

4. OBSERVATIONS ON THE SHALLOW-WATER MARINE FAUNA

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The following observations on the zonation and distribution of marine invertebrates were made during the course of 18 days reconnaissance collecting in July 1967.

A. Intertidal zonation

Under this heading is discussed zonation on beachrock and on vegetation in the littoral fringe* and eulittoral zones.

On seaward shores beachrock exposures are common either as continuous units, broken blocks or both. On lagoon shores beachrock is not frequent but in the southern parts of the lagoon there are widespread exposures of horizontally bedded limestone associated with the barachois. Intertidal fauna may occur on tree trunks and vegetation overhanging the lagoon shores.

The most exposed seaward shore studied on Diego Garcia is at West Island. Here there is a raised limestone ramp with surge channels and potholes at the lower portions and loose boulders higher up the shore (Fig. 26).

The littoral fringe* is occupied by blue green algal encrustations on the limestone and a sparse colonisation by the gastropods Littorina glabrata and Nerita plicata. Below this there is a bare grey coloured zone about 5 m in width followed by a red algal turf, a green algal zone, and in the surf a crust of calcareous red algae. This lower eulittoral zone is characterised by many predatory gastropods such as Drupa, Morula, Strigatella litterata, Engina bonasina and Conus sponsalis. The only other common species is Nerita albicilla. Limpets and barnacles are conspicuously absent. Grapsus tenuicrustatus is common all over the shore and Clibanarius abundant in the lower parts of the eulittoral zone.

* For an explanation of zonation and terminology, see Lewis, J. R., 1964, The ecology of rocky shores, and Taylor, J. D., Phil. Trans. R. Soc. London B, 254: 129-206, 1968.

At South Point on a beachrock exposure (Fig. 27) the zonation is essentially similar to that of West Island but with fewer molluscan species in the eulittoral zone. The higher parts of the beachrock are occupied by blue green algae and the lower by calcareous red algae. Limpets and barnacles are again absent. The crab Eriphia laevimana is common in the mid-eulittoral.

At other beachrock sites the fauna is similar but usually less abundant and frequently the beachrock is colonised solely by blue green algae, Littorina glabrata and Nerita plicata.

In the lagoon a rather different fauna is seen. Nerita plicata and the usual predatory gastropods are uncommon and most of the fauna consists of algal grazers. The zonation on a gently shelving cobbled shore at Carcasse is shown in Figure 28. The cobbles on the lower shore are colonised by the green algal Enteromorpha and the higher portions by blue-greens which produce a blackening effect. Cerithium morum and Cerithium pretosum are both exceedingly abundant, replaced a little higher on the shore by Nerita albicilla and Planaxis sulcata.

At Mamzelle Adélie (Fig. 29) the beachrock is horizontally bedded and stepped. The most conspicuous element of the higher levels is a blue green algal crust which supports a few Littorina scabra. Lower on the shore Cerithium morum and Cerithium pretosum are common with occasional Morula granulata which feeds upon polychaetes.

B. Beaches

Both seaward and lagoon beaches are colonised by the crabs Ocypode ceratopthalma and Coenobita rugosa. The burrowing bivalve Atactodea glabrata is only found on lagoon shores.

C. Seaward platforms

Shallow water marine invertebrate collections and observations were made at a number of sites around the Atoll. These included Eclipse Point, West Island, South Point, Point Thomas, East Point, Cust Point and Barton Point. Because of a lack of mobility the most comprehensive collections were made at East Point.

The seaward platform is remarkably uniform in character around the atoll and the descriptions given below for East Point and Eclipse Point cover most of the variations found.

1. East Point

The reef platform here is about 120 m in width. It lies at a shallow sublittoral level and is not fully emersed at low spring tides, many boulders however project up into the eulittoral zone.

At the base of the beach there is a zone about 10 m in width of coral boulders up to 0.5 m in diameter. Outwards there is then a narrow (5-10 m) belt of rippled sand which is followed abruptly seawards by a crust consisting predominantly of the byssate bivalve Modiolus auriculatus and the calcareous red alga Jania. The bivalves are attached in some places to an irregular reef platform or in others to masses of coralgall cobbles and debris. The surface of the crust is fairly uniform but interrupted by depressions which may be floored by sand or bare reef rock.

Interspersed with the Modiolus crust are sporadic patches of Cymodocea ciliata (= Thalassodendron ciliatum) with the rhizomes and roots deeply embedded between the cobbles.

Small coral growths of Pocillopora demicornis, Porites lutea and Platygyra lamellina are common.

Toward the seaward edge of the platform, calcareous algae become much more common and form a low cavernous "algal ridge." Corals occur on the outer edge of the ridge and these are small, stumpy or encrusting growths and include Acropora disticha, Pocillopora danae, Favites yamanarii and Leptoria phrygia. In the surf zone the cavernous "algal ridge" becomes smoother and more solid and small surge channels develop which are lined with small growths of Pocillopora danae and Acropora disticha but dominantly by sheets of calcareous algae. The surface of the algal ridge is covered by growths of the soft algae Turbinaria, Dictyosphaeria, Caulerpa and Dictyurus.

The upper surface of the boulders at the base of the beach are bare except for growths of Enteromorpha. Beneath the boulders the gastropods Strigatella litterata, Cypraea annulus and Cerithium nesioticum are particularly common. The small xanthid crab Leptodius sanguineus and the porcelain crab Petrolisthes lamarckii are extremely abundant.

In the Modiolus/Cymodocea area of the mid-platform the fauna is much more diverse. Large boulders up to 1 m in diameter are common all across the platform and these are colonised by the algae Turbinaria and Dictyosphaeria. Beneath the boulders and cobbles the large encrusting Foraminifera Carpentaria, Homotrema and Sporadotrema and many sponges occur.

Apart from Modiolus only a few invertebrates are present on open surfaces. About 30 m from the shore there is a belt about 15-20 m width in which the echinoid Tripneustes pileolus is exceedingly common; Holothurians are also abundant and in particular Holothuria atra, Actinopyga mauritiana and Microthele nobilis. Other holothurians are found beneath the boulders in crevices or in sand pockets; these are Holothuria cinerascens, H. albiventer, and Bohadschia argus. Ophiuroids particularly Ophiocoma erinaceus and O. scolopendrina and O. brevipes,

live in the crevices of the platform and boulders. Echinoids are less common (excepting Tripneustes) and only Echinometra matthai and Echino-sterphus molaris were found in crevices beneath the boulders and in the cavernous algal platform.

Gastropods are very common mostly occurring beneath the boulders or within crevices. Drupa morum occurs on the upper surfaces of boulders and Rissoina ambigua, R. plicata and Pyrene azora occur in the algal turf.

Predators such as Conus ebraeus, C. lividus, C. rattus, Vasum turbinellus, Cymatium pileare, C. nicobaricum and Bursa bufonia are found beneath the boulders.

On the leaves of Cymodocea, Cypraea annulus, C. moneta, Cerithium rostratum and Smaragdia rangiana are characteristic.

Crabs occurring in this belt are Percnon planissimum, Actaea rufopunctata, Xanthias lamarckii, Daira perlata, Dromiopsis dormia and Petrolisthes lamarckii.

2. Eclipse Point

At North West Point the seaward platform is about 250 meters in width. The platform is very shallow and almost dries at low spring tides. The major morphological zonation features are shown in Figure 30. At the base of the beach there is a narrow (5 m) belt of cobbles up to 10 cm in diameter resting on sand. These may be coated with green algae. Seawards there is then a belt of 130-150 m wide of Cymodocea ciliata beds resting upon a patchy cobble, sand and boulder substrate held together by thick rhizome growths. The seaward edge of the Cymodocea beds is irregular and passes into a belt about 30 m wide consisting of boulders up to 30 cm in diameter resting upon the hard substrate of the reef platform. The boulders are coated with encrusting growths of calcareous algae. Seaward from this boulder belt is an area of bare reef platform which, with the exception of isolated boulders and small pockets, is sediment-free and smooth in appearance. This also is coated with sheet-growth of calcareous red algae. This bare area passes transitionally into an area of much prolific calcareous algal growth accompanied by a rise in height of about a third of a meter. This area is a low "algal ridge" and consists of prolific growth of calcareous algae into branching heads and encrusting sheets. The resulting structure is cavernous and many boulders are cemented to the surface by the growth of the algae. Surf conditions did not permit observations further seawards but the heads of many small surge channels lined with calcareous algae were observed.

a) Cymodocea beds

The growth of the phanerogam Cymodocea at this site is more continuous and luxuriant than any other seaward site observed around the atoll. Algae such as Caulerpa, Laurencia and Halimeda grow amongst the phanerogam and Turbinaria and Dictyosphaeria occur attached to the boulders and cobbles. The leaves of the Cymodocea are encrusted by melobesioid red algae and many other small epiphytes. Only a few animals live on the open surface of the beds and these include Holothuria atra and the echinoid Tripneustes gratilla. Some species live upon the leaves of the Cymodocea, these include the crab Menaethius monoceros, the gastropods Cerithium rostratum and Smaragdia rangiana, and the foraminiferan Marginopora. Most of the fauna is found beneath the boulders and cobbles common throughout the beds. The molluscan fauna is prolific and gastropods particularly common. These include the herbivores Trochus flammulatus, Cerithium nesioticum and two species of Rissoina. Common predatory gastropods are Drupa ochrostoma, Morula margariticola, Vasum turbinellus, Strigatella litterata, Bursa granularis, Cantharus undosus and Conus lividus. General grazers are Cypraea annulus and five other species of Cypraea. Bivalves are uncommon and the only records are of the byssate Pinctada margaritifera, Barbatia helblingi and Lima fragilis, and a small Tridacna maxima.

Crabs, particularly Xanthias lamarckii and Acteus rufopunctata, are abundant beneath the boulders. The ophiuroid Ophiocoma brevipes is abundant in crevices within the blocks.

b) Boulder belt

The boulders rest upon a relatively smooth substrate coated with a crust of calcareous algae. Most of the fauna in this zone is found beneath the shelter of the boulders. Encrusting sponges, ascidians, bryozoa and hydroids are common. The boulders are extensively penetrated by boring polychaetes. The undersides support a very diverse molluscan fauna. Bivalves are limited to the cemented Chama aspersa, Ostrea numisma and the byssate Barbatia helblingi and small Pinctada margaritifera. Gastropods are much more common and include a large proportion of vermivorous predators such as six species of Conus (especially Conus ebraeus, C. lividus, C. rattus and C. sponsalis), Vasum turbinellus, Bursa granularis. Other predators include Thais armigera, Morula uva, Maculotriton digitalis, Cymatium poleare and Bursa bufonia. Grazers on the encrusting fauna and flora include four species of Cypraea, two species of Rissoina, Triphora monilifera, Modulus tectum, Cerithium nesioticum and Vanikoro.

The porcelain crab Petrolisthes lamarckii is exceedingly common upon and beneath the boulders. The rest of the crab species occurring here are very similar to those occurring on the algal ridge discussed below.

c) Algal ridge

Within the algal ridge are heads of branching Porolithon which become much more abundant seawards, as do the corals. The corals are all small with semi-encrusting or stubbily branching species and include Tubipora musica, Stylophora mordax, Pocillopora eydouxi and Acropora disticha. Species of Millepora were remarkable by their absence.

The species composition of the molluscan fauna is essentially similar to that found in the boulder zone but more abundant.

The ophiuroids Ophiocoma erinaceus and O. scolopendrina are abundant in crevices.

Crabs are common and include the Percnon planissimum, Zosimus aeneus, Daira perlata, Actaea rufopunctata, Liomera bellus, Liomera monticulosus, Pilumnus hirsutus and Eriphia scrabacula.

3. South Point

Here the seaward platform is about 200 m wide and has many of the features described for East Point. The reef here receives more wave action and the inshore area is covered by boulders. The platform has an algal ridge, a Modiolus crust and a turf of red algae. On the algal ridge corals are much more abundant than at East Point and include the additional species Millepora tenera and M. platyphylla. The invertebrate fauna is very similar to that described for the other sites. Some of the boulders are very large and project up into the eulittoral zone; they are penetrated by vast numbers of sipunculids and by the boring barnacle Lithotrya valentiae. Cypraea caputserpentis, a species tolerant of wave action, was found in small crevices in the boulders.

4. Barton Point

At Barton Point almost the entire width of the seaward platform is covered by boulders up to 0.5 m in diameter. Calcareous red algae are prolific cementing the boulders together. Other algae present are Dictyosphaeria, Caulerpa, Dictyurus, Halimeda and Turbinaria. The fauna on and beneath the boulders is very similar to that found on and beneath the boulders at the sites discussed previously.

D. Lagoon shores

On lagoon shores the beaches are shallowly dipping, consist of fine sand and are overhung by supralittoral vegetation.

At the base of the beach there is usually an accumulation of small cobbles. On the eastern lagoon shores the platform is variable in

width from 75 to 300 m and on the western side the widest point is at Pointe Marianne which is 950-1150 m wide. The depth of the platform varies between intertidal and 2-3 meters but in many places the lagoonward edge of the platform is not sharp and slopes more or less gradually into the deeper central lagoon. The platform margins on the western side appear rather sharper than those to the east.

On the eastern side the platform is covered by a thick accumulation of fine sand upon which sporadic patches of algae, Cymodocea and corals occur. The zonation on the lagoon platform seen 0.5 km north of East Point is fairly typical for the eastern side of the lagoon. The platform shelves gently from the beach lagoonwards with an average depth of 1-2 m. Nearshore the fine sandy substrate is colonised by patches of the algae Padina and Laurencia between which there is open sand colonised by several species of sponge embedded into the sediment. Further lagoonwards patches of Cymodocea ciliata occur with the Padina and Laurencia. In these patches are small colonies of the corals Porites lutea and Pocillopora damicornis. The holothurian Holothuria atra and the asteroid Culcita schmideliana are abundant. The Cymodocea is heavily infested with epiphytic algae.

Further from the shore corals appear, becoming more abundant lagoonwards. They occur in patches separated by areas of open sand with abundant polychaetes. The coral patches are not more than 1.5 m high and largely dead on the upper surfaces and centres of the patches. These patches are made up of quite a diverse coral fauna. Most common is the branching Porites nigrescens with a massive Porites, spray growths of Acropora reticulata, Lobophyllia costata, massive Favia pallida and Porites (Synaraea) iwayamaensis. Other species occurring are Goniopora cf. savignyi, Porites solida, Favia pallida, several species of Montipora, Astreopora ocellata, large colonies of Stylophora pistillata and Pocillopora damicornis. The free living species Fungia repanda and Halomitra philippensis occur on the sand between the coral colonies.

The corals form a substrate for a large number of epifaunal and boring molluscs. In crevices and on dead branches the byssate species Barbatia helblingi and Isognomon legumen, I. perna and Septifer bilocularis are very common. Other species are Lima lima, Gloripallium pallium. Pedum spondyloideum occurs solely in narrow crevices in massive Porites colonies. The coral colonies themselves are bored by Lithophaga teres, Botula cinnamomea and Gastrochaena cuneiformis. Tridacna maxima occurs byssate on upper surface of coral colonies and in crevices. The holothurian Stichopus chloronotus is common amongst the corals and on the sand surrounding the patches. The sand patches themselves support a sparse fauna of polychaetes, Rhinoclavis asper and the bivalve Fragum fragum.

The sponge colonies which occur nearer the shore support an individual fauna including many ophiuroids of the species Ophiactis savignyi, O. exigua, crangonid shrimps, and an erycinid bivalve.

At Carcasse the lagoon platform is 70 m wide and the patches of algae, Cymodocea and coral much more sparse than at East Point. The coral colonies at this site are particularly heavily colonised by the boring and epifaunal molluscs. The upper surfaces of the coral colonies are covered by growths of the algae Turbinaria, Padina, and Dictyosphaeria.

At Cust Point the lagoon platform is wider but the inshore areas for about 200 m are covered by luxuriant Cymodocea beds. Together with Cymodocea ciliata, algae are common particularly Halimeda, Laurencia, Hydroclathrus, Caulerpa and Codium. On cobbles and dead coral colonies Turbinaria and Dictyosphaeria are epilithically attached. The Cymodocea and Turbinaria are infected by abundant epiphytic algae and are coated with abundant marginoporoid foraminifera. Brown sponges are common. Coral occurring in this bed are Porites lutea, Porites nigrescens and Pocillopora damicornis. The stems of the Cymodocea are frequently encrusted by bryozoan colonies.

The holothurians Holothuria atra and Stichopus chloronotus and the ophiuroids Ophiocoma scolopendrina and O. brevipes are abundant.

The molluscs occurring upon the Cymodocea leaves and stems include Cypraea moneta and C. annulus, Smaragdia rangiana, Cerithium rostratum, Strombus decorus decorus and Drupa margariticola. Burrowing into the sediment are Polynices mammilla, Pinna muricata, Anadara urypigymelana and Codakia tigerina.

On the western side of the lagoon at Pointe Marianne there is a wide intertidal sandy belt with isolated patches of Laurencia, Padina and some Cymodocea. Further from the shore the amount of Cymodocea progressively increases. In the open sandy areas there are large quantities of brown sponges buried in the sediment and small cobbles coated with Dictyosphaeria. Other sponges contain the commensal bivalve Vulsella spongiarum. The crab Calappa hepatica is very common in the sand and Thalamita amongst the algae. Holothuria atra is present in numbers up to 2-3 per square meter and Stichopus chloronotus rather less common. Further out in the Cymodocea the molluscs Strombus decorus decorus, S. labiatus, Cypraea moneta, Cerithium rostratum, Codakia tigerina, Ctena divergens and Pinna muricata are present.

The edge of the platform on this western side was not studied but observations from a boat indicate a platform front of massive coral colonies, probably Porites, 2-3 m in diameter.

Near the entrance to the lagoon, the lagoon shore supports a more prolific coral fauna. On the lagoon side of Eclipse Point there is a coral-dominated area with a large number of species. The dominant coral in terms of area occupied is Acropora reticulata which occurs in plate-like growths over a meter in diameter. Acropora palifera in

club-shaped branches is also abundant. There is some growth of staghorn Acropora. Lobophyllia costata occurs in large mound-like growth. Goniastrea pectinata, Favia halicora, Favia abdita and Porites australensis occur as small rounded heads. Delicate foliose growths of Echinopora lamellosa are also abundant. Other corals include Cyphastrea microphthalma, Platygyra lamellina, Porites (Synaraea) iwayamaensis, Herpolitha limax, Pavona varians and Stylophora pistillata. The alcyonaceans Sinularia and Lobophyton are common in masses up to 50 m in diameter.

E. The barachois

The barachois situated at the southern end of the lagoon have narrow entrances and represent areas of extremely restricted circulation opening on to an area of lagoon which also has restricted circulation. It is not surprising, therefore, that the fauna is rather peculiar.

The higher fringes of the barachois are occupied by the crab Cardisoma carnifex, causing extensive disturbance of the sediment. Lower in the true intertidal areas where the sediment is a fine lime mud it is colonised by vast numbers of the fiddler crab Uca tetragonon. Other Crustacea include alpheid prawns and the crab Thalamita crenata. Deposit-feeding bivalves are more common in the barachois than at other sites: species include Asaphis deflorata, Leptomya rostrata, Quidnipagus palatam and Scissulina dispar. Suspension feeders Gafrarium pectinatum and Atactodea glabrata occur in coarser sediments. The gastropods Cerithium morum and Rhinoclavis asper are abundant.

The beachrock surrounding the barachois is colonised by the ellobiid gastropod Melampus castareus and Littorina scabra and sometimes under overhangs Ostrea cucullata.

Stromatolithic-like masses of algally fixed sediment are common around the edges of the barachois. Amongst these masses two holothurians are found together with burrowing crangonid shrimps, and Thalamita.