

The status of the sea cucumber fisheries and trade in Japan: past and present

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Abstract

Dried holothurian has been a major export commodity from Japan for at least 350 years, although recently it has become less important. On the other hand, the Japanese holothurian, “namako,” is mainly consumed raw in the domestic market as slices soaked in a mixture of vinegar and soy sauce. The ovaries are dried, called “konoko,” and the intestines are salt-fermented, called “konowata.” These products are rare, expensive and a good source of income for holothurian processors. In order to discuss suitable resource management systems, this paper reviews the history of holothurian fisheries and trade in Japan. Information on recent holothurian exploitation is also presented, including fishing regulations in Japan, holothurian species and products and, finally, resource management programs being implemented in northern Hokkaido.

Keywords: Fisheries Cooperative Association, fisheries regulations, holothurians, resource management

日本海参开发利用和贸易回顾

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摘要

干海参（iriko），曾经是日本主要的出口商品，其历史至少可追述到350年以前，但现在已经不占主导地位。在日本国内，日本海参（namako）的消费方式是以生食为主，将海参切成薄片，佐以醋和酱油。干制的海参性腺叫做“konoko”，而海参肠经盐制和发酵制成的产品叫做“konowata”。这些副产品既稀少又名贵，是海参加工业者的一项可观收入。为探讨合适的资源管理系统，本文首先回顾了海参加工业的历史，包括干海参贸易和海参的捕捞和加工；其次，提供了当今日本海参开发的信息，包括日本海参捕捞的法规，对海参的种类和产品作了简要的讨论，最后，介绍了在日本北海道北部的资源管理项目的执行情况。

关键词：渔业合作组织、日本渔业法规、海参利用的多种方法、自发的海参管理

Introduction

The current dried holothurian - also known as trepang, beche-de-mer or iriko - market is almost exclusive to Chinese culinary culture, within which it is called “hai shen” or “hai san”¹. In other words, most trepang producers do not consume the product themselves. This is one characteristic of the holothurian fishery industry. Another characteristic is its high value. The animal is dried for at least a month in storage and the dried form must then be soaked in water overnight, followed by repeated simmering for about a week, before use. Thus production is a complicated and time-consuming process. This is one of the reasons why trepang is considered such a delicacy.

Growing concerns regarding biodiversity conservation and environmental protection have made these important issues in the trepang industry worldwide. In order to better understand the structure of the industry, especially between Chinese consumers and other producers, it is necessary to look at its historical development, how it has expanded and how neighbouring nations became involved. Japan provides an ideal case study as the Japanese not only prefer raw holothurian but have also exported trepang to China for at least the last 350 years.

How could Japan continue to produce trepang for such a long time? How did the Japanese exploit their holothurian resources? What is the fisheries system in Japan? To provide answers to these questions, this paper will briefly introduce (a) the history of the trepang industry in Japan, (b) fisheries regulations regarding resource management, and (c) current efforts to manage holothurian resources by local fisheries cooperative associations in the Rishiri district, northern Hokkaido.

History of the trepang industry in Japan

The date when trepang became popular in China is controversial. FAO (1990) simply noted that for a thousand years or more, the Chinese sought trepang in Indian, Indonesian and the Philippine waters, without any particular sources cited. However, from a socio-economic and historical viewpoint, the beginning of the trepang industry and its development should be more precise. This is because Chinese trepang culinary culture has involved neighbouring maritime peoples and that most of the producers, except the Japanese and possibly the Koreans, did not eat trepang themselves and thus began to produce trepang only in response to an outside demand.

Although it is difficult to provide historical evidence on exactly when the trepang culinary culture began, it is possible to conclude that the popularity of trepang increased in China around the 16th to 17th centuries. This conclusion is supported by Chinese literature and the occurrence of trepang trade between China and neighbouring nations at these times.

In Chinese literature, the earliest record of trepang as food is said to come from a book entitled “Miscellanies of Five Items (Wuzashu)” written by Xie Zhaozhi in 1602 in the late Ming period. In this book, it is explained that trepang mildly invigorates the human body similar to “ginseng”, which is the reason it is called “hai-shen” (sea ginseng) (Dai, 2002). Another literary reference is “Suiyuan’s Culinary Companion (Suiyuan Shidan)” written by Yuan Mei, in 1792. Illustrating food delicacies, Yuan Mei noted that in the old days (pre 1790s) the Chinese had poorly appreciated marine foods, but this trend has since changed. He described eight marine delicacies such as bird’s nest, shark’s fin, abalone and trepang (Yuen, 1980). From the descriptions in the two books mentioned it can be concluded that trepang became a popular food item in China at the end of the 16th century.

The second piece of evidence to enforce the above supposition is trepang trade between China and neighbouring nations. For example, the Shogunate government in the Edo period (or Tokugawa in Japan, 1601-1867) controlled all foreign trade. At that time the Japanese officially began exporting trepang, called “iriko” in Japanese, to the Qing dynasty in 1698 in exchange for Chinese silk and medicines. Prior to this date, it is confirmed that in 1861 three Taiwanese ships exported a total of 0.9 tonnes of trepang (Nagazumi, 1987) and an Annan ship also exported some amounts of trepang in 1683 (Yamawaki, 1995). Korea also exported trepang to China by land in 1648 (Sasaki, 2002). During the same period, trepang harvested from tropical waters was also an important trade item that Europeans brought into China in exchange for tea, silk, and porcelains. Macknight (1976), who wrote an exhaustive archeological study on Makassan trepang fisheries in northern Australia, assumed the beginning of the trepang industry to be between 1650 and 1750.

Japan produced trepang as early as the 8th century. It was used as a kind of tax to the ruler, though it is not clear how it was cooked and consumed in those days. In this sense, it was different from other neighbouring trepang producers such as the Philippines and Pacific islands where people had never produced trepang for their own consumption. In other words, Japan already had the knowledge and techniques to produce trepang when China’s market expanded in the 16th and 17th centuries. However, this does not mean that Japan simply exported surplus trepang out of the domestic market. The Tokugawa feudal government not only encouraged coastal people in the maritime communities to produce more trepang for export, but also encouraged Hokkaido, in the northern most part of the Japanese archipelago, to become a major producing area.

Under Tokugawa’s trade regulations, trepang was gathered by several traders in Nagasaki, an official trading port, and classified into 10 categories depending on quality and size². Figure 1 illustrates a trend of trepang exports from Japan in the 17th and 18th century based on the “Catalogue of Imports and Exports in Chinese Trades” compiled by Nagazumi Yoko (Nagazumi, 1987)³. Although the catalogue is not complete, it greatly contributes to reconstructing

¹ The present paper uses ‘holothurian’ for fresh animals and ‘trepang’ for dried holothurian products

² Trepang was the top export commodity in value followed by kelp, and second highest export commodity in volume after the kelp.

Sino-Japanese trade as there are no other valid materials available. In practice, a considerable amount of trepang was exported every year, but the original record was only marked by the number of straw bags instead of the volume unit “kin.” This is the reason it is impossible to draw a bar in Figure 1⁴.

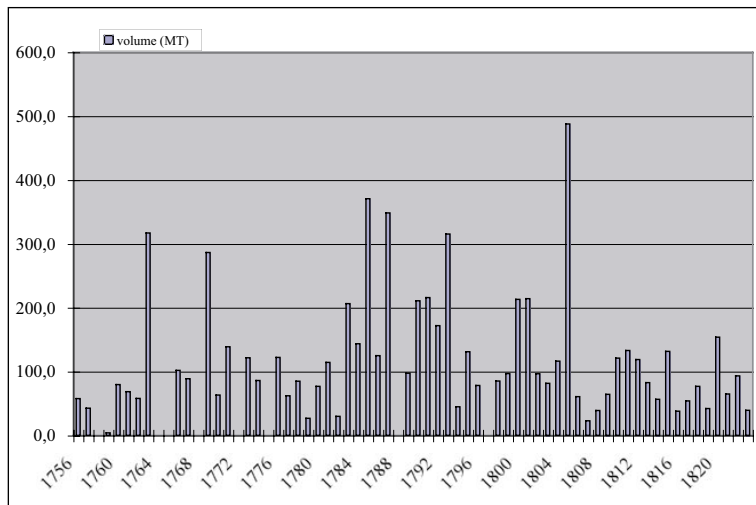


Figure 1. Trepang export from Japan 1756-1823 (Nagazumi 1987).

In 1763, the volume reached 317 tonnes. This was the year that imports of gold and silver from China began and the Tokugawa government needed more trepang for its trade with China. Since the Tokugawa government did not produce as much copper as demanded by China, they needed more trepang for export as compensation. Thus, in 1785, the Tokugawa government appointed contractors to collect trepang throughout the archipelago, and exports reached 371 tonnes (Arai, 1975). This increased effort in trepang production made it possible to export 487 tonnes of trepang in 1805.

Tokugawa’s monopoly in the trepang trade lasted until 1865, after which European and Chinese traders became involved. Two years later, Japan experienced the Meiji Restoration and free trade was enhanced. In the Meiji Government, trepang continued to be one of the main cash earning commodities. This encouraged the Government to open more fishing grounds in Hokkaido and led to the establishment of inland cultivation sites. Hakodate, in southern Hokkaido, in addition to Nagasaki, became one of the leading trading centres for the Japanese trepang trade.

Though holothurians in Hokkaido are small, they have spiny bodies, which are highly appreciated by the Chinese market, especially in northern China. Thus, trepang produced in Hokkaido became important and this is why Hakodate played such an important role in the trepang trade.

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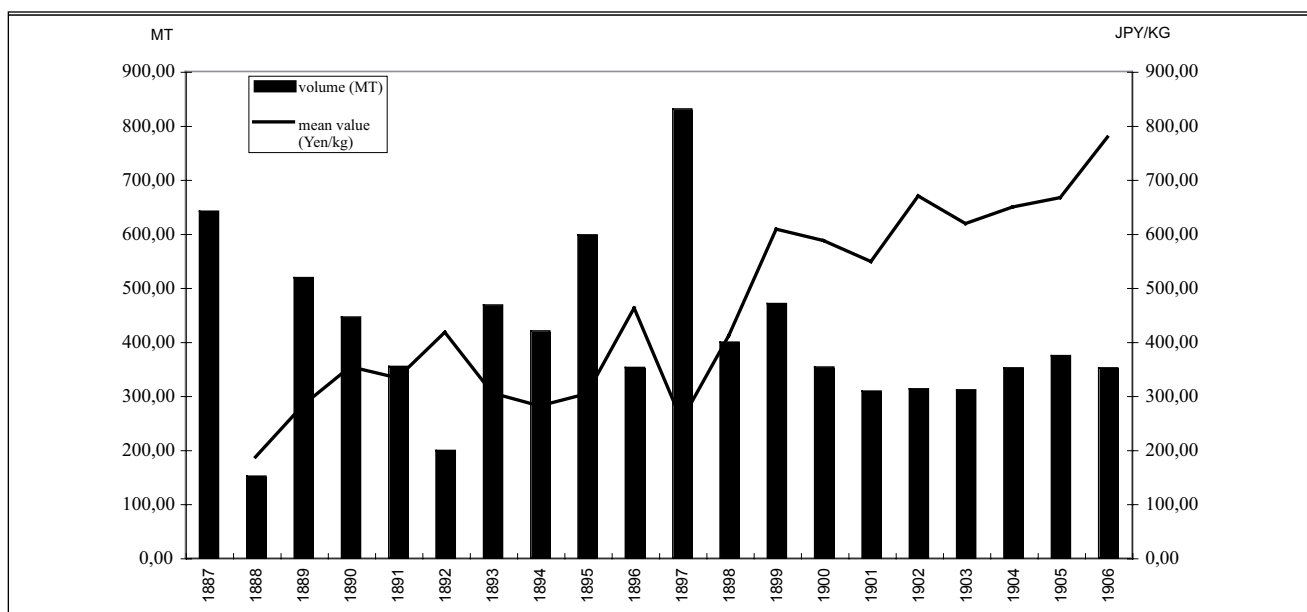


Figure 2. Volume and mean value of trepang production in Japan 1887-1906.

³ Nagazumi researched Dutch archives on Japanese trade with China because there are, unfortunately, few records on Sino-Japanese trade left both in Japan and China. Interestingly the Dutch were so concerned about their Chinese competitor that they recorded considerable information on Sino-Japanese trade.

⁴ For example, in 1788, a total of 4 630 bags of trepang, at least, was exported by 11 ships. These bags, originally used to pack rice, would be equal to 120 kin (72 kg). Thus, it is estimated that about 333 tonnes of trepang were exported.

Unfortunately, there are no concrete trade statistics of trepang exports available after the Meiji period⁵. Trepang production statistics from 1887 to 1906 are shown in Figure 2. An average of 435 tonnes were produced annually during this period, which is more than the highest record in the Tokugawa period. Since there was little domestic trepang demand in Japan, it is likely that almost all of it was exported.

In contrast, we have conclusive holothurian landing statistics from 1894-2000 as shown in Figure 3. In 1968 holothurian landings reached a peak of 13 023 tonnes but a low in 1993 of 5 996 tonnes. After 1993, the holothurian catch remained at the 6 000 tonnes level. Some possible reasons for the current landings are: (a) local fisheries cooperative associations practiced stock enhancement since 1977 as shown in Table 1a and Table 1b, (b) due to aging fishermen, fishing pressure may have decreased, and (c) holothurian fisheries are well managed under the current fisheries policy.

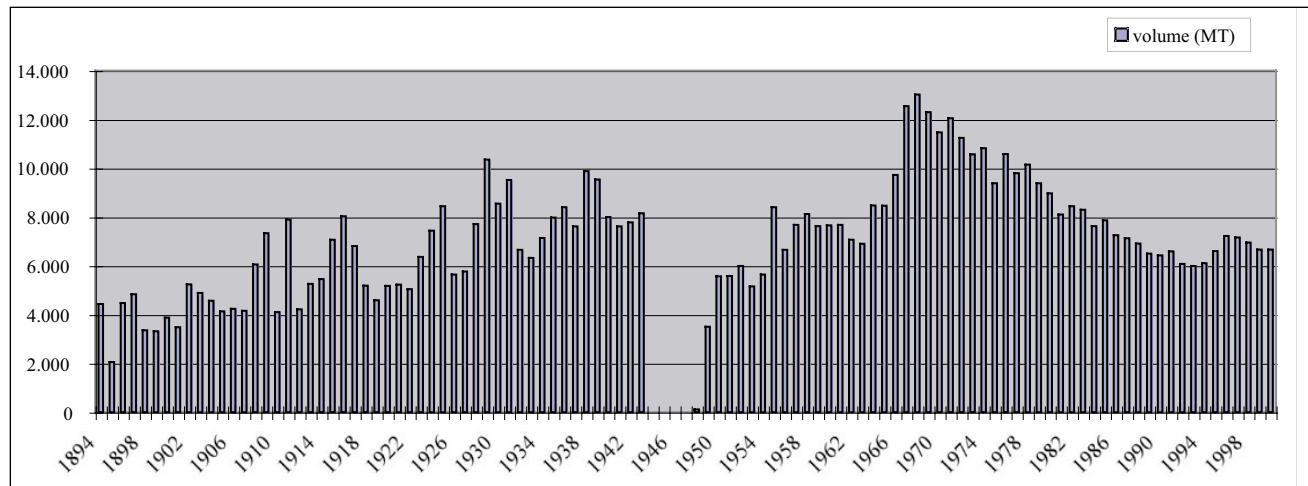


Figure 3. Holothurian catch in Japan from 1894-2000 (Source: Ministry of Agriculture, Trade Statistics, Fishery and Mariculture Production Statistics).

Table 1a. Holothurian stock enhancement in Japan from 1977-1989 (Stock Enhancement Report).

Location	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Soya													
Oshma													
Aomori									0	0	4	1	24
Miyagi										249	275	473	50
Isikawa							3	1	1	20	12	76	119
Fukui												308	174
Aichi							24		26	39	24	35	170
Mie													
Hyogo						11	28						
Okayama													
Ehime													
Hirosima													
Yamaguchi													
Fukuoka	85						900	15	21	77	140	15 153	25 624
Saga				24	1 705	270	262	99	183	1	69	58	196
Nagasaki		69		7	1 111	773			501	380	17	240	117
Kumamoto													
Ooita										84		415	282
Total	85	69	0	31	2 816	1 054	1 217	115	732	850	541	16 759	26 756

Unit: 1 000 individuals.

⁵ In contemporary Japan, there are no independent statistics available on trepang export since it is lumped together with other marine animals.

Table 1b. *Holothurian stock enhancement in Japan from 1990-2001 (Stock Enhancement Report).*

Location	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Soya			54		143	140	200	150	202	203	220	258
Oshma						22					6	2
Aomori	35	20	5	26	41	221	166	204	200	250	200	210
Miyagi	15	30	77	111								
Isikawa	1											
Fukui	711	568	300	592	192	573	400	209				
Aichi	150	200	200	100		700	700	700	700	700	700	700
Mie			1	2	3	7	15	7	2			
Hyogo												
Okayama			346	230	930	2 144	945	758	753	521		
Ehime			200	65	42	52	80	10	12	33	25	1
Hirosima								55				50
Yamaguchi				12	390	755	444	16				
Fukuoka	936	444	31	181	62	140	64		24	10	11	10
Saga	220	224	367	521	506	1 035	397	491	315	349	59	209
Nagasaki	283	656		7	4	14	2	215	33	114	446	349
Kumamoto								2	6			
Ooita	287	310	600	583	244	765	335	516	106	720	188	88
Total	2 638	2 452	2 181	2 430	2 557	6 568	3 748	3 333	2 353	2 900	1 855	1 877

Unit: 1 000 individuals.

Fisheries legislation in Japan ⁶

Fisheries Law

The objective of the Fisheries Law, established in 1949, is to establish a fundamental management system and to ensure fishery productivity with multi-layered exploitation of the water resources and democratisation of the fishery industry. The basic premise of the law is to maintain order in all fisheries by using the “fishery rights” system in the case of stationary fisheries and by using the “fishery permit” systems in the case of mobile fisheries. In addition, the law directs that decision-making concerning important matters be administrated by the Fishery Adjustment Commissions (FACs), which are mainly composed of fishery operators and fishery employees.

Fishery Rights

Some types of fisheries, e.g. the fixed net fishery and culture fishery, cannot be administered unless fishing areas are controlled to a certain extent. In order to adjust these operations among the operators and to maintain order, a system of fishery rights over public waters has been established. The fishery right, entitled by prefectural governors, is a right with which one can operate certain fisheries, exclusively, in given waters⁷. Only local fishery cooperative associations are eligible for the right. To apply and exercise the licence, fishery cooperatives have to determine regulations for exercising fishery rights, i.e. target species, fishing seasons and the method of catching. They also oversee the fisheries conducted by individual members.

Within the fishery rights, there are three categories: common fishery, fixed (set-net) fishery and demarcated fishery (aquaculture). For the first category, three types are further distinguished: (a) a fishery operated to gather seaweed, (b) a fishery operated to gather shellfish, and (c) a fishery operated to gather other stationary aquatic animals.

⁶ Information extracted from Kaneda (1995) and the Overseas Fishery Cooperation Foundation (n.d.).

⁷ The *fishes*□

Tokugawa's feudal system.

Holothurians are one of the animals designated in type (c). Thus, no one can gather holothurians without a fishing right in given waters.

Fishery Permits

Certain types of fisheries may not be conducted without a fishery permit. A fishery permit is different from a fishery right. Issuing the permit means that there is an administrative action to lift a prohibition in a specific case for what is normally a prohibited fishery.

There are numerous types of fisheries permitted, and at present almost all the important fisheries have a fishery permit. There are two types of permits: those issued by the Minister of Agriculture, Forestry and Fisheries and those issued by the prefectural governor. The latter type is called a “governor permitted fishery” and these observe the regulations of each prefecture. Small-scale trawl fisheries that use a powered vessel of less than 15 gross tonnes are regulated under the governor permitted fishery. The dredge net fishery for holothurians falls under this category and, therefore, requires a permit issued from the prefectural governor. The permit is valid for 10 years and every 10 years, the fishing ground plan is discussed for renewal of the permit.

Fishery Adjustment System

There are two types of fishery adjustment commissions: the Sea-area Fishery Adjustment Commission (SFAC) and the Broad-area Fishery Adjustment Commission (BFAC). Taking fishery conditions into consideration, the Minister of Agriculture, Forestry and Fisheries divides the sea into 66 areas across the nation. In principle, an SFAC is set up for each area in each prefecture and is under the authority of the prefectural governor. Each area is a unit for fishery adjustment and therefore, fishery management.

The SFAC is normally composed of 15 commissioners. Of the commissioners, 9 members are elected from fishermen through official elections and 6 are appointed by the governor (4 as academic experts with fishery expertise and 2 representing the public interests). The SFAC has an advisory function to the prefectural governor. Designating the fishery rights, and all other matters that the administrative agency handles in regard to the fishery right, must be carried out after consulting with the SFAC. As for the governor permitted fishery, each prefectural fishery adjustment regulation requires that a governor has to consult with the SFAC before granting a permit. In addition, the SFAC has the authority to make any decisions concerning the arbitration, instruction and authorization of the permit.

To conclude this section, according to the observed Fisheries Law in Japan, no-one can freely collect and gather holothurians without a fishing right, as the animal is designated a common fishery right species. Even if one has the fishing right, they can fish only by using hooks, clips and twists, or by diving. Those who wish to fish holothurians with dredge nets have to apply for a permit to the prefectural governor because the dredge net fishery is designated as a governor permitted fishery. Thus, the prefectural governor, together with the SFAC, plays an important role in resource management, especially for holothurian fisheries in Japan.

Holothurian fisheries in Japan

Species Fished

Aside from species found in the subtropical waters in Okinawa, the most common species in the Japanese archipelago is *Apostichopus japonicus*. In his classic study, Choe (1963) noted two other holothurians that are commercially harvested, *Parastichopus nigripunctatus* (“okiko”) and *Cucumaria japonica* (“kinko”). However, currently these two species are rarely harvested and thus only a small quantity is processed⁸. In the following discussion, ‘holothurian’ or ‘trepan’ refers only to *A. japonicus*.

Until the 19th century, wealthy Japanese often consumed trepan, but it is not common nowadays. On the other hand, holothurians are commonly consumed raw in the domestic market in slices soaked in a mixture of vinegar

⁸ In 1999, the author observed dried *P. nigripunctatus* in retail shops in Chinatowns in Yokohama and Kobe, where dried *A. japonicus* sold for 25 000 yen/kg and dried *P. nigripunctatus* for 18 000 to 20 000 yen/kg. *P. nigripunctatus* production was estimated to be not more than 200 kg.

and soy sauce. The ovaries (“konoko”) are dried and the intestines (“konowata”) are salt-fermented. These products are rare and expensive, and are a good source of income for the trepang processors. For the Japanese, holothurians are a seasonal delicacy preferred only in winter, especially at the winter solstice and during the New Year. For raw consumption, the red *A. japonicus* variety is preferred and its price is almost double that of the green and black varieties. Most of the processors, therefore, process the green and black into the dried product.

An Example of a Fishery Organization: Semposhi Fisheries Cooperative Association, Northern Hokkaido

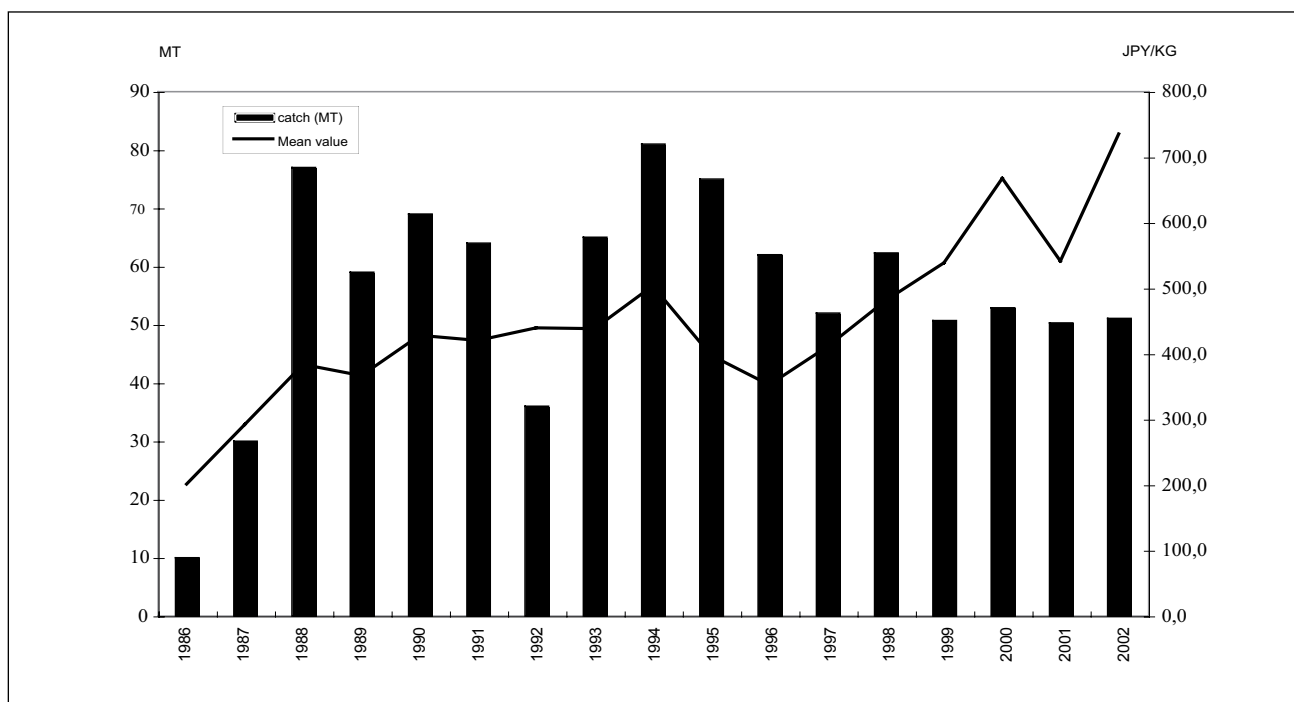
Rishiri is a small island divided into two municipalities lying on the northern tip of Hokkaido. Rishiri Town currently has a population of about 3 000 and 400 are engaged in fishing. Aside from holothurians, Rishiri is also famous for kelp (*Laminaria ochotensis* Miyabe), sea urchin (*Strongylocentrotus intermedius* and *S. nudus*) and Atka mackerel (*Pleurogrammus azonus*) fisheries. There are two fishery cooperative associations in Rishiri Town: Semposhi Fisheries Cooperative Association (SFCA) and Kutsugata Fisheries Cooperative Association (KFCA).

The *A. japonicus* fishery is classified by the fishing gear used: dredge net fishery, hook fishery, clip and twist fishery, or diving. The spear and dart fishery is not common because of the damage caused to the body of the holothurian during fishing. In the SFCA, more than 98 % of the catch is from dredge net fishing. As of July 2003, there were 11 dredge net operations permitted.

In the Semposhi district, dredge net fishing was once very common and the fishermen processed their catch into trepang. However, dredge net fishing stopped after World War II. It became active again in 1982 with three fishing vessels (Figure 4). Governmental agencies may have played an important role in the revival of this fishery. The Hokkaido Fisheries Experimental Station tried to diversify and expand holothurian processing in 1974 (Hokkaido Fisheries Experimental Station, 2001). The work of the station may partly be responsible for the revival of the dredge net fisheries in the district.

Dredge net fishing is conducted in waters 40-50 metres deep, as few holothurians are found in shallow waters. The closed fishing season is regulated by the association. In the case of the Rishiri district, holothurian fishing is not permitted from May 1 to June 15 as this is considered the spawning season. Therefore, there are two fishing periods: from March to April (spring season) and from the end of June and July (summer season).

Figure 4. Volume and mean value of holothurian traded at the SFCA from 1986-2002.



Resource Management at SFCA

The SFCA practices an integrated resource management programme that combines several management tools.

Size limit - In 1990, the SFCA decided that holothurians under 130 g in weight should be released and not retained in the catch. Undersized holothurians are in fact not profitable as the trepang processors in mainland Hokkaido offer low prices. As mentioned earlier, the Japanese prefer to eat raw holothurian only in winter and therefore the SFCA catches are processed directly into trepang. Approximately 100 to 120 processed sea cucumbers make up 1 'kin' in weight (Chinese traditional unit) equivalent to 600 g (80 % of the weight is lost when trepang is processed reducing a specimen of 130 g to 5-6 g)⁹. The market prices are very low for specimens under the indicated size therefore justifying the minimum size of 130 g imposed by the association.

Quota - From 1999, the SFCA voluntarily limited their annual catch to not more than 50 tonnes. The reason for the quota is economic rather than scientific. At that time, there were 10 vessels engaged in dredge net fishing and the SFCA discussed how much quota was reasonable for each operator. The result was 0.5 tonnes per vessel for one season. Thus, the quota limit may change if the situation changes. However, the SFCA does not expect to have more fishermen begin dredge net fishing due to the high initial investment required.

Closed season - The dredge net fishermen have long felt that the spawning season should be different from that ordained by the SFCA. In 2001, research indicated that the spawning season effectively starts at the end of July to August (Rishiri District Fisheries Extension Office, 2001) and based on this research the SFCA have since requested to move the close fishing season to July 20th to the end of September. The proposal is still being examined by the local authorities.

Others - The SFCA is still not fully convinced on what actions are required to properly manage the local holothurian fishery. Currently a stock enhancement programme is in place, however the additional sea cucumber juveniles required are not available locally or from other private and public facilities. Furthermore, the SFCA is eager to exchange ideas and learn more from other organizations. In January 2001, holothurian fishermen and representatives from the association visited the Aomori City Fisheries Experimental Station and held meetings with similar associations in Southern Hokkaido and the Aomori Prefecture to exchange ideas on resource conservation.

Observations for the future

The dredge net fishermen do not rely only on holothurians only at the SFCA. Most of them are engaged in kelp and sea urchin fishing when they are in season. Some fishermen work part-time as carpenters and construction workers. Variation in resource use is an important factor in managing marine resources. Unregulated fisheries and concentration on one or two species may soon deplete those resources.

Monitoring and understanding the holothurian market is a key factor in resource management. In this sense, the SFCA has been successful in monitoring the market, as evidenced by the provision of a size limit for *A. japonicus*. In a different fishery, the SFCA totally closed abalone fishing in 2003, for resource conservation reasons. In 2002, they opened abalone fishing only twice and discovered that the abalones were too small. The sea urchin fishery is another example of understanding the market. Even during the sea urchin fishing season, the SFCA does not allow its members to fish sea urchin every day. By monitoring the market price, the SFCA decides when to fish and what to fish - either *Strongylocentrotus intermedius* or *S. nudus*. If the market is low, they ban sea urchin fishing.

Situations are different from region to region and from country to country. It may be difficult to establish holistic or comprehensive regulations for resource management. The problem lies in how to set up the division of management, as the Japanese SFAC did, and how to take into consideration the regional characteristics for planning resource management. Toward this end, we have to understand ecology, culture and human nature.

⁹ According to a processor in Yamaguchi Prefecture, very large holothurian specimens are not always preferred. There are two dried product-size demanded by the Chinese market: 11-17 g and 18-23 g equivalent to 220-340 g and 360-460 g in the fresh form. Thus, fresh specimens weighing over 500 g are not suitable for processing.

Acknowledgements

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