# New report urges management reforms to save Fiji's sea cucumber fishery

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## Introduction

Sea cucumbers are one of the oldest traded commodities in Fiji, dating back 200 years (Ram et al. 2016). Due to their high economic value in China, sea cucumbers have been heavily exploited in Fiji over the past two decades (Mangubhai et al. 2017a), as they have in many other Pacific Island countries. Between 1998 and 2012, Fiji was the second largest exporter of sea cucumbers in the Pacific, and sea cucumber was the second-most valuable commodity, after tuna (Carleton et al. 2013).

In the past 10 years, Fiji's sea cucumber fishery has been evaluated in three major reports; a study made by the PROCFish project of the Pacific Community (Friedman et al. 2010), a study on the status of sea cucumber resources and fisheries management (Pakoa et al. 2013a), and a study on the economic value of sea cucumbers in Papua New Guinea, Solomon Islands, Vanuatu, Fiji and Tonga (Carleton et al. 2013). All three concluded that Fiji's sea cucumber fishery is overexploited and called for urgent management actions. Pakoa et al. (2013a) further recommended the finalisation and implementation of the national sea cucumber management plan to address depleted stocks. However, no management actions were taken in Fiji and the national sea cucumber management plan was drafted but is still not enacted.

Fiji's Ministry of Fisheries together with the Wildlife Conservation Society compiled a comprehensive report to summarise the latest science on the sea cucumber fishery in Fiji since 2013, and recommended key management measures.

Here, we summarise the eight studies in the recently published report, *Fiji's sea cucumber fishery: Advances in science for improved management*[3] (Mangubhai et al. 2017a), and highlight key findings and recommendations that are relevant and applicable to sea cucumber fisheries in other Pacific Island countries.

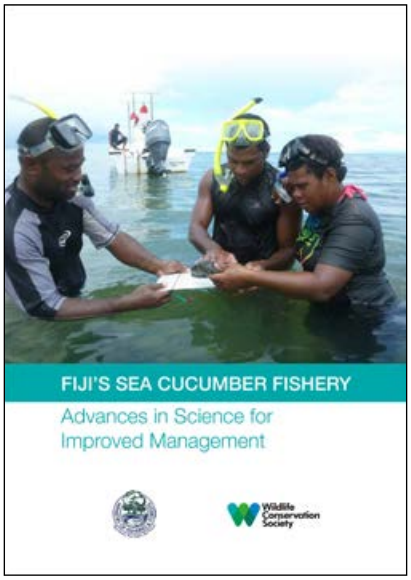


Figure 1. The 2017 report *Fiji's sea cucumber fishery: Advances in science for improved management.*

## Findings

### *Stock status*

Underwater surveys in Fiji by Lalavanua et al. (2017) found 17 out of the 27 commercially exploited species reported by Pakoa et al. (2013a). Densities of sea cucumbers in the eight locally managed marine areas were critically low, including in *tabu* areas, and most sea cucumber densities were low compared with theoretical regional reference densities.[4] Fishing should, therefore, only be permitted on a short list of species with healthy abundance. Despite a national ban on the exportation of sandfish (locally called *dairo*, *Holothuria scabra*) since 1988, the low abundance of this species and the presence of mainly immature individuals, indicates overexploitation. Apart from sandfish, all of the dragonfish (*Stichopus horrens*) found on transects were below the regional common body size (32 cm).

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[2] National Marine Science Centre, Southern Cross University, Coffs Harbour NSW 2450, Australia
[3] Available to download at: https://fiji.wcs.org/Resources/Reports.aspx
[4] Assessments conducted by SPC in 2002-2012, generated threshold densities for 17 species of sea cucumbers by averaging the 25% highest densities from the Pacific. These can be used as a baseline for comparison or as a reference in the case that a site has no specific site density data available.

Figure 2. Soni (left) and Steve (center) conducting a questionnaire-based interview of a fisher (image: ©Steven Purcell).

## Fisher perceptions

Purcell et al. (2017) demonstrated that socioeconomic surveys of fisher knowledge and perceptions were cost-effective for diagnosing changes in sea cucumber stocks. Within eight study locations in Fiji, 78% of the 235 fishers surveyed believed that sea cucumber stocks were in decline. Fishers believed that stock declines were mainly the result of too many fishers targeting sea cucumbers (i.e. excessive fishing capacity). Fishers caught, on average, 3.5 times more sea cucumbers per day 10 or more years ago than they do currently. The socioeconomic surveys reinforced underwater visual censuses by Lalavanua et al. (2017), showing that sea cucumber stocks are overexploited across Fiji.

## Value chain analysis

A value chain analysis of the sea cucumber fishery showed sea cucumbers passing through various actors as either raw or fully processed product (Mangubhai et al. 2017b). The majority of Fijian fishers sold their sea cucumber raw, with only a few fishers investing in partial or fully processed to fully dried form. There was also great variation in price per species received by fishers, which is likely a result of poor bargaining power and variation in the quality of product by fishers.

## Postharvest processing by fishers

A study funded by the Australian Centre for International Agricultural Research showed that fishers processed sea cucumbers to various stages and standards across Fiji (Purcell and Lalavanua 2017). Over half (59%) of fishers had never received information or training on processing methods. In addressing this issue, a year-long programme provided workshops, a manual[5] and training video[6] to fishers to help them understand best practices of processing sea cucumbers. Of the 353 fishers trained in 24 villages, the majority found the village-based workshops more useful than the training manual and video. More than 95% of workshop participants reported gaining new knowledge on processing, and our recent follow-up interviews show that 79% of participants later change their methods. After applying the new methods, both women (92%) and men (93%) believed their products are better quality. Training is still needed, however, on postharvest processing methods for fishers in other coastal villages.

## Pre-export size

A study by Tabunakawai-Vakalalabure et al. (2017a) on pre-export sizes of sea cucumbers showed that immature sea cucumbers are being harvested and exported from Fiji. Of the 7,497 sea cucumbers measured, 31% were below the

[5] http://aciar.gov.au/publication/cop026

[6] Online version: www.youtube.com/watch?v=KH6u0oZoclk
Downloadable files: http://scu.edu.au/environment-science-engineering/index.php/125

minimum legal size limit of 7.6 cm. Fiji's current size limit is unlikely to be effective for a multi-species fishery where different sea cucumber species reach sexual maturity at different sizes. Monitoring of export consignments prior to export is a cost-effective way of assessing the state of the fishery over time, compared to in-water field surveys. This study also reinforced that different size limits are needed for different species groups.

## Impact of underwater breathing apparatus

An economic study by the Ministry of Fisheries and SPC demonstrated that the use of UBA (underwater breathing apparatus) in the sea cucumber fishery had a large socio-economic cost to rural communities, as well as a financial cost to the government and wider society (Tabunakawai-Vakalalabure et al. 2017b). UBA exemptions had an estimated cost to Fijian society of FJD 5.8 million over three years. A total of 37 injured sea cucumber divers were admitted at the hyperbaric unit in Suva for treatment of decompression sickness between 2012 and 2014. Three-quarters of those admitted were young divers between the ages of 18 and 28.

## Ecological impact

An experimental field study by Lee at al. (2017) showed that the removal of sandfish (*H. scabra*) from reef flats negatively impacted reef sediments (sand and mud). Because sea cucumbers eat large quantities of sediments and turn over sediment layers through daily burying (Fig. 4), the removal of sea cucumbers impacts the efficiency of reef sediments to function as a filter system. Sediment oxygen consumption rates were consistently lower in enclosures with high densities of sea cucumbers than in enclosures where they had been removed. Oxygen penetration into the sediments decreased significantly where sea cucumbers had been removed. Excessive reductions in sea cucumber abundances through fishing, therefore, appears to negatively affect the function and productivity on inshore reef ecosystems, potentially impacting other fisheries.

## Genetic connectivity

A genetic study of lollyfish (*Holothuria atra*) showed that there is an overall connectivity among populations at four locations in Fiji, with gene flow moving from east to west

Figure 3. Sea cucumber fishers ready for a fishing trip with scuba tanks (image: ©Watisoni Lalavanua).

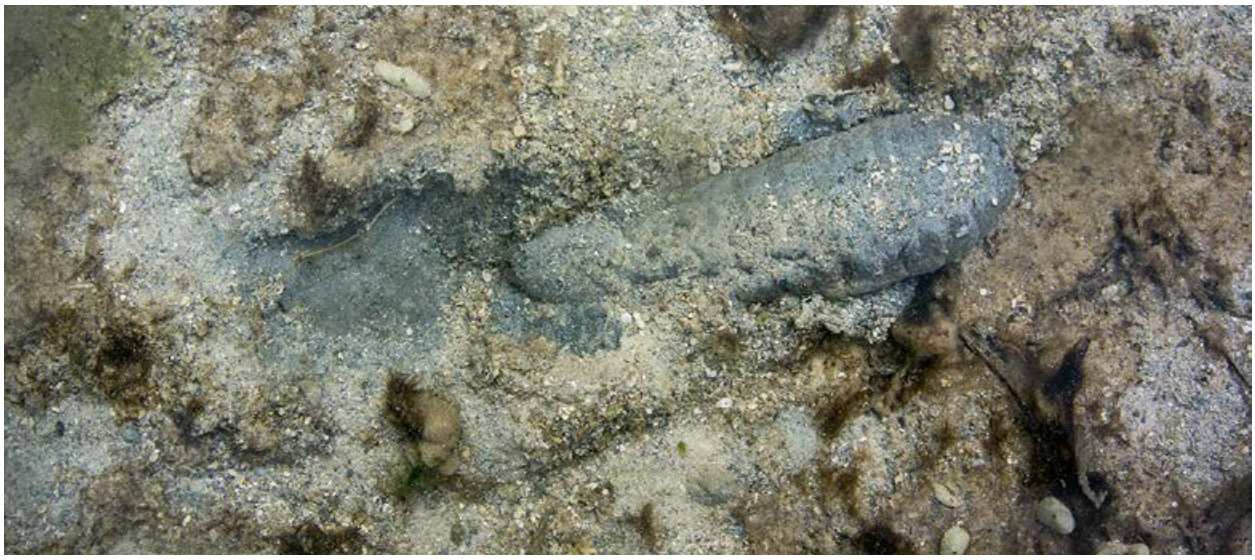

Figure 4. Sandfish (*dairo, Holothuria scabra*) turning over sediment layers through daily burrowing (image: ©Steven Lee).

between Vanua Levu and Viti Levu (López et al. 2017). This means that in order to safeguard Fiji's sea cucumber fishery, sea cucumbers in the eastern islands (Lau and Lomaiviti groups) need to be sustainably harvested because they might act as source of population replenishment and gene flow for stocks in western Fiji. It is, therefore, important for management plans to consider the fishery as a network of reefs.

## Implications for the management of sea cucumber fisheries

Overexploitation of sea cucumbers in the Pacific has prompted national moratoria in Papua New Guinea, Solomon Islands, Vanuatu (Purcell et al. 2013) and Tonga (Pakoa et al. 2013b). Because a ban does not manage exploitation but only stops the fishery, the recent report suggests a shift in the management strategy of the sea cucumber fishery in Fiji to avoid moratoriums (Purcell and Pomeroy 2015).

A shift in management strategy includes a number of urgent actions needed immediately:

1. Impose a shortlist of permissible species that can be harvested;
2. Reduce fishing capacity by employing limited-entry rules or very short fishing seasons;
3. Develop and adopt nation-wide standards for the pricing of raw and dried sea cucumbers;
4. Impose minimum size limits for different species groups for fresh and dried products;
5. Continue the recent complete ban on the issuance of exemptions on the use of scuba; and
6. Strengthen enforcement of all regulations, especially the size limits and permissible species at the exit point of products out of the country.

If the above recommendations cannot be adopted promptly, the Ministry of Fisheries should consider imposing a 10-year moratorium on harvesting and exporting sea cucumbers in Fiji. The fishery should only be reopened after this period of time and if underwater assessments show that populations to be harvested are well above the regional reference densities recommended by SPC (Pakoa et al. 2013a), and if most animals are above the size at maturity.

Fiji, therefore, must swiftly choose between significant management reforms or a fishery moratorium. Failure to act promptly in either case will result in increasing local extinctions and the eventual loss of this critical livelihood from Fiji. It would be a pity to resort to a moratorium, which has been the fall-back for other Pacific Island fisheries because this measure fails to improve the management system to regulate fishing within sustainable harvest rates.

Clearly, as has been the case in other Pacific Island countries, harvesting by small-scale artisanal fishers can lead to depletion of wild populations, loss of biodiversity and potential flow-on effects to ecosystems.

Numerous scientific studies now make it clear that sea cucumbers do not replenish their populations quickly, and so should only be fished at light rates of exploitation. Fishery managers must, therefore, focus on stricter controls on fishing effort and to species at risk if sea cucumbers are to endure as an economic resource for coastal livelihoods.

## References


Carleton C., Hambrey J., Govan H. and Medley P. 2013. Effective management of sea cucumber fisheries and beche-de-mer trade in Melanesia: Bringing the industry under rational control. SPC Fisheries Newsletter 140:24–42.

Friedman K., Kronen M., Vunisea A., Pinca S., Pakoa K., Magron F., Chapman L., Sauni S., Vigliola L., Tardy E. and Pierre L.F. 2010. Fiji country report: Profiles and results from survey work at Dromuna, Muaivuso, Mali and Lakeba (November 2002, April to June 2003, June and July 2007 and February 2009). Noumea, New Caledonia: Secretariat of the Pacific Community. 467 p.

Lalavanua W., Mangubhai S., Vandervord C., Dulunaqio S., Fox M., Naisilisili W., Jupiter S., Tuinasavusavu I. and Vodivodi T. 2017. Sea cucumber diversity and densities within locally managed marine areas. p. 9–18. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Lee S., Ferse S., Ford A., Wild C. and Mangubhai S. 2017. Effect of sea cucumber density on the health of reef-flat sediments. p. 56–63. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

López E.H., Eastwood E. and Drew J. 2017. Genetic connectivity among populations of lollyfish (*Holothuria atra*). p. 64–70. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Mangubhai S., Lalavanua W. and Purcell S.W. (eds). 2017a. Fiji's sea cucumber fishery: Advances in science for improved management. Wildlife Conservation Society. Report No. 01/17. Suva, Fiji. 72 p.

Mangubhai S., Nand Y., Ram R., Fox M., Tabunakawai-Vakalalabure M. and Vodivodi T. 2017b. Value-chain analysis of the wild-caught sea cucumber fishery. p. 26–32. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Pakoa K., Saladrau W., Lalavanua W., Valotu D., Tuinasavusavu I., Sharp M. and Bertram I. 2013a. The status of sea cucumber resources and fisheries management in Fiji. Secretariat of the Pacific Community, Noumea. 62 p.

Pakoa K., Ngaluafe P.V., Lotoahea T., Matoto S.V. and Bertram I. 2013b. The status of Tonga's sea cucumber fishery, including an update on Vava'u and Tongatapu. Secretariat of the Pacific Community, Noumea. 35 p.

Purcell S.W. and Pomeroy R.S. 2015. Driving small-scale fisheries in developing countries. Frontiers in Marine Science 2:44. doi: 10.3389/fmars.2015.00044

Purcell S.W. and Lalavanua W. 2017. Postharvest processing of sea cucumbers in Fiji. p. 33–40. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Purcell S.W., Lovatelli A. and Pakoa K. 2013. Constraints and solutions for managing Pacific Island sea cucumber fisheries with an ecosystem approach. Marine Policy 45:240–250. doi: 10.1016/jmarpol.2013.11.005

Purcell SW., Lalavanua W. and Tagica S. 2017. Fisher perceptions about abundance and catch rates of sea cucumbers in Fiji. p. 19–25. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Ram R., Chand R.V. and Southgate P.C. 2016. An overview of the sea cucumber fishery management in the Fiji Islands. Journal of Fisheries and Aquatic Science 11:191–205.

Tabunakawai-Vakalalabure M., James P.A.S., Lalavanua W. and Mangubhai S. 2017a. UBA: What is the social and economic cost to society? p. 49–55. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.

Tabunakawai-Vakalalabure M., Kuridrani N., Lalavanua W., Mangubhai S. and Bertram I. 2017b. Pre-export sizes of bêche-de-mer in Fiji. p. 41–48. In: Fiji's sea cucumber fishery: Advances in science for improved management. Mangubhai S., Lalavanua W. and Purcell S.W. (eds). Wildlife Conservation Society. Report No. 01/17. Suva, Fiji.


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