

1. Geographical features and environment

Kerama Islands lay 20 to 40 km west of Okinawa Island, and comprise some 30 islands of various sizes. Akajima (Akajima Island) is located near the center of Kerama Islands (Fig. 1). From the distribution of Japanese cedar and Japanese cypress fossils in the rock stratum, it is thought that the Kerama Islands were part of a mountain range that extended to (northern) Okinawa and exceeded 1500m above sea level in the Pliocene (1.5 million years ago). Well developed coral reefs formed around Okinawa 600,000-200,000 years ago, and remain as uplifted Ryukyu limestone. This limestone layer in Kerama Islands, however, is about 80 m below sea levels. The Kerama Islands have subsided because of diastrophism. As a result, the sea spread out the Okinawa Island and Kerama Islands, and the peaks of the mountain range became the groups of small islands now known as Kerama Islands. The inland sea of Kerama consequently exhibits the geographical features of a subsided coast and presents a beautiful landscape.

The seawater temperature is lowest in February and March, but the monthly average never falls below 20°C, and is usually the highest, at 27.1 to 29.6°C in July and August. The water temperature rose exceptionally high in August 1998 when the monthly average recorded was 30.4°C. It caused coral bleaching and given catastrophic damage on coral reefs around Okinawa Island, however the percentage of dead colonies was merely 6.7 to 23.4% around Akajima. The reason for this lower mortality level is thought to be due to the presence of lower temperature water on the shelf around Kerama Islands. Typhoons are common, and are often experienced even in early summer. Oceanographic conditions with about five typhoons approaching every year, bringing high waves, wind and rain, followed by calm intermittent periods. From October to April, the northern monsoon brings strong north winds and large swells.



Fig.1. Map of Kerama Islands



Fig.2. Protected areas and survey localities Using belt transect

2. Hermatypic corals

There are approximately 248 hermatypic coral species found on Akajima and the surrounding Kerama Islands (59 genera and 14 families) - or 62% of the species recorded in Japan. Considering their relatively small size the Kerama Islands are extremely rich in coral fauna. Figure 2 shows protected areas and survey localities using belt transects around Akajima Island.

The northern coast of Zamami Island supports spurs and grooves and a tabular *Acropora* community, which used to be more extensive before the 1998 bleaching event and a more recent outbreak of crown-of-thorns starfish (*Acanthaster planci*). The southwestern coast of the island supports high diversity, and Agonoura Bay, in the southwest island, is said to have unique coral communities but a satisfactory survey has not been conducted.

Kushibaru, on the northwestern coast of Akajima, also has extensive spur and groove systems and large tabulate *Acropora* colonies from reef edge to 4-6m down the reef slope. Again, recent *A. planci* predation has reduced corals. Nishihama, on the eastern coast, supports diverse coral assemblages on shallow slope. Maenohama, on the southern coast, supports artificial breakwaters about 100m offshore; the sand bottom is scattered with sea grasses and rocks supporting massive faviids branching *Montipora* (Fig.3).

Mass coral spawning has been observed annually on Akajima. The spawning occurs in summer from May to September. Many *Acropora* and *Montipora* species spawn in May-June, *Merulina* in July, and some *Favia* in August-September. On the morning following the mass spawning, slicks may be observed on the sea surface. Although many eggs and embryos are washed ashore, some drift toward the west coast of Okinawa main island, and the larvae settles on the seabed. That is to say, the larvae from Kerama Islands enhance the coral communities around Okinawa main island.



Fig.3. Coral reef in Akajima Island

3. Other biota

Three hundred and sixty fish species, about 1,640 invertebrate species, including hermatypic corals, and about 220 seaweed species have been recorded in the Kerama Islands to date, but many groups of organisms have not yet been surveyed.

Green turtles, loggerheads, and hawksbill turtle lay eggs on the beaches in summer. Humpback whales (*Megaptera novaeangliae*) are watched very frequently in January to April, since they use the



Fig.4. Kerama Island

Kerama Islands as their breeding ground.

In the land, 620 species of flora have been recorded. Many birds and butterflies are observed. The Kerama deer, a subspecies of the Japanese deer, live only in the Kerama Islands (Fig.4). The Kerama deer is smaller and darker than Japanese deer. The deer population on Akajima increased to 130 in 1995. They are fully protected on some islands as a nature treasure of Japan.

4. People's life in Akajima

Kerama Islands provided good moorings for ships that navigated between Okinawa and China during the Ryukyu Kingdom era from the middle of 1400s to the late 1800s, and for some 600 years the islanders had been employed as skillful navigators for the kingdom's trading vessels.

After Okinawa became part of Japan, the island prospered with bonito fishing and processing industry ("katsuobushi", dried bonito) until the World WarII. As is seen, the resident islanders have lived for centuries with the sea and shared in the blessings of the ocean. Swordfish, tuna, and skipjack are still being caught using hooks and lines; aggregations of spinefoot ("suku") are caught using gill nets in summer. In addition, local residents collect shellfish and octopus by scouring the reef flat at ebb spring tide. Most of the catches are consumed locally.

The motive force of recent development has also been the bountiful nature of the islands. In Kerama Islands, considered one of the most beautiful coral reefs in the world, the tourist business such as recreational diving and lodging services has flourished, taking advantage of the diving boom, and this development is continuing even today. There are 43 diving business and even more for accommodation in Zamami Village that is consisted of 3 main islands including Akajima. While fishing was the main source of income in the past, now more than 80% of the resident islanders are engaged in tourism. Owing to this, the population of Akajima increased from 214 to 348 during the 15 years from 1985 to 2000, despite the fact that many of the other islands in Okinawa have been troubled by depopulation.

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