Changes in the trans-equatorial distribution of Sherborn's basslet, *Howella sherborni*, and Atlantic pelagic basslet, *Howella atlantica*, and *Bathysphyraenops simplex* in the northern tropical Atlantic

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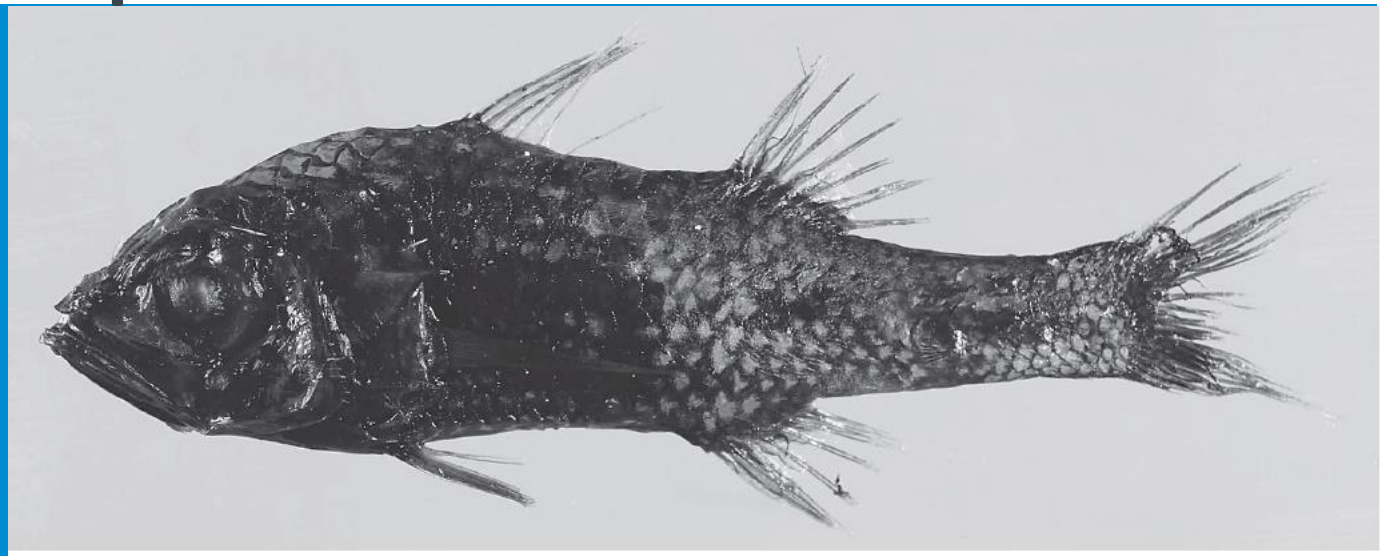
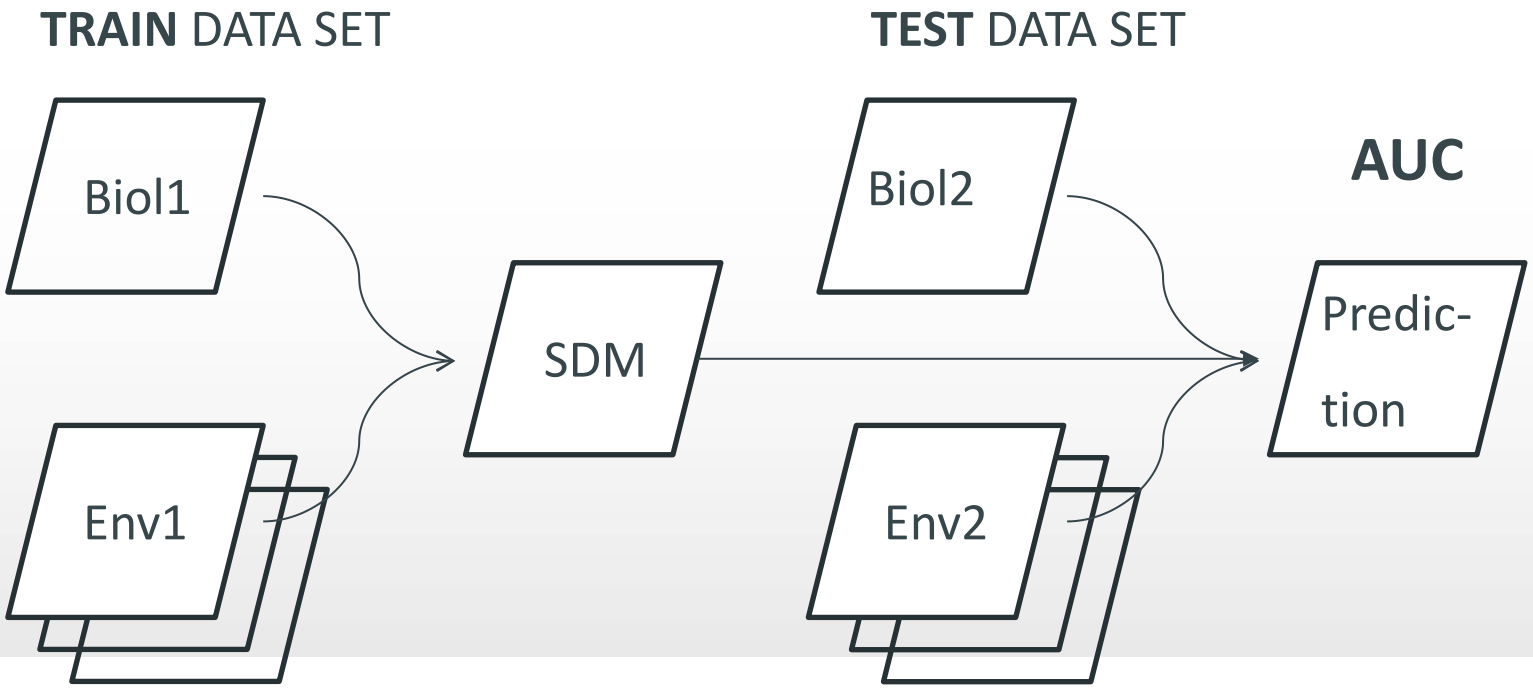


Fig. 96. *Bathysphyraenops simplex*, HUMZ 211043, 57.7 mm SL.

WP 12, MS41, tuna prey field dynamics

- **'Population dynamic approaches': GCM based S and S/R modelling**
- **'Bioclimatic envelope modelling' (BEM): physiology-based projections based upon changes in environmental conditions**



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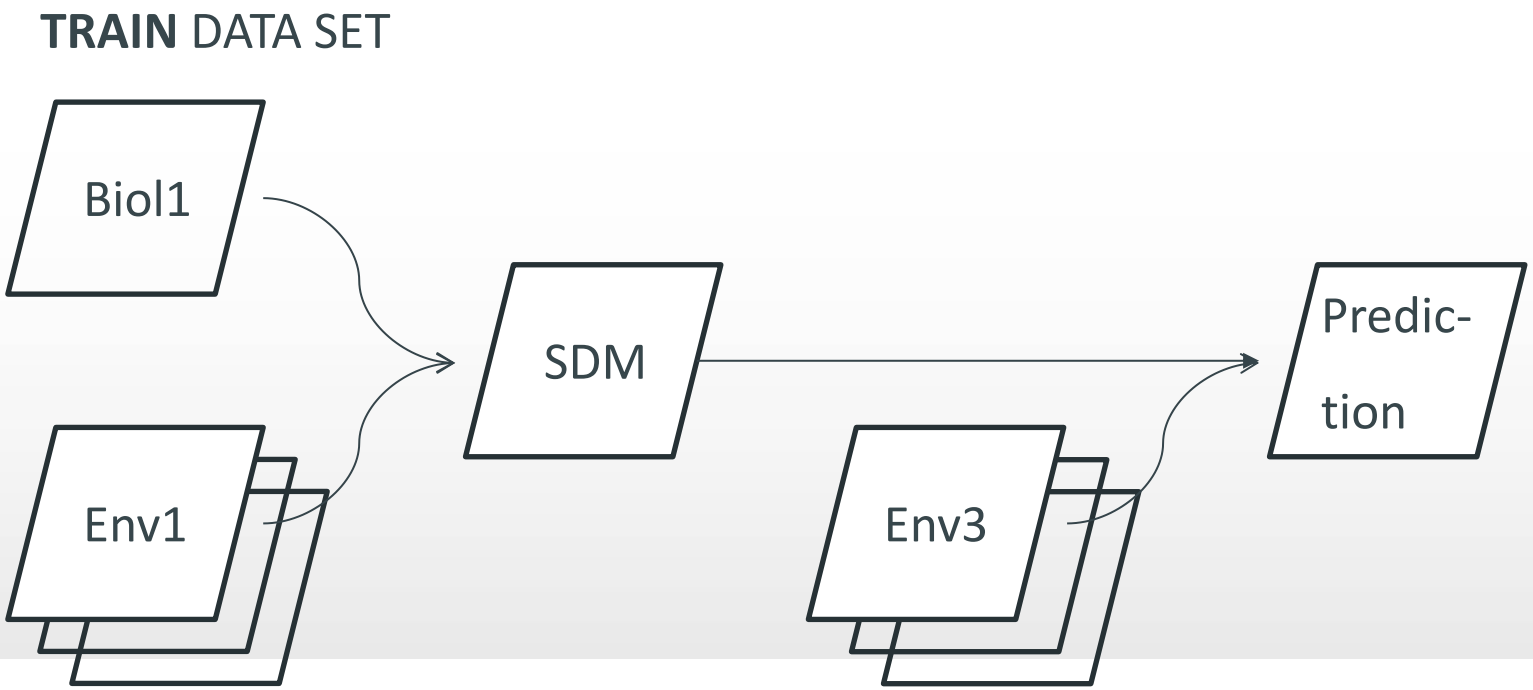


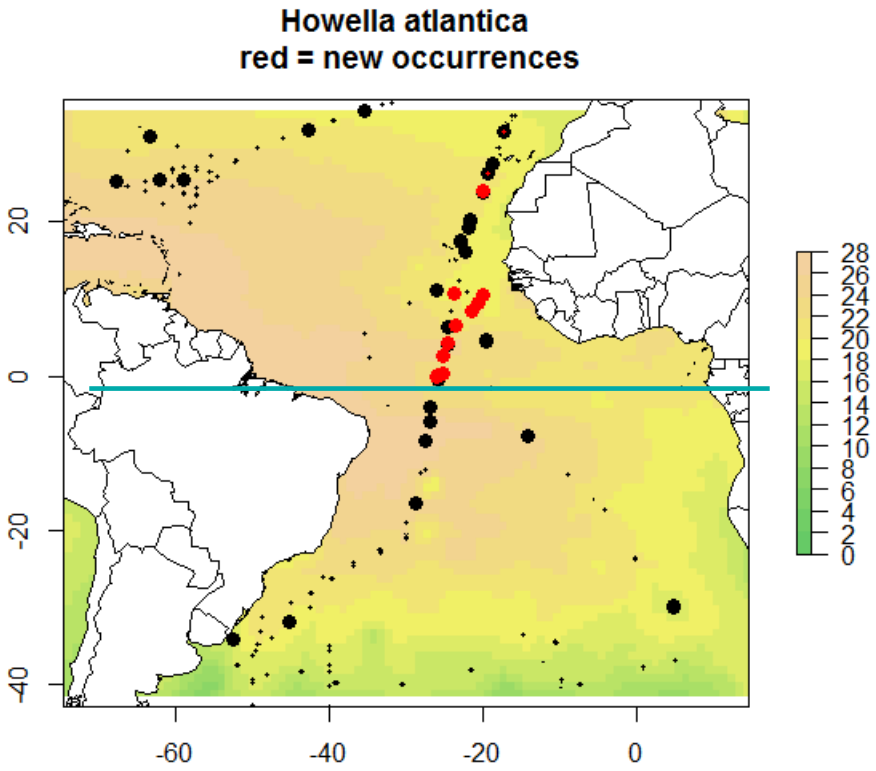
Environmental layers, biological layers, models

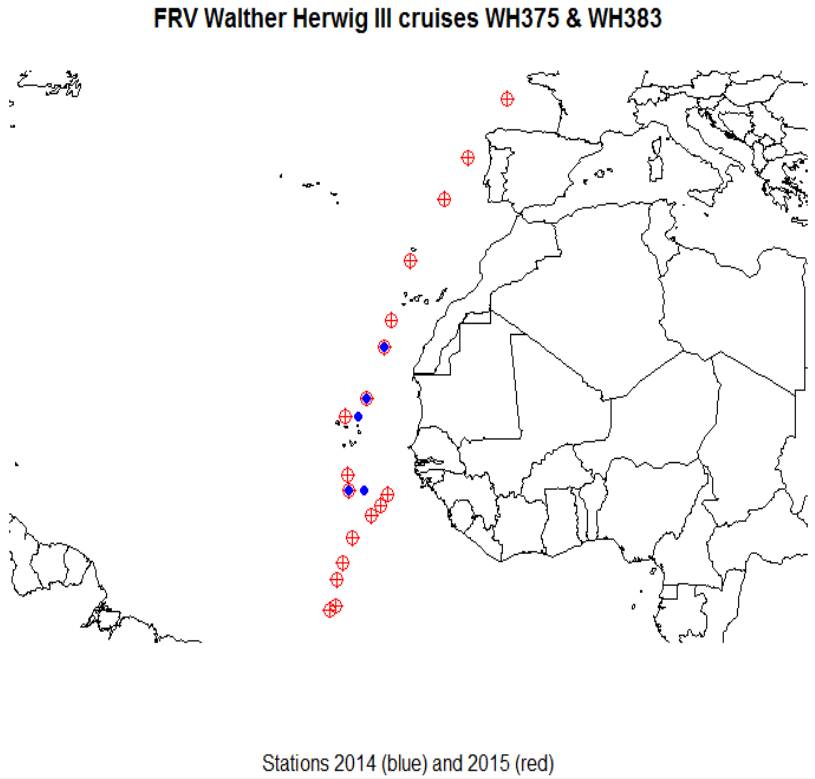
World Ocean Atlas decadal means 1965-75, 2005-12

Salinity	**0-100, 100-300, 300-500**
Temperature	**0-100, 100-300, 300-500**
Oxygen	**0-100, 100-300, 300-500***

*linear model based on Stramma et al. 2012

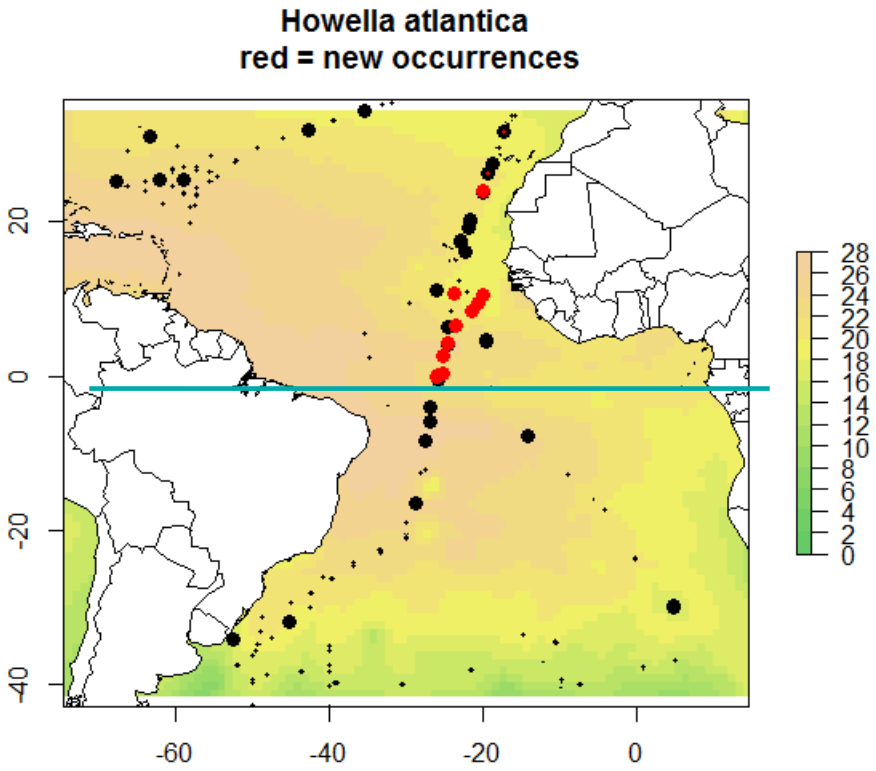
Environmental layers, **biological layers**, models

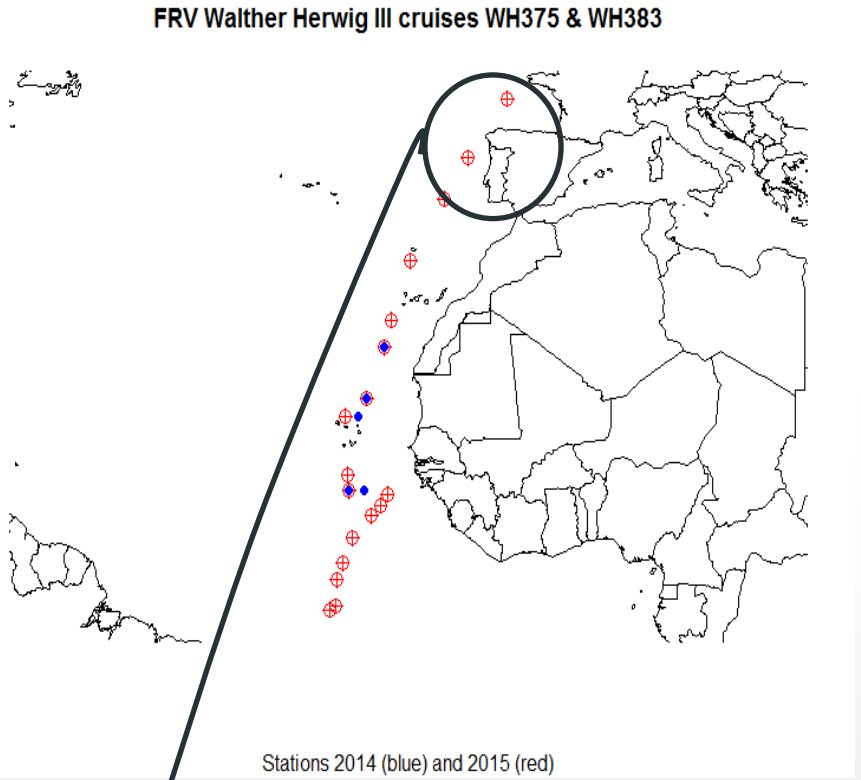




over T0-100 1965-74

Environmental layers, **biological layers**, models





Closing the gap

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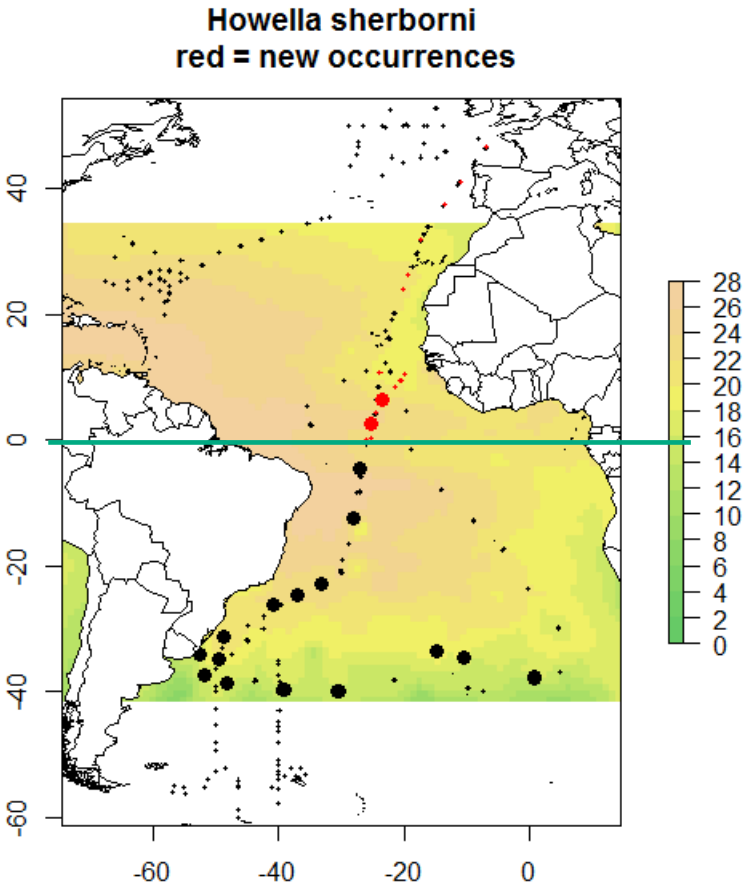
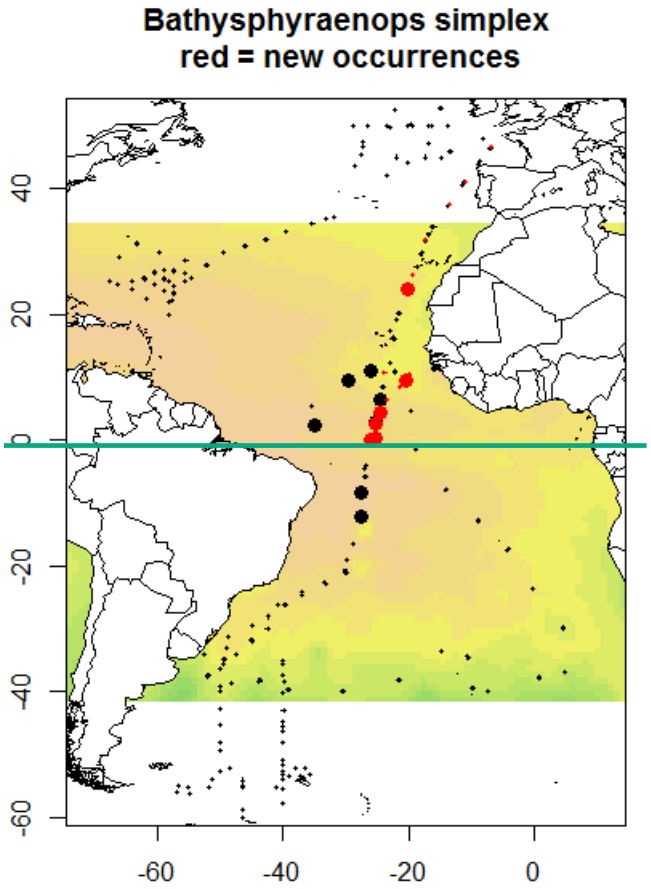
Environmental layers, **biological layers**, models





over T0-100 1965-74

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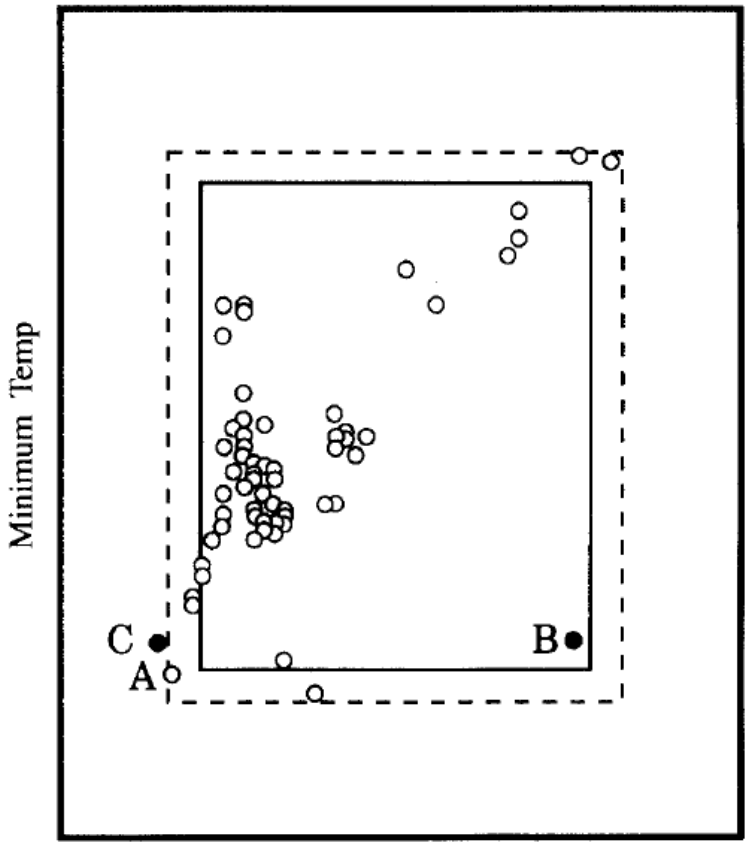
Environmental layers, biological layers, **models**

BIOCLIM – boxcar approach identifying all environmental values falling within the extremes of the distributional range,

the minimum percentile score across all the environmental variables is computed (i.e. this is like Liebig's law of the minimum)



Environmental layers, biological layers, **models**

DOMAIN – computes the Gower distance between environmental variables at any location and those at any of the known locations of occurrence ('training sites').

Integration is carried out

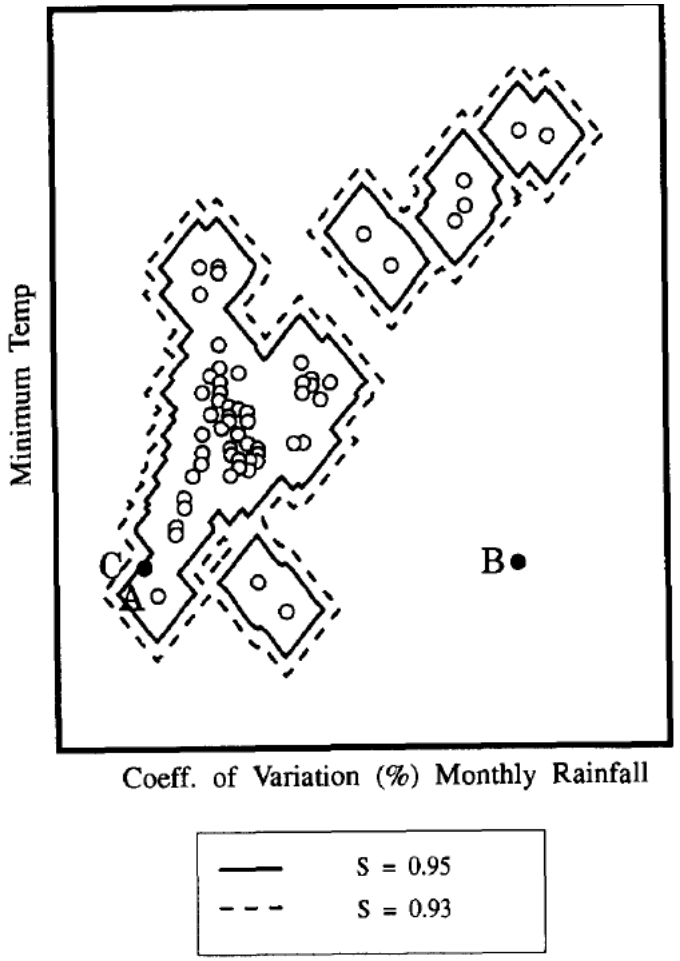


Figure 3. DOMAIN environmental envelope.

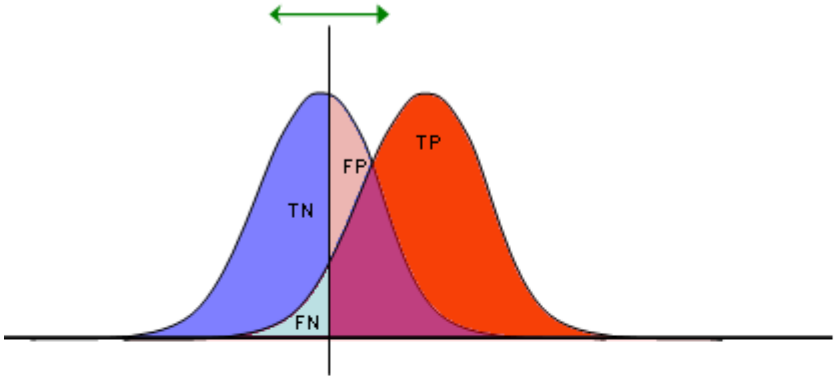
Environmental layers, biological layers, **models**

MAXENT - Based on the conditional density of the covariates at the presence sites, f1(z), the marginal (i.e., unconditional) and density of covariates across the study area f(z), and the knowledge of the prevalence Pr(y = 1),

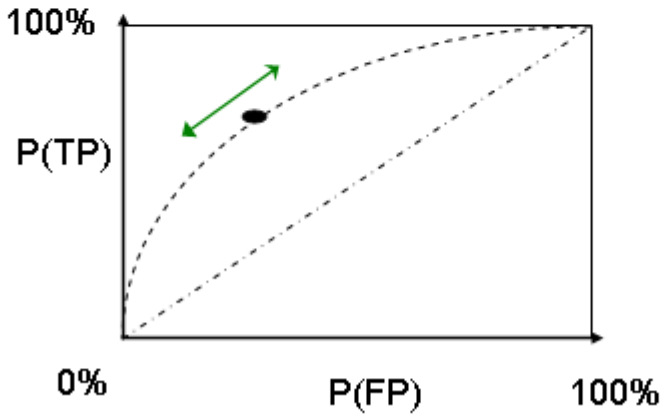
the probability of occurrence in environmental space z is calculated:

$$\Pr(y = 1 \mid \mathbf{z}) = f_1(\mathbf{z}) \Pr(y = 1) / f(\mathbf{z})$$

Area-under-curve (AUC): Counting the right ones



TP	FP
FN	TN
1	1



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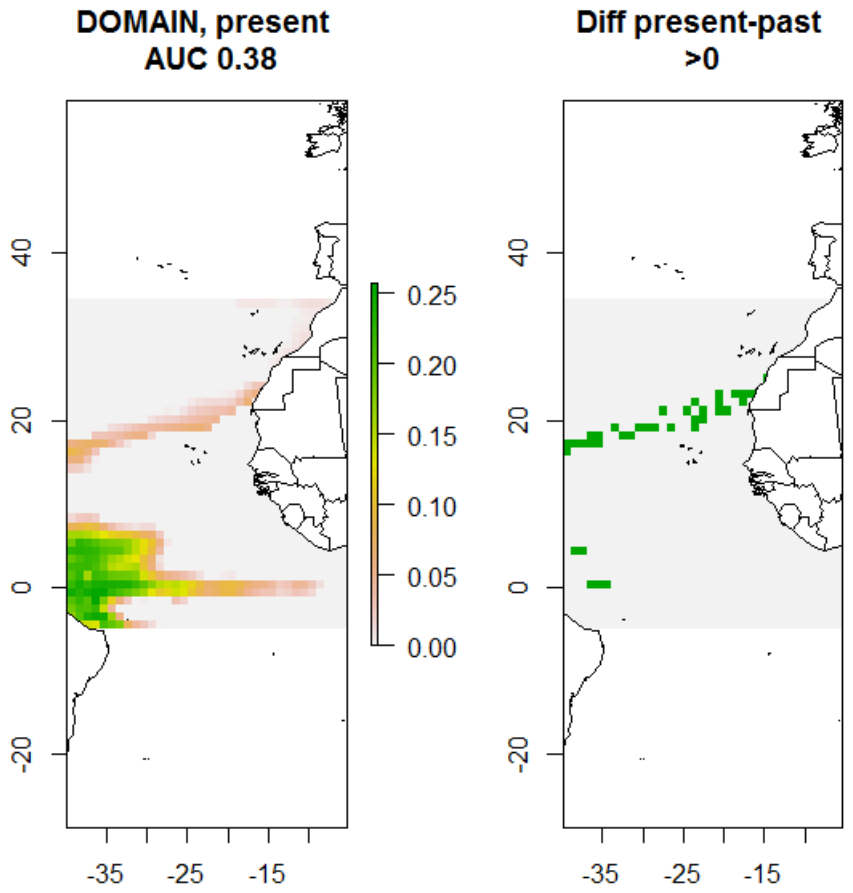
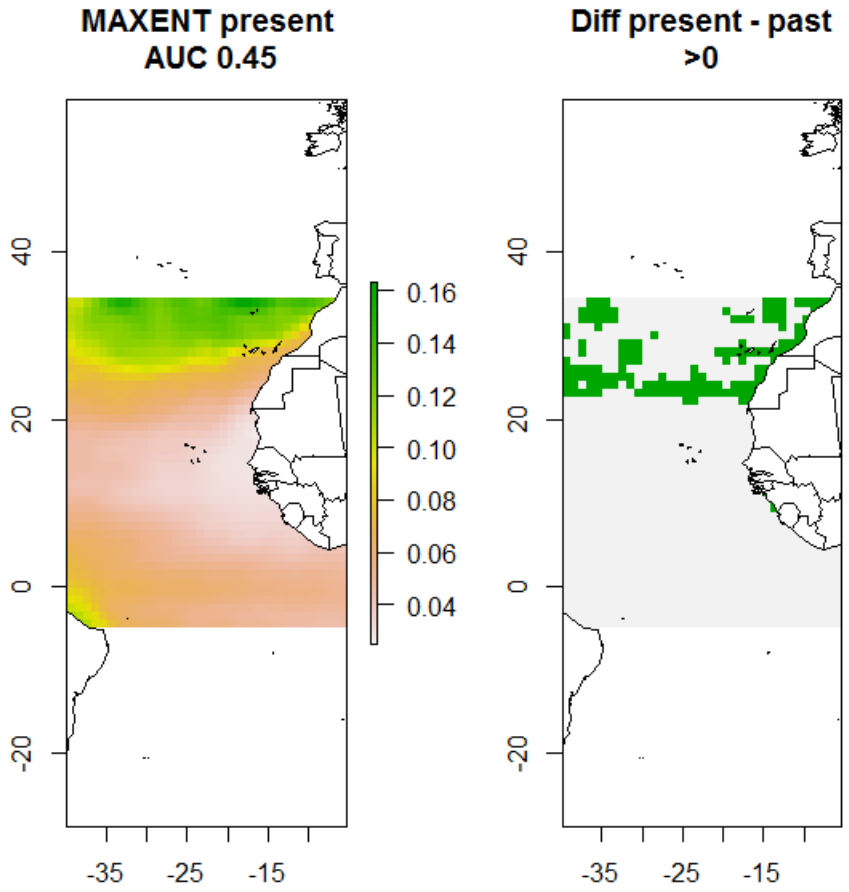
Howella sherborni : 2 points are not enough



BIOCLIM failed

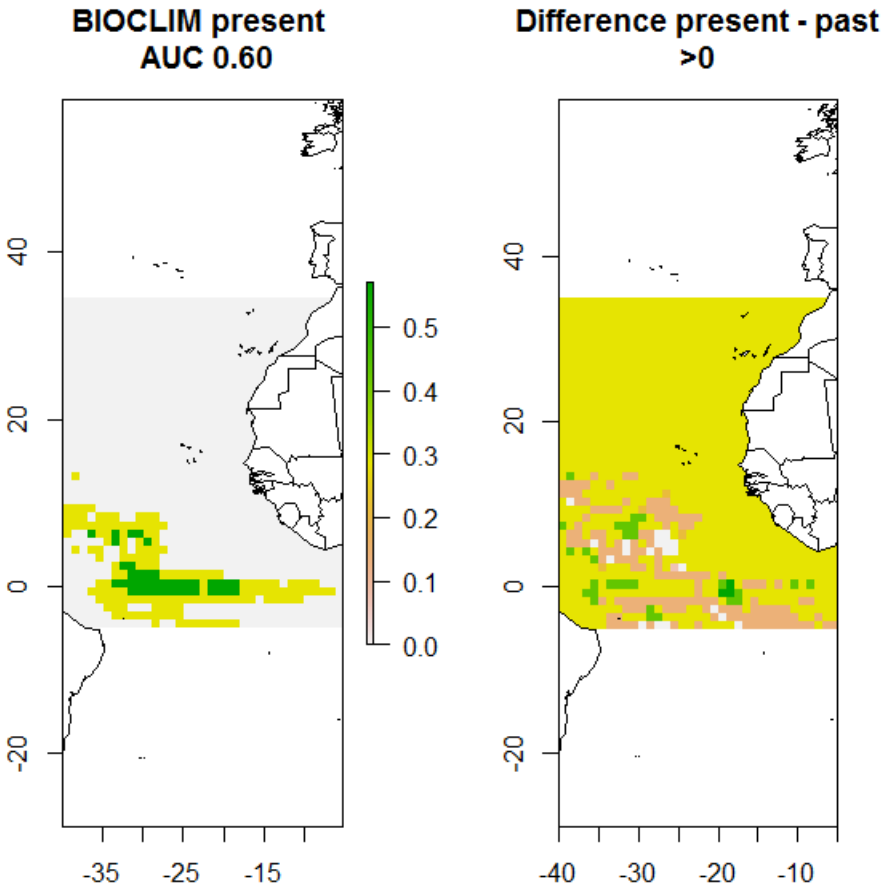
DOMAIN realistic representation of habitat, but no indication of northward expansion, poor AUC

Howella sherborni : 2 points are not enough



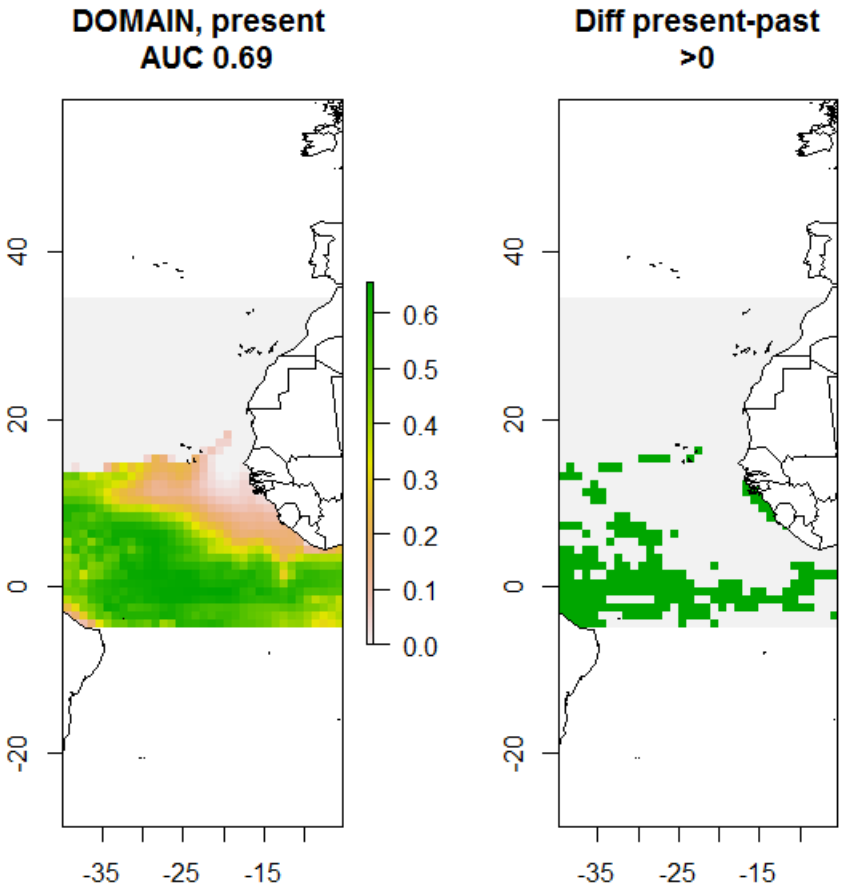
MAXENT – poor representation of habitat and, unlikely northerly expansion indicated, poor AUC

B. simplex



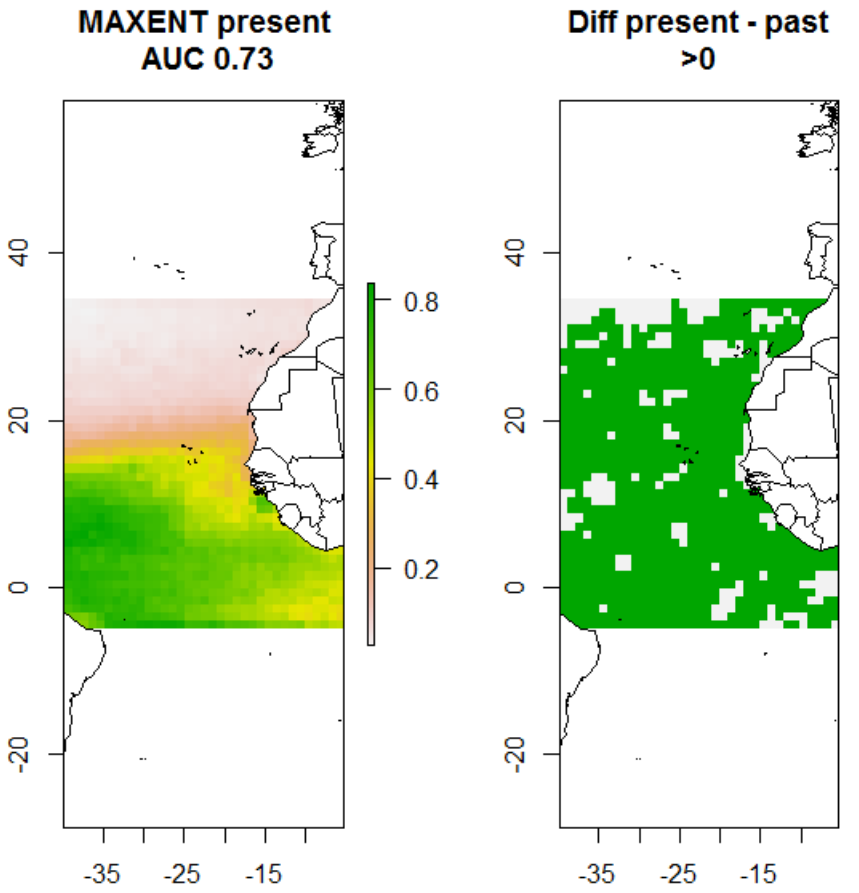
Constrained representation of habitat, unspecific description of northerly expansion

B. simplex



Less constrained representation of habitat, no indication of northerly expansion

B. simplex: Ranking models

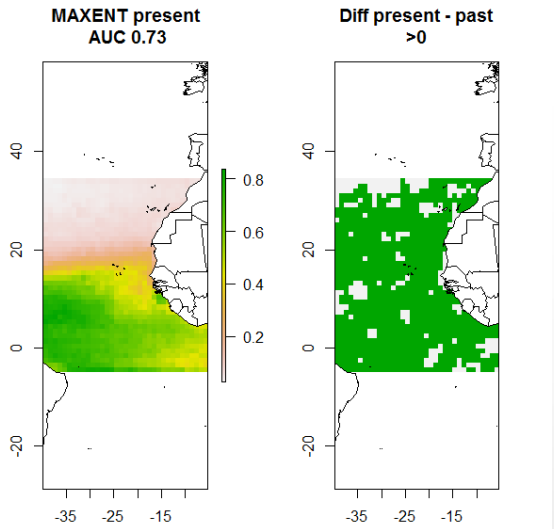


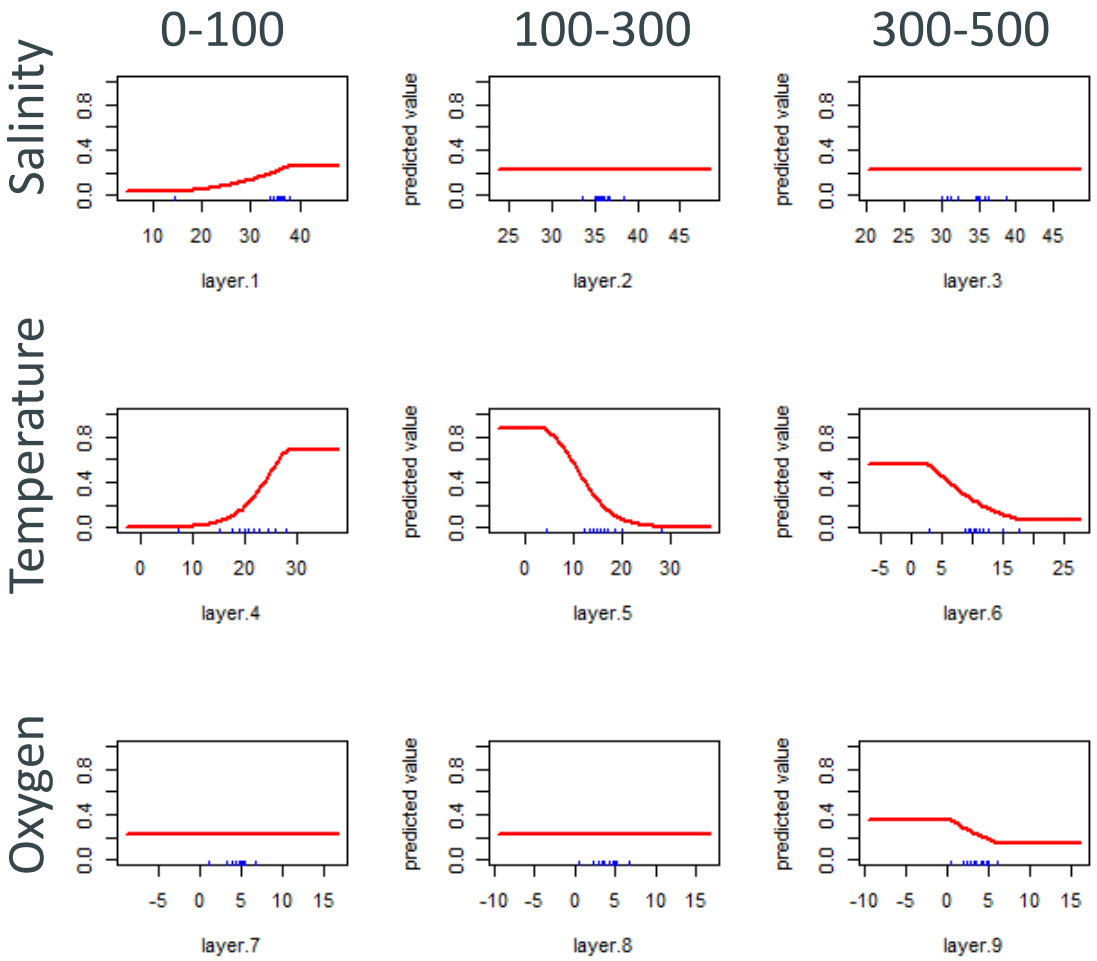
Sufficient representation of habitat, indication of northerly expansion beyond core habitat

AUC

BIOCLIM	DOMAIN	MAXENT
0.60	0.69	0.73

B. simplex: Some environmental layers non-informative





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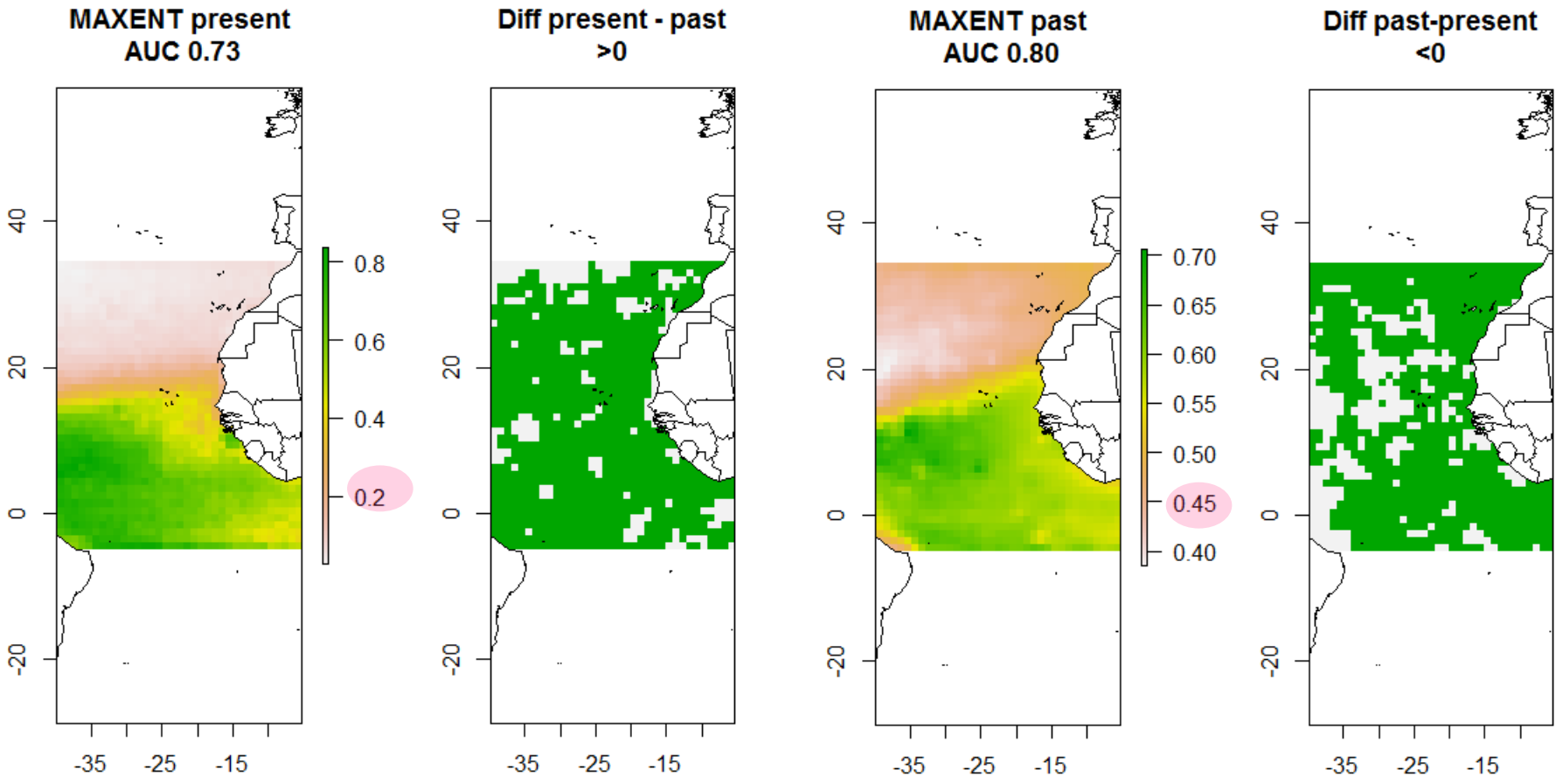
B. simplex: Whos‘s the better trainer ?



Past data

Present data

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Facing MS41

- Closing the sample gap in 2016
- Expanding BEM to common species, incl model class GLM/GAM (no problems with detectability)
- As shown for redundancy analsis, biological data can be used to test environmental data ensembles.

Thank you!

Sensitivity of BEM : predictor layers