Marine Environmental Research xxx (2017) 1–12

Contents lists available at ScienceDirect

Marine Environmental Research

journal homepage: www.elsevier.com/locate/marenvrev

# Mediterranean banks in EBSA area: Hotspots of biodiversity under threat

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ARTICLE INFO

*Article history:*
Received 1 February 2017
Received in revised form
7 September 2017
Accepted 9 September 2017
Available online xxx

*Keywords:*
Benthic ecology
Biodiversity
Conservation
Convention on biological diversity
Ecosystem evaluation
Ecosystem-based management
Mediterranean sea banks

ABSTRACT

This study demonstrates that, in the Central Mediterranean Sea, the Graham, Nereo and Pantelleria Vecchia Banks of the Strait of Sicily represent, in the wide and diversified 'Sicily Channel' Ecological or Biological Significant Area, unknown hot spots of biodiversity threatened by human activities. The investigated banks show an high ecological and biological value (EBV), assessed through presence/absence of specific indicators. The ecological groups of Graham Bank show the maximum EBV; the same as Nereo and Pantelleria Vecchia, except for the benthic component. All three banks are highly threatened, mainly the benthic and benthopelagic ecological groups. However, these Banks still have wide pristine areas to protect and can be considered eligible sites for the imposition of area-based management measures of conservation. This study represent also a support for decision makers involved in protection of the Mediterranean open sea areas, to pinpoint other priority conservation banks.



## 1. Introduction

Despite its high biodiversity value and the presence of areas of relatively high productivity, the open sea continues to be one of the least protected regions, also in the Mediterranean, where areas beyond national jurisdiction make up the largest part. The development of a network of Marine Protected Areas (MPAs) in the open seas is a challenging task, mandated by several international decisions, including the World Summit on Sustainable Development (Summit, 2002) and the Aichi Targets (COP 10 Decision X/2, 2010). Since 2008, the Regional Activity Center for Specially Protected Areas (RAC/SPA) has been contributing to promote this objective by the MedOpenSeas project (MOS). The MOS is aimed at facilitating the establishment of Specially Protected Areas of Mediterranean Importance (SPAMIs), as defined in the SPA/BD protocol of the Barcelona Convention (United Nation Environment Programme and Mediterranean Action Plan, 1995), embracing open seas. In 2010, the first phase of the project led to the identification of twelve Priority Conservation Areas (PCAs) in the open seas, likely to contain sites, that could be candidates for SPAMI list (Joint Management Action of the European Community with the United Nations Environment Programme and Mediterranean Action Plan, 2010). The study area - Graham Bank, Nereo Bank and Pantelleria Vecchia Bank - falls into the PCA called Northern Strait of Sicily (Central Mediterranean Sea). These banks are also included in the 'Sicilian Channel' Ecologically or Biologically Significant Marine Area (EBSA), recognized in 2014 by the Contracting Parties of the Convention on Biological Diversity (CBD) (COP 12 Decisions, 2014). The EBSAs are special areas in the ocean that serve important purposes to support the healthy functioning of oceans and the many services that it provides (Conference of the Parties to the

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http://dx.doi.org/10.1016/j.marenvres.2017.09.005
0141-1136/

Convention on Biological Diversity, 2008). In 2008, the ninth meeting of the CBD (COP9) adopted seven scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats. Although in 2010, the CBD (COP10) noted that application of the EBSA criteria is a scientific and technical exercise and that it has no obligation to consider MPAs directly, however, this recognition represents the first step provided by CBD to include an area in 10% of the marine biomes preserved by 2020 (Aichi Target 11). Indeed, areas found to meet the criteria may require enhanced conservation and management measures, which can be achieved through a variety of means. The EBSA criteria is an open and evolving process that should be continued to allow ongoing improvement and updating, as improved scientific and technical information becomes available in each region (Conference of the Parties to the Convention on Biological Diversity, 2008).

In order to progress toward the achievement of the Aichi Target 11, conservationists urged upon the identification of priority 'biodiversity hotspots', mainly in the EBSAs, for protection and sustainable management (United Nations Environment Programme and Mediterranean Action Plan, 2015; Myers et al., 2000).

In 2015 during the second RAC/SPA consultation meeting for the neighboring countries of the open seas of the Sicily Channel/ Tunisian Plateau (April 2015, Sciacca, Italy) was pointed out the need to define specific hot spots of biodiversity within the Strait of Sicily, where develop SPAMIs in areas beyond national jurisdiction.

The paper intends to demonstrate that Graham Bank, Nereo Bank and Pantelleria Vecchia Bank represent, in a wide and diversified EBSA area, hot spots of biodiversity, with distinct strengths and weaknesses. The study also demonstrated that these remote areas are under threat and for this reason, require a site-specific, spatially explicit conservation policy. The Graham Bank, Nereo Bank and Pantelleria Vecchia Bank can represent eligible points for the institution of efficient and realistic area-based management measures, able to guarantee their protection and sustainable use.

The Strait of Sicily represents a point of connection between the Western and Eastern Mediterranean basin. It is a vast physiographic and tectonic structure among Italy, Tunisia and Malta. The Strait comprises the eastern sill with a maximum depth of about 540 m and the western sill, which have a maximum depth of 530 m sloping into the central basin with deep trenches more than 1700 m deep, oriented northwest-southeast (Boccaletti et al., 1987; Cello, 1987; Civile et al., 2010; Reuther and Eisbacher, 1985; Spanò et al., 2013). The Strait of Sicily geomorphology is characterized by the presence of Banks, extensive offshore shallow waters of different origin and morphology (volcanoes and sedimentary rocks) (Civile, 2015; Colantoni, 1985; Falzone et al, 2009).

The complex bathymetry of the Strait of Sicily influences on the mesoscale oceanography, characterized by filaments, meanders and eddies, that along the shelf edge of the Banks can cause upwelling, able to locally increase biological productivity. Moreover, the Strait of Sicily plays an important role as nursery, spawning and/or recruitment areas for many fishing target species (Bo et al., 2008; Fiorentino et al., 2003, 2004, 2008, 2011; Freiwald and Taviani, 2009; Gancitano et al., 2008, 2011; Garofalo et al., 2008; Gristina et al., 2013; Ragonese et al., 2009; Spanò et al., 2013; Zibrowius and Taviani, 2005).

It's worthy to note the recent detection of submarine hydrothermal activity, nearby some banks of late volcanism origin, relevant not only from a geological point of view but also for the related biological aspects (Bosman et al., 2008; Esposito et al., 2015; Falzone et al., 2009; Giacobbe et al., 2011).

The results of this paper may represent a support system for international decision makers involved in protection and valorization of the Mediterranean open sea areas. The applied area-specific, semi-quantitative scoring methodology was based on Taranto et al. (2012) method: the Ecosystem Evaluation Framework for global Seamount conservation and management.

The framework, initially elaborated by Pitcher and Bulman (2007) and Pitcher et al. (2007, 2010), was developed within the conservation part of the Seamount Ecosystem Evaluation Framework, SEEF, in order to locate potential ecologically or biologically significant seamount areas and evaluate its main threats, based on the best information currently available.

The SEEF can provide an intuitive form of systematizing and displaying of information, and can supply a platform both to characterize peculiarities of seamounts and identify knowledge gaps (Kvile et al., 2014).

The data set utilized in this study came from an accurate literature review and the preliminary results of two scientific surveys carried out in 2014 and 2015, by the Italian National Institute for Environmental Protection and Research (ISPRA) in the frame of the project 'Regional Observatory of marine and terrestrial Biodiversity of the Sicilian Region (ORBS).

This method could be a valid support to pinpoint the priority Mediterranean banks for conservation management.

## 2. Materials and methods

### 2.1. Study area

The paper is focused on three banks located in international water in the Strait of Sicily (United Nations Convention on the Law of the Sea, 1982), Central Mediterranean Sea: Graham Bank, Nereo Bank and Pantelleria Vecchia Bank. In Fig. 1 the main banks of the Strait of Sicily were represented, following the official localization of the Italian Navy Hydrographic Institute; the square points indicate the investigated banks. In this paper the term 'bank' is used to indicate morphological highs in open sea. Following Staudigel et al. (2010), seamounts will be also included, defined as: "any geographically isolated topographic feature on the seafloor taller than 100 m, including ones whose summit regions may temporarily emerge above sea level, but not including features that are located on continental shelves or that are part of other major landmasses".

The Graham Bank is composed by numerous volcanic edifices, mainly oriented NW-SE, such as the ephemeral Ferdinandea Island, located about 30 nautical miles from Pantelleria Island and 16 nautical miles from Sciacca. The volcanic cones are all well developed and vary widely both in size and depth, ranging from 9 m b.s.l. (ephemeral Ferdinandea Island) and 250 m b.s.l. (Falzone et al., 2009; Rovere and Wurtz, 2015).

The Nereo Bank represents one of the numerous shallows spotting the Adventure Plateau, the wide and flat continental platform of carbonatic origin in the north-western sector of the Strait of Sicily (Colantoni et al., 1985). This morphological high is located about 19 nautical miles from the south-west coast of Sicily. The Bank is composed of three main parallel NE-trending minor shoals separated by narrow channels. In this study, the northern main ridge was investigated; it is about 3.7 km long and 3.5 km wide, ranging from about 30 m to 60 m of depth (Civile et al., 2015).

The Pantelleria Vecchia Bank, along with Nereo Bank and many other morphological highs, compose the Adventure Archipelago within the Adventure plateau. This Bank is located 20 nautical miles north of Pantelleria Island. It is composed of two main shoals, ranging from 16 to 24 m b.s.l., and a number of smaller isolated bathymetric highs (Lodolo and Ben-Avraham, 2015).

### 2.2. Ecosystem evaluation framework

In order to demonstrate that the investigated banks represent

Please cite this article in press as: Altobelli, C., et al., Mediterranean banks in EBSA area: Hotspots of biodiversity under threat, Marine Environmental Research (2017), http://dx.doi.org/10.1016/j.marenvres.2017.09.005