Managing Beche-de-Mer in Tonga
Issues for Consideration

Tonga Fisheries Project

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MANAGING BECHE-DE-MER

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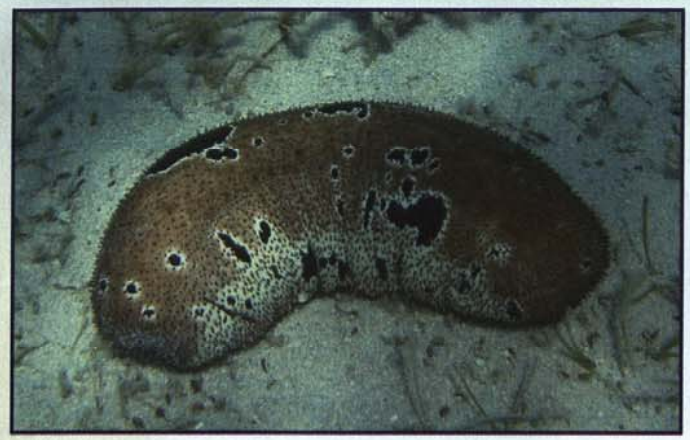
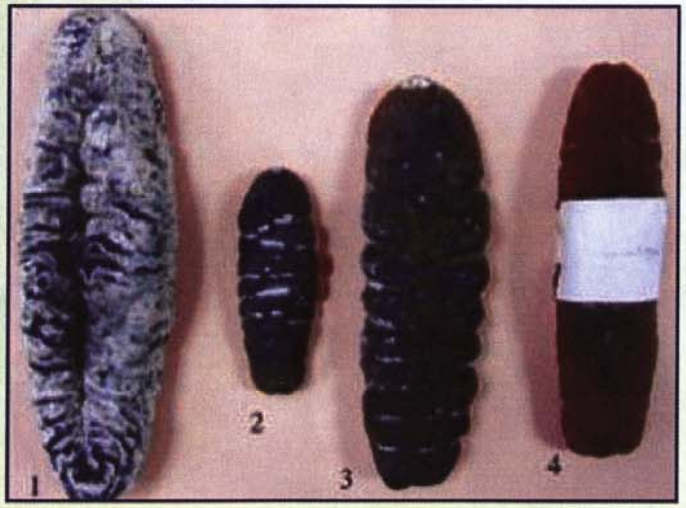


Golden sandfish (*Holothuria scabra versicolor*), the most highly valued source of beche-de-mer.



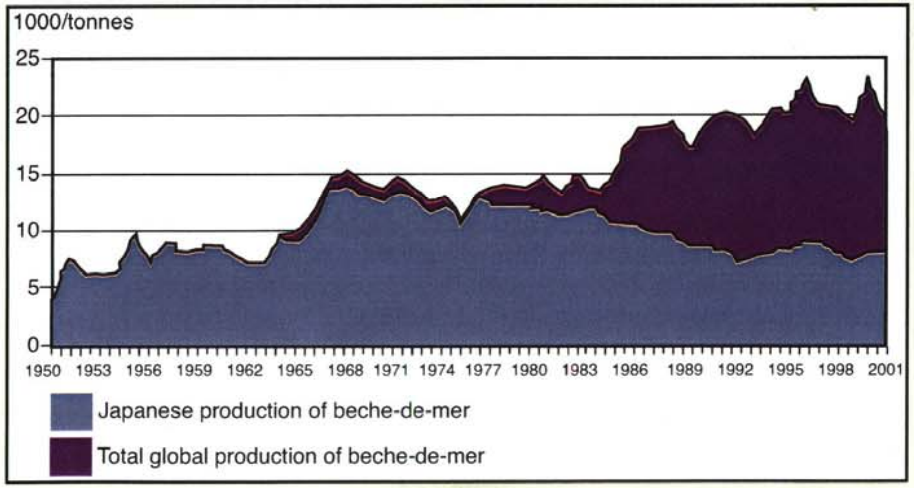
Beche-de-mer processed from sandfish.

1. BACKGROUND

Beche-de-mer is the name given to the dried body wall of sea cucumbers. Sea cucumbers are processed into beche-de-mer by a process of gutting, drying and smoking.

Sea cucumbers are members of the Echinoderm family. Other members of this family include starfish, sea urchins and brittle stars. Sea cucumbers live on the seabed and are found in most of the world's seas and oceans. There are around 1200 species of sea cucumber and about 30 of these support fisheries. The fisheries are widely distributed between Africa, Chile, Cuba and Alaska with the biggest fisheries found in Japan, Indonesia, the Philippines and Pacific Island countries.

About 20,000 tonnes of processed beche-de-mer are produced around the world each year. The main markets are in China and Singapore where it is used in Asian cuisine and as a tonic and pharmaceutical ingredient. Prices vary with species, size and quality. The highest grade of beche-de-mer is sourced from sandfish (*Holothuria scabra*) and fetches more than US$50/ kilogram. Other species are far less valuable. Tongan species with high value include sandfish (*H. scabra versicolor*), black teatfish (*H. nobilis*) and white teatfish (*H. fuscogilva*). Demand for beche-de-mer is rising as the Chinese economy grows.



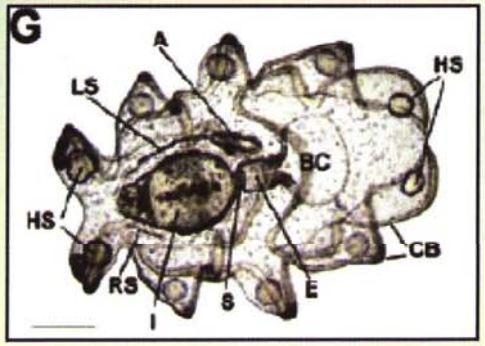
World production of beche-de-mer (from Conand et al. 2004) from 1950 to 2001.

At present, there is intense interest in the culture of sea cucumbers and considerable progress is being made towards developing major sea cucumber aquaculture programmes. China produces around 3,000–5,000 tonnes of beche-de-mer a year from cultured sea cucumbers and pilot projects are now running in countries as widely separated as Solomon Islands, Australia, Japan, New Caledonia, the Maldives and the Galapagos Islands.

Hatchery-reared sea cucumbers.

2. BIOLOGY OF SEA CUCUMBERS

Sea cucumbers live on the seabed. Some bury themselves at times and others hide under rocks and coral, but generally they are quite visible. They move very little as adults – usually only a few metres a day. Reproduction occurs when eggs and sperm are shed into the water in a process known as broadcast spawning. Fertilisation rates almost certainly depend on the density of the spawning adults. If they are not close together when spawning takes place, the rate of fertilisation will be very low. The fertilised eggs undergo a series of microscopic larval phases over a 2–4 week period before settling on the seabed as juvenile sea cucumbers. These larvae can drift considerable distances before they settle.



Larvae of a sea cucumber, about 15 days old

Growth rates are known for only a few species. Sandfish (*Holothuria scabra*), the Galapagos sea cucumber (*Isostichopus fuscus*) and the Japanese sea cucumber (*Apostichopus japonicus*) are known to reach a harvestable size in 2 years or less. Other species may not grow as quickly.

The reproductive timing of a number of species is known. While many tropical species spawn in the summer months, a few spawn in the cooler months. Many species have secondary spawning activity outside their major spawning periods. Spawning is linked to the phases of the moon.

Most species of sea cucumber feed on bacteria and micro-algae that live in the upper layer of the sea bottom. They play an important role in the ecology of the seabed by turning over the sediment as they feed, thus keeping this zone oxygenated and its nutrient level stabilised.

The prickly redfish, *Thelenota ananas*.

3. FISHERIES AROUND THE WORLD

Production from existing sea cucumber fisheries increased and new fisheries began as demand for beche-de-mer grew in the 1980s and 1990s. Many of these fisheries suffered severe overfishing and both production levels and average prices have fallen as fishers take smaller animals and less valuable species.

Production in the Philippines fell from a peak of more than 3,000 tonnes in 1993 to less than 800 tonnes in 2001. In Papua New Guinea, production peaked at just over 2,000 tonnes in 1998, falling to about 1,100 tonnes in 2001. The Solomon Islands fishery produced more than 700 tonnes a year up to 1995, but production declined to about 50 tonnes by 2001.

This story is repeated in national fisheries around the world – a massive increase in production in the early and mid 1990s followed by a decline in production with less valuable species being targeted and, in some instances, closure or collapse of the fishery. Production levels and supplies to the major markets have been maintained by expanding fisheries to new areas. Unfortunately, few of the world's fisheries appear to be managed sustainably.

4 **Quotas for each species**, based on estimates of existing population numbers and target exploitation levels for each species. Such a system is more rigorous than a universal quota but needs accurate baseline data and is difficult to police.

5 **Spatial management**, which involves the closure of large areas of the sea cucumber fishery and allows fishing only within limited areas. The closed areas then act as spawning reserves. This procedure would reduce the risk of overfishing but would be difficult to police and could cause problems for local communities living adjacent to the closed areas.

6 **Rotational management** is a variation of spatial management. It involves mapping potential fishing grounds into a series of grids. One or two of these grid areas can be opened for a short time for fishing and then closed for some years to allow the local population to rebuild. Other areas of the grid can be opened and closed on a rotating schedule to allow for fairly continuous fishing. Such systems are safe but again are complex to administer and police.

MAXIMIZING YIELD

Maximizing yield involves taking animals at a size or age when gains in weight or yield balance population losses due to natural mortality. If young, small animals are taken, they may be numerous, but they will be too small to be of value. If left for too long, natural mortality will mean unnecessary waste of the resource.

Yield can be maximized by:

1 **Using size limits.** Using size limits to maximize yield requires information on growth and natural mortality. However, such information is not available for most species. Arbitrary size limits can be set to limit waste in a sea cucumber fishery.

2 **Seasonal harvesting** can be used if there is evidence that the condition or value of sea cucumbers varies with time of year. Currently, Tonga has no data on possible seasonal variation in the condition of its sea cucumber species.

ALLOCATING ACCESS RIGHTS

Determining who should be allowed to fish for sea cucumbers, and who should be allowed to process and export the product, is one of the most difficult issues in fisheries management. The Fisheries Management Act gives broad guidelines for allocating access rights with preference given to Tongan nationals.

OPTIONS FOR ALLOCATING RIGHTS TO FISH FOR SEA CUCUMBERS INCLUDE:

1 **Open or common access.** This allows everybody to fish for sea cucumbers. Open access to a sensitive resource such as sea cucumbers leads to the risk of overfishing, unless other carefully considered management conditions are put in place.

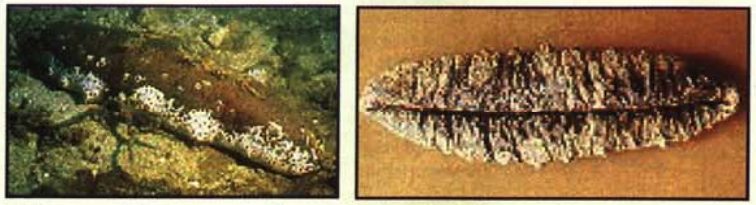
2 **Licenses or permits.** Access to fish can be authorized and controlled by a specific license or permit. If this option is used, the number of licenses issued should be kept as low as possible to help with compliance and monitoring of sea cucumber populations. There must be clear guidelines for issuing licenses. Successful applicants should have a history of obeying fisheries laws and regulations, understand proper handling techniques, have good knowledge of different species of sea cucumber and understand the need for careful management of the fishery. This option does lead to unequal sharing of wealth from the resource, and involves making difficult decisions on who has access. Access rights may be awarded by ballot, tender or other procedure after potential entrants have met the selection criteria.

3. **Community management**, which is possible in Tongan waters. The Fisheries Management Act allows for the establishment of Coastal Community groups that have power to manage marine resources in Special Management Areas under a management plan. Such a process could be used to manage localised sea cucumber fisheries. It offers the advantages of fair distribution of wealth, but would take some time to set up and would require a national management framework.

OPTIONS FOR ALLOCATING RIGHTS FOR PROCESSING AND EXPORTING INCLUDE:

1 **Competitive access** – allowing several processors the right to buy, process and export sea cucumbers. Competition between processors could lead to illegal practices such as purchase of undersized product, purchase of product from unlicensed fishers and production of poor quality beche-de-mer. Although it has the advantage of ensuring fishers receive competitive prices, the risks associated with serious competition between processors outweigh the potential benefits.

2 **Limited access** – giving rights to only one processor on each island group. Such a system is easy to monitor and encourages compliance with other management arrangements. However, it may lead to uncompetitive prices being offered to fishers.



White teatfish in its natural environment and processed

ENVIRONMENTAL ISSUES

Fishers take sea cucumbers by hand or using drop spears, which is a low-impact form of fishing because there is no bycatch or direct disturbance of other species. There are two environmental issues to be considered:

1 Taking an excessive proportion of the sea cucumber population may lead to degradation of the seabed habitat by reducing the rate at which the seabed is turned over and oxygenated.

2 Processing sea cucumbers into beche-de-mer requires a considerable amount of timber for fuel and smoke. One report suggests that up to 10 tonnes of timber may be required to produce a tonne of finished beche-de-mer. The impact of this demand for timber must be considered in the context of Tonga's environment.

Processing beche-de-mer

6. CONCLUSIONS

- There may be scope for re-opening Tonga's sea cucumber fishery. If it does re-open, it must never be allowed to grow as it did between 1990 and 1995 when the management regime and level of production were clearly unsustainable.
- A fishery for high and medium value beche-de-mer in Tonga should not take more than 20–30 tonnes a year. If the average price is US$20 per kilogram, the wholesale value of the fishery will be in the order of TOP$800,000–1,200,000. The value to fishers would be considerably less than this.
- A sea cucumber fishery is complex and difficult to manage; there are no simple measures for maintaining a sustainable fishery.
- Experience with sea cucumber fisheries in Tonga and other areas of the world clearly shows that the fishery will collapse if not managed carefully.
- Sea cucumber stocks will have to be monitored regularly if the fishery is re-opened.
- Re-opening the sea cucumber fishery will generate costs for the Ministry of Fisheries for licensing (which should be recovered), policing and monitoring. Monitoring costs could be considerable.