

# BIORESOURCES AND COMMERCIAL UTILIZATION: TRENDS, MARKET, SUPPLYCHAIN, AND SUSTAINABILITY



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Kailasam, T.C.24/3219, No. 43,  
Belhaven Gardens, Kowdiar P.O.,  
Thiruvananthapuram - 695 003

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Published By  
**Member Secretary**  
Kerala State Biodiversity Board

February 2022

ISBN: 978-93-5620-348-8

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**Editors**

Dr. C. George Thomas  
Dr. Preetha Nilayangode



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## 3.1 CORAL RESOURCES OF KERALA

Jasmine S<sup>1</sup>. and Divya Viswambharan<sup>2</sup>

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### Corals and Coral reefs

Coral reefs are marine ecosystems made of calcium carbonate structures which are mostly secreted by reef-building corals and encrusting macroalgae. These reefs occupy less than 0.1% of the marine world and provide habitat for wide variety of marine organisms including fishes. Corals are of two types, hard coral and soft corals. Hard corals come under the phylum Cnidaria and the class Anthozoa. Hard corals are commonly known as stony corals (scleractinians) as they produce a rigid skeleton made of aragonite which is basically Calcium carbonate. Due to the presence of hard skeleton, they form the primary or the keystone species in coral reefs. Each coral colonies in the reef comprises millions of individual polyps, which are joined together by the calcium carbonate secrete. Soft corals belong to the phylum Cnidaria and the class Alcyonacea. They are commonly known as soft corals as they fail to produce the rigid calcium carbonate structure. They are colonial ahermatypic corals and they are the second most abundant benthic organism in the coral reefs of the world. Other than these corals the coral reef ecosystem provides a nurturing habitat for a wide variety of marine life, including various sponges, oysters, clams, crabs, sea stars, sea urchins, and many species of fish. These reefs also help in coastal protection, and provide an appealing environment for tourism.

### Uses of corals and coral reefs

Coral reefs are commonly called the rainforests of the sea due to species diversity and high productivity. A healthy reef provides habitat to various marine organisms, provide food and generate income for the local community, act as a natural barrier for the coast. Some of the soft corals have chemical compounds with proven therapeutic uses. The corals are used in cement industries as well as in jewelleryes. Live corals are also traded in marine aquarium industries around the world. In India, the blanket ban on the collection and sale of corals have resulted in illegal trade of corals. There is no recent evidence on illegal coral collection from Kerala coast but Jasmine et al. (2009) has recoded the removal of live coral colonies for ornamental reef fish trade by the local people at Vizhinjam.

### Coral reefs of India and Kerala

The coral reef cover of India is estimated to be 2374 sq.km. which includes the sensitive fringing reef ecosystems of Gulf of Mannar, Palk Bay, the Gulf of Kutch, the atolls of the Lakshadweep Islands and the continental island reefs of Andaman and Nicobar. Apart from these major reefs, there are patches of coral reefs in the intertidal and sub-tidal regions of the main land as well as from the in-shore and off-shore rocky islands along the west coast of India. Apart from these, submerged deep-water coral reefs were reported from Quilon bank (Pillai and Jasmine, 1995), Gaveshini Bank (Nair and Qasim, 1978), and Angria Bank. These patch as well as submerged reefs have reported nearly 36 genera of various hard corals (Viswambharan et al., 2021).



Kerala coast does not have any major coral reefs but patch coral reefs were recorded in the intertidal, subtidal and submerged sites along its coast. Patch corals were recorded from the coastal waters of Vizhinjam, Kovalam, Thumba, Thankashery, Thirumullavaram and Thikkodi along the Kerala coast. Occurrences of deep water hard corals were also recorded from various depths off Travancore and Quilon coast. Other than these records, submerged Scleractinian assemblage belonging to Pleistocene and Holocene periods were obtained from a Vazhakala, near Cochin (Pillai et al., 1999).

### **Diversity and distribution of deep-water hard corals**

The recording of hard corals, off Kerala Coast could be dated back to the last decade of 19<sup>th</sup> Century. The Royal Indian Marine Survey Ship "Investigator" has done deep-water surveys all along the Indian coast, and this survey has recorded deep-water hard corals off Travancore coast. Most of these collections were from the depth of 787m and hence were ahermatypic corals (Alcock, 1898). Alcock in his book has stated that the deep-water corals are found in great abundance and variety in sea which is sandwiched between the Laccadive and Maldives Islands on the west and the Malabar coast on the east. There is particular mention in the book regarding a 'spot' off the Travancore coast, at a depth of about 787m depth have dredged nearly half a ton of living and dead coral in a haul, which was a considered strange by the naturalists on the 'RMS Investigator'. After this record, there seems to be no record of the coral fauna of this area in literature for nearly a century, until survey and collections of hard corals were made by FORV Sagar Sampada. Pillai and Jasmine (1995) had recorded 16 ahermatypic corals dredged from a depth of 40 to 100m off Quilon bank, all of which were dredged by FORV Sagar Sampada. After these records, no extensive studies were observed on deep-sea hard coral species along the coast. There are limited exploratory surveys for exploring submerged reefs and much of these known submerged deep-sea areas along the Kerala coast have not been studied in detail. Hence there is need for more exploratory surveys along the coast to bring out the rich diversity of the region.

### **Diversity and distribution of shallow water hard corals**

The first survey which explored patch coral reef along the Kerala coast was done during 1987 to '89 between Vizhinjam and Enayam by Vizhinjam Research Centre of ICAR-CMFRI (Pillai and Jasmine, 1995). This study had documented 29 species belonging to 17 genera of scleractinians in the intertidal and subtidal regions of Vizhinjam and Enayam coast. The investigation has also thrown light on the harvesting and sales of hard corals which prevailed at Enayam during the survey period. Extensive survey conducted nearly 15 years after the initial study could record only 15 species from Vizhinjam and Enayam areas (Jasmine et al., 2009; George et al., 2019). The decrease in species diversity observed during the later study was attributed to the destruction caused to the reef due to the removal of live coral colonies for ornamental reef fish trade by the local people at Vizhinjam (Jasmine et al., 2009). In Vizhinjam colonies are found to occur in the natural rocks and also in the huge granite and concrete boulders used as wave breakers.

In 2019, presence of numerous colonies of hard corals were reported at Kovalam and St. Andrews Beach, near Thumba by Department of aquatic biology and fisheries, University of Kerala and an NGO (Friends of Marine Life – FML (Times of India)). The team had conducted 3-year survey and report the occurrence of multiple species of hermatypic hard corals. These corals were observed in the intertidal and subtidal region at 1-4m depth at Kovalam and upto 20m depth at St. Andrews beach, Thumba. The species composition of hard corals in these areas are yet to be published and survey team has expressed their concern on the plastic pollution and impact of discarded fishing nets on the health of corals in these areas.

Patch and spares coral distributions were recorded from the Thirumullavaram and Thankassery Harbour in Kollam (George et al., 2019). In the intertidal areas of Thirumullavaram, colonies of *Porites lutea* and *Favites sp.* were observed and *Porites lutea* forms the major coral colony. Bleached and diseased corals were more prominent in these intertidal reefs of Thirumullavaram and it was also observed that the rocky patches along with live and dead corals were dominated by algae. The hard coral spread around Thankassery Harbour in Quilon were found to be dominated by Pocilloporids. The region recorded *Pocilloporadamicornis*, *P. verrucosa* and *P. meandrina* in minor quantities. The coral cover of both Thirumullavaram and Thankassery was found to be declining due to heavy siltation during monsoon season. The subsequent reduction in siltation in post and pre-monsoon will helps in the revival and growth of the existing coral colonies (George et al., 2019).

Recent surveys conducted by Kozhikode regional station of ICAR-CMFRI in the inter-tidal areas of Thikkodi coast, Kozhikode has recorded the presence of few hard coral species in the area. The survey recorded multiple colonies of *Pseudosiderastreatayami* and *Porites lutea* in rocky reef of Thikkodi (personal communication- Dr. Vinod K., ICAR-CMFRI). The reef patch is reported to be healthy though incidence of seasonal bleaching were observed by the researchers. The list of deep water hard corals off Kerala coast and hard coral species recorded from Enayam and Vizhinjam areas were given in Table 1 and 2, respectively.

**Table 1.** The list of deep water hard coral species recorded from off Kerala coast

SI No	Off Kollam (Pillai and Jasmine, 1995)	Off Travancore (Alcock, 1898)
1.	<i>Cladangiaexusta</i>	<i>Caryojiliylliacominunis</i>
2.	<i>Paracyathusstokesi</i>	<i>Caryophyllia paradoxus</i>
3.	<i>Paracyathusprofundus</i>	<i>Desmophyllum vitreum</i>
4.	<i>Caryophyllia paradoxus</i>	<i>Lophoheliainvestigatoris</i>
5.	<i>Caryophyllia clavus</i>	<i>Solenosmiliajeffreyi</i>
6.	<i>Caryophylliaarcuata</i>	
7.	<i>Heterocyathusaequicostatus</i>	
8.	<i>Solenosmilia variabilis</i>	
9.	<i>Flabellum stokesi</i>	
10.	<i>Balanophylliagumingii</i>	
11.	<i>Endopachysgrayi</i>	
12.	<i>Heteropsammia cochlea</i>	
13.	<i>Tubastraeaaurea</i>	
14.	<i>Dendrophyllia indica</i>	
15.	<i>Dendrophylliacornigera</i>	
16.	<i>Dendrophylliaminuscula</i>	

**Table 2.** The list of hard coral species recorded from patch coral reefs of Enayam and Vizhinjam

SI No:	Species	Pillai and Jasmine (1995)	George et al. (2019)
1	<i>Pocilloporadamicornis</i>	*	*
2	<i>Pocilloporaverrucosa</i>	*	*
3	<i>Pocilloporameandrina</i>	*	*
4	<i>Pocilloporaligulata</i>	*	
5	<i>Pocilloporawoodjonesi</i>		*
6	<i>Pocilloporaeydouxii</i>	*	*
7	<i>Acropora efflorescens</i>	*	*
8	<i>Acropora hyacinthus</i>	*	
9	<i>Acropora variabilis</i>	*	
10	<i>Montiporaaequituberculata</i>		*
11	<i>Montiporafoliola</i>	*	
12	<i>Montiporaverrilli</i>		*
13	<i>Montiporaturgescens</i>	*	*
14	<i>Montiporahispida</i>		*
15	<i>Montiporamillepora</i>		*
16	<i>Porites lutea</i>		*
17	<i>Porites lichen</i>	*	*
18	<i>Goniastreaplectinata</i>		*
19	<i>Favitesabdita</i>	*	
20	<i>Pseudosiderastreatayami</i>	*	
21	<i>Turbinariamesenterina</i>	*	*
22	<i>Tubastreaaurea</i>	*	
23	<i>Dendrophyllia indica</i>	*	
24	<i>Dendrophylliacornigera</i>	*	
25	<i>Dendrophylliaminuscula</i>	*	
26	<i>Endopachysgrayi</i>	*	
27	<i>Heteropsammia cochlea</i>	*	
28	<i>Flabellum stokesi</i>	*	
29	<i>Solenosmilia variabilis</i>	*	
30	<i>Heterocyathusaequicostatus</i>	*	
31	<i>Paracyathusstokesii</i>	*	
32	<i>Paracyathusprofundus</i>	*	
33	<i>Caryophylliaarcuata</i>	*	
34	<i>Cladangiaexusta</i>	*	

Though only patch reefs and deep-water corals are reported, the coral assemblages are less diverse in the Kerala coast. Most of the hermatypic corals found in these reefs are encrusting, massive or foliose, while a few species of *Pocillipora* and *Acropora* are of the 'ramose-form'. As observed in common, the conducive environmental conditions, larvae exchange from the major reefs (Atolls of Lakshadweep and Maldives as well as Gulf of Mannar and Palkbay),

availability of hard substrates like rocky reefs for attachment and growth has led to the establishment of coral in these patch reefs.

### Soft corals of Kerala

The estimated soft coral diversity is nearly 2000-4000 species while, India has recorded only 253 species belonging to 21 families and 66 genera (Padmakumar and Chandran, 2012). There are very few studies on the distribution and diversity of soft corals along the Kerala coast. Nearly 21 species of soft corals are recorded from Kerala coast, most of which are from the coastal waters of Thiruvananthapuram and deep water off Quilon bank. The list of soft coral species record and their distribution are given in Table 3.

**Table 3.** List of soft coral species recorded from South west coast including Kerala coast (Padmakumar and Chandran, 2012).

Between Vizhinjam and Kanyakumari coast	Vizhinjam coast	Kovalam coast	Off Quilon coast	South west coast of India
<i>Scirpearia filiformis</i>	<i>Junceella juncea</i>	<i>Carijoarisei</i>	<i>Acanthogorgia ceylonensis</i>	<i>Junceella juncea</i>
<i>Ellisella andamanensis</i>	<i>Gorgonellaum brachulum</i>		<i>Acanthogorgia turgida</i>	<i>Gorgonellaum brachulum</i>
<i>Ellisellam aculata</i>	<i>Leptogorgia australiensis</i>		<i>Gorgonellaum brachulum</i>	<i>Leptogorgia australiensis</i>
<i>Gorgonella rubra</i>	<i>Echinogorgia flora</i>		<i>Echinomuricea andamanensis</i>	<i>Echinogorgia flabellum</i>
<i>Muricella complanata</i>	<i>Echinogorgia flabellum</i>		<i>Parisisfruticosa</i>	
<i>Echinomuricea indica</i>			<i>Echinogorgia flabellum</i>	
<i>Echinogorgia reticulate</i>			<i>Muricella dubia</i>	
<i>Echinogorgia flora</i>			<i>Ellisellam aculata</i>	
<i>Echinogorgia flabellum</i>			<i>Gorgonellaum brachulum</i>	
<i>Echinogorgia complexa</i>				

### Threats faced by corals and coral reefs

Coral reefs are one most delicate ecosystems of the world and any slight disturbance can lead to severe damage to this ecosystem. The major threats faced by coral reefs include climate change, ocean acidification, pollution, disease out-break, increased sedimentation, marine debris, illegal collection for trade, destructive fishing practice, irresponsible tourism, and coral mining.

### Coral reef conservation in India

The coral reefs of India come under the dominion of the Ministry of Environment, Forests and Climate Change, Government of India. The MOEF&CC is entrusted to develop laws and action plan to manage and conserve the coral reef resources. In India, law and policy specifically for coral reef conservation is virtually non-existent. Few laws can be indirectly used for the protection and conservation of coral reef areas. These include the Coastal Regulation Zone Notification of 1991 issued under the broad Environment (Protection) Act, 1986, as well as the Wildlife (Protection) Act, (WPA) 1972. The other laws that would help in conservation of coral reef areas are the Indian Forest Act, 1927; the Forest Conservation Act, 1980 and the Indian

Fisheries Act, 1897. All the reef building corals (all Scleractinians), Black corals (All Antipatharians), Organ pipe coral, Fire coral (all *Millipora* species) and Sea fan (all Gorgonians) are protected under the Sch 1 (Part IVA) of the Wildlife Protection Act (1972). One of the most powerful measures for conservation of coral reefs in India was by establishing Marine Protected Areas (MPAs). With scientific monitoring and community participation, the coral ecosystems are sustained in their pristine condition by minimising anthropogenic interventions. India has designated four legal categories of protected areas: National Park, Wildlife Sanctuary, Conservation Reserve and Community Reserve. Other than the blanket protection given under the Sch 1 (Part IVA) of the Wildlife Protection Act (1972), there is no MPAs aimed to protect and conserve patch corals in Kerala. The corals outside the purview of MPAs' are not included in the WPA and hence it is difficult to take action against offenders outside the national park (Baswapoor and Irfan, 2018).

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