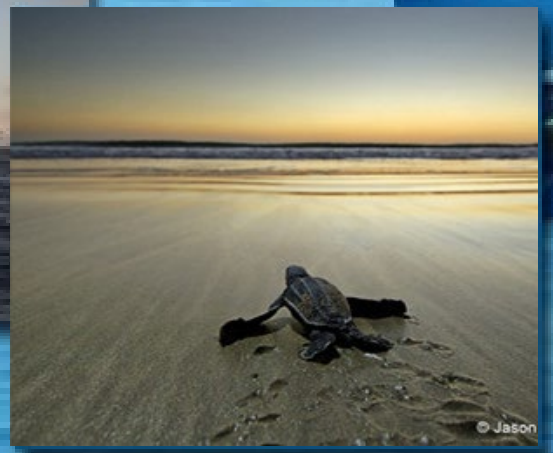
Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission



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A MACHINE LEARNING SPECIES DISTRIBUTION MODEL FOR THE CRITICALLY ENDANDERED EAST PACIFIC LEATHERBACK TURTLE (*DERMOCHELYS CORIACEA*)

Jon Lopez, Shane Griffiths, Bryan Wallace, Veronica Caceres, et al.

Document-Documento BYC-11-01

Data – Observations / Datos - observaciones

Summary of the observation data used in the model

Resumen the los datos utilizados en el modelo

No. Countries *Países*	No. Gears/ *Artes*	Range *Periodo*	Data type *Tipos de datos*	Effort *Esfuerzo*	No presences *presencias*	Total ind.	Total obs.	% av. Presences *Presencias*	Source *Fuente*
6 + IATTC	Several (LL, PS, gillnet, etc.)	1995 (2001)-2020	Abundance, presence only (Y/N)	Some	1,145	1,190	594,563	0.19	Various (observer, NGO, logbooks, etc.)

Data - Environmental information / Datos – variables ambientales

All available variable

Todas las variables disponibles

	Environmental									
Spatio-temporal	Surface						Subsurface			Static
	Abiotic	Sp. Res	T. Res	Biotic	Sp. Res	T. Res		Sp. Res	T. Res	
Latitude	SST	1/4	D	CHL	1/4	W	Temp 100m	1/4	D	Bathymetry
Longitude	Δ SST	1/4	D	Δ CHL	1/4	W	MLD	1/4	D	Distance to coast
Day of the year	Salinity	1/4	D							
	SSH	1/4	D							
	Speed	1/4	D							
	Heading	1/4	D							
	EkE	1/4	D							
	FSLE	1/25	D							
	Front index	1/4	W							

Methods – modelling / *Métodos - modelado*

Machine learning algorithm – Boosted Regression Trees
Algoritmo de aprendizaje automatizado – Arboles de regresión

Boosted Regression Trees

- Tune the models
- Simplify (if needed)
- K-fold (10, 75 vs 25)
- AUC/TSS/Dev

Hierarchical model building (all data)/ *Modelado jerarquizado*

- Spatio-temporal
- Surface
- Subsurface
- Environmental
- Static
- Full

Sensitivity analysis and Final Models / *Análisis de sensibilidad y modelos finales*

- Different presence/absence ratios
- 50% to 0.5%
- Compare different performance metrics
- Select candidates for final model(s)

Prediction / *Predicción*

- Daily since 2002 (>6500 days)
- Averages per year and prediction period

Ensemble models-predictions / *Modelos-predicciones conjuntas*

- Most likely models based on statistics and expert knowledge
- Estimate statistical threshold values
- Select final distribution map for EASI-Fish

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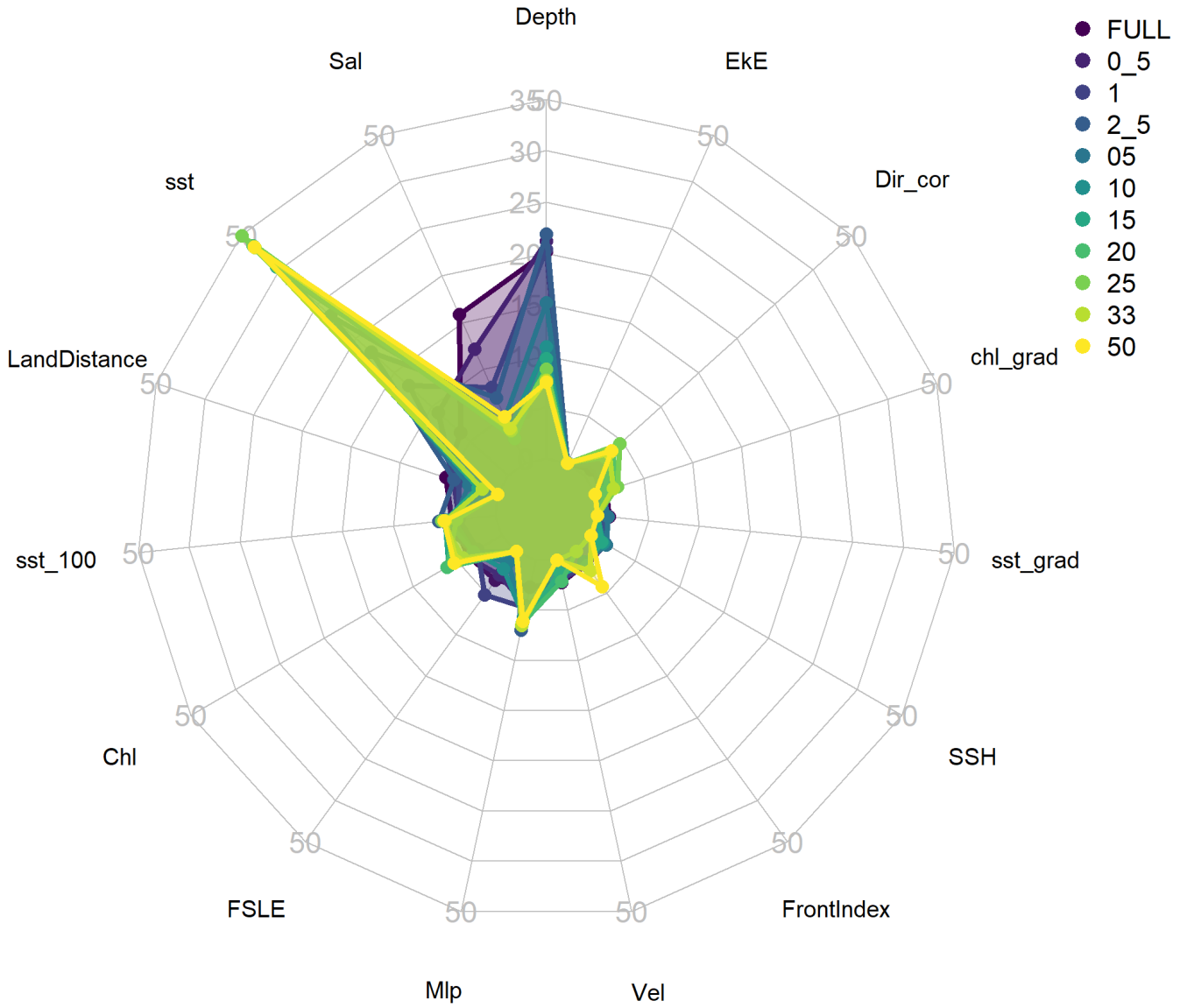
Results – performance metrics / *Resultados – métricas de desempeño*

		lr	n.trees	Dev	AUC	TSS	Drop
1	fit	0.01	4500	38.64	0.89	0.66	
ST	simp	-	-	-	-	-	No drop
2	fit	0.01	5150	32.28	-	-	
SUR	simp		5150	32.40	0.92	0.71	EkE
3	fit	0.01	3600	23.62	0.88	0.65	
SUB	simp	-	-	-	-	-	No drop
4	fit	0.01	5600	38.14	0.94	0.74	
ENV	simp	-	-	-	-	-	No drop
5	fit	0.01	4400	19.71	0.79	0.51	
STA	simp	-	-	-	-	-	No drop
6	fit	0.01	7000	40.57	0.94	0.76	
FULL	simp	-	-	-	-	-	No drop

Results – Sensitivity Analysis / *Resultados – Análisis de sensibilidad*

		lr	n.trees	Dev	AUC	TSS	Drop
50	fit	0.005	2900	58.10	-	-	
n = 2176	simp	0.005	3650	59.37	0.92	0.71	7 variables
33	fit	0.01	2050	59.16	-	-	
n = 3264	simp	0.01	2650	61.54	0.94	0.76	5 variables
25	fit	0.01	2700	59.70	-	-	
n = 4352	simp	0.01	3250	60.42	0.96	0.81	7 variables
20	fit	0.01	3200	60.29	-	-	
n = 5440	simp	0.01	3350	59.14	0.94	0.77	6 variables
15	fit	0.01	3950	60.21	-	-	
n = 7250	simp	0.01	3650	58.96	0.94	0.76	3 variables
10	fit	0.01	5050	60.93	-	-	
n = 10880	simp	0.01	4800	60.16	0.95	0.78	2
5	fit	0.01	5300	56.36	0.95	0.78	
n = 21760	simp	-	-	-	-	-	No drop
2.5	fit	0.01	6400	54.67	-	-	
n = 43520	simp	0.01	5650	52.08	0.95	0.77	7 variables
1	fit	0.01	6650	49.24	0.94	0.78	
n = 108800	simp	-	-	-	-	-	No drop
0.5	fit	0.01	6100	45.23	0.94	0.76	
n = 217600	simp	-	-	-	-	-	No drop
0.19	fit	0.01	7000	40.57	0.94	0.76	
n = 573889	simp	-	-	-	-	-	No drop

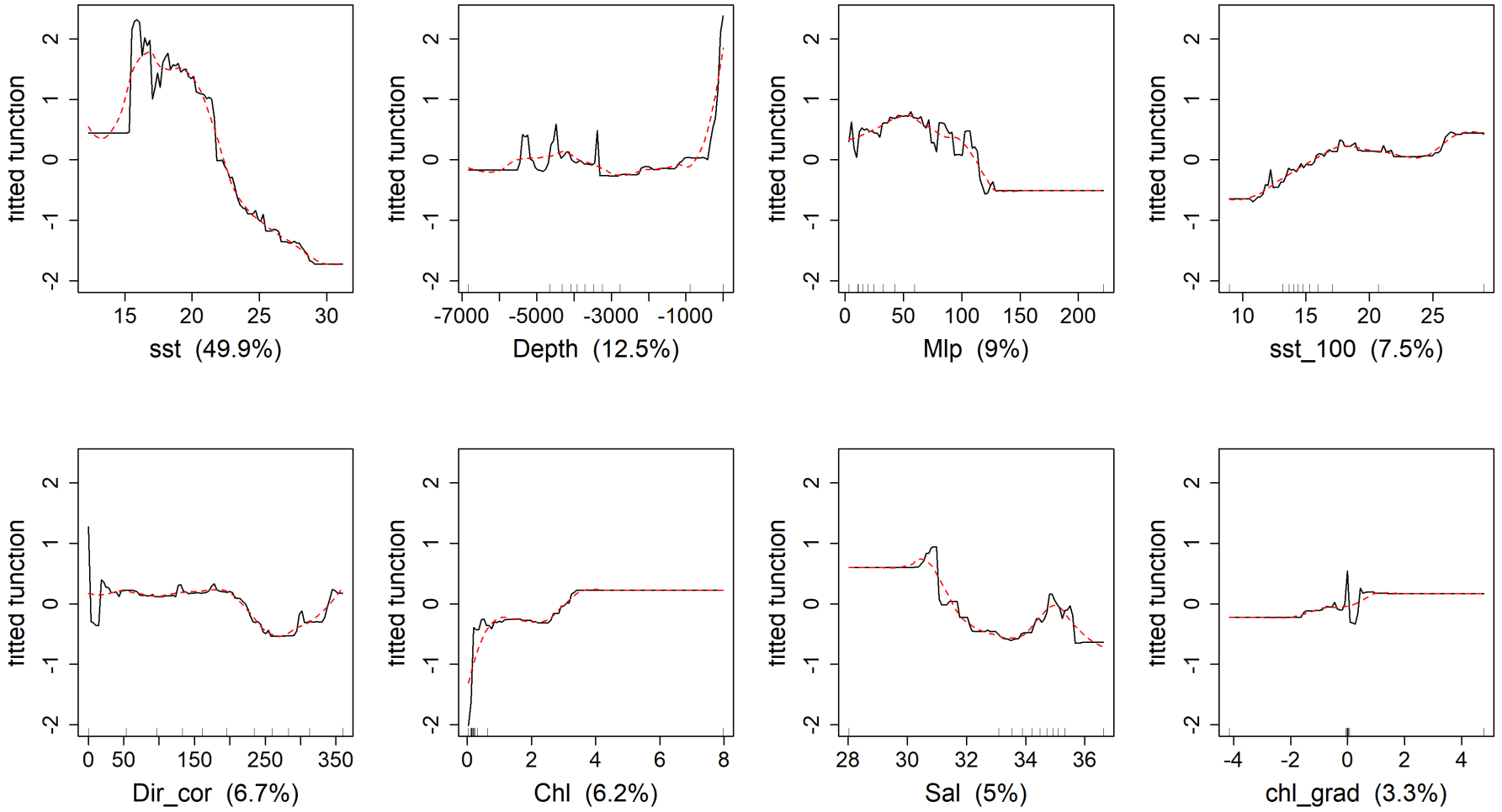
Results – variable importance / *Resultados – importancia de las variables*



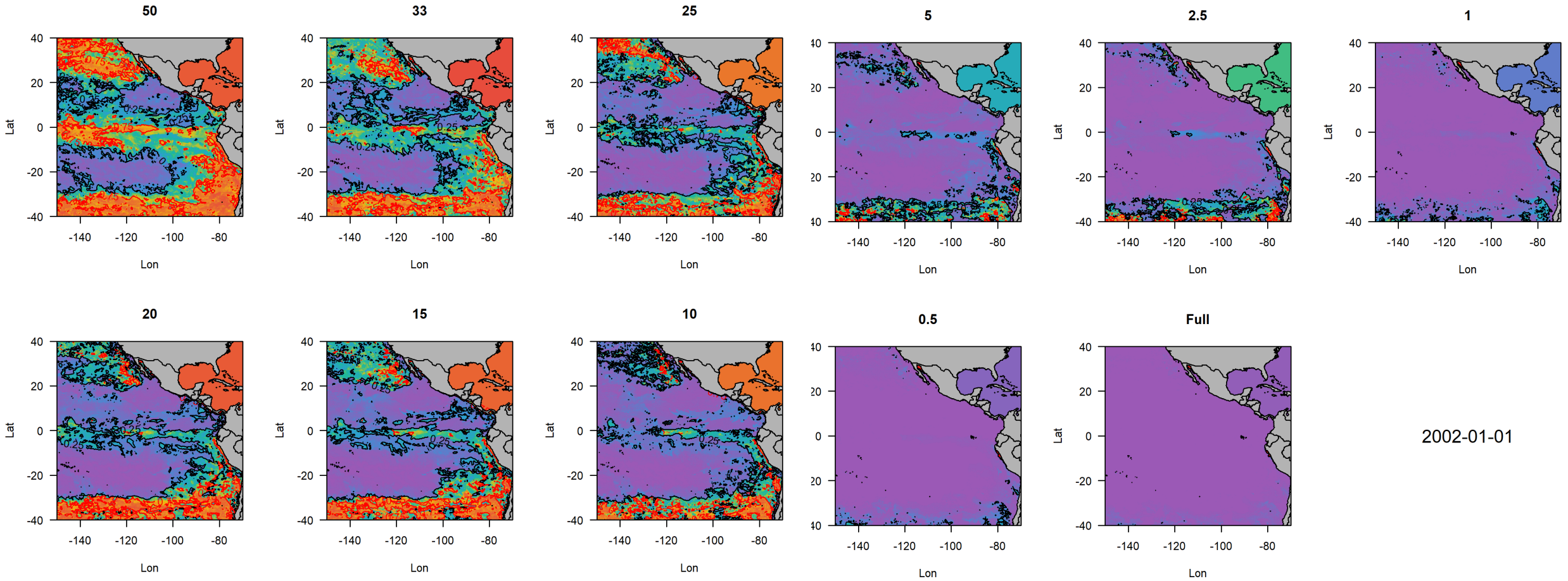
Results – partial dependence plots / *Resultados – figuras de dependencia parcial*

Example – 25% presence-absence ratio model

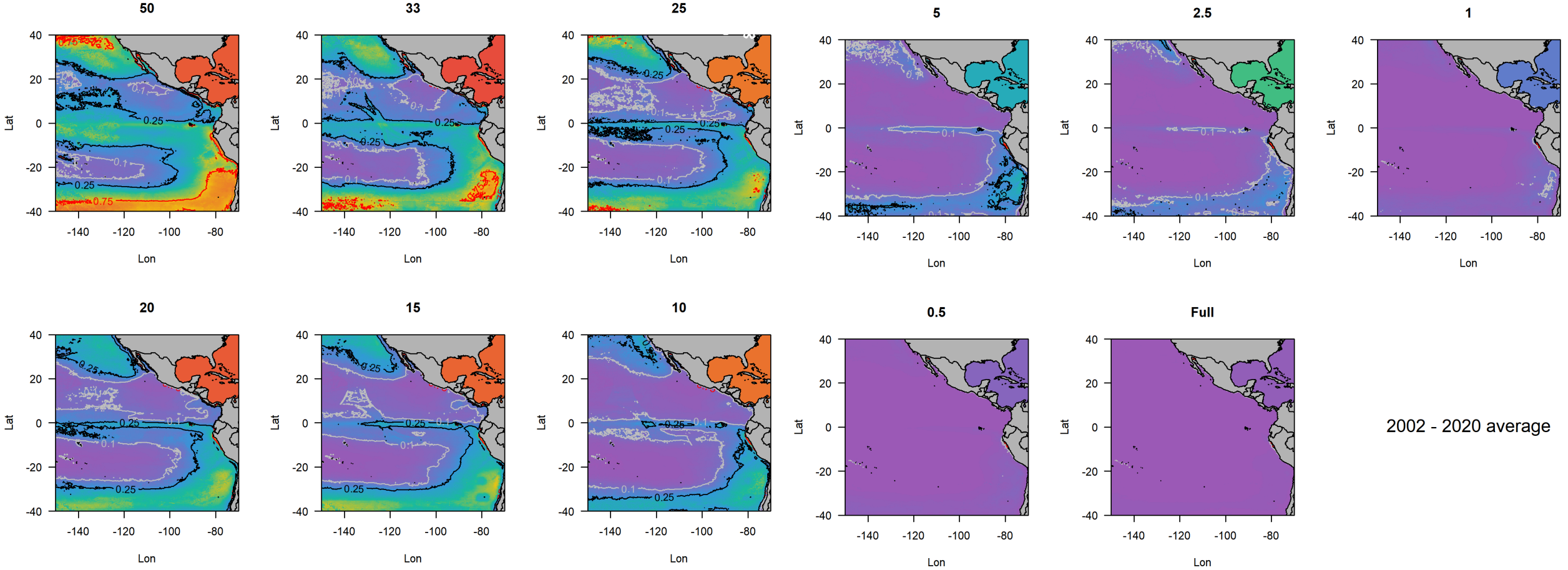
Ejemplo – modelo con un ratio de presencia-ausencia del 25%



Results – daily predictions / *Resultados – predicciones diarias*

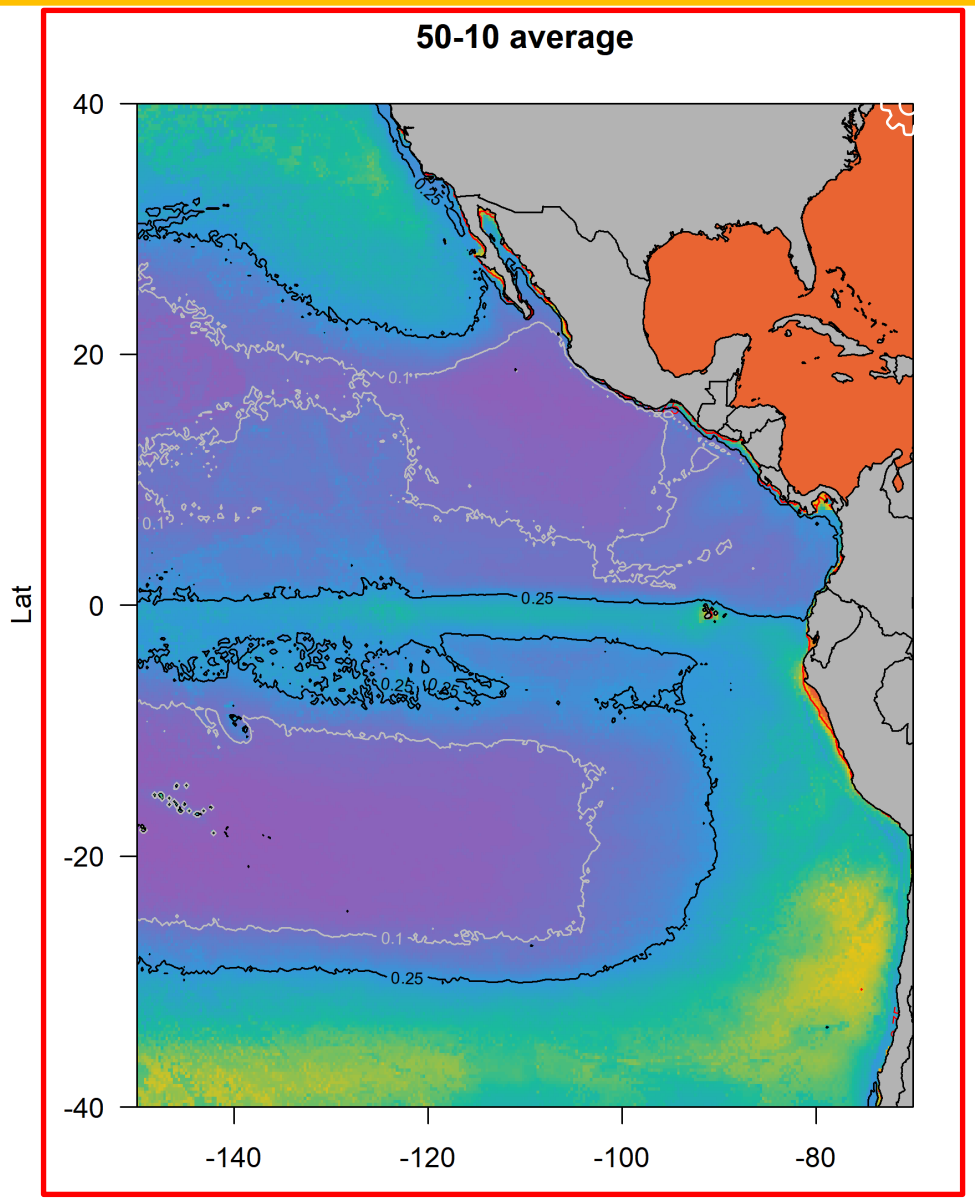


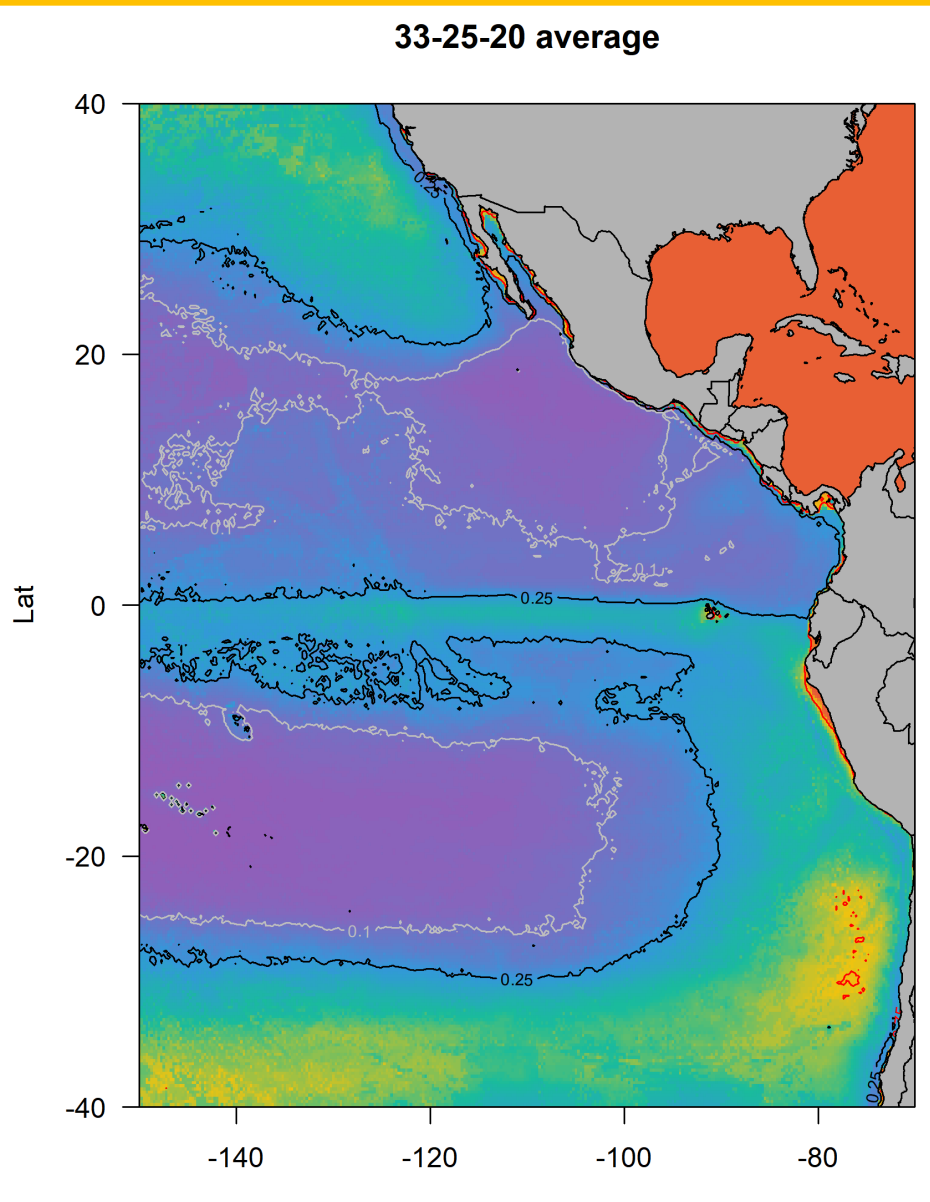
Results – average predictions / *Resultados – predicciones medias* (2002-2020)



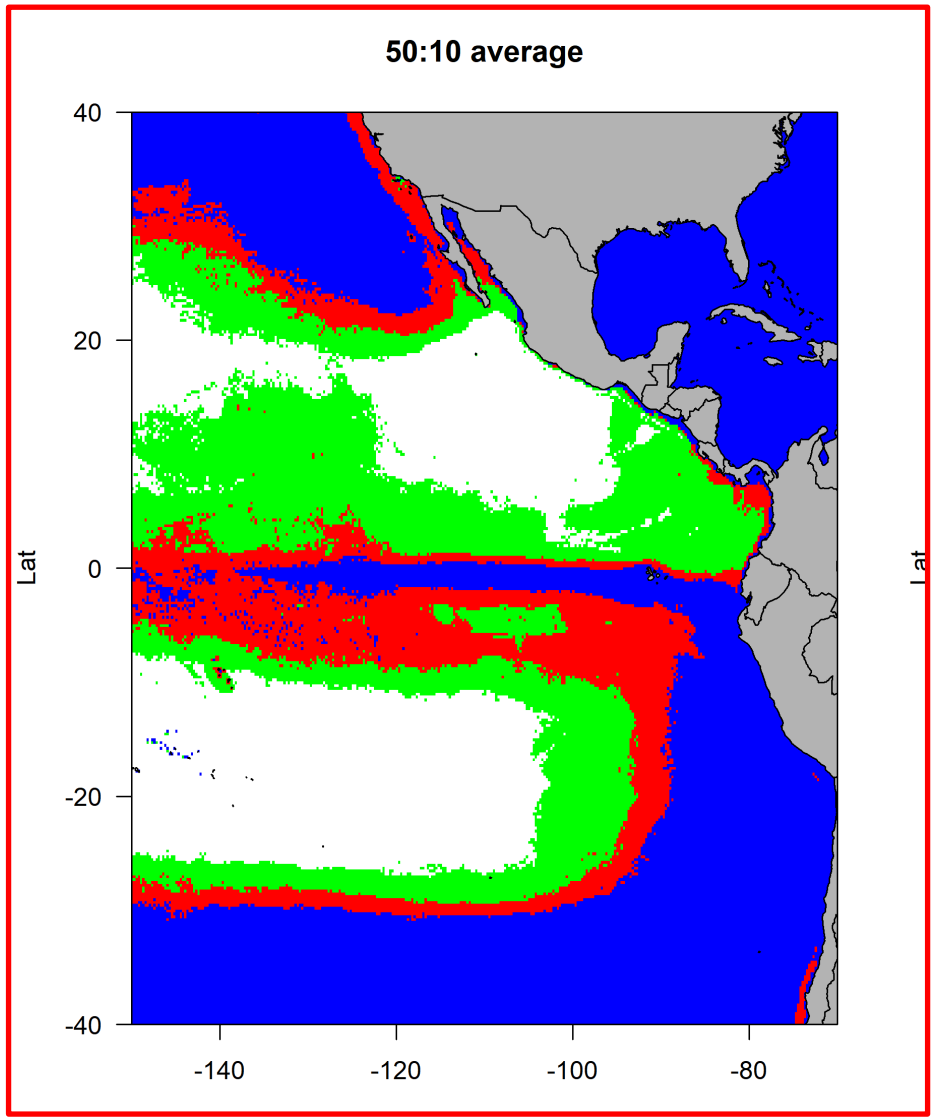
2002 - 2020 average

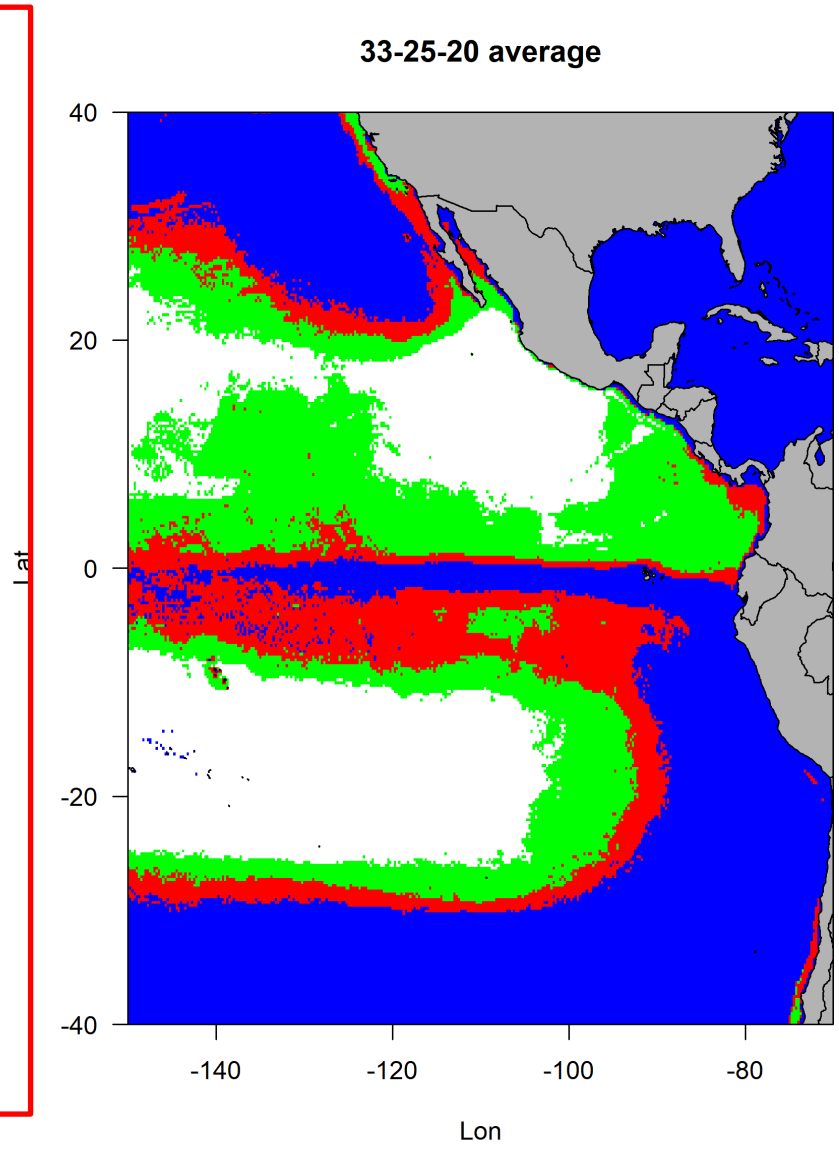
Results – ensemble predictions / *Resultados – predicciones conjuntas*





Results – ensemble predictions / *Resultados – predicciones conjuntas*





Thresholds:
0.1 – Green
0.2 – Red
0.3 – Blue

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Inter-American Convention for the Protection and Conservation of Sea Turtles
Convención Interamericana para la Protección y la Conservación de las Tortugas Marinas
Convenção Interamericana para a Proteção e a Conservação das Tartarugas Marinhas

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Questions? / Preguntas?

Photo: WWF