Cortez to determine how many tons can be taken each year and still leave enough to support a self-sustaining population.

While Lily Romina Salgado Castro of PESCA, the Mexican Department of Fisheries, continues her count and finds far fewer cucumbers than she expected, the government continues to issue permits.

Not much is known about the slow-growing animals which may live 25 years. Salgado advises, 'We should stop any (commercial) diving activity until we know exactly how many we have, what size, and at what age the juveniles become adults.'

Although diving for the cucumbers is dangerous for both Salgado and those who do it for money, the market value of the strange little species makes it worth the risk. The competition for permits is growing as is the price for the small brown slug. Salgado worries that the cucumber may be fished to less than commercial numbers before her study is even complete.

Recent publications on beche-de-mer fisheries

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Review of the beche-de-mer (sea cucumber) fishery in the Maldives, by Leslie Joseph, Programme Officer, Bay of Bengal Programme (April 1992), 34pp. Document number BOBP/WP/79 of the Bay of Bengal Programme, 91 St.Mary's Road, Abhiramapuram (Post Bag No.1054), Madras 600 018, India, Fax: 044-436102.

This is a brief, but comprehensive review of the beche-de-mer fishery in the Maldives – the extensive island chain to the southwest of Sri Lanka in the Indian Ocean. The species exploited, and the recent rapid rise of the fishery, will sound familiar to South Pacific readers.

The description of the gradual shift from high-value to low-value species since the fishery started in 1986, and the worries that are expressed about economic losses due to poor-quality processing gave me, at least, a strong sense of *déjà-vu*.

As well as a description of the fishery, including export figures, prices, descriptions of processing, a brief economic analysis, examples of catch rates, length frequency histograms, and social consequences, there is a seven-page annex describing the nine major exploited species, with colour photographs of each, either processed or as they appear fresh out of the water.

It may be useful to reproduce the review's recommendations in full:

Recommendations

The bêche-de-mer fishery in the Maldives, despite its very short history, displays all the signs characteristic of an overexploited fishery. The fact that the trends observed in the islands visited are borne out by the trends derived from an analysis of the export data, shows that they are applicable to the entire archipelago. In the absence of a monitoring mechanism, these signs have not been recognised during a very rapid growth phase. Current levels of exploitation may also hinder future sustainable exploitation of this resource. In order to ensure a long-term sustainable exploitation of the resource, it is imperative to introduce regulatory mechanisms without delay.

The following recommendations are made, in the light of available information, for consideration by the concerned authorities.

*(a) The collection and export of **T. ananas** (prickly redfish) should be suspended for 4–5 years to permit the recovery of the resource.*

*(b) The collection of beche-de-mer using scuba diving should be banned. This will take the pressure off the spawning stocks of the valuable species **T.ananas** and **M. nobilis** (white teatfish) inhabiting deeper waters.*

*(These two measures, when implemented together, may lead to eventual rehabilitation of **T.ananas** resources.)*

*(c) Collection and export of small-sized **H. atra** (lollyfish) should be stopped by imposing a minimum size limit – say above 6" processed.*

*(d) Night fishing for nocturnal species such as **B. marmorata** (brown sandfish) should be discouraged as a first step and then followed by a ban if increased fishing is accompanied by low catches.*

(e) A data collection and monitoring mechanism should be established for the fishery. It should be possible to collect some basic data on the fishery without too much effort. For instance, the Island Chiefs, or the Government officials responsible for

fisheries matters on the islands, could periodically gather data on the number of fishermen or craft involved in the beche-de-mer fishery. If a system is introduced requiring exporters to keep records of quantities and varieties of beche-de-mer obtained from different islands, these data, together with the fishing effort from the islands, would serve to establish prevailing trends in the fishery in the different islands/atolls so that the requisite management strategies could be developed. Since the resource is very vulnerable to exploitation and highly sensitive to over-exploitation, the need for a monitoring mechanism cannot be over emphasised.

(f) Regulations should be introduced giving exclusive rights to the use of sedentary resources, such as beche-de-mer within an atoll, to fishermen of that atoll only. Since the beche-de-mer fishery is now carried out in almost all atolls, it is unlikely that the resources would remain under-utilised in any atoll as a result of such a regulation. On the contrary, it is likely to lead to greater responsibility in exploitation and a better organised fishery. Monitoring and data collection would also become more efficient and reliable.

(g) Fisher-folk should be instructed in the correct and hygienic methods of processing to achieve maximum economic returns from the processed product. Different species are processed in different ways. Demonstrations, leaflets and the radio can be used in such extension activities.

(h) The establishment of sea-ranching programmes for sea cucumber, with the active participation of fishermen, should be considered. Participation by resort owners could also be included. A sea ranching programme would be a very viable proposition, particularly in the context of a devolution of use rights as recommended in (f) above.

740 tonnes of processed beche-de-mer were exported from the Maldives in 1990, the latest year included in this report: an amount that has escalated rapidly from the 3 tonnes exported at the start of the fishery in 1986. It would be very interesting to have some information on the progress of the fishery through 1991 and 1992, and on the effects of implementing the recommendations outlined above.

All in all, this is a very competent case-study cum resource-profile, and recommended reading for anyone who has to consider the management of a tropical bêche-de-mer fishery.

Evidence for a marked decline of beche-de-mer populations in the Suva and Beqa areas of Fiji, and a preliminary description of a method of identifying beche-de-mer individuals based on characteristic body wrinkles, by Brian Stewart, University of Otago, New Zealand (1993), 20pp. University of the South Pacific Marine Studies Technical Report No.1/93. ISSN 1018-2896.

This report describes part of the research work that Brian Stewart performed in Fiji in February and March 1992 towards his Masters degree.

The transect surveys in the Suva area are particularly interesting because they can be related to the only previous baseline available for Fijian beche-de-mer: the work of Mark Gentle around Suva in 1979 and 1980.

Brian extends the observations to other species, and to Beqa Island, and provides a useful new benchmark for monitoring the state of the resource in the Suva area. It is notable (but not entirely unexpected) that the catch rate for *Holothuria scabra* (sandfish) appears to be less than 20 per cent of that reported in 1979, although in 1979 sandfish (Fijian: *dairo*) was already fairly well exploited around the Suva area for subsistence consumption.

Some length-weight (fresh and processed) body measurements and gonad weights are provided for *H.scabra* , and the potential utility of photographic records of wrinkle patterns for identifying holothurian individuals is pointed out.