Food and Agriculture Organization of the United Nations

4
WORK PACKAGE

Ecosystem functions, services, and goods

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Objectives

The North Atlantic sponge grounds, characterized by large, physiologically active, and highly silicified sponges, offer a natural laboratory to quantify for the first time the ecological significance of sponge-mediated energy and nutrient fluxes to both the deep-sea ecosystem and the regional balance of major biogeochemical cycles.

This Work Package aims to assess the roles of sponge grounds in terms of ecological functioning, and goods and services. In order to reach the aim, the following objectives will be addressed:

- Quantification of the impact of sponge grounds on the benthic-pelagic coupling of major biogeochemical cycles of ocean nutrients (Si, C, N);
- Quantification of the impact of sponge grounds on the deep-sea marine food web; and
- Quantification of the impact of sponge grounds in deep-sea ecosystem metabolism (i.e., productivity and respiration).

Other services and goods provided by sponge grounds such as habitat and refugia provision are included in Work Package 2, whereas their biotechnological potential is addressed in Work Package 5.

Focus

The focus is to uncover and document how deep-ocean areas with sponge grounds are functioning and how their ecological performance affects the general deep-sea ecosystem in which the sponge grounds are integrated. We have emerging evidence that sponge grounds are key players in the turnover of energy, organic matter, and inorganic nutrients in the deep-sea. A role that has been overlooked so far, despite these processes being relevant to the health of the entire ecosystem and, indirectly, facilitating the proliferation of both commercially exploitable and non-exploitable deep-sea organisms. While the traditional research perspective has focused on explaining how organisms are impacted by the environment, we also seek to investigate the opposite view: how and how much sponge grounds impact on the surrounding ecosystem from a functional point of view.

Why is this important?

Understanding how ecosystems function is necessary to preserve them efficiently. Determining the biogeochemical and physiological connections of these organisms to ocean conditions is the only way in which the future of the deep sea can be reliably predicted and mathematically modeled to anticipate major changes. These organisms are foreseen as key in designing environmental preservation and restoration strategies. Yet, sponges have remarkable biotechnological interest as sources of biomaterials and chemical compounds with pharmacological potential. Their genomes are also crucial to understanding the origin and early evolution of animals on earth. To understand how these deep-sea sponge communities function is pivotal for future strategies of conservation, sustainable exploitation and even laboratory culturing aimed to subsequent scientific and biotechnological applications.

SponGES

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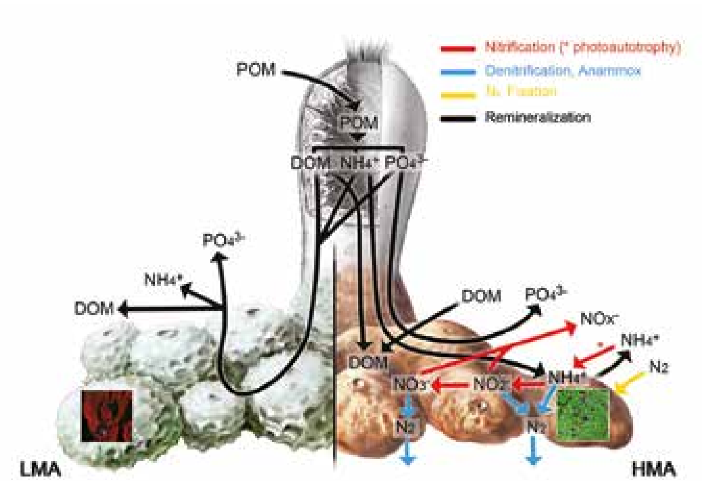
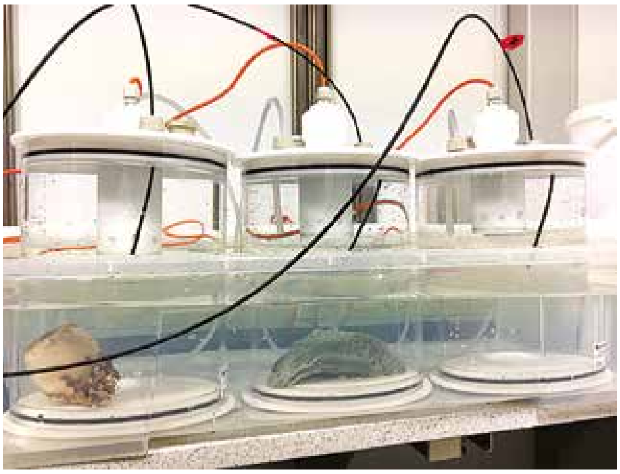
The EU-funded SponGES project will contribute to the sustainable management of deep-sea fisheries, and the protection of sponge-dominated vulnerable marine ecosystems in the North Atlantic through the collection of data and the development of knowledge on the vulnerability and threats as well as protection measures leading to a sustainable use of the deep-sea areas.

What are the key knowledge gaps to address?

We have indirect evidence that the ecological role of sponge grounds in the deep sea can be important not only in terms of maintainance of biomass and biodiversity, as traditionally known, but in relevant functional networks of energy and matter. However, the participation of sponges in such processes has seldom been quantified at either the individual or populaton level. Due to technical dificulties, the magnitude of fluxes accross extensive, dense sponge grounds and their impact on the rest of deep-sea ecosystem remain largely unassesed. The main challenge in Work Package 4 is attempting to measure accurately the effects of sponges on the ecosystems, using a combination of in-situ and laboratory experiments.



Summary of known nutrient fluxes in high (HMA) and low (LMA) microbial. While most nutrient fluxes are at some point mediated by sponge-associated microbes, silicon fluxes are not, strictly associated to the production of the sponge skeleton (modified from Maldonado et al. 2012)



Chamber designed to conduct “in situ” incubations at the deep sea (Photo credit: de Goeij & Mueller, University of Amsterdam)

Expected major outputs

Quantification of the ecological role of sponge grounds in deep-sea ecosystems in order to support the preservation and sustainable exploitation of the deep-sea.

Results achieved so far

We have preliminary quantitative information about the ecological role of sponges in terms of using dissolved and particulate organic matter, oxygen and inorganic dissolved nutrients. We also started assesing the magnitude at which sponges could impact on major nutrient cycles.

What methods/technologies/ approaches are you using

We are highly involved with physiological and biogeochemical experimentation in-situ (deep sea) and in laboratory controlled conditions. To this aim we use special incubation chambers and remote operated vehicles for both runing experiments in the deep sea and collecting alive specimens for subsequent laboratory experimentation.

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