

**Challenging “boom and bust” market pressures:  
Development of self-managed sea cucumber conservation in  
Rishiri Island, Hokkaido, Japan**

Akamine Jun

*School of Humanities and Social Sciences, Nagoya City University, 1 Yamanohata, Mizuho-cho, Mizuho-ku,  
Nagoya City, 467-8501, Japan*

Wildlife Conservation Society

# Challenging “boom and bust” market pressures: Development of self-managed sea cucumber conservation in Rishiri Island, Hokkaido, Japan

Akamine Jun

*School of Humanities and Social Sciences, Nagoya City University, 1 Yamanohata, Mizuho-cho, Mizuho-ku,  
Nagoya City, 467-8501, Japan*

**Abstract** The rapid expansion of the dried sea cucumber market since the late 1980s has created a serious conservation issue worldwide. In fact, since 2002 sustainable use versus protection of sea cucumbers has been hotly debated at CITES meetings. In order to better understand the issue, this paper first explores the historical development of “sea cucumber foodways” in Asia. Only a few spiky sea cucumbers, among the 40 commercially traded species, are currently highly appreciated by Chinese gourmets. The second part of the paper introduces case studies of communal resource management based on my fieldwork on Rishiri Island, northernmost Japan, where the most expensive sea cucumbers with sharpest spikes in the world are harvested. In particular, I have focussed on: how the Rishiri sea cucumber fishery began, how a quality branding was achieved, and how resources are managed. Competing with strong market pressures and poaching, the fishermen of Rishiri Island have developed self-managed communal rules resulting from the exchange of ideas and practices with other societies.

**Key words:** sea cucumber conservation, CITES, foodways in Asia, communal resource management, self-regulation, collaboration with trading sectors

## INTRODUCTION

The global market for dried sea cucumber expanded during the late 1980s and this led to serious conservation issues worldwide. One of the most notorious examples comes from the Galapagos Islands in Ecuador (Stutz 1995). Fishermen not only over-exploited the endemic sea cucumber *Isostichopus fuscus*, but also they developed land on the protected pristine islands for processing them. Mangrove trees were cut for cooking fuel, destroying the habitat for the most endangered of the Darwins’ finches (Camhi 1995). Furthermore, ships with livestock and domestic animals anchored close to these protected islands accidentally introduced non-native species such as rats, ants and cockroaches (Powell and Gibbs 1995). As a consequence, the Ecuadorian government banned sea cucumber fisheries in August 1992. After a short experimental re-opening of the fishery in Oc-

tober 1994, the ban was put in place again, but local fishermen violently protested against the ban in early 1995, which triggered international debate on how to conserve sea cucumbers (Stone 1995, Verrall 1995, MacFarland and Cifuentes 1996, Jenkins and Mulliken 1999, Ferber 2000, Bremner and Perez 2002, Edgar *et al.* 2004, Shepherd *et al.* 2004, Hearn *et al.* 2005).

The international debate was formally opened when the U.S. Government proposed the possibility of CITES Appendix II listing of sea cucumbers at the CoP12 in 2002 (U.S.A. 2002, Bruckner *et al.* 2003, Bruckner 2006). As a maritime ethnologist working among the sea cucumber fishing communities in Southeast Asia and Japan (Akamine 2001, 2002, 2005), I was invited to several workshops and meetings focused exclusively on sea cucumber management. The participants not only admitted their lack of scientific data for designing a resource man-

agement plan, but they also agreed on the necessity to evaluate the socio-economic and cultural background of sea cucumber fisheries and livelihoods of coastal fishing communities (Lovatelli *et al.* 2004, CITES 2007). Since dietary culture or so called foodways, affects production and the market, it is necessary to look deeply into dining habits and values (Conand 2001, 2006).

For this reason I will provide a rather narrative and ethnographic description in order to understand the socio-cultural aspects of the sea cucumber fisheries and their historical development. In this paper, I first explore what Chinese “sea cucumber foodways” are and explain how the recent foodways in Hong Kong and southern China affect sea cucumber fisheries and production. Among the 30 to 40 species of commercially-traded sea cucumbers in the world, only a few kinds of spiky sea cucumbers have gained in popularity in recent years. The Galapagos species has noticeable spikes, and this may be one reason its price has increased. Moreover, the Japanese common species, *Stichopus japonicus*, is most appreciated among the spiked species. Focusing on the utilization of this particular species, the second

part of the paper considers the significance of promoting self-regulated resource management at the community level by presenting a case study of dried sea cucumber production in Hokkaido.

### DEVELOPEMNT OF SEA CUCUMBER FOODWAYS

Currently, the use of sea cucumbers in cooking is limited to the Chinese food diaspora. This includes China, Hong Kong, Taiwan, and Singapore, as well as Korea, Japan, and populations of overseas Chinese living in a wide range of countries include Southeast Asia, the U.S.A, Canada, and Australia. Among the dominant sea cucumber markets in Asia, Hong Kong is the largest importer, though nearly 70 percent of its total imports are re-exported, with China being the largest outlet (Ferdouse 2004). For example, in 2006 Hong Kong imported 4,180 metric tons of dried sea cucumber (19.1 billion yen equivalent) from at least 54 countries and regions (Figure 1).

Although Chinese cooking boasts a long history, the use of dried sea cucumber in China began to

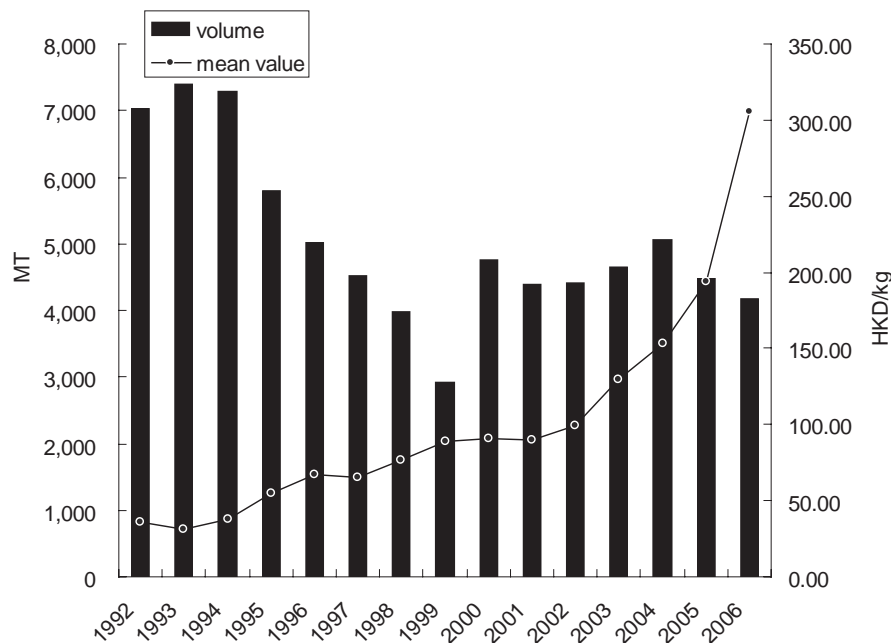


Figure 1. Dried sea cucumber imports into Hong Kong 1992-2006.

spread only between the end of the 16<sup>th</sup> century and the beginning of the 17<sup>th</sup> century (Dai 2002). In Chinese literature, the first reference to the medicinal qualities of dried sea cucumber was recorded in 1602 in *Wuzazu*, which stated that “sea cucumbers (*hai-shen* in Chinese, meaning literally sea-ginseng) can be found in the coastal area of Liaodong...they rival ginseng in warming the body and replenishing the blood, hence their name” (Xie 1998). Later, during the 18<sup>th</sup> and 19<sup>th</sup> centuries, sea cucumber dishes gained explosive popularity in the imperial court.

The Chinese classify sea cucumbers into two types depending on their shape. Just as described in the section on sea cucumbers in *Bencao Gangmu Shiyi*, compiled in 1765, the Chinese call sea cucumbers with spikes “*ci-shen*” (spiky sea cucumber) and those without “*guang-shen*” (shiny sea cucumber) (Zhao 1971). “Spikes” actually refer to the parapodia lining a sea cucumber’s back and sides that harden when dried.

There are some morphological and ecological differences between *ci-shen* and *guang-shen*. Generally speaking, *ci-shen* are slim and small but *guang-shen* are meaty and large. *Ci-shen* are most common among temperate sea cucumbers while *guang-shen* are more typical among tropical ones.

Chinese cooking is largely divided into Beijing, Shanghai, Sichuan, and Canton cuisines. The regional differences, however, are most pronounced between Beijing and Canton. Traditionally, the Beijing style uses the temperate *S. japonicus*, found in the Bohai Sea and along the Korean, Japanese, and Russian maritime coasts, while the Cantonese prefer the tropical *Holothuria fuscogilva* or *H. scabra* harvested in the Indian and the Pacific Oceans. Of course, geographical location plays a part in these preferences for the temperate one in the north and the tropical ones in the south. Although I won’t go into detail here, each style also has distinct differences in cooking methods and seasoning. The major difference relating to regional sea cucumber cuisine is that the Pekinese prefer to serve food in small dishes while the Cantonese use a large serving dish

placed in the center of a round table. It makes sense that these differences in serving style are behind the higher demand for small sea cucumbers in Beijing style cooking and large sea cucumbers in Cantonese cooking.

Like fashion, however, different foods go in and out of style. Cantonese sea cucumber dishes are now being served Beijing style in small dishes. Rather than cutting up the larger *H. fuscogilva* into small servings, Cantonese chefs are using the smaller *S. japonicus*. This new movement in Canton style is known as *nouvelle chinoise*. A sharp rise in Hong Kong’s imports of Japanese sea cucumbers after 2001 (See Figure 2) supports this view. The recent price hike in Japan, especially in Hokkaido, is probably attributable to this trend that occurred in Hong Kong (Akamine 2007).

There is no scientific reason available, but it is well known among traders and consumers that among the sea cucumbers harvested in the Japanese archipelago, the ones which inhabit the northern waters, for example those in Hokkaido and Aomori, have sharper spikes than those that inhabit the western part of the Japanese archipelago. The Hong Kong market traditionally classifies the former as *guandong-shen* (eastern variety) and the latter as *guanxi-shen* (western variety). *Guandong-shen* prices almost double compared to *guanxi-shen* when it is exported from Japan. Export prices of dried sea cucumber in 2007 varied from ¥30,000 per kilogram for the western variety, to ¥40,000 per kilogram for the Aomori variety, and as much as ¥50,000 per kilogram for the Hokkaido variety.

#### SEA CUCUMBER FISHERIES IN JAPAN

Under the current Japanese Fisheries Law, originally enacted in 1949, coastal fisheries include sea cucumber fisheries. The purpose of the new fisheries law was to modernize and democratize the fishing industry along the lines of the agricultural land reforms that took place after World War II. There have been two distinctive, reputable achievements: the es-

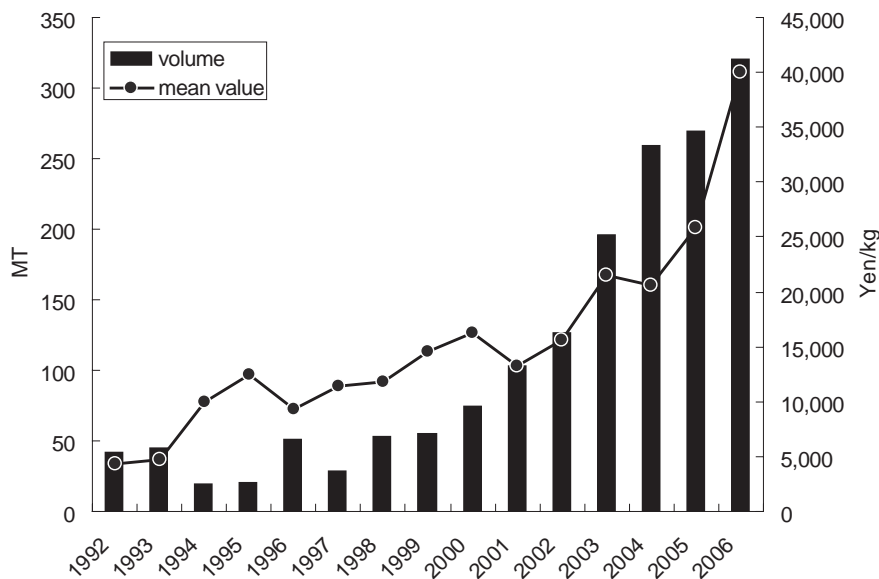


Figure 2. Dried sea cucumber imports into Hong Kong from Japan (1992-2006).

establishment of a decentralized supervised system and recognition of common property rights.

The law stipulates that decision-making concerning important matters such as the fishery season and licensing be administrated by the Fishery Adjustment Commissions (FACs). In principle, an FAC is set up for each prefecture and is under the authority of the prefectural governor. This sea-area becomes a unit for fishery management, and this is the reason the central Fisheries Agency cannot directly regulate resource management in each water.

The communal property rights are realized by a combination of fishery rights and fishery license. The fishery right, controlled by prefectural governors, allows certain fisheries to be operated exclusively in given waters. Only local Fisheries Cooperative Associations (FCAs) are eligible for the right. In addition, certain types of fisheries may not operate without a fishery license issued by the prefectural governor.

Sea cucumbers fall under either general fishery rights or licensed fishing depending on type of the gear employed. The Fisheries Law places sea cucumbers under Type 1 common fishery rights, which means that only fishermen are able to harvest them. If dredge nets are used, a license is required from the

prefectural governor for the use of fishing boats weighing 15 tons minimum (Akamine 2004).

In addition, regional regulations, placed by the FAC, control fishing seasons and equipment restrictions according to local conditions. Fishermen operate according to the fishing rules established by the FCA to which they belong. Among the FCAs, a sea cucumber fisheries unit (SFU) is organized and the unit members decide the details of each year's operational plan including: fishing period, gear, total amount of harvest, and size limits, everything regarding on resource management within the regional regulations ordered by the FAC.

Authority has been decentralized so that the national Fisheries Agency cannot oversee local operations. Consequently, it is difficult for the national government to intercede in resource management or even in the poaching of sea cucumbers. Although the various regional FACs stipulate how and when to fish, actual practice is dependent on the self-regulation of local FCAs.

During March 2005, I conducted an interview with Charlie Lim, the general secretary of the Shark-fin and Marine Products Association (SMPA) in Hong Kong, an association that is composed of wholesalers of dried sea cucumbers (see Table 1).

Table 1. Classification of Japanese Dried Sea Cucumbers among the Hong Kong Wholesalers.

size number	number of pieces per 600g	weight per piece (g)
1	20-30	20-30
2	30-40	15-20
3	40-50	12-15
4	50-60	10-12
5	60-70	8.6-10
6	70-80	7.5-8.6
7	80-100	6.0-7.5
8	100-120	5.0-6.0
9	120-150	4.0-5.0
10	150-180	3.3-4.0
11	180-220	2.7-3.3
12	220-250	2.4-2.7
13	250-300	2.0-2.4
14	300-350	1.7-2.0
15	350-400	1.5-1.7

Source: Interview to Charlie Lim of SMPA in March 2005.

Lim explained that in Hong Kong, dried sea cucumbers from Japan are usually divided by size into fifteen different categories. Prior to about 2000, the regular size was an 8 or above (see Table 1), recently, however, sizes 7 to 11 are selling well, while larger dried sea cucumbers do poorly. Lim explained that this is because *nouvelle chinoise* cuisine has taken root in Hong Kong. Instead of cutting up large, meaty sea cucumbers and presenting them in a large serving plate, which is the typical Cantonese serving style, single sea cucumbers are served on small plates, which is more in the Beijing style. If a large sea cucumber is used for each plate, the cost per plate is obviously higher. But if smaller sizes are used, for example 400 pieces of dried sea cucumbers per 600 grams batch, the cost per sea cucumber would be just ¥140 even if the batch as a whole costs ¥60,000.

Separate from this demand for smaller sea cucumbers in Hong Kong, however, Lim noted that the proportion of smaller sea cucumbers being exported

from Japan has become greater. Lim believed that the ultra small sea cucumbers were being fished in novice regions that had just entered into the dried sea cucumber business: "There's a difference in the precision of resource management between communities where sea cucumbers have been harvested for a long time and communities that have only recently joined the market. We're concerned about regulation in these newcomer areas." He was apprehensive about the current state of sea cucumber harvesting in Japan, and remarked that "the Japanese government should take action and manage the resources."

It is, however, impossible under the current system for the Fisheries Agency to directly oversee activities in regional waters. Note that two main characteristics of the current Fisheries Law, decentralization of authority and establishment of communal property rights are generally appreciated (Ruddle 1987, 1989, Feeny *et al.* 1990). The problem is that if FCA and its members are not interested in sustainable use of their resources, they may easily yield to "boom and bust" market pressures. Still, as Lim also acknowledged, Japan has a long history of local resource management; i.e. self-regulated practices by FCAs.

#### THE EMERGENCE OF SEA CUCUMBER FISHERIES AROUND RISHIRI ISLAND

Of the four FCAs on Rishiri Island (Oshidomari, Oniwaki, Semposhi, and Kutsugata), the Oniwaki FCA in the southeast harvests the fewest sea cucumbers. Although Rishiri Island has been known for its sea cucumber fisheries since the latter half of the 18<sup>th</sup> century, the industry was revitalized only in the mid-1980s with the introduction of dredge net fishing. The following is an historical reconstruction of sea cucumber fisheries in two FCAs: Oshidomari and Semposhi.

#### *The Case of the Oshidomari Fisheries Cooperative Association (OFCA)*

Table 2. Sea cucumber production and sales at SFCA (1980-2007).

Year	Dried Sea Cucumber			Fresh Sea Cucumber		
	Weight (kg)	Amount (Yen)	average price per kg	Weight (kg)	Amount (Yen)	average price per kg
1980	29.0	110,015	3,794			
1981	300.0	1,155,936	3,853			
1982	60.0	178,000	2,967			
1983	72.7	474,790	6,531			
1984	0			5,162	2,825,000	547
1985	0			16,000	3,917,000	245
1986	0			10,447	2,001,000	192
1987	0			30,378	8,741,000	288
1988	0			76,676	29,478,000	384
1989	0			58,556	21,567,000	368
1990	0			68,978	29,474,000	427
1991	0			63,719	26,846,000	421
1992	0			36,301	15,783,000	435
1993	0			65,436	28,432,000	435
1994	0			81,560	40,717,000	499
1995	0			75,708	29,759,000	393
1996	0			61,888	21,803,000	352
1997	0			52,397	21,334,000	407
1998	0			62,311	29,911,000	480
1999	0			50,739	27,256,000	537
2000	0			52,999	35,269,000	665
2001	0			50,259	27,179,000	541
2002	0			51,116	37,533,000	734
2003	0			51,052	64,615,000	1,266
2004	0			50,020	81,116,000	1,622
2005	0			51,000	87,002,000	1,706
2006	0			53,959	136,098,000	2,522
2007	0			51,954	156,339,000	3,009

Source: SFCA Business Report.

Satoshi Yoshida (born in 1944) first became involved in sea cucumber harvesting in 1984 and began fishing in earnest with dredge nets the following year in Oshidomari, Rishirifuji Town. He began selling fresh sea cucumbers in 2003, but until then had dried all his harvested sea cucumbers at home. Of the eleven members dredge net fishing in the Oshidomari Fisheries Cooperative Association (OFCA),

Yoshida has been the only one to do so consistently over the years. As chair of the SFU of the OFCA until 2005, he is the leading expert on sea cucumber fisheries in Oshidomari area.

When Yoshida was in his 30s, the fishing industry in Rishiri Island was booming, especially for tuna but also for sand lance *Ammodytes* spp., squid, and octopus. Reflecting the boom, Rishiri Island was



featured in a 1981 NHK program called *Shin Nihon Kikou*, or “The New Japan Travels,” when it was not uncommon for a fisherman to make one million yen in a single day. Yoshida has kept the back fin of a 267 kilogram blue fin tuna he once caught using only a hook and line. The sand lance frenzy was due in part to the 200 nautical mile exclusive economic zones implemented by the U.S.A. and the U.S.S.R. in 1977. Prices increased as buyers speculated on a scarcity of sand lances as a result of the zoning. Of course, there was no reason to labor over sea cucumbers at the time.

Suddenly though, perhaps because of changes in the ocean currents, both tuna and sand lances stopped coming north. With both tuna and sand lances gone, Yoshida had to turn to octopus and sea cucumbers instead. He explained, “I was always thinking about what was likely to make money.” He knew that sea cucumbers used to be harvested in Rishiri Island by small surfboats. When he heard from adjoining FCAs that dried sea cucumbers were fetching a good price, he “figured there would be resources since the area hadn’t been fished in years.” He learned how to process sea cucumbers from a friend Fukuda (pseudonym) who, originally from Yoshida’s local area on Rishiri Island, then lived in Wakkanai, a port city at the northern tip of the mainland of Hokkaido. With this shared homeland, Fukuda taught Yoshida everything he knew.

Out of eleven boats currently fishing for sea cucumbers in OFCA in 2006, five or six boats had started in the spring of 2004, and by the summer the number had increased to ten. Octopus fishing had been sluggish in the summer of 2003, and interests shifted to sea cucumbers in the spring of 2004 around the same time that demand abroad was driving prices up.

Yoshida explained to me, “There are eleven boats operating now in OFCA because we don’t make dried sea cucumbers, and we sell them fresh instead. If we had to dry them, the number of boats would be cut in half. Anyone can make dried kelp, but sea cucumbers aren’t that easy. It’s smoky and it’s hot.”

Unlike machine drying used today, sea cucumbers used to be dried naturally in the sun. As Yoshida’s wife recalled in our interview in April 2006, “Sea cucumbers are just too hard on the body. Of all the different work I’ve done, sea cucumbers were the hardest.” “You have to stay outside all day for sea cucumbers while kelp is done in one or two hours,” and “once kelp is dry all you have to do is put it in storage, but with sea cucumbers, you have to dry it all day, put it away if it starts to rain, and even if the weather cooperates, it still takes 20 days to dry.”

Furthermore, she spoke about the hardship of collecting seawater and cutting sagebrush for processing the sea cucumbers. “Even though it costs money, we get freshwater if we just turn the tap. Seawater is free, but we have to get it ourselves, and that’s not easy and neither is getting sagebrush.” Today, sea cucumbers are harvested in the spring and summer before and after the no-fishing period from May 1<sup>st</sup> to June 15<sup>th</sup> established by the administration. Previously, sea cucumbers were only fished in the summer, when there was plenty of sagebrush available used for smoking.

Although sagebrush “can be cut today and used until tomorrow,” sagebrush is no good if dry. Thus, fishermen essentially have to cut it fresh each time they return from the sea. Sagebrush grows naturally all over Rishiri Island but people have to separate it out from other grasses that grow in the same places. When sea cucumber fisheries open on June 16<sup>th</sup>, the sagebrush is still not very tall and consequently, more of it needs to be cut. Without the sagebrush, the sea cucumber cannot be dried correctly, and it takes around 40 to 50 kilograms of sagebrush to process 100 to 150 kilos of sea cucumber. Fresh sagebrush is so heavy that if it is strapped to the back of a motorbike, the front end will tip up.

Yoshida’s routine was to fish for sea urchin in the morning, bring it home, and then set out again for sea cucumber dredging. His wife would peel the sea urchins, go out to collect sagebrush and seawater, and then keep a fire going until her husband came home. First, they would boil a large pot filled with



seawater, scrap iron, and sagebrush. Only iron pots could be used because stainless pots would not change the color of the sea cucumbers into shining black, which the market favoured. After thirty minutes, the water would turn dark and the iron scraps and sagebrush were removed. The sea cucumbers were gutted and placed in the pot. After adding the iron scraps again, the sea cucumbers were simmered for about 40 minutes and then smoked with sagebrush for approximately two hours. If Yoshida and his wife cut down the smoking time to just one and half hours or so, the high-priced spikes fell off the sea cucumbers. If the weather was bad, they had to extend the smoking time up to three hours.

To smoke the sea cucumbers, the sagebrush was placed in two layers, fresh on the bottom and boiled on top. The sea cucumbers would burn if the flame grew too strong, so the fire had to be watched constantly. During a two-hour smoking, the sea cucumbers would also have to be flipped from side to side or stirred in a draining board five to six times so that the heat and smoke spread evenly. Mr and Mrs Yoshida also recalled how the palms of their hands hurt from having to turn the spiky sea cucumbers as they dried in the sun all day. She described the sea cucumber business as follows: "When it's calm, the land is tired," referring to the fact that if the seas were friendly and fishing was good, it meant that she had more work to do processing the sea cucumbers. Aside from sea cucumber fishing itself, it is clear that women played an essential role in the domestic cottage industry of processing sea cucumbers.

Today, however, all four FCAs in Rishiri Island, including OFCA, sell fresh sea cucumbers only and do not process them at home. The main reason is a shortage of labor, but another factor may be that profits can only be made at the end of the year for dried sea cucumbers. As Yoshida recalled, "Bidding usually happened in November and we didn't collect any money until around Christmas. Until then, we'd weigh our goods and dream about what we'd get for it compared to prices the year before."

This brief case study of OFCA reveals that Yoshi-

da was the first to revive his fishery to harvest sea cucumbers when tuna and sand lance could no longer be caught. He happened to pay attention to the sea cucumber because the neighbouring municipal government launched a sea urchin transplanting project as described below, and sea cucumbers were caught as a by-catch of the project.

#### *The Case of the Semposhi Fisheries Cooperative Association (SFCA)*

The first reference to sea cucumbers in the Semposhi Fisheries Cooperative Association (SFCA)'s business report was in 1980. The amounts and sale prices of dried sea cucumbers were recorded for four years through 1983 (see Table 2). In 1984, however, the sales shifted to fresh sea cucumbers. The reason for this switch was because "it took too much effort for too little money." The people of SFCA felt that the laborious effort required to process dried sea cucumber just described in the previous section was simply not worth expending.

Although it is not exactly clear what triggered the start of sea cucumber fisheries in 1980, the opportunity was indirectly presented through local government which supported the transplant and replenishment of northern hard-spine sea urchin *Strongylocentrotus nudus* populations. In the early 1970s, the Rishiri Town Municipal Government launched a project transplanting northern hard-spine sea urchins living in deep waters to shallower waters. The municipal government provided funding for dredge net boats to catch sea urchins from 6 to 9 meter depths and transfer them to shallow-water coasts. Dredge nets made in Suttsu, southwestern coastal mainland Hokkaido, were imported to Rishiri and copied by local ironworkers. However, the dredge net did not retain the sea urchin well, and in fact broke off their spines. With each year, the shells of the sea urchins also became smaller and smaller. What the nets did manage to catch were more sea cucumbers than sea urchins.

The details of this project need further investigation, but it is certain that it opened the door to dredge

net fishing of sea cucumbers around Rishiri Island. The SFCA's report in 1980 reflected the first time dried sea cucumber production was conducted on a trial basis after the transfer project ended. Veteran fishermen in the SFCA taught sea cucumber drying methods to young members. Despite successful catches though, the fishermen could not make ends meet with dried sea cucumber. They switched to selling raw sea cucumber in 1984 and continue to do so today. This is the time when Yoshida hit on sea cucumber fisheries.

#### SEA CUCUMBER RESOURCE MANAGEMENT AT SFCA

Dredge net fishing of sea cucumbers by the SFCA began in earnest in 1984 when sales turned to fresh sea cucumber. The town of Rishiri issued financial support, and dredge nets were made to order by seven or eight fishermen at iron factories outside Rishiri Island because nobody knew how to make them at that time.

It was not until 1988 that a SFU was officially established within the SFCA. At this time, resource management was actively practiced and catches were limited to sea cucumbers weighing at least 80 grams. In 1989, this weight limit was raised from 80 to 100 grams and sea cucumbers less than 10 centimeters in length were to be thrown back to sea. The next year, in 1990, the bar was again raised to 130 grams. In 1999, the SFCA implemented a self-regulatory 50-ton limit to its total catch in the interest of conserving resources. This number was arrived at roughly based on market conditions and the calculation that each of the SFU's boats would be allowed to catch 0.5 tons.

Although the SFCA has engaged only in the fresh sea cucumber trade, almost all of the sea cucumbers shipped to mainland Hokkaido are processed and dried for export. In fact, the size and weight restrictions implemented by the SFU were based on the premise that the sea cucumbers would ultimately be dried. If the sea cucumbers were too small, buyers

would bargain for cheaper prices. For example, supposing a yield rate of 3.5 percent, 130 grams of fresh sea cucumber would become 4.5 grams of dried product and would be classified a size 9 (see Table 1), which is at the very limit of sizes that sell at a reasonable price. These marketing conditions led the SFCA to return not only undersized sea cucumbers, but also "anything damaged" to the sea for recovery. Beginning in 2002, each boat collected these small or damaged sea cucumbers and lined up each day to return them to the sea.

It is worth noting that upon establishment of the SFU in SFCA, a weight limit was imposed in order to conserve their resources. As discussed, however, the market price for smaller sea cucumbers has now increased because of recent demand from Hong Kong and China. But the fishermen of SFCA seem to distrust the market and they stick to their self-regulated rule of 130 grams minimum size. This firm position has to be understood in the following context.

When the SFCA started trading in fresh sea cucumber, one of the major marine product processing plants in Hokkaido submitted several complaints. At one point, they required the SFCA to make shipments using barrels that were labelled with the name of the boat that made the catch. Although the SFCA made an effort to retain moisture and shipped at a ten percent premium, the buyers still complained about poor quality and demanded a higher premium. If they agreed, they knew that they would eventually face the same demands again from the buyers. Instead of raising the premium percentage, they negotiated with the buyers to resolve their complaints. For example, both sides have agreed that water should not be put in barrels and that sea cucumbers should be divided up at sea and then checked again on land for size. One member of the SFU boasted about nurturing the Sempoishi brand, explaining, "It's not a matter of gains or losses. If you cheat, it comes back to you."

Resource management by the SFU at the SFCA was not limited just to size restrictions. In 2001, six

members of the SFU and the SFCA's sales representative went to observe the sea cucumber business in Aomori Prefecture. Unfortunately, sea cucumber fishing grounds in Aomori were too shallow to be compared to Semposhi, where dredge nets were dragged at depths of 60 to 70 meters. Moreover, Aomori at that time was focused on fresh food products but not on dried products, so they kept small, soft sea cucumbers and tossed large ones back to sea. Still, the Semposhi fishermen were impressed that the town of Yokohama had standardized fishing equipment and regularly checked for violations.

As a result of their visit to Aomori, the SFU at the SFCA was also inspired to re-examine the spawning period of sea cucumbers. Sea cucumber fishing is banned in the Soya Sea Area, where Rishiri belongs to, from May 1<sup>st</sup> to June 15<sup>th</sup>, which is believed to be the spawning period. However, some fishermen, based on their experiences, raised the possibility that sea cucumbers in the area were actually reproducing in July and August. These fishermen are currently still appealing to Hokkaido Prefectural Government to change the regulations related to fishing season dates.

In addition to resource management, the SFU provides a kind of social assistance to other non-unit members of the SFCA. Presently, there are eleven dredge net fishing boats in SFCA. There were ten boats until 2004, and the eleventh boat was added in 2005 when the SFCA recommended that a novice fisherman in his early 50s be included in the SFU when the man made an appeal to the SFCA, stating that he needed money to support his three children. Previously, the number of fishing boats had been unrestricted. The number of boats was limited to ten only in 1999 at the same time that the 50-ton limit on a total catch was implemented. The eleventh boat was admitted in 2005 because the SFU felt an obligation to support a fellow cooperative member and because the price of sea cucumbers was on the rise.

During my fieldwork, one of the SFCA fishermen lost a family member. Since three SFU members living in the same district had to attend the funeral and

were unable to fish even though conditions were favourable, the entire unit took the day off. They explain, "We have this organization to work together," "The 50-ton limit is there so that everyone uses resources equally, otherwise, everyone would just operate on their own."

## CONCLUSIONS

Together, the two case studies of OFCA and SFCA illustrate sea cucumber fisheries and self-regulation in local communities. Although Rishiri Island is only one of many places in Japan where sea cucumbers can be harvested, it is known for its uniquely high quality within the particularly high quality market of Hokkaido because it has the sharpest spikes. While sea cucumber fisheries were introduced in the late 18<sup>th</sup> century, it was not until the mid-1980s that Rishiri Island became such an active centre for sea cucumber fishing. Its success can be attributed to the pride of local fishermen who have striven to meet the insistent demands of buyers.

While the debate was divided and should be further investigated, another example of local self-management could be seen in the FCA's attitude between the FCA as a ruling body and the SFU as the subordinate regarding the issue of admitting new unit members. It is an issue that is specific to sea cucumber dredge net fishing, as spoon-net fishing by small surfboats is open to all (for example, catch landings of sea cucumber by spoon-net in SFCA were four metric tons in 2006 and 2.5 metric tons in 2007). Fishing in Rishiri Island has tended to concentrate heavily on coastal resources such as kelp and sea urchin, both of which have developed strong communal identities that have also been applied to sea cucumbers as coastal marine products.

Self-management by local communities continues by trial and error, which can be called adaptive management. Certainly, a prefectural government can do its part to respond quickly to proposals born from experience regarding changes to fishing regulations. In addition, traders and wholesalers should pay re-

spect to FCAs' efforts and support their activities. While the national Fisheries Agency is prohibited from directly supervising the local practices by law, those in the private sector can freely collaborate with FCAs. For example, one of the SMPA members in Hong Kong established close business ties with an FCA in Aomori Prefecture. Technically, he advises that FCA on how to add value to their products and consults with them on resource management. This is, of course, part of *his* risk management, and puts him in the position of monopolizing high value products. However, it is the traders and wholesalers who seriously seek the "sustainability" of sea cucumber foodways and industry.

Although the stakeholders have their own goals in mind, all seek the sustainability of the species and, together with domestic and foreign business sectors, must be involved in local community-based resource management. CITES should be called upon only after every effort has been made by local communities to manage their own resources. Rather than depending on laws or imposed systems, local fishermen should tap into the experience and knowledge that is inherent in their communities.

#### ACKNOWLEDGEMENTS

This research was supported in part by a grant from Agriculture, Forestry and Fisheries Research Council's Research project for utilizing advanced technologies in agriculture, forestry and fisheries in 2007. I thank Machiguchi Yuji of the Fisheries Research Agency for leading the "Development of Systematic Production Technologies for Dried Sea Cucumber Exports" program under this project.

#### REFERENCES

- Akamine, J. (2001) Holothurian exploitation in the Philippines: continuities and discontinuities. *Tropics* 10(4): 591-607.
- Akamine, J. (2002) Trepang exploitation in the Philippines: updated information. SPC Beche-de-mer Information Bulletin 17: 17-21.
- Akamine, J. (2004) The status of sea cucumber fisheries and trade in Japan: past and present." In: Lovatelli, A. *et al.* (eds.); *Advances in Sea Cucumber Aquaculture and Management*, FAO, Rome, pp. 39-47.
- Akamine, J. (2005) International intervention is not the only way to save depleting resources. *Journal of Chinese Dietary Culture* 1(2): 1-30.
- Akamine, J. (2007) *Namako* and *iriko*: historical overview on holothuria (sea cucumber) exploitation, management and trade in Japan. In: Cheung, S.C.H. and Tan C.B. (eds.); *Food and Foodways in Asia: Resource, Tradition and Cooking*, Routledge, London, pp. 23-36.
- Bremner, J. and J. Perez. (2002) A case study of human migration and the sea cucumber crises in the Galapagos Islands. *Ambio* 31(4): 306-310.
- Bruckner, A.W. ed. (2006) Proceedings of the CITES workshop on the conservation of sea cucumbers in the families Holothuridae and Stichopodidae: 1-3 March 2004 Kuala Lumpur, Malaysia. NOAA technical memorandum NMFS-OPR-34. U.S. Department of Commerce, Washington, D.C., 244pp.
- Bruckner, A.W., K.A. Johnson, and J.D. Field. (2003) Conservation strategies for sea cucumbers: can a CITES Appendix II listing promote sustainable international trade? *Beche-de-mer Information Bulletin* 18: 24-33.
- Camhi, M. (1995) Industrial fisheries threaten ecological integrity of the Galapagos Islands. *Conservation Biology* 9(4): 715-719.
- CITES (2007) Decision 14.98. Sea cucumbers. <http://www.cites.org/eng/dec/index.shtml>
- Conand, C. (2001) Overview of sea cucumbers fisheries over the last decade-what possibilities for a durable management? In: Barker, M. (ed.) *Echinoderms 2000*, Swets & Zeitlinger, Balkema, pp. 339-344.
- Conand, C. (2006) Harvest and trade; utilization of sea cucumbers: sea cucumber fisheries; current international trade; illegal, unreported and unregulated trade; bycatch; socio-economic characteris-

- tics of the trade in sea cucumbers. In: Bruckner, A.W. (ed.); Proceedings of the CITES workshop on the conservation of sea cucumbers in the families Holothuridae and Stichopodidae: 1-3 March 2004 Kuala Lumpur, Malaysia, U.S. Department of Commerce, Washington, D.C., pp. 51-73.
- Dai, Y.F. (2002) Food culture and overseas trade: the trepang trade between China and Southeast Asia during the Qing dynasty. In: Wu, D.Y.H. and S. C.H. Cheung (eds.); The Globalization of Chinese Food. University of Hawai'i Press, Honolulu, pp. 21- 42.
- Edgar, G.J., R.H. Bustamante, J.-M. Fariña, M. Calvopiña, C. Martínez, and M.V. Toral-Granda. (2004) Bias in evaluating the effects of marine protected areas: the importance of baseline data for the Galapagos Marine Reserve. *Environmental Conservation* 31(3): 212-218.
- Feeny, D., F. Berkes, B.J. McCay, and J.M. Acheson. (1990) The tragedy of the commons: twenty-two years later. *Human Ecology* 18: 1-19.
- Ferber, D. (2000) Galápagos station survives latest attack by fishers. *Science* 290(5499): 2059-2061.
- Ferdouse, F. (2004) World markets and trade flows of sea cucumber/beche-de-mer. In: Lovatelli, A. *et al.* (eds.); *Advances in Sea Cucumber Aquaculture and Management*, FAO, Rome, pp. 101-117.
- Hearn, A., P. Martinez, M.V. Toral-Granda, J.C. Murillo, and J. Polovina. (2005) Population dynamics of the exploited sea cucumber *Isostichopus fuscus* in the western Galapagos Islands, Ecuador. *Fisheries and Oceanography* 14(5): 377-85.
- Jenkins, M. and T.A. Mulliken. (1999) Evolution of exploitation in the Galapagos Islands: Ecuador's sea cucumber trade. *TRAFFIC Bulletin* 17(3): 107-118.
- Lovatelli, A., C. Conand, S. Purcell, S. Uthicke, J-F. Hamel, A. Mercier eds. (2004) *Advances in Sea Cucumber Aquaculture and Management*. FAO fisheries technical paper series 463, FAO: Rome, 425pp.
- MacFarland, C. and M. Cifuentes. (1996). Case study: Ecuador. In Dompka, V. (ed.) *Human Population, Biodiversity and Protected Areas: Science and Policy Issues*, American Association for the Advancement of Science, Washington, DC, pp. 135-188.
- Powell, J. and J.P. Gibbs. (1995). A report from Galápagos. *TREE* 10(9): 351-354.
- Ruddle, K. (1987) *Administration and Conflict Management in Japanese Coastal Fisheries*. FAO fisheries technical paper series 273, FAO: Rome, 93pp.
- Ruddle, K. (1989) Solving the common property dilemma: village fisheries rights in Japanese coastal waters. In Berkes, F. (ed.) *Common Property Resources*, Belhaven, London, pp. 168-184.
- Shepherd, S.A., P. Martinez, M.V. Toral-Granda and G.J. Edgar. (2004) The Galápagos sea cucumber fishery: management improves as stock decline. *Environment Conservation* 31(2): 102-110.
- Stone, R. (1995) Fishermen threaten Galápagos. *Science* 267(5198): 611-612.
- Stutz, B. (1995) The sea cucumber war. *Audubon* (May-June 1995): 16-18.
- Verrall, M. (1995) Darwin's islands under threat. *Nature* 373 (6514): 465.
- Xie, Z.Z. (1998) *Wuzazu 5*, (Toyo Bunko 629). Heibonsya, Tokyo, 254pp. (Original Chinese text translated by Iwaki Hideo into Japanese)
- Zhao, X.M. (1971) *Bencao Gangmu Shiyi*. Shangwuyin Shuguang Xianggang Fenguang, Hong Kong, 522pp. (In Chinese)
- United States of America. (2002) Trade in sea cucumbers in the families Holothuridae and Stichopodidae. Presented to the 12<sup>th</sup> Conference of the Parties of Convention on International Trade in Endangered Species of Wild Fauna and Flora. (CoP12 Doc.45) <http://www.cites.org/eng/cop/12/doc/index.shtml>