Food and Agriculture Organization of the United Nations

# Sponges and their role in the marine environment

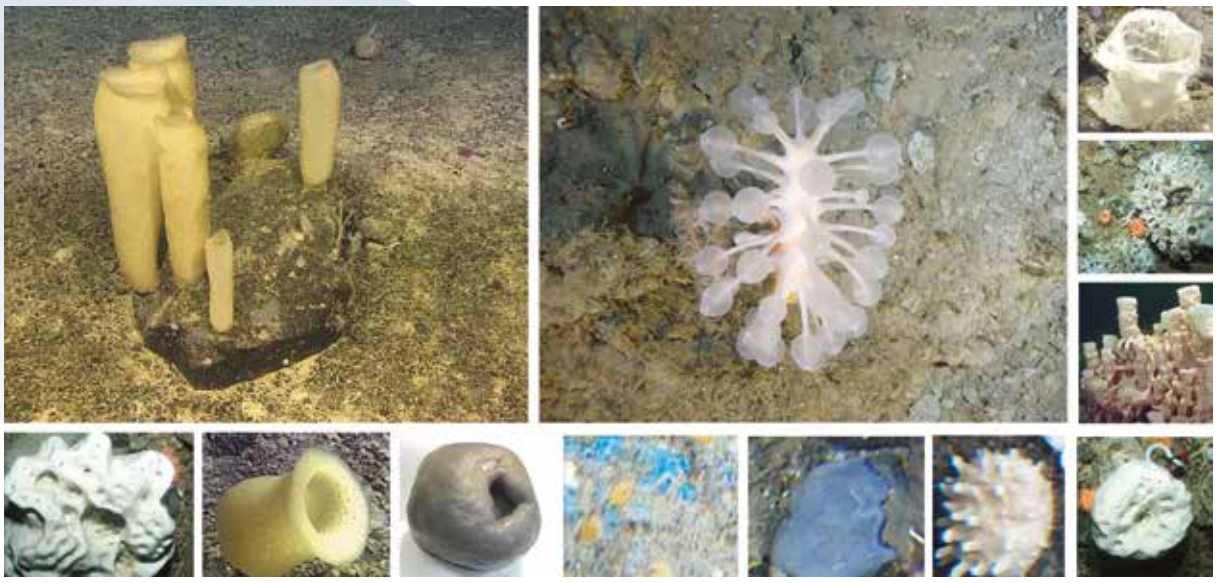
## Sponges are multicellular organisms that have porous bodies with channels, allowing water to circulate through them

They consist of a jelly-like layer between two thin layers of cells. Sponges may have a skeleton of spicules, made of silica, calcium carbonate and spongin, a protein. Sponge species may be identified by examining size and shape of their spicules, and only a few can be identified from outward appearance alone.

Sponges do not have nervous, digestive or circulatory systems. Most sponges feed on bacteria and organic matter by drawing water in through the pores. Collar cells line the channels in the pores.

The collars of these cells surround a flagellum that beat to create water currents. There are a few species of carnivorous sponges that feed by using their spicules to capture prey such as small crustaceans.

In general, sponges are not eaten by other organisms. They can contain toxins and their spicule structures probably do not make them very easy to digest. However, Hawksbill sea turtles and nudibranchs are known to eat sponges, as are a few fish species.



SponGES

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One remarkable feature is the **filtration capacity** of sponges. The sponge species *Geodia barretti* can filter up to 1,000 liters of water per kilogram of tissue each day. Other species have filtration rates of up to 20,000 liters seawater kg-1 h-1 [dry wt]. Sponges can remove up to 95% of bacteria and particles from the water (POM) and 90% of dissolved organic carbon (DOC), thereby converting suspended particles and dissolved matter into food for other animals. Up to 97% of the diet can be dissolved matter. Sponges seem to also play a role for the recirculation of carbon, silicon, and nitrogen.

Sponges provide a potential for biotech and innovation because sponges contain a great diversity of microbial symbionts. These symbiotic bacteria can be responsible for up to 60% of the weight of the sponges. A remarkable diversity of **bioactive compounds**, including some anti-cancer and anti-malarial compounds, have been found in sponges. Some of these compounds are likely to be made by microbial symbionts within the sponges rather than by the sponges themselves. More than 5,300 different natural products are identified from sponges, and more than 200 additional new metabolites from sponges are reported each year. Identification and testing of compounds and learning how the bacteria can be grown without sponges in fermentation systems is of major interest.

Sponge dominated ecosystems are very diverse in terms of community composition and structure, the geomorphological features they inhabit and their geographical and bathymetric distributions. Sponge ecosystems are found along continental shelves, slopes, seamounts, mid-ocean ridges, canyons and deep fjords at depths from 30 to 3,000 meters.

## Ecosystem services provided by sponge grounds

**SUPPORTING SERVICES:**

- Habitat: structural complexity providing food, refugia, spawning areas for fish; specialized habitats through spicule deposition
- Benthic-pelagic coupling (through filtration)
- Conversion of DOC to POM (food provision)

**PROVISIONING SERVICES:**

- Pharmaceuticals (bioactive compounds)
- Biotechnological materials

**REGULATING SERVICES:**

- Carbon and silicon sequestration
- Water purification

## SponGES

The EU funded **SponGES project** studies a range of issues related to the distribution and functioning of deep-sea sponges. Ecosystem function and services like silicon budget and fluxes, energy transfer and carbon cycling as well as nitrogen fluxes and balance is being studied. Also, the biotechnological potential is an important and economically interesting component.

All photos courtesy of DFO, Canada

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