

# Tropicalización del Pacífico oriental y otras escalas de variación para el diseño de modelos de distribución de megafauna

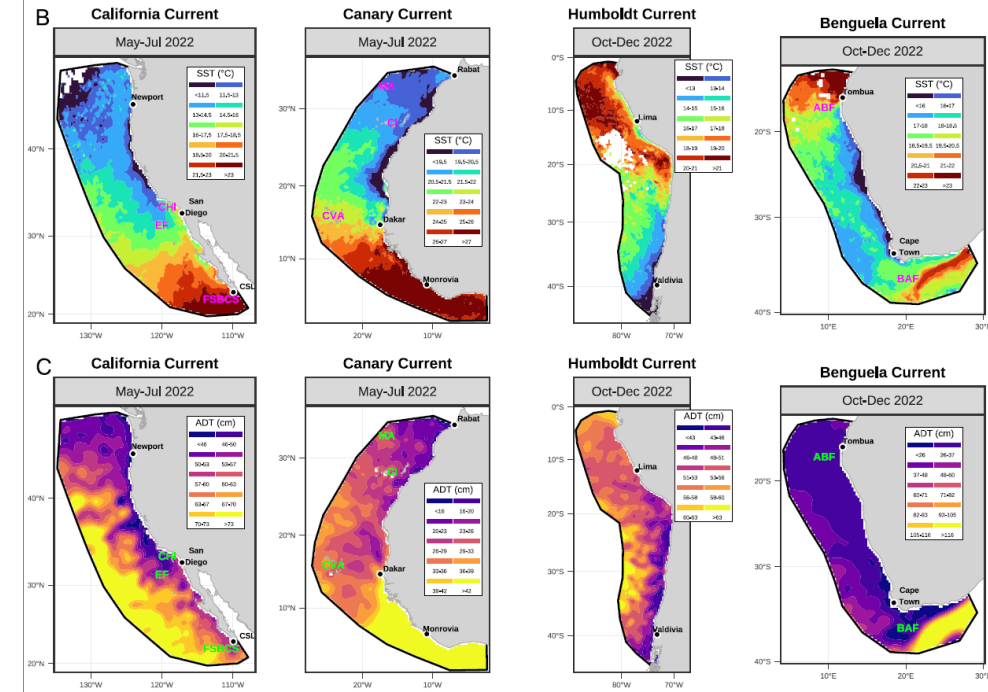
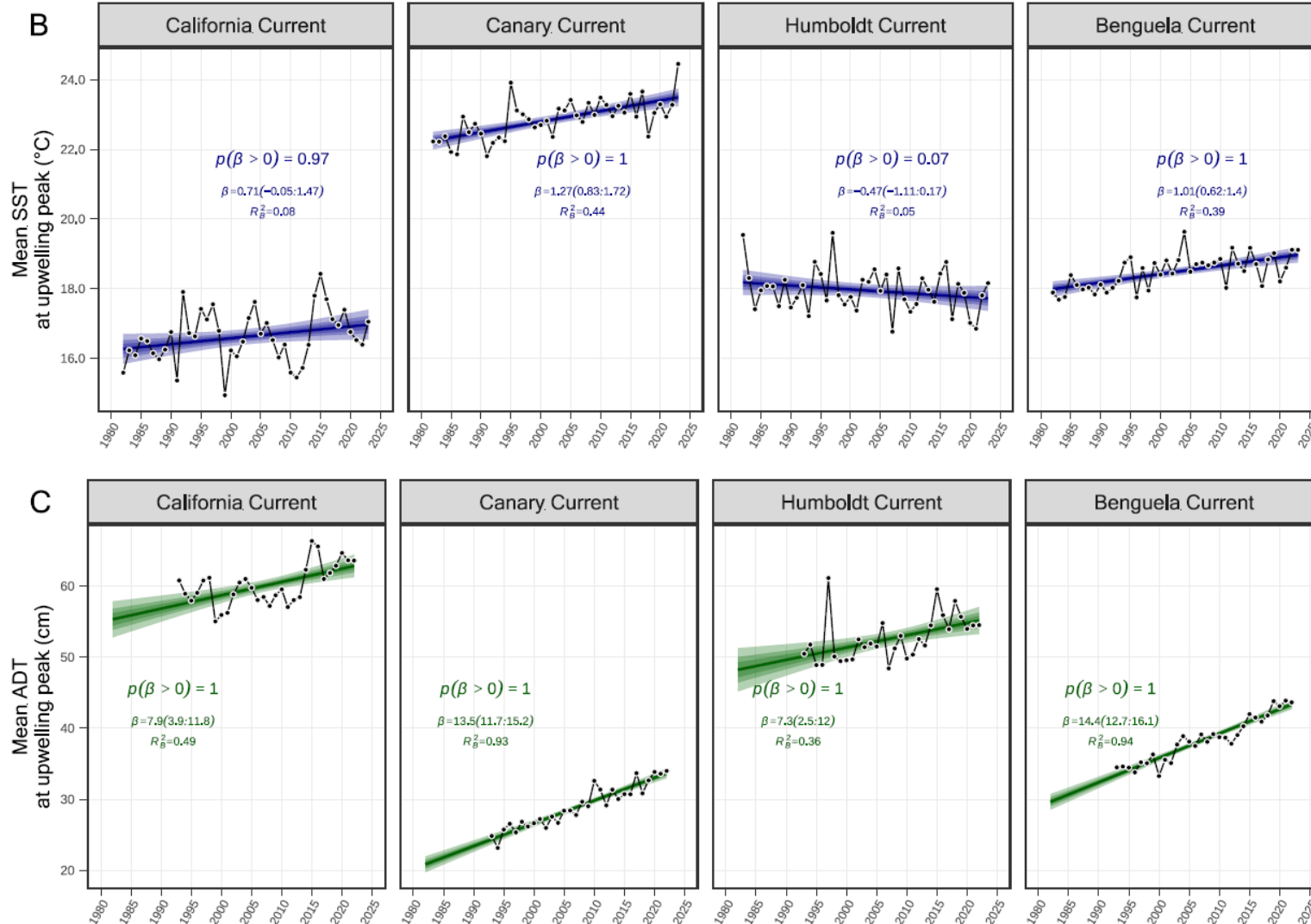
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# Is the surface temperature increasing?



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Multidecadal loss of surface thermal structure in the largest marine upwelling ecosystems

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Mario A. Pardo, Emilio Beier

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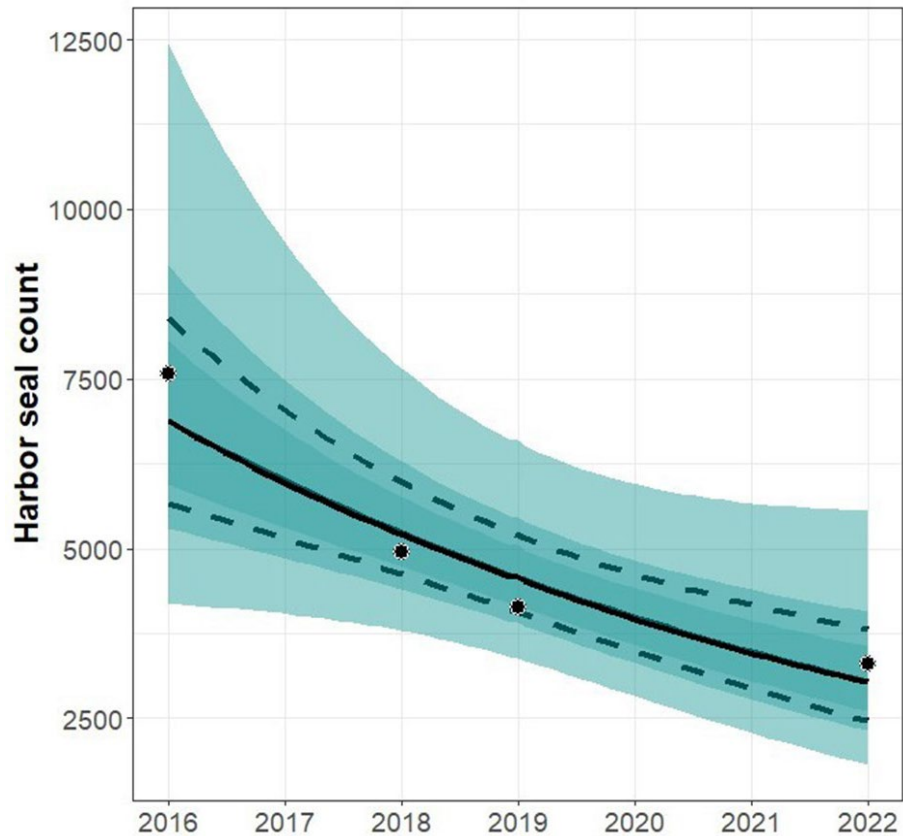
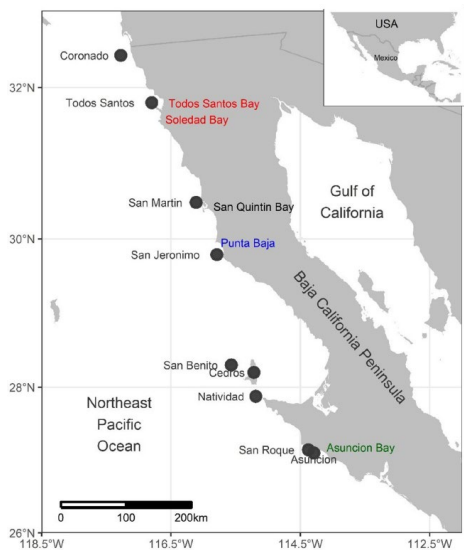
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4 Mario A. Pardo<sup>1\*</sup> & Emilio Beier<sup>2</sup>

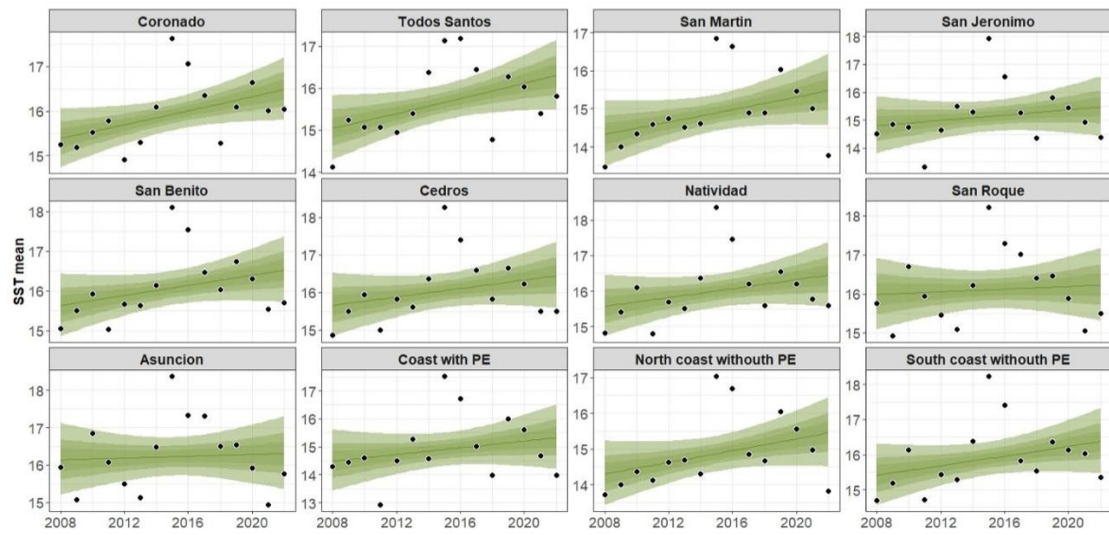
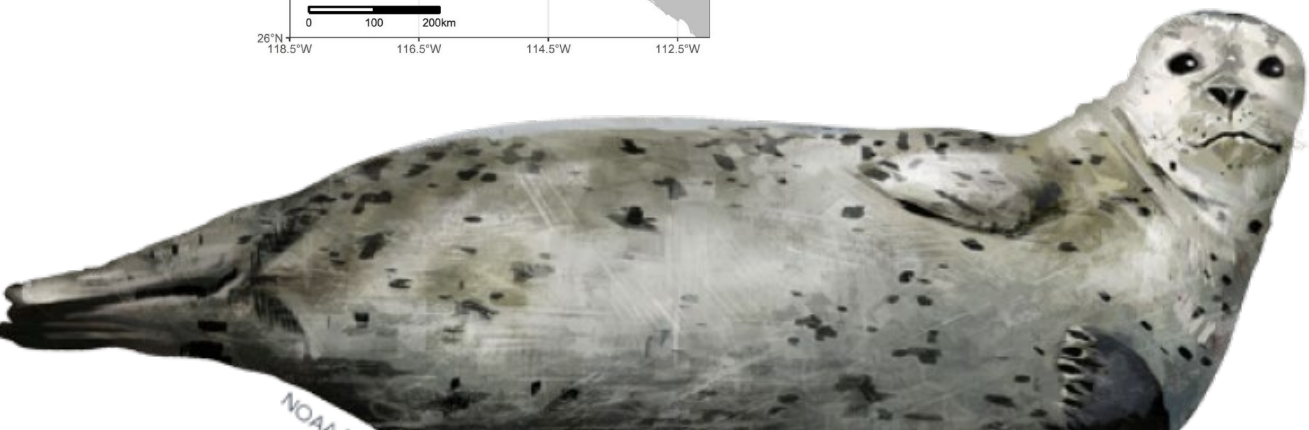


# Decrease in Pacific harbor seal counts in the Southern California current large marine ecosystem

María Guadalupe Ruiz-Mar<sup>1</sup> · Mario A. Pardo<sup>2</sup> · Yolanda Schramm<sup>3</sup> ·  
Denise Lubinsky-Jinich<sup>3</sup> · Alejandro Arias-Del-Razo<sup>4</sup> · Sofía Daniela Flores-  
Mejía<sup>4</sup> · Gisela Heckel<sup>4</sup>

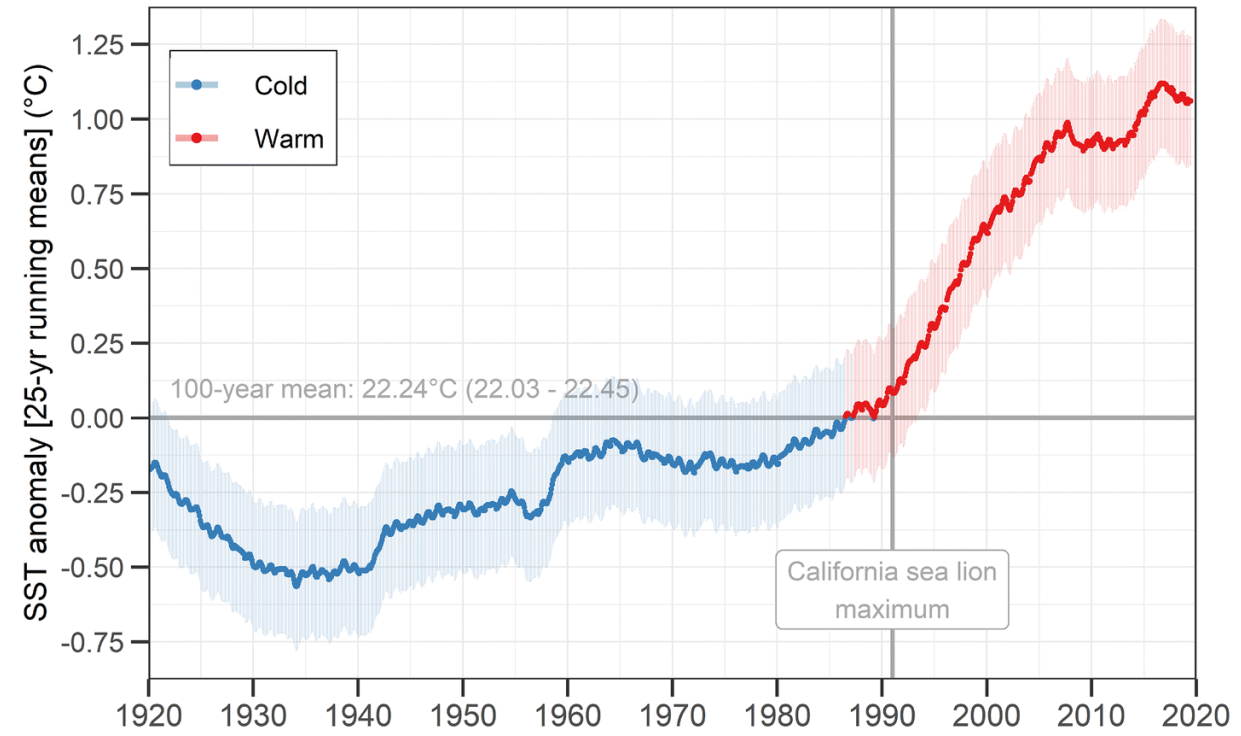
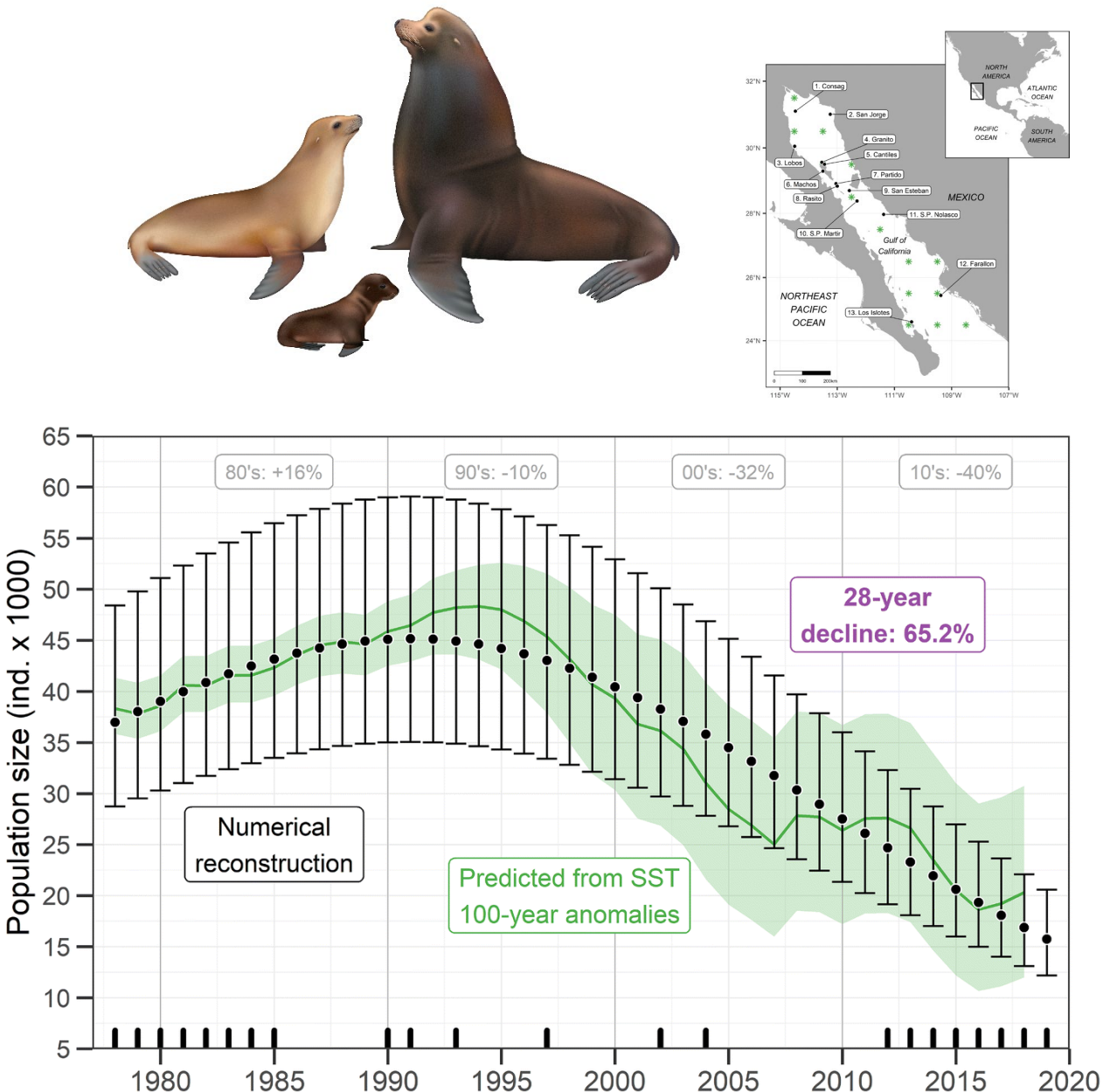


The boundaries of  
the population  
indicate  
retraction





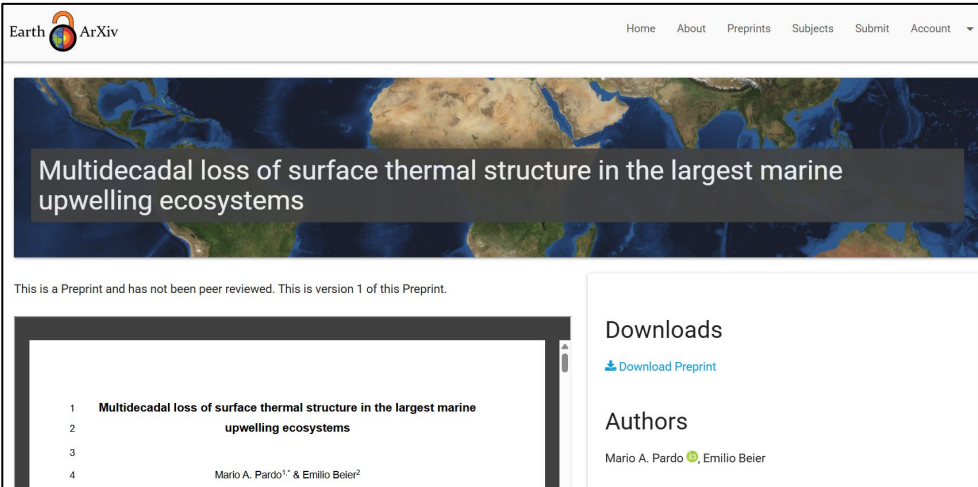
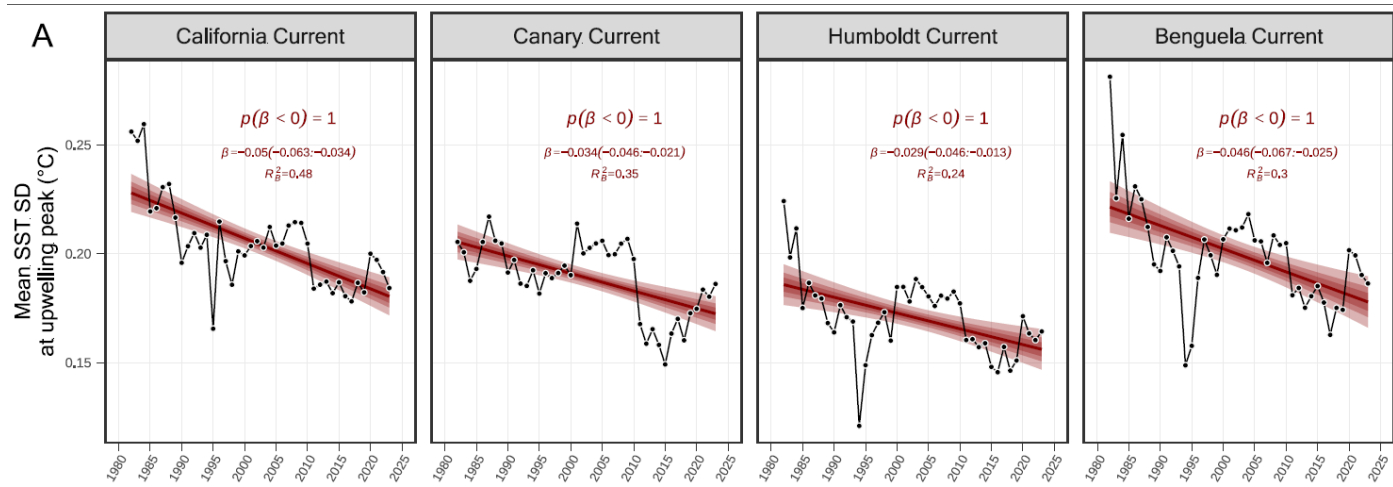
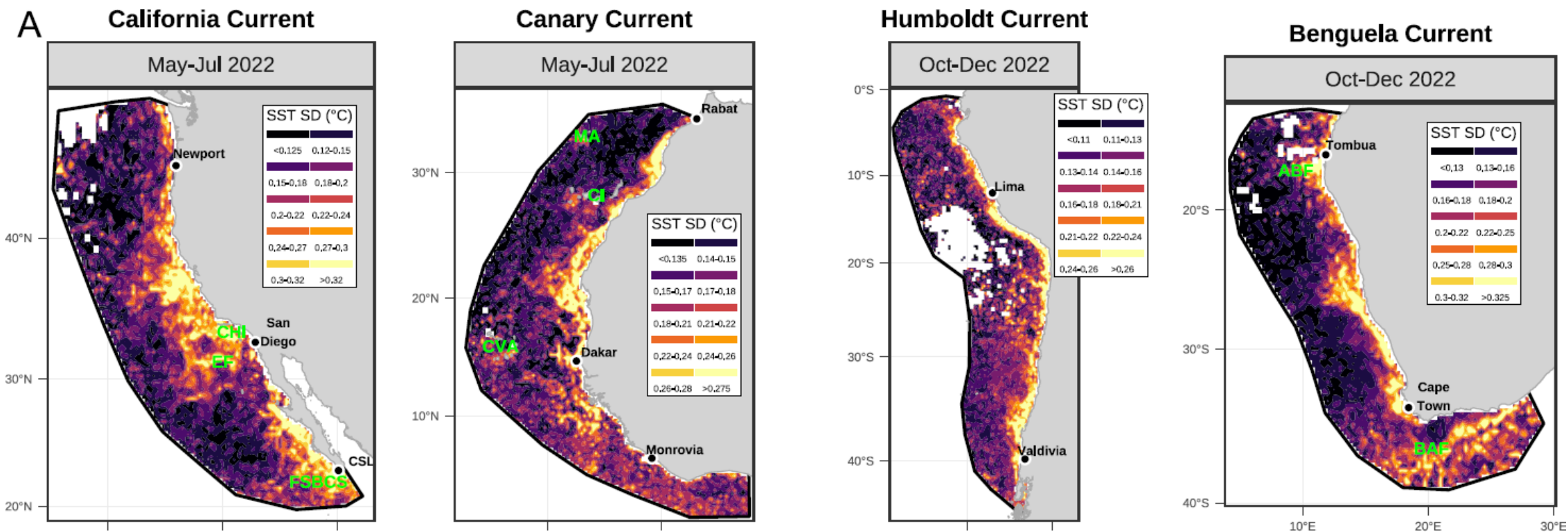
# Diversification of fish species depletes a sea lion population?



**The demographic decline of a sea lion population followed multi-decadal sea surface warming**

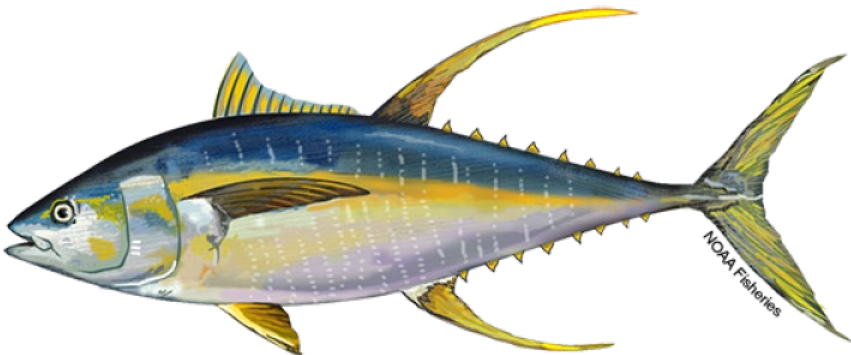
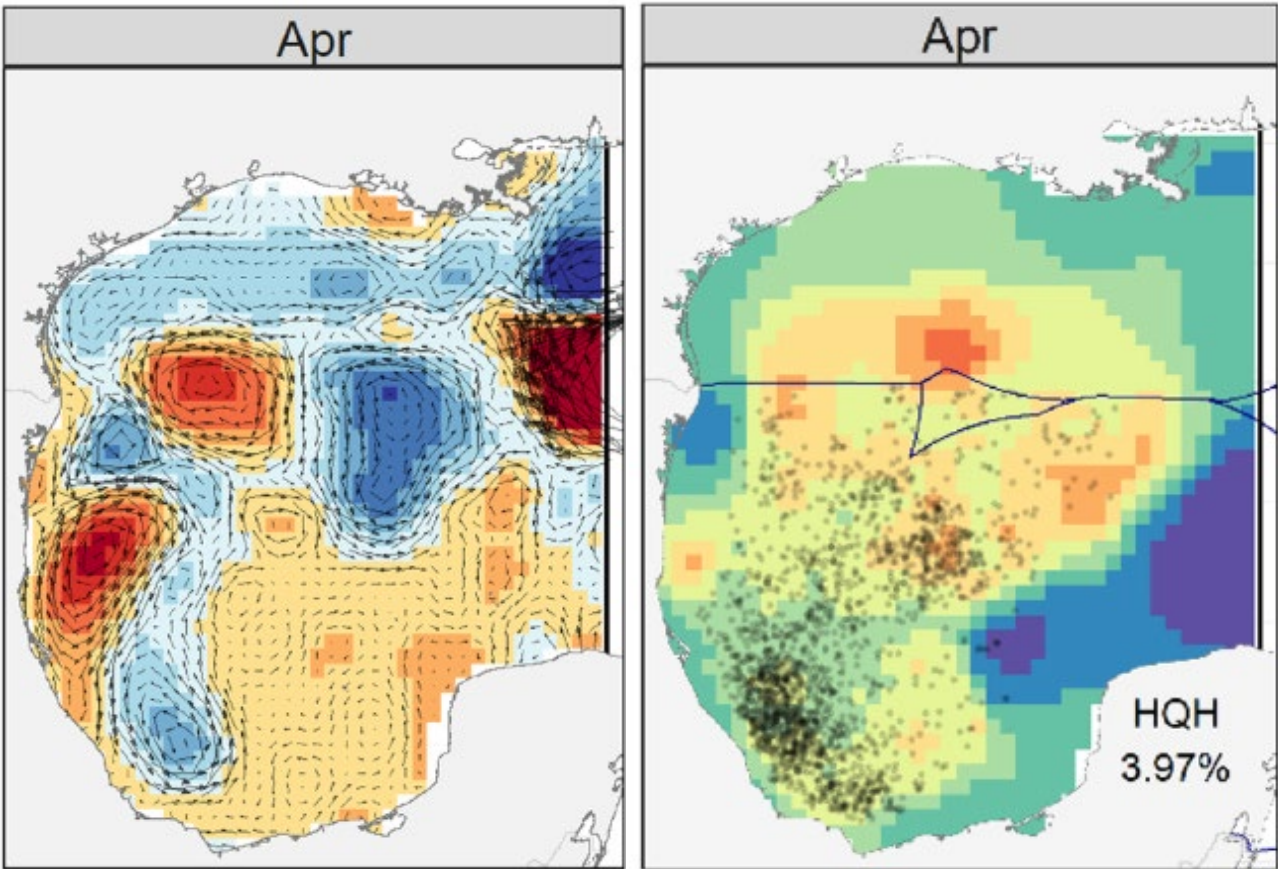
Karen Adame<sup>1,2</sup>, Fernando R. Elorriaga-Verplancken<sup>2</sup>, Emilio Beier<sup>1</sup>, Karina Acevedo-Whitehouse<sup>3</sup> & Mario A. Pardo<sup>4</sup>

# A mix: long-term trends and local heterogeneity





# Effects of altimetry anomalies on yellowfin tuna distribution

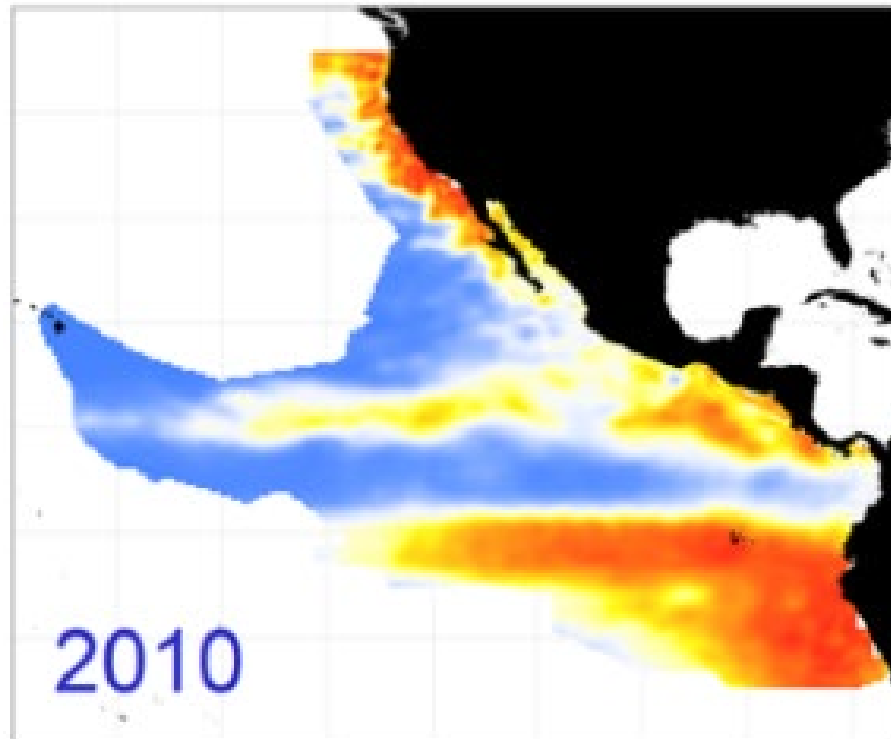
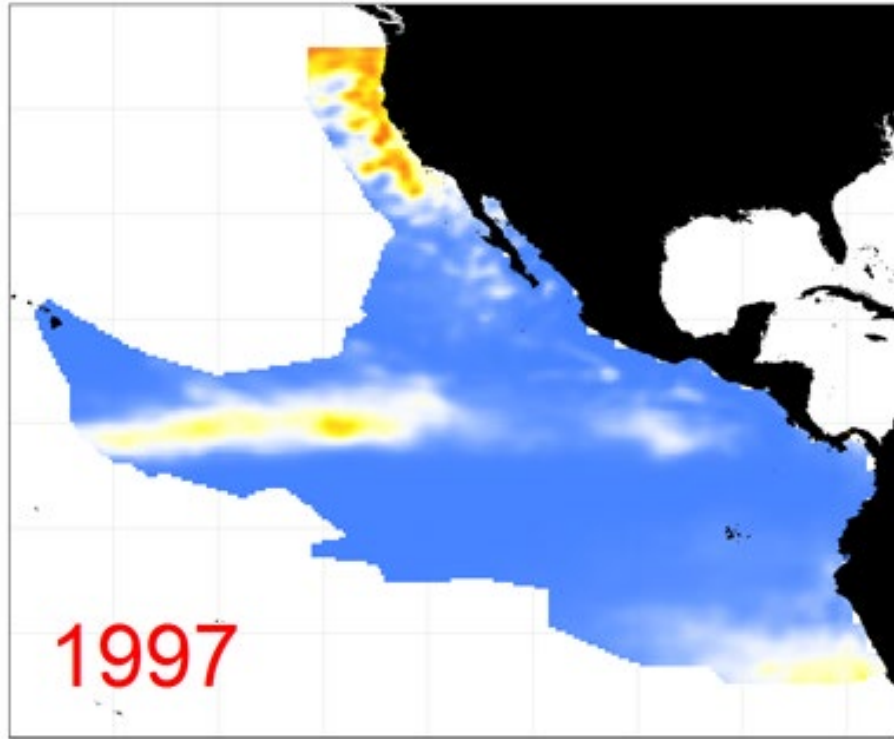
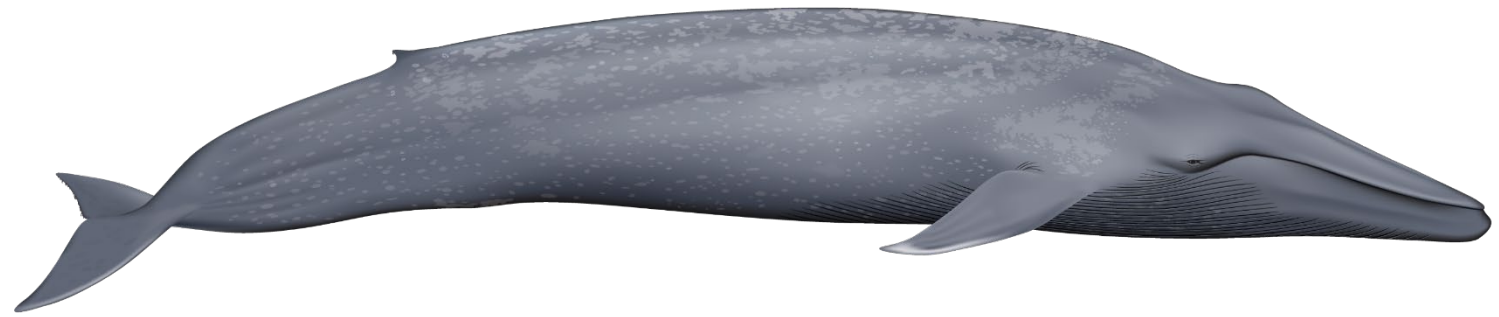


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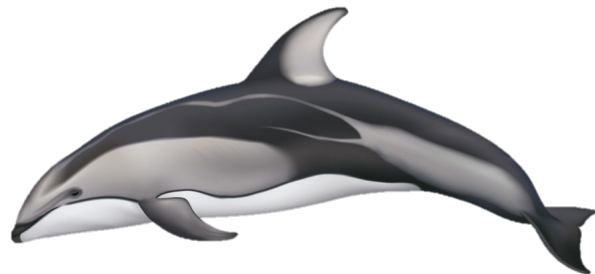
OPEN Mesoscale activity drives the habitat suitability of yellowfin tuna in the Gulf of Mexico

Zurisaday Ramírez-Mendoza<sup>1</sup>, Oscar Sosa-Nishizaki<sup>1</sup>, Mario A. Pardo<sup>2,3</sup>, Sharon Z. Herzka<sup>3</sup>, R. J. David Wells<sup>4,5</sup>, Jay R. Rooker<sup>4,5</sup>, Brett J. Falterman<sup>6</sup> & Michel J. Dreyfus-León<sup>7</sup>

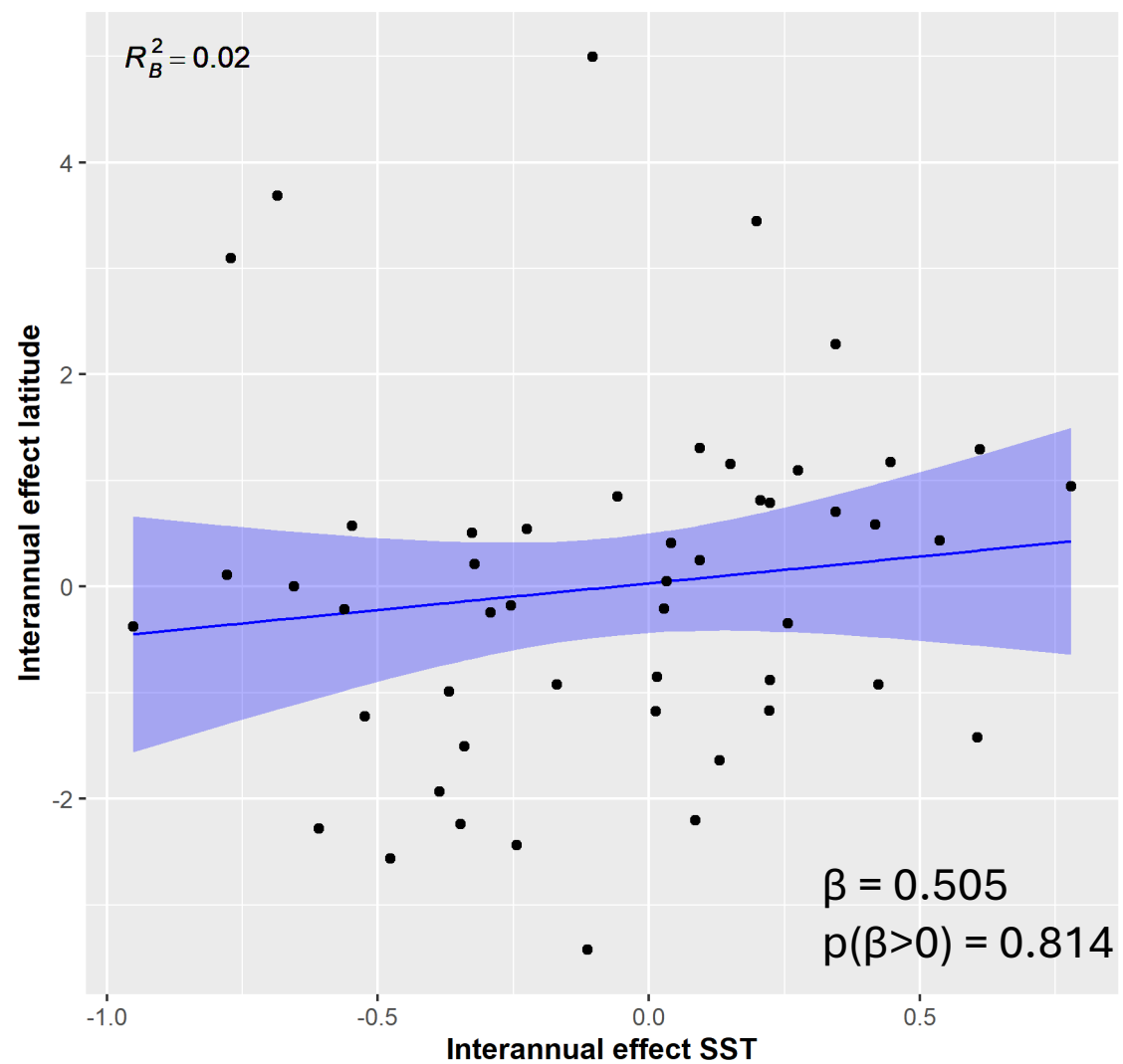
## Interannual events



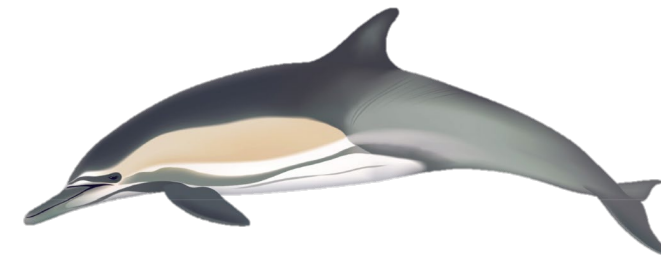
## Interannual events



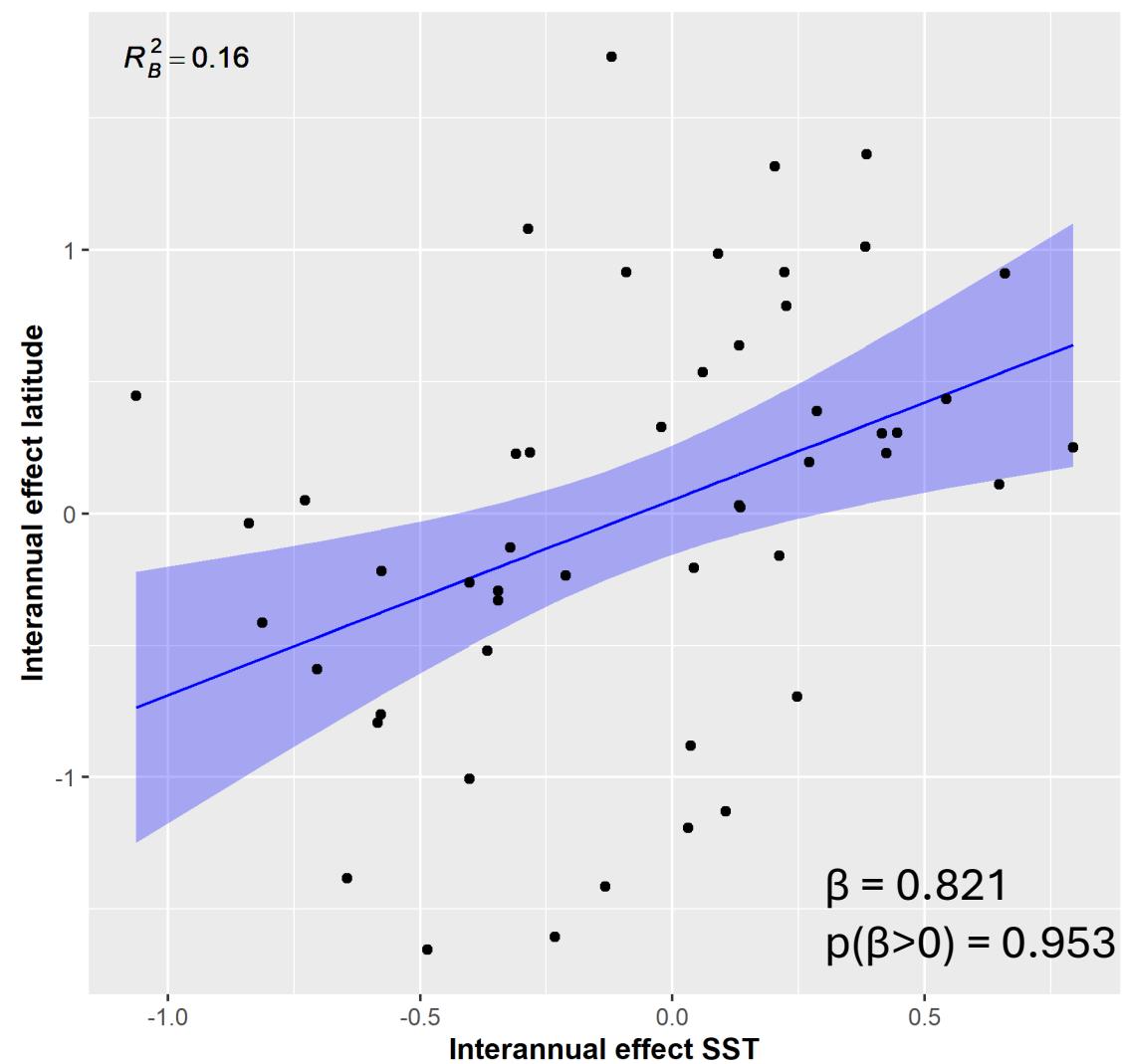
Lagenorhynchus obliquidens - California Current System



Llapapasca et al. (en prep.)

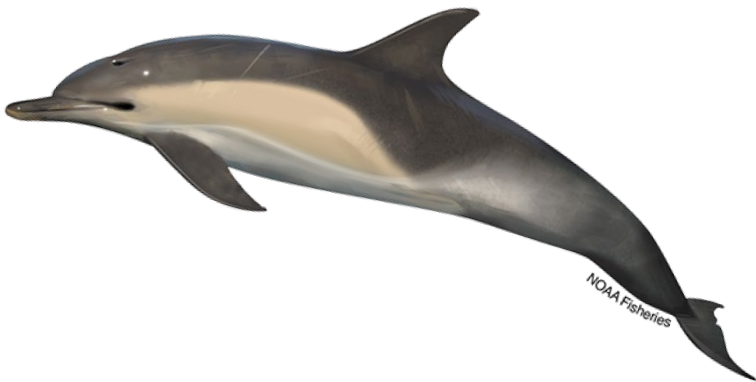
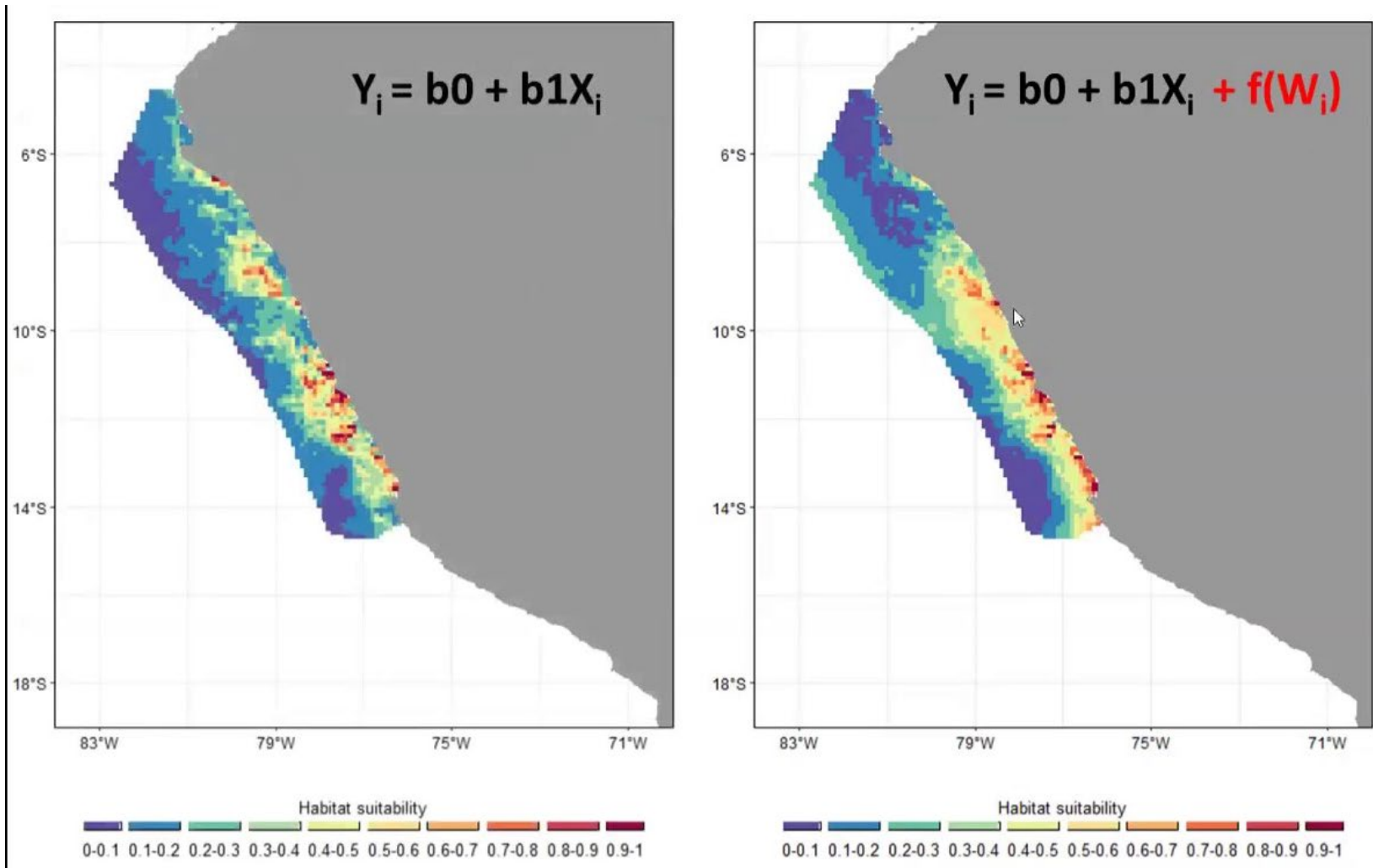


Delphinus delphis - California Current System





Not less important: Spatial autocorrelation of data:



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The oxygen minimum zone  
relative depth is a key driver of  
dolphin habitats in the northern  
Humboldt Current System

Miguel A. Llapapasca<sup>1</sup>, Mario A. Pardo<sup>2\*</sup>, Daniel Grados<sup>3</sup>  
and Javier Quiñones<sup>3</sup>

## Recommendations for future distribution models:

1. Incorporate isolated scales of variations in mixed-effects models (temporal and spatial).
2. Incorporate spatial autocorrelations of variables (response and predictors).
3. Project changes under different scenarios.

# Muchas gracias!



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