

6-2-5 Kyushu

(Map 6-2-5)

Province: Kumamoto Pref. at west, Oita Pref. at northeast, Miyazaki Pref. at southeast, and Kagoshima Pref. at south of Kyushu **Location:** Kyushu lies at west of Shikoku and southwest of Honshu **Air temperature:** 17.8°C (annual average, at Ushibuka City, Kumamoto.) **Seawater temperature:** 22.9°C, 22.2 °C and 20.9 °C (annual average, at east off Aburatsu, southwest off Kushikijima (Is.) and Yatsushiro Sea, respectively) **Precipitation:** 2,027.9 mm (annual average, Ushibuka City, Kumamoto) **Total area of coral communities:** 581.8 ha

Protected areas: Unzen-Amakusa National Park: at around Amakusa, including 3 Marine Park Zones and 2 Protected Water Surfaces; Nippo Kaigan Quasi-National Park: coastline at south of Oita and north of Miyazaki, including 2 Marine Park Zones; Nichinan Kaigan Quasi-National Park: coastline at south of Miyazaki and east of Kagoshima, including 1 Marine Park Zone; Kirishima-Yaku National Park: a part of coastline in Kagoshima, including 2 Marine Park Zones.



6-2-5-①

* "号" on this map means "site".



6-2-5-②

* "号" on this map means "site".

6-2-5-④



6-2-5-③

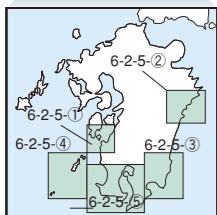


* "号" on this map means "site".



6-2-5-⑤

* "号" on this map means "site".



a. Kumamoto Prefecture

(Map 6-2-5-①)

Satoshi Nojima

1 Corals and coral reefs

1. Geographical features

On the west of Kyushu in Kumamoto Prefecture lie the Amakusa Islands. About 120 islands, including Ohyano Island, Amakusa Kamishima, and Amakusa Shimoshima, are surrounded by the Ariake Sea, the Yatsushiro Sea, and the Sea of Amakusanada, which is part of the East China Sea. Amakusa Shimoshima is the westernmost and largest island; its oval shape measures about 45 km in the north-south direction and 23 km east to west. While large rivers are not found in the Amakusa area, small rivers include the Shimotsufukae, Icchoda, Kamegawa, and Hirose rivers. The northern parts of the coastline are relatively smooth, while the southern parts involve a more complex ria coast.

The western coasts of the Amakusa Islands are subtropical. Marine park zones have been designated at seven sites - two in Reihoku (Tomioka Marine Park), one in Amakusa (Amakusa Marine Park), and four in Ushibuka (Ushibuka Marine Park) - in recognition of their subtropical nature and distinguished marine landscapes (Department of National Park, Ministry of Health and Welfare National Parks Department 1970).

2. Coral distribution

In Kumamoto Prefecture, corals are mostly found around the Amakusa Islands and the southern Yatsushiro Sea including Minamata Bay. Ninety-eight hermatypic coral (hereafter, coral) species have been recorded from around Amakusa (Veron 1992a, c; Nishihira and Veron 1995). Colonies are observed all along the west-facing rocky shores from Itsuwa, Reihoku, Amakusa, and Kawaura to Ushibuka on Amakusa Shimoshima. In fact, corals are found on 94 % of this southern area's rocky shores (Nature Conservation Bureau, Environment Agency 1994). Coral communities can cover several to a dozen hectares around Ushibuka and the neighboring

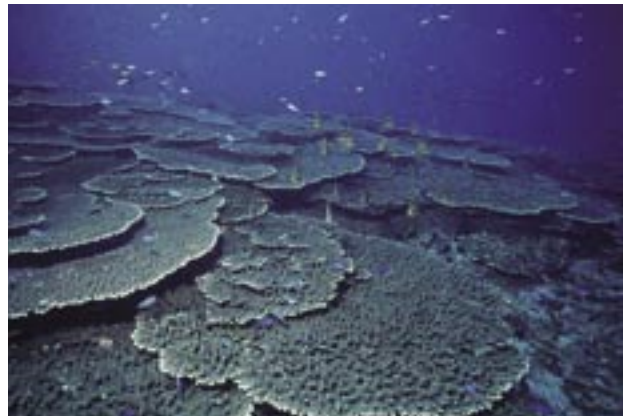


Photo. 1. Tabulate *Acropora* dominant community in Kuwashima (Is.), Ushibuka City, Kumamoto Prefecture.

islands, such as Katashima, Oshima, and Kuwashima (Photo. 1) (Nature Conservation Bureau Environment Agency 1994).

Near Ushibuka, the dominant coral species is *Cyphastrea serailia*, followed by *Acropora solitaryensis*, *Favia speciosa*, *Mycedium elephantotus*, *Favites abdita*, *Porites heronensis*, *Hydonophora exesa*, *Goniastrea australiensis*, and *Psammocora superficialis* (Nojima and Yeemin 1999). Tabulate corals, such as *A. solitaryensis*, *A. hyacinthus*, and *A. gemmifera*, are found at depths of less than 10 m, while massive or encrusting colonies of *C. serailia*, *Echinophyllia aspera*, and *Favia speciosa* are seen at depths from 10 m to at least 30 m (Nojima and Yeemin 1999). Partial bleaching of some coral colonies was observed in 1998, but subsequently these well-developed coral communities appear to have remained in a relatively stable condition (Nature Conservation Bureau, Environment Agency 1999b).

3. Water quality and physical environment

The Tsushima Warm Current, flowing from the East China Sea, influences the seas around the Amakusa Islands. Diverging from the Kuroshio Current at the edge of the continental shelf to the west of Amami Oshima (Is.), the Tsushima Warm Current flows to the west of the Danjo and Goto archipelagos, through the Tsushima Straits, and into the Sea of Japan. The Tsushima Warm Current mixes with cold continental coastal water, and its water quality becomes quite different from that of the parental Kuroshio Current (Kumamoto Prefecture 1968).

A shunt current of the Tsushima Warm Current diverges from the main stream southwest of Kyushu, changes direction south of the Goto Archipelago, and then flows

southward as an anti-current along the western coasts of the Amakusa Islands, influencing the coastal region. The western shores of Kyushu, including Amakusa, have a tidal range that generally exceeds 3 m, and the range can be even greater in the inner bays. Big waves and strong currents are common features of the seas west of Amakusa facing to the East China Sea. During the rainy season, the salinity can drop as low as 14 PSU in the Hayasaki and Nagashima straits at the entrances to the Ariake and Yatsushiro seas, while the west coast, washed by oceanic water, generally has salinities above 30 PSU.

The water temperature usually fluctuates between 16 and 28°C in the course of the year near Ushibuka. In February 1963, a year known for heavy snow, a record low water temperature of 12.6°C occurred, and a large number of coral colonies died. During the 40 years since this event, however, the average monthly water temperatures for February, the month with the lowest water temperatures of the year, have gradually risen.

4. Notable species and ecosystems

A large *Porites* colony (ca., 3 m in diameter), probably the largest in Kumamoto Prefecture, was found in 1995 in the inner bay of Haruhai off Ushibuka. A specimen of *Acanthastrea amakusensis* (= *Micromussa amakusensis*) was collected off Ushibuka in 1990 by J.E.N. Veron, who described it as a new species; it was subsequently designated a rare species of Kumamoto Prefecture (Environment Conservation Division Kumamoto Prefecture 1998). *Cycloseris vaughani* was collected in Tomioka Bay in northern Amakusa Shimoshima in 1965, but it has not been observed since and has thus been designated an extinct species in the red data book for Kumamoto Prefecture (Environment Conservation Division Kumamoto Prefecture 1998). Moreover, at two locations, reef-like accumulations of coral carbonate have been found; these could be an evidence of the former existence of patch reefs.

2 Situation of usages

1. Tourism

Many of the Amakusa Islands are within the boundaries of Unzen-Amakusa National Park, with different park districts located in various areas. Glass-bottomed boats, including a half-submersible glass-bottomed boat that has been gaining in popularity since its recent introduction,

operate in concentrated marine park zones in Ushibuka. The number of visiting SCUBA divers has increased in recent years, and, according to a 1994 questionnaire, many dive shops (mostly in Kumamoto) use the “Famous 15” dive spots in Amakusa and Ushibuka. Locations in Myokengaura in Amakusa are popular training spots for those seeking to acquire diving certification (Study Group for Undersea Scenery Resources in Amakusa District 1995). Additional activities on the western coasts of the Amakusa Islands include recreational surfing, off-shore recreational fishing, and boats for hire.

2. Fishery

Small-scale fisheries target diverse species in the Amakusa Islands; ventures include net fishing for *Trachurus japonicus*, *Scomber japonicus*, and *Sardinopus melanostictus*; dragnet fishing for *Penaeus japonicus*; and rod fishing, fixed-net fishing and gill-net fishing for *Parapristipoma trilineatum*, *Pagrus major*, *Trachurus japonicus*, *Scomber japonicus*, squids, *Coryphaena hippurus*, and *Trichiurus japonicus*. Fishes such as *Pagrus major*, *Seriola quinqueradiata*, and *Takifugu rubripes*, shellfishes such as pearl oysters and *Mimachlamys nobilis*, and prawns (*Penaeus japonicus*) are actively cultivated in aquaculture facilities near the inner bay of the Yatsushiro and Ariake seas.

3 Threats and disturbances

1. Crown-of-thorns starfish

The first crown-of-thorns starfish (*Acanthaster planci*) reported from the Amakusa Islands was in Katashima in 1994, and one or two individuals of *A. planci* have been reported from the area every year since. However, funded by a grant from the Ministry of the Environment, members of the Ushibuka Diving Club collected and exterminated approximately 200 *A. planci* in Katashima between July 2002 and August 2003, and this starfish has not been seen in the area since then (Nature Conservation Bureau, Ministry of the Environment 2003; Ushibuka Diving Club 2003d, 2003f).

2. Coral-eating gastropods

Six species of coral eating gastropods have been found around Ushibuka: *Habromorula spinosa*, *Drupella fragum*, *Coralliophila bulbiformis*, *C. erosa*, *C. costularis*, and *C. radula* (Nojima 1993). In September 1991, the sequen-

tial typhoons Nos. 17 and 19 heavily damaged the coral communities of this area, and predation damage caused by coral-eating gastropods became obvious shortly afterward. Volunteer divers, mostly from the Ushibuka Diving Club, collected and exterminated these gastropod species during the subsequent 6 years. This activity continues mainly in Ushibuka Marine Park as it is a priority site. 46,607 individual coral-eating gastropods, chiefly *H. spinosa*, had been collected by the end of March 2003.

4 Monitoring

In several dive spots, the Ushibuka Diving Club has been monitoring water temperature and populations of coral-eating gastropods and *A. planci*. The Amakusa Marine Biological Laboratory (Kyushu University) has been monitoring water temperature and regularly conducting surveys of coral coverage, spawning events, and juvenile coral recruitment.

5 Conservation

The typhoons of 1991 caused the destruction and collapse of many *A. solitaryensis* colonies at Gesushima in Ushibuka Marine Park. Volunteer divers, mostly from the Ushibuka Diving Club, retrieved broken colonies from where they had fallen into deeper areas and transplanted them to their former locations. These corals are showing some signs of recovery.

6 Necessary measures

Outbreaks of *A. planci* or coral-eating gastropods are not occurring around the Amakusa Islands at present. However, preventative measures have not been taken at Koshikijima (Is.) in the south of Amakusa, where there was an *A. planci* outbreak in the past. It is very possible that the *A. planci* outbreaks at Ushibuka arose from populations in Kohiskijima, and preventative measures around Koshikijima should be necessary in the future.

Disagreements between stakeholders (traders, recreational fishers, professional fishers) regarding the use of the marine resources of Amakusa have not yet caused major problems, but conflicts concerning sites are occurring between divers and glass-bottomed boat companies. It will be necessary to seek mutual understanding and

agreement between all interested parties for the future management of the area.

b. Oita Prefecture

(Map 6-2-5-②)

Satoshi Nojima

1 Corals and coral reefs

1. Geographical features

Oita Prefecture is located in the north east of the island of Kyushu, facing the Suonada Sea to the north; Beppu Bay is located at the center, and along the coast, Bungo Strait is located at the south. From the Suonada coast at Nakatsu, a vast tidal flat extends to Bungotakada. Most of the coastline of Beppu Bay is reclaimed land or has revetments. The Kunisaki Peninsula, from Bungotakada to Kitsuki, was formed by volcanic activity and is surrounded primarily by rocky shores. The southern coastline from Saganoseki to Fukushima Island, near the border of Miyazaki Prefecture, has a ria coastline. This part of the southern coastline falls within the Nippo Kaigan Quasi-National Park, where four sites were designated as the Kamae Marine Park in 1974. The adjoining Minamikitaura Marine Park in Miyazaki Prefecture was also established in 1974 (Nature Conservation Bureau, Environment Agency 1974).

2. Coral distribution

The temperature, salinity, and transparency (Yanagi 1985) of the waters in Oita Prefecture support hermatypic corals (hereafter corals) around Kamae Marine Park in the south and Kunisaki Peninsula in the north. In Kamae Marine Park, a 1965 survey recorded 21 identified coral species (Table 1) and many unidentified species, suggesting that the total number of coral species in the park is approximately 40 (Oita Prefecture 1969). In the Kamae Marine Park area *Pavona decussata* and *Acropora tumida* dominates along the mainland Kyushu coast. *Acropora hyacinthus* and *Montipora* sp. are dominant on Yakatajima Island, and a tabulate *Acropora* (possibly *A. solitaryensis*) dominates near Fukushima (Oita Prefecture 1969). Around Kamae Marine Park, a 1990 survey revealed 14 sites occupied by coral communities, whose area reached 133 ha in total. 65 % of this total 86.2 ha, were located within Kamae Marine Park. Of the communities, the large

est coral community, measuring 51.5 ha and dominated by tabulate corals, was found near Fukushima (Nature Conservation Bureau, Environment Agency 1994).

3. Water quality and physical environment

The sea between Sekizaki in southern Oita Prefecture and Cape Sata in Ehime Prefecture (Shikoku) is constrained, forming a narrow pass in the Bungo Suido Channel that is called 'Hayasuinoseto'. The current in the Bungo Suido Channel moves at 80-100 cm/s during the rise and fall of the spring tide and reaches a maximum flow rate of 200 cm/s at Hayasuinoseto (Yanagi 1985). The water transparency in the Bungo Strait is comparatively high at 15-20 m, while it decreases to 4-10 m near the Kunisaki Peninsula; The salinity in this area is influenced by the open sea and measures 33.5 Ppt or greater, throughout the year (Yanagi 1985). A survey of Kamae Marine Park conducted in 1966-67 found that the seawater temperature in Kamae Bay fluctuated between 13°C (in February) and 25.5°C (in September); the same survey found that the water temperature off Udozaki ranged from 15 to 28°C, owing to the influence of the open sea. The inner bay frequently exhibits a low transparency of 10 m or less, while the transparency outside the bay, in waters facing Yakatajima and Fukushima, often exceeds 12 m both in winter and summer (Oita Prefecture Fisheries Experiment Station 1967).

4. Notable species and ecosystems

A 1968 survey revealed large coral communities dominated by *Pavona* and *Acropora* (possibly *A. pruinosa*) off Koetao near the town of Kamae, and coral communities comprised mainly of *Acropora* (possibly *A. pruinosa*) along the west coast of Nagoyahana. In addition, an extensive tabulate coral community of *A. solitaryensis* (identified from photographs) and *A. hyacinthus* was found offshore near Yakatajima and Fukushima (Oita Prefecture 1969).

2 Situation of usages

On tidal flats facing the Suonada Sea, *Meretrix lusoria*, *Scapharca broughtonii*, and *Penaeus japonicus* are raised by aquaculture; *Pleuronectes yokohamae* is cultivated in Beppu Bay at Hinode Town; *Seriola quinqueradiata* and pearl oysters are raised at several locations along southern stretches of the ria coastline. The Bungo Suido Channel is known for the *Trachurus japonicus* and *Scomber japonicus* that are hauled in with single-rod fishing.

3 Threats and disturbances

Although only limited information is available, there is no indication of any recent outbreaks of the crown-of-thorns starfish (*Acanthaster planci*). However, several individuals of *A. planci* were collected in waters off the adjacent Miyazaki Prefecture in 1973 (Liaison Conference of Marine Parks 1975), raising the possibility that this species may be found within Oita Prefecture. An outbreak of *Drupella fragum* was reported in Nichinan Marine Park in Miyazaki Prefecture (Takayama and Shirasaki 1990; Nature Conservation Bureau, Environment Agency 1994), but no sightings of this coral-eating gastropod have been reported in Oita Prefecture.

4 Conservation

Active aquaculture of yellowtail and pearl oysters can be found in the bays along the ria coast, but it is feared that these operations will result in the deterioration of water quality and coral habitat (Oita Prefecture 1969; Liaison Conference of Marine Parks 1975). Of the four marine park zones, two are actively used for surf-casting, and the lack of proper garbage disposal has been noted there. This problem has become evident since the areas were designated as the marine parks (Liaison Conference of Marine Parks 1975). *A. planci* has not been observed

in Oita Prefecture, but the outbreaks have occurred off Amakusa in Kumamoto Prefecture. The similarity of the seawater temperatures in Oita and Kumamoto areas argues that monitoring and a precautionary approach should be implemented in Oita Prefecture (Nature Conservation Bureau, Ministry of the Environment 2003a).

Table 1. Hermatypic coral species list in Kamae Marine Park Zone by Oita Prefecture (1969).

Listed species	Remarks
<i>Pocillopora damicornis</i>	
<i>Montipora</i> sp.	
<i>Acropora squarrosa</i>	<i>A. tumida</i> at present
<i>Acropora pectinata</i>	<i>A. hyacinthus</i> at present
<i>Acropora stuederi</i>	possibly <i>A. pruinosa</i>
<i>Acropora leptocyathus</i>	possibly <i>A. solitaryensis</i>
<i>Porites</i> sp.	
<i>Goniopora planulata</i>	<i>G. lobata</i> at present
<i>Pavona decussata</i>	
<i>Podabacia</i> sp.	<i>Lithophyllon undulatum</i> at present
<i>Pectinia lactuca</i>	<i>Physophyllia ayleni</i> at present
<i>Acanthastrea hemprichi</i>	identified as <i>A. hemprichii</i>
<i>Lobophyllia</i> sp.	
<i>Hydonophora exesa</i>	
<i>Caulastrea tumida</i>	
<i>Favia speciosa</i>	
<i>Favites abdita</i>	
<i>Platygyra lamellina</i>	possibly <i>P. daedalea</i> or <i>P. contorta</i>
<i>Euphyllia fimbriata</i>	<i>E. ancora</i> at present
<i>Turbinaria peltata</i>	
<i>Turbinaria</i> sp.	

Total : 21 species

c. Miyazaki Prefecture

(Maps 6-2-5-②, ③)

Satoshi Nojima

1 Corals and coral reefs

1. Geographical features

Miyazaki Prefecture is located to the east of mainland Kyushu; it has a 400-km coastline that faces Shibushi Bay in the southern region, the Hyuganada Sea in the south-central region, and the Bungo Strait in the northern region. The coastline in the northern and southern regions is characterized by complex rocky shores. In the central region, the coastline consists of flat beaches and sandy beaches. The southern coastal region has been designated as the Nichinan Kaigan Quasi-National Park, and six sites (total area, 55.9 ha) within the park district have been designated as the Nichinan Marine Park (Department of National Parks, Ministry of Health and Welfare 1970). The northern coastal region was designated as the Nippo Kaigan Quasi-National Park. Six sites within the park, along with Kamae Marine Park, were designated as Minamikitaura Marine Park (total area, 62.2 ha) (Nature Conservation Bureau, Environment Agency 1974).

2. Coral distribution

In Miyazaki Prefecture, hermatypic corals (hereafter referred to as corals) are distributed throughout Shibushi Bay and the Nichinan Coast in the south and in the Minamikitaura Marine Park in the north (Nature Conservation Society of Japan 1967; Nature Conservation Bureau, Environment Agency 1994). In a survey of the Minamikitaura Marine Park conducted in 1966, seven coral species were recorded (Table 1; Nature Conservation Society of Japan 1967). In a similar survey conducted in 1991, 22 species, including *Acropora solitariaensis* and *A. af. hyacinthus*, as well as large colonies of *Turbinaria peltata* (Fukuda *et al.* 1991), were recorded. Based on this survey, the average coral coverage in the region was estimated to be 13 %.

Seven species of coral were recorded in the Nichinan

Marine Park (Table 1; Nature Conservation Society of Japan 1967). In a survey of Komeotoura Bay conducted in 1991, the mean coral coverage was found to be low (8 %); however, 52 coral species were recorded. The coral community at this site was dominated by tabulate corals such as *A. af. hyacinthus*, *A. af. solitaryensis*, and *A. gemmifera* (Fukuda *et al.* 1991).

In a survey conducted in 1990, coral communities were located at 49 sites in the prefecture, giving a total coral coverage area of 460 ha. In the Nichinan Marine Park, the total coverage area for six of the sites totaled approximately 75 ha. However, in the Minamikitaura Marine Park, the total coverage area for six of the sites totaled only about 3.4 ha. Coral communities with high coverage were also found in areas adjacent to these marine park zones. The communities at these sites were dominated by tabulate forms (especially *A. af. hyacinthus*), which accounted for 60–70 % of the total coral abundance (Nature Conservation Bureau, Environment Agency 1994).

3. Water quality and physical environment

The Kuroshio Current exerts a strong influence on the dynamics of water movement in the region from Hyuganada to Bungo Strait. This current flows close to Miyazaki Prefecture and forms a return current near Hososhima Island that flows in the direction of Okinoshima Island. The current then flows toward Cape Ashizuri (Shikoku) and Cape Shionomisaki on the Kii Peninsula (Nature Conservation Society of Japan 1967).

At Aburatsuhigashi, located near the Nichinan Marine Park, the lowest and highest seawater temperatures recorded in 1975 were 17.6°C in March and 25.4°C in August, respectively. The salinity at this site remains constant throughout the year, at around 34 PSU, which is close to that of the open ocean. Transparency at the site exceeds 10 m (Nature Conservation Society of Japan 1967).

At Miyanoura Bay, located close to the Minamikitaura Marine Park, the lowest and highest seawater temperatures recorded in 1975 were 15°C in February and 26°C in August, respectively. The salinity at this site is 34 PSU. Transparency is about 10 m inside the bay, but can reach 15 m near Shimanourajima Island (Nature Conservation Society of Japan 1967).

4. Notable species and ecosystems

Large-scale tabulate coral communities are observed

at Mimihokesho (ledge) and in the southern regions of Shimanourajima Island, close to the Minamikitaura Marine Park. Similar types of community are also found at Oshima Island, Meotoura Bay, and on the Tsuchishimazaki/Dojima Islands in the Nichinan Marine Park (Nature Conservation Society of Japan 1967). Large colonies of *T. peltata*, reaching 2–3 m in diameter, are found at several sites in the Minamikitaura Marine Park (Site 1) (Nature Conservation Bureau, Environment Agency 1994). *Merulina ampliata* and *Echinopora lamellosa* are present at Komeotoura, which is likely to be the northern distribution limit for these species (Fukuda *et al.* 1991; Veron 1992; Nishihira and Veron 1995).

2 Situation of usages

Coastal waters in this region are strongly influenced by the Kuroshio Current which flows in a northerly direction. This current produces complex oceanographic conditions in areas where it mixes with river inflow water and coastal water from the Bungo Strait. This region is important as a fishery for sardines and mackerel. Further offshore, this region is important as a fishing area for skipjack and tuna.

The fisheries in this zone rely on net fishing techniques and the use of encircling nets and dragnets. In the northern area, the aquaculture of yellowtail and red sea bream represent important industries. In the central areas, patch net, pole-and-line, dragnet, long line, and trawl nets are used as the primary fishing techniques. Offshore, in the southern regions, pole-and-line fishing for skipjack and long line fishing for tuna are important deep-sea fishing industries (Miyazaki Prefecture 2002).

3 Threats and disturbances

1. Crown-of-thorns starfish

Several crown-of-thorns starfish (*Acanthaster planci*) were collected in Miyazaki Prefecture during a survey conducted in 1973 (Liaison Conference of Marine Parks 1975). However, no outbreaks have been reported in this area in recent years.

2. Coral-eating gastropods

Outbreaks of *Drupella fragum* have been frequently reported in the Meotoura region since 1988 (Takayama and Shirasaki 1990; Fukuda *et al.* 1991; Nature Conservation Bureau Environment Agency 1994). A survey conducted in 1990 found the damage to corals located at various sites in the Nichinan Marine Park (Nature Conservation Bureau Environment Agency 1994).

4 Necessary measures

Predation damage caused by *D. fragum* (Nature Conservation Bureau Environment Agency 1994) represents the most immediate threat to the coral communities in Miyazaki Prefecture. Occurrence of *A. planci* has been reported since 1973 (Liaison Conference of Marine Parks 1975). The abundance of these coral predators should be carefully monitored, especially considering that the dominant coral species in the marine park zones, *A. af. hyacinthus*, is preyed upon by both *D. fragum* and *A. planci*.

Table 1. Hermatypic coral species list in Minami Kitaura and Nichinan Marine Park Zones by Nature Conservation Society of Japan (1967).

Species	Minami Kitaura Marine Park Zone	Nichinan Marine Paerk Zone	Remarks
<i>Pocillopora damicornis</i>	○		
<i>Stylophora pistillata</i>	○	○	
<i>Acropora studeri</i>	○	○	possibly <i>A. pruinosa</i> or <i>A. tumida</i>
<i>Acropora leptocyathus</i>	○	○	possibly <i>A. hyacinthus</i>
<i>Porites tenuis</i>	○		<i>P. australiensis</i> at present
<i>Caulastrea tumida</i>		○	
<i>Favia speciosa</i>	○	○	
<i>Platygyra lamellina</i>		○	possibly <i>P. daedalea</i> or <i>P. contorta</i>
<i>Turbinaria undata</i>	○	○	possibly <i>T. peltata</i>
Total	7	7	

d. Kagoshima Prefecture

(Maps 6-2-5-①, ③~⑤)

Satoshi Nojima

1 Corals and coral reefs

1. Geographical features

Both the Coral reef and High-latitude coral community regions exist in Kagoshima Prefecture. These two regions both have their boundaries at the Tokara Archipelago, which is the reported northern limit of coral reefs, except for the recently discovered Iki Islands (Yamano *et al.* 2001).

This section describes the non-coral reef region that is located primarily around mainland Kyushu. For Coral reef region, refer to Chapter 6-1-2. The northern part of Kagoshima Prefecture is in southern mainland Kyushu and features two big peninsulas, the Satsuma and Osumi peninsulas. Between them lie Kagoshima Bay and Sakurajima Island, which is the most eminently active volcano in Japan. Kagoshima Prefecture faces both the East China Sea and the Pacific Ocean. In the south, a chain of islands extends from Tanegashima Island and Yakushima Island to the Amami Archipelago. In addition, the Kusanagi, Uji, and Koshikijima archipelagos face the East China Sea in the west. Nagashima and Shishijima islands are located in the northwest and face the Yatsushiro Sea.

In the Kyushu area, two marine park zones, Sakurajima and Satamisaki, encompass a total of 26.5 ha. These marine parks were among the first to be designated in Japan, in 1970. (Department of National Parks, Ministry of Health and Welfare 1970).

2. Coral distribution

Many hermatypic corals (hereafter, corals) have been recorded in the Kyushu area, including in Nagashima and Shishijima to the north (Nature Conservation Bureau, Ministry of the Environment 1994). In a coral survey conducted in 1968, 17 coral species were identified in Sakurajima Marine Park and eight species on Chiringashima Island near Ibusuki (Table 1). Moreover,

in Nagasakibana at the tip of the Satsuma Peninsula, 11 coral species were identified. In Satamisaki Marine Park at the tip of the Osumi Peninsula, 23 species were identified (Table 1; Kagoshima Prefecture 1969).

A 1990 survey reported coral communities in 24 locations, totaling 45 ha, around the Osumi and Satsuma Peninsula, the Uji and Koshikijima Archipelago, and Nagashima. One of the 24 locations, an area of 3 ha, disappeared as a result of reclamation following the survey. Communities that had especially high coral coverage, with on branching *Acropora* in calm areas and tabulate *Acropora* in wave-exposed areas, were found around the Uji and Koshikijima archipelagos (Nature Conservation Bureau, Environment Agency 1994).

3. Water quality and physical environment

The sea area around Kagoshima area of mainland Kyushu is relatively warm owing to the influence of the warm Kuroshio and Tsushima currents. The water temperatures range from 15 to 28°C even off Nagashima which is located at the northernmost Kagoshima. Kagoshima Bay is long and narrow, being about 15 km wide and 100 km long; the depth drops rapidly to 200 m. The current during spring tides reaches approximately 50 cm/s in the center of the bay and about 90 cm/s at the fastest point, around the Nishisakurajimasuido waterway. The salinity is high at 33 PSU or higher throughout the year (Sakurai 1985). The seawater temperatures of inner Kagoshima Bay range from 15 to 28°C, as in Nagashima, but Cape Sata, at the entrance of the bay, experiences slightly higher winter temperatures of between 17 and 29°C (Kagoshima Prefecture 1969; Sakurai 1985).

4. Notable species and ecosystems

Around the Uji and Koshikijima Archipelago, the main coral community type is that of so-called 'southern Japan coastal type,' (Fukuda *et al.* 1991), as seen on the Shikoku and Kii Peninsula. In the comparatively wave-exposed areas of the Uji and Koshikijima archipelagos, Nagasakibana, and Cape Sata, coral communities are formed primarily by tabulate corals, such as *Acropora hyacinthus*, *A. solitaryensis*, and *A. gemmifera* (Nature Conservation Bureau, Ministry of the Environment 1994).

2 Situation of usages

Aquaculture is actively undertaken in Kagoshima

Prefecture; for example, *Seriola quinqueradiata* is cultivated around Nagashima and Shishijima in the north, and *Seriola dumerili* is raised in Kagoshima Bay. Drifting gill-net fishing is prevalent in Hokusatsu of the northern Satsuma area and in the Koshikijima Archipelago.

3 Threats and disturbances

An outbreak of the crown-of-thorns starfish (*Acanthaster planci*) was found off Kannonzaki near Sakurajima Marine Park in the summer of 2003. Since that time, about 200 individual starfish have been successfully exterminated by local divers. An outbreak of *A. planci* also occurred around the Koshikijima and Uji archipelagos, which are not marine parks, some time in 1990 (Nature Conservation Bureau, Ministry of the Environment 1994). Fragmentary information showed that *A. planci* still inhabits the area, but a current,

detailed status survey of the area is needed.

4 Necessary measures

As mentioned above, an outbreak of *A. planci* occurred around the Koshikijima and Uji archipelagos in 1990 (Nature Conservation Bureau, Ministry of the Environment 1994), but no specific measures have yet been taken to deal with this. Damage caused by *Terpios* (see also Chapter 2-2) has also been reported in the Uji Archipelago. Koshikijima and Uji archipelagos could serve as the supply sources of *A. planci* larvae to the Amakusa Islands in Kumamoto Prefecture and to the Goto Archipelago in Nagasaki Prefecture to the north. Therefore, it should be necessary to immediately survey of all of these areas in order to understand their current status and design appropriate actions.

Table 1. Hermatypic coral species list in Kagoshima Prefecture (Kagoshima Prefecture 1969).

Species	Sakurajima Marine Park Zone	Chiringashima	Nagasaki-bana	Satamisaki Marine Park Zone	Remarks
<i>Pocillopora damicornis</i>	○			○	
<i>Stylophora pistillata</i>				○	
<i>Stylophora mordax</i>				○	
<i>Montipora informis</i>	○			○	
<i>Montipora cactus</i>	○			○	
<i>Montipora</i> sp.			○		
<i>Acropora pectinata</i>	○	○	○	○	possibly <i>A. hyacinthus</i>
<i>Acropora reticulata</i>	○				
<i>Acropora nasuta</i>		○			
<i>Acropora nasuta crassilabita</i>	○				
<i>Acropora leptocyathus</i>			○	○	possibly <i>A. solitaryensis</i>
<i>Acropora humilis</i>			○	○	possibly <i>A. gemmifera</i>
<i>Acropora danai</i>				○	
<i>Acropora cf. danai</i>			○		
<i>Acropora specifera</i>	○	○			
<i>Acropora cymbicyathus</i>	○				
<i>Acropora</i> sp.	○	○		○	
<i>Porites tenuis</i>	○	○	○	○	<i>P. australiensis</i> at present
<i>Porites singaporensis</i>				○	
<i>Goniopora lobata</i>	○				
<i>Psammocora exesa</i>				○	
<i>Pavona decussata</i>	○		○	○	
<i>Lobophyllia robusta</i>				○	
<i>Symphyllia recta</i>				○	
<i>Hydnophora exesa</i>	○	○	○	○	
<i>Hydnophora microconos</i>				○	
<i>Caulastrea tumida</i>				○	
<i>Favia speciosa</i>	○	○	○	○	
<i>Favites abdita</i>	○	○	○	○	
<i>Goniastrea pectinata</i>	○				
<i>Platygyra lamellina</i>	○		○	○	possibly <i>P. daedalea</i> or <i>P. contorta</i>
<i>Oulastrea crispata</i>				○	
Total	17	8	11	23	