

# Japan: Mangrove areas and their utilization

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## Abstract

Although Japan has large-scale aquaculture, there is no aquaculture development in mangrove areas because the total area is small (553 ha) and strictly protected. Mangroves are preserved in comparatively good condition. Future development of aquaculture in mangrove areas is considered small-scale. Rather than aquaculture, Japan practices enhancement and management of wild fisheries. Tourism is another industry that would have an important role in mangrove utilization. But basic research on mangrove ecosystems is essential prior to determining policies for utilization of mangrove areas. International cooperative research work is important to encourage mangrove-friendly aquaculture and protect the environment.

## Introduction

Research on mangroves has been conducted for several decades. In Japan, several books concerning mangroves were published recently (Tsuji *et al.* 1994; Odaki 1997; Nakamura & Nakasuga 1998). However, information on mangrove ecosystems and its utilization for fisheries are limited to several fish and crustacean species (Shokita 1988). This paper reports the present status of aquaculture in Japan and the utilization of mangrove areas, and discusses strategy for the sustainable utilization of mangrove areas.

## Brief overview of aquaculture

The total fishery and aquaculture production has been decreasing after its peak of 12.8 million tons in 1984 (Figure 1). This trend is mainly due to decreasing landings of sardine and walleye pollock. But aquaculture production has been stable for the last 10 years (1987-1996), ranging from 1.2-1.4 million tons which is valued at 6-7 hundred billion yen.

The ratio of aquaculture production against that of total fisheries has been increasing, due to the decrease of total fishery production. In 1996, aquaculture accounts for 18% in weight and 30% in value. Marine aquaculture is dominant, accounting for more than 90% of total.

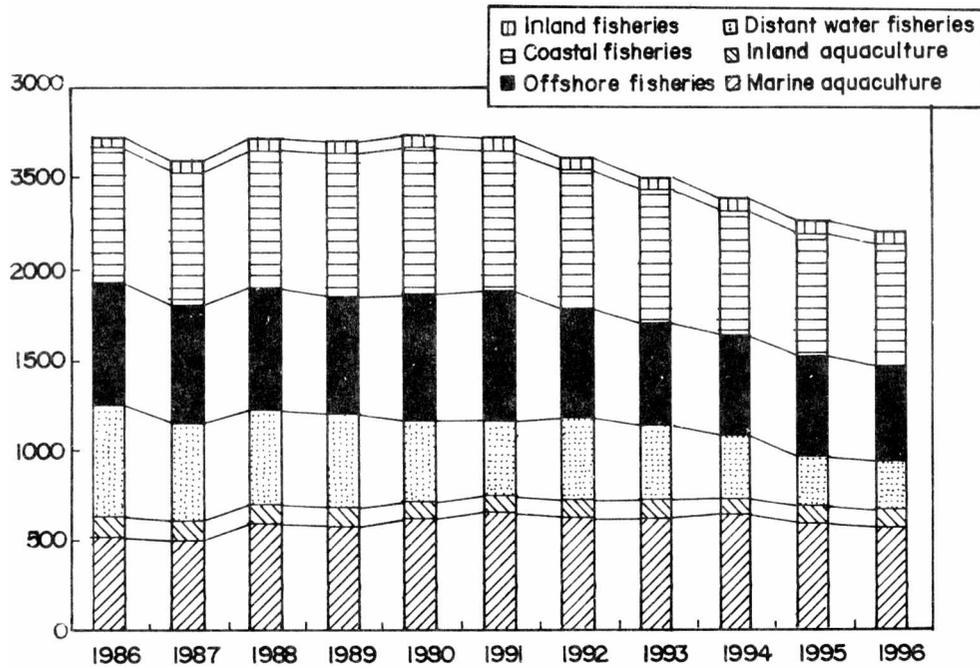


Figure 1. Catch and yield in fisheries and aquaculture in Japan, 1986-1996

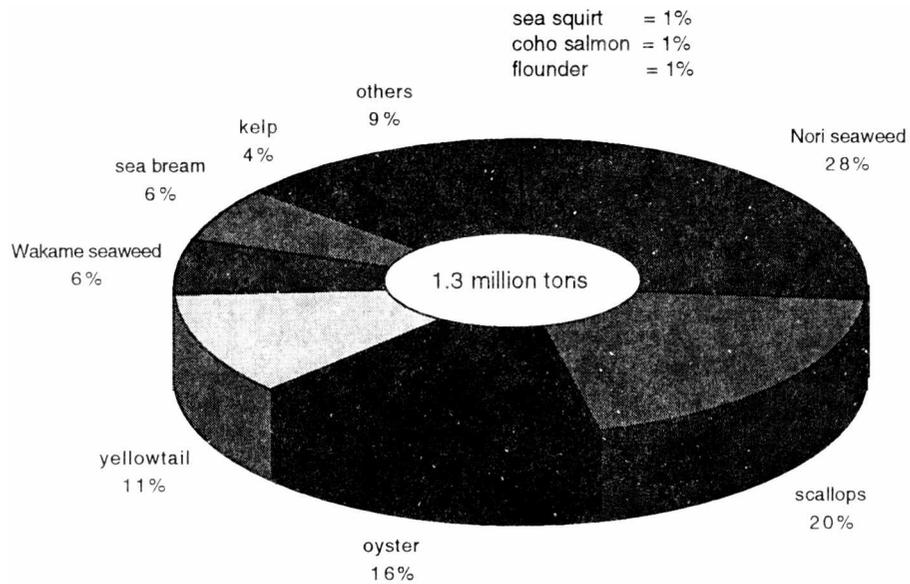


Figure 2. Aquaculture production in Japan, 1996

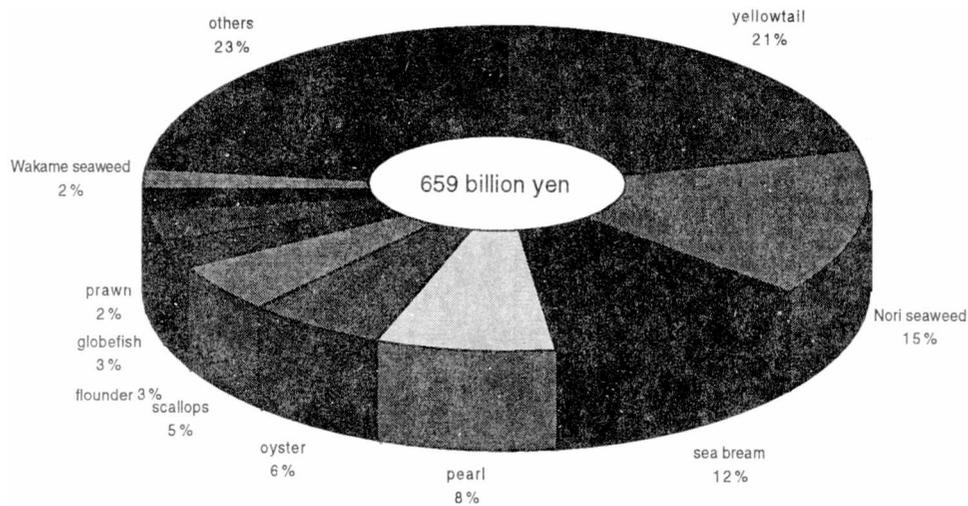


Figure 3. Value of aquaculture products in Japan, 1996

The top five aquaculture species in 1996 are: nori (seaweed), scallop, oyster, yellowtail and wakame (seaweed) in quantity (Figure 2) and yellowtail, nori, sea bream, pearl and oysters in value (Figure 3). Aquaculture in mangrove areas is nil because the area is small and legally well-protected.

## Exploitation and protection of mangrove areas

### History and utilization

Mangroves grow from Kagoshima to Okinawa (Figure 4) with more than 80 mangrove communities. The northern limit of mangroves is located in Kiire, a town in Kagoshima (31°20'N), where a *Kandelia candel* community is designated as a natural monument. The total mangrove area in Japan is only 553 ha and the mangroves in Iriomote Island accounts for 80% of the total. There are seven typical constituent species (Table 1), although mangrove areas have 7 to 19 species. Mangroves can be used as timber, firewood, dyeing materials, antiseptic and so on. At present, however, they are seldom utilized as raw materials in primary industries except for their use as textile dyes.

Fisheries in mangrove areas are limited to several fishes, crustaceans and molluscs. These are the shellfish *Terebralia palustris*, mud crab *Scylla oceanica*, shrimps *Penaeus monodon*, *Metapenaeus moebi*, *Macrobrachium* spp; and the black porgy *Acanthopagrus sivicolus*, mullets (Mugilidae) and snappers (Lutjanidae) and so on. Total landings of these species are so small that no statistics are kept, except for *A. sivicolus* of which annual landings are approximately 20-45 tons. *A. sivicolus* inhabit brackishwater areas in young and adolescent ages, later moving to coastal waters. Therefore, catches in mangrove and coastal waters are included in statistics of *A. sivicolus*.

Mangrove areas are very important as nurseries for many aquatic animals including target species in capture fisheries. At present, there is no aquaculture in mangrove areas, except for mud crab which have been experimentally reared in a pond constructed near the tidal flat in Iriomote Island.

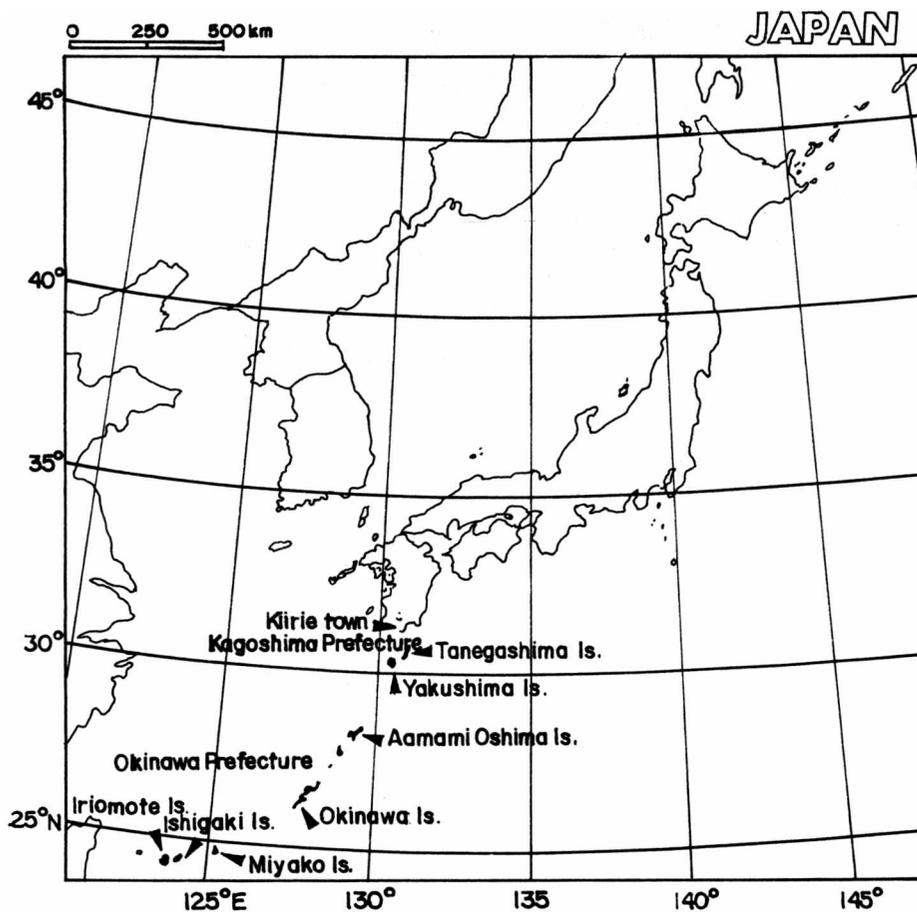


Figure 4. Areas in Japan where mangroves grow (arrow)

Table 1. Typical mangrove species found in Japan

Family	Species	English name	Japanese name
Sonneratiaceae	<i>Sonneratia alba</i>		Mayapushiki
Rhizophoraceae	<i>Bruguiera gymnorrhiza</i>	Black mangrove	Ohirugi
	<i>Kandelia candel</i>		Mehirugi
	<i>Rhizophora stylosa</i>	Spider mangrove	Yaeyamahirugi
Combretaceae	<i>Lumnitzera racemosa</i>		Hirugimodoki
Verbenaceae	<i>Avicennia marina</i>	Grey mangrove	Hirugidamasi
Arecaceae	<i>Nipa fruticans</i>		Nippayashi

*The protection of mangroves*

Some mangrove areas are protected as a natural monument or by various laws. Deforestation is not permitted except in some cases such as research.

Pressures on mangrove forest by human activity come from direct destruction like construction of ponds and ports, and from indirect effects of these works. Although the mangrove areas have not been changed on a large-scale, influence of regional small-scale destruction to the ecosystem is considered substantial. Recently, ecotourism is gaining popularity. Large motorboats run at high speed in mangrove areas and, as a result, mud near the roots of mangrove is washed away by waves made by boats. This is considered to be one probable cause of mangroves falling down and decaying.

There is a mangrove area that was planted by the government. This was at a construction site of a fish port. The purpose was to maintain the stability of the beach and to protect the environment. Non-profit organizations and several corporations have planted mangrove seedlings, too. Some of these corporations even investigated methods of planting seedlings.

*Mangrove research related to fisheries*

International cooperative research has been conducted on several themes related to mangrove areas. One is a program that seeks to establish the status of marine fisheries and stock management. This was started in 1995 between Malaysia and Japan. Another is a research to develop techniques of diagnosing and controlling viral diseases in prawn, conducted between SEAFDEC and Japan.

The Japan International Research Center for Agricultural Sciences and other national fisheries research institutes under the Ministry of Agriculture, Forestry and Fisheries play principal roles in mangrove projects. Domestic research on productivity in mangrove areas and ecology of the mud crab is proceeding in Ishigaki Island. Research objectives are focused on the process of organic matter supply, the role of benthos to dissolve organic matter, and actual state and ecology of zooplankton, crustaceans and fishes. For mud crab, the ecology at settlement, especially characteristics of the juvenile habitat, are being investigated. Techniques of mass seed production and releasing seedstock in sea ranching have been developed for mud crab and black porgy. The Japanese Government subsidizes the development of sea ranching techniques.

## **Strategies for utilization, protection and improvement of mangrove areas**

Mangrove ecosystems have six main values and functions:

- (1) maintaining the stability of coast, estuary and beach areas
- (2) protecting the land behind the mangrove areas from tide and river
- (3) trapping substances derived from land
- (4) maintaining biodiversity
- (5) providing habitat for animals including important species in fisheries at various stages of their life cycles
- (6) providing nursery of juveniles of target species in capture fisheries

These values and functions can not exist unless the mangrove ecosystem is maintained. For fisheries and aquaculture, themes 4-6 should be resolved first. The understanding of mangrove ecosystems, in a broad sense, is necessary before or during the process of determining policies to enhance

value and preserve mangrove areas. Towards this goal, research priorities must be on:

- understanding the functions of and relationships within mangrove ecosystems
- developing enhancement techniques for fishery resources
- establishing a scheme for the sustainable utilization and management of fishery resources

In terms of aquaculture, there is little possibility that mangrove areas will be utilized for aquaculture in Japan. The reasons are (1) the suitable area for aquaculture is so small that large-scale aquaculture in mangrove areas can not occur; (2) cutting and destroying mangroves are strictly restricted, therefore making ponds by cutting mangrove is legally not possible; and (3) tourism is a more beneficial industry than aquaculture.

Instead of aquaculture, the enhancement and management of natural fishery resources are expected. Sea ranching is a prospect for mangrove areas and sustainable farming can be done within the natural ecosystem. Target species of the sea ranching in mangrove areas are the mud crab and the black porgy. Other than fishery production, tourism is an important industry in mangrove areas. Protection and restriction for human activity in mangrove areas are essential for the sustainable utilization as resources for tourism. Usage of mangrove areas for education regarding the environment will increase. On the contrary, the situation in Southeast Asia is very different from that of Japan.

Mangrove areas are important fishing grounds and utilized in a wide variety of ways. The Japanese government has supported the solution of controversial issues on the sustainable utilization of mangrove areas in Southeast Asia based on research in domestic waters. For example, international cooperative research has been progressing on extensive polyculture techniques and the development of techniques of diagnosis and control of shrimp viral diseases. In terms of mangrove-friendly aquaculture, the Japanese government has began a five-year project this year to support SEAFDEC activities. International research cooperation must be promoted further.

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