

# Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente - Ciclo XL

## Past, present and future of Elasmobranchs in Italian waters: Trends in abundance, species Occurrence and Resource Use (TORU)

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### Background

Global populations of elasmobranchs (sharks and rays) have declined over the past 50 years<sup>5</sup>. Their K-strategy life-traits, e.g., slow growth, late maturity, and low fecundity, make them highly vulnerable to overexploitation<sup>2,5</sup>. The Mediterranean Sea, a biodiversity hotspot, shows severe declines due to fishing, pollution, and habitat loss<sup>4</sup>. Elasmobranchs are heavily impacted by both direct fishing (commercial and recreational), and bycatch<sup>3</sup>. At least 65% of Mediterranean species are threatened, according to the IUCN Red List (Figure 1). Elasmobranchs act as mesopredators or apex predators, playing crucial roles in marine ecosystems<sup>1</sup>. More information on their ecology and movement are vital for understanding anthropogenic and climate threats and setting up appropriate conservation strategies.

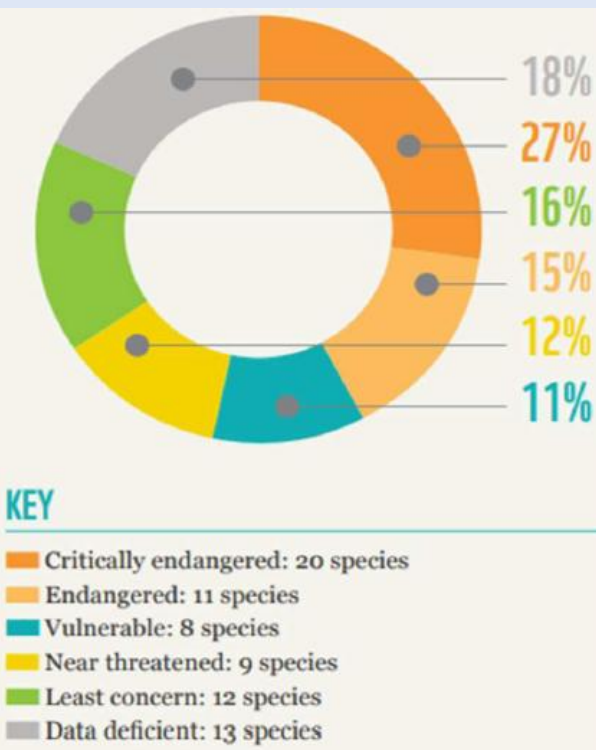
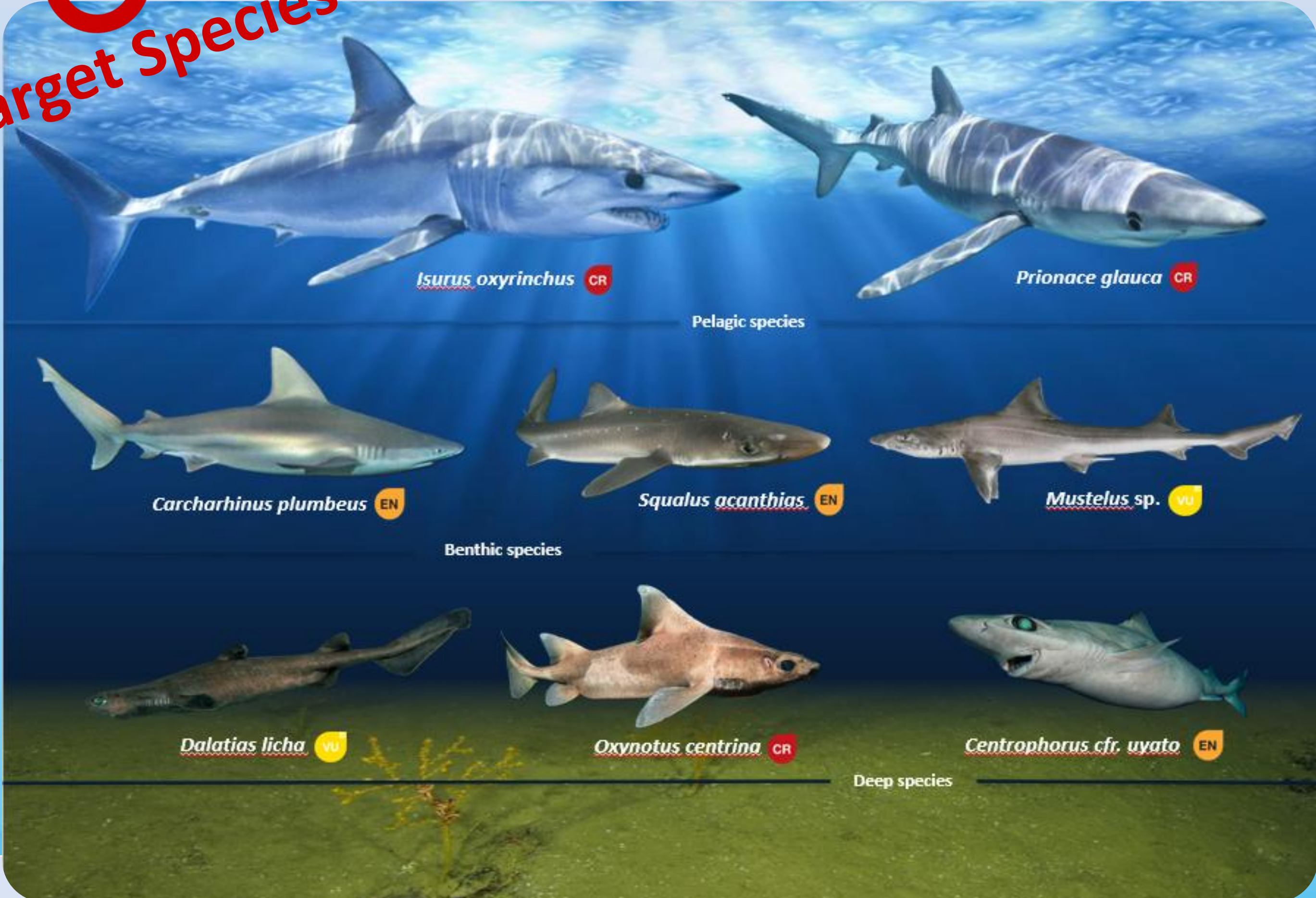


Figure 1. IUCN Red List figure for shark and ray species for the Mediterranean Sea (source: WWF Report 2019)

### AIMS:

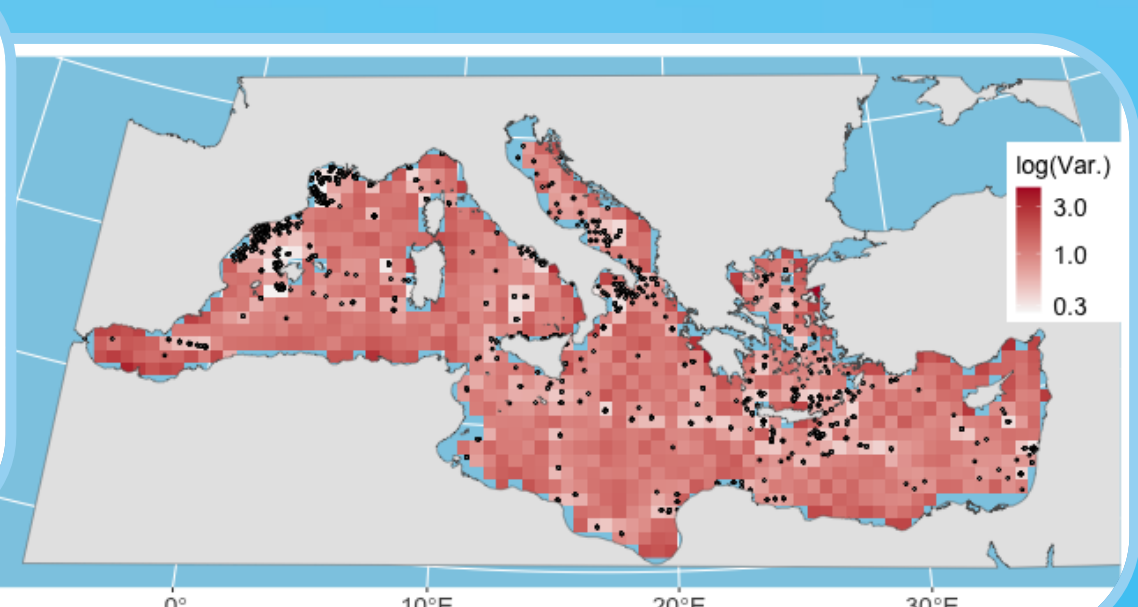
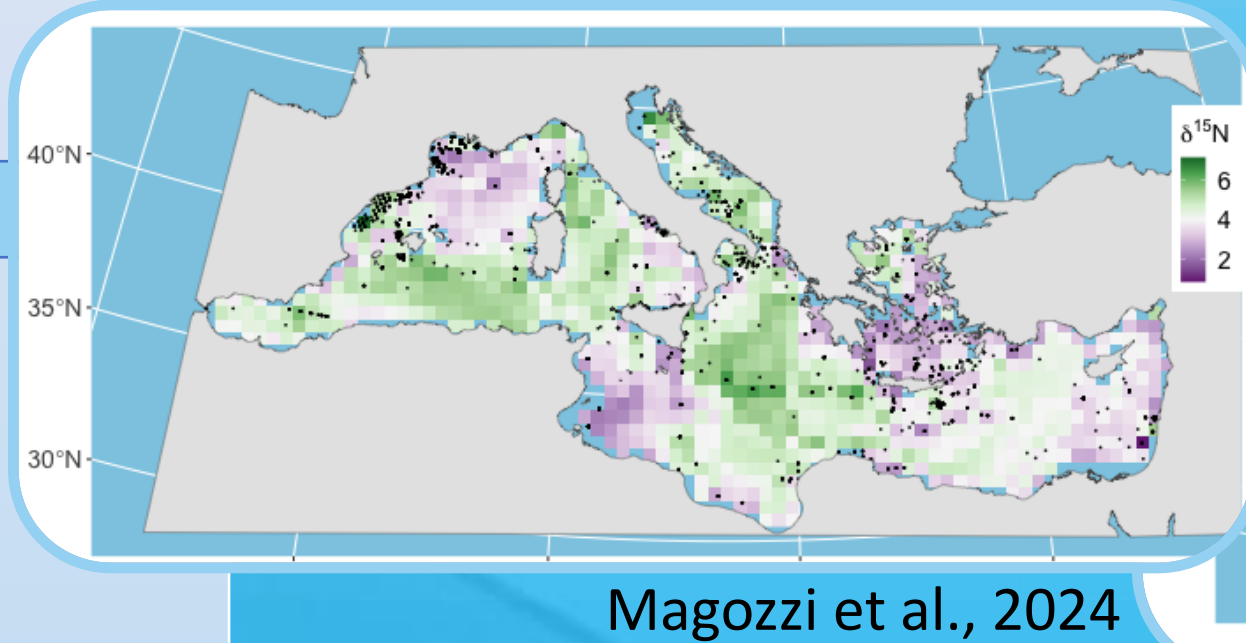
- Reconstruct PAST patterns of species abundance and occurrence and their trophic ecology.
- Analyze PRESENT patterns of species abundance and occurrence and their trophic ecology.
- Set up a solid baseline to build isoscapes for FUTURE determination of habitat use

### Target Species



### Materials & Methods

Samples will be collected from:



What am I going to do?

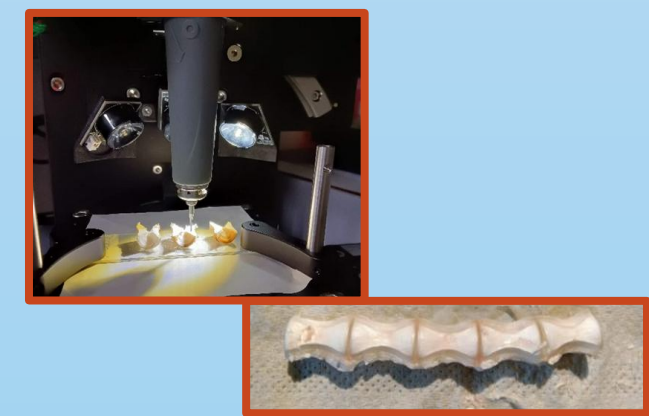
$\delta^{15}\text{N}$  Trophic position  
 $\delta^{13}\text{C}$  Movement/migration patterns  
 Source of carbon

**Stomach Content Analysis (SCA)** provides instant information on a consumer's diet in a specific interval of time and space.

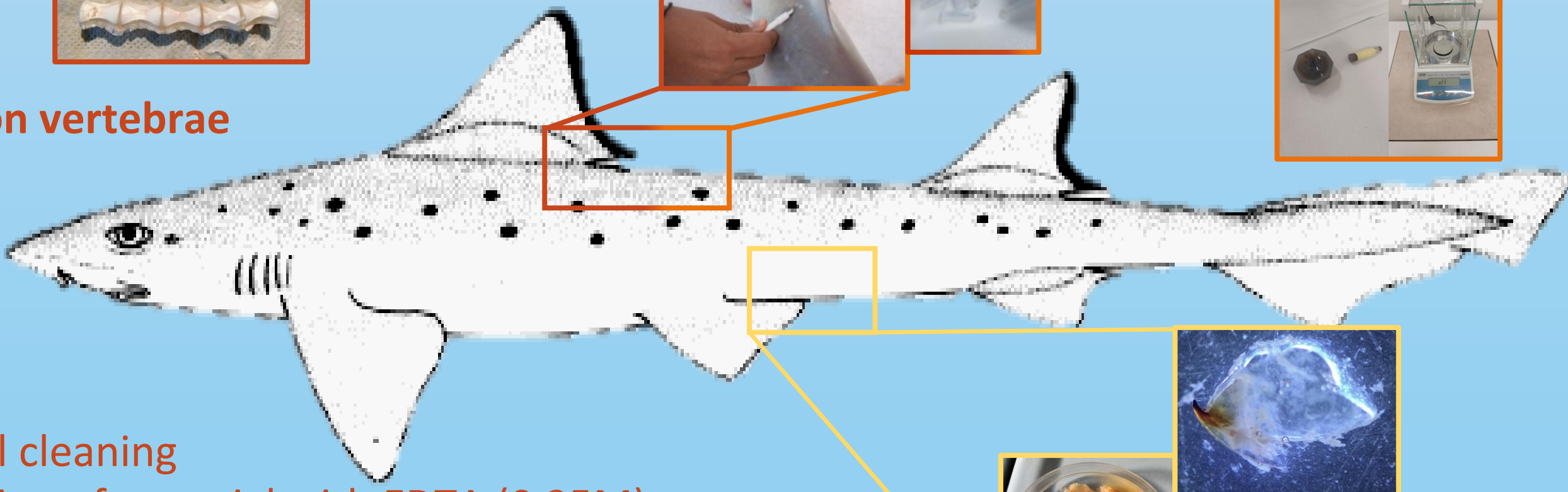
**Stable Isotope Analysis (SIA)** provides time-integrated information on the contribution of a food item to the diet of the species.

- Urea extraction (Kim & Koch et al., 2012)
- Over-dried at 60°C

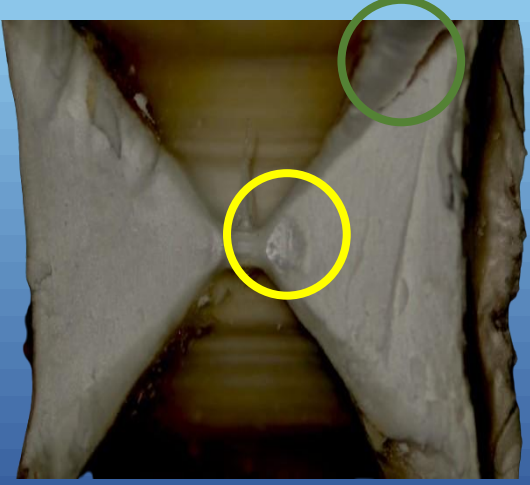
### SIA on muscle



### SIA on vertebrae



- Manual cleaning
- Extraction of material with EDTA (0.25M)
- Age estimation
- Analysis of birth mark and last growth band



### SCA

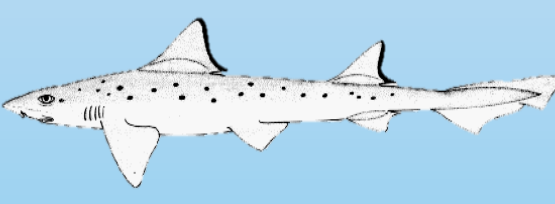
- Biological indices (HSI and fullness)
- Diet composition (%W, %N, %IRI)
- Trophic diversity ( $H'$ )

### Preliminary results

YEAR 1				YEAR 2				YEAR 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4



6 Italian museums involved



More than **200** samples collected of **4** different species

### Expected results

- New knowledge of PAST and PRESENT feeding ecology, resource use and migration patterns of threatened species for FUTURE management strategies.
- New data on PAST and PRESENT diversity and abundance of elasmobranchs in Italian waters for gaining an increasingly wide view of their presence.
- Species distribution models (see Premici poster) and isoscapes

### References

- Ferretti et al., 2010 Patterns and ecosystem consequences of shark declines in the ocean. *Ecol. Lett.*, 13 (8), 1055-1071.
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- Ramírez-Amaro et al., 2020 The diversity of recent trends for chondrichthyans in the Mediterranean reflects fishing exploitation and a potential evolutionary pressure towards early maturation. *Sci. Rep.*, 10(1), 1-18.
- Walls & Dulvy 2021 Tracking the rising extinction risk of sharks and rays in the Northeast Atlantic Ocean and Mediterranean Sea. *Sci. Rep.*, 11(1), 1-15.
- Williamson et al., 2019 Satellite remote sensing in shark and ray ecology, conservation and management. *Front. Mar. Sci.*, 6, 135.