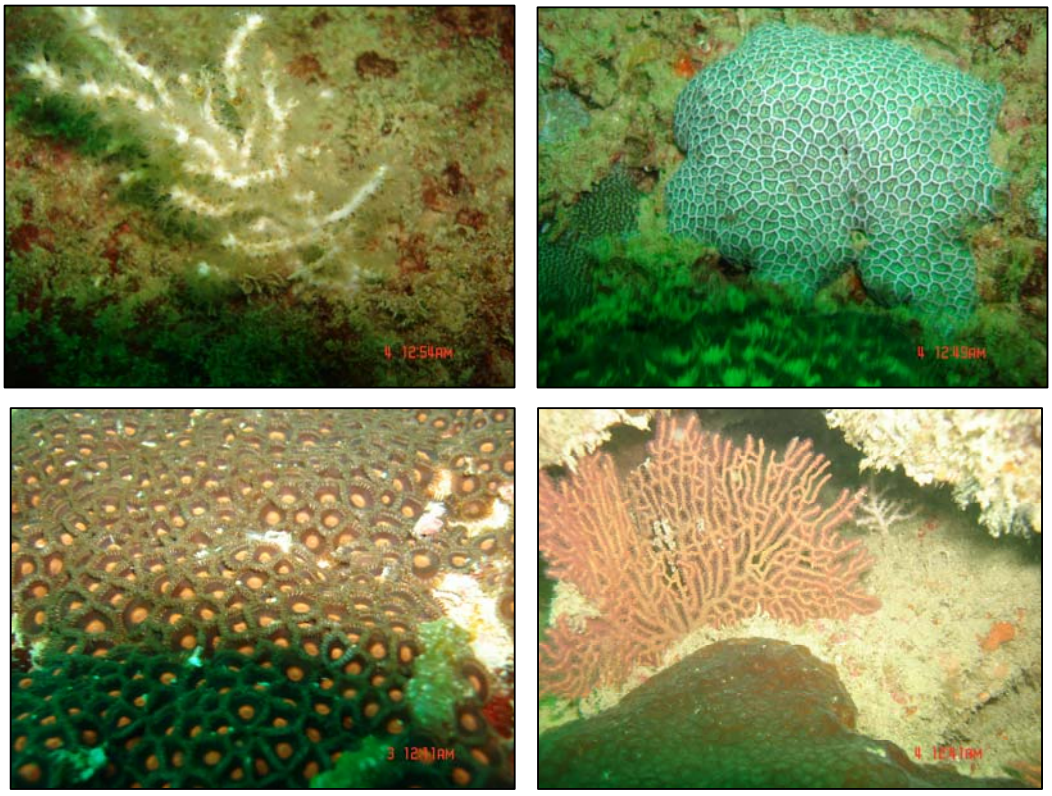
CORAL REEFS IN GWADAR BAY

(Survey conducted in February, 2011)



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Discovery of Corel Reefs in Gwader

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1 Introduction

Coral Reefs are the "Rainforests" of the ocean. Reefs are ecologically important ecosystems and have a high biodiversity that serves as a storage bank of rich genetic resources. They are a source of food and medicine, and they protect the coast from wave erosion. Scientists have found an abundance of compounds to help fight heart disease, asthma, cancer, HIV and more.

Coral reefs are structures made of limestone deposited by living organisms. Although thousands of species inhabit coral reefs, however, only a fraction produces the limestone that builds the reef. There are three basic kinds of coral reefs: fringing reefs, barrier reefs, and atolls. Fringing reefs grow in shallow waters close to the coast. Barrier reefs are separated from land by a lagoon, growing parallel to the coast and forming a large and continuous reef. Atolls are ring-shaped reefs that develop near the sea surface on underwater islands or islands that sink, or subside.

Coral Reefs are the most diverse communities on the planet. These tropical marine communities occupy less than 1 % of the ocean floor, but are inhabited by at least 25% of all marine species and form the nurseries for about a quarter of the ocean fish. Scientists estimate that more than 25,000 described species from 32 of the world's 34 animal phyla live in reef habitats as compared to 9 animal phyla found in tropical rain forests. Coral reefs are also one of the oldest environments on earth. Most of the existing reefs have been growing from over 5,000 years. Coral reefs are found within the jurisdiction of more than 100 countries and occupy more than 600,000 square kilometers of tropical oceans. They generally require clear, warm water and high light intensity for survival. This limits them to shallow water, with maximum diversity occurring between 10 to 30 meters below sea surface.

Coral reefs are found in about 100 countries. In the last few decades over 35 million acres of Coral Reefs have been obliterated. Reefs off of 93 countries have been damaged. When corals are stressed by high temperature, ultraviolet light or other environmental changes, they lose their symbiotic algal cells, and appear white (the white skeleton is actually visible through the transparent tissue). Depending on the intensity and duration of the stress, the corals may recover or die. If the present rate of destruction continues. Sadly, coral reefs are rapidly disappearing. Scientists estimate that 19 percent of the world's coral reefs are already dead and if current trends continue this precious resource may be lost within the next 30 to 50 years.

Coral reefs are the oldest, most productive ecosystems on earth. Existing for more than 500 million years, they're named the rainforests of the sea because they maintain the biological diversity of our world's oceans. Corals are literally teeming with life. They serve as habitat or nursery grounds for 25 percent of all known marine life and support thousands of species of fish, plants and animals.

2 Types of Corals

There are two different types of coral reefs: hard corals (such as brain, star and Elkhorn coral) and soft corals (such as sea fans, sea whips and sea rods). Both hard and soft corals come in all shapes, sizes and colors and a few are even fluorescent. Hard corals (hermatypic) grow in colonies and are the architects of coral reefs. These corals extract plenty of calcium from surrounding seawater and use this to create a hard stony skeleton for protection and growth. Reef building corals need tiny algae (zooxanthellae) to survive. The algal association to coral also contributes to its brilliant colour. In addition this

symbiotic association of coral and algae develop the large massive, branching, or encrusting carbonate skeletons that provide habitat and food resources for other reef organisms, such as fish, lobsters, giant clams and sea urchins etc. In contrast, soft corals (ahermatypic) are soft and bendable and often resemble brightly colored plants or trees. These corals do not have stony skeleton and are unable to produce reef. They do not always have algal (zooxanthellae) association.

3 Importance of Corals

Fisheries: Coral reefs are vital to coastal fisheries. It provide spawning, nursery, refuge and feeding areas for a large variety of organisms, including economically important crustaceans (e.g. shrimps, spiny lobsters and crabs) and cephalopods (e.g. octopus, squids and cuttlefish) and thus providing revenue for local communities as well as national fishing fleets. If properly managed, reefs can yield around 15 tonnes of fish and other seafood per square kilometre each year.

Ecological relationships: Coral reefs maintain a network of intimate ecological relationship with other marine communities such as mangrove forests, sea grass beds, open sea and coastal wetlands, as water current transport larvae, plants, animals, nutrients, and organic material. Therefore, any disruption of coral reef communities can break up these ecological bonds.

Species Diversity & Productivity: Coral reefs are often called the rainforests of the sea because these harbour large numbers of species diversity and yield high productivity. In addition to hundreds of species of corals, reefs also support an extraordinary biodiversity and are home to a multitude of different types of fish, invertebrates and sea mammals.

Source of medical advances: Scientists have only just begun to understand how reefs can contribute to medicine. At present coral reef organisms are being used in treatments for diseases like cancer and HIV and we can expect its much bigger role in future medical advances.

Tourism: Aesthetic values of coral reefs are of immense attraction for tourists. Sustainably managed coral reef-based tourism is providing significant alternative or additional sources of income to poorer coastal communities in developing countries. In contrary, unsustainable reef based tourism where tourists are touching reefs, stirring up sediment, collecting corals, and dropping anchors on reefs are also not uncommon that cause severe damages to these unique ecosystems. In order to discourage unwise practices e.g. trawling in coral areas and also to provide alternatives or additional sources of livelihood to coastal. Tourism brings billions of dollars to local economies and sustains 10 percent of all jobs on earth

Coastal protection: Reef structures also play an important role as natural breakwaters, which minimize or break the power of the waves during storms, hurricanes, typhoons, and even tsunamis. Corals also provide protection for coastal communities, defending them against storms, wave damage and erosion.

4 Threats to the Corals

Major threats to coral reefs and their habitats along the Makran Coast include:

Destructive fishing practices: Trawling is one of the Major threats to the recently explored coral reef ecosystem along the Makran Coast. Trawlers usually try to operate

close to reefs to take advantage of the higher levels of fish aggregated around them, but often end up with their trawls caught on the reefs. The entangled nets are usually cut away and discarded that suffocate the underlying corals. In most other cases (as observed in Astola Island) the fishermen pull their entangled nets with force and thus they break the corals. Such unwise practices are causing heavy damage to the corals and coral reef ecology in the region. Similarly, anchoring of fishing boats in the reef area of Astola Island also damage these fragile habitats.

Over fishing: Over-fishing in general, and of highly demanding species e.g. lobsters, squids, octopuses etc in particular near coral reefs can easily affect the ecological balance of these communities, adversely affecting the food chain and can cause damages far beyond the directly over fished population.

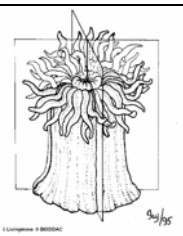
Sedimentation: Excessive erosion along the Makran Coast caused both by natural and anthropogenic factors ultimately ends up in the sea, where it can 'smother' corals by depriving them of the light needed to survive. Similarly, the destruction of mangrove forests, which normally trap large amounts of sediment, is exacerbating the problem.

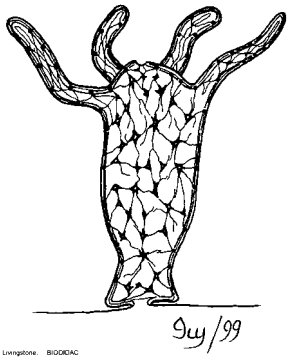
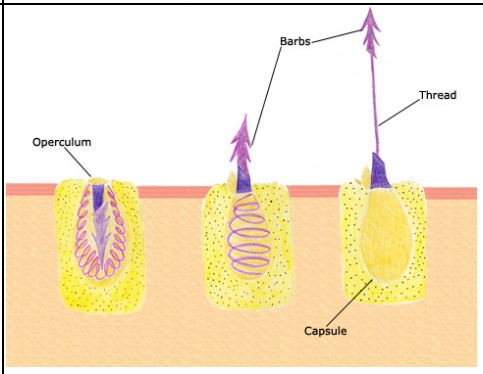
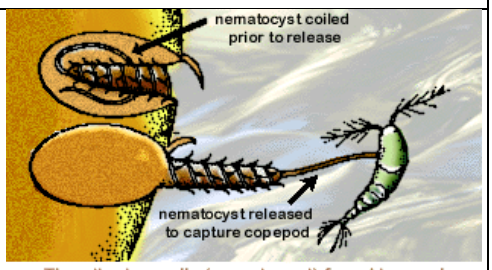
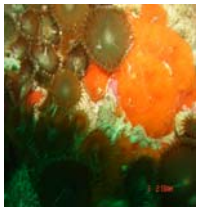
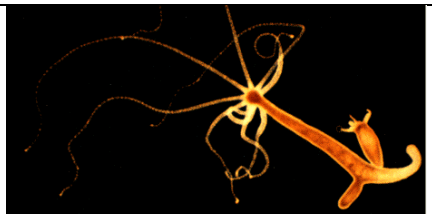
Coral Mining and Aquarium trade: Live coral mining for construction and stocking of marine aquaria with wild species are some of the other threats, however, such practices are rarely observed along the Makran Coast. But precautionary measures would still be needed to safeguard these fragile ecosystems against such unwise practices.

Pollution: coral reefs need clean water to thrive. From litter to waste oil, pollution is damaging reefs worldwide. Domestic and industrial wastes and sources of oil pollution such as ships traffic, cleaning of bilges and tanks by a large number of merchant vessels and tankers, small and occasional major oil spills along the Makran Coast are some of the threats to these newly discovered coral ecosystem s in Gawder.

Climate change: Corals cannot survive if the water temperature is too high. Global warming has already led to increased levels of coral bleaching and this is predicted to increase in frequency and severity in the coming decades. Adverse affects of this phenomenon cannot be avoided in terms of reef ecosystems along Makran Coast.

5 Life Cycle of Corals

Corals	Corals are marine animals related to Jellyfish and anemones (Cnidarians). They have soft and symmetrical body, constructed from specialized tissues. Mouth is surrounded by stinging tentacles. Corals are also called rain forest of the oceans.	
Polyps	Animal portion is called Polyp which absorbs Calcium Carbonate for reef building.	

Body wall	Respiration and body waste removal takes place through Body wall.	
Cells	Corals have stinging cells called nematocysts. It protects and helps coral to catch food.	
Sharp Barb	When cell is stimulated it releases sharp barb which catches food and bring it back towards the mouth.	 The stinging cells (nematocyst) found in coral tentacles in coiled and released positions.
Symbiotic Relationship	Zooxanthella is algae which live in the skin of coral. Algae are protected by coral and use its waste as a food. In return, algae provide colors and food through photosynthesis process.	
Asexual Reproduction	Asexual reproduction in coral is called budding in which a bay polyp starts growing off the adult and when ready it is detached and live on its own. This cannot start new colony but help old colonies to grow bigger.	

Sexual Reproduction	This is called spawning. Sperms and eggs are released through water column. Fertilized egg called planula swim until it finds a good place to live	

6 Coral Reef Discovery in Pakistan:

Southeast Asia is considered the global epicentre of marine diversity. Its 100,000 km2 of coral reefs (34% of the world's total coral reef area) is home to over 600 of the 800 reef-building coral species in the world. Regardless of the regional importance, coral and coral reef discovery is comparatively a more recent phenomenon in Pakistan. A field mission of the Pakistan Wetlands Programme (PWP), lead by coral expert from Millport University, UK, has only five years back in 2006 identified the first ever coral reef ecosystem near the Astola Island. Before this discovery, it was blindly believed that coral reef is not existed in Pakistan's jurisdiction of the Arabian Sea. Encouraged by this breakthrough and on the basis of information collected about coral reef associated fish species from the fishing areas near Gwadar, an expedition team encompassing divers from PWP and Pakistan Navy conducted a survey of the possible coral sites in February, 2011 and discovered large area of deep sea corals near Gwadar.

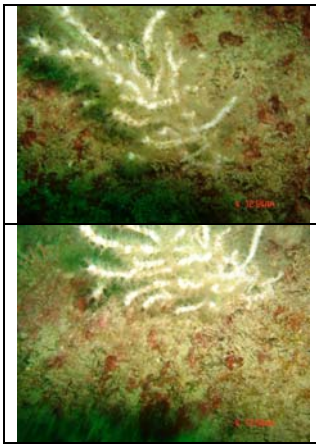
This underwater survey was conducted in seven different sites in Gwadar along the Arabian Sea. The most significant sites were: Cher Koh, Baladi Koh and Ganjabad. The sea depth of the investigated sites varied from 13 to 31 meters. At each site the divers went underwater several times with Buoyancy Compensation Devices. They undertook dives of various durations from 15 minutes to 1.5 hours to take photographs of corals and coral associated fish species for proper identification. The navigation equipment of the 'Oasis Boat' of PWP were used to track the transect, record GPS locations, and depth of the sea. The coral colonies occurring at the Cher Koh, Baladi Koh and Ganjabad are mostly in growing stage and present a healthy condition. The corallites are large and expanded, which is probably an adaptation to the deep sea environment, where light penetration is comparatively insignificant. The expansion and large size of corallites might be an adaptation to absorb more sunlight and heat, which is important for their growth.

The survey was conducted late in winter season and therefore detailed investigations were not possible. However, PWP intends to continue the effort and carry out further detailed assessments of the identified sites in desirable season in near future. The major objectives of future surveys will be to investigate species abundance, communities' composition and biodiversity of these fragile coral reef ecosystems. Efforts would be also made to find out major threatening factors to these unique ecosystems along the Makran Coast.

7 The discovered Species of Corals

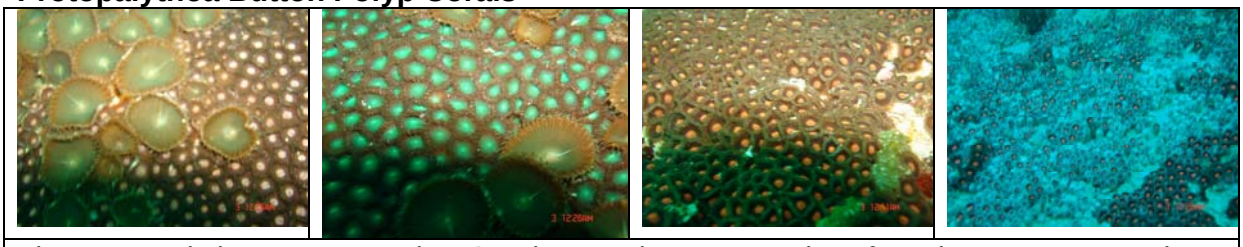
The corals and coral fish were identified with help of field guides and relevant books. About 17 species of hard and soft corals and about 25 species of coral associated fish species have been recorded in the investigated coral reef ecosystem. The general description of discovered species is highlighted below:

Snow corals



The species forms erect, branching colonies with flexible stems. Each tall axial polyp has many short lateral polyps. Polyps, when extended, have eight white frilly tentacles, like the rays of a snowflake. Most commonly found in the fouling community of harbors, usually on pier pilings or wrecks which are not exposed to direct sunlight. It is found outside of harbors.
Phylum:Cnidaria
Class:Anthozoa
Subclass:Octocorallia
Order:Telestacea
Family: Clavulariidae

Protopalythoa Button Polyp Corals

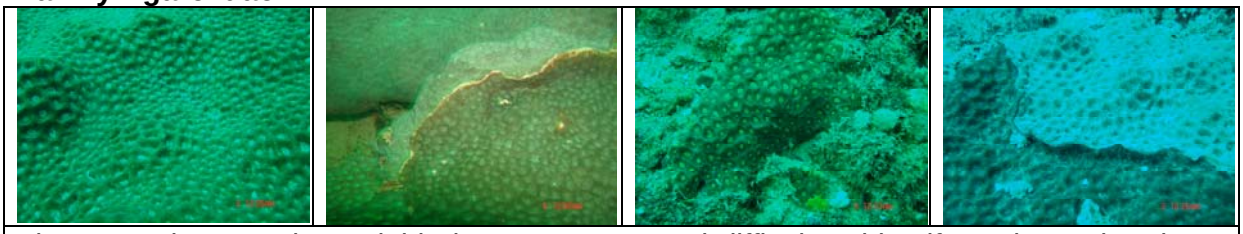


The Protopalythoa Button Polyp Corals are also commonly referred to as Moon Polyps, Encrusting Anemones, or Sea Mats, are generally brown or tan in color, but may also be green and fluoresce under actinic lighting. Button Polyp Corals are a colonial animal with multiple individual polyps attached to a piece of live rock or coral rubble. Over time with proper conditions Button Polyp Corals grow out with more and more colonies being produced and over time can create a mat or carpet like appearance.

Their polyps have the ability to sting other animals and are semi-aggressive; therefore, they need to have space between their colony and any other neighbors. Button Polyp Corals grow rapidly and can crowd out their neighbors including any sessile life; it is this rapid growth and the resulting appearance that gives them the name Sea Mats. Button Polyp Corals can reproduce easily by budding (splitting off a portion of their base or mouth), which increases the size of their colony. For continued good health, they will also require the addition of iodine and other trace elements to the water. As with other semi-aggressive fast growing corals, be sure to place this species where it will have room to grow without coming into contact with other specimens.

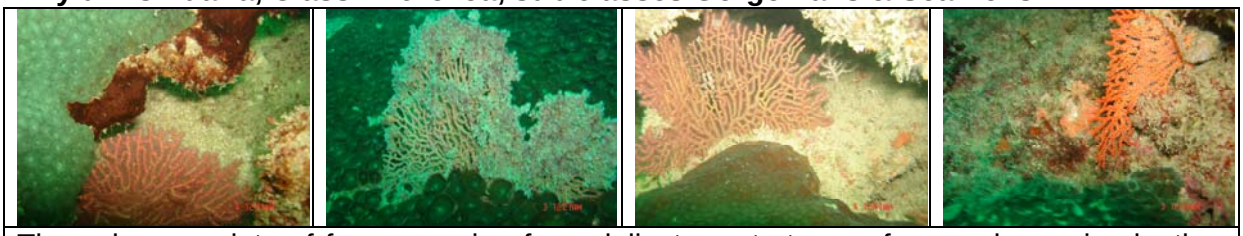
Button Polyp Corals receive most of their nutrition through the symbiotic algae zooxanthellae hosted within their bodies, which provides the majority of their nutritional requirements through photosynthesis.

Family Agarclidae



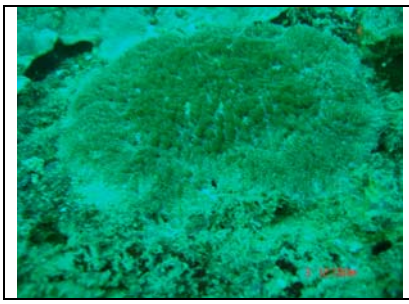
These corals are quite variable in appearance and difficult to identify at time. They have small star shaped calices with line radiated septa that that are shaped by adjacent calices making it difficult to find where each individual begins and the other ends.

Phylum Cnidaria, Class Anthozoa, sub classes Gorgonians & Sea Pens



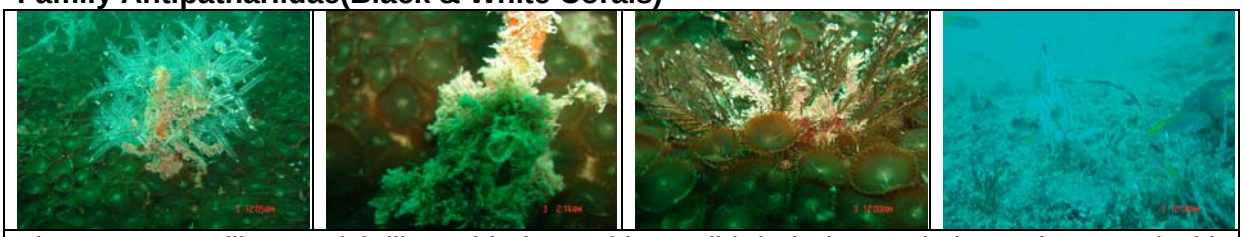
These have variety of forms ranging from delicate mats to sea fans and massive leather corals. They share a common trait in having polyps with eight tentacles(hard corals have six) These are more prolific in the area of high water flow where they capture zooplanktons with stinging cells. Identification of these species is very difficult beyond the genus or family level without dissection.

Disk corals



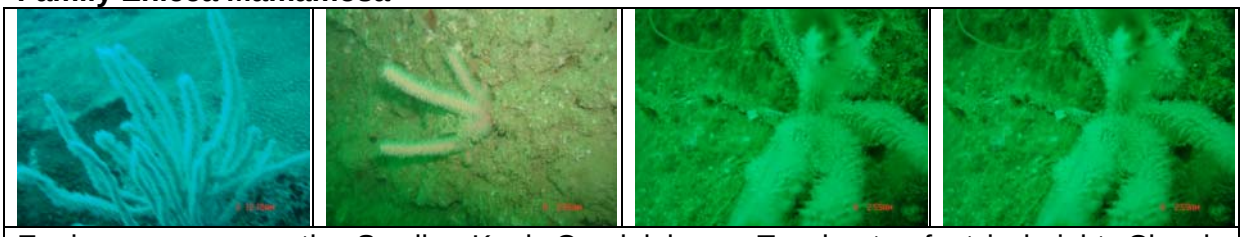
Turbinaria species is far less abundant than vase coral with which it usually co-occurs. Instead of a vase-like appearance the coral grows as a flat, thick disk which seldom exceeds 10 cm diameter. Calyces on the disk's upper surface are larger than for vase coral. Averaging 5 mm diameter, are evenly spaced and often show expanded or partly expanded polyps during the day.

Family Antipathariidae(Black & White Corals)



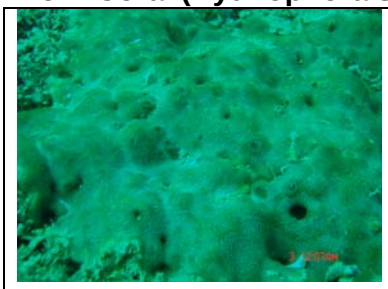
These are tree-like or stick-like cnidarians with a solid dark drown skeleton decorated with small spines or knobs. The rough surface distinguishes it from gorgonians and arborescent hydroids. Colonies occur along current-swept drop-offs and under ledges. Live colonies may be rusted brown, orange, yellow, green or white due to colors of polyps. They may also be fluoresce, this color is not recorded when flash photograph is taken. These provide food or shelter to several forms of marine life, including fishes, mollusks and crustaceans)

Family Enicea Mamamosa



Eunicea mammosa, the Swollen-Knob Candelabrum. To about a foot in height. Closely packed tubular calyces. Candelabrum like in appearance overall. Have tube-like calyces and candelabra-like colonies. Most are light gold in color. Exist in many types of reef environments. High to low light, water movement.

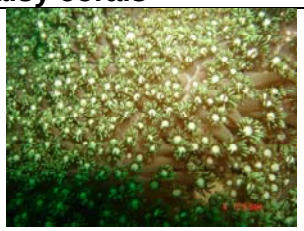
Horn Coral (Hydnophora sp.)

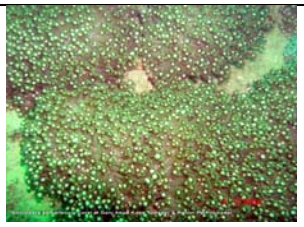


Horn Coral (Hydnophora sp.) is similar to Acropora but lacks the individual polyp formations. It is instead covered in fleshy tissue which is typically brown or intense fluorescent green. The branches can resemble thick tree branches or the coral can be found in a more encrusting/plating formation.

Hydnophora rely heavily on their zooxanthallae algae for food and need high light to preserve color and provide energy. They should not be placed close to other corals as they may sting nearby competitors

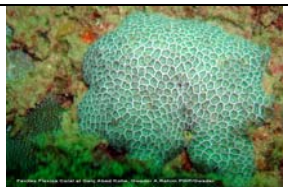
Daisy corals





This genus is easily recognized from its highly expanded flower-like polyps which project several centimeters above the coral's skeleton, waving back and forth with each passing current or wave. When disturbed, the polyps will be retracted and show a smooth coral surface, but often polyps can not be pulled completely into the calyx and are easily detached from the corals surface. Unlike most corals, this species usually has its polyps highly extended during the day. The skeleton of individual coral is massive but usually smaller than 1 m diameter, with larger, deeper set calyces than Porites species. It can assume a variety of growth forms, from massive or columnar, to highly irregular shapes.

African Pillow corals



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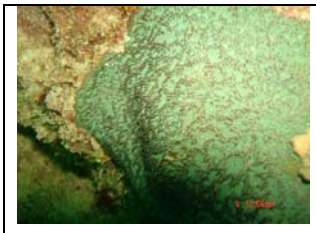
Thorn corals

	Thorn coral usually exists as quite small, nondescript encrustations on the bottom which are easily overlooked. It's most characteristic feature is small, thorn-like projections that lie between closely spaced calyces which are only 8-10 mm in diameter and less than 5 mm apart. The spiny projections give the coral a rough sandpapery surface, especially in the cleaned skeletons.

Galaxea Fascicularis corals

	Galaxea fascicularis is a hermatypic coral that is relatively resilient to stress from bleaching and from sedimentation. Corallite dimensions – width, height, corallite densities and inter-corallite distances – of Galaxea fascicularis colonies varied significantly with depth, and so with incident light. This specie belong to Oculinidae family and genus Glaxia. Colonies are massive or encrusting shaped. Corallites are cylindrical, thin walled and separated by blistering coenosteum. It can form a large colonies and become dononate species with large sedimentation rates and turbidity.

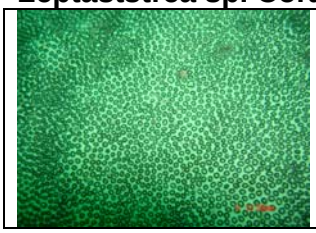
Finger Corals

	Finger Coral (Porites compressa) has finger-like branches with porous skeletons. The tips of its branches are usually blunt or flattened. It is light-brown to yellowish in color. Finger coral's structure has calices that flush with the surface. The upper septa surface looks like elevated rods. This species can be found in wave protected areas, 0-50 meters from shore.

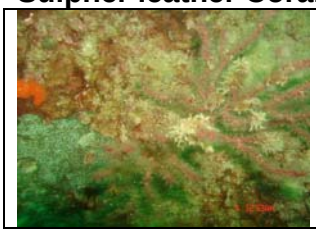
Hump Corals

	It can be difficult to tell that hump coral is a living coral colony because it looks just like a large, lumpy rock. Closer inspection will show that the coral grows as a series of large lobes formed into a dome. The living polyps are tiny, with tentacles that are only about in (1 mm) long, and during the day, they are hidden in their shallow skeleton cups. At night, they extend their tentacles to feed and the colony takes on a softer appearance. Hump coral is an important reef-building species.

Leptaststrea sp. Corals

	Crater Corals (Leptastrea sp.) are encrusting or dome-shaped colonies similar in appearance to Goniastrea sp. and Montastrea sp. corals. They have small round or polygonal corrallites that do not share their walls with thier neighbors. Color can vary highly in these colonies; purples, browns, greens and reds are not uncommon

Sulpher leather Corals



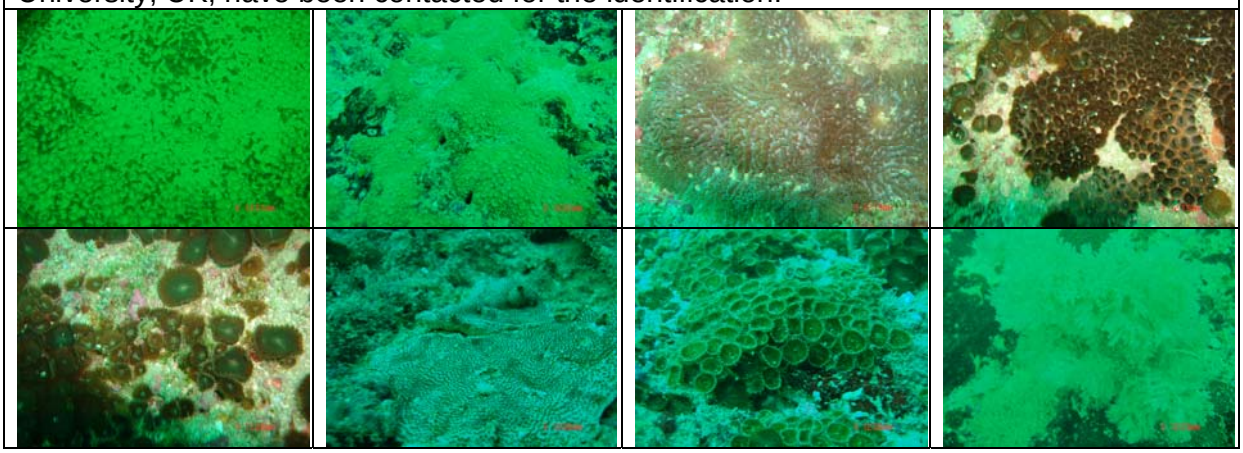

Specimen belong to anthozoan and are known as soft corals. Forms yellow crusting sheet 1.5cm high. Usually found on hard bottom of sheltered dead coral reef.

Leptaststrea sp. Corals

This is belonging to Mussidae family and colonies are phaceloid. Corallites are usually less tha 7mm in diameter although a few specimens had corallites up to 11mm. Septa have finely serrated margins and color varies between brilliant red to dark brown with green oral disks. It found in deep and sometime in turbid water.

Unidentified species of corals

The under mentioned coral species are yet to be identified. The experts from Millport University, UK, have been contacted for the identification.



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3	Abdul Rahim (Marine Biologist)
4	Muhammad Yasin (Boat Driver)
5	Muhammad Ali (PADI Open Water Diver)
6	Sherazi, Tanvir, Khizer (Volunteer Divers from Pakistan Navy)