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Trophic segregation between two demersal opportunistic predators coexisting in the Mediterranean Sea

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Information about the feeding ecology of marine organisms is pivotal to understanding their ecological role in ecosystems and also to achieve the efficient management of commercial species by implementing ecosystem-based approaches (Coll et al., 2009). Although a large amount of information about the feeding ecology of marine species has been published, accurate information for some species as the black anglerfish (*Lophius budegassa*) and the white anglerfish (*Lophius piscatorius*) is scarce in the Mediterranean Sea.

In this study, our main objective was to examine the feeding habits of the black and white anglerfish in the northwestern Mediterranean Sea with the use of stomach content and stable isotopic methodologies. Specifically, the study aimed at: i) quantifying the diet composition and trophic position of both species; ii) evaluating the effect of body size on feeding behaviour; and iii) describing the species' spatial distribution to help us interpret trophic behaviour patterns (López et al., 2016).

The study was developed along the continental shelf and slope of the Catalan Sea associated with the Ebro River delta (northwestern Mediterranean Sea). We collected 190 black anglerfish and 116 white anglerfish individuals from March 2012 until July 2013 from commercial bottom trawlers and during experimental fishing surveys conducted in February and July 2013 (ECOTRANS Project, Institut de Ciències del Mar CSIC). The depth of all catches ranged between 40-446 m and 40-775 m for the black anglerfish and white anglerfish, respectively. We classified individuals into two size ranges (small size, TL < 30 cm; large size, TL ≥ 30 cm).

We described the diet and trophic level of the black and white anglerfish using stomach content analyses (SCA) and isotopic mixing models (Barría et al., 2015).

Stomach contents revealed a high diversity of prey in the diet of these two species. Both, stomach and isotopic results indicated that these two species mainly consume fish followed by crustaceans (Fig. 1). The wide spectrum of prey found in the stomach contents of the two species confirmed their opportunistic behavior (Laurenson and Priede, 2005; Fariña et al., 2008; Stagoni et al., 2013).

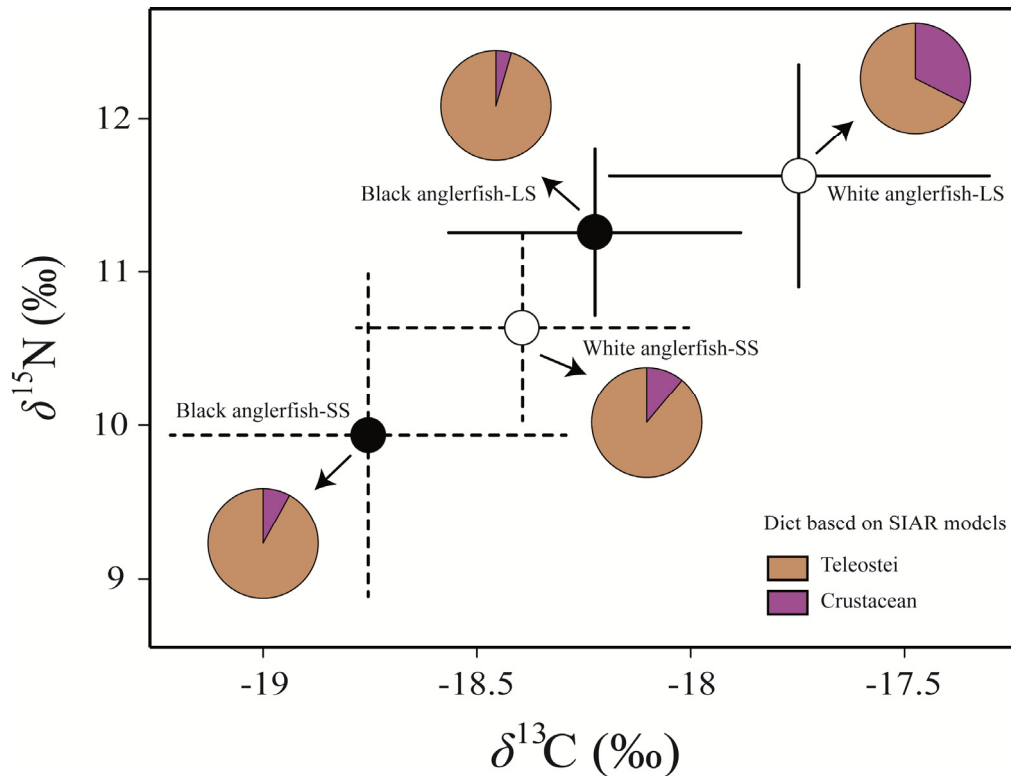


FIGURE 1. Mean and standard deviation values of $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values and mean contribution of the main prey groups (Teleostei and Crustacea) to the diets based on Bayesian isotopic SIAR models of black and white anglerfish (SS=small-sized individuals; LS=large-sized individuals) from the northwestern Mediterranean Sea.

Although the two anglerfish species shared some prey as *Gadiculus argenteus* and *Ophidion barbatum*, they differed in particular species such as *Lesueurigobius friesii* and *Gnathophis mystax*. These differences could be explained by the differences in the temporal activity rhythms between the two species (Colmenero et al., 2010, 2015b; Aguzzi et al., 2015) and to the differences in spatial distribution between them (López et al., 2016).

Differences in the diet composition between the sizes of each species could also be related to differences in their spatial distribution. In particular, the small sizes of black anglerfish are more abundant on the continental shelf and mainly feed on small benthic fishes such as *Gobius niger*, while the large-sized individuals that are distributed in deeper waters associated with the continental slope usually feed on deep-water fish species such as *Merluccius merluccius*. Regarding white anglerfish, the small sized individuals are found mainly in inshore waters and thus feed on inshore fishes such as *Citharus linguatula* and the crustacean *Squilla mantis*, while large individuals are distributed at the edge of the continental shelf and upper slope and prey on deep-sea species such as the cephalopod *Ancistroteuthis lichtensteinii*.

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Regarding to the trophic level (Fig. 1), our results suggest that both anglerfish species are predators located high up in the food web of the study area, corroborated by its high trophic level and classified as top carnivores with a preference for fish and crustaceans, as Stergiou and Karpouzi, 2002 described. In comparisons to other predators from the study area, we found that anglerfish showed similar trophic levels to predators like dolphins, large pelagic fishes and adult hake (Coll et al., 2006; Navarro et al., 2013). These results confirm that both anglerfish species play an important role as predators in the food web of the northwestern Mediterranean Sea.

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