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## Where, when and why: modelling the distribution and habitat of deep-diving cetaceans incorporating variables depicting the deep oceanic layers

Auriane Virgili, Valentin Teillard, Ghislain Doremus, Timothy E. Dunn, Sophie Laran, Mark Lewis, Maite Louzao, Jose A. Martínez-Cedeira, Emeline Pettex, Leire Ruiz Sancho, et al.

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# Where, when and why: modelling the distribution and habitat of deep-diving cetaceans incorporating variables depicting the deep oceanic layers



24th Biennial Conference on the  
Biology of Marine Mammals  
Palm Beach, Florida - August 1-5, 2022

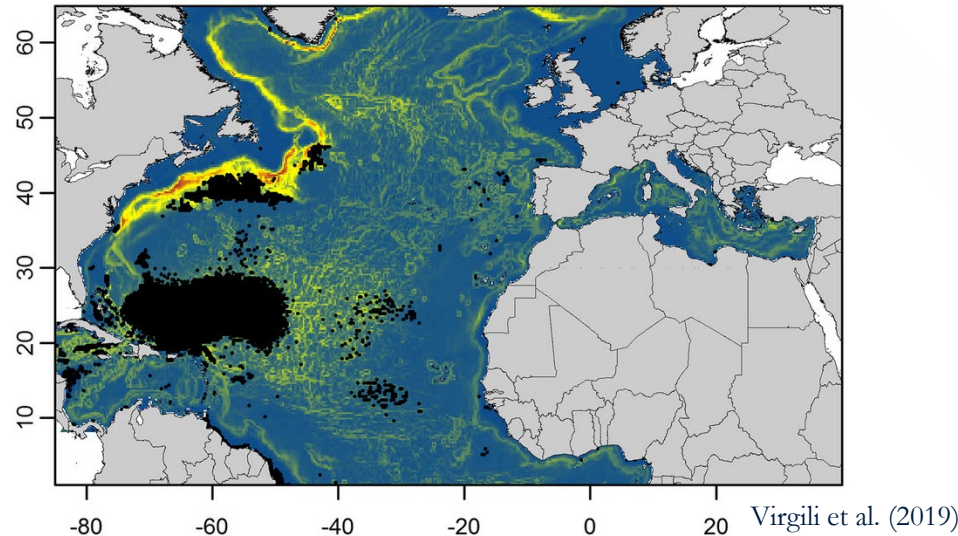
SMM conference – August 1-5, 2022

Virgili, A., Teillard, V., Dorémus, G., Dunn, T.E., Laran, S., Lewis, M., Louzao, M., Martínez-Cedeira, J., Pettex, E., Ruiz, L., Saavedra, C., Van Canneyt, O., Vázquez Bonales, J.A., Ridoux, V.



# Context

- Species distribution models are commonly used with static and surface dynamic environmental variables to predict top predator distributions

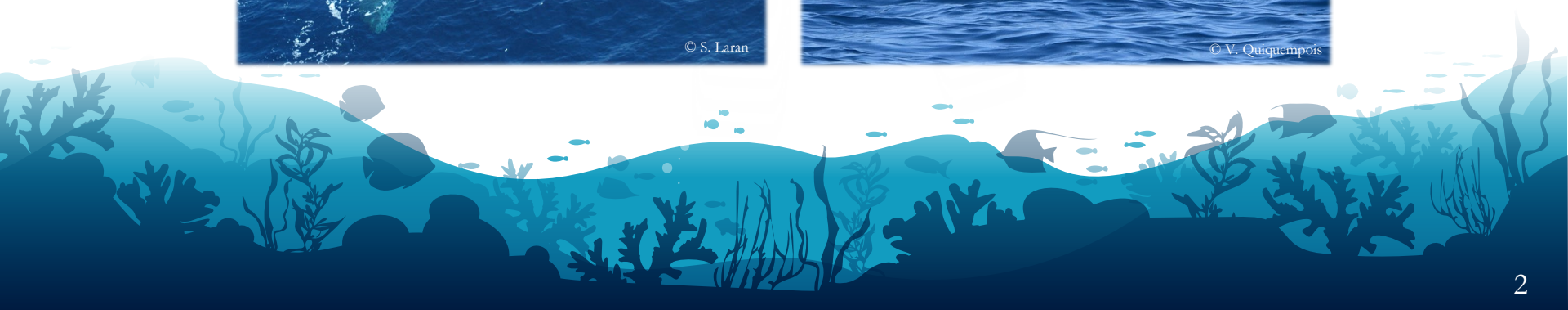




# Context

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- Species distribution models are commonly used with static and surface dynamic environmental variables to predict top predator distributions
- Deep-divers spend most of their time in deep waters to feed





# Context

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- Species distribution models are commonly used with static and surface dynamic environmental variables to predict top predator distributions
- Deep-divers spend most of their time in deep waters to feed
- The use of surface variables may limit the ability to correctly infer their habitats through habitat models

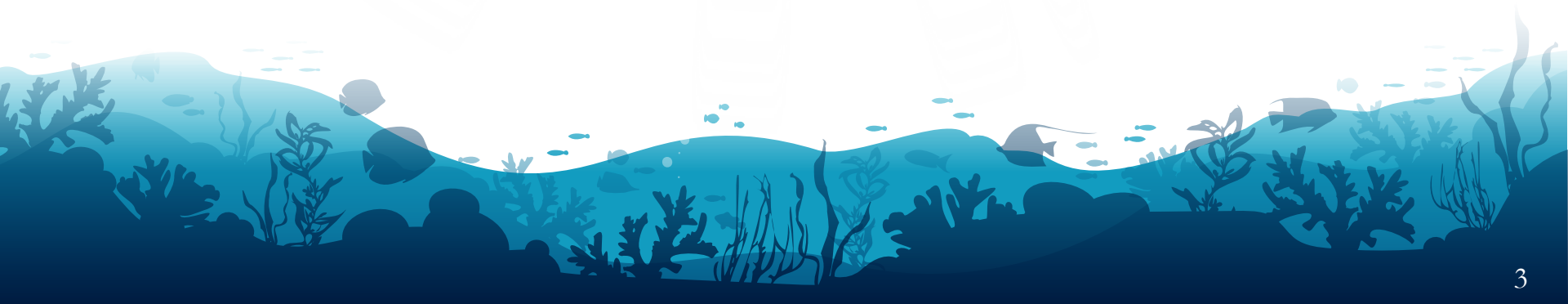




# Objective

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Combining static and dynamic variables integrated over different depth classes of the water column to model the distribution of deep-diving cetaceans



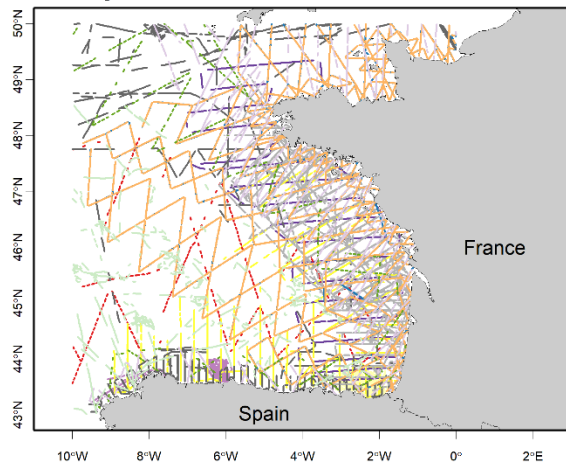


# Methods

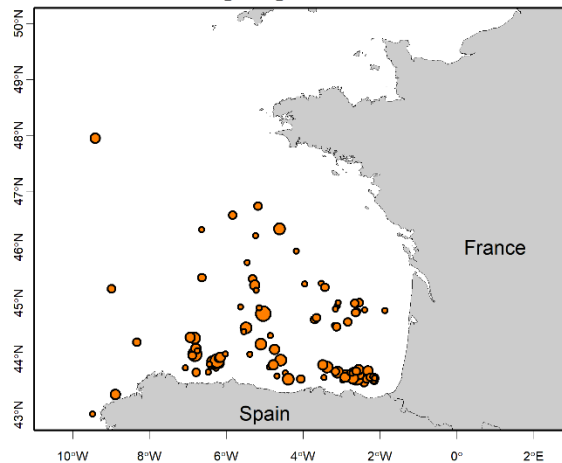


## ❖ Effort and sighting data

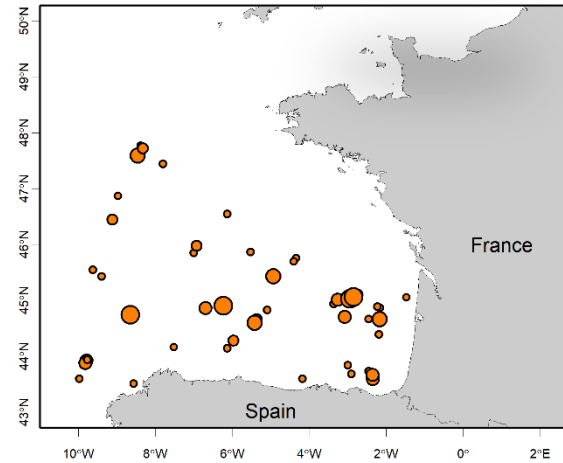
a/ Study area



b/ Beaked whale sightings



c/ Sperm whale sightings



Survey groups

— AMBAR  
— ATLANCET  
— CODA  
— INDEMARES  
— JNCC-ESAS

— JUVENA  
— PELACUS  
— PELGAS  
— SAMM1-WINTER  
— SAMM1-SUMMER

— SCANS2  
— SCANS3  
— THUNNUS

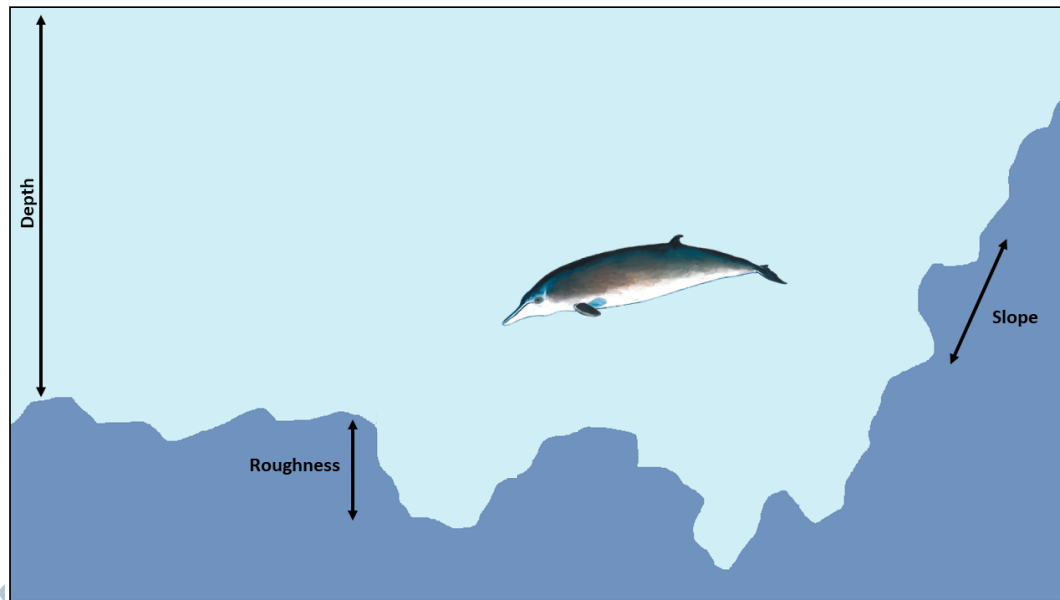
Group size (number of individuals)

• 1   • [2;4]   • [5;10]   • 10+



# Methods

## ❖ Environmental variables

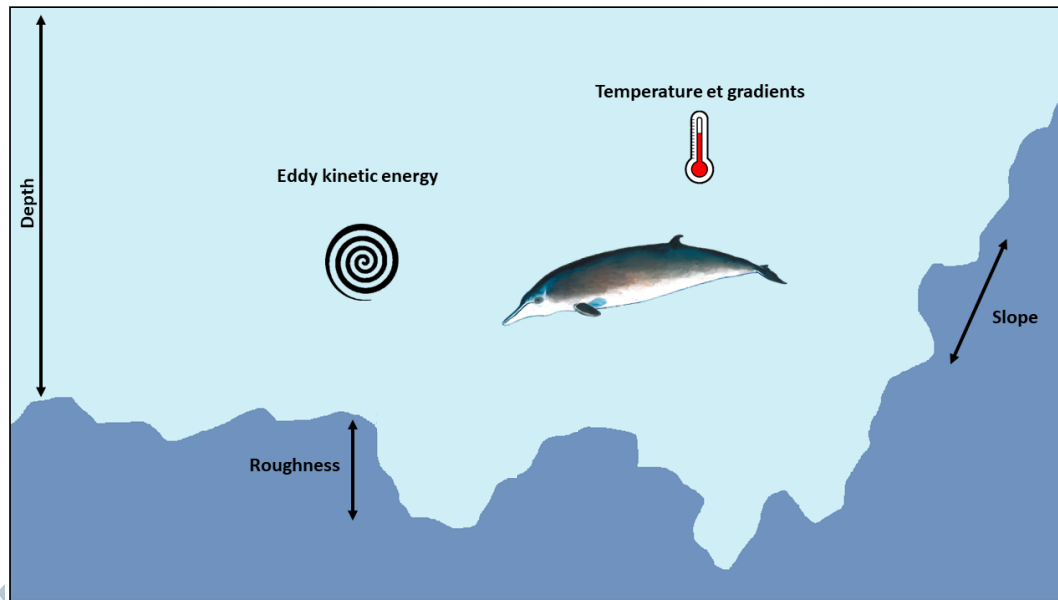






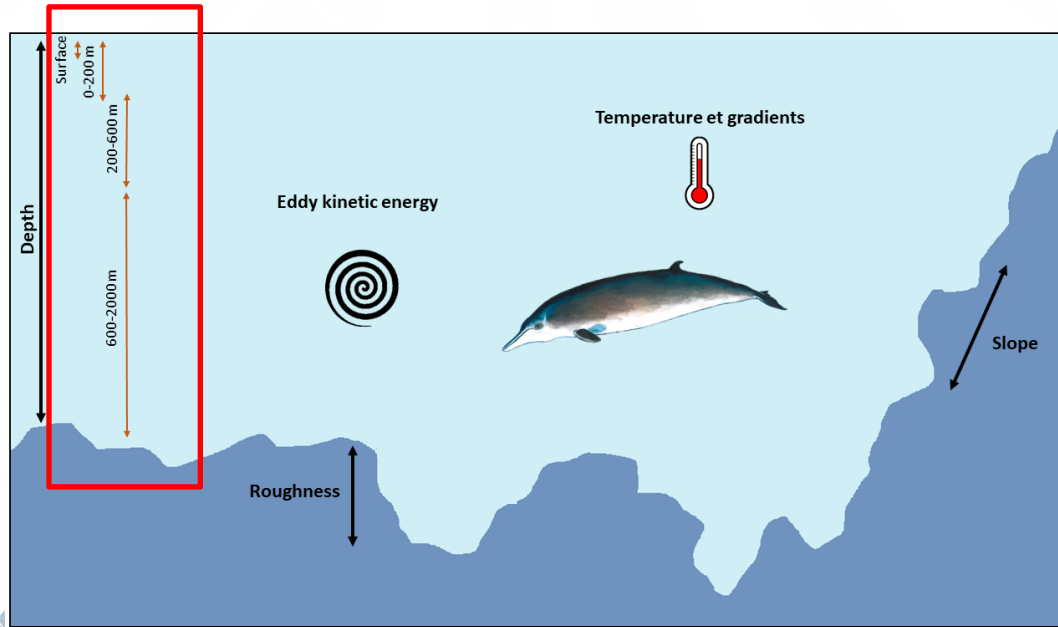
# Methods

## ❖ Environmental variables



# Methods

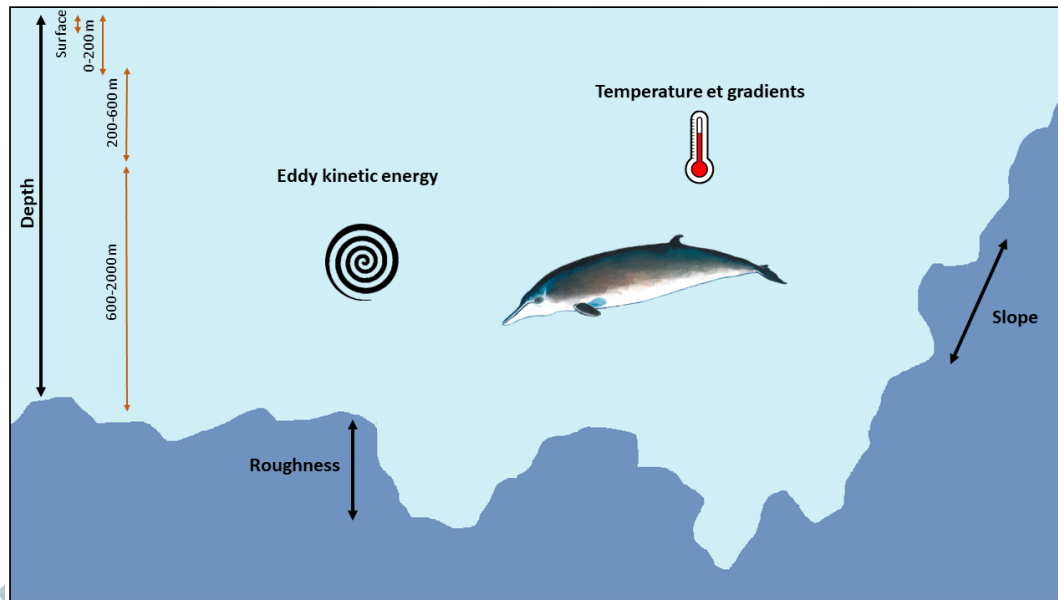
## ❖ Environmental variables





# Methods

## ❖ Models



Sightings



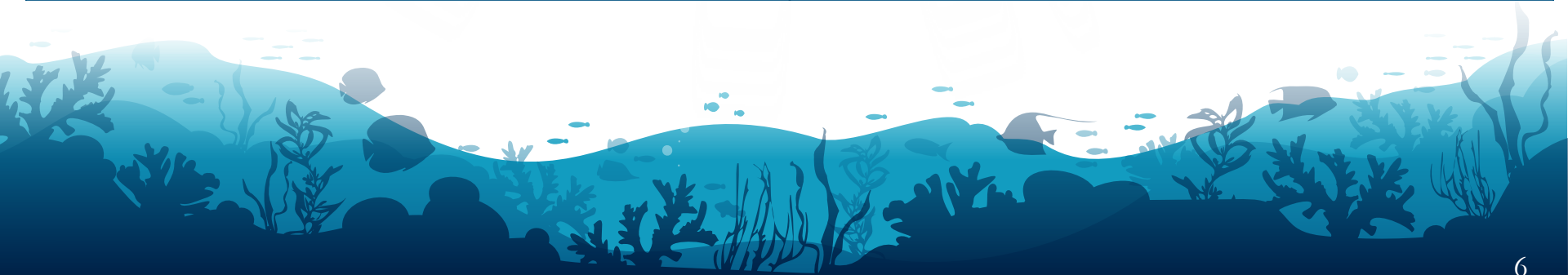
**GAMs**



# Results

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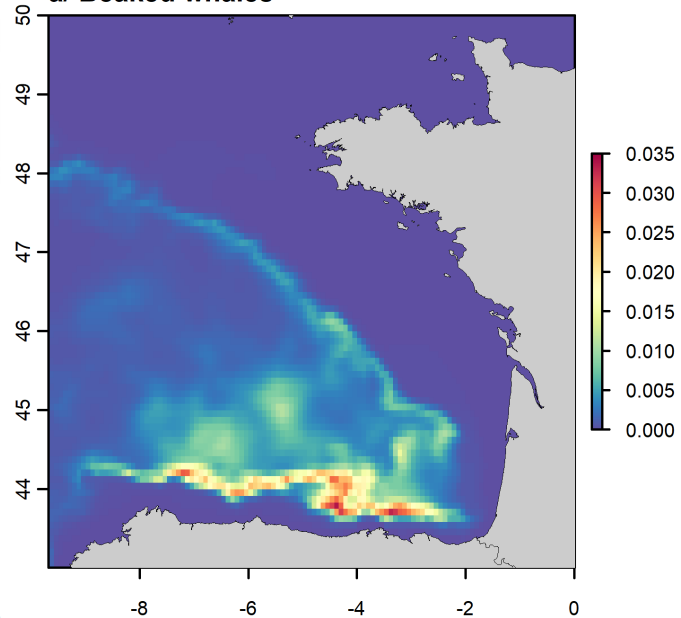
Beaked whales		Sperm whales	
Mean Temperature <sub>surface</sub>	86 %	Mean Eddy Kinetic Energy <sub>200-600m</sub>	40 %
Standard deviation Temperature <sub>0-200m</sub>	70 %	Standard deviation Gradients of T <sub>surface</sub>	19 %
Roughness	38 %	Mean Temperature <sub>surface</sub>	16 %
Depth	28 %	Mean Temperature <sub>200-600m</sub>	16 %



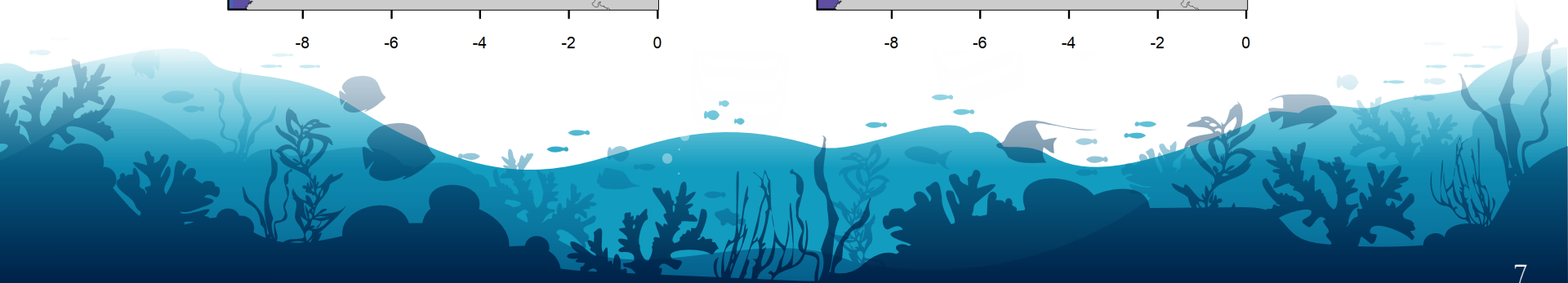
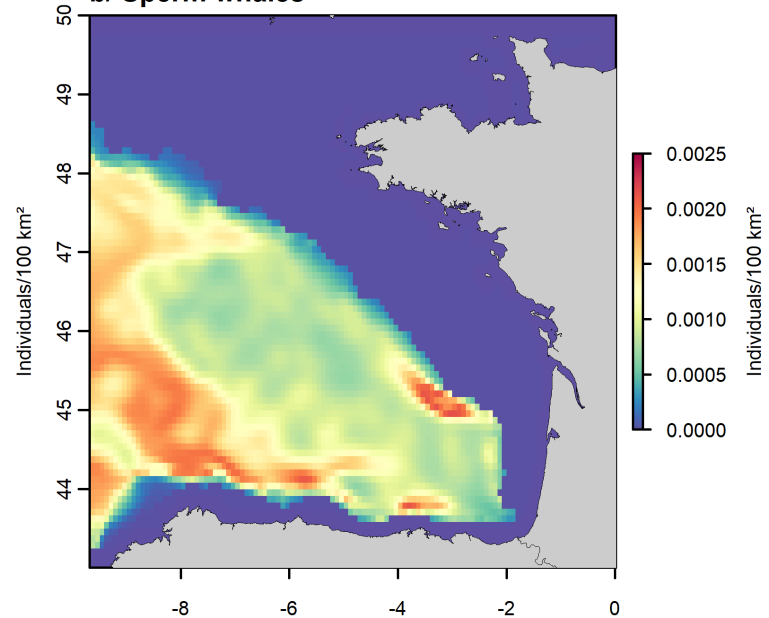


# Results

a/ Beaked whales



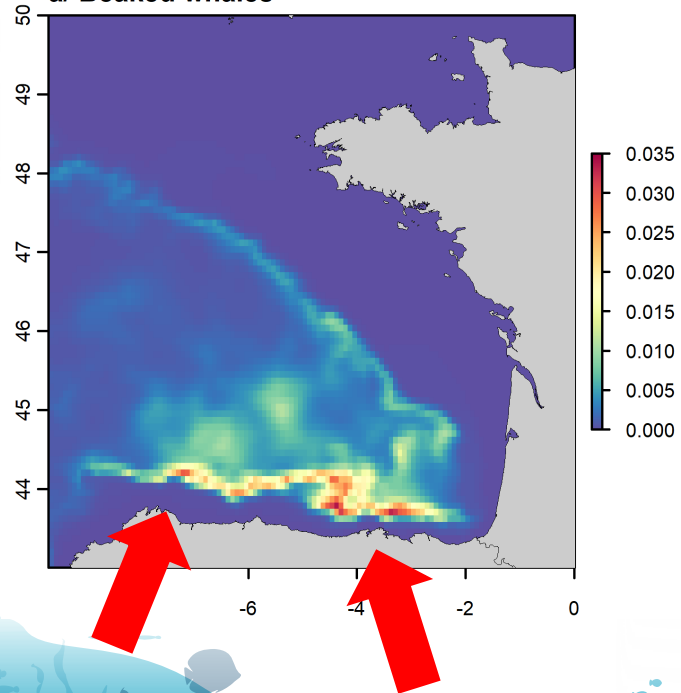
b/ Sperm whales



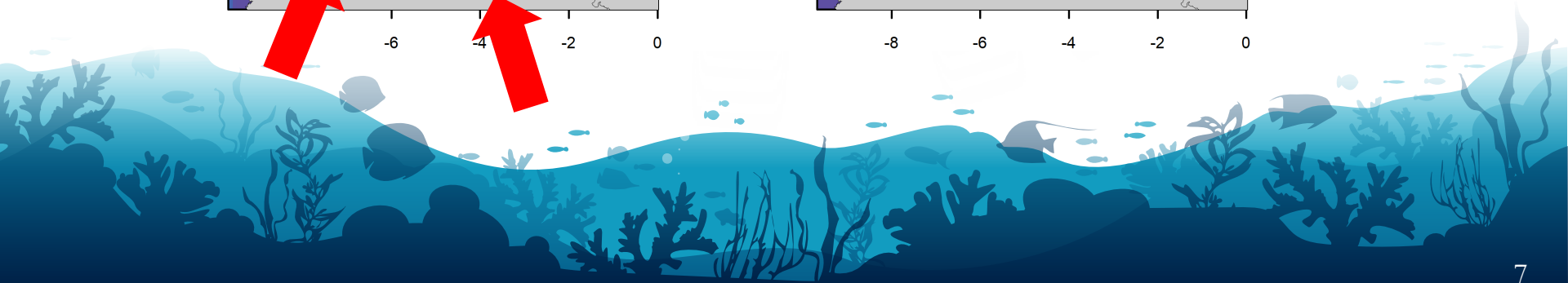
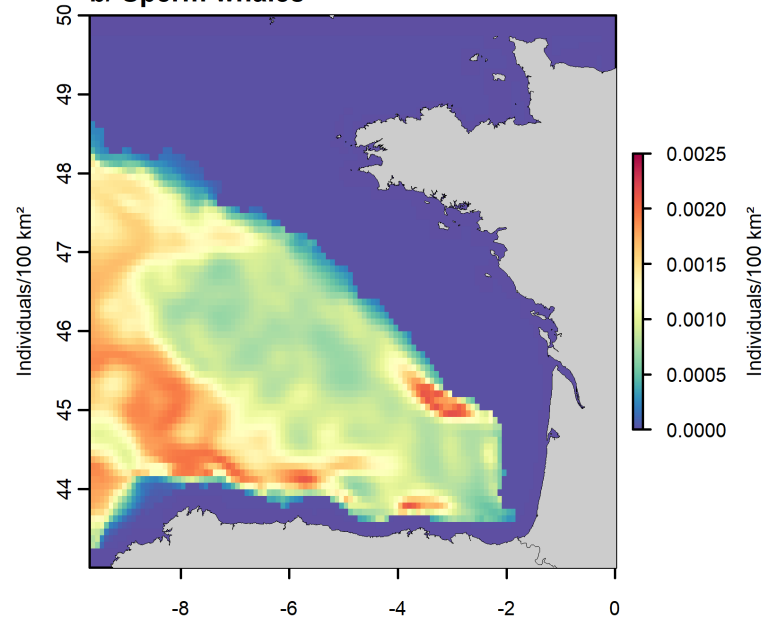


# Results

a/ Beaked whales



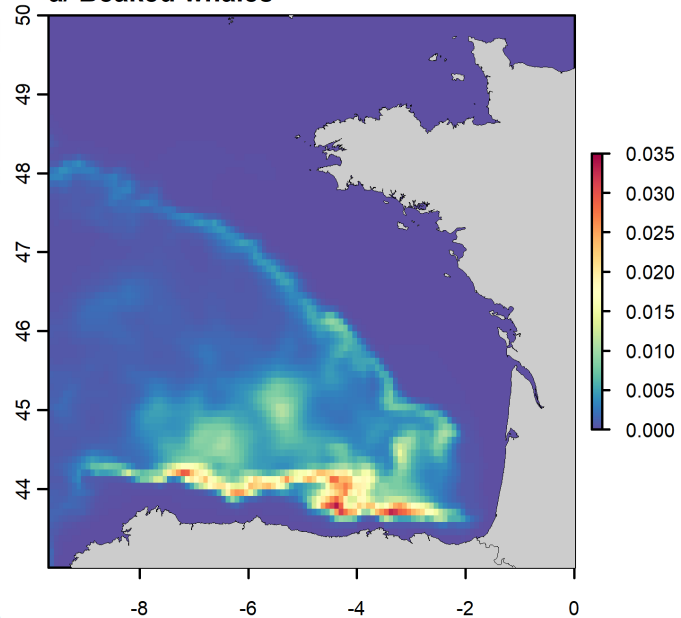
b/ Sperm whales



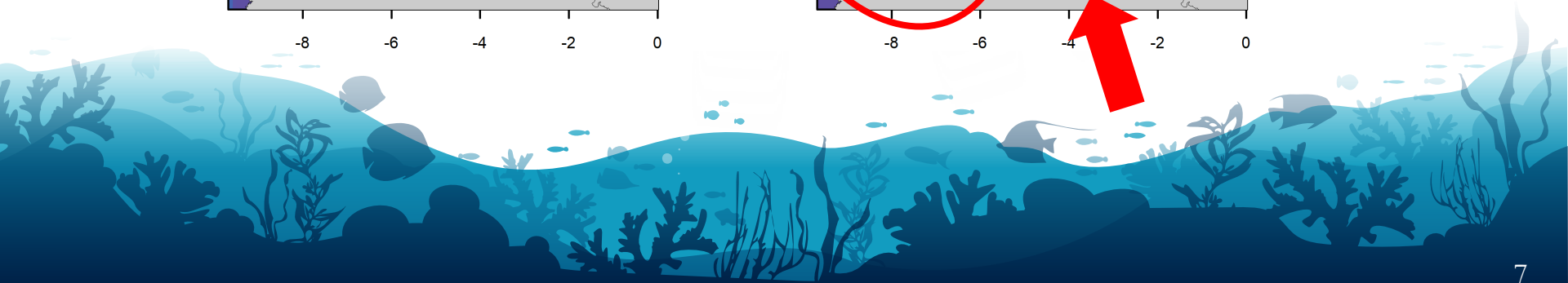
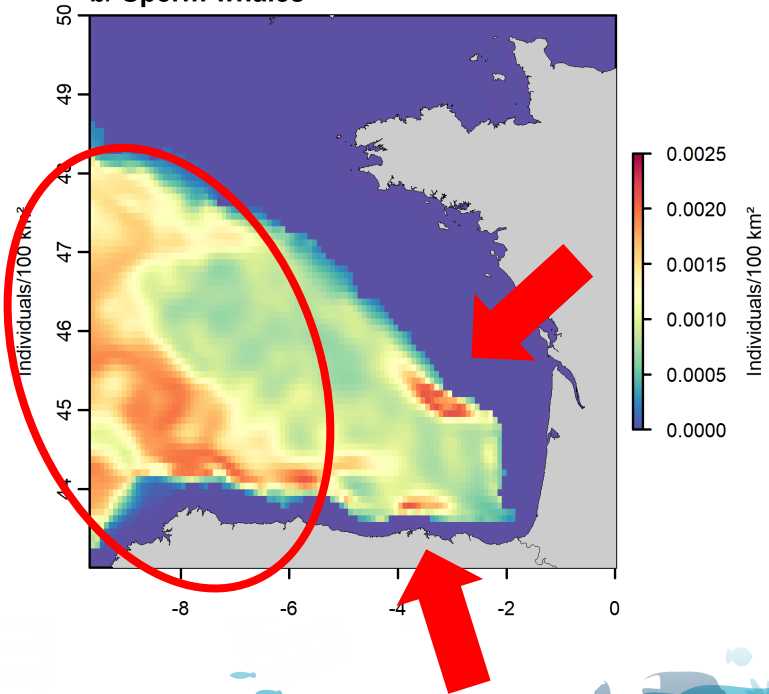


# Results

a/ Beaked whales



b/ Sperm whales

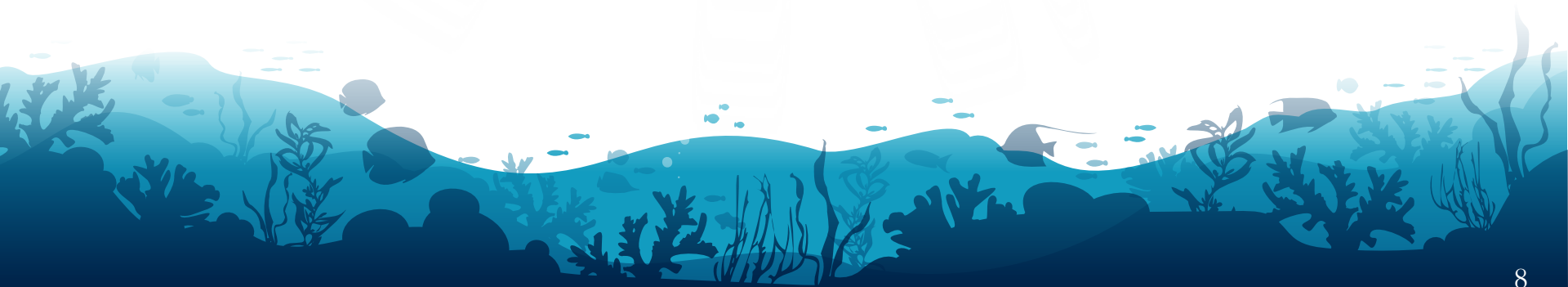




# Take home message

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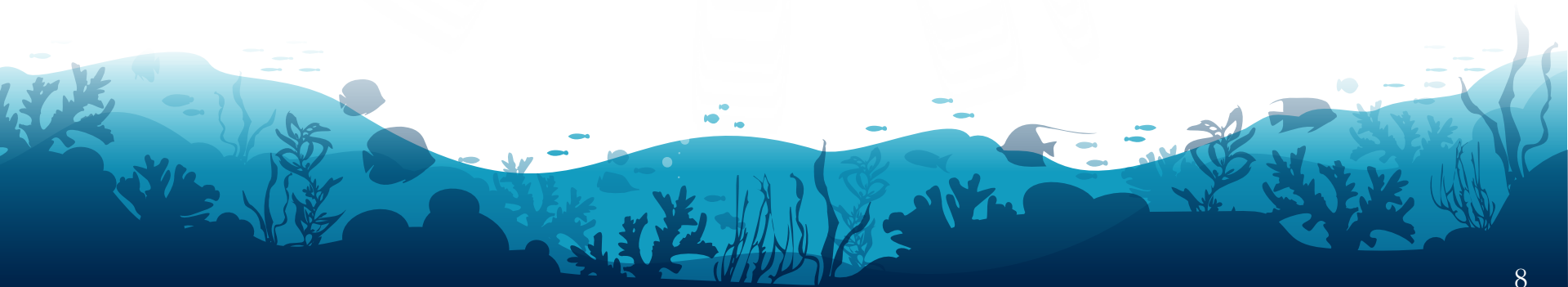
- ❖ Highest densities of both taxa predicted near the continental slope, canyons and in the abyssal plain



# Take home message

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- ❖ Highest densities of both taxa predicted near the continental slope, canyons and in the abyssal plain
- ❖ But different variables were selected in the models
  - Static and surface to subsurface dynamic variables for beaked whale
  - Surface and deep-water variables for sperm whale



# Take home message

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- ❖ Highest densities of both taxa predicted near the continental slope, canyons and in the abyssal plain
- ❖ But different variables were selected in the models
  - Static and surface to subsurface dynamic variables for beaked whale
  - Surface and deep-water variables for sperm whale
- ❖ Increasing the use of deep-water variables should be considered to improve knowledge of habitats used by species





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# Thank you for your attention!

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