

# INVESTIGATING THE FOOD WEB IN THE NW MEDITERRANEAN SEA WITH STABLE ISOTOPES AND MODELLING RESULTS

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## Abstract

In the present work we described the marine food web structure of the Ebro Delta marine area by applying; (1) an ecological model and (2) stable isotope analyses. Stable isotope analyses provide information of the predator-prey relationships and the foraging areas of each species in the food-web. The ecological model also delineated the food web structure of each species by estimating their trophic level. We showed some discrepancies and similarities between both approaches. In conclusion, both methodologies were insightful to describe the food-web traits of the Southern Catalan Sea and enabled us to complement our understanding of the area and to validate our results.

*Keywords: Food Webs, Ebro Delta, Carbon, Models, Predation*

## Introduction

Due to the importance of predator-prey relationships and their dynamics on the evolution and structure of marine communities, ecologists have focused their research into different aspects of food webs to determine the influence of the community structure on its stability, complexity, connectivity and equilibrium. In the present communication, by using two complementary approaches, ecological modelling (with EwE: Ecopath with Ecosim) and stable isotope analyses (SIA:  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values), we described the food web structure of the Southern Catalan Sea (NW Mediterranean). We compare results from both tools regarding abundant marine species in the area.

## Material and methods

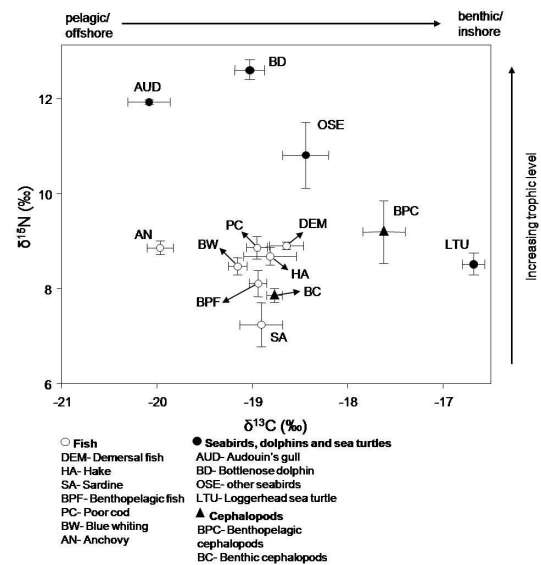
The study was conducted in the continental shelf of the Ebro Delta (ED) marine area (NW Mediterranean). To establish the predator-prey relationships among the different marine species we analyzed both  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values from different marine species of the ED; 16 fish and 1 seabird species (the Audouin's gull) sampled in the ED during 2003. We used published SIA values of 3 predators species: the bottlenose dolphin [1], the loggerhead sea turtle [2] and the Balearic shearwater [3]. EwE was used to model this area and described the structure and functional traits of the food web [4], calculating the trophic level of each species.

## Results and Discussion

By using SIA method we depicted the predator-prey relationships among the different species of the food web in the ED. As expected,  $\delta^{15}\text{N}$  values indicated that bottlenose dolphin, Audouin's gull and the group composed by other seabirds were located at the top of the food web, while sardine, benthopelagic fish and the other demersal and pelagic fish and cephalopods were located at the base of the food-web or at intermediate positions (Fig. 1). Moreover,  $\delta^{13}\text{C}$  values helped to determine the foraging areas of each species, in relation to their pelagic or benthic localisation; the low  $\delta^{13}\text{C}$  values of Audouin's gull and anchovies indicated that these species fed on pelagic waters, whereas the high  $\delta^{13}\text{C}$  values showed in the loggerhead sea turtle and the benthopelagic cephalopods indicated that these species fed on benthic waters (Fig. 1).

The EwE approach showed some discrepancies and similarities with the stable isotope approach. For several groups, the TL values estimated in the EwE were similar to the estimated by SIA method (i.e. the loggerhead sea turtle or the bottlenose dolphin). However, the EwE showed lower TLi for the seabirds suggesting that seabird species were located at the base of the food web. This is an artefact in the EwE due to consideration of the discards, the main food for the studied seabirds, with very low trophic level value (TL=1) because we did not consider demersal and pelagic fish in the discards. Thus, the real trophic position of seabirds in the area may be around TL=4.

In conclusion, both methodologies were insightful to describe the food-web traits of the ED and enabled us to complement our understanding of the area and to validate our results.



**Fig. 1. Carbon and nitrogen isotope values of fish, seabirds, dolphins, sea turtles and cephalopods from the Ebro Delta (NW Mediterranean) during 2003.**

## References

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