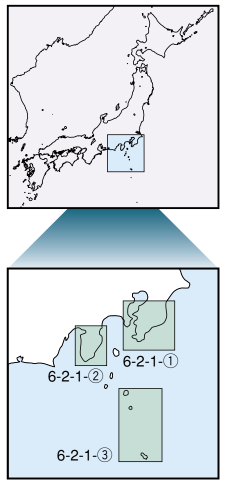
6-2-1 Boso Peninsula, Izu Peninsula and Izu Islands
(Map 6-2-1)

Province: Boso Peninsula: Chiba Pref.; Izu Peninsula: Shizuoka Pref.; Izu Islands: Metropolis of Tokyo **Location:** Boso Peninsula: east of Tokyo Bay; Izu Peninsula: between Sagami Bay (at east) and Suruga Bay (at west); Izu Islands: lies along 140˚E and between 35˚-33˚N **Air temperature:** 16.5˚C (annual average, at Irozaki, southern tip of Izu Peninsula) **Seawater temperature:** 20.5˚C (annual average, at west off Irozaki, Izu Pininsula) **Precipitation:** 1,834.8 mm (annual average, at Irozaki) **Total area of coral communities:** 425.3 ha **Protected areas:** Fuji-Hakone-Izu National Park: includes part of coastal area of Izu Peninsula and whole Izu Islands; Minami Boso Quasi-National Park: coastline of Boso Peninsula; Miyakejima Marine Park Zone in Izu Islands, and Katsuura Marine Park Zone in Boso Peninsula

＊ "号" on this map means "site".



a. Boso Peninsula

(Map 6-2-1-①)

Kazuyuki Shimoike

1 Corals and coral reefs

1. Geographical features

The coastal area of the southern Boso Peninsula was dominated by shallow coral reefs 7,000–5,000 years ago, but crustal movements produced upheaval with recurrent earthquakes in the Kanto region (flat land around Tokyo). Therefore, three to four steps of a marine terrace have developed below the cliff, and marine deposits containing fossil layers of corals and shellfishes extend 20 m or more above sea level (Kaizuka 2000). A fossil coral layer is located 15–20 m above sea level in the vicinity of Tateyama Bay, which is geologically important as the only upheaval coral reef on Honshu (the main island of Japan). Notably, a coral layer of Numa is well preserved in Tateyama City, and about 100 Scleractinian coral species have been confirmed (Eguchi 1971a).

2. Coral distribution

According to the report of the marine biotic environment survey in the 4th National Survey on the Natural Environment (Nature Conservation Bureau, Environment Agency 1994), hermatypic coral communities were distributed from Tateyama Bay, on the west coast of the Boso Peninsula, to Ohara on the east coast. Corals in Japan tend to extend their distribution according to a temperature gradient that is influenced by the Kuroshio Current, and the coral distribution on the Boso Peninsula is thought to reflect this gradient. In the coastal area of Chiba Prefecture (mostly in Tateyama Bay, e.g., Banda, Hazama, Okinoshima, and Daibusa), 32 species of hermatypic corals and four species of soft corals have been identified. The northern limit corals identified on the Boso Peninsula are *Goniopora* sp. and *Acropora* sp. at Cape Daibusa in Tomiura on the west coast and *Oulastrea crispata* at Amatsukominato on the east coast. The latter has been confirmed as the hermatypic coral species that is distributed at the highest latitude (Nishihira and Veron 1995). In Tateyama Bay, 25 coral species have been identified at depths of 10–15 m (Veron 1992a), but no corals have been found at depths shallower than 5 m, except in Okinoshima and Daibusa (Nature Conservation Bureau, Environment Agency 1994).

3. Water quality and physical environment

A four-year survey conducted in this region (Hagiwara 2003) found that the highest mean monthly water temperature was 23.8°C in August; the lowest means were 14.3°C in March and lessthan 18°C in December–May. salinity ranged from 33.0 to 35.0 PSU and mean salinity was 34.3 PSU. The amount of suspended solids (SS) in seawater was 1.27 mg/l on average, i.e., 2.1–4.0 times the value reported at Akajima in Okinawa Prefecture.

4. Notable species and ecosystems

The region around Cape Myojin, near the city of Katsuura on the east coast, was designated the Katsuura Marine Park Zone (14.5 ha), Minamiboso Quasi-National Park, in 1974, and has thus been protected by law. The signature feature of this marine park zone is that it contains both warm and cold sea elements and the associated characteristic seaweeds (e.g., *Ecklonia cava*, *Eisenia bicyclis*, *Sargassum giganteifolium*, and *S. fulvellum*) and fishes (e.g., *Prionurus scalprum*, *Calotomus japonicus*, *Girella punctata*, Labridae, Chaetodontidae, and damselfish). The invertebrate community (e.g., *Solanderia secunda*, *S. misakiensis*, *Melithaea flabellifera*, and *Echinogorgia rigida*) is equally diverse (Marine Parks Center of Japan 2001).

In Tateyama Bay, mass spawning of *Acropora tumida* and *Favia* sp. (Sanpei personal communication) and larval dispersal of brooder *Alveopora japonica* (Harii *et al.* 2001) have been observed (Photo. 1). These findings suggest the possibility that the coral communities at their northern limits maintain their gene pool by sexual reproduction (Hagiwara 2003).

2 Situation of usages

1. Tourism

The Katsuura Underwater Observatory, one of the largest in the east, was constructed in 1980; it allows visitors to view underwater scenery at a depth of 6.5 m. In addition, the Coastal Beach of the Natural History Museum and Institute, Chiba, opened in 1999 and continues to attract numerous tourists.

Photo. 1. Spat of *Alveopora japonica* recruited on a substrate in an aquaria in the Banda Marine Laboratory of Tokyo University of Marine Science and Technology. (photo by S. Harii)

Photo. 2. *Hydnophora exesa*, observed in Okinoshima. (photo by M. Taguchi)

SCUBA diving is an attraction in this area. Popular diving spots include Katsuura and Kamogawa along the east coast, and Nishikawana, Banda, and Hazama on the southern coast. Fish are relatively dense year-round owing to the warm Kuroshio Current, and ocean-ranging fishes such as *Seriola latandi* and *S. dumerili* can be observed depending on the season.

2. Fishery

Fisheries are active at Katsuura, Choshi, and Chikura in the southern Boso region. The fishing port of Chikura boasts the highest landings in this region, mostly by the fishing boat and rocky shore fisheries. The former consists mainly of small boats (3 t or less) that catch primarily horse mackerel, chub mackerel, squid, and flying fish, while the latter fishery catches ear shell, *Turbo cornutus*, *Panulirus japonicus*, and seaweed along the natural rocky shores.

3 Monitoring and conservation

1. Research

The Banda Marine Laboratory of Tokyo University of Marine Science and Technology is located in Tateyama at the mouth of Tokyo Bay. The station was established in 1980, and since then research and education have been conducted related to the physiology, ecology, and resource production of marine fauna and flora (e.g., hermatypic coral, abalone, and algae) (Photo. 1).

2. Coral Monitoring Association of Okinoshima

This nonprofit organization was established in 1997 by citizens and persons concerned with education. The main activities are conducting coral research around Okinoshima (Photo. 2), organizing observation programs on rocky shores and shore cleanups, and actively working to conserve *Vargula hilgendorfii* (a light-emitting organism) in Tateyama Bay (Mitsui Public Relations Committee 1999).

3. Coastal Conservation Basic Plan

In accordance with the enforcement of the revised Coastal Law of April 2000, administrators have begun to establish the Coastal Conservation Basic Plan by incorporating regional opinions from academic experts, heads of local authorities, and coastal managers. On this basis, Chiba Prefecture has formulated plans for two coastal areas, i.e., along the east and west coasts of the peninsula. Integrated coastal conservation plans, which include the use of targeted areas as well as preservation of the environment, have been implemented*.

Cited website:

* http://www.pref.chiba.jp/syozoku/i_kasen/umihozen/

b. Izu Peninsula

(Map 6-2-1-②)

Shinpei Ueno

1 Corals and coral reefs

1. Geographical features

The targeted area in this section is the west coast of Izu Peninsula, from Cape Irozaki on the south end of the peninsula, to the back of Suruga Bay. The Suruga Trough runs north to south in the center of Suruga Bay, and reaches 2,500 m at the mouth of the bay. The submarine topography differs greatly in the east and west, with Suruga Trough acting as a boundary. The seabed topography on the west side is complex, supporting a shoal called 'Senoumi', and the Senoumi Basin. While the sandy beach coastline is fairly monotonous, there are no hermatypic corals adjacent to the beaches. On the other hand, on the east side of the trough, a monotonous slope continues from the coast to the trough basin, and the rocky shore coastline is complex and supports corals. The coastline of Uchiura Bay, an innermost bay of Suruga Bay, is also similar, but a gradual, insular shelf slope continues to depths of 61–75 m, where the bottom sediment is sandy mud (Nemoto *et al.* 1989).

2. Coral distribution

The water surface layer of Suruga Bay is under the influence of the warm Kuroshio Current, but the winter low water temperatures reduce the number of species and no reef development is evident. There have been 42 coral species reported in Nakagi, at Minamiizu Town and in Shimoda City (Nishihira and Veron 1995). In Uchiura Bay, 31 species (of 22 genera) were reported (Sugiyama 1937), and a further 29 coral species (of 17 genera) have been additionally reported (Minegishi and Ueno 1995). The coral community in Uchiura Bay extends to 5–10 m, covering approximately 5,000 m^2. It is almost the most northern coral community in the world (ICUN 1988). *Acropora tumida* (Photo. 1) is dominant in here, covering up to 80–100 % of the substrate, with an average colony height of 28 cm. However, the bedrock, or the rocks that function as a substrate for corals, are not exposed, but buried in sand 1.5–2.0 m below the ocean floor. Thus *A. tumida* colonies grow on the sandy bottom.

Apart from Uchiura Bay, corals are distributed in Tago, in Nishiizu Town and Mera, in Minamiizu Town on the west coast of Izu Peninsula, but the extent of coral coverage at both localities is small: 260 m^2 and 300 m^2, respectively. *A. tumida* dominates both localities, but there the base substrate is exposed, suggesting a significantly different sedimentary environment than Uchiura Bay.

3. Water quality and physical environment

Uchiura Bay is a sheltered bay, but the water quality is more akin to oceanic conditions because a branch of the

Photo. 1. Close-up of a *Acropora tumida* colony.

Kuroshio Current flows into the bay. Monthly measurements, from March 1993 to August 1994, of the bottom water at 10 m, where the *A. tumida* community thrives, recorded an average pH of 8.3, dissolved oxygen of 8.5 ppm, and salinity at 34.3 PSU (Minegishi and Ueno 1995). These values hardly fluctuated in four subsequent measurements in January 2003 while the values of surface water (1-3 m) fluctuated greatly, being affected by terrestrial runoff during the rainy season but these surface fluctuations appear to have little influence on the coral communities. Sediment deposition was measured using sediment traps, with monthly values, in June-September, amounting to 5-9 mm and 1-5 mm in October-January, suggesting sedimentation is higher in spring-summer than in autumn-winter. The annual amount of sediments deposited was 3.5 cm (Ueno 1996). It appears that the most significant factor affecting the *A. tumida* community in Uchiura Bay is water temperature. According to hourly measurements, using an *in situ* thermometer set up in the bedrock at 5 m, since 1998, the highest temperature recorded was 27-28°C in August and the lowest temperature was 12-13°C recorded in February, well below optimal for coral growth. Indeed, coral growth may stop for several months every year during the coldest season.

4. Notable species and ecosystems

A striking feature of the Izu Sea coast is that corals and large seaweeds coexist. In Uchiura Bay, from December to June, the brown algae *Colpomenia sinuosa* and *Undaria undarioides* grow in thickets alongside *A. tumida*. *C. sinuosa* can cause up to 90 % coral shading for up to five months a year, reducing the zooxanthellae density of *A. tumida* to 40-50 % (Nakanishi and Ueno 1998). Under such circumstances, *A. tumida* frequently bleaches and dies.

2 Situation of usages

1. Tourism

Most of the areas where corals are located are visited by SCUBA divers. In Uchiura Bay, however, diving is restricted to Cape Ohsezaki by the fisheries cooperative association.

2. Fishery

Corals live along the rocky shore where recreational line and net fishing is not common, except that octopus trap fishing is conducted on a small scale in Uchiura Bay.

3 Threats and disturbances

1. Bleaching

Coral bleaching, due to high water temperatures, have not been reported in the Izu area, but there have been reports of coral bleaching related to lowwater temperature (Kosaka *et al.* 2001). Especially in Uchiura Bay, which is located within Suruga Bay, water stagnation is common. The average water temperature at 5 m in January and February 1996 is around 12.6°C. The elapsed time of less than 13°C was 1,198 hours over January-April in 1996, and 209 hours in 1997. These figures are remarkable, compared with 0-2 hours for 1993-2000. Consequently, many of *A. tumida* colonies bleached and died, which resulted in a decline in coral coverage from approximately 85 % to 40 %. Live coral coverage has continued to decrease; some studies suggest that an increase in the density and grazing pressure of the sea urchin *Diadema setosum* are responsible for the coral decline (Okubo *et al.* 2003).

2. *Diadema setosum*

In monthly surveys, the highest number of *D. setosum* individuals in a 5,000 m^2 *A. tumida* community was 21,000 in April 2000, and the lowest was 15,000 in December, 2000. The amount of grazing damage by *D. setosum* was estimated to be 59 kg/month (Okubo *et al.* 2003). On the other hand, coral growth (*A. tumida*) was estimated to be 47 kg/month in May 2001, which suggests that *A. tumida* is gradually decreasing under the present situation.

Photo. 2. *Diadema setosum* and a cage to protect *Acropora tumida* from *D. setosum* grazing. The tips of branches are grazed and shown in white appearance.

4 Monitoring and conservation

1. Survey

The surveys conducted in recent years are as follows:
1991: The 4th basic survey on conservation of the Natural environment (Environment Agency)
1993: Coral survey in Uchiura Bay (Shizuoka Prefecture)
1993-2003 (present): Water quality diffusion monitoring survey of the coastal environment maintenance program in Nishiura fishing port (Numazu City)

2. Conservation measures

The principal cause of a recent decrease in *A. tumida* is considered to be related to grazing damage by the sea urchin *D. setosum*. Grazing damage prevention cages, of about 100 m^2 have been established since 2000. The cages are made of plastic net (Takiron), 62 × 62 × 31 cm/piece (Photo. 2). Within the experimental cages the coral coverage has increased by 20.6-35.2 % in eleven months compared with that of the control (Funakoshi and Ueno 2004).

c. Izu Islands

(Map 6-2-1-③)

Takeshi Igarashi

1 Corals and coral reefs

1. Geographical features

The Izu Islands are distributed along the Izu-Ogasawara ridge, which lies along the 140˚ meridian and stretches south to north between 35˚ and 33˚ N.

Miyakejima (Is.) is a round volcanic island located ca. 180 km south (34˚04' N) of Tokyo. It is ca. 8.7 km in diameter, 55 km^2 in area, and made from basalt. Most of the island's coastline is rocky. Mt. Oyama is located at the center of the island; it slopes evenly toward the coastline on all sides and erupts about every 20 years (Kaizuka 1989). The most recent eruption, in 2000, was large and severely impacted the island's ecosystem (Kamijyo *et al.* 2002; Kato *et al.* 2002). Volcanic ash fell mainly on the northern shore, mud containing ash flowed along the eastern and southern shores, and mudflows and cliff failures occurred along the western coast. These events caused dimensional changes in the coastline and resulted in the accumulation of ash on the sea floor (Tokyo Metropolitan Fisheries Experiment Station 2001; Fig. 1).

Fig. 1. Map of Miyakejima (Is.).

Hachijojima (Is.) is a basaltic volcanic island ca. 300 km south of Tokyo, located at the southern end of the Izu Islands (33˚ 07' N). Outflow of lava and eruption of volcanic ash have not occurred since 1606. The island is oblong, with a periphery of ca. 59 km that covers 68 km^2, stretching in a south-north direction. Two mountains skirt the island's coastline: Mt. Hachijofuji (854 m above sea level) in the north and Mt. Miharayama (700 m above sea level) in the south. Most of the coastline consists of drop-offs and rocky shores that generally plunge sharply to the sea bottom (Takahashi 1983; Kaizuka 1989) (Fig. 2).

2. Outline of coral distribution

a) Miyakejima

Zooxanthellae corals (hereafter corals) on the island are abundant along the western and southern shores, but are rare along the eastern shore where an upwelling occurs. Eighty species from 36 genera and 13 families have been reported for the entire island (Tribble and Randall 1986).

Togahama, the southwest of the island, has the community that tabulate *Acropora* is dominant. The communities lies on the large rocks and bedrocks that extend for about 1200 m^2, at depths between 1.5 m and 8.0 m, south of Togahama. Although facing the outer sea, the area is relatively protected from ocean waves by ledges in the offing. Six *Acropora* species (e.g., *A. solitaryensis*), *Pocillopora damicornis*, *Acanthastrea echinata* are well-represented. Faviids (e.g., *Montastrea valenciennsi*), *Montipora*, *Porites*, *Goniopora* and *Turbinaria* are also present (Igarashi 2002).

Fig. 2. Map of Hachijojima (Is.).

In 1979, Igaya, the western end of the island, had 59 coral species, 31.1 % coral cover, and a coral species diversity index (H_c') of 2.76. Moreover, it was the only area that exhibited development of a reef structure throughout the island (Tribble and Randall 1986). This structure was not a true coral reef; it consisted mainly of tabulate *Acropora* built on the framework of an old lava flow along the shore next to the fishery harbor. Here, corals were relatively abundant, 33 species, 24.1 % coral cover, and H_c' = 2.53 were recorded. However, live colonies of *Acropora* were rare, and the most common corals were *Acanthastrea echinata*, *Psammocora vaughani*, Faviidae (e.g., *Favia speciosa*), *Hydnophora exesa*, and *Echinophyllia aspera*. Coral coverage was also high (31.1 %) at depths of 6–7 m on an offshore large lava flow. Tabulate *Acropora* was relatively abundant, but a reefal structure was not seen. Species diversity was high at depths shallower than 15 m on the offshore lava flow, and highest at a depth of 4 m (H_c' = 2.76). This level of coral diversity is similar to that of the Line Islands (3° N) in the central Pacific Ocean, and at Eilat (29° N) in the Red Sea (Tribble and Randall 1986).

b) Hachijojima

At Hachijojima, 35 genera from 14 families were recorded, and most of the genera reported from Miyakejima were also found (Takahashi 1990). The most common genera were faviids (e.g., *Favia*, *Favites* and *Goniastrea*). *Acanthastrea*, *Echinophyllia*, and *Goniopora* were also abundant. Moreover, *Alveopora* was remarkably abundant in Sokodo and Kaminato, as compared to other areas of the Izu Islands, in July 1986 (Takahashi 1990; Igarashi unpublished data). Corals were abundant from Sokodo on the east coast, toward Kaminato. This area is made up of gently inclined but relatively diversified ledges, which are protected from typhoon waves. Coral-abundant areas also occurred around Yaene, on the east coast, and at Nazumado, on the north coast, but habitats there were relatively small and restricted by the bottom topography. The growth form of Hachijojima corals were generally encrusting or submassive influenced by waves; foliaceous and branching were extremely rare. Tabulate *Acropora* were common but they did not form large community, like those in Togahama, Miyakejima (Takahashi 1983).

3. Water quality and physical environment

The Izu Islands are located across the northern Kuroshio Current, along the coasts of mainland Japan. Thus, the main factors influencing this area are the direction and positioning of the Kuroshio Current, and the movement of cold water mass.

The average surface water temperatures around Miyakejima range from 14.2°C (February to March) and 27.0°C (July to August). Extreme temperatures are a low of 13.0°C in February and a high of 29.5°C in August. Waves are influenced by strong monsoons and typhoons. West to west-northwest winds dominate from December through to February, southwest or northeast winds occur from March through to May, southeast winds blow from June through to August, and northeast winds occur during September through to November (Hayashi *et al.* 1974).

The average monthly surface water temperature in Hachijojima ranges between 17 and 28°C, but in years when a cold water mass approached the shore, surface water temperature decreased to 13.9°C in February and 22.7°C in August (Tokyo Metropolitan Fisheries Experiment Station 1976). Waves are also strongly influenced by monsoons and typhoons, as they are in Miyakejima.

4. Organisms and ecosystems to be noted

The *Acropora* dominated community of Togahama, Miyakejima, is the largest in the Izu Islands (Hayashi *et al.* 1974). Moreover, *Chaetodon daedalma*, a fish species endemic to Japan, is distributed from the Izu Islands to the Ogasawara Islands.

2 Situation of usages

1. Tourism

In Miyakejima, Togahama and Igaya are SCUBA diving sites. Additionally, Choutaroike – a 200 m² tide pool, 2.5 m deep, located on the southern coast – is used for observing and learning marine organisms and for sea bathing. However, the island has seen limited landing since the volcanic eruption in June 2000. Sokodo, Kaminato, Yaene, and Nazumado in Hachijojima are also used as SCUBA diving sites.

2. Fishery

The Red algae (*Gelidium*), used to make agar-agar, and the shellfish (*Sulculus diversicolor*) are important aquatic resources in the island. However, fishing is not undertaken in areas where coral communities are located. In

Miyakejima, many of the fishing grounds were damaged by mud inflows, ash falls, and cliff failures resulting from the Miyakejima volcanic eruption in 2000 (Tokyo Metropolitan Fisheries Experiment Station 2001). In Hachijojima, these resources are decreasing because of rocky-shore denudation in recent years (Takahashi personal communication). Flying fish (e.g., *Prognichthys agoo*) are also an important fishery stock; these fish are caught by gill nets that are peculiar to this region.

3 Current state of the ecosystem, and points of transition

1. Miyakejima

At Igaya, many *Acropora* colonies in the reefal area have died due to (1) an inflow of terrestrial soils that resulted from engineering projects between 1972 and 1974, (2) predation damage by *Drupella fragum* and crown-of-thorns starfish (*Acanthaster planci*) during the late 1970s and early 1980s, and (3) typhoon damage (Moyer 1978; Moyer *et al.* 1982; Tribble *et al.* 1982). Moreover, about 90 % of *Acropora* and *P. damicornis* in the reefal area died from heavy silting during a breakwater expansion project in the late 1990s and part of the reef disappeared when it became a foundation for the breakwater (Unno personal communication). In the 2000 volcanic eruption, mudflows occurred, and up to 20 cm of volcanic ash accumulated on the sea floor of the reefal area (as of October 2001). Water transparency decreased to 5 m in turbid waters. The number of coral species in the reefal area decreased to 12, H_c' decreased to 1.56, and few live *Acropora* were observed. Coral cover was 6.7 % and consisted mostly of encrusting *A. echinata*, *Montipora* sp., and Faviidae (e.g., *F. speciosa*), concentrated at the lateral faces or on the bumps of the lava flow bed, where ash accumulation was relatively low. Although they avoided ash accumulation, these colonies still showed partial mortality, a decrease in zooxanthellae, and bleaching (Igarashi 2002). Volcanic ash also accumulated offshore from the harbor, killing nearly 80 % of tabulate *Acropora*. However, many encrusting coral colonies have survived outside the breakwater, where accumulated ash was washed away by oceanic water (Tokyo Metropolitan Fisheries Experiment Station 2001).

At Togahama, damages from soil inflow caused by construction operations in 1976 and 1978, and from predation by *D. fragum* and *A. planci* were observed. Predation damage extended to about 35 % of the *Acropora* colonies over a period of two years (1979–1981; Moyer 1978; Moyer *et al.* 1982). On the other hand, corals were healthy, even after the volcano erupted in 2000. Notable differences were not apparent when results from surveys conducted in August 1995 were compared with results from surveys conducted after the eruption occurred. Moreover, the impact of the eruption was limited in Choutaroike, where nine coral species, including *Cyphastrea serailia*, were observed (Igarashi 2002).

2. Hachijojima

Coral communities in Hachijojima have also received the influence of physical factors, similar to those noted in Miyakejima, such as bottom topography, waves generated by seasonal winds and typhoons, low water temperatures (Takahashi *et al.* 1983), and construction works. Some of the corals observed in Kaminato Port in July 1984 disappeared after the expansion of the breakwater; a decrease in zooxanthellae and partial mortality of colony were observed on remaining corals such as *Goniopora*, *Hydnophora*, and *Acanthastrea*. Likewise, part of the coral community disappeared in Sokodo after the offshore breakwater was constructed. However, foliaceous *Turbinaria* (ca. 7 m^2) developed along the inner side of the breakwater at depths of 3–5 m (Igarashi, unpublished data). The maximum diameter of *Turbinaria* colonies in Sokodo before the breakwater construction (1961–1982) was 1 m; other colonies were 50 cm or smaller in diameter (Takahashi 1983).

4 Monitoring and conservation

Togahama in Miyakejima has been designated as a marine park zone. However, no in-depth investigations of coral communities in the area have been conducted. Furthermore, there has been no thorough investigation of the coral communities of Igaya since the surveys conducted by Tribble and Randall (1986). The same is true for the other Izu Islands. Quantitative estimates of species abundance are needed, therefore, in order to understand the structure and dynamics of the coral communities, and to propose much needed conservation measures needed for the area, which should be implemented in the near future.