

Hermatypic Corals of Japan



I.E.N. YERÓN



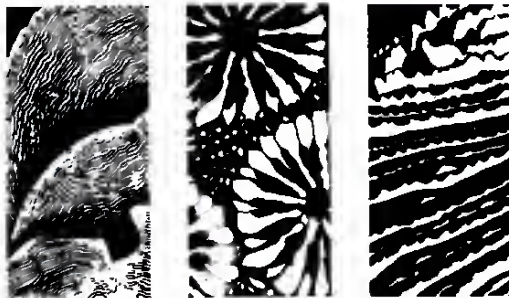
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Hermatypic Corals of Japan



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*Hermatypic Corals
of Japan*



J.E.N. Veron



Australian Institute of Marine Science

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Abstract

Original studies, together with a review of past studies, are combined in a species-level account of all known Japanese hermatypic corals. Original studies were made at 98 collecting stations. These include the three groups of the Ryukyu Is.: the Yaeyama Is., Okinawa Is. and Amami Is., all of which have extensive fringing reefs, and seven regions of mainland Japan and neighbouring islands, which have non-reefal coral communities: Tanegashima, the Amakusa Is. (Kyushu), Tosashimizu (Shikoku) and Shirahama, Kushimoto, Izu Peninsula and Tateyama (Honshu). A total of 400 confirmed species are recorded from the Ryukyu Is. and mainland Japan; an additional 9 species have been recorded from previous studies from other Japanese localities or with doubt from the Ryukyu Is. All previous studies from Japanese localities are reviewed and locality records (of both past and present studies), taxonomic data, and *in situ* appearance are recorded. The major oceanographic control of distribution and abundance of species, the Kuroshio Current, is discussed in light of detailed data on sea surface temperature and available data on circulation patterns. Distribution changes during the Holocene and recent, including human- and *Acanthaster planci*-related effects, are discussed.

Species diversity progressively attenuates from the southern-most (Yaeyama) islands (359 species) to the northernmost extremity of coral occurrences near Tokyo. There are major differences between the corals of the Ryukyu Is., which mostly occur in reefal communities, and those of mainland Japan, which occur on terrigenous substrates. Analysis of presence/absence data indicates that species distributions are primarily correlated with sea surface temperature and secondly correlated with the presence of reefal environments and degree of regional isolation.

1

Introduction

Historically, Japanese coral reef biologists and geologists have made a major contribution to the study of Indo-Pacific reef corals. Two very distinct periods are reflected in the literature. The first, centered on the studies of Yabe and his colleagues, mostly pre-dates the Second World War and ranks internationally as one of the most taxonomically important groups of studies of the time. The second is made up of a relatively recent complex of mostly geographically discrete smaller studies undertaken from university marine research stations and public aquaria.

The first period is pre-SCUBA; the second spans the introduction of SCUBA in both taxonomic studies and field surveys and have primarily been undertaken by divers collecting corals for subsequent identification by non-diving taxonomists, using the taxonomic framework of Yabe and his colleagues with only minor modifications.

One overall outcome of these two periods combined, is that Japanese coral fauna as a whole is well-known relative to most other countries with major coral reefs. A second outcome, however, is that the taxonomic framework is not well integrated with the reality of the reef. As with most coral taxonomic studies undertaken without the use of extensive in situ observation, there is little understanding of environment-correlated intraspecific variation. As a result, reliable species identifications are mostly restricted to families or genera where species are few in number or are relatively distinct. Thus, major genera which display extensive intraspecific variation (notably *Montipora*, *Acropora*, *Porites* and *Turbinaria*) are largely identified according to the British Museum Catalogues (of Bernard and Brook). In contrast, other genera that were more fully studied (eg. *Caulastrea* and *Lithophyllon*), have been given a complex of species and sub-species names which do not reflect true intraspecific variation and which belies the fact that similar variation occurs in most other hermatypic genera.

A final historical outcome of Japanese coral studies, along with that of all other regional studies up to the time of Wells (1954), is that they give a false impression of regional isolation. This study, and that of Veron and Hodgson (1989) and Veron (1988) respectively show that the corals of the Ryukyu Is. are essentially similar to that of the Philippines and, to a lesser extent, the Great Barrier Reef, yet any biogeographic study based on previous accounts would indicate a relatively minor species similarity between these regions.

The aim of the present study was initially a biogeographic one: to integrate the coral fauna of Japan with that of other countries and thus span the latitudinal range of the Indo-west Pacific centre of scleractinian diversity. In this context, the Ryukyu Is. and the southern coastline of the mainland islands are almost ideally placed,

forming a continual arc from high diversity tropical reefs to the high latitude extremes of coral distribution.

A second and equally important aim, which evolved during the course of the present work, has been to provide a taxonomic framework for other areas of coral research, much of which is urgently needed for conservation purposes. Based on data from the present publication, Veron (in press a) has concluded that 30% of all Japanese species are uncommon throughout their range in Japan and are at some risk of regional extinction, 28% additional species are rare, or are restricted to the Yaeyama Is., where they occur only in very limited areas of high diversity or in species-specific refuges, and 5 of the 8 known regional endemics are primarily restricted to species-specific refuges. The inevitable conclusion is that this is an unstable situation and that, in the long term, at least one third of all Japanese hermatypic corals are threatened with regional or total extinction.

Nishihira and Veron are preparing a fully illustrated field guide to Japanese corals based on the present publication.

2 *Historical Resumé*

An unpublished manuscript (Fujiwara, 1979) is the most comprehensive account of the generic distributions of corals in Japan. Veron (1988, Table 1) gives an updated version of this, after conversion to the present taxonomic framework. Generic records are, however, of little value other than as a crude measure of regional diversity and subsequent distributions recorded here are at species level.

As mentioned above, there have been two distinct periods of coral taxonomic research in Japan, the first being overwhelmingly dominated by the prolific writings of Yabe and his colleagues at Tohoku University. Yabe and Sugiyama (1935c) give a detailed tabulation of the distribution of species throughout Japan and Yabe *et al.* (1936) and Yabe and Sugiyama (1941) give an expanded, well illustrated taxonomic account of about half the species involved. This series was terminated by the Second World War, leaving the biogeography of some major taxa, notably families Acroporidae and Poritidae (which mostly follows Bernard 1903, 1905, 1906 and Brook, 1893), without a clear taxonomic base. Yabe and his group published some 14 studies on the extant corals of Japan and many more on fossil corals. Several of these are taxonomic papers concerning specific genera, others are primarily updated versions of earlier publications.

Yabe *et al.* (1936) give many references to their collecting localities in the Ryukyu Is. (Fig. 1) (as the Sakisima, Okinawa and Osima Subgroups, now usually referred to as the Yaeyama, Okinawa and Amami Is.). Even so, their collections from the Ryukyu Is. is not as comprehensive as it is from mainland Japan, with only 4, 3 and 4 sites (respectively) for each island group, to which Yabe and Sugiyama (1941) added one additional site for each of the Okinawa and Amami Is.. Not surprisingly, their records from the Ryukyu Is. do not indicate the true diversity of the region. They give only a brief account of the collecting that was undertaken, none of it being by the authors themselves and, although specific grid references are given, there is no indication of how extensive individual collecting stations were. The authors also note that identifications were made from the literature, without references to type specimens. Identifications are, however, generally consistent (after Yabe and Sugiyama, 1935a) throughout the publications of Yabe's group, allowing most to be interpretable in the present taxonomic framework.

Original records from the Yaeyama Is. are exclusively those of Yabe and his colleagues (Yabe *et al.*, 1936); all subsequent studies are relatively recent. Suzuki (1972) gives the first, brief, account of the corals of Iriomote I.; Eguchi (1974) lists 84 species from Iriomote and Ishigaki Is.; Eguchi (1975a) lists the genera recorded at that time, noting that he has 'discriminated some 240 species', including a hermatypic and

HISTORICAL RESUME

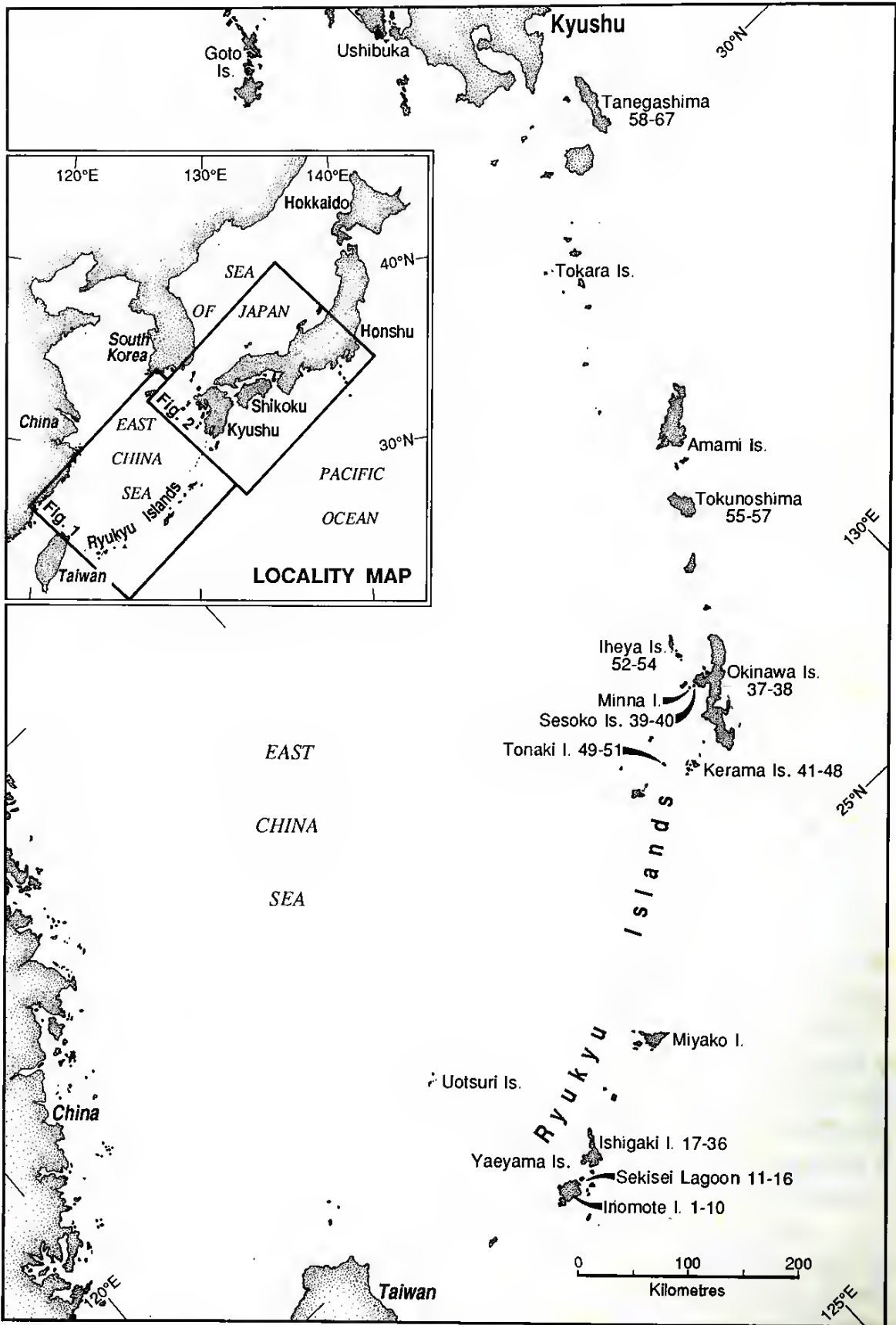


Figure 1. The Ryukyu Islands, showing place names cited in the text and collection stations 1-57. Inset: locations of Figures 2 and 3.

HISTORICAL RESUME

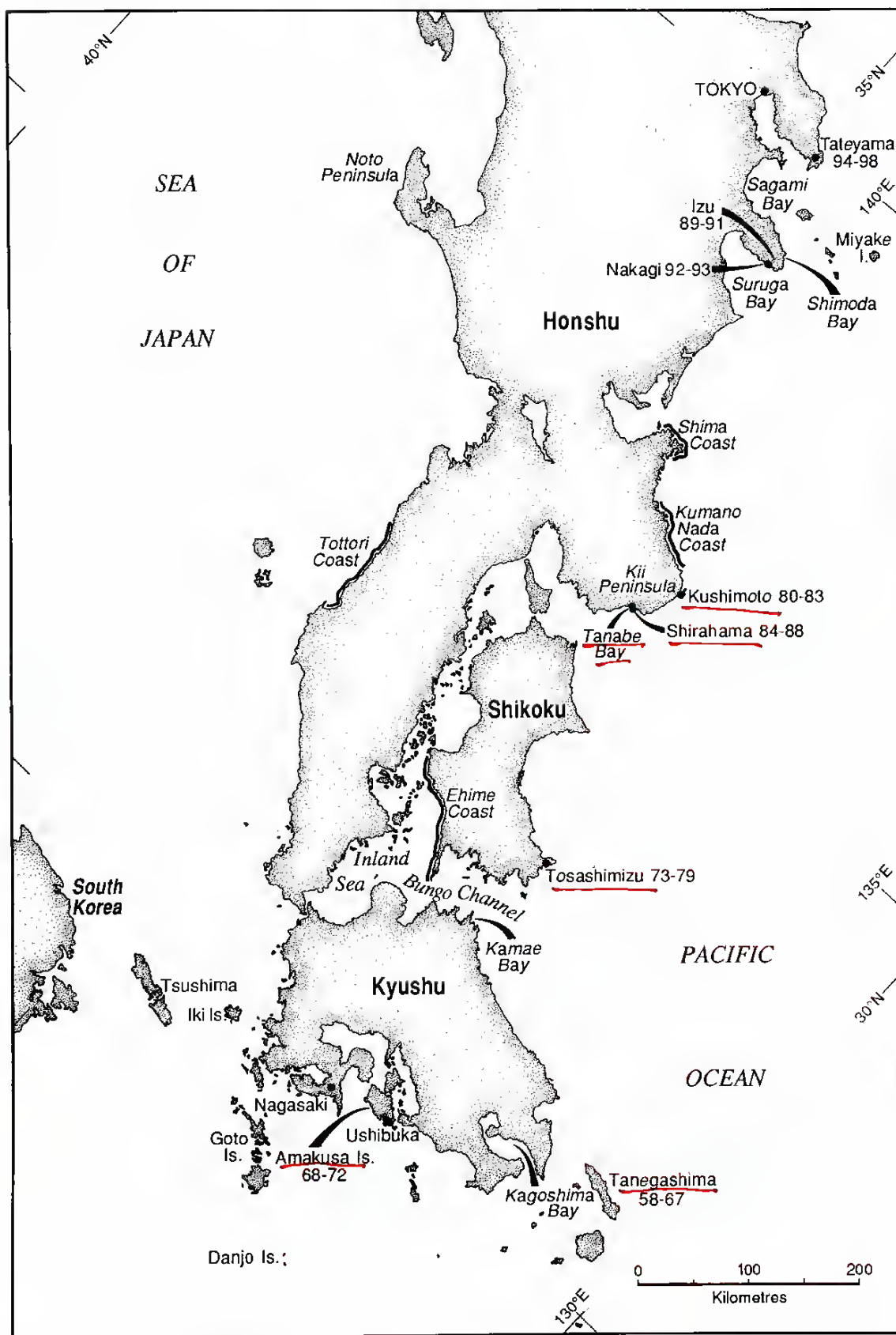


Figure 2. Southern mainland Japan, showing place names cited in the text and collecting stations 58-98.

non-scleractinian species. Takahashi and Koba (1978) give the first general description of the zonation of southern parts of Ishigaki I.; Horikoshi *et al.* (1975), Horikoshi (1979), Takahashi (1983), Shirai (1980) and Kawaguti (1983) give additional records from Ishigaki I. Nakamori (1986) gives a detailed analysis of community structures of Ishigaki I. and Sekisei Lagoon; 144 species of 51 genera are recorded and 11 community types discriminated. There have been several brief reports of the corals and coral communities of Shiraho Lagoon, Ishigaki I., including Muzik, 1984a, 1984b; Shirai and Sano, 1985 (primarily from notes taken on a preliminary survey by Veron and K uhlemann); Masuda, 1986 and Yasumoto, 1986). Veron (1988) gives a summary of the corals of Ishigaki, to which the present account is a substantial update based on additional field work at collecting stations 1-16 and 25.

There have been two recent studies of the corals of Iriomote Is. based on the taxonomic framework of the present study and included in the results of the present study: Habe (1989) lists 93 species from Amitori Bay, Iriomote I. (collecting stations 2-10 of the present study) and Nishihira and Yokochi (1990) list 191 species from the adjacent Sakiyama Bay.

Yamazato *et al.* (1982) gives an account of the coral communities of the remote Uotsuri Is. to the north of the Yaeyama group, apparently very depauperate reefs as only 37 hermatypic species are listed.

As with the Yaeyama Is., the original publications of Okinawa and Amami Is. corals are those of Yabe and his colleagues. Subsequently, Eguchi (1974) listed 84 hermatypic species from the Kerama Is., and there have been several quantitative studies of coral communities around the Okinawa Islands, some of them (Yamazato 1971, 1978; Nakasone *et al.* 1974; Nishihira *et al.*, 1974; Yamazato, *et al.*, 1974, 1976, 1978, 1980), listing the species found. More recently, Nishihira *et al.* (1987) Sakai and Yamazato (1987) and Chou and Yamazato (1990) give lists of species of Kudaka I. and Sesoko I., using the taxonomic framework of the present study.

The only publication on the corals of the Amami Is. since Yabe are brief observations (Hirata and Oosako, 1968a, 1968b and Ooishi and Yagi 1964).

Tanegashima, 30 km from the southern tip of Kyushu, is treated in the present study as geographically part of mainland Japan (Fig. 2). Corals of Tanegashima have not been previously studied but Tokioka (1953), Baba (1954) and Utinomi (1956) give brief accounts of the shallow-water corals of the Tokara Islands approximately 30 km to the south-west, recording in total only 14 hermatypic species. Hirata *et al.* (1969) lists 17 hermatypic species, many with illustrations, from Kagoshima Bay immediately north of Tanegashima. All species that are identifiable were recorded from Tanegashima during the present study.

As noted above, mainland Japan corals have received much more attention from Yabe and his colleagues than those of the Ryukyu Is. For this work, Sugiyama and others collected from 20 localities around Kyushu and their records are relatively complete, at least at generic level. Since then, Kikuchi (1968), also Kikuchi and Araga (1980) (identified by Eguchi) published a list of the corals around the Amakusa

Marine Biological Laboratory, Eguchi (1971) lists the corals of Goto Is., north-west of the Amakusa Is. and Fukuda and Iwase (1984) give a brief account of the corals of the Danjo Is. to the south-west. Eguchi (1975b) gives a general account of the corals of Nagasaki Prefecture.

A branch of the Kuroshio Current flowing into the Sea of Japan via the narrow Strait of Korea, passes either side of Tsushima. Eguchi (1970a) gives a brief list of mostly ahermatypic corals from Tsushima strait, listing only 2 hermatypic species. In a survey around Tsushima itself, Eguchi (1973) recorded 26 hermatypic species, a fauna similar to that of the Tateyama at the far east extremity of hermatypic coral distribution. Eguchi and Fukuda (1972) list 21 hermatypic species at Iki Island, between Tsushima and north-west Kyushu. Eguchi (1970b) lists 5 corals from the Tottori coast of the southern Sea of Japan, none of them being hermatypic. The northernmost record of a hermatypic coral in the Sea of Japan is *Oulastrea crispata* from the Noto Peninsula (Yajima *et al.*, 1986).

Yagi (1970), Shirai (1971) and Utinomi (1971) give accounts of the corals of different locations of eastern Kyushu. The most complete of these studies is that of Utinomi (1971) who gives an account of 42 hermatypic species of Kamae Bay, north-east Kyushu, which is, however, well below the number that might be predicted from the present studies at Tosashimizu, approximately 100 km to the east.

Yabe *et al.* (1936) list 6 collecting localities of Shikoku which probably include all major coral outcrops except those of the south-west coast adjacent to the Bungo Channel. Utinomi (1965a) gives a brief list of the corals of this region; Utinomi (1965b) gives a fuller account of a collection from approximately 60 km from the author's study site at Tosashimizu, as well as collections from Tosashimizu itself. He recorded 33 species as opposed to the 121 species recorded by the author, primarily a reflection on the advantages of SCUBA in compiling a full species inventory. Even so, he records two species (*Caulastrea tumida* and *Montipora digitata*) which were not recorded by the author. Tokioka (1968) gives an account of a 'giant' colony of *Pavona decussata* (as *Pavona frondifera*) from Tatsukuchi Marine Park, near Tosashimizu. Utinomi (1970) also lists and illustrates the corals of the Ehime coast, 45 species being hermatypic. Among these are species at their distribution extremes: *Acropora echinata*, *A. loripes* and three free-living fungiids (*Ctenactis echinata*, *Fungia fungites* and *Fungia ?concinna*), none of which were recorded by the author. The Ehime coast may have a semi-transitory coral fauna as it normally receives a small branch of the Kuroshio Current extending into the southern Inland Sea. Warm conditions are sufficiently unstable to make it possible that these species are no longer present in the region.

Yabe *et al.* (1936) and Yabe and Sugiyama (1941) include 9 collection localities from southern Honshu. All but three of these (Suruga Bay, Sagami Bay and Tateyama) are from the Kii Coast between Tanabe Bay and the Shima coast (Hahazima). The most important biogeographic factor of the Kii coast is the difference in oceanographic conditions between the south-west coast (between Shirahama and the Kushimoto region) and the eastern coast. The latter periodically has relatively low sea

temperatures, depending on the movements of the Kuroshio Current, and corals are much less prolific.

Many studies have been made of the corals of Shirahama-Kushimoto coast: originally by Yabe's group (Yabe and Sugiyama 1935a), and subsequently by Sakaguchi (1954), Utinomi (1966, 1968, 1972), Eguchi (1972b), Eguchi and Miyawaki (1975), Anonymous (1977), Shirai (1986) and a large number of notes in the journal *Pavillion*. Eguchi and Miyawaki (1975), following Utinomi (1966), give a relatively detailed account including colour, Indo-Pacific distributions and depth ranges (which are generally inaccurate and are probably just the depth ranges of collected specimens) and Anonymous (1977) give good illustrations, including colour photographs of most species in situ. Miyawaki (1978) adds an additional 5 records, only one of which (*Goniastrea retiformis*) is hermatypic.

The relatively depauperate east (Kumano-nada) coast of Kii Peninsula has received relatively little recent study (Shirai *et al.*, 1965; Shin, 1979; Shirai, 1986). Shirai (1986), using the taxonomic framework of the present study, lists 53 hermatypic species from the Kii coast as a whole, confirming this region as the present eastern mainland distribution limit of several genera: *Caulastrea*, *Cynarina*, *Pocillopora*, *Lithophyllon*, *Lobophyllia*, *Madracis*, *Pectinia*, *Stylophora*, *Trachyphyllia* and *Turbinaria* and also species of more widely ranging genera, including *Acropora glauca*, *A. loripes*, *Cyphastrea microphthalma* and *Pavona decussata*. Four of these genera (*Caulastrea*, *Lithophyllon*, *Stylophora* and *Turbinaria*) have been previously recorded from Tateyama (see below), but may no longer be present there.

The corals of Izu have been recorded by Eguchi (1972a) who lists 12 hermatypic species.

Eguchi (1968) gives a detailed account of the Milleporina, Stylasterina and Scleractinia of Sagami Bay, the latter being largely ahermatypic. Twenty-one hermatypic species are recorded and their distributions within and beyond Japan listed. However, only eight species are from the Sagami Bay itself (6 originally recorded by Eguchi, 1935a, 1935b), the other records being from surrounding peninsulas, including Tateyama, after Hamada (1963b).

The corals of Tateyama have long been of interest because they are at the extremity of hermatypic coral distribution and because a substantial outcrop of Holocene fossils occurs there (Yabe and Sugiyama, 1931, 1935a, 1935c; Hamada 1963a, 1963b Eguchi and Mori, 1973 and Veron, in press b). A total of 35 species have been recorded by these authors; the identities of 23 of these have been confirmed.

The distribution of corals along the Izu Rise, which forms a chain of islands running south from Tokyo across the path of the Kuroshio Current, is known from only two studies. Tribble and Randall (1986) give an account of the corals of Miyake I., a small volcanic island 160 km south of Tokyo, where they collected 80 hermatypic species. Because the island lies directly in the path of the Kuroshio Current, sea temperatures are markedly higher than that of adjacent mainland localities and this presumably also allows for enhanced recruitment of propagules from tropical

localities. The island however, is subject to ENSO-related temperature decreases which probably cause periodic decrease in hermatypic coral diversity. Takahashi (1983) gives a brief generic level account of the corals around Hachijo I., also on the Izu Rise, some 300 km south of Tokyo.

The Ogasawara (or Bonin) and Volcano Is. are a series of mountainous islands approximately midway between the Mariana Is. and Tokyo, nearly 1,000 km to the north. The corals were originally studied by Yabe and Sugiyama (1935c, 1941), Yabe *et al.* (1936) and Sugiyama (1937). There was little Japanese contact with the islands for 20 years after the war until an expedition was sent there in 1968. There are several descriptions of Ogasawara I. corals immediately after that time: Imajima (1969, 1970a) made reports for the establishment of a marine national park and Imajima (1970b) is a public version of these reports. Oishi (1970) gives a brief synopsis covering 29 species; Kurata *et al.* (1969) gives a more comprehensive although still very incomplete account. Tachikawa (pers. comm, 1991) has prepared a substantial tentative list of species, most of which are included below.

3

Sea Surface Currents and Temperatures

Oceanographic conditions throughout the northern Philippines, the Ryukyu Is. and southern Japan, are overwhelmingly dominated by the warm Kuroshio Current, the core of which 'begins' at Luzon (Philippines) (Nitani, 1972), enters the East China Sea through the strait between Taiwan and the Yaeyama Is., flows northward along the continental shelf edge break of eastern Asia (100-200 km west of the Ryukyu Is. chain) (recently reviewed, Bingxian, 1986), then veers to the east and flows along the south coast of mainland Japan before entering the northern Pacific as the Kuroshio Extension (Fig. 3). This is the northern limit of hermatypic coral distribution, where the Kuroshio interfaces with the cold southward flowing Oyashio current of eastern Honshu. Within Japan, there are three aspects of the Kuroshio which are particularly important to coral dispersal: (1) the current is one-directional although it generates a complex of unstable return gyres, (2) with the exception of the variations described below, its main path, and to a lesser extent its speed, shows less seasonal or inter-annual variation than other western boundary currents and (3) it maintains relatively high temperatures in high latitudes.

The primary influence on surface circulation around the Ryukyu Is. is the core of the Kuroshio to the west; secondary influences are meso-scale gyres from the core path creating periodic southward reversals in the prevailing northward current and weak periodic currents from the eastern Philippines Sea. Current maps of the Japan Oceanographic Data Center (from 1986) seldom show currents over 0.9 m/sec. In theory at least, current records demonstrate the possibility of transport in both directions along the Ryukyu Is. chain. In the region of the northern limit of reef formation, Konaga *et al.* (1980) has recorded large geostrophic returns from the Tokara Strait south of Tanegashima to the Amami Is. which have the northernmost coral reefs. Beyond the Tokara Strait, the Kuroshio influence is one-directional.

To the west of Kyushu, the Tsushima current, a small branch of the Kuroshio, flows north through Korea Strait, after which it mixes with the cold waters of the North Korean Current in the Sea of Japan (Moriyasu, 1972). The Tsushima, combined with strong tidal influences, forms complex eddies which may allow for return currents from west Kyushu to the east. The main Kuroshio path crosses from the Ryukyu Islands to the south mainland coast primarily in the vicinity of the Tokara Strait where currents always flow strongly, the surface velocity and geostrophic transport varying according to the path of the current to the east.

SEA SURFACE CURRENTS
AND TEMPERATURES

One of the most distinctive characteristics of the Kuroshio, not found in other western boundary currents, is that in the south of central Japan, it has essentially five paths (Fig. 3). The first is a straight path virtually parallel to the south coast; the least direct path has a major offshore meander between south-west Shikoku and Tateyama, accompanied by a large cold eddy off the Kii coast. These paths are unusual for western boundary currents in that they last for several years, reflecting the Kuroshio's inlet velocity and viscosity and, in turn, more global variations of the atmosphere, oceans and cryosphere, including ENSO events (Kawabe, 1980, 1985, 1986; Yoon and Yasuda, 1987).

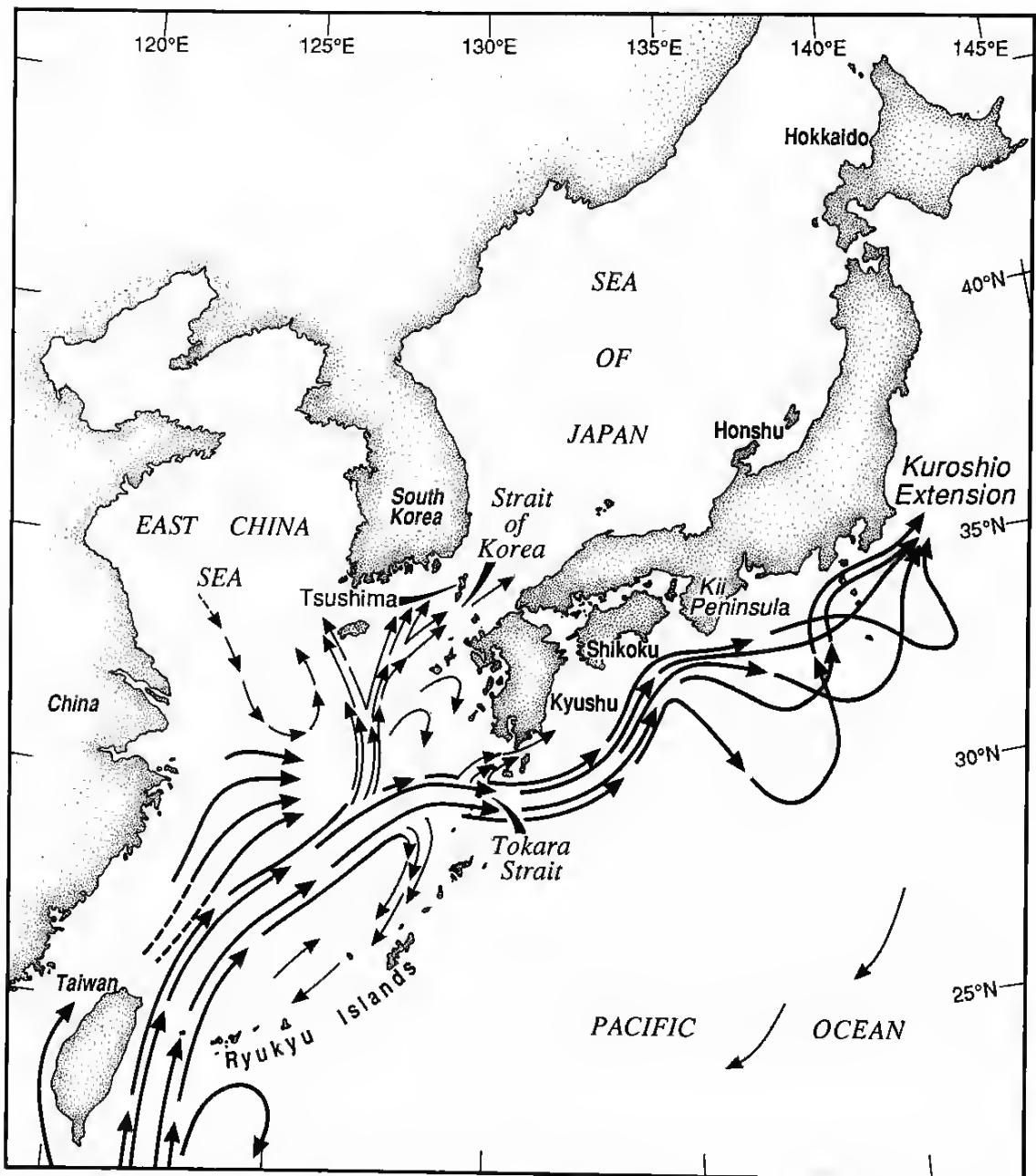


Figure 3. Generalised diagrammatic representation of the surface patterns associated with the Kuroshio Current.

SEA SURFACE CURRENTS AND TEMPERATURES

The large meander path of the Kuroshio is the more prevalent, having been present over 35 years between 1895 and 1984 (Kawabe, 1985); it has a relatively low volume transport and a greatly increased transport time east of the Kii coast. However, all paths, and most recorded variations of them, provide transport between Tanegashima, southern Kyushu, southern Shikoku and Kushimoto. The meandering path, forming a loop between Kushimoto and Izu or (less frequently) Tateyama, is accompanied by the 'Kyucho', a cold sudden current which may have catastrophic effects on the coastal biota east of Kushimoto (Uda, 1953; Ishino and Otsuka, 1970; Otsuka 1985). Temperatures in Sagami Bay are high during transition from the direct to a less direct meander path and cold during the reverse transition (Kawabe and Yoneno, 1987).

Southward of the eastern Kuroshio, the surface circulation in the subtropical eastern Philippines Sea is dominated by many eddies, but net movement is west towards the Kuroshio (Otsuka and Ishino, 1988), providing transport from the Ogasawara Is. to the Ryukyu Is., but not the reverse.

Extensive sets of temperature data have been recorded throughout Japan, and these, along with current data, have been correlated with the coral distributions of the present study by Veron and Minchin (in press).

4

Spatial and Temporal Patterns

There have been few biogeographic accounts of Japanese corals, or comparisons between them and those of other countries, since the studies of Yabe and his colleagues. Yamazato (1985) gives an integrated summary of comparisons between the corals of Japan and the Great Barrier Reef, together with ecological observations. Veron (1988) specifically address comparisons between Japanese and Australian corals, the latter publication being preliminary to the present one.

Table 1, on page 20, summarises the distribution of corals in the principal geographic zones of this study. Data are from the present study and confirmed records of previous studies. Figure 4 is a classification of these zones. These results, collectively, show a well defined spatial pattern dominated by an orderly reduction of species diversity in a progressive drop-out sequence from the Yaeyama Is. to Tateyama. There is a much higher degree of similarity between between Kushimoto and the distant Amakusa Is. than there is between Kushimoto and nearby Shirahama, indicating that, at high latitudes, physical environment has a greater control over species diversity than geographic proximity. These data are further analysed by Veron and Minchin (in press).

Temporal patterns are much less well defined. On an ecological time scale, the distribution limits of many species, especially regionally rare species in high latitudes, are likely to be in a natural state of flux. As noted above, species of *Acropora*, *Pavona* and *Fungia* have been recorded from the Ehime coast by Utinomi (1970) but were not found there during the present study. Moyer (pers. comm.) has observed the disappearance of *Cycloseris somervillei*, recorded by Tribble and Randall (1986) from Miyake I. in what was attributed to and ENSO-related temperature decrease, and several species including *Blastomussa wellsi*, *Euphyllia ancora*, *Pavona venosa*, *Acanthastrea lordhowensis*, *Hydnophora bonsai*, *Mycedium elephantotus* and *Oxypora lacera*, recorded by the author from Izu and/or Tateyama, are sufficiently rare to be only transitory populations.

Environment-correlated changes in coral distributions due to oceanographic conditions are, however, likely to be very minor compared with those resulting from *Acanthaster planci* predation and recent human influences. Outbreaks of *Acanthaster planci* (reviewed, Yamaguchi 1986) have cause extensive damage to coral communities throughout the Ryukyu Is. and in most mainland Japan locations. Land clearing for agriculture and changes to the coastline of most major islands resulting from a wide range of foreshore constructions are presently rapidly accelerating. The

effects of this on species abundances are difficult to determine. Of all studies of reefal corals, those based at Sesoko I. (Yamazato *et al.*, 1978; Sakai and Yamazato, 1987 and Chou and Yamazato, 1990) are of particular interest as they provide quantitative evidence of biodiversity decrease resulting from *Acanthaster* predation and coastal construction.

Regional estimates of abundance recorded subjectively during the present study (Veron *in press*), indicate that a group of 149 species, which occur in small, perhaps disjunct populations, or are otherwise uncommon are also usually uncommon throughout most of their Indo-Pacific distribution ranges and thus their low abundance in Japan may represent no significant departure from other countries and perhaps no significant departure from a pristine state. A second group of 107 species, or 27% of the total species complement of Japan, are either rare throughout the Ryukyu Is. (69 species) or restricted to the Yaeyama Is. (38 species). The latter are mostly occur in small biotopes of high diversity, such as a moat on the south side of Kuroshima (several branching *Montipora*), a deep water site of Amitori Bay, Iriomote I. (*Leptoseris amitoriensis*), perhaps a single embayment of Ishigaki I. (*Zoopilus echinatus*). (*Siderastrea* sp.). These species are presently threatened with regional extinction and it follows that an unknown number of other species, including many of those recorded from the Philippines, but not Japan, may have already become regionally extinct.

Of 8 species which are relatively common in mainland Japan as opposed to the Ryukyu Is., *Catalaphyllia jardinei* and *Acropora stoddarti* have not been found in the Ryukyu Is. and are dependant on small isolated outcrops for their continued existence in Japan. Both species must have occurred in the Ryukyu Is. at some past time, but there is no evidence as to when. Although there is increasing evidence that many if not most species from high latitude locations undergo normal sexual reproduction (Heyward, *pers. comm.*), colonisation may, in the long term, be dependant on recruitment from the Ryukyu Is. in the event of widespread death from low temperatures.

Of the species that may be endemic to mainland Japan and adjacent Asian countries, only *Alveopora japonica*, *Goniastrea deformis* and, perhaps, *Hydnophora bonsai*, are sufficiently widely distributed to not be at risk of total extinction (Veron, *in prep. a*).

Beyond the ecological time-scale, comparison between Holocene and extant faunas of Tateyama (Hamada, 1963b; Eguchi and Mori, 1973 and Veron, *in press b*) reveals a major change in species distributions and apparent relative abundance. Tateyama is not only the site of the world's most northern outcrop of hermatypic corals but is also the site (in the Numa beds) of a substantial outcrop of Holocene fossil corals with a radiocarbon date of 5,000 - 6,000 years BP. This extraordinary co-occurrence has provided the opportunity for a detailed reconstruction of environmental change during the Holocene, especially change in sea surface temperature. The Numa beds have 70 species, of which 51 have been positively

identified, and 35 species extant species have been recorded at Tateyama, of which 23 have been positively identified. Nearly one-third of all Numa bed species have remained extant at Tateyama, 85% are extant as far north as the Kii Peninsula and all except two have been recorded extant somewhere in mainland Japan. There has been a major change in species dominance at Tateyama. Analysis of species complements show that the Numa bed fauna has only a slightly closer affinity with the extant coral of Tateyama than with those of Izu and that a temperature increase of only 1.2-1.7°C would be adequate for the observed faunal change at Tateyama.

The Ryukyu Is. have widespread Pleistocene reefs containing corals that have received relatively extensive study, including comparisons with extant corals. Yabe and Sugiyama (1935b) and Nakamori (1986) give accounts of pre-war and recent studies respectively. With few exceptions, however, the Ryukyu Limestones do not contain sufficiently well-preserved corals to allow for detailed comparisons between fossil and extant community compositions.

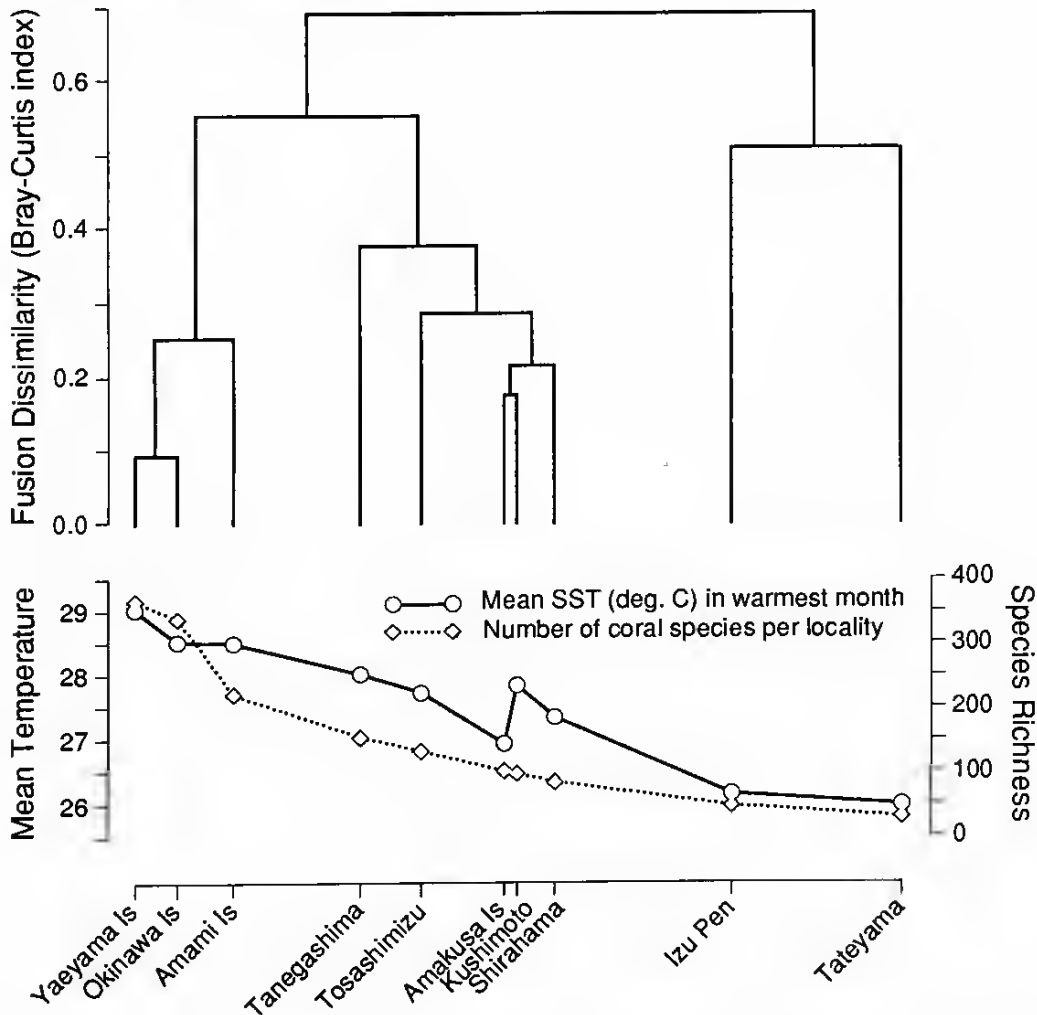


Figure 4. Average linkage clustering and unidimensional NMDS ordination of coral composition data from the 10 localities indicated. Also shown are the trends of SST (average mean of the warmest months) and species richness along the ordination axis (after Veron and Minchin, in press).

SPATIAL AND TEMPORAL PATTERNS

Table 1. Summary of the distribution of hermatypic corals in the principal geographic zones of the Ryukyu Is. and mainland Japan.

	Yaeyama Is.	Okinawa Is.	Amami Is.	Tanegashima	Tosashimizu	Amakusa Is.	Kushimoto	Shirahama	Izu	Tateyama		Yaeyama Is.	Okinawa Is.	Amami Is.	Tanegashima	Tosashimizu	Amakusa Is.	Kushimoto	Shirahama	Izu	Tateyama	
<i>Acanthastrea amakusensis</i>	X	-	-	X	X	X	X	X	X	X	-	<i>Acropora latistella</i>	X	X	X	X	-	X	-	-	-	-
<i>Acanthastrea bowerbanki</i>	X	X	-	-	X	X	-	-	-	-	-	<i>Acropora listeri</i>	X	X	-	X	-	-	-	-	-	-
<i>Acanthastrea echinata</i>	X	X	X	X	X	X	X	X	X	-	X ¹	<i>Acropora longicyathus</i>	X	X	-	-	-	-	-	-	-	-
<i>Acanthastrea hemprichii</i>	X	X	X	X	X	X	X	X	X	-	-	<i>Acropora loripes</i>	X	X	X	X	X	X	-	-	-	-
<i>Acanthastrea hillae</i>	X	X	X	X	-	X	X	X	-	-	-	<i>Acropora microclados</i>	X	X	-	-	-	-	-	-	-	-
<i>Acanthastrea ishigakiensis</i>	X	X	X	X	-	-	-	-	-	-	-	<i>Acropora microphthalma</i>	X	X	X	-	-	-	-	-	-	-
<i>Acanthastrea lordhowensis</i>	-	X	X	X	X	X	X	-	X	-	-	<i>Acropora millepora</i>	X	X	X	-	-	-	-	-	-	-
<i>Acanthastrea rotundoflora</i>	X	X	X	X	-	-	-	-	-	-	-	<i>Acropora mirabilis</i>	X	X	-	X	-	-	-	-	-	-
<i>Acrhelia horrescens</i>	X	-	-	-	-	-	-	-	-	-	-	<i>Acropora monticulosa</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora abrolhosensis</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora nana</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora aculeus</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora nasuta</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora accuminata</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora nobilis</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora akajimensis</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora palifera</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora anthocercis</i>	X	X	X	X	-	-	-	-	-	-	-	<i>Acropora paniculata</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora aspera</i>	X	X	X	-	X	X	X	X	-	-	-	<i>Acropora parilis</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora austera</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora pruinosa</i>	-	-	-	X	X	-	-	X	-	-
<i>Acropora brueggemanni</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora pulchra</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora carduus</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora robusta</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora cerealis</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora rosaria</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora clathrata</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora samoensis</i>	X	X	X	X	-	-	-	-	-	-
<i>Acropora copiosa</i>	X	X	-	X	-	-	-	-	-	-	-	<i>Acropora sarmentosa</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora cuneata</i>	X	X	-	X	-	-	-	-	-	-	-	<i>Acropora secale</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora cytherea</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora sekiseiensis</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora danai</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora selago</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora dendrum</i>	X	-	-	X	X	X	X	-	-	-	-	<i>Acropora solitaryensis</i>	X	X	X	X	X	X	X	X	X	X
<i>Acropora digitifera</i>	X	X	X	X	-	X	-	-	-	-	-	<i>Acropora stoddarti</i>	-	-	-	X	-	-	-	-	-	-
<i>Acropora divaricata</i>	X	X	X	X	X	X	-	-	-	-	-	<i>Acropora striata</i>	-	X	X	X	-	-	-	-	-	-
<i>Acropora echinata</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora subglabra</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora elegans</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora subulata</i>	X	X	X	X	X	-	-	-	-	-
<i>Acropora elseyi</i>	X	-	-	-	-	-	-	-	-	-	-	<i>Acropora tanegashimensis</i>	-	-	-	X	-	-	-	-	-	-
<i>Acropora exquisita</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora tenella</i>	X	-	-	-	-	-	-	-	-	-
<i>Acropora florida</i>	X	X	X	X	X	X	X	X	-	-	-	<i>Acropora tenuis</i>	X	X	X	-	-	-	-	-	-	-
<i>Acropora formosa</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora teres</i>	-	X ¹	-	-	-	-	-	-	-	-
<i>Acropora gemmifera</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora tumida</i>	-	-	-	X	-	X	X	-	X ¹	-
<i>Acropora glauca</i>	-	-	-	X	X	X	X	-	-	-	-	<i>Acropora valenciennesi</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora grandis</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora valida</i>	X	X	X	X	X	X	X	X	-	-
<i>Acropora granulosa</i>	X	X	X	-	-	-	-	-	-	-	-	<i>Acropora vaughani</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora horrida</i>	X ¹	X	-	-	-	-	-	-	-	-	-	<i>Acropora verweyi</i>	X	X	X	X	-	-	-	-	-	-
<i>Acropora humilis</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora wallaceae</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora hyacinthus</i>	X	X	X	X	X	X	X	X	-	-	-	<i>Acropora willisae</i>	X	X	X	-	X	-	-	-	-	-
<i>Acropora insignis</i>	X	X	X	-	X	-	-	-	-	-	-	<i>Acropora yongei</i>	X	X	-	-	-	-	-	-	-	-
<i>Acropora kiristyaee</i>	X	X	-	-	-	-	-	-	-	-	-	<i>Acropora sp. 1</i>	X	-	-	-	-	-	-	-	-	-

SPATIAL AND TEMPORAL PATTERNS

	Y O A T T A I S		Y O A T T A I S
<i>Acropora</i> sp. 2	- - - X - - - - -	<i>Cyphastrea microphthalmia</i>	X X X X X X X - - X ¹
<i>Alveopora allingi</i>	X X - - - - - - -	<i>Cyphastrea ocellina</i>	X - - - - - - - -
<i>Alveopora catalai</i>	X - - - - - - - -	<i>Cyphastrea serailia</i>	X X X X X X X X X X
<i>Alveopora excelsa</i>	X X X X - - X X - -	<i>Diaseris distorta</i>	X X - - - - - - -
<i>Alveopora japonica</i>	- - - X X ¹ X X X X X	<i>Diaseris fragilis</i>	X X ¹ - - - - - - -
<i>Alveopora spongiosa</i>	X X X - - X - X - -	<i>Diploastrea heliopora</i>	X X - - - - - - -
<i>Alveopora tizardi</i>	X - - - - - - - -	<i>Echinophyllia aspera</i>	X X X X X X X X X X
<i>Alveopora verrilliana</i>	X X X - - - - - - -	<i>Echinophyllia echinata</i>	X X X - X X - - - -
<i>Anacropora forbesi</i>	X X - - - - - - -	<i>Echinophyllia echinoporoides</i>	X X X - - - - - - -
<i>Anacropora matthai</i>	X X - - - - - - -	<i>Echinophyllia nishihirai</i>	X X - - X - - - - -
<i>Anacropora puertogalerae</i>	X X - - - - - - -	<i>Echinophyllia orpheensis</i>	X X - - - - - - -
<i>Anacropora reticulata</i>	X - - - - - - - -	<i>Echinophyllia patula</i>	X X - X - - - - - -
<i>Anacropora spinosa</i>	X - - - - - - - -	<i>Echinopora gemmacea</i>	X X X - - - - - - -
<i>Anacropora</i> sp.	X - - - - - - - -	<i>Echinopora lamellosa</i>	X X X X X - - - - -
<i>Astreopora explanata</i>	X - - X - - - - - -	<i>Echinopora mammiformis</i>	X - - - - - - - -
<i>Astreopora gracilis</i>	X X X - X ¹ - X - - -	<i>Echinopora pacificus</i>	X X X - - - - - - -
<i>Astreopora incrustans</i>	X X X X X - X X - - -	<i>Euphyllia ancora</i>	X X X X X X X X ¹ - X
<i>Astreopora listeri</i>	X X X - - - - - - -	<i>Euphyllia cristata</i>	X X - - - - - - - -
<i>Astreopora macrostoma</i>	- X - X - - - - - -	<i>Euphyllia divisa</i>	X - - - - - - - - -
<i>Astreopora myriophthalma</i>	X X X X X ¹ X ¹ - - - -	<i>Euphyllia glabrescens</i>	X X X - - - - - - -
<i>Astreopora ocellata</i>	X - - - - - - - - -	<i>Euphyllia paraglabrescens</i>	- - - X - - - - - -
<i>Astreopora suggesta</i>	X - - - - - - - - -	<i>Euphyllia yaeyamaensis</i>	X X X - - - - - - -
<i>Australomussa rowleyensis</i>	X X X - - - - - - -	<i>Favia danae</i>	X X - X X - - - - -
<i>Barabattoia amicornum</i>	X X X X X X X X - -	<i>Favia fava</i>	X X X X X X X X - -
<i>Blastomussa merleti</i>	X X X - - - - - - -	<i>Favia helianthoides</i>	X X - - X X X - - -
<i>Blastomussa wellsi</i>	X ¹ X X X X X X - X	<i>Fungia fungites</i>	X X X - X ¹ - - - - -
<i>Catalaphyllia jardinei</i>	- - - - - X X - - -	<i>Fungia granulosa</i>	X X X - - - - - - -
<i>Caulastrea curvata</i>	- X - - - - - - - -	<i>Fungia moluccensis</i>	X X - - - - - - - -
<i>Caulastrea echinulata</i>	X X X - - - - - - -	<i>Fungia paumotensis</i>	X X X - - - - - - -
<i>Caulastrea furcata</i>	X X X - - - - - - -	<i>Fungia repanda</i>	X X X - - - - - - -
<i>Caulastrea tumida</i>	X X X X X ¹ X X X - X ¹	<i>Fungia scabra</i>	X X - - - - - - - -
<i>Coeloseris mayeri</i>	X X - - - - - - - -	<i>Fungia scruposa</i>	X X X ¹ - - - - - - -
<i>Coscinaraea columna</i>	X X X X X X X X X -	<i>Fungia scutaria</i>	X X X X - - - - - -
<i>Coscinaraea crassa</i>	- X X X - - - X - - -	<i>Fungia spinifera</i>	- X - - - - - - - -
<i>Coscinaraea exesa</i>	- X - - - - - - - -	<i>Fungia valida</i>	X X X - - - - - - -
<i>Coscinaraea hahazimaensis</i>	- - - X X - X - X -	<i>Galaxea astreata</i>	X X - - X - - - - -
<i>Coscinaraea monile</i>	- X - X X - - - X ¹ -	<i>Galaxea fascicularis</i>	X X X X X - - - - -
<i>Coscinaraea wellsi</i>	- X - - X - - - - -	<i>Gardineroseris planulata</i>	X X X X - - - - - -
<i>Ctenactis crassa</i>	X X X - - - - - - -	<i>Goniastrea aspera</i>	X X X X X - X ¹ - X -
<i>Ctenactis echinata</i>	X X X - X ¹ - - - - -	<i>Goniastrea australensis</i>	X X X X X X X X X -
<i>Cycloseris costulata</i>	X X - - - - - - - -	<i>Goniastrea deformis</i>	- - - X X X X X X X
<i>Cycloseris curvata</i>	X X - - - - - - - -	<i>Goniastrea edwardsi</i>	X X X - X - - - - -
<i>Cycloseris cyclolites</i>	- X X ¹ - - X ¹ X ¹ X ¹ X ¹	<i>Goniastrea favulus</i>	X X X X X X X X X -
<i>Cycloseris hexagonalis</i>	X - - - - - - - - -	<i>Goniastrea pectinata</i>	X X X X X - - - - -
<i>Cycloseris patelliformis</i>	X X - X - - - X - -	<i>Goniastrea retiformis</i>	X X X X X X ¹ X ¹ - -
<i>Cycloseris sinensis</i>	X X - - - - - - - -	<i>Goniopora burgosi</i>	X X - - - - - - - -
<i>Cycloseris taughani</i>	X X X - - X - - - -	<i>Goniopora cellulosa</i>	- - X X X - - - - -
<i>Cycloseris</i> sp.	- - - X - - - - - -	<i>Goniopora columna</i>	X X X - - - - - X X
<i>Cynarina lacrymalis</i>	X X - X X X X X - -	<i>Goniopora djiboutiensis</i>	X - X X - - - - - -
<i>Cyphastrea agassizi</i>	X X X - - - - - - -	<i>Goniopora fruticosa</i>	X X - - - - - - - -
<i>Cyphastrea chalcidicum</i>	X X X X X X X X X X ¹	<i>Goniopora lobata</i>	X X - X X X X X - -
<i>Cyphastrea decadia</i>	X X - - - - - - - -	<i>Goniopora minor</i>	X X X - - - - - - -
<i>Cyphastrea japonica</i>	X X X X X X X X X -	<i>Goniopora pandoraensis</i>	X - - - - - - - - -

SPATIAL AND TEMPORAL PATTERNS

<i>Goniopora pendulus</i>	- - - X - X X - - -	<i>Montipora cactus</i>	X X - - - - - - - -
<i>Goniopora polyformis</i>	- - - - - X - - - -	<i>Montipora caliculata</i>	X - - - - - - - - -
<i>Goniopora somaliensis</i>	X X X X - - - - - -	<i>Montipora capitata</i>	X - - - - - - - - -
<i>Goniopora stokesi</i>	X X - X X X - - - -	<i>Montipora cebuensis</i>	X - - - - - - - - -
<i>Goniopora stutchburyi</i>	X X - - X - X X - -	<i>Montipora danae</i>	X X X X X - X - - -
<i>Goniopora tenuidens</i>	X X - - - - - - - -	<i>Montipora digitata</i>	X X X - - - - - - -
<i>Goniopora sp.</i>	X X - - - - - X - -	<i>Montipora efflorescens</i>	X X - - - - - X - -
<i>Gyrosmlia interrupta</i>	X - - - - - - - - -	<i>Montipora effusa</i>	X X X - X X X - - -
<i>Halomitra pileus</i>	X X - - - - - - - -	<i>Montipora foliosa</i>	X X X - - - - - - -
<i>Heliopungia actiniformis</i>	X - - - - - - - - -	<i>Montipora foveolata</i>	X X X - - - - - - -
<i>Herpolitha limax</i>	X X X - - - - - - -	<i>Montipora friabilis</i>	X X - X - - - - - -
<i>Herpolitha weberi</i>	X - - - - - - - - -	<i>Montipora gaimardi</i>	X X - - - - - - - -
<i>Heteropsammia cochlea</i>	- X - - - - - - - -	<i>Montipora grisea</i>	X X - - - - - - - -
<i>Hydnophora bonsai</i>	- - - - X X X X X -	<i>Montipora hirsuta</i>	X X - - - - - - - -
<i>Hydnophora exesa</i>	X X X X X X X X X X	<i>Montipora hispida</i>	X X X X X X X X - -
<i>Hydnophora microconos</i>	X X X - - - - - - -	<i>Montipora hoffmeisteri</i>	X X X X - - - - - -
<i>Hydnophora rigida</i>	X X X - - - - - - -	<i>Montipora incrassata</i>	X X X X - - - - - -
<i>Leptastrea bewickensis</i>	X X X X - - - - - -	<i>Montipora informis</i>	X X - X X X X X - -
<i>Leptastrea inaequalis</i>	X X - - - - - - - -	<i>Montipora mactanensis</i>	X - - - - - - - - -
<i>Leptastrea pruinosa</i>	X X X - X - - - X -	<i>Montipora malampaya</i>	X - - - - - - - - -
<i>Leptastrea purpurea</i>	X X X X X X X X X ¹	<i>Montipora millepora</i>	X X - - X X X X - -
<i>Leptastrea transversa</i>	X X X - - - - - - -	<i>Montipora mollis</i>	X X X X X X X X - -
<i>Leptoria irregularis</i>	X X X - - - - - - -	<i>Montipora monasteriata</i>	X X - X X - - - - -
<i>Leptoria phrygia</i>	X X X - - - - - - -	<i>Montipora peltiformis</i>	X X - - - - - - - -
<i>Leptoseris amitoriensis</i>	X - - - - - - - - -	<i>Montipora samarensis</i>	X X - - - - - - - -
<i>Leptoseris explanata</i>	X X X - - - - - - -	<i>Montipora spongodes</i>	X - - X X X X X - -
<i>Leptoseris foliosa</i>	X X X - - - - - - -	<i>Montipora spumosa</i>	X X X X - - X - - -
<i>Leptoseris gardineri</i>	X - - - - - - - - -	<i>Montipora stellata</i>	X X X - - - - - - -
<i>Leptoseris hawaiiensis</i>	X X X X - - - - - -	<i>Montipora tuberculosa</i>	X X - - - - - - - -
<i>Leptoseris incrustans</i>	X - - - - - - - - -	<i>Montipora turgescens</i>	X X X X X X X X X -
<i>Leptoseris mycetoseroides</i>	X X X X X X X X X X	<i>Montipora undata</i>	X X X X X - - - - -
<i>Leptoseris papyracea</i>	X X - - - - - - - -	<i>Montipora venosa</i>	X X X - - - - - - -
<i>Leptoseris scabra</i>	X X X - X - - - - -	<i>Montipora verrucosa</i>	X X X - - - - - - -
<i>Leptoseris solida</i>	X X - X - - - - - -	<i>Montipora sp.</i>	X X X - - - - - - -
<i>Leptoseris yabei</i>	X X X X - - - - - -	<i>Mycedium elephantotus</i>	X X X X X X X X X -
<i>Lithophyllon lobata</i>	X X X - - - - - - -	<i>Mycedium robokaki</i>	X - - - - - - - - -
<i>Lithophyllon undulatum</i>	X X - X X ¹ X X X - X ¹	<i>Oulastrea crispata</i>	X X X X X X X X X X
<i>Lobophyllia corymbosa</i>	X X X X - - - - - -	<i>Oulophyllia bennettiae</i>	X X X - - - - - - -
<i>Lobophyllia hataii</i>	X X X X - X X - - -	<i>Oulophyllia crispa</i>	X X X X X ¹ X X X - -
<i>Lobophyllia hemprichii</i>	X X X X - X X X - -	<i>Oxypora glabra</i>	X - - - - - - - - -
<i>Lobophyllia pachysepta</i>	X X - - - - - - - -	<i>Oxypora lacera</i>	X X X X X X X X X -
<i>Lobophyllia robusta</i>	X X X X - X X ¹ - - -	<i>Pachyseris gemmae</i>	X X - - - - - - - -
<i>Madracis asanoi</i>	- - - - - X - - - -	<i>Pachyseris rugosa</i>	X X X - - - - - - -
<i>Merulina ampliata</i>	X X X X - - - - - -	<i>Pachyseris speciosa</i>	X X X X X - - - - -
<i>Merulina scabricula</i>	X X X X - - - - - -	<i>Palauastrea ramosa</i>	X X - - - - - - - -
<i>Montastrea annuligera</i>	X X - - - - - - - -	<i>Pavona bipartita</i>	X X - - - - - - - -
<i>Montastrea curta</i>	X X X X X X X X - -	<i>Pavona cactus</i>	X X X X - - - - - -
<i>Montastrea magnistellata</i>	X X X X X - - - - -	<i>Pavona clavus</i>	X X - - - - - - - -
<i>Montastrea multipunctata</i>	X X - X - - - - - -	<i>Pavona danai</i>	X X - - - - - - - -
<i>Montastrea valenciennesi</i>	X X X X X X ¹ X ¹ - - -	<i>Pavona decussata</i>	X X X X X X X - - -
<i>Montipora aequituberculata</i>	X X X X - - - - - -	<i>Pavona explanulata</i>	X X X X X X - - X -
<i>Montipora altasepta</i>	X - - - - - - - - -	<i>Pavona frondifera</i>	X X X X - - - - - -
<i>Montipora angulata</i>	X X X - X - - - - -	<i>Pavona maldtensis</i>	- X X X - - - - - -

SPATIAL AND TEMPORAL PATTERNS

<i>Pavona minuta</i>	X X X X - X - - - -	<i>Porites mayeri</i>	X - - - - - - - -
<i>Pavona varians</i>	X X X X - - - - - X	<i>Porites murrayensis</i>	X X - - - - - - - -
<i>Pavona venosa</i>	X X X - - - - - - -	<i>Porites negrosensis</i>	X - - - - - - - - -
<i>Pectinia alvicornis</i>	X X - - - - - - - -	<i>Porites nigrescens</i>	X X X - - - - - - -
<i>Pectinia lactuca</i>	X X X - X ¹ X X X ¹ - -	<i>Porites okinawensis</i>	- X - - - - - - X -
<i>Pectinia paeonia</i>	X X X - - X X X - -	<i>Porites rus</i>	X X X - - - - - - -
<i>Pectinia teres</i>	X - - - - - - - - -	<i>Porites sillimaniani</i>	X X - - - - - - - -
<i>Physogyra lichtensteini</i>	X X - - - - - - - -	<i>Porites solida</i>	X X - - - - - - - -
<i>Physophyllia ayleni</i>	X - - - X ¹ X X X - -	<i>Porites stephensoni</i>	X X - - - - - - - -
<i>Platygyra contorta</i>	X X X X X X X X X -	<i>Porites vaughani</i>	X X - - - - - - - -
<i>Platygyra daedalea</i>	X X X X X X X ¹ X ¹ X ¹ -	<i>Psammocora contigua</i>	X X X X - - - - - -
<i>Platygyra lamellina</i>	X X - - - - - - - -	<i>Psammocora decussata</i>	- X X - - - - - - -
<i>Platygyra pini</i>	X X X - X X - - - -	<i>Psammocora digitata</i>	X X X - - - - - - -
<i>Platygyra ryukyuensis</i>	X X X - - - - - - -	<i>Psammocora haimeana</i>	X X - - - - - - - -
<i>Platygyra sinensis</i>	X X X X - - X ¹ - - -	<i>Psammocora nierstraszi</i>	X X - X - - - - - -
<i>Platygyra verweyi</i>	X X X X - - - - - -	<i>Psammocora profundacella</i>	X X X X X X X X X X
<i>Platygyra yaeyamaensis</i>	X X - - - - - - - -	<i>Psammocora superficialis</i>	X X X X X X X X X X
<i>Plerogyra eurysepta</i>	- - X - - - - - - -	<i>Psammocora vaughani</i>	X X - - - - - - - -
<i>Plerogyra sinuosa</i>	X X X - - - - - - -	<i>Pseudosiderastrea tayamai</i>	X X - - - - - - - -
<i>Plesiastrea versipora</i>	X X X X X X X X X X	<i>Sandalolitha robusta</i>	X X X - - - - - - -
<i>Pocillopora damicornis</i>	X X X X X X X X - -	<i>Scapophyllia cylindrica</i>	X X X - - - - - - -
<i>Pocillopora eydouxi</i>	X X X - X ¹ - - - - -	<i>Scolymia vitiensis</i>	X X - - - - - - - -
<i>Pocillopora meandrina</i>	X X - - - - - - - -	<i>Seriatopora caliendrum</i>	X X X - - - - - - -
<i>Pocillopora verrucosa</i>	X X X X X ¹ - - - - -	<i>Seriatopora hystrix</i>	X X X - - - - - - -
<i>Pocillopora woodjonesi</i>	X - - - - - - - - -	<i>Stylocoeniella armata</i>	X X - - X ¹ - X ¹ X ¹ X ¹ -
<i>Podabacia crustacea</i>	X X X - - - - - - -	<i>Stylocoeniella cocosensis</i>	X - - - - - - - - -
<i>Podabacia motuporensis</i>	X - - - - - - - - -	<i>Stylocoeniella guentheri</i>	X X X X X X X X - -
<i>Polyphyllia talpina</i>	X X X - - - - - - -	<i>Stylophora pistillata</i>	X X X X X X - - - -
<i>Porites annae</i>	X X - - - - - - - -	<i>Stylophora sp.</i>	- X - - - - - - - -
<i>Porites aranetai</i>	X X - - - - - - - -	<i>Symphyllia agaricia</i>	X X X X X - - - - -
<i>Porites attenuata</i>	X X X - - - - - - -	<i>Symphyllia radians</i>	X X X X X - - - - -
<i>Porites australiensis</i>	X X - - - - - - - -	<i>Symphyllia recta</i>	X X X - X ¹ - - - - -
<i>Porites cylindrica</i>	X X - - X ¹ - - - - -	<i>Symphyllia valenciennesii</i>	X X X - X X X X - -
<i>Porites deformis</i>	X - - - - - - - - -	<i>Trachyphyllia geoffroyi</i>	X X - X ¹ X X ¹ X X - -
<i>Porites evermanni</i>	X X - - - - - - - -	<i>Turbinaria frondens</i>	X X X X X X - X - -
<i>Porites heronensis</i>	- X X X X X X X X X	<i>Turbinaria irregularis</i>	X X X X X X X X ¹ - -
<i>Porites horizontalata</i>	X X - - - - - - - -	<i>Turbinaria mesenterina</i>	X X X X X - - - - -
<i>Porites latistella</i>	X X - - - - - - - -	<i>Turbinaria peltata</i>	- X X X X X X - - -
<i>Porites lichen</i>	X X X X - - - - - -	<i>Turbinaria reniformis</i>	X X X X X - - - - -
<i>Porites lobata</i>	X X X - X ¹ - - - - -	<i>Turbinaria stellulata</i>	X X X X X - X X - -
<i>Porites lutea</i>	X X X - X - - - - -	<i>Zoopilus echinatus</i>	X - - - - - - - - -

¹ A record from a previous study (see text). Doubtful records from previous studies are not included, although these may be included in the text under 'Previous studies'. Numerical data and analyses are from this table.

5

Collecting Stations

All collections were made using SCUBA, with 1-6 dives at each of the collecting stations listed below. Repeated dives were made in areas of highest diversity or when specific taxa were sought. Divers with good local knowledge (see Acknowledgements) helped to select diving sites in all places except Ishigaki I. where sites were selected systematically.

This study also involved examination of a wide range of previous collections held in Japanese universities, museums and aquaria (see Acknowledgements). Essential specimens of Yabe and his colleagues were examined at Tohoku University, Sendai. This very extensive collection, occupying several large rooms, is in the process of restoration and was not generally accessible to the author at the time of the present study.

Voucher specimens of all species, together with specimens of particular taxonomic interest, were sent to the Australian Institute of Marine Science for laboratory study. Available type specimens were obtained where appropriate (see text).

The Ryukyu Islands

Well-developed coral reefs are mostly restricted to the Ryukyu Is. (Fig. 1) and (not included in this study), the Ogasawara and Volcano Is. The Ryukyu Is. are a mountainous chain of islands, forming the eastern margin of the East China Sea and the western margin of the Philippine Sea. Almost all are surrounded by well-developed fringing reefs and these form an island arc which is continuous with the east and west coasts of Kyushu and the southern coast of Shikoku and Honshu. Other islands in this region, including Tanegashima and Miyake I., have actively accreting areas of reefal limestone, but these are not coral reefs in a functional sense.

Yaeyama Islands

The Yaeyama Islands consist of two mountainous islands, Iriomote I. in the west and Ishigaki I. in the east, separated longitudinally by a 22 km-wide complex of small, low islands and shallow reefal areas, collectively known as Sekisei Lagoon. The whole of the Yaeyama Islands is surrounded by 246 km of fringing reef, 1-1.5 km offshore, broken only by narrow embayments and passes. The coastline of the two main islands is complex and the fringing reef is likewise complex, giving a wide range of reefal environments including very exposed to very protected biotopes.

The greatest complexity of coastline is on the western side of Iriomote I., and includes Sakiyama and Amitori Bays and a complex of small islands to the north of

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Amitori Bay. This study was concentrated in Amitori Bay but it also incorporates collections from Sakiyama Bay from a survey by Nishihira and Yokochi (1990). Most localities for study at Iriomote I. were selected from the results of unpublished surveys of *Acanthaster* outbreaks.

Study sites in Sekisei Lagoon were also selected on the basis of studies of *Acanthaster* outbreaks (Ui, 1985; Kamezaki et al. 1987; Nomura and Kamezaki, 1987 and Iwase and Nomura, 1988), and include the localities of highest coral diversity of the region.

Studies at Ishigaki I. (Veron, 1988) were concentrated in and around the entrance to Kabira Bay where coral diversity is at its highest. Other sites visited include most of the coastline except the northern peninsula, but virtually all coral communities except those of reef flats have been extensively damaged by *Acanthaster* and, on the south side of the island, by construction work and water pollution. Distribution and abundance records of Shirai and Sano (1985) are partly based on notes from a preliminary survey undertaken by Veron and Kühlemann which were not intended for publication.

1. Sakiyama Bay, Iriomote I., partly exposed slope, moderate diversity, 2-25m.
2. Amitori Bay, Iriomote I., protected slope, high diversity, 5-20m.
3. Amitori Bay, Iriomote I., exposed outer slope, moderate diversity, 4-20m.
4. Amitori Bay, Iriomote I., protected slope, high diversity, 2-20m.
5. Amitori Bay, Iriomote I., very protected, low diversity, 2-15m.
6. Amitori Bay, Iriomote I., protected, low diversity, 2-20m.
7. Amitori Bay, Iriomote I., partly exposed, very low diversity, 2-35m.
8. Amitori Bay, Iriomote I., very exposed outer slope, high diversity, 5-15m.
9. Amitori Bay, Iriomote I., mostly protected, low diversity, 5-30m.
10. Amitori Bay, Iriomote I., very exposed outer slope, very high diversity, 5-28m.
11. Kayama I., Sekisei Lagoon, exposed outer slope, very high diversity, 10-27m.
12. Kayama I., Sekisei Lagoon, very protected lagoon, low diversity, 1- 2m.
13. Kuroshima, Sekisei Lagoon, in reef mote, low diversity, 0-3m.
14. Kuroshima, Sekisei Lagoon, exposed outer slope, very low diversity, 0-25m.
15. Sekisei Lagoon, west side, very protected, luxuriant *Acropora* and *Anacropora* growth on sides of mud banks, 0-9m.
16. Aragusuku I., south side, Sekisei Lagoon, exposed outer slope, moderate diversity, 5-15m.
17. Entrance to Kabira Bay, Ishigaki I., high diversity, 0-25m.
18. Kabira Bay channel, Ishigaki I., high diversity, 2-10m.
19. Yoshiwara, Ishigaki I., partly exposed, high diversity, 2-25m.
20. Yonehara Bank, Ishigaki I., partly exposed, very high diversity, 5- 35m.
21. Datefu Point, Ishigaki I., partly exposed, low diversity, 5-20m.
22. Yasura Point, Ishigaki I., reef flat and lagoon, low diversity, 1- 8m.
23. Tamatori Point, Ishigaki I., reef flat and lagoon, low diversity, 1- 15m.
24. Golf Course, Ishigaki I., reef flat and lagoon, low diversity, 1- 12m.

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25. North Shiraho, Ishigaki I., reef flat and outer slope, high diversity dominated by *Porites cylindrica* and *Heliopora coerulea*, 1- 15m.
26. Shiraho, Ishigaki I., reef flat, low diversity, 1-8m.
27. Miyara, Ishigaki I., reef flat, low diversity, 1-6m.
28. Oh-hama, Ishigaki I., reef flat, very low diversity, 1-8m.
29. Sakura Passage, Ishigaki I., low diversity, 5-15m.
30. Kannon Point, Ishigaki I., coral mostly dead, 0-4m.
31. Nagura Bay, Ishigaki I., mostly dead arborescent *Acropora*, 1-5m.
32. North Nagura, Ishigaki I., mostly dead, formerly very diverse, 3- 15m.
33. Ohsaki Point, Ishigaki I., partly exposed, low diversity, 5-25m.
34. Ogan Point, Ishigaki I., partly exposed, moderate diversity, 5-35m
35. Sakieda Bay, Ishigaki I., partly exposed, moderate diversity, 5-18m.
36. Ishi Point, Ishigaki I., partly exposed, moderate diversity, 5-20m.

Okinawa Islands

The Okinawa Islands are dominated by Okinawa I., the largest of the Ryukyu Islands. The distribution of corals around Okinawa is not well known. The coastline of the northern half of the island (east and west sides) contains few bays and thus fringing reefs are exposed to heavy wave action. The most protected coastlines (east and west sides) are found midway along the east and west coasts (Nago Bay).

The Okinawa Is. also includes several small island archipelagos to the west, of which the Kerama Is. have the most luxuriant coral. The Kerama Is. are a complex of high islands interconnected by fringing reefs forming a wide variety of biotopes. Coral recovery since *Acanthaster* outbreaks in the early 1980's has been more extensive than observed in the Yaeyama Islands.

37. Cape Zanpa, Okinawa I., exposed outer slope, moderate diversity, 0-35m.
38. Minna I., partly protected, moderate diversity, 5-10m.
39. Sesoko I., boat harbour, moderately low diversity, 0-3m.
40. Sesoko I., patch reef, low diversity, 3-25m.
41. Ginanotatejyan, Aka I., protected reef flat, very high diversity, 1- 5m.
42. Ago Bay, Zamami I., very protected, soft substrate, low diversity, 16-25m.
43. Fukaji I., west side, fringing reef, moderate diversity, 3-14m.
44. Between Geruma and Fukaji Is., west side, fringing reef, very high diversity, 4-15m.
45. Ago Bay, Zamami I., very protected, soft substrate, low diversity, 18-25m.
46. Yakarahama, Aka I., fringing reef, high diversity, 8-16m.
47. Kuba I., west side, fringing reef, high diversity, 8-20m.
48. Ginanohama, Aka I., fringing reef, high diversity, 2-20m.
49. Tonaki I., reef flat lagoon, moderate diversity, 1-5m.
50. Tonaki I., north-west side, fringing reef outer slope, high diversity, 5-20m.
51. Tonaki I., south-east side, fringing reef, low diversity, 5-20m.
52. Cape Dana, Iheya I., soft substrate, low diversity, 5-8m.

- 53. Cape Yone, Iheya I., fringing reef, low diversity, 3-25m.
- 54. Qushikawa I., Iheya I., fringing reef, low diversity, 0-25m.

Amami Islands

The Amami Islands are composed of Amami I. and Tokunoshima I., together with many smaller islands. Amami I., to the north, together with a complex of adjacent smaller islands, makes up the largest land mass of the group. These islands were not included in the present study. Tokunoshima I., to the south, is approximately oval in shape. The coastline, and consequently the reefs, of the western side, are relatively straight and the habitat diversity low. The central eastern side has a complex of irregular reefs which form a very wide range of biotopes.

- 55. Ikema, Tokunoshima I., protected fringing reefs, high diversity, 3- 15m.
- 56. Kaminomine, Tokunoshima I., outer reef slope, very high diversity, 5-35m.
- 57. Kan'nishi Point, Tokunoshima I., protected reefs, high diversity, 0- 14m.

Mainland Japan

The corals of mainland Japan (Fig. 2) grow directly on terrigenous rock substrata and thus lack the range and quality of habitats normally associated with large coral reefs, especially lagoons with areas of soft substrate protected from strong wave action, and slopes which have good exposure to light but which are sufficiently steep to restrict wave surge and the associated abrasion of coarse terrigenous sediment. There are several other major differences between reefal and non-reefal coral communities: the latter may have a very high percentage cover in shallow water, but these are usually *Acropora*-dominated to the exclusion of almost all other species; they have a low species diversity, and, because non-reefal communities cannot form their own substrate, they are generally restricted to small areas within narrow environmental constraints (commonly a 2-8m depth range, with exposure to some current and moderate but not strong wave action). The benthos of most high latitude mainland localities studied was dominated by macro-algae, notably *Sargassum* spp. and *Ecklonia cava*. In these cases, competitive exclusion between corals and macro-algae appears to be of primary importance to both local distribution and the abundance of most coral species. The dominance of macro-algae causes most non-reefal and reefal coral communities to exist in very different trophic environments, the former likely to be greatly affected by seasonal cycles.

Tanegashima is of particular biogeographic interest as it is situated immediately north of the northern limit of true coral reef development. The island is elongate in a north-south direction and has an irregular, rocky coastline for most of its length. There are small patches of reefal limestone along the south-east coast, but most coral; including that of the richest areas (around Ojiya Port) grows directly on non-carbonate rock substrate, mostly sandstone and conglomerates. As with most non-reefal locations, corals are very restricted in their local distribution, with a high proportion of the coastline having few, or no colonies.

The Amakusa Islands of west Kyushu have few corals except for the small rock outcrop of O-gase and the relatively diverse outcrop on the west coast of Kuwashima, near Ushibuka. The latter is an bed of coral extending from an extensive area of tabular *Acropora* in shallow water to an area of maximum diversity at 11m depth, where rock substrate meets sand.

Corals of south-west Shikoku are situated in several small areas in a wide range of bathymetry and exposure to wave action and currents. In the present study, corals were collected from a series of rocky promontories and embayments within 4km of the city of Tosashimizu. In some areas, notably collecting station 78, grazing echinoids had removed virtually all benthos including corals and macro-algae, in others, notably collecting station 74, *Acropora* almost totally covers the substrate as it does at Kuwashima (Amakusa Is.) and Kushimoto.

The Kushimoto Marine Park and some places around Shirahama contain pockets of corals growing on irregular rock outcrops. Most occur in shallow, partly protected biotopes. At Kushimoto, these pockets are extensive in places, with corals being the dominant benthos.

The environmental diversity of the Izu Peninsula is very great, reflecting the irregular mountainous terrain both above and below water. Only four corals were found at Nabeta and Shimoda Bays: *Oulastrea crispata*, *Porites heronensis*, *Porites okinawensis* and *Alveopora japonica*. *Oulastrea* is uncommon and forms small colonies only at collecting station 91. The other species were also at this station and *Porites heronensis* was also found in intertidal rock pools at the western entrance to the Bay. The high coral diversity areas of Izu are either side of the entrance to Nakagi Port. The western entrance is very rugged and exposed to strong wave action. Corals, intermixed with algae, are predominantly in the most exposed areas and most occur to depths of at least 30 m. The highest diversity of all, collecting station 92, is at the northern tip of Hirido island, which forms the eastern edge of Nakagi Port, at the southern tip of the peninsula. Most species were found at this station, at various depths between 2 and 22 m, the depth limit of rock substrate.

There is less environmental diversity at Tateyama than at any of the other principal geographic regions studied. The foreshore consists of small beaches interspersed between low rocky promontories. All intertidal and subtidal areas are likewise either sand or flat rock, mostly protected from strong wave action but with relatively turbid water. The proportion of rock substrate gradually decreases offshore. It is dominated by kelp (*Ecklonia* and *Sargassum*) at depths of approximately 10 m or less and the coral fauna is restricted to occasional colonies of *Favia speciosa*, *Psammocora profundacella*, *Oulastrea crispata* and *Alveopora japonica*. At greater depth the benthos gradually becomes more diverse until, at 15 m or more, it is dominated by a wide diversity of mostly temperate fauna of sponges and coelenterates. The above-mentioned species remain the most common corals along with *Cyphastrea serailia*, *Echinophyllia aspera*, *Hydnophora exesa*, *Porites heronensis* and *Psammocora superficialis*. Other species listed in Table 1 are recorded from one (in the case of

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Blastomussa wellsi) or a few colonies only. The highest diversity observed (collecting station 96) was at 16-18 m depth where the substratum was deformed giving vertical and undercut surfaces. The water is much less turbid in this region than at shallower depths.

58. Sumiyoshi, Tanegashima, exposed rock substrate, low diversity, 2-7m.
59. North of Ojioya Port, Tanegashima, exposed rock substrate, low diversity, 25-35m.
60. South of Ojioya Port, Tanegashima, exposed rugged rock substrate, high diversity, 1-9m.
61. South of Ojioya Port, Tanegashima, protected rock substrate, low diversity, 1-9m.
62. South of Ojioya Port, Tanegashima, exposed rugged rock substrate, high diversity, 5-25m.
63. North of Ojioya Point, Tanegashima, very exposed submerged rock substrate, low diversity, 5-25m.
64. South of Ojioya Point, Tanegashima, rocky shore, moderate diversity, 2-15m.
65. 10 km south of Tanegashima, very exposed submerged rock substrate, low diversity, 10-27m.
66. South of Kumano Harbour, Tanegashima, exposed rock substrate, moderate diversity, 5-17m.
67. East of Kumano Harbour, Tanegashima, protected rocky ridge, moderate diversity 3-12m.
68. Kuwashima, Amakusa Is., partly protected bay, partly protected rocky slope, high diversity, 2-11m.
69. O-gase, Amakusa Is., exposed rock substrate, moderate diversity, 0- 15m.
70. Otomekokashi, Amakusa Is., partly exposed, very low diversity, 0- 15m.
71. Tsuji I., Amakusa Is., protected, very low diversity, 2-12m.
72. Tomioka Point, Amakusa Is., very protected, very low diversity, 3- 7m.
73. South of lighthouse, Shimizu Port, Shikoku, rugged rock terrain sloping to sand, partly exposed, moderate diversity, 4-18m.
74. Unohae, Tosashimizu, Shikoku, rugged rock terrain, exposed, *Acropora* very dominant at <8m, 7-16m.
75. Hirabae, Tosashimizu, Shikoku, rugged rock pinnacle, exposed, moderate diversity, 15-28m.
76. North of lighthouse, Shimizu Port, Shikoku, irregular rock substrate sloping to sand, 0-12m.
77. Adjacent to lighthouse, Shimizu Port, Shikoku, irregular rock substrate sloping to sand, 0-15m.
78. Hinare, Tosashimizu, Shikoku, very rugged terrain, strong currents, low diversity, 10-30m.

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79. Ichinohae, Tosashimizu, Shikoku, irregular rock substrate, low abundance but high diversity, 15-25m.
80. Near the Sabiura Marine Park Research Station (Kushimoto region), partly protected, moderate diversity, 1-14m.
81. north-west coast of Shionomisaki (Kushimoto region), partly protected, low diversity with conspicuous *Catalaphyllia*, 2-12m.
82. 1 km east of the Sabiura Marine Park Research Station (Kushimoto region), partly protected, moderate diversity, especially Faviidae, 0-4m.
83. West Shionomisaki (Kushimoto region), algal dominated irregular rock slope, moderate diversity, 15-20m.
84. Off west tip of Sirahama, partly protected, moderate diversity, 0-6m.
85. Detached rock outcrop, south-west Tanabe Bay (Shirahama region), exposed, very low diversity, 5-20m.
86. South of Shirahama, partly protected, low diversity, 2-12m.
87. South Kanayama Bay (Shirahama region), exposed, moderate diversity, 10-25m.
88. Adjacent to the Seto Marine Biological Laboratory (Shirahama region), partly protected, moderate diversity, 0-8m.
89. West side Nabeta Bay, Shimoda, Izu, rock face, partly protected, sloping steeply to sand, no coral, 0-15m.
90. Shimoda Bay, Shimoda, Izu, rock face, very protected, sloping to sand, no coral, 0-8m.
91. East side, Nabeta Bay, Shimoda, Izu, irregular rock substrate, protected, low diversity, 0-5m.
92. Tonai, Nakagi, Izu, rugged rock pinnacles, very exposed, has most species of the region, 0-25m.
93. Hirido, near Nakagi, Izu, rugged rock substrate sloping to sand, partly exposed, has the highest diversity of the region, 2-22m.
94. Opposite Banda Marine Laboratory, Tateyama, flat rock substrate sloping to sand at 9m, partly protected, low diversity.
95. Hasama, Tateyama, flat rock substrate surrounded by sand, partly protected, low diversity, 14-18m.
96. Hasama, Tateyama, flat rock substrate surrounded by sand, partly protected, low diversity, 12-15m.
97. Hasama, Tateyama, flat rock substrate surrounded by sand, partly protected, low diversity, 14-18m.
98. Near Banda Marine Laboratory, Tateyama, irregular rock substrate surrounded by sand, partly protected, has most species of the region, 16-22m.



Editorial Note

Locality Records

Locality records listed under 'This study' are from the principal coral zones indicated above. They are primarily from the author's original field work (including Veron, 1988), but also include various additional records from recent collections, publications and unpublished surveys on which the author has worked.

Locality records listed under 'Previous records' are from publications previous to the present authors work and are intended as a guide only. In most cases, collected coralla have not been re-examined and thus they are not synonymies. Only original records are listed.

Locality records from all sources are combined in Table 1. The species inventory for each of the resulting zones is considered to be highly representative.

References to colour illustrations are given to aid field identifications. Incorrect or doubtful references are not noted except where there is particular need to do so.

6
Family
Astrocoeniidae
Koby, 1890

The genus *Stylocoenia* Edwards and Haime, 1848 was used by Yabe and Sugiyama (1932) for *S. japonica* Yabe and Sugiyama, 1932 and *S. hanzawai* Yabe and Sugiyama, 1933. The former species was originally described as 'two small fragments', 'more or less abraded' from the north-eastern Izu coast (Yabe and Sugiyama, 1932b, 1932c) which appear to have been lost, but which are probably synonyms of *S. armata*. The latter species was placed in *Astrocoenia* by Wells (1935) and *Stylocoeniella* by Yabe and Sugiyama (1935b).

Genus Stylocoeniella
Yabe and Sugiyama, 1935

Stylocoeniella guentheri
Bassett-Smith, 1890

Generally common throughout the distribution range, especially on outer slopes. Is very polymorphic. Colonies have encrusting to massive or columnar growth forms with nodular surfaces and are commonly up to 1m diameter throughout the distribution range. Encrusting colonies have superficial, widely spaced corallites and relatively weak development of coenosteum styles. Columellae are boss-like and fused to first cycle septa to thin, style-like, and not superficially fused. Second cycle septa are sub-equal to abortive. Much of this variation may occur in different parts of a single large corallum. Calice structures are usually highly granulated. No geographic variation in structure was observed. Colonies are mostly mottled dark green. Rarely red, brown or cream colonies, with or without light blue tentacles occur in mainland localities. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

The holotype of *Stylocoeniella hanzawai* (Yabe and Sugiyama, 1932), the type species of *Stylocoeniella*, was re-examined during the present study and found to be a junior synonym of *S. guentheri*, not *S. armata* as indicated by Wells (1966a) and

subsequent authors. It was initially described by Yabe and Sugiyama (1932c) as *Stylocoenia hanzawai* and subsequently placed in the genus *Stylocoeniella* by Yabe and Sugiyama (1935b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe and Sugiyama (1932c) (as *Stylocoenia hanzawai*): Amami Is.; Yabe *et al.* (1936): (as *S. hanzawai*) North to Suruga Bay; Eguchi (1973) (as *S. hanzawai*): Tsushima; Yamazato *et al.* (1978): Okinawa; Tribble and Randall (1986): Miyake I.; Kawaguti (1983) (as *S. hanzawai*): Yaeyama Is.

Stylocoeniella armata

(Ehrenberg, 1834)

Much less common than *S. guentheri*; usually encrusting. Corallites are larger than those of *S. guentheri*, septa are thick, sub-equal, and have margins which either slope gradually to the columella, or plunge steeply. All coralla studied have at least some corallites with well-developed 'pseudo-pali', as described by Yabe and Sugiyama (1935b). Usually pale cream or green. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: ?Yabe and Sugiyama (1932a, b) (as *Stylocoenia japonica*): Izu; Utinomi (1966, 1971): north-east Kyushu and Kii coast; Eguchi (1971): Goto I.; Eguchi (1974): Yaeyama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto.

Stylocoeniella cocosensis

Veron, 1990

A rare and very cryptic species recorded only from the Ryukyu Is. and the Cocos (Keeling) Is. Coralla are encrusting. Corallites are irregular in size, shape and orientation, and are inclined on the corallum surface. Calices are oval or crescent-shaped, depending on the degree of development of the associated style and degree of inclination on the corallum surface. The coenosteum is covered by spinules similar in size and appearance to those of other *Stylocoeniella*, except that their tips have *Palauastrea*-like elaborations. Most corallites on convex surfaces have style-like hoods. Septa are in two sub-equal cycles, similar to those of *S. armata*.

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Pseudo-pali are weakly developed in some corallites. Columellae are weakly developed. The only recorded colour is greenish-brown.

Records:

This study: Yaeyama Is.

Previous studies: Veron (1990): Yaeyama Is.

7

Family
Pocilloporidae

Gray, 1842

Genus Pocillopora

Lamarck, 1816

Pocillopora damicornis

(Linnaeus, 1758)

Very common throughout the Ryukyu Is., generally uncommon at Tanegashima and mainland localities. Commonly forms compact clumps on upper reef slopes exposed to strong wave action. Ryukyu Is. coralla have a similar range of variation as those from the Great Barrier Reef; mainland coralla are mostly small and thick-branched, as are coralla from the higher latitudes of eastern and western Australia. Usually pale to dark brownish-purple or green, sometimes pink in the Ryukyu Is. and Tanegashima, dark yellow-grey to brownish-purple in mainland localities. Recorded in most studies north to Shirahama. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936): north to near Kushimoto; Utinomi (1965b, 1971): north-east Kyushu and south-west Shikoku; Ooishi (1970): Ogasawara and Volcano Is.; Kikuchi (1968): Amakusa Is.; Yagi (1970): south-west Shikoku; Anonymous (1970): Ehime coast; Eguchi (1974): Yaeyama Is. and Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Pocillopora verrucosa

(Ellis and Solander, 1786)

Common on exposed upper reef slopes throughout the Ryukyu Is., rare at Tanegashima. Has a similar range of variation on the Great Barrier Reef. A single corallum collected from Tanegashima shows no distinctive characters. Usually brown or pink in shallow water. Illustrated in colour: Shirai (1980) (as *P. setchelli*), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936) (as *P. meandrina nobilis*, *P. setchelli* and *P. verrucosa*): Ryukyu, Ogasawara and Daito Is.; Ooishi (1970): Ogasawara and Volcano Is.; Anonymous (1970): Ehime coast; Eguchi (1974) (as *P. verrucosa* and *P. meandrina nobilis*): Yaeyama Is.; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Pocillopora meandrina

Dana, 1846

Common on some exposed reef slopes. Has a similar range of variation on the Great Barrier Reef. As in other countries, this species may be difficult to separate from *P. verrucosa* unless both occur in close proximity. Usually pale brown in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974) (as *P. meandrina nobilis*): Kerama Is.; Habe (1989): Iriomote I.

Pocillopora woodjonesi

Vaughan, 1918

Rare, difficult to distinguish from *P. eydouxi* and has ill-defined corallite characters requiring further study. Has a more lax growth form than *P. eydouxi* in the same biotope. Colonies were green at Aragusuku I., Yaeyama Is.

Records:

This study: Yaeyama Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Pocillopora eydouxi

Edwards and Haime, 1860

Generally uncommon except on some upper reef slopes and shallow biotopes subject to strong currents. Has a similar range of variation on the Great Barrier Reef and has the same environment preferences. Shows no geographic variation. Uniform brown or pink in colour, the latter occurring in shallow water only, the same as *P. verrucosa*. Illustrated in colour: Shirai (1980) (as *P. modumanensis*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936) (as *P. modumanensis*): Ryukyu Is.; Anonymous (1970): Ehime coast; Eguchi (1974) (as *P. modumanensis*): Yaeyama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Genus Seriatopora

Lamarck, 1816

Seriatopora hystrix

Dana, 1846

Common throughout the distribution range except in high energy environments, where it is seldom found. Colonies may show wide, continuous variation within the same biotope, especially in deeper (>20m depth, eg. station 42) or very protected water (eg. station 15), where colonies are finely branched, but show considerable variation in branch thickness. An early re-coloniser, along with *Pocillopora damicornis* and *Stylophora pistillata* after *Acanthaster* damage. Colonies frequently contain gall-forming crabs (*Hapalocarcinus marsupialis*). They are mostly cream or yellow, sometimes pink, especially in shallow water. Illustrated in colour: Shirai (1980) (as *S. crassa*, *S. octopera*, *S. hystrix*, and *S. caliendrum* var. *subtilis*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Ryukyu Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978) (as *S.*); Habe (1989): Iriomote I. *S. hystrix* and *S. angulata*): Okinawa; Kawaguti (1983) (as *S. angulata* and *S. hystrix*): Okinawa; Chou and Yamazato (1990): Okinawa.

Seriatopora caliendrum

Ehrenberg, 1834

Relatively common on some lower reef slopes. Coralla are similar to those from the Great Barrier Reef. Colonies are usually cream in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): north to Okinawa Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Kawaguti (1983): Yaeyama Is.

Genus Stylophora

Schweigger, 1819

There appears to be no significant differences between the *Stylophora* of Japan and that of the Philippines. Further study (as indicated in Veron and Hodgson, 1989) suggests that *Stylophora dendritica* Nemenzo is not a *Stylophora*, but a synonym of *Seriatopora caliendrum*.

Stylophora pistillata

(Esper, 1797)

Rare in exposed biotopes; seldom (never in higher latitudes) forms thick-branched colonies common in tropical localities. Common on lower reef slopes throughout the distribution range except Amakusa Is. Shallow water colonies are usually deep pink; finely branching colonies from deeper or protected water are commonly pale cream, sometimes pink, rarely green at Tanegashima. Illustrated in colour: Shirai (1980) (as *S. pistillata* and *S. mordax*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is. (laboratory specimen only).

Previous studies: Yabe *et al.* (1936) (as *S. pistillata* and *S. mordax*): north to south-west Shikoku; Eguchi (1968) (as *Stylophora* sp.): Sagami Bay; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Eguchi and Mori (1973): Tateyama; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa.

Stylophora sp.

Variation within this supposed species has been studied from a series of nine specimens from Ago Bay. At one extreme these have all the characters of *Seriatopora*, including corallites arranged in rows. At the other they integrate with a deep water ecomorph of *Stylophora pistillata*. Specimens from the Philippines are clearly the same species, but this cannot be named until the present species is better defined, especially in relation to *S. pistillata*. Several nominal species of both *Stylophora* and *Seriatopora* have similar structure, the closest being *Stylophora flabellata* Quelch, 1886 from the Philippines, believed by Veron and Hodgson (1989) to be a junior synonym of *S. pistillata*. Very pale brown or cream in colour.

Records:

This study: Okinawa Is.

Previous studies: Not recorded.

Genus Palauastrea

Yabe and Eguchi, 1941

Palauastrea ramosa

Yabe and Sugiyama, 1941

Forms large stands at Sakiyama Bay, Iriomote I. (Nishihira, in prep.); commonly forms compact colonies up to 0.5m diameter in Sekisei Lagoon (station 12 and 13) and also commonly forms lax colonies >2m diameter in Ago Bay (station 42). Shallow water colonies are mostly mottled dark cream and green; deeper water colonies mostly pale cream or brown. Illustrated in colour: Shirai (1980) (as *P. ramosa* and *P. ramosa iwayamaensis*), Uchida and Fukuda (1988a).

There is substantial variation in coralla from different environments. Coralla from shallow water have short compact branches with proliferous coenosteum styles (analogous to those of *Stylocoeniella*) on their tips, have corallites that are relatively deep and have two clearly developed (even sub-equal) septal cycles. Coralla from deep water have finer, open branches, form larger colonies, and have relatively superficial corallites with abortive second cycle septa. The former is at the extreme of the range of variation found on the Great Barrier Reef. As this variation is continuous and clearly environment-correlated, it appears that only one species is involved. The subspecies *Palauastrea ramosa iwayamaensis* Yabe and Sugiyama, 1941 is not clearly correlated with this variation.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Madracis

Edwards and Haime, 1849

Madracis asanoi

Yabe and Sugiyama, 1941

It is not known if this is a hermatypic species or not. The only corallum studied had fine, irregular branches, a growth form more suggestive of an ahermatypic species than the much more robust (hermatypic) *M. kirbyi*. Yabe and Sugiyama (1936) list characters separating this species from *M. kauaiensis* Vaughan (from Hawaii), most of which are ill-defined in the present specimen.

Records:

This study: Kushimoto (laboratory specimen only, from 40m depth).

Previous studies: Eguchi (1968): Sagami Bay; Anonymous (1977): Kushimoto; Miyawaki (1978): Kushimoto; Shirai (1986): Kii coast.

8

Family
Acroporidae

Verrill, 1902

Genus Montipora

de Blainville, 1830

Montipora monasteriata

(Forskål, 1775)

Common on upper reef slopes. Forms tiers of brown plates in Sekisei Lagoon (station 15). Is primarily distinguished from *M. tuberculosa* by having smaller corallites, a coarse reticulum and a relatively uniform cover of papillae (or tuberculae) which are not concentrated around the corallites. Is often brightly coloured eg. pale pink with orange polyps. Has a similar range of variation on the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu.

Previous studies: Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora tuberculosa

(Lamarck, 1816)

Common. Corallites are both immersed and exsert and are surrounded (partly or entirely) by thecal papillae which are more abundant than reticulum papillae. Commonly mauve or pale brown in colour, sometimes with white reticulum papillae. Collected specimens are similar to Great Barrier Reef coralla. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Montipora hoffmeisteri

Wells, 1954

Common in the Yaeyama Is., especially in exposed sites (eg. stations 11 and 14). Colonies are usually encrusting. Corallites are minute and are imbedded in tuberculae. Has a wide range of colours: grey or brown or bright red, green or purple. Collected specimens are similar to Great Barrier Reef coralla.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Montipora millepora

Crossland, 1952

Probably common in the Yaeyama Is., especially in exposed sites, where colonies are usually encrusting. Tuberculae seldom contain corallites. Collected specimens are similar to Great Barrier Reef coralla. Usually dark brown in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu, Amakusa Is., Kushimoto, Shirahama

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Montipora mollis

Bernard, 1897

Columnar growth forms of this species have previously been called *Montipora* sp. 1 by Veron and Wallace (1984) and Veron and Hodgson (1989). Further collecting in Japan has established that this growth-form is a shallow-water ecomorph of *M. mollis*. Illustrated in colour: Uchida and Fukuda (1988a).

Colonies are encrusting or are of indeterminate shape or consist of irregular, compact, highly fused columnar or nodular upgrowths. Corallites are widely spaced, immersed, the theca indistinguishable, or nearly so. They are small (0.5 - 0.7mm diameter) and uniform in appearance. There are no thecal or reticulum papillae, the coenosteum being uniformly spongy, medium-fine, with moderately to highly elaborated outer tips. Primary septa are well-developed, up to 3/4 the calice radius, each consisting of a row of inward projecting spines, becoming plate-like

near the theca. One pair of primary septa may be slightly larger than the others. Second cycle septa are weakly developed, usually incomplete, $<1/3$ the calice radius.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yamazato *et al.* (1978) (? as *M. crista-galli*): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora spongodes

Bernard, 1897

Uncommon but distinctive. Colonies are flat plates with finger-like upgrowths. Septa are better developed in Japanese coralla than in those from the Great Barrier Reef. Uniform pale to medium brown in colour.

Records:

This study: Yaeyama Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Montipora peltiformis

Bernard, 1897

Common throughout the distribution range. Colonies are usually flat plates with columnar vertical branches. Pale brown in colour. Has a similar range of variation in the Philippines and Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.

Montipora turgescens

Bernard, 1897

Probably common, but has not been studied *in situ* in detail. Colonies are usually small; coralla show no differences from those from the Great Barrier Reef. Mostly mottled brown or purple in colour. Illustrated: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Eguchi and Miyawaki (1975) and Anonymous (1977) (as *M. mollis*): Kushimoto; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora effusa

Dana, 1846

Common throughout Ryukyu Is.; less common in mainland localities. Colonies are submassive or plate-like, superficially characterised by having *M. turgescens*-like corallites with thecal and/or reticulum papillae (visible *in situ*). Usually dark greenish-brown but may be pale cream and other colours.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Not recorded.

Montipora spumosa

(Lamarck, 1816)

Rare, does not form large colonies. Reticulum spinules are similar to those of Philippine coralla and generally less coarse than of Great Barrier Reef coralla. The only recorded colour is pale brown.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Kushimoto.

Previous studies: Kawaguti (1983): Yaeyama Is.

Montipora undata

Bernard, 1897

Sometimes common in Amitori Bay and Tanegashima, generally uncommon elsewhere. Large colonies with prominent reticulum ridges have not been seen in Japan. Coralla, like those from the Philippines, have slightly finer structures than those from the Great Barrier Reef. Otherwise, specimens collected show no geographic variation. Colonies are brown with pale margins and have the same

appearance *in situ* as those on the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Montipora mactanensis

Nemenzo, 1979

Common at Amitori Bay and Sekisei Lagoon, especially common at station 15. Coralla are similar to those from the Philippines, consisting of thin plates with fine, radiating reticulum ridges. Pale brown or off-white in colour.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Montipora danae

(Edwards and Haime, 1851)

Generally uncommon. Verrucae may be tightly compacted in colonies exposed to strong wave action, but variation is generally the same in coralla from the Philippines and the Great Barrier Reef. Mostly a uniform pale brown at the Ryukyu Is., or dark brown at Tanegashima. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Kushimoto.

Previous studies: Yamazato *et al.* (1978): Okinawa; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Montipora verrucosa

(Lamarck, 1816)

Generally rare; environmental and geographic variation have not been studied. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974) (as *M. conferta* and *M. verrucosa*): Yaeyama Is. and Kerama Is.; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora capitata

Dana, 1846

Found only at stations 12, 19 and 20, the first site at 1.5m depth, where many colonies are dispersed along a shallow shoreline for approximately 50 m. Coralla are very similar to those from the Philippines while those from Vanuatu tend to have thicker branches. Uniform pale cream in colour.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Montipora incrassata

(Dana, 1846)

Generally uncommon. Colonies in the Ryukyu Is. tend to be submassive, without sub-digitate upgrowths as are sometimes found on the Great Barrier Reef. Thecal tuberculae are less well-developed.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Not recorded

Montipora foveolata

(Dana, 1846)

Generally uncommon, colonies are usually plate-like or submassive. Usually found on upper reef slopes. Corallites are very similar to those of Philippines coralla and smaller than those from the Great Barrier Reef. Less distinct from *M. venosa* than on the Great Barrier Reef. Usually creamy pink, pale brown or fawn. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.

Montipora venosa

(Ehrenberg, 1834)

Rare, less easily distinguished from *M. foveolata* than on the Great Barrier Reef. Usually cream coloured (station 14). Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

jmjRecords:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora caliculata

(Dana, 1846)

Uncommon or rare, recorded only on exposed upper slopes of Sekisei Lagoon (notably station 11). The reticulum of a collected corallum is finer than that of most Great Barrier Reef coralla; corallites are very similar.

Records:

This study: Yaeyama Is.

Previous studies: ?Utinomi (1971): north-east Kyushu; Yamazato *et al.* (1978): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora angulata

(Lamarck, 1816)

Generally uncommon except in some shallow lagoons (notably station 13). Environmental and geographic variation has not been fully studied. Usually pale brown in colour with whitish reticulum ridges towards branch tips.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Montipora cactus

Bernard, 1897

Generally common in protected shallow biotopes throughout the distribution range (eg. station 13 and in the small boat harbour, Aka I.). Branches are usually upright and irregularly contorted and bases are usually massive. The range of variation is very similar to that of Philippine colonies. Colonies are cream or brown in colour with white branch ends and white reticulum papillae.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: There are many incorrect references to this species. *In situ* photographs in Eguchi and Miyawaki (1975) and Anonymous (1977) (Kushimoto) resemble this species, but collected coralla are *M. informis*; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.

Montipora samarensis

Nemenzo, 1967

Forms extensive stands (station 13), where colonies have branches >300mm in length. Probably rare in the Okinawa Is. The reticulum is covered with papillae with elaborated tips, especially towards branch ends where they have a frosted appearance. These are visible *in situ*. Usually pale brown, yellow-brown or brown with white papillae. Colour differences between colonies may confuse species recognition *in situ*.

As well as resembling *M. altasepta* and *M. digitata* (see below), this species also resembles *M. stellata* which also has elaborated reticulum papillae but has smaller, usually more contorted branches.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: ?Utinomi (1965b) (as *M. ramosa*): south-west Shikoku; Habe (1989): Iriomote I.

Montipora altasepta

Nemenzo, 1967

Forms extensive stands (Sekisei Lagoon, station 13) with *M. samarensis*. Not recorded elsewhere. Branches are of variable size and shape. In thick stands of

Montipora, branches may be long and straight; in more isolated colonies, branches usually become short and irregular. Corallites are of variable size; septa are generally exsert. Corallites of Japanese coralla tend to be more excavated than those from the Philippines. Pale brown or grey in colour.

This species is readily confused with *M. samarensis* and *M. digitata*, especially where all three co-occur and have the same growth form and branch size. *Montipora digitata* has a smooth reticulum surface without papillae; *M. altasepta* has simple papillae without elaborated ends; *M. samarensis* has highly elaborated papillae.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Montipora digitata

(Dana, 1846)

Very common in protected shallow (subtidal) water throughout the distribution range and has a similar range of variation on the Great Barrier Reef. Colonies are pale brown, grey-brown or cream in colour. May be confused with *M. samarensis* and *M. altasepta in situ* (see above). Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974) (as *M. levis* and *M. ramosa*): Yaeyama Is.; Yamazato *et al.* (1978) and Kawaguti (1983) both record a series of synonyms of *M. digitata* from Okinawa: (Yamazato *et al.* (1978) as *M. compressa*, *M. fruticosa*, *M. levis*, *M. marenzelleri*, *M. ramosa* and *M. rubra*; Kawaguti (1983) as *M. divaricata*, *M. fruticosa*, *M. indentata*, *M. marenzelleri*, *M. ramosa* and *M. tortuosa*). These specimens have not been re-examined during the present study and are presumed to refer, in part, to other branching *Montipora*. Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora gaimardi

Bernard, 1897

Uncommon; variation has not been fully determined. Like *M. digitata* but with short, contorted branches.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Montipora hispida

(Dana, 1846)

Generally uncommon in the Ryukyu Is. except in Sekisei Lagoon, especially station 13; common at Kushimoto. Colonies have a similar range of variation as those of the Philippines and the Great Barrier Reef. Coralla from mainland localities are plate-like and lightly calcified. Pale brown or grey in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Eguchi (1968): Sagami Bay; Ooishi (1970): Ogasawara and Volcano Is.; ?Hamada (1963b) and Eguchi and Mori (1973): Tateyama; Eguchi (1974): Kerama Is.; Chou and Yamazato (1990): Okinawa.

Montipora informis

Bernard, 1897

Sometimes common, has a similar range of variation on the Great Barrier Reef. Massive colonies are frequently >500mm diameter at Tanegashima. Has an especially wide colour range at Tanegashima. Illustrated in colour: Nishihira (1988, Uchida and Fukuda (1988a)).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Kikuchi (1968) (as *M. cactus*): Amakusa Is.; Eguchi and Miyawaki (1975) and Anonymous (1977) (as *M. cactus*): Kushimoto.

Montipora efflorescens

Bernard, 1897

Common, especially at Amitori Bay, where colonies have a similar range of variation in the Philippines, but tend to develop branch-like up-growths more than is usual on the Great Barrier Reef. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is., Izu.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora grisea

Bernard, 1897

Common, especially at stations 2 and 41, where colonies have a similar range of variation in the Philippines and the Great Barrier Reef. Colonies may be colourful, but are often a uniform dark brown.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Montipora hirsuta

Nemenzo, 1967

Generally common, especially in shallow water. As noted by Veron and Hodgson (1989), this species is distinguished from *M. stellata* by having smaller branches and finer corallites. It also tends to have longer reticulum papillae giving an 'hirsute' appearance *in situ*. Colonies are cream in colour and have a similar range of variation in the Philippines.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Montipora stellata

Bernard, 1897

Common in Amitori Bay and several stations at Ishigaki I., but probably uncommon elsewhere. Colonies are generally finely branched. Coralla show no differences from those of the Philippines. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora malampaya

Nemenzo, 1967

Generally rare, common at station 4 where colonies have compacted branches. Colonies show no differences from those of the Philippines. The growth form is similar to that of *M. cactus* but reticulum papillae are longer, especially at branch tips.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Montipora sp.

Common in Amitori Bay and Sekisei Lagoon over a wide range of environments (including stations 11, 12, 13 and 15), probably less common elsewhere. Colonies consist of thin plates like those of *M. foliosa* with irregular coenostial ridges and elongate papillae. Corallites are minute and widely spaced. Usually dark brown in colour.

Coralla are very similar to those of the Philippines (*Montipora* sp. 2 of Veron and Hodgson, 1989). Further study of type specimens is required before this species can be described as a new species.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Montipora foliosa

(Pallas, 1766)

Generally uncommon or rare. Coralla are very similar to those of the Philippines and the Great Barrier Reef. Colonies are pale or dark grey-brown with paler reticulum ridges. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974) (as *M. foliosa* and *M. pulcherrima*): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978) (as *M. foliosa*, *M. prolifera* and *M. pulcherrima*): Okinawa; Kawaguti (1983) (as *M.*

prolifera and *M. pulcherrima*): Okinawa; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora cebuensis

Nemenzo, 1976

Generally uncommon except station 3 where colonies are pale brown with yellowish coenostial ridges.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Montipora aequituberculata

Bernard, 1897

Generally uncommon throughout the distribution range and seldom forms large plates. Coralla are very similar to those of the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: ?Eguchi (1974) (as *M. challenger*i and ?*M. verrilli*): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Montipora friabilis

Bernard, 1897

Uncommon and little studied. Colonies from flat whorls. Veron and Hodgson (1989) note that this species and *M. florida* may be synonyms.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Genus Anacropora

Ridley, 1884

Anacropora forbesi

Ridley, 1884

Generally uncommon but may be a dominant species on soft substrates. Often a dominant species in deeper water (eg. in Ago and Amitori Bays) and forms extensive stands in shallow water of Sekisei Lagoon. Colonies are usually pale brown with white branch tips.

This is a very polymorphic species, the full variation of which has probably not been seen. Coralla from Japan are very similar to those from Vanuatu in having prominent, conical shaped corallites, but differ in having blunt, rather than pointed branch tips.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Anacropora puertogalerae

Nemenzo, 1964

Generally uncommon but forms extensive stands on soft substrates in shallow-water of Sekisei Lagoon (eg. station 15) and in deeper water (eg. in Ago and Amitori Bays). Colonies are very similar to those of the Philippines and other equatorial western Pacific countries, but differ substantially from those of the Great Barrier Reef in having finer branches and relatively prominent coenosteum styles. Possible species-level differences are under study. Pale brown in colour. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publications.

Anacropora spinosa

Rehberg, 1892

Common in Amitori Bay where it may form extensive stands (eg. station 15, along with other *Anacropora* spp.). Branches may be up to 600mm long in very protected habitats, but become short and compact in partly exposed ones. Either cream or pale blue in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama Is.

Previous studies: Not recorded except in the abovementioned publication.

Anacropora matthai

Pillai, 1973

Rare, but forms some extensive colonies in Amitori Bay (station 2) consisting of compact branches up to 300mm high; also common in Ago Bay (station 45, at 25m depth) where it forms small dark brown colonies. Was not found in Sekisei Lagoon. Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Anacropora reticulata

Veron and Wallace, 1984

As in the Philippines, branches are very robust; up to 12mm diameter 20mm from the tip. This species has been found only at station 13, where it is scattered over an area of approximately 50m². Is pale to dark brown on upper and lower branch surfaces (respectively), with pale branch tips. Coralla from the Philippines are very similar, those from the Great Barrier Reef have a relatively fine coenosteum and elaborated coenosteum spinules.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Anacropora sp.

This is a rare, undescribed species, previously recorded from a single specimen from the Philippines. As indicated by Veron and Hodgson (1988), branches are like those of *A. forbesi*; the single corallum from Japan has more compact branches than the corallum from the Philippines. The species is primarily characterised by having numerous small corallites with small thecal spines, giving a rasp-like appearance. Pale brown in colour.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Genus Acropora

Oken, 1815

More than in most other genera, there is a marked distinction between the *Acropora* of Japanese coral reefs and those of higher latitude non-reefal areas. In both regions, *Acropora* remains the overwhelmingly dominant genus; the differences being (a) in skeletal structure, colour and general appearance *in situ*, (b) in the relative abundance of dominant species and (c), in total species composition. Skeletal structures of mainland *Acropora* are relatively thick, solid and highly calcified. Colour patterns may be the same or be completely different; they are usually darker and more intense. Relative abundance of species is generally uniform between adjacent localities of relatively high diversity (eg. between Shirahama and Kushimoto), but may vary greatly between distant mainland localities (eg. between the Amakusa Is. and Kushimoto). In general, for any given species, there is less geographic variation within the Ryukyu Is. than there is within mainland localities. This may be genetic or it may be the result of more critical environmental gradations.

Acropora palifera

(Lamarck, 1816)

A dominant species of the Ryukyu Is. on very exposed upper reef slopes where it may form flat plates covering the whole surface (notably stations 8 and 16). Generally uncommon in other habitats, but may form large branching colonies (eg. stations 41 and 48) with branches up to 150mm diameter. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies are pale pinkish-brown. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Yaeyama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora cuneata

(Dana, 1846)

Uncommon. As in the Philippines, corallites tend to be smaller than normal for Great Barrier Reef colonies. At Tanegashima, encrusting colonies occur in exposed habitats. These have irregular corallites with some tendency to form incipient axial corallites. Grey or pale to dark brown in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima

Previous studies: Kawaguti (1983) (as *A. securis*): Okinawa.

Acropora brueggemanni

(Brook, 1893)

Very common on reef flats and upper reef slopes and may be a dominant species in both exposed and protected habitats. Has a similar range of variation in the Philippines and the Great Barrier Reef. Dark brown greyish-white in colour. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa.

Acropora humilis

(Dana, 1846)

Restricted to exposed biotopes where it is generally uncommon to rare (common, station 18). Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974): Kerama Is.; Yamazato et al. (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora gemmifera

(Brook, 1892)

Restricted to exposed biotopes where it is usually much more abundant than *A. humilis*. Usually yellowish-brown in colour with pale axial corallites. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: ?Utinomi (1956, 1965b (as *A. humilis*): Tokara Is. and south-west Shikoku; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974): Yaeyama Is.; Kawaguti (1983): (as *A. pyramidalis*): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora monticulosa

(Brüggemann, 1897)

Restricted to exposed biotopes where it is generally uncommon. Has a similar range of variation on the Great Barrier Reef. Usually dark blue in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publications.

Acropora samoensis

(Brook, 1891)

Rare, except at station 11, and not studied in detail. Collected coralla are similar to those from the Philippines.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Chou and Yamazato (1990): Okinawa.

Acropora digitifera

(Dana, 1846)

Restricted to exposed upper reef slopes of the Ryukyu Is. where it may be very common (eg. station 8). Also common in some exposed biotopes of Tanegashima. Polyps are often extended during the day. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a, p.86 only).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is.

Previous studies: ?Yagi (1970): south-west Shikoku; Utinomi (1971): north-east Kyushu; Eguchi (1974) (as *A. leptocyathus*): Yaeyama Is. and Kerama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora verweyi

Veron and Wallace, 1984

Generally uncommon, but may be found in both protected and exposed biotopes. Uniform pale brown with yellow axial corallites as with Great Barrier Reef colonies. Shows no geographic variation in growth form or colour.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Not recorded.

Acropora glauca

(Brook, 1893)

Generally uncommon at Tanegashima, becoming common in mainland locations. Colonies consist of irregularly anastomosing horizontal branches and short upward-curving branchlets forming large corymbose plates. Coralla are similar to those from high latitudes of eastern Australia, except that radial corallites tend to have thinner outer lips giving a rasp-like appearance and axial corallites tend to be smaller.

Records:

This study: Tanegashima, Tosashimizu, Amakusa Is. and Kushimoto.

Previous studies: Anonymous (1977) (as *A. symmetrica*): Kushimoto; Shirai (1986): Kii coast.

Acropora robusta

(Dana, 1846)

Uncommon. Has a similar range of variation and habitat preference on the Great Barrier Reef and elsewhere and a similar appearance in situ. Radial corallites are finer than usual in Great Barrier Reef coralla. Usually dark brown in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Anonymous (1970) (as *A. humilis*): Ehime coast; Eguchi (1974) (as *A. smithi*): Kerama Is.; Kawaguti (1983) (as *A. smithi*): Okinawa; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora danai

(Edwards and Haime, 1816)

Uncommon. Colonies generally have finer, more highly fused branches than on the Great Barrier Reef and may form very large (up to 2m diameter at station 43) corymbose plates. Colonies are usually uniform brown in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974) (as *A. abrotanoides*): Yaeyama Is.; Yamazato et al. (1978) (as *A. irregularis* and *A. rotumana*): Okinawa; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora nobilis

(Dana, 1846)

Common, may form extensive monospecific stands in a wide range of environments (notably stations 8 and 15). Has a similar range of variation on the Great Barrier Reef. May be green, blue or brown in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Kerama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora listeri

(Brook, 1893)

Rare in the Yaeyama Is. to generally uncommon in the Kerama Is. Restricted to exposed fringing reefs. Coralla are very similar to those on the Great Barrier Reef. Colonies are a uniform pale yellow. Uchida and Fukuda (1988a)

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded except in the abovementioned publications.

Acropora grandis

(Brook, 1892)

Common, sometimes forms very extensive stands in protected biotopes (eg. stations 2, 12, 13 and 15). Commonly forms open thickets, but has a similar range of variation in the Philippines and on the Great Barrier Reef. Has a wide range of colours, the most common being pale brown with blue branch tips.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora formosa

(Dana, 1846)

Very common, sometimes forms very extensive stands in protected biotopes (eg. station 15). Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually brown or blue with pale branch tips. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Utinomi (1965b): south-west Shikoku; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974): Kerama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora abrolhosensis

Veron, 1985

Generally uncommon except in Sekisei Lagoon and some reef flat lagoons. Forms extensive thickets with straight branches. These resemble those of *A. grandis*, but have large axial corallites, usually blue in colour. Coralla are similar to those of Western Australia.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Acropora teres

(Verrill, 1866)

This is an arborescent species, primarily characterised by very straight branches and immersed radial corallites. It has been recorded from the Philippines (Ross and Hodgson, 1982 and Veron and Hodgson, 1989) but not Japan during the present study. The type locality is the Amami Is.

Records:

This study: Not recorded.

Previous studies: ?Kawaguti (1983): Yaeyama Is.

Acropora acuminata

(Verrill, 1864)

Uncommon, except on high diversity reef flats of the Kerama Is. where the species forms large, circular, pale to dark brown, corymbose plates. Branches are finer and closer, and corallites smaller, than in most coralla from the Great Barrier Reef, but are similar in these respects to coralla from Thailand. The skeleton bleaches white, whereas in all other Indo-west Pacific countries (where studied), it retains dark pigments after bleaching. The present identification must be considered doubtful and the species warrants further study.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora valenciennesi

(Edwards and Haime, 1860)

Rare (Yaeyama Is.) to uncommon (Kerama Is.). Restricted to exposed reef slopes. Coralla are very similar to those of the Great Barrier Reef. Colonies are a uniform brown with pale branch tips.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Habe (1989): Iriomote I.

Acropora parilis

Quelch, 1816

Common in some lagoon biotopes and may form extensive stands (station 15); rare elsewhere. Colonies are bushy, caespitose, finely branched, with fine exsert labellate radial corallites. These are very similar to those from the Philippines. Bright or pale blue or pale brown (with or without blue branch tips) in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Acropora exquisita

Nemenzo, 1971

Common, stations 13 and 17, uncommon elsewhere. Colonies display very wide environment-correlated, and possibly age-related, variation, analogous to that of *A. pulchra*. Colonies from very protected shallow biotopes may have long straight branches with fine, widely spaced radial corallites. These appear to be undergoing rapid growth with relatively little calcification. In deeper water, branches become much more sturdy and have more elongate, more calcified corallites. In exposed biotopes, colonies have shorter branches and finer corallites. Coralla are similar to those of other Indo-west Pacific countries. Colonies have a wide range of colours, always with white branch tips.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Acropora akajimensis

Veron, 1990

Colonies are irregularly arborescent with proliferous, occasionally anastomosing, primarily horizontal branches, giving a sprawling growth form. Axial corallites are moderately exsert; incipient axial corallites are abundant on the upper surface of horizontal branches. Radial corallites are exsert, tubular, fluted towards branch ends. The coenosteum is costate and coarse and the skeleton lightly calcified. This species is closest to *A. exquisita*, which differs in having an upright growth form, non-anastomosed branches and more uniform radial corallites. Common on high diversity reef flats of the Kerama Is. Living colonies have a range of colours, predominantly blue and yellow. Also recorded from the Philippines.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Veron (1990): Yaeyama and Okinawa Is.

Acropora sp. 1

Colonies form small compact clumps with proliferous, tapering branches and very small axial corallites. Radial corallites are likewise very small, tubular, outward projecting, with circular openings on main branches, becoming dimidiate towards branch tips. The skeleton is hard; the species has the general appearance of a diminutive *A. microphthalma*. The only recorded colour is blue.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Acropora microphthalma

(Verrill, 1869)

Forms extensive stands, stations 13 and 17 and may be common in a wide range of biotopes. Colonies are very similar to those of the Philippines and Great Barrier Reef. They are mostly pale grey in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Acropora copiosa

Nemenzo, 1967

An ill-defined species recorded from Japan only from collected coralla. Growth forms range from compact thickets to sprawling horizontal branches. The only recorded colour is dark brown.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Acropora kirstyae

Veron and Wallace, 1984

Forms very extensive stands at station 15, common in protected parts of Amitori Bay, rare elsewhere. Branches are open, lax, forming dense thickets. Corallites are very similar to those of Great Barrier Reef coralla, but have less flared lips than those from the Philippines. Colonies are pale brown or occasionally blue and may have pale blue or whitish branch tips.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora sekiseiensis

Veron, 1990

Common over a wide range of environments, including reef flats and lagoons. Colonies are composed of irregular branches, usually forming upright bushy, sometimes subcorymbose, thickets. Coralla are primarily characterised by very irregular radial corallites, which readily form incipient axial corallites, and a very coarse coenosteum (visible *in situ*). In several respects, this species is like a diminutive *A. horrida*; it also has resemblances to *A. insignis*. Colonies are brown in colour. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Veron (1990): Yaeyama, Okinawa and Amami Is.

Acropora horrida

(Dana, 1846)

Uncommon and not studied in detail. Forms compact bushes or has a sprawling growth form. There remains some doubt about the present identification; only two coralla were collected, both from station 41, and these have a more compact branching pattern and slightly smaller corallites than is usual for the species. Generally yellowish in colour; the characteristically blue-coloured colonies of the Philippines and Great Barrier Reef have not been observed.

Records:

This study: Okinawa Is.

Previous studies: Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora vaughani

Wells, 1954

Common, Kerama Is., rare elsewhere. Coralla are similar to those of the Great Barrier Reef, but environment-correlated variation has not been studied. Grey or yellow-grey in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora austera

(Dana, 1846)

Found in a wide range of environments. Sometimes common in areas of high diversity. Coralla are very similar to those of the Philippines and Great Barrier Reef with peripheral branches curving away from main branches and radial corallites having open, almost square, calices. Forms large pale brown, greenish-brown or dark blue stands (notably at station 8). Axial corallites are usually yellow, as they are in Great Barrier Reef colonies. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974) (as *A. scherzeriana*): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora aspera

(Dana, 1846)

Generally common in a wide range of biotopes. Colonies from reef flats are characteristically corymbose. Those from mainland localities are highly anastomosed, becoming plate-like or forming solid plates; these are usually dark colours. Usually cream coloured at Amitori Bay, but may be bright blue or green in shallow biotopes. *Acropora yaeyamaensis* Eguchi and Shirai, 1977 is a junior synonym of this species. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Several Japanese references to *A. studeri* Brook, 1893 (Eguchi, 1968; Hamada, 1963a; Utinomi, 1971; Yabe and Sugiyama, 1932a, 1935a) may be this species, but this has not been confirmed by re-examination of specimens.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Eguchi (1974) (as *A. hebes*): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978) (as *A. aspera* and *A. hebes*): Okinawa; Chou and Yamazato (1990): Okinawa.

Acropora pulchra

(Brook, 1891)

May form very extensive stands in shallow, protected environments of Sekisei Lagoon (notably stations 12, 13 and 15) and Ishigaki I., but is generally uncommon elsewhere. Has a similar (wide) range of variation in the Philippines and the Great Barrier Reef. Usually blue or cream. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978): Okinawa; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora millepora

(Ehrenberg, 1834)

Sometimes common and found in a wide range of biotopes in the Yaeyama Is., generally uncommon elsewhere. Has a similar range of variation in the Philippines and the Great Barrier Reef. May be the same distinctive salmon-pink colour as it often is on the Great Barrier Reef and has a wide range of other colours. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978) (as *A. squamosa*): Okinawa.

Acropora tenuis

(Dana, 1846)

Uncommon, except in some reef flats, notably of the Kerama Is. Has a similar appearance in situ in the Philippines: colonies have a sprawling growth form and large, distinctive corallites with wide flaring lips. Usually the same cream colour in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except in the abovementioned publications.

Acropora selago

(Studer, 1878)

Very common in protected biotopes and on reef flats. Collected coralla have fine branches and fine corallites; it is not known if the full range of variation determined on the Great Barrier Reef occurs in Japan. Radial corallites of collected coralla are slightly more appressed than usual in Great Barrier Reef coralla. Has a wide colour range, including grey-brown, cream, blue and yellow. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora sp. 2

A single corallum from Tanegashima appears to be a distinct species. It is a corymbose plate with an open branching pattern and is primarily characterised by flaring radial corallites (similar to, but smaller than, those of *A. selago*) and a very coarse lace-like skeleton.

Records:

This study: Tanegashima.

Previous studies: Not recorded.

Acropora dendrum

(Bassett-Smith, 1890)

A rare, ill-defined species, readily confused, in mainland localities, with mainland *A. valida* (see below). Forms corymbose plates with tapering branchlets and thick-lipped immersed corallites. This identification of mainland coralla is tentative as the species was not clearly recognised *in situ*.

Records:

This study: Yaeyama Is., Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora yongei

Veron and Wallace, 1984

Common in high diversity areas of upper reef slopes and flats, especially in the Kerama Is. and Sekisei Lagoon where it characteristically forms large sub-corymbose colonies. Can be readily confused with *A. tenuis in situ*, the latter having more regular and more flared radial corallites. Always pale colours, usually brown or cream.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974) (as *A. haimeii*): Yaeyama Is. and Kerama Is.; Chou and Yamazato (1990) (as *A. haimeii*): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora cytherea

(Dana, 1846)

Forms extensive stands in shallow water in some localities, uncommon in others. Has a similar range of variation in the Philippines and the Great Barrier Reef. Mostly pale greys and browns in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983)(as *A. reticulata*): Okinawa; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora microclados

(Ehrenberg, 1834)

Common, Yaeyama Is., uncommon elsewhere. Occurs in a wide range of biotopes and has a similar range of variation on the Great Barrier Reef and Philippines, which includes the presence of proliferous, elongate, incipient axial corallites in coralla from protected biotopes. Those from exposed, or partly exposed reef slopes have compact, almost *A. nasuta*-like axial and radial corallites. Colonies are pale brown, not the distinctive pinky-brown of Great Barrier Reef colonies.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora tenella

(Brook, 1892)

Recorded from a single specimen from the Amitori Research Center, Iriomote I., recovered from deep water attached to a boat anchor.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Acropora elegans

Edwards and Haime, 1860

Recorded only from laboratory specimens only. Colonies are all flat interlocking branches with corallites on the upper side only.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Acropora insignis

Nemenzo, 1967

Uncommon. Colonies form compact, irregular clumps, with distal branches much finer than proximal ones. Corallites are primarily immersed on main branches, but have fine, labellate lips distally. Environment-correlated variation has not been studied. Philippines coralla have similar skeletal detail.

This species is similar to *A. pruinosa*, but branches and corallites are both finer.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: Not recorded.

Acropora paniculata

Verrill, 1902

Rare. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale brown in colour.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Acropora hyacinthus

(Dana, 1846)

Usually common on shallow upper reef slopes (especially of the Yaeyama Is.) and is the overwhelmingly dominant species of shallow-water coral communities of Tanegashima. Has a similar range of variation in the Philippines and the Great Barrier Reef. Shows little geographic variations except that, in mainland localities, branchlets tend to be thick and radial corallites immersed (except those near the corallum margins). Recorded in most studies north to Shirahama. Usually pinkish-brown. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Utinomi (1956, 1966, 1971) (as *A. pectinata* and *A. spicifera*): Tokara Is., south-west Shikoku, north-east Kyushu; Eguchi (1974) (as *A. hyacinthus*, *A. pectinata* and *A. spicifera*): Yaeyama Is. and Kerama Is.; Anonymous

(1977) (as *A. pectinata*): Kushimoto; Yamazato *et al.* (1978) (as *A. hyacinthus* and *A. spicifera*): Okinawa; Kawaguti (1983) (as *A. hyacinthus*, *A. pectinata* and *A. surculosa*): Okinawa; Shirai (1986): Kii coast; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora tanegashimensis

Veron, 1990

Colonies are flat corymbose plates similar to those of *A. hyacinthus*. Branches are uniform in size, 9-11mm diameter and branchlets are short, terete, and uniform. Axial and radial corallites are of similar size, the latter being uniformly crowded over the upper surface of the colony. What little coenosteum there is between corallites is very coarse. Living colonies are greenish-grey in colour. Readily distinguished from *A. hyacinthus* by having crowded radial corallites, indistinct axial corallites, and, *in situ*, by its greenish-grey colour. Illustrated in colour: Veron (1990b).

Records:

This study: Tanegashima.

Previous studies: Veron (1990): Tanegashima.

Acropora striata

(Verrill, 1866)

Uncommon except at Tanegashima, station 58, where it forms monospecific stands many hundreds m². Colonies are bushy or form sub-corymbose plates. Radial corallites are irregular, with flaring lips. Colonies are greyish-brown with white branch tips and white exsert radial corallites.

Coralla are similar to Verrill's (type?) specimens from the Amami Is.: #5808, Museum of Comparative Zoology, Harvard and, to a lesser extent, #371, United States National Museum.

Records:

This study: Okinawa and Amami Is., Tanegashima.

Previous studies: ?Anonymous (1977) (as *A. quelchi*): Kushimoto.

Acropora anthocercis

(Brook, 1893)

Sometimes common on exposed upper reef slopes (notably station 11). Has a similar range of variation and the same colour as Great Barrier Reef colonies. Colonies at Tanegashima have almost solid plate-like bases. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora tumida

Verrill, 1866

Common around Kushimoto and Shirahama. Colonies have irregular to submassive bases and irregular, digitate branches. Radial corallites are aligned along branches, are appressed, with thick lips and wide calices. Mottled yellowish-grey and dark green in colour. Recorded elsewhere only from the South China Sea (Brook, 1893) (a doubtful record) and Hong Kong (Verrill, 1866 (type locality) and Veron 1980). Verrill's type specimen (#5811, Museum of Comparative Zoology, Harvard University) is very close to specimens in the present series.

Records:

This study: Tosashimizu, Kushimoto, Shirahama.

Previous studies: ?Eguchi (1971) (as *Acropora squarrosa*): Goto I.; ?Eguchi (1972a) (as *A. squarrosa*): Izu; Anonymous (1977) (as *A. squarrosa*): Kushimoto .

Acropora latistella

(Brook, 1892)

Common on most upper reef slopes where it has a wide colour range. The range of variation in the Ryukyu Is. is similar to that in the Philippines and the Great Barrier Reef, mainland coralla are relatively heavily calcified, sturdy, with relatively solid bases. Colonies are often bright green at mainland islands.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is.

Previous studies: Eguchi (1974) (as *A. latistella* and *A. loricata*): Kerama Is.; Anonymous (1977) (as *A. surculosa*): Kushimoto; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora subulata

(Dana, 1846)

Usually common in the Ryukyu Is. and occurs in a wide range of biotopes. Uncommon at Tanegashima. Colonies are very similar to those of the Philippines and the Great Barrier Reef. Has a wide colour range including blue, pink and mauve.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora nana

(Studer, 1878)

Restricted to exposed upper reef slopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Commonly bright blue at the Ryukyu Is., brown, blue-grey or cream at Tanegashima. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Tachikawa (in prep., 1991): Ogasawara Is.

Acropora pruinosa

(Brook, 1893)

A distinctive species restricted to the environmental extremes of *Acropora* distribution. Colonies are irregularly arborescent with immersed radial corallites, except towards branch ends, where they become appressed with slightly flaring margins, similar to those of *A. aculeus*. Is the dominant species at Tomioka Point (station 72) where it has two colour morphs: greenish and brown. It is also a dominant species in a small area at Hirido, Izu (station 93), where colonies are green.

Non-Japanese occurrences of the species include the Straits of Korea and 'China' (type localities) and Hong Kong (Veron, 1980). Nemenzo (1967) records this species from the Philippines, a record accepted by Veron and Hodgson (1989), but now believed to be *A. insignis*, which it resembles.

Records:

This study: Tosashimizu, Amakusa Is., Izu.

Previous studies: ?Anonymous (1977) (as *A. prostrata* (Dana, 1846)).

Acropora aculeus

(Dana, 1846)

Uncommon, except in Amitori Bay (eg. station 10). Colonies are pillow-shaped with outwardly curving horizontal branches as on the Great Barrier Reef. Mostly blue *in situ* (becoming purple at the water surface) or else brown or cream.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora cerealis

(Dana, 1846)

Uncommon, has a similar range of variation in the Philippines and on the Great Barrier Reef. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Utinomi (1966, 1971): Kii coast and north-east Kyushu; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978) (as *A. cerealis* and *A. tizardi*): Okinawa; Kawaguti (1983) (as *A. hystrix*): Okinawa; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora nasuta

(Dana, 1846)

Common. Has a similar range of variation on the Great Barrier Reef. Has a wide colour range. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974) (as *A. quelchi*): Yaeyama Is.; Yamazato *et al.* (1978) (as *A. nasuta* and *A. quelchi*): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa.

Acropora valida

(Dana, 1846)

Common on upper reef slopes. May be a dominant *Acropora* species in some mainland localities where there is a distinct geographic subspecies primarily characterised by having radial corallites with thick rounded lips. These are similar to mainland *A. dendrum*. Ryukyu Is. coralla have a similar range of variation as Great Barrier Reef coralla. May have the same distinctive colours (see Nishihira (1988) and Uchida and Fukuda (1988a) as Great Barrier Reef colonies.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Anonymous (1970) (as *A. syringodes*): Ehime coast; Eguchi (1974) (as *A. variabilis*): Yaeyama Is.; Anonymous (1977) (as *A. digitifera*): Kushimoto.

Acropora secale

(Studer, 1878)

Sometimes common on exposed upper reef slopes. Has a similar range of variation on the Great Barrier Reef. Usually brown or bright blue in colour (as on the Great Barrier Reef). Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978): Okinawa; Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora clathrata

(Brook, 1891)

Uncommon in the Yaeyama Is., common in some other regions (eg. Kerama Is.). Forms horizontal plates composed of anastomosed branches without significant development of upright branchlets. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale to dark brown. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publication.

Acropora divaricata

(Dana, 1846)

Uncommon throughout range. Has a similar, very wide, range of variation on the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is.

Previous studies: Chou and Yamazato (1990): Okinawa; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora solitaryensis

Veron and Wallace, 1984

Uncommon in the Ryukyu Is., where colonies are found on upper reef slopes. Becomes common at Tanegashima and may be a dominant species in some biotopes. One of the most common species of the Amakusa Is. Colonies are very similar in colour, structure and abundance to those from both eastern and western Australia. In all cases, this species shows a wide range of growth form variation; it is relatively rare in tropical localities and becomes abundant at higher latitudes. There remains a possibility that colonies forming a solid plate (as illustrated, Veron, 1986) are a separate species rather than an ecomorph of this species. Usually blue or green in colour, usually with pale margins. Probably recorded by most authors from mainland localities under different names, few of which have been verified by the present author. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Anonymous (1977) (as *A. abrotanoides* and *A. sp.*): Kushimoto; Tribble and Randall (1986) (as *Acropora sp. 1*): Miyaki I.; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora stoddarti

Pillai and Scheer, 1976

The most common *Acropora* of many localities of Tanegashima; not recorded elsewhere. At Tanegashima, colonies in partly protected biotopes form corymbose plates with irregularly fused basal branches; in very exposed biotopes (eg. station 65), they form compact thickets. Radial corallites are strongly appressed (as they are

throughout the geographic range of the species) but are smaller than those of coralla from other Indo-west Pacific countries. This species requires further study; the conclusion of this study is that it forms a distinct geographic subspecies, but may prove to be a separate species. Colonies are brown with pale axial corallites.

Records:

This study: Tanegashima.

Previous studies: Not recorded.

Acropora echinata

(Dana, 1846)

Common in some protected habitats with soft substrates (eg. stations 2 and 45), rare elsewhere. Colonies are a uniform brown or are brown with pale branch or corallite tips, not blue as elsewhere in the Indo-west Pacific. Recorded north to the Ehime coast, but not found further north than Okinawa by the author. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Anonymous (1970): Ehime coast; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.

Acropora subglabra

(Brook, 1891)

Very common in some protected deeper biotopes (eg. stations 2, 34 and 45) and may form extensive stands in shallow lagoons (eg. station 15). Colonies may be up to 1m high. Usually cream and/or pale brown, sometimes blue, in colour. *Acropora spiniformis* Eguchi and Shirai, 1977, is a junior synonym of this species. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi and Shirai (1977); Eguchi (1974): Kerama Is.; Kawaguti (1983): Yaeyama Is.

Acropora carduus

(Dana, 1846)

Sometimes common in protected biotopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually uniform brown colour, sometimes with blue branch tips. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora elseyi

(Brook, 1892)

Generally uncommon to rare except at station 12, where it forms extensive stands. Colonies are very similar to those of the Great Barrier Reef and Philippines. Pale cream or off-white, occasionally blue in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama Is.

Previous studies: Not recorded except in the abovementioned publication.

Acropora longicyathus

(Edwards and Haime, 1860)

Common. Has a similar range of variation in the Philippines and the Great Barrier Reef, with bushy colonies being relatively common. Coralla are very similar to those of the Great Barrier Reef and Philippines. Brown in colour. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yamazato *et al.* (1978) (as *A. syringodes*): Okinawa; Habe (1989): Iriomote I.; Tachikawa (in prep., 1991): Ogasawara Is.

Acropora rosaria

(Dana, 1846)

Generally uncommon. This species has not been sufficiently studied for detailed comparisons with other countries to be made. Colonies are pale brown or pinkish-cream, not deep blue as they usually are on the Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978): Okinawa.

Acropora loripes

(Brook, 1892)

Only colonies from the Ryukyu Is. are readily identified as this species. These are very similar to those of the Philippines and Great Barrier Reef except that only corymbose growth forms have been recorded. Coralla from Tanegashima and the Amakusa Is. are corymbose plates with highly fused bases and relatively small corallites. These are only tentatively placed in this species. Fawn or dark green in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is.

Previous studies: ?Utinomi (1965b) (as *A. squarrosa*): south-west Shikoku; Anonymous (1970) (as *A. squarrosa*): Ehime coast; Yamazato *et al.* (1978) (as *A. squarrosa*): Okinawa; ?Shirai (1986): Kii coast; Chou and Yamazato (1990): Okinawa.

Acropora granulosa

(Edwards and Haime, 1860)

Uncommon throughout range except in some shallow, exposed biotopes (station 11). Forms plates similar to those of Great Barrier Reef colonies. Pale grey-brown in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983) (as *A. rayneri*): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Acropora willisae

Veron and Wallace, 1984

Uncommon, colonies are very similar to those of the Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Acropora florida

(Dana, 1846)

Generally uncommon in the Yaeyama Is. where it is pale brown in colour but common on exposed fringing reefs of the Kerama Is. where it is usually pinkish-brown (the common colour of Great Barrier Reef colonies), occasionally dark brown with orange axial corallites. May also be bottle-green as are Western Australian colonies. Very large colonies such as are found on the Great Barrier Reef were not found in Japan but extensive grey-brown plates occur at Tanegashima. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Eguchi (1974) (as *A. affinis* and ?*A. compressa*): Yaeyama Is. and Kerama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Acropora wallaceae

Veron, 1990

Uncommon, restricted to upper reef slopes. Fully developed colonies are composed of upright branches which decrease in size in a regular pattern, each generation of sub-branches growing from the preceding generation in a regular manner and remaining distinct. Branches taper in a regular manner to small axial corallites. Living colonies are brown with yellowish radial corallites. Illustrated in colour: Veron (1990b).

This species has previously been collected on the Great Barrier Reef (Veron and Wallace, 1984), the Philippines (Veron and Hodgson, 1989) and Thailand. It shows very little variation over this range and is readily recognised *in situ*.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Veron (1990): Yaeyama and Okinawa Is.

Acropora sarmentosa

(Brook, 1892)

Uncommon and little studied. Coralla are very similar to corymbose plate-like coralla from the Philippines and Great Barrier Reef. Usually mustard coloured.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Acropora mirabilis

(Quelch, 1886)

Uncommon; forms corymbose plates with tapering branchlets. Axial corallites are small. Radial corallites are similar to those of *A. millepora*, only much smaller and less exsert. Radial corallites have very well developed septa, including distinct directive septa and an abortive third cycle (as discussed, Quelch, 1886 and Veron and Wallace, 1984).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Genus Astreopora

de Blainville, 1830

Astreopora myriophthalma

(Lamarck, 1816)

Generally common throughout the distribution range. Has a similar range of variation on the Great Barrier Reef. Usually purple or pinkish-brown colours. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936) and Yabe and Sugiyama (1941): north to Amakusa Is.; Utinomi (1965b): south-west Shikoku; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Astreopora gracilis

Bernard, 1896

Less common than *A. myriophthalma*. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually cream in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Kushimoto.

Previous studies: Yabe *et al.* (1936) and Yabe and Sugiyama (1941): north to south-west Shikoku; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978): Okinawa; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Astreopora incrustans

Bernard, 1896

Second to *A. myriophthalma* in abundance in the Ryukyu Is. but is the most common *Astreopora* of mainland localities. Well-developed colonies are characterised by an encrusting growth form with short contorted upgrowths which are frequently associated with polychaete worm tubes.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936) and Yabe and Sugiyama (1941): Ogasawara Is. and Amami Is., Kawaguti (1983): Yaeyama Is. Of Yabe and Sugiyama's collection, specimens #44848 and #44849 from the Ogasawara Is. are encrusting coralla with small irregular corallites. A second specimen numbered #44849 is *A. myriophthalma*; Anonymous (1977) (as *A. gracilis*): Kushimoto.

Astreopora explanata

Veron, 1985

An uncommon but distinctive species at Tanegashima forming thin tiers of pale brown plates, usually on vertical rock surfaces. Recorded in the Yaeyama Is. (Iriomote I.) from a single dark orange-brown colony. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama Is., Tanegashima.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Astreopora ocellata

Bernard, 1896

Rare; corallites are usually inclined on the corallum surface and have wide, open calices. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Astreopora suggesta

Wells, 1954

Very rare, recorded from a single specimen collected from Kayama I., Sekisei Lagoon. Corallites are very small, as are those of the holotype (United States National Museum); they differ in having better developed septa. The present identification is tentative.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Astreopora listeri

Bernard, 1896

Rare and little studied. Coralla are similar to those of the Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Astreopora macrostoma

Veron and Wallace, 1984

Rare except at some stations at Tanegashima (notably 61) where colonies form large flat plates. The species is readily recognised by its large irregular corallites; coralla are very similar to those from the Great Barrier Reef. Various shades of brown in colour.

Records:

This study: Okinawa Is., Tanegashima.

Previous studies: Not recorded.

9

Family
Poritidae

Gray, 1842

Genus Porites

Link, 1807

Non-massive *Porites* (as with all other species) were studied *in situ* as well as from collections. Sample specimens of massive colonies were collected only if distinguishing characters were observed *in situ*. One hundred and eighty-six coralla were thus obtained, which, together with coralla from other collections, give some insight into intraspecific variation, but little into the relative abundance or habitat preferences of species. Fourteen of these coralla have not been identified are not included in the following account.

Porites remains the least satisfactorily studied of the major coral genera of Japan, partly because massive species are usually difficult to identify *in situ*, partly because a wide variety of taxonomic problems remain unresolved.

Most *Porites* species are restricted to the Ryukyu Is., especially the Yaeyama and Okinawa groups. In this respect they are most similar to *Fungia*.

Porites solida

(Forskål, 1775)

Probably rare. The species is recognisable *in situ* by the neat, regular appearance of the septa which lack pali. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publications.

Porites lobata

Dana, 1846

Probably the most common *Porites* of the Ryukyu Is. Distinguishing characters, notably corallite walls having three concentric rows of denticles (illustrated, Veron 1986), are the same in coralla from the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Anonymous (1970): Ehime coast; Eguchi (1974): Yaeyama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Porites murrayensis

Vaughan, 1918

Probably common. Distinguishing characters, notably small corallites with a conspicuous central fossa and usually four well-developed pali (illustrated, Veron 1986), are the same in coralla from the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Porites australiensis

Vaughan, 1918

Probably uncommon. Coralla have corallite structures similar to those from the Great Barrier Reef except that in some, there is little tendency to have three pali on the septal triplets.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yamazato *et al.* (1978): Okinawa; Kawaguti (1983) (?as *P. australiensis* and *P. fragosa*): Okinawa.

Porites lutea

Edwards and Haime, 1860

Probably common. Some coralla of the present series have the same corallite characters (notably the septal triplet fused into a trident and five tall pali associated

with the lateral pairs of septa and the triplet) as Great Barrier Reef coralla, but several specimens are attributed to this species with doubt. The holotype of *P. tenuis* Verrill, 1866 (USNM #407), with the Ryukyu Is. as type locality, has been re-examined. It is a spherical corallith 62mm maximum dimension with small corallites (0.8-1.1mm diameter). The corallites have well-developed columellae, thin walls and thin septa with fused triplets sometimes forming a trident, usually five weakly developed pali and two denticles. The inner synapticular ring is well-developed and five radii are usually present. Despite the wide useage of this species in the taxonomic literature of Japan (Eguchi (1972a): Izu; Eguchi (1974): Yaeyama Is. and Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.) and other countries including the Philippines (Veron and Hodgson, 1988), the conclusion of the present study is that it is a likely synonym of *P. lutea*, but that this remains to be further studied.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: (It is probable that most references to *P. tenuis* (see above) are also this species.) ?Utinomi (1956, 1966, 1971): Tokara Is., Kii coast and north-east Kyushu; ?Yagi (1970): S. Kyushu; Eguchi (1974) (as *P. lutea* and *P. haddoni*): Yaeyama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Porites heronensis

Veron, 1985

Common in mainland localities, uncommon in the Ryukyu Is. Skeletal detail is similar to that of *P. lutea*, especially as septal triplets are fused in corallites where they can be distinguished. Septa are usually not as disarranged as those from extra-tropical Australian localities; otherwise there is little difference. Has the same general appearance, and is usually greenish-brown, in all mainland localities.

Records:

This study: Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Porites stephensoni

Crossland, 1952

Probably uncommon; little studied. Corallites of some coralla collected show no differences from those Great Barrier Reef coralla.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Chou and Yamazato (1990): Okinawa.

Porites mayeri

Vaughan, 1918

Probably rare; recorded in the present study from a single corallum from Ishigaki I. This is indistinguishable from Great Barrier Reef coralla.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Porites evermanni

Vaughan, 1907

Uncommon but very distinctive. Colonies are massive or columnar. Corallites are large and shallow and have long septa. Lateral pairs of septa have tall pali; shorter pali usually occur on the directive septum and also on each septum of the triplet. The latter are sometimes fused or partly fused, in which case they have one or two pali. As elsewhere in the Indo-west Pacific, polyps are usually extended during the day and are yellow-brown in colour.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Porites okinawensis

Veron, 1990

Colonies are massive or encrusting. Corallites are superficial, unevenly distributed, up to 1.7mm diameter. Wall thicknesses between adjacent corallites vary from less than the thickness of a septum, to over 2mm. Septa vary in number according to the size of the corallite, both small and large corallites with below and

above normal numbers of septa (respectively) are common. The *Porites* pattern of fusion is obscure in most corallites, due to a very high degree of fusion. The triplet is fused and frequently the directive septum is fused to one of the lateral pairs. The directive septum and the triplet are usually both fused to the columella. There are two weakly developed denticles per septum. Columellae are small or absent; highly fused radii link the septa to the corallite centre.

Records:

This study: Okinawa Is., Izu.

Previous studies: Veron (1990): Okinawa Is.

Porites cylindrica

Dana, 1846

Forms extensive monospecific stands in a wide variety of environments. Usually a uniform yellow in colour. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Utinomi (1971) (as *P. andrewsi*): north-east Kyushu; Eguchi (1974): Yaeyama Is. and Kerama Is.; Kawaguti (1983) (as *P. andrewsi*): Okinawa; Habe (1989): Iriomote I.; Chou and Yamazato (1990) (as *P. andrewsi*): Okinawa.

Porites nigrescens

Dana, 1848

Generally common in a wide range of environments. Usually pale to dark brown or yellow-brown in colour. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Yaeyama Is. and Kerama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa.

Porites sillimaniani

Nemenzo, 1976

Common. Coralla show differences from those of the Philippines. Commonly forms thickets, usually yellow in colour.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Porites latistella

Quelch, 1886

Uncommon. Coralla show no differences from those of the Philippines.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974): Yaeyama Is.

Porites attenuata

Nemenzo, 1955

Common, but less so than in the Philippines. Colonies have the same appearance *in situ*, with branches of irregular size and shape and corallites more excavated than those of *P. cylindrica*. Holes in the centre of many corallites, presumably made by parasites, which expose the inner synapticular ring and remove the columella, are common. Usually greenish-yellow. Illustrated in colour: Shirai (1980).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except in the abovementioned publication.

Porites deformis

Nemenzo, 1955

Generally uncommon. Readily recognised *in situ* by having irregular, highly anastomosed branches. Corallites are shallow, giving the corallum a smooth appearance.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Porites negrosensis

Veron, 1990

Rare. Colonies are irregularly arborescent with contorted anastomosing branches with flattened tips. Corallites are separated by approximately one corallite diameter; corallites on smaller branches may be aligned length-wise. Septa are neatly and regularly spaced. The triplet is usually, but not always fused. The columella and inner synapticular ring are well-developed. Calicular structures and the coenosteum are uniformly covered with fine spinules. The coenosteum is coarse. Colonies are usually pale brownish-grey. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama Is.

Previous studies: Veron (1990): Yaeyama Is.

Porites lichen

Dana, 1846

Generally common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually yellow or mustard in colour, but may be other colours eg. dark pink. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a, p. 219).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Eguchi (1968): Sagami Bay; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1973): Tsushima; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Porites vaughani

Crossland, 1952

Probably uncommon. Collected coralla are similar to those from the Philippines and Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Porites annae

Crossland, 1952

Generally uncommon, usually grey, yellowish-grey or brown in colour. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publications. Eguchi (1974) records two varieties of *P. compressa* Vaughan from the Yaeyama and Kerama Is.; these possibly refer to the present species which has an undefined relationship with *P. compressa*; Tachikawa (pers. comm., 1991): Ogasawara Is.

Porites eridani

Umbgrove, 1940

This species has not been recorded during the present study. It is likely that the following records refer to *P. sillimaniani*, which may have a similar growth form but which is primarily distinguished by having relatively excavated corallites.

Records:

This study: Not recorded.

Previous studies: Yamazato *et al.* (1978): Okinawa; Chou and Yamazato (1990): Okinawa.

Porites aranetai

Nemenzo, 1955

Probably rare. Coralla are similar to *P. lichen*, but corallites are smaller and septal structures are reduced so that the *Porites* pattern seldom distinguishable.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Porites horizontalata

Hoffmeister, 1925

Generally uncommon, except on some upper reef slopes but may form extensive monospecific stands, notably at station 2 at 10m depth, where colonies

form large tiered plates. Grey, cream, brown or grey-brown in colour. Has a similar range of variation in the Philippines.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.

Porites rus

(Forskål, 1775)

May be common and may form very large colonies (up to 5 m diameter). Usually grey, brown or blue in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa Is. and Amami Is.

Previous studies: Eguchi (1974) (as *P. convexa*): Yaeyama Is.; Kawaguti (1983) (as *P. irregularis* and *P. iwayamaensis*): Okinawa; Habe (1989): Iriomote I.

Genus Goniopora

de Blainville, 1830

No specimens of *G. sagamiensis* Eguchi (from Sagami Bay) have been found during this study. Eguchi and Miyawaki's (1975) and Utinomi's (1965b) records of *G. planulata* Ehrenberg have not been traced; the type specimen is lost and existing descriptions are inadequate for recognition. As this species has been recorded from Tateyama, it is likely to be a synonym of *G. lobata*, the only *Goniopora* now extant there.

It is likely that the following account of *Goniopora* is incomplete as the present study is primarily based on collected coralla, not detailed field work.

Goniopora djiboutiensis

Vaughan, 1907

Generally uncommon. Colonies are submassive or massive and show no differences from those of the Great Barrier Reef and the Philippines. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Amami Is., Tanegashima.

Previous studies: Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniopora stokesi

Edwards and Haime, 1851

Uncommon, but may form extensive clones through the production of daughter colonies (e.g. at station 45 at 20m depth). Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually pale green, yellow, or brown in colour.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu and Amakusa Is.

Previous studies: Tribble and Randall (1986): Miyake I.

Goniopora lobata

Edwards and Haime, 1860

Generally common throughout the distribution range and frequently forms large colonies. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually grey-brown with cream oral cones and pink mouths. Probably recorded in most studies of mainland corals under a variety of names that have not been verified. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Eguchi (1973): Tsushima; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniopora pendulus

Veron, 1985

Uncommon, has long, tapering, pale to dark brown tentacles. Has the same appearance *in situ* as colonies from Western Australia and coralla are also very similar.

Records:

This study: Tanegashima, Amakusa Is., Kushimoto.

Previous studies: Anonymous (1977) (as *Goniopora* sp.): Kushimoto; Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniopora columna

Dana, 1846

Common, may form large colonies. Has a similar range of variation in the Philippines and the Great Barrier Reef except at mainland localities where colonies are encrusting. Usually brown in colour, with or without a white oral cone. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Izu, Tateyama.

Previous studies: Not recorded except in the abovementioned publication.

Goniopora somaliensis

Vaughan, 1907

Generally uncommon in the Ryukyu Is., becoming common at Tanegashima. Forms large flat plates with even surfaces. Polyps are extended during the day and have short tentacles of even length. Colonies are dark, uniform colours.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Tribble and Randall (1986): Miyake I.; Habe (1989): Iriomote I.

Goniopora tenuidens

Quelch, 1886

Particularly common in shallow water of Sekisei Lagoon (station 13) and may be common elsewhere. Has a similar range of variation in the Philippines and the Great Barrier Reef. Commonly brown in colour. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies:

Goniopora burgosi

Nemenzo, 1955

Uncommon. An encrusting species with very small corallites. These are similar to those of *G. minor*, except that the columella is less developed and septa fewer. Has not been studied in detail, but has the same appearance *in situ* Philippine colonies and is commonly dark red or brown in colour.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Goniopora minor

Crossland, 1952

Common. Has similar colours and range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Goniopora cellulosa

Veron, 1990

Colonies are massive. Mature corallites are six sided, or rounded, 2.4-3.3mm diameter. Walls are thin and highly perforated. Calices of the same corallum show very great variation. Most are deep; some have irregularly developed septa which fuse to form a columella tangle, while others have no distinctive septa, the floor of the corallite consisting of irregularly fused skeletal rods and a rudimentary columella. This species has not been studied *in situ*.

Records:

This study: Amami Is., Tanegashima, Tosashimizu.

Previous studies: Veron (1990): Amami Is. and Tanegashima.

Goniopora fruticosa

Saville-Kent, 1891

Rare. Colonies are composed of encrusting bases with short, irregular upgrowths. Corallites are irregular in shape, especially those on the upgrowths. Calices are 2.8 - 3.2mm diameter. The present series shows wide variation in septal development, encrusting coralla having fine irregular septa. Colonies are brown in colour.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniopora polyformis

Zou, 1980

This species has previously been referred to by the author as *Goniopora* sp. of the Philippines (Veron and Hodgson, 1989).

Rare. Colonies are encrusting, with contorted bases and irregular upgrowths. Corallites are irregular in shape, especially those on upgrowths, and have thin walls. Calices 3.5 - 4.2mm diameter. Septa are numerous and even. The appearance of this species in situ is not known. It is primarily distinguished from *G. fruticosa* by its larger corallites and more numerous and regular septa. Brown or grey in colour.

Records:

This study: Amakusa Is.

Previous studies: Not recorded.

Goniopora pandoraensis

Veron and Pichon, 1982

Generally uncommon but may form stands over 10m diameter in some localities, notably station 5. Mostly brown in colour, with some branches being bleached, as is common on the Great Barrier Reef (as illustrated, Nishihira (1988)).

Records:

This study: Yaeyama Is.

Previous studies: First recorded from Japan, Nishihira (1988).

Goniopora sp.

This is very likely the same species as *Goniopora* sp. 1 of Eastern Australia (Veron and Pichon, 1982).

Colonies are massive or submassive. Corallites are shallow, rounded to polygonal, with calices 3.5 - 4mm diameter. The walls are thin and highly perforated. Septa are in three orders although the gonioporoid pattern of fusion is less obvious in Japanese coralla than in Australian coralla. The columella is weakly developed. This species has not been studied *in situ*.

Records:

This study: Yaeyama and Okinawa Is., Shirahama.

Previous studies: Not recorded.

Goniopora stutchburyi

Wells, 1955

Generally uncommon. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually uniform dark colours, especially rust red, brown or green, sometimes pale pink. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu, Shirahama.

Previous studies: Habe (1989): Iriomote I.

Genus Alveopora

de Blainville, 1830

Alveopora catalai

Wells, 1968

Forms very extensive stands in Amitori Bay (station 2), also found in Kabira Bay (station 18), but has not been found elsewhere. Has a similar range of variation in the Philippines and the Great Barrier Reef. Creamy-yellow in colour, with white centres.

Records:

This study: Yaeyama Is.

Previous studies: Habe (1989): Iriomote I.

Alveopora allingi

Hoffmeister, 1925

Generally uncommon but may form large colonies in protected environments. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale brown in colour. Illustrated in colour: Shirai (1980).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Habe (1989): Iriomote I.

Alveopora verrilliana

Dana, 1872

Generally uncommon but conspicuous. Colonies are typically composed of a complex of nodular branches. Skeletal characters are very similar to those of Great Barrier Reef and Philippines coralla, with corallites having well-developed septal spines and a palisade of trabecular rods on the walls. Colonies are usually grey-brown in colour, with or without white tentacle tips, but are occasionally other colours such as pale brown or pink. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Kerama Is.; Eguchi (1973): Tsushima; Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Alveopora spongiosa

Dana, 1846

Common. Found in a wide range of environments, including moderately exposed ones. Colonies are usually pillow-shaped. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually chocolate brown, often green, sometimes other colours. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Amakusa Is., Shirahama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Alveopora excelsa

Verrill, 1863

Generally uncommon but conspicuous. Usually found in exposed environments. Coralla are similar to those from the Philippines. Usually grey or brown in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Kushimoto, Shirahama.

Previous studies: Not recorded.

Alveopora tizardi

Bassett-Smith, 1890

Rare. Similar to colonies from the Philippines. Pale brown to pinkish brown in colour. This species requires further study.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Alveopora japonica

Eguchi, 1968

Restricted to shallow water of high latitude localities where it occupies habitats where other corals are seldom found. Usually rare, but relatively common at station 70. Appears to be endemic to Japan and Korea (Song, 1982). Polyps have green tentacles with pale cream tips. Recorded in most studies north to Tateyama Peninsula. Illustrated: Shirai (1980), Eguchi, (1968).

Records:

This study: Tanegashima, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe and Sugiyama (1935c) (as *A. cf. verrilliana*): Sagami Bay; Hamada (1963b) (as *A. verrilliana*): Tateyama; Eguchi (1965, 1968): Kii coast and Sagami Bay; Utinomi (1966, 1971): north-east Kyushu and Kii coast; Eguchi (1968): Sagami Bay; Kikuchi (1968): Amakusa Is.; Eguchi (1972a): Izu; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Kikuchi (1985): Tsuji-shima; Shirai (1986): Kii coast.

10
Family
Siderastreidae

Vaughan and Wells, 1943

Genus Pseudosiderastrea

Yabe and Sugiyama, 1935

Pseudosiderastrea tayamai

Yabe and Sugiyama, 1935

Uncommon but very distinctive and restricted to shallow, usually non-reefal substrates where other corals are seldom found. Forms small brownish-grey colonies with white corallite walls. Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Genus Psammocora

Dana, 1846

A single specimen collected from Kushimoto, not listed below, could be an abnormal *P. vaughani*, but may be a distinct species.

Psammocora digitata

Edwards and Haime, 1851

Uncommon or rare but may form large, columnar colonies up to 800mm high. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually blue-grey in colour, but may be bright green. Illustrated in colour: Shirai (1980) (as *P. togianensis*), Masuda and Hayashi (1989), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936) (as *P. exesa*): Ogasawara Is.; Kawaguti (1983) (as *P. togianensis*): Okinawa; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Psammocora contigua

(Esper, 1797)

Generally common, may form colonies >1m diameter and often forms coralliths. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually grey in colour. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is.; Ooishi (1970): Ogasawara and Volcano Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Psammocora decussata

Yabe and Sugiyama, 1937

A rare and little known species. Colonies have irregularly flattened to subcylindrical branches. Corallites are superficial although larger and more deeply excavated than those of *P. contigua*. Septa are coarsely beaded and petaloid septa are conspicuous. The *in situ* appearance is not known.

Records:

This study: Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1937): Amami Is. and south Kyushu.

Psammocora superficialis

Gardiner, 1898

Generally common throughout the Ryukyu Is. where it may form large, brightly coloured colonies. Common in mainland localities, where colonies are usually dark green or brown but may be other colours, eg. brick red. Calices of mainland colonies are relatively large with distinct septa and this is observable *in situ*

Coralla from the Ryukyu Is. have a similar range of variation to those from the Philippines. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Eguchi (1971): Goto I.; Eguchi (1973): Tsushima; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Psammocora haimeana

Edwards and Haime, 1851

Rare, not studied in detail. Coralla show no significant differences from those of the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Psammocora profundacella

Gardiner, 1898

Common over the full distribution range. Does not form large colonies; occasionally forms coralliths. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1989).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Eguchi (1968): Sagami Bay; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Psammocora nierstraszi

van der Horst, 1921

Uncommon; not studied in detail. Colonies have a wide range of valley shapes, from short to sinuous; they show no significant differences from those of the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Yamazato *et al.* (1978): Okinawa.

Psammocora vaughani

Yabe and Sugiyama, 1936

Common at Ishigaki I. (station 17); probably uncommon elsewhere, but has not been studied in detail. The species is retained in the genus *Psammocora* primarily because the corallites are the same size as other species of the genus; most skeletal characters, however, are *Coscinaraea*-like. It is unlikely that this is the *Psammocora* sp. of Vaughan (1918) from the Cocos (Keeling) Is., as recorded by Yabe and Sugiyama (Veron, 1990a)

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yabe and Sugiyama: Ogasawara Is.; Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Coscinaraea

Edwards and Haime, 1848

Type specimens of *C. kusimotoensis* Yabe and Sugiyama, 1936 have not been located. It has not been identified from the original description and illustrations.

Coscinaraea exesa

(Dana, 1846)

Rare, recorded from a few coralla only and not studied in detail.

Records:

This study: Okinawa Is.

Previous studies: ?Kawaguti (1983): Yaeyama Is.

Coscinaraea columna

(Dana, 1846)

Usually uncommon but may be common in some localities (eg. station 11). Forms colonies plate-like colonies up to 3m diameter at Kushimoto. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually yellow or

grey (as on the Great Barrier Reef). Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988b, p. 67).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Eguchi (1974): Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977) (as *C. columna* and possibly *C. kusimotoensis*: Kushimoto; Yamazato et al. (1978): Okinawa; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Coscinaraea wellsi

Veron and Pichon, 1980

Rare. Has the same structure as coralla from the Philippines and the Great Barrier Reef.

Records:

This study: Okinawa Is., Tosashimizu.

Previous studies: Kawaguti (1983): Yaeyama Is.

Coscinaraea crassa

Veron and Pichon, 1980

Rare but conspicuous, forming large, flat plates; not studied *in situ*. Coralla show no significant differences from those of the Great Barrier Reef.

Records:

This study: Okinawa and Amami Is., Tanegashima, Shirahama.

Previous studies: Not recorded.

Coscinaraea monile

(Forskål, 1775)

Generally rare except at Tanegashima, where it is very common; usually grey in colour.

Records:

This study: Okinawa Is., Tanegashima, Tosashimizu.

Previous studies: ?Eguchi (1972a): Izu.

Coscinaraea hahazimaensis

Yabe and Sugiyama, 1936

Uncommon, recorded from single specimens from each of the localities below. The holotype of Yabe and Sugiyama (1936) (#44691) has been re-examined. The species is a likely high latitude endemic of Japan. It is morphologically close to *C. columna*, but has much smaller corallites and valleys, but relatively coarse septal elements. The appearance of living colonies has not been recorded.

Records:

This study: Tanegashima, Tosashimizu, Kushimoto, Izu.

Previous studies: Yabe and Sugiyama (1936): eastern Kii coast.

11
Family
Agariciidae
Gray, 1847

Genus Pavona
Lamarck, 1801

Pseudocolumnastrea Yabe and Sugiyama, 1933 was created for *P. yamanarii* Yabe and Sugiyama, 1933, a single corallum from the Daito Is. This has not been re-examined during the present study. The genus was used as a sub-genus of *Pavona* by Wells (1954) and others; the species may a synonym of *Pavona maldivensis*.

Pavona cactus
(Forskål, 1775)

Common in protected habitats, especially on soft substrates where it may form extensive stands. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale cream in colour at the Ryukyu Is., but may be grey-brown at Tanegashima (stations 58 and 60). Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yamazato *et al.* (1978) (as *P. cactus* and *P. praetorta*): Okinawa; Kawaguti (1983) (as *P. cactus* and *P. praetorta*): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona decussata
(Dana, 1846)

Common, Amakusa Is., sometimes common, Yaeyama Is., uncommon elsewhere. May form very large colonies at the Ryukyu Is., Tanegashima and Amakusa Is., with vertical plates up to 600mm high. Has a similar range of variation in the Philippines and the Great Barrier Reef. Yellowish-brown in colour at the Ryukyu Is. and Tanegashima, chocolate brown, sometimes with green tentacles

at mainland localities. Tentacles are normally extended the day at mainland localities, not in the Ryukyu Is. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Yabe *et al.* (1936): north to Suruga Bay; Utinomi (1965b, 1966, 1971): south-west Shikoku, Ehime coast, Kii coast and north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Yagi (1970): Ehime coast; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I., Kawaguti (1983) (as *P. decussata*, *P. lata*): Okinawa; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona explanata

Veron, 1985

Sometimes common (eg. Amitori Bay and Tanegashima). Usually restricted to steeply sloping substrates. Has a similar, very wide range of variation in the Philippines and the Great Barrier Reef. Corallites vary in size, shape and orientation both within and between colonies, especially those from differing depths. Increased variation occurs in coralla from different localities, with those from Tanegashima having recognisably smaller corallites than those from the Ryukyu Is. from similarly exposed biotopes. Coralla with similar corallites have, however, been found elsewhere, eg. Thailand. Colonies are usually uniform in colour, browns, greys and greens being the most common, often with calices of distinct colours. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Izu.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona danai

Edwards and Haime, 1860

Rare and restricted to shallow water. Has not been studied in situ, but coralla have a similar range of variation as those from the Philippines.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Pavona frondifera

(Lamarck, 1816)

Generally uncommon at the Ryukyu Is., but may be common in some localities (from Iriomote I. and Tanegashima). Has a similar wide range of variation in the Philippines. Usually pale orange-brown in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936): north to south-west Shikoku; Utinomi (1965b): south-west Shikoku; Tokioka (1968): south-west Shikoku; Eguchi (1974): Kerama Is.; Kawaguti (1983): Yaeyama Is.

Pavona maldivensis

(Gardiner, 1905)

Rare and restricted to wave washed habitats with steep substrates. Colonies at Tokunoshima (station 56) and the only colony observed in the Okinawa Is. (Kuba I., station 47), had well-developed columnar growth forms and thin explanate bases. At Tanegashima, large, thin, explanate colonies were found on steep rock substrates (stations 60 and 62). Explanate growth forms are much more common in Japan than observed elsewhere; there is no discernable geographic variation in the structure of the corallites. All colonies observed were grey or had grey columns and margins and greenish central parts.

Records:

This study: Okinawa and Amami Is., Tanegashima.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona clavus

(Dana, 1846)

Uncommon to rare, but may form large colonies. Colonies may be either columnar or have flattened branches. They have a similar range of variation in the Philippines and the Great Barrier Reef. Usually pale pinkish-cream or orange brown in colour, with or without green calices. Illustrated in colour: Shirai (1980), Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983) (as *P. lilacea*): Okinawa; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona minuta

Wells, 1954

Uncommon to rare and does not form large colonies. Corallites are similar to those of the Great Barrier Reef and Philippines. Uniform grey or grey-brown in colour except at Tanegashima where it is cream. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is.

Previous studies: Yabe *et al.* (1936) (as *P. maldivensis*): Daito Is.; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona bipartita

Nemenzo, 1980

Rare, usually restricted to the same biotopes as *P. minuta*, which it closely resembles. Has not been studied in detail *in situ*.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Pavona varians

Verrill, 1864

Common throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually dark or pale greenish-cream in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tateyama.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pavona venosa

(Ehrenberg, 1834)

Uncommon. Valleys are usually short. Usually bright greenish-yellow in colour. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Leptoseris

Edwards and Haime, 1849

Leptoseris papyracea

(Dana, 1846)

Found only on soft substrated in deeper water at Amitori Bay (stations 2 and 4 and with *L. amitoriensis*), Kabira Bay and Ago Bay (station 42). Colonies form continuous pale pink mats composed of fine, tightly compacted fronds.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Leptoseris gardineri

van der Horst, 1921

Generally rare, but forms extensive stands in deeper water of Amitori Bay (station 2). Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Leptoseris amitoriensis

Veron, 1990

Colonies form extensive stands *in situ* in Amitori Bay, Iriomote I. at a depth of approximately 50m (Yokochi, pers. comm.), where it is intermixed with *L. gardineri*. Coralla are very thin and delicate, foliose, unifacial laminae, with subentire to irregularly bifurcated margins and upward curving sides. Laminae vary in width; those of collected specimens are up to 67mm wide but *in situ* photographs show that they may be several times this width. Septocostae are in neat, straight rows. Corallites are elongate and very superficial. Living colonies are brown in colour, becoming pale towards the margins, which have whitish borders. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama Is.

Previous studies: Veron (1990): Yaeyama Is.

Leptoseris explanata

Yabe and Sugiyama, 1941

Uncommon; colonies are pale cream in colour, often with a white border. They have a similar range of variation to those of the Philippines and Great Barrier Reef. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoseris scabra

Vaughan, 1907

Generally uncommon and restricted to steeply sloping substrates. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually yellowish brown in colour with whitish margins. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoseris hawaiiensis

Vaughan, 1907

Rare throughout the distribution range and restricted to steeply sloping substrates. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies are dark coloured with pale costae and white colony margins.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoseris mycetoseroides

Wells, 1954

Common, Ryukyu Is. and Amakusa Is., uncommon elsewhere. Usually found on steeply sloping substrates and has a wide range of variation on the Great Barrier Reef and in the Philippines. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually uniform dark colours, most commonly green. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936) (as *Agaricia minikoiensis*): north to Suruga Bay; Kikuchi (1968) (as *Agaricia minikoiensis*): Amakusa Is.; Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoseris incrustans

(Quelch, 1886)

Rare, recorded from three coralla; not studied *in situ*.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Leptoseris yabei

(Pillai and Scheer, 1976)

Sometimes common on upper reef slopes of the Ryukyu Is.; rare, Tanegashima. Coralla from the Ryukyu Is. may be very similar to those from the Great Barrier Reef but some have less well defined radiating ridges. Coralla from Tanegashima are relatively finely structured. Colonies are uniform brown in colour with white margins. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoseris foliosa

Dineson, 1980

Rare. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies usually have very dark calices.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Leptoseris solida

(Quelch, 1886)

Rare. Coralla are similar to those of Western Australia, but this remains a poorly known species; not studied *in situ*.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Genus Gardineroseris

Scheer and Pillai, 1974

Gardineroseris planulata

(Dana, 1846)

Generally uncommon but may form conspicuous, large, massive colonies in Amitori Bay. Has a similar range of variation in the Philippines and the Great Barrier Reef. Is a uniform purple-grey to fawn in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936) (as *Agaricia ponderosa*): Ogasawara and Daito Is.; Yamazato *et al.* (1978): Okinawa; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Coeloseris

Vaughan, 1918

Coeloseris mayeri

Vaughan, 1918

Common, especially on exposed upper reef slopes, Yaeyama Is. and also in some shallow lagoons. Has a similar range of variation in the Philippines and the Great Barrier Reef. Most commonly a uniform green, brown or blue in colour. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yabe *et al.* (1936): Yaeyama Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Pachyseris

Edwards and Haime, 1849

Pachyseris rugosa

(Lamarck, 1801)

Uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Blue-grey in colour. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b) (p. 97 as *P. speciosa* and p. 98).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Daito Is. and Okinawa Is.; Eguchi (1974): Yaeyama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pachyseris speciosa

(Dana, 1846)

Generally common, Yaeyama Is., becoming uncommon at higher latitudes. Colonies at Tanegashima are fine plates up to 1m diameter growing on vertical surfaces. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale brown in colour. Recorded in most studies north to Tateyama Peninsula. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b) (p. 96).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Eguchi (1974): Kerama Is.; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Pachyseris gemmae

Nemenzo, 1955

Common in exposed environments where colonies are frequently >1m diameter. This is an ill-defined species, similar to plate-like *P. rugosa*. Colonies are dark grey-brown, becoming pale on the sides of collines. Illustrated in colour: Shirai (1980).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.

12
Family
Fungiidae
Dana, 1846

As on both east and west Australian coasts, Japanese fungiids, more than any other major family, are restricted to the lower latitudes of the Ryukyu Is. (with the notable exceptions of one species of *Lithophyllon*, which thrives in mainland latitudes and *Cycloseris*, which are mostly non-reefal).

This account of the Fungiidae has been modified from earlier accounts of Veron and his colleagues to incorporate the recent revision of Hoeksema (1989) who made a substantial series of subgeneric changes within *Fungia*. Of these, the raising of *Ctenactis* to generic status is supported by the present author; the incorporation of *Cycloseris* and *Diaseris* into *Fungia* is not considered justified.

Genus Cycloseris
Edwards and Haime, 1849

In great contrast to the Philippines, all species of *Cycloseris* are rare in Japan. All specimens observed *in situ* throughout this study (with the exception of *C. costulata* from site 42) were collected.

As noted above, Hoeksema (1989), as have most earlier museum taxonomists, places *Cycloseris* as a subgenus of *Fungia* in contrast to the treatments of Wells (1966b) and Veron and Pichon (1980). Both *Cycloseris* and *Fungia* have few species (none in Japan) of doubtful affinity: they are as distinct morphologically as most faviid genera. Ecologically they are very distinct, *Cycloseris* being typically non-reefal, often mobile, and having high latitude distribution ranges, *Fungia* being reef dwelling, mostly non-mobile and restricted more than any other major genus to tropical latitudes. Wells (1966b) also records the fossil record of *Cycloseris* as being approximately twice that of other free-living fungiids.

Most records of *Cycloseris* in Japan are likely to be dredged specimens from non-reefal biotopes. These were seldom visited by the author and this is likely to be the reason why many records (below) have not been confirmed by the author.

Cycloseris cyclolites

(Lamarck, 1801)

Rare, restricted to non-reefal biotopes. Specimens from Okinawa are similar to those from the Philippines but are larger, more irregular, and have coarser septa than those from the Great Barrier Reef. This trend is greatly extended in mainland localities where there is either a high latitude ecomorph of *cyclolites* or, possibly, a high latitude endemic.

Records:

This study: Okinawa Is.

Previous studies: (including mainland records, see above): Hamada (1963b) (as *Fungia cyclolites*): Tateyama; Eguchi (1968): Amami Is. to Sagami Bay; Kikuchi (1968): Amakusa Is.; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cycloseris hexagonalis

(Edwards and Haime, 1848)

Rare, known only from a series of specimens collected from deep water, Amitori Bay, Iriomote I.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Cycloseris sinensis

Edwards and Haime, 1851

Specimens of the present series are similar to *C. sinensis* (Edwards and Haime) of Veron and Hodgson (1989) from the Philippines but have distinctively higher septa than those from lower latitudes.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: ?Hoeksema (1989) (as *Fungia (Cycloseris) sinensis*): Yaeyama Is.

Cycloseris somervillei

(Gardiner, 1909)

No specimens of this species has been observed in Japan by the author.

Records:

This study: Not recorded.

Previous studies: Tribble and Randall (1986): Miyake I.

Cycloseris sp.

Known in Japan from a single specimen from Tanegashima (station 61). As in the Philippines, the corallum is 'strongly arched, and has the septal characters of *C. vaughani*. Costae are markedly cyclical and well developed.' (Veron and Hodgson, 1989 as *Cycloseris* sp. 2).

Records:

This study: Tanegashima.

Previous studies: Not recorded.

Cycloseris erosa

(Doderlein, 1901)

No specimens of this species has been observed in Japan by the author.

Records:

This study: Not recorded.

Previous studies: Yabe *et al.* (1936) (as *Fungia erosa*): Ogasawara Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cycloseris patelliformis

(Boschma, 1923)

Rare; only six specimens have been observed. Those from the Ryukyu Is. are similar to those from the Philippines; those from Tanegashima and the Shirahama (Tanabe Bay) are doubtful.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Shirahama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Cycloseris vauhani

(Boschma, 1923)

Rare, only four specimens have been observed during this study. The single specimen from the Amakusa Is. is lightly calcified and is included here with doubt.

Records:

This study: Yaeyama, Okinawa, Amami and Amakusa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cycloseris marginata

(Boschma, 1923)

No specimens of this species has been observed in Japan by the author.

Records:

This study: Not recorded.

Previous studies: Kawaguti (1983): Yaeyama Is.

Cycloseris costulata

(Ortmann, 1889)

Rare, except at site 42 where a group of specimens were found together. Collected with *C. vauhani* (Nishihira, pers. comm.) from shallow sandy biotope, Okinawa. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Cycloseris curvata

(Hoeksema, 1989)

This is a new name for *Cycloseris elegans* Verrill which is pre-occupied (Hoeksema, 1989). It is a distinctive species with wavy margins and prominent septocostae. The colour ranges from brown to a distinctive pale pink.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Genus Diaseris

Edwards and Haime, 1849

Hoeksema (1989) includes *Diaseris* in subgenus *Cycloseris* of *Fungia*. The key to this is a confusion (well illustrated by Hoeksema) between *Cycloseris sinensis*, *C. hexagonalis* and the following two species of *Diaseris*. The former *Cycloseris* is one of the most common and distinctive of all *Cycloseris* in equatorial countries, the latter is very rare and (as far as the author knows) remains little studied. Neither are known to occur on the Great Barrier Reef and are not, in any situation, field or laboratory, similar to *Diaseris*.

Diaseris typically occurs in isolated pockets of non-reefal habitats, which is probably why they are seldom found in museum collections. Their distinctive mode of asexual reproduction by autotomy is not environment-correlated, nor is it an abnormality: it is always the principal means of reproduction and makes the genus morphologically and ecologically distinct from both *Cycloseris* and (by any standards within the Scleractinia), *Fungia*. *Cycloseris*, like most *Fungia* species, rarely develops multiple centres, let alone lines of autotomy and seldom, if ever, reproduces by autotomy. The fine structure of *Diaseris septocostae* is not genus-specific, but, as originally noted by Wells (1966b), neither is that of *Fungia*.

Diaseris is a useful, distinctive genus, which would only include *sinensis* if the latter were shown to undergo reproduction by autotomy and have a corresponding septal configuration. Recent unpublished studies of Nishihira and others in Thailand indicate that there is likely to be more than two species of *Diaseris* in the Indo-west Pacific.

Diaseris distorta

(Michelin, 1843)

Rare, except in isolated biotopes. Tentacles are normally extended during the day at Okinawa, not at Iriomote I. (Nishihira pers. comm.). Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Verrill (1866) (as *Diaseris pulchella*): Yaeyama and Okinawa Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Diaseris fragilis

Alcock, 1893

Recorded only from Ishigaki I. and Amitori Bay at approximately 40m depth. Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama Is.

Previous studies: Hoeksema (1989) (as *Fungia* (*Cycloseris*) *fragilis*): Okinawa.

Genus Heliofungia

Wells, 1966

Heliofungia actiniformis

(Quoy and Gaimard, 1833)

Usually uncommon and restricted to protected biotopes (eg. station 15). Has a similar range of variation in the Philippines and the Great Barrier Reef. Polyps are pale to dark blue-grey with white tips to the tentacles. Illustrated in colour: Shirai (1980) (as *Fungia actiniformis*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a, 1988b).

Records:

This study: Yaeyama Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Fungia

Lamarck, 1801

For the identification purposes, *Fungia* have historically been divided into subgeneric groups, which have been variously changed according to different authors eg. Wells (1966), Veron and Pichon (1980) and Hoeksema (1989). They are not used here as this confusion has not yet been resolved, and also to give consistency of treatment with other genera. The raising of *Ctenactis* from subgenus to genus after Hoeksema (1989), is an appropriate solution to instability in this subgenus, which formally included *Herpetoglossa*.

Fungia are very common throughout the Ryukyu Is., show little geographic variation within this range, and are readily identifiable *in situ*. There also appears to

be little variation in relative abundance within the three major groups of the Ryukyu Is., yet only one species, *F. scutaria*, has been recorded further north (Tanegashima) during the present study. A similar pattern occurs on both the east and west coasts of Australia. There is little difference between the *Fungia* of the Philippines and that of Japan.

In these several respects there is a great difference between *Fungia* and *Cycloseris*. The basis of this may be physiological, ecological, or involve some aspect of reproductive biology, but, when combined with consistently distinct morphological characters, provides sound grounds for retaining *Cycloseris* as a separate genus (after Wells, 1966 and Veron and Pichon, 1980) as opposed to combining them (after Hoeksema, 1989).

Nishihira (pers. comm.) has shown the author a *fungites*-like species, common at a single locality at Okinawa I., which remains permanently attached to the substratum. This appears to be an undescribed species; it has not been observed by the author and is not included in the present account.

Fungia fungites

(Linnaeus, 1758)

Very common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941): Amami and Miyako Is.; Anonymous (1970): Ehime coast; Eguchi (1974): Yaeyama Is. and Kerama Is.; amazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Hoeksema (1989): Okinawa.

Fungia danai

(Edwards and Haime, 1851a)

Common. Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yamazato *et al.* (1978): Okinawa.

Fungia scabra

Doderlein, 1901

Generally uncommon; not studied in detail. Coralla observed were similar to those of the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974): Kerama Is.

Fungia scruposa

Klunzinger, 1879

Generally common over a wide range of biotopes; not studied in detail. Coralla are similar to those of the Philippines and the Great Barrier Reef. Illustrated in colour: Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yabe and Sugiyama (1941): Amami Is.

Fungia valida

Verrill, 1864

Probably rare. Coralla are similar to those from the Great Barrier Reef. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama (laboratory specimen only), Okinawa and Amami Is.

Previous studies: Chou and Yamazato (1990): Okinawa.

Fungia repanda

Dana, 1846

Very common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941): Yaeyama, Okinawa and Amami Is., Ogasawara Is., south Kyushu; Yamazato *et al.* (1978): Okinawa;

Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; ?Hoeksema (1989): Okinawa, south-east Honsyu.

Fungia concinna

Verrill, 1864

Very common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941): Amami and Okinawa Is.; ?Anonymous (1970): Ehime coast; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Fungia granulosa

Klunzinger, 1879

Common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Yaeyama Is.; Habe (1989): Iriomote I.

Fungia spinifer

Claereboudt and Hoeksema, 1987

Recorded from a single corallum which is similar to Philippines coralla.

Records:

This study: Okinawa Is.

Previous studies: Not recorded.

Fungia scutaria

Lamarck, 1801

Common in the Ryukyu Is., becoming rare at Tanegashima (station 61). Has a similar range of variation in the Philippines and the Great Barrier Reef. Commonly bright green in colour; uniform pale brown at Tanegashima. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe and Sugiyama (1941): Yaeyama and Amami Is. and Ogasawara and Daito Is.; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974) (as *F. scutaria* and *F. scutaria placunaria*): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Fungia paumotensis

Stutchbury, 1833

Common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Pale grey-brown in colour. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941): Amami Is.; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Fungia moluccensis

van der Horst, 1919

Sometimes common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Chou and Yamazato (1990): Okinawa.

Genus Ctenactis

Verrill, 1864

A specimen with the colouration of *Ctenactis albitentaculata* Hoeksema, 1989 (the primary diagnostic character of the species) has been collected and photographed at Okinawa by Nishihira. It differs from Hoeksema's description of this species in having septal dentations indistinguishable from those of *C. echinata*, in being elongate (227mm long and 69mm wide at the centre) rather than rounded, and in having three mouths. It is concluded that this specimen is a colour morph of *C. echinata*, of which species *C. albitentaculata* is a probable synonym (a conclusion which applies in the Great Barrier Reef where, contrary to Hoeksema, *C. echinata* as illustrated by Veron *et al.* (1980), is not divisible into two species on any grounds).

Ctenactis echinata

(Pallas, 1766)

Very common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour (as *Fungia echinata*): Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: (as *Fungia echinata*) Yabe and Sugiyama (1941): Yaeyama and Okinawa Is.; Anonymous (1970): Ehime coast; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa.

Ctenactis crassa

(Dana, 1846)

The name *simplex* has been changed to *crassa* by Hoeksema (1989) because Dana's type, recorded by Veron and Pichon (1980) as lost, was found.

Uncommon (stations 6 and 7) or rare. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a) (as *Fungia (Ctenactis) simplex*).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except in the abovementioned publications.

Genus Herpolitha

Eschscholtz, 1825

Herpolitha limax

(Esper, 1797)

Very common. Has a similar range of variation in the Philippines and Great Barrier Reef. A uniform brown or grey-brown in colour. Illustrated in colour: Shirai (1980) (as *H. limax* and *H. stricta* (Dana), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941) Amami Is.; Kawaguti (1983) (as *H. limax* and *H. stricta*): Okinawa.

Herpolitha weberi

(van der Horst, 1921)

Rare, recorded from a single corallum which is very similar to the syntypes.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Genus Polyphyllia

Quoy and Gaimard, 1833

Polyphyllia talpina

(Lamarck, 1801)

Generally uncommon. Polyps are extended during the day to give colonies a mop-like appearance. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe and Sugiyama (1941): Amami Is.

Genus Sandalolitha

Quelch, 1884

Hoeksema (1989) records two species of *Sandalolitha*, both from the Australia to Japan. However, the only likely occurrence of a second species in the Indo-west Pacific, excluding Indonesia, is at the Cocos (Keeling) Is. (Veron 1990).

Sandalolitha robusta

(Quelch, 1886)

Very common in a wide range of environments. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980) (as *Parahalomitra robusta* and *P. irregularis* Gardiner), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974) (as *Halomitra robusta*): Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Hoeksema (1989) (as *S. dentata* and *S. robusta*): Okinawa.

Genus Halomitra

Dana, 1846

Halomitra pileus

(Linnaeus, 1758)

Rare. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies are grey-brown with pale septo-costae and calices and usually with blue (*in situ*, pink when photographed with artificial light) margins. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publication.

Genus Zoopilus

Dana, 1846

Zoopilus echinatus

Dana, 1846

Rare, recorded only from Sakieda Bay (station 35), Ishigaki I. at 18m depth, where there are numerous large colonies. Coralla show no significant differences from this species in equatorial regions. Uniform dark brown in colour. Illustrated in colour: Veron (1986b), Nishihira (1988).

Records:

This study: Yaeyama Is.

Previous studies: Not recorded except in the abovementioned publications.

Genus Lithophyllon

Rehberg, 1892

In his recent revision, Hoeksema (1989) records two species of *Lithophyllon* in total, as concluded by Veron (1986b). One species occurs on the Great Barrier Reef: *L. mokai* Hoeksema, an appropriate new name for the *L. cf. edwardsi* of Veron and Pichon, 1980 and subsequent uses of that name by Veron from Australian localities, but not Japan. *Lithophyllon undulatum sensu* Hoeksema (1989), occurs in north-west Australia but has not, to this author's knowledge, been found on the Great Barrier Reef. There are probably no species of *Lithophyllon* in common between the Great Barrier Reef and Japan. Three species of *Lithophyllon* have been observed by the author *in situ* in the Philippines and two in Japan: the latter two (which are common to the Philippines) are illustrated by Hoeksema (1989), Figs. 567 and 568, referred to below as *L. lobata* and 570 and 571, referred to below as *L. undulatum*.

Specimens of Yabe *et al.* (1936) have been re-examined during this study. The names *Podabacia formosa* and *P. varians* are confused on several. *Podabacia elegans plicata* (#36905) has a large central corallite and coarse septo-costae; peripheral corallites are similar to those of *P. elegans varians* (#39098); both are from Tanabe Bay. All specimens of *P. elegans lobata* and *P. elegans formosa* are very similar.

Lithophyllon undulatum

Rehberg, 1892

Uncommon, but very conspicuous, especially in high latitudes where colonies may be >1m diameter and have a wide range of growth forms. Yellowish-brown or greenish-brown in colour. Illustrated in colour: Nishihira (1988) (as *L. elegans*), Uchida and Fukuda (1988b) (as *L. edwardsi*).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Previous studies: The following records may include some *L. lobata*: Yabe *et al.* (1936) (as *Podabacia elegans varians*, *P. elegans plicata*, *P. elegans lobata nomanensis*, *P. elegans lobata* and *P. elegans formosa*): north to Tanabe Bay; Utinomi (1965b, 1966, 1971) (as *L. lobata* and *L. elegans*): south-west Shikoku, Kii coast, north-east Kyushu; Kikuchi (1968) (as *Podabacia elegans lobata*): Amakusa Is.; Anonymous (1970) (as *L. lobata*): Ehime coast; Yagi (1970) (as *L. lobata*): Ehime coast; Eguchi (1971) (as *L. lobata*): Goto I.; Eguchi (1973) (as *L. lobata*): Tsushima; Eguchi (1974): Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977) (as *L. elegans*): Kushimoto; Yamazato *et al.* (1978) (as *L. elegans*): Okinawa; Shirai (1986): Kii coast.

Lithophyllon lobata

van der Horst, 1921

Rare, especially in the Ryukyu Is., but very conspicuous throughout its range. Skeletal detail is similar to those of *L. undulatum*. The most distinguishing character is that coralla are almost always monocentric: only very large colonies from mainland localities (including the holotype if this is applicable) have peripheral corallites. Small, free-living colonies have been found in shallow lagoons. The usual colour is pale yellowish-brown.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: See previous species.

Genus Podabacia

Edwards and Haime, 1849

Podabacia crustacea

(Pallas, 1766)

Generally uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually amber-brown in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Podabacia motuporensis

Veron, 1990

A single corallum of this species has been recorded from Iriomote I.; it has not been seen *in situ*. Colonies are thin, unifacial plates attached at or near one edge. Corallites are irregularly but equidistantly arranged; there is no central corallite. Mature corallites are less than 5 mm diameter; calices are less than 2.5mm. This species is similar to *P. crustacea*, but much is finer and is readily distinguished *in situ*. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama Is.

Previous studies: Veron (1990): Yaeyama Is.

13
Family
Oculinidae
Gray, 1847

Genus Galaxea
Oken, 1815

Galaxea astreata
(Lamarck, 1816)

Generally uncommon, but common at station 13, where colonies are mostly pillow-like, less than 150mm diameter. Forms an extensive monospecific stand at station 2, which (if regarded as a single colony), is one of the largest coral colonies seen by the author. The colony is dark brown in colour with whitish calices and consist of tiers of unifacial plates. Otherwise the species has a similar range of variation (including a range of abnormalities associated with mud) in the Philippines and the Great Barrier Reef. Usually grey-brown in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu.

Previous studies: Yabe *et al.* (1936) (as *G. musicalis*): Yaeyama and Miyako Is. and Ogasawara Is.; Oishi (1970) (as *G. clavus*): Ogasawara and Volcano Is.; Eguchi (1974) (as *G. musicalis*): Yaeyama Is. and Kerama Is.; Kawaguti (1983) (as *G. astreata*, *G. musicalis* and *G. clavus*): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Galaxea fascicularis
(Linnaeus, 1767)

Common throughout the Ryukyu Is. where colonies are frequently of large size. Large numbers of what appear to be daughter colonies of the same colour are often found in close proximity to parent colonies. Uncommon at Tanegashima where colonies are small, dark green in colour, and occur in a wide range of biotopes. Otherwise, the species has a similar range of variation as colonies from the Philippines and the Great Barrier Reef. *Galaxea columnaris* Eguchi and Shirai, 1977 is a junior synonym of this species. Has a wide range of colours (illustrated, Nishihira

(1988)), green being the most common. Also illustrated: Shirai (1980) (as *G. columnaris* and *G. fascicularis*, Masuda and Hayashi (1989), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936): Yaeyama, Miyako, Okinawa and Amami Is.; Anonymous (1970): Ehime coast; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Acrhelia

Edwards and Haime, 1849

Kawaguti (1983) records *Simplastrea* Umbgrove, 1939 from Okinawa..

Acrhelia horrescens

(Dana, 1846)

Generally uncommon except in some exposed biotopes. As in the Philippines, but not the Great Barrier Reef, colonies frequently occur in turbid environments where they have lax growth forms. Usually yellowish-brown in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

14
Family
Pectiniidae

Vaughan and Wells, 1943

The genus *Oxyphyllia* Yabe and Eguchi, 1935a, an invalid genus, was created for two varieties of *Echinophyllia aspera* (*tosaensis* and *sugiyamai*). Yabe and Eguchi (1935b) compare the skeletal characters of this and related genera.

Genus Echinophyllia

Klunzinger, 1879

Echinophyllia aspera

(Ellis and Solander, 1786)

Generally common in a wide range of habitats and is especially common at Tanegashima and the Amakusa Is. Uncommon at Shirahama and Kushimoto. Has a similar range of corallite variation on the Great Barrier Reef. Colonies are distinctive dark reds and greens at higher latitudes. Recorded in most studies north to Tateyama Peninsula. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936) (as *Oxyphyllia aspera*, *Oxyphyllia aspera tosaensis* and *Oxyphyllia aspera sugiyamai*): north to Suruga Bay, Ogasawara and Daito Is.; Utinomi (1965b, 1971): south-west Shikoku, Kochi, north-east Kyushu; Kikuchi (1968): Amakusa Is.; Eguchi (1971): Goto I.; Eguchi (1972a): Izu; Eguchi (1973): Tsushima; Eguchi (1974): Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Yamazato *et al.* (1978): Okinawa; Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Echinophyllia orpheensis

Veron and Pichon, 1980

Generally uncommon throughout the distribution range. Colonies are usually mottled orange, or have dark yellow-brown septo-costae.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (pers. comm. 1991): Ogasawara Is.

Echinophyllia echinata

(Saville-Kent, 1871)

Uncommon but very distinctive and colourful, mottled browns and greens being the most common colours. The central corallite of most colonies is often very large. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Amakusa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Echinophyllia nishihirai

Veron, 1990

Rare, but very conspicuous. Coralla have a very large central corallite with a compact, circular or elongate columella up to 20mm diameter. Septo-costae radiate from the central corallite to the corallum perimeter. There are no clearly formed secondary corallites. Colonies are dark, usually mottled, greens and browns. Illustrated in colour: Uchida and Fukuda (1988a) (as *Scolymia vitiensis*); Veron (1990b).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu.

Previous studies: Veron (1990b): Yaeyama and Okinawa Is.

Echinophyllia echinoporoides

Veron and Pichon, 1980

Rare except in some protected biotopes. Has a similar range of variation in the Philippines. Mostly rust red in colour, often with mottled green or white calices, occasionally grey with green or red calices.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Echinophyllia patula

(Hodgson and Ross, 1982)

Rare, except at Tanegashima where it has the same grey-green colour and appearance as Philippines colonies. This species is primarily distinguished from *E. aspera* by having smaller corallites and finer septo-costae.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Genus Oxypora

Saville-Kent, 1871

Oxypora lacera

(Verrill, 1864)

Common throughout the Ryukyu Is. to Tanegashima, uncommon in mainland localities. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies are usually pale grey or brown at the Ryukyu Is., or yellowish-brown to creamy grey at Tanegashima or bright green (sometimes red) at mainland localities. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Paratype 44872 of *Oxypora titizimaensis* Yabe and Sugiyama, 1935 from Tohoku University was re-examined during the present study and shows no distinguishing characters from *O. lacera*.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936) (as *O. titizimaensis*): Ogasawara Is.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Oxypora glabra

Nemenzo, 1959

Uncommon, frequently thin, brittle sheets. Has a similar range of variation in the Philippines and the Great Barrier Reef. Almost white in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama Is.

Previous studies: Not recorded except in the abovementioned publications.

Genus Mycedium

Oken, 1815

Mycedium elephantotus

(Pallas, 1766)

Common at the Ryukyu Is. and Kushimoto, where it has a very wide colour range. Uncommon at Tanegashima and other mainland localities, but forms large colonies with a wide range of dark colours (predominantly green) and a wide variation in corallite structure. Illustrated in colour: Shirai (1980) (as *M. elephantotus* and *M. tubifex*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Eguchi (1974) (as *M. elephantotus* and *M. tubifex*): Kerama Is.; Tribble and Randall (1986): Miyake I.; Kawaguti (1983) (as *M. elephantotus* and *M. tubifex*): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Mycedium robokaki

Moll and Borel Best, 1984

Rare, recorded only from Ishigaki I. and not studied *in situ*. Coralla are similar to those from several equatorial Indo-Pacific countries.

Records:

This study: Yaeyama Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Physophyllia

Duncan, 1884

This is a poorly defined genus with one species. Further study is likely to indicate that *P. ayleni* can be placed in *Pectinia*.

Physophyllia ayleni

Wells, 1934

Rare throughout the distribution range. Dark grey in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936): Ogasawara Is., north to Suruga Bay; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Anonymous (1977): Kushimoto.

Genus Pectinia

Oken, 1815

Pectinia lactuca

(Pallas, 1766)

Generally uncommon. Usually found in partly protected biotopes but sometimes found on partly exposed upper reef slopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Always battleship grey. Illustrated in colour: Shirai (1980) (as *P. laciniata*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa, Amami and Amakusa Is., Kushimoto

Previous studies: Yabe *et al.* (1936) (as *Tridacophyllia lactuca japonica*): north to Tanabe Bay; Utinomi (1965b, 1971): south-west Shikoku, north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Eguchi (1971): Goto I.; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Chou and Yamazato (1990): Okinawa.

Pectinia paeonia

(Dana, 1846)

Uncommon. Usually restricted to partly protected biotopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually pale orange, yellow or cream. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa, Amami and Amakusa Is. (laboratory specimen only), Kushimoto, Shirahama (laboratory specimen only).

Previous studies: Yabe *et al.* (1936) (as *Tridacophyllia lactuca tanabensis*): north to Tanabe Bay.

Pectinia alcicornis

(Saville-Kent, 1871)

Uncommon and restricted to protected lagoons. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983) (as *P. alcicornis* and *P. plicata*): Yaeyama Is.

Pectinia teres

Nemenzo and Montecillo, 1981

Rare, usually restricted to lower reef slopes. Not studied *in situ*. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama Is.

Previous studies: Not recorded except in the abovementioned publication.

15
Family
Mussidae
Ortmann, 1890

Genus Blastomussa
Wells, 1961

Blastomussa wellsi
Wijsman-Best, 1973

Rare throughout the distribution range. Usually sub-plocoid but may be completely cereoid, especially in mainland localities. Greenish or red in colour. Illustrated in colour: Nishihira (1988).

Records:

This study: Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Tateyama.

Previous studies: Kawaguti (1983): Yaeyama Is.

Blastomussa merleti
(Wells, 1961)

Very rare, red (station 37), green (station 43) or brownish (stations 2 and 4) in colour. Described in detail by Eguchi (1975a) as *Cladocora kabiraensis* with Kabira Bay as the type locality and noting that the living polyps have a 'dark green oral disk with purplish brown tentacles'. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980) (as *Cladocora kabiraensis*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1975) (as *Cladocora kabiraensis*): Eguchi (1975); Kawaguti (1983) (as *Cladocora kabiraensis*): Yaeyama Is.

Genus Cynarina

Brüggemann, 1877

Yabe and Sugiyama (1931, 1936) combined *Cynarina* with *Trachyphyllia* in the genus *Antillia* Yabe and Sugiyama, 1931, and then *Antillophyllia* Vaughan, 1932. *Protolobophyllia* Yabe and Sugiyama, 1935 was created for *Antillia japonica* Yabe and Sugiyama, 1931, a confusion of *Cynarina lacrymalis* and *Scolymia vitiensis* Brüggemann, 1877.

Cynarina lacrymalis

(Edwards and Haime, 1848c)

Very rare, but conspicuous. Three specimens only were observed at Okinawa (Nishihira, pers. comm.) and Tanegashima, two at Shirahama, but not found in situ at Kushimoto. Cream, brown or grey in colour. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe and Sugiyama (1931) (as *Antillia japonica* and *A. nomaensis*): Sima and Suruga Bay; Utinomi (1966, 1971): north-east Kyushu and Kii coast; Eguchi (1971): Goto I.; Eguchi and Miyawaki and Anonymous (1977): Kushimoto; Tribble and Randall (1986) (as *Acanthophyllia deshayesiana*): Miyake I.; Kawaguti (1983) (as *Acanthophyllia* sp.): Okinawa; Masuda (1986): Iriomote I.

Genus Scolymia

Haime, 1852

Scolymia australis

Edwards and Haime, 1849b

Tribble and Randall's specimen from Miyake I. has been re-examined during the present study and shows no differences from coralla of this species from southern Australia.

Records:

This study: Not recorded.

Previous studies: Tribble and Randall (1986): Miyake I.; Tachikawa (pers. comm. 1991): Ogasawara Is.

Scolymia vitiensis

Brüggemann, 1877

Very rare; observed in the Okinawa Is. by Nishihira (pers. comm.).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Australomussa

Veron, 1985

Australomussa rowleyensis

Veron, 1985

Rare throughout distribution range and known in the Okinawa Is. from a single lab. specimen. Colonies are dark grey in colour. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except in the abovementioned publication.

Genus Acanthastrea

Edwards and Haime, 1848

Acanthastrea echinata

(Dana, 1846)

Generally common throughout the Ryukyu Is., especially on exposed upper reef slopes. Less common in higher latitudes. Colonies are frequently >100mm diameter throughout the distribution range. They have a similar range of variation in the Philippines and the Great Barrier Reef. Usually red, grey or mottled yellow in colour. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936): north to south-west Shikoku; Kikuchi

(1968) (as *A. cf. echinata*): Amakusa Is.; Eguchi (1974): Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Acanthastrea rotundoflora

Chevalier, 1975

Rare, except as station 11, where colonies were various dark colours. Has a similar appearance *in situ* as colonies from the Philippines.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.

Acanthastrea hillae

Wells, 1955

Rare, especially in the Ryukyu Is., where colonies are mostly grey, brown or mottled green in colour. At Tanegashima and mainland localities, colonies are also commonly red. Has a similar range of variation on the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Acanthastrea bowerbanki

Edwards and Haime, 1857

Rare. As in eastern Australia, living colonies do not have the fleshy appearance of other *Acanthastrea* species. Coralla are similar to those from eastern Australia.

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu, Amakusa Is.

Previous studies: Not recorded.

Acanthastrea hemprichii

(Ehrenberg, 1934)

Generally uncommon, but may form conspicuous orange-yellow colonies over 1m diameter in the Ryukyu Is. and uniform brownish-grey to dark green or red colonies at mainland localities. Has a similar range of variation in the Philippines. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Eguchi (1971): Goto I.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tachikawa (pers. comm., 1991): Ogasawara Is.

Acanthastrea ishigakiensis

Veron, 1990

Uncommon to rare, but very conspicuous. Colonies massive, usually hemispherical, often >300mm diameter. Corallites are cereoid, becoming plocoid on the colony sides, with angular calices up to 24mm diameter. Several colonies were observed at stations 8, 10, 11, 16, 17 and 50. Colonies have the same appearance and the same structure as those from the Philippines. They are blue-grey in colour, with occasional exceptions. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Veron (1990): Yaeyama, Okinawa and Amami Is.; Tachikawa (pers. comm. 1991): Ogasawara Is.

Acanthastrea lordhowensis

Veron and Pichon, 1982

Very rare except in higher latitudes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies have a very wide range of colours (as illustrated, Veron, 1986), most commonly red, less commonly green.

Records:

This study: Okinawa, Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Izu.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Acanthastrea amakusensis

Veron, 1990

Rare. Colonies are cerioid, with neat, angular corallites with calices up to 7.5mm diameter. The nearest species structurally (and with a similar *in situ* appearance) is *A. lordhowensis* which has larger, less regular corallites. Colonies are fleshy, brightly coloured, green or red. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Veron (1990): Tanegashima, Amakusa Is., Kushimoto, Shirahama; Tachikawa (pers. comm. 1991): Ogasawara Is.

Genus Lobophyllia

de Blainville, 1830

Lobophyllia hemprichii

(Ehrenberg, 1834)

The most common *Lobophyllia*. Colonies from the Ryukyu Is. have a similar range of variation as those from the Philippines and the Great Barrier Reef but at the Amakusa Is. they are extremely fleshy. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936) (as *L. costata*, *L. hemprichii* and *L. robusta*): Ogasawara and Daito Is. and Okinawa and Amami Is.; Kikuchi (1968) (as *Lobophyllia costata*): Amakusa Is.; Eguchi (1971): Goto I.; Eguchi (1974) (as *L. costata* and *L. hemprichii*): Yaeyama Is. and Kerama Is.; Anonymous (1977): Kushimoto; Yamazato *et al.* (1978) (as *L. costata*): Okinawa;; Kawaguti (1983) (as *L. hemprichii* and *L. costata*): Okinawa; Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Lobophyllia corymbosa

(Forskål, 1775)

Uncommon in the Ryukyu Is., rare at Tanegashima. Has the same appearance in situ in the Philippines and the Great Barrier Reef where it exhibits little growth form variation. Usually blue-grey in colour, but may be creamy-yellow. Illustrated in colour: Shirai (1980), (as *L. costata*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936): Ogasawara Is.; ?Eguchi (1971): Goto I.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Lobophyllia pachysepta

Chevalier, 1975

Uncommon throughout the distribution range and seldom forms colonies over 300mm diameter. Exsert septo-costae are the same yellow colour in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publication.

Lobophyllia hataii

Yabe, Sugiyama and Eguchi, 1936

Rare throughout the distribution range, but very distinctive. Similar to Great Barrier Reef colonies. Usually mottled dark bluish-grey and cream in colour. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto.

Previous studies: Ooishi (1970) (as *Lobophyllia (Palauphyllia) hataii*): Ogasawara and Volcano Is.; Eguchi (1971) (as *Palauphyllia hataii*): Goto I.; Eguchi (1974) (as *Lobophyllia (Palauphyllia) hataii*): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Lobophyllia robusta

Yabe, Sugiyama and Eguchi

Uncommon, but sometimes forms conspicuous colonies over 2m diameter. Has the same appearance *in situ* and a similar range of variation as colonies from the Philippines. Very large colonies have not been found on the Great Barrier Reef, but *Lobophyllia* sp. from east Australia of Veron *et al.* (1980) is probably this species. Usually dark blue-grey in colour.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is.

Previous studies: Yabe *et al.* (1936): north to Suruga Bay; Kikuchi (1968): Amakusa Is.; Anonymous (1977): Kushimoto.

Genus Symphyllia

Edwards and Haime, 1848

Symphyllia recta

(Dana, 1846)

Sometimes common. Has a similar range of variation in the Philippines and the Great Barrier Reef. Has a wide colour range. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Ogasawara, Daito, Okinawa and Amami Is.; Anonymous (1970): Ehime coast; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978) (as *S. nobilis*); Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Symphyllia radians

Edwards and Haime, 1849

Probably less common than *S. recta*. In the Ryukyu Is., this species has a similar range of variation and the same appearance *in situ* as colonies from the Philippines and Great Barrier Reef, but at Tanegashima, where it is rare, colonies are small, encrusting, and brick- or bright red in colour. Illustrated in colour: Shirai (1980), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936): north to south-west Shikoku; Anonymous (1970): Ehime coast; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; ?Shirai (1986): Kii coast; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Symphyllia agaricia

Edwards and Haime, 1849

Uncommon throughout the distribution range, except in isolated locations (notably station 11). Rare at Tanegashima, but forms large blue-grey colonies. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu

Previous studies: Yabe *et al.* (1936): Ogasawara Is. and Yaeyama, Okinawa and Amami Is.; Anonymous (1970) (as *Lobophyllia hemprichii*): Ehime coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Symphyllia valenciennesii

Edwards and Haime, 1849

Rare throughout the distribution range. Colonies at the Ryukyu Is. are mostly grey and have a similar range of variation in the Philippines and the Great Barrier Reef. Colonies at mainland localities are distinctive, with thick, fleshy polyps of a wide range of colours, including brown, red, blue, grey and green. There is some doubt that Ryukyu Is. and mainland colonies are the same species. The latter are distinguished, at least, as a geographic sub-species. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936): south-west Shikoku; Tachikawa (pers. comm., 1991): Ogasawara Is.

16
Family
Merulinidae
Verrill, 1866

Genus Boninastrea
Yabe and Sugiyama, 1935

This genus has not been found in the Ryukyu Is. or mainland Japan.

Boninastrea boninensis
Yabe and Sugiyama, 1935

This species superficially resembles *Platygyra contorta* and, as the holotype was believed lost, was confused with this species by Veron (1986,) and Nishihira (1988).

Records:

This study: Not found.

Previous studies: Yabe *et al.* (1936): Ogasawara Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Hydnophora
Fischer de Waldheim, 1807

Hydnophora rigida
(Dana, 1846)

Common throughout the distribution range where it frequently forms extensive monospecific stands in shallow water of both exposed (eg. stations 8, 11 and 41) and protected (eg. stations 9 and 18) biotopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Uniform pale grey-brown in colour. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936) (as *Merulina laxa*): Yaeyama and Okinawa Is.; Eguchi (1974) (as *Merulina laxa*): Yaeyama Is.; Yamazato *et al.* (1978) (as *Merulina laxa*): Okinawa; Kawaguti (1983) (as *H. laxa* and *Merulina laxa*): Okinawa; Habe (1989): Iriomote I.

Hydnophora bonsai

Veron, 1990

Uncommon. Colonies are encrusting, plate-like, with short irregular branch-like upgrowths. Colonies are mostly pale colours; tentacles are not extended during the day. This species is apparently a high-latitude Japanese endemic. The growth form is similar to *H. exesa* but is finer, with relatively stunted branches.

Records:

This study: Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Veron (1990): Amakusa Is., Kushimoto, Shirahama.

Hydnophora exesa

(Pallas, 1766)

Uncommon throughout the Ryukyu Is. but common in mainland localities. Usually plate-like. Tentacles are usually retracted during the day in the Ryukyu Is., but are usually extended in mainland localities. Usually pale coloured, but may be green, red or brown at Shirahama. Recorded in most studies north to Tateyama Peninsula. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936) (as *H. grandis*): north to Sagami Bay; Hamada (1963b): Tateyama; Eguchi (1968): Sagami Bay; Utinomi (1965b, 1971): south-west Shikoku, north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Eguchi (1973): Tsushima; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1971): Goto I.; Eguchi (1972a): Izu; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I., Kawaguti (1983): Yaeyama Is.; Kikuchi (1985): Tsuji-shima; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Hydnophora microconos

(Lamarck, 1816)

Generally rare throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually mottled or uniform yellowish-brown in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Daito Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Genus Merulina

Ehrenberg, 1834

Merulina ampliata

(Ellis and Solander, 1786)

Common, colonies frequently form flat plates, with or without nodular upgrowths in the Ryukyu Is. and are almost always without nodular upgrowths in mainland localities. Always yellowish-orange in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b, not p. 47).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is, north to east Kyushu; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990); Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Merulina scabricula

Dana, 1846

Common in the Ryukyu Is. where colonies usually have bluish extremities, and a similar range of variation in the Philippines and the Great Barrier Reef. Rare at Tanegashima where colonies consist only of flat sheets which are a dark yellowish-orange. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Not recorded except in the abovementioned publication.

Genus Scapophyllia

Edwards and Haime, 1848

Scapophyllia cylindrica

(Edwards and Haime, 1848)

Uncommon, especially on upper exposed reef slopes. Colonies are usually plate like, rarely columnar. Skeletal detail is similar to that of Great Barrier Reef coralla. Usually very pale brown.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Ogasawara Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

17
Family
Faviidae
Gregory, 1900

Genus Caulastrea
Dana, 1846

Caulastrea echinulata
(Edwards and Haime, 1949)

Rare throughout the distribution range.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Probably not recorded.

Caulastrea furcata
Dana, 1846

Generally common, forming extensive compact colonies in exposed biotopes. Some coralla, especially those from shallow biotopes, are strongly costate and have irregular corallite walls and irregularly exsert septa. Usually phaceloid but may become completely plocoid. Brown with yellow exsert septa. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: ?Yabe *et al.* (1936) (as *C. furcata* and *C. aiharai*: north to Suruga Bay; Ooishi (1970): Ogasawara and Volcano Is.; ?Eguchi (1971): Goto I.; Kawaguti (1983): Yaeyama Is.; Veron's (1988) records of *E. echinulata* from Ishigaki I. are the present species.

Caulastrea tumida

Matthai, 1928

Generally uncommon in the Ryukyu Is., becoming relatively common in mainland localities. As in the Philippines, colonies may be sub-plocoid, even plocoid. Yellow-brown to grey-green in colour. Recorded in most studies north to Shirahama. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936) (as *C. tumida*, *C. tumida multiseptata* and *C. tumida conglobata*): north to Tanabe Bay; Utinomi (1965b, 1966, 1971): south-west Shikoku, Kii coast and north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Yagi (1970): Ehime coast; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Yabe's collections of the three subspecies listed above were re-examined during the present study; they fall within the normal variation of the species.

Caulastrea curvata

Wijsman-Best, 1972

Rare, recorded from a single outcrop at station 45. The corallum shows no significant differences from those from the Great Barrier Reef.

Records:

This study: Okinawa Is.

Previous studies: Not recorded.

Genus Favia

Oken, 1815

It is likely that there are more species of *Favia* in Japan than are included in the present account. Illustrated specimens, presumably holotypes, of *Favia rariseptata* Eguchi and Shirai, 1977; *F. elongata* Eguchi and Shirai, 1977; and *F. deformis* Eguchi and Shirai, 1977 have been re-examined by the author and are believed unlikely to be valid species. *Favia* sp. nov., illustrated Shirai (1980, top of p. 551), has

been recognised *in situ* as possibly a distinct species which, as yet, remains unstudied. A single corallum of what is likely to be *Favia* sp.2 of Veron *et al.* (1977), from Okinawa, remains to be verified.

Favia stelligera

(Dana, 1846)

Generally common in some localities. Restricted to exposed biotopes where columnar colonies may be large and conspicuous. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Daito Is.; Habe (1989): Iriomote I.

Favia laxa

(Klunzinger, 1879)

Uncommon throughout distribution range and not studied in detail. There appears to be no significant difference between Ryukyu I. and mainland coralla. Colonies are mostly dark brown or dark red-brown.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Kawaguti (1983): Yaeyama Is.

Favia helianthoides

Wells, 1954

Rare throughout distribution range. Coralla from the Ryukyu Is. and the mainland show no significant differences and are similar to those from the Philippines and the Great Barrier Reef. Pale orange-brown in colour at the Ryukyu Is., dark colours at mainland localities. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Not recorded except in the abovementioned publication.

Favia pallida

(Dana, 1846)

Common throughout the Ryukyu Is. and Tanegashima, uncommon further north. Corallites of Ryukyu Is. colonies usually have dark calices as do those of the Philippines and the Great Barrier Reef. Colonies in mainland localities have a wider range of colours. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Yabe *et al.* (1936) (as *F. speciosa*): north to Suruga Bay; Ooishi (1970): Ogasawara and Volcano Is.; Kikuchi (1968): Amakusa Is.; Eguchi (1973): Tsushima; Eguchi (1974) (? as *F. speciosa*): Yaeyama Is. and Kerama Is.; Utinomi (1971) (as *F. speciosa*): north-east Kyushu; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia speciosa

(Dana, 1846)

Relatively common, especially in mainland localities, but readily confused with *F. pallida*. Ryukyu Is. colonies have uniform colours, usually pale brown. Mainland colonies are often more colourful. Has a similar range of variation in the Philippines and the Great Barrier Reef except that corallites tend to be relatively small. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Kikuchi (1968): Amakusa Is.; Eguchi (1971): Goto I.; Eguchi (1972a): Izu; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Kikuchi (1985): Tsuji-shima; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia lizardensis

Veron, Pichon and Wijsman-Best, 1977

Generally uncommon throughout the distribution range except at Tanegashima where it is common. Has a similar range of variation in the Philippines and the Great Barrier Reef. As on the Great Barrier Reef, colonies are

characteristically pinkish-brown with cream or greenish oral discs. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Izu ?

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia danae

Verrill, 1872

Common in some Ryukyu I. localities where colonies are usually mottled green, yellow-green and brown. Uncommon at Tanegashima where colonies are mostly dark colours.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima, Tosashimizu.

Previous studies: Not recorded.

Favia favaus

(Forskål, 1775)

Generally uncommon throughout the Ryukyu Is.; generally common in mainland localities. Has a similar range of variation in the Philippines and the Great Barrier Reef. Has a wide range of colours, either uniform colours, or with oral discs and walls of different colours. Is darker in high latitude localities. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Tribble and Randall (1986): Miyake I.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia matthaii

Vaughan, 1918

Common throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. and a similarly wide colour range. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Tribble and Randall (1986): Miyake I.; Habe (1989): Iriomote I.; Tachikawa (pers. comm. 1991): Ogasawara Is.

Favia rotumana

(Gardiner, 1899)

Rare and not studied *in situ* where it is readily confused with several *Platygyra* species. The colour of colonies has not been recorded.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm. 1991): Ogasawara Is.

Favia maxima

Veron, Pichon and Wijsman-Best, 1977

Rare, usually pale colours, in the Philippines.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Shirahama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia rotundata

(Veron, Pichon and Wijsman-Best, 1977)

Rare throughout the distribution range. Corallites are slightly smaller than usual in Great Barrier Reef coralla. The distinctive grey and orange colouration of Great Barrier Reef colonies is not always found in Japanese colonies, which are sometimes greenish-yellow. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama Is., Okinawa Is., Tanegashima, Kushimoto.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia veroni

Moll and Borel Best, 1984

Uncommon throughout the distribution range. Has a similar range of variation as colonies from the Philippines and the Great Barrier Reef. Pale coloured in the Ryukyu Is., usually dark in mainland localities. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia maritima

(Nemenzo, 1971)

Uncommon throughout the distribution range. Usually dark colours.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Favia sp.

Rare; known in Japan from two coralla only. This may be the same species as *Favia* sp. of Veron and Hodgson (1989), known from Thailand and the Philippines. These coralla are primarily characterised by small corallites (4 - 5.5mm diameter) with neat septa and a well-developed paliform crown. They are close to *F. laxa*, differing primarily in having corallites with thinner, (*Barabattoia*-like) walls.

Records:

This study: Okinawa Is.

Previous studies: Not recorded.

Genus Barabattoia

Yabe and Sugiyama, 1941

Barabattoia amicornum

(Edwards and Haime, 1850)

Generally uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Has a wide colour range, commonly uniform dark brown. Illustrated in colour: Shirai (1980) (as *B. mirabilis*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Ooishi (1970) (as *Barabattoia mirabilis*): Ogasawara and Volcano Is.; Kawaguti (1983) (as *B. mirabilis*): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Favites

Link, 1807

Favites abdita

(Ellis and Solander, 1786)

Common over a wide range of habitats. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually honey or cream coloured; colonies from mainland localities have a wider range of darker (grey, green and brown) colours. Recorded in most studies north to Izu Peninsula. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is. and north to Suruga Bay; Hamada (1963b) (as *F. favosa*): south-west Shikoku; Utinomi (1965b, 1971): south-west Shikoku, north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Yagi (1970): Ehime coast; Eguchi (1972a) (as *F. favosa*): Izu; Eguchi (1974): Yaeyama Is. and Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Ooishi (1970): Ogasawara and Volcano Is.; Kawaguti (1983): Yaeyama Is.; Kikuchi (1985): Tsuji-shima; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa.

Favites halicora

(Ehrenberg, 1834)

Usually uncommon. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually cream or yellowish-brown in colour. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b) (p. 210).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974): Kerama Is.; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favites flexuosa

(Dana, 1846)

Generally uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936) (as *F. favosa* and *F. virens*, (*pars*)): north to between Shirahama and Kushimoto; Kikuchi (1968) (as *F. virens*): Amakusa Is.; Utinomi (1971) (as *F. virens*): north-east Kyushu (Utinomi, 1971 places 'Gen. et sp. nov.?' of Yabe *et al.*, 1936 in synonymy with *F. virens*); Eguchi (1971) (as *F. cf. virens*): Goto I.; Eguchi (1974) (as *F. virens*): Yaeyama Is. and Kerama Is.; Eguchi and Miyawaki (1975) (as *F. favosa* and *F. flexuosa*) and Anonymous (1977): (as *F. favosa* and ?*F. virens*): Kushimoto; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favites chinensis

(Verrill, 1866)

Sometimes common, especially at Tanegashima where it forms large colonies which are dark coloured, often with pale grey rings around mouths. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is.

Previous studies: Habe (1989): Iriomote I.

Favites complanata

(Ehrenberg, 1834)

Generally uncommon. Usually uniform pale grey, brown or cream in colour, except at Tanegashima where it is generally common and has a wide colour range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Probably recorded in most studies of mainland corals under several names, most of which have not been verified.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936) (as *F. virens (pars)*): north to south-west Shikoku; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favites pentagona

(Esper, 1794)

Common throughout the Ryukyu Is. and at Tanegashima, where it has a wide range of uniform or mottled colours, pale brown or cream being the most common. Generally uncommon in mainland localities where colonies are usually encrusting and have a very wide range of pale or bright colour combinations. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936): north to between Shirahama and Kushimoto; Kikuchi (1968): Amakusa Is.; Utinomi (1971): north-east Kyushu; Eguchi (1974): Yaeyama Is. and Kerama Is.; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Favites stylifera

Yabe and Sugiyama, 1937

Probably rare. Like *F. pentagona* but with smaller corallites. Corallites are angular, septa are few and irregular, with irregular dentations. A paliform crown is weakly developed. The only recorded colour is cream with dark colony sides.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Yabe and Sugiyama (1937): Amami Is. and south Kyushu.

Favites russelli

(Wells, 1954)

Rare throughout the Ryukyu Is, but common in mainland localities. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies have a wide range of colours, commonly green or pale grey. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Goniastrea

Edwards and Haime, 1848

Four specimens, all from Tanegashima, are close to *G. favulus*, but differ in having very granulated septa with a high degree of septal fusion. These specimens may represent a separate species.

Goniastrea retiformis

(Lamarck, 1816)

Generally common in shallow, exposed biotopes except at Tanegashima, where it is rare. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually pale orange-brown throughout the distribution range, but may be bright green where light is limiting (eg. station 8). Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is. and north to south-west Shikoku; Kikuchi (1968): Amakusa Is.; Anonymous (1970) (as *G. pectinata*): Ehime coast; Eguchi (1974): Yaeyama Is. and Kerama Is.; Miyawaki (1978): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniastrea edwardsi

Chevalier, 1971

Occupies the same biotopes as *G. retiformis*, where it is probably more common and is the same pale orange-brown colour. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu.

Previous studies: Yabe *et al.* (1936) (as *G. parvistella*): Yaeyama and Miyako Is.; Eguchi (1974) (as *G. parvistella*): Yaeyama Is.; Habe (1989): Iriomote I.

Goniastrea favulus

(Dana, 1846)

Uncommon to rare, except at stations 13 and 73 where honey-coloured colonies are relatively common. These have the same appearance *in situ* as Great Barrier Reef colonies.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Tribble and Randall (1986): Miyake I.

Goniastrea aspera

Verrill, 1905

Uncommon in most localities but may be common in some (eg. stations 11, 13 and 16). Appears to have very localised dispersal in some sub-tidal biotopes. Coralla are similar to those from the Philippines and the Great Barrier Reef. Usually

a uniform pale to dark orange-brown throughout the distribution range. Illustrated in colour: Shirai (1980) (as *G. pectinata*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Izu.

Previous studies: Yabe *et al.* (1936) (as *G. aspera* (*pars*) and *G. yamanarii*): Ogasawara Is. and north to south Kyushu; Eguchi (1974): Yaeyama Is. and Kerama Is.; Eguchi and Miyake (1975) and Anonymous (1977) (as *G. pectinata*): Kushimoto; Yamazato *et al.* (1978) (as *G. aspera* and *G. incrustans*): Okinawa; Kawaguti (1983) (as *G. spectabilis*): Okinawa; Habe (1989): Iriomote I.; Tachikawa (*pers. comm.*, 1991): Ogasawara Is.

Goniastrea deformis

Veron, 1990

Uncommon and probably largely confined to high latitude localities. Coralla are massive, cerioid, with angular to irregular corallites up to 8.8mm diameter. Septa are equal or slightly alternate and usually have strong, almost *Acanthastrea*-like dentations and granulated sides. Most coralla have a high degree of septal fusion. Paliform lobes are usually well developed, but this, as with other *Goniastrea* species, is variable and some coralla, especially those from Kushimoto, have only weakly formed paliform lobes and hence a *Favites*-like appearance. Some coralla from Kushimoto have some development of a 'groove and tubercle' formation. Colonies are usually dark colours, usually deep red. Illustrated in colour: Veron (1990b).

Records:

This study: Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Veron (1990b): Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Goniastrea pectinata

(Ehrenberg, 1834)

Generally uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Usually the same pale pinkish-brown as are Great Barrier Reef colonies, but may be dark colours, especially in mainland localities. Illustrated in colour: Masuda and Hayashi (1986), Nishihira (1988), Uchida and Fukuda (1988b) (not p. 223).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936) (as *G. pectinata* and *G. aspera* (*pars*)):

Ogasawara and Daito Is. and north to Suruga Bay; Utinomi (1965b): south-west Shikoku; Hamada (1963b): Tateyama; Anonymous (1970) (as *Platygyra lamellina*): Ehime coast; Ooishi (1970): Ogasawara and Volcano Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983) (as *G. pectinata*, *G. planulata*): Okinawa; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Goniastrea australensis

(Edwards and Haime, 1857)

Rare throughout the Ryukyu Is. and at the Amakusa Is., common at Shirahama and Kushimoto. Usually uniform grey or brown in colour, but sometimes has green valleys. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Platygyra

Ehrenberg, 1834

Platygyra daedalea

(Ellis and Solander, 1786)

Generally uncommon throughout most of the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b) (p. 75).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is.

Previous studies: Yabe *et al.* (1936) (as *Coeloria rustica (pars)* and *Coeloria lamellina (pars)*): Ogasawara and Daito Is. and north to Tanabe Bay; Kikuchi (1968) (as *Platygyra rustica*): Amakusa Is.; Eguchi (1971): Goto I.; ?Eguchi (1972a) (as *P. rustica*): Izu; Eguchi (1974): Anonymous (1977) (as *P. lamellina*): Kushimoto; Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa. Other records of *P. lamellina* and *P. rustica* are likely to be primarily this species: Utinomi (1965b, 1971): Ehime coast, north-east Kyushu, south-west Shikoku; Eguchi

(1968): Sagami Bay; Ooishi (1970): Ogasawara and Volcano Is.; Yagi (1970): Ehime coast; Eguchi (1974): Kerama Is.; Eguchi and Miyawaki (1975): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Kikuchi (1985) (as *P. lamellina*): Tsuiji-shima; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Platygyra contorta

Veron, 1990

Rare in the Ryukyu Is., becoming common in mainland Japan. Colonies are massive or encrusting, usually with explanate margins, rarely with contorted upgrowths. Valleys are 3.5 - 5mm wide, usually long and relatively straight and radiating on the margins, becoming short and/or sinuous and contorted towards the colony centre. Walls are thin and acute. Septa are irregular in all respects giving walls a ragged appearance similar to those of *P. daedalea*. Colours are uniform, commonly red, grey, pale yellow or green. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Anonymous (1977) (as *P. rustica*): Kushimoto; Veron (1990): Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Platygyra lamellina

(Ehrenberg, 1834)

Uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Uniform brown or pale brown with pale grey valleys. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: ?Eguchi (1971): Goto I.; ?Eguchi (1974): Yaeyama Is.; Habe (1989): Iriomote I. ; ?Chou and Yamazato (1990): Okinawa.

Platygyra sinensis

(Edward and Haime, 1849)

Generally uncommon throughout the distribution range. Generally uniform brown in colour but may be a range of bright colours.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Anonymous (1977): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa.

Platygyra ryukyuensis

Yabe and Sugiyama, 1936

Uncommon in most localities throughout the distribution range. Has a similar range of variation in the Philippines. Usually dark brown or grey in colour. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Okinawa and Amami Is. and Ogasawara Is.; Eguchi (1974): Kerama Is.; Yamazato *et al.* (1978) (as *Leptoria ryukyuensis*): Okinawa.

Platygyra pini

Chevalier, 1975

Probably the most common *Platygyra* of Japan. Has a similar range of variation in the Philippines. Has a wide range of colours, most commonly brown with green valleys. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Amakusa Is.

Previous studies: Yabe *et al.* (1936) (as *Coeloria astreiformis*): Daito Is.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Platygyra verweyi

Wijsman-Best, 1976

Uncommon or rare. Colonies are similar to those from the Philippines but skeletal variations have not been studied. Usually honey-coloured.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Not recorded.

Platygyra yaeyamaensis

(Eguchi and Shirai, 1977)

Rare. Colonies are encrusting or submassive. Coralla are monocentric, especially towards the colony centre, or form short valleys at the margins. Coralla are primarily characterised by exsert septa which have irregular dentations and a ragged appearance. Columellae are mostly continuous, with centres indistinguishable. Paliform lobes are weakly developed. Illustrated in colour: Shirai (1980).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Shirai (1980) (as *Goniastrea yaeyamaensis*): Yaeyama Is.

Genus Leptoria

Edwards and Haime, 1848

Leptoria phrygia

(Ellis and Solander, 1786)

Common throughout the distribution range. Usually restricted to upper reef slopes. Has a similar range of variation in the Philippines and the Great Barrier Reef. Uniform blue-grey in colour. Illustrated in colour: Shirai (1980) (as *L. gracilis*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: (It is possible that some records of *L. gracilis* are *L. irregularis* (see below). Yabe *et al.* (1936) (as *L. phrygia* and *L. gracilis*): Okinawa, Miyako and Okinawa Is. and Ogasawara and Daito Is.); ?Hamada (1963b) (as *Platygyra phrygia*):

Tateyama; Eguchi (1968) (as *Platygyra phrygia*): Sagami Bay; Eguchi (1974) (as *L. phrygia* and *L. gracilis*): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978) (as *L. gracilis*): Okinawa; Kawaguti (1983) (as *L. phrygia* and *L. gracilis*): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptoria irregularis

Veron, 1990

Colonies are submassive or plate-like, up to 1.5m diameter. Valleys are 2.8 - 3.9mm wide, mostly straight and parallel at the corallum margins, becoming sinuous towards the corallum centre. Septa are equal, with strong dentations. Columellae do not form centres; they are not plate-like. Living colonies are pale blue-grey. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Veron (1990): Yaeyama, Okinawa and Amami Is.

Genus Oulophyllia

Edwards and Haime, 1848

Oulophyllia crispa

(Lamarck, 1816)

Generally uncommon to rare throughout the distribution range. At the Amakusa Is., colonies become hemispherical and develop larger valleys than found in Great Barrier Reef colonies. A similar range of variation is found in the Philippines where Veron and Hodgson (1989) note that the possible validity of *Coelogyra laevis* Nemenzo (as a third species of *Oulophyllia*) requires further study. Usually pale brown in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936) (as *Coeloria gigantea*): north to south-west Shikoku; Kikuchi (1968) (as *Platygyra gigantea*): Amakusa Is.; Anonymous (1970) (as *Platygyra gigantea*): Ehime coast; Eguchi and Miyawaki (1975) and Anonymous (1977) (as *Platygyra gigantea*): Kushimoto; Tribble and Randall (1986) (as *O. aspera*): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Oulophyllia bennettiae

(Veron, Pichon and Wijsman-Best, 1977)

Rare. Has the similar colours as colonies from the Philippines and Great Barrier Reef.

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded.

Genus Montastrea

de Blainville, 1830

Montastrea curta

(Dana, 1846)

Common throughout the Ryukyu Is., especially on exposed upper reef slopes. Corallites are relatively large in coralla from mainland localities. Otherwise the species shows no differences from coralla from the Philippines and the Great Barrier Reef. Usually orange-brown in the Ryukyu Is. and in deeper water of mainland localities and dark brown in shallow water of mainland localities. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama.

Previous studies: Yabe *et al.* (1936) (as *Orbicella curta*): Ogasawara and Daito Is. and north to between Shirahama and Kushimoto; Hamada (1963b): Tateyama; Eguchi (1974) (as *Plesiastrea curta*): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Montastrea annuligera

(Edwards and Haime, 1849)

Rare in Japan in the Philippines. Japanese coralla have more exsert and more dentate septa than those from the Great Barrier Reef. Usually mottled dark greens and browns in colour. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except in the abovementioned publication.

Montastrea multipunctata

Hodgson, 1985

Rare; not studied in detail. Corallites have thick walls with conspicuous groove and tubercle formation. Colonies are similar to those from the Philippines. The only recorded colours are mottled yellow or green with dark calices.

Records:

This study: Yaeyama and Okinawa Is., Tanegashima.

Previous studies: Not recorded.

Montastrea magnistellata

Chevalier, 1971

Generally uncommon and not studied in detail. Has a similar range of variation in the Philippines. Usually a uniform creamy-brown to orange-brown in colour, dark grey-brown at Tanegashima. Illustrated in colour: Shirai (1980) (as *M. curta*), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Anonymous (1970) (as *Favia speciosa*): Ehime coast; Eguchi (1974) (as *Favia magnistellata*): Kerama Is.; Yamazato *et al.* (1978): Okinawa; Tachikawa (pers. comm. 1991): Ogasawara Is.

Montastrea valenciennesi

(Edwards and Haime, 1848)

Generally uncommon in the Ryukyu Is., common at mainland localities. Usually found on exposed upper reef slopes (Ryukyu Is.) or on partly exposed rock faces (mainland localities). Has a similar range of variation in the Philippines. Corallites are much smaller than usual in Great Barrier Reef coralla, indicating the presence of geographic subspecies. Usually mottled colours. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936) (as *Phymastrea valenciennesi*): north to Kushimoto; Utinomi (1965b) (as *Favia valenciennesi*): south-west Shikoku; Kikuchi (1968) (as *Phymastrea valenciennesi*): Amakusa Is.; Eguchi (1971) (as *Phymastrea valenciennesi*): Goto I.; Eguchi (1974) (as *Phymastrea valenciennesi*): Kerama Is.; Kawaguti (1983): Yaeyama Is.

Genus Oulastrea

Edwards and Haime, 1848

Oulastrea crispata

(Lamarck, 1816)

Rare except in isolated sub-tidal biotopes (very rarely >12m depth) where other corals are seldom found. Has a similar range of variation in the Philippines. Nearly black with pale septo-costae above the corallite walls. Recorded in most studies north to Tateyama and north to the Noto Peninsula on the west coast of Honsyu where it tolerates near freezing temperatures in shallow water (Yajima *et al.*, 1986). It thus has the northernmost distribution on any normally hermatypic species. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936): north to Sagami Bay; Hamada *et al.* (1963): Tateyama; Eguchi (1968): Sagami Bay; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Shirai (1986): Kii coast; Kikuchi (1985): Tsuji-shima; Yajima *et al.* (1986): north to Noto Pen.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Plesiastrea

Edwards and Haime, 1848

Plesiastrea versipora

(Lamarck, 1816)

Uncommon throughout the Ryukyu Is. and Tanegashima, common at mainland localities. Has a similar range of variation in the Philippines and the Great Barrier Reef. In the Ryukyu Is., colonies are a uniform fawn or brown colour. In mainland localities they are occasionally other colours including pale green and grey with pink tentacles. Polyps are often partly extended during the day. Recorded in most studies north to Tateyama Peninsula. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936): Daito Is.; Eguchi (1968): Sagami Bay; Eguchi (1971): Goto I.; Eguchi (1972a): Izu; Eguchi (1973): Tsushima; Eguchi (1974): Yaeyama Is. and Kerama Is.; Ooishi (1970): Ogasawara and Volcano Is.; Kikuchi (1968): Amakusa Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Diploastrea

Matthai, 1914

Diploastrea heliopora

(Lamarck, 1816)

Generally common and shows no colour, structural or ecological differences from colonies elsewhere in the Indo-west Pacific. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Eguchi (1974): Kerama Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Leptastrea

Edwards and Haime, 1848

Leptastrea inaequalis

Klunzinger, 1879

Uncommon; cream or yellow with black calices. Has a similar range of variation in the Philippines and the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983) (as *L. bottae*): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptastrea purpurea

(Dana, 1846)

Common throughout the distribution range. Corallites are more uniform in size than usual for Great Barrier Reef colonies and some may form a short, indistinct series. Colonies are usually a uniform or mottled greenish-yellow with cream walls. Recorded in most studies north to Tateyama. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936): Ogasawara and Daito Is. and north to Sagami Bay; Hamada (1963b): Tateyama; Eguchi (1968): Sagami Bay; Kikuchi (1968): Amakusa Is.; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Yamazato *et al.* (1978): Okinawa; Tribble and Randall (1986): Miyake I.; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptastrea transversa

Klunzinger, 1879

Generally uncommon or rare. Colonies are usually mottled pale yellowish-brown and white. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yamazato *et al.* (1978): Okinawa; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptastrea pruinosa

Crossland, 1952

Uncommon. Colonies are similar to those from the Philippines but with smaller corallites (3 - 4mm diameter). Often purple with white oral discs (as illustrated, Veron, 1986) but may be a wide range of other colours, notably green or greenish-yellow calices and brown coenosarc.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tosashimizu, Izu.

Previous studies: Tribble and Randall (1986): Miyake I.; Shirai (1986): Kii coast; Tachikawa (pers. comm., 1991): Ogasawara Is.

Leptastrea bewickensis

Veron, Pichon and Wijsman-Best, 1977

Rare throughout the Ryukyu Is., but common at Tanegashima (station 63). Coralla from the Great Barrier Reef, the Ryukyu Is. and Tanegashima all show geographic variations, especially in the development of the columella and the size of the calices, with Great Barrier Reef coralla having the least well-developed columellae and the largest corallites. Coralla from Tanegashima have primary septa fused at the corallite centre; these show no essential differences from *Parasimplastrea simplicitexta* (Umbgrove, 1939) collected by Sheppard from Oman and deposited in the BM(NH). Further study may indicate that *Parasimplastrea* Sheppard, 1985 is a junior synonym of *Leptastrea*. The holotype of *simplicitexta*, a fossil from Indonesia, also recorded from the Pliocene of Papua New Guinea by Veron and Kelley (1988), has not been re-examined.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Genus Cyphastrea

Edwards and Haime, 1848

The series of *Cyphastrea* in the present collection contains six specimens of two species from the Ryukyu Is. that are likely to be additional to those listed below. One of these may be *Cyphastrea zhongjianensis* Zou, 1980.

Cyphastrea serailia

(Forskål, 1775)

Very common throughout the distribution range and varies greatly in colour, especially in shallow water and in higher latitudes where colonies, or the sides of colonies, may be dark. Otherwise, colonies are uniform in colour, commonly red, green or grey. Has a wide range of corallite characters. Recorded in most studies north to Tateyama Peninsula. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu, Tateyama.

Previous studies: Yabe *et al.* (1936): north to Sagami Bay; Eguchi (1971): Goto

I.; Eguchi (1973): Tsushima; Eguchi (1974): Kerama Is.; Anonymous (1977): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cyphastrea chalcidicum

(Forskål, 1775)

Common throughout distribution range, except Shirahama where it is uncommon. Has a similar range of variation in the Philippines and the Great Barrier Reef. Colonies usually have uniform colours. Recorded in most studies north to Shirahama. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936): Ogasawara Is. and north to Sagami Bay; Utinomi (1965b): south-west Shikoku; Kikuchi (1968): Amakusa Is.; Eguchi (1971): Goto I.; Eguchi (1974): Kerama Is.; ?Eguchi and Miyawaki (1975) and Anonymous (1977) (as *C. serailia* in part): Kushimoto; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cyphastrea ocellina

(Dana, 1864)

Rare and little studied. Corallites are small, neatly arranged, usually exsert. The only recorded colour is dark green.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

Cyphastrea japonica

Yabe and Sugiyama, 1932

The name *japonica* has been incorrectly used for *C. decadia* by Veron *et al.* (1977) and all subsequent taxonomic accounts of *Cyphastrea*. *Cyphastrea chalcidicum tanabensis* Yabe and Sugiyama, 1932 appears to be a synonym of this species.

Holotypes of both nominal species have been re-examined during the present study: substantial differences in corallite structure appear to be environment-correlated. The holotype is submassive but very porous due to a heavy infestation of polychaete worms and barnacles.

Common in shallow exposed biotopes throughout the distribution range. *Coenosteum* spinules are prominent; corallites are small, often crowded and have two very unequal orders of septa, first order septa being very exsert and irregularly dentate. 'Groove and tubercle' formations are often present. Colonies are often infested with parasitic barnacles. Coralla have the same range of variation as those from the Philippines. Colonies are usually mottled colours, commonly cream or yellowish-green, but may be mottled grey.

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Kushimoto, Shirahama, Izu.

Previous studies: Yabe *et al.* (1936): north to between Shirahama and Kushimoto; Utinomi (1971): north-east Kyushu; ?Yabe *et al.* (as *C. chalcidicum tanabensis*): north to Tanabe Bay (type locality); Tachikawa (pers. comm. 1991): Ogasawara Is.

Cyphastrea microphthalma

(Lamarck, 1816)

Common, especially in exposed biotopes of the Ryukyu Is., generally uncommon in mainland localities. Has a similar range of variation in the Philippines and the Great Barrier Reef. Has a wide range of colours which are uniform over the colony surface or are relatively pale on upper surfaces. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Yabe *et al.* (1936): north to east of Kushimoto; Utinomi (1966): Kii coast; Kikuchi (1968): Amakusa Is.; Ooishi ?: Ogasawara Is.; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Ooishi (1970): Ogasawara and Volcano Is.; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Cyphastrea agassizi

(Vaughan, 1907)

Rare, but distinctive. 'Primarily characterised by large, widely spaced corallites, separated by a smooth coenosteum and exsert, irregular primary septa. Irregular 'groove and tubercle' formation may be present' (Veron and Hodgson (1989). The species is further characterised by the septa, which are arranged in three distinct orders. Mottled cream, pale brown or white in colour, sometimes with orange septa. Illustrated in colour: Uchida and Fukuda (1988b, as *Leptastrea inaequalis*).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except in the abovementioned publication.

Cyphastrea decadia

Moll and Borel Best, 1984

This species has been mistakenly called *Cyphastrea japonica* by Veron et al. (1977) and all subsequent taxonomic accounts of *Cyphastrea*. Holotype (#40327) and paratype (#40588) of *C. japonica* from Tohoku University have been re-examined during the present study, and as these are a different species, a name change is obligatory.

Generally uncommon or rare on upper reef slopes, where colonies usually have tightly compacted branches. May form large colonies with an open growth form on soft substrates in deeper water. Is uniform cream in colour.

There may be substantial differences between Great Barrier Reef, Indonesian, Philippines and Japanese coralla. The former and latter are similar in having 10 to 12 (most commonly 12) primary septa in axial corallites and well-developed, granular costae. Indonesian and Philippine coralla typically have 10 primary septa and relatively weakly developed, smooth costae. This latter form was re-named *C. decadia* by Moll and Borel-Best (1984). The present study indicates that only one species is involved, and thus the name *decadia* is applicable to it. Illustrated in colour (as *C. japonica*): Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded except as illustrated in the abovementioned publications.

Genus Echinopora

Lamarck, 1816

Echinopora lamellosa

(Esper, 1795)

Generally common throughout the distribution range and especially common at station 46 where many colonies are over 5m diameter and consist of overlapping tiers of plates (intermixed with plates of *E. gemmacea*). Also forms very big colonies at Tanegashima (station 60) which have contorted centres. Uniform pale brown or honey-coloured. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: Yabe *et al.* (1936): Okinawa Is. and Ogasawara Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Echinopora gemmacea

(Lamarck, 1816)

Common throughout the distribution range. Colonies are mostly plate-like, but may have irregular, contorted branches, which is the same range of variation in the Philippines and Great Barrier Reef. Usually a uniform grey or grey-brown to grey-green in colour, with pale branch ends. Illustrated in colour: Nishihira (1988).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Echinopora pacificus

Veron, 1990

Generally uncommon throughout the distribution range. Colonies are unifacial (rarely bifacial) plates, usually with free margins and thick, encrusting or attached, centres. Corallites are similar to those of *E. lamellosa*, but are much larger, with calices up to 9.8mm diameter. Costae are beaded, the beads integrating with

the coenosteum spinules which are very numerous and equi-distant, giving both coralla and living colonies a velvet-like appearance. Colonies are green to grey-brown in colour. Illustrated in colour: Veron (1990b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Veron (1990): Yaeyama, Okinawa and Amami Is.

Echinopora hirsutissima

(Edwards and Haime, 1849)

This species has not been observed by the author in Japan.

Records:

This study: Not recorded.

Previous studies: ?Tribble and Randall (1986): Miyake I.; ?Kawaguti(1983): Yaeyama Is.

Echinopora mammiformis

(Nemenzo, 1959)

Rare, but occasionally forms large colonies in protected lagoons (notably site 12). Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Echinopora horrida

Dana, 1846

This species has not been observed by the author in Japan.

Records:

This study: Not recorded.

Previous studies: ?Eguchi (1974): Yaeyama Is.; ?Kawaguti (1983): Yaeyama Is.

18
Family
Trachyphylliidae
Verrill, 1901

Genus Trachyphyllia
Audouin, 1826

Wellsophyllia radiata Pichon, 1980 was renamed *Trachyphyllia radiata* by Borel Best and Hoeksema (1987) and made a junior synonym of *Trachyphyllia geoffroyi* by Veron and Hodgson (1988).

Trachyphyllia geoffroyi
(Audouin, 1826)

Rare. All coralla collected fall within the range of variation of Great Barrier Reef and Philippine coralla. All are monocentric and <50mm diameter. A pale green or brown mantle is extended during the day. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988a).

Records:

This study: Yaeyama and Okinawa Is., Tosashimizu, Kushimoto, Shirahama.

Previous studies: Yabe and Sugiyama (1931) (as *Antillia flabelliformis* and *Antillia duncani*) and Yabe *et al.* (1936) (as *Antillophyllia constricta kuensis*, *Antillophyllia flabiformis* and *Trachyphyllia amarantum*): south-west Shikoku to Suruga Bay; Utinomi (1965b, 1966, 1971): south-west Shikoku, Kii coast, north-east Kyushu; Kikuchi (1968): Amakusa Is.; Anonymous (1970): Ehime coast; Ooshi (1970) (as *Antillia constricta*): Ogasawara Is.; Yagi (1970): Ehime coast; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Masuda (1986): Shirahama; Tachikawa (pers. comm., 1991): Ogasawara Is.

19
Family
Caryophylliidae
Gray, 1847

Heterocyathus japonicus (Verrill) (Eguchi, 1968) appears to be an ahermatypic species. Recorded only from Okinawa.

Genus Euphyllia
Dana, 1846

Catalaphyllia okinawaensis Eguchi and Shirai, 1977 is a large colony of *E. glabrescens*.

Euphyllia glabrescens
(Chamisso and Eysenhardt, 1821)

Euphyllia paraglabrescens has essentially the same skeleton as *E. glabrescens*. Uncommon throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. As in the Philippines and Australia, colonies have long grey or greenish-grey tentacles with white tips; other colours recorded in the Philippines were not observed in Japan. Illustrated in colour: Shirai (1980) (as *E. glabrescens* and *Catalaphyllia okinawaensis* Eguchi and Shirai), Nishihira (1988) and Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Yabe *et al.* (1936): Yaeyama Is. and Ogasawara Is.; Eguchi (1974): Yaeyama Is. and Kerama Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Tribble and Randall (1986): Miyake I. (A specimen in the Seto Marine Biological Laboratory, is likely to be from the Shirahama).

Euphyllia paraglabrescens
Veron, 1990

Euphyllia glabrescens has essentially the same skeleton as *E. paraglabrescens*. Coralla are phaceloid, branches being 30-37mm diameter near the calices. Branches

are costate, without epithecae. Tentacles are short and bubble-like and are extended day and night, retracting only if disturbed. They are a uniform grey, or varied greens, or combinations of both grey and green. In general appearance they resemble the vesicles of *Plerogyra* and thus colonies look much like *Plerogyra simplex* Rehberg, 1892 *in situ*.

Known only from Ojioya Port, Tanegashima, Japan where this is one of the dominant species. The diversity of this area is low. Colonies are attached to sandstone. Illustrated in colour: Veron (1990b).

Records:

This study: Tanegashima.

Previous studies: Veron (1990): Tanegashima.

Euphyllia cristata

Chevalier, 1971

Rare, recorded only from Iriomote I. and Sekisei Lagoon. Colonies were small, monocentric, with brown tentacles with white tips. Coralla are similar to those from the Great Barrier Reef.

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Not recorded.

Euphyllia ancora

Veron and Pichon, 1980

Generally uncommon throughout the distribution range. They are often over 1m diameter. They have a similar range of variation in the Philippines and the Great Barrier Reef. Colonies are usually brown or greenish-brown with cream margins to tentacle tips, but, as in the Philippines, colonies are sometimes green, pink or grey. Recorded from many mainland localities as *E. fimbriata* or *Catalaphyllia*. *Euphyllia kabiraensis* Eguchi and Shirai, 1977 appears to be this species with widely spread tentacle tips. Illustrated in colour: Shirai (1980) (as *E. kabiraensis* and *E. fimbriata*), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto, Tateyama.

Previous studies: (all records as *E. fimbriata*); Yabe *et al.* (1936): Ogasawara Is. and north to Tanabe Bay; Utinomi (1965b, 1966, 1971): south-west Shikoku, Kii coast north-east Kyusyu; Anonymous (1970) (as *Euphyllia fimbriata*): Ehime coast; Yagi (1970): Ehime coast; Eguchi (1974) (as *E. fimbriata*): Yaeyama Is. and Kerama Is.; Eguchi and Miyawaki (1975) and Anonymous (1977) (as *E. fimbriata*): Kushimoto; Ooishi (1970): Ogasawara and Volcano Is.; Yamazato *et al.* (1978): Okinawa; Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I. ; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

Euphyllia divisa

Veron and Pichon, 1980

Rare; observed only in Amitori Bay, Iriomote I. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988) (lower illustration), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama Is.

Previous studies: May have been recorded as *E. fimbriata* (see above).

Euphyllia yaeyamaensis

(Shirai, 1980)

Uncommon, colonies have the same colour and appearance as those from the Philippines. Illustrated in colour: Shirai (1980) (as *Botryphyllia yaeyamaensis*), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Not recorded except as illustrated in the abovementioned publications.

Genus Catalaphyllia

Wells, 1971

Catalaphyllia jardinei

(Saville-Kent, 1893)

Common at station 81 and also found at Shirahama. Colonies have the same general appearance as those from the Philippines and the Great Barrier Reef. They have the same grey-green tentacles with pink tips, but minor colour and ecological

differences suggest the presence of distinct geographic sub-species. *Catalaphyllia sabiuraensis* is a junior synonym of this species. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Kushimoto, Shirahama.

Previous studies: Eguchi and Miyawaki (1975) and Anonymous (1977) (as *C. sabiuraensis*): Kushimoto.

Genus Plerogyra

Edwards and Haime, 1848

Plerogyra eurysepta

Nemenzo, 1960

Rare, found only at Tokunoshima (stations 55 and 56) where it is conspicuous, with very large vesicles. It is readily distinguished from *P. sinuosa in situ* when both species co-occur in the same biotope, but difficult to identify with certainty otherwise.

Records:

This study: Amami Is.

Previous studies: Not recorded.

Plerogyra sinuosa

(Dana, 1846)

Generally rare throughout the distribution range. Has a similar range of variation in the Philippines and the Great Barrier Reef. Grey in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988a, 1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is.

Previous studies: Eguchi (1974): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Physogyra

Quelch, 1884

Physogyra lichtensteini

(Edwards and Haime, 1851)

Generally uncommon. Colonies have a similar range of variation on the Great Barrier Reef except that, as in the Philippines, vesicles are often tapered or tubular rather than spherical or ovoid. Has a similar range of variation in the Philippines and the Great Barrier Reef. Grey or greyish-brown in colour. Illustrated in colour: Shirai (1980), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama and Okinawa Is.

Previous studies: Kawaguti (1983): Yaeyama Is.; Habe (1989): Iriomote I.

Genus Gyrosmilia

Edwards and Haime, 1851

Gyrosmilia interrupta

(Ehrenberg, 1834)

A single specimen corallum collected by an unknown person at Ishigaki I. (at or near station 17) is the only presently existing record of this genus in the western Pacific.

Records:

This study: Yaeyama Is.

Previous studies: Not recorded.

20
Family
Dendrophylliidae
Gray, 1847

Genus Turbinaria
Oken, 1815

Turbinaria is much less abundant in Japan than on either the eastern or western coasts of Australia. As in Australia it is relatively common in the higher latitudes.

Yabe and Sugiyama's (1941) account of *Turbinaria* is based on Bernard (1896) which, in turn, is based entirely on museum specimens. As species distinctions bear little relation to natural variation, Yabe and Sugiyama's account of *Turbinaria* has not been further studied except where noted below.

The identity of *T. immersa* Yabe and Sugiyama (1941) has not been determined. The holotype (#4484c) is an encrusting colony.

Turbinaria peltata
(Esper, 1794)

Not found in the Yaeyama Is., rare in the Okinawa and Amami Is., generally uncommon at Tanegashima where it may form large flat plates, grey in colour, with polyps extended during the day. Has a similar range of variation in the Philippines and the Great Barrier Reef. Recorded in most studies north to Kushimoto. Illustrated in colour: Shirai (1980), Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Yabe *et al.* (1936): from west Kyushu to Suruga Bay; Utinomi (1965b, 1966, 1971): south-west Shikoku, Kii coast, north-east Kyushu; Anonymous (1970): Ehime coast; Kikuchi (1968): Amakusa Is.; Yagi (1970): Ehime coast; Eguchi (1971): Goto I.; Eguchi (1973): Tsushima; Eguchi and Miyawaki (1975) and Anonymous (1977): Kushimoto; Kawaguti (1983): Yaeyama Is.; Shirai (1986): Kii coast; Habe (1989): Iriomote I.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Turbinaria frondens

(Dana, 1846)

Rare, except at Tanegashima, where it is generally uncommon. As in the Philippines, highly convoluted colonies which occur in very shallow waters of the Great Barrier Reef, have not been observed. Otherwise, coralla are similar to those of the Great Barrier Reef. Colonies are grey to brown in colour. Illustrated in colour: Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Shirahama.

Previous studies: Yabe and Sugiyama (1941) (as *T. rugosa*, ?*T. auricularis*, *T. tubifera* (pars), *T. contorta* and *T. mollis*): north to Tanabe Bay; Eguchi (1968) (as *T. contorta* and *T. rugosa*): Sagami Bay; Kikuchi (1968) (as *T. contorta*): Amakusa Is.; Utinomi (1971): north-east Kyushu; Kawaguti (1983): Yaeyama Is.; Chou and Yamazato (1990): Okinawa; Tachikawa (pers. comm., 1991): Ogasawara Is.

The specimens of Yabe and Sugiyama (1941) were re-examined during this study. A wide range of specimens labeled *T. rugosa* fall clearly within the range of the species. *Turbinaria tubifera* (#40203) and *T. contorta* (#40205 and #40209) are both plate-like, the former having strongly convoluted margins; *T. tubifera* # 40212 is upright. Some specimens of *T. auricularis* (#64502) and *T. contorta* (#40210) are less clearly *T. frondens*.

Turbinaria mesenterina

(Lamarck, 1816)

Uncommon throughout the distribution range. As in the Philippines, the growth form range observed is similar to that of *T. frondens*. Colonies are brown in colour. Illustrated in colour: Nishihira (1988) Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: ?Yabe *et al.* (1936) (as *T. crater* and *T. undata*): south Kyushu to Tanabe Bay; Tribble and Randall (1986) (as *T. undata*): Miyake I.; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Turbinaria reniformis

Bernard, 1896

Uncommon throughout the distribution range, but may form extensive monospecific stands in deeper, protected biotopes (notably Amitori Bay). Has the same yellow-green colour and a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu.

Previous studies: ?Yabe *et al.* (1936) (as *T. brueggemanni*, *T. elegans* and *T. reniformis*): north to Tanabe Bay; ?Hamada *et al.* (1963): Tateyama; Eguchi (1968) (as *T. brueggemanni*): Sagami Bay; Kawaguti (1983): Yaeyama Is.; Tachikawa (pers. comm., 1991): Ogasawara Is.

Turbinaria irregularis

Bernard, 1896

Generally common. Colonies consist of contorted free or encrusting fronds and irregular, exsert corallites. Colonies are usually uniform or mottled, dark colours. Illustrated in colour: Uchida and Fukuda (1988b) (as *T. ramosa*).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Amakusa Is., Kushimoto.

Previous studies: Yabe *et al.* (1936) (as *T. tubifera*): Ogasawara Is. and north to Tanabe Bay; Shirai (1986): Kii coast.

Turbinaria stellulata

(Lamarck, 1816)

Usually uncommon. Usually a uniform brown, pink or purple in colour. Has a similar range of variation in the Philippines and the Great Barrier Reef. Illustrated in colour: Masuda and Hayashi (1989), Nishihira (1988), Uchida and Fukuda (1988b).

Records:

This study: Yaeyama, Okinawa and Amami Is., Tanegashima, Tosashimizu, Kushimoto, Shirahama.

Previous studies: Yabe and Sugiyama (1941): (as *T. titizimaensis*): Ogasawara Is.; Kawaguti (1983): Yaeyama Is.

Turbinaria bifrons

Brüggemann, 1877

This species has not been recorded by the author from Japan.

Records:

This study: Not recorded.

Previous studies: ?Yabe and Sugiyama (1941): south-west Shikoku, ?Utinomi (1965b, 1966, 1971): south-west Shikoku, Kochi, Kii coast, north-east Kyushu; ?Yagi (1970): Ehime coast; ?Shirai (1986): Kii coast; ?Habe (1989): Iriomote I.

Genus Heteropsammia

Edwards and Haime, 1848

Heteropsammia cochlea

(Spengler, 1781)

Has a similar range of variation in the Philippines and the Great Barrier Reef.
Illustrated in colour: Nishihira (1988).

Records:

This study: Okinawa Is.

Previous studies: Not recorded except in the abovementioned publication.



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