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# Can global warming cause a northward shift in the distribution of *Balaenoptera edeni* in the North Atlantic? Insights from opportunistic data

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## INTRODUCTION


In future scenarios predicted as a consequence of **global warming**, many tropical species could see their ranges disturbed. One way to better understand these alterations is through the study of cetaceans, **sentinels** of the ocean.

This study looks for changes in the occurrence patterns of a tropical whale (**Bryde's whale**, *Balaenoptera edeni* ) in the subtropical **Azorean waters**, and analyses its habitat suitability in relation to the **sea surface temperature** (SST), an indicator of global warming.

### OBJECTIVES

I. To study the **spatial** and **temporal distribution** of Bryde's whale in the Azores archipelago.

II. To analyse the relationship between the **distribution** of Bryde's whale and the **sea surface temperature** in the archipelago.

## METHODOLOGY

monicet

12 years of **opportunistic data** (Azores, 2009 – 2020)

To reduce **pseudoreplications:**
- One point per sighting used
- Time-space filter applied (~4km, 1 hour)

**1** Temporal distribution → Encounter rate index

$$ER = \frac{\textit{Number of trips with sightings of Be per y/m/w}}{\textit{Total number of trips per month}}$$

**Weight of effort**

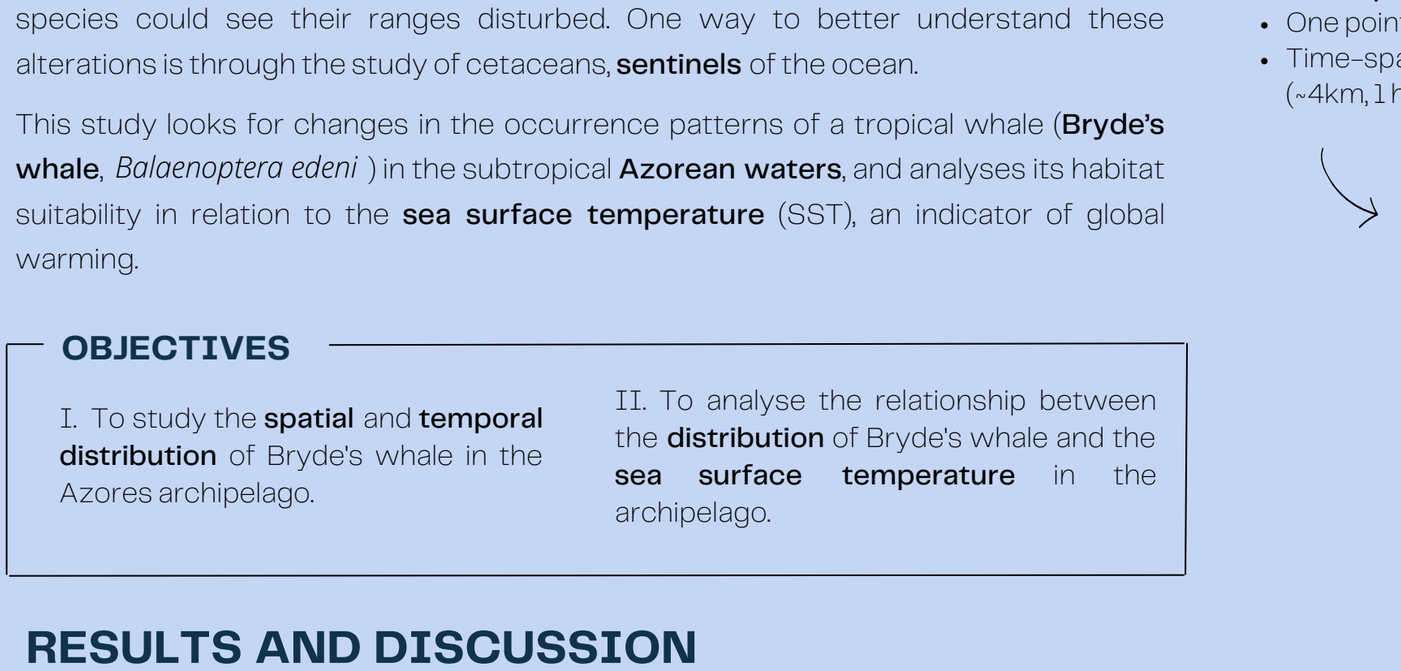
**2** Habitat suitability → Generalized Additive Model (GAM)

**Pseudo-absence** approach:
- Presence (1): *Balaenoptera edeni* sightings (Be)
- Absence (0): 1000 random points within the study area and period

Environmental variable:
- **Sea surface temparture** (SST) (Copernicus Marine Service, OSTIA product)

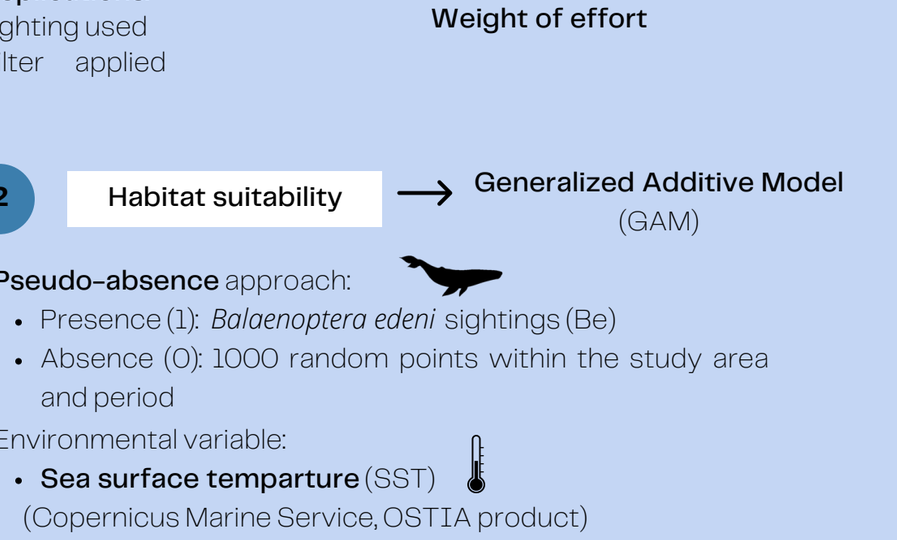
## RESULTS AND DISCUSSION

- <u>Temporal distribution</u>

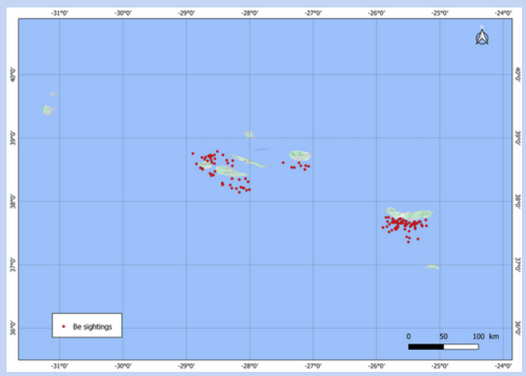



Present only between July and October

- <u>Sea surface temperature</u>

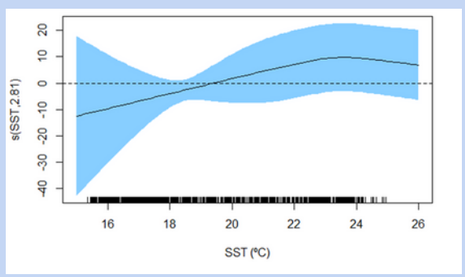



- <u>Spatial distribution</u>




Sightened where WW companies belonging to the MONICET platform operate

- <u>GAM model</u>




| MODEL | |
|---|---|
| n | 1123 |
| p-value | <2e-16 |
| DEV (%) | 44,8 |
| AUC | 0,9248 |

- **44,8%** of Bryde's whale distribution explained
- AUC indicates a **very high fit** of the model

## CONCLUSIONS


- Occasional migrations of *Balaenoptera edeni* in the Azores archipelago occur **between July and October**. The highest encounter rate occurred in the Eastern Group in August 2017, followed by September 2013 in the Central Group.
- The distribution model manages to explain **44,8% of deviance** considering only sea surface temperature as predictor, with a very high fit (AUC = 0,9248). A preference for waters warmer than 19ºC has been observed, reaching the **maximum suitability around 23ºC**.
- Under future scenarios predicted as a consequence of climate change, it is likely that Bryde's whales will see their distribution ranges in the Atlantic Ocean **extended** to more **northerly waters**, thus being sighted more frequently in the Azores.
- Opportunistic platforms such as MONICET offer valuable information, providing **long-term data**, covering **regular areas** of study and in a **cost-effective way.**

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