

BIOFUN: BIODIVERSITY AND ECOSYSTEM FUNCTIONING IN CONTRASTING SOUTHERN EUROPEAN DEEP-SEA ENVIRONMENTS: FROM VIRUSES TO MEGAFUNA - A EURODEEP PROJECT PROPOSAL

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Abstract

What little we know of deep-sea ecosystems indicates that they host one of the highest biodiversities on the planet as well as important mineral and biological resources, which are increasingly being exploited. Understanding deep-sea biodiversity and ecosystem functioning, from viruses to megafauna, is essential to assess the impact of natural and anthropogenic factors and provide management options. The Mediterranean, in particular, is a unique system for such studies, characterised by homeothermia and a steep gradient of increasing oligotrophy towards the East. BIOFUN, a EuroDEEP project proposal, aims at investigating and comparing deep-sea sites across a trans-Mediterranean transect and in the Eastern Atlantic.

Keywords : *Abyssal, Bathyal, Biodiversity, Deep Sea Processes.*

The bathyal and abyssal ecosystems are the largest habitats on Earth, covering over 60% of its surface, and one of the least explored. What little we know indicates that the deep oceans have biodiversity levels amongst the highest on the planet [1, 2], much of which undescribed, as well as important mineral and biological resources are increasingly being exploited. However, the impact of deep-sea exploitation on the habitat and its fauna, often including long-lived species with long recovery times to disturbance, is still poorly understood [3, 4]. There is also accumulating evidence to the effects of climate change in the composition and structure of deep-sea communities and baseline studies are required to provide initial data from which to detect long-term ecosystem changes and their causes. The gap in knowledge of marine biodiversity has been recognised by the *Census of Marine Life* programme, which was at the origin of the EuroDEEP initiative to address the need for thorough description of species and understanding deep-sea ecosystem functioning, its links to the global biosphere and potential long term changes caused by natural and anthropogenic forces. The Mediterranean Sea is a unique environment for deep-sea studies [5, 6]. It is a close sea with high salinity and oligotrophy. Furthermore, one of the most important characteristics of the deep Mediterranean Sea is that it is homeothermic below 200-300 m depth, with temperatures of 13-14°C reaching abyssal. This homeothermia has two major implications: first, there is no thermal barrier to the bathymetric distribution of the deep fauna; second, the high temperature increases the rate of degradation of the sinking particles, resulting in a higher refractory index of the organic matter reaching the seafloor. This is especially important in a sea that is characterised by a strong longitudinal trophic gradient with increasing and intense oligotrophy towards the East. However, our knowledge of Mediterranean deep-sea communities below 1000 m is poor, the effects of homeothermia and oligotrophy mostly unknown and the relationships with Atlantic fauna yet to be established. With increasing anthropogenic and natural (climate change) impact on deep-water communities [3, 7, 8], it is timely and critical to investigate the deep-sea ecosystem biodiversity and functioning, providing the necessary baseline information to propose management and conservation options.

The aim of BIOFUN is to characterise, under an ecosystem approach, two deep-sea habitats - the mid-slope and abyssal plain - including for the first time the analysis from viruses to megafauna, to understand the linkages between biodiversity patterns and ecosystem functioning in relation to environmental conditions along a gradient of increased oligotrophy from West to East. The BIOFUN team proposes a multidisciplinary coordinated research programme to investigate the Algerian-Balearic Basin (1000-3000 m), the Ionian Sea including the Messina Abyssal Plain (1000-4100 m depth) and the Levantine Basin (1000-3100 m depth) in the Mediterranean and the Galicia Bank in the Atlantic. The programme is organised around a coordination workpackage (WP0) and 4 scientific workpackages: WP1- Physicochemical characteristics of the habitats; WP2- Community structure: census of biodiversity and biogeography; WP3 - Ecosystem functioning: food web processes and life-history patterns; WP4- Linkages between ecosystem functioning and biodiversity: tools for disturbance evaluation. The sampling programme is based on 3 major multidisciplinary BIOFUN cruises to be conducted in 2008 (depending on shiptime and funding): two trans-Mediterranean cruises using the new Spanish *RV Sarmiento de Gamboa* and the Italian *RV Urania* and a cruise to the Galicia Bank with the Dutch *RV Pelagia*. Other asso-

ciated cruises will also provide samples for BIOFUN, such as the Italian trans-Mediterranean VECTOR cruise on board *RV Universitatis*, French geophysical investigations of the W Med, German cruises on board *RV Meteor* and *M.S. Merian* for Central Mediterranean and Greek shiptime on board *RV Philia* for East Mediterranean. The cruises will use a variety of sampling equipment, including CTDs, sediment traps, current-metres, long-term moorings, benthic trawls, sledges, corers, landers and direct observation systems to sample both the habitat and its associated fauna.

The BIOFUN Collaborative Research Project proposal comprises 7 individual projects (CSIC, Spain; CNR, Italy; NIOO and NIOZ, Netherlands; UGent, Belgium; CEFREM, France; NUIG, Ireland) and 3 associated projects (UNIVPM, Italy; HCMR, Greece; SNG, Germany) with a wide range of expertise and strong history of collaborations. The project also aims at interacting with a number of major European and international initiatives, such as the deep-sea CoML projects COMARGE and CeDAMar, the EU funded HERMES project, CIESM-SUB and MarBEF, to maximise the results from the efforts conducted internationally. BIOFUN also proposes interactions with EuroBIS as a depository for taxonomical data and with CoML-DESEO (Deep-Sea Education and Outreach) to share the project's results with society. The BIOFUN project proposal has received positive evaluations by the international EuroDEEP Review Panel and is currently in the phase of budget approval by the respective National Funding Agencies. At this stage, no guarantees concerning funding or final project decision have been made yet.

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