

CORAL REEFS

Prof. G.C. Hembram



Coral Reefs of India

CORAL REEF-WHAT IS IT?

- **INTRODUCTION:**-Oceanic coral reefs are made up of communities of tiny living things. They are the sub-aquatic coral polyp-based structures that calcium carbonate holds together. Just 0.1% of the ocean's surface is occupied by coral reefs, which are also known as the tropical rainforest of the sea and constitute the habitat for 25% of marine species. They are typically located at depths of less than 150 feet in shallow locations. However, some coral reefs reach depths of as much as 450 feet.
- **DEFINITION:**-An organically constructed, wave- resistant rock structure created by carbonate secreting animals and plants called coral reef. The biodiversity and trophic dynamics of a reef ecosystem are so distinctive and spectacular that they deserve serious consideration.
- **Biology of corals-** The vast bulk of coral reef consists of the build-up of loose to well cemented organic debris-fragments of shells and skeletons- composed of calcium carbonate, in rock form, it is referred to as limestone. The living part of the reef is mainly a veneer growing on the surface of massive limestone deposits that record the existence of ancient reef communities. In effect, the thick limestone base is covered by a thin living "skin". When coral and other carbonate secreting organisms in this "skin" die, their hard parts are added to the reef structure, helping the reef mass grow in size over geologic time.

KINGDOM	PHYLUM	CLASS	Organism	
Metazoa	Cnidaria	Hydrozoa	Corals	

- Corals are super-organisms that include both plants and animals that are situated between populations and communities at the ecological level of organisation. The phylum Cnidaria's class Anthozoa is responsible for the animal component, whereas zooxanthellae, an algae with chlorophyll pigment, makes up the plant component. Because of its capacity for photosynthesis, this alga can give coral polyps the carbon molecules they need to produce energy. The polyps defend the zooxanthellae in return.

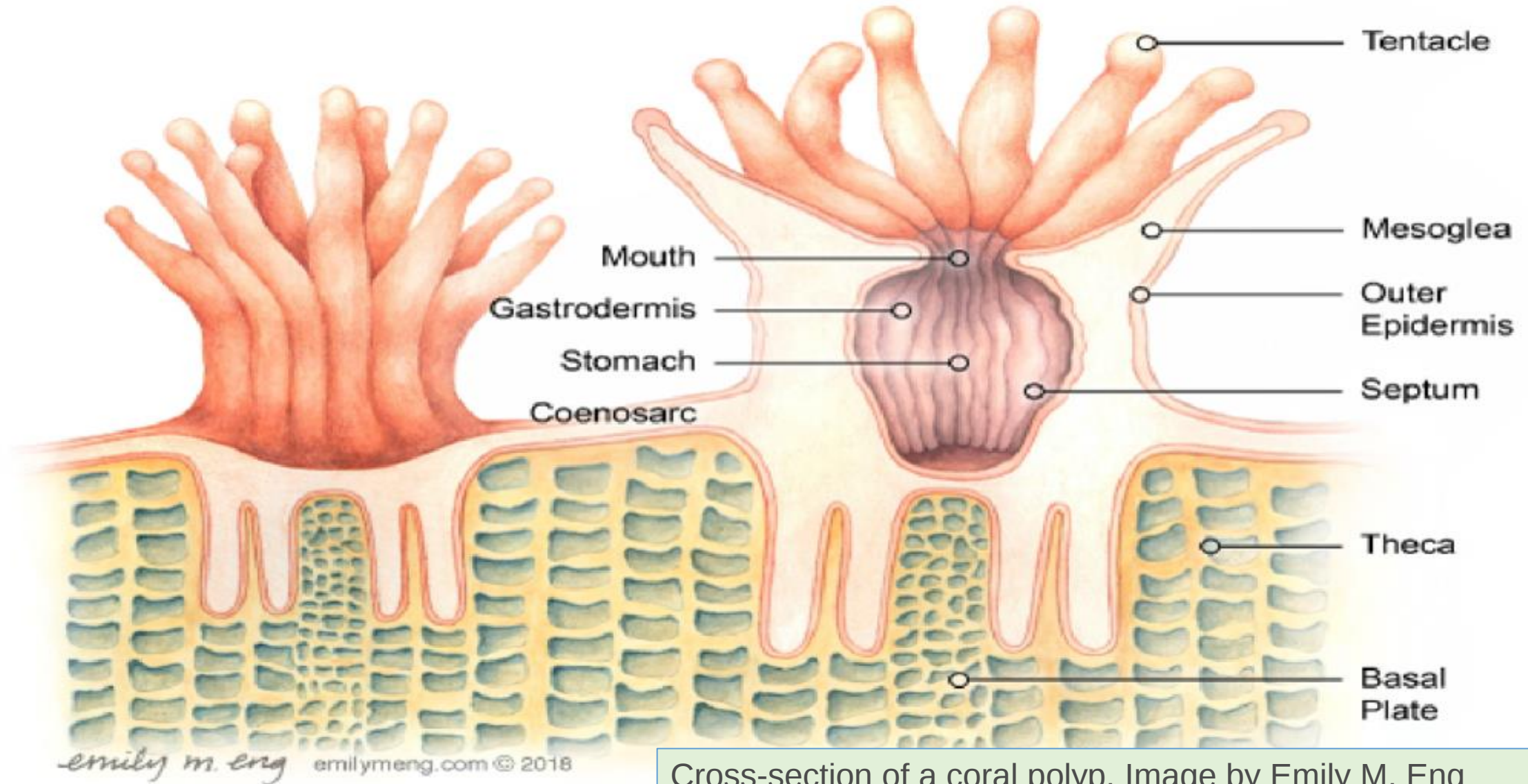
Component:-A coral reef is made up of *three* main components:

(1) A hard surface- Submerged rocks or other hard surfaces provide a place for corals to attach and serve as habitat for many coral reef animals.

(2) Coral polyps- Coral polyps are tiny little animals that are related to anemones and jellyfish. They can live individually, or in large colonies that comprise a coral reef.

(3) Reef animals- Between 1 and 8 million species are associated with coral reef ecosystems, and many play crucial roles in maintaining a healthy, functioning, and balanced reef.

CORAL POLYP- CROSS SECTION



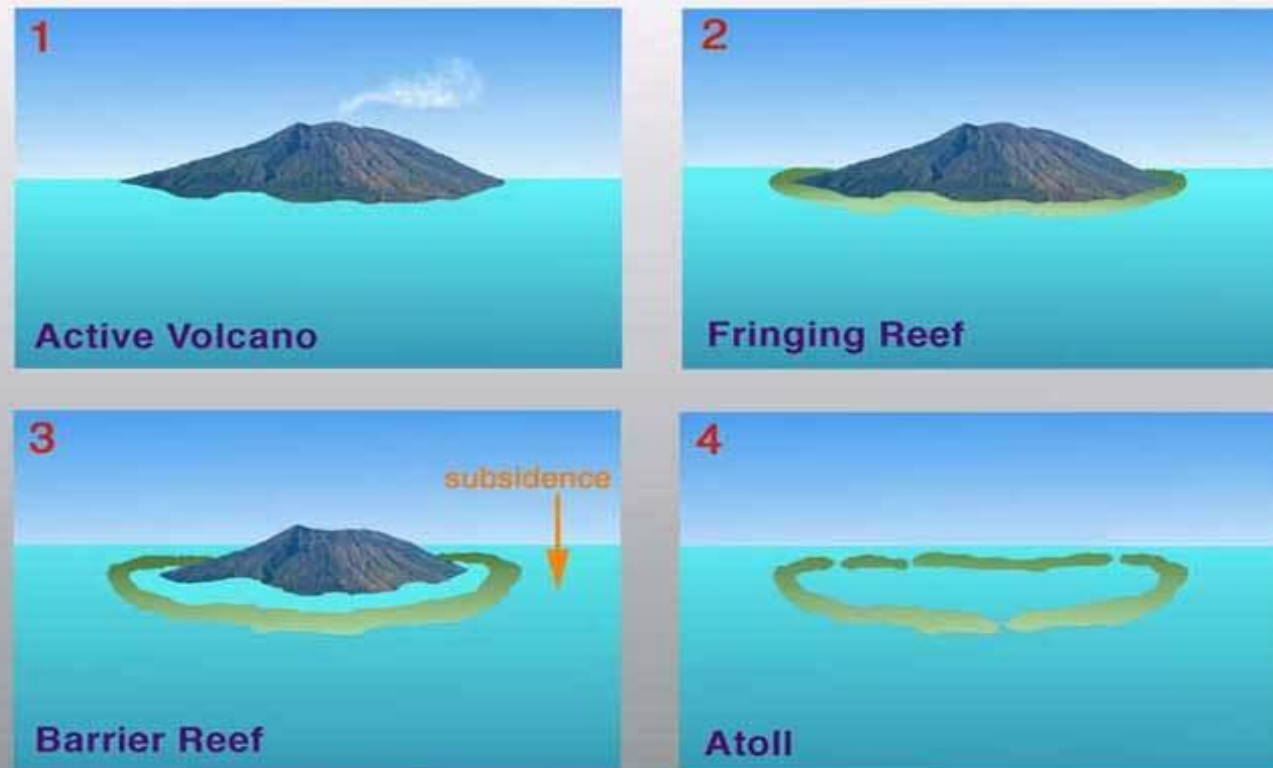
Cross-section of a coral polyp. Image by Emily M. Eng

FORMATION

Step 1: A fringing reef forms first, and starts growing in the shallow waters close to a tropical island.

Step 2: Over time, the island subsides and the reef grows outwards, and the distance between the land and the reef increases. The **fringing reef develops into a barrier reef**.

Step 3: If the island completely subsides, all that is left is the reef. The reef retains the approximate shape of the island it grew around, forming a ring enclosing a lagoon.



Atoll Formation in the Indo-Pacific

ECOLOGY AND GEOLOGY OF CORALS

- **ECOLOGY**-In the broadest sense, coral can be divided into two major groups: hermatypic coral which possess zooxanthellae and build the colonial reefs found in tropical areas and ahermatypic coral which do not possess zooxanthellae, by contrast, tend to be solitary in habit and they can be found in the deep, dark cold waters of the polar seas.

Coral do best in water of normal salinity. In fact, they can not survive in fresh water or even in brackish water. An additional environmental control on reef development is water turbidity, producing muddy waters.

Human impact is adversely affecting the ecology of many of the world's reef systems. Deforestation of rainforest for lumber and farming, for example, results in severe soil erosion. Additionally, overfishing, tourism, industrial and municipal effluents are having an impact on coral reefs worldwide as never before. Finally, slight rises in water temperature are forcing coral polyps to expel their symbiotic algae, the zooxanthellae, causing the coral to turn white and eventually die.



ECOLOGY AND GEOLOGY OF CORALS

- **GEOLOGY:** From his study of Pacific coral reefs, Darwin recognized three distinctive kinds of reef; **the fringing reef, the barrier reef and the atoll.** Fringing reef form limestone shorelines around islands and the tropical areas of continents. Barrier reef grow further offshore and are separated from the mainland by a lagoon. Atolls are found in the open ocean, far from land and consist of ring, oval, or horse-shoe shape.
- Calcareous [algae](#) (stony seaweeds), [mollusks](#), [echinoderms](#), and [protozoans](#) also contribute to the reef. Different organisms have different reef-building roles. Some, especially the corals, provide the main structural framework of the growing reef, although in parts of the world such as the central Pacific, where the surf is very strong, calcareous algae may be more important in the roughest places. Almost all shelly and calcareous organisms and those with spicules, such as [sponges](#) and [sea cucumbers](#), provide fragments that [wash](#) into or fall into the gaps between corals. Other organisms, especially algae and protozoans, bind and cement everything together with sheetlike growth. ped reef structures that enclose a lagoon.

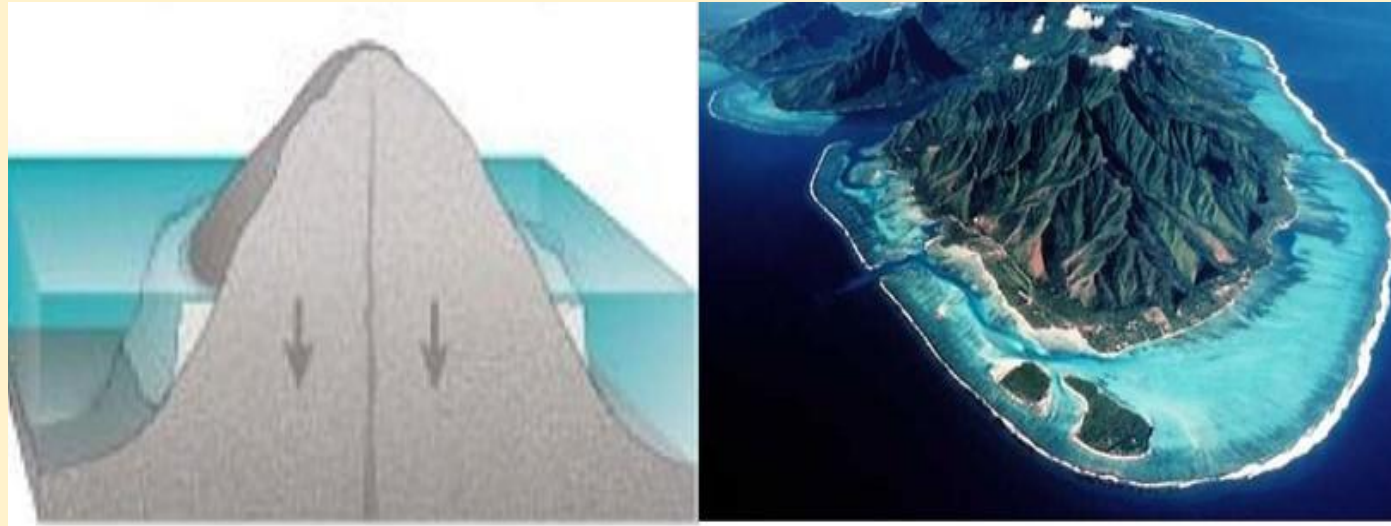
FRINGING REEF

- **Fringing Reefs (Shore Reefs)**-Fringing reefs are reefs that **grow directly from a shore**. They are located very **close** to land, and often form a **shallow lagoon** between the beach and the main body of the reef.

A fringing reef runs as a narrow belt [1-2 km wide]. This type of reef grows from the deep sea bottom with the seaward side sloping steeply into the deep sea. Coral polyps do not extend outwards because of **sudden and large increase in depth**.

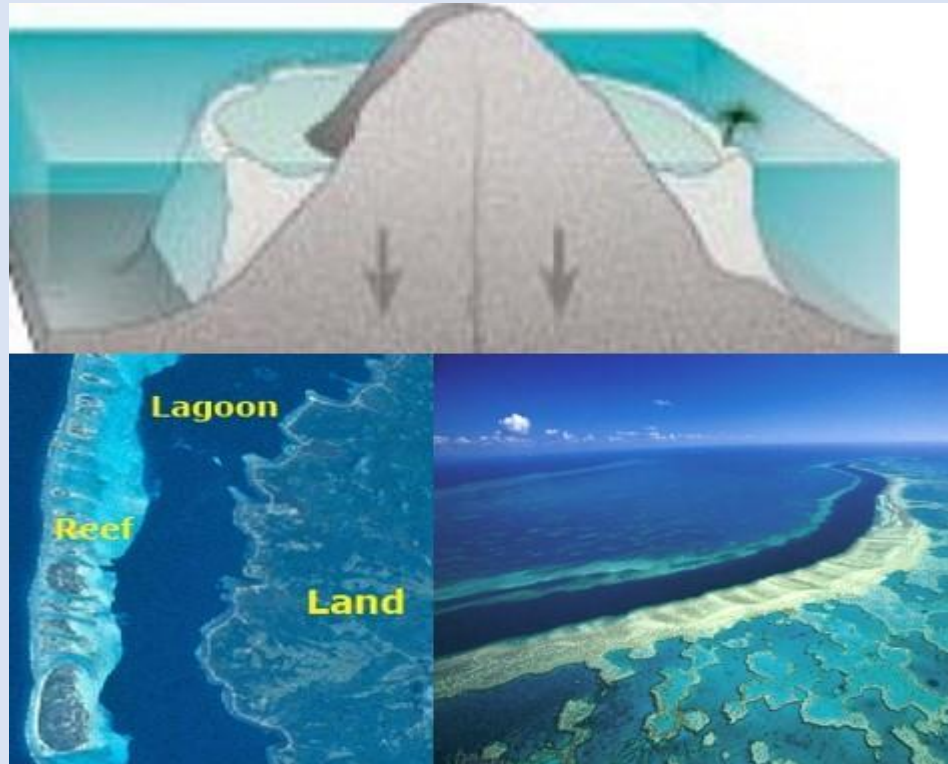
The fringing reef is by far the **most common** of the three major types of coral reefs, with numerous examples in all major regions of coral reef development.

Fringing reefs can be seen at the New Hebrides Society islands off Australia and off the southern coast of Florida.



BARRIER REEF

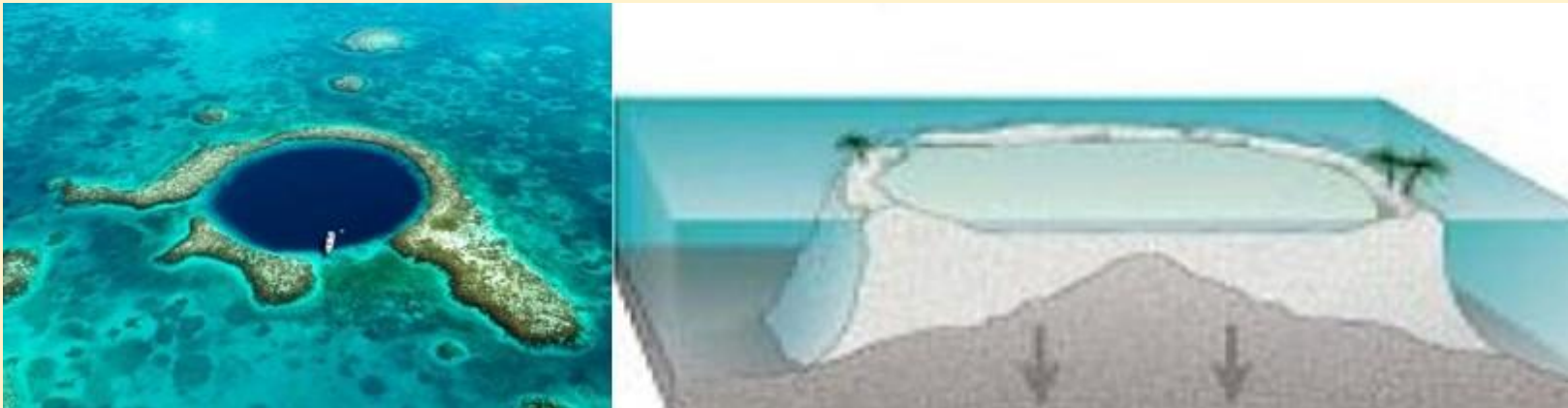
- **Barrier Reefs-** Barrier reefs are **extensive linear reef** complexes that **parallel a shore**, and are separated from it by **lagoon**. This is the **largest (in size, not distribution)** of the three reefs, runs for hundreds of kilometres and is several kilometres wide. It extends as a broken, irregular ring around the coast or an island, running almost parallel to it. Barrier reefs are **far less common** than fringing reefs or atolls, although examples can be found in the tropical Atlantic as well as the Pacific. The **1200-mile long Great Barrier Reef** off the NE coast of Australia is the world's largest example of this reef type. The GBR is not actually a single reef as the name implies, but rather a very large complex consisting of **many reefs**.



ATOLL

- **Atolls-** An atoll is a roughly circular (annular) oceanic reef system surrounding a large (and **often deep**) **central lagoon**. The lagoon has a depth 80-150 metres and may be joined with sea water through a number of channels cutting across the reef. Atolls are located at **great distances** from deep sea platforms, where the submarine features may help in formation of atolls, such as a **submerged island or a volcanic cone** which may reach a level suitable for coral growth. An atoll may have any one of the following three forms- (1) **true atoll—a circular reef enclosing a lagoon with no island**; (2) **an atoll surrounding a lagoon with an island**; and (3) **a coral island or an atoll island which is, in fact, an atoll reef, built by the process of erosion and deposition of waves with island crowns formed on them.**

Atolls are **far more common in the Pacific** than any other ocean. The **Fiji atoll** and the Funafuti atoll in the Ellice/Island are well known examples of atolls. A large 'number of atolls also occur in the **Lakshadweep Islands**. In the South Pacific, most atolls occur in mid-ocean. Examples of this reef type are common in **French Polynesia**, the **Caroline and Marshall Islands**, **Micronesia**, and the **Cook Islands**. The Indian Ocean also contains numerous atoll formations. Examples are found in the **Maldives** and **Chagos island groups**, the **Seychelles**, and in the **Cocos Island group**.



FAVOURABLE CONDITION

- (1) **Shallow Water-Coral** reefs must develop in areas of shallow water. The distance between the reef's surface and the water's surface should not exceed 80 metres. The photosynthetic activities carried out by the Zooxanthellae require sufficient sunshine.
- (2) **Hard or Semi-hard Surfaces-The** coral polyp skeletons must be compacted, cemented, and solidified on a semi-hard or hard surface.
- (3) **Clean water-In** locations with seas that are heavily contaminated with sediment, the lovely coral polyps die. Additionally, they vanish from seas that are murky. This is due to the fact that the presence of sediments and murky water restricts the amount of sunlight that can reach the algae that support their existence.
- (4) **Lukewarm water-The** warm ocean waters are intimately related to coral reefs. The water must be close to 20 degrees in temperature. So, coral reefs typically predominate on a continent's eastern shore. This is not the situation with India, either, as the eastern seas are heavily contaminated with sediment.
- (5) **Waters splashed with salt-The** growth of coral polyps is greatly aided by the little saltiness of ocean waters. For the purpose of preserving their skeletons, the polyps draw calcium from the water. Therefore, for coral reefs to thrive, there must be a low salinity environment.
- (6) **Rich nutritional supply-Because** of the consistent flow of nutrient-rich water supported by ocean waves, coral reefs thrive in seawater. Coral polyps multiply more quickly when given nourishment.

IMPORTANCE

Coral Reef Importance:

Corals are essential to the marine ecosystem's health. They are referred to as the ocean's rainforests since they are home to a variety of habitats. Many different kinds of fish can dwell in corals. The marine ecosystem's main source of food is corals.

(1) Coastal Defence- The coastal regions are shielded by coral reefs from powerful ocean currents and waves. They offer defence against cyclones and ocean storms. These natural barriers have gained extra importance as storms in India are becoming more frequent as a result of climate change.

(2) Food supply- Fish that are found in and around coral reefs provide millions of people, mostly those who live along coastlines, with a wholesome supply of protein. Some fishing companies rely only on coral reefs and the fauna they draw.

(3) Medicinal attributes- As the sea's pharmacy, coral reefs are believed to be. The corals draw certain fish, and some of those fish leave behind chemical residues that resemble those seen in hospitals.

(4) Meteorology- According to a recent study by the Indian Institute of Meteorology, corals along the north-western coast provide information on the patterns of the arrival and departure of the Indian monsoon.

(5) Tourism- Due to these stunning corals, the tourism industry accounts for the majority of the gross domestic product (GNP) of nations with coral reef industries. According to research, coral reefs are worth \$10 billion, and they provide about \$360 million in direct economic benefits annually.

THREATS

Threats to Coral Reefs-

(1) **Global Warming-** The coral ecosystem is in danger because of the increasing acidity of the oceans brought on by global warming. Additionally, as glaciers throughout the planet melt, sea levels are rising. Because of inadequate sunshine and drowning caused by rising sea levels, coral reefs grow slowly.

(2) **Coral Bleaching-** When the waters get warmer, coral bleaching occurs. Due to their limited temperature tolerance, corals experience stress and emit symbiotic algae as a result. They lose their source of life when the algae is gone, which results in their extinction.

(3) **Marine debris-** Corals are dying because of marine pollution brought on by plastic waste and other activities. To breathe, coral reefs require both air and space. We might lose them sooner than we anticipated due to the increasing levels of sea pollution.

(4) **Stronger Storms and Acidification of the Ocean-** Increased storm intensity has resulted in ocean waves that break and harm coral reefs. They may even destroy colonies and make them dangerous places to live. The pH levels rise as more and more CO₂ is absorbed by the water. Coral skeletons weakened by high pH levels are more susceptible to disease and storm damage.

(5) **Ozone depletion-** Coral polyps have in-built UV rays protection. However, now that the radiation is increasing, the corals in shallow waters can get damaged and destroyed.

(6) **Over fishing, (7) Agricultural practices, (8) Industrial effluents, and (9) Coastal development and Tourism.**

