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Checklist of the Hermatypic Corals of Urasoko Bay, Ishigaki Island, Southwestern Japan

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Hermatypic corals of Urasoko Bay, Ishigaki Island, were listed in systematic order. A total of 234 species belonging to 59 genera and 16 families were recorded from field studies carried out during 1994–1996. Although Urasoko Bay is a very small bay with an area of only 2.6 km^2, the number of hermatypic coral species found in the bay sums up to approximately 70 percent of that found in the whole Yaeyama Islands, and 63 percent of that in the entire Japanese waters. High species diversity (richness of species) observed in such a small bay is considered to be caused by the two factors: compactly aggregated diverse coral reef topography and diverse physico-chemical environmental conditions.

Key words: coral, hermatypic coral, diversity, Scleractinia, fauna, Ryukyu Islands, southwestern Japan

Hermatypic corals in Japanese waters have been recorded by Yabe and Sugiyama 1935, 1941, Yabe *et al.* 1936, Shirai, 1977, Nishihira 1988, Veron 1988, 1992a, 1992b, and Uchida and Fukuda 1989a, 1989b, whose studies cover a wide range of areas including the Ryukyu Islands and the Nansei Islands. Nishihira and Veron (1995) gave the most comprehensive account of the distribution of species and genera throughout Japan. There are also some check lists of hermatypic corals surveyed at small bays or restricted areas in various parts of the Ryukyu Islands (Eguchi 1974, Yamazato *et al.* 1982, Yamazato 1985, Shirai and Sano 1985, Nishihira *et al.* 1987, Nishihira and Yokochi 1990, Mezaki 1991, Fukuda *et al.* 1991, Okinawa Pref. 1994), though most of them are incomplete and/or tentative ones.

This study is intended to provide basic knowledge on the hermatypic corals of Urasoko Bay, one of the small bays in southwestern part of the Ryukyu Islands. The ecological studies concerning the community structure of the hermatypic coral were carried out for three years from 1994–1996 in this bay. These studies are still being continued and more detailed knowledge will be obtained in near future. Thus, the primary purpose of this article is to describe the hermatypic coral fauna currently recognized in Urasoko Bay. A hypothesis to better understand the species diversity of the Ryukyu Islands as well as other coral reefs is also discussed.

Materials and Methods

Urasoko Bay, which is situated in the northern part of Ishigaki Island of the Ryukyu Islands, is a small bay with approximately 1.5–2.0 km in diameter, 2.6 km^2 in area, and 25 m in a maximum depth, opening to the north (Fig. 1). A fringing reef less than 2–3 m deep extends approximately 100–1500 m off the shoreline. The reef flat consists of a mosaic of coral patches, sand and algal zones, and the innermost is influenced by the brackish waters flooded from several small rivers. There is a broad reef flat jutting out toward the offing at the western side of the bay. Spur and groove formation is developed outside the offshore reef flat and there is strong wave exposure along the reef margin.

The community structure of hermatypic corals at Urasoko Bay has been studied in detail for

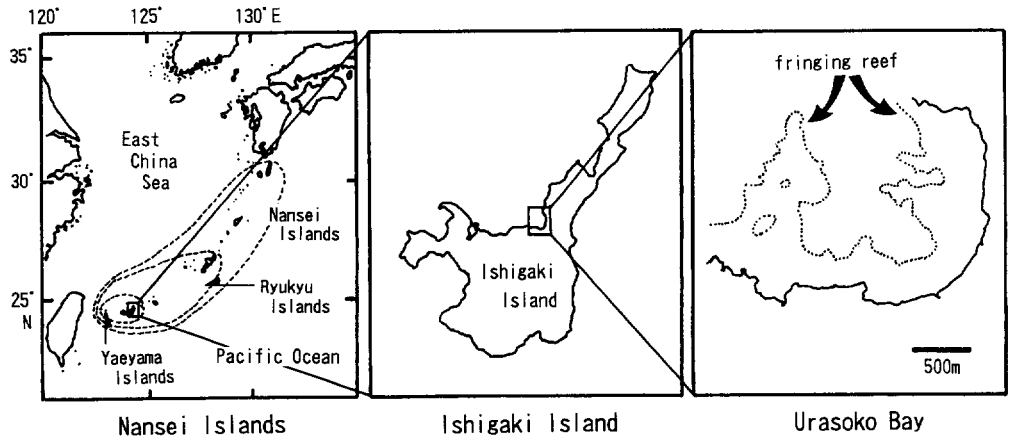

Fig. 1. Location map of the study sites, showing the Nansei Islands (left), Ishigaki Island (center), and Urasoko Bay (right).

the past three years. A quantitative survey using line transect and quadrat methods was irregularly carried out five times: December 1994, March 1995, August-September 1995, March 1996, and September 1996. This survey included *in situ* identification of coral species, collection of specimens and taking underwater photographs of the study sites. A total of approximately 30 days were devoted to this ecological survey. In addition, we examined the coral fauna in the whole of the bay, spending extra two weeks, with the aim of making a complete species list.

Observation and sample collection were done using SCUBA with underwater camera. A combination of underwater photos and the skeletal specimens were especially useful for the definitive identification of some taxa, but this method was not adopted for all species.

One of the most serious problem in making a species list is the correct identification on the basis of the common taxonomical framework. In this list, only the species for which the specimens had been collected and/or the photos had been obtained were presented. More than 10 species for which only in situ observation had been made and approximately 20 taxonomically uncertain species were excluded from the present list.

The taxonomic framework including the scientific name given by Veron (1986) and Nishihira and Veron (1995) was adopted for this study.

Results and Discussion

A species list of hermatypic corals with the relative abundance within Urasoko Bay and information on the main habitats was shown in Table 1. A total of 234 hermatypic coral species belonging to 59 genera and 16 families have been identified, of which 229 species in 57 genera are scleractinian and 5 species in 2 genera are non-scleractinian. It will bring the total number of species over 260, when uncertain and unidentified species are included.

The Acroporidae was the most dominant family (69 species in 4 genera), followed by the Faviidae (50 species in 13 genera) and the Poritidae (21 species in 3 genera) in order of abundance. The Trachyphylliidae and Helioporidae were not found. The composition of taxa exhibited a close similarity with those found in the other western Pacific regions (Veron 1986, 1988, 1989, 1990, Wells and Jenkins 1988).

Table 1. Hermatypic corals recorded in Urasoko Bay, Ishigaki Island. Relative abundance is indicated as follows:
A = abundant, C = common, U = uncommon, R = rare.
Main habitat is indicated as follows:
OF = outer reef flat (exposed environment)
IF = inner reef flat (sheltered environment)
US = upper reef slope (exposed environment)
LS = lower reef slope (sheltered environment)
S = sand or mud (sheltered environment)
99–99 m = depth ranges of vertical distribution recorded in this study.

Scientific name	Japanese name	Abundance	Habitat	
Family Astrocoeniidae				
1 *Stylocoeniella guentheri* (Bassett-Smith)	Mukashi-sango	C	OF, IF, US, LS	1–16 m
2 *Stylocoeniella armata* (Ehrenberg)	Hime-mukashi-sango	R	US	6 m
Family Pocilloporidae				
3 *Pocillopora damicornis* (Linnaeus)	Hanayasai-sango	C	IF	1–2 m
4 *Pocillopora verrucosa* (Ellis & Solander)	Ibohada-hanayasai-sango	C	OF, US	1–3 m
5 *Pocillopora meandrina* Dana	Chirimen-hanayasai-sango	U	OF, US	1–3 m
6 *Pocillopora eydouxi* Edwards & Haime	Herajika-hanayasai-sango	U	US	1–5 m
7 *Seriatopora hystrix* Dana	Toge-sango	C	OF, IF, US, LS	2–20 m
8 *Stylophora pistillata* (Esper)	Shouga-sango	C	OF, IF, US, LS	1–10 m
Family Acroporidae				
9 *Montipora monasteriata* (Forskål)	Koibo-komon-sango	U	US,LS	4–13 m
10 *Montipora tuberculosa* (Lamarck)	Himeibo-komon-sango	R	US	7 m
11 *Montipora mollis* Bernard	Morisu-komon-sango	U	OF, US	1–15 m
12 *Montipora peltiformis* Bernard	Itaibo-komon-sango	C	OF, IF	1–2 m
13 *Montipora turgescens* Bernard	Abata-komon-sango	U	OF	1 m
14 *Montipora spongodes* Bernard	Suponji-komon-sango	U	IF	1–2 m
15 *Montipora mactanensis* Nemenzo		U	US	4–5 m
16 *Montipora capitata* Dana		U	OF, IF	1–4 m
17 *Montipora foveolata* (Dana)	Ookubomi-komon-sango	R	US	3 m
18 *Montipora venosa* (Ehrenberg)	Komon-sango	R	OF	1–2 m
19 *Montipora angulata* (Lamarck)	Yasuri-komon-sango	R	?	?
20 *Montipora samarensis* Nemenzo		R	OF, IF	1–2 m
21 *Montipora digitata* (Dana)	Eda-komon-sango	A	IF	1–2 m
22 *Montipora gaimardi* Bernard	Kobu-komon-sango	U	IF	1–2 m
23 *Montipora hispida* (Dana)	Toge-komon-sango	C	IF	1–5 m
24 *Montipora informis* Bernard	Nori-komon-sango	U	OF, IF	1–2 m
25 *Montipora efflorescens* Bernard	Shimo-komon-sango	C	OF, IF, US	1–5 m
26 *Montipora grisea* Bernard	Gurisea-komon-sango	R	OF	1–2 m
27 *Montipora stellata* Bernard	Togeeda-komon-sango	C	IF	1–2 m
28 *Montipora cactus* Bernard	Saboten-komon-sango	C	IF	1–6 m
29 *Montipora foliosa* (Pallas)	Usu-komon-sango	U	LS	10–12 m
30 *Montipora aequituberculata* Bernard	Chijimiusu-komon-sango	C	OF, US	1–13 m
31 *Anacropora forbesi* Ridley	Maikuro-toge-midoriishi	R	LS	20 m
32 *Anacropora puertogalerae* Nemenzo	Oo-toge-midoriishi	C	IF, LS, S	1–5 m
33 *Anacropora matthaii* Pillai	Hime-toge-midoriishi	U	LS, S	4–14 m
34 *Acropora brueggemanni* (Brook)	Futoeda-midoriishi	C	US	3–7 m
35 *Acropora humilis* (Dana)	Tsutsuyubi-midoriishi	U	OF, US	1–8 m

36	*Acropora gemmifera* (Brook)	Oyayubi-midoriishi	C	OF, US	1–5 m
37	*Acropora monticulosa* (Brüggemann)	Sankaku-midoriishi	C	OF, US	1–3 m
38	*Acropora samoensis* (Brook)	Samoa-midoriishi	U	US	2–5 m
39	*Acropora digitifera* (Dana)	Koyubi-midoriishi	A	OF, US	1–5 m
40	*Acropora robusta* (Dana)	Yasuri-midoriishi	U	OF, US	1–3 m
41	*Acropora danai* (Edwards & Haime)	Togematsu-midoriishi	C	OF, US	1–6 m
42	*Acropora nobilis* (Dana)	Togesugi-midoriishi	C	OF, IF	1–5 m
43	*Acropora grandis* (Brook)	Kuromatsu-midoriishi	C	LS, S	3–12 m
44	*Acropora formosa* (Dana)	Suginoki-midoriishi	A	OF, IF, US, LS	1–8 m
45	*Acropora valenciennesi* Veron		U	US	3–5 m
46	*Acropora exquisita* Nemenzo		U	OF, IF	1–3 m
47	*Acropora akajimensis* Veron	Akajima-midoriishi	R	LS	6–20 m
48	*Acropora microphthalma* (Verrill)	Koeda-midoriishi	C	OF, IF, US	1–4 m
49	*Acropora sekiseiensis* Veron	Sekisei-midoriishi	R	LS	21 m
50	*Acropora austera* (Dana)	Koibo-midoriishi	C	OF, US	1–3 m
51	*Acropora aspera* (Dana)	Himematsu-midoriishi	C	OF, IF	1–2 m
52	*Acropora pulchra* (Brook)	Otome-midoriishi	A	OF, IF	1–3 m
53	*Acropora millepora* (Ehrenberg)	Haimatsu-midoriishi	C	OF, IF	1–4 m
54	*Acropora tenuis* (Dana)	Usueda-midoriishi	C	OF, IF, US	1–5 m
55	*Acropora selago* (Studer)	Tachihanagasa-midoriishi	C	IF, US, S	1–8 m
56	*Acropora yongei* Veron & Wallace	Yangu-midoriishi	C	OF, US	1–3 m
57	*Acropora cytherea* (Dana)	Hanabachi-midoriishi	C	US	2–6 m
58	*Acropora microclados* (Ehrenberg)	Hosozutsu-hanagasa-midoriishi	U	US	6–8 m
59	*Acropora hyacinthus* (Dana)	Kushihada-midoriishi	A	OF, US	1–10 m
60	*Acropora anthocercis* (Brook)	Tamayubi-midoriishi	C	US	3–6 m
61	*Acropora nana* (Studer)	Suge-midoriishi	U	OF, US	1–2 m
62	*Acropora cerealis* (Dana)	Muginoho-midoriishi	R	US	3 m
63	*Acropora nasuta* (Dana)	Hanagasa-midoriishi	A	OF, IF, US	1–5 m
64	*Acropora valida* (Dana)	Hosoeda-midoriishi	C	OF, US	1–3 m
65	*Acropora secale* (Studer)	Toge-hosoeda-midoriishi	U	OF, US	1–3 m
66	*Acropora divaricata* (Dana)	Yakko-midoriishi	U	OF, IF, OS	3–8 m
67	*Acropora echinata* (Dana)	Togezutsu-midoriishi	C	LS,S	8–15 m
68	*Acropora subglabra* (Brook)	Hosozutsu-midoriishi	U	LS	5–8 m
69	*Acropora carduus* (Dana)	Tsutsu-midoriishi	U	LS	4–15 m
70	*Acropora elseyi* (Brook)	Maruzutsu-midoriishi	C	IF, LS, S	1–8 m
71	*Acropora longicyathus* (Edwards & Haime)	Oozutsu-midoriishi	U	US, LS	3 m
72	*Acropora florida* (Dana)	Saboten-midoriishi	R	US	7 m
73	*Acropora wallaceae* Veron	Uooresu-midoriishi	U	IF	1–2 m
74	*Acropora donei* Veron & Wallace		R	OF	3 m
75	*Astreopora myriophthalma* (Lamarck)	Ana-sango	U	OF, IF, US, LS	2–3 m
76	*Astreopora listeri* Bernard	Hira-ana-sango	R	LS	9 m
77	*Astreopora gracilis* Bernard	Senbei-ana-sango	C	IF, US, LS	1–6 m
Family Poritidae					
78	*Porites lobata* Dana	Fukaana-hama-sango	C	OF, IF, US, S	1–3 m
79	*Porites australiensis* Vaughan	Hama-sango	C	OF, IF, S	1–5 m
80	*Porites lutea* Edwards & Haime	Kobu-hama-sango	A	IF, S	1–2 m
81	*Porites okinawensis* Veron	Okinawa-hama-sango	U	LS	6–8 m
82	*Porites cylindrica* Dana	Yubieda-hama-sango	C	IF, S	1–5 m
83	*Porites nigrescens* Dana	Amime-hama-sango	U	OF, IF	1–3 m

84	*Porites lichen* Dana	Beni-hama-sango	C	US	1–5 m
85	*Porites annae* Crossland	Iwa-hama-sango	U	OF, IF	1–2 m
86	*Porites vaughani* Crossland	Boon-hama-sango	R	US	5–6 m
87	*Porites horizontalata* Hoffmeister	Kubomi-hama-sango	R	OF, IF	1–2 m
88	*Porites rus* (Forskål)	Parao-hama-sango	C	IF, LS	1–5 m
89	*Goniopora stokes*i Edwards & Haime	Komochi-hanagasa-sango	R	IF, S	5 m
90	*Goniopora lobata* Edwards & Haime	Hanagasa-sango	U	IF, S	3–5 m
91	*Goniopora columna* Dana	Eda-hanagasa-sango	C	IF, LS, S	3–23 m
92	*Goniopora tenuidens* (Quelch)	Maruana-hanagasa-sango	C	OF, US	2–10 m
93	*Goniopora minor* Crossland	Roppou-hanagasa-sango	U	US	3–5 m
94	*Goniopora fruticosa* Saville-Kent		R	LS	8–20 m
95	*Goniopora stutchburyi* Wells	Ko-hanagasa-sango	U	US	1–7 m
96	*Alveopora catalai* Wells	Shahou-awa-sango	R	LS, S	16 m
97	*Alveopora verrilliana* Dana	Awa-sango	U	US, LS	3–15 m
98	*Alveopora spongiosa* Dana	Awayuki-sango	U	US	1-3 m
Family Siderastreidae					
99	*Psammocora contigua* (Esper)	Yakko-amime-sango	C	IF	1–2 m
100	*Psammocora superficialis* Gardiner	Berubetto-sango	U	OF, IF	1–2 m
101	*Psammocora digitata* Edwards & Haime	Yasuri-amime-sango	R	US	3–5 m
102	*Psammocora haimeana* Edwards & Haime	Toge-amime-sango	R	OF	1–2 m
103	*Coscinaraea columna* (Dana)	Yasuri-sango	U	US, LS	3–5 m
Family Agariciidae					
104	*Pavona cactus* (Forskål)	Saotome-shikoro-sango	C	IF, LS, S	2–20 m
105	*Pavona frondifera* (Lamarck)	Konoha-shikoro-sango	C	IF, S	1–2 m
106	*Pavona clavus* (Dana)	Komon-shikoro-sango	U	LS	10 m
107	*Pavona minuta* Wells	Hama-shikoro-sango	R	LS	5 m
108	*Pavona varians* Verrill	Shiwa-shikoro-sango	C	OF, IF, US	1–4 m
109	*Pavona venosa* (Ehrenberg)	Shikoro-kikumeishi	U	OF, IF, US	1–3 m
110	*Pavona diminuta* Veron		R	LS	8 m
111	*Leptoseris gardineri* van der Horst	Eda-senbei-sango	U	LS, S	18–22 m
112	*Leptoseris explanata* Yabe & Sugiyama	Senbei-sango	R	LS	8 m
113	*Leptoseris scabra* Vaughan	Hashira-senbei-sango	R	LS	18–22 m
114	*Leptoseris mycetoseroides* Wells	Abata-senbei-sango	U	US	1–3 m
115	*Gardineroseris planulata* (Dana)	Hirafuki-sango	U	US, LS	3–6 m
116	*Coeloseris mayeri* Vaughan	Yoron-kikumeishi	U	OF, IF, US	1–6 m
117	*Pachyseris rugosa* (Lamarck)	Shiwa-ryuumon-sango	C	OF, IF, US	1–5 m
118	*Pachyseris speciosa* (Dana)	Ryuumon-sango	C	LS	10–22 m
119	*Pachyseris gemmae* Nemenzo	Ibo-ryuumon-sango	U	LS	6–10 m
Family Fungiidae					
120	*Cycloseris hexagonalis* (Edwards & Haime)	Mutsukado-manjyuuishi	R	LS, S	25 m
121	*Cycloseris patelliformis* (Boschme)		U	LS, S	25 m
122	*Diaseris distorta* (Michelin)	Ware-kusabiraishi	R	LS, S	22 m
123	*Diaseris fragilis* Alcock	Ooware-kusabiraishi	U	LS, S	21–23 m
124	*Heliofungia actiniformis* (Quoy & Gaimard)	Parao-kusabiraishi	U	LS, S	5–22 m
125	*Fungia fungites* (Linnaeus)	Shitazara-kusabiraishi	C	IF, US, S	1–4 m
126	*Fungia valida* Verrill	Nokogiri-kusabiraishi	U	LS, S	8–18 m
127	*Fungia repanda* Dana	Maru-kusabiraishi	U	IF, S	1–3 m

128 *Fungia concinna* Verrill	Hirata-kusabiraishi	U	IF, S	1–6m
129 *Fungia granulosa* Klunzinger	Nami-kusabiraishi	R	IF, S	1m
130 *Fungia paumotensis* Stutchbury	Zouri-ishi	C	IF, US, S	1–20 m
131 *Fungia moluccensis* van der Horst	Nejire-kusabiraishi	R	LS, S	12 m
132 *Ctenactis echinata* (Pallas)	Toge-kusabiraishi	C	LS, S	5–12 m
133 *Sandalolitha robusta* (Quelch)	Herumetto-ishi	R	LS, S	12 m
134 *Lithophyllon lobata* van der Horst	Minami-kawara-sango	R	US	3 m
135 *Podabacia crustacea* (Pallas)	Yaeyama-kawara-sango	R	LS	8 m
136 *Podabacia motuporensis* Veron	Motsupoori-yaeyama-kawara-sango	R	LS	15 m
Family Oculinidae				
137 *Galaxea astreata* (Lamarck)	Chibi-azami-sango	C	IF, LS, S	1–20 m
138 *Galaxea fascicularis* (Linnaeus)	Azami-sango	C	OF, US, LS	1–10 m
139 *Acrhelia horrescens* (Dana)	Eda-azami-sango	U	LS, S	4–5 m
Family Pectiniidae				
140 *Echinophyllia aspera* (Ellis & Solander)	Kikka-sango	C	LS	3–5 m
141 *Echinophyllia orpheensis* Veron & Pichon	Abare-kikka-sango	R	LS	3–5 m
142 *Echinophyllia nishihirai* Veron	Okinawa-kikka-sango	R	LS	12 m
143 *Echinophyllia echinoporoides* Veron & Pichon	Ryukyu-kikka-modoki	C	US, LS	3–12 m
144 *Oxypora lacera* (Verrill)	Ana-kikka-sango	U	LS	2–12 m
145 *Oxypora glabra* Nemenzo	Togehana-sango	R	LS	23 m
146 *Mycedium elephantotus* (Pallas)	Usukami-sango	C	US, LS	2–25 m
147 *Pectinia lactuca* (Pallas)	Suji-umibara	U	LS	3–8 m
148 *Pectinia paeonia* (Dana)	Reesu-umibara	U	LS	5–23 m
149 *Pectinia alcicornis* (Saville-Kent)	Azami-umibara	R	IF, LS	1–5 m
Family Mussidae				
150 *Blastomussa merleti* (Wells)	Kabira-taba-sango	R	LS	22 m
151 *Cynarina lacrymalis* (Edwards & Haime)	Ko-hanagata-sango	R	LS, S	20 m
152 *Scolymia vitiensis* Brüggemann	Azami-hanagata-sango	R	LS	20–23 m
153 *Acanthastrea echinata* (Dana)	Hime-ootoge-kikumeishi	U	OF, US	1–4 m
154 *Acanthastrea rotundoflora* Chevalier		R	LS	10–12 m
155 *Acanthastrea ishigakiensis* Veron	Ishigaki-ootoge-kikumeish	R	US, LS	2–10 m
156 *Lobophyllia hemprichii* (Ehrenberg)	Oo-hanagata-sango	C	LS	2–22 m
157 *Lobophyllia corymbosa* (Forskål)	Maru-hanagata-sango	U	US, LS	2–25 m
158 *Lobophyllia pachysepta* Chevalier	Ibo-hanagata-sango	U	US, LS	3–12 m
159 *Lobophyllia hataii* Yabe, Sugiyama & Eguchi	Parao-hanagata-sango	R	LS	4–20 m
160 *Lobophyllia robusta* Yabe, Sugiyama & Eguchi		U	LS	3–20 m
161 *Symphyllia recta* (Dana)	Hoso-dainou-sango	C	OF, US	2–5 m
162 *Symphyllia radians* Edwards & Haime	Dainou-sango	U	OF, US	1–5 m
163 *Symphyllia valenciennesii* Edwards & Haime	Hanagata-sango	U	US	2–8 m
Family Merulinidae				
164 *Hydnophora rigida* (Dana)	Eda-ibo-sango	C	US, LS	3–10 m
165 *Hydnophora exesa* (Pallas)	Toge-ibo-sango	C	OF, US	1–3 m
166 *Hydnophora microconos* (Lamarck)	Ryukyu-ibo-sango	C	OF, US	1–10 m
167 *Merulina ampliata* (Ellis & Solander)	Sazanami-sango	U	US, LS	1–25 m
168 *Merulina scabricula* Dana	Usu-sazanami-sango	C	OF, US, LS	2–5 m

Family Faviidae

169	*Caulastrea furcata* Dana	Nejire-tabane-sango	U	LS, S	3–23 m
170	*Caulastrea curvata* Wijsman-Best	Hosoeda-tabane-sango	R	LS, S	15–23 m
171	*Caulastrea tumida* Matthai	Tabane-sango	R	?	?
172	*Favia stelligera* (Dana)	Hoshi-kikumeishi	C	US, LS	1–7 m
173	*Favia pallida* (Dana)	Usucya-kikumeishi	C	IF	1–4 m
174	*Favia speciosa* (Dana)	Kikumeishi	U	US, LS	2–6 m
175	*Favia favus* (Forskål)	Subomi-kikumeishi	C	OF, IF, US, LS	1–18 m
176	*Favia matthaii* Vaughan	Ara-kikumeishi	C	OF, IF, US	1–10 m
177	*Favia rotundata* (Veron, Pichon & Wijsman-Best)	Atsu-kikumeishi	U	OF	2 m
178	*Favia lizardensis* Veron, Pichon & Wijsman-Best	Rizaado-kikumeishi	R	US	5 m
179	*Favia veroni* Moll & Borel-Best	Abare-kikumeishi	U	OF, IF	1–4 m
180	*Barabattoia amicorum* (Edwards & Haime)	Barabatto-sango	U	IF, S	1–2 m
181	*Favites chinensis* (Verrill)	Shina-kikumeishi	C	IF	1–2 m
182	*Favites abdita* (Ellis & Solander)	Kamenoko-kikumeishi	C	OF, IF	1–3 m
183	*Favites halicora* (Ehrenberg)	Maru-kamenoko-kikumeishi	U	OF, IF	1–3 m
184	*Favites flexuosa* (Dana)	Oo-kamenoko-kikumeishi	R	OF, IF	1–2 m
185	*Favites russelli* (Wells)	Shimofuri-kamenoko-kikumeishi	R	IF	1–2 m
186	*Goniastrea retiformis* (Lamarck)	Komon-kikumeishi	C	OF	1–3 m
187	*Goniastrea edwardsi* Chevalier	Hira-kamenoko-kikumeishi	U	OF	1–3 m
188	*Goniastrea aspera* Verrill	Pari-kamenoko-kikumeishi	C	OF, IF	1–5 m
189	*Goniastrea pectinata* (Ehrenberg)	Ko-kamenoko-kikumeishi	C	OF, IF	1–2 m
190	*Platygyra daedalea* (Ellis & Solander)	Hira-nou-sango	U	OF, IF, US	2–5 m
191	*Platygyra lamellina* (Ehrenberg)	Nou-sango	U	OF, US	1–4 m
192	*Platygyra sinensis* (Edwards & Haime)	Shina-nou-sango	C	OF, IF, US	1–4 m
193	*Platygyra ryukyuensis* Yabe & Sugiyama	Ryukyu-nou-sango	C	OF, US	1–3 m
194	*Platygyra pini* Chevalier	Hime-nou-sango	U	OF, US	1–3 m
195	*Platygyra contorta* Veron	Midare-nou-sango	C	OF, US	1–10 m
196	*Platygyra yaeyamaensis* (Eguchi & Shirai)	Yaeyama-nou-sango	R	OF, US	1–4 m
197	*Leptoria phrygia* (Ellis & Solander)	Nagare-sango	U	US	1–3 m
198	*Leptoria irregularis* Veron	Midare-nagare-sango	R	US	2 m
199	*Oulophyllia crispa* (Lamarck)	Oo-nagare-sango	R	US	5 m
200	*Oulophyllia bennettae* (Veron, Pichon & Wijsman-Best)		U	US	3 m
201	*Montastrea curta* (Dana)	Maru-kikumeishi	U	OF, IF	1–3 m
202	*Montastrea annuligera* (Edwards & Haime)	Ruri-maru-kikumeishi	U	OF, US	3–5 m
203	*Montastrea magnistellata* Chevalier	Oo-maru-kikumeishi	C	OF, IF	1–3 m
204	*Montastrea valenciennesi* (Edwards & Haime)	Takaku-kikumeishi	U	OF, US	1–3 m
205	*Diploastrea heliopora* (Lamarck)	Dainou-sango	C	US,LS	3–10 m
206	*Leptastrea purpurea* (Dana)	Ruri-sango	C	OF, IF, US, LS	1–12 m
207	*Leptastrea transversa* Klunzinger	Ara-ruri-sango	R	IF	1–2 m
208	*Leptastrea pruinosa* Crossland	Toge-ruri-sango	U	US, LS	5–10 m
209	*Leptastrea bewickensis* Veron, Pichon & Wijsman-Best	Hime-ruri-sango	R	OF, US	1–3 m
210	*Cyphastrea serailia* (Forskål)	Fuka-toge-kikumeishi	C	OF, IF, LS, S	1–12 m
211	*Cyphastrea chalcidicum* (Forskål)	Ko-toge-kikumeishi	C	OF, IF, US, LS	1–10 m
212	*Cyphastrea ocellina* (Dana)	Hime-toge-kikumeishi	U	OF, US	1–5 m
213	*Cyphastrea microphthalma* (Lamarck)	Toge-kikumeishi	R	US, LS	3–22 m
214	*Cyphastrea decadia* Moll & Borel Best	Eda-toge-kikumeishi	U	OF, IF, LS, S	2–10 m
215	*Echinopora lamellosa* (Esper)	Ryukyu-kikka-sango	C	US, LS	2–25 m
216	*Echinopora pacificus* Veron	Taiyou-ryukyu-kikka-sango	R	LS	12 m

217 *Echinopora gemmacea* (Lamarck)	Oo-ryukyu-kikka-sango	R	US, LS	1–12 m
218 *Echinopora mammiformis* (Nemenzo)	Hira-ryukyu-kikka-sango	U	LS	3–18 m
Family Caryophylliidae				
219 *Euphyllia glabrescens* (Chamisso & Eysenhardt)	Hana-sango	U	LS	12–18 m
220 *Euphyllia cristata* Chevalier	Kanmuri-hana-sango	R	LS	13 m
221 *Euphyllia divisa* Veron & Pichon	Koeda-nagare-hana-sango	R	LS	5 m
222 *Euphyllia ancora* Veron & Pichon	Nagare-hana-sango	U	LS, S	3–15 m
223 *Euphyllia yaeyamaensis* (Shirai)	Hanabusa-tsutsumaru-hana-sango	R	LS, S	18–20 m
224 *Plerogyra sinuosa* (Dana)	Mizutama-sango	U	LS	3–6 m
225 *Physogyra lichtensteini* (Edwards & Haime)	Oo-hana-sango	R	LS	12 m
Family Dendrophylliidae				
226 *Turbinaria frondens* (Dana)	Une-suribachi-sango	R	LS	5–10 m
227 *Turbinaria reniformis* Bernard	Yokomizo-suribachi-sango	U	LS	5 m
228 *Turbinaria irregularis* Bernard	Tsutsu-suribachi-sango	U	LS	1–10 m
229 *Turbinaria stellulata* (Lamarck)	Hime-suribachi-sango	R	LS	2 m
Family Tubiporidae				
230 *Tubipora musica* Linnaeus	Kuda-sango	U	US, LS	3–8 m
Family Milleporidae				
231 *Millepora platyphylla* Hemprich & Ehrenberg	Ita-ana-sango-modoki	U	US	3 m
232 *Millepora exaesa* Forskål	Kanboku-ana-sango-modoki	C	OF, IF, US	1–3 m
233 *Millepora intricata* Edwards	Hosoeda-ana-sango-modoki	C	OF, US	2–3 m
234 *Millepora murrayi* Quelch	Hime-ana-sango-modoki	U	OF, US	2–3 m

The richest coral communities were found on the offshore reef flat in which coral cover exceeded 80% and the *Acropora* constituted the greater part of them. Less diverse communities dominated by *Porites* or *Montipora* were observed on the inner reef flat near the shoreline. Large-scale communities (more than approximately 5000 m^2) characteristically found in each topographic area were as follows: *Acropora hyacinthus* on the reef edge, *Acropora digitifera* and *Acropora formosa* on the offshore reef flat, *Porites lutea* and *Montipora digitata* on the inward reef flat near the shoreline. Fairly large communities (approximately 200–500 m^2 or more) consist of a single distinctive species such as: *Acropora echinata, Goniopora columna, Leptoseris gardineri, Galaxea astreata, Pavona cactus*, and so on, were found in some sheltered places mainly in the vicinity of the lower reef slope and the bottom of the bay.

Although Urasoko Bay is a very small bay with an area of only 2.6 km^2, extremely large number of species and genera of hermatypic corals have been recorded in this survey. It is generally known that each coral community is distributed in a specific topographic area (*e.g.* Yonge 1963, Nakamori 1986, Sorokin 1993, Veron 1995). Diverse coral reef topography, such as inward reef flat, offshore reef flat, reef edge, seaward reef slope, inward reef slope, moat, and so on, is compactly aggregated within a very small area of Urasoko Bay, and thus, a great variety of habitat types contribute to the species richness of hermatypic corals.

The second possible factor to improve the species richness of hermatypic corals is diverse

physico-chemical environmental conditions observed in Urasoko Bay. It has been revealed in this bay that the species and generic compositions differ conspicuously between the offshore reef platform and the inward reef platform near the shoreline, in relation to their physico-chemical properties such as salinity, turbidity, transparency, sedimentation, degree of wave exposure, and so on (Fujioka 1997). Thus, high species diversity found in such a small bay seems to be caused by the compactly aggregated diverse coral reef topography and the diverse physico-chemical environmental conditions.

Nishihira and Veron (1995) reported 371 species of hermatypic corals (including 8 non-scleractinian species) from the whole Yaeyama Islands. The number of species found in Urasoko Bay sums up to approximately 70 percent of the total species recorded in the Yaeyama Islands, and is also equivalent to approximately 63 percent of that found in the entire Japanese waters.

Such high species diversity (richness of species) is not restricted to Urasoko Bay. For example, 232 species belonging to 68 genera and 17 families have been identified in Kabira Bay of the same Ishigaki Island by Shirai (1976, 1987) and Shirai and Sano (1985), and 198 species, 58 genera, 17 families have been recorded tentatively in Sakiyama Bay of the Iriomote Island by Nishihira and Yokochi (1990). The latter presented a reliable species list. Both these bays are very small in size (the former is *ca.* 2.8 km^2, the latter is *ca.* 1.7 km^2), like Urasoko Bay, and they have the ecological system similar to Urasoko Bay, in the light of the compactly aggregated diverse coral reef topography and the diverse physico-chemical environmental conditions.

On the other hand, repeated researches on the Shiraho region, which is situated on the south-eastern coast of the same Ishigaki Island, showed that the number of hermatypic coral species was only 79 representing 33 genera and 12 families (Muzik 1984a, 1984b, WWFJ 1986, Shirai and Sano 1985, Shirai 1987, 1989, Mezaki 1991, NACS-J 1991, Okinawa 1994, 1995, 1996, personal observation). Although the Shiraho region is almost equal in size to Urasoko Bay, the topographic feature is characterized by a relatively simple fringing reef system consisting of shallow moats and broad reef flats.

Thus, the number of hermatypic coral species in a area does not depend on the physical size of the reef or coastal area alone, but it correlates with the two ecological factors: compactly aggregated diverse coral reef topography and diverse physico-chemical environmental conditions. This idea can be apply not only to Urasoko Bay but also to other areas of the southern Ryukyu Islands or the Yaeyama Islands, and the topographic diversity and the physico-chemical environmental diversity allow a possible prosperity of hermatypic corals over 200 species even in a small bay. It is, therefore, presumed that a similar number of hermatypic coral species to Urasoko Bay inhabits wherever these two factors are sufficiently provided.

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石垣島浦底湾の造礁サンゴ生物相

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石垣島浦底湾における造礁サンゴの種をとりまとめた。1994～1996年の3年間に実施したフィールド調査の結果，現在までに16科59属234種を確認した。浦底湾は面積わずか 2.6 km^2 の非常に小さな湾であるにもかかわらず，出現した種数は八重山列島全域のおよそ70%，日本全域のおよそ63%にもおよぶものであった。しかしながら，特定の海域で見られるこうした高い種多様性（種数の豊富さ）は浦底湾に限定されたものではなく，同じ石垣島の川平湾や西表島の崎山湾においても確認されている。小さな湾や海域における造礁サンゴの高い種多様性（種数の豊富さ）は，サンゴ礁や海域の物理的大きさとはほとんど関係なく，コンパクトに凝縮したサンゴ礁地形の多様さと物理化学的環境条件の多様さという二つの要素によってもたらされるという考え方を述べた。

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