

Handbook on
Hard Corals
of Gulf of Kachchh

CH SATYANARAYANA
RAMAKRISHNA



ZOOLOGICAL SURVEY OF INDIA

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PREFACE

The primary objective in preparing this book on hard corals is to develop the interest and capacity building in taxonomy of hard corals. There is an urgent need to protect these animals not only because of their important contribution as the major reef builders of coral reefs – but also because of the fact that much of the hard coral species are disappearing without discovery and the remaining are predicted to be at the verge of extinction in less than a century from now. The World scenario is alarming. Out of 845 known species of reef-building corals only 704 species have enough data to assess their status. Out of these 704 species, 5 species are critically endangered, 25 are endangered and a massive number (201) are in vulnerable category. Near threatened are 176 and remaining 297 are in the least concern category. Many species are disappearing without discovery. Coming to the status of hard coral taxonomy in our country, not even half of the species available in our reefs are discovered.

Gulf of Kachchh, the northern most coral reef region of India is always wrongly considered as the least important and least exciting of all the reefs in our country. If we look at it with a right perspective, Kachchh reefs are more valuable than the remaining reefs. Kachchh is like a natural open laboratory, hard corals and other associates can be observed in live condition without diving into the waters. High tidal amplitude prevailing in this region exposes the inhabitants very frequently giving ample scope to those who wanted to do research on coral reefs and associated organisms for unlimited time without worrying about air in the SCUBA cylinder and dangers in diving. It is the right destination to start taxonomic studies.

This book is divided into four chapters. The first chapter is meant to give an introduction on coral reefs, in lieu of the fact that majority of us in India, including literates in Zoology have meagre knowledge about the paradises (coral reefs) and their associates may be because of their occurrence under a medium which is not easily accessible to us. This chapter deals with subsections on reef definition, composition, occurrence, importance, reef types, coral reefs in India and recorded hard coral diversity.

The second chapter is on the hard corals of Gulf of Kachchh and their identification. It includes subsections on coral polyp, coral skeleton and hard corals of Kachchh. This chapter includes technical information related to identification including difficulties and hints for identification, symbiosis, reproduction and destruction to coral reefs also. At the end of the chapter, taxonomic account and checklist of hard corals of Kachchh are given. Distribution of all the species described was given in the form of maps depicting their spread in Indian reefs and other reefs in the Indian Ocean region. The maps were prepared with a combination of personal observations and published literature hits,

following the pattern adopted by Dr. J.E.N. Veron (2000) in his valuable volumes on 'Corals of the World'

The third chapter is exclusively created for introducing the beautiful and varied members of coral reefs, the coral associates (primarily crustaceans, molluscs and echinoderms). Only a glimpse of the representatives of coral reefs is given since dealing each and every one of them is a voluminous affair.

Since, the ultimate objective of this book is to sustainably conserve the fragile coral reef ecosystems through creation of interest and awareness by providing necessary information, some list of references suggested for reading, related web site addresses available online were given under the fourth chapter. The concluding section is a glossary of technical terms used in the book

In a nutshell, this book is primarily meant for budding zoologists and for those with a naturalist's heart. Unlike other handbooks which target specific group, this handbook is a cookies gift pack with different varieties of cookies for people with different tastes. Proud owners of this book will certainly taste the chapters according to their preference and it is sure that ultimately none of the chapters will be left unturned.

**CH SATYANARAYANA
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CONTENTS

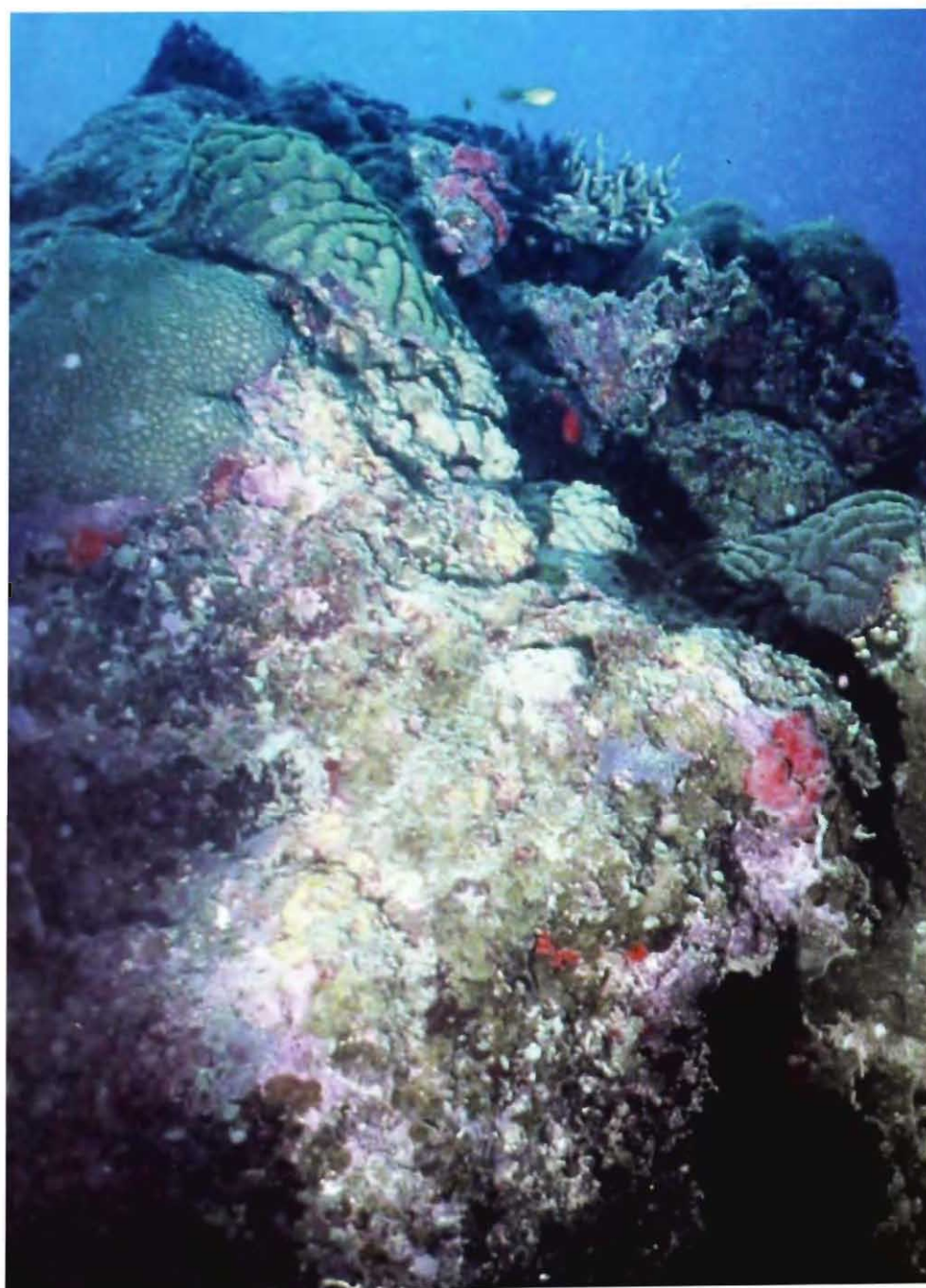
INTRODUCTION	1
FORMATION OF CORAL REEFS	2
IMPORTANCE OF CORAL REEFS	3
Nature's natural sancturies of Biological Diversity	3
Breeding and nursery grounds	4
Food and fishery to mankind	4
Tourism	4
Shore protection	5
Building material and sand production	5
TYPES OF REEFS	5
MAJOR CORAL REEF REGIONS IN INDIA	6
Harmatypes and Ahermatypes	7
Recorded Hard Coral Diversity in the World	8
Hard Coral Diversity (Zoo and Azoo) in the major reef regions of India	8
CORAL REGIONS OF KACHCHH	9
HARD CORALS IN THE HARSH ENVIRONMENT OF GULF OF KACHCHH	16
SCLERACTINIAN FAUNA OF GULF OF KACHCHH	20
SYSTEMATIC POSITION OF HARD CORALS	22
POLYP	23
IDENTIFICATION OF HARD CORALS	24
Skeletal characters used for the Identification of a Hard Coral	25
Growth forms	26
Corallite arrangement	27
Types of Septal arrangement	28

Septa Categories	31
Columella Catagorisation	32
SYMBIOTIC RELATIONSHIP	36
REPRODUCTION AND SPECTACULAR SPAWNING EVENT	37
Asexual Reproduction	38
DESTRUCTION TO CORAL REEFS	39
TAXONOMIC ACCOUNT	41
CORAL ASSOCIATES	93
SUGGESTED READINGS	106
RELATED WEBSITES	108
GLOSSORY	109

INTRODUCTION

Gulf of Kachchh – the first Marine National Park in India is bestowed with unique coral reefs around 42 odd islands in this southern part. Inspite of the priority given for their protection, the reefs of Kachchh are the worst affected due to Industrialisation.

Coral reefs – the highly productive ecosystems in the coastal zone are highly valuable and contributing to the sustenance of the country through fisheries, tourism, raw materials for pharmaceutical industry, craft making etc., and protects the shore from erosion and natural calamities.



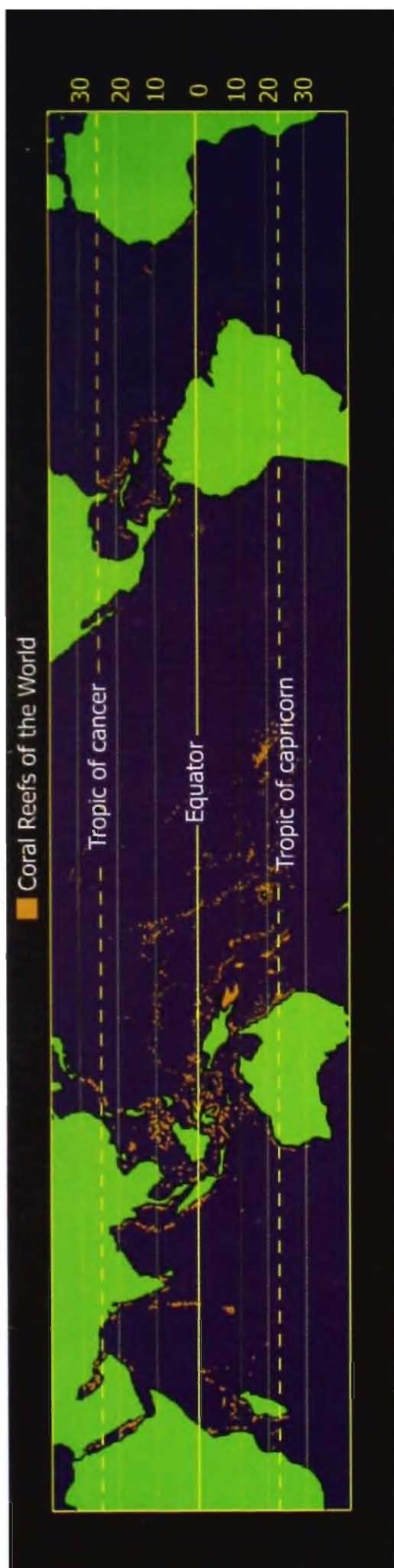
Hard corals or Stony corals are the major builders of coral reefs and facing hardships due to anthropogenic and natural interferences. Many of them are getting disappeared before registering their names in the nature's diversity register due to their sensitivity and inaccessibility. The corals of Kachchh have broken these two barriers (sensitivity and inaccessibility) to some extent.

According to Vaughan (1917) *"A coral reef is a ridge or mound of limestone, the upper surface of which is near the surface of the sea and which is formed of calcium carbonate by the action of organisms chiefly corals"*. For easy understanding it can be described as a limestone structure in relatively shallow water that results from the complex association of many calcium secreting plants and animals.

FORMATION OF CORAL REEFS

A coral reef is formed by Hard corals and Calcareous algae with considerable contributions from Molluscs, Soft corals, Horny corals and Calcareous sponges.





Coral reefs are found in shallow sea (less than 50 meters depth) on both sides of the equator between latitudes 35° N to 32° S. This amounts to only 2% of the earth's surface area. This restriction in distribution is mainly because of their preference to sunlight for food production by zooxanthellae. Coral reefs grow very well in places where there are clear waters with good circulation and stable salinity 27-38‰ and temperature 25-30°C range.

More than 100 countries in the world are with coral reefs. Indonesia stands first in the total reef area 51,020 km² and Great Barrier Reef on the northeast coast of Australia is about 2,000 km in length and is the longest reef in the world.

IMPORTANCE OF CORAL REEFS

Coral reefs can be nicknamed as treasure houses because of the valuable services and goods they provide to the human kind. What ever available in the coral reef areas is useful to the humankind in one way or other. The following are some of the uses of coral reefs and their inhabitants:

Nature's Natural Sanctuaries of Biological Diversity

Coral reefs are the highly productive ecosystems in the coastal zone. Because of their location in clear waters, where there are not much of physico-chemical variations and also because of the variety of hiding spaces coral reefs provide, almost all the animals belonging to different animal phyla reported from the marine environment are found in coral reef areas. In 2001 Spalding and his friends who were working on Caribbean reefs could able to identify about 534 species belonging to 27 phyla from just 70% of the sample they have collected in a 5 square meter reef area. This clearly shows the richness of a coral reef area. That is one reason why coral reefs are compared with the tropical rain forests.

Breeding and nursery grounds

Many shell fishes and fin fishes use coral reefs as their breeding and nursery grounds because of the food, shelter and pristine conditions available for their young ones after their birth. Coral reefs not only provide crucial food and shelter to the fin and shell fishes during their young stages but also play a crucial role in the transport of larvae and young.

Food and fishery to mankind

The prime utility of coral reefs to mankind is through its fisheries. It is estimated that coral reefs contribute 25% of the world fishery even though they occupy only 2% of earth's surface.

Tourism

Coral reefs with its reef builders and associated organisms like ascidians, polychaetes, giant clams, octopuses, sea cucumbers, sea anemones, sea urchins, sea fans, starfishes, sea lilies, turtles etc., along with colourful fishes form spectacular live theatres underwater and attract tourists. Because of the unlimited adventure and visual treat they provide they are considered by many as 'Paradises underwater'. Most of the developing countries in the tropics are now considering Tourism as the primary source of their income since the income it generates is overshooting the income they get from fisheries. For example in the Republic of Maldives in 1997 and 1998 the estimated gross domestic product contribution of tourism exceeded the combined total of all primary industries and was about twice as great as the contribution of fisheries. In Australia the Great Barrier Reef attracts about 1.6 million tourist visits with the industry valued at over \$1 billion per year (GBRMPA, 1998). When compared to this only \$250 million is the annual income from the Great Barrier Reef fisheries (Kenchington *et al.*, 2003).



Shore protection

Reefs are natural barriers and act as first line of defence against natural disasters like floods, storms and tsunamis and protect the shore from erosion.

Building material and sand production

Calcium carbonate produced in the coral reefs is used and being used as building material in many developing countries. It is estimated that on an average limestone production per square meter of healthy coral reef range from 0.8 to 8.9 kilograms per year. Fragments of calcium carbonate skeleton accumulate as sediments on the sheltered, low energy side of reefs. There they may foster the growth of mangrove forests and seagrass beds which in turn also assist shoreline protection and produce ecosystem goods in the form of seafood products

In addition to the above uses many bioactive substances are being extracted from the corals as well as their associates as drugs for human usage. The skeleton of hard corals is being tried as alternative material for bone grafting. Coral reefs contribute black coral & red coral for jewellery and stony corals and shells for ornamentation purposes. There is always lot of demand for reef fishes and other colourful associates in the aquarium industry. Rate of coral growth depends on favourable climate, hence corals are now being used as Indicators of climate change in the past. In addition to these benefits they provide many services especially in the form of production of sand, maintenance of biological diversity, providing the seed for affected ecosystems in the vicinity and many more.

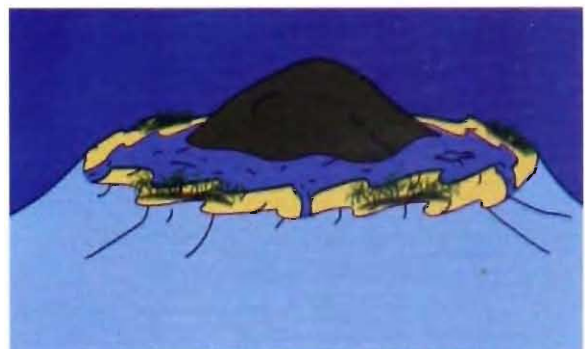
TYPES OF REEFS

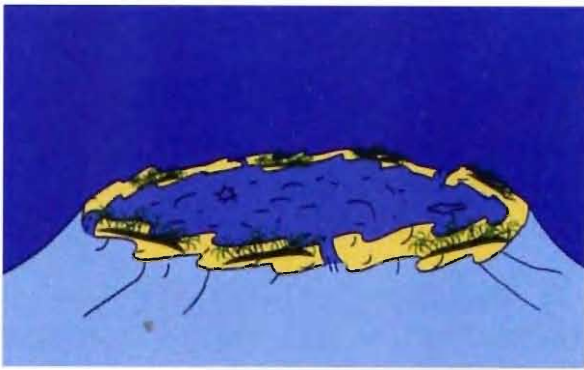
Depending on their growth pattern, coral reefs are primarily divided into fringing, barrier and atoll reefs.



Fringing reefs are reefs found adjacent to a shore line. Most of the reefs found in India are of fringing type.

Barrier reefs are reefs well separated from land masses with a lagoon in between. Few reefs in Andaman region are of barrier type.

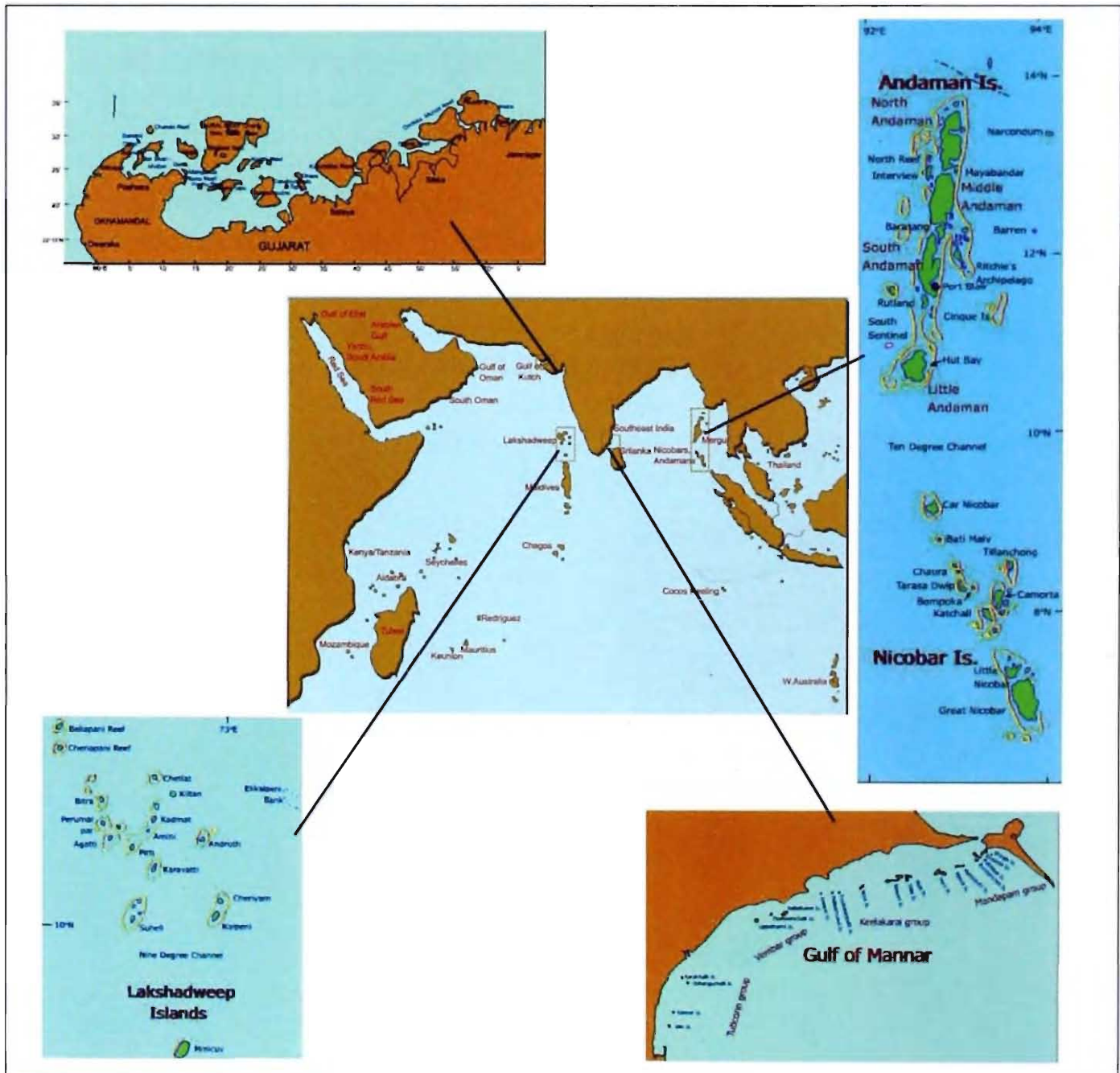




Atoll reefs are oceanic reefs grown over submerged land masses. Lakshadweep reefs are of atoll type.

MAJOR CORAL REEF REGIONS IN INDIA

All the three major types of reefs are found in India. Patch reefs are found all along the west coast, especially Malvan coast and some parts of east coast. The following is a brief account about the four major reef regions in India.



Gulf of Kachchh is the northern most Reef region in India and is located in the Gujarat State on the west coast. It consists of 42 islands. It is the first Marine National Park in India.

Lakshadweep islands consisting of about 32 islands are situated close to Cochin, Kerala on the west coast of India. Atoll type of reefs are found only in this reef region.

South-east coast reefs are found along the coast of Tamilnadu state between Rameswaram and Tuticorin. Gulf of Mannar consists of about 21 coral islands. It is declared as a Marine National Park and Biosphere Reserve.

Andaman & Nicobar Islands consisting of more than 530 islands on the east coast of India are the largest reef regions in India and are considered to be the best reefs in the whole of Indian Ocean region.

India stands 10th in the world with a total reef area of 5,790 km².

Hard Coral Diversity

Hard Corals can be divided into two groups on the basis of their symbiotic dependence on photosynthetic algae called Zooxanthellae.

Corals with zooxanthellae in their tissues are called Zooxanthellates and those without zooxanthellae are called Azooxanthellates.

Zooxanthellate corals are mostly colonial, found in the shallow seas exposed to sunlight and responsible for the formation of reefs. Azooxanthellates are mostly solitary and naturally found in deeper waters away from sunlight. The tables given below show the present day (extant) hard coral diversity documented in the World (Zooxanthellate & Azooxanthellate) and those observed in the four major reef regions in India (Zooxanthellate & Azooxanthellate combined).

Hermatypes and Ahermatypes

Reef building corals are called as Hermatypic corals and those don't contribute to the formation of Coral reefs are called as Ahermatypic corals.

Recorded Hard Coral Diversity in the World

	Families	Genera	Species
Zooxanthellate	18	111	>800
Azooxanthellate	13	>135	>800
Total	31	>246	>1600

Hard Coral diversity in the major reef regions of India

	Gulf of Kachchh	Laksha-dweep	South East Coast	Andaman & Nicobar	Total
Families	10	16	14	17	17
Genera	25	45	38	71	87
Species	49	114	96	297	345

CORAL REGIONS OF KACHCHH

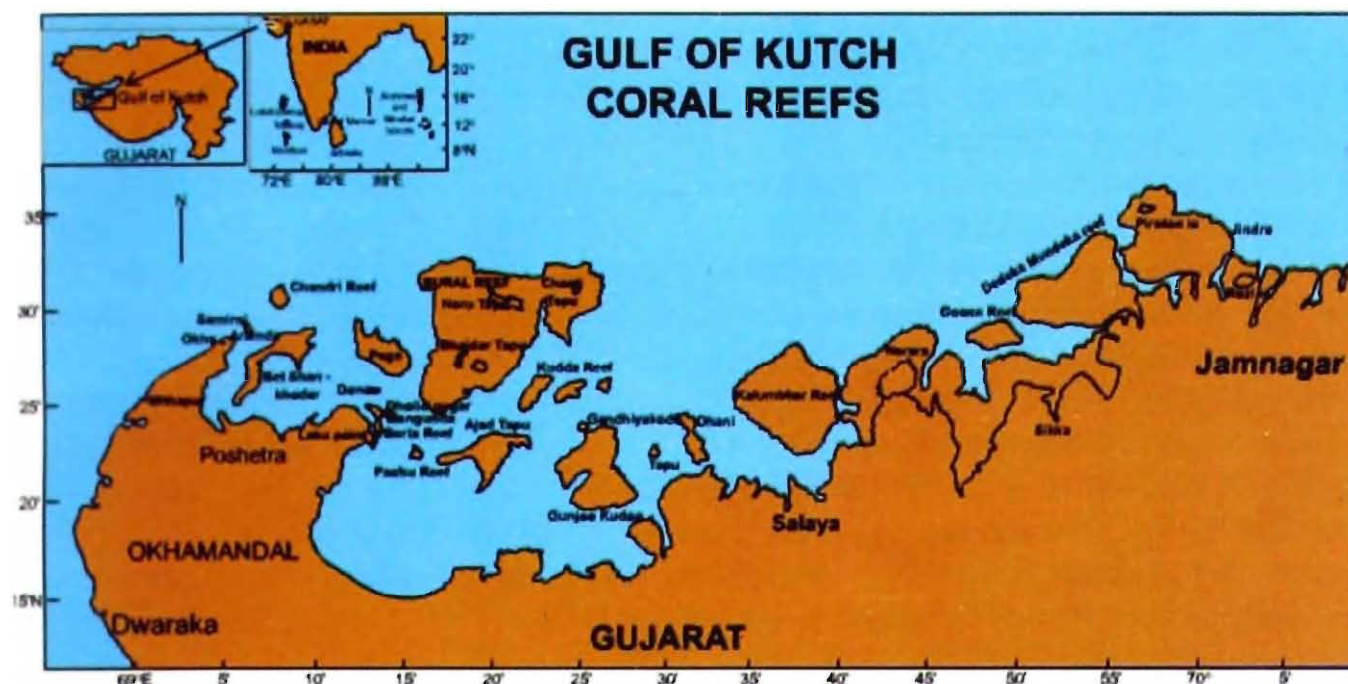
Gulf of Kachchh is the northern most reef region of India. It is 170 km long and has an area of 7350 km². The physiographic and faunistic composition of Kachchh is attributable to its location in the tropics. It is with characteristic arid climate, large semi-diurnal tidal amplitudes and negative water balance. These three crucial parameters along with the surface currents and sediment input determine the occurrence, abundance and distribution of biota of this region.

The surface water currents in this region vary from 1.5 to 5 knots. A high velocity tidal stream through the central channel of the Gulf acts as a barrier to the southern shores and diverts the sediments flowing into Gulf due to its proximity to river Indus on to the northern side. This is the major factor for the disappearance of the reefs in the northern shores and appearance of 42 islands with unique marine ecosystem in an area of 931 km². Out of the 42 islands, two islands are inhabited. Coral reefs, Mangroves and Seagrass ecosystems, the three major ecosystems, which are considered as the nature's natural sanctuaries of biological diversity are found in this region. To protect these ecosystems an area of 457.92 km² was declared as the Marine Sanctuary in 1980 and 162.89 km² out of the sanctuary area was declared as Marine National Park in 1982.

The description of some of the coral formations of Gulf of Kachchh are given below:

1. Pirotan Island

It is located between 22°24.4'N - 22°27.5'N and 69°35.3'E - 69°39.4'E and is known for its biodiversity and natural beauty. It is located 12 km away from the coast. It has got a lighthouse with the quarters for the staff of lighthouse department and also a cubicle of the Forest department. Live corals are found on the eastern and northern sides. *Avicennia*, *Rhizophora*, *Cerriops* and few trees of *Aegiceros* are the major contributors of the vegetation. Island is surrounded by sandy beach from all sides and on the west and central part is the high tidal mudflat. Intertidal mudflats are found on the east and west.



In addition to Little cormorant, Large Egret, Darter herons, Pond Heron, Night Heron, Little Green Heron, Indian Reef Heron, Grey Heron are the bird visitors of this island. Rainwater is harvested during the rainy season for meeting the needs of the lighthouse staff residing on the island. The anthropogenic interferences include the calcareous sand mining for the preparation of cement was carried out before the declaration of the Park and visits by employees of light house, fishermen, pirs, staffs of the MNP; tourists, scientists, nature lovers and students.

2. Narara Bet

It is located between $22^{\circ} 25.8'N$ - $22^{\circ} 28.3'N$ and $69^{\circ} 42.1'E$ - $69^{\circ} 44.70'E$ and is 3 km away from the coast. Once known as a nursery ground for fish, shellfish and prawns and also for turtle nesting was ruthlessly exploited for coralline sand. This is the most affected reef of all the reefs leased for coralline sand excavation. The situation further worsened with the laying out of pipeline by Indian Oil Corporation for the supply of crude oil from Single Buoy Mooring to the Crude Oil Terminal. A road was laid by IOC connecting the islands. All these activities resulted in the increase of sedimentation and much of the coral reef was buried under mud. The profuse growth of macro algae *Ulva* sp., *Sargassum* sp., and *Padina* sp., is another threat to the corals competing for space. *Avicennia* sp. is the major contributor of mangrove vegetation. It is a nice nesting site for Reef Heron, Grey Heron, Largest Egret and Pond Heron. In addition to the laying of crude oil pipeline and calcareous sand mining carried out long back the other anthropogenic interferences include visits by tourists, scientists, nature lovers and students. It is an excellent site for Nature Education camps.

3. Coral area near Sikka Creek

It is located between $22^{\circ} 28.6'N$ - $22^{\circ} 29.2'N$ and $69^{\circ} 46.4'E$ - $69^{\circ} 47.2'E$ nearly 7.5 km away from the coast. It remains submerged during high tide.

4. Goose Reef

It is located between 22° 28.6'N - 22° 30.6'N and 69° 47.0'E - 69° 50.4'E and remains submerged during high tides and is situated 6 km. away from the coast. The total area of this island is 678 hectares with a coral area of 56 hectares approximately. It contains a sandy area of 26 hectares. Thin mud mixed with sand is also found on some parts of the island. Mangroves are totally absent on this reef. The elevated middle portion of the reef and the big pool like formation on the north-western side of the reef allows the corals and its associates to remain exposed to the seawater during low tide. A gradation in the coral composition is clearly visible from the bottom to the top of the island. The major contributor of the basic structure of the reef is *Acropora* spp. This was another island leased for removal of calcareous material for cement industry; the resultant sedimentation had lead to the disappearance of many benthic animals including pearl oyster *Pinctada fucata*, sacred chank *Turbinella pyrum* (Patel, 1985). The channels dug out around this reef and frequent visit of fishermen to lay nets on the reef during high tide pose additional threat to this reef.

5. and 6. Dedika and Mundeka Reefs

Mundeka Reef : Located between 22°30.8N - 22°33.2N' and 69°51.8'E - 69°56.2'E and is 4.5kms from the coast. Mundeka reef is a part of Island, which stands second in the extent, among the 42 islands in Gulf of Kachchh. Dedika and Mundeka Island covers a total area of 4615 hectares. This island stands 3rd in the coverage of mangroves. The thick coverage of mangroves covering an area of 596 hectares includes, *Avicennia*, *Ceriops* and *Rhizophora*. *Salvadora* and few *Prosopis* trees are also found on the island. It stands second in the mud flat coverage, amounting to 1032 hectares next to Kalubhar Island; intertidal mudflat is found surrounding the island except in the northwest. High tidal mud flats on central part of the island and sandy beach in the west, north and eastern side of the island. It stands fourth in the coral reef area, extending to 1030 hectares. Rich coral reef is found in the north-western side of the island. This island tops in the reef vegetation, covering a sprawling area of 1440 hectares. Coral reefs support rich fauna including the rear *Bonellia*. Leasing of some area of the island in the past and subsequent illegal removal of coral sand and corals had deleterious effect on the reefs and its associated fauna of this island. Enquiries revealed regular visits by Fishermen.

Dedika reef : It is situated close to Reliance Jetty. Soft corals are found in plenty on this part of the reef.

7. Kalubar Island

It is located between 22° 24.4'N - 22° 27.5'N and 69° 35.3'E - 69° 39.4'E and is the biggest island in the whole of Gulf of Kachchh. Island covers a total area of 5972 hectares. It is located very close to Vadinar Jetty and is 4 to 10 kms away from the coast. This island stands 2nd in the coverage of mangroves. The thick coverage of mangroves covering an area of 602 hectares is dominated by *Avicennia* spp. with *Ceriops* in small patches. *Salvadora* is also found on this island. It stands first in the Mud flat coverage, covering an area of 2202 hectares; intertidal mudflat is found in the sound and southwest

part of the island. High tidal mudflats are found in the central and northern part of the island. Many creeks supply tidal water to the vegetation on the island. Sandy beach is found in the north, east and northwest with an area of 317 hectares and stands first among all the islands of Kachchh. It stands seventh in the coral reef area, extending to 458 hectares. Live coral reef is found in the east, north and north-western side of the island, extending to 458 hectares. This island stands second in the reef vegetation, covering a sprawling area of 1400 hectares. Coral reefs support rich fauna including the rear *Bonellia*. On enquiry it is found that the Muslim community visits this island for pirs, fishermen visit for fishing in the creeks; a lighthouse is situated on the western side and the staff stays there to make it functional. Illegal cutting and camel grazing of mangroves was reported in the past. Many water birds were seen resting on the mangroves, which are moderate in size.

8. Jindra Island

It is located between 22° 33.3'N 22° 35.4'N and 69° 59.6'E - 70° 01.8'E stands 10th with an area of 1319 hectares. It is located very close to Navabandar and is 6kms away from the coast. This island stands 5th in the coverage of mangroves. The mangroves cover an area of 442 hectares. *Avicennia* spp., *Ceriops* spp. and *Rhizophora* spp. *Aericeros*, *Salvadora* and *Suaeda* are the other vegetation available on this island. It is recorded as a nesting site for Indian Reef Heron, Darter, Grey Heron and large Egret. It stands eighth in the Mud flat coverage, covering an area of 410 hectares; high tidal mudflats are found in the central part of the island and intertidal mudflats in the east. Nice sandy beach is found on the eastern side of the island and the total sandy area on this island is recorded as 139 hectares, 5th among the islands of Kachchh. Total coral reef area recorded on this island is 130 hectares. Corals reef is found in the east and north and few patches in the north-eastern side of the island. The area covered by reef vegetation is 198 hectares. In addition to the calcareous sand and coral removal in the past by the Dig Vijay Cement factory, Illegal cutting and camel grazing of mangroves was also reported in the past. Evidences show fishing on coral reef and in creeks.

9. Laku Point

It is the coastline with small embayment lying close to Poshitra point and connected to the mainland. This area contains eulittoral fringing reefs about 100 meters wide each, which rarely get exposed to the sun and are with high coral diversity. Above them there were several rocky pools with rocks covered by barnacles and oysters giving a rugged appearance and needs care while treading through them because of the knife edged topography. These rocky pools harbour dense patches of corals with less diversity, attributable to high rate of evaporation. These rock pools are found in tiers clearly showing variation to coral distribution and diversity depending on the exposure to the tides. Tourists visit this place to see the corals and Educational camps are also being organised in this place to create awareness among the public. It is told that the fishermen visit this place occasionally to catch crabs and reef fishes.

10. Islands very close to Poshitra Point

Devdi, Dhabdhaba, Lefa are rocky islands located between 22°22.0'N - 22°23.0'N and 69°11.1'E - 69°12.0'E. Close to Poshitra point and were connected to the mainland in the past. They are all rocky islands with scrub forests composed of Aloe, Euphorbia Goral etc., similar to the scrub forests on the coast of Poshitra. They are almost devoid of mangroves and coral formations, when some *Avicenia* patches are found on Dhabdhaba. Rocks sprinkled at high tide were supported by small scattered colonies of few coral species. Rich windowpane oyster beds attract fishermen. Local people also occasionally visit these areas for recreation and fishing around these islands is also not ruled out.

11. Paga Reef

It is located between 22° 28.8'N - 22° 30.0'N and 69° 11.6'E - 69° 15.0'E and is 5 kms away from the coast. It is an excellent reef with high diversity of corals and coral associates and remains submerged during high tides. Pearl oysters beds were reported from these reefs by earlier workers. The total area of this island is 1268 hectares. It is totally devoid of mangroves because of its total submergence during high tides. 654 hectares of this area is covered by reef vegetation standing 9th among the reefs in the Kachchh. It stands 6th in the reef coverage with a total of 591 hectares with corals. A total of 23 hectares of sand was also recorded from this reef. Lagoons surrounding this island harbour fishes and wide variety of molluscs. This island was leased in the past by the fisheries department for collection of shells and pearls. Fishing is a regular feature surrounding this island.

12. Pashu Reef

This reef is located east of Marodi island between 22° 22.4'N - 22° 23.4'N and 69° 14.6'E - 69° 16.0'E and is 5 km away from the coast. It gets totally submerged during high tide. It covers an area of 203 hectares. 97 hectares of this reef is covered by reef vegetation. Reefs contain high diversity of corals with diverse associates. Corals are found all over the island with rich congregations on the western and east-west side. Good growth of *Goniopora* spp. on the eastern side of the island is noticed. Other corals found in plenty in association with *Goniopora* spp. are *Symphyllia radians* and *Turbinaria peltata*. Occasional fishing is reported from this area.

13. Mangunda

This reef is located north of Boria reef and is 2 km away from the coast. It gets totally submerged during high tide. This is considered as a part of Boria reef complex, which gets divided into Boria, Mangunda and Savaj during low tide. The Boria reef covers an area of 560 hectares. 26 hectares of mangrove area and 11 hectares of sandy area were recorded on this reef. Mangunda reef is rich with hard coral and soft coral fauna mostly on the southern and western sides. The southern side of this island is mostly dominated by *Montipora* spp. among hard corals and *Sinularia* sp. among soft coral fauna. *Symphyllia radians*, *Coscinaraea monile* and *Cyphastrea serailia* are other species found in abundance. Occasional fishing is reported from this area.

14. Boria reef

Boria reef is located south to Mangunda. A Major portion of Boria is covered with heaps of well-eroded broken branches of *Acropora* formed into pebbles. This substratum supports the survival of sea anemones, which bury themselves a bit deep into the pebbles during low tide to keep them exposed to the water retained between the pebbles. Large number of Sea anemones belonging to the same species are found on the island during low tide. Few coral species mostly dominated by *Monipora* spp. are found on the surface of the island in pools where sea water is found trapped even during low tide. Corals are found on the eastern and western side of the island. Evidences indicate fishing on this reef.

15. Azad Island

Azad is an inhabited island located between 22° 22.23'N - 23° 23.0'N and 69° 19.5'E 69° 20.5'E with an area of 1055 hectares. Some part of the island is used for cultivation by the population living on it. Two ponds were created for water harvesting during rainy season. A temple was also built long back. It is located 8 kms away from the coast. The mangroves cover a meagre area of 5 hectares *Avicennia* spp. was planted on this island. *Salvadora* and *Acacia* are the dominant vegetation on this island. Mud flat covers an area of 162 hectares. It contains a sandy area of 194 hectares, standing 2nd among the islands of Kachchh. Total coral reef area recorded on this island is 310 hectares, keeping it in the 9th place among the reefs of Kachchh. Corals reef is rich with hard coral, soft coral and associated fauna. The area covered by reef vegetation is 286 hectares. This island is rich with bauxite and bauxite ore is excavated in large chunks from this island in the past. It was also used as a fish-landing site. Grazing and cutting of vegetation was also practiced in the past. People visit this island to visit the temple. Fishing is also practiced on and around the reefs of this island.

16. Dholiogugar

Dholio and Gugar are two reefs located north to Lefa, close to Laku point. Dholio is with eroded sand stones and harbour isolated coral colonies. Gugar hardly gets exposed during high tide. Can be visited during minus tide. It contains loose boulders of sand stones and harbour good growth of hard corals and soft corals. *Turbinaria peltata* is the dominant form among hard corals. A hunt for crabs by the local fishermen resulted in the toppling of the live *Turbinaria peltata* in many parts of the reef.

17. and 18. Lenga Marudi and Man Marudi

A pair of tiny islands located west to Azad between 69°12.8'N - 69°13.0'N. Rocky islands with dangerously cut sharp edged boulders. They are 100 meters away from each other and are located 2 kms away from the shore. A ruined old building was found on Lengamarudi Island. Goral, Euphorbia, *Salvadora*, Aloe are some of the shrubs found on these islands. It is recorded as a nesting site for Indian Reef Heron, Darter, Grey Heron and large Egret, Pond Heron, painted Stork and Night Heron. Regarded as one of the best

nesting site for Painted Stork. Temporary pools formed on the rocks above high-tide mark consist of *Favia fava* and *Montipora* spp. are fishermen halt on these islands. Local people also visit these islands occasionally.



Man Marudi Island – A typical Kachchh Island

19. Bhaidar Island

It is located between 22°27.9'N - 22°28.2'N and 69°17.6'E - 69°19.5'E stands 3rd with an area of 3660 hectares and situated 11kms away from the coast. This island stands 6th in the coverage of mangroves. The mangroves cover an area of 416 hectares. *Avicennia*, *Ceriops* and *Rhizophora* are the dominant mangroves found on this island. It is recorded as a nesting site for Indian Reef Heron, Darter, Grey Heron and large Egret. Mud flats cover an area of 134 hectares. Sandy beach is found on the western side of the island and the total sandy area on this island is recorded as 31 hectares. Island proper has coral reef with degraded corals in patches. It is well known as a nesting site for Sea turtles. Fishermen carry out fishing on the reef and stay on the island especially during rough weather conditions.

20. Bural Reef

Bural reef lies north to Noru bet. A lighthouse was located on the northern side of the island. The surface of the island is with half dead coral species mostly belonging to *Porites* sp. Much of the reef is covered by mud and the algal invasion (*Ulva* sp.) is more on this island. The channels and crevices on the island harbour rich Ichthyic and other fauna.

21. and 22. Mitha Chusna Island and Khara Chusna Island

Pair of islands lying close to each other and are 8 km away from the main land. It is a religious place for Muslims. The peculiarity of these islands is that the fauna on these

islands show drastic variation in the vegetation. When the Khara chusna island is with good growth of mangroves, Mitha chusna is with scrub forests, which are mostly freshwater dependent. Khara chusna is located between 22°25.0'N - 22°25.1'N and 69°16.6'E - 69°16.7'E. A small patch of excellent mangroves forest with old trees of *Avicennia* sp. are found on the island. Recorded as a good nesting site and breeding site for Indian Reef heron, Grey Heron, Large Egret, Darter and Pond Heron. Fishermen and villagers visit this island and carryout fishing near the island. Mitha chusna is located at 22°24.8'N - 22°24.9'N and 69°16.7'E - 69°15.2'E. Scrub forest with *Salvadora*, *Euphorbia*, and *Commiphora wightii* are the principal vegetation. A temple on the island. Reef Heron, Grey Heron and large Egret were seen on this island. Regularly visited by Muslims. Together both the islands occupy an area of 280 km². Moderate reefs are found on the northern side of the island and occupy an area of 71 km². The dominant coral species observed around these islands are *Favia favius*, *Cyphastrea serailia* and *Porites compressa*.

23. Savaj Reef

It is a submerged reef lying close to Mangunda between Mangunda and Paga reefs. It hardly gets exposed even during low tide and can be seen only during minus tide. High diversity of corals all through the reef was seen on the surface because of its submerged nature. This is the best reef in the Poshitra region. The coral species observed on this reef include *Montipora explanata*, *Montipora hispida*, *Coscinaraea monile*, *Pseudosiderastrea tayami*, *Porites lichen*, *Porites compressa*, *Goniopora columna*, *Goniopora stutchburyi*, *Favia favius*, *Favites complanata*, *Goniastrea pectinata*, *Platygyra pini*, *Cyphastrea serailia*, *Hydnophora exesa*, *Symphyllia radians*, *Acanthastrea hillae*, and *Turbinaria peltata*. The reef gets exposed mostly during low tides.

24. Chandri Reef

It is located between 22°30.4'N - 22°31.8'N and 69°07.0'E - 69°08.4'E and situated 10kms away from the coast. It is without mudflats and mangroves. The reef vegetation occupies an area of 175 km². It is the western most reef of Gulf of Kachchh subjected to heavy currents because of its location in the open sea. It covers an area of 266 km² and remains underwater during high tide. Sandy beach is found on the southern side of the island. Good growth of corals is found on the western and northern sides. The most dominant group on the surface of the reef is *Porites* and in the areas on the western side which mostly found submerged in the sea, good growth of *Montipora* spp. are seen without a gap to tread across, *Goniastrea pectinata* and *Platygyra pini* are also found in abundance on this island. High diversity of associated fauna including eels were observed in the numerous crevices and channels formed on the island due to continuously flowing high velocity currents. Fishermen and tourists rarely visit this island due to its location in the open sea.

25. A Coral area of Shankhodhar (Doni)

Beyt Shankhodhar is a big island situated between 22°24.2'N to 22°28.6'N and 69°05.1'E to 69°09.1'E. It derived its name from its shape, appearing like a conch shell. It has got

three villages and a large population resides on this island. It was believed to be the summer resort of Lord Krishna and thousands of pilgrims visit this island. It is located just 2 kms away from Okha port. Many shrubs like Acacia, Euphorbia, Salvadora, Aloe, Zyzyphus, Prosopis are seen on this island. 120 species of macro algae are reported from this island. It is also used for educational and awareness camps. An area of 28 hectares on this island is reported to contain coral reefs.

26. Chakhadi

It is located between 22°31'N 22°32.0'N and 69°55.4'E - 69°56'.2'E with an area of 186 hectares. It derived its name from the shape of the island like the paduks of a Sadhu. It is located 5kms away from the coast and the islands in the vicinity are Chaabelli and Pattabir. This island stands 8th in the coverage of mangroves. The mangroves cover an area of 172 hectares. *Avicennia* is the dominant mangrove available on this island; much of the area was subjected to illegal cutting in the past. Mud flats cover an area of 14 hectares. Evidences show fishing on coral reef, mudflats and in creeks. Good coral reefs are found on the eastern side. *Favia fava* is the dominant coral found on this island.

27. Dhani island

It is located between 22°22.2'N 22°25.6'N and 69°30.5'E 69°33.4'E stands 6th with an area of 2363 hectares. It is located 6kms away from the coast. The mangroves cover an area of 45 hectares. *Avicennia* is the dominant mangrove available on this island, much of the area was subjected to illegal cutting and now forest department is taking serious steps to revive the vegetation by planting saplings in the lost areas. It stands third in the Mud flat coverage, covering an area of 1030 hectares. Total sandy area on this island is recorded as 141 hectares, 4th among the islands of Kachchh. Total coral reef area recorded on this island is 232 hectares. Good coral reefs are found on the eastern side. The area covered by reef vegetation is 915 hectares, 5th among Kachchh reefs. In addition to the calcareous sand and coral removal by the Dig Vijay Cement Factory in the past, before the declaration of the Marine National Park, Illegal cutting of mangroves was also reported in the past. Evidences show fishing on coral reef, mudflats and in creeks.

HARD CORALS IN THE HARSH ENVIRONMENT OF GULF OF KACHCHH

Very less diversity of corals was recorded in Gulf of Kachchh, which stands second in India next to Andamans in reef flat area (148.4 Km²). Usually coral diversity changes with latitudinal difference. In the case of Kachchh, geographical isolation and unfavourable climatic conditions are considered to be responsible for less diversity.

The most striking change which makes Gulf of Kachchh different from most of the world's coral reefs is the total disappearance of the most beautiful and dominant branching corals. The one time dominance of these branching corals is evident from the eroded base of all the islands. Staghorn corals belonging to genus *Acropora* are the very common contributors to almost all the reef areas in the world. These corals were dominant in this

area once and have disappeared totally at present due to changed environmental conditions. Not even a single live *Acropora* species was found even after extensive surveys. Pillai and Patel who have carried out their studies during eighties also described two *Acropora* species only with the help of dead specimens. Total disappearance of these species may be attributable to the increased turbidity and increased salinity due to the reduction of freshwater flow of river Indus, which resulted due to the uplifting of gulf region. Studies by Chauhan and Vora 1990 indicate that the Gulf region is rising at the rate of 1.3 cm per year, as a result of Holocene transgression of the sea.

The negative water balance is also very high in Kachchh. With an average depth of 30 meters, Gulf of Kachchh can be considered as a shallow reef region. It is less than 3 meters deep in some of the coastal areas like creeks. The estimated total volume of Gulf of Kachchh is 2,20,000 million cubic meters and the evaporation rate is estimated to be around 180 cm per year on the coastal area and a rate of 100 cm per year in the Gulf proper, which would result in the evaporation of a volume of 7350 million cubic meters per year.

The adaptability level of the organisms living in Gulf of Kachchh is astonishing and this makes Kachchh valuable on par with all other major reefs in India. The organisms living here are adapted to changing tides, currents and anthropogenic disturbances. Because of their elevated nature they can play a major role as seeding sources to ravaged coral reefs in other parts of the globe. The following are some of the representative hard corals of Kachchh with different growth forms. Some corals which pose problems to taxonomists



Dead *Acropora* beds

because of their structural and colour change resulted due to changing environmental conditions are also given below :



Leafy (foliose) whorls - Beautiful velvet coral *Montipora foliosa*.



Knobby branching corals - *Porties lichen* and *Porties compressa* from the boulder group - a special appearance.



Massive corals - *Symphyllia radians* and from the brain coral group - moderate appearance.



Encrusting corals - *Cascinaraea monil* a common appearance in Kutch reefs with a rare appearance on Indian reefs.



Colour change - *Acanthastrea hilae* changes its colour due to moderate exposure during low tide.



Structure change - Massive *Symphyllia radians* loses its general structure due to prevailing currents.



Structure change - *Goniastrea pectinata* like many other corals of Kutch with changed structure due to exposure during low tide.

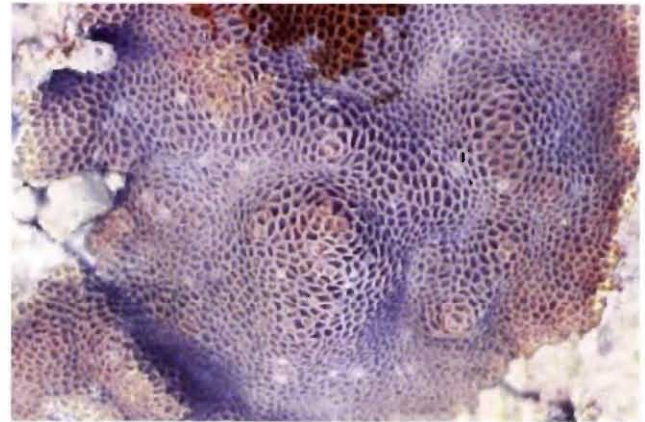


Submassive coral belonging to the flowerpot coral group - rarely gets exposed - exposes only during minus tide.

Because of their high adaptability, almost all the recorded coral species of Gulf of Kachchh are found in all the islands of Kachchh. While species like *Symphyllia radians*, *Goniastrea pectinata* and *Goniopora* spp., are with habitat preferences, the occurrence of some corals like *Turbinaria peltata* and *Favia fava* even on moving substrates like Gastropod shells and on loose sand reveals the adaptability and struggle they are carrying out to survive in a challenging environment.



Favia fava and *Turbinaria peltata* two dominantly occurring species growing on mobile rocks and shells.



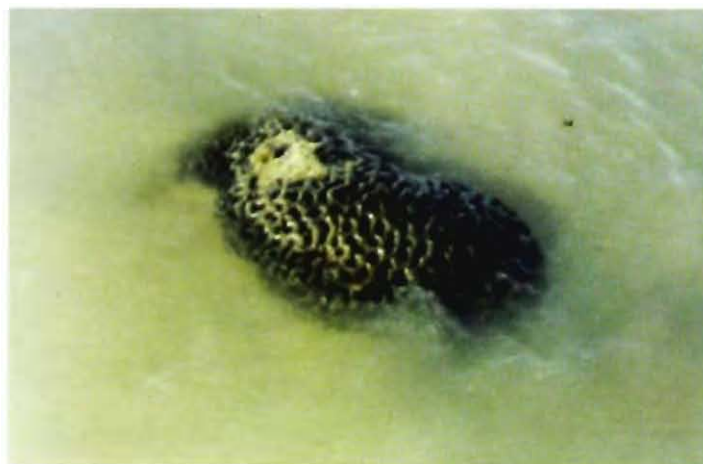
Goniastrea pectinata - prefers never go dry, rock pools.



Montipora sp - prefers eulittoral regions, which rarely get exposed even during low tide.



Turbinaria mesenterina - grows even on loose sandy bottom on a reef flat and avoids exposure to sun.



Symphyllia sp. - grows to massive proportions in sub-tidal areas, which remains submerged most of the time.

SCLERACTINIAN FAUNA OF GULF OF KACHCHH

Favia favus is the most dominant coral species of Kachchh. *Siderastrea savignyana* which is uniquely found in muddy regions is reported only from Gulf of Kachchh and South-east coast in India. *Acanthastrea hillae* is reported only from Gulf of Kachchh. *Hydnophora exesa* and *Turbinaria peltata* are found in plenty in Kachchh reefs when compared to other reef regions in India. The following is a glimpse of representative Scleractinian fauna of Kachchh with a note on their contribution to the live coral abundance of Kachchh :



A subtidal contributor - *Echinohyllia aspera*, a new species record to Kachchh.



A Common member- from the knob coral group - *Cyphastrea serailia*.



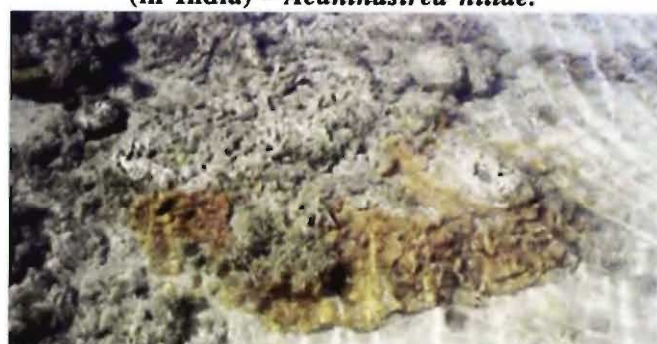
Most Prevalent member - *Turbinaria peltata*.



Unique member - found only in Kachchh reefs (in India) - *Acanthastrea hillae*.



Moderate contributors - Brain coral *ymphyllia radians* and *Goniastrea pectinata* from the moon coral group.



Rare contributor - the pagoda coral *Turbinaria frondens*.



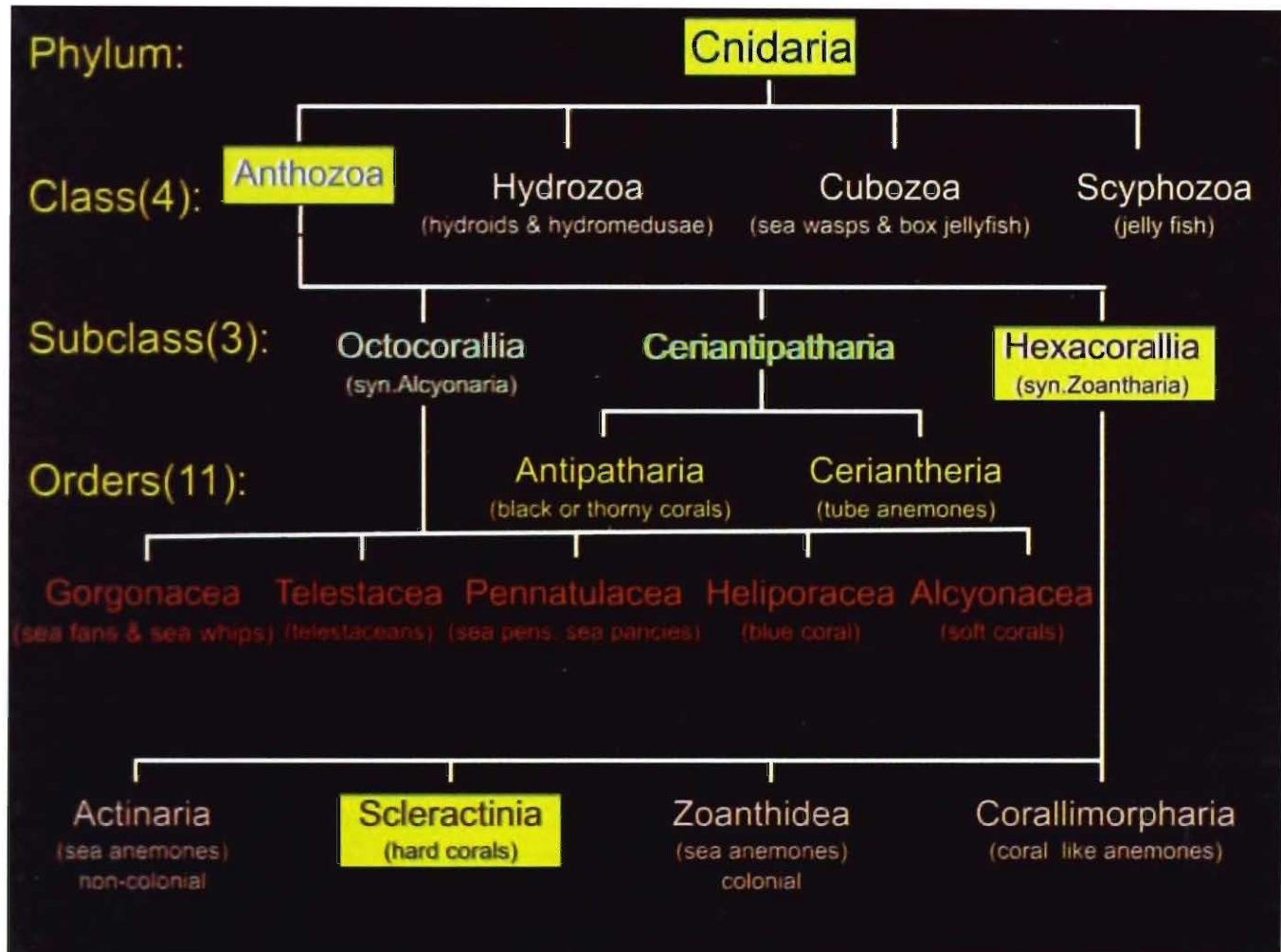
Unique and common member – from the starlet coral group *Siderastrea savignyana* reported only from Kachchh and South-east coast reefs (in India).



Dominant contributor - *Favia favus* from the moon coral group found in all the reef areas of Kachchh.

SYSTEMATIC POSITION OF HARD CORALS

Hard corals are a diverse group of organisms which are placed in the phylum called Cnidaria. The word 'cnidos' in Greek means stinging nettle. All the animals grouped under this phylum are with stinging cells called *Nematocysts*. Nematocysts eject stings tipped with poison with barbed threads at their end and cause irritation to the animals which come in contact with them.



Phylum Cnidaria is divided into four classes. Class Anthozoa which includes hard corals, sea anemones, horny corals or sea fans, soft corals and sea pens, is the most primitive of the four classes. Class Hydrozoa is composed of hydroids, siphonophores, fire corals and many medusae. Some of the representatives of class Hydrozoa like fire corals also contribute to the formation of the reefs. Big jelly fishes are grouped under class Scyphozoa and class Cubozoa consists of deadly box jellies with complex eyes.

Class Anthozoa is divided into three subclasses, Octocorallia, Cerianthipatharia and Hexacorallia. Hexacorallia derives its name because of the presence of tentacles in multiples of 6. Zoantharia is the synonym of Hexacorallia.

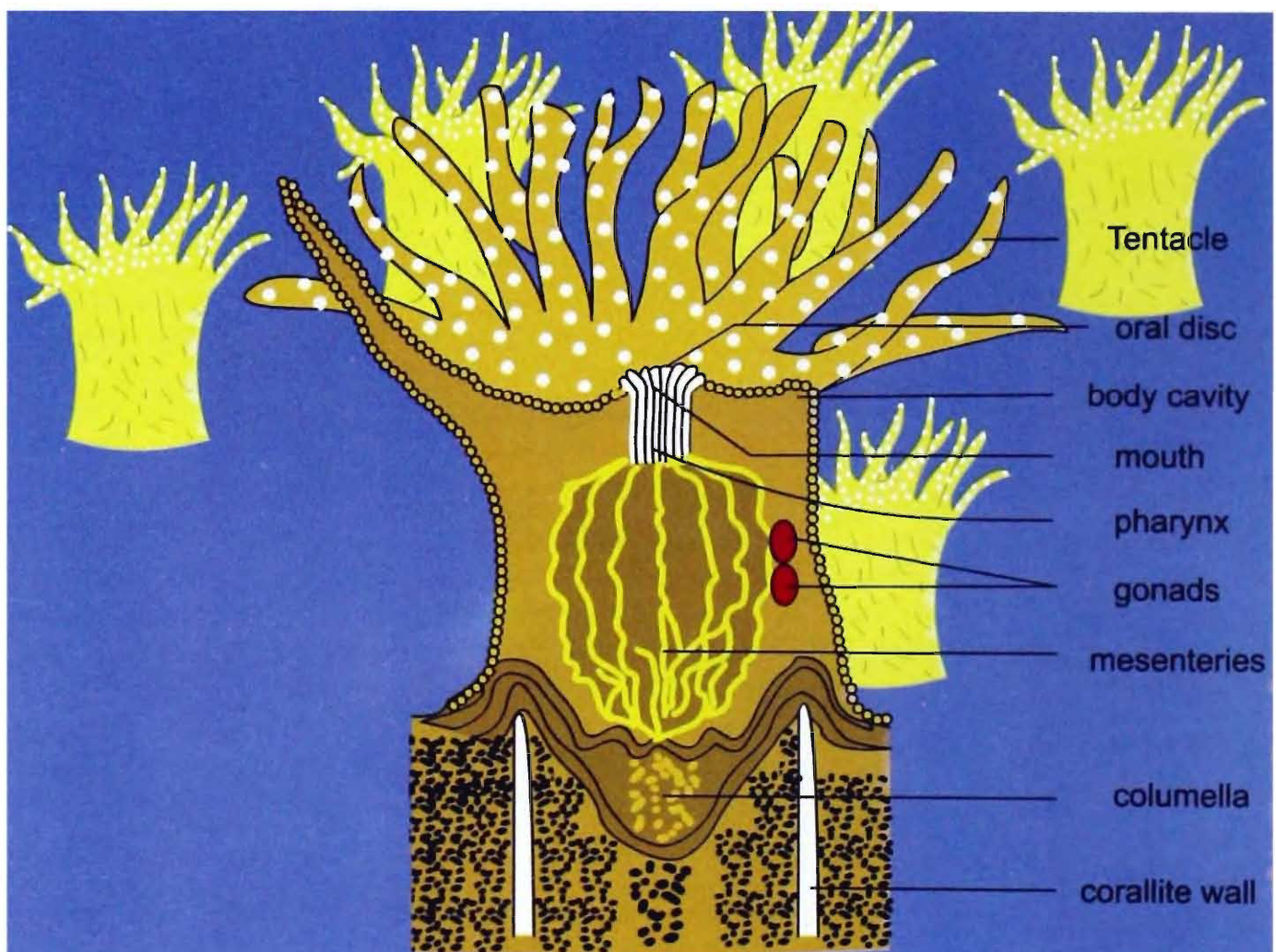
Black or thorny corals belonging to order Antipatharia and tube anemones belonging to order Ceriantheria are grouped under Cerianthipatharia.

All the remaining organisms with eight tentacles or multiples of 8 are grouped into five orders and placed under subclass Octocorallia otherwise called as Alcyonaria. Horny corals (sea fans and sea whips) come under order Gorgonacea, soft corals under order Alcyonacea, blue corals which also contribute to the formation of reefs come under order Scleroporacea, sea pens and sea pansies are grouped under order Pennatulacea and teleosteans are grouped under order Teleostei.

Subclass Hexacorallia is divided into four orders. Actinaria (comprising of non-colonial sea anemones), Zoanthidea (colonial sea anemones), Corallimorpharia (coral like anemones) and Scleractinia (hard corals). Scleractinians are called as hard corals or stony corals because of their hard and stony appearance, resulted due to their hard external skeleton made up of calcium carbonate. Polyps, the living components of hard corals are with simple tissue grade of organization. Since, this simple grade of organization creates difficulty in comparing taxa, hard corals are identified with the help of the morphology of their skeleton.

POLYP

Polyps are the basic units or building blocks of a coral colony. They are tiny flower like animals without internal skeleton. They are aquatic, bottom living animals found attached to hard substratum. To counter their non-mobile nature, nature has armoured



them with specialized cells called cnidoblasts for their protection and to catch prey. To support their structure and to protect themselves from enemies they secrete hard components like calcium carbonate around or within their bodies, which forms their external skeleton. Corals mostly live in colonies connected with a common tissue, which will be useful to them for sharing food. The colony begins with a single polyp which grows and divides to form numerous polyps. In colonial corals polyps share a common skeleton. Corals are grouped into three major types depending on their skeletal structure and commonly called as hard corals, soft corals and horny corals.

The body of a hard coral polyp is smooth and tubular with a free horizontal *oral disc* above and an attached *basal disc* below. An opening in the center of the oral disc which opens into the polyp interior is used as mouth and anus, for taking in and sending out the materials. There is a small oesophagus like connection called pharynx or *stomadaeum* between the mouth and the interior body cavity (*gastrovascular cavity*). The mouth opening is surrounded by one or more rings of tubular retractile structures called tentacles. Reproductive organs (gonads) are placed in the body cavity. Corals usually extend during night and retract immediately with simple touch. Retraction of the coral body is effected through muscular partitions in the body called mesenteries which are extended radially and distributed evenly in its tubular body.

IDENTIFICATION OF HARD CORAL

Identification of a hard coral underwater is effected by visual observation and by feeling the skeletal characters through touch. The crystalline and hard skeleton underneath its body tissue helps us in identifying it as hard coral and counting of the tentacles which are multiples of six helps us in distinguishing it from its counterparts, horny and soft corals.

Corals are at present identified on the basis of their skeletal morphology. Learners of coral taxonomy face considerable number of hitches in the initial stages of their learning due to some of the reasons listed below:

Hard coral species mostly spawn at one time and there is always a chance for exchange of genetic material between species, which results in a mixture of characters belonging to different species or sometimes even different genera.

Coral colour cannot be taken as a major identifying character for the simple reason that the colour to the coral is mostly given by symbiotic algae which lives in its body tissues. Sometimes, a species can be seen in different colours in the same locality itself. Coral colour can be used for quick and temporary identification in some corals where the coral colour is effected by the pigmentation in combination with the colour provided by the symbiotic algae.

Another hitch for learners is the plastic nature of coral skeleton. The shape, size and structure of a coral skeleton changes with the environmental conditions especially, depth and light availability. Almost all the reef forming corals are found in different growth forms

and some species, especially the branching forms can be seen in different shapes and sizes with varying depth. These kinds of structural or colour variants are called as “Ecomorphs” and there was a time when all these *ecomorphs* were named as different species.

In spite of all the above mentioned tricky problems, identification of a hard coral using its skeletal morphology is more effective and dependable since much of the times it is not possible for a taxonomist to observe all the species in living condition, that too in its actual locality.

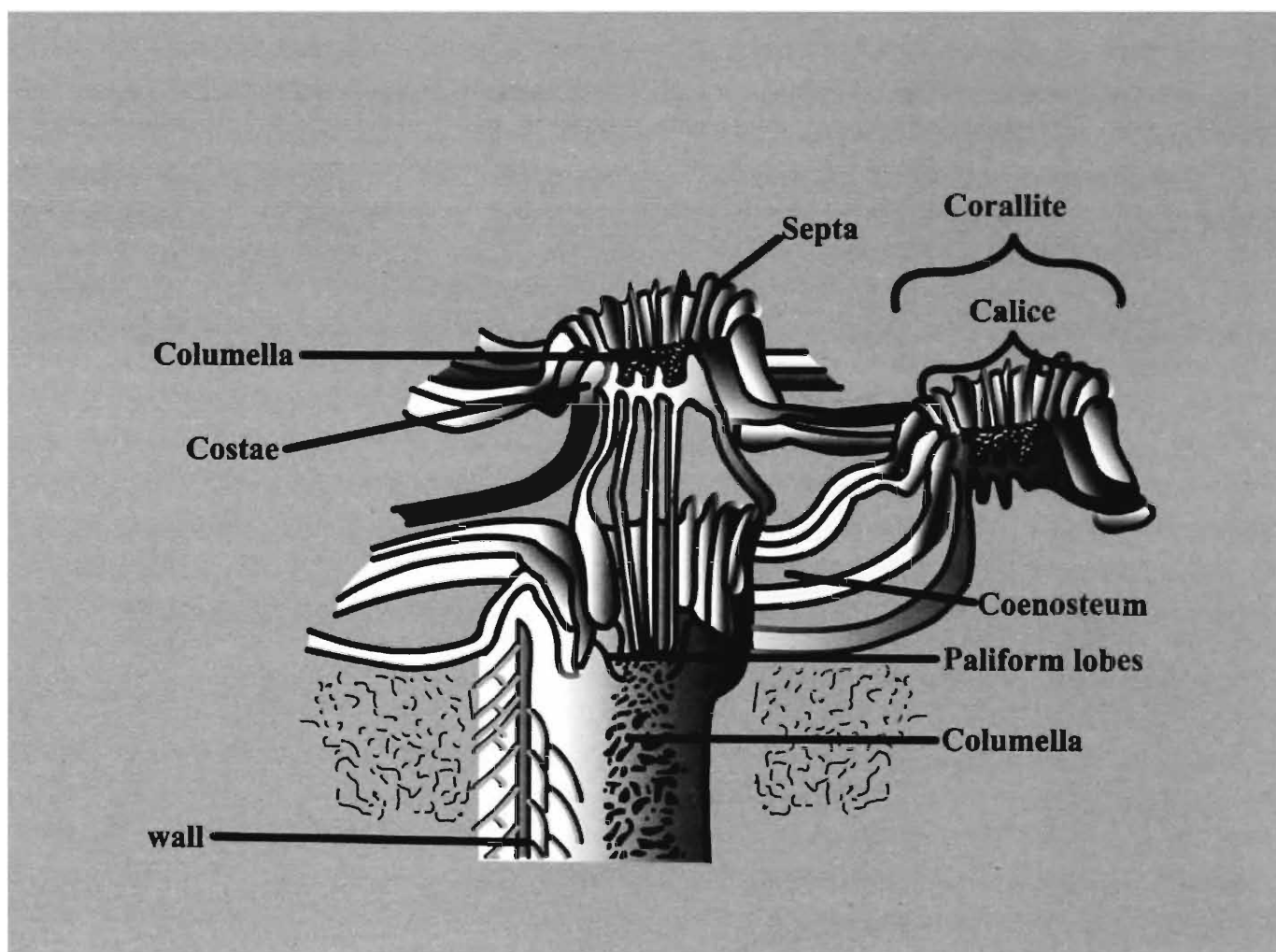
Since the skeletogenesis takes place very quickly in corals, skeletal morphology is taken as the yardstick in identifying juvenile corals also.

Identification of a coral using genetic material is a growing science and is proving to be challenging.

In the following sub-sections, all the above mentioned difficulties in identification and the skeletal characters used for the identification of hard corals are discussed in detail with illustrations.

Skeletal characters used for the Identification of a Hard Coral

Learning some technical terms related to the Coral skeleton is a prerequisite, as the coral taxonomy is based on the morphology of the skeleton.



The skeletal structure of an individual polyp is called a *corallite*. The skeletal structure of the corallite surrounded by a corallite wall is called a *calice* and the same is called as a *center* if there is no wall formed. *Wall* is the outer boundary of the corallite. Radial skeletal elements projecting inwards from the corallite wall are called as *septa* and those projecting outwards from the corallite wall are called as *costae*. When these two radial structures are united and continuous they are called as *septo-costae*. The wall and the radial structures (septa and coastae) are the supporting structures for the tentacles of the polyp. Septa are formed in between mesenteries. The innermost dentation of a septum is called as a *paliform lobe*. Paliform lobes sometimes forms a *crown* around *columella*, which is the skeletal structure located at the centre of the corallite. Columella is composed of single or multiple elements. Columella supports the oral disc and mouth of the polyp.

The skeleton of a coral as a whole is called the *corallum* and the surface of the corallum in between the corallites is called the *coenosteum*.

Growth forms

The coralla of hard corals are found in different growth forms and are used in the identification and description of corals. The following are the photographs and definition of some of the major growth forms found among Kachchh hard corals.



Massive = Colonies which are solid and are typically hemispherical or otherwise have approximately similar dimensions in all directions.



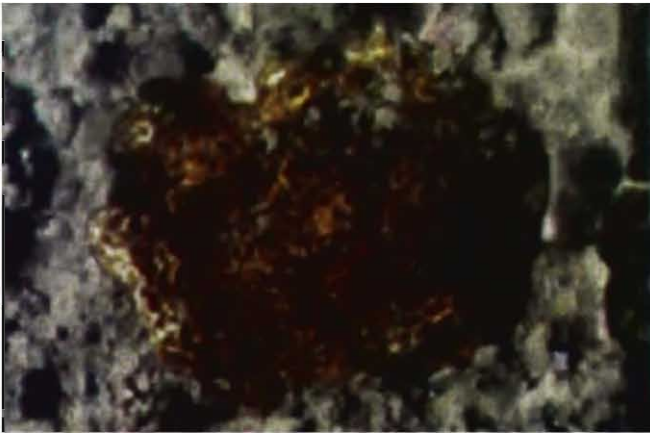
Sub massive = Colonies which tend to form small columns, knobs or wedges.



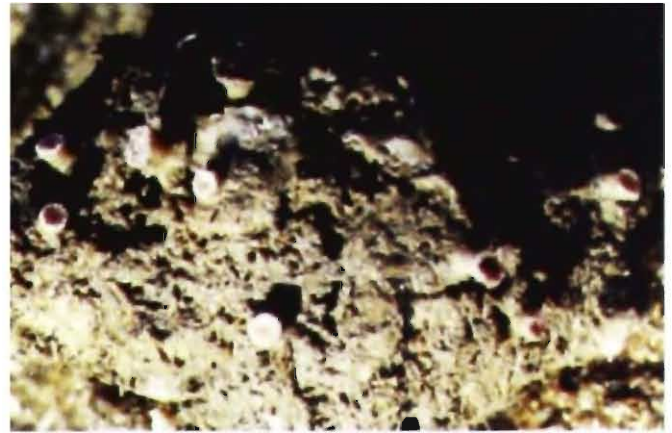
Branching = A descriptive term for a branch with compact radial sub-branches.



Foliose = Coral colonies attached at one or more points, leaf-like, or plate-like in appearance.



Encrusting = Coral colonies which form a thin layer or crust over underlying substratum.



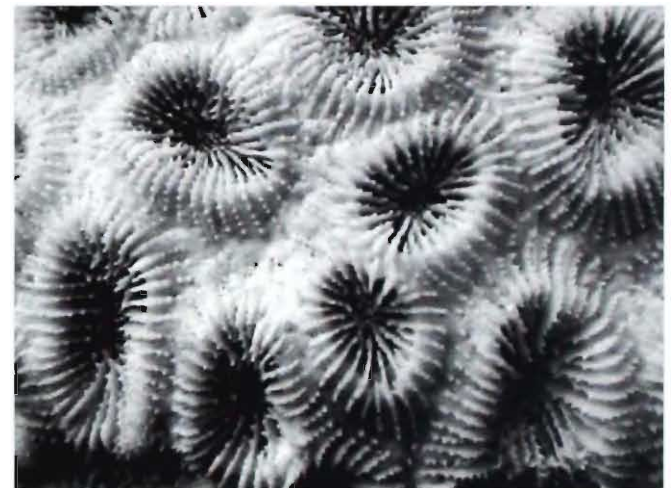
Solitary = Corals composed of single individuals.

Corallite arrangement

The arrangement or alignment of corallites in a corallum is a major character in the identification of a coral. The following are the photographs and definition of some of the corallite arrangement patterns found among Kachchh hard corals.



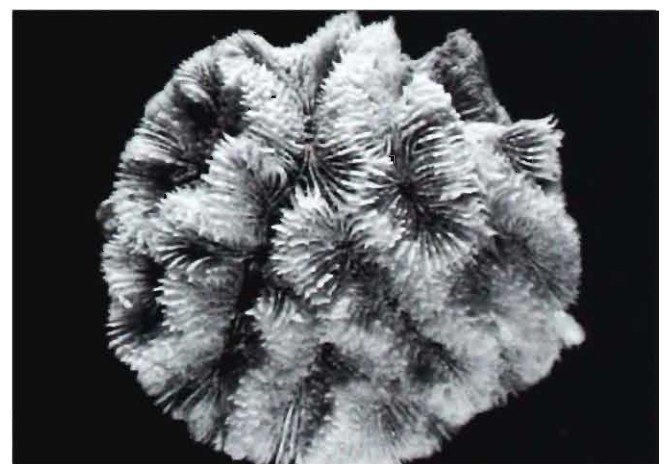
Cerioid = Adjacent corallites share the same wall.



Plocoid = Each corallite has its own separate wall.



Phaceloid = Corals that have corallites of uniform height adjoined towards their base.



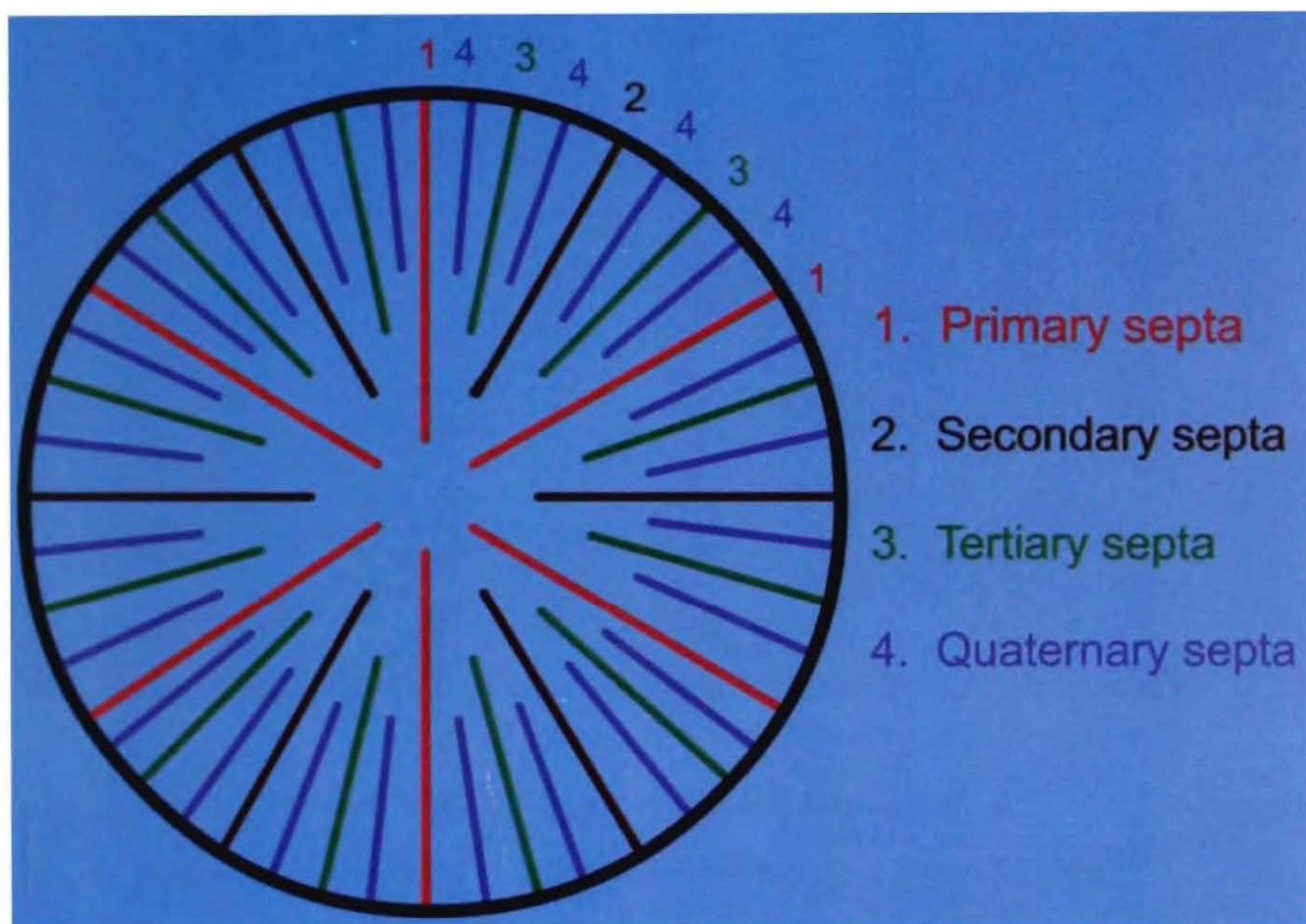
Meandroid = Massive colonies that have corallite mouths aligned in valleys such that there are no individual polyps.



Hydnophoroid = Septa fusing to form monticules or mould like structures

Types of septal arrangement

Septa are the major identifying characters formed after the settlement of the planula larvae of corals. They are the radial invaginations in the basal calcareous plate of young polyp. They are usually in multiples of six. The first six septa formed are called *primary*



Septal arrangement Cycles :

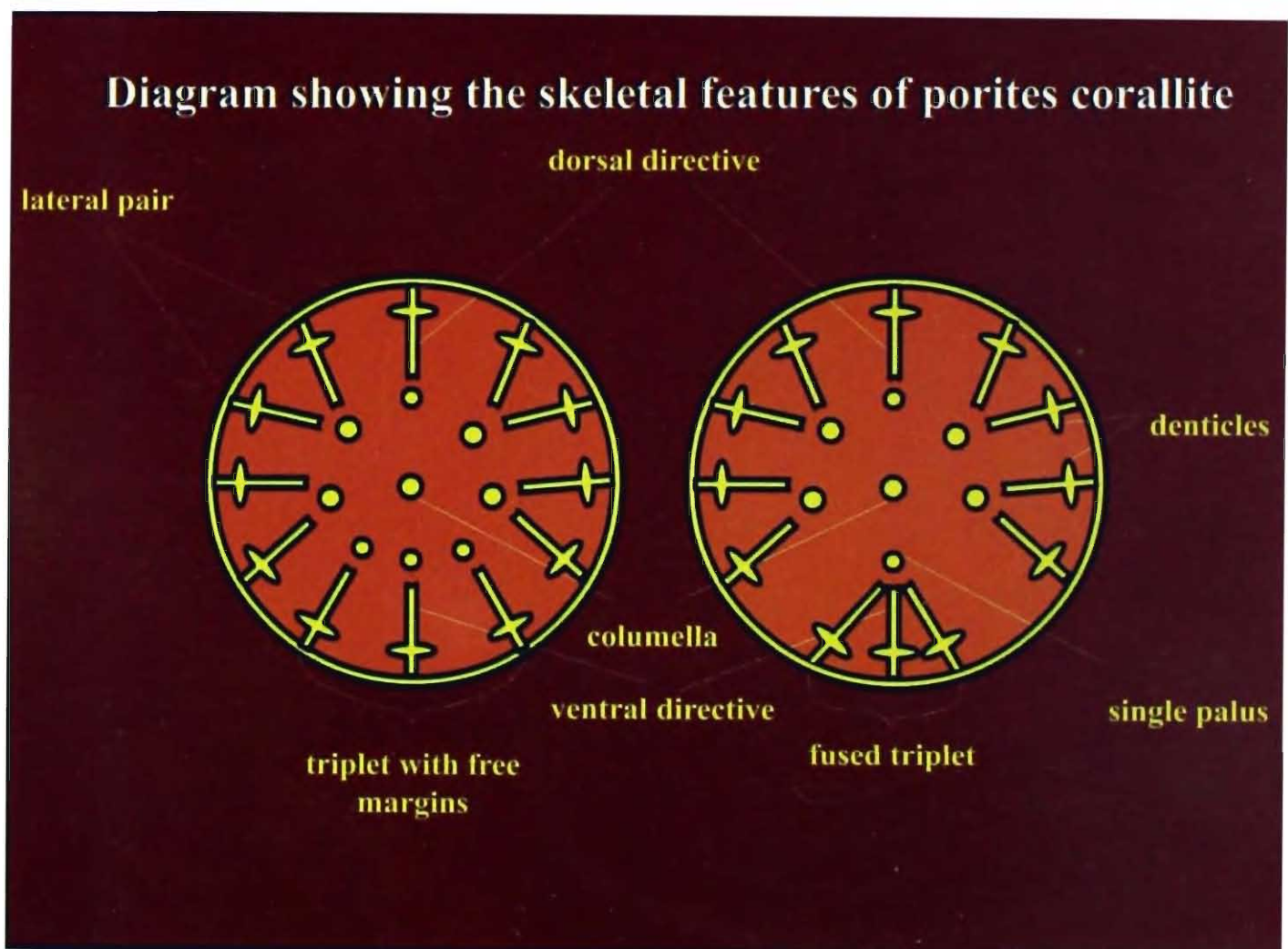
Primary (6)
Secondary (6)
Tertiary (12)
Quaternary (24)

Septation:

Cycle : Equal (in thickness & height)
Subequal
Unequal

septa and are termed as the first cycle. The second cycle of septa which forms next to primary cycle also consists of 6 septa and these septa are called as *secondary septa*. Secondary septa are placed between the primary septa and are smaller in size when compared to primary septa. *Tertiary septa* which are further small in size are 12 in number and form the third cycle. They are placed equidistantly between primary and secondary septa. This pattern of number and septal size continues resulting in fourth cycle of 24, fifth cycle of 48 and so on.

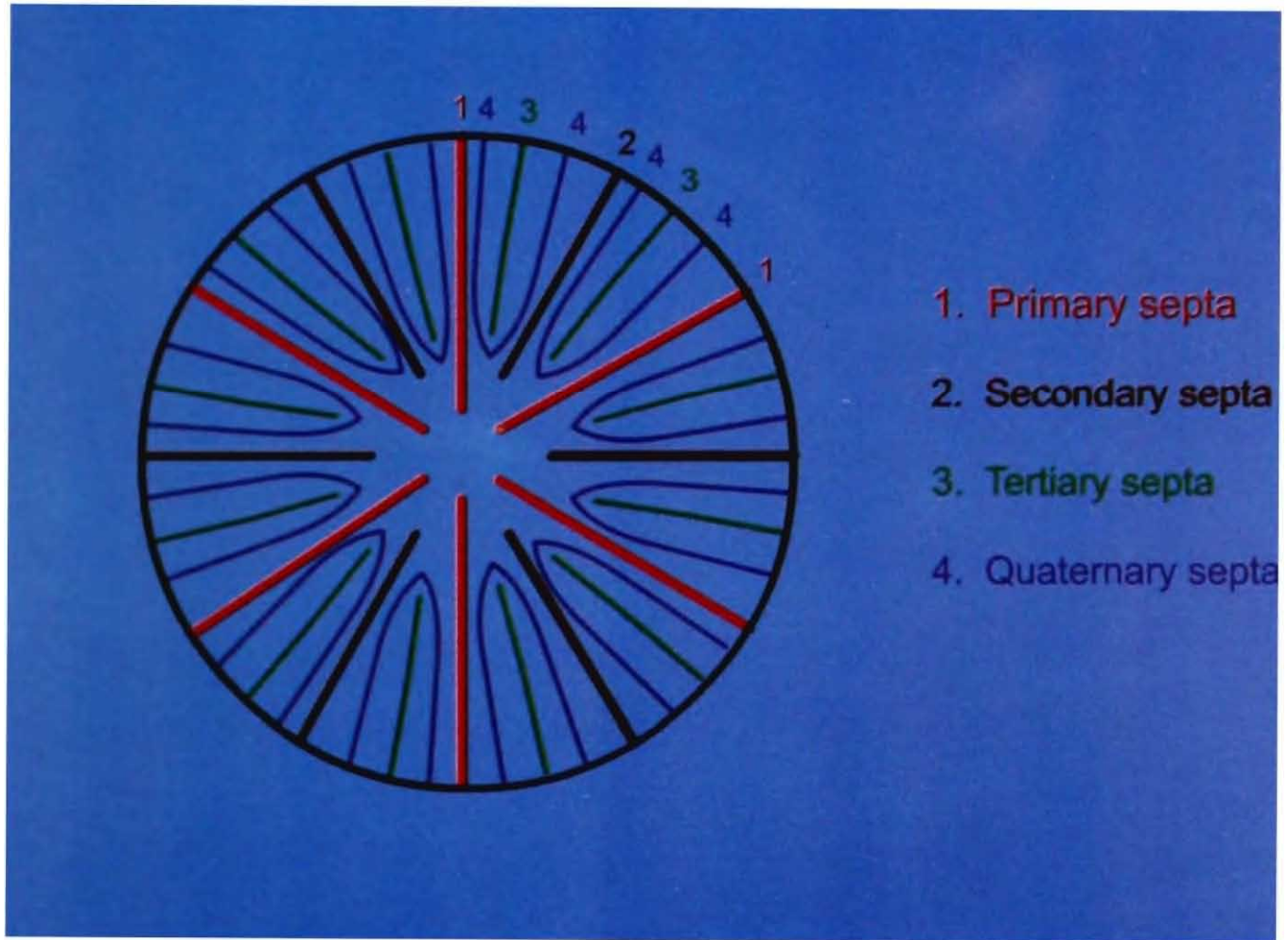
If the cycles of septa are clearly equal in thickness and height, they are called *equal*. They are called as *subequal* when the differences are slight and unequal when the differences are striking.



Patterns of fusion of the triplet in Porites

- a) Triplet with free lateral septa and three pali
- b) Triplet with lateral & ventral directive fused & one palus

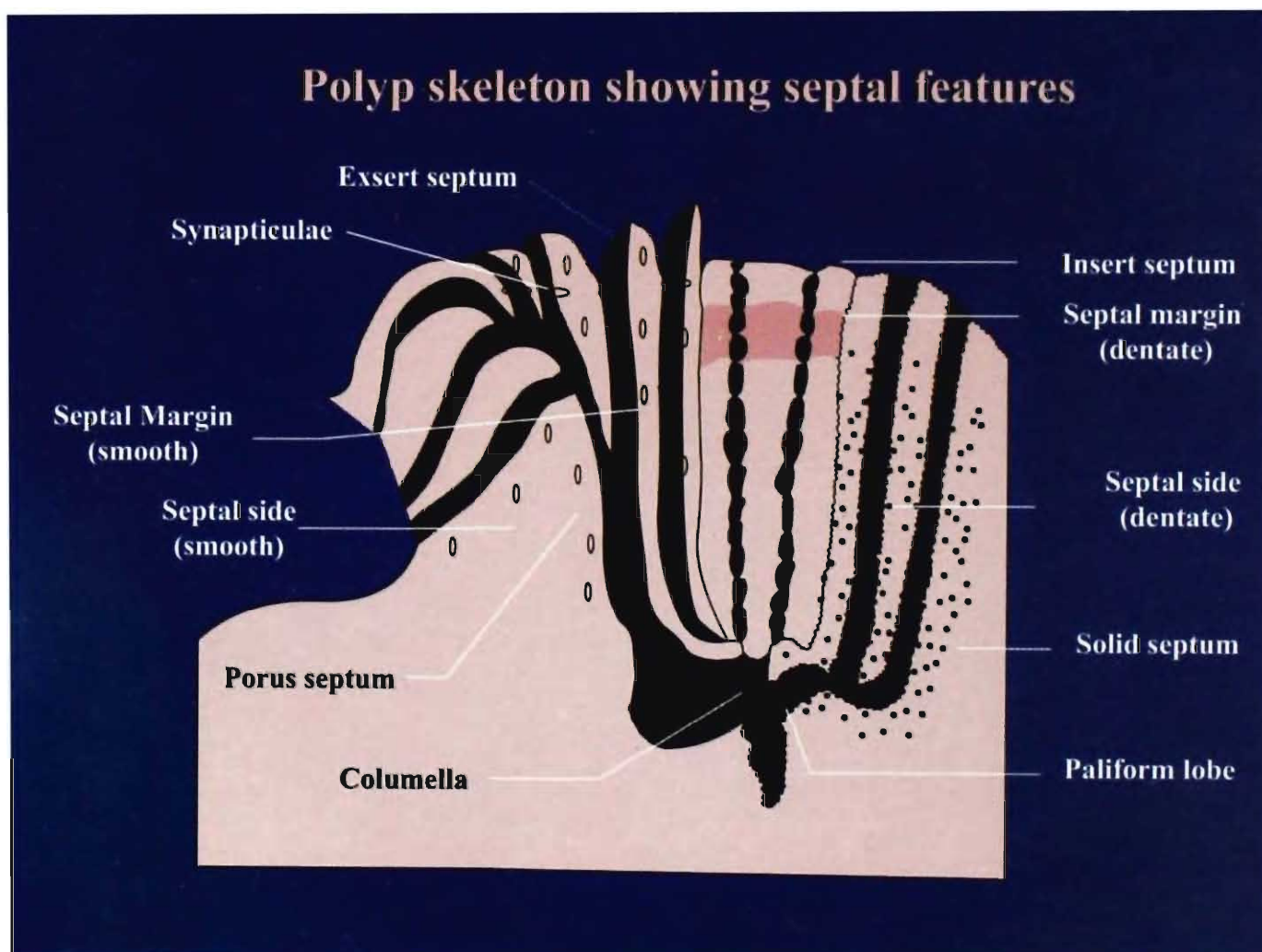
The general pattern of septation is not found in genus *Porites* and dendrophyllid corals. In the case of *Porites* there is an inclination for fusion among three septa (two lateral septa with one ventral directive). This pattern of fusion is called as *triplet*. There are three kinds of triplet formation which play a major role in differentiating porites species.



In the case of Dendrophyllid corals the quaternary or the fourth cycle septa grows above and loop over the tertiary septa. This pattern of fusion of the two quaternary septa around the tertiary septa, which is characteristic of dendrophyllid corals, is called as *Pourtales plan*.

Septa categories

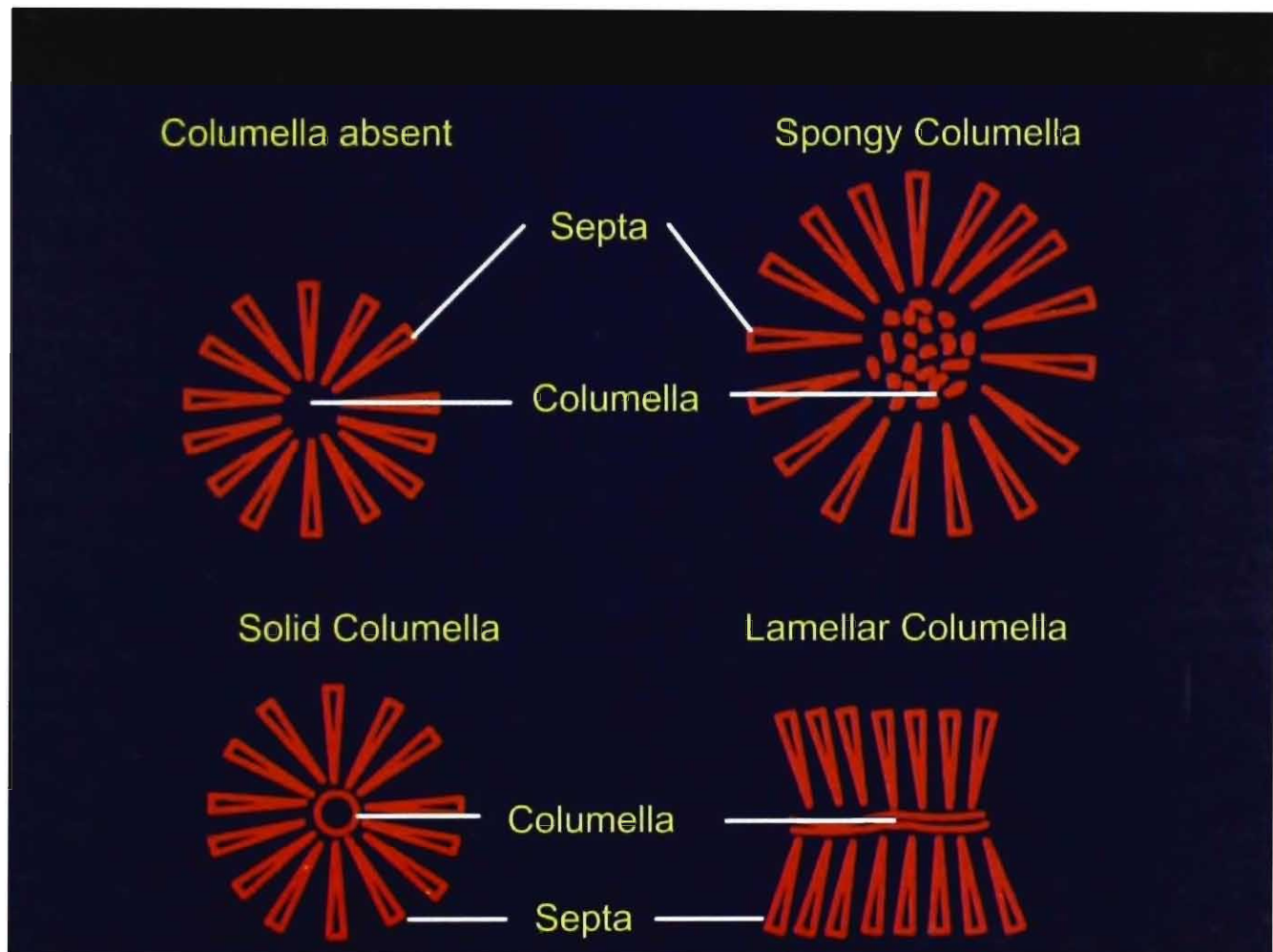
Septa are of many kinds. A septum may form a *solid* plate or a porous (*fenestrate*) plate. In some species it may be reduced to rows of *vertical spines* or *horizontal spines* or may be absent. When a septum is well above the corallite wall it is called as an *exsert septum* and termed as *insert septum* when it is otherwise. Septal margin may be *dentate* or *smooth* and septal side is also termed *smooth* or *dentate* depending on its roughness.



Columella categorisation

Columella, the axial structure which is situated below the stomadaeum of the polyp may be broadly classified into the following categories based on its built:

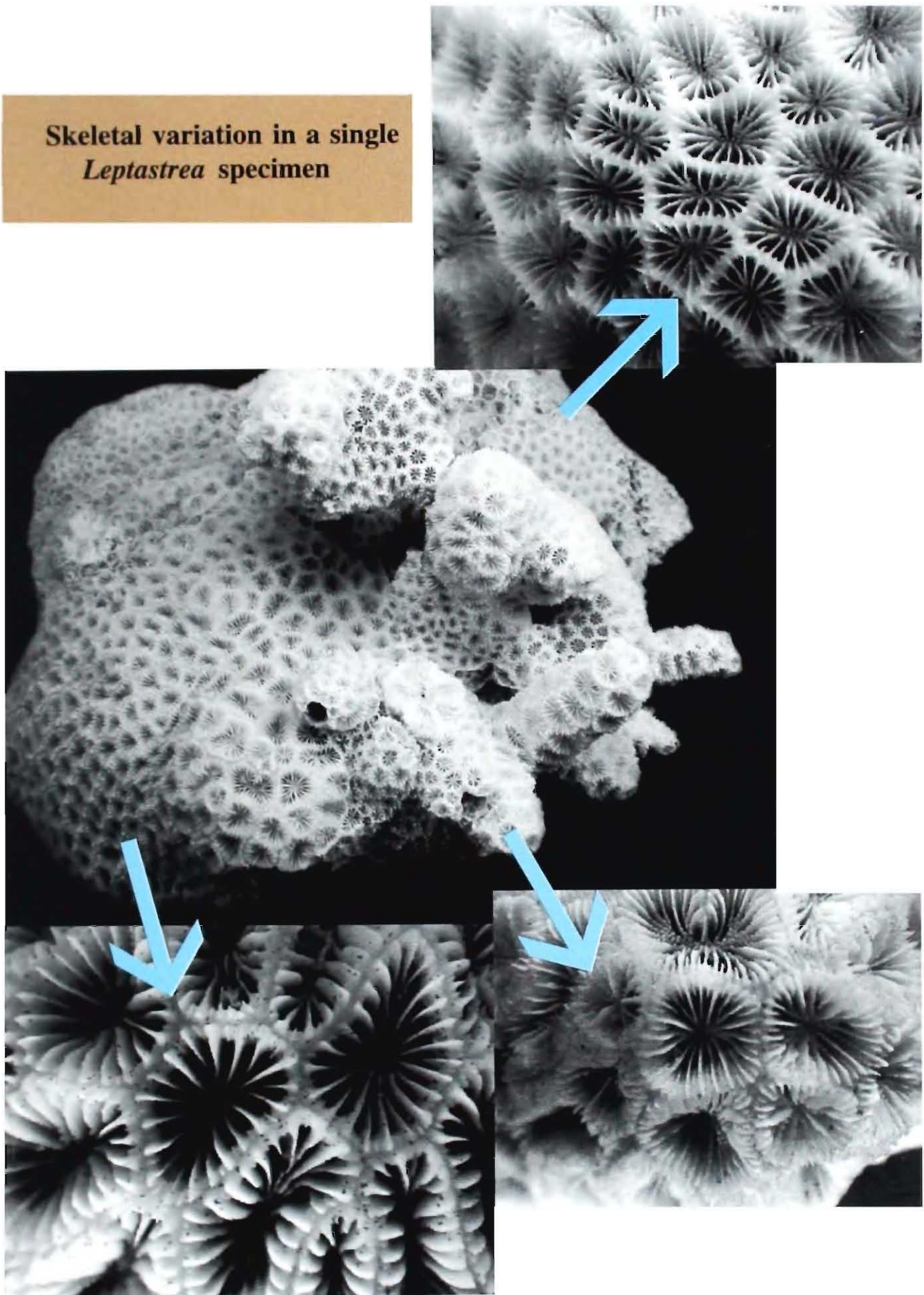
A *spongy* or trabecular columella is formed by the intermingling irregularly twisted expansions from the inner septal margins and basal plate. If the expansions from the septa are vertical rods or ribbons, then it is called a *papillose* columella. When the papillose structures fuse to form a single rod it is called as *solid* or styliform columella. Lamellar columella is a plate like columella, usually arranged in a longitudinal series along the axis of elongated calices. It is recorded as *absent* when there are no projections at the corallite's base.



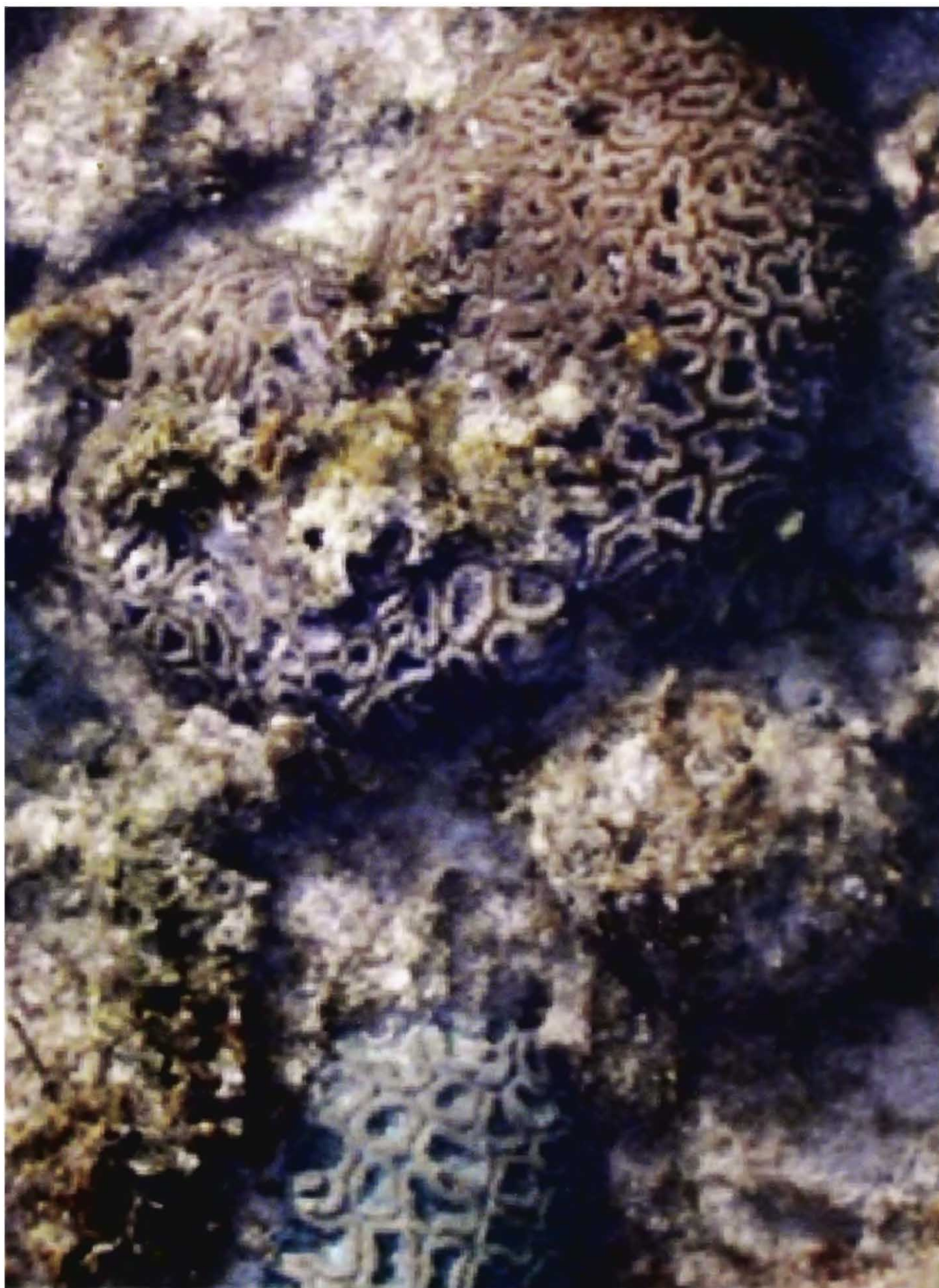
Skeletal and colour variation in *Pocillopora damicornis* due to their occurrence in different habitats and depths



**Skeletal variation in a single
Leptastrea specimen**



Polymorphism – Colour variation in *Favia fava*

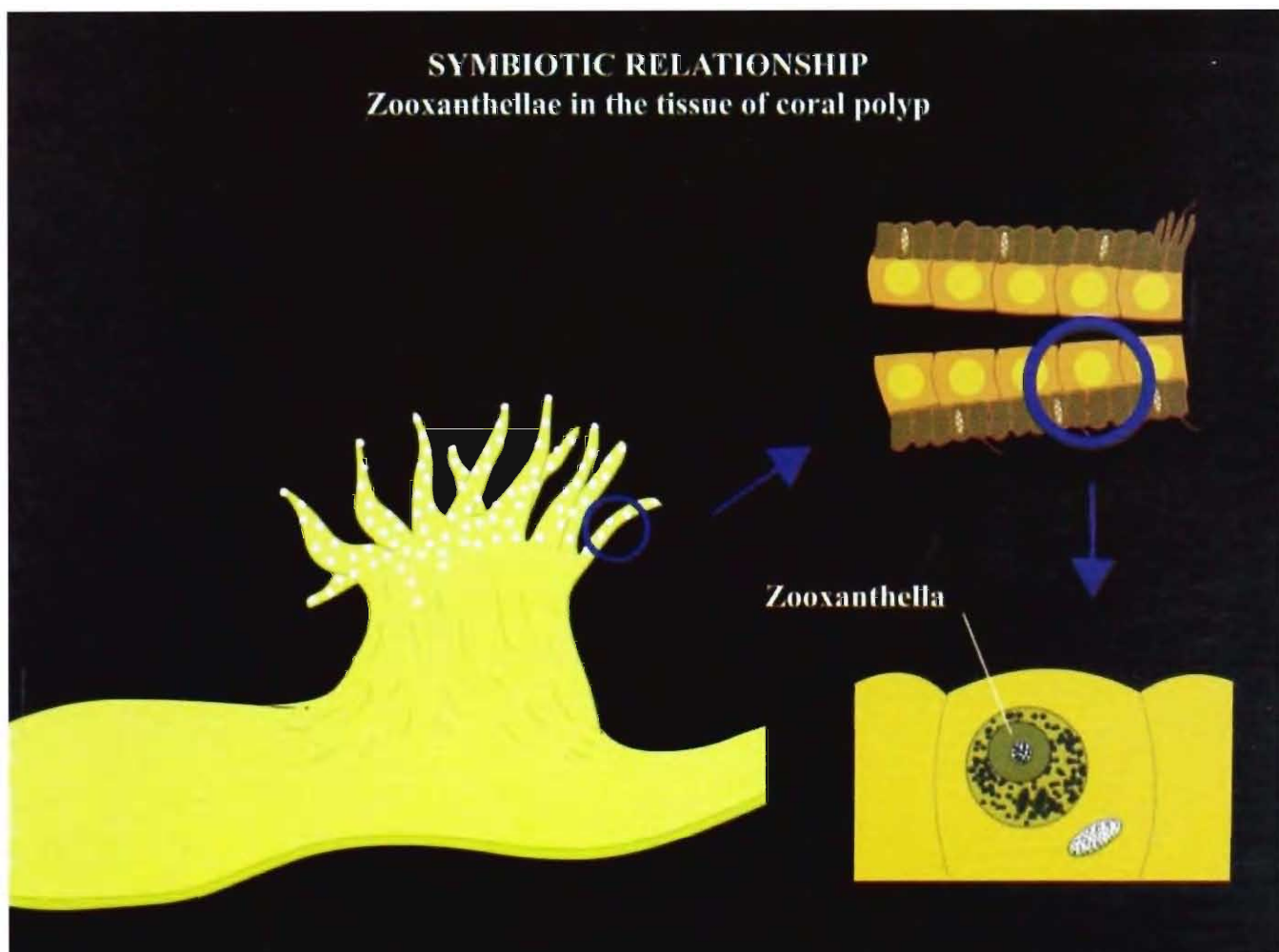


SYMBIOTIC RELATIONSHIP

This is an interesting story about the pact between two primitive groups (corals and zooxanthellae), that has great significance in the history of evolution.

Because of their benthic nature, corals can catch only few micro organisms with their tentacles and depend on unicellular flagellated yellow-brown planktonic algae called *zooxanthellae* for more and sustaining food complement. As a result, Zooxanthellae are given placement in the gastroderm (a layer of endodermal cells bordering the gastro-vascular cavity) of corals, from there, Zooxanthellae trap sunlight and produce food for themselves as well as corals. It is estimated that 80% of the food produced is complemented to corals. In return, zooxanthellae get security and the nitrogenous waste products of corals as nutrients for their growth. Zooxanthellae also help in the enhancement of skeletal material secretion leading to reef growth. Zooxanthellae belong to the genus *Symbiodinium* under dinoflagellate group. In addition to the nutrition and calcification of the hosts, zooxanthellae believed to help in the defense of the hosts also by secreting protective chemical substances.

Corals get their body colour also because of the brilliant colours zooxanthellae possess. Unfortunately, because of raising temperature due to Global warming, this unique bond between zooxanthellae and their hosts is broken and zooxanthellae are expelled out of the



coral tissue. This phenomenon is termed as “bleaching” because of the resultant pale colour of the corals. Bleaching is a major threat for coral survival all over the world. Even the highly managed Great Barrier Reef has lost much of its coral reef area due to bleaching. It is estimated that 27% of the world’s coral reefs had died from bleaching by late 2000, and 60% may disappear by 2030, and, most of the world’s coral reefs may vanish by 2100. This will also affect many species, since coral reefs harbour about one-quarter of the marine life.

Disappearance of Coral reefs would mean a major setback for the environment and for human beings not only because of the diversity they harbour but also because of the goods and services they offer.

REPRODUCTION AND SPECTACULAR SPAWNING EVENT

Stony corals are hermaphroditic or unisexual. They reproduce sexually and asexually. In sexual reproduction, *planula* a free swimming larva is produced, it settles on hard substratum under favourable conditions and grows into a colony through asexual reproduction called *budding*.

Coral spawning is a spectacular sight to watch since, almost all the corals release their eggs and sperms in bundles into the water at the same time in a grand and spectacular manner. This phenomenon was discovered only few decades back. Another interesting fact is that the eggs and sperms released by the same colony won’t mate with each other even though they are released as packed bundles.

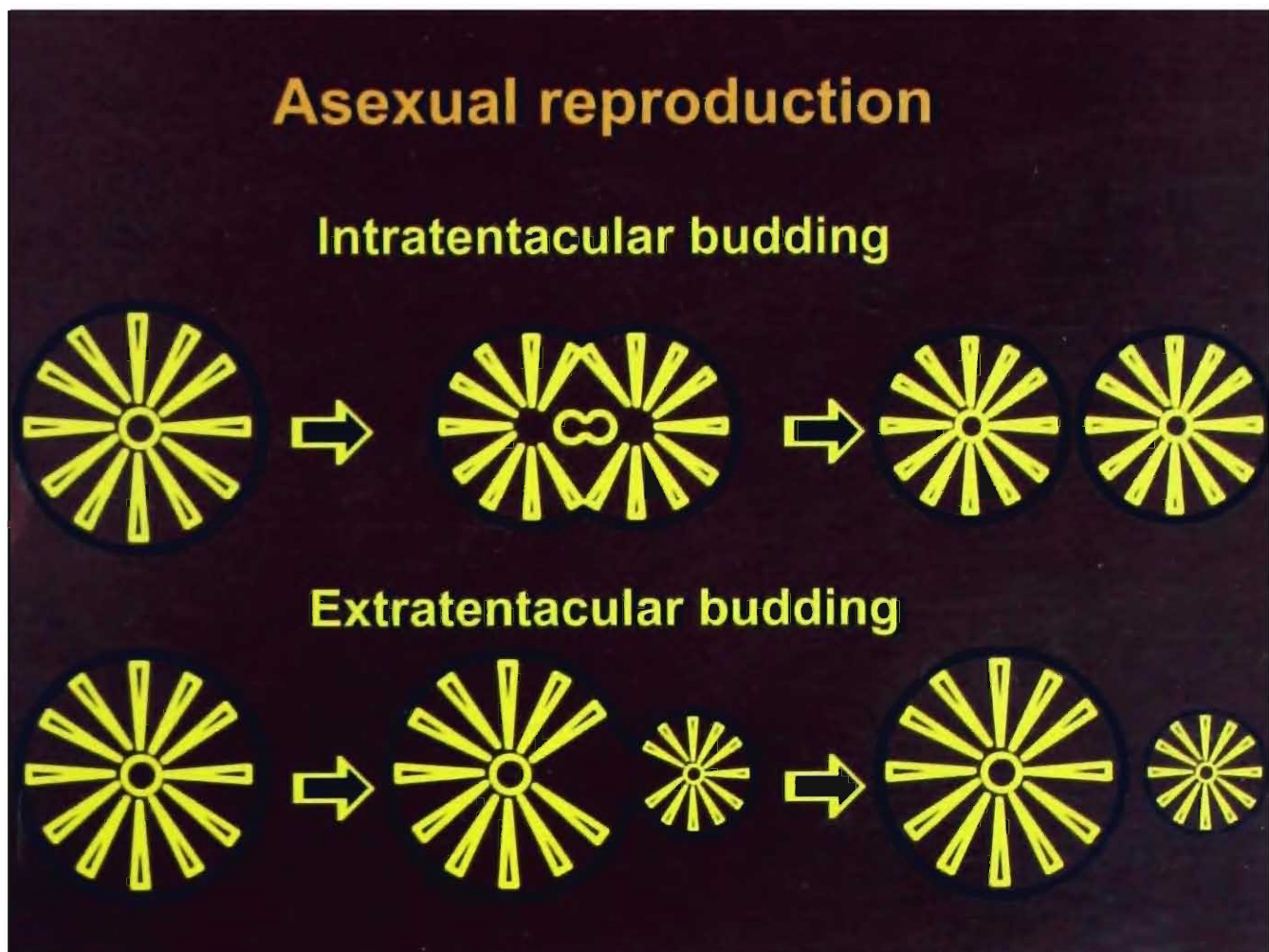


Asexual reproduction

In asexual reproduction, individual coral polyps divide into more number of young polyps through a process called budding. Colony formation in corals occurs through this asexual method. There are many types of budding.

1. **Intratentacular budding** (formation of new corallites inside the corallite wall). It is described as mono-, di-, tri- or polystomodeal budding depending on the formation of number of new corallites.
2. **Extratentacular budding** (formation of new corallites outside the wall, inside the coenosteum).

Budding can be called as *intramural budding*, when it is effected inside the walls of elongated rows of corallites. Budding can also be termed as *circumoral*, when the corallites are arranged in spirals around the first formed corallite and as *marginal* when the new corallites are formed along the growing edge. It is also called as *circummural* when the corallite wall is totally surrounded by new corallites. Type of budding is also used as a major character in coral identification.



DESTRUCTION TO CORAL REEFS

The most painful and alarming fact about coral reefs is that they are going to disappear from the world oceans in less than a century.

GCRMN reports edited by Dr. C. Wilkinson state that “11% of the coral reefs have already been damaged beyond recovery or totally destroyed. Another 16% were wrecked in 1998 by climate change related coral bleaching. Without effective management, another 30% of the world reefs will become seriously depleted in the next 20 to 40 years – which is very short time in human history” (Satyanarayana, 2005).

The major stresses to coral reefs around the world are : 1. Sediment; 2. Inorganic and Organic pollution and 3. Over fishing, all directly created by humans. Another major threat to coral reefs is Bleaching due to Global warming and this is also an indirect pressure created due to human activity.

Other anthropogenic impacts on coral reefs which are site specific in nature are :

1. Oil pollution,
2. Heavy metals and pesticides,
3. Engineering activities,
4. Destructive fishing,
5. Coral mining,
6. Physical damage from boat anchors and
7. Uncontrolled tourism.

In a nut shell : Undoubtedly much reef damage has been caused by human impacts. The well known saying among reef conservationists is that the corals will survive on their own if they were not disturbed by human activities. The best strategy for reef conservation is to keep the humans away from coral reef areas.

Another unchallenged fact is that : Coral reefs are facing extinction primarily due to human interference because of the goods and services they are providing to us. When coral reefs are providing us nice places for recreation, in the name of tourism we are throwing anchors and waste on to the reefs, stampeding on corals, killing and taking away some of the animals for decorative purposes. We are over exploiting them with greed for the fishery yield they are providing us. Many destructive fishing methods like Trawl nets, Cyanide fishing, Blast fishing etc., were used to fish in reef areas. Some species disappeared and many are commercially threatened because of these irresponsible, selfish acts.

Coral reefs on an average grow only at the rate of 1½ cm per year. In spite of this fact they are dynamited within few minutes because of their utility as building material. Many reefs were lost both in India and abroad due to this irresponsible barbarous activity.

Some reef associated species (e.g. Gorgonians) from our reefs have dwindled drastically in numbers due to their overexploitation, to use them in the drug industry. There is no end to this list, it goes on and on.

In addition to the already mentioned human interferences, off late, coral reefs are subjected to stress due to natural threats like predators, cyclones, Tsunami etc .

It is believed that Natural disasters are mostly reversible, temporary and cause less damage to the reefs when compared to man made damages, which are persistent and cause irreparable damage to coral reefs. Unfortunately, now this belief is also proving to be wrong. There is a multifold increase in the frequency of natural calamities in the recent past. Andaman reefs which were graded by the scientists as the best in the whole of Indian Ocean were jolted by the big wave, Tsunami in 2004.

A beautiful starfish commonly called as Crown-of-Thorns Starfish (*Acanthaster planci*) is a voracious predator of corals in the Indo-pacific region. Sometimes it occurs in bloom proportions and devastate coral reefs. Coral diseases are also getting multiplied due to weakening of coral strength due to various impects.



Acanthaster planci (Crown-of-thorns star fish) feeding on *Acropora* (staghorn) coral

The most recent and deadly among threats is Coral Bleaching. This phenomenon takes place due to the expulsion of zooxanthellate algae from the coral tissues due to the creation of unfavourable conditions like increase in the temperature in the surrounding medium. Corals appear white like bleached material after losing their food providing partners and die slowly if the unfavourable situation continues. Many reefs in the world including the well-managed Great Barrier Reef are affected due to 1998 bleaching event. A recent scientific report depicts irreparable damage to almost all the reefs in the world in another 40 years due to bleaching.

TAXONOMIC ACCOUNT

Altogether 49 species (45 zooxanthellates and 4 azooxanthellates) are described. 12 species are described for the first time from this region. *Barabattoia amicorum* is a generic record to India while *Favia lacuna*, *Favites flexuosa* and *Turbinaria frondens* are the three species records to India. *Coscinaraea columna*, *Goniopora tenuidens*, *Favites halicora*, *Favites pentagona*, *Echinophyllia aspera*, *Turbinaria mesenterina* are new records to Kachchh region. One more species of *Acropora* (*Acropora microphthalma*) once prevailed was added in addition to already reported two species of *Acropora* described by Dr. Gopinatha Pillai from the dead specimens. A species of Cauliflower corals, *Pocillopora damicornis* which is present in all the reef regions of India is also reported from this region for the first time with the help of a dead specimen collected. The taxonomic status of few species recorded earlier is also updated.

UPDATED CHECKLIST OF HARD CORALS OF KACHCHH

Phylum CNIDARIA

Class ANTHOZOA

Subclass HEXACORALLIA

Order SCLERACTINIA

Family POCILLOPORIDAE

Pocillopora damicornis (Linnaeus, 1758)

Family ACROPORIDAE

Montipora explanata Brueggeman, 1879

Montipora foliosa (Pallas, 1766)

Montipora monasteriata (Forsk., 1775)

Montipora turgescens Bernard, 1897

Montipora venosa (Ehrenberg, 1834)

Montipora hispida (Dana, 1846)

Acropora humilis (Dana, 1846)

Acropora squarrosa (Ehrenberg, 1834)

Acropora microphthalma (Verrill, 1869)

Family SIDERASTREIDAE

Pseudosiderastrea tayami Yabe & Sugiyama, 1933

Siderastrea savignyana (Milne Edwards and Haime, 1850)

Psammocora digitata Milne Edwards & Haime, 1851

Coscinaraea columna (Dana, 1846)

Coscinaraea monile (Forskal, 1775)

Family PECTINIDAE

Echinophyllia aspera (Ellis and Solander, 1788)

Mycedium elephantotus (Pallas, 1766)

Family MUSSIDAE

Acanthastrea hillae Wells, 1955

Symphyllia radians (Milne Edwards and Haime, 1849)

Family MERULINIDAE

Hydnophora exesa (Pallas, 1766)

Family FAVIIDAE

Favia speciosa (Dana, 1846)

Favia lacuna Veron, Turak, DeVantier, 2000

Favia favius (Forskal, 1775)

Barabattoia amicorum (Milne Edwards and Haime, 1850)

Favites pentagona (Esper, 1794)

Favites chinensis (Verill 1806)

Favites halicora (Ehrenberg, 1834)

Favites complanata (Ehrenberg, 1834)

Favites flexuosa (Dana, 1846)

Goniastrea pectinata (Ehrenberg, 1834)

Platygyra pini Chevalier, 1975

Plesiastrea versipora (Lamarck, 1816)

Leptastrea purpurea (Dana, 1846)

Cyphastrea serailia (Forskal, 1775)

Family CARYOPHYLLIDAE

Paracyathus stokesi (Milne Edwards and Haime, 1848)

Polycyathus verrilli Duncan, 1889

Family PORITIDAE

Porites lutea (Milne Edwards and Haime, 1851)

Porites lichen Dana, 1846

Porites compressa Dana, 1846

Goniopora minor Crossland

Goniopora tenuidens (Quelch, 1886)

Goniopora planulata (Ehrenberg, 1834)

Goniopora stutchburyi Wells, 1955

Family DENDROPHYLLIDAE

Tubastrea aurea (Quoy and Gaimard, 1833)

Dendrophyllia minuscula Bourne, 1905

Turbinaria peltata (Esper, 1797) and

Turbinaria reniformis Bernard 1896

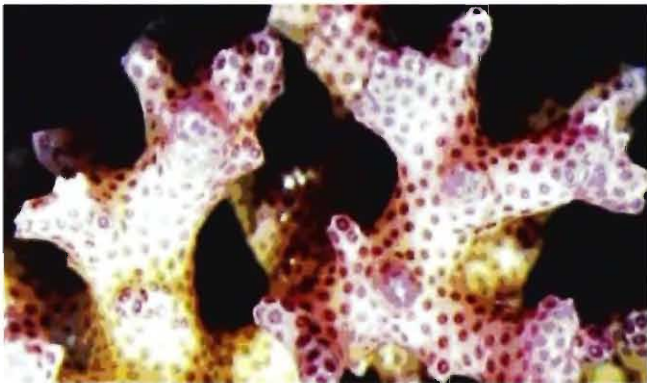
Turbinaria mesenterina (Lamarck. 1816)

Turbinaria frondens (Dana, 1846)

DESCRIPTION OF HARD CORALS OF GULF OF KACHCHH

Pocillopora damicornis (Linnaeus, 1758)
Cauliflower coral

The surveys conducted so far yielded only dead specimens. The identification is made only from the dead specimens collected. The live specimen photograph given below is from some other reef region and provided for easy understanding.



Taxonomic Position	
Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	POCILLOPORIDAE



Key Characters : Branching colony with verrucae intergrading with branches.

General Description : Colonies are compact clumps. Lacks true verrucae. Verrucae and branches intergrade. Colonies are pale brown, greenish or pink in colour in live condition.

Description : Branches may be fine and widely separated (in calm environments) to very compact (on upper reef slopes). Branches comprised of cerioid corallites and are highly compact and sturdy in habitats exposed to strong wave action and are thin and open in deep or protected habitats. Calices round at the base of the branches and polygonal at the top, about 1 mm in diameter.

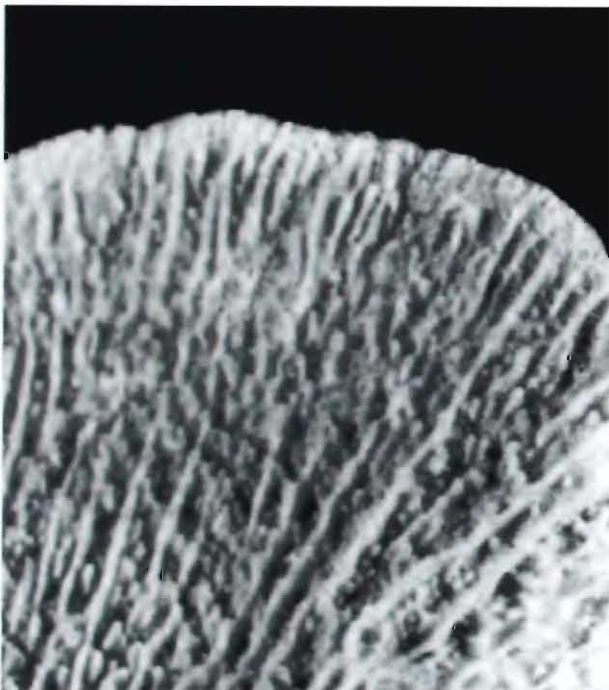
Habitat : Found in wide range of Habitats in reef areas.

Distribution : It is one of the most widely distributed species. In India it is recorded from Lakshadweep, South-east coast and Andaman and Nicobar Islands. Only dead forms are found in Gulf of Kachchh. Worldwide, it is occurring throughout Indo-pacific from Arabian gulf, Red Sea, Madagascar in the Indian Ocean upto Austral islands in the Pacific Ocean.



Montipora foliosa* (Pallas, 1766)*Velvet Coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Foliaceous growth form with ridges on the periphery formed by fused tubercles.

General Description : Colonies are foliaceous with broad laminar margins sometimes forming tiers or whorls. Fronds 3 to 5 mm thick. Colour usually cream brown or pink.

Technical Description : The development of tuberculae varies greatly forming ridges which are conspicuous and usually lie perpendicular to the corallum margin. Corallites may be immersed or exert with the upper wall parathecate and the lower (submerged) wall absent or partly septothecate. Corallites are arranged in rows between reticulum edges. Calices <1 mm in diameter. Coenosteum medium in size, coarse and spongy except for that of papillae, which is fine and has spinules with elaborated tips.

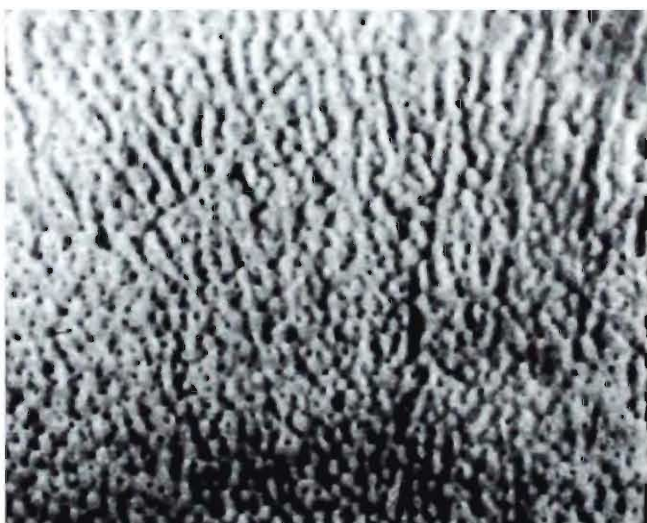
Habitat : Very common, on reef flat region.

Distribution : In India it is fairly common in Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide, widely distributed in the tropical Indo-Pacific from the Red Sea east to the New Hebrides and Fiji.



Montipora monasteriata* (Forskal, 1775)*Velvet Coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Reticulum is coarse and is uniformly covered with papillae and tuberculae. All papillae and tuberculae are composed of fine reticulum with elaborated spines.

General Description : Colonies are encrusting. Living colonies usually pale brown or pink in colour.

Technical Description : Corallites mostly immersed and 0.7 mm in diameter and with prominent septa. Septa in two cycles.

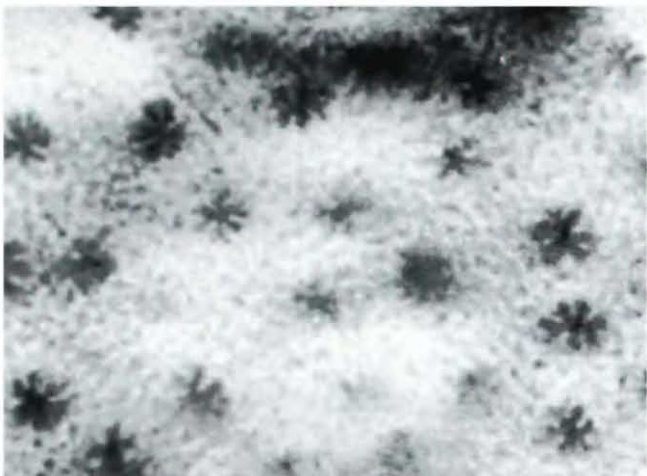
Habitat : Found in subtidal regions

Distribution : In India it is recorded from Gulf of Kachchh and South-east coast. Worldwide it is widely distributed from the Red Sea in the Indian ocean to Fiji islands in the Pacific Ocean.



Montipora turgescens* Bernard, 1897*Velvet Coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Small corallites on corallum with mounds. Rugose appearance of the coenosteum. Tapered septa.

General Description : Colonies Encrusting to Submassive with the surface raised into subcircular mounds. Living corals usually brown, cream or purple in colour.

Technical Description : Corallites uniformly distributed on and between mounds and immersed with calices less than 1 mm in diameter. Reticulum uniform in structure, spongy with an outer covering of highly elaborated spinules. Septa are tapered and with two cycles with second cycle sometimes incomplete.

Habitat : Not so common in Gulf of Kachchh. Found in water immersed reef flat regions.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Globally, it is widely distributed

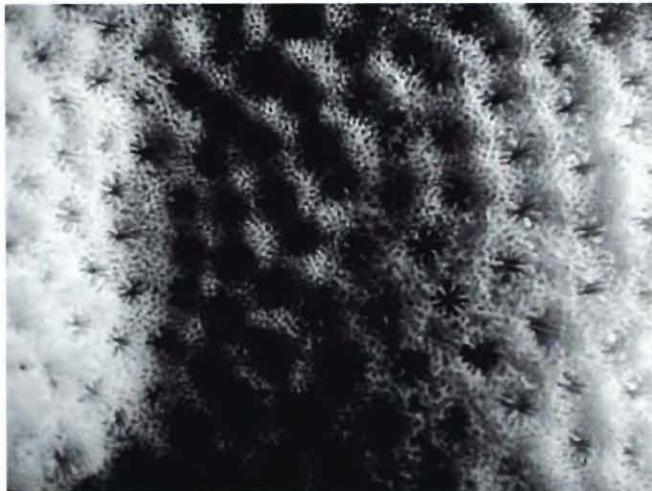
from the Red Sea, Madagascar in the Indian Ocean to Kyushu, Marshal, Midway, Tubuai and Lord Howe islands in the Pacific Ocean.



Montipora venosa (Ehrenberg, 1834)
Velvet Coral



Taxonomic Position	
Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Calices distinctive deep and open.

General Description : Colonies are massive, sub-massive or explanate. Living colonies are pale brown in colour.

Technical Description : Tuberculae and Papillae are absent. Calices distinctive deep and open. Thecal wall distinctive. Septa 12 in number. Corallites are foveolate and about 1 mm in diameter.



Habitat : Mostly common in all reef environments in India. In Kachchh it is found in subtidal regions and gets exposed during minus tides.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide it is widely distributed in the tropical Indo-Pacific from the Arabian Gulf, Red Sea, Madagascar in the Indian ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and Lord Howe Islands in the Pacific Ocean.

Montipora hispida* (Dana, 1846)*Velvet Coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Thick tubercles. Shaggy surface crowded with digitiform branches

General Description : Colonies encrusting with digitiform branches on the surface. Most of the branches found to possess a central worm tube. Colonies pale brown in colour.

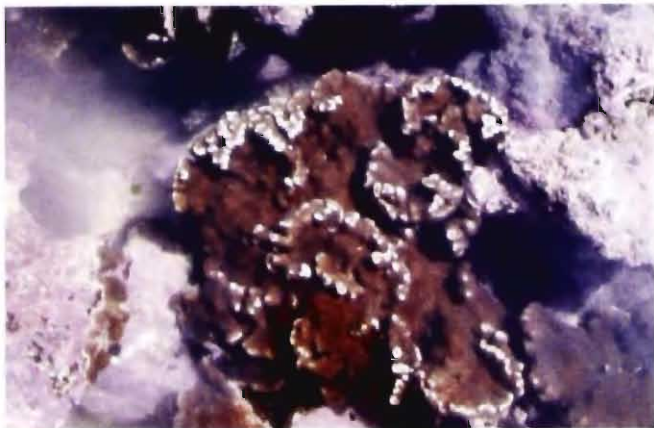
Technical Description : Corallites both immersed and exert. Calices conspicuous 0.7 to 0.8 mm in size, level or slightly projecting in appearance. Septa in two cycles, primary septa fused at centre of axial fossa. 6 to 8 tubercles around a calyx fuse to form ridges. Over the branches the tubercles from ridges, particularly in older branches. Reticulum coarse with shorter papillae.

Habitat : Commonly found in turbid reef flat regions.

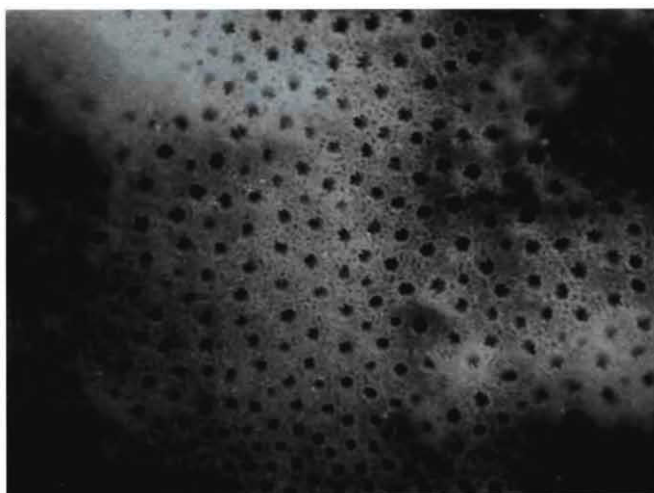
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. In the Indian ocean its distribution is scattered with reports from Aldabra



islands and worldwide wide spread from Maldives, Lakshadweep islands in the Indian ocean to Kyushu, Marshall, Phoenix, Midway, Tubuai, Tonga and Lord Howe islands in the Pacific ocean.

Montipora explanata* Brueggeman, 1879*Velvet Coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Coenosteum reticulate with small spines and sometimes with round topped tubercles. It is characterised by the presence of scattered low tubercles though it is essentially a glabrous form.

General Description : Colonies are encrusting and with small gibbosities on the surface

Technical Description : Calices less than 1 mm in diameter. Irregular in outline and crowded. Primary septa well developed. Second cycle usually not seen.

Habitat : Common on reef flats of Gulf of Kachchh.

Remarks : Even though rarely seen in other reef regions in India very commonly found in Gulf of Kachchh. It is believed to form a connecting link between glabrous and tuberculate species of *Montipora*. Pillai (1967) reported this species from Palk Bay, Mandapam and it was not included in Veron and Wallace (1984) and Veron (2000). The identity and the taxonomic status of the present species is still not clear.



Distribution : Its distribution is reported only from Indian Ocean. In India it is recorded from Gulf of Kachchh, Lakshadweep and South-east coast. Outside India it is reported only from Maldives. The scanty reporting of this species may be due to the uncertainty of the taxonomic status of this species.

Acropora humilis* (Dana, 1846)*Staghorn coral**

The surveys conducted so far yielded only dead specimens. The identification is made only from the pieces of dead specimens with eroded characters, which were not worth photographing. The live photograph given below is taken from some other reef region and provided for better understanding.

**Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE

Key Characters : Sturdy, digitate to corymbose colonies with large obvious axial corallites and mostly evenly sized radial corallites are the distinguishable features in the field.

General Description : A sturdy corymbose or digitate species with thick tapering branches, large and obvious axial corallites and thick-walled radial corallites. This species may be cream, brown or blue, purple, yellow-green or blue with cream tips when alive.

Technical Description : Axial corallites are up to 2 mm exsert 3.0–8.0 mm in diameter with calices 1.2–1.6 mm in diameter. Radial corallites are usually of two sizes and in rows, evenly distributed, short tubular with dimidiate openings and thickened walls.

Remarks: The shape of radial corallites in this species is tubular, and the calice opening may also vary. Of all living *Acropora* species, *A. humilis* has the oldest fossil record (at least 25 million years).

This may be the reason it occurs throughout the Indo-Pacific and has many variations in form.

Habitat : Exposed and probably elevated reef flats of Gulf of Kachchh.

Distribution : This is the only species in genus *Acropora* found in all the four major coral reef areas in India. Globally, it is distributed throughout the tropical Indo-Pacific from the Red Sea to Durban in the Indian ocean to the Marshall Islands, Hawaii, Tamotu Archipelago and Lord Howe islands in the Pacific ocean.



***Acropora squarrosa* (Ehrenberg, 1834)**
Staghorn Coral

The surveys conducted so far yielded only dead specimens. The Technical description is made only from the pieces of dead specimens collected, which were not worth photographing.

Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE

Key Characters : Scattered corallites and exposed coenosteum.

General Description : Colonies corymbose. Branches tapering.

Technical Description : Axial corallites about 4mm in diameter with calices about 1 mm in diameter. Radial corallites immersed to appressed tubular with round openings. Coenosteum echinulate.



Habitat : Exposed and elevated reef flats of Gulf of Kachchh.

Distribution : Rare and restricted to Red Sea. Reported only from Gulf of Kachchh in India.

Acropora microphthalmalma* (Verrill, 1869)*Staghorn Coral**

The surveys conducted so far yielded only dead specimens. The Technical description is made only from the dead specimens collected.

**Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	ACROPORIDAE



Key Characters : Branching colony with bushy appearance with smooth branches. Slightly longer axial corallite with rosette forming tubular radial corallites.

General Description : Colony Branching with tapering multi branches. Colour grey, cream to white in live specimens. Sometimes blue.

Technical Description : Axial corallite slightly long. Incomplete secondary septa. Tubular radial corallites with round to oblique openings.

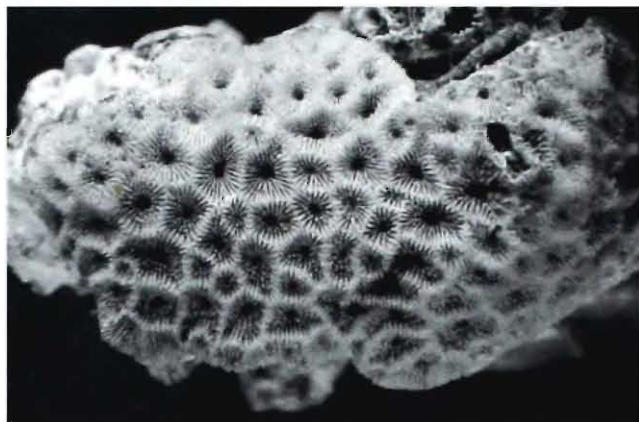
Habitat : Turbid shallow environments.

Distribution : Dead acropora forms were seen on many islands of Kachchh. In India it is recorded from South-east coast. Very recently it is recorded from Lakshadweep islands. Worldwide it is distributed in the tropical and subtropical Indo-Pacific from Madagascar in the west, east to the Tubuai Islands and also to north upto Ryukyu Islands.



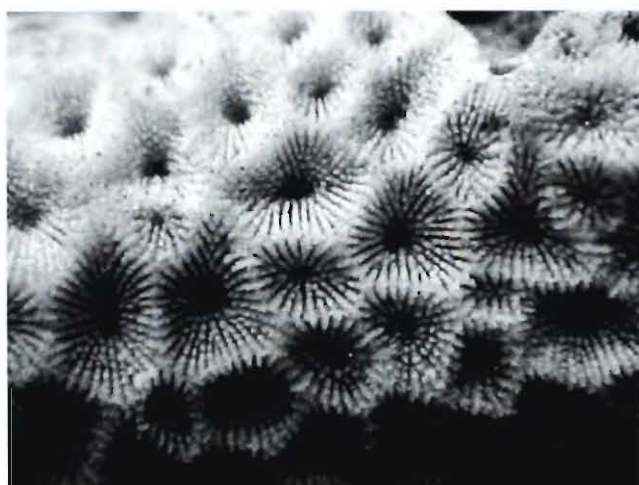
Pseudosiderastrea tayami Yabe and Sugiyama, 1935

White margined Starlet coral



Taxonomic Position

Phylum	CNIDARIA
CLASS	ANTHOZOA
SUBCLASS	HEXACORALLIA
ORDER	SCLERACTINIA
Family	SIDERASTREIDAE



Key Characters : Saw like septal teeth and well defined corallite walls which appear distinctly, mostly in white colour in living condition.

General Description : Colonies are encrusting to massive, dome-shaped. Pale grey with distinctive white corallite walls in colour.

Technical Description : Corallites are cerioid, polygonal, 4-6 mm in diameter. Septa are evenly spaced and fuse with each other in fan-like groups. They have fine, saw-like teeth. There are 8-12 dentations or granules on the septa. Total number of septa is around 35-48. Columellae is a solid mass or sometimes with more than 1 pinnule.

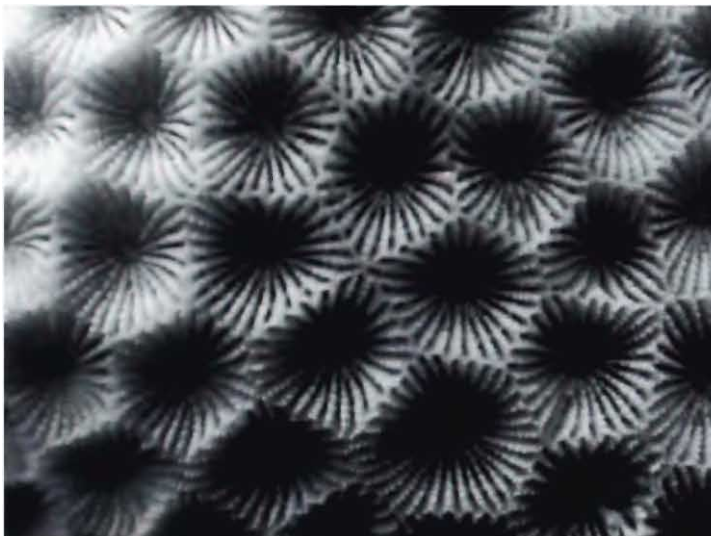
Habitat : Mostly found in shallow water, attached to bare rocks.

Distribution : It is reported from all three major reef areas in India except Lakshadweep Islands. It is reported from west coast of Kerala (Quilon). Globally, it is distributed from Arabian gulf, Red Sea, Madagascar in the Indian ocean to Kyushu, Marshall, Fiji islands in the Pacific ocean.



Siderastrea savignyana* Edwards and Haime, 1850*Starlet coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
FAMILY	SIDERASTREIDAE



Key Characters : Acute corallite walls with fan like septal arrangement. Two rows of synapticalae in the wall.

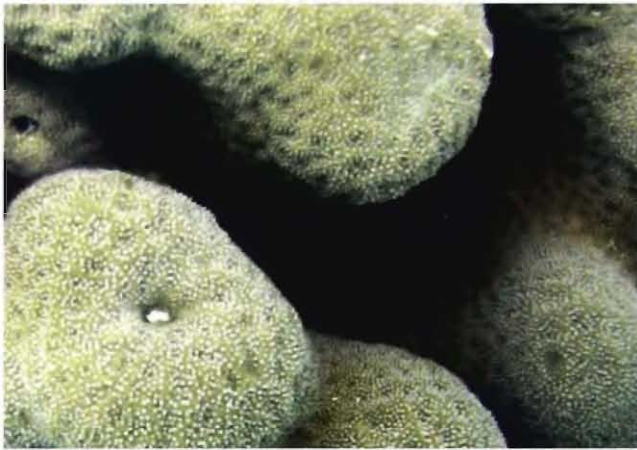
General Description : Colonies are encrusting or low mounds.

Technical Description : Corallites cerioid in arrangement and polygonal, 2-4mm diameter. Septa 24-32, neatly arranged. Fusing in neat fan-like groups. 12 or more than 12 septa reach columella. Walls have a fine ridge along the top. Style like Columella.

Habitat : Mostly found on shallow reef environments.

Distribution : In India it is recorded from Gulf of Kachchh and Southeast coast. Worldwide, it is distributed from Arabian gulf, Red Sea, Madagascar in the Indian Ocean to Marshal, Gilbert and Fiji islands in the Pacific Ocean.



Psammocora digitata* Milne Edwards and Haime, 1851*Petal coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	SIDERASTREIDAE



Key Characters : Small corallites on corallum with mounds. Rugged appearance of the coenosteum. Tapered petal like septa.

General Description : Encrusting, explanate to solid with vertical column form expansions. Colour range from purple to medium purple-grey or grey-brown.

Technical Description : Individual corallites or short series of them are irregularly arranged by low coenosteal ridges, giving corallum surfaces slightly rough in appearance. The petaloid septa form psammocoroid corallites of 2.5 mm in diameter with axial fossa 0.4 mm in diameter, and usually 2-3 mm apart. The columella consists of central style.

Habitat : Mostly found on all reef environments.

Distribution : In Kachchh it is rarely found. In India it has been recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. Globally, its distribution extended from Aldabra in the Indian ocean to Tubuai islands in the Pacific ocean.



Coscinaeraea columna* (Dana, 1846)*Sand paper coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	SIDERASTREIDAE



Key Characters : Corallites not aligned in valleys. Indistinct corallite walls and rugged appearance of the corallum surface. Confluent and bifurcating septa. Non alternating septo-costae.

General Description : Colonies are encrusting or massive.

Technical Description : Septo-costae are not heavily granulated. Pinnules present on top of corallite walls. Pinnulated columella set well below the septo-costae.

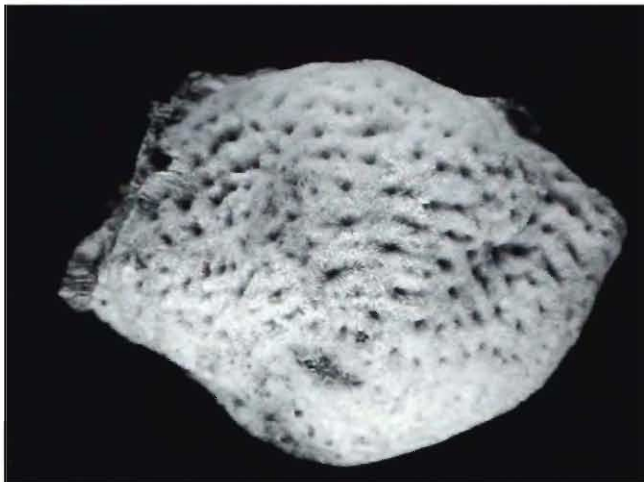
Habitat : Mostly found on shallow reef environments.

Distribution : In Kachchh it is reported for the first time, in addition to this, it is already reported from Southeast India and Andaman and Nicobar islands. Widely distributed from Arabian gulf, Red Sea and Madagascar in the Indian ocean to Kyushu, Ogasawara gunto, Marshall, Fiji and New Caladonia In the Pacific ocean.



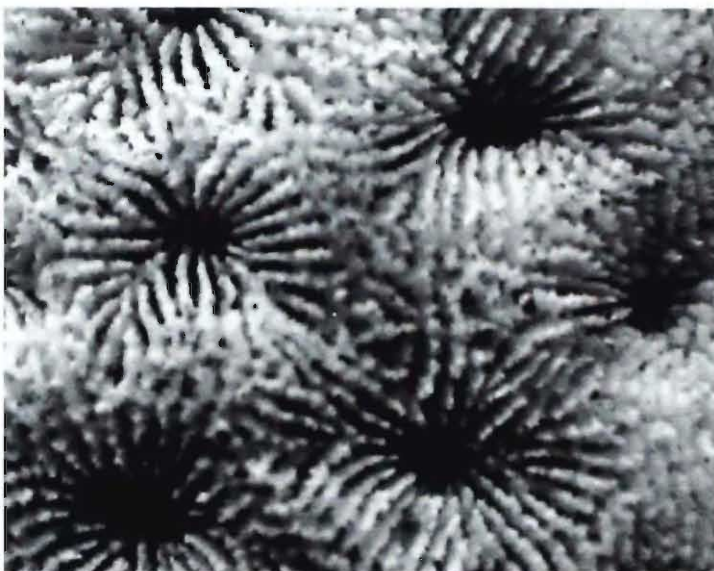
Coscinaraea monile (Forskal, 1775)

Sand paper coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	SIDERASTREIDAE



Key Characters : Indistinct corallite walls and rugged appearance of the corallum surface. Confluent and bifurcating septa.

General Description : Corallum encrusting or submassive, calices 6-8 mm in diameter, about 2 mm deep.

Technical Description : Intercorallite walls not distinct. Septa 34 to 45 per calyx. Septa confluent between centres, bi or tri furcating and about 8 to 12 reach columella. Septal edges with frosted teeth, sides granular. Axial fossa circular and about 1mm in diameter with a papilliform columella.

Habitat : Mostly found on shallow reef environments.

Distribution : In India it is recorded from Gulf of Kachchh and South-east coast. Its distribution is wide in the Indian ocean compared to Pacific ocean. It is distributed from Arabian gulf, Red Sea, Durban to Kyushu and Palau islands in the Pacific ocean.



Echinophyllia aspera* (Ellis and Solander, 1788)*Spiny leaf coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PECTINIDAE



Key Characters : Heavily granulated laminae, indistinct and straight corallites. Inconspicuous central corallite.

General Description : Colonies thick and heavy encrusting laminae. Colony periphery contorted. Toothed corallites.

Technical Description : Granulated Coenosteum with exsert corallites. Corallites 6 to 9 mm in diameter.

Habitat : Not so common in Gulf of Kachchh. Found in lower subtidal regions.

Distribution : In Kachchh waters it is recorded for the first time. In India it is reported from Lakshadweep and Andaman and Nicobar Islands also. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Durban and Madagascar in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and Lord Howe islands in the Pacific ocean.



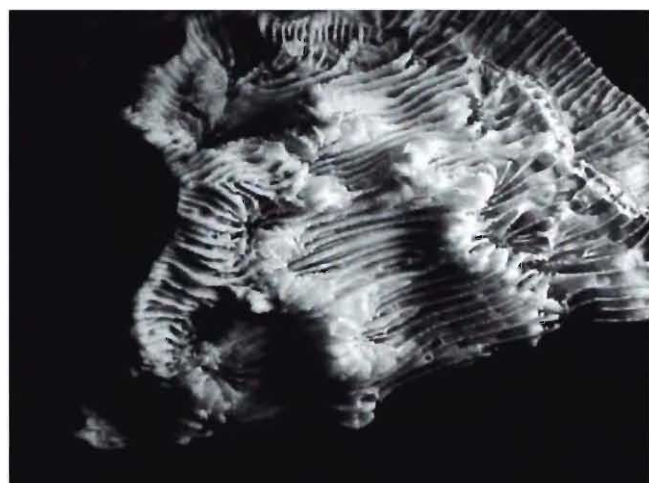
Mycedium elephantotus (Pallas, 1766)

Elephant nose coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PECTINIDAE



Key Characters : Nose shaped corallites, indistinct corallite wall. Absence of pits at the insertion of septo-costae. Costal ridges inconspicuous.

General Description : Colonies are laminar or foliaceous. Uniform brown, or green in colour.

Technical Description : Corallites uniformly distributed. Corallites are nose-shaped, facing outwards towards the corallum perimeter. Septa and columellae are well developed and costae form outwardly radiating ribs on the corallum surface which may become highly elaborated on corallite walls. The coenosteum is never pitted at the insertion of new septo-costae.

Habitat : Subtidal reef environments protected from strong wave action.

Distribution : In India it is reported in Gulf of Kachchh, Lakshadweep islands, South-east coast and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Red Sea and Madagascar



in the Indian Ocean to Kyushu, Marshal, Phoenix, Tahiti, Tonga and Lord Howe islands in the Pacific Ocean.

Acanthastrea hillae Wells, 1955

Spiny star coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	MUSSIDAE



Key Characters : Big subplocoid to cerioid corallites with prominent mussid like septal teeth. Teeth numerous and equal.

General Description : Colonies massive to encrusting with subplocoid to cerioid corallite arrangement and usually small in spread when compared to other mussids. Colonies have moderately fleshy tissue over the skeleton.

Technical Description : Corallites have irregular shapes and may form short valleys with several centers. Corallites distorted or polygonal in shape. 30 to 35 mm in diameter. Monostomadaeal. Septa spiny with prominent teeth, exsert and swollen at the wall.

Habitat : Mostly found on shallow reef environments.

Distribution : In India it is recorded from Gulf of Kachchh only. It is with a doubtful distribution in the Western Indian ocean and worldwide, it is distributed from Sumatra, Ryuku islands to Coral Sea.

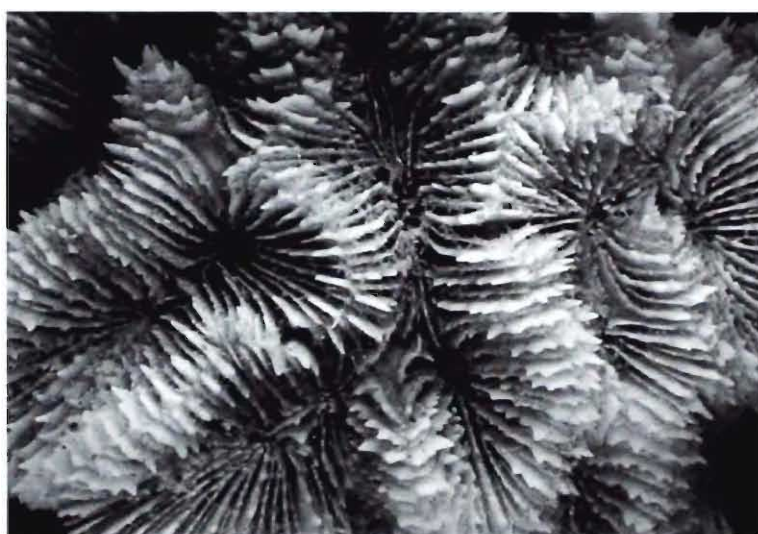


***Symphyllia radians* Milne Edwards & Haime, 1849**
Brain Coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	MUSSIDAE



Key Characters : Meandroid and massive growth form. Strong septal teeth. About 2 cm wide valleys.

General Description : Colonies meandroid and are massive to flat. Well spread out colonies found in the eulittoral zones. Living colonies may be very colourful, greenish to brownish in colour.

Technical Description : Valleys are fairly straight, especially if colonies have flat surfaces, otherwise irregularly sinuous. Valleys are in a radiating pattern. Valleys average 20-25 mm wide. Collines 2.5 to 3 mm in thickness. Prominent septa with 6 to 8 teeth. Columella trabecular, formed by the fusion of the septal ends.

Habitat : Subtidal reef regions

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. In the Indian ocean it is reported from Arabian Gulf, Oman and Red Sea region. Worldwide it is widely



distributed from Maldives, Lakshadweep in the Indian ocean to Kyushu, Marshal, Gilbert, Fiji and New Caledonia islands in the Pacific ocean.

Hydnophora exesa* (Pallas, 1766)*Mound coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	MERULINIDAE



Key Characters : Presence of lengthy monticules. Coarse coenosteum.

General Description : Colonies are submassive, encrusting or sub-arborescent. Living colonies are brown, cream or dull cream in colour. Green coloured colonies were also seen in Kachchh.

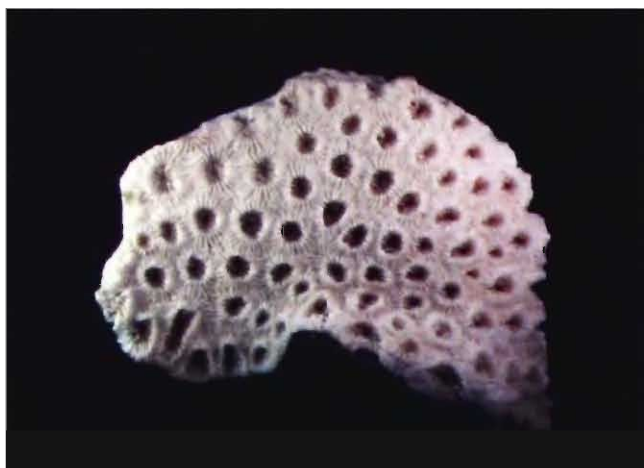
Technical Description : Monticules 5 to 14 mm long and about 5 mm in height. Mostly elongated cones in shape. Evenly distributed over the corallum, in some parts arranged in regular rows. In branching colonies, the monticule axis, which is normally perpendicular to the general surface of the corallum, tends to become increasingly inclined towards the tips of the branches. Columella trabecular.

Habitat : It is found in all reef environments, prefers protected slopes.

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands.



Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Durban and Madagascar in the Indian Ocean to Kyushu, Marshal, Phoenix, Samoa, Fiji and Lord Howe islands in the Pacific Ocean.

Favia speciosa* Dana, 1846*Moon coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Septa thin, numerous and regular. Peritheca costate and highly blistery, Corallum light in weight.

General Description : Colonies are massive but light in weight. Colonies are pale grey, green or brown in colour, usually with calices of contrasting colour.

Technical Description : Corallites are crowded together, circular or subcircular with calices upto 10-20 mm in diameter. Septa 25 to 40 and thin in composure. Paliform lobes are poorly developed. Peritheca costate and highly blistery.

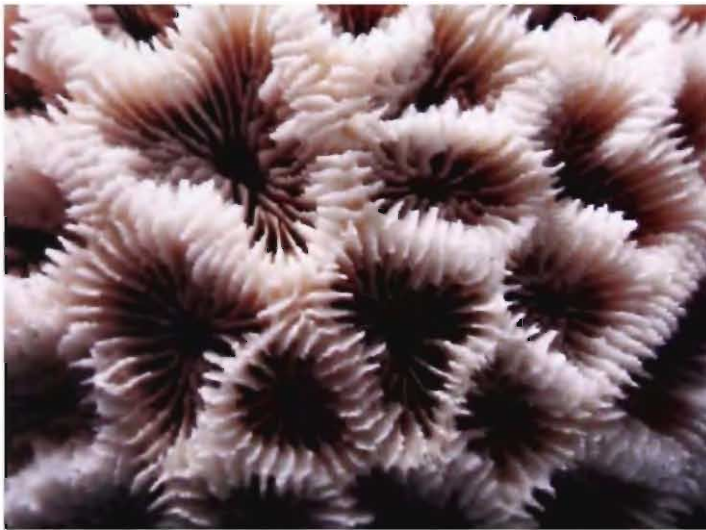
Habitat : Rare and found on shallow reef environments.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. In Kachchh its distribution is rare, restricted to few reefs. Worldwide it is widely reported, throughout Indo-Pacific from Arabian Gulf, Red Sea, Madagascar and Durban in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Pitcairn, Tonga and Lord Howe islands in the Pacific Ocean.



Favia lacuna* Veron, Turak, DeVantier, 2000*Moon coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Subplocoid corallites, crowded and irregular in shape, not conical, regular in height, subequal and thin costae. Costae not connected to adjacent corallites

General Description : Colonies massive or submassive. Brownish yellow with white centers.

Technical Description : Subplocoid corallites mostly irregular in shape. Septa thin, subequal and regular in height. Costae of adjacent corallites rarely meet. Indistinct paliform lobes. Columellae are small and compact.

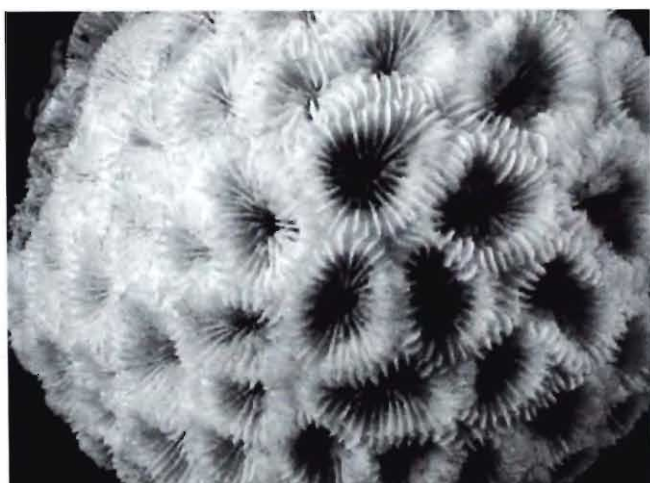
Habitat : Not so common. Shallow exposed reef environments.

Distribution : This species is elevated to species level recently and is reported from Red sea region. This is the first report to Indian region itself.



Favia fava* (Forskal, 1775)*Moon coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Corallites are conical in shape. Septa have an irregular appearance. Swollen at wall. Costae very prominent.

General Description : Colonies are massive, rounded or flat. Colonies are brown, dark green or grey in colour. This species displays wide variation in structure and even colour to a greater extent in Gulf of Kachchh.

Technical Description : Corallites conical in shape level or projecting to 2 mm. Calices 10-20 mm in diameter, circular, oval or distorted in shape. Septa exsert and vary from 45 to 75 depending on its size. Costae are prominent. Paliform lobes are poorly developed. Columella trabecular.

Habitat : Dominant in reef flat regions

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. It is the most dominant and common species recorded from all the reefs in Gulf of Kachchh. Worldwide, widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Madagascar and Durban in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and New Caledonia islands in the Pacific Ocean. It is distributed all around northern Australia and upto Houtman Abrolhos islands in the West Australian side.



Barabattoia amicum* (Milne Edwards and Haime, 1850)*Cylinder coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Tubular corallites. Predominant extratentacular budding. Small colonies with massive growth form.

General Description : Colonies are massive and small in size. Corallites plocoid to tubular. Budding mostly extratentacular. Usually brown, cream or green in colour.

Technical Description : Costae equal and well developed. Poorly developed paliform lobes. Columella small and compact.

Habitat : Rare and found on shallow reef environments away from wave action.

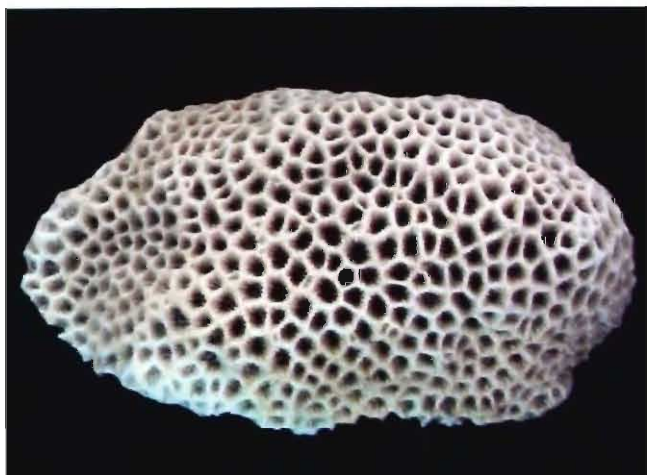
Distribution : This is the first record of this genus itself in India.

Elsewhere : It is distributed from Srilanka to central pacific.



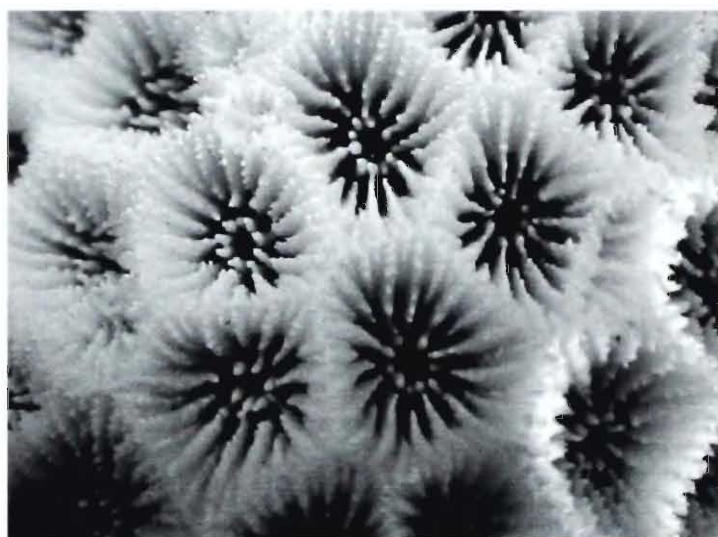
Favites pentagona (Esper, 1794)

Pineapple coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Medium sized polygonal corallites. Thick intercorallite wall and prominent paliform ring.

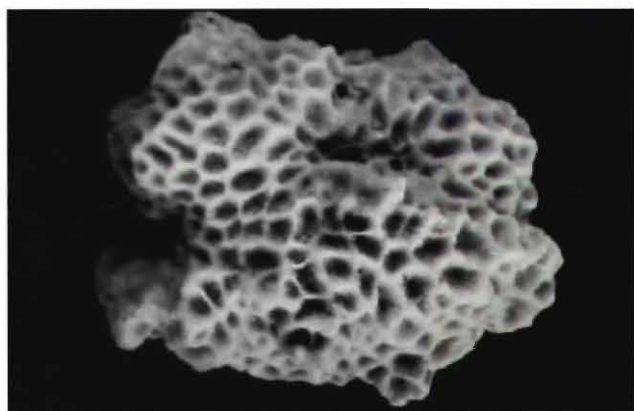
General Description : Encrusting corallum. Colour brown with green oral disc.

Technical Description : Corallites polygonal. Calices circular or round 4-6 mm in diameter. Intercorallite wall thick with a raised up ridge. Septa finely toothed. Columella visible with a prominent paliform ring.

Habitat : Shallow reef environments.

Distribution : It is recorded for the first time from Gulf of Kachchh region. Earlier it is reported from Gulf of Mannar and Lakshadweep islands and recently from Andamans. Worldwide, it is reported from Western Indian Ocean to Coral Sea and Ryuku islands in the China Sea.



Favites chinensis* (Verill, 1866)*Pineapple coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Penta or hexagonal corallites with prominent columella. Walls thinner at the summit than the base.

General Description : Colonies are encrusting and the surface rising to hillocks.

Technical Description : Corallites and calices are polygonal, penta or hexagonal, 5-7 mm long and 4-6 mm broad or 2-3 mm broad and 2-3 mm deep. Wall fused, thinner at the summit than at the base. Septa numerous alternating in size, slightly exsert, continuous over the wall. Lower part of the septa broader than the upper two-thirds. Septal edges dentate, sides granular. Columella is trabecular.

Habitat : Found in wide range of reef environments. Uncommon in Gulf of Kachchh.

Distribution : It is so far described as *Favites melicerum* in Gulf of Kachchh and Gulf of Mannar. In India it is recorded from Gulf of Kachchh, Lakshadweep, and South-east coast. Worldwide, it is distributed all through the Indian ocean except Mergui Archipelago region and upto Ryuku in the north and Fiji in Central Pacific Ocean.



Remarks : *F. melicerum* Eherenberg, 1834 described by Pillai (1986, 1988) was synonymised with *Favites chinensis* (Verrill, 1866) by Veron and Pichon (1977). Earlier to that *F. melicerum* was considered a synonym of *F. pentagona* by Matthai (1914) and a valid species by Vaughan (1918) and Wijsman-Best (1972). The same species (*F. melicerum*) has been again newly named as *Favites bestae* by Veron recently (2000).

Favites halicora* (Ehrenberg, 1834)*Pineapple coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Cerioid to subplocoid corallites, Hillocky colony surface.

General Description : Colonies are massive, either rounded or hillocky. Living colonies are usually uniform pale yellowish or greenish-brown in colour.

Technical Description : Corallites cerioid, have very thick walls and tend to become subplocoid. Polygonal in shape. Calices average 10 mm in diameter. Septa are about 30 in number and half of them reach columella. Dentate septal edges. Budding is both intra and extratentacular. Paliform lobes may be developed. Columella trabeculate.

Habitat : Mostly found on shallow reef environments.

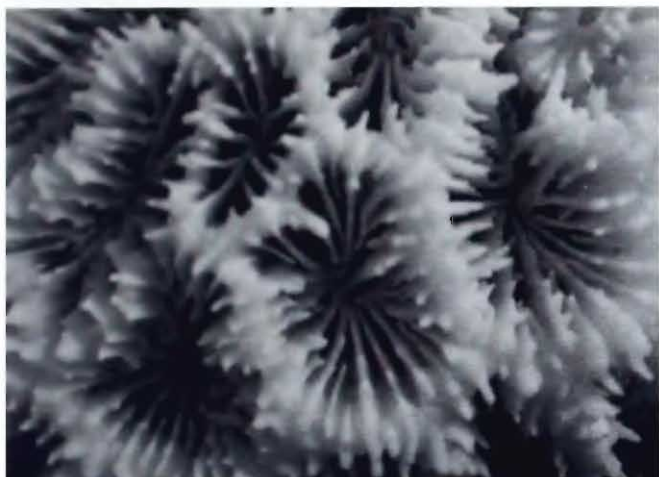
Distribution : It is being reported for the first time from Kachchh waters. In India it is reported from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide, it is widely distributed throughout the Indo-Pacific. Red Sea, from Duaban, Madagascar in the Indian ocean to Samoa in the Pacific ocean.



Remarks: Pillai has merged *F. halicora* with *F. complanata* because of the close resemblance he found among the specimens he collected from this region. They are presented separately in this book after the clear cut variation visible between these two species, after numerous comparisons made during the surveys.

Favites complanata* (Ehrenberg, 1834)*Pineapple coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Polygonal corallites with one side elevated. Septal teeth frosted giving spiny look to corallum. Exsert ends unite at the top of the wall.

General Description : Colonies are massive. Living colonies are with wide range of colours. Usually brown in colour, sometimes with green oral discs. Always found with barnacle infestation.

Technical Description : Calices are 10-20 mm long and 15 mm broad with strongly alternating septa and weakly developed paliform lobes. Frosty septal teeth give a spiny appearance to the corallum. Septa 35-50 in number. Usually with a large columella.

Habitat : Not very common, found in subtidal regions.

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, and Madagascar in the Indian Ocean to



Kyushu, Marshal, Phoenix, Tubuai, Tonga and Lord Howe islands in the Pacific Ocean.

Favites flexuosa* (Dana, 1846)*Pineapple coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Corallites spiny angular and deep. Septa with conspicuous teeth. Paliform lobes not so prominent.

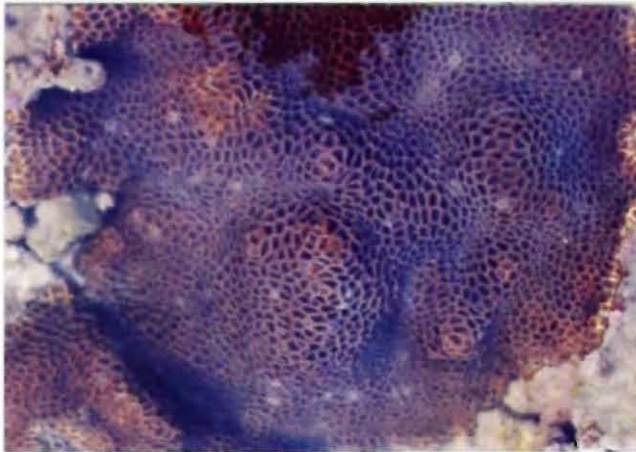
General Description : Hemispherical or flat corallum.

Technical Description : Corallites cerioid, spiny angular and deep. Septa prominent with large conspicuous teeth. Moderately exsert. Paliform lobes not so prominent. Small and compact columella.

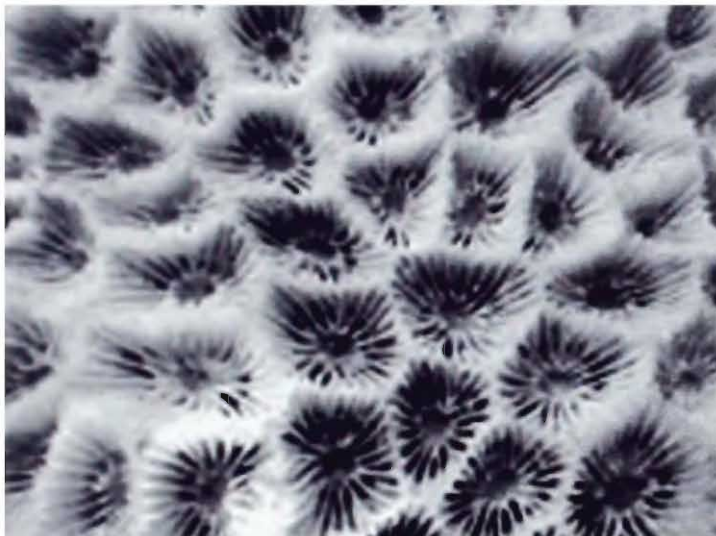
Habitat : hallow reef environments.

Distribution : It is reported for the first time in Kachchh. In India it is reported from Lakshadweep and Andaman and Nicobar islands also. Worldwide it is distributed throughout the Indo-Pacific. Durban, Madagascar in the Indian ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and Lord Howe islands in the Pacific Ocean.



Goniastrea pectinata* (Ehrenberg, 1834)*Pineapple star coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Well developed paliform lobes with thick corallite walls. Cerioid corallite arrangement.

General Description : Colonies are encrusting or massive. Living colonies are pale brown or pink, dark brown in deep or turbid water.

Technical Description : Corallites are cerioid rarely submeandroid. Prominent Septa are 25 to 30 in number with much smaller ones in between, slightly exsert. Walls are thick, paliform lobes are well developed. Columella trabecular.

Habitat : Mostly found on the shallow reef environments.

Distribution : In India it is reported from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Red Sea, Durban and Madagascar in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and Lord Howe islands in the Pacific ocean.



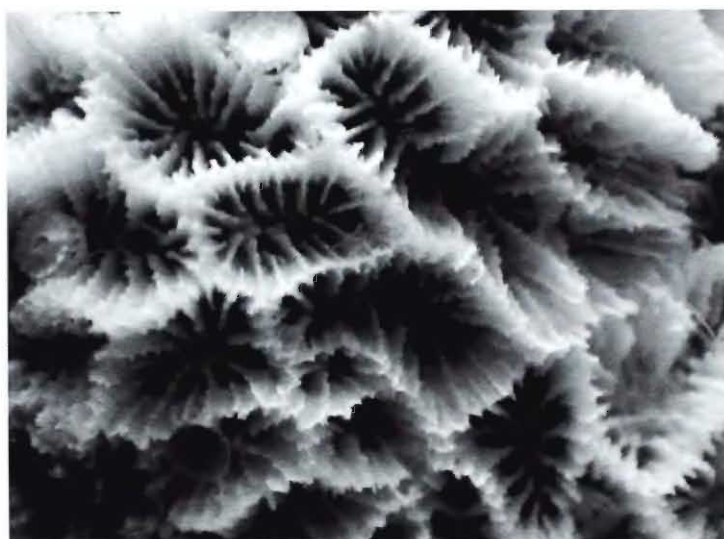
Platygyra pini Chevalier, 1975

Maze coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Monocentric corallites with a wavy and thick corallite wall. Weakly developed columella.

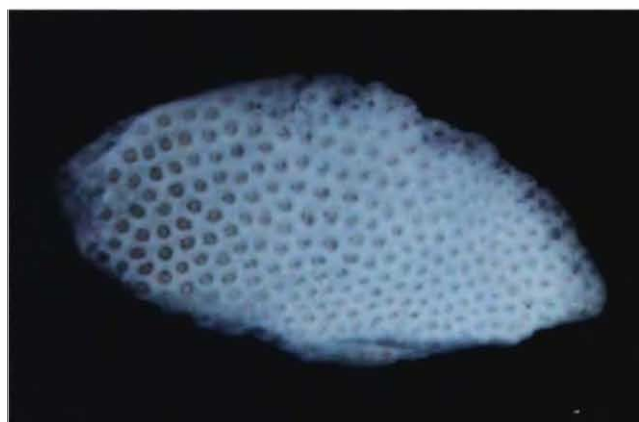
General Description : Colonies are mostly massive, sometimes encrusting. Corallites are mostly monocentric or at the maximum form very small valleys.

Technical Description : Corallites monocentric and meandroid with a wavy common wall between the corallites. Wall thick with rounded edges. Septa thin and evenly spaced. Some times there is some development of indistinct columella centres or paliform lobes. Columella trabecular and continuous.

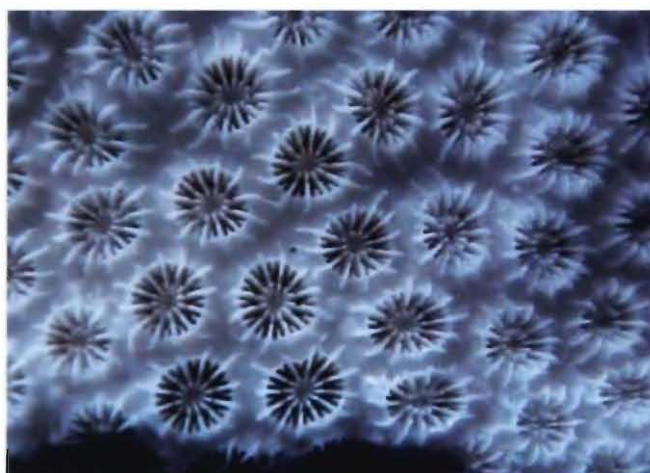
Habitat : Shallow reef environments

Distribution : In India other than Kachchh, it is reported from Andaman & Nicobar islands. Its distribution in the Indian ocean region is with report from west of Madagascar and distributed widely from the Southeast Asia to Central pacific.



Plesiastrea versipora* (Lamarck, 1816)*Pleasant moon coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Medium sized corallites, plocoid in arrangement and with formation of neat paliform lobe circle around small columella.

General Description : Colonies Encrusting to Submassive with the surface raised into subcircular mounds. Living corals usually brown, cream or purple in colour.

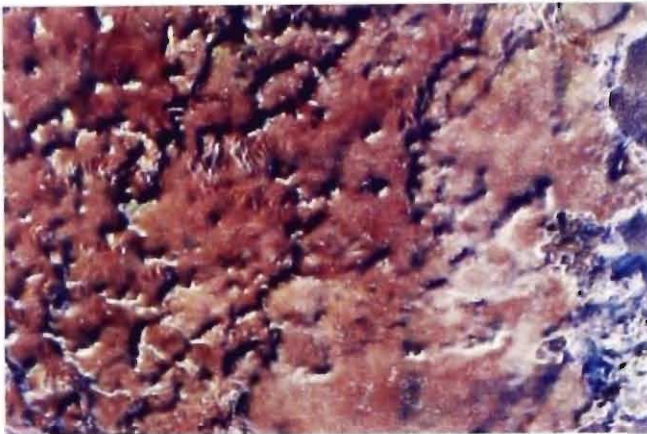
Technical Description : Corallites are monocentric and plocoid. Daughter corallites are produced by extratentacular budding. Corallites have calices approximately 2.5 mm in diameter. Paliform lobes form a neat circle around small columellae.

Habitat : Mostly occur in shaded places protected from strong wave action.

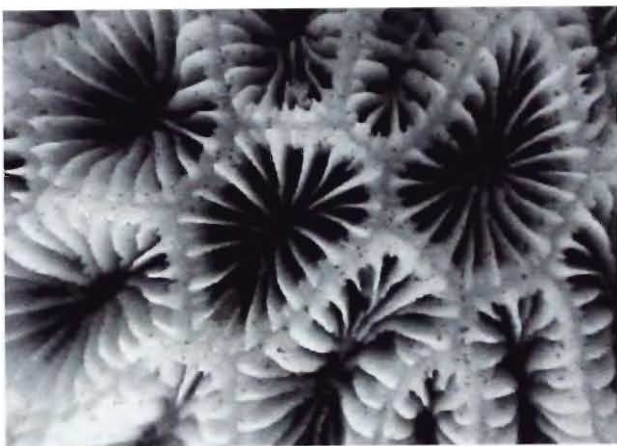
Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, and Madagascar in the Indian



Ocean to Kyushu, Marshal, Phoenix, Tubuai, Pitcairn, Kermadec and Lord Howe islands in the Pacific Ocean

Leptastrea purpurea* (Dana, 1846)*Star coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Characteristic prominence in primary septa, variability in corallite sizes in corners and gradually inclining inner septal margins along with non-granulated sides of septa makes it distinct from other species.

General Description : Colonies are irregular. Encrusting or massive and range in size upto about 1 m in diameter. Colonies are sub-ceroid. Living colonies are usually brown or pale yellow on their upper surface with dark calices. The sides of colonies are usually uniformly dark, although the under surfaces of corallites are bleached.

Technical Description : Corallites are always discrete and polygonal and are characteristically variable in size (2-11 mm in diameter). Wall thickened in some places with a middle groove. Septa vary from 40 to 60 depending upon the size of the calyx. The septa are seldom thickened above the thecae. Costae are usually poorly developed, the coenosteum between adjacent corallites is usually a narrow, smooth strip overshadowed by the exsert septa.

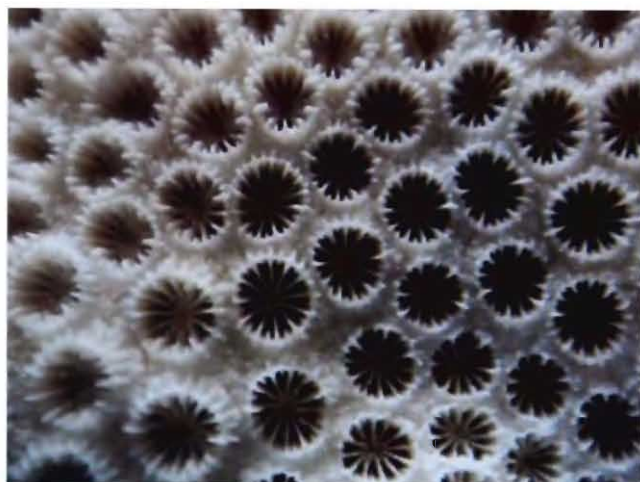


Habitat : Mostly found in a wide range of reef environments.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar, Palk Bay and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Durban and Madagascar in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Pitcairn, Tonga and New Caledonia islands in the Pacific Ocean.

Cyphastrea serailia* (Forskal, 1775)*Tubular moon coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	FAVIIDAE



Key Characters : Small plocoid tube like corallites with 12 primary septa make it distinct from other species.

General Description : Colonies are usually massive or sub-massive, sometimes encrusting. Living colonies are usually grey, brown or cream in colour.

Technical Description : Corallites are round and very variably exsert. Calices of mature corallites are 1.5 to 2.8 mm in diameter. The corallites having 12 septa. The columella are usually inconspicuous and trabecular. The costae are equal or subequal and are frequently poorly developed. Thecae vary greatly in height and thickness. The coenosteum is often largely composed of dissepimental blisters and is always covered with granulated exothecal spines.

Habitat : Found in wide variety of Habitats.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands.



Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea and Madagascar in the Indian Ocean to Kyushu, Marshal, Phoenix, Marquesas, Tubuai, Samoa and Lord Howe islands in the Pacific Ocean.

Paracyathus stokesi* (Milne Edwards and Haime, 1848)*Solitary coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	CARYOPHYLLIDAE



Key Characters : Solitary and tapering to a pointed base.

General Description : Azooxanthellate. Solitary with an attachment base. Corallites white in colour.

Technical Description : Corallum tapering to a pointed base. Without epitheca. 5 to 11 mm in height. Calice diameter varies with the size of the corallum, usually falls between 5 to 11 mm. Depth 2 to 6 mm. Septa exsert. Septa entire with granular sides. Pali prominent and merges with the columella.

Habitat : Mostly found as overhangs under rocks and dead corals.

Distribution : In India it is reported from Gulf of Kachchh and South-east coast. In the Indian ocean itself it is also reported off Oman and Mergui Archipelago.



Polycyathus verrilli* Duncan, 1889*Community coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	CARYOPHYLLIDAE

Key Characters : Solitary forming colonies. Epitheca present.

General Description : Solitary, attached, forming small colonies in the form of patches upto 10-15 cm spread.

Technical Description : Corallites formed of extra tentacular budding. Initial settlement isolated growing into a closely placed cluster of individually appearing polyps. Corallite height ranges from 7–10 mm and width 2–4 mm. Epitheca present which may reach upto the rim. Azooxanthellate.

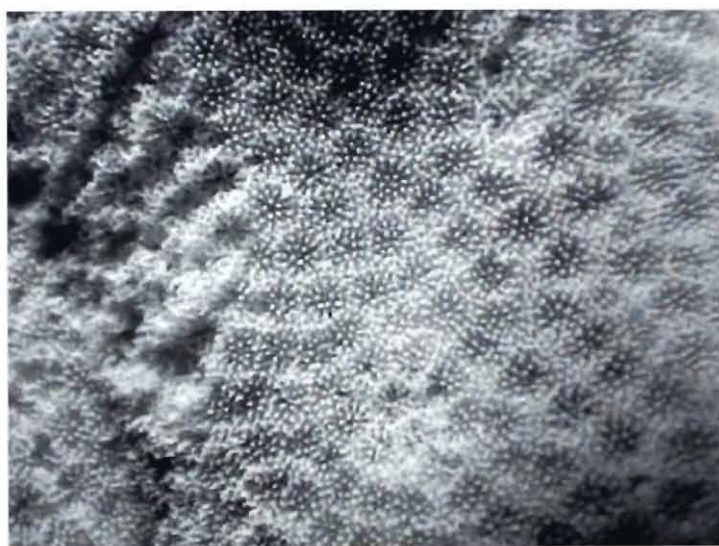
Habitat : Mostly found under the dead acropora plates and tables or rocks in reef areas. Sometimes even on dead shells etc.

Distribution : In India it is reported from Gulf of Kachchh, South-east coast and Andaman Nicobar islands. In the Indian ocean itself it is also reported from Maldives and Mergui Archipelago. In the Pacific ocean region it is reported from Marshall islands and Loyalty islands.



Porites lutea* Milne Edwards and Haime, 1860*Boulder coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Massive growth form. Minute and compact corallites. Trident formed due to the fusion of ventral triplet at the tip. Eight pali.

General Description : Colonies massive. The surface is usually smooth. Green or cream coloured in shallow waters.

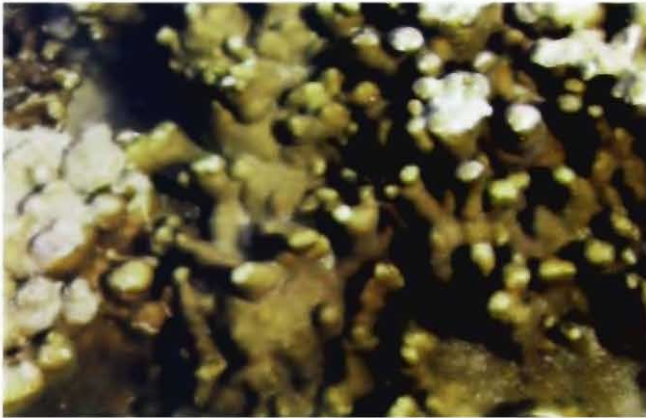
Technical Description : Corallites 1-1.25 mm long. Inter-corallite wall zigzag or straight. The ventral triplet of septa fuse at the tip to form trident. Eight pali.

Habitat : Mostly occur on back reef margins.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Madagascar and Durban in the Indian Ocean to Kyushu, Marshal, Midway, Tubuai, Pitcairn, Tonga and New Caledonia islands in the Pacific Ocean.

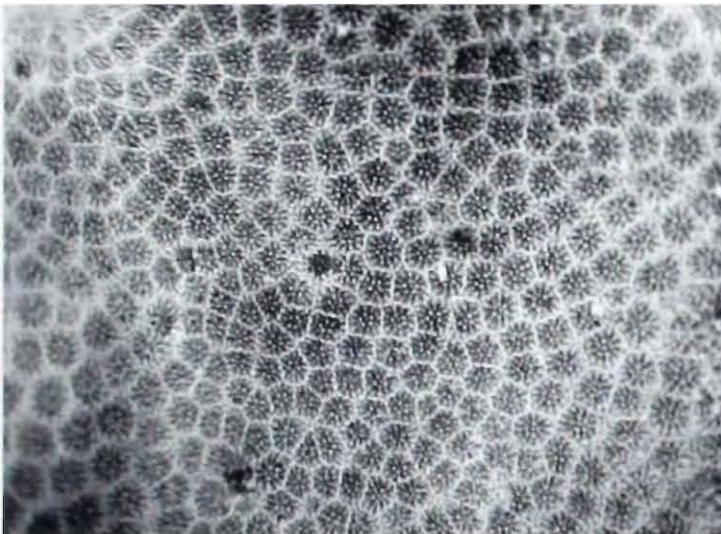


***Porites lichen* Dana, 1846**
Boulder coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Growth form encrusting or fused nodules and columns.

General Description : Colonies Encrusting or submassive. Colonies are bright yellowish-green, sometimes brown in colour

Technical Description : 1 mm diameter corallites are aligned in irregular rows separated by low ridges. Often 2 to 6 running together without intercorallite walls. Septal structures are variable and irregular. Poorly developed pali.

Habitat : Usually a dominant species of lagoons and reef slopes found in rock pools and reef flat in Gulf of Kachchh area.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Madagascar and Durban in the Indian Ocean to Kyushu, Marshal, Midway, Tubuai, Tonga and Lord Howe islands in the Pacific Ocean.

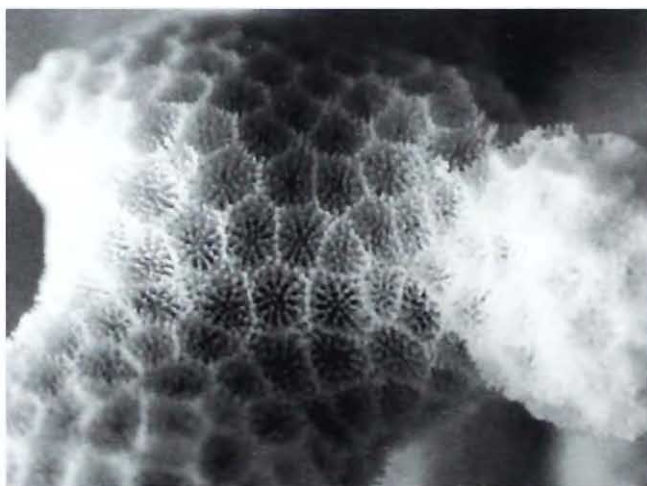


***Porites compressa* Dana, 1846**
Branching pore coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Branching growth form separate it from other species of *Porites* reported from this region. Thin columella and free ventral triplet are other key characters.

General Description : Corallum composed of thick solid base and with digitiform branches.

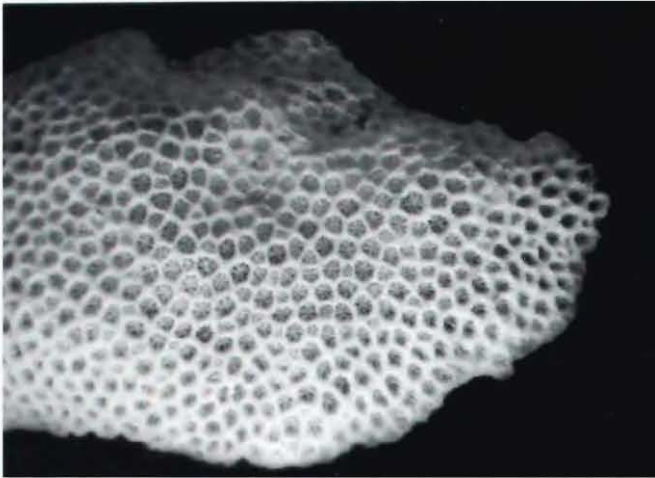
Technical Description : Calices polygonal, excavated 1.5 mm long. Wall thin, with frosted twisted mural denticles. A single septal denticle between the palus and the wall. Ventral triplet do not form a trident. Two rings of synapticalae. Pali poorly developed, one each on the lateral pairs of septa and the fifth on the ventral directive. Columella thin, compressed style joined to the fused ends of septa by radii.

Remarks : Dr. Veron (2000) named this species which is reported from the western Indian Ocean region as *P. harrisoni*. He has considered, thin columella and never forming trident as the characters of *P. harrisoni*. According to him *P. compressa* is with a restricted distribution i.e., from Hawaiian islands only.

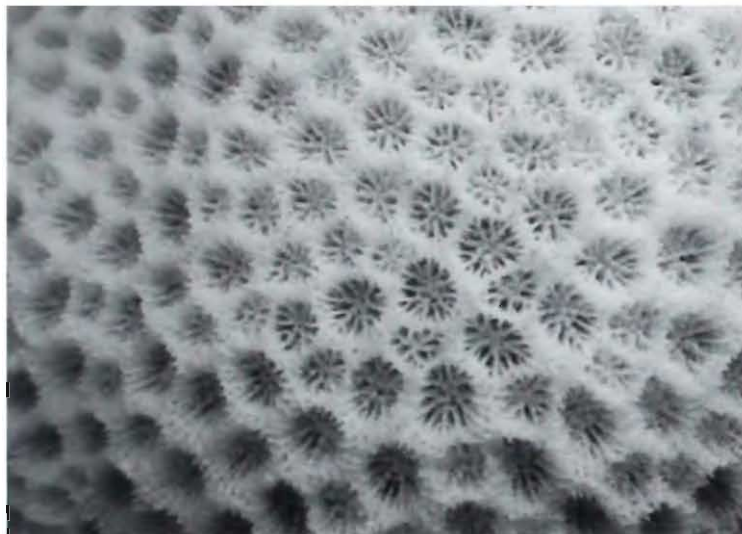


Habitat : Mostly found on the protected reef environments.

Distribution : In India it is recorded from Gulf of Kachchh and South-east coast. Its distribution is restricted to Arabian sea in the Indian ocean. According to Dr. Veron (2000) *P. compressa* is endemic to Hawaiian islands.

Goniopora minor* Crossland, 1952*Flower pot coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Circular corallites with 2-3 mm calices and thick walls.

General Description : Colonies are hemispherical or encrusting. The live coral is brown or green, usually with distinguished coloured oral discs and pale tips to the tentacles.

Technical Description : Calices are 2-3 mm in diameter. There are usually six thick pali, which are in contact forming a crown. All septal structures are heavily granulated.

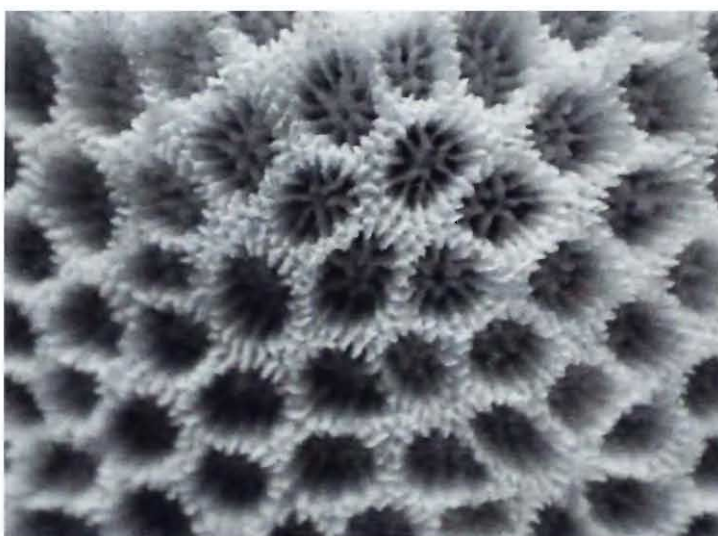
Habitat : Mostly found in subtidal reef environments, especially lagoons.

Distribution : In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. World wide it is widely distributed throughout Indo-Pacific from Socotra and Madagascar in the Indian Ocean to Ryuku, Marshal, Phoenix, Tubuai, Tonga and New Caledonia islands in the Pacific Ocean.



Goniopora tenuidens* (Quelch, 1886)*Flower pot coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Moderate excavated corallites with uniform septal development among corallites make it appear different from other *Goniopora* species in Kachchh region.

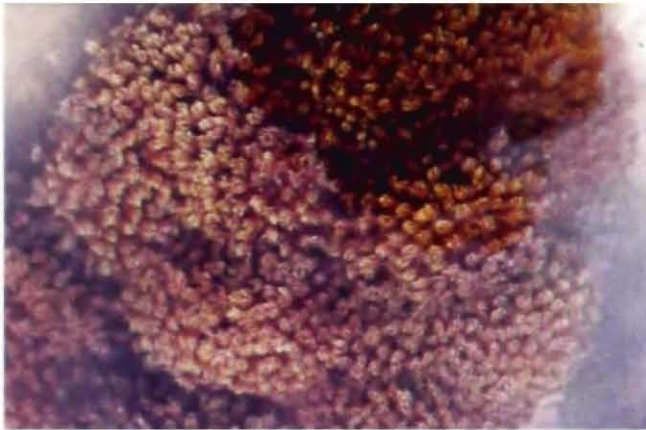
General Description : Colonies submassive or massive. Colour uniform blue (appear pink in photographs), green or brown

Technical Description : Corallites more than 4-5 mm in diameter, Uniform septal development among corallites. Excavated corallites and primary septa rarely form a delta. Six prominent paliform lobes.

Habitat : Subtidal reef environments.

Distribution : In India this species is recorded for the first time in Gulf of Kachchh. It is reported earlier from Andaman & Nicobar islands. World wide it is reported from Indian Ocean, SE Asia and the Pacific upto Fiji islands.



Goniopora planulata* (Ehrenberg, 1834)*Flower pot coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Polygonal corallites with 3-5 mm diameter calices.

General Description : Colonies are columnar. Polyps extend during daytime

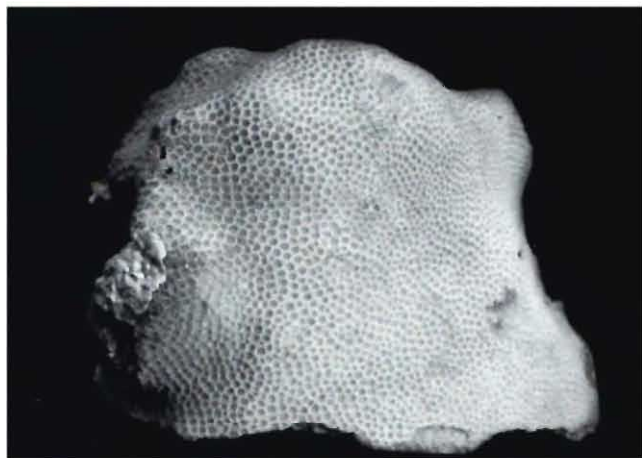
Technical Description : Septa 24, mostly regular, the tertiaries fuse to the secondaries. Septa are descending vertically at the wall. Edges with 4 to 5 teeth. 6 to 12 pali present of which those of the primaries are very prominent and frosted. They stand high above the columella. Columella are loose trabecular or sometimes solid.

Habitat : Mostly found on the shallow reef environments.

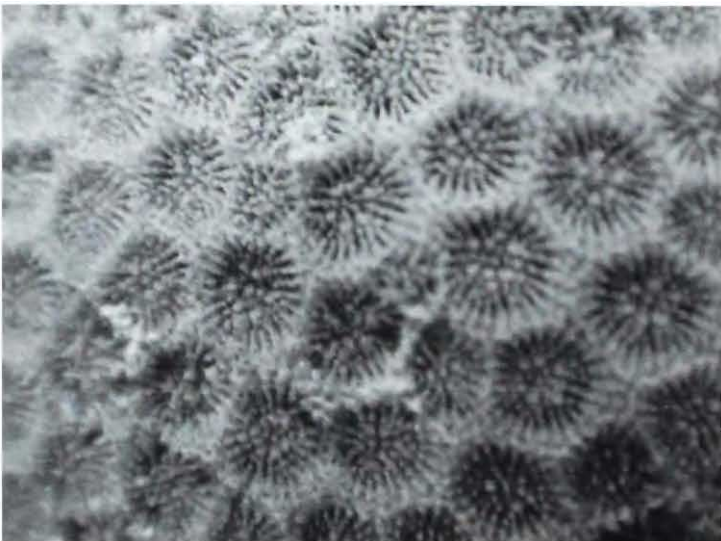
Distribution : In India it is reported from Gulf of Kachchh, South-east coast and Andaman and Nicobar Islands. Worldwide its distribution is patchy with much congregation from Srilanka to coral triangle. In the Indian ocean it is also reported from Red Sea, Aldabra islands to south of Maldives.



Goniopora stutchburyi Wells, 1955
Flower pot coral



Taxonomic Position	
Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	PORITIDAE



Key Characters : Calices less than 3 mm in diameter and shallow giving colonies a smooth surface. Polygonal corallites.

General Description : Colonies are submassive to explanate. Polyps have short tapering tentacles, which may not be extended during the day. Colonies are usually pale brown or cream in colour, sometimes with pale blue mouths.

Technical Description : Septa in three cycles. All the 24 septa are almost straight from wall to columella.

Habitat : Mostly found on the shallow reef environments.

Distribution : In India this species recorded from Gulf of Kachchh and South-east coast. World wide, its occurrence is much restricted in Indian ocean region and widely distributed in the Pacific ocean region. From Southeast India in the Indian ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and New Caledonia islands in the Pacific Ocean.



Tubastrea aurea* (Quoy and Gaimard, 1833)*Turret coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE



Key Characters : Dendroid corallites with imperfect Pourtales plan.

General Description : Azooxanthellate. Colonies are dendroid becoming bushy by extra-tentacular budding. Living coral red in colour (as seen in the above picture).

Technical Description : Corallites are tubular with septa of immature corallites only following 'Pourtales Plan'. Corallites nearly 1 cm in diameter and about 5 mm in height. Septa in three cycles with incomplete fourth cycle.

Habitat : Prefers sheltered subtidal waters and grows under overhanging coral rocks.



Distribution : It is reported from all the four major coral reef regions in India. World wide reported from Red sea, Singapore and Fanning island.

Dendrophyllia minuscula* Bourne, 1905*Branch coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE

Key Characters : Dendroid corallites with perfect Pourtales plan

General Description : Azoo-xanthellate. Colonies are dendroid becoming bushy by extra-tentacular budding.

Technical Description : Corallites are tubular with septa fused according to 'Pourtales Plan'. *Dendrophyllia* resembles *Tubastrea* and can be distinguished by the latter's mature corallites not having septa clearly arranged according to 'Pourtales Plan'. Main branch is about 2 cm thick and subdividing. Corallites 3 to 5 mm in diameter. Septa in four complete cycles. Columella distinct at the bottom of the calyx.

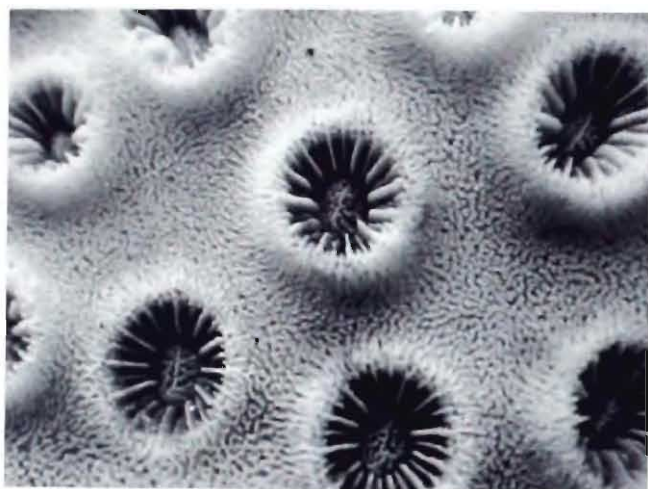


Habitat : Prefers sheltered deeper waters.

Distribution : It is reported from all the three major coral reef areas in India except Lakshadweep. No information is available about its distribution elsewhere.

Turbinaria peltata* (Esper, 1794)*Bowl coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE



Key Characters : Very distinct species. Short wide opened corallites with well developed columella.

General Description : Colonies are flat plates. In Gulf of Kachchh often seen growing even in loose sand and loose boulders and chanks. Large polyps are frequently extended during the day. Usually grey, sometimes brown in colour.

Technical Description : Corallites are immersed to tubular, with 4-6 mm in diameter. Septa in three cycles with a few in the fourth. Columella well developed, spongy and almost filling the calyx.

Habitat : It usually occurs in shallow rocky foreshores with turbid water. Also occurs on shallow reef slopes.

Distribution : It is the second very common hard coral species found in Kachchh, with its representation from almost all the reef regions. In India it is recorded from Gulf of Kachchh, Lakshadweep islands, South-east coast and Andaman and Nicobar



Islands. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Socotra, and Aldabra in the Indian Ocean to Kyushu, Marshal, Phoenix, Samoa and Lord Howe islands in the Pacific ocean.

Turbinaria reniformis Bernard, 1896
Yellow scroll coral



Taxonomic Position

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE



Key Characters : Smooth colony surface. Corallites with small calices and are widely placed on the corallum.

General Description : Colonies are composed of unifacial laminae, sometimes forming tiers, but mostly they are horizontal. Usually yellow-green or brown with distinct margins in colour.

Technical Description : Corallites are variable, widely spaced, thick-walled, crowded to almost touching, most conical, thick walls and small calices. Corallites on an average about 2 mm in diameter. Septa 12-34. Columella deep seated.

Habitat : Sometimes form large stands on fringing reefs where the water is turbid.

Distribution : In India it is recorded from Gulf of Kachchh and Andaman and Nicobar Islands. In the Indian ocean it is reported from almost all the reef regions except Maldives, Lakshadweep and Southeast coast region. Worldwide it is fairly distributed throughout Indo-Pacific from Arabian Gulf,



Red Sea, and Madagascar and the whole of western Australia in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and New Caledonia in the Pacific ocean.

Turbinaria mesenterina* (Lamarck, 1816)*Vase coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE



Key Characters : Contorted fronds and relatively well crowded corallites with small calices.

General Description : Colonies are composed of unifacial laminae which are highly contorted and anatomized in subtidal Habitats, are upright or tiered fronds on upper reef slopes and are horizontal fronds in deeper water, according to light availability. Usually grey-green or grey-brown in colour.



Technical Description : Corallites are crowded, slightly exsert, with calices 1.3-2 mm in diameter.

Habitat : It is dominant in shallow turbid environments.

Distribution : In Kachchh waters it is recorded for the first time. In India it is recorded from Gulf of Kachchh, Lakshadweep, South-east coast and Andaman and Nicobar Islands. Worldwide it is widely distributed throughout Indo-Pacific from Arabian Gulf, Red Sea, Durban, Madagascar and the whole

of Western Australia in the Indian Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga and New Caledonia islands in the Pacific Ocean.

Turbinaria frondens* (Dana, 1846)*Bowl coral****Taxonomic Position**

Phylum	CNIDARIA
Class	ANTHOZOA
Subclass	HEXACORALLIA
Order	SCLERACTINIA
Family	DENDROPHYLLIDAE



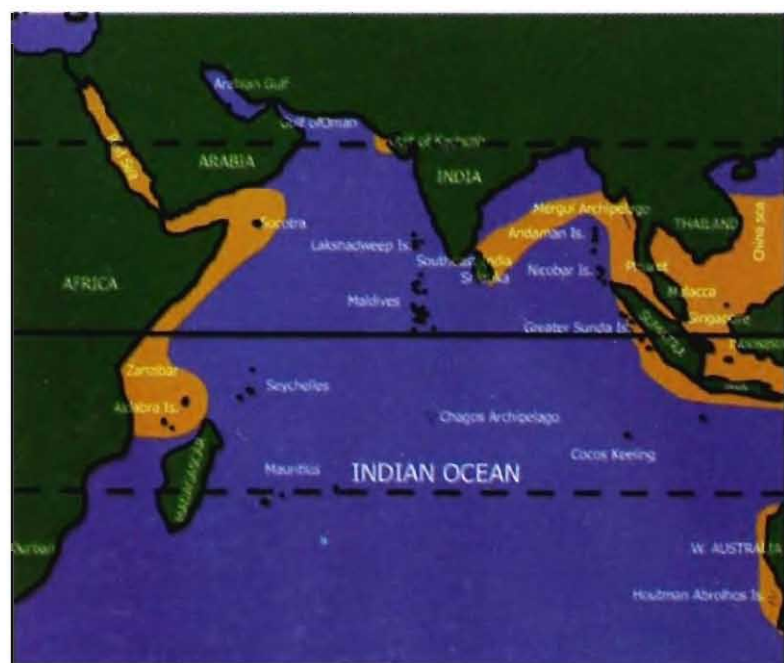
Key Characters : Unifacial upright or horizontal fronds with moderate sized corallites which are sometimes elongated or tubular.

General Description : Colonies unifacial upright to horizontal fronds or become irregularly contorted. Colour yellowish brown or greenish brown.

Technical Description : Corallites on an average are 3.5 mm in diameter. Corallites are immersed, moderate to tubular. Much elongated at the elevated portions.

Habitat : Not so common. Shallow regions of the reefs. Recorded on reef flat regions in Gulf of Kachchh.

Distribution : It is recorded for the first time in India. In the Western Indian ocean region it is reported from Red Sea to Aldabra islands and widely distributed in the tropical Indo-Pacific from Southeast India and whole of Western Australia in the Indian



Ocean to Kyushu, Marshal, Phoenix, Tubuai, Tonga New Caledonia islands and around Australia in the Pacific Ocean.

CORAL ASSOCIATES

Gulf of Kachchh reefs are believed, underestimated and considered as the poorest biodiversity spots when compared to other reef regions of India. In reality, Kachchh reefs are significant when compared to other reef regions in India because of their associates and their accessibility.

The Zoodiversity recorded from this reef region so far is less than 800 species (Porifera : 49; Cnidaria : 60; Annelida : 27; Mollusca : 178; Arthropoda : 58; Sipuncula : 18; Echiura : 15; Phoronida : 1; Bryozoa : 21; Brachiopoda : 1; Echinodermata : 29; Pisces: 98; Reptilia : 4; Aves : 174; Mammalia : 3 (Subbarao & Sastry 2005)) they are infact the most neglected and underestimated treasure houses. It is observed that the dead stony corals (*Acropora* spp.) of Kachchh harbour a diverse group of organisms many of which are yet to be recorded. In addition to this Gulf of Kachchh is the better place to record the diversity because of



the high tidal amplitude and easy accessibility of organisms during low tide. Biodiversity can be observed and collected in this reef region without worrying much about the SCUBA diving and related hazards. The following is just a glimpse of some of the inhabitants, in and around the coral reefs of Kachchh.

PROBOSCIS WORM

Common Name : They are commonly called as proboscis worms or ribbon worms because of their ribbon like body and eversible proboscis they possess.

Nemertine worms are unsegmented marine invertebrates belong to the phylum Nemertea. Their scientific classification is as follows :

Classification

Kingdom	ANIMALIA
Subkingdom	METAZOA
Superphylum	LOPHOTROCHOZOA
Phylum	NEMERTEA Schultze, 1851



Habitat : Shallow coastal areas. Some freshwater species are also there.

Characters : They possess a proboscis which lies in a fluid filled coelom. Some species are armed with a poisonous stylet. Size varies from 1mm to several meters.

Diet : Carnivorous feeding on small invertebrates. Proboscis is used to catch prey.

Behaviour : They feed either by swallowing or by stinging the prey with the neurotoxin stylet they have. Like snakes they even swallow animals bigger in size than them.

Reproduction : Hermaphroditic and reproduce sexually.

Interesting Facts : Nemerteans are named after *Nemertes*, one of the sea-nymphs of Greek mythology. Some records put their length upto 60m which makes them longest than whales and gives the credit of longest animal alive.

PISTOL SHRIMP

Common Name : Alpheidae is a Family of caridean snapping shrimp that typically have large claws. Other common names of these species include pistol shrimp or alpheid shrimp. There are 57 species in this Family.

Classification

Kingdom	ANIMALIA
Phylum	ARTHROPODA
Subphylum	CRUSTACEA
Class	MALACOSTRACA
Order	DECAPODA
Infraorder	CARIDEA
Superfamily	ALPHEOIDEA
Family	ALPHEIDAE Rafinesque, 1815



Behaviour : This Family of shrimps which are usually with poor vision live in association with gobiid fishes for their safety. The burrow is built and tended to by the pistol shrimp, while the goby guards him from danger by alerting the blind shrimp. The pistol shrimp snaps a specialized claw shut to create a cavitation wave that generates noise in excess of 200 decibels, capable of killing small fish and breaking glass up to 1.8 meters away.

Interesting Facts : Social behavior has been discovered in the genus *Synalpheus*. One species of *Synalpheus* lives inside sponges in colonies that can number over 300 members. All of them are the offspring of a single large female, the queen, and possibly a single male. The offspring are divided into workers who care for young, and the soldiers who protects the colony with their huge claws. Most of the soldiers are males. So far only one social species has been described, but many scientists think it is likely that there are more species in the genus with complex social behavior that is yet to be discovered.

MANTIS SHRIMP

Common Name : They are commonly called as stomatopods or Mantis shrimp because of their resemblance to the insect 'praying mantis' even though they are not shrimps.

Squilla belongs to the order Stomatopoda. About 400 species are at present recorded worldwide. Their scientific classification is as follows :

Classification

Kingdom	ANIMALIA
Phylum	ARTHROPODA
Subphylum	CRUSTACEA
Class	MALACOSTRACA
Subclass	HOPLOCARIDA Calman, 1904
Order	STOMATOPODA Latreille, 1817



Habitat : Found below rock formations and burrows in the marine environment.

Characters : Their size range from few centimetres to about 1 foot. Their carapace covers only the rear part of the head and the first three segments of the thorax. They appear in different colours including some brilliant florescent colours.

Diet : Diet varies with the kind of claws they possess. Crabs, univalves and bivalves are the victims of animals with club like claws and small fish are the prime target of stomatopods with barbed claws.

Behaviour : They are solitary with complex social behaviour and aggressive. Unlike most crustaceans they hunt their prey instead of waiting for the prey. They rarely come out of their habitat except to feed and to change place. Eyes on mounted stalks have the capability to move independent of each other.

Range : Tropical, subtropical and temperate seas.

Reproduction : Females are fertile only during certain phases of the tidal cycle. Females carry or lay the eggs in their burrow. Male and female come together only to mate.

Interesting Facts : Some of them are used as pets in the aquaria because of their brilliant body colouration. Mantis shrimps possess powerful claws which they use to attack even aquarium tanks in which they are kept as pets. Their claw structure is used as one of the major identification character for their grouping. Their visual system is considered to be the most complex in the animal kingdom. They have hyperspectral colour vision.

BENTHIC CRAB

Common Name : Benthic Crab. Crabs can be broadly divided into pelagic (free swimming) and benthic (walking) crabs. Coral crabs are crabs found in coral reef areas which are primarily benthic and with necessary modification of their legs for mobility.

Crabs in general are called as decapod crustaceans belonging to infraorder Brachyura means 'Short tail' according to Greek terminology. They have an abdomen hidden under the thorax. Their scientific classification is as follows :



Classification

Kingdom	ANIMALIA
Phylum	ARTHROPODA
Subphylum	CRUSTACEA
Class	MALACOSTRACA
Order	DECAPODA
Suborder	PLEOCYEMATA
Infraorder	BRACHYURA Latreille, 1803

Habitat : Crabs are found in all aquatic environments. Coral crabs are found even inside the corals.

Characters : Thick exoskeleton, 10 legs out of which two modified into claws/pincers or chelae used for holding are the striking characters of crabs. Most of the Coral crabs are benthic in nature and lack swimming legs which are modified for swimming in free swimming crabs. Adaptive capabilities to camouflage themselves with the surroundings are very high in coral crabs.

Diet : Omnivorous. Feeds primarily on algae and then molluscs, worms, crustaceans, fungi, detritus etc., depending on the availability.

Behaviour : Adaptive capabilities to camouflage themselves with the surroundings are very high in coral crabs.

Range : Cosmopolitan world wide.

Reproduction : Distinct sexual dimorphism. Males and females can be easily distinguished with the shape of the abdomen. Female abdomen is broad modified for accommodating the fertilised eggs.

Interesting Facts : Autotomy or regeneration of lost legs or other parts compels the crabs to moult quickly leading to quick growth in the body size. World wide nearly 1½ million tonnes of crabs are consumed. 'Crab fattening' is a process of catching and growing young crabs in the wild.

HERMIT CRAB

Common Name : Hermit Crab. Hermit crabs have soft abdomens. To protect their soft abdomens almost all the Hermit crabs carry empty gastropod shells, from which they derive the name “hermit”.

Hermit crabs are decapod crustaceans of the super Family Paguroidea, not closely related to true crabs.



Classification

Kingdom	ANIMALIA
Phylum	ARTHROPODA
Subphylum	CRUSTACEA
Class	MALACOSTRACA
Order	DECAPODA
Suborder	PLEOCYEMATA
Infraorder	ANOMURA
Superfamily	PAGUROIDEA Latreille, 1803

Habitat : There are about five hundred known species of hermit crabs in the world, most of which are aquatic, living at a range of depths from shallow coral reefs and shorelines to deep bottoms, although some species are terrestrial. A number of species, most notably king crabs, have abandoned seashells for a free-living life; these species have forms similar to true crabs and are known as carcinised hermit crabs.

Characters : Hermit crabs have 8 legs and two 2 claws. The left claw is always larger than the right claw. The left claw lock the shell when the crab is tightly packed inside. Some Hermit crabs are red, orange, and yellow in colour and make good aquarium specimens.

Diet : Hermit crabs tend to be nocturnal and they eat near sunrise or at dark. They may eat coral, clams and other crustaceans. They are also active during daytime in captivity. These omnivorous or herbivorous species are useful in the household aquarium as scavengers, eating algae and other debris.

Behaviour : Hermit crabs usually live in the wild in colonies of 100 or more. Hermit crabs must return to sea to reproduce.

Interesting facts : Hermit crabs carry shells on their backs to protect themselves from predators. Hermit crabs have a soft abdomen with a lot of tiny legs that they use to get in and out of their shells. There are several species of hermit crabs that are common in the marine aquarium trade. Hermit crabs carry a small amount of water in their shells at all times to keep their abdomen moist and their modified gills hydrated. *Birgus latro*, coconut crab is the largest known invertebrate on land.

GHOST CRAB

Common Name : They are commonly called as sand crabs or ghost crabs because of their occurrence in the sand and ability to disappear quickly within no time.

Ghost crabs belong to the genus *Ocypode*. Their scientific classification is as follows:

Classification

Kingdom	ANIMALIA
Phylum	ARTHROPODA
Subphylum	CRUSTACEA
Class	MALACOSTRACA
Order	DECAPODA
Infraorder	BRACHYURA
Superfamily	OCYPODOIDEA
Family	OCYPODIDAE
Genus	<i>Ocypode</i> Weber, 1795



Habitat : Live in tunnels with 1 to 2 inch wide holes made in the sea shore sand.

Characters : Two elevated black eyes with 360° vision.

Diet : Feed on dead and live animals they can get in the shore and seen catching insects from the air.

Behaviour : Busy moving in the beaches, especially between sunset and dawn. Hibernate during winter. Like male fiddler crabs they also have one claw bigger than the other but not so markedly.

Range : Very commonly seen along the beaches of Indo-pacific and Australian region.

Reproduction : Sexes are separate.

Interesting Facts : One record says that they can move with a speed of 10 miles per hour. In some places along the Indian coast fishermen population use the juice of these animals to catch long polychaete worms to use them as bait to catch fish.

COWRIE

Common Name : Commonly called as Cowries or marine snails.

Cowries belong to genus *Cypraea* and placed under Family Cypraeidae. Their scientific classification is as follows :

Classification

Kingdom	ANIMALIA
Phylum	MOLLUSCA
Class	GASTROPODA
Subclass	ORTHOGASTROPODA
Infraclass	APOGASTROPODA
Superorder	CAENOGASTROPODA
Order	SORBEOCONCHA
Suborder	HYPSOGASTROPODA
Infraorder	LITTORINIMORPHA
Superfamily	CYPRAEOIDEA
Family	CYPRAEIDAE
Genus	<i>Cypraea</i>

Habitat : Benthic.

Characters : Shell is mostly smooth with colourful patterns. More or less egg shaped and size varies from 5 mm to 15 cm.

Diet : Feed on algae.

Behaviour : When alive they close their shells with mantle and move gently with the foot.

Range : Found mainly in tropical regions.

Interesting Facts : In olden days, cowries were used as currency for trade mostly in Africa. Even now they are used as dice. As they are considered as symbols of womanhood, fertility, birth and wealth they are worn as jewellery and used as ornaments or charms.



MARINE SNAIL

Common Name : Snails. The scientific name Gastropoda is given to them due to a ventral foot (GK., *gaster*=stomach and *poda*=feet).

Gastropods or univalves belong to Class Gastropoda. Most successful among molluscs with 60000-75000 known species. The scientific classification of this group is as follows:

Classification

Kingdom ANIMALIA

Phylum MOLLUSCA

Class GASTROPODA Cuvier, 1797

Habitat : More than two thirds in Marine environment, remaining terrestrial and freshwater.

Characters : Characterised by a body coiled to one side. They have two or four sensory tentacles. Eyes are placed at the tip of tentacles. Ventral foot is used for locomotion. Most gastropods have shells. Operculum or a door to close shell is found in many species.



Diet : Gastropods are Herbivores, detritus feeders and carnivores.

Interesting Facts : The shell of a gastropod larva is called as 'protoconch'. 'Radula' a rasping organ is present in gastropods for rasping food.

SEA HARE

Common Name : Aplysia are one type of sea slugs commonly called as sea hares.

Aplysia belongs to Family Aplysiidae under superfamily Aplysioidea. The Classification is as follows :

Classification

Kingdom ANIMALIA

Phylum MOLLUSCA

Class GASTROPODA

SubClass ORTHOGASTROPODA

Superorder HETEROBRANCHIA

Order OPISTHOBRANCHIA

Suborder ANASPIDEA
 Superfamily APLYSIOIDEA
 Family APLYSIIDAE
 Genus *Aplysia*



Characters : Size ranges from 15 to 75 cm. Found in different colours. Good swimmers.

Behaviour : When threatened these animals release a type of dye to blind the attacker. The young usually follow the trails left by their parents and move in a queue.

Range : Cosmopolitan. Found abundantly in tropical and temperate seas.

Interesting Facts : Since the ink releasing mechanism of these animals is mediated by electrical synapses, neurobiologists are studying these animals.

SEA SLUG

Common Name : Commonly called as sea slugs because of the absence of shell or operculum. The name nudibranch is a mixture of Latin and Greek words (L. nudes=naked and brankhia=gills) given to them because of their ability to breathe through exposed branchial plume or tentacle like structures on their back.

Nudibranchs are soft-bodied snails placed under suborder Nudibranchia. Its scientific classification is as follows:

Classification

Kingdom ANIMALIA
 Phylum MOLLUSCA
 Class GASTROPODA
 Order OPISTHOBRANCHIA
 Suborder NUDIBRANCHIA

Habitat : At all depths in the marine environment. Prefers shallow cold waters.

Characters : Possesses tentacles on head which are sensitive to touch, taste and smell. Size varies from 4 cm to few metres.



Diet : Carnivores feeding on attached hydroids, tunicates, barnacles, poriferans and bryozoans. Cannibalism is also reported.

Behaviour : They have the ability to vary their body form and with high camouflaging capabilities.

Range : World wide.

Reproduction : Hermaphroditic. Eggs are deposited in a gelatinous spiral.

Interesting Facts : Nudibranchs which feed on hydroids store the stinging cells of the hydroids in their upper body wall to distance predators.

BRITTLE STAR

Common Name : These animals are closely related to sea stars and are called as brittle stars because of the brittle nature of their arms.

Brittle stars belong to class ophiuroidea. About 1500 species are recorded in the world so far. Their scientific classification is as follows :

Classification

Kingdom ANIMALIA

Phylum ECHINODERMATA

Class OPHIUROIDEA Gray, 1840

Habitat : Marine environment from shallow depths to a depth of about 500m hiding under rocks and also in association with other organisms like corals. They are even recorded from depths greater than 6000 m.

Characters : Generally have five flexible arms which may reach upto 2 feet in larger specimens. They use their arms for locomotion on the ocean floor. Their skeleton is made up of calcium carbonate in the form of calcite and their body is called as test. Internal organs are restricted to the disk or the central body which is demarcated clearly from the arms. Digestion takes place in the stomach pouches. It lacks an intestine or anus. Ophiuroids are without eyes but have the ability to sense light through receptors in the epidermis.



Diet : Majority of them are scavengers or detritivores. They feed on small crustaceans or worms found in the plankton. Feeding is effected by suspension feeding using the mucus coating on their arms.

Behaviour : They move with the help of wriggling movement of their arms.

Range : Found in marine environment from poles to tropics.

Reproduction : Sexes mostly are separate.

Interesting Facts : Autotomy or capacity to regenerate lost arms or arm segments is existing in this group of animals. They use this capacity to escape from their enemies by leaving their arms with the attacker, the way the lizards leave their tails to divert the attention of the enemies.

FEATHER STAR

Common Name : Feather stars or Sea lilies.

Crinoids are 'sea lilies' or 'feather stars' belonging to Class Crinoidea of phylum Echinodermata. The scientific classification is as follows:

Classification

Kingdom ANIMALIA

Phylum ECHINODERMATA

Class CRINOIDEA Müller, 1821

Characters : An elevated mouth surrounded by feeding arms. Anus is placed next to mouth. Most of the crinoids are with more than five arms.

Diet : Plankton. Filter feeders.

Range : Marine environment. In shallow environment to a depth of 6000 meters.

Interesting Facts : Some crinoids are with stalks and most of the modern crinoids are free swimming.



SEA SQUIRT

Common Name : Commonly known as the ascidians or sea squirts.

Ascidians are a sac-like marine filter feeders placed in subphylum Tunicata.

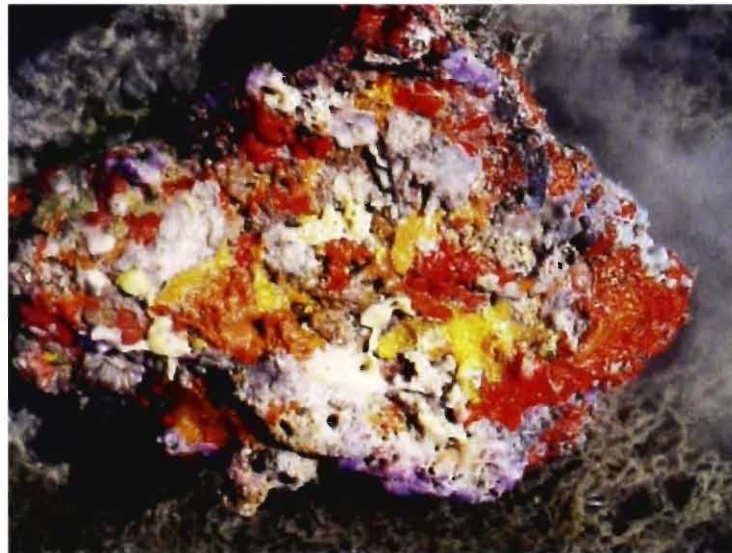
Classification

Kingdom ANIMALIA

Phylum CHORDATA

Subphylum UROCHORDATA

Class ASCIDIACEA Nielsen, 1995



Habitat : Sea squirts are sessile animals found firmly attached to rocks and shells.

Characters : Ascidians are characterized by a tough outer “tunic” made of the polysaccharide *tunicin* whilst other tunicates are much less robust.

Diet : Ascidians feed on Plankton. Sea squirts feed by taking in water through the oral siphon. The water enters the mouth and pharynx, flows through mucus-covered gill slits (also called pharyngeal stigmata) into a water chamber called the atrium, and then exits through the atrial siphon.

Range : They are found all over the world, usually in shallow water with salinities over 25‰.

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GLOSSORY

Appressed corallites : corallites which are pressed or fused with the coenosteum on one side, so that their axis is placed parallel or approximately parallel with the coenosteum.

Axial corallite : a corallite placed at the tip of a branch. Mostly acropora have axial corallites.

Azooxanthellate corals : corals without zooxanthellae.

Budding : splitting of a polyp into two new polyps.

Calice : the area of a corallite (usually the upper area), excluding the walls.

Ceriod : one type of corallite arrangement in a colony where adjacent corallites share the wall.

Coenosteum pit : a pit in the coenosteum found at the point of commencement of septa. Pectiniidae and Fungiidae.

Coenosteum style : rod like projections in the coenosteum

Coenosteum : the corallum in between the corallites.

Collines : skeletal ridges of coenosteum which separate corallites.

Colony : a group of similar and inter connected coral polyps.

Columella : centre of the corallite formed by single or multiple elements.

Compact branching : branches of a colony arranged close to each other.

Corallite : skeleton of an individual polyp (usually cup like).

Corallum : The skeleton of a coral (plural: corolla).

Corymbose : a term used to describe colonies with horizontal interlocking branches with short upright branchlets. (usually found in some acropora species).

Costae : radially arranged skeletal elements outside the corallite wall usually adjacent or opposite to Septa.

Cycles of septa : The arrangement of Septa in a set sequence of size or origin. (primary, secondary, tertiary).

Deltas of septa : a pattern of fusion septa with columella (usually like a crown mostly found in *Goniopora*).

Digitate : a colony with short upwardly projecting finger like branches.

Diversity : the variety of taxa in a group or place.

Encrusting : growth form of a coral in which the animal grows and takes the shape of the substratum on which it is growing.

Entire : without significant irregularities.

Epitheca : a thin layer of calcium carbonate that grows outside corallite walls. Originally derived from the basal plate.

Explanate corals : corals with horizontally growing plate like colonies.

Explanate : plate like growth form.

Extant : existing at present.

Extinct : not existing at present.

Extratentacular budding : a type of polyp reproduction where a new polyp buds/grows outside the ring of tentacles of the old polyp.

Family : group of related genera (taxonomic ranking).

Flabello-meandroid : corals with both valleys and separate corallite walls i.e., they have valleys with walls that are separate from the walls of adjacent valleys.

Foliaceous : leaf like growth form.

Fossa : a hole or opening in the coral skeleton.

Foveolate corallites : funnel-shaped corallites (*Montipora*).

Genus : comprising a group of related species (taxonomic ranking).

Glabrous : smooth or devoid of structures.

Granulate : covered with tiny projecting particles.

Growth form : shape of the entire coral skeleton.

Hermatypic : means reef building.

Holotype : the principal specimen on which a species name is based.

Immersed corallites : corallites which are embedded in the coenosteum.

Intratentacular budding : growth of polyps from the inside wall of parent corallites.

Lamellar : plate-like.

Latitudinal attenuation : the progressive decrease in diversity with increasing distance from the equator.

Massive colonies : colonies which are solid and have approximately similar dimensions in all directions.

Meandroid colonies : colonies that have corallites without individual walls and with mouths aligned in valleys.

Monticules : conical projections in the coenosteum of a coral formed due to fusion of sections of walls between corallites.

Nominal species : species that exists in name only.

Paliform lobe : upward skeletal growths of a septum formed at the inner distal margin.

Paliform crown : a crown like formation of paliform lobes surrounding the columella.

Palus : innermost dentition of septum (formed differently from paliform lobe) (plural pali).

Papillae : projections on the coenosteal surface usually not bigger than a corallite.

Peritheca : coenosteal area outside the corallite, also called as exotheca.

Phaceloid corals : corals that have projected corallites of uniform height connected near their base.

Phylum : a group of related families (taxonomic ranking).

Pinnule : small cylindrical upright structures (usually columellae).

Plocoid : a type of corallite arrangement in a colony where each corallite has its own separate wall.

Polyp : small, cylindrical shaped animal with a ring of tentacles (Cnidaria).

Pourtales plan : a specific pattern of fusion of septa (usually quaternary around the tertiary).

Radial corallite : corallites on the sides of branches of *acropora* and *anacropora* (unlike axial corallites which are found at the tip of the branch).

Radii : fine septal elements connecting septa with the columella. (used in the identification of *porites*).

Reef flat : the flat uppermost parts of reef that are exposed to wave action.

Reefs : limestone platforms of shallow tropical seas built by corals, coralline algae and other calcium forming biota.

Reef slope : the sloping reef below the reef flat.

Scleractinian corals : stony corals which have skeleton made up of solid limestone and placed under order Scleractinia.

Septa : radial skeletal elements of a corallite projecting inwards from the wall.

Septal teeth : sharp structures along the margins of septa.

Septo-costae : radial skeletal elements across the corallite wall composed of both septa and costae.

Solitary corals : corals composed of single individuals.

Species : individual animals that look similar and are capable of interbreeding with one another.

Spinule : small spines found between the corallites of a coral skeleton.

Spongy : compactly reticulate.

Staghorn : common name for acropora species.

Synapticulae : rod like skeletal structures linking septa in some corals.

Synonymy : a list of names given to a taxon other than the name by which the taxon should be known.

Systematics : The science of systematic classification of living organisms.

Taxonomy : classification of organisms into groups based on similarities of structure or origin and their naming.

Tentacles : elongated tactile or prehensile flexible organs around the mouth of a coral polyp.

Trabeculae : radiating skeletal fibres that grow together to form septa and other skeletal elements in a coral.

Trident : pattern of fusion of the ventral septa of corallites of porites species where the septa are linked by a cross-bar.

Triplet of septa : the three septa in the ventral portion of the corallites of porites species.

Tuberculae : projections of coenosteum that are more than a corallite wide (mostly found in *Montipora* species).

Type locality : the place where a species was originally described from.

Type species : the species that a genus is primarily based on.

Type specimens : the specimens that a species was originally described from. A single or principle specimen is the holotype.

Unifacial : plates with corallites on one side only.

Verrucae : mounds of coenosteum that are wider than a corallite and sometimes bear corallites on their surface. (Mostly found in *Pocillopora* and *Montipora*).

Zooxanthellae : photosynthetic algae (dinoflagellates) that are found symbiotically in animal tissue.

Zooxanthellate corals : corals that have zooxanthellae