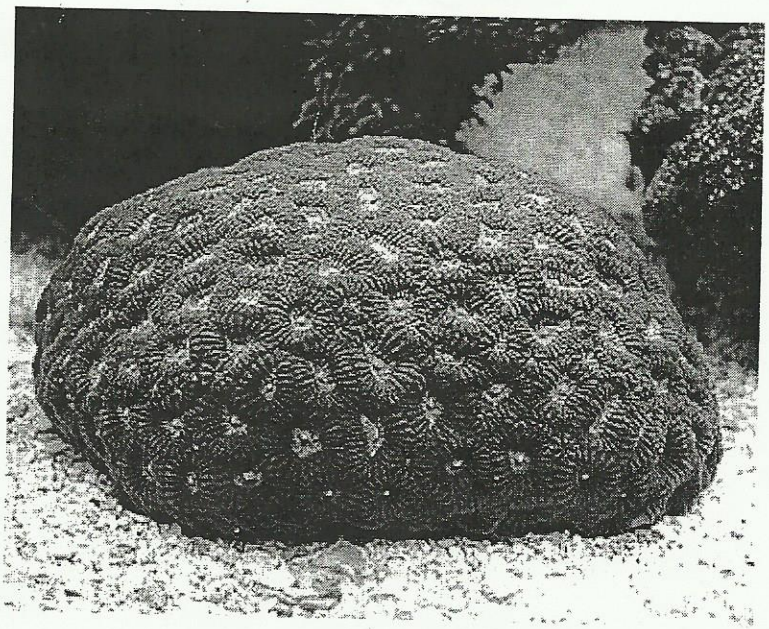
BRAIN CORAL

Closed Brain Coral (*Favites sp.*)



Brain coral is a type of stony coral which is named after its unusual appearance. As brain coral grows, it develops a rounded surface covered in deep meandering ridges and grooves, causing it to look eerily like a brain. This coral can be found in warm, shallow waters in many parts of the world, most notably in Australia's Great Barrier Reef. Like many other species of coral, brain coral is in danger due to changes in the marine environment, many of which have been brought about by human activity.

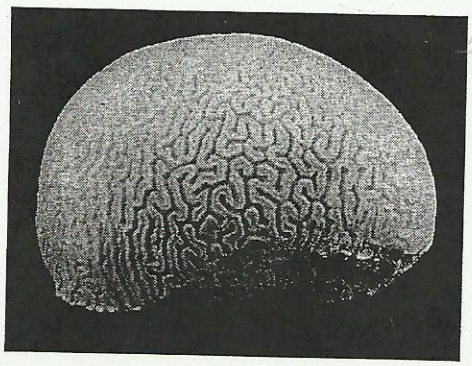
Like other corals, brain coral is not a single organism. Instead, it is a colony of individuals known as polyps. The polyps band together and slowly build a calcium carbonate skeleton. Each species builds a slightly different style of skeleton, which explains why corals are so physically diverse, and in fact several species including polyps in the *Meandrina* and *Diploria* genera build brain-like skeletons. Brain coral's hard layers of calcium carbonate explain why it is known as a "stony" coral.

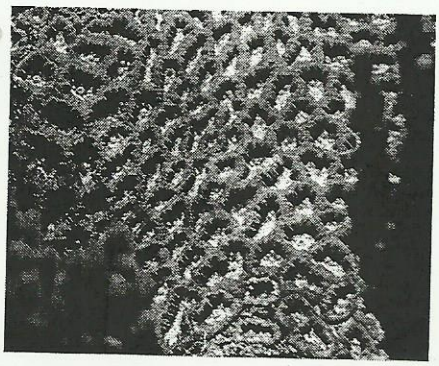
This coral is a major player when it comes to reef building. Brain coral develops extremely slowly, sinking resources into developing a very strong skeleton and base. This means that the coral is difficult to dislodge, so it will endure turbulence, hurricanes, and other threats. Once brain coral establishes itself, it can provide shelter for other corals and organisms, contributing over time to the development of a true coral reef.

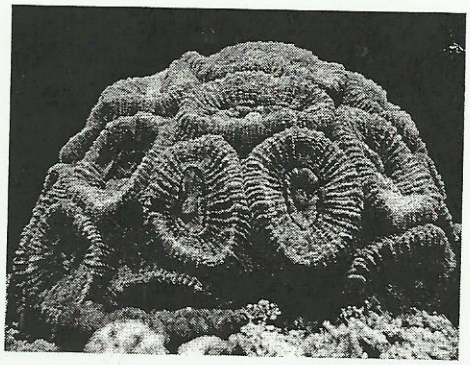
Most brain corals reproduce by "broadcasting" sperm and ova. The polyps in the coral simply release their sperm and ova into the water, counting on currents to bring reproductive material close enough to create a gamete, which then drifts through the ocean until it finds a spot to settle and start a new brain coral colony.

The polyps in brain coral have a number of food sources. They can feed on the algae which exist symbiotically with them, growing inside the sheltering grooves of the coral, and they can also use sweeper tentacles to trap passing free-floating organisms. When threatened, the polyps retract their tentacles into the grooves of the coral so that they cannot be eaten by predators or destroyed by turbulent waters. The organisms also use their tentacles to clean house now and then, removing accumulated sand and other materials.

Because this coral takes so long to grow, it should always be appreciated in situ. Harvesting brain coral almost always kills it, unless the harvesting is performed by a trained professional, and the loss of a brain coral can be a blow for a reef. For the same reason, divers should be careful around brain coral and other corals to prevent damage which could kill the coral or inhibit its growth.







THE SEA FAN

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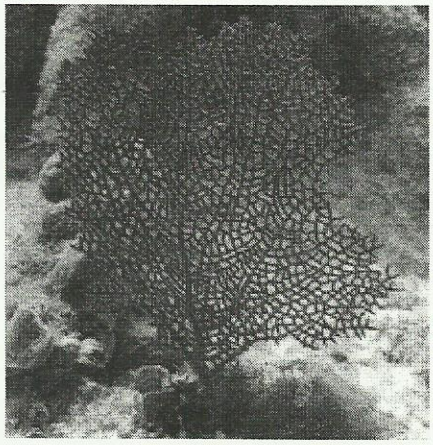

Taxononmy
Phylum: Cnidaria
Class: Anthazoa
Subclass: Alcyonaria
Order: Gorgonacea
Suborder: Holaxonia
Family: Gorgoniidae

Abstract
Gorgonia ventalina is a unique coral that grows in the shape of a fan and has a distinctive purple coloring, which is where it gained the common name "purple sea fan". *G. ventalina* can be found in many environments and varying depths throughout the Caribbean and Bermuda reefs. With their surface sclerites and chemical compounds they are able to defend off predators and diseases. One of the diseases that do infect this sea fan is Aspergillosis, which has been well studied in the recent years.

Habitat
Gorgonia ventalina can be found in many different habitats, it was once believed that their growth was restricted to outer and rim reefs (Sterrer 1986), however they have since recruited to shallower waters in Bermuda and elsewhere in the Caribbean. The reason for their growth in many areas is because they flourish in areas with consistent water flow for feedings and respiration reasons (Matsumoto 2004).

Ecology
Gorgonia ventalina can be distinguished by their purple tissue and fan shape hence the common name 'purple sea fan'. They are most commonly purple, however they can be yellow or brown in color but these colors are much rarer (Sterrer 1986). Their branches are rounded and slightly compressed in the plane of a fan, with small calyces located in 2 rows along the edges of these branches (Sterrer 1986). They can grow to be about 180cm tall by 150cm wide (Sterrer 1986). The time needed to grow to this length is estimated to be about 2 to 5 years; however they do continue to grow beyond the average but at a much slower rate (Cary 1915). The life span of a gorgonian is unknown, however Cary (1915) states that there is no evidence from fossil or current records of a sea fan dying from old age. The most common death to a sea fan is destruction by wave energy and overgrowth of their tissues by organisms such as *Millepora alcicornis* and some encrusting bryozoans (Cary 1915). The rate at which gorgonian death occurs is about 1/5 of the population in an area annually (Cary 1915), however it has been seen that recruitment vs. mortality is nearly balanced (Grigg 1977).

Commercial Importance
Gorgonia ventalina are commercially important in a couple of different aspects. They are used by aquarium owners who have saltwater reef aquariums to add color and beauty (Westrum 2001). They are also sold and taken as souvenirs throughout the Caribbean (Westrum 2001). *G. ventalina* is indirectly commercially important because they add to the beauty of a coral reef, and attract tourist to the area through snorkeling and scuba diving.

Bermuda Laws
G. ventalina is protected in Bermuda by the Coral Reef Preserve Act of 1966. This act prohibits the removal of any coral living or dead from any coral reef within the North and South coral reef preserve (Wood and Jackson 2005). They are also protected within the 29 different no take zones that have been established throughout the Bermuda platform (de Putron 2006).

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Disk Coral (or Mushroom Coral) (*Fungia Spp.*)

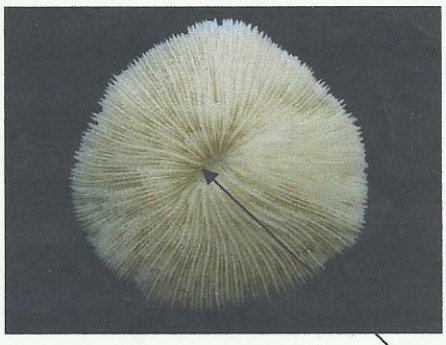
The Disk Coral is a mover, it looks stationary but watch out... it will even climb and flip!

The Disk Corals from the ***Fungia*** genus are quite hardy creatures that easily move about on the substrate. They are solitary, free-living corals and they use water and current to get where they want to be. They can actually move up to 12" per day (30 cm). They have also been known to climb slight slopes up to a 30 degree angle, and to right themselves if they get flipped over.

As the name implies, the Disk Coral ***Fungia spp.*** are mostly round, though an occasional specimen will be elongated. They range from saucer-like shapes to dome shapes and can also be dented. Other common names they are known by are Rough Feather Coral, Common Mushroom Coral, Elongate Mushroom Coral, Distorted Mushroom Coral, Plate Coral, Disc Coral, Tongue Coral, Fungus Coral, and Chinaman Hat Coral.

Disk Corals are awesome animals with the unique beauty and characteristics of the Fungiidae family. They come in a wide array of colors that make them an attractive addition to your display. They are most commonly green or purple, but just name the color and the ***Fungia*** genus comes in it.

Disk Corals have short tapering tentacles, which in the wild retract during the day, coming out only at night. In the Aquarium they will generally stay partly extended during the day, though quickly retracting if disturbed. These tentacles are nestled between the blade-like septal teeth that radiate out from the center. When young the ***Fungia spp.*** are connected with a stalk to rock work. Over time as the coral develops, the stalk gradually weakens and breaks, leaving a central scar. The scar is then gradually overgrown.



All species of ***Fungia*** have wide slit-like mouths, often housing various parasites. In fact a bivalve gastropod ***Faungiacava eilatensis***, is a parasite that lives exclusively within the mouths of Fungia. It is not known why the mouth of the ***Fungia spp.*** are so large. But Disk Corals have been observed eating jellyfish, possibly as a main source of food for them in nature.

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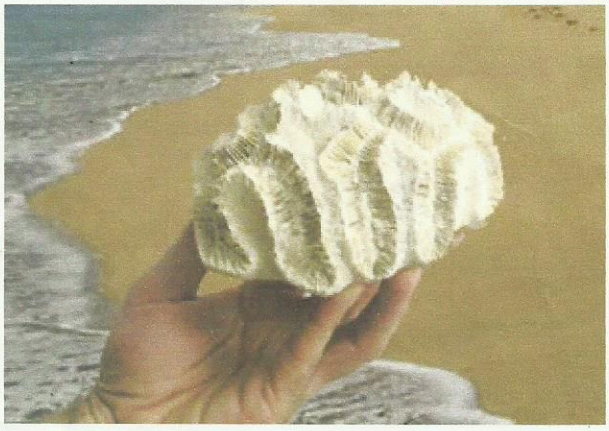
ROSE CORAL *(Trachyphyllia radiata)*



Distribution / Background ***Trachyphyllia Coral Information:*** The ***Trachyphyllia*** genus was described by Milne-Edwards and Haime in 1848. There are probably 6 nominal species, one or possibly two of which are valid species. The ***Trachyphyllia*** genus has been propagated in captivity.

Where Trachyphyllia Corals Are Found: The ***Trachyphyllia*** genus is found in the Western Central Pacific in the Philippines and around Australia on the Great Barrier Reef and then south to Passage Island on the west coast.

Trachyphyllia Coral Habitat: The ***T. radiata*** are found in deeper waters under shaded overhangs, from 98 to 131 feet (30 - 40 m) in depth. They are reportedly always found attached to a hard substrate and will form colonies. The ***T. geoffroyi*** are not generally found on reefs, but around islands and inter-reef areas in muddy lagoons and reef slope bottoms with gentle water flow and moderate light. They are found with other solitary or free-living corals in the Fungiidae family.

Status ***Trachyphyllia*** are listed on the IUCN Red List of Endangered Species as Near Threatened (NT).

Description ***What do Trachyphyllia Corals look like:*** The Pacific Rose Coral ***T. radiata*** is very much like the Open Brain Coral ***T. geoffroyi***, but it is always distinctly round rather than flat, and usually more folded in form. They grow in colonies once mature. The ***T. geoffroyi*** forms free-living polyps that have valleys with their own corallite walls, while the walls on the ***T. radiata*** are fused. The Pacific Rose coral also has a flattened bottom is attached to hard substrate, rather than the cone-shaped bottom found on the ***T. geoffroyi*** used to anchor itself into soft substrates.

Their polyps are large fleshy mantles, and they come in varying shades of brilliant metallic greens, reds, and pinks. ***Trachyphyllia*** corals can have up to 3 separate mouths, reaching up to just over 3" (8 cm) across, but the width of the valleys are just under 1/2" (10 mm) across. The septa, or the "teeth" on the inside of the corallite wall, are large and form a ridging look under the flesh. The ***Trachyphyllia*** corals feed at night, extending polyp tentacles. They can be long-lived in captivity, but their actual life span is unknown.

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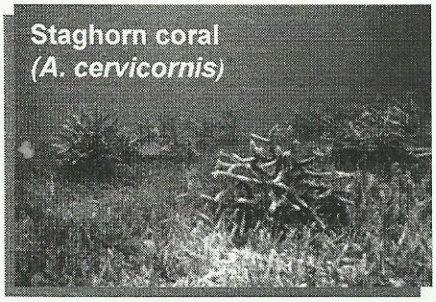
NOAA Fisheries

General fact sheet
Atlantic *Acropora* corals

What is a coral?


Staghorn coral
(A. cervicornis)

Corals are colonial invertebrates that excrete a calcium carbonate skeleton. There are two main types of corals: hermatypic, which produce reefs and are only found in tropical regions, and ahermatypic, which do not produce reefs and are found worldwide.

Most hermatypic corals host symbiotic (living together) algae, which live inside their tissue. The algae are called zooxanthellae. Zooxanthellae give corals their color and need sunlight for photosynthesis. They provide food to the coral and remove some of the corals waste products. In return the coral provides protection and access to light.

What do corals do?

Corals provide habitat for reef fish and invertebrates. They also increase biological diversity. Corals reefs form a barrier along coasts and around islands offering shoreline protection from storms. Coral reefs support fishing, scuba diving, boating, and other recreational activities, as well as subsistence and commercial extraction that generate billions of dollars per year worldwide.

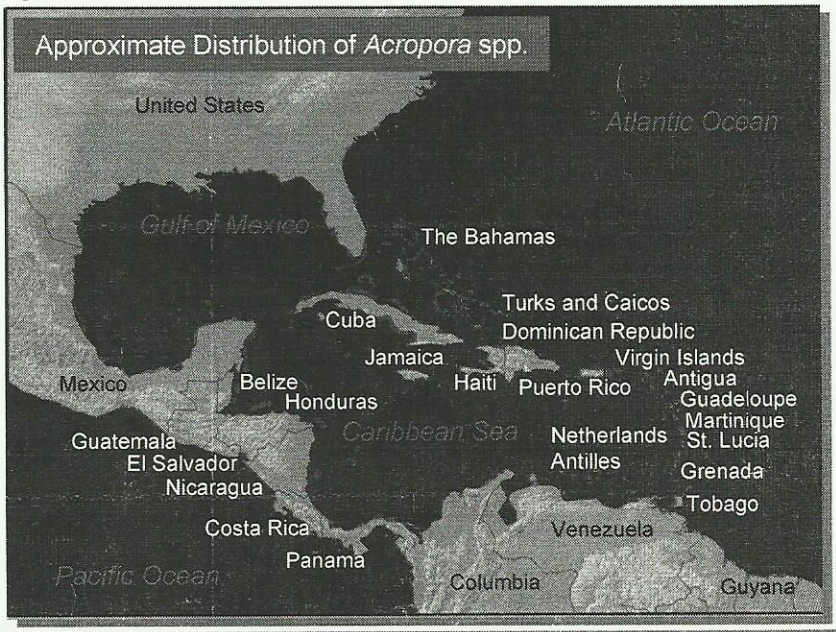
What is *Acropora*?

The *Acropora* genus is the most abundant and species-rich group of corals in the world. Only three species exist in the Atlantic/Caribbean region, Staghorn coral (*Acropora cervicornis)*, Elkhorn coral (*A. palmata)*, and Fused staghorn (*A. prolifera)*, a hybrid of the two. Acroporids are branching corals. These three coral species were the dominant reef building species throughout Florida and Caribbean.

Where are the Atlantic Acroporids found?

Atlantic acroporids are found typically in shallow water on reefs throughout the Bahamas, Florida and the Caribbean. Acroporids live in high-energy zones, with a lot of wave action. Too much wave action (major storms) can cause branching corals to break. However, fragmentation via branch breakage is one method of reproduction for acroporids.


Elkhorn coral
(A. palmata)



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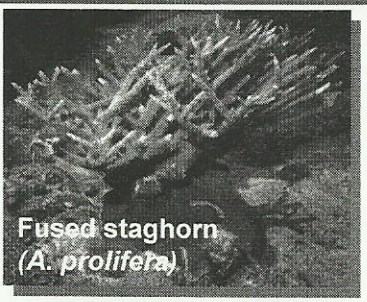
NOAA Fisheries


Fused staghorn (*A. prolifera*)

What salinity do *Acroporids* require?

Although some corals can tolerate extremes, most acroporids require normal marine salinity (33-37‰).

What temperatures do *Acroporids* need to survive?

Acroporids are typically found in water temperatures from 66°F to 86°F. Some degree of stress is experienced at water temperatures greater than 2-3°F cooler or warmer than normal for an extended period.

Do *Acroporids* need sunlight?

Corals depend on the symbiotic zooxanthellae for food. Zooxanthellae need sunlight to photosynthesize. Runoff from land deposits nutrients, which trigger algal blooms, and sediments onto the reef that cloud water. Without sufficient light, the photosynthetic rate is reduced and with it the amount of nutrition produced by the zooxanthellae and the ability of corals to secrete calcium carbonate and build reefs. For branching corals, the optimum range is 60-100 percent of tropical sunlight. Corals grow best in clear water free from excess nutrients, runoff, or algal blooms. Acroporids are particularly sensitive to sediment, as they are among the least effective of the reef-building corals at trapping and removing sediment from their surface. On the other hand, excessive ultraviolet (UV) light may lead to bleaching.

What is coral bleaching and what causes it?

Bleaching is the temporary or permanent loss of zooxanthellae (symbiotic algae) from the coral. Many types of physiological stress can cause coral bleaching (e.g., UV, excessively warm or cold water temperatures, in some cases bacterial infection, etc.). However, the recent mass bleaching events are caused by warm water temperatures and have caused widespread coral mortality on coral reefs throughout the world,

What things negatively affect *Acroporids*?

There are many stresses affecting acroporids, both natural and human-induced. Land based sources of pollution, such as runoff, sewage discharge, dredging and coastal development can increase nutrient levels, sediment loading and turbidity. Runoff can also reduce oxygen levels and possibly introduce pathogens. Excess nutrients allow large fleshy algae (macroalgae) to proliferate and overgrow corals. Pathogens may cause diseases in corals such as white-band disease and white pox/patchy necrosis, which are thought to be two of the most significant causes of mortality to Atlantic acroporids. Climate change, associated with increased water temperature and elevated light levels, may cause bleaching, reduced coral growth rates and deposition rate of their calcium carbonate skeleton. Overfishing and disease have caused a reduction in number of important predatory fishes such as groupers and herbivores (plant eaters) such as parrotfish. Reduction in number to predatory fishes can possibly lead to an increase in organisms that prey on acroporids, such as the short coral snail, fireworm, and damselfish. Furthermore, without a healthy herbivorous fish population, macroalgae growth limits the recovery of stressed corals and the settlement of new baby corals to replace those that have been lost from disease, bleaching, predation and overgrowth.

NOAA Partners in *Acropora* Research, Monitoring, and Conservation

Atlantic and Gulf Rapid Reef Assessment (AGRRA)
Caribbean Coastal Marine Productivity Network (CARICOMP)
Coral Disease and Health Consortium (CDHC)
Florida Marine Research Institute (FMRI)
Louisiana State University (LSU)
National Center for Caribbean Coral Reef Research (NCORE)
National Coral Reef Institute (NCRI)
National Park Service (NPS)
U.S. Geological Survey – Biological Resources Division (USGS–BRD)
University of Miami
University of Puerto Rico
University of the Virgin Islands

The Sea Anemone
Class ANTHOZOA

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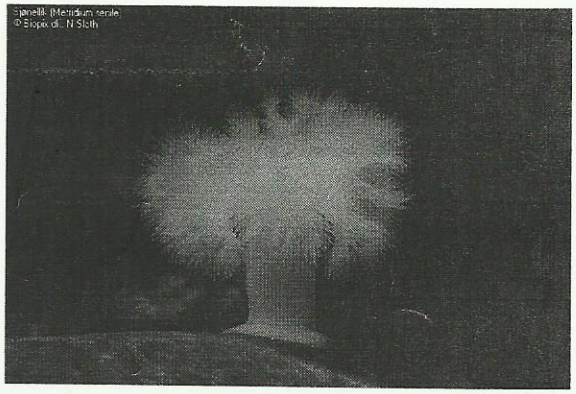


Description: In size they range from a few millimetres to approximately 1.5 metres in diameter. They have a stout, muscular body, most of which is formed by a heavy column. The column is expanded at its upper end into an oral disk having a central mouth surrounded by several circlets of hollow tentacles. The basal end of the column forms a smooth slimy disk on which the anenome can slide about very slowly and by which it holds onto rocks. The interior is one large stomach subdivided by curtains of tissue which hang down and partially divide the stomach into eight compartments. The gullet is not cylindrical but is flattened and at one or both ends of its long diameter is a longitudinal groove lined with flagella longer than the ones lining the rest of the gullet. The flagella in these gullet-grooves beat downward, drawing a current of water and mucous into the gastrovascular cavity and provides the internal parts with a ready supply of oxygen. At the same time, the flagella lining the gullet proper beat upward, creating an outgoing current of water and mucous that takes with it carbon dioxide and other wastes. Most anenomes are either males or females but some hermaphrodites exist. Anenomes are solitary polyps that lack a skeleton and are classified by the number and arrangement of tentacles that surround the mouth. In some species of anenomes, zooxanthellae or symbiotic algae occur beneath the tissues. The colour of the anenome is created by the colour of the algae living there. For example, the pink colour of the Strawberry anenome is due to the algae. Not only does the algae give colour to the anenome but it also provides nutrients to the anenome.

Distribution: Oceans, worldwide

Habitat: Found from the tidal zone of all oceans to depths of more than 10,000 metres (about 33,000 feet). Some live in brackish water. The largest and most colourful are found in warmer seas.

Food: Fish and other marine animals

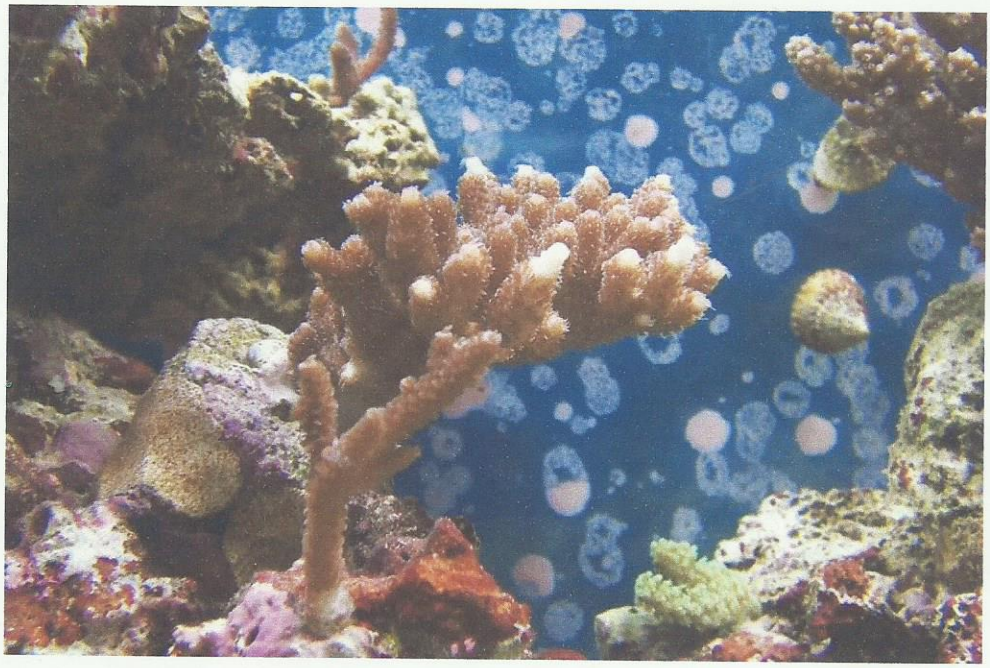
Reproduction and Development: Some anenomes split in half longitudinally to form separate individuals or grow a ring of tentacles half way down the body after which the top half breaks away. Some shed eggs and sperm into the water while in other species, the larva develops in the parent body escaping through the mouth to glide down the column and become embedded in the pedal disk to remain there until they are fully formed little anemones. Pieces of the base which break off when moving over rocks regenerate into very minute but otherwise perfect anenomes.

Adaptations: The tentacles have stinging cells, double-walled capsules filled with poison, set in the outer surface. Each contains a coiled hollow thread sometimes barbed at the base. At the outer end of the capsule is a thornlike trigger. When this is touched the coiled thread is shot out. It turns inside-out as it is ejected, its fine point pierces the prey and the paralyzing poison flows down the hollow thread. Some kinds of nematocysts stick to the skin while a third type wraps itself around the victim. The tentacles are coated with mucous which enables the anenome to recognize them as part of its own body and thus stops it from attacking itself. There are some species of fish coated with the same mucous which live among the tentacles and keep the mouth of the anenome clean. The mucous protects the fish from the anenome and the anenome protects the fish from larger fish.

Threats to Survival: Eaten by large sea-slugs, sea spiders, fish and sometimes starfish and crabs.

Status: Common

ARKive
IMAGES OF LIFE ON EARTH
www.arkive.org



Staghorn or Brush coral (*Acropora hyacinthus*)

Facts

Kingdom Animalia
Phylum Cnidaria
Class Anthozoa
Order Scleractinia
Family Acroporidae
Genus *Acropora (1)*

Status

Classified as Near Threatened (NT) on the IUCN Red List (1) and listed on Appendix II of CITES (2).

Description

Staghorn corals are among the fastest growing corals on reefs, and are excellent reef-builders (3). The name *Acropora* literally means a porous stem or branch (4), but *Acropora* species express a much greater variety of growth forms than the name suggests. Colonies can resemble antlers (staghorns) and be up to two meters tall, or can form delicately engineered plates and tables that may be up to three meters across. They can also form bush-like structures, some with short non-dividing branches like the fingers of a hand (3). Staghorn corals often out-compete all other corals in shallow tropical reefs, however, their speed of growth (which can be up to 10 to 20 centimetres a year (5)) is balanced by the fragility of some of the structures, as they are easily damaged in storms allowing other coral species a chance of growth. With 368 *Acropora* species currently known, and with such an amazing array of shapes, sizes and colours, identifying individual species can be a tricky task (3).

Range

Acropora species are the most abundant coral of most reefs in the Indo-Pacific (3).

Habitat

Staghorn corals occur in tropical reef environments, down to a depth of 30 meters. The upper depth limit is defined by wave action, whilst the lower limit at which *Acropora* can inhabit is determined by light availability and the amount of suspended sediments. Staghorn corals require normal marine salinity (5).

Biology

Like many corals, staghorn corals have a special symbiotic relationship with algae, called zooxanthellae. The zooxanthellae live inside the tissues of the coral and provide the coral with food, which it produces through **photosynthesis** and therefore requires sunlight. In return, the coral provides the algae with protection and access to sunlight.

Staghorn corals are reef-building or **hermatypic** corals, and are incredibly successful at this task for two reasons. Firstly, they have light skeletons which allow them to grow quickly and out-compete their neighbouring corals. Secondly, the skeleton, or corallite, of a new **polyp**, is built by specialised 'axial' corallites. These axial corallites form the tips of branches, and as a result, all the corallites of a **colony** are closely interconnected and can grow in a coordinated manner (3).

Staghorn corals reproduce sexually or asexually. **Sexual reproduction** occurs via the release of eggs and sperm into the water. Most staghorn corals on the Great Barrier Reef sexually reproduce simultaneously, an incredible event that occurs soon after the full moon, from October to December. Streams of pinkish eggs are released from corallites on the sides of branches, to be fertilized by sperm released from other **polyps** at the same time. The water turns milky from all the eggs and sperm released from thousands of colonies. Some of the resulting **larvae** settle quickly on the same reef, whilst others may drift around for months, finally settling on reefs hundreds of kilometers away (3). **Asexual reproduction** occurs via fragmentation, when a branch breaks off a colony, reattaches to the substrate and grows (4).

Threats

Staghorn corals face the many threats that are impacting coral reefs globally. At present, around one third of the world's reef-building corals are threatened with extinction. The principal threat to corals is the rise in sea temperature associated with global climate change. This leads to coral bleaching, where the symbiotic algae are expelled, leaving the corals weak and vulnerable to an increasing variety of harmful diseases. Climate change is also expected cause more extreme weather incidents and to increase ocean acidification, which impairs the coral's ability to form a skeleton. These global threats are compounded by localised threats from pollution, destructive fishing practices, invasive species and human development (6).

Staghorn corals are considered to be environmentally sensitive corals that require clear, well-circulated water. Unlike other corals, which can obtain nourishment from **zooplankton**, staghorn corals are almost entirely dependent on the zooxanthellae for food. This means that sunlight is essential, and they are particularly sensitive to any human activities that increase water turbidity, reducing light availability (4).

Acropora species constituted 13 percent of the global coral trade between 1985 and 1997. Coral is harvested for building materials, curios, jewellery, and for aquariums. Staghorn corals are more common in the dead coral trade, rather than the live aquarium trade (7).

Conservation

Staghorn corals are listed on Appendix II of the Convention on International Trade in Endangered Species (CITES), and therefore trade in this coral should be carefully regulated, and a permit is required to bring the coral, or objects made from them, into the countries that have signed the CITES convention (2). Staghorn corals will also form part of the marine community in many marine protected areas, or in areas where management plans are in place to protect the coral community. In some areas, coral reefs restoration attempts are being undertaken; in Florida Keys National Marine Sanctuary, efforts have been made to reattach coral fragments, or culture and settle coral larvae. Both activities have had limited success, and new techniques are being pursued (5).

Glossary

- **Asexual reproduction:** reproduction that does not involve the formation of sex cells, such as sperm and eggs. Asexual reproduction only involves one parent, and all the offspring produced by asexual reproduction are identical to one another.
- **Colony:** relating to corals: a coral composed of numerous genetically identical individuals (also referred to as zooids or polyps), which are produced by budding and remain physiologically connected.
- **Hermatypic:** reef-building corals. Most hermatypic corals have a close association with algae known as zooxanthellae, which live in their tissues. These corals are restricted to shallow, tropical, marine environments. Over time the accumulated deposition of calcium carbonate (limestone) by many hermatypic corals can form large limestone structures known as coral reefs.
- **Larvae:** relating to corals: the stages of development before settlement on the reef. Larvae are typically very different in appearance to adults; they are able to feed and move around but usually are unable to reproduce.
- **Photosynthesis:** metabolic process characteristic of plants in which carbon dioxide is broken down, using energy from sunlight absorbed by the green pigment chlorophyll. Organic compounds are produced and oxygen is given off as a by-product.
- **Polyp:** typically sedentary soft-bodied component of Cnidaria (corals, sea pens etc), which comprise of a trunk that is fixed at the base; the mouth is placed at the opposite end of the trunk, and is surrounded by tentacles.
- **Sexual reproduction:** a form of reproduction that involves fertilization of a female cell or egg, by a male sperm. It usually involves two parents, one of either sex, but in some species individuals are hermaphrodite (possess both male and female sex organs).
- **Zooplankton:** floating or weakly swimming animals, many of them microscopic, that drift with water currents, particularly near the surface of the sea.