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墾丁國家公園海域的石珊瑚相

SCLERACTINIAN FAUNA IN THE COASTAL WATERS OF KENTING NATIONAL PARK

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摘　要

墾丁國家公園由於位處臺灣最南端及具有適宜的海洋環境，因此其海域擁有臺灣本島最豐富的石珊瑚相。本報告依據Veron等（1976−84）所提出珊瑚種的定義，重新檢驗了自1972年起採自此海域的珊瑚標本，並對該海域的珊瑚生物相加以分類描述及討論其生物地理。結果共鑑定出63屬250種硬珊瑚，其中包括57屬238種石珊瑚及6屬12種不屬於石珊瑚目的硬珊瑚。本海域之石珊瑚相與鄰近之菲律賓及琉球群島均極相似，同屬於印度—西太平洋生物地理系，而石珊瑚在北太平洋之散佈可能與黑潮有關。

關鍵字：墾丁(Kenting)、石珊瑚相(scleractinian fauna)、臺灣南部(southern Taiwan)、珊瑚生物地理(coral biogeography)

ABSTRACT

Because of her remote locality and her favorable marine environment, the coastal waters around Kenting National Park has the richest scleractinian fauna in Taiwan. Coral specimens collected from this area from 1972 to the recent were re−examined according to the species concept proposed by Veron and his coworkers. A revised species checklist of scleractinian corals, a description on principal coral biotopes and a discussion on the regional significance of the scleractinian fauna were presented. A total of 238 species representing 57 genera of scleractinians and 12 species representing 6 genera of non−scleractinian hard corals were identified. The scleractinian fauna of the Park is closely related to the Philippines and the Ryukyu Islands and is a part of the

Indo-West Pacific biogeographical province. The Kuroshio Current is thought to be responsible for the northward dispersal of scleractinian corals in the west Pacific Ocean.

INTRODUCTION

Kenting National Park, located on the southern tip of Taiwan, includes both marine and terrestrial provinces (Fig. 1). The most prominent geographical features of the Park are the emergent coral reefs widely distributed throughout the Park and the well-developed fringing reefs in coastal areas. Because of her remote location to major cities and industrial areas and also because of her favorable marine environment, the coastal areas of the Park have the richest coral fauna in Taiwan. Owing to their long-standing reef-building activities, scleractinian corals have contributed to the construction of many beautiful scenery spots of the Park. It would be adequate to say that corals and coral reefs are the most important natural resources of Kenting National Park. Therefore, a general understanding on scleractinian fauna is the prime concern for conservation of natural resources of the Park. In addition, the scleractinian fauna of southern Taiwan is of considerable biogeographical importance since it is situated at the center of the west Pacific island chain and on the edge of the highest diversity region of the west Pacific Ocean. A detailed knowledge of its coral fauna and of other marine organisms associated with coral reefs will aid in understanding both biogeographical and dispersal questions of the Pacific Ocean.

The scleractinian fauna of southern Taiwan have aroused the interest of many scientists ever since 1930s. Most previous work dealing with the scleractinian corals and coral reefs of this area has been in the form of species checklist compiled from coral collections. Sugiyama (1937) reports 43 species and 24 genera from a coral collection made by Ehara in southern Taiwan. Kawaguti (1942, 1943) listed 78 species and 34 genera from Garanpi (Oluanpi) and compared the coral fauna there with other collections from Taiwan waters. He also discussed the geographic distribution of corals along the Taiwan coast and offshore islands. Kawaguti (1953) summarized the previous coral collections from Oluanpi and listed 87 species and 35 genera. A collective list of corals by Ma(1957, 1958, 1959) reveals 26 species and 18 genera as being collected from Oluanpi. Jones *et al.* (1972) collected 340 coral specimens from the reefs of southern Taiwan and provided a list of 52 genera and 173 species, of which 121 are new to the study area. Subsequent investigations by Yang *et al.* (1976, 1977, 1982) increased the list to 245 species and 69 genera. But owing to the confused status of species at that time and the lack of prudent systematic studies, the species lists presented by the above authors include numerous synonyms.

The present study presents a revised species checklist of scleractinian fauna, a brief description of principal coral biotopes and a discussion of the regional significance of the scleractinian fauna. Detailed systematic studies on scleractinian corals will be published separately in a series of reports (Dai, 1989; Hoeksema and Dai, 1990).

MATERIALS AND METHODS

Coral Specimens

Scleractinian specimens examined during this study are from three major sources: (1) the collections made by Jones *et al.* (1972) including a total of 340 coral specimens which are deposited at the Institute of Oceanography, National Taiwan University (TUIO), Taipei; (2)the collections made by Yang *et al.* (1976-1982) including about 1000 specimens and also deposited at TUIO, and (3)field observations and collections made by the auther during many dives in 1981-1984 and 1985-88. Collections were made at sites throughout the fringing reefs of the Park at the stations shown in Figure 1.

Approach to Coral Taxonomy

The identification of the scleractinian species of southern Taiwan was carried out largely following the species concept proposed by Veron and his co-workers (Veron and Pichon, 1976, 1980, 1982; Veron and Wallace, 1984; Veron *et al.* 1977). Frequent reference was made to original descriptions by various authors (e.g., Brook, 1893, Bernard, 1896, 1897; Matthai, 1928) and to the collections at Yale University. Scleractinians recorded from adjacent waters, e.g., the Philippines (Nemenzo, 1955-80), the Ryukyu Islands (Yabe and Sugiyama, 1935, 1936, 1941; Eguchi and Shirai, 1978), Guam (Randall and Myers, 1983);and Hainan Island (Zou, 1976) were also reviewed according to the same spceies concept and synonymy. This review provides a basis for discussion of the biogeography of scleractinian corals of the west Pacific reefs.

RESULTS

The Coral Fauna

Table 1 presents an updated species list including scleractinian and non-scleractinian hard corals from the waters of Kenting National Park. A review of previous records and the bathymetric distribution of each species are also given. A few species and genera listed by previous authors are omitted here; these have been reassigned to other taxa or synonymized.

The present study recognizes 247 species of hard corals, including 235 species representing 61 genera of scleractinians and 12 species representing 6 genera among non-scleractinians. Among the scleractinians, 233 species from 59 genera are hermatypic and two species from two genera are ahermatypic. Twelve genera are new to the study area, in which eight of them are previously unrecorded (*Anacropora, Podabacea, Caulastrea, Pectinia, Blastomussa, Scolymia, Plerogyra*, and *Physogyra*) and three of them are reassigned (*Gardineroseris, Sandalolitha*, and *Oxypora*). Most of the species assignments correspond to Veron and Pichon (1976, 1980, 1982), Veron and Wallace (1984) and Veron *et al.* (1977) for widespread species. Three species of *Acropora*, two species of *Montipora*, one species of *Porites*, and one species of *Blastomussa* do not conform to previous descriptions, and hence remain unassigned.

Veron and Pichon (1980) questioned the taxonomic validity of genus *Simplastrea*, Umbgrove, 1939. However, after closely examining the description by Umbgrove (1939) and the specimen stored in TUIO, I have confirmed that *Simplastrea* as a valid genus and have assigned the specimen collected from Nanwan (TUIO-C-203) as *S. versicularis*. Another species of this genus, *S. leytensis*, was described by Nemenzo (1979); the distinctive features mentioned by him in separation this species from *S. versicularis* are not present in the specimen examined from Taiwan.

Since the collecting effort in southern Taiwan is not very intense, there are likely to be some undiscovered scleractinian genera such as *Madracis, Physohpyllia, Diaseris, Acrhelia*, and *Cynarina*. More species of some genera, particularly *Acropora, Montipora*, and *Porites*, are also likely to be discovered since the traditional taxonomic difficulties of these genera indicate that species may be easily overlooked. New species from deep water of the study area may similarly exist since depths greater than 25 m have rarely been studied. However, the majority of species found in southern Taiwan are included in Table 1. Species that have not been discovered must be either rare or have very restricted distributions.

The Principal Biotopes

A number of terms have been used to describe regional coral faunas associated with particular physical environments, e.g. biotopes (Jones *et al.* 1972; Maragos and Jokiel, 1986), associations (Rosen, 1975; Sheppard, 1981), assemblages (Rosen, 1971; Head, 1980), zones (Goreau, 1959), and communities (Bouchon, 1981). Discussions of these terminologies have been provided by Head (1980) and Goodall (1986). A biotope as used here is defined as "the smallest subdivision of a habitat, characterized by a high degree of uniformity in its environmental conditions and its plant and animal life." (Burchfield, 1972).

Jones *et al.* (1972) described 16 biotopes on the reefs of southern Taiwan. Their descriptions are somewhat unnecessarily complicated; hence, they are simplified here. Two major biotopes are found in the study area: exposed reefs and protected reefs. In many cases the biotope is distinguished by its particular reef topography and coral morphology rather by its dominant species.

I. Exposed Reefs

Biotope 1. The shallow lagoon and reef flat

The environment of this biotope is characterized by a progressive decrease in wave energy toward the shore, high light intensity, and for the reef flat periodic emersion. The biotope of both areas includes the following species in great abundance: *Psammocora contigua, Stylocoeniella armata*, and *Millepora tuberosa*. These species are abundant in this biotope and rarely appear on the outer reef slopes. The shallow lagoon is also characterized by microatolls of *Porites lutea*.

Biotope 2. The shallow water (0-5 m)

This biotope exists in the reef margins of exposed areas. Emersion of the upper platform during low spring tide and strong wave action are the main ecological factors in this biotope. Corals of this biotope comprise species adapted to strong wave action; massive and encrusting forms or compact, branched colonies are dominant. Species representing this biotope are: *Acropora hyacinthus, A. palmerae, A. monticulosa, A. digitifera, Montipora informis, Pocillopora damicornis, P. meandrina*, and *Millepora platyphylla*. This biotope is characterized by intense competition between scleractinian corals and coralline algae and they both contribute to active reef growth in this region.

Biotope 3. The intermediate water (5-15 m)

This biotope exists in reef fronts and submarine terraces of exposed areas. As depth increases, wave action decreases and current force increases. However, with its intermediate depth (5-15 m), this region is less influenced by strong water movement than any other region on the reef. The biotope is characterized by the richest coral fauna and the most active reef growth in southern Taiwan. Most of the coral cover is contributed by soft corals. They are mainly species of *Sarcophyton, Lobophytum*, and *Sinularia*. Scleractinians representing this biotope are chiefly massive species such as *Favia speciosa, Favites abdita, Platygyra lamellina*, and *Porites lutea*.

Biotope 4. The deep water (15-25 m)

This biotope exists in the block-and-fissure zone of exposed sreas. Periodical strong current is the main ecological factor in this region. Due to the erosive action of strong currents, this region is characterized by huge blocks and deep troughs. Characteristic species for this biotope are difficult to distinguish; the biotope is mainly populated by small, widely distributed species which are tolerant to varied ecological conditions. The scleractinian fauna includes the following: *Pocillopora verrucosa*, *P. eydouxi*, *Platygyra daedalea*, *Hydnophora exesa*, *Montipora foveolata*, and *Porites lutea*. Small colonies of alcyonaceans such as *Sarcophyton trocheliophorum*, *S. ehrenbergi*, and *Lobophytum sarcophytoides*, are common in this area.

Ⅱ. The Protected Reefs

Biotope 5. The shallow water (0-5 m)

This biotope exists in the reef margins of protected areas. Constant wave agitation and terrestrial runoff are the main ecological factors of this biotope. Active coral growth and reef development are evident in this biotope and are represented by large coral colonies and clusters of corals which form ridges, knobs, and pinnacles. This biotope is characterized by massive, encrusting and compact branching species: *Heliopora coerulea*, *Montipora informis*, *M. spumosa*, *Acropora humilis*, *Seriatopora hystrix*. Various shapes of the blue coral, *H. coerulea*, are especially common in this biotope.

Biotope 6. The intermediate water (5-15 m)

This biotope exists in the reef fronts and the submarine terraces of protected areas. Heavy sedimentation from terrestrial runoff may be an important ecological factor of this biotope. Features of the reef surface are flat or cascaded platforms. The following branching or massive species are common: *Acropora formosa*, *A. hyacinthus*, *A. cytherea*. *Stylophora pistillata*, *Platygyra lamellina*, and *Favites abdita*.

Biotope 7. The deep water (15-25 m)

This biotope exists on the reef slopes of protected areas. This region is less influenced by both terrestrial runoff and water movement. Light intensity may be the main ecological factor of this biotope. The biotope is characterized by the species usally inhabiting deeper waters and in foliaceous forms such as: *Merulina ampliata*, *Mycedium elephantotus*, *Echinophyllia aspera*, *Pachyseris speciosa*, and *Montipora foliosa*. Species dominance of this biotope is evident and the coral cover is high.

DISCUSSION

THe Coral Fauna

With 61 genera and 235 species, the scleractinian fauna of Kenting National Park area is very rich and is comparable to the richest areas in the weat Pacific in terms of species diversity. Veron (1985) includes Taiwan in the 60 genera contour on the map of worldwide coral distributions. This study confirms his estimation, however, a significant decrease of species diversity from south to north on the island can be expected. Possibly only southern Taiwan has such high species diversity.

Despite the high diversity, there are few endemic species on the reefs of the Park. The absence of endemism is related to the fact that the fauna is of relatively recent origin and to the lack of geographical isolation of the island. By using radiocarbon methods, coral rocks collected from the seashore (1–2 m above sea level) around Hengchun Peninsula have been dated as 1300–1500 yr b.p. (Peng *et al.* 1977). These data indicate that the living reefs of southern Taiwan are younger than 1500 years. The corals of the Park represent a newly colonized fauna; the prevailing current past Taiwan, the Kuroshio Current, is responsible for the transportation of colonizers from the south.

Southern Taiwan is located about 200 miles north of Luzon, and with a series of islets lying between them. The Kuroshio current is a continuation of the North Equatorial Current which flows north from the central Philippines toward Taiwan at an average velocity of 1.0 knot (Nitani, 1972). Drift time from the Philippines to southern Taiwan is thus about eight days. Since coral larvae may remain in the plankton for a few weeks (e.g., Atoda, 1947; Fadlallah, 1983; Harrison *et al.* 1984), larvae from coral reefs of the Philippines and central Pacific Ocean can easily reach the waters of southern Taiwan and still have the ability to settle. Because of its close position to the richest scleractinian fauna in the central Pacific and because of its favorable environment, southern Taiwan thus has a very rich coral fauna despite its small area of reefs.

In addition, the coral fauna in the waters of Kenting National Park may have a high species turnover rate. Catastrophic events such as typhoons and heavy sedimentation could be frequent enough to cause local extinctions. Indeed, in spite of the fact that a large number of species were discovered during this study, a number of species reported by previous authors in the study area were not observed even under intense searching. The high recruitment rates with frequent disturbances seem to be the important factors in maintaining the species diversity of this fauna.

Biogeography

To date, most of the published studies on coral distributions are based on generic level records (Rosen, 1971, 1980; Stehli and Wells, 1971; Scheer, 1971). But to treat all genera as equivalent without regard to the fact that they may contain one or a large number of species is questionable. Veron (1985) first used species to discuss distribution of scleractinians in the west Pacific based on his studies in Australia and the Ryukyu Islands (Ishigaki I.). The present study also attempts to compare the distribution of scleractinians in the west Pacific by reviewing several taxonomic studies based on the synonymy proposed by Veron and his co-workers. Since inconsistency of scleractinian taxonomy at the species level is still common and sometimes descriptions and figures in the literature are not sufficient for identification, study of coral specimens collected from different localities in the West Pacific is advisable for questionable species.

205 species (88 %) recorded from southern Taiwan also occur on the Great Barrier Reef. Most of the species common to both regions do not show significant taxonomic differences. Similarly, Veron (1986) reported that 89 % of the scleractinian recorded from Ishigaki I. also occur on the Great Barrier Reef. These comparisons indicate a high degree of homogeneity of scleractinians at species level. The distribution of coral species is largely determined by the availability of suitable substrate and favorable environmental conditions. The depauperate coral fauna of Hong Kong is mainly due to its unfavorable environment from heavy sedimentation and periodical low water temperature (Veron, 1980). Since taxonomic studies on scleractinians of the Philippines, Guam, and Hainan Island show inconsistencies, more work on the question of synonymy and revisions of species lists from these areas are needed to clarify their relationships at the species level.

Table 2 shows the distribution of scleractinians at the generic level. Homogeneity of areas of major diversity such as Eastern Australia, the Philippines, Guam, Hainan Island, and southern Taiwan is obvious at the generic level. This table also shows the major differences in the capacities of different genera and families to occupy marginal or isolated regions. It is generally accepted that there is a progressive decrease in diversity from the central Pacific to both the north and the south and from west to east in the Pacific Ocean (Wells, 1969; Stehli and Wells, 1971; Veron, 1986). However, the diminishing of coral species is not random. For example, species of *Acropora, Pocillopora*, and the Fungiidae diminish more rapidly along latitudinal gradients. On the contrary, species of the Faviidae appear to have a larger proportion of both genera and species sustained at marginal areas such as Hong Kong and Sagami Bay, Japan. Temperature has long been considered as the primary factor limiting the distribution of corals along the latitudinal gradients. The effects of temperature on corals may be directly by reducing their calcification rates and affecting the reproductive cycles, or indirectly by increasing the growth of other organisms such as macroalgae which are easily able to outgrow corals (Johannes *et al.* 1983).

The distribution of Indo-Pacific corals is generally homogeneous throughout the province at both generic and specific levels (Wells, 1969; Potts, 1983; Veron, 1985). Two models have been proposed to explain the phenomenon. The evolutionary stability model holds that corals have experienced prolonged, undisturbed evolutionary history under conditions

similar to those that exist today. The present distribution is either by dispersal from a Tertiary center of speciation (Rosen, 1971; Stehli and Wells, 1971) or from differential persistence of Tethys relicts (McCoy and Heck, 1976; Heck and McCoy, 1978; McManus, 1985). On the contrary, the evolutionary disequilibrium model holds that corals were subjected to chronic evolutionary disturbances by frequent sea level fluctuations. But the average time (3200 yr) for any given bathymetric level to remain in the zone of active coral growth (〈 20 m) was too short for populations of long-lived corals to complete enough generations to approach evolutionary equilibrium (Potts, 1983, 1984). The lack of species endemism, geographical homogeneity, and broad-scale sea level changes seem to support the evolutionary disequlibrium model. Homever, it remains to be proven, further studies on the genetic structure of widespread species and morphologically flexible species will provide a more comprehensive understanding of the evolution of scleractinian corals.

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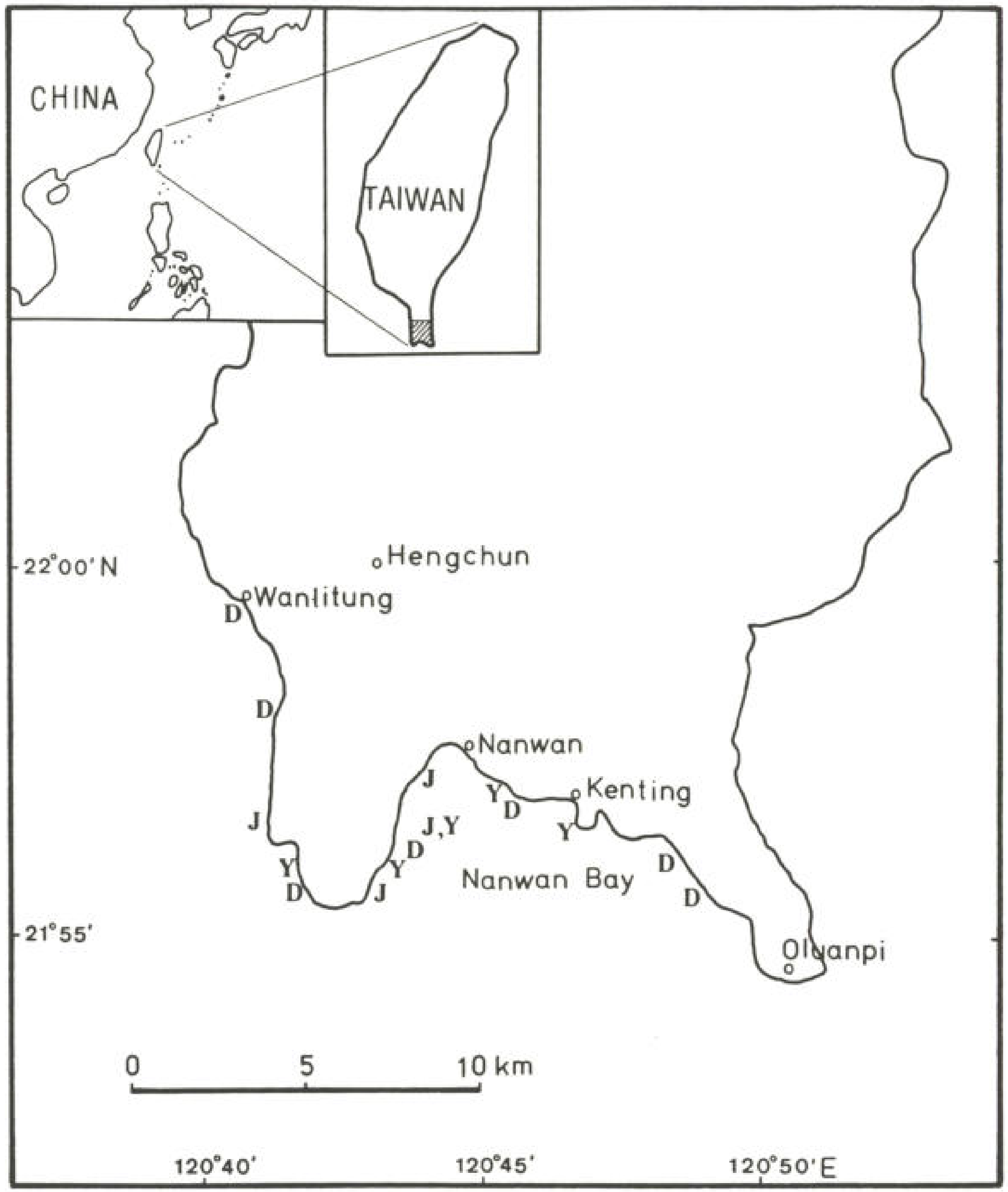

Fig. 1. Map of the study area showing collecting stations of scleractinian specimens. J: Jones et al. 1972; Y: Yang et al. 1976, 1977, 1982; D:Dai, 1989 and the present study.

Table 1. The known scleractinian and nonscleractinian reef-building coral species on the fringing reefs of Southern Taiwan. Key to previous records– S: Yabe and Sugiyama (1935, 1936, 1941), Sugiyama (1937); K: Kawaguti(1942, 1943, 1953); M: Ma(1957, 1958, 1959); J: Jones *et al.*(1972); Y: Yang *et al.*(1976, 1977, 1982); R: Randall and Cheng(1984); N: synomized from the above records. Distribution of coral species is based on collection records and field observation records from the following depths– A: recorded from 0–5 m; B: recorded from 5–15 m; C: recorded from 15–25 m. '*' indicates species not examined in this study because specimens were lost or not available.

Species	Previous record	A	B	C
ORDER SCLERACTINIA				
ACROPORIDAE				
Acropora (*Isopora*) *palifera* (Lamarck)	K,J,Y	+		
A. (*I.*) *cuneata* (Dana)		+		
A. (*A.*) *humilis* (Dana)	K,J,Y	+	+	
A. (*A.*) *gemmifera* (Brook)		+		
A. (*A.*) *monticulosa* (Brugemann)	J,Y	+	+	
A. (*A.*) *digitifera* (Dana)	J,Y	+	+	+
A. (*A.*) *glauca* (Brook)	N	+	+	
A. (*A.*) *robusta* (Dana)	N	+	+	
A. (*A.*) *palmerae* Wells	J,Y	+		
A. (*A.*) *nobilis* (Dana)	N	+	+	
A. (*A.*) *grandis* (Brook)	N	+	+	
A. (*A.*) *formosa* (Dana)	S,K,J,Y	+	+	+
A. (*A.*) *valenciennesi* (Edwards & Haime)	N		+	+
A. (*A.*) *microphthalma* (Verrill)	N	+	+	
A. (*A.*) *aspera* (Dana)	N	+	+	+
A. (*A.*) *pulchra* (Brook)	N		+	
A. (*A.*) *millepora* (Ehrenberg)	N	+	+	
A. (*A.*) *tenuis* (Dana)	Y	+	+	
A. (*A.*) *dendrum* (Basett-Smith)		+	+	
A. (*A.*) *selago* (Studer)	N		+	+
A. (*A.*) *cytherea* (Dana)	N	+	+	+
A. (*A.*) *microclados* (Ehrenberg)			+	
A. (*A.*) *hyacinthus* (Dana)	K,Y	+	+	
A. (*A.*) *anthocercis* (Brook)		+	+	
A. (*A.*) *latistella* (Brook)	+	+		
A. (*A.*) *studeri* (Brook)	S,K,Y	+	+	+
A. (*A.*) *nana* (Studer)	J,Y	+	+	+
A. (*A.*) *azurea* Veron and Wallace		+	+	
A. (*A.*) *cerealis* (Dana)	K,J,Y	+	+	+
A. (*A.*) *nasuta* (Dana)	J,Y	+	+	+
A. (*A.*) *secale* (Studer)			+	+
A. (*A.*) *valida* (Dand)	J,Y	+	+	+
A. (*A.*) *clathrata* (Brook)	N		+	
A. (*A.*) *divaricata* (Dana)		+	+	
A. (*A.*) *florida* (Dana)		+	+	
A. (*A.*) *austera* (Dana)			+	+
A. (*A.*) *granulosa* (Edwards & Haime)			+	+
A. (*A.*)*acuminata* Verrill	J,Y	+	+	
A. (*A.*) *angulata* (Quelch) *	K,Y			
A. (*A.*) sp 1		+	+	
A. (*A.*) sp 2		+		
A. (*A.*) sp 3		+	+	
Anacropora matthaii Pillai			+	
Astreopora myriophthalma (Lamarck)	J,Y	+	+	
A. listeri Bernard		+	+	
A. gracilis Bernard			+	
A. randalli Lamberts		+	+	
A. cucullata Lamberts			+	
A. suggesta Wells *	J,Y		+	
Montipora monasteriata (Forskal)	N	+	+	+
M. tuberculosa (Lamarck)		+	+	
M. peltiformis Bernard	N	+	+	+
M. turgescens Bernard		+		
M. spumosa (Lamarck)		+	+	
M. undata Bernard			+	+
M. verrucosa (Lamarck)	K,J,Y	+	+	+
M. danae Edwards & Haime		+	+	
M. foveolata (Dana)	K,J,Y	+	+	
M. venosa (Ehrenberg)	J,Y	+		
M. angulata (Lamarck)			+	
M. digitata (Dana)	N		+	+
M. hispida (Dana)	J,Y	+	+	
M. efflorescens Bernard		+	+	
M. nodosa (Dana)		+	+	
M. grisea Bernard		+		
M. stellata Bernard	N	+	+	+
M. informis Bernard	K,J,Y	+	+	+
M. foliosa (Pallas)	S,M,K,J,Y	+	+	+
M. aequituberculata Bernard	N		+	+
M. incrassata (Dana)	N	+	+	
M. ehrenbergi Bernard	Y	+	+	
M. marshallensis Wells	J,Y	+	+	
M. lichen Dana	J,Y	+		
M. edwardsi Bernard	K,J,y	+	+	
M. sp. 1		+	+	
M. sp. 2		+	+	
THAMNASTERIIDAE				
Psammocora profundacellar Gardiner	K,Y	+		
P. digitata Edwards & Haime	N	+	+	
P. contigua (Esper)	K,Y	+	+	
P. brighami Vaughan *	K			
P. verrilli Vaughan *	K			

ASTROCOENIIDAE				
Stylocoeniella armata Ehrenberg	J,Y	+	+	
S. guentheri Bassett-Smith	J,Y	+	+	
POCILLOPORIDAE				
Pocillopora damicornis Linnaeus	S,K,J,Y	+	+	
P. eydouxi Edwards & Haime	K,J,Y	+	+	+
P. meandrina (Dana)	S,K,J,Y	+	+	
P. verrucosa Ellis & Solander	K,J,Y	+	+	+
P. woodjonesi Vaughan		+	+	
Seriatopora caliendrum Ehrenberg	K,J,Y	+	+	
S. hystrix Dana	K,Y	+	+	
Stylophora pistillata (Esper)	K,J,Y			
AGARICIIDAE				
Pavona clavus (Dana)	M,J,Y	+	+	+
P. divaricata Lamarck	K,Y		+	+
P. decussata Dana			+	+
P. cactus (Forskal)			+	+
P. maldivensis (Gardiner)	M,K,Y		+	
P. varians Verrill	J,Y	+	+	+
P. venosa (Ehrenberg)	J,Y	+	+	+
P. frondifera (Lamarck) *	S,K			
P. lilacea (Klunzinger) *	S,k			
P. gardineri Van der Horst *	S,K			
Gardineroseris planulata (Dana)	N	+	+	
Leptoseris hawaiiensis Vaughan	J,Y		+	+
L. incrustans (Quelch)	J,Y		+	+
L. sxplanata Yabe & Sugiyama			+	+
L. yabei (Pillai & Scheer)			+	+
L. tenuis Van der Horst				+
Coeloseris mayeri Vaughan	M,K,J,Y	+	+	
Pachyseris rugosa (Lamarck)	J,Y	+	+	+
P. speciosa (Dana)	K,J,Y		+	+
SIDERASTREIDAE				
Coscinarea columna (Dana)	J,Y	+	+	
FUNGIIDAE				
Fungia (Cycloseris) sinensis (Edwards & Haime)			+	+
F. (C.) cyclolites Lamarck				+
F. (C.) fragilis (Alcock)			+	+
F. (C.) costulata Ortmann			+	+
F. (C.) tenuis Dana			+	+
F. (C.) vaughani Boschma			+	+
F. (Verrillofungia) concinna Verrill			+	+
F. (V.) repanda Dana				+
F. (Danafungia) horrida Dana			+	+
F. (D.) scruposa Klunzinger			+	+
F. (Fungia) fungites (Linnaeus)			+	+
F. (Wellsofungia) granulosa Klunzinger			+	+
F. (Lobactis) scutaria Lamarck			+	+
F. (Pleuractis) moluccensis Van der Horst			+	+
F. (P.) taiwanensis Hoekesema & Dai				+
F. (P.) gravis Nemenzo				+
F. (P.) paumotensis Stutchbury			+	+
Ctenactis echinata (Pallas)				+
C. crassa (Dana)			+	+
Herpolitha limax (Esper)			+	+
Polyphyllia talpina (Lamarck)			+	+
Sandalolitha dentata Quelch			+	+
S. robusta Quelch			+	+
Lithophyllon undulatum Rehberg		+	+	+
L. mokai Hoeksema			+	+
Podabacia crustacea (Pallas)		+	+	+
PORITIDAE				
Alveopora verrilliana Dana	J,Y	+	+	+
A. fenestrata (Lamarck)			+	
A. spongiosa Dana			+	
Goniopora lobata Edwards & Haime		+	+	
G. djiboutensis Vaughan		+	+	+
G. minor Crossland		+	+	+
G. columna Dana			+	+
G. stuchburyi Wells			+	
G. tenella (Quelch)	J,Y	+	+	
Porites (Porites) australiensis Vaughan	J,Y	+	+	+
P. (P.) solida (Forskal)		+	+	
P. (P.) murrayensis Vaughan	+	+		
P. (P.) lichen Dana	J,Y	+	+	
P. (P.) lobata Dana	J,Y	+	+	+
P. (P.) lutea Edwards & Haime	J,Y	+	+	+
P. (P.) cylindrica Dana	N		+	+
P. (P.) nigrescens Dana	K,Y		+	
P. (P.) tenuis Verrill	J,Y	+	+	
P. (P.) annae Crossland		+	+	
P. (P.) stephensoni Crossland		+	+	
P. (P.) compressa Dana	J,Y	+	+	+
P. (P.) cocosensis Wells *	J,Y			
P. (Synaraea) rus (Forskal)	N	+	+	
P. (P.) sp.				
FAVIIDAE				
Cyphastrea chalcidicum (Forskal)	M,K,J,Y	+	+	
C. microphthalma (Lamarck)	J,Y	+	+	
C. serailia (Forskal)		+	+	
Caulastrea furcata Dana			+	+

Diploastrea heliopora (Lamarck)	K,J,Y		+	+
Echinopora lamellosa (Esper)	K,J,Y		+	+
Favia favus (Forskal)	J,Y	+	+	+
F. pallida (Dana)	J,Y	+	+	+
F. rotumana (Gardiner)	J,Y	+	+	+
F. speciosa (Dana)	S,M,K,J,Y	+	+	+
F. stelligera (Dana)	J,Y	+	+	+
F. laxa (Klunzinger)	Y	+	+	
F. maxima V., P. & W.			+	+
F. maritima Nemenzo			+	
Favites abdita (Ellis & Solander)	M,K,J,Y	+	+	+
F. chinensis (Verrill)	N	+	+	+
F. complanata (Ehrenberg)	K,Y		+	
F. rotundata V., P. & W.		+	+	
F. flexuosa (Dana)	J,Y	+	+	+
F. russelli (Wells)		+	+	
F. pentagona (Esper)	M,J,Y	+	+	+
F. halicora (Ehrenberg)	J,Y	+	+	
Barabattoia amicorum (Edwards & Haime)	N		+	
Montastrea valenciennesi (E. & H.)	N	+	+	
M. curta (Dana)		+	+	
Goniastrea australiensis (E. & H.)	N	+	+	+
G. edwardsi Chevalier	N	+	+	+
G. aspera (Verrill)	N	+	+	+
G. pectinata (Ehrenberg)	M,K,J,Y	+	+	+
G. retiformis (Lamarck)	K,J,Y	+	+	+
Hydnophora exesa (Pallas)	J,Y	+	+	+
H. microconos (Lamarck)	K	+	+	
H. rigida (Dana)	J,Y		+	+
Leptoria phrygia (Ellis & Solander)	M,K,J,Y	+	+	+
Oulophyllia crispa (Lamarck)	M,J,Y		+	+
Platygyra pini Chevalier		+	+	+
P. lamellina (Ehrenberg)	M,K,J,Y	+	+	+
P. daedalea (Ellis & Solander)	N	+	+	+
P. sinensis (Edwards & Haime)	N	+	+	+
Plesiastrea versipora (Lamarck)	M,K,J,Y	+	+	+
Leptastrea purpurea (Dana)	M,K,J,Y	+	+	+
L. pruinosa Crossland	J,Y	+	+	
L. transversa Klunzinger		+	+	
QCULINIDAE				
Galaxea fascicularis (Linnaeus)	K,J,Y	+	+	
G. cf. astreata (Lamarck)		+	+	
Simplastrea versicularis Umbgrove	J,Y		+	
MERULINIDAE				
Merulina ampliata (Ellis & Solander)	K,J,Y	+	+	+
Scapophyllia cylindrica (E. & H.)	J,Y		+	+

PECTINIIDAE				
Echinophyllia aspera (Ellis & Solander)	K,J,Y		+	+
Oxypora lacera (Verrill)			+	+
O. glabra Nemenzo			+	+
Mycedium elephantotus (Pallas)	N		+	+
Pectinia lactuca (Pallas)			+	+
P. paeonia (Dana)			+	+
MUSSIDAE				
Blastomussa sp.			+	
Scolymia cf. vitiensis Bruggemann				+
Acanthastrea echinata (Dana)	M,K,J,Y	+	+	+
A. hillai Wells		+	+	
Lobophyllia hemprichii (Ehrenberg)	M,K,Y		+	+
L. corymbosa (Forskal)	K,J,Y		+	+
L. hataii Yabe, Sugiyama & Eguchi			+	
Symphyllia recta (Dana)	M,K,J,Y	+	+	+
S. radians Edwards & Haime			+	+
S. agaricia Edwards & Haime	M,K,J,Y		+	+
S. cf. valenciennesii Edwards & Haime			+	+
CARYOPHYLLIIDAE				
Euphyllia (E.) glabrescens C. & E.	K,J,Y	+	+	
E. (E.) cristata Chevalier			+	
E. (Fimbryaphyllia) ancora V. & P.	N	+	+	
Plerogyra sinuosa (Dana)			+	+
Physogyra lichtensteini (E. & H.)			+	+
DENDROPHYLLIIDAE				
Turbinaria peltata (Esper)	K,J,Y		+	+
T. frondens (Dana)	N		+	+
T. mesenterina (Lamarck)	N		+	+
T. reniformis Bernard			+	+
T. immersa Yabe & Sugiyama	J,Y		+	+
Tubastrea aurea Quoy & Gaimard	J,Y		+	+
Dendrophyllia micranthus (Ehrenberg)				+
Non-scleractinian Corals				
CLASS ANTHOZOA: SUBCLASS OCTOCORALLIA				
ORDER STOLONIFERA				
TUBIPORIDAE				
Tubipora musica Linnaeus	K,J,Y	+	+	
ORDER COENOTHECALIA				
HELIOPORIDAE				
Heliopora coerulea (Pallas)	K,J,Y	+	+	+

CLASS HYDROZOA				
ORDER MILLEPORIDA				
MILLEPORIDAE				
Millepora platyphylla H. & E.	K,J,Y,R	+	+	
M. dichotoma Forskal	R	+	+	
M. tenera Boschma	K,J,Y,R	+	+	
M. murrayi Quelch	K,J,R	+	+	
M. intricata Edwards & Haime	J,Y,R	+	+	
M. foveolata Crossland	R	+	+	
M. tuberosa Boschma	R	+	+	
ORDER STYLASTERIDA				
STYLASTERIDAE				
Stylaster cf. gracilis Edwards & Haime	R		+	+
Allopora scabiosa (Broch)	R		+	+
Distichopora violacesa (Pallas)	R		+	+

Table 2. Distribution of scleractinian corals in the west Pacific. Numbers represent the number of known species in that area. EA: Eastern Australia; PH: The Philippines(5–18°N); Guam (13°N); SC: Hainan Island (19–20°N); HK: Hong Kong (21°N); ST: South Taiwan (22°N); NT: North Taiwan (25°N); RK: The Ryukyu Islands (27°N); SJ: Kyushu (31–33°N); MJ: Sagami Bay (35°N).

genera	EA	PH	GM	SC	HK	ST	NT	RK	SJ	MJ	Total
ACROPORIDAE											
Acropora	67	66	26	16	3	40	14	27	10	1	94
Anacropora	4	4	–	–	–	1	–	1	–	–	5
Astreopora	7	3	5	1	–	6	1	3	1	–	10
Montipora	31	43	21	15	3	28	14	17	4	2	67
POCILLOPORIDAE											
Pocillopora	5	4	8	3	1	6	1	3	1	–	8
Seriatopora	2	3	2	–	–	2	1	2	–	–	3
Stylophora	1	5	1	–	–	1	1	1	1	1	5
Palauastrea	1	–	–	–	–	–	–	–	–	–	1
Madracis	1	1	1	–	–	–	–	–	–	1	2
ASTROCOENIIDAE											
Stylocoeniella	2	2	2	–	1	2	2	1	1	–	2
THAMNASTERIIDAE											
Psammocora	7	3	7	1	3	5	1	4	1	1	10
AGARICIIDAE											
Pavona	9	6	11	4	1	10	6	6	1	–	13
Gardineroseris	1	1	1	1	–	1	1	–	–	–	1
Leptoseris	7	3	7	–	1	5	4	1	1	–	10
Coeloseris	1	1	–	1	–	1	1	1	–	–	1
Pachyseris	2	2	1	2	–	2	2	2	–	–	2
SIDERASTREIDAE											
Coscinaraea	5	2	1	–	1	1	–	1	1	–	6
Pseudosiderastrea	1	1	–	–	–	–	–	–	–	–	1
FUNGIIDAE											
Cycloseris	7	3	2	–	–	5	1	1	1	1	9
Fungia	15	11	8	3	–	10	1	6	2	–	15
Diaseris	2	1	1	–	–	–	–	–	–	–	2
Heliofungia	1	1	–	–	–	1	–	–	–	–	1
Herpetoglossa	2	1	–	–	–	–	–	–	–	–	2
Herpolitha	1	1	–	–	–	1	1	1	–	–	1
Polyphyllia	1	1	1	1	–	1	–	–	–	–	1
Sandalolitha	1	1	1	1	–	1	–	–	–	–	1
Halomitra	1	1	1	–	–	1	1	–	–	–	1
Lithophyllon	1	1	–	–	1	1	1	2	–	–	2
Podabacea	1	1	1	1	–	1	–	1	–	–	1
Zoopilus	–	1	–	–	–	1	–	1	–	–	1
PORITIIDAE											
Alveopora	7	4	1	–	1	3	2	3	–	1	11
Goniopora	13	12	7	1	2	6	5	5	2	1	21
Porites	14	24	11	7	3	14	6	6	4	1	33
Stylaraea	1	–	1	–	–	–	–	–	–	–	1
FAVIIDAE											
Caulastrea	4	5	–	1	–	1	–	2	1	–	5
Cyphastrea	4	5	3	1	2	3	3	3	3	–	6
Barabattoia	2	2	–	–	1	1	–	1	1	–	2
Diploastrea	1	1	1	1	–	1	1	1	–	–	1
Favia	11	9	7	2	5	9	7	6	3	–	15
Favites	9	6	3	3	4	8	6	2	3	1	9
Montastrea	4	4	2	–	1	2	2	2	1	1	5
Goniastrea	7	5	3	4	2	6	3	5	2	1	7
Platygyra	5	3	2	3	3	4	4	3	3	2	6
Leptoria	1	1	1	1	–	1	1	1	–	1	1
Oulophyllia	1	1	1	1	1	1	1	1	–	–	1
Oulastrea	–	2	–	–	1	–	–	1	–	1	2
Hydnophora	3	4	3	2	1	3	2	2	1	1	4
Plesiastrea	1	1	1	–	1	1	1	1	1	1	1
Leptastrea	5	2	3	1	2	3	1	1	1	1	5
Moseleya	1	–	–	–	–	–	–	–	–	–	1
Australogyra	1	–	–	–	–	–	–	–	–	–	1

OCULINIDAE											
Galaxea	2	3	1	1	1	2	2	2	–	–	3
Acrhelia	1	1	1	–	–	–	–	1	–	–	1
Simplastrea	–	1	–	–	–	1	–	–	–	–	2
MERULINIDAE											
Merulina	1	1	1	1	–	1	1	1	–	–	1
Boninastrea	–	–	–	–	–	–	–	1	–	–	1
Clavarina	1	–	–	1	–	–	–	–	–	–	1
Scapophyllia	1	1	1	1	–	1	1	–	–	–	1
Paraclavarina	1	–	–	–	–	–	–	–	–	–	1
PECTINIIDAE											
Echinophyllia	4	1	1	1	1	1	1	1	1	–	5
Oxypora	2	2	–	–	–	2	1	1	–	–	2
Mycedium	1	1	1	–	–	1	1	1	–	–	1
Pectinia	3	3	2	1	–	2	2	2	–	1	5
Physophyllia	–	2	–	–	–	–	–	1	1	–	3
MUBBIDAE											
Blastomussa	2	2	–	–	–	1	–	–	–	–	2
Cynarina	1	1	–	–	–	–	–	1	1	–	1
Scolymia	2	1	–	–	–	1	1	–	1	–	4
Acanthastrea	4	2	2	1	1	2	2	1	1	–	4
Lobophyllia	4	3	3	2	–	3	2	2	2	–	5
Symphyllia	4	3	1	3	–	4	4	3	3	–	4
Australomussa	1	1	–	–	–	–	–	1	–	–	1
TRACHYPHYL-LIIDAE											
Trachyphyllia	1	1	–	–	–	–	–	1	1	–	1
CARYOPHYLLIDAE											
Euphyllia	4	4	2	–	–	3	2	3	1	–	5
Plerogyra	1	3	1	–	–	1	1	1	–	–	3
Catalaphyllia	1	1	–	–	–	–	1	1	–	–	1
Physogyra	1	1	–	–	–	1	1	1	–	–	1
Nemenzophyllia	–	1	–	–	–	–	–	–	–	–	1
DENDROPHYL-LIIDAE											
Turbinaria	9	15	4	3	3	5	4	4	7	–	23
Duncanopsammia	1	–	–	–	–	–	–	–	–	–	1
Heteropsammia	1	–	–	–	–	–	–	–	–	–	1