Management of beche-de-mer (sea cucumber) Fisheries

by Dr Tim Adams, South Pacific Commission, Noumea, New Caledonia

The recommendations on the management of the Maldives bêche-de-mer described on pp. 11–12 above could be applied, in large part, to just about any tropical insular beche-de-mer fishery.

We have decided to publish in this bulletin recommendations that have been made about the management of South Pacific bêche-de-mer fisheries. Whilst some of these recommendations may appear obscure outside the context of their covering documents (apologies to those authors whose work may be thus distorted), it is likely that some consensus recommendations may emerge, of value as general principles applicable in different situations.

FIJI

Fiji Fisheries Division recommendations on regulating exploitation in the beche-de-mer fishery, made before the start of the Fiji beche-de-mer boom (i.e. when the Government was actively trying to develop the resource), were approved by Cabinet in 1984 and the resulting Bêche-de-mer Exploitation Guidelines were published in *Fishery resource profiles: information for development planning*, edited (and mainly written) by A.D. Lewis (1985), Fisheries Division, Ministry of Primary Industries, Fiji, as follows:

> *(1) Harvesting and processing of product to be restricted to Fiji nationals;*
>
> *(2) No size limits are necessary as prices vary with size and small individuals are neither collected nor are they commonly seen;*
>
> *(3) The use of SCUBA gear for the collection of beche-de-mer is forbidden.*

Following a 10- to 20-fold increase in exploitation by 1988 the second of these guidelines was reversed by the Fisheries (Amendment) Regulations, 1988. Amongst other things, these inserted a new regulation 25A to enact a 3-inch minimum size limit on all beche-de-mer exported (whether processed or not), and to ban the export of *Holothuria scabra* (sandfish, *dairo*) (*Fiji Republic Gazette Supplement*, 16 December 1988).

This was designed to put a sharp brake on the industry in an attempt to mitigate almost certain over-exploitation, although it was not clear if the subsequent halving of the export volume was a direct result of the size limit, of overfishing already accomplished, or of a reduction in fishing effort (there had been a marked upsurge in exploitation of all sedentary marine resources for export in 1988, due to the number of people thrown onto the subsistence sector after the 1987 coups, but the economy started to recover in 1989). The protection for *H. scabra* reflected the importance of this species as a local and emergency item of diet.

Note that the Minister for Primary Industries had the power to waive the requirements of Regulation 25A and to permit the export of sandfish under specified conditions. In practice, such permission was only given at the explicit request of the customary fishing rights owners for *dairo* originating from certain areas, and only exporters who could demonstrate the ability to produce a good quality sandfish product were to be permitted.

After a resource survey, concentrating on blackfish (*Actinopyga miliaris* and relatives) in Vanua Levu, the SPC Inshore Fisheries Research Project made the following recommendations to the Fiji Government early in 1989 (in *Exploitation of the sea cucumber* Actinopyga miliaris *(blackfish,* driloli*) in Northern Fiji* by G.L. Preston, V. Vakamoce, P. Lokani and F. Viala (1989). Unpublished report of the SPC IFRP to the Government of Fiji):

> *1. The least favoured management technique is to allow harvesting to go uncontrolled until such time as it ceases either because the resource is depleted or market conditions make harvesting uneconomic.* [Editor's note: the simplest alternative to this 'default' method of management is the periodic moratorium, as is practised on a one-year-on / one-year-off basis at Ontong Java in the Solomon Islands (mainly fishing *Microthele*), or apparently on a two-year rotating basis in Yemen for *H. scabra*]

2. The main objective of management of this fishery should be to ensure that the stock does not crash because of recruitment failure. To this end a temporary but very strict mechanism of control needs to be imposed to prevent growth overfishing. The blanket size limit on all beche-de-mer species imposed by the Fiji Government may well achieve this.

3. Steps should be taken to ensure that harvesting and processing of beche-de-mer continues to be carried out largely on a small scale basis by village processors. The trend towards large scale operators and centralised processing facilities should be discouraged. These steps would maximise returns to coastal villages and help avoid localised resource depletion.

4. Once biological information on recruitment becomes available a move away from size limits and towards the establishment of catch quotas would be preferable. The imposition of quotas would tend to encourage the selective harvesting of the larger and more valuable animals. For a quota system to work properly, however, there needs to be in place some means of gathering data on the catch being taken and some legal means of enforcing this quota. To this end the Fiji Government should introduce legislation which makes the acquisition of an export licence mandatory for all beche-de-mer exporters. [Editor's note: Legislation was prepared, but never introduced, since it was found that relevant business licensing powers were already vested in the Ministry for Trade & Commerce. For data-gathering purposes, the informal 'Export Licence' issued by the Fisheries Division (which acted as a *certificate of origin* for the importing authorities, and a *certificate of inspection* for Fiji Customs at the point of export) could be effective.]

5. Establish an Association of Seafood Exporters in Fiji whose function would be to liaise between the Fisheries Division and the exporters. Membership of the Association would be mandatory for all exporters and all members should agree to provide detailed statistics on harvesting activities to the Fiji Fisheries Division. Regular meetings between the Association and the Fisheries Division should ensure a two-way flow of information on the management of the fishery. [Editor's note: some of the subsequent history of the Fiji Beche-de-mer Exporters Association is described in Issue #4 of this bulletin. Whatever its value in other areas, it should be noted that no member of the Association ever actually volunteered any hard information about harvesting activities or purchases.]

Beche-de-mer Information Bulletin #4 contains most of the recent history of the Fiji bêche-de-mer fishery. Whilst the Cabinet guideline banning the use of SCUBA was never given the force of law, it was influential in preventing investment in the purchase of SCUBA gear for commercial fishing.

However, by 1991 it apparently became essential to fish deeper and more distant waters to maintain reasonable catch rates. It was also realised that whilst the Cabinet ban applied to SCUBA, it did not include Hookah (surface-supplied air), and a secondary boom took off, this time sweeping the outer islands of Fiji and extending to Tonga.

Unfortunately, in the absence of detailed catch data, this secondary boom, combined with a gradual progression of exploitation through the species, gives the Fiji yearly beche-de-mer export tonnage graph the appearance of a fishery approaching stability. Total exports have hovered around 300 tonnes for the past three years after the 1988 spike to over 1,000 tonnes.

TONGA

Proposed regulations under the Fisheries Act include, in addition to a ban on the use of both SCUBA and any diving equipment that utilises compressed gas for the purpose of fishing, a blanket 12 cm minimum size limit on dried beche-de-mer, and a ban on the export of any beche-de-mer without a permit from the Minister.

We have recently heard from Tonga that the 12cm blanket size limit will be impractical, and that a separate size limit is likely to be implemented for each species exported.

In 1990 the SPC Inshore Fisheries Research Project performed a beche-de-mer resource survey for the Tonga Government (*Report of a survey of the sea cucumber resources of Ha'apai, Tonga*, by G.L. Preston and P. Lokani, June 1990) and included the following advice on management should a beche-de-mer fishery ever develop in Ha'apai:

The most meaningful approach to management at this stage in the fishery would be to legislate against or otherwise prevent or discourage the use of underwater breathing apparatus for sea cucumber collecting. The introduction of SCUBA gear, Hookahs, or other types of underwater breathing apparatus would radically alter the development of the fishery and require an entirely different management approach. In addition, the use of SCUBA gear without adequate training brings with it a very high risk of permanent disability or death. The seriousness of such risks has been demonstrated in Tonga in the past.

... Focus should now be placed on promoting the development of the fishery. As an integral part of this, provision should be made for instituting a scheme to collect production statistics, hopefully in co-operation with local processors, so that the growth of the fishery, and the response of the resource, can be monitored and later management approaches be planned in advance.

A beche-de-mer fishery subsequently developed very rapidly in Tonga, at the same time, and probably in response to the same factors, as the boom in the neighbouring Lau group of Fiji (see box).

Anecdotal reports from both Lau and Tonga early last year used similar phraseology: that a beche-de-mer fever was sweeping the islands, with whole villages fishing for beche-de-mer. In Fiji, there was concern that gardens and plantations were being neglected and that villages would thereby lose capacity for self-sufficiency.

There were also complaints raised by certain islands against other islanders poaching on their traditional fishing grounds: a type of complaint that was normally settled by traditional means, and only raised with the authorities against non-Fijians.

Tongan gold (sea cucumbers) exported to Asia, France, Canada

by Fuai'api Sime

'The most needed gold in Asia is found in Tonga', according to Mrs Eseta Tapueluelu, a Talafo'ou exporter of that gold – sea cucumbers.

Her firm dries sea cucumbers for export not only to such Asian destinations as Hong Kong and Korea, but also to France and Canada.

'Very delicate fishing methods are used for sea-cucumbers to avoid scratches which would show during the drying process', Mrs Tapueluelu said.

Both white and black varieties are collected, as are sandfish.

After a period of resting in containers of sea water, the sea cucumbers are cooked three times, then smoked and dried using different methods for different varieties. Some are even buried in sand for a few days as part of the curing process.

Bags of the dried product are exported monthly at an average price of T$9,548 for 20 bags.

'Despite the fact that we rely on fishing for a large part of our income, we make sure that the marine environment is not disturbed', Mrs Tapueluelu said. For example, workers collect only sea cucumbers that are nine or more inches long.

Mrs.Tapueluelu noted the food value of sea cucumbers, which contain 43 per cent protein, 2 per cent fat and 21 per cent minerals.

Since starting the business in June 1991, she and her husband Semisi have shared their experience with others, including fishermen in Ha'apai and Vava'u. As a result, similar businesses are now flourishing at Hu'atolitoli Prison, at 'Ata Island, and in Ha'apai.

As Mr Tapueluelu is Deputy Superintendent of Prisons, Mrs Tapueluelu sees her involvement in teaching the business skills to convicts as a way of helping her husband in his work.

'An investment of about T$20,000 is needed to initiate such a business', Mrs Tapueluelu said. Requirements include a vessel and fishing gear.

Mrs Tapueluelu worked from 1986–89 in Victoria, Australia, for a firm which exports seafood to Asia.

Tonga Chronicle
(1/10/1992)

SOLOMON ISLANDS

Beche-de-mer exports from the Solomons increased dramatically (by 500% over the previous year) in 1991, after a downturn in 1989/90 (see Seamus McElroy's article in *BDM Information Bulletin #2*).

No legislation specifically concerning beche-de-mer currently exists in Solomon Islands, and the only documented case of any management practice is the biennial year-long moratorium on bêche-de-mer harvesting in Ontong Java.

According to sources in Malaita and the New Georgia group, beche-de-mer does not appear to be a dietary item in the larger Solomon islands. It is likely that there has never been any need for traditional controls on exploitation except in the low, outer islands.

The Solomon Islands *Marine resource profiles* (FFA Report 90/61) does not make any recommendations concerning the management of beche-de-mer, except the need to gather *baseline information on catch rates, species and size composition, and total fishing effort in areas of high exploitation such as Ontong Java, Temotu, Malaita and Western Provinces. Basic data such as species composition and average sizes should gathered for other areas and the information gathered routinely by traders and exporters should be collated and analysed.*

The SPC Inshore Fisheries Project made a brief study of invertebrate export resources in the Western Province of Solomon Islands in 1992 (*Pilot survey of the status of trochus and beche-de-mer resources in the Western Province of the Solomon Islands with options for management*, by T. Adams, J. Leqata, P.Ramohia, M. Amos, P. Lokani (June/July 1992). Unpublished SPC report to the Solomon Islands Government).

Field work showed that beche-de-mer stocks across the New Georgia Group were very heavily exploited. The recommendations on beche-de-mer management are not easily extricated from the general discussion covering several species, but are broadly as follows:

☞*Measures should be taken, as a matter of urgency, to rehabilitate stocks. The most effective form of management will be one that operates on a reef-by-reef basis and selectively reduces fishing effort on the most overfished areas. The encouragement of communities to impose appropriate restrictions on reefs under their customary jurisdiction, with Government empowerment and support, is the preferred option. The system is already understood and appreciated by the fishermen; it is flexible and quickly adaptive to changes in resource status; it makes use of local knowledge and feedback, and it is fine-grained. Even though the system will be less effective in some areas than others, due to the erosion of traditional values or other factors, the overall effect could be considerable and, most importantly, such a system would be feasible. It would cost the Government far less than a Province-wide 'officials-only' law-enforcement effort, and would probably be far more effective.*

☞*The standby alternative for reducing catches* [if beche-de-mer proved to be too untraditional to be drawn into the community management model] *would be commercial control via a restriction in the number of export businesses allowed to operate, and the imposition of firm yearly product export quotas on each.* [This option might be difficult to sustain politically, as was proven by experience with the Fiji Beche-de-mer Exporters Association, which didn't even get as far as quotas. Note that it is the quota, and not the restriction on the number of exporters, that is the management tool. Restricting the number of exporters is mainly to permit each operator to be profitable under a limited total quota. For an idea of the amount of grief that can be caused to Government fisheries officers by the introduction of such a scheme on an established fishery, refer to the introduction of transferrable quota systems to New Zealand and Australia].

☞*Make sure that any official size, effort, gear, or season limitations apply to 'taking' as well as 'selling'. That is, that they apply to the subsistence fishery as well as the commercial fishery.* [Otherwise an enormous loophole is introduced. For beche-de-mer in the South Pacific, the commercial fishery is prosecuted almost entirely by subsistence fishermen and women.]

☞*It was recommended that the Western Province appoint a specialist dedicated officer to enforce fisheries and conservation regulations in the Province. Such an officer would preferably have familiarity with bringing prosecutions, but would mainly be responsible for liaising with, listening to reports from, advising and encouraging honorary fish wardens and local communities in the management of their reefs.* [Also, the case often arises where different traders can form different alliances within a reef-owning community, requiring outside arbitration].

☞ [Another possible Governmental option, which arose from the equally depleted nature of trochus shell (*Trochus niloticus*) stocks in the Western Province, and recognising the need for rural fishermen to maintain some source of income, would be to] *impose alternate closed seasons for beche-de-mer and trochus for 6 or 12 months at a time.* [However, this was not considered particularly feasible in face of the need by established trochus button factories to obtain a year-round supply of shell.]

☞*Ban the use of SCUBA or Hookah apparatus for fishing except by conditional permit for certain fisheries (e.g. gold-lip pearl shell collection for pearl-seeding);*

☞*Consider setting up marine reserves, either in little-fished areas or close to tourism centres. The aim is to preserve broodstock to help replenish surrounding areas, but the area must be completely enforced, and this is easiest when non-destructive users (e.g. dive operators) have a stake in keeping the area pristine.* [Note: this recommendation was made concerning a whole group of organisms. It is possible that the long planktonic stage in the life-cycle of sea-cucumbers would mean that broodstock reserves were of little **local** value, and that beche-de-mer reserves really need to be co-ordinated on a national or sub-regional basis. It would be interesting to look at the genetic variation of beche-de-mer, at regional, national, and individual reef levels, to get an idea of the extent of reef-to-reef and country-to-country genetic mixing.]

☞*Monitor beche-de-mer size-frequencies for each species periodically, at traders' warehouses. As well as providing an opportunity to get news about the industry, a continued decline in average size of a species from a particular area will indicate that management measures in that area may need to be strengthened.*

Note that no recommendation was made in this report to impose a minimum size limit of the kind imposed in Fiji and suggested in Tonga. At the time, no account was taken of the stratification of market prices by size, and the Western Province Government already had it within its power to put a severe brake on the industry, if so desired, through limiting and applying conditions to commercial licences (an option which was not available to the Fiji Fisheries Division).

COOK ISLANDS

When *Resource Profile No.6, Beche-de-mer, Rori of the Cook Islands* was prepared in 1988, there was no beche-de-mer export industry established in the Cook Islands, and *Actinopyga mauritiana* (surf redfish) was considered to be the only species with any commercial potential.

To that list might be added *Stichopus chloronotus* (greenfish) and *Holothuria atra* (lollyfish), which have since become of some commercial importance in Melanesia. The *Profile* has the following detailed section on Management Recommendations:

Management of rori [generic term for sea-cucumber in the Cook Islands] *resources is extremely important as it is very easy to overfish these sessile, slow-moving animals. In the Philippines, where there has been little or no management effort, many areas have been stripped of high commercial value species and others of all* rori *species (M.J. Trinidad-Roa, 1987* [Beche-de-mer fishery in the Philippines. *Naga, the ICLARM Quarterly*, Manila, 10 (4):15-17]*). In the Cook Islands the reef area and* rori *resources are relatively limited, making management essential to ensure a long term commercial yield. Because of this and the fact that relatively little is known about* rori *life cycles, management guidelines at this point in time should be conservative.*

Before starting any commercial fishery, baseline surveys of the areas to be exploited should be done. Results and recommendations (including management plans) from the Ministry of Marine Resources should be presented to the governing body (i.e. the Island Council) so that it can implement a suitable programme. Possible management plans are listed as follows:

(a) harvest bans during rori *breeding seasons, which for some species in New Caledonia seem to be from November to January, and from June to July for rori-u (black teatfish). If possible, these times should be confirmed for the Cook Islands.*

(b) dividing any reef area to be harvested into sections, with each section opened to harvesting during a certain time period on a rotational basis (this equates to the traditional raui *system). Alternatively, all the reef area could be harvested during certain time periods over the course of a year (i.e. one day a month). Either of these would lessen harvest-*

ing pressure during breeding seasons and allow time for stocks to recover.

(c) rotate harvests between participating islands, and pool beche-de-mer produced in Rarotonga. This will make it easier to get enough beche-de-mer to fill containers for export, and also relieve pressure on individual islands.

(d) the establishment of quotas and minimum size limits for each species, to ensure that the total depletion of any species will not occur (larger animals are the most valuable anyway). The current limit for all species in Fiji is 7.6 cm [3"], and 15 cm in Queensland, Australia (C. Shelley, 1988) [The status of the beche-de-mer fishery in Queensland. In: *Proceedings of the SPC Workshop on Pacific Inshore Fishery Resources, Noumea*]. [Editor's note: the Queensland size limit appears to apply to the animal before processing. The Fiji size limit technically applies to the animal at all stages of processing, but is only used on dried, processed animals].

(e) the establishment of permanent survey sites, to be surveyed before, after and between harvests. These will be used to monitor harvesting pressure on the rori *populations, their recovery from harvests, and seasonal variation. Results from these surveys should be used to determine when harvests are feasible, and to set their quotas.*

(f) the establishment of a reserve area, which may help in the recruitment of stocks.

(g) limiting entry at first to a few (maybe to those who first show interest) on each island, to help prevent over-harvesting. Entry could then be increased, according to the potential of the exploited stocks.

(h) the keeping of good records from the time of harvesting to sale. These records should include: harvesting date, time, duration, location, catch (species, amount and weight); processing times and methods (noting any variations); dry weights of beche-de-mer and price obtained.

(i) banning the use of SCUBA from harvesting, except for any species found only in very deep waters. [Note that the Cook Islands used to hold the world free-diving record until recently, so deep may need to be interpreted relatively!]

Whilst such management plans are ambitious, and would require a great deal of Government investment, it should be noted that the Cook Islands Government and the Aitutaki Island Council between them have been successful in regularly surveying and managing the Aitutaki trochus fishery and maintaining good stocks of trochus at a time when trochus is overfished in much of the rest of the South Pacific.

A management infrastructure is already in place in the Cook Islands, and plans are obviously easier to implement in small island fisheries and relatively homogeneous communities.

During the reporting phase of the SPC Aitutaki trochus fishery case study to the Ministry of Marine Resources, in 1992, some informal recommendations were made concerning the potential management of beche-de-mer resources on Aitutaki:

> *The* rori puakatoro *(surf redfish) resource occupies a similar reef stratum, and has a similar population density to trochus shell, and a similar management pattern might be adopted (i.e. a short open harvesting season, determined by the length of time it took to reach a quota set by a sample transect survey. A harvest of 30 per cent of the population of sexually mature animals might be allowed in the first instance (and adjusted from year to year as results became apparent); an appropriate minimum size limit determined; and the existing trochus sanctuary also be declared a* rori *sanctuary).*

The trochus harvest on Aitutaki is a community affair, and normally lasts one week or less. A time-limited *rori* harvest might be run concurrently or, if this proved too onerous, staggered by six months.

Note that the *rori* harvest would probably take longer due to the sheer time-consuming nature of processing, but that fishermen out collecting trochus might save a great deal of effort by collecting *rori puakatoro* as well.

This might have significant benefits if a public holiday has to be declared for the duration of the harvest, as happened in 1992.

Note also that the short open season for trochus on Aitutaki has made it feasible to run a kind of individual transferrable quota system. Designed to ensure that at least some of the financial benefit derived from the communal trochus resource reaches the entire community, the total quota for the harvest (as determined by pre-survey) is split equally between every household on the island, resulting in certificates for a few kilograms of shell each.

These quotas can then be traded on the free market, and the Island Council (which handles all shell marketing) will only pay fishermen for shell that they can account for by their quota shares on hand.

Because Government officers are present full time at the few designated landing points, any illegal-sized shell, or shell over quota, can be returned to the reef, alive. Equal quotas are reissued from scratch every harvest.

Reply to the request for information published in Bulletin #4

Source: Dr Lyle Vail, Lizard Island Research Station, Cairns, Australia

A request for information on spawning behaviour of tropical holothurians was published in the Beche-de-mer Information Bulletin #4.

A list of observations compiled by Dr Lyle Vail (18/1/93) is presented below.

For two species, *Stichopus chloronotus* and *Holothuria coluber*, it gives the first observations on spawning. The details provided will be very useful for a general analysis.

We hope that other colleagues will have the chance to observe spawning and will send their observations and photos to: Maria Byrne, Histology F13, University of Sydney, NSW 2006, Australia, **or** Chantal Conand, Laboratoire de Biologie marine, Université de la Réunion, 97489 Saint-Denis Cedex, La Réunion, France.

These observations will included in the next bulletin.

Holothurian spawning – Lizard Island – 18/1/93

Observer	Anne Hoggett
Species	*Stichopus chloronotus*
Number	Four individuals spawning out of a group of about 50 animals in an area of about 50 m x 50 m. Anterior half of the body elevated when spawning with a slight swaying from side to side.
Locality	In front of Lizard Island
Date	4/11/90
Moon phase	One day after full moon
Time	18h30 (daylight saving time)
Habitat	Algae/seagrass patch
Observer	Lynda Axe
Species	*Bohadschia argus*
Number	One individual
Locality	North Reef, Lizard Island
Date	8/6/91
Moon phase	Two days after the last quarter
Observer	Campbell Davies, Gary Russ
Species	*Bohadschia graffeii*
Locality	Lizard Island
Behaviour	Anterior end raised
Date	11/11/92
Moon phase	1 day after full moon
Observer	Brigid Kerrigan
Species	*Holothuria coluber*
Locality	Watsons Bay, Lizard Island
Date	12/11/92
Moon phase	2 days after full moon
Time	16h00 (about 2.5 hours before sunset)
Depth	6–8 m