

Observations on Depleting Resource Management*

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1. INTRODUCTION

Growing concern over biodiversity conservation has caused some unease about certain food cultures in the world becoming extinct. Whale, for example, has been consumed by Japanese for centuries but whaling currently is downsized only to a regulated or controlled industry. No fisherman can hunt as much whale as possible employing his knowledge, experience and techniques.

In relation to the eco-political perspectives, I would like to point out three viewpoints concerning the whale issue. First, whale is a cover term for more than seventy species. Not all of them are in danger of extinction. Discussion on biodiversity conservation has to be species specific.

Second, whale must not be considered only as a food resource, especially in Japanese settings. It has been utilized in many ways as non-edible resources: its flexible baleen has been used in traditional puppet shows as well as a fishing tool; whale oil has been used for insect repellent in rice fields; and bone meal has been used for fertilizer, etc. These users of whale by-products do not always live in whaling communities. Most of them live inland but still utilize whale by-products.

Third, the Japanese not only make good use of the entire whale, but they also worship the whale as a symbol of good luck for all kinds of fishing. Japanese people appreciate their existence and pray for the ever-lasting symbiotic relationship between men and whales. Thus, each whaling community consoles and worships the whale's soul at temples and shrines. There are many tombs for whales on the Japanese Archipelagos.

The whaling issue in Japan, thus, cannot be properly understood from the simple viewpoint of whether to protect them or not. It is necessary to examine the cultural history of exploitation of each species. Our perspectives on "wise use" of resources should possess insightful historical and contemporary dimensions.

Among other Asian food cultures, not a few species including tuna, turtle eggs, sharks' fin, birds' nest, etc., provoke concern from outside nations. Like the Japanese whaling issue, among those endangered animals, we first have to clarify which species are at risk of extinction. The relationship between producers and consumers has to be investigated. The relationships must have changed through the years. We need to be, thus, very careful about changes and their ecological, social, economical, and political reasons.

Trepang or dried holothurian may be one of the items to consider. The trepang market is almost exclusive to Chinese culture. It has been a major export commodity from Japan and Southeast Asia to China for at least three hundred years. Interestingly, no trepang is consumed by the producers. It has been developed as an export-oriented commodity from the beginning. Currently, tropical countries like the Philippines and Indonesia export over twenty species, while temperate countries including Japan, export one or two species to Hong Kong, which is the center of trepang trading.

* This article develops themes already sketched in Akamine [2001] using updated data. An earlier version of this paper was presented at "Foodscapes: The cultural politics of food in Asia", held at the Shaw Foundation Building, National University of Singapore, June 13-15, 2002. The main portion of the data used in the present paper was collected during fieldwork in Indonesia in September to October 1997 and in the Philippines in July 1997, July to October 1998, August to September 2000, and September 2001. At the time of the research, USD 1 was equal to 3,600 Indonesian Rupiah in 1997 and USD 1 equaled to PHP 44 in 1998, PHP 45 in 2000 and PHP 51 in 2001 respectively.

In this paper, I will present an overview on trepang exploitation and its trade networks to better understand the “trepang culture” against the global criticism on depleting resources eaters. Pointing out some characteristics observed in the information flow from the Chinese traders at Hong Kong to the Philippine islands, I will emphasize: 1) trepanging has long been institutionalized in tropical maritime societies, 2) the trepang industry has established multi-ethnic network chains from producers to consumers and 3) thus, the trepang resource management needs more cultural, rather than political, considerations.

2. ORGANIZATION OF THE STUDY

This study aims to address three interrelated issues. First, the paper briefly explores the history of trepang exploitation in relation to species exploited during colonial times. Although the origin of trepang food culture in China is beyond the scope of the present study, we need to examine the beginning of trepang exports to China from the surrounding regions and the kinds of trepang exploited during the earlier times. From what is known, consumption of trepang in China became popular during the 15th century and expanded during the 17th century, being considered an expensive and aristocratic food served at court. The study will explore historical trade records to identify the species traded in the 19th and early 20th centuries and point out their economical values.

Second, the study will report the present condition of trepang domestic trade in the Philippines. As of September 2001, there were at least 24 species being commercially exploited in the Philippines and the most expensive kind was worth 95 times the value of the least expensive species. The number of commercially valued trepang has almost doubled in the last several decades. The expansion of the exploited species in such a short time is particularly noteworthy considering that trepang trade has had a long history. In order to interpret the current expansion of trepang production, it is necessary to gain insights into the domestic and international trepang trade networks from the viewpoint of the global market economy.

Third, the paper will explore several phenomena that are occurring on Mangsee Island, the southern Palawan Province, in the Philippines, focusing on how the fishermen have adapted themselves to the conditional changes. According to export statistics, the volume of trepang exported from the Philippines has decreased since 1985. In fact, in 1989 and 1998 it decreased to one third of its peak level. The latest statistics, however, point out increasing trends. Regardless of the trends, if we look at the trepang fishing situation in the Mangsee community, over-exploitation of trepang is becoming more evident as divers increasingly complain of decompression sickness. Fishermen target the more profitable species and consequently dive at deeper levels, resulting in an increase in incidence of paralysis and death. In September 2000, in order to avoid decompression diseases, divers switched their targets to more accessible, albeit less profitable populations, which are abundant in shallow waters. As a result, a greater fishing quota is required to assure adequate financial income.

3. HISTORY OF TREPANG EXPLOITATION

Trepang should be dried for at least a month in storage and the dried form must be soaked in water overnight and be repeatedly simmered for about a week until re-hydration. From production to consumption, it requires complicated time-consuming procedures. This is one of the reasons why trepang is considered a delicacy.

The popularity of trepang increased in China around the 16th to 17th century. It is supported from the historical evidence that the Shogunate government at Edo (or Tokugawa's Japan, 1601-1867) officially began exporting trepang, called *iriko* (熬海鼠 or 煎海鼠) in Japanese, to the Qing dynasty in 1698 in exchange for Chinese silk. During the same period, trepang, harvested from tropical waters, was also one

of the important trade items that European countries brought into China in exchange for tea, silk, and porcelains. In 1727, during the reign of Emperor Yongzheng (雍正), the Qing government officially ended its ban on shipping to Southeast Asia, and named Xiamen (Amoi, 廈門) the only port open for trade between China and Southeast Asia. Since then, there existed official records of trepang trade between China and Southeast Asia [DAI 2002: 30-33].¹⁾

Here, two questions arise. Which ports in China imported trepang from the southern islands? Which species were commercially exploited in the earlier times? According to Dai Yifeng (戴一峰), who wrote a splendid maritime trade history in the Pan-South China Sea, Xiamen was the most active port of trepang imports after 1727 up to 1869, when the amount of trepang imported through Shanghai exceeded the amount that went through Xiamen [DAI 2002: 33-34].

Although Dai did not mention the port of Canton's role in Sino-European trades, Canton seemed to have imported a considerable amount of trepang from the 18th up to middle of the 19th century through Western traders who gathered trepang in the southern waters [WARD 1972; WARREN 1985]. After the Opium War, when Hong Kong was established, Hong Kong took Canton's place as the leading port. Presently, most of the trepang from the world goes through Hong Kong, which is the redistribution center to other countries like Singapore, Taiwan, USA, and Canada, all countries where there exists a considerable Chinese population [CONAND 1990, 1993; CONAND and BYRNE 1993; SPC 1994; FERDOUSE 1999; JAQUEMET and CONAND 1999].

To my understanding, the first indication of a particular trepang species exploited in the southern waters was in the early 19th century. Flinders, a British captain, witnessed the trepang fishery in the Bay of Carpentaria, northern Australia in 1803 and he recorded two trepang vernacular names: *koro* and *baatoo* [FLINDERS 1814: 231], which most likely would be *Holothuria fuscogilva* and *H. nobilis* respectively. In about 1810, Crawfurd, a senior officer of the British East India Company, recorded 15 kinds of trepang traded at Makassar in Sulawesi [CRAWFURD 1820: 442-443]. He, however, named the identical species differently, according to the length and place of harvest. Employing current vernacular names, there are at least eight species identified: *Bohadschia graeffei*, *Holothuria fuscogilva*, *H. fuscopunctata*, *H. nobilis*, *H. scabra*, *Stichopus chloronotus*, *S. hermanni*, and *S. horrens*. *Itam* in his record is probably *Actinopyga* spp. (mainly *A. miliaris* and *A. lecanora*) and *kawasa* probably *Bohadschia* spp.²⁾

What were the commercial values of those trepangs at that time? Crawfurd recorded the price of each trepang for Spanish dollar per pikul (60 kilograms). Let us interpret his records from the current commercial value of trepang in Kupang, West Timor, Indonesia. Among them, *H. scabra* is the most valuable and *H. fuscogilva* is the second most valuable. *S. hermanni*, *S. horrens*, *Actinopyga* spp. and *S. chloronotus* follow in descending order. The unidentified *tacheritang* and *tundang* were considered as valuable as *H. scabra* and *H. fuscogilva*, in contrast with the less valuable *mosi* and *pachang goreng*. While *itam* (*Actinopyga* spp.) is considered valuable, *kawasa* (*Bohadschia* spp.), *B. graeffei* and *H. fuscopunctata* are in a very lower price range. We, thus, know that there were two kinds of trepang, expensive and less expensive, traded in the 19th century.³⁾

4. TREPANG EXPORTS FROM THE PHILIPPINES

According to the 1992 *FAO Yearbook*, the Philippines owned 15.6 percent of the world trepang trade by volume. However, the trade value was only 8.2 percent of the world trade. In that same year, Sri Lanka exported only 0.4 percent of the total world market in volume, but had a trade value of 1.7 percent. The mean trade value per kilogram for the Philippines was USD 2.05, while that of Sri Lanka was USD 18.9, which is a surprising 9-fold difference. This explicitly shows that the Philippines exported lower valued trepang compared to other major trepang exporting countries. This is very much typical of the Philippine trepang production and we will investigate it in section 5 and 6.

Trepang appeared in the trade statistics of the Philippines in 1970 for the first time since World War II. Export statistics from 1970 to 2000 are illustrated in **Figure 1**. Not less than eighty percent of the quantity has been exported to Hong Kong.

In 1985, the Philippines reached its peak production of 3,499 metric tons worth almost 3 million US dollars. After that year the export volume decreases, especially in 1989 with 1,022 metric tons and in 1998 with 1,040 metric tons, marking the lowest export volume. However, the export volume seems to be recovering with 1,692 metric tons in 2000. Interestingly the average price per kilogram since 1984 has increased except for a sharp drop in 1998.

According to a Philippine trepang exporter, the sharp price fall in 1998 was due to one of the heaviest floods in China's history. That flood in southern China was so severe that even a thirty percent depreciation of the Philippine peso against the US dollar, which normally helps exports, did not help maintain the level of exports. One of the exporters in Manila said that he once had a lot of trepang stock in September 1998, especially over 40 metric tons of *legs* (*Thelenota anax*), and he had to control his stock by discontinuing purchases and down-pricing for a while. Thus we understand that there is a strong economical relationship between the Chinese market and Philippine production.

5. TREPANG TRADE NETWORKS IN THE PHILIPPINES

Of the 1,200 holothurians known today [CONAND 1990], there are at least twenty four commercially exploited species in the Philippines (see **Table 1**). Almost all of the islands in the Archipelagoes produce trepang. Among them, Zamboanga City in Mindanao and Puerto Princesa City in Palawan are the largest entrepôts in the Philippines [TRINIDAD-ROA 1987].

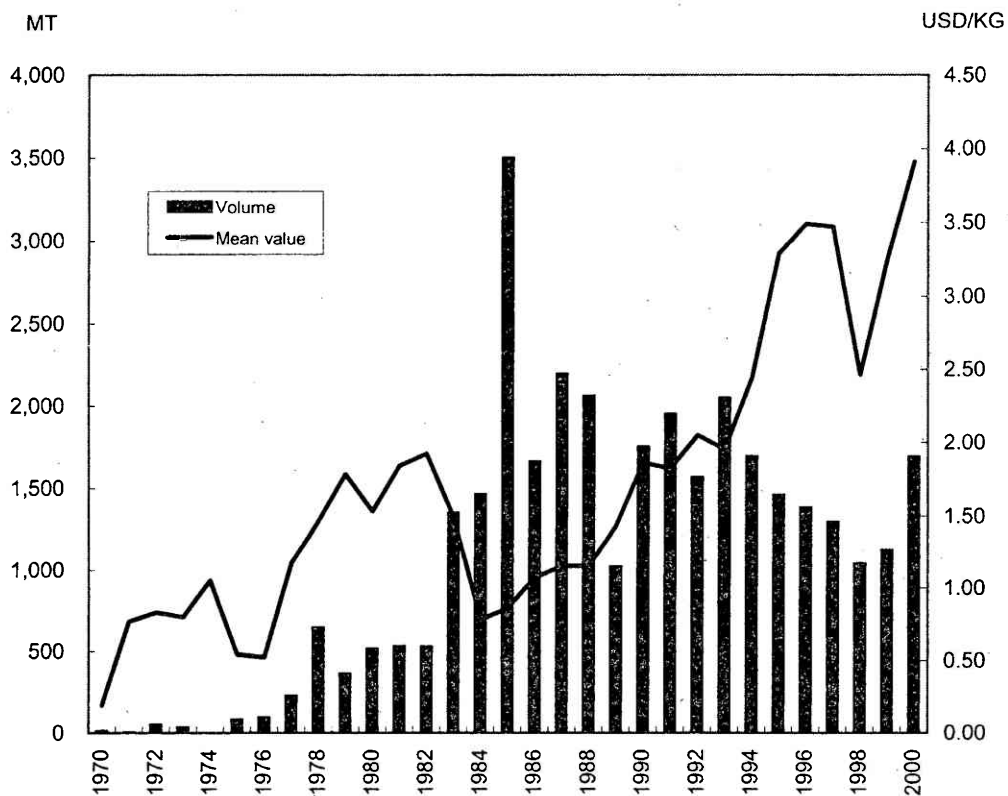


Figure 1. Volume and Mean Value of Trepang Exports from the Philippines 1970-2000

Table 1. Trepanng Names and Prices in Puerto Princesa City (per kilogram)

NO.	Vernacular Name	Scientific Name ¹	Size Assesment		Size	PHP	USD ⁴
			Weight ²	Length ³			
1	putian	<i>H. scabra</i>	15		XL	1,900	37.3
			20		L	1,500	29.4
			40		M	1,100	21.6
			60		S	700	13.7
			80		XS	650	12.7
2	susuan	<i>H. fuscogilva</i>	3-4		XL	1,800	35.3
			5-6		L	1,700	33.3
			7-8		M	1,100	21.6
			8-10		S	800	15.7
			11-15		XS	500	9.8
3	buliq-buliq	<i>Actinopyga</i> spp.		3" up	L	1,100	21.6
				2.5"	M	800	15.7
				1"-2.5" (<1")	S XS	600 400	11.8 7.8
4	hanginan	<i>S. horrens</i>		3.1" up	L	1,100	21.6
			<i>S. hermanni</i>		2.5"-3"	M	800
				2"-2.5" (<2")	S XS	600 300	11.8 5.9
			<i>H. nobilis</i>	5-6		L	1,000
5	bakungan		7-8		M	900	17.6
			8-10		S	700	13.7
			11-15		XS	500	9.8
6	katro kantos	<i>S. chloronotus</i>		na		1,000	19.6
7	tinikan	<i>T. ananas</i>		na		700	13.7
8	khaki	<i>A. mauritiana</i>		3" up	L	650	12.7
				2.5"	M	450	8.8
				1.5"-2.5"	S	280	5.5
				1"-1.5"	XS	120	2.4
9	hudhud	<i>A. echinites</i>		na		650	12.7
10	hudhud payat	?				450	8.8
11	leopard	<i>B. argus</i>		na		420	8.2
12	lawayan hongkong	<i>Bohadschia</i> sp.		na		320	6.3
13	lawayan	<i>Bohadschia</i> spp.		4" up	L	300	5.9
				2.5"	M	270	5.3
				(<2.5")	S	170	3.3
14	red beauty	<i>H. edulis</i>		na	L	240	4.7
					S	200	3.9
15	white beauty	?		na		230	4.5
16	patola red	?		na		230	4.5
17	brown beauty	?		na		220	4.3
18	black beauty	<i>H. atra</i>		5" up	L	200	3.9
				4"-5"	M	120	2.4
				2"-4"	S	80	1.6
19	patola	<i>H. leucospilota</i>		na		200	3.9
20	legs	<i>T. anax</i>		na		190	3.7
21	sapatos	<i>H. fuscopunctata</i>		na		140	2.7
22	bulaklak	<i>B. graeffei</i>		na		90	1.8
23	patola white	?		na		20	0.4
24	labuyug	?		na		20	0.4

Source: Price list of Exporter A (as of September 2001)

1: A, B, H, S, and T in the third row are genera *Actinopyga*, *Bohadschia*, *Holothuria*, *Stichopus*, and *Thelenota* respectively.

2: The nominal number of individuals needed for one kg; this is assessed by weighing one by one in the hand.

3: Assesment in relation to length of middle finger. The brackets indicate figures inferred by the author.

Not applicable (na) indicates size not assessed.

4: At the date of research, USD 1 equals to PHP 51.

5: Trepanng marked by a dotted line did not appear the list in September 2000, one by a broken line in October 1999.

There are four major trepang exporters in the Philippines, all of whom are Chinese-Filipino, and they deal with other dried marine products, like sharks' fin, dried sea horse, sea weed and sea shells, whose main market is China as well.⁴⁾ They have branches or agents in the other parts of the Philippines (henceforth, mnemonically called A, B, C and D). All of them have close business ties with the wholesale importers in Hong Kong and, for some, in Singapore. The exporters A, B and C have their branches in Puerto Princesa City (shown as middlemen A', B' and C' in this paper). Strong business ties exist between exporter D and the middleman D' in Puerto Princesa City.⁵⁾

The purchasing value of the four middlemen remains competitively similar. They prepare the price list for the price inquiry from their customers, on which Table 1 is based. Generally, larger trepang with a thick body wall is preferred. The prices listed are for well-dried and good shaped top-quality specimens.

Every year a new species becomes popular and gains commercial value. For example, two species *hudhud payat* (10) and *lawayang Hong Kong* (12) gained new commercial value after September 2000. Between October 1999 and September 2000, *patola red* (16) and *patola white* (23) became newly classified. They were formerly classified as just *patola* (19).

However, the value of most of the species is decreasing. Even though some species prices increased, the profit from these species did not increase because of the 113 percent depreciation of the PHP against the USD from September 2000 to September 2001. Two examples are *susuan* (2) and *tinikan* (7) whose values in the PHP increased but whose values in USD decreased. For this reason, it is clear that demand for *putian* (1) and *hanginan* (4) was tremendous because it offset the value of the depreciating PHP.⁶⁾

Furthermore, the observed trend should be examined in a broader perspective. Trinidad-Roa, a marine biologist, reported that only sixteen trepang species were traded in the Philippines in 1986 [TRINIDAD-ROA 1987], with no mention of *red beauty* (14), *white beauty* (15), *bulaklak* (22) and *labuyug* (24), possibly because they had no commercial value at that time. These four species are relatively lower grade, though the new commercial species after September 2001, *hudhud payat* (10) and *lawayang Hong Kong* (12) are relatively valuable species.

From the present survey and Trinidad-Roa's observations, we can, therefore, assume that 1) commercial classification of species has been changing; 2) newly commercialized species are relatively cheaper; and 3) the lower-valued species have been intensively exploited for the last decade or so in the Philippines.

6. TREPANG PRODUCTION ON MANGSEE ISLAND

The present research was conducted on the small island named Mangsee in the southern part of Palawan Province. The island lies only one nautical mile away from the national border with Malaysia and almost all necessities are imported across the border (**Figure 2**).

The population of the island was about 6,000 in 1997, with about 95 percent being Sama, also known as Bajau, a common ethnonym. The Mangsee community emerged from the "national crisis" when the late President Marcos declared Martial Law in 1972. Most of the inhabitants are refugees from conflicts that arose in the southern Philippines between the Moro National Liberation Front (MNLF) and the Philippine Constabulary (PC) during the 1970s.

Since then, Mangsee island has developed into a prosperous community known as the "Money Island" due to active smuggling and rich neighboring fishing resources, which attract new immigrants from other parts of the Philippines. The main fishing activities practiced on the island are dynamite fishing and diving for trepang, both often conducted in the Spratly Islands.

The catch from dynamite fishing is limited to *Caesio* spp. and all of it is processed into salt-preserved dried fish. Stockfish is traded in Mindanao Island where the inland farmers produce dollar-earning crops such as banana, pineapple and coconut. Dried trepang, however, is shipped to Manila through Puerto

Princesa City and exported abroad.

In 1998, trepang was harvested in two ways. Active trepang fishing, with a crew of 10 to 15, equipped with an echo-sounder and a hookah type air-compressor, spend several weeks fishing in the Spratly Islands. Alternatively, trepang was fished as a by-product of daily commercial fishing trips. One or two fishermen fish in the early morning near Mangsee Island using air-compressors, and then return in the afternoon. They harvest different kinds of marketable marine products like lobster, *sunuq* (Epinephelidae) and *lak* (*Trochus niloticus*).

For active trepang fishing, the boat owners pay all necessary expenses in advance and deduct them from the catch and divide the net profit among the crew. According to the divers, the most valuable trepang, *putian* (*H. scabra*), can only be found in muddy mangrove swamps and are rare in the coral reefs surrounding the Spratly Islands. Thus, the second most valuable trepang, *susuan* (*H. fuscogilva*), is the preferred target species as a source of profit. At the same time, divers compensate their expenses with *susuan*.

The following is one example of fishing activity in the Spratly Islands. Yusop (born in 1959) was back from the Spratly Islands on August 17, 1998 from a 43 day fishing trip. He is the leader of the crew, locally called *nakuraq*. The crew consisted of 10 divers and five non-divers who processed the catch on board. The boat has a 39-foot length keel with a 56 horse-power second hand engine and is owned by Ali, who runs a small general merchandise shop on Mangsee Island. The capital invested for the operation was about PHP 70,000 (about USD 1,700). Divers started diving at 30 meters and dived as deep as 50 meters. There were 960 specimens of *susuan* (*H. fuscogilva*) collected along with other species designated as *sari-sari*, meaning "assorted" according to local terminology. *Susuan* was salt-preserved and stored in the ship's hull, while other *sari-sari* species were cooked and dried on the boat.

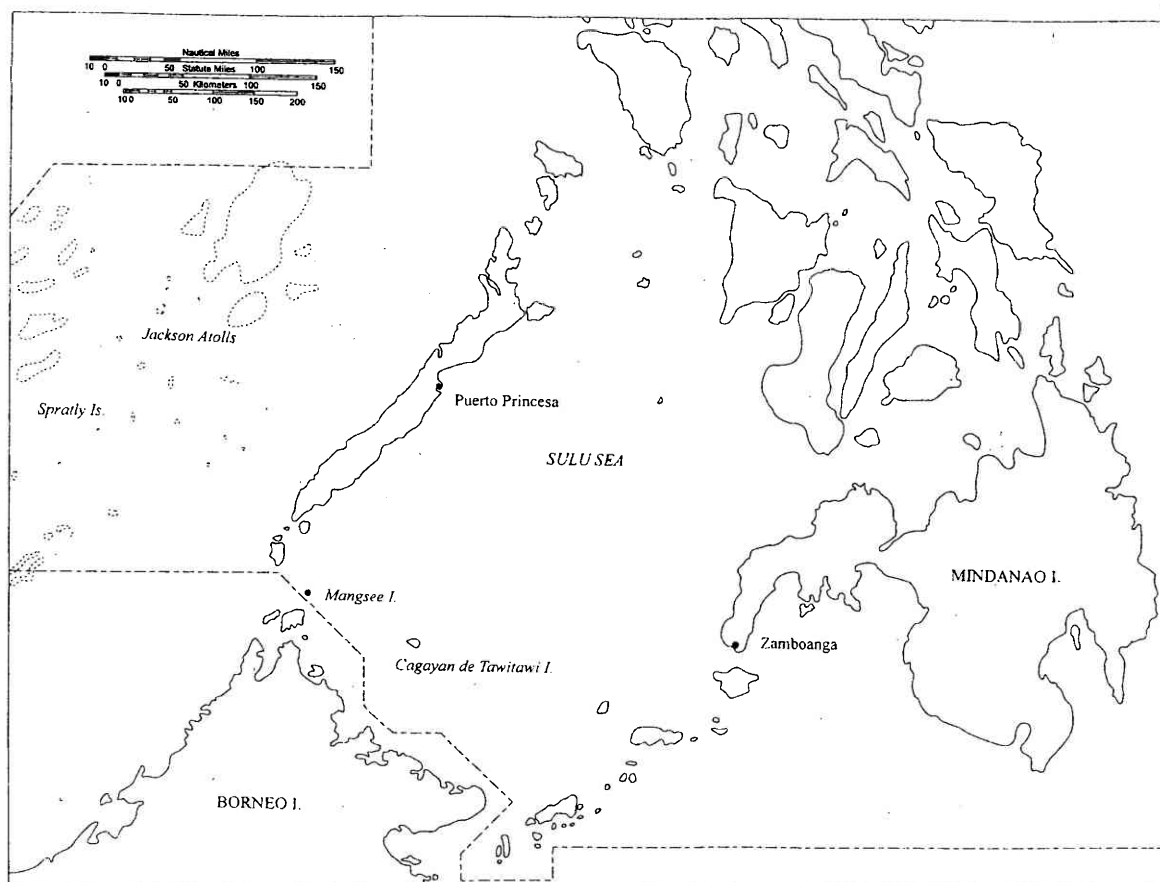


Figure 2. Mangsee Island and Neighboring Waters

Table 2. Example of Ali's Catch in 1998

	species	weight(kg)	%
1	legs	192.65	49.09
2	sapatos	95.75	24.40
3	leopard	35.90	9.15
4	tinikan	24.45	6.23
5	katro kantos	14.65	3.73
6	hanginan	12.40	3.16
7	hudhud	5.60	1.43
8	black beauty	3.20	0.82
9	brown beauty	2.15	0.55
10	lawayan	2.15	0.55
11	builq-bulq	1.75	0.45
12	bulaklak	1.00	0.25
13	red beauty	0.80	0.20
total		392.45	

Source: Details issued by Exporter C.

Table 3. Example of Omar's Catch in 2000

	species	weight(kg)	%
1	lawayan	293.41	34.17
2	black beauty	252.90	29.45
3	legs	113.30	13.19
4	hanginan	65.09	7.58
5	leopard	61.41	7.15
6	builq-bulq	22.87	2.66
7	katro kantos	15.70	1.83
8	brown beauty	12.50	1.46
9	sapatos	12.30	1.43
10	tinikan	3.25	0.38
11	hudhud	3.00	0.35
12	khaki	1.75	0.20
13	hakungan	0.84	0.10
14	bulaklak	0.20	0.02
15	putian	0.15	0.02
total		858.67	

Source: Details issued by Exporter B.

The first 500 specimens of *susuan* paid for Ali's initial investment, worth PHP 140 each, though the market price for a piece of uncooked salt-preserved *susuan* was PHP 230. Ali sold all the *susuan* in Malaysia for R24, almost equal to PHP 240 and earned at least PHP 56,000 in profit. After deducting his expenses, the net catch for the divers was 460 *susuan* and about 390 kilograms of the dried *sari-sari* species (Table 2). They, however, had to sell all the trepang to Ali at cheaper prices. The sale of 460 *susuan* was PHP 64,400. The total sale of the *sari-sari* was not known, though Ali sold them to middleman C' in Puerto Princesa City for about PHP 70,500. Ali handled all transactions and he calculated that one share for each diver was PHP 5,500 with an additional bonus of PHP 7 for each *susuan* caught.

Ali got three shares for use of his boat, engines and echo-sounder. However, Ali, made a profit as a middleman, rather than as the boat owner. The common profit-sharing practiced in 1998 was that the investor handled all transactions and the divers were not informed of the details, and sales from the *susuan* were smaller than those from the *sari-sari* species.

In 1998, there were at least 15 fishing boats engaged in trepang fishing in the Spratly Islands, with those actively harvesting trepang having a greater catch. After two years, at the time of the research in August 2000, there were only a few vessels fishing in the Spratly Islands. Instead, they preferred fishing near Cagayan de Tawi-Tawi in the Sulu Sea. A crew of 10 to 15 divers fish about 10 days with air-compressors, looking for *susuan* in not very deep waters. Not a few fishermen illegally fish in Malaysian waters in pursuit of the valuable trepang species. They fish not by group but alone or in pairs and they skin-dive at night with waterproof flashlights and come back the following morning.

According to the local fishermen, trepang emerges from corals at night, facilitating harvesting by skin-diving. Skin-diving costs less than heavy equipped diving and this is probably the reason skin-diving conducted at night gained popularity, even in the Spratly Islands, a practice never observed in 1998. Omar's example below illustrates this.

Omar (born in 1952) owned a fishing vessel and was a leader of a crew of 13. They fished in the Spratly Islands for about 2 months from mid May to July 2000. They fished at night at the seven fishing sites located on different banks, shoals, and coral reefs in the eastern part of the Spratly Islands. There were only 20 *susuan* harvested, 858 kilograms of dried *sari-sari* species and 104 kilograms of *botoq goyak*, a sea

urchin used for ornaments (**Table3**). Each diver earned PHP 9,000 from the trip.

Omar harvested more than double the volume of Ali's 1998 expedition. There are differences, however, in the contents of their catches. While Ali targeted *susuan*, Omar did not. Omar harvested more species than Ali did. The percentage of the species is also different. *Legs (T. anax)* in Ali's catch consisted of nearly half of the harvests but not in the case of Omar's.⁷⁾

The most distinct difference is the profit-sharing system. Omar's one share was much better than that of Ali's. This is partially because Omar gained not a single peso out of his transactions as a middleman. He sold all the trepang, including *susuan*, to the middleman B' in Puerto Princesa City and divided the profit equally. This kind of profit-sharing never existed in 1998 when an investor worked as a middleman at the same time.

The trepang fishery in the Mangsee community probably has experienced successive changes for the last 30 years. According to locals, skin-diving for trepang in neighboring Palawan waters occurred in the 1970s. During this period, 4 to 5 fishermen went on weeklong expeditions and harvested only *H. fuscogilva* and *H. nobilis* which they cooked back on the coast.

The second phase was during the late 1970s, when the hookah type air-compressor was introduced, making it possible to dive longer and deeper. Almost at the same time, trepang of the *Actinopyga* spp. and *T. ananas* gained commercial value and local fishermen began harvesting them. However, lots of decompression accidents occurred because they were not familiar with safe usage of the equipment. Many divers abandoned the air-compressor and went back to skin-diving.

Around the end of the 1980s and early 1990s, fishing grounds expanded to the Spratly Islands, with larger vessels and the air-compressor employed again for diving. This was the time when Bisayan divers, who were very familiar with air-compressors, began to migrate from the central Philippines and participated in trepang fishing in the Spratly Islands. By that time, most of the species currently traded became their targets.

In the mid-1990s, deeper fishing grounds were sought and the use of echo-sounders increased to explore underwater topography. In 1997, fishing was apparently conducted at a depth of around 30 to 40 meters. After a year, the fishing depth increased to 50 or 60 meters in search of *H. fuscogilva*. Naturally, they encountered several decompression accidents. For a year from July 1997, there were at least three divers who died from decompression accidents. In December 1998, there were three fishing vessels that sank with only two divers surviving out of more than thirty at the Jackson Atolls when they were hit by a typhoon. After this tragedy, the fishing shifted back to shallow waters in Malaysian territory or the Spratly Islands.

7. CONCLUSION

Trepang fishing is a part of an institutionalized livelihood among islanders in the Philippines. Though it is "traditional", it is never static. It has always been changing in regards to fish stock, fishing grounds, fishing techniques and species fished. The fishermen have been actively reacting to these changes. Because targeted species are the less valuable variety, fishermen nowadays need to harvest greater volumes in order to make a profit. As a result, a common sharing system of the profit changed.

Changes in fishing styles mentioned above have made it possible to depend on the same resources for the last thirty years. This is one of the characteristics in trepang fishing in the tropical waters compared to temperate waters where only a few species are commercially traded. Trepanging can never be properly understood if we consider only a static image of a fishing community and its surrounding ecology.

Trepang is one of the most important maritime resources for the remote islanders. I like to encourage trepanging in the tropical maritime communities as a promising resource. Trepang, of course, is not a single species of holothurian. It is, again, a cover term for more than 20 species in the tropical waters.

Some high valued trepang is nearly depleted. If we discuss trepang conservation or management, we have to make clear which species and in what ecological conditions. For example, those high valued trepang is becoming depleted and there are many studies concerning reproduction and mariculture of these species. More interdisciplinary research on trepang culture will help us to draw a picture on "wise use" of the resource.

NOTES

- 1) Macknight, 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 [MACKNIGHT 1976].
- 2) Four types of trepangs, *tacheritang*, *tundang*, *mosi*, and *pachang goreng*, are as yet unidentified.
- 3) About a century later, only six kinds of trepang were traded in Manila; they were: *Actinopyga* spp., *H. fuscogilva*, *H. nobilis*, *H. scabra*, *Thelenota ananas* and *S. chloronotus* [SEALE 1911: 284-285]. There was no mention of *S. hermanni* and *S. horrens*, although *T. ananas*, which did not appear in Crawford's list, was listed and is the seventh most valuable species in the current Philippine market. Seale [1917] listed more species but I doubt if all of them were commercially traded at that time.
- 4) According to a major exporter branch in Puerto Princesa City, they bought 12 metric tons of dried trepang, sharks' fin, dried sea horse and shells during the month of September 1999, which had a value of 5 million pesos, equivalent to 125,000 US dollars.
- 5) Aside from the major middlemen who affiliate with the exporter in Manila, there are innumerable small-scale trepang buyers in Puerto Princesa City, locally called "buy-and-sell", who resell their stock with a little margin to the major middlemen in the City.
- 6) *Putian* and *susuan* are the most popular species sold in the Hong Kong retail market. At my rough observation in Hong Kong's retail market for the last three years (1999-2001), the price of *susuan* is decreasing but that of *putian* is increasing. *Hanginan* is the most popular species in the Korean market, where it is cooked with shrimps, shell meat, and other seafood called "samsun or samseon (三鮮)".
- 7) According to the fishermen, *legs* inhabits deeper waters. This is probably the reason why Omar was able to harvest less *legs* than Ali because Omar's crew only skin-dived in shallow waters and never reached deeper waters.

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