

Insights on the Trophic Behavior of **Sardine** and **Anchovy** in the Morocco Atlantic coast

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Abstract

Small pelagic fish play a key role in marine food webs by transferring energy from zooplankton to higher trophic levels and supporting regional fisheries. This study examined the diet of European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) along the Moroccan Atlantic shelf between Cape Ghir and Cape Boujdour. A total of 509 individuals (150 anchovy and 359 sardine) were collected during a hydroacoustic survey in November 2022. Stomach content analysis revealed that anchovy exhibited a mainly zooplanktivorous diet dominated by copepods, with secondary prey including amphipods, euphausiids, mysids, and small fish. Sardine also fed primarily on copepods, consistent with a filter-feeding strategy targeting small prey. Diet composition varied with local environmental conditions and prey availability. Overall, the results highlight copepods as the main trophic resource for both species in the Moroccan upwelling system and emphasize potential biases linked to differential prey digestion rates.

Introduction

Small pelagic fish play a pivotal role in marine food webs, acting as key intermediaries that transfer energy from plankton to higher trophic levels and sustaining major fisheries worldwide. In the highly productive Moroccan upwelling system, the European anchovy (*Engraulis encrasicolus*) and the European sardine (*Sardina pilchardus*) coexist but are thought to occupy distinct trophic niches. This is a critical factor in understanding ecosystem functioning and managing fisheries.

Objectives

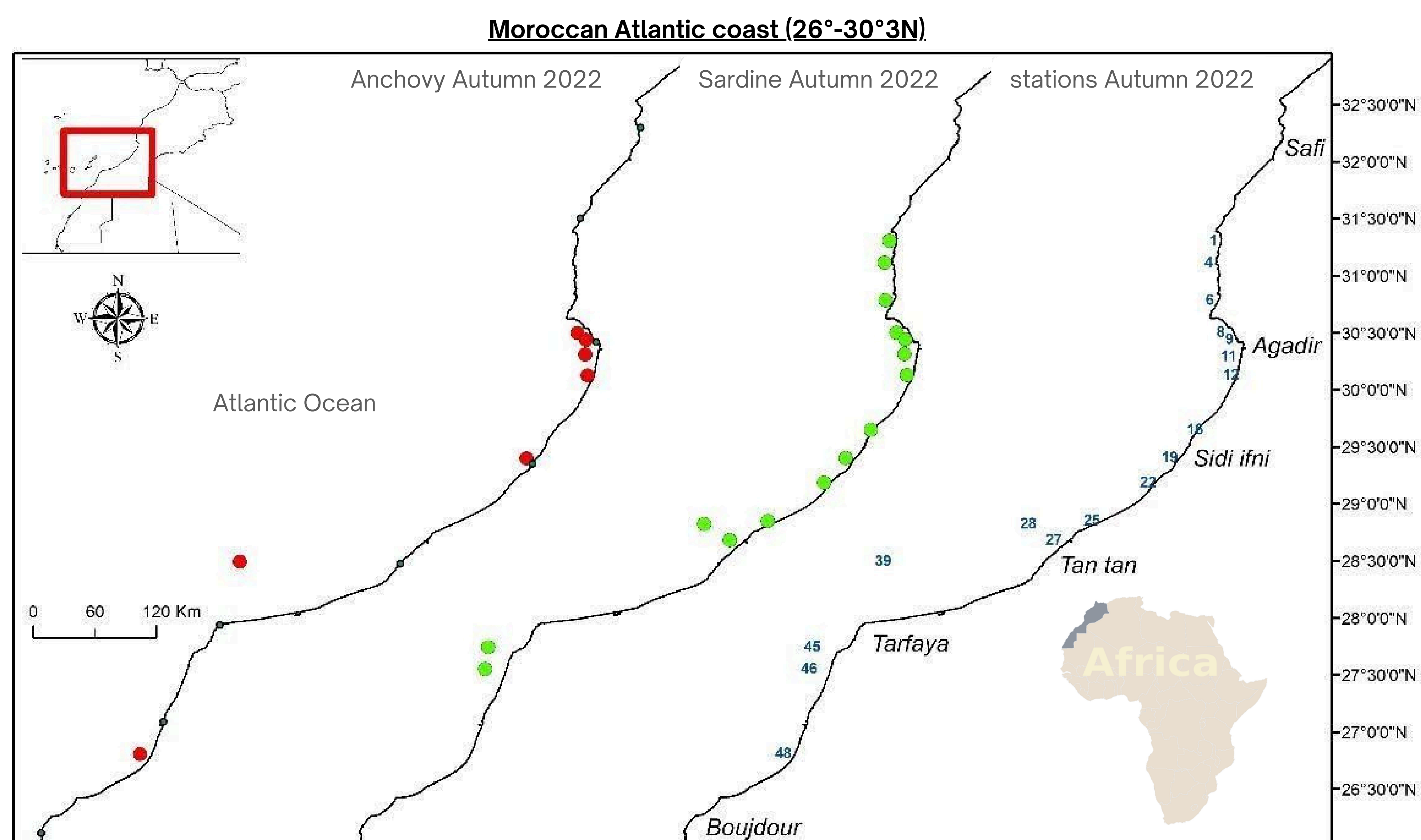
- Analyze the dietary habits of small pelagic fish, focusing on anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*).
- Identify consumed prey and evaluate their relative importance.
- Understand trophic interactions and the influence of local environmental conditions on feeding strategies.

Methodology

- Acoustic surveys were conducted for the detection of small pelagic fish aggregations.
- Control fishing operations were carried out to validate the results and collect biological data.
- A sample of 60 individuals per species was analysed after thawing.
- Morphological measurements were taken, and sex and sexual maturity stages were determined.
- Analysis of 15 Individuals and Sample Fractionation by Sieving at Different Mesh Sizes.
- Study of Pooled Stomach Samples Fractionated at 1mm, 0.5mm, and 0.2mm.
- The prey were identified, counted, and weighed, despite difficulties due to their advanced state of digestion.

Study area

- The study was conducted along the Atlantic continental shelf of Morocco, between Cap Ghir and Cap Boujdour
- This region is characterized by high productivity driven by seasonal upwelling
- Sampling/data collection was carried out in autumn 2022, during the summer upwelling which extends in Autumn.



Conclusion

- The diets of both sardine and anchovy in the Moroccan Atlantic are dominated by copepods, indicating a strong reliance on planktonic conditions.
- Differences between sardine and anchovy in their diet and habitat strongly influence their populations and the flow of energy within the ecosystem.
- However, potential biases related to differential prey digestion require cautious interpretation and highlight the need for complementary approaches (e.g., stable isotope analysis).

Analyses

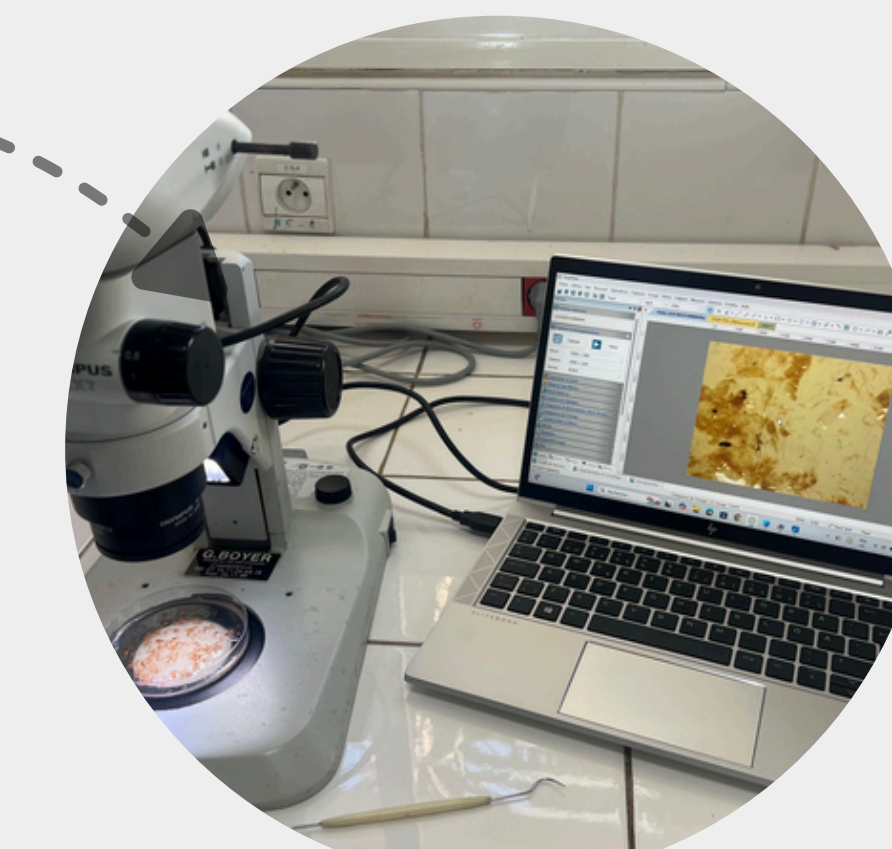
- Prey items were identified to the lowest possible taxonomic level.
- Percentage occurrence, numerical abundance, and weight of prey were calculated for each species.
- Data dispersion was examined using boxplots to compare prey counts and prey weight between species.



Dissection



Preservation of stomachs



Stomach content examination

Results

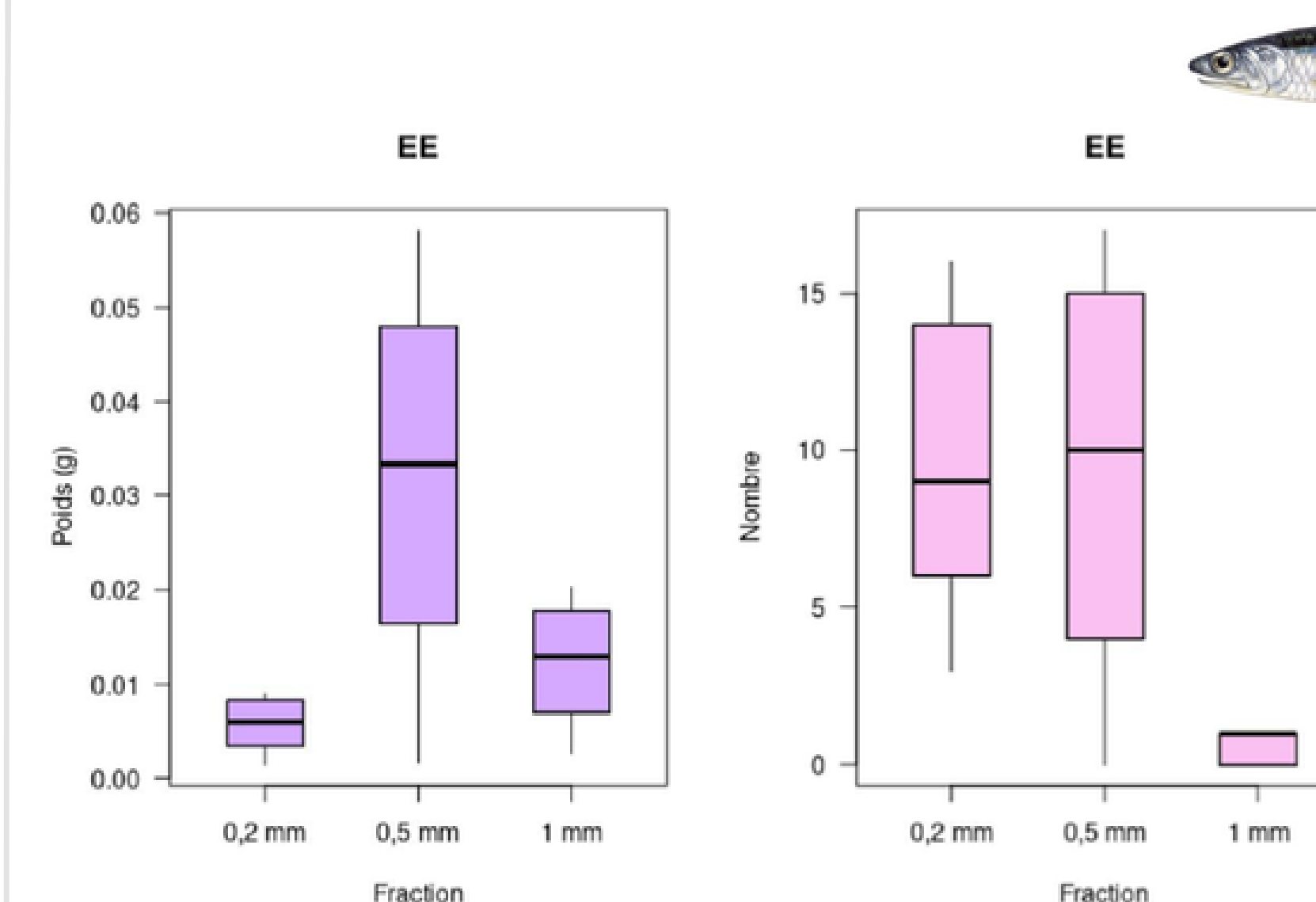


Figure 1—Distribution of stomach content weight and count in anchovy

Small size fractions (0.2–0.1 mm) dominate in numerical abundance, indicating that very small prey are consumed most frequently. However, larger fractions (0.5–1 mm) contribute more to the total weight, suggesting that a few larger prey items make up the bulk of the biomass.

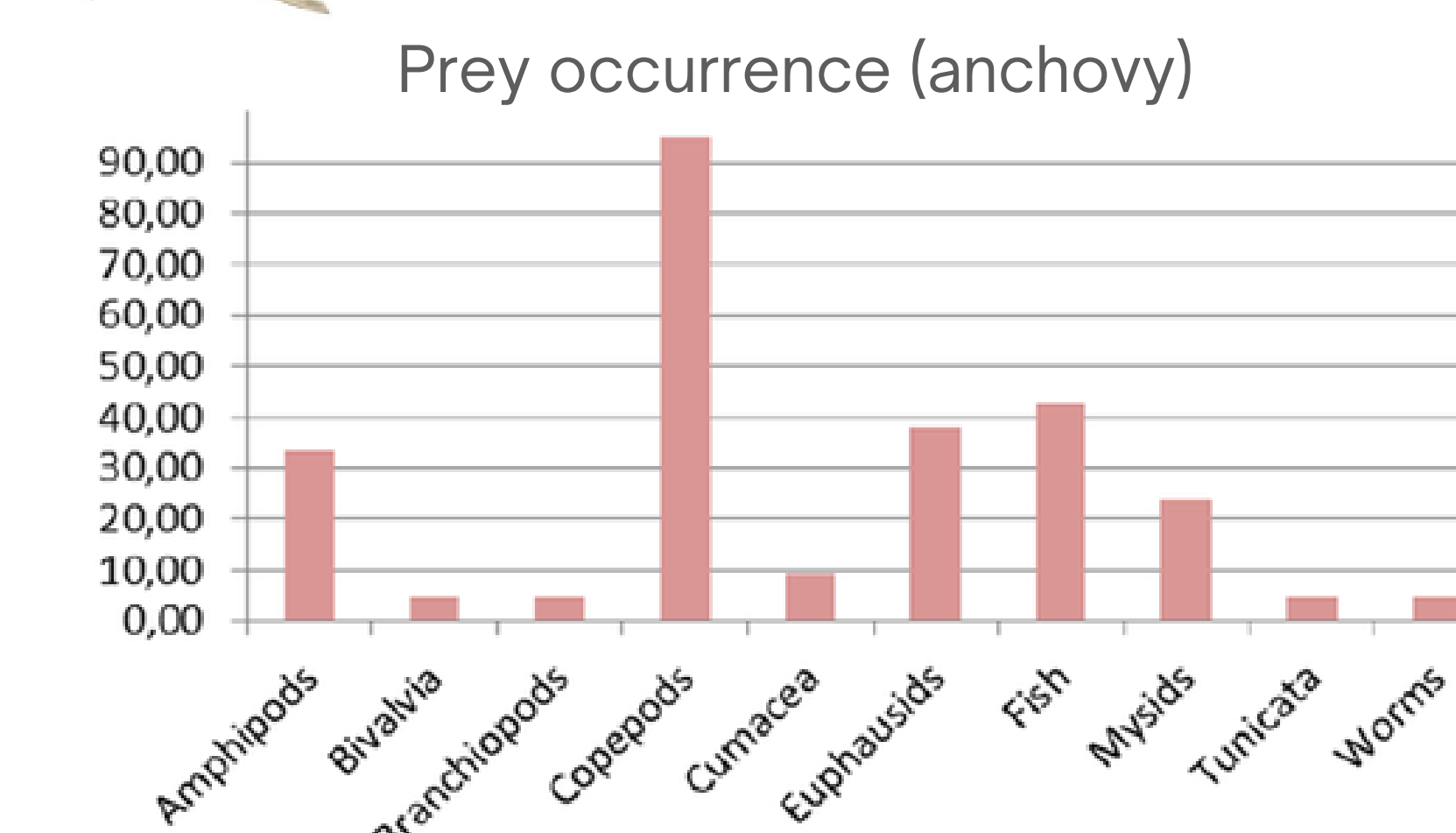


Figure 2—Prey occurrence frequency (percentage) in anchovy

Copepods are the most frequently occurring prey, indicating their primary importance in the diet. The remaining taxa (amphipods, bivalves, branchiopods, etc.) occur at lower frequencies, reflecting opportunistic feeding on a wide range of secondary prey.

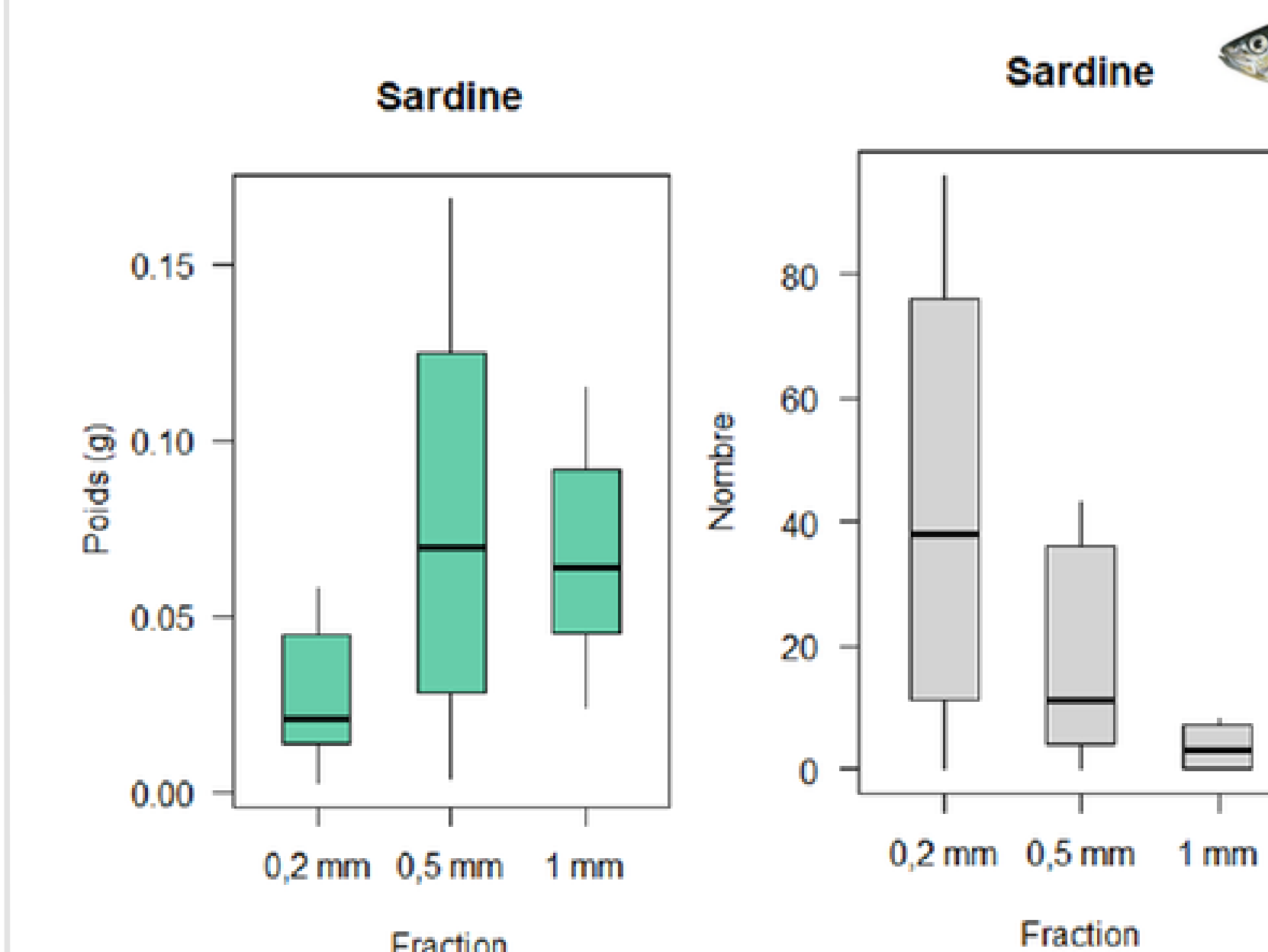


Figure 3—Side-by-side boxplots showing dispersion of prey (a) number and (b) weight for sardine

Prey number likely has higher dispersion wider boxplot range in small fraction due to variable ingestion rates, whereas prey weight dispersion may increase in larger fractions.

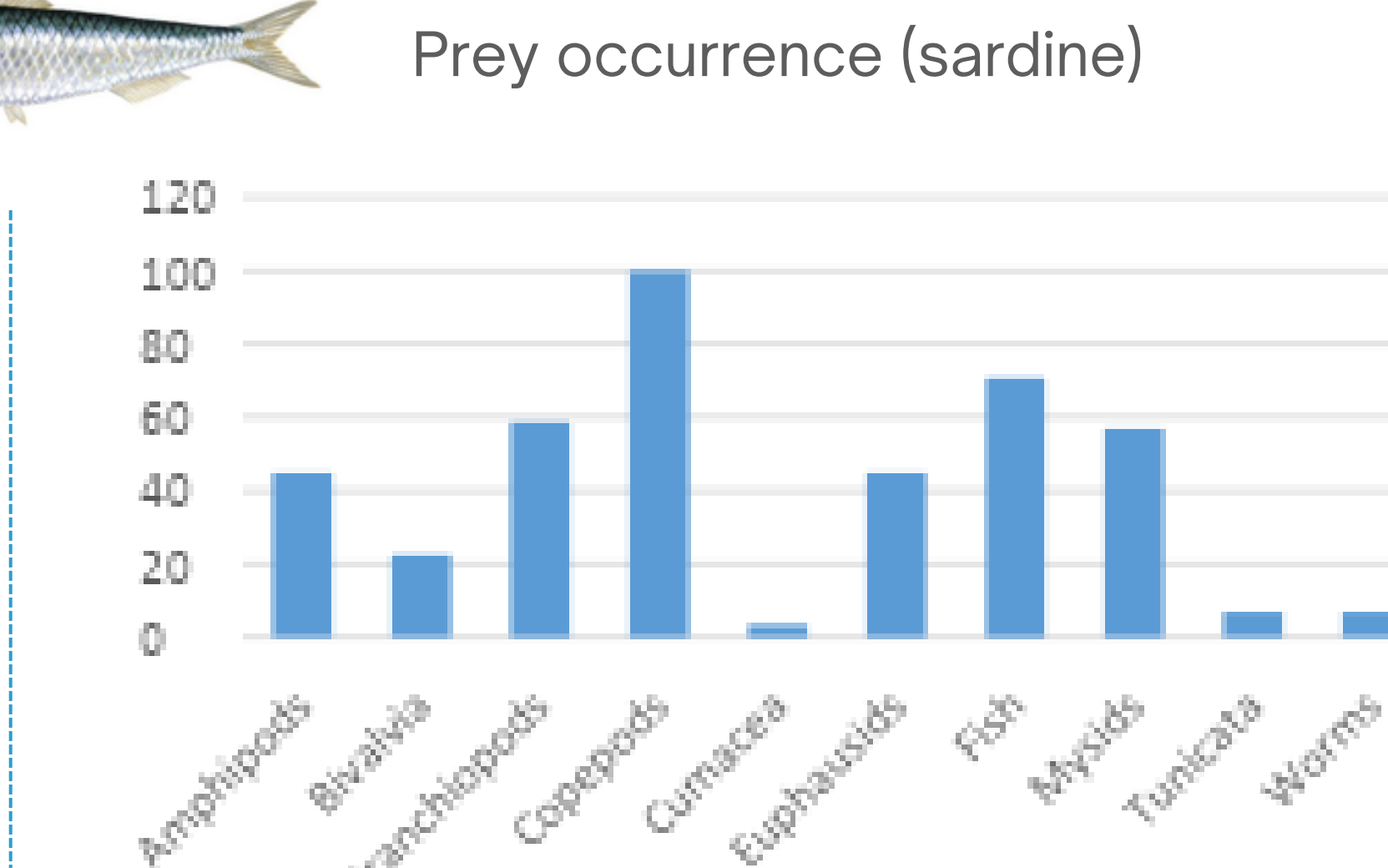


Figure 4—Percentage of prey occurrence in sardine

Copepods dominate the prey occurrence, highlighting their key role in the diet of the studied species. The remaining prey groups (amphipods, bivalves, branchiopods, cumaceans, euphausiids, fish, mysids, tunicates, and worms) show lower occurrence, suggesting opportunistic feeding on a variety of alternative prey.

- Upwelling at Cap Ghir is primarily a seasonal phenomenon, peaking during summer and autumn [Benazzouz et al., 2014]
- The area exhibits strong meso-scale activity (fronts, eddies, filaments) [Anabalón et al., 2014].
- Diet studies help explain growth, reproduction, migration, and feeding behavior.
- Sardine and anchovy partition zooplankton resources by size [Nikolioudakis et al., 2012].

References

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