Chefaoui, R. M. and Serrão, E. A. 2017. Accounting for uncertainty in predictions of a marine species: integrating population genetics to verify past distributions. - Ecological Modelling

Supplementary material - Appendix A

Table A.1 Environmental variables used in the study. Maximum, minimum and range values were calculated for Kd, SST, and wave height from the sources indicated. Bottom slope and bottom aspect were derived from the bathymetric data.

Predictor (units)	Source	Reference
Maximum winter Kd (m^{-1})	SeaWiFS (Sea Wide Field Sensor) satellite radiance	(Gohin et al. 2005)
Minimum summer Kd (m^{-1})	MODIS (Moderate Resolution Imaging Spectroradiometer)	(Huot et al. 2005)
Minimum winter SST (ºC)	OSTIA system	(Stark et al. 2007)
Maximum summer SST (ºC)		
Mean winter wave height (m)	AVISO altimeter data	(Schaeffer et al. 2012)
Salinity (unitless)		
Nitrate (µmol N L^{-1})		
PAR max. (mol quanta m^{-2} d^{-1})	Bio-ORACLE	(Tyberghein et al. 2012)
pH (unitless)		
Phosphate (µmol P L^{-1})		
Bottom aspect (degrees)	General Bathymetric Chart of the Oceans	(GEBCO 2010)
Bottom slope (degrees)		

SST: Sea surface temperature. The OSTIA system (Stark et al. 2007) combines infrared and microwave satellite data with *in situ* measurements.

Kd: Diffuse attenuation coefficient in direct relation with the traditional Secchi disk (Chen et al. 2007); PAR: Photosynthetically available radiation.

Table A.2 Landscape metrics used at class level in the study, based on McGarigal et al. (2012) and adapted from Chefaoui et al. (2015). [(a)] Indicates metrics identified as effective by Chefaoui (2014), while [(b)] indicates for Cushman et al. (2008).

Metric	Description
Mean perimeter-area ratio (PARA_MN) [(a)]	Ratio of the patch perimeter to area, it measures shape complexity (unitless)
Percentage of landscape (PLAND) [(a)]	The proportion of the landscape occupied by the class (unit: %)
Mean shape index (SHAPE_MN) [(a)]	Measure of the complexity of the class shape compared to a standard shape (square) of the same size (unitless)
Mean edge contrast index distribution (ECON_MN) [(b)]	The average edge contrast along the patch perimeter (unit: %)
Area-weighted mean fractal dimension index (FRAC_AM) [(b)]	Shape complexity. Each class is considered according to its size. Two times the logarithm of class perimeter divided by the logarithm of class area (unitless)
Total edge contrast index (TECI) [(b)]	The percentage of edge contrast in relation to the maximum possible (unit: %)

Table A.3 The table shows an overview of the number of occurrences found for all species (Global) and Alismatales order in GBIF, and for *Cymodocea nodosa* in an exhaustive search in publications and databases for each country. Data publishing activity in GBIF and the level of development according to the United Nations are also provided. Finally, the weight column represents the sampling probability obtained from these data using the decision table. Levels of development from higher to lower levels: 1 = Developed region (G7); 2 = Developed region (nonG7); 3 = Emerging region (BRIC); 4 = Emerging region (MIKT); 5 = Emerging region (G20); 6 = Developing region; 7 = Least developed region.

Country	Abbr	Global	Alismatales	C. nodosa	Level of development	Data publishing	Region	Weight
Spain	ES	10225137	2387	179	2	10196237	South-West Europe	1.00
France	FR	11937392	1820	6	1	17547385	South-West Europe	0.95
Portugal	PT	805132	48	14	2	167793	South-West Europe	1.00
Greece	GR	443489	58	22	2	0	South-East Europe	0.85
Italy	IT	673311	12	30	1	32606	South-East Europe	1.00
Croatia	HR	61023	9	9	2	52	South-East Europe	0.80
Malta	MT	17349	4	0	2	0	South-East Europe	0.30
Bulgaria	BG	120122	1	0	2	20189	South-East Europe	0.75
Slovenia	SI	281316	0	2	2	266295	South-East Europe	0.35
Bosnia and Herzegovina	BA	12726	0	0	6	0	South-East Europe	0.10
Montenegro	ME	9811	0	0	6	0	South-East Europe	0.10
Albania	AL	10230	0	0	6	0	South-East Europe	0.10
Romania	RO	190815	0	0	2	0	South-East Europe	0.15
Egypt	EG	139659	22	2	5	0	North Africa	0.70
Tunisia	TN	172034	4	8	6	0	North Africa	0.45
Morocco	MA	271457	2	1	6	3550	North Africa	0.40
Algeria	DZ	88099	2	0	6	0	North Africa	0.25
Libya	LY	24184	0	0	6	0	North Africa	0.10
Mauritania	MR	29794	3	0	7	1812	Tropical West Africa	0.75
Senegal	SN	91156	0	3	7	0	Tropical West Africa	0.20
Western Sahara	WS	50798	0	0	6	0	Tropical West Africa	0.10
Guinea	GN	65081	0	0	7	493	Tropical West Africa	0.50
Guinea-Bissau	GW	22327	0	0	7	0	Tropical West Africa	0.10
Cyprus	CY	40410	1	3	2	0	West Asia	0.45
Israel	IL	559696	1	1	2	433463	West Asia	0.80
Turkey	TR	313395	0	13	4	0	West Asia	0.60
Lebanon	LB	26380	0	1	6	0	West Asia	0.20
Syria	SY	42873	0	1	6	0	West Asia	0.20
Ukraine	UA	78390	0	0	6	0	West Asia	0.10
Russian Federation	RU	1323396	0	0	3	31456	West Asia	0.55
Georgia	GE	31970	0	0	6	0	West Asia	0.10
The Gambia	GA	28717	0	0	7	0	Tropical West Africa	0.10
Cape Verde	CV	58283	0	0	6	0	Tropical West Africa	0.10
Sierra Leone	SL	248	0	0	7	0	Tropical West Africa	0.10

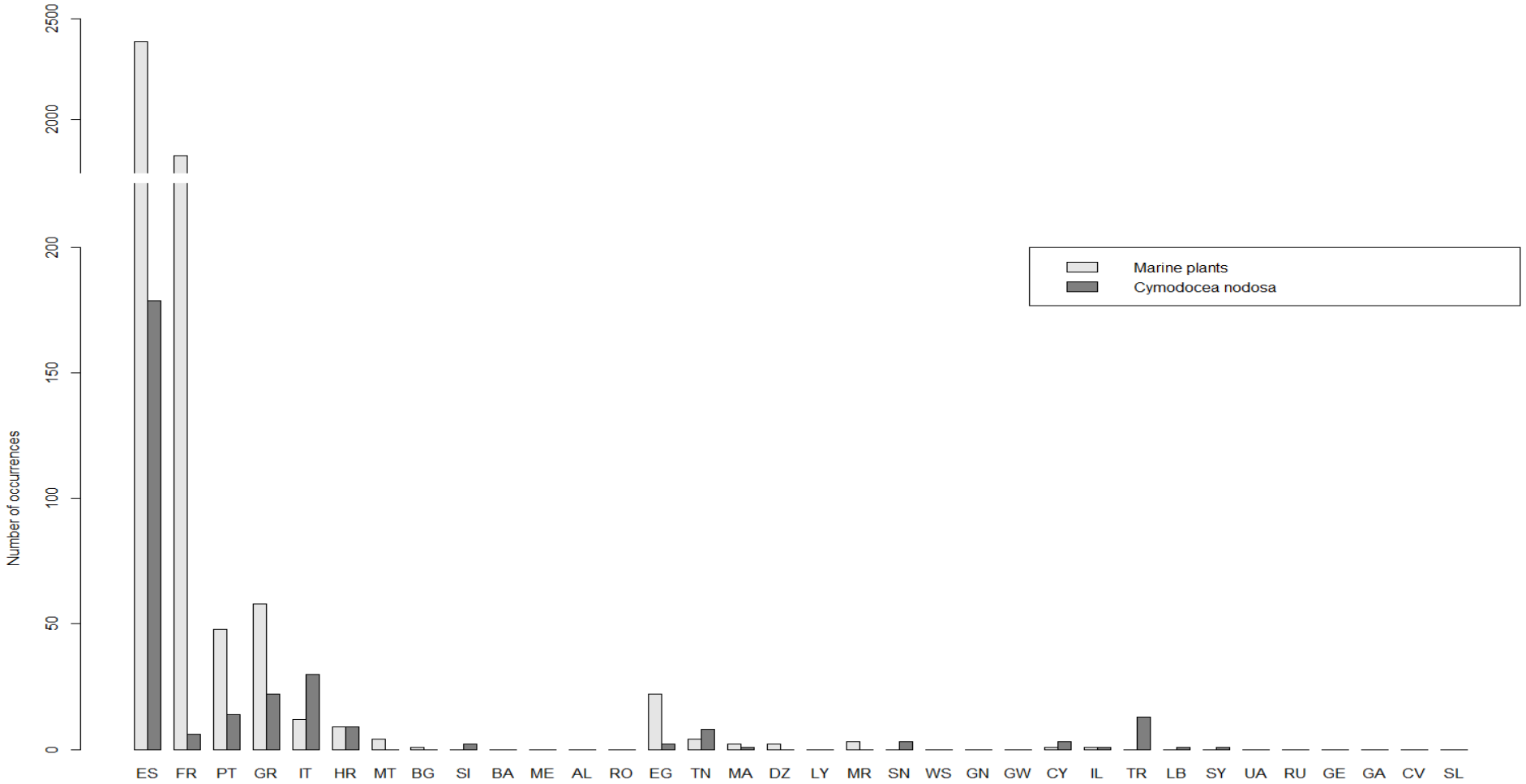
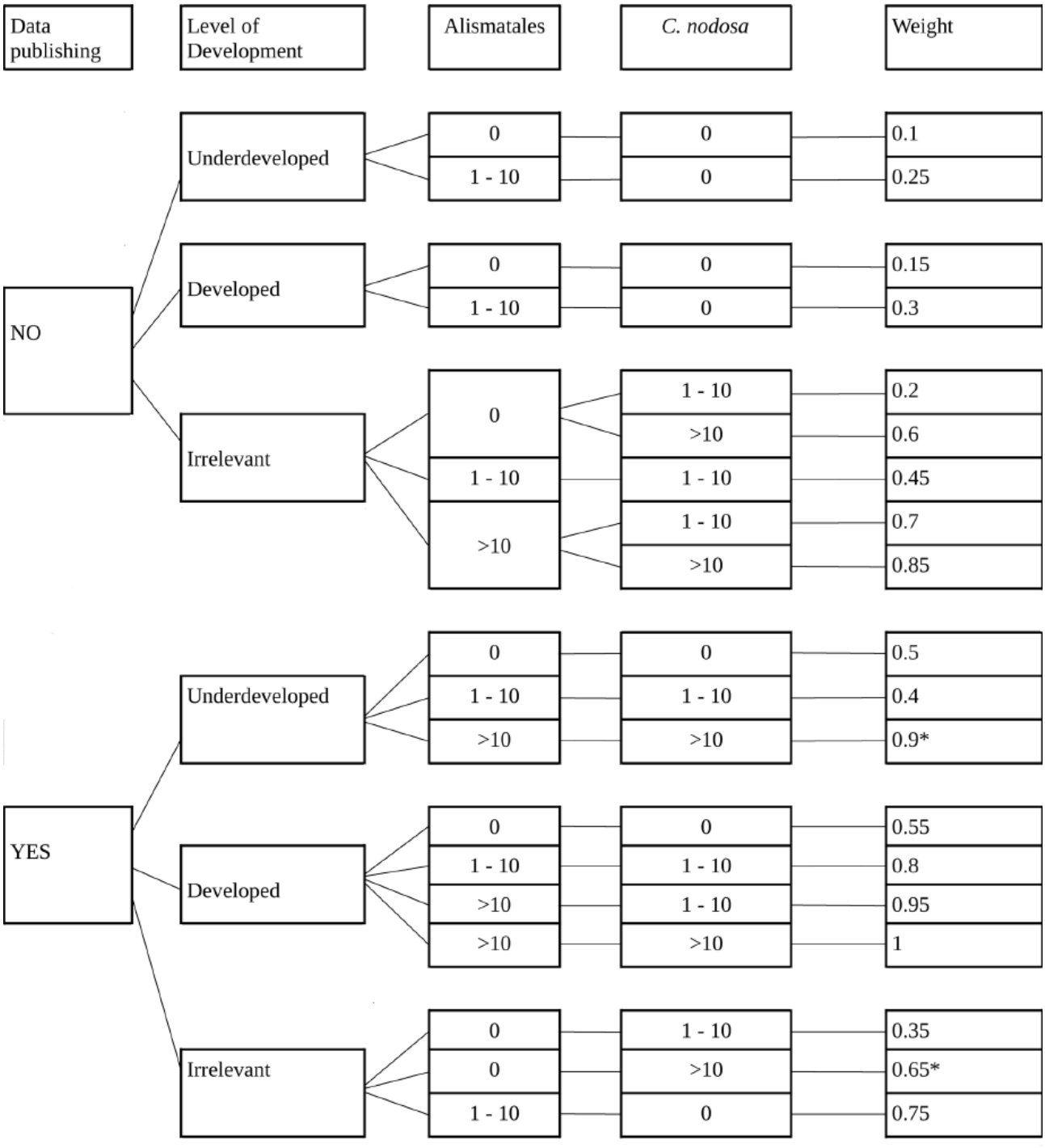


Fig. A.1 Barplot showing the number of records found for the total of marine plants of the Alismatales order in comparison to those of *Cymodocea nodosa* in each country of the study area. (ES: Spain; FR: France; PT: Portugal; GR: Greece; IT: Italy; HR: Croatia; MT: Malta; BG: Bulgaria; SI: Slovenia; BA: Bosnia and Herzegovina; ME: Montenegro; AL: Albania; RO: Romania; EG: Egypt; TN: Tunisia; MA: Morocco; DZ: Algeria; LY: Libya; MR: Mauritania; SN: Senegal; WS: Western Sahara; GN: Guinea; GW: Guinea-Bissau; CY: Cyprus; IL: Israel; TR: Turkey; LB: Lebanon; SY: Syria; UA: Ukraine; RU: Russian Federation; GE: Georgia; GA: The Gambia; CV: Cape Verde; SL: Sierra Leone).

Fig. A.2 Decision tree describing the set of rules used to estimate the sampling effort of each country for Cymodocea nodosa, and calculate a a weighted probability filter (Weight) score for background data according to: a) the GBIF data publishing activity of the country (NO: no records provided by the country; YES: the country contributes with records to GBIF); b) the level of development of the country according to the United Nations and shown in Table A.3 (Developed: countries classified as developed regions (G7 and non G7) and emerging regions (BRIC, MIKT and G20); Underdeveloped: developing and l*east developed* regions; Irrelevant: level of development irrelevant for that case); c) the number of occurrences found in GBIF for species pertaining to Alismatales order and for Cymodocea nodosa. (* = no cases are found meeting these conditions).



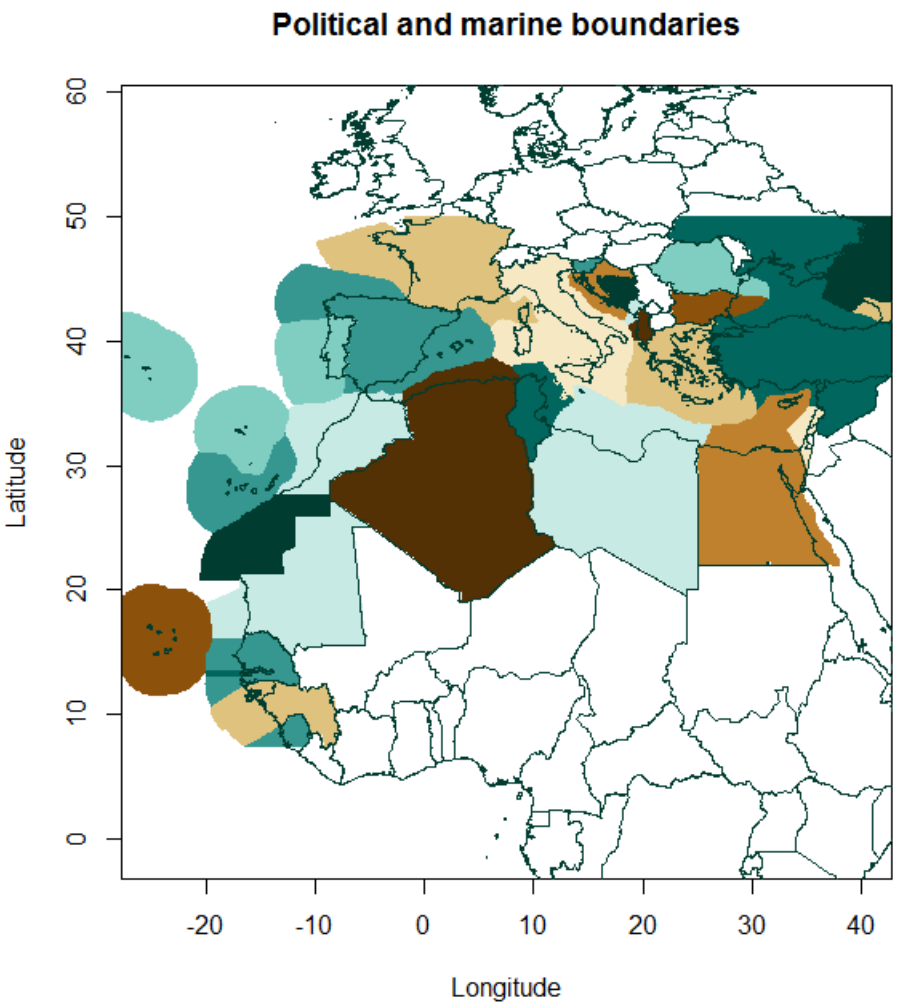


Fig. A.3 Political (Natural Earth, 2015) and marine boundaries (Claus et al., 2015) used to create weighted sampling probability ("Weight") filter for background data.

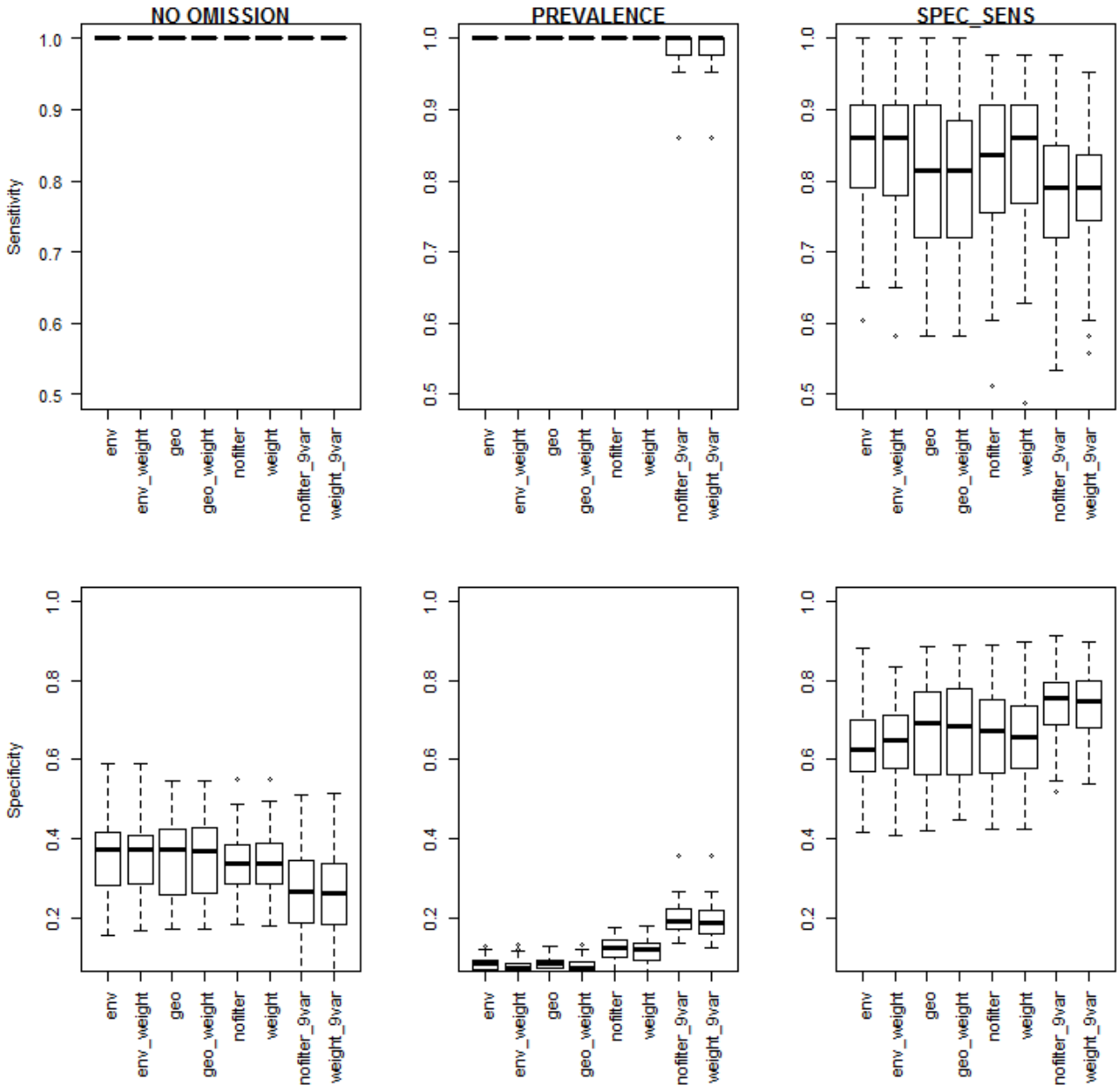
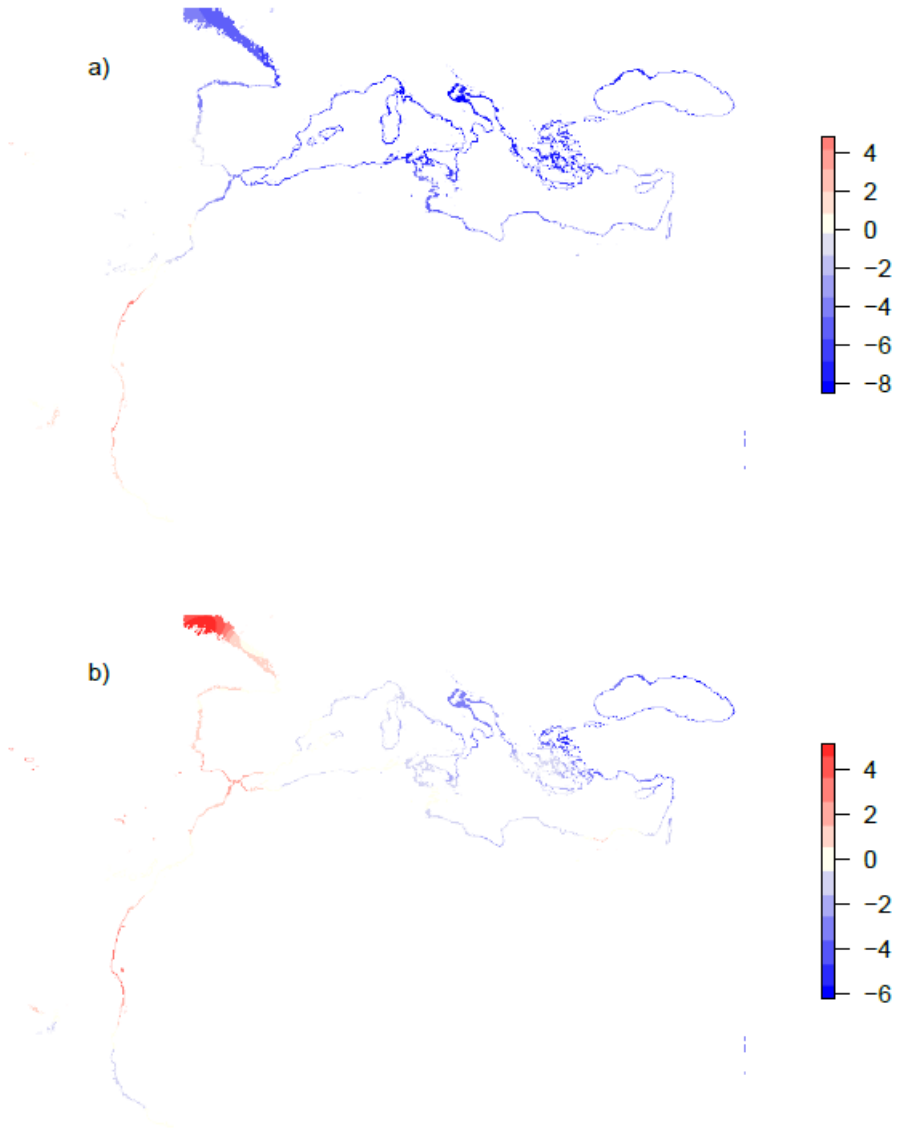


Fig. A.4 Mean sensitivity and specificity ROC derived measures obtained for MaxEnt models according to the filter and threshold used. “No omission” and “prevalence” thresholds optimized the sensitivity of the models with values close to 1, while “Spec_sens” increased specificity.

Fig. A.5 Comparison between the Last Glacial Maximum sea surface temperature (SST) obtained from the two Ocean General Circulation Models: CCSM4 and CNRM-CM5. The values show temperature anomalies between CCSM4 and CNRM-CM5 for maximum SST (a) and minimum SST (b) in Celsius degree (ºC).



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