

FOOD WEB STRUCTURE OF DEEP-SEA COMMUNITIES IN THE BALEARIC BASIN: EVIDENCE FROM $D^{13}C$ AND $D^{15}N$ ANALYSIS

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Abstract

Food web structure of deep-sea communities off the Catalan Sea (NW Mediterranean) was investigated using carbon and nitrogen stable isotope tracers on a total of 124 taxa. Samples were collected close to Barcelona, between 650 and 1600 m depths, from January 2007 to February 2008. The higher trophic levels were occupied by benthic fish (*Nezumia aequalis* and *Bathypterois mediterraneus*, $d^{15}N=11.30\text{‰}$ and 11.36‰ , respectively) and infaunal species (carnivores polychaetes such as *Nephtys* spp. and the deposit feeder *Molpadia musculus*). At the lower trophic levels we found *Salpa maxima*, and the pteropod *Cymbulia peroni* (TL=2). The overall range of $d^{13}C$ values was indicative of more than one source of carbon sustaining deep-sea communities: from different kinds of sinking particles to sedimented and frequently recycled POM.

Keywords: *Deep Sea Ecology, Food Webs, Western Mediterranean*

Introduction

The use of stable nitrogen and carbon isotopes for the study of trophic interactions is now common in aquatic ecosystems. However studies of the trophic web structure of deep-sea organisms are very limited [1,2] and only few were applied to lower trophic levels (benthos, suprabenthos, zooplankton) [3,4]. As part of the Spanish funded **BIOMARE** project, this study is aimed to identify the trophic levels of bathyal communities' dominant species, with particular respect to benthic and zooplanktonic organisms as resources for megafaunal species and to determine the origin of the primary food source and the different sources of food of bathyal ecosystems.

Materials and methods

Samples were collected from cruises sampling megafauna, benthos, zooplankton and suprabenthos off the Catalan Sea slope (Balearic Basin, NW Mediterranean) at depths ranging from 651 to 1600 m. Samples of megafauna and megabenthic, invertebrate epifauna were obtained by trawling the sea floor with a semi-balloon otter trawl (OTSB-14). Macrobenthos (infauna) was collected with box corers, suprabenthos by a MACER-Giroq sledge, while macroplankton, micronekton fauna was obtained by a WP2 net with a system of closure. Once collected samples were frozen at $-20^{\circ}C$ on board, then sorted in the laboratory, identified to species level and prepared for stable isotope analysis (see [4] and [5] for details on the methodology). A hierarchical cluster analysis was carried out on $\delta^{13}C$ and $\delta^{15}N$ mean values per species and per survey. An ANOSIM test was performed on the same matrix to compare groups identified based on knowledge of gut contents, and then a pair-wise comparison was done on the average $\delta^{13}C$ and $\delta^{15}N$ values of these groups.

Results and discussion

Overall the nMDS analysis separated samples as a function of the trophic level: on the right mainly species belonging to epi/infauna and to megafauna were found, while on the left suprabenthic and macroplankton/micronekton species occurred (Figure 1).

among surface deposit feeders (ranging from -21.0‰ to -16.4‰), suggesting exploitation of POM of both terrigenous and oceanic origins.

The same organization was found among macroplankton/micronekton: the lowest values were found for filter feeders which feed on particulate organic matter. Only two trophic levels were found in the zooplanktonic community off Cabrera (Algerian Basin, [4]). $d^{13}C$ ranges were particularly wide among carnivores (from -20.7‰ to -16.6‰), suggesting predation on a variety of prey from gelatinous zooplankton to small fishes and decapods. Three trophic levels were also found among suprabenthos according to [3] and [4], while megafauna occupied TL 3 and 4 with few fish species located at TL=5 (*Bathypterois mediterraneus*, *Phycis blennoides*, *Mora moro*, *Nezumia aequalis*, *Coryphaenoides guentheri*, *Lepidion lepidion*). Generally decapods occupied a lower trophic level than fish, according to [8] and [9], though 2 levels have also been identified.

References

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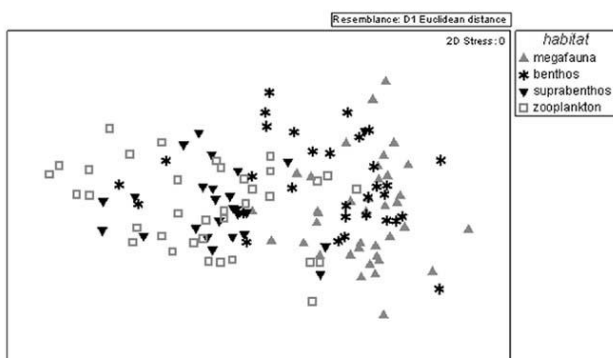


Fig. 1. NMDS plot of the mean $d^{15}N$ and $d^{13}C$ values of 124 taxa

A high complexity were found among each compartment. Epibenthic, invertebrate fauna was organized in three trophic levels based on a $d^{15}N$ -enrichment factor of 2.54‰ per level [6]. $d^{13}C$ ranges were particularly wide