Food and Agriculture Organization of the United Nations

SponGES POLICY BRIEF

The social and cultural value of deep-sea sponges

Deep-sea sponges inhabit very remote areas, which are difficult to access and to study. For centuries, the deep-sea seafloor was almost considered as bare soil hosting very little biodiversity. However, this perception radically changed when, through advances in technology, deep-sea sponge aggregations were discovered. The first sponge ground was detected in 1987 around the Faroe Islands and the occurrence of scattered deep-sea sponge grounds was later confirmed in several other areas of the Northeast Atlantic (Klitgaard and Tendal, 2004).

These discoveries sparked a debate, within the international community, on how to reconcile the conservation of sponge grounds with ongoing economic extractive activities in the deep sea.

Today the relevance and the vulnerability of deep-sea sponge grounds are widely recognized at the international level.

SponGES

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Deep-sea sponge grounds are classified as Vulnerable Marine Ecosystems (VMEs) (FAO, 2009), are considered ecologically and biologically significant areas (UNEP-WCMC, 2010), and since 2008 are included in the Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR convention) (OSPAR, 2008).

Government representatives, gathered in the United Nations General Assembly, committed to taking actions to protect VMEs by reducing adverse impacts caused by bottom fisheries in international waters (high seas) (UNGA, 2007; UNGA, 2009). Besides this recognition at the international level, **what sort of values could different individuals place on deep-sea sponges?**

Possible benefits and values associated to deep-sea sponges

Values express the multifaceted way in which nature, ecosystems, or ecosystems services are considered important by individuals and social groups. Individuals can hold a plurality of values towards ecosystems according to the different benefits received (Box 1).

Below, examples of different values associated to the existence of deep-sea sponges are listed. As shown, reasons for which deep-sea sponges could be valued could greatly differ.

DIRECT USE VALUE – CONSUMPTIVE

I value deep-sea sponges because:

- different anticancer drugs commercially available are derived from natural compounds found in sponges.

DIRECT USE VALUE – NON-CONSUMPTIVE

I value deep-sea sponges because:

- being out in the ocean and exploring them through underwater oceanographic instruments is an extraordinary experience;
- the microscopic geometric patterns found in their spicules spark my creativity and my artwork;
- I enjoy the beautiful underwater landscapes they create in the deep sea;
- they are living examples of primitive life forms;
- they are incredibly intriguing organisms to study, characterized by an amazing complexity which is yet to be unraveled;
- I feel reverence and respect for the ocean and all its life forms.

INDIRECT USE VALUE

I value deep-sea sponges because:

- they provide a habitat for a variety of other marine organisms;
- they are essential habitats for the fish I eat;
- they contribute to the regulation of biochemical processes in the deep sea.

BOX 1 Plurality of values held towards natural ecosystems

- **Direct use values:** are related to benefits received from direct utilization. The utilization could lead to consumptive or non-consumptive uses.
- **Indirect use values:** are related to the benefits received from ecosystem maintenance.
- **Option values:** are related to benefits that will be received in the future from both direct and indirect uses.
- **Bequest values:** are related to benefits that will be received by future generations.
- **Altruistic values:** are related to benefits that will be received by others.
- **Existence values:** are related to benefits received by knowing that the ecosystem exists and will continue to exist.

OPTION USE VALUE

I value deep-sea sponges because:

- they are a potential source of new pharmaceuticals and new therapies which could prove to be effective for treating serious or life-threatening diseases;
- in the future, biosilica bone-graft implants derived from deep-sea sponges may be useful in healing my bone fractures, osteoporosis or other bone defects;
- they have a great potential for providing future (still unknown) biotechnological innovations.

NON USE VALUE (BEQUEST, ALTRUISTIC, EXISTENCE)

I value deep-sea sponges because:

- they are part of the natural heritage, which I would like to pass on to my children and my grandchildren;
- I would like all the benefits that they convey to be available to others;
- they are unique life forms in the deep sea.

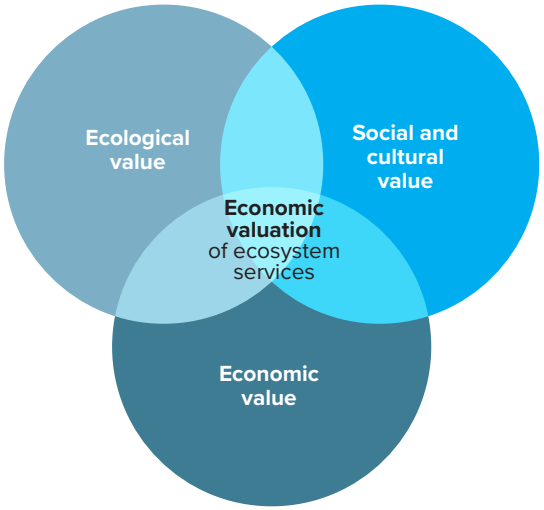
Plurality of values and approaches needed

The plurality of existing values towards natural ecosystems is not easily accounted using a single approach. An economic valuation, lying at the interface of economic, ecological and social dimensions, is often carried out to demonstrate the contribution of ecosystems to people's wellbeing (Figure 1).

However, **an economic valuation is usually able to include only a limited number of ecosystem services due to data limitation.**

In the case of deep-sea sponges, the economic valuation carried out by FAO (2020a) could not comprehensively reflect: future option uses (in the economic dimension), the ecological relevance of deep-sea-sponges concurring to the maintenance of processes of the deep sea and threats and impacts generated by human activities (in the ecological dimension), and the non-material cultural benefits conveyed by deep-sea sponges (in the social and cultural dimension).

FIGURE 1 **Economic valuation of ecosystem services lies at the interface among economic, ecological, social and cultural dimensions**



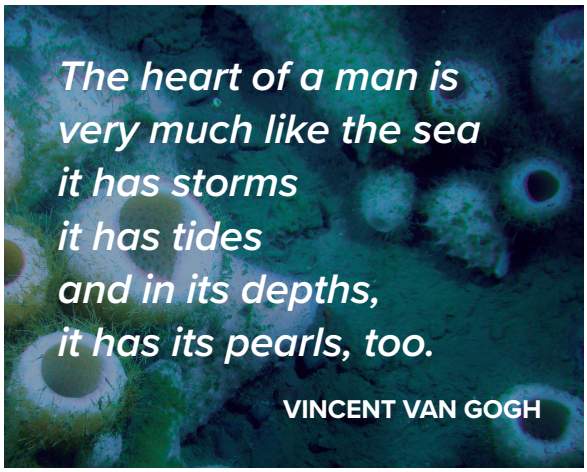
Source: Author's elaboration

A large share of social and cultural values often remain unaccounted for and are usually related to cultural services that do not provide material or physical benefits, but rather benefits related to thoughts, beliefs, and emotional responses within the inner life of an individual (Figure 2). Aesthetic experience, art inspiration, spiritual experience, and cultural heritage are all examples of cultural services. These nonmaterial benefits are by definition intangible and subjective. Thus, they are very difficult to capture and even more difficult to quantify and to translate in monetary terms.

Society's interest towards deep-sea sponges: first indications

Deep-sea sponges raise great interest in the scientific community. This interest peaked in 2016, when 72 researchers, belonging to

FIGURE 2 **Intangible values associated to deep-sea sponges can be expressed by reflections and emotions belonging to the inner life of an individual.**



Source: Author's elaboration. *Photo*: ©Fisheries and Oceans Canada

25 different institutions from Canada, the Unites States of America and Europe created a consortium under the SponGES project to make progress in the study of deep-sea sponges.

During the SponGES project, the relevance of deep-sea sponges for scientific research and education was shown by the over 90 peer-reviewed publications, with an average impact factor of 4.36, which recorded 23 522 reads on the Researchgate platform (SponGES project, 2020).

However, the interest in deep-sea sponges is not confined to the scientific realm, but it is slowly percolating in other disciplines too.

One example is found in modern architecture, in which the simulation of patterns, structures and processes observed in nature is used as an approach to finding innovative solutions (i.e. biomimicry).

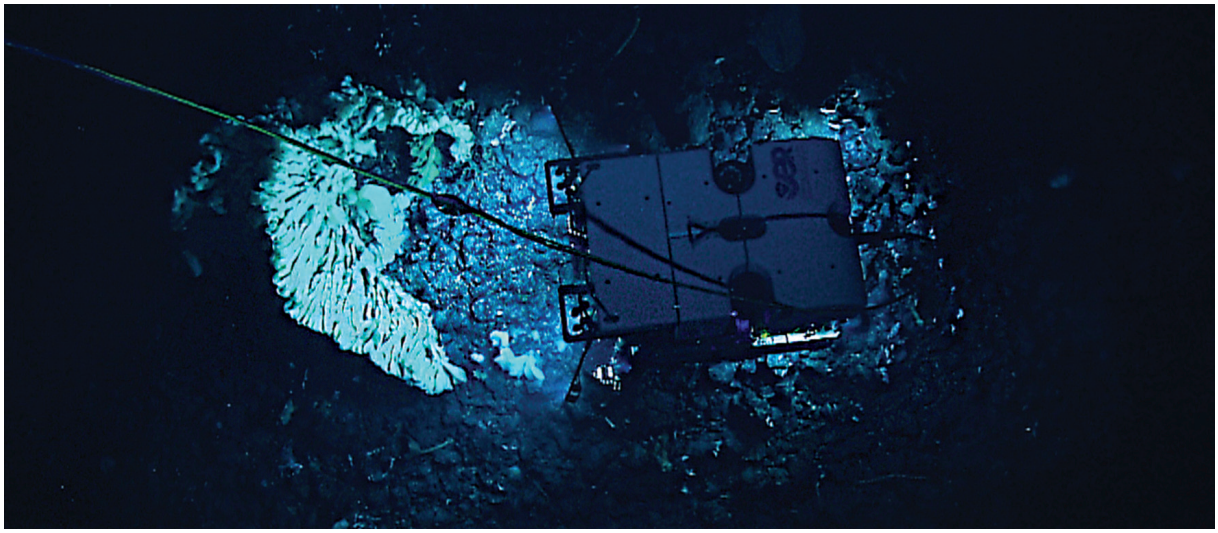
The skeleton of the deep-sea sponge (*Euplectella aspergillum*), known as the Venus' flower basket, with the helicoidal arrangement of its filaments, has given the inspiration for the London's Gherkin skyscraper designed by Foster and Partners (Davidson, 2020).

At the same time **deep-sea sponges could also be considered part of our world natural heritage.** Some massive specimens, unique sponge grounds or reef formations clearly represent unique features in the deep-sea (Figure 4). The World Heritage Convention, promoted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and adopted in 1972, is an international agreement aimed to protect our common cultural and natural heritage. For the preservation of the world natural heritage, the Convention lists natural features, formations and natural sites of outstanding universal value. Some of the criteria used to select UNESCO natural sites can also be applied to marine ecosystems (Abdulla *et al.*, 2013). While several coral reefs are already included among World Heritage marine sites, there is also potential for inclusion of deep-sea sponges characterized by exceptional natural beauty (criterion vii), but also features contributing to exceptional ecological or ocean processes (criterion ix) or those supporting an exceptional level of biodiversity (criterion x).

FIGURE 3 **Inspiration provided by the deep-sea sponge (*Euplectella aspergillum*) for the construction of a famous skyscraper in London.**

Sources: left, ©FAO; right, ©Aurelien Guichard, CC BY-SA 2.0.

FIGURE 4 **The largest ever known deep-sea sponge, measuring over 3.5 m in length, 2.0 m in width and 1.5 m in height, recently discovered by Wagner and Kelley (2017).**



Source: ©NOAA

The reaction of the general public to the outcomes of the SponGES project seems to suggest the interest of a potential diversified audience consisting of researchers, university students, fishery managers, decision makers, industrial actors, NGOs, pupils/children and adults. **The SponGES project with its dissemination and outreach strategy has reached out to over 2 million people worldwide,** through 120 conferences and workshops, 80 exhibitions, pitches, public engagement actions and a strong digital presence (SponGES project, 2020).

Surveys of people's attitude towards VMEs

A common belief is that, based on the old saying "out of sight, out of mind" the general public will have little interest in the conservation and management of the deep sea, including deep-sea sponge grounds. On the contrary, a recent large meta-analysis of 25 surveys, covering 21 countries across North and Central America, Europe, Africa, Asia, New Zealand and Australia, revealed that 70 percent of the interviewed people (n = 32 800) believed the marine environment to be under threat due to human activities, and 45 percent considered the threat to be high or very high. To reduce this threat, 73 percent of the respondents supported the idea of establishing marine protected areas (Lotze *et al.*, 2018).

No specific surveys so far have been carried out to describe, in a structured way, public perceptions and opinions towards deep-sea sponges, but some are available for cold-water corals.

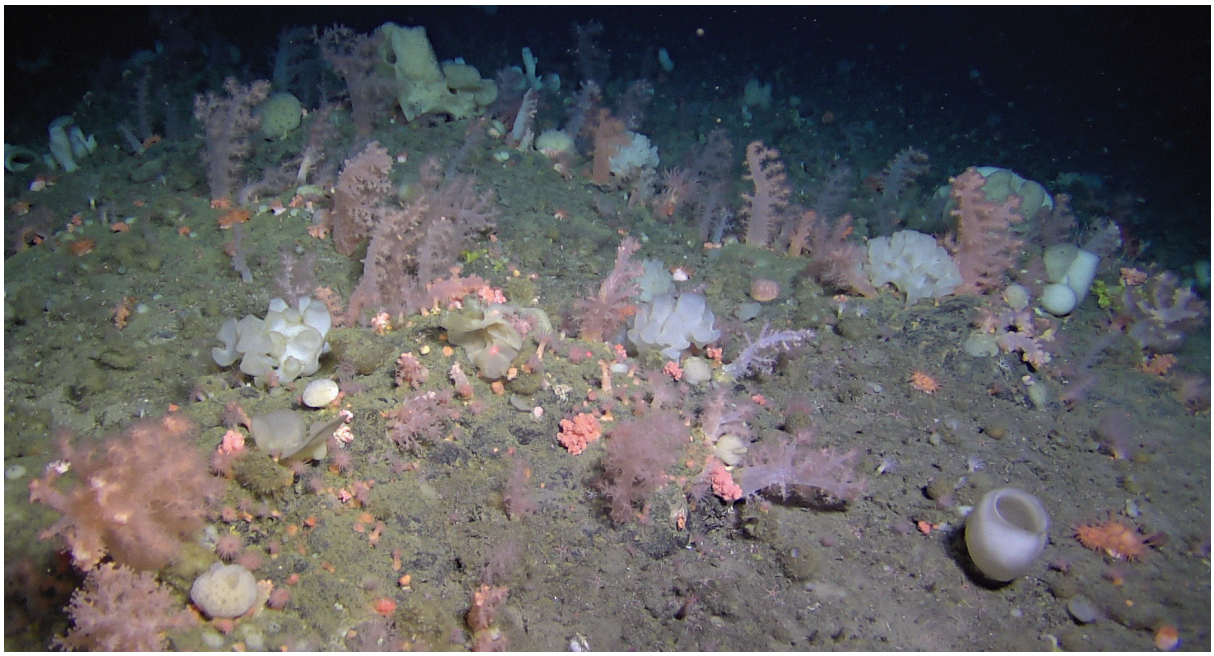
Not only cold-water corals and deep-sea sponge grounds are both benthic habitats classified as VMEs, but they can occur together in mixed formation (Figure 5) (UNEP-WCMC, 2011).

Therefore, the attitude of stakeholders towards cold-water corals is likely to be relevant for deep-sea sponges, too.

In Europe surveys on public attitude towards cold-water corals have been carried out in Ireland (Wattage *et al.*, 2011; Armstrong and Aanesen, 2019), Norway (Aanesen *et al.,* 2015; Aanesen and Armstrong, 2019; Armstrong *et al.*, 2019), and Scotland (Jobstvogt *et al*., 2013).

In these types of surveys, scenarios made for different attributes were presented to respondents. All analyzed surveys had a similar core structure, in which different scenarios

FIGURE 5 **Example of cold-water corals and deep-sea sponges occurring together together on the Schulz bank, Arctic Mid-Ocean Ridge**



Source: ©Hans Tore Rapp, University of Bergen

arose from the interplay of three main attributes: the size of the area established for protection for cold-water corals (e.g. MPA or area closure), the type of economic activity (e.g. bottom fishing and/or oil and gas extraction) allowed in the protected area, the monetary contribution (e.g. taxes) that respondents were willing to pay for cold-water coral protection. Respondents were asked to select the preferred scenarios or to rank them. This implied assessing the **trade-offs between respondent's inner beliefs and values towards cold-water corals' conservation, personal economic loss** (i.e. additional taxes)**, and/or the economic loss of others** (i.e. restrictions for deep-sea bottom fisheries and/or deep-water oil and gas industry) (Jobstvogt *et al.*, 2013). Although respondents were usually not very familiar with cold-water corals, they were able to acquire new information provided during the survey and to process it with their own beliefs and moral values (Jobstvogt *et al.*, 2013).

The number of proposed scenarios was variable among the surveys. However, one scenario always described the "business as usual situation" in which there were no additional protected areas for cold-water corals, no activity restrictions, and no increased cost borne by society.

In all surveys, the business as usual scenario never represented the preferred option. **On the contrary, the most common attitude towards cold-water corals was that they are worthy of protection because of their existence value and because they are habitat for fish.**

A critical point, which emerged in several surveys, regarded the trade-offs between cold-water corals' protection and restrictions of bottom fishing activities.

In the Irish survey, respondents showed a strong preference for banning bottom fisheries where corals were thought to exist (Wattage *et al.*, 2011), but a more mixed attitude was later found by Armstrong *et al*. (2019). In Scotland and Arctic Norway, the decision on this trade-off was not unequivocal but some heterogeneity was found in the sample of respondents.

A positive preference towards **bottom fisheries was expressed by local coastal communities depending on fisheries, by people with higher education, who were not directly involved in the sector, but were concerned about the potential impacts on the national economy, and by those underlining the historical and cultural relevance of this activity** (Jobstvogt *et al.*, 2013; Aanesen and Armstrong, 2019).

Implications for management and decision making

Policy makers and managers are likely to increasingly face situations in which they need to decide on further implementation of protected areas for the conservation of deep-sea sponge grounds in the waters of their national jurisdictions or in international waters (FAO, 2020b).

The plurality of values that can be associated to deep-sea sponges will be reflected into different stakeholders' behaviors and attitudes (Box 2).

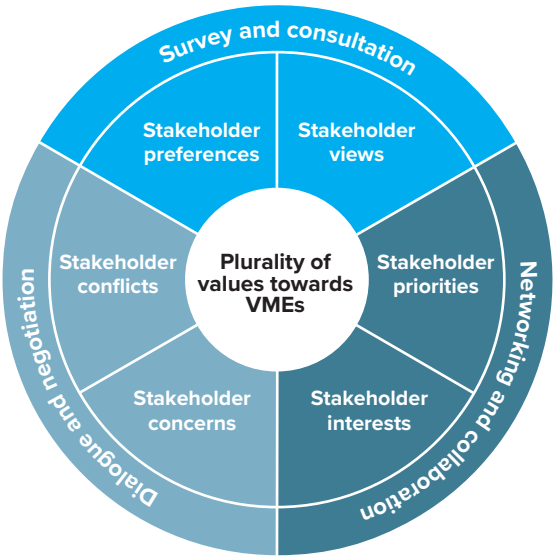
BOX 2 Insight on people's attitude towards VMEs in a nutshell

- People can place a value on VMEs despite their location in remote areas and the general lack of familiarity with these habitats.
- People can recognize VMEs as habitat for fish species, which is not necessarily instrumental for higher current or future fish catch (use value or option value).
- People can consider VMEs worth of protection for a pure existence or bequest, non-use values.
- People can have conflicting views when they had to choose between VMEs conservation and economic activities, especially deep-sea fisheries.

Understanding such plurality of values is pivotal for a participatory decision-making process.

A representative stakeholder consultation will provide insights on the existing plurality of values associated to VMEs, which in turn will reveal stakeholders' views and preferences. Similar values will lead to similar interests and priorities, which will constitute a common ground to establish increased networking and collaboration among different stakeholders. On the contrary, contrasting values and priorities are likely to determine areas of conflicts among stakeholders' groups (Figure 6).

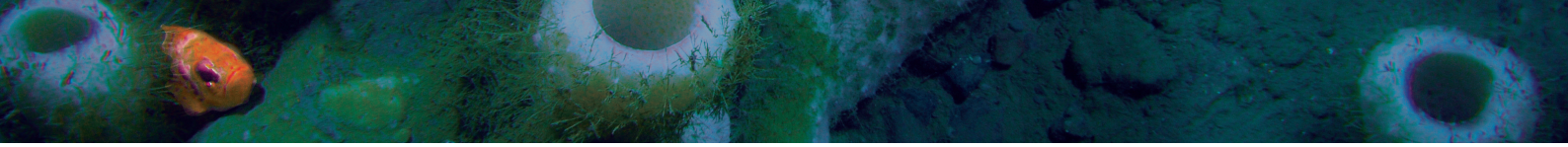
FIGURE 6 Plurality of values towards VMEs can be reflected in different stakeholder behaviors and attitudes



Source: Author's elaboration

Evidence found in the literature suggests that the lack of knowledge by the general public on VMEs should not be confused with a lack of interest.

Stakeholders motivations and views towards VMEs might not be entirely captured by economic considerations (Box 4). On the contrary, non use values can be a key driver of the preferences of the general public towards increased VME's protection.



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