

BIODIVERSITY OF CORAL REEF ECOSYSTEM

Dr. P. SANTHANAM

Assistant Professor

Marine Planktonology & Aquaculture Lab.,

Department of Marine Science, School of Marine Sciences

Bharathidasan University, Tiruchirappalli-620 024, Tamil Nadu.

E-mail: santhanam@bdu.ac.in

Website: www.mpalbdu.weebly.com

Biodiversity of Coral reef ecosystem

Coral reefs include a wide range of diversity, with 32 of the world's 34 animal phyla present.

Coral reefs produce 2500 g/m²/yr biomass in comparison with 125 g/m²/yr in the open ocean.

The clarity of water in the reef ecosystem allows sunlight to penetrate deeply so that high levels of photosynthesis occur in the algae living mutualistically inside the coral.

Extensive niche specialization among coral sp, and adaptations to varying levels of disturbance may also account for the high species richness found in coral reefs.

Biodiversity of Coral reef ecosystem

- ❖ The world's largest coral reefs is Australia's Great Barrier reef, with an area of 3,49,000 km². The Great Barrier reefs contains over 350 sp. of coral, 1500 sp. of fish, 4000 sp. of molluscs & 5 sp. of turtles and provides breeding sites for some 252 sp. of birds (IUCN/UNEF 1988)
- 0.1 % of ocean surface area, the great Barrier reefs contains about 8% of the world's fish species (Gold man & Talbot, 1976)
- More than 2000 fish species are found in the Philippine islands, 448 sp. found in the Mid-Pacific Hawaiian Islands and 500 sp. around the Bahama Islands.

Biodiversity of Coral reef ecosystem

- Compared to tropical coral reefs, the number of marine fishes in temperate areas is low.
- The mid-Atlantic seaboard of North America has only 250 fish sp., Mediterranean has fewer than 400 sp.
- Most of the animals inhabiting coral reefs are smaller in size and poorly studied, tens of thousands of species or more still await discovery and description.

Reef Distribution

- Coral reefs are highly productive with annual production rates ranging from 2,000 to 5,000 g C/m²/yr.
- In the Indian subcontinent, the reefs are distributed along the east and west coasts at restricted places and all the major reef types are present.
- Fringing reefs are found in the Gulf of Mannar and Palk Bay. Platform reefs are seen along the Gulf of Kachchh. Patchy reefs are found near Ratnagiri and Malwan coasts. Atoll reefs are found in the Lakshadweep archipelago. Fringing and barrier reefs are found in Andaman and Nicobar islands.
- A total of 155 hermatypic coral species belonging to 50 genera and 44 ahermatypic species belonging to 21 genera have been recorded from the Indian coral reef areas.

Reef Distribution

Category	Extent of Coral Reef (Km ²)			
	Gujarat	Tamil Nadu	Lakshadweep Islands	A&N Islands
Reef flat	148.4	64.9	136.5	795.7
Sand over reef	11.8	12.0	7.3	73.3
Mud over reef	117.1	-	-	8.4
Coraline shelf	-	-	230.9	45.0
Coral heads	-	-	6.8	17.5
Live coral platform	-	-	43.3	-
Algae	53.8	0.4	0.4	-
Seaweeds	-	-	0.7	-
Seagrass	-	-	10.9	-
Reef vegetation	112.1	13.3	-	8.9
Vegetation over sand	17.0	3.6	0.4	10.5
Lagoon	-	0.1	322.8	-
Sandy substrate	-	-	(67.4)	-
Reef patch	-	-	(13.4)	-
Deep	-	-	(98.5)	-
Uncertain	-	-	(143.5)	-
Total	460.2	94.3	816.1	959.3

Source: DOD & SAC, 1997

Reef Distribution

- In Indian waters, totally 218 species under 60 genera and 15 families were reported (Venkataraman *et al.*, 2003).
- Among the four major reef areas of India, Andaman and Nicobar islands are rich in coral species diversity whereas those of Gulf of Kachchh is poorer.
- Lakshadweep islands have more number of species than the Gulf of Mannar.

Reef Distribution

Among the deepwater corals, so far 686 species belonging to 110 genera and 12 families have been reported from the world of which 227 species belonging to 71 genera and 12 families have been reported from the Indian Ocean region

Species composition in different areas of India

Andaman & Nicobar island - 180

Gulf of Mannar - 94

Lakshadweep - 104

Gulf of Kutchchh - 36

CORAL REEF DISTRIBUTION OF KERALA COAST

- A well preserved, submerged assemblage of **Scleractinian corals** observed from a well dug to a depth of 8 m from the present mean sea level (MSL) and about 8 km inland, at Vazhakala near Cochin (Kerala).

Family	Name of Species
Pocilloporidae	<i>Pocillopora damicornis</i>
	<i>P. verrucosa</i>
Acroporidae	<i>Acropora formosa</i>
	<i>Montipora tuberculosa</i>
Poritidae	<i>Porites</i> sp. (indeterminable)
Favidae	<i>Favia palliada</i>
	<i>Goniastrea retiformis</i>
	<i>Leptastrea transersa</i>
	<i>Platygyra lamellina</i>
	<i>Leptoria phrygia</i>
Oculidae	<i>Galaxea astreata</i>
Caryophylliidae	<i>Heterocyanthus aequicostatus</i>

CORAL REEF DISTRIBUTION OF GOA COAST

- Three species of reef building corals : *Porites* (*Porites*) *lutea*, *Favites* *pentagona* and *Turbinaria* *mesenterina* were recorded near Grandi island, off Marmagoa (Goa).
- A non-reef building solitary coral of the Atlantic region *Astrangia* *sp.* was also recorded and could have been introduced in Indian waters due to maritime activities

CORAL REEF DISTRIBUTION OF THE GULF OF KACHCHH

- The coral fauna of the Gulf of Kachchh includes **36 species** coming under 20 genera.
- The eulittoral pools had discontinuously distributed coral species such as *Turbinaria*, *Montipora*, *Favia*, *Leptoria*, *Porites*, *Leptastrea*, *Goniopora* and *Goniastrea*.
- The submerged reefs of this area can be classified into four zones such as **Shoreward reef**, **Back reef**, **Surface reef** and **Oceanic reef**. Coral composition of the submerged reefs was made of *Turbinaria*, *Montipora*, *Porites*, *Symphyllia*, *Favia*, *Favites*, *Goniopora*, *Goniastrea*, *Leptoria*, *Podabacia*, *Pavona*, *Hydnophora* and *Leptastrea*.

CORAL REEF DISTRIBUTION OF THE LAKSHADWEEP ISLANDS

- A total of 104 scleractinian corals belonging to 37 genera was reported from this region (Gopinadha Pillai and Jasmine, 1990)
- The genus *Acropora* is the commonest as is the case with all the Indian Ocean reefs and forms about 25% of the total species known from Minicoy. A notable feature of the coral fauna of Lakshadweep is the absence of foliaceous forms such as *Montipora foliosa* and *Echinopora lamellosa*. The massive coral species such as *Porites solida*, *P. lutea* and *Diploastrea* sp. are very common in Minicoy (Gopinadha Pillai, 1986)

CORAL REEF DISTRIBUTION OF THE GULF OF MANNAR

- **Ninety four scleractinian coral species** under 37 genera were recorded in the **Gulf of Mannar and Palk Bay** (Gopinadha Pillai, 1973)
- Of the **18 species of stony corals** recorded from Tuticorin, *Acropora formosa*, *Porites compressa*, *P. somaliensis*, *Favia valenciennesi* and *Tubipora sp.* alone contribute 82% (Santhanam and Venkataramanujam, 1996).
- *Montipora* and *Acropora* put together constitute 39% of the total species recorded and species belonging to *Poritidae* and *Faviidae* constitute the dominant reef builders here (Gopinadha Pillai, 1971)

CORAL REEF DISTRIBUTION OF THE ANDAMAN AND NICOBAR ISLANDS

- Andaman and Nicobar islands comprise 180 species of scleractinian coral species belonging to 59 genera. Species of *Alveopora*, *Coeloseris*, *Seriatopora*, *Plerogyra*, *Physogyra* and *Oulastrea* are present here.
- The reefs of Andaman are dominated by either *Acropora* sp. or massive *Porites* sp. in different parts. Wherever *Acropora* sp. is dominant *Porites* sp. is scarce and vice versa.
- Nearly 4% of the reef area of Mahatma Gandhi Marine National Park was covered with live and luxuriant corals of different species. Soft corals formed about 3% and dead corals 36% of the reef areas. Of the 31 corals recorded under 25 genera, *Acropora*, *Porites* and *Millepora* were the dominant forms

Reef Distribution Limiting factors

- Temperature-Nearly all found within the 20°C surface isotherm
- Depth-25 m of water or less due to hermatypic requirement for light to support symbiotic algae (zooxanthellae)
- Light Intensity-Compensation intensity appears to be about 1-2% of surface intensity
- Salinity-intolerant of salinities that deviate significantly from normal seawater
- Runoff/Sedimentation-cannot withstand heavy sedimentation. Sedimentation also causes turbidity which impacts light intensities

Reef Distribution Limiting factors

Species Interaction

- Competition-Space is a primary limiting factor in coral reefs
- Exploitative Competition-one species extends itself up and over another in competition for light. Where this occurs, the encrusted species does not get sufficient light and the part in the shade dies.
- At surface levels, faster growing corals will overtop massive, slower growing corals and kill them.
- Adaptation of slower growing corals include shade tolerance, so they can grow at greater depth
- Interference Competition-slow growing species can extend digestive filaments which kill adjacent competing species.
- There is also competition between corals and other species, especially algae. Competition among corals and algal forms is reduced by grazing

Reef Distribution Limiting factors

- Predation-Many species graze the coral polyps as well as the algae in reefs.
- Species tend to be dietary specialists, feeding on only one type of coral and have a tendency to prey on faster growing corals.
- **Crown of thorns starfish** is capable of destroying an entire colony, if not controlled by symbiotic shrimp that repulse the starfish.
- 2 groups of grazers: the corallivores which specifically target the coral polyps, and the multivores, which remove coral polyps to get at algae or other boring invertebrates

Reef Distribution Limiting factors

Role of Algae

- Cementing action of coralline algae
- Formation of algal ridge breaks velocity of waves allowing for presence of other organisms in the reef flats
- Green algae are contributors to sand found in reefs
- Some algae are important as nitrogen fixers
- *Primary Producers*

Reef Distribution Limiting factors

Catastrophic Mortality and Reef Recovery

- Suffer from major large-scale destructive forces.
- Severe tropical storms.
- Population explosions of predators, especially the sea star.
- El nino – causes temperature elevation and local redirection of water levels which result in large tracts of reef being damaged.
- Coral bleaching – corals expel their zooxanthellae. This can be a result of higher water temperature due to changing local weather patterns and may be an early warning sign of global warming.

Reef Distribution Limiting factors

Human activity

- dredging
- Pollution
- Overfishing