# *Montastrea cavernosa* (Great Star Coral)

Order: Scleractinia (Stony Corals)
Class: Anthozoa (Corals and Sea Anemones)
Phylum: Cnidaria (Corals, Sea Anemones and Jellyfish)

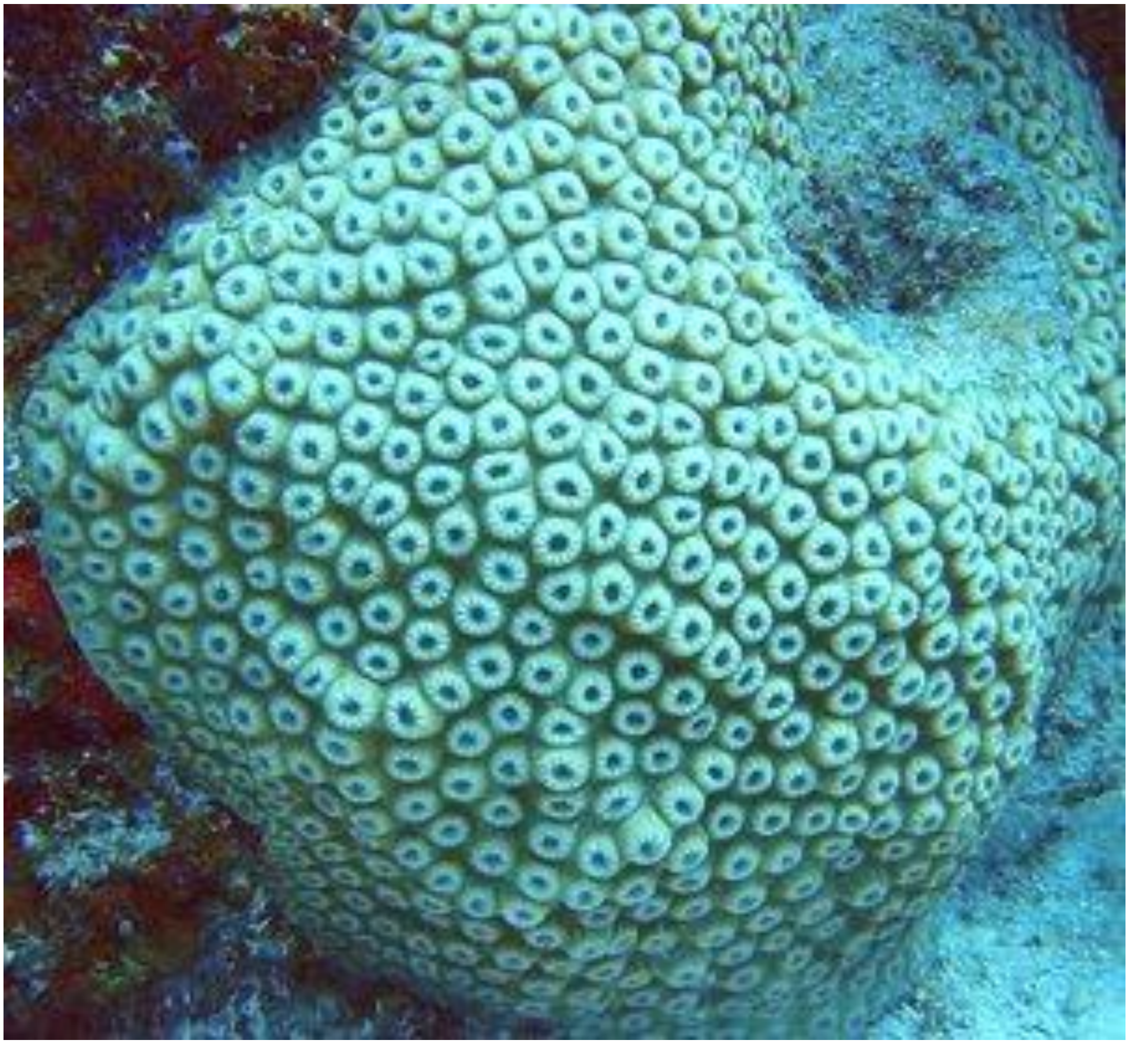

**Fig. 1.** Great star coral, *Montastrea cavernosa*.

[http://reefguide.org/carib/greatstarcoral.html, downloaded 26 March 2015]

**TRAITS.** *Montastraea cavernosa* is a hermatypic (stony or reef-building) coral, meaning that they form an aragonite skeletal structure and have symbiotic relationships with zooxanthellae. *Montastraea cavernosa* is a colonial coral species that is usually found in massive boulders and domes (Fig. 1), but can also grow as an encrusting form (Szmant et al., 1991). Colonies can be from 10-250cm in diameter and can appear with red, green and brown coloration (Acosta and Zea, 1997). Corallites, the calcium carbonate skeletons produced by individual polyps, are from 5.5-7.5mm in diameter with 36-48 septa radiating from the centre (Veron, 2000). The distance between neighbouring corallites is 5-9mm (Humann, 1993). *M. cavernosa* is gonochoric, which means polyps are either male or female and thus so too are their colonies which are formed via asexual reproduction. Variation in polyp expansion and activity cycles, zooxanthellae density, coloration and polyp shape, size, and density can be used to divide shallow water colonies of *Montastrea cavernosa* into two morphs, diurnal and nocturnal. Polyps of the diurnal morph of *M. cavernosa* expand both day and night, while those of the nocturnal morph expand only at night (Lasker, 1979, 1981). The diurnal morph tends to be brown, and the nocturnal morph to have brighter coloration like orANGE AND RED.

**DISTRIBUTION.** *Montastraea cavernosa* is native to Trinidad and Tobago. It occurs across the Atlantic Ocean; in the Caribbean Sea, Gulf of Mexico, Bahamas, Bermuda, Brazil, and some parts of West Africa (Aronson et al., 2008).

**HABITAT AND ACTIVITY.** *M. cavernosa* is found at depths of 0.5-95m, with peak population size found from 10-30m (Goreau and Wells, 1976). The species is able to dominate in turbid and silty environments due to the sediment rejection capabilities of its shape and sweeper tentacles, which are able to remove sediments from the polyp surface (Lasker, 1980; Richardson et al., 1979). Colonies of *M. cavernosa* exhibit two separate types of activity cycle: nocturnal, where by polyp expansion occurs at night (Fig. 2); and diurnal, where by polyp expansion occurs both night and day (Lasker, 1979). Diurnal morphs are found to have smaller polyps, shorter polyp heights and higher polyp densities than the nocturnal morph. Diurnal morph colonies are more commonly planar (flat) in shape, while nocturnal morph colonies were more commonly nodular (domed). The relationship between morphology and activity were most pronounced in shallow waters less than 15m. The diurnal morph's greater zooxanthellae densities correspond with greater rates of gross primary production than the nocturnal morph colonies (Lasker, 1981).

**FOOD AND FEEDING.** *M. cavernosa* exhibits both autotrophic and heterotrophic feeding strategies. They are heterotrophic in that they are primary consumers that feed on suspended zooplankton with the use of their tentacles. They are also considered unspecified detritus feeders capable of utilizing a wide range of organic matter and bacteria. Polyp extension activity depends on the morphology of the colony however expansion is more prevalent at night when zooplankton concentrations increase due to the vertical migration of plankton (Lasker, 1979). *Montastraea cavernosa* carries out symbiosis with zooxanthellae, a photosynthetic algae that lives in the coral's tissue. The coral gets sugars and essential nutrients from the zooxanthellae while the coral provides protection and a suitable environment for the algae. The zooxanthellae of *M. cavernosa* acquire nitrogen from endosymbiotic cyanobacterial nitrogen fixation. This endosymbiotic cyanobacteria is believed to be the reason for the orange colour seen in some colonies (Lesser et al., 2004; Lasker, 1981).

**POPULATION ECOLOGY.** Although they might appear as one organism, coral colonies are made up of many genetically identical polyps. A corallite is the term used to describe the calcareous skeletons produced by individual polyps. Stony corals secret calcium carbonate in the form of aragonite, thus creating an exoskeleton that protects the polyps. A tissue layer covers the calcium carbonate skeleton thus connecting the coral polyps. The average age of maturity for reef building corals is between three and eight years, so it assumed that the average age of a mature *M. cavernosa* polyp is about eight years. The average generation length is also assumed to be that of average reef building corals and as such is though to be 10 years long. The coral's total longevity is unknown, but is believed to be upwards of ten years (Aronson et al., 2008).

**REPRODUCTION.** Colonies are dioecious in that separate colonies are either male or female, with a 1:1 sex ratio in the population. The species goes through one reproductive cycle a year (Acosta et al., 1997). Sexual reproduction occurs through spawning, which happens at night in late summer, about a week after a full moon. First to spawn are the male colonies followed soon after by the female colonies; shallow and deep-water colonies spawn at the same time. After fertilization the embryo undergoes planktonic development to its planula form. The planula travels in the open water and eventually settles and develops into a polyp. The single polyp forms a colony via asexual reproduction, through budding. The new corallites develop amongst existing corallites. The polyps deposit calcium carbonate below them thus building on the current structure and forming the large boulder shape the species is known for. Zooxanthellae are not present in coral eggs thus indicating that algal symbionts are acquired either after settlement or during the planktonic phase (Acosta et al., 1997).

**BEHAVIOUR.** *Montastrea cavernosa* possesses sweeper tentacles, which have enlarged nematocysts. These sweeper tentacles are used to defend the coral's living space and deter attacks from the more aggressive corals. *Montastrea cavernosa* can actively attack other corals that encroach on their space by use of their sweeper tentacles, which are extensions of the digestive system. This allows them to basically digest the encroaching corals. *M. cavernosa* is capable of tolerating high levels of sedimentation because it can move sediment particles that settle on the polyp surface with their tentacles, and it is also able to secrete mucus to help remove sediment (Richardson et al., 1979).

**APPLIED ECOLOGY.** According to the IUCN Red list *Montastrea cavernosa* is considered a species of least concern as it is abundant throughout its range and is thought to be more resilient to habitat loss and other threats due to its large population sizes and generally high genetic connectivity and stable levels of genetic variation. Major threats to *M cavernosa* include: diseases such as white plague and black band disease as well as ocean acidification, coral bleaching and habitat loss. Other more localized threats are: high sedimentation, hurricane damage, bioerosion by sponges and other organisms and predation (Aronson et al., 2008). *Montastrea cavernosa* plays an important role in biodiversity, fisheries, eco-tourism and storm surge protection in many parts of the world. *M. cavernosa* is usually protected under international programs, organizations and conventions like UNEP, UNESCO, CBD, RAMSAR Convention etc.; and national coral protection acts and laws, these laws vary from country to country.

**REFERENCES**

Acosta, A. and Zea, S. 1997. Sexual reproduction of the reef coral Montastrea cavernosa

Aronson, R., Bruckner, A., Moore, J., Precht, B. & E. Weil 2008. *Montastraea cavernosa*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. <**www.iucnredlist.org**>. Downloaded on 27 March 2015

Goreau, T.F, and J.W Wells. "The Shallow-Water Scleractinia of Jamaica: Revised List of Species and Their Vertical Distribution Range." Bulletin of Marine Science 17.2 (1976). Print.

Hoeksema, B. (2015). *Montastraea cavernosa* (Linnaeus, 1767). Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p=taxdetails&id=287962 on 2015-04-07

Humann, Paul. 1993. Reef Coral Identification: Florida, Caribbean, Bahamas. Jacksonville, Florida: New World Publications, Inc. 86-116

Lasker, H.R. 1979. Light dependent activities among reef corals: *Montastrea cavernosa*. Biological Bullentin. Vol. 156; 196-211.

Lasker, H.R. 1980. Sediment rejection by reef corals: the roles of behaviour and morphology in *Montastrea cavernosa* (Linnaeus) *J.exp.mar.Biol.Ecol.* **47**:77-87

Lasker, H.R. 1981. Phenotypic variation in the coral *Montastrea cavernosa* and its effects on colony energetic. Biological Bullentin. Vol. 160; 292-302.

Lesser, M.P. *et al*. 2004. Discovery of Symbiotic Nitrogen-Fixing Cyanobacteria in Corals. *Science* **5686**: 997-1000

Richardson, C.A. et al. 1979. Maintenance of Living Space by Sweeper Tentacles of *Montastrea cavernosa*, a Caribbean Reef Coral. *Marine Biology* **55:** 181-186

Szmant, A.M. 1991. Sexual reproduction by the Caribbean reef corals *Montastrea annularis* and *M. cavernosa.* Marine Ecology Progress Series. Vol. 74; 13-25.

Veron J.E.N. 2000. *Corals of the World. Volume 2.* Townsville. Australian Institute of Marine Science

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**Fig. 2.** Great star coral at night with tentacles extended.

[http://www.reefnews.com/reefnews/photos/corals/stars.html, downloaded 27 March 2015]