

Xestospongia muta (Giant or Caribbean Barrel Sponge)

Order: Haplosclerida (No Common Name)

Class: Demospongiae (Common Sponges)

Phylum: Porifera (Sponges)



Fig. 1. Giant barrel sponge, *Xestospongia muta*.

[<http://eol.org/pages/338183/overview>, downloaded 27 March 2015]

TRAITS. The giant barrel sponge, as the name suggests, is soft and barrel-shaped with a wall that can be up to 2.5 cm thick at the top, increasing in thickness to the base. Smaller sponges are cone-shaped. The cavity only spans the top half of the structure. Also referred to as the “redwood of the reef”, its diameter and height often exceeds 1m, with the largest sponges reaching up to 2m in diameter. Common colours it is found in include brown, reddish-brown, grey and rose-purple (Fig. 1). The reddish-brown coloration is due to the presence of the cyanobacteria *Synechococcus spongiarum* intracellularly and intercellularly with respect to the sponge tissue. The external surface is irregularly organized with jagged ridges, with the spaces between the ridges having a smooth texture. Oscules (pores) are absent most times. However, in some cases, small openings around 2-3 mm in diameter which are oscular-like are found (De Kluijver et al., 2015). The giant barrel sponge is dioecious, but not sexually dimorphic; the separate male and female sponges are morphologically similar to each other.

DISTRIBUTION. Typically, they are endemic to the Caribbean Sea, from the reefs around the Florida Keys, to the northern coastline of South American countries, spanning from the Gulf of Mexico e.g. Belize to the Lesser Antilles and Trinidad and Tobago. This is due to the clockwise motion of the ocean currents within that oceanic region which facilitates the dispersal of the spores, eggs and larvae of the plankton responsible for sponge formation. *Xestospongia muta* are found in coral reefs, at depths greater than 10m.

FOOD AND FEEDING. These sponges are filter feeders, which feed on collected particles that are the size of bacteria. A large population of cyanobacteria belonging to the *Synechococcus* group, such as *Synechococcus spongiarum*, are found in their peripheral tissues. These rod-shaped, unicellular bacteria serve as both a direct food source by consumption of the bacteria through filter feeding, and they utilize nutrients that are obtained from the bacteria (Pawlik, 2011). This demonstrates a symbiotic relationship between the bacteria and the sponges (Gomez et al., 2004). The giant barrel sponge is considered to be on the second trophic level, meaning that it is a primary consumer since it consumes photosynthetic cyanobacteria, which are primary producers (McMurray et al., 2008).

POPULATION ECOLOGY. The giant barrel sponge, though living as a solitary sponge as seen in Fig. 1, is found abundantly in reef communities. It has been found to make up 9% of all sponges found in some regions, and have been found on the reef around Key Largo, Florida in densities of approximately 0.2 sponges/m² of reef. Studies have found that the ages of these sponges range from 100, exceeding 1000 years old (McMurray et al., 2008).

REPRODUCTION. *Xestospongia muta* only reproduce sexually. They are oviparous, and fertilization of eggs occurs externally in relation to the sponge. Spawning of these sponges within a given area is synchronous, whereby all females release their eggs and all males release their sperm at the same time, during a time frame of approximately an hour. This occurs at a minimum of twice a year, since it was seen occurring during spring and late summer more commonly. The eggs of the sponge are not buoyant, and remain within the opening or atrium of the sponge and scattered around the sponge in gelatinous masses. On the other hand, the sperm are very buoyant, and move as a “cloud” into the water column of the sponge containing the eggs, as seen in Fig. 2. The fecundity or reproductive rate of this species has been found to be similar to that of its relative *Xestospongia bergquistia*, which has been found to spawn around 1.4 million eggs with 71.4% fertilization. The larvae of these sponges are lecithotrophic, meaning that they obtain their nutrition from yolk (McMurray, 2008).

BEHAVIOUR. The sponges are sessile (fixed in one place), making them homes to various bacteria and species of fish. Lower growth rates have been found in winter for these sponges, due to energy being diverted towards gamete production in time for spawning in May i.e. in spring (McMurray, 2008).

Anti-predator behaviour: The presence of spicules (small mineral spines) is a form of physical defence against predation in many sponges. However, in the giant barrel sponge, the tracts of the glass spicules have been found to be running parallel to the surface of the sponge and not facing outward. This was found not to deter predators from feeding on this sponge. It has also been found that the giant barrel sponge showed variable results in its ability to chemically defend itself (Waddell and Pawlik, 2000). No deterrent compounds, such as secondary metabolites commonly found on many sponges, were found concentrated on the surface of the sponge’s tissue (Chanas

and Pawlik, 1995). However, their larvae have chemical protective mechanisms which prevent them from being prey to many species of fish (McMurray, 2008).

APPLIED ECOLOGY. *Xestospongia muta* has not been assessed by the International Union for Conservation of Nature or IUCN to be considered for entry on the IUCN Red List. This sponge is also not listed by the UNEP World Conservation Monitoring Centre. No record was found of this sponge posing any threats to humans, or being harvested by humans for utilization in any way, except for research.

REFERENCES

- Chanas, B. and Pawlik, J. R. (1995). Defenses of Caribbean sponges against predatory reef fish. 11. Spicules, tissue toughness, and nutritional quality. *Mar. Ecol. Prog. Ser.* **127**: 195-211.
- De Kluijver, M., Gijswijt, G., de Leon, R. and da Cunda, I. (2015). Giant barrel sponge (*Xestospongia muta*). http://species-identification.org/species.php?species_group=caribbean_diving_guide&menuentry=soorten, downloaded 27 March 2015.
- Gomez, R., Erpenbeck, D., Richelle-Maurer, E., Van Dijk, T., Woldringh, C. L. and Van Soest, R. W. M. (2004). Affinities of the *Aphanocapsa feldmanni*-like cyanobacteria from the marine sponge *Xestospongia muta* based on genetic and morphological analysis. *Boll. Mus. Ist. Biol. Univ. Genova.* **68**: 335-347.
- McMurray, S. E. (2008). Demography of the Giant Barrel Sponge *Xestospongia muta* in the Florida Keys. Master's Thesis, the University of North Carolina Wilmington.
- McMurray, S. E., Blum, J. E. and Pawlik, J. R. (2008). Redwood of the reef: growth and age of the giant barrel sponge *Xestospongia muta* in the Florida Keys. *Mar. Biol.* **155**: 159-171.
- Pawlik, J. R. (2011). The Chemical Ecology of Sponges on Caribbean Reefs: Natural Products Shape Natural Systems. *BioScience.* **61**: 888-898.
- Ritson-Williams, R., Becerro, M. A. and Paul, V. J. (2004). *Xestospongia muta* spawning on the Belize outer reef. *Journal for the International Society of Reef Studies.* **24**: 160.
- Waddell, B. and Pawlik, J. R. (2000). Defenses of Caribbean sponges against invertebrate predators. I. Assays with hermit crabs. *Mar. Ecol. Prog. Ser.* **195**: 125-132.

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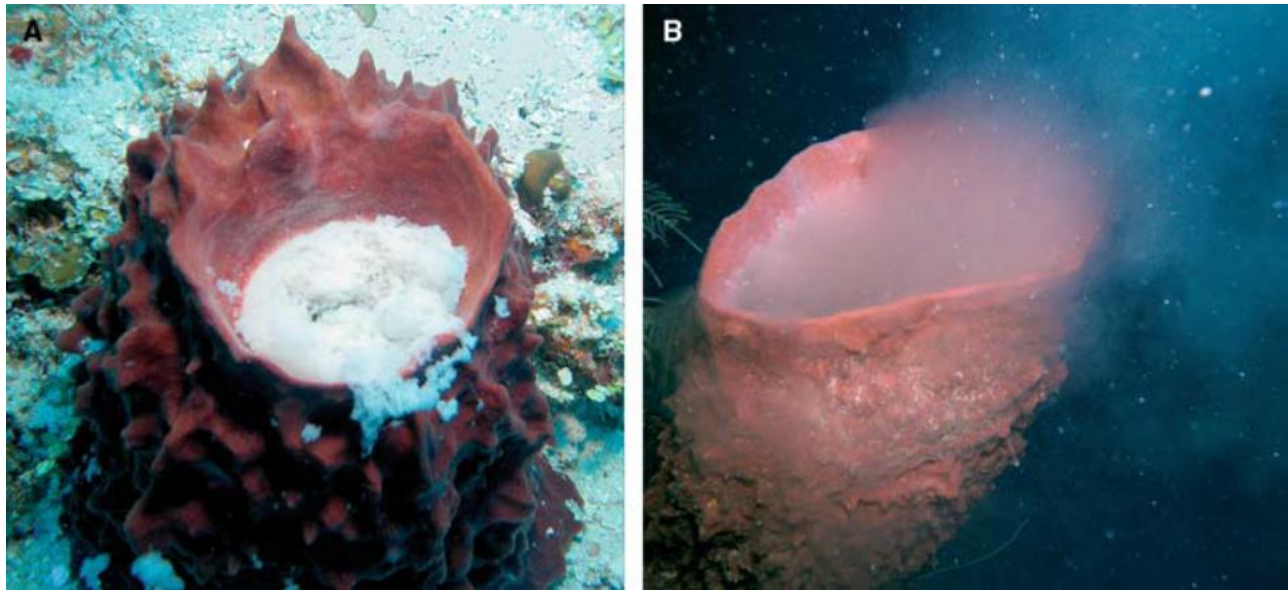


Fig. 2. Female (A) and male (B) giant barrel sponges during spawning.

[Fig. 1 of Ritson-Williams et al. (2004)]

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