



## Body condition of the deep water demersal resources at two adjacent oligotrophic areas of the western Mediterranean and the influence of the environmental features



L. Rueda <sup>a,\*</sup>, J. Moranta <sup>a</sup>, P. Abelló <sup>b</sup>, R. Balbín <sup>a</sup>, C. Barberá <sup>a</sup>, M.L. Fernández de Puelles <sup>a</sup>, M.P. Olivar <sup>b</sup>, F. Ordines <sup>a</sup>, M. Ramón <sup>a,b</sup>, A.P. Torres <sup>a</sup>, M. Valls <sup>a</sup>, E. Massutí <sup>a</sup>

<sup>a</sup> Instituto Español de Oceanografía, Centre Oceanogràfic de les Balears, Moll de Ponent s/n, 07015 Palma de Mallorca, Spain

<sup>b</sup> Institut de Ciències del Mar (CSIC), Passeig Marítim 37-49, 08003 Barcelona, Spain

### ARTICLE INFO

#### Article history:

Received 25 March 2013

Received in revised form 14 November 2013

Accepted 29 November 2013

Available online 4 December 2013

#### Keywords:

Demersal resources

Body condition

Hydrography

Trophic resources

Balearic Islands

Western Mediterranean

### ABSTRACT

Body condition indices not only are often used as reliable indicators of the nutritional status of individuals but also can they be utilized to provide insights regarding food availability and habitat quality. The aim of this study was to evaluate the connection between the body condition of the demersal species and the environmental features in the water column (i.e. the hydrographic conditions and the potential trophic resources) in two proximate areas, the north and south regions of the Balearic Islands (western Mediterranean), viz., the Balearic sub-basin (BsB) and the Algerian sub-basin (AsB), respectively, with different geomorphological and hydrodynamic features. Body condition indices were calculated for individuals of 21 demersal species including 11 teleosts, 4 elasmobranchs, 3 cephalopods and 3 crustaceans, which represented >70–77% of the deep water resources, captured by bottom trawling. The morphometric indices, viz., Relative Condition Index (Kn) and Standardised Residuals (SR) from the length–weight relationship, were used. The results for each one of the 21 species indicated a significantly better condition in terms of Kn and SR in the BsB, for 7 and 9 species, respectively. In addition, a general model, including the 21 species together, showed better body condition in the BsB, and during the summer. The spatial and temporal differences in the body condition are discussed in the context of the environmental variables characterising both the study areas, which showed significant variations, for some of the hydrographic features (chlorophyll *a*, dissolved oxygen, salinity, potential density and temperature), as well as for some of the potential trophic resources (mesopelagic and epibenthic fauna). These findings suggest an environmental effect on the body condition of the deep-water resources in the Balearic Islands, one of the most oligotrophic areas of the western Mediterranean, and reveal more suitable environmental conditions for these species on the northern insular margin, off the Archipelago. In addition to these ecological connections, the results also hold interest for the management and conservation of the habitats essential for the sustainability of fisheries.

© 2013 Elsevier B.V. All rights reserved.

### 1. Introduction

Over the last few decades, understanding the effect of climate, in harmony with the food web structure, trophic interactions and fishing pressure on the population dynamics of the species exploited, has grown to become vitally important for an ecosystem-based assessment and management of fisheries (Casini et al., 2010; Link, 2002; Planque et al., 2010). Besides these crucial ecological links, the conservation and management of fish habitats are also essential to sustain fisheries (Fogarty, 1999; Lloret et al., 2002).

Body condition is often used as an indicator of the amount of energy stored within an individual and can be considered as a measure of the physical and biological occurrences that happened during some prior period in the life of that individual (Lloret and Ratz, 2000). It is an

important factor, not only at the individual level, as an indicator of the health of the fish, but also for the maintenance of the fish populations because it influences the essential biological processes such as growth, reproduction and survival (Lloret et al., 2002). Body condition has also been used to indicate the habitat quality and food availability (Johnson, 2007; Lloret et al., 2002). Thus, individuals inhabiting the areas affected by environmental forcing, which could enhance the biological productivity and provide more food supply, have a better body condition than those inhabiting the less productive areas (Lloret et al., 2002, 2005; Love, 1974; Shulman and Love, 1999).

The north-western Mediterranean continental margin is one of the most extensively explored environments, particularly over the last few decades. In this area, many authors have studied the composition and dynamics of the deep water communities (e.g. Cartes and Sardà, 1993; Sardà et al., 1994; Stefanescu et al., 1993) and the life histories of the most important species (e.g. Cartes, 1998; Company and Sardà, 1998, 2000). Some of these studies have also analysed the potential

\* Corresponding author. Tel.: +34 971133720; fax: +34 971404945.  
E-mail address: [lucia.rueda@ba.ieo.es](mailto:lucia.rueda@ba.ieo.es) (L. Rueda).

environmental factors influencing these populations (e.g. Company et al., 2008; Sardà et al., 2009; Tecchio et al., 2011), especially in the submarine canyons, which facilitate the transport of organic matter to the deep ecosystems enhancing their productivity (Canals et al., 2006; Company et al., 2008; Zuñiga et al., 2009). These areas apparently act as hotspots for the local faunal diversity and biomass, increasing habitat heterogeneity and food availability.

In the oligotrophic areas such as the Balearic Islands (western Mediterranean), with the absence of terrigenous nutrient supply and without advective inputs of organic matter via the submarine canyons (Canals et al., 2006, 2009; Company et al., 2008; Sánchez-Vidal et al., 2008; Zuñiga et al., 2009), trophic webs are supported to a greater extent by the planktonic biomass, rather than by the benthic biomass (Cartes et al., 2001; Maynou and Cartes, 2000; Polunin et al., 2001). In these areas, the small- and meso-scale processes involving gyre circulations, boundary currents, eddies and fronts, are crucial and may represent sites of enhanced nutrient inputs for biological production (Williams and Follows, 2003; Sabatés et al., 2004, 2012), as well as playing an important role in the productivity of the western Mediterranean (Estrada, 1996). Several authors have studied the deep water communities and species off the Balearic Islands (e.g. Carbonell et al., 1999; Massutí et al., 2004; Moranta et al., 1998), as well as the potential influence of the environment on the population dynamics of their most important species (Carbonell et al., 2008; Guijarro et al., 2008, 2009, 2012; Hidalgo et al., 2008a,b; Massutí et al., 2008).

Some studies have analysed the body condition of the demersal species in the western Mediterranean, linking its relationship to the environmental factors. Most of these researches were conducted in the more productive areas of the north-western Mediterranean (Lloret and Planes, 2003; Lloret et al., 2002, 2005, 2007; Quetglas et al., 2011). In the oligotrophic deep water ecosystems around the Balearic Islands, several studies have also focused on this subject, however, considering only a single species (Carbonell et al., 2008; Guijarro et al., 2008, 2009, 2012; Hidalgo et al., 2008a). The aim of this study was to compare the somatic body condition of the major components of the deep-sea assemblages, considering the most important demersal species in these oligotrophic ecosystems, between two geographically adjacent areas,

the north and south regions of the Archipelago, experiencing different environmental conditions. These areas were studied during two different seasons, taking into account the main oceanographic factors, as well as the availability of the potential trophic resources in the different components of the deep ecosystems viz., the mesozooplankton along the water column, as well as the mesopelagic fauna, suprabenthos and epibenthos communities. This paper takes a multispecific and integrated approach, considering a large number of species, and several potential environmental factors as well as components of the food web which affect their body condition.

## 2. Materials and methods

### 2.1. Study areas

The study was conducted in two locations separated from each other by about 120 km in the Balearic (BsB) and Algerian (AsB) sub-basins, which are situated in the north and south regions of the Balearic Islands, respectively, and connected by the Mallorca channel (Fig. 1). These areas reveal very different geomorphological and hydrographic features. In the BsB, the upper slope is irregular, with numerous small canyons, while in the AsB, it is smooth.

The BsB is more influenced by atmospheric forcing and the Mediterranean waters, which are colder and more saline, whereas the AsB is influenced basically by the forcing due to the thermohaline density gradient and receives the warmer and less saline Atlantic waters. The Balearic channels have been described as important passages for exchange between these waters (Pinot et al., 2002). These marked differences between the north and south are reflected in the water column structure. Both temperature and salinity show more variability in the north than in the south, where the water column variations appear much smoother, as the south is less affected by the processes mentioned above (López-Jurado et al., 2008).

In addition, the BsB is more greatly affected by the system of fronts, which are generated in the colder and more productive waters of the Gulf of Lions and flowing cyclonically along the continental and insular shelf break and slope (Monserrat et al., 2008). In light of the pronounced

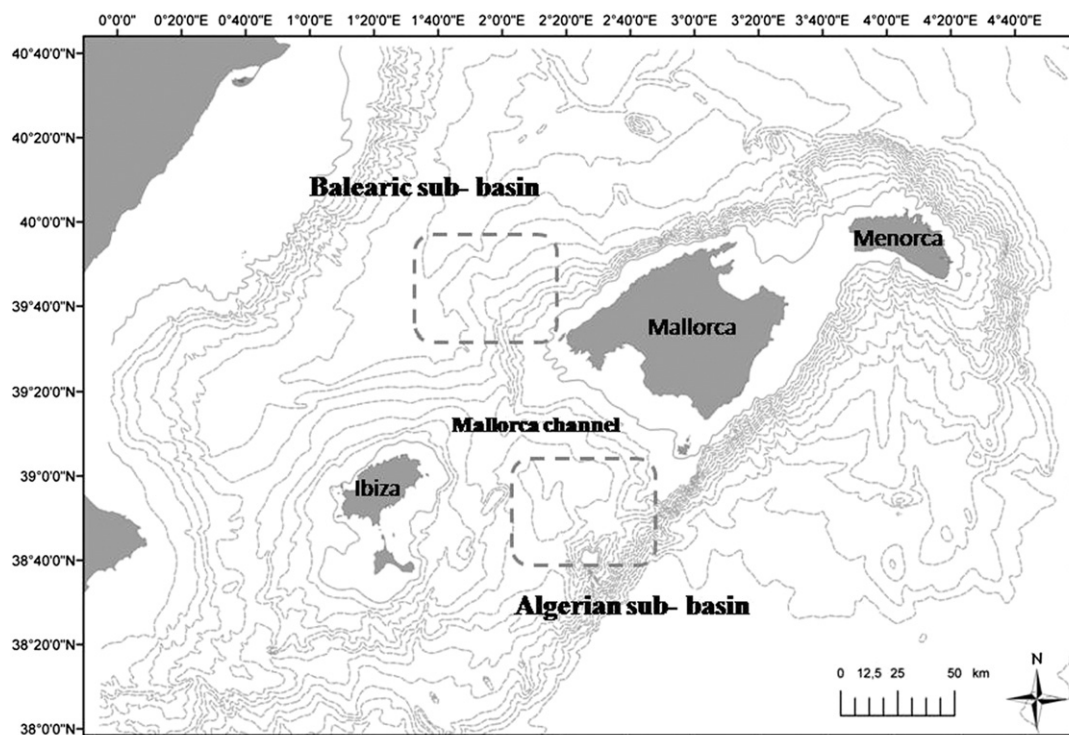


Fig. 1. Map of the study area (Balearic Islands, western Mediterranean), showing the grids where sampling was conducted. See [Material and methods](#) section for more details.

Download English Version:

<https://daneshyari.com/en/article/4548011>

Download Persian Version:

<https://daneshyari.com/article/4548011>

[Daneshyari.com](https://daneshyari.com)