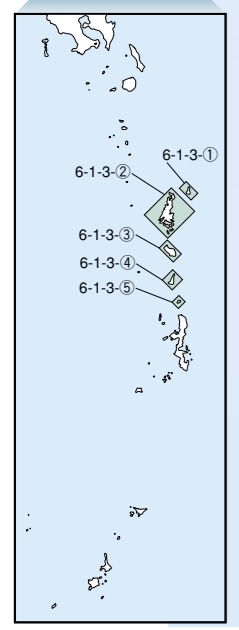
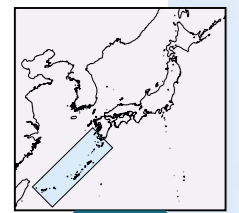
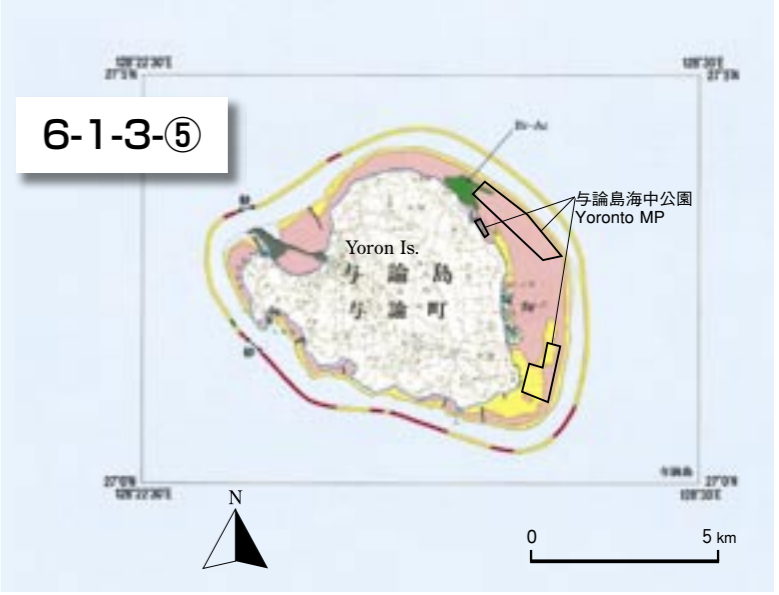
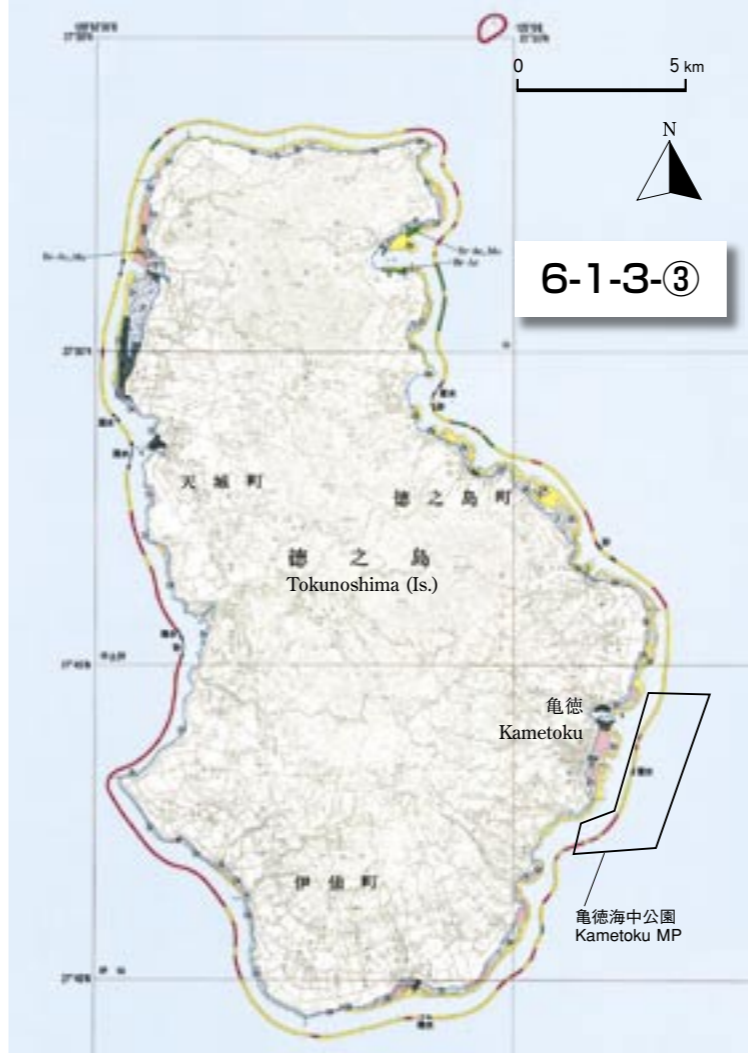
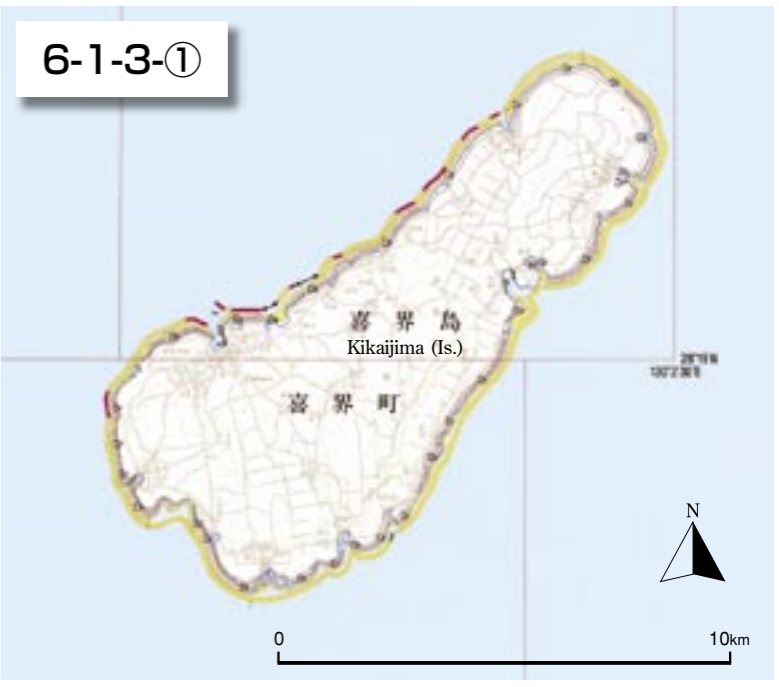


6-1-3 Amami Archipelago (Map 6-1-3)

Province: Kagoshima Prefecture **Location:** ca. 400 km southwest off Kagoshima City, including Amami Oshima (Is.), Kikaijima (Is.), Tokunoshima (Is.) and Okinoerabujima (Is.) and Yoron Is. **Air temperature:** 21.5°C (annual average, in Naze City) **Seawater temperature:** 24.5°C (annual average, at north off Naze) **Precipitation:** 2,913.5 mm (annual average, in Naze) **Total area of coral communities:** 5951.2 ha **Total length of reef edge:** 420.3 km **Protected areas:** Amami Gunto Quasi-National Park: centering on coastal areas of Amami Oshima, Kikaijima, Tokunoshima and Okinoerabujima and Yoron Is.; Marine Park Zone: 2 zones in Amami Oshima, 1 zone in Kakeroma Island, 1 zone in Tokunoshima, and 1 zone in Yoron Island.



Amami Archipelago

(Maps 6-1-3-①~⑤)

Tatsuo Nakai, Katsuki Oki

1 Corals and coral reefs

1. Geographical features

The Amami Archipelago stretches between latitudes 27° 00' N and 28° 30' N. Coral reefs at various stages of development are found throughout the islands. Reef development is extensive along the coast of the Kasari Peninsula, north of Amami Oshima Island, and off Kikaijima Island, but poor off southeastern Amami Oshima and in the Oshima Strait between Amami Oshima and Kakeroma Island (refer to Fig. 1 of 6-1-2). These differences are thought to be influenced by the Kuroshio warm current and tectonic movements. Reef development is also significant on the islands of Tokunoshima, Okinoerabu, and Yoron to the south of Amami Oshima. The reefs of Yoron Island are particularly well-developed structures with widths of over 1 km, distinct reef crests, and continuous backreef lagoons up to 3 m in depth; they representing the typical fringing reef formation that is also seen in the south of Okinawa Island.

This reef system is located on an uplift zone that lies along the Ryukyu Trench. On Kikaijima, Okinoerabu Island, and Yoron Island, most of the highest points are on a plateau that was originally formed under the sea. At Kikaijima, one of the world's primary regions of uplift, coral reefs that formed during the last interglacial period (ca. 130,000–120,000 years ago) have now been lifted to 200 m above sea level. This movement has been caused by plate-tectonic subduction under the Philippine Sea Plate, and the phenomenon characterizes the whole of the Ryukyu Islands. Several intensive geological surveys have been undertaken, including those of coral fossil depositions, beach rocks, and notches formed during the Quaternary (Nakta *et al.* 1978). Many drilling surveys on the Holocene coral reefs surrounding Kikaijima (Konishi *et al.* 1974; Ota *et al.* 1978) and Yoron Island (Yonekura *et al.* 1994) have also been conducted to better understand the geology and geography of the region.

Consequently, sea-level change and crustal movement during the Quaternary and the developmental history of the coral reefs in this area are relatively well understood. The information gleaned from these surveys, together with data from other locations such as the Okinawa Islands, Miyako, the Yaeyama and Tokara Archipelagos, and Tanegashima Island, has also contributed to understanding the development of the Ryukyu Islands.

2. Coral distribution

Approximately 220 species of hermatypic corals (hereafter, corals) have been identified in the Amami sea area (Nishihira and Veron 1995). Well-developed communities dominated by *Acropora* were found throughout the islands until the 1998 mass-bleaching event, after which the dominant corals of the lagoon and reef crest communities shifted to *Porites* and *Favia*.

A survey commissioned by Kagoshima Prefecture and undertaken by the Kagoshima Prefecture Nature Association (1980) described the coral communities that were affected by crown-of-thorns starfish (*Acanthaster planci*) predation during the 1970s. The survey data collected included the coral distribution, the status of *A. planci*, and the extent of coral damage; the surveys were conducted in all of the marine park zones. The numbers of coral species identified at each site were: inner bay of Kasari Peninsula's east coast, 37; Surikozaki, 96; Setouchi, 83; Amami Oshima and Kametoku, 84; and Tokunoshima and Yoron Island, 71. The survey report also recorded the *A. planci* density and coral recovery status, and highlighted human impacts such as terrestrial red-soil runoff and the collection of tropical fishes for the aquarium trade. The Nature Conservation Bureau, Environment Agency (1994) also conducted coral coverage surveys throughout all of the coral reef regions in Japan, including Kikaijima and Okinoerabu Island; however, the report of these surveys did not contain systematic survey data such as lists of the species identified.

3. Water quality and physical environment

Most of the reefs that fringe the islands are seaward facing and thus located in water that is largely oceanic. In the inner bays and straits, however, turbidity and sedimentation from the land can be observed.

4. Notable species and ecosystems

Seventy-one hectares of mangrove forests at Sumiyo in Amami Oshima have been designated as Special Protection Zones of Amami Gunto Quasi-National Park.

On Katoku Beach in Setouchi, the leatherback turtle (*Dermochelys coriacea*), an extremely rare species in Japan, was first recorded coming ashore to nest in 2002 (Kamezaki *et al.* 2003).

2 Situation of usages

1. Tourism

In the Amami Archipelago, there are about 50 dive operators around Amami Oshima, and the area is heavily used by SCUBA divers. A semi-submersible boat is operated in Naze Bay and the Oshima Strait. Sea-kayaking among the bays and straits and canoe tours among the mangroves are also popular. In addition, the coral reefs are used for shellfish harvesting and leisure fishing by local residents.

2. Fishery

The main fishery in this region is pole-and-line fishing for skipjack, tuna, grouper, and sea bream, but offshore long-line fisheries and gill net, drive-in, and diving fisheries on the reefs are also important. The commercial aquaculture of kuruma prawn (*Penaeus japonicus*), ocellate puffer (*Takifugu rubripes*), red sea bream (*Chrysophrys major*), a brown algae (*Nemacystus decipiens*), and pearl oysters is also undertaken.

3 Threats and disturbances

1. Crown-of-thorns starfish

Between 1973 and 2002, a total of about 1.55 million *A. planci* were exterminated in the Amami Archipelago by the Amami Oshima Marine Park Marine Resource Conservation Association. In 1973, an *A. planci* outbreak occurred on Yoron Island, and 31 million *A. planci* were exterminated. Subsequently, the *A. planci* outbreak spread throughout the archipelago, and extermination projects extended into the marine park zones of Setouchi in 1974 and into Kasari, Surikozaki, and Kametoku in 1976. During the 1980s, nine million *A. planci* individuals were exterminated in Setouchi, after which the population was in decline until 2001, when the population again started to grow (Photo. 1).

2. Bleaching

A large-scale, mass-bleaching event caused by abnor-



Photo. 1. Crown-of-thorns starfish (*Acanthaster planci*) outbreak in 2002 in Amami Oshima.



Photo. 2. A mass-bleaching event occurred in August 1998 in Amami Oshima.

mally high water temperatures occurred at the end of August 1998 (Photo. 2). The *Acropora* colonies that were dominant in lagoons and on reef crests until this event almost died out. No subsequent major bleaching events have occurred, and new recruits of coral spats can now be seen, indicating that recovery of the coral communities is progressing. Coral damage from bleaching was relatively light along the southern coast of Amami Oshima, especially in the Oshima Strait, although these areas have been suffering from renewed outbreaks of *A. planci* predation since 2001.

4 Monitoring

Extermination projects for *A. planci* have been conducted by the Amami Oshima Marine Park Marine Resource Conservation Association. The Association, formed in 1973, consists of the prefectural government



Photo. 3. Underwater monitoring survey on coral reefs by members of Amami Marine Museum in Naze City, Amami Oshima.

and local authorities. In addition to the extermination program, monitoring by visual census is also conducted. Reef Check surveys, using internationally standardized monitoring methods for coral reefs have been on-going at Yoron Island since 2000 and at Setouchi since 2001. Every few years since 2001, coral monitoring surveys have also been conducted by the Amami Marine Museum in Naze (Photo. 3). Six permanent survey sites, each consisting of 30 m × 50 cm belt transects, were established, and coral coverage to genus level has been monitored.

5 Conservation

1. Crown-of-thorns starfish

The countermeasures against the current outbreaks of *A. planci*, especially in Setouchi, have consisted of the establishment of two priority protection sites at Kurosaki and Ankyaba, east of the Oshima Strait. These sites have high coral coverage and are important scenic spots; intensive extermination of *A. planci* has taken place at these sites.

2. Sedimentation

Kagoshima Prefecture has established the ‘Amami Region Red-clay Outflow Prevention Measures Promotion Conference’, and has been offering lectures and fieldtrips. Efforts have been made to prevent red-soil runoff from public construction works, based on enterprise-specific guidelines, for example, the ‘Oshima Branch Office Strategy for Soil Runoff Countermeasures’

(Kagoshima Prefecture White Paper on the Environment in fiscal 2001).

3. Conservation measures in the tourism industry

Several practices have been implemented to conserve coral reefs at tourist sites. One example is the placement of mooring buoys at major dive sites by the dive operators; these alternate mooring sites prevent coral communities from anchor damage.

6 Necessary measures

In order to implement the measures necessary to prevent coral reef degradation in this district, up-to-date information on the status of regional reefs is required. It is therefore desirable that an archipelago-wide monitoring framework that extends beyond the national parks should be put into place in the near future.