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ON

LIVING RESOURCES *of* THE SEAS AROUND INDIA

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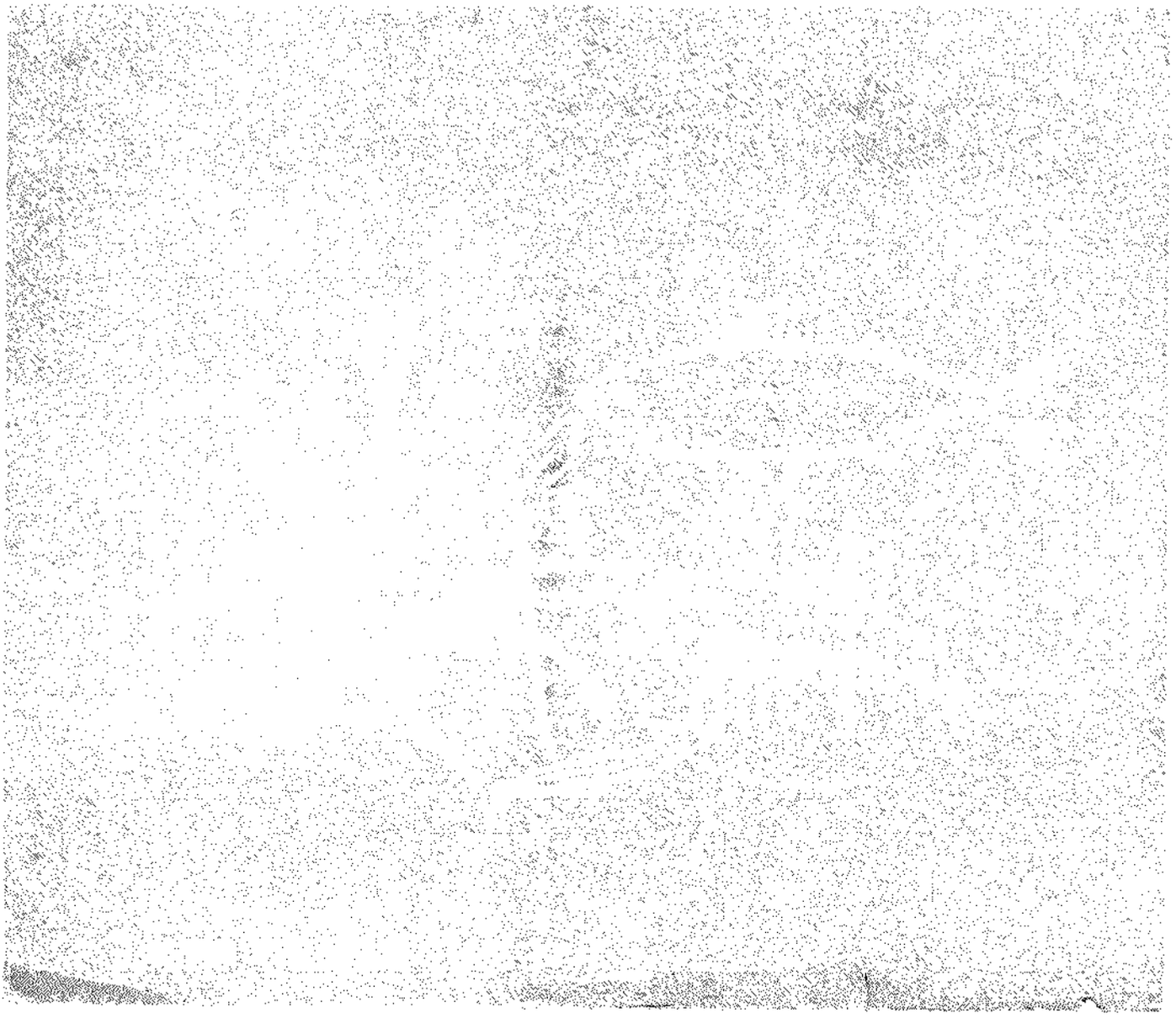

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CORAL RESOURCES OF INDIA WITH SPECIAL REFERENCE TO PALK BAY AND GULF OF MANNAR

C. S. GOPINADHA PILLAI

Central Marine Fisheries Research Institute, Mandapam Camp

ABSTRACT

Coral formations are found within the seas around India, in the Gulf of Kutch, in Andaman and Nicobar Islands, in Palk Bay and Gulf of Mannar on the eastern coast and in the Laccadive Archipelago. In the former areas we have fringing reefs whereas the whole of Laccadives are atolls. These reefs harbour a rich and varied coral fauna of appreciable economic importance. The black coral of commerce—*Antipatharia*—is found to occur in the Gulf of Mannar and in the Laccadives at a depth of about 5 to 200 metres. But the feasibility of their commercial exploitation still remains to be ascertained. The blue coral (*Heliopora*) is available in large scale in Laccadives at moderate depths.

The most important commercially valuable corals of the Indian coasts are the scleractinias. They form a major source of calcium carbonate and are used in the preparation of calcium carbide, lime and cement, besides as building blocks and in the construction of roads. The corals from Palk Bay and Gulf of Mannar around Mandapam are brought ashore in large quantities for the above purposes affording livelihood for about 500 people. A quantitative estimation of the potential exploitable stock is yet to be made. In the present paper a qualitative analysis of the commercially important corals of this area, based on field studies and survey of the exploited stock, is given. A few problems on conservation are also suggested.

INTRODUCTION

CORALS form one of the major marine tropical communities of appreciable economic importance. Quite recently they have obtained a place in the map of the wealth of India as a notable source of livelihood for many families, especially in the Ramnad and Tinnevely Districts of the Tamil Nadu. The precious coral—a highly esteemed marine product of commerce—is so far not recorded from the seas around India and our needs are met by import. The scleractinians are the only group of corals in our waters with economic importance. In this paper an attempt is made to present a qualitative survey of the reef-building corals, which are exploited from the fringing reefs of the Palk Bay and Gulf of Mannar, for various economic purposes.

DISTRIBUTION OF CORAL REEFS ALONG THE INDIAN COAST

Coral formations are found throughout the tropics and in Indian waters, though restricted to a few places, we have several examples of fringing reefs and atolls. Fringing reefs occur around Andaman and Nicobar Islands, along Palk Bay and Gulf of Mannar at the south-eastern coast of the Indian peninsula and in the Gulf of Kutch on the north-west coast. The Laccadive archipelago comprises 20 atolls where the reefs harbour a rich and varied coral fauna. The absence of any reef in the vast stretches of Bay of Bengal is attributed to a large extent to the immense quantity of freshwater and silt brought by the great rivers (Sewell, 1932). Further the waters of the Ganges

during monsoon have a very high percentage of nitric acid, (Sewell, 1935) about 2·52 tons per sq. mile; which when emptied into the Bay is detrimental to any large-scale coral growth.

Corals of Commercial Value

All corals except *Milleporina* and *Stylasterina* belong to the Anthozoa. The following are the different types of corals that are of economic importance.

Heliopora

The genus includes only a single species, *H. coerulea*. It possesses a hard skeleton with a deep blue colour and is of much aesthetic value. It is found abundant on the reef flat of the Minicoy Atoll. It is one, could prove worthwhile in handicrafts.

Tubipora

The skeleton is deep red in colour and is used in certain indigenous system of medicine in India.

Gorgonids

All the gorgonids are brilliantly coloured both in living and in dried condition. When dried, they afford one of the most attractive marine objects of aesthetic value. The precious, red coral of commerce is a member of this group. There existed a trade of *Corallium* between Mediterranean countries and India even from the dawn of Christian era and the trade flourished till World War II, when Japan stepped in to meet our requirements. During the period 1933 to 1950 corals worth Rs. 617,679 were imported (Annonymous, 1950). The known geographic distribution of *Corallium* is the Mediterranean, along the north-west coast of Africa, Japan, Ireland and Borneo. The waters around Andamans are worth investigating for this coral. Several gorgonids are reported from the Bay of Bengal and the Arabian Sea.

Antipatharia

This is the black coral of commerce and is carved into beads and mouthpieces for cigar holders (Tressler and Lemon, 1951). It was once abundant in the Persian Gulf from where India imported it. The coral has a tree-like corallum with a horny black axial skeleton. It is reported to occur in the Gulf of Mannar and in the Laccadives at a depth of 5 to 200 metres, but the feasibility of their commercial exploitation still remains to be ascertained.

Scleractinia

The stony corals form a raw material for calcium carbonate and in this respect they are no less important than Mollusca. The quarrying of corals for various economic purposes was in existence for a long time in South India. Hornell (1916) has stated that dead and broken pieces of *Acropora*, locally called *challi*, were collected in large quantities at Tuticorin in the Madras State in early nineteen hundreds for the preparation of lime. An average canoe-load of *challi* was sold at that time at Rs. 2 to 3, a fairly good amount when one considers the low cost of living of that time. The massive forms of corals were also utilised as building blocks and in the construction of roads. The setting up of three factories recently in the Tinnevelly district where corals are used as raw material for the preparation of calcium carbide and cement has resulted in yet greater demand for corals.

At present a large number of country boats and men are employed in Madras State, bringing corals ashore. Mahadevan and Nagappan Nayar (in Press) have discussed in detail the *modus operandi* of coral collections of this area and the socio-economic conditions of the fishermen employed in this work. At Mandapam area alone about 50 boats each manned by 4 to 6 people are at present engaged in this work. Each boat, depending on the size and the number of crew, is capable of bringing ashore, after a day's work in fair weather, 4 to 6 cubic metres of corals. A cubic metre

is sold at present at the rate of Rs. 6 to 7. Enquiries reveal that at least 500 people here are making their livelihood by this profession.

Analysis of the Coral Fauna of Palk Bay and Gulf of Mannar

In Palk Bay there extends a reef about seven kilometres in length along the northern side of the Mandapam Peninsula. The eastern end of this reef terminates at the Pamban Pass. This fringing reef is situated about 200 to 500 metres away from shore and is broken here and there. In the Gulf of Mannar fringing reefs occur mostly around the small islands lying between Rameswaram and Tuticorin. All these reefs are found in shallow areas where the depth usually does not exceed 1 to 1·5 metres at high tide and during low tide the crests will be hardly under a few centimetres of water. They are mostly of dead and semifossilised *Porites* with intermittent sandy areas and patches of various types of living corals. The depth of the reef is yet to be ascertained by boring and such an approach will only yield precise information on the total exploitable stock. The present-day exploitation is confined to the surface, thus causing severe destruction to the living colonies. The dominant corals of this reef are scleractinians, the alcyonarians being rare though not absent. The gorgonids and the Antipatharia are not seen in the shallow waters but are often found brought by trawlers from deeper waters. The following analysis of the coral fauna is chiefly based on a study of the reefs of Palk Bay and the Shingle, Krusadai, Pulli, Pullivasal, Manauli, Hare and New Islands of the Gulf of Mannar around Mandapam. The coral fauna of this area as it is known includes 117 species divided among 32 genera (Pillai, 1967, unpublished). Of these 7 species belonging to 7 genera are hermatypic (*i.e.*, non-reef builders) and as such are of no economic value. A qualitative survey of the major reef building corals (hermatypic) which are found in appreciable quantity here are presented below.

Pocillopora

This genus is represented here by two species, *viz.*, *P. damicornis* (Pl. II, Fig. 2) and *P. danae*. The latter is rare and has been recorded only once whereas the former is fairly common, with its colonies attaining a size of about 20 cm in spread and height. However, due to the ramose nature of the corallum it is not favoured for any economic use.

Acropora (Pl. I, Fig. 3; Pl. II, Fig. 3)

Twenty-five species of this genus are found to occur (Pillai, *op. cit.*) in this area. They are used in the preparation of lime, though the lime thus produced is of the lowest quality when compared to the one prepared from the molluscan shells (Hornell, 1916). The commonest members of the genus occurring here are: *A. formosa*, *A. nobilis*, *A. erythraea* (Klunzinger), *A. corymbosa* (Lamarck), *A. surculosa* (Dana) and *A. hyacinthus* (Dana). The first mentioned two species are characterised by an arborescent corallum while *A. erythraea* is having a tufted corallum. *A. surculosa* and *A. hyacinthus* are characterised by vasiform colonies. The genus is found here mostly on reefs but a few are seen in the lagoon.

Montipora

Out of the 20 species that are known to occur (Pillai, *op. cit.*) in this area only one, *viz.*, *M. foliosa* (Pallas) is found in any considerable quantity. In most of the islands around Mandapam it cuts large platforms of one to two metres or more in diameter. But this is again exempted from large-scale exploitation due to the thin foliaceous corallum which is very fragile. The two ramose species occurring here, *viz.*, *M. divaricata* (Brüggemann) (Pl. I, Fig. 4) and *M. digitata* (Dana) are usually met with in the sandy, shallow areas. The other members are found as encrustations on reef rocks and other massive corals.

Pavona and Goniopora

These two genera are not dominant elements among the coral fauna of this area, but may be found occasionally.

Porites (Pl. I, Figs. 1, 2)

This is the foremost among the economically important stony corals and is one of the chief constituents of the reef builders throughout the Indo-Pacific. At least 80% of the South Indian reefs are composed of this genus. The growth form of this genus can be encrusting, ramose, flabellate but is mostly massive. The genus may grow to considerable size, colonies often attain several centimetres to a few metres in height and circumference. The massive, hard corallum of this genus along with its abundance has made it a favourite object as building blocks and a source of lime. The following are the species of this genus so far recorded from the reefs of Palk Bay and Gulf of Mannar: *P. solida* (Forskâl), *P. fragosa* Dana, *P. mannarensis* Pillai, *P. lutea* Milne Edwards and Haime, *P. somaliensis* Gravier, *P. thurstoni* Pillai, *P.* sp., *P. alveolata* Milne Edwards and Haime, *P. lichen* Dana, *P. exserta* Pillai, *P. compressa* Dana and *P. (Synaraea) convexa* and *P. nodifera* Klunzinger. Out of these, *P. nodifera* has been recorded only once. *P. lichen* and *P. exserta* are encrusting forms not found in abundance. *P. compressa* has a flabellate corallum and is very rare here. The commonest member is *P. solida* which occurs in great quantities mostly in dead and semi-fossilised condition. *P. lutea* and *P. mannarensis* are also fairly common.

Favia (Pl. III, Figs. 2, 3)

This massive species with comparatively large corallites is one of the common members of the reef building corals of this area. Five species of this genus are hitherto recorded from here, out of which *F. pallida* is the commonest. The colonies here are generally within 15 to 25 cm in size but may reach half-a-metre in diameter and height. The skeleton is used along with *Porites*.

Favites (Pl. III, Fig. 1)

Out of the six species of this genus known from this area, *F. abdita* (Ellis and Solander) is common though not abundant. The colonies may attain a diameter of 50 to 75 cm in Gulf of Mannar. *F. virens* is fairly common in Palk Bay.

Goniastrea

This is another massive genus represented by three species here, but none is found in a commercially exploitable quantity. One of the members of this genus, *viz.*, *G. retiformis* (Lamarck) Pl. III, Fig. 5) forms huge colonies on the lagoon knolls of Minicoy atoll. Towards the north-eastern side of the atoll a knoll about a kilometer in length and about 40 to 70 metres in width is formed entirely of this species.

Besides those already mentioned, a few genera and species such as *Platygyra lamellina* (Ehrenberg) (Pl. II, Fig. 2), *Leptoria phrygia* (Ellis and Sollander) (Pl. III, Fig. 4), *Hydnophora* spp. (Pl. II, Fig. 1), *Leptastrea transversa* (Klunzinger), *L. purpurea* (Dana), *Cyphastrea* spp. and *Symphyllia* spp. also occur here but none is available in exploitable quantity. *Echinopora lamellosa* (Esper), a foliaceous species, cutting large platforms, is found in abundance but as in the case of *M. foliosa* it is not favoured for commercial use.

Qualitative Analysis of Exploited Corals

An analysis of the corals commercially exploited reveals that only massive, and encrusting forms attached to them are brought ashore. The branching and foliaceous species, which constitute a good percentage of the total species known from here, are not utilised because of their fragile nature

More than 90% of the exploited corals are made up of the various species of *Porites* in living, dead or fossilised condition. The rest of the exploited quantity includes *Favia* spp., *Favites* spp., *Platygyra lamellina*, *Leptastrea* spp. and *Cyphastrea* spp. that are found growing on the dead *Porites*. *Chemical Composition of Corals.*

The hard skeleton of the stony corals comprises about 96% of calcium carbonate with a small percentage of compounds of magnesium and silicon. The rest is constituted by minerals, phosphates and water. On ignition they yield an average of about 53% of CaO, 0·1 to 0·2% of MgO and SiO_2 with a loss of 44 to 45% of weight. The calcium carbonate contents of red coral and Black coral is 86·97% and 85·801% respectively. Both of them possess about 6·75% of magnesium carbonate in their skeleton with a small percentage of calcium sulphate, silicon oxide, ferrous oxide and phosphoric acid (Tressler and Lemon, 1951). Corals from islands which are inhabited by large number of oceanic birds are reported to have a comparatively higher content of phosphoric acid in their skeleton, incorporated from the excreta of birds (Annonymous, 1950).

An Assessment of Corals Removed from Palk Bay and Gulf of Mannar around Mandapam

As already pointed out, a country boat manned by about six people is capable of bringing ashore 4 to 6 cubic metres of corals per day. At Mandapam alone during the period of peak activity about 50 boats are engaged in this work. Allowing an average of 5 cubic metres per boat per day and assuming that all the 50 boats are engaged, it works out to a landing of 250 cubic metres of corals per day. In other words, a reef 250 metres in length, one metre in width and height is removed in a day from the sea.

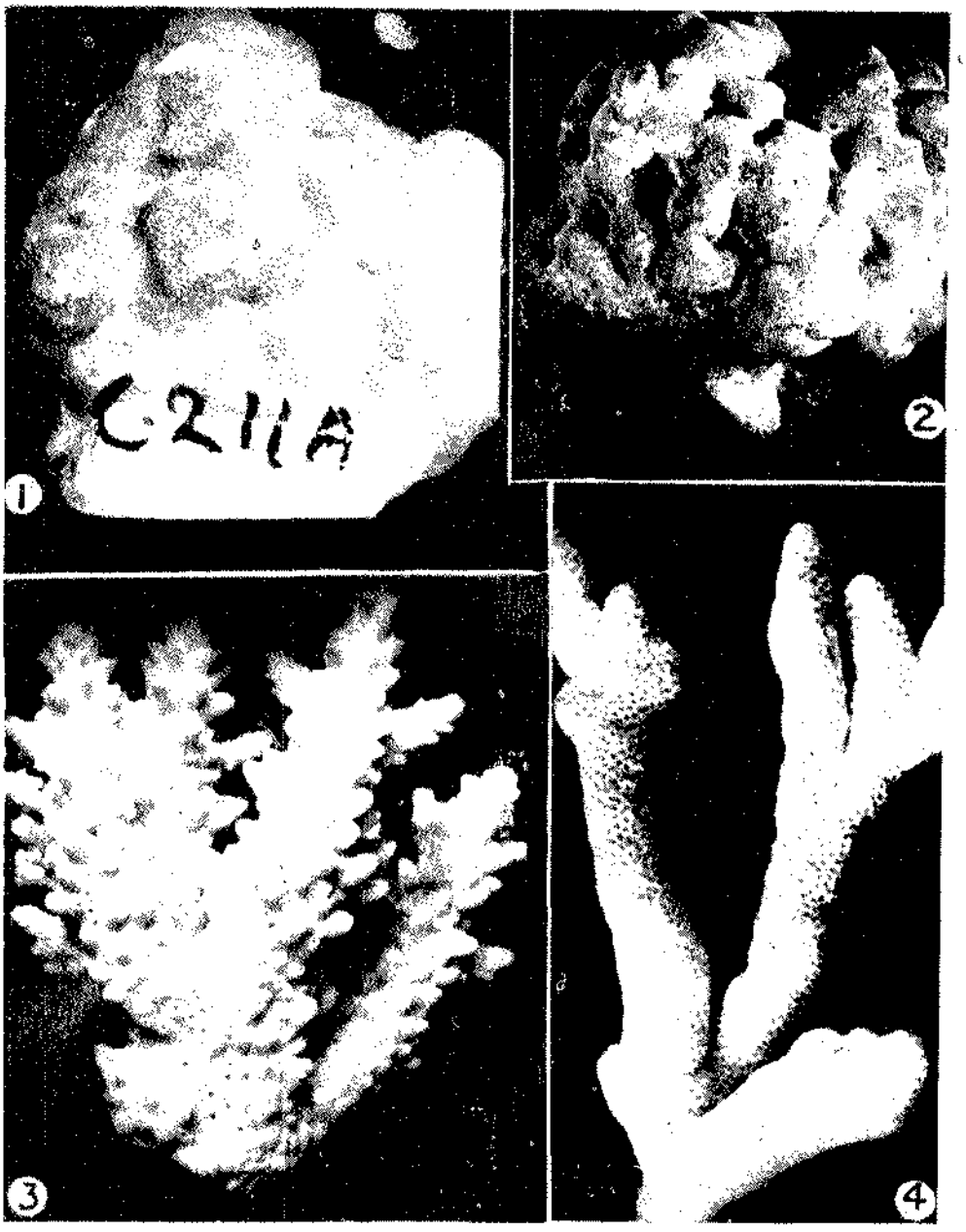
Impact of Coral Quarrying on General Fishery

The quarrying of corals has both indirect and direct effect on the general fishery of this area. The coral reef areas are proved to be highly productive and is well known for its large number of fishes and other animals living associated with it. Needless to say that the destruction of the coral beds is detrimental to many reef dwelling animals including fishes.

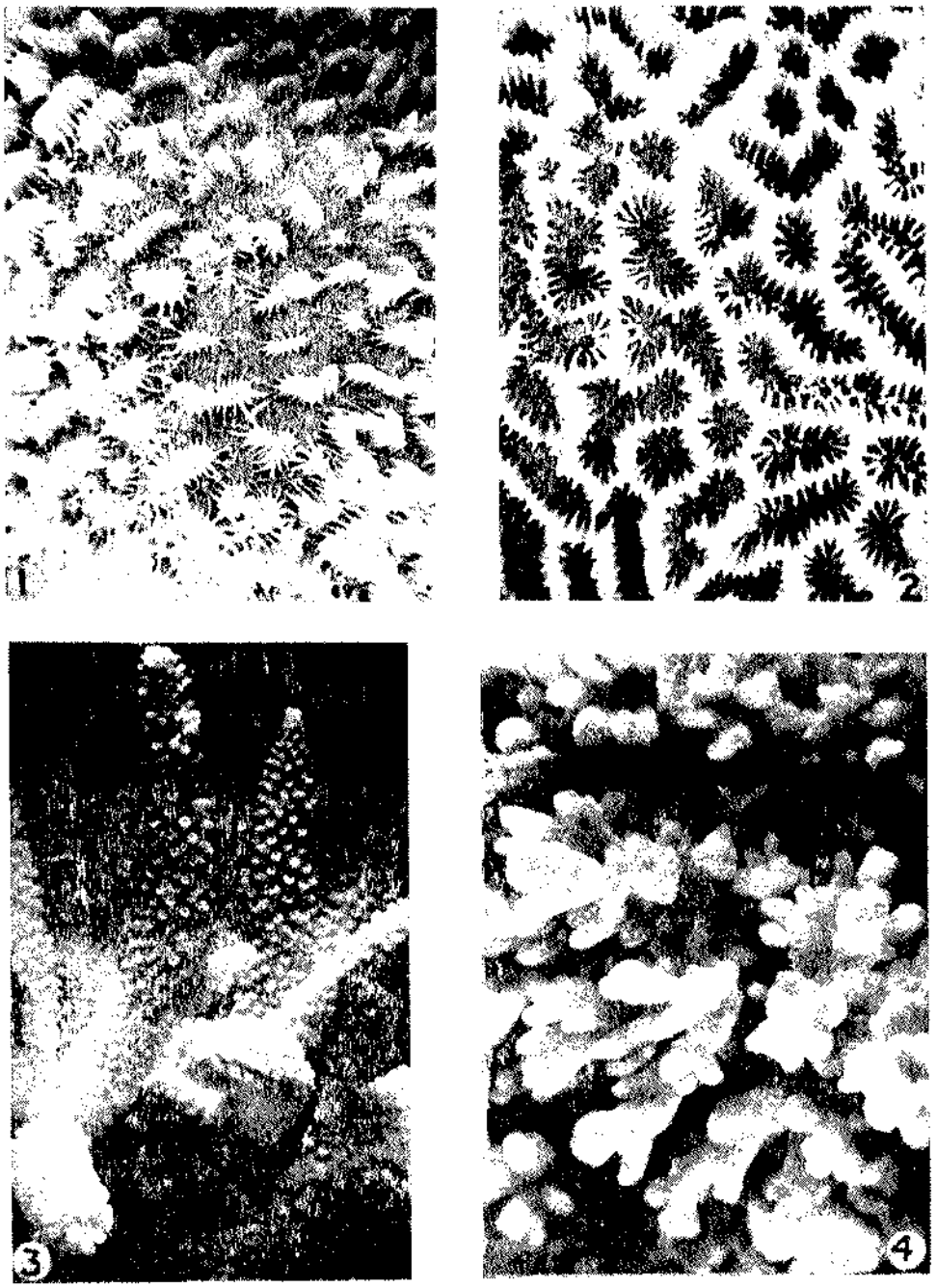
Silas (1967) has pointed out that the wages obtained by a labourer engaged in bringing corals is comparatively higher than what is obtained by fishing, especially when the fishery is not exceptionally good. Around Mandapam, at present a worker engaged in quarrying corals is able to earn Rs. 4 to 5 per day whereas fishing by country boats with conventional gear will fetch him only Rs. 2 to 3 per day depending on the fishery. This higher rate of wages and lesser degree of risk involved drive any people to the reef for quarrying corals than to the sea to cast their nets for catching fish.

Rate of Growth of Corals

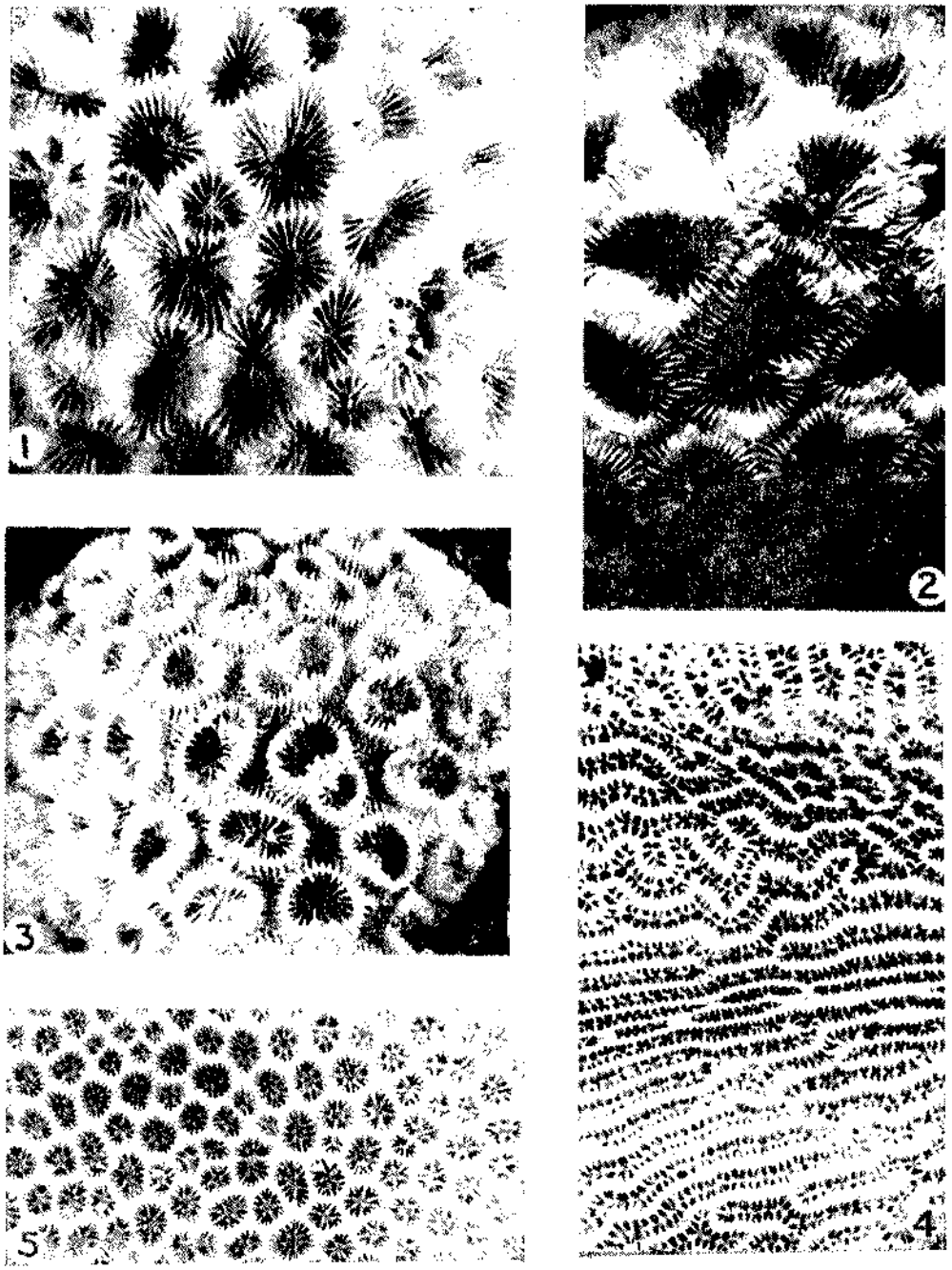
A few words on the annual rate of growth of corals, however, may not be out of place here, since this will help to understand the necessity of conservation of corals, which is discussed at the concluding part of this paper. The annual rate of growth of reef corals, especially the massive forms, is very slow. Guppy (1889) observed that at Cocos-Keeling Island the massive *Porites* had a gain of 12·7 to 19 mm in height per year and a 24 to 40 fold increase in weight in 15 years. Gardiner (1903) has noted that the massive corals at the Maldives had an annual increase of 23·6 mm. The branching forms are generally faster growing and may annually increase by 4 to 5 cm in height and diameter depending upon the species and the prevailing environmental conditions. Young colonies of corals generally have a faster growth rate than the older ones and many species may experience a total cessation of growth either temporarily or permanently after attaining a considerable size (Mayer, 1918). Only very little information is available on the rate of growth of a coral reef.



Figs. 1–4. Fig. 1. *Porites somaliensis* (Gravier) from Gulf of Mannar, × 0·5. Fig. 2. *Porites mannarensis* Pillai, from Manauli Island in Gulf of Mannar, × 1. Fig. 3. *Acropora diversa* (Brook), from Krusadai Island in Gulf of Mannar, × 1. Fig. 4. *Montipora divaricata* Bruggemann from Palk Bay, × 1.



Figs. 1–4. Fig. 1. *Hydnophora exesa* (Pallas) from Palk Bay, × 1·5. Fig. 2. *Platygyra lamellina* (Ehrenberg) from Gulf of Mannar, × 2. Fig. 3. *Acropora intermedia* (Brook) from Palk Bay, × 1. Fig. 4. *Pocillopora damicornis* (Linnaeus) from Gulf of Mannar, × 1.



FIGS. 1–5. Fig. 1. *Favites virens* (Dana), from Palk Bay, × 1. Fig. 2. *Favia favus* (Forskål) from Palk Bay, × 1. Fig. 3. *Favia pallida* (Dana) from Palk Bay, × 1. Fig. 4. *Leptoria phrygia* (Ellis and Solander) from Gulf of Mannar, × 1. Fig. 5. *Goniastrea retiformis* (Lamarck) from Palk Bay, × 2.

According to Gardiner (1903) there is an increase of about 4 feet in height in the Maldivian reefs in 20 to 30 years though Mayer (1918) envisages a foot in 12 years in the Samoan reefs. The growth of reef-building organisms might be influenced by several factors such as food (zooplankton), depth of water, degree of sedimentation, intensity of light, acidity of water and temperature.

There is an overall tendency among coral reefs to die out in the present era to which the fringing reefs of South-East India is no exception. Every post-monsoon period witnesses a distruction of corals of Palk Bay and Gulf of Mannar due to the large degree of suspended slit stirred up by the agitated inshore waters (Pillai, 1967, Unpublished). To add to this corals are removed in large quantities causing destruction of high magnitude to the reefs. It is apparent that the rate of growth of corals of this area is not sufficient to replenish the loss due to death and removal.

Conservation

We are exploiting fast one of our marine resources which are the results of the continued activity of several millions of minute coral polyps for several thousand years. This indiscrimate exploitation is causing severe destruction to both reef-dwelling and reef-building organisms. A legitimate exploitation of corals is of importance from the point of view of the conservation of the resources. At present, however, the exploitation is confined to the reef surface, leaving the deeper fissilised basement untouched. If removal of corals is continued at this rate it is possible that this limited stock will be exhausted within a few years time. The industries which use the corals will be forced in the long run to seek other lime-producing raw materials to feed them. But utilisation of deeper, dead substratum, causing lesser degree of destruction to living colonies, will assure a more prolonged supply. Further such an approach will leave the living colonies to propagate and replenish the stock to some small extent though not adequately. But this will involve mechanical devises since exploitation from a depth of more than one metre is not feasible by the methods adopted at present.

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