well. The development banks should give loans to allow fishers to access equipment for final processing. In this way, we will try to eliminate the middle-person, keep earnings in our own countries, create more jobs locally and get more money for our precious marine resources.

We should not forget that there is a local market, too, for final processed beche-de-mer for local Asian consumers who eat it or export it overseas as gifts. In the Suva Market, local fishers sell boiled holothurians to local Asians who then final-process the product at home.

Final processing of holothurians produces organic waste which should be disposed of carefully.

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Beche-de-mer markets and utilisation

by Fatima Ferdouse[1]

Asian countries such as China, Hong Kong, Taiwan, Singapore, Malaysia and Korea, are major consumers of dried fishery products such as sharkfins, beche-de-mer, fish maws, dried molluscs, etc. Japan, though a leading market for fishery products, has a considerably lower beche-de-mer consumption than other Asian countries.

Generally dried beche-de-mer from the Pacific Island nations (PINs) are imported by Hong Kong and Singapore. In 1995 Singapore imported 135 mt of dried products, mainly from Fiji, Papua New Guinea and Solomon Islands, and Hong Kong bought about 900 mt the same year (Table 1).

The market for beche-de-mer is dominated by only two trading nations, namely Hong Kong/ China and Singapore, although products are imported from all over the world. Imports from South Pacific Island countries consist of high-value species of dried beche-de-mer.

The Asian market for beche-de-mer is estimated to be worth US$ 60 million annually. Seven countries account for almost 90 per cent of the total trade of fresh/frozen/dried beche-de-mer, with an average quantity of 13,000 mt.

Almost 95 per cent of the beche-de-mer is imported in dried form. A small volume of fresh, chilled and frozen products is imported into Hong Kong and Taiwan for speciality restaurants.

Table 1: Imports of fresh/frozen/dried beche-de-mer, 1992–1994 (Q = mt, V = US$ 1,000)

Country		1992		1993		1994
HongKong	Q	7,030	Q	7,401	Q	7,281
	V	35,136	V	29,774	V	35,136
China*	Q	2,423	Q	3,508	Q	3,163
	V	N/A	V	9,140	V	8,260
Singapore	Q	1,435	Q	880	Q	1,242
	V	11,001	V	6,953	V	11,341
Malaysia	Q	401	Q	335	Q	400 (e)
	V	1,081	V	761	V	1000 (e)
Taiwan	Q	1,191	Q	1,135	Q	1,124
	V	9,229	V	6,030	V	5,543
Korea	Q	18	Q	21	Q	25
	V	265	V	327	V	400 (e)
Japan	Q	40	Q	17	Q	17 (e)
	V	1,263	V	635	V	635 (e)
Total	Q	12,538	Q	13,297	Q	13,252
	V	55,018	V	53,620	V	62,315

Note: (e) estimate; * imports from Hong Kong only

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Some of these products imported from the Pacific Islands are re-exported world-wide after sorting, regrading and repacking at premium prices.

Products imported by Singapore are consumed locally and also exported to Malaysia and Hong Kong. China is the major outlet for products imported through Hong Kong. The Territory also exports to other South-East Asian countries, and to European and North American markets with sizeable Oriental populations.

Performances of major markets

Hong Kong

In 1995 Hong Kong imported 5,789 mt of dried beche-de-mer at a value of HK$ 316 million (US$ 40.5 million). Indonesia and the Philippines from Asia, and Madagascar and Tanzania from the Indian Ocean were leading exporters of sea cucumber to Hong Kong in 1995. Pacific Island countries supplied more than 800 mt of beche-de-mer in 1995 at a value of nearly HK$ 50 million (US$ 6.4 million). The leading suppliers from the Pacific Island nations were Fiji, the Solomon Islands and Papua New Guinea. Exports from these countries to Hong Kong have slightly increased over the years. On the other hand, supplies from Kiribati increased significantly from two mt in 1992 to 130 mt in 1994. Exports have also increased from Tonga, Vanuatu and Western Samoa during the last three years (table 2)

Products from the Pacific Island nations fetched high prices, as the bulk of exports were high-value sandfish and teatfish. The average import price was HK$ 76.8/kg (US$ 9.8/kg) in 1994, compared to prices of Indonesian and Filipino products, which were HK$ 31.9/kg (US$ 4.08/kg) and HK$ 16 (US$ 2.05/kg) respectively.

The domestic market uses only 10 per cent of the total beche-de-mer imported into Hong Kong. Analysis of domestic consumption indicated that between 500 and 700 mt of dried sea cucumber are consumed annually.

Population growth has remained static for the last few years. Immigrants from mainland China have not had any major impact on the total consumption of beche-de-mer, as these are considered expensive. Moreover, the products are popular only among those aged over 40 years, for their medicinal value, low fat and high calcium content. The product is also popular during Chinese New Year celebrations, wedding dinners and banquets.

Consumers in Hong Kong prefer large and medium-sized dried sandfish and teatfish with skin on and calcium-coated. Recently, chilled, skinless (split sandfish) beche-de-mer from New Zealand have been introduced into Hong Kong, mainly for restaurants and hotels. Frozen, gutted beche-de-mer are also imported from Canada and the USA for the domestic market or for re-export to the southern provinces of China.

Imports and exports

Imports of all fish and fishery products, including dried items, are not taxed. Most of the products imported into Hong Kong are regraded according to quality, size and species before being sold to

Table 2: Hong Kong imports of beche-de-mer (dried, salted or in brine) (Q = mt, V = HK$ 1,000)

Country	1993		1994		1995	
	Q	V	Q	V	Q	V
Indonesia	2,620	75,314	2,599	82,974	1,694	78,786
Philippines	1,872	28,951	1,726	28,053	1,270	28,132
Madagascar	379	10,267	318	8,948	170	13,215
South Africa	28	1,429	93	5,502	*	*
Tanzania	478	12,987	303	13,457	257	7,285
Kiribati	99	3,674	130	6,059	N/A	N/A
Solomon Islands	319	100,076	247	11,312	161	8,494
Fiji	119	7,601	176	11,245	402	27,046
Vanuatu	6	400	40	2,353	*	*
Papua New Guinea	179	8,655	150	9,289	236	14,443
Total (including others)	6,099	249,354	5,782	179,192	4,190	177,401

* included under others

domestic or re-export markets. Big importers maintain warehouses where sorting takes place.

According to official records, Hong Kong exports nearly 4,000 mt of beche-de-mer annually. Some 85 per cent of these exports are directed to China and 10 per cent to Taiwan, while the balance is exported to the USA, Europe, Korea, and Singapore. Products exported to China range from high-value sandfish to low-value lollyfish.

Singapore

Imports and exports

Beche-de-mer is a preferred seafood delicacy in Singapore. Imports of dried beche-de-mer have ranged from 800 to 1,200 mt during the last three years. During the late 1980s, the imports ranged from 500 to 600 mt a year. Total imports have decreased slightly in 1995 due to lower supplies from Madagascar and Tanzania.

Imports of African origin mainly consist of cheaper-quality sandfish and some white teatfish. Some of the best-quality products are imported from Tonga, Fiji and Australia. These products are usually consumed by the domestic market. A reasonable quantity of beche-de-mer is imported from Indonesia, but is not officially reported. The total import figures may therefore be much higher.

As in Hong Kong, imported products are regraded in Singapore and then re-exported. High-quality teatfish and sandfish are usually exported to Taiwan. Exports to Malaysia consist of medium-grade sandfish of various sizes and a small quantity of the high-value teatfish.

Consumption

Domestic consumption of beche-de-mer (primarily sandfish) in Singapore ranges from 150 to 200 mt annually. The market demands high-value products. Although the retail sector takes only 10 per

Table 3: **Singapore imports of beche-de-mer (dried, salted or in brine) (Q = mt, V = S$ 1,000)**

Country	1993		1994		1995	
	Q	V	Q	V	Q	V
Australia	13	308	47	1,154	80	3,013
New Zealand	4	159	9	182	N/A	N/A
The People's Republic of China	N/A	N/A	1	114	1	54
Taiwan	N/A	N/A	5	128	10	65
HongKong	44	1,151	46	936	43	497
India	16	240	39	900	121	2,844
Sri Lanka	36	592	39	1,597	63	1,459
Malaysia	25	128	17	125	14	164
Philippines	77	1,253	66	1,727	56	1,774
Myanmar	5	76	6	88	8	86
Vietnam	16	242	15	122	8	84
Fiji	3	75	8	131	17	345
Maldives	52	894	49	549	45	659
Papua New Guinea	146	1,840	80	838	89	281
Solomon Islands	3	72	4	38	N/A	N/A
Mauritius	N/A	N/A	6	96	3	66
Kenya	19	120	36	493	24	733
Madagascar	245	1,505	333	2,368	139	1,163
Mozambique	N/A	N/A	6	86	5	90
Tanzania	111	1,130	249	2,070	155	1,877
UA Emirates	14	380	18	704	6	191
Yemen	18	264	45	601	60	1,075
USA	3	55	N/A	N/A	2	42
Oceania	25	466	43	707	33	635
Other countries	5	175	49	1,258	71	1,474
Total	880	11,125	1,216	17,012	1,053	18,671

cent of the market share, the best products are usually sold through this sector. Restaurants, which are the main users of dried beche-de-mer, buy their products from wholesalers and reprocess their own products.

Reprocessors, who generally use small dried sandfish (40–80/kg), play an important role in Singapore. Retail outlets, which sell processed/wet beche-de-mer through wet markets and speciality shops, get their supplies directly from reprocessors. Consumption is high during the Chinese New Year, at mid-year and year-end festivals, dinners and at almost every wedding dinner, irrespective of income group.

Other markets

Consumption of dried seafood, especially of beche-de-mer, is popular in many countries in the region. China, Taiwan, Malaysia, Indonesia, Thailand, the Philippines and Vietnam import a significant volume of beche-de-mer for local consumption. The national trade liberalisation policy of China has in fact contributed to the high imports of dried beche-de-mer into China.

Taiwan, a traditional consumer of high-quality dried seafood, goes for high-value products. Imports of beche-de-mer products remained fairly stable at 1,100 mt per year. Malaysia imports about 300 to 400 mt of dried beche-de-mer annually, with Indonesia as the main supplier.

Prospects in oriental markets

The international trade in dried sea cucumber is almost exclusively limited to countries in the Indo-Pacific area. Trade with the western world is fairly low. However, with increasing settlement of ethnic oriental people in the USA, Europe and Australia, a constant flow of products to these markets has been noticed in recent years. For example, regular shipments of beche-de-mer from Hong Kong to the USA and Canadian markets were visible from 1992 to 1995 and the value of this trade is on the rise.

As major trading importers, trading centres and re-exporters, Hong Kong and Singapore are expected to maintain their stronghold in the market. However the emergence of China as the driving force in global trade appears to be a major challenger in this trade. Consumption of dried beche-de-mer is expected to increase in future and the market has the capability to absorb any volume of products, irrespective of species, quality, size and shape of products. The most important market areas in China are the Special Administrative Regions (SARs), where per capita income is high compared with the average per capita GNP of China.

Major cities such as Guangdong, Shangai, Shenzhen, Xiamen and Beijing demand good-quality, high-value products as a result of their high disposable family incomes, which are expected to grow in the next five years. Guanzhao and Shangai provinces, for example have 65 million and 13 million people respectively, with a per capita income of more than US$ 3,000. These areas have become important export markets for Hong Kong traders.

Although China is the biggest market for beche-de-mer, it is very unlikely that direct imports of these specialised products will increase in future. Due to long-existing social, cultural and ethnic ties with Hong Kong, most of these products are expected to be channelled to China through Hong Kong. Moreover, there has been a substantial investment by Hong Kong in China.

Because of cheap labour, available processing technology and common cultural understanding, importers will still prefer to use China as the main processing base. However, in the short term, better-quality raw materials from the PINs will fetch higher prices in these market areas.

Importers and reprocessors in Singapore are moving in a different direction from Hong Kong in product development. They are willing to process more value-added products in the producing countries, although their market share is low compared to Hong Kong. Demand for value-added beche-de-mer (skinless, cleaned, smoked) is expected to improve further in future. Even in mainland China, where skin-on and calcium-rich products are more popular, other forms of high value processed sea cucumber are expected to receive good market acceptance in view of the growing incomes, more health consciousness and preference for better-quality products.

Supply of beche-de-mer is not expected to grow much in the world market from its current level. Nevertheless, demand will continue to rise. This will eventually lead to upgrading of more species from medium value to high value, and lower value to medium value. However, quality is the major prerequisite to achieve this development. Introduction of new species to the market is also expected.

Prices of sea cucumber are likely to go up in the future. In Singapore, for example, beche-de-mer prices have increased by 100 per cent at wholesale level during the past three years. The same trend has also been noticed in China, Hong Kong and Taiwan.

Consumption of these high-value fishery products is likely to increase in Singapore and Malaysia, and there is also an upward trend from China, particularly from the Southern Province. Nevertheless, consumers will demand better quality and more convenience foods and are expected to pay good prices for these products.

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(Source: *INFOFISH International* 6/97, pp. 23–29)

Reproductive cycle of the holothurian *Holothuria scabra* in Saugi Island, Spermonde Archipelago, Southwest Sulawesi, Indonesia

by Dr Ambo Tuwo [1]

Introduction

Holothuria scabra is one of the 16 commercial holothurians harvested in Southwest Sulawesi (Tuwo & Conand, 1996). Its reproductive cycle has been studied at different sites, but there was confusion about its spawning periods. Some authors have described a semi-annual reproductive cycle or two spawning periods in a year (Ong Che &Gomez, 1985). The present research aims to study the reproductive cycle and to find explanations for the spawning period of *Holothuria scabra* in Sulawesi, Indonesia.

Methods

Specimens of *Holothuria scabra* were collected monthly during a year at Saugi Island, Spermonde Archipelago, South Sulawesi, Indonesia. Thirty specimens were collected from each sampling.

In the laboratory, the total length (TL), body-wall wet weight (BW) and gonad wet weight (GW) were measured. Gametogenesis was examined using histological observation. The individual maturity stage was determined according to the maturity stage of dominant tubules in the gonad. Percentages of different maturity stages were calculated for each sampling. Gonad indices (GI) were calculated using body-wall wet weight (BW) and gonad wet weight (GW):

$$GI = (GW \times 100)/BW$$

Results and discussion

Microscopically, characteristics for both sexes were similar to those of other holothurians (Tanaka, 1956; Tuwo & Conand, 1992). The maturing tubules contain the previtellogenic and vitellogenic oocytes in females (Figure 1A and 1B), and spermatocytes and spermatozoa in males (Figures 1E and 1F). The mature tubules contained only vitellogenic oocytes in females (Figure 1C) and only spermatozoa in males (Figure 1G). In spent tubules we observed the presence of relict oocytes in females (Figure 1D) and relict spermatozoa in males (Figure 1H).

Maturation (Stage III) was observed from July to March. Maturity (Stage IV) was present practically

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