Trophic niches of cetaceans of the Azores

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Background:

Niche partitioning of time, space or resources is a key mechanism allowing the coexistence of sympatric competitors, especially guilds of predators. In the Azores, **28 species of cetaceans** occur both seasonally and year-round.
How do such diverse species share the local resources?
Gathering data for cetacean trophic studies is challenging, especially in oceanic archipelagos like the Azores, where strandings are very rare and stomach content data are scarce. We used **carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope ratios**, which are a powerful tool for the identification of trophic niches and potential diets.

Objectives:

• **Investigate** the trophic niches of the cetacean community occuring the the Azores.
• **Describe** the trophic guilds, inter- and intra- guild variabilities and species niche characteristics.
• **Assess** niche overlaps between species in the community.

Fig. 1: The Azores: an oceanic archipelago in the Altantic Ocean. Samples collected between 2002 and 2019.

Results :

A total of **407 skin samples from 12 cetacean species** were analysed. Values of $\delta^{15}N$ ranged from 7.78 to 15.26‰ and $\delta^{13}C$ values from -20.43 to -15.09‰. Species could be grouped into **three guilds**. Withing each, the **highest overlaps** were between *D. delphis* and *S. coeruleoalba* with 35.1%, *P. macrocephalus* and *T. truncatus* with 34.3% and between *B. musculus* and *B. physalus* (23.3%), respectively. The rest of pairwise overlaps were notably lower and not surpassing 10%. The lowest **trophic position** was attributed to *B. borealis* (4.01 ± 0.19) and the highest to *P. crassidens* (5.09 ± 0.13).

Trophic guilds were not overlapping between each other and are described as follows:

• **Baleen whales:** low trophic position (4.18 ± 0.22), larger range of $\delta^{13}C$ (2.81 ± 1.29) except for *M. novaeangliae*,and lower $\delta^{15}N$ ratios (2.71 ± 0.8)

• **Small delphinids and Sowerby's beaked whale:** intermediate trophic position (4.39 ± 0.17), reduced $\delta^{13}C$ ranges (1.53 ± 0.93) and large $\delta^{15}N$ ranges (2.32 ± 1.64)

• **High trophic position** predators (4.86 ± 0.17) with intermediate $\delta^{13}C$ (1.57 ± 0.77) and larger $\delta^{15}N$ (2.25 ± 1.28)

Fig. 2: 40% Standard Ellipse Areas (SEA) for each species.

Niche size appears larger for baleen whales (especially *B. borealis* and *B. musculus*),while it was reduced for *M. bidens*.

• *M. novaeangliae* and *S. coeruleoalba* showed larger SEA_C than mean SEA_B.
• *B. physalus* and *M. bidens* showed **low variability** in SEA_B
• *S. frontalis*, *D. delphis* and *M. bidens* display small SEA_B with low variability and similar values of SEA_C and SEA_B.

Fig. 3: Bayesian standard ellipse areas (SEA_B) for each species. Boxes represent the 50%, 75% and 95% credible intervals, black dots the mean SEA_B and white crosses the Corrected standard ellipse areas (SEA_C).
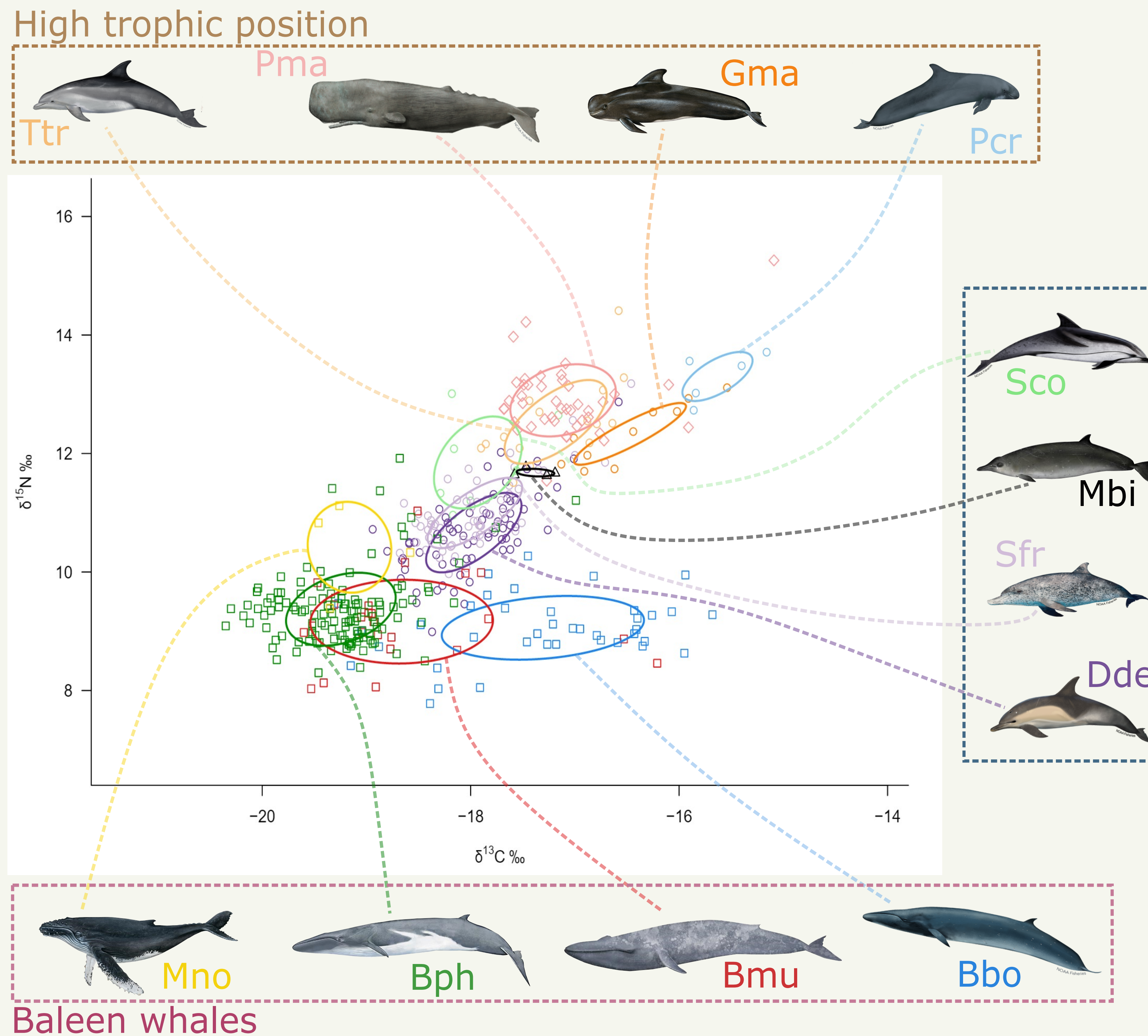
Wide diversity of isotopic niches with different characteristics:
• **Dietary diversity** was the highest for *B. borealis* and *B. musculus* while it was the lowest for *M. bidens* and *P. crassidens.*
• Great **dissimilarities and uneven distribution** of individuals for *M. novaeangliae* and *S. coeruleoalba*

Conclusions :

The 12 species of cetaceans existing in the Azores occupy a broad range of niches and feed at **various trophic levels and habitats**. Species with similar niches can be grouped into three guilds that do not overlap between them. In each trophic guild, overlaps are limited indicating **segregation mechanisms**, except for one pair of species that displays a considerably higher proportion of overlapping, suggesting potential **resource competition.**
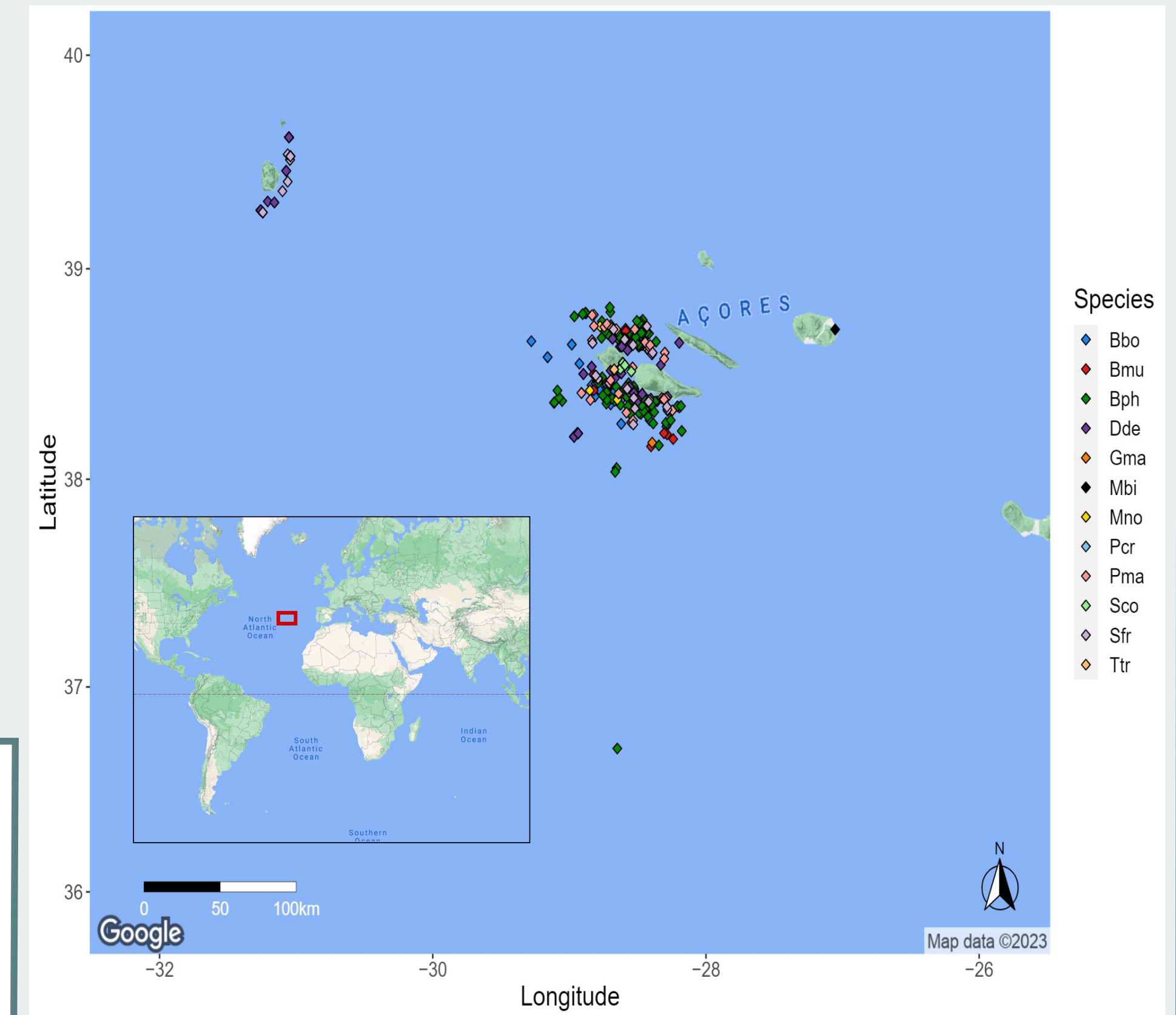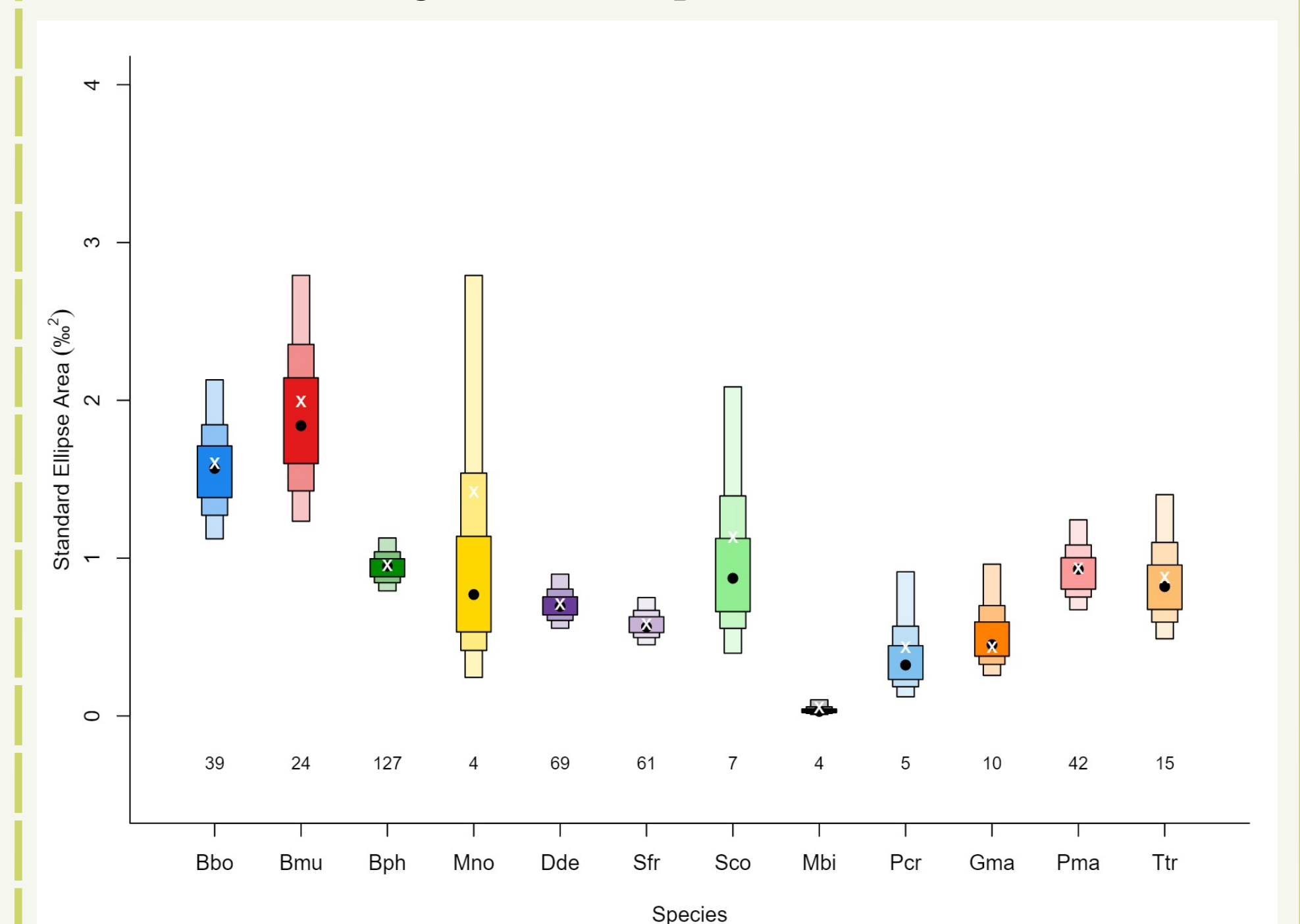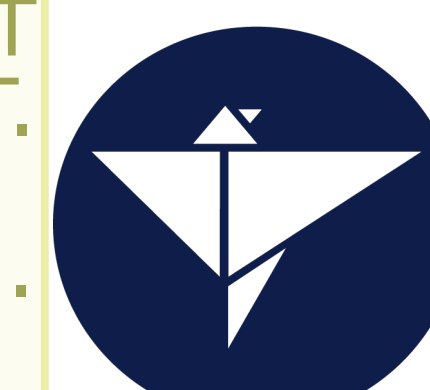
References: Jackson et al. (2011) ; Layman et al. (2007) ; Post (2002) ; Silva et al. (2019)