   0.6   0.8   1

Parsimonious Random Forest

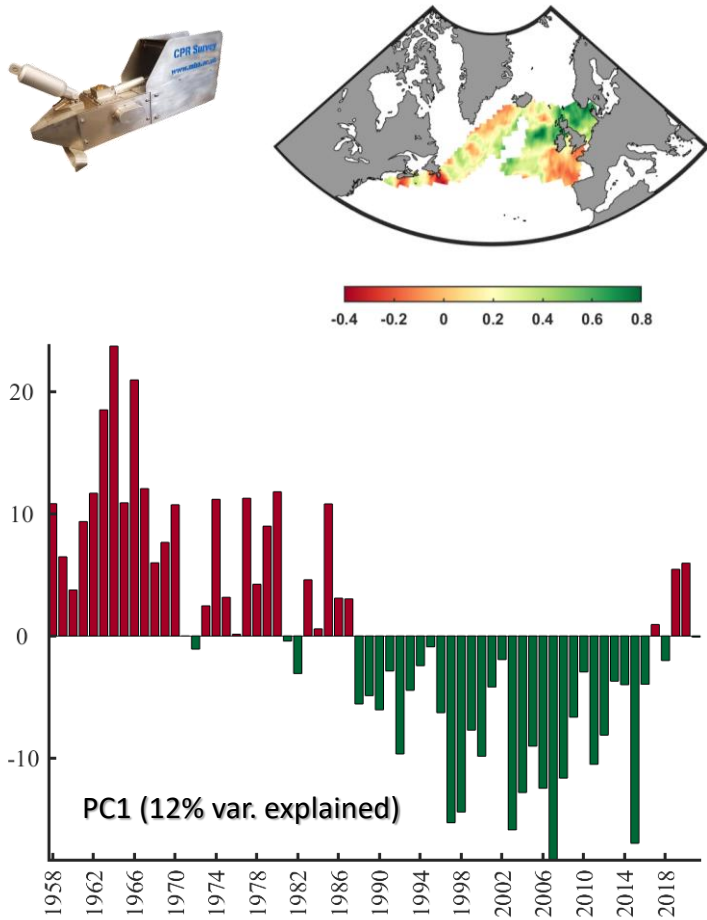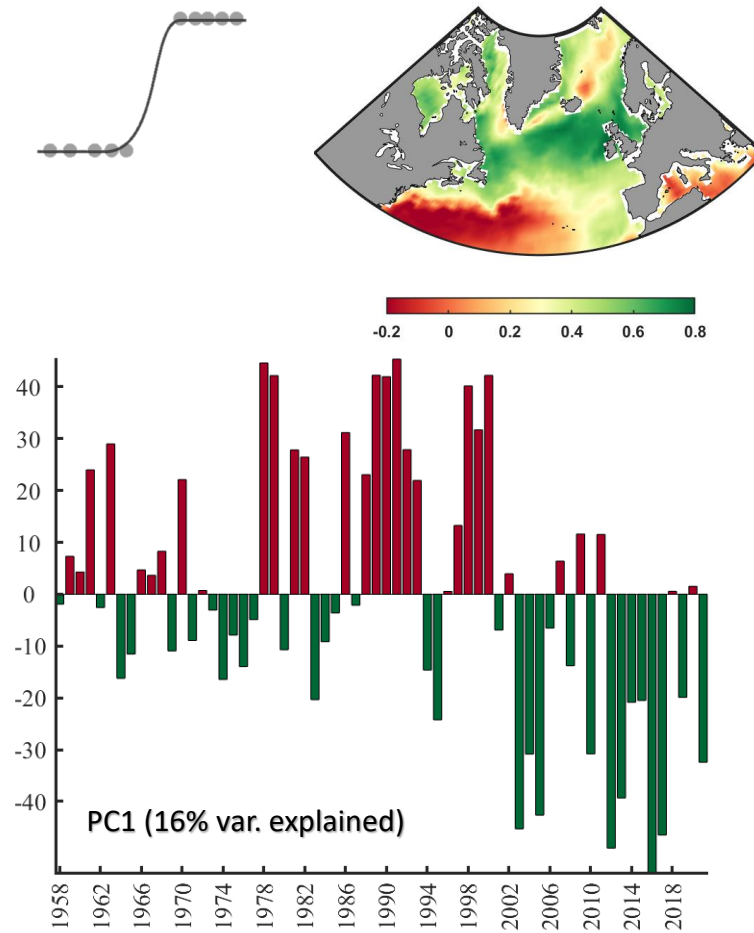|		Observations	
		1	0
Predictions	1	tp	fp
	0	fn	tn

Assessing the robustness of models using long-term time series ... Reconstructing the past for a better evaluation...
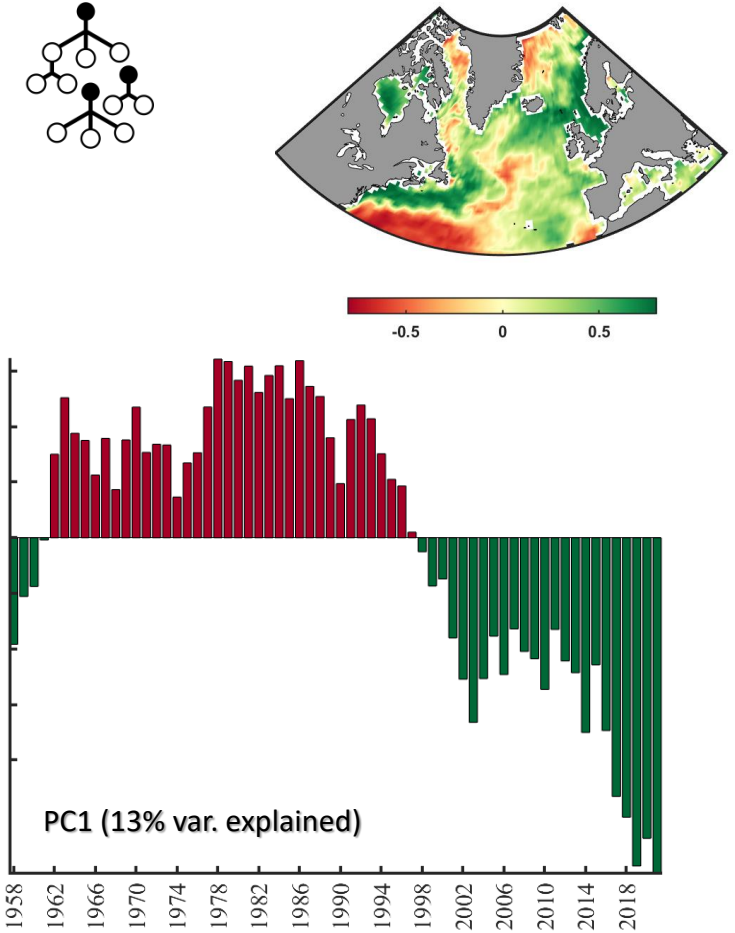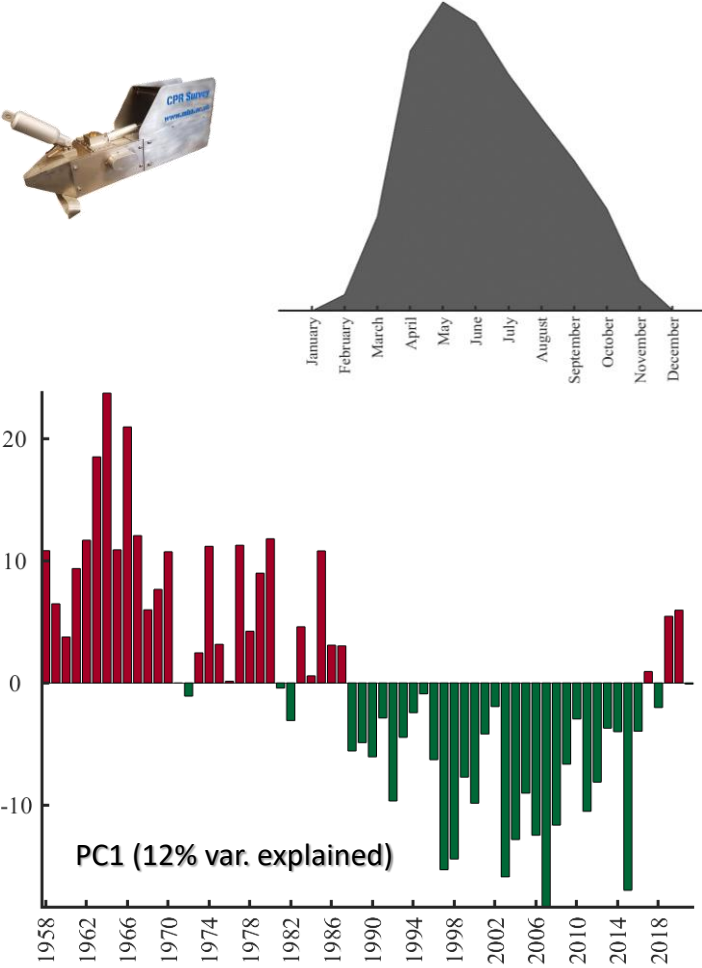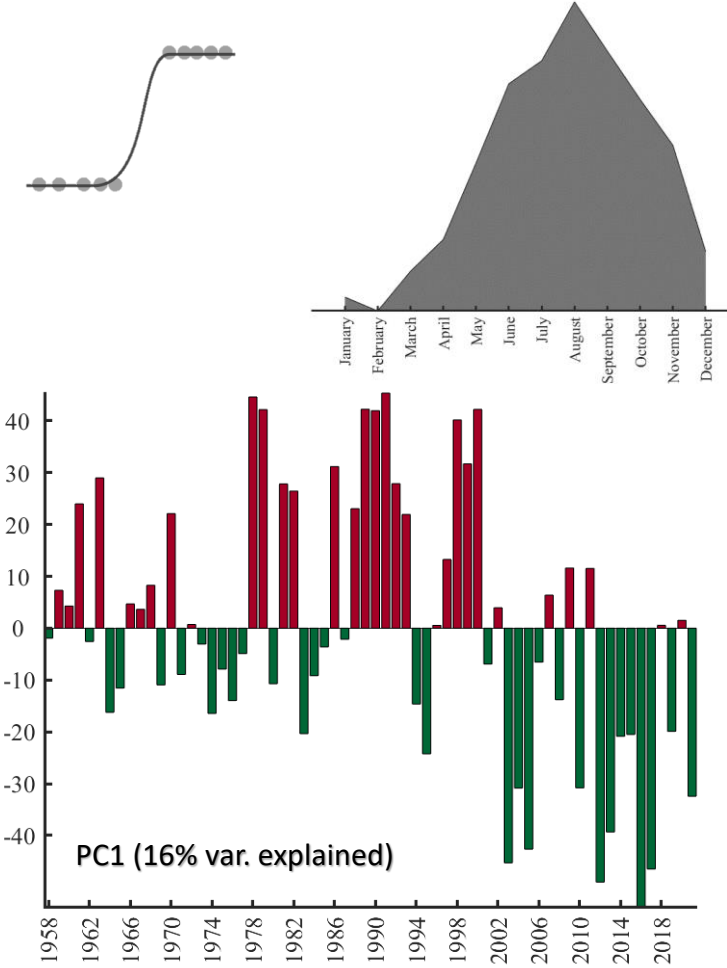
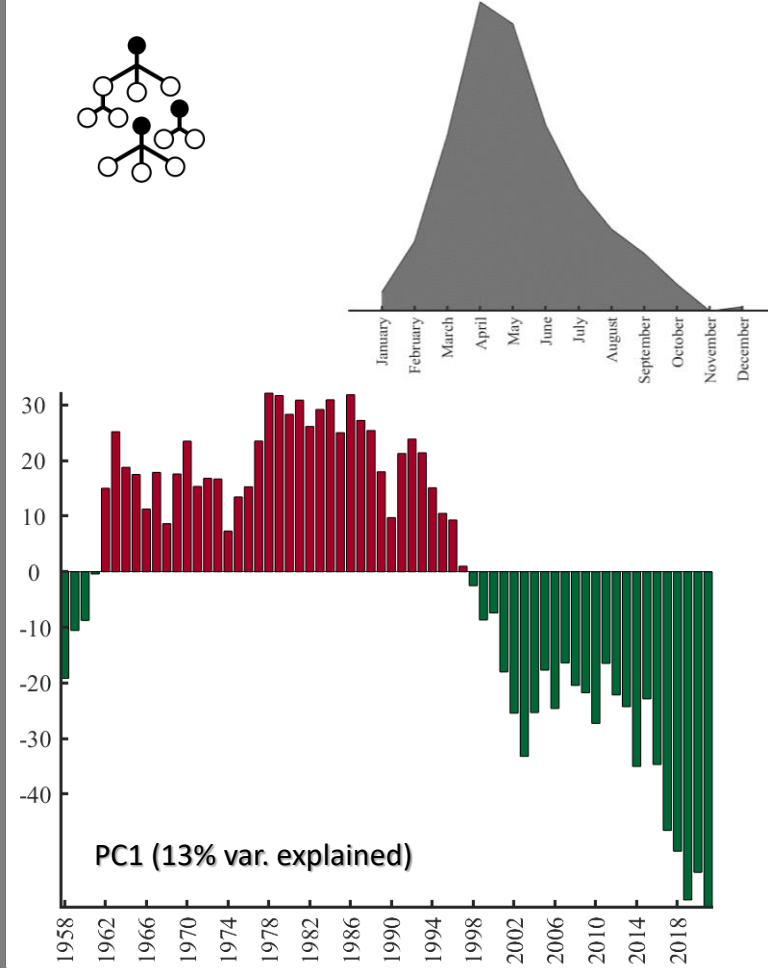# Assessing the robustness of models using long-term time series … Reconstructing the past for a better evaluation…

Take home message

**"… All models are wrong, but some are useful …**

George Box … a sentence overly used in modelers' presentations during conferences...

… The practical question is, how wrong do they have to be to not be useful …

One way to test a model's forecasting capacity is to assess its accuracy through hindcasting … relying more heavily on historical time series

To take into account data from past ecosystem
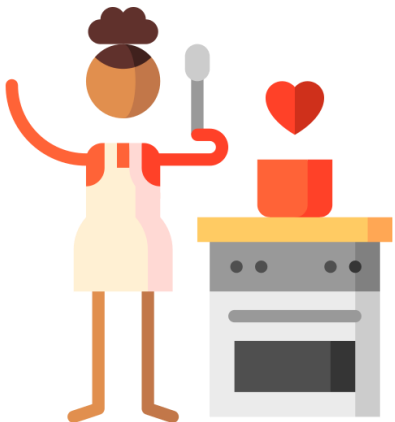
- To implement additional algorithms to explore their sensitivity
- To consider the weight of abundances, not just presence/absence
- To broaden the spectrum of species