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**Effective management of sea cucumber fisheries and bêche-de-mer trade in Melanesia: bringing the industry under rational control**

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# Effective management of sea cucumber fisheries and bêche-de-mer trade in Melanesia: bringing the industry under rational control

## Executive Summary

### *The bêche-de-mer industry*

1. Coastal communities in many of the Pacific Islands Countries and Territories (PICTs) derive significant cash income from the harvesting of sea cucumber and its transformation to the tradable product bêche-de-mer (BdM). These dried products are consolidated in-country by specialist bêche-de-mer traders who export consignments to the main market entrepôts of Hong Kong, Guangzhou and Singapore.
2. Originally sourced from the coastal waters of the Far East, starting some two hundred years ago these supplies were supplemented with product from the islands of the Indo-Pacific region. Outside the countries of the Far East the dominant producers of bêche-de-mer have been the Philippines, Indonesia, Papua New Guinea, the Solomon Islands and Fiji. The pattern of exploitation has been predominantly of a “boom and bust” nature, with stocks given a matter of years to recover. In more recent times little to no resting period has been provided and stocks have become locally depleted.
3. This has prompted the trade to look elsewhere for supplies – encouraging exploitation elsewhere in the Indian Ocean and tropical Pacific, and exploitation of cold water species in the North East Pacific and the North Atlantic. Very quickly these other tropical sources of product have become over-exploited; new cold water sources of product are mainly exploited on an industrial scale and subject to tighter and more formed controls.
4. Demand for BdM continues to grow in line with the growth of the Chinese and other Asian economies, but supplies cannot keep pace with this demand. A “boom and bust” pattern of exploitation is no longer appropriate to the needs of this market, but the high prices paid for BdM provide strong incentive to fishermen and traders to continue to over-exploit. The traditional BdM producing countries of what has recently been named the Coral Triangle have the resource capacity to dominate the supply of tropical BdM to this market, but only if the currently depleted stocks are rebuilt, and the pattern of exploitation is shifted from one of “boom and bust”. With tens of thousands of isolated coastal households dependent on this trade for a significant proportion of their regular cash income requirements there is also a strong political rationale to improved management of these fisheries and this trade.

## ***The study***

5. This study is focused on the BdM industries in four Melanesian countries and one Polynesian country – Papua New Guinea (PNG), the Solomon Islands (SOL), Vanuatu (VAN), Fiji (FIJ) and Tonga (TON). The study is part of an initiative by ACIAR implemented by SPC, and responds to concerns raised by Melanesian country leaders through the Melanesian Spearhead Group (MSG), and more broadly by the Heads of Fisheries of PICTs through the SPC. By the mid-2000s, over-exploitation of these sea cucumber stocks had reached the point where in subsequent years each of the governments of PNG, SOL and VAN placed moratoria on their fisheries to allow stocks to recover. The government of Tonga had been forced into this position in an earlier time period, putting in place a ten year moratorium from 1997 to 2006. At the time of this study, the fisheries of Tonga and Fiji are the only two to be currently functioning, and thus where fishing and the trade can be observed.
6. The South Pacific BdM trade is a multi-million dollar marine product trade, second only to the significantly larger tuna trade. There is wide recognition that the persistent over-exploitation of sea cucumber resources is substantially depressing the overall value of this trade, and in doing so is also creating hardship in hundreds of coastal communities that have come to depend on this as a source of cash income. This situation is being further exacerbated by a lack of transparency in the management and practice of this trade and, where moratoria have been imposed, to significant Illegal, Unreported and Unregistered (IUU) fishing and trading activity. This has provided fertile ground for petit corruption, and where moratoria are in place has required very significant increases in the resources that governments have had to deploy to keep a lid on illegal activity – resources that governments can ill-afford.
7. Accordingly this study is in the form of a scoping study to identify courses of action that can be taken forward. Its focus is five-fold:
  - profiling of the current and historic structure, operation and scale of sea cucumber harvesting and BdM production and export in the five countries under study;
  - estimation of the scale of revenues being foregone as a result of persistent over-exploitation and the “boom and bust” nature of these fisheries;
  - identification of fiscal and trade tools that could be used to better control the production and trade of BdM;
  - identification of how the management regime could be strengthened to encourage the more sustainable exploitation of these fragile resources and to boost income to peripheral coastal communities;
  - identification of the potential for regional cooperation in strengthening management and increasing the revenues that can be derived from these fisheries and the trade in BdM.

## **Production**

8. Sea cucumbers comprise a large and diverse group of organisms that are found in most marine environments, and are typically detritus feeders and reef grazers. Of 1400 species known to science some 60 are traded commercially as a food delicacy. The majority of the traded species are from tropical sources. Some 35 of these species of sea cucumber are found in the waters of Melanesia, of which 21 species make up over 90 per cent of the volume of trade of bêche-de-mer from this area, and eight of these species make up over seventy-five per cent of the value of such trade – and at a more local level it is usually three or four of these species that make up three-quarters of value.
9. We have compiled export data from each of the countries, providing a long-run series for BdM exports as a generic category, and shorter-run series for exports by species. Where data has allowed we have also compiled production series by species by Province or District. From the available data it is clear that in a general sense the recent BdM trade developed dramatically from a low level across the 1970s to an early first peak in the late 1980s. This was followed by a distinct fall-off in production, followed by a second peak in the late 1990s, early 2000s. Nesting below these overall trends are the independent boom and bust cycles of the local fisheries, none of which are exactly the same.
10. BdM from different sea cucumber species command quite different prices, and the combination of the state of exploitation of the local resource and the value of BdM derived from that resource will dictate fishing patterns and effort, with fishermen tending to focus on the most cost-effective resource / species at any given time. The two main fishing methods are reef gleaning and free diving. It is the free divers that have greater control over the direction of their effort; reef gleaning activity – whether for shellfish, sea cucumber or octopus, etc. - is much less discriminate.
11. Peak production is not a very good indication of production capacity. Instead we have taken a fifteen year average as being more representative. We have also sought to determine a “signature” species mix by Province – based on actual data, where available, but otherwise extrapolated from quantitative and anecdotal evidence. The table below presents an indication of the general scale of production across the last fifteen years, and a typical breakdown of species composition. We have also estimated the current value of a harvest of this scale and species mix at the prices typically paid by in-country traders for finished dried product.
12. We estimate that if these resources had been managed on a more precautionary basis that moved exploitation away from the “boom and bust” cycle that typifies this fishery, medium-run revenues derived from the BdM trade would be double those that have been achieved. This is based on the reversing of various characteristics that plague current production:
  - serial over-exploitation of resources means that the stocks of each species are below the size of stock that would yield Maximum Sustainable Yield (MSY) – which is likely to impact negatively on reproduction and stock recruitment, and thus on stock biomass;
  - because fishermen focus on harvesting the largest individuals of each species available to them, and most stocks have been over-exploited, there is a preponderance of smaller sized individuals in the populations of each species – which translates into lower value BdM;

- the highest value species of BdM tend to be from sea cucumber species that are slow growers and are found on the fishing grounds in relatively low densities; because the greater fishing effort tends to be focused on these higher value species, and the stocks of these species are not given sufficient time to recover, the average size of individuals available tends to steadily decrease over time, and thus command lower values;
  - as the availability of high value species decreases, so effort on lower value species increases – as a result the relative value of BdM exports tends to decrease over time as the mix of species sold tends towards lower value species;
  - process management and the general quality of BdM processing is not good; greater care and attention is given to processing the high value species such as white teatfish and sandfish, but overall up to 30 per cent of value is lost due to poor processing.
13. In the medium term it is projected that more precautionary management would result in sea cucumber harvests and BdM production equivalent to the average of recent harvests, but this would be achieved each and every year, the mix would shift towards higher value species, and the value of individual BdM would be improved because more sea cucumbers would be harvested at larger sizes. In addition, if greater care and attention were paid to the quality of processing, a further uplift in value of between 10 and 20 per cent could be achieved.

**15 year average of BdM exports per country, by species, 1998 to 2012 – expressed in tonnes of dried BdM; plus estimated current purchase value**

	15 year average exports - t dried BdM					Value at current purchase prices - US\$M				
	PNG	SOL	VAN	FIJ	TON	PNG	SOL	VAN	FIJ	TON
Sandfish	75	1	1	-	0	\$3.59	\$0.03	\$0.03	\$0.00	\$0.01
White teatfish	96	30	1	22	4	\$4.31	\$1.37	\$0.06	\$0.98	\$0.17
Golden sandfish	-	-	-	-	-	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Black teatfish	11	5	1	8	2	\$0.27	\$0.11	\$0.02	\$0.20	\$0.04
Greenfish	10	0	1	5	1	\$0.24	\$0.01	\$0.02	\$0.13	\$0.02
Prickly redfish	23	0	0	6	1	\$0.48	\$0.01	\$0.00	\$0.13	\$0.02
Deepwater blackfish	-	1	0	-	-	\$0.00	\$0.01	\$0.00	\$0.00	\$0.00
Deep water redfish	0	3	0	3	0	\$0.00	\$0.07	\$0.00	\$0.06	\$0.00
Surf redfish	23	-	3	6	6	\$0.41	\$0.00	\$0.05	\$0.10	\$0.10
Blackfish	8	4	0	10	1	\$0.07	\$0.03	\$0.00	\$0.10	\$0.01
Curryfish	36	4	-	14	1	\$0.34	\$0.03	\$0.00	\$0.13	\$0.01
Stonefish	-	4	-	5	3	\$0.00	\$0.04	\$0.00	\$0.05	\$0.03
Tigerfish	34	5	1	25	5	\$0.32	\$0.05	\$0.00	\$0.23	\$0.05
Snakefish	10	9	1	44	10	\$0.07	\$0.06	\$0.01	\$0.32	\$0.07
Peanutfish	-	5	-	-	0	\$0.00	\$0.03	\$0.00	\$0.00	\$0.00
Chalkfish	21	8	-	14	2	\$0.13	\$0.05	\$0.00	\$0.09	\$0.01
Flowerfish	2	-	0	0	0	\$0.01	\$0.00	\$0.00	\$0.00	\$0.00
Brown sandfish	36	23	4	19	4	\$0.24	\$0.15	\$0.02	\$0.13	\$0.03
Amberfish	22	6	0	16	2	\$0.15	\$0.04	\$0.00	\$0.11	\$0.01
Lollyfish	32	45	4	66	10	\$0.17	\$0.24	\$0.02	\$0.34	\$0.05
Elephant trunkfish	21	7	0	8	2	\$0.11	\$0.04	\$0.00	\$0.04	\$0.01
Pinkfish	8	5	0	3	0	\$0.02	\$0.01	\$0.00	\$0.01	\$0.00
<b>Total</b>	<b>467</b>	<b>164</b>	<b>18</b>	<b>274</b>	<b>54</b>	<b>\$10.94</b>	<b>\$2.38</b>	<b>\$0.26</b>	<b>\$3.15</b>	<b>\$0.66</b>
<b>Average unit value of exports - US\$/kg dried BdM</b>						\$23/kg	\$15/kg	\$14/kg	\$12/kg	\$12/kg

14. In the longer term, better management of each species stock will allow the rebuilding of stocks at the local level, and this in turn will allow larger volumes of each species to be harvested on a sustainable basis.
15. In addition to the above, there will be substantial benefits to coastal communities. Under a “boom and bust” exploitation system revenues from sea cucumber harvesting go up and down between years, and are normally accompanied by serial over-exploitation. Accordingly revenues to the communities go up and down and are unpredictable. In most of the countries under study this has resulted in fisheries having to be closed for multiple years – when communities receive no BdM revenues at all. Under a sustainable management regime revenues are maintained year on year.
16. The overall recommendation arising from the study is that every effort should be made to move from a “boom and bust” basis of exploitation to a more precautionary and sustainable steady state pattern of exploitation. The following actions are proposed to achieve this.

### ***Improving control and enforcement***

17. The current management regime includes many relevant and appropriate controls, but application is inconsistent, and ineffective. As a result, monitoring systems do not yield the data that could better inform the appropriate harvest levels. The failure to utilise available data for management purposes means that the data is under-valued, and thus less effort is used to collect it and to ensure that it is accurate. A failure to control the levels of exploitation, or to set exploitation levels at sustainable levels, has resulted in persistent over-exploitation, which in turn has resulted in the necessity of closing fisheries to allow the stocks to recover. Where fisheries have been closed, the intended impact of such action has been undermined by substantial increases in Illegal, Unregulated and Unrecorded (IUU) fishing and export. A number of actions are proposed to reverse these conditions.

### **Combatting illegal activity**

***Recommendation 1*** - *As a matter of management objective, sea cucumber fisheries and BdM supply chains should be managed in such a way as to preclude the need to close a fishery.*

***Recommendation 2*** - *Use of UBA gear should continue to be outlawed, and control resources focused on achieving full compliance with this; the primary target of such fishing is white teatfish and opportunities for identifying UBA caught white teatfish through the supply chain should be explored.*

### **Data**

***Recommendation 3*** - *As part of efforts to remove the conditions where illegal activity and petty corruption can thrive, each country should make clear and unambiguous annual declarations on industry performance over the preceding period, and on government expectations and rules governing industry performance in the subsequent period.*

**Recommendation 4** - Data provision conditions forming a condition of export, buyer and processor licenses should be enforced and systematically collected, collated and analysed.

**Recommendation 5** - Data collected by Customs and Fisheries Departments should, within the limits of the law and commercial confidentiality, be shared one with the other.

**Recommendation 6** - Data provision should as a minimum link to the Province of harvest.

**Recommendation 7** - Export packing lists should nominate the species and average size of product in each bag, and this should be verified by sample weighings at point of inspection prior to shipment.

### **Cost recovery**

**Recommendation 8** - A valid commercial invoice, nominating value per species and product size / quality should be required as part of export documentation, and subject to verification – it is this value that is used in the calculation of an export levy.

**Recommendation 9** - Exporters should also routinely provide Fisheries Departments, in confidence, with a schedule of prices used in the purchase of finished BdM from buyers and fishermen – this provides an alternate basis for calculation of an export levy.

**Recommendation 10** - The cost of a BdM export license should be raised significantly to better reflect the value of this trade, to discourage small-scale operators, and to discourage side deals by which foreign partners secure access to product.

**Recommendation 11** - The eligibility criteria for export licenses should be narrowed and deepened to exclude operations that where the risk of non-compliance is high – including greater scrutiny of the integrity and background of the principals and partners of the business owners.

**Recommendation 12** - The primary (i.e. excluding small-scale household and village based consolidators) BdM buyers and processors operating at a Provincial level should be required to hold a buyer / processor license, a condition of which requires the provision of monthly species based throughput data, including details of source fishery.

**Recommendation 13** - Consideration should be given to holding auctions at Provincial level for the sale to licensed exporters - i.e. price and quality considerations become more critical at the Provincial level, and more evident to producers.

### **Management framework**

18. The BdM Management Plans that are already in operation, and the revisions currently in draft, form a sound and coherent basis to sector management. Weaknesses in dissemination and compliance are evident, but the main shortcoming is the absence of any clear mechanism for adaptive management – decisions for future action that respond to the evidence from the effects of past action.

19. Review of past exploitation and export levels, by species, and where possible by Province, suggest that a reasoned basis for establishment of national and Provincial annual quota ceilings can be presented. Preliminary work to fit a predictive model to the available information – using in the first instance export quantities by species and price differentials – suggests that further modelling, incorporating more biological data, should be able to provide additional support for and confidence in the setting of Provincial quotas.
20. Given the largely sessile nature of these organisms, the limited range of larval dispersion and recruitment to commercial stocks, and the very local nature of exploitation, the setting of quotas is not a precise activity, and whilst it should provide a useful control at national and Provincial levels, it would be inappropriate to extend this particular system to the local level. What is proposed is that local communities be encouraged to set and apply harvest control rules (HCRs) based on changes in the average size of sea cucumbers harvested – shifting effort between stocks or stock groups, and where feasible using area closures.

### Information flow and data transfer

**Recommendation 14** – *Each government should prepare and publish an annual compendium on BdM sector rules, performance, and expectations, and make this more readily available to traders, intermediaries, fishermen, community leaders – using a wide range of media and routes.*

**Recommendation 15** - *Whilst it is recognised that the capacity of Provincial administrations to support industry management is limited, it is important that they play their part – through licensing, through data collation and analysis, and through industry contact.*

**Recommendation 16** - *To this end, all principal Province based buyers / processors should be licensed, the license conditions to include the provision of monthly purchase information.*

**Recommendation 17** - *Compliance with Provincial quotas should be monitored through data provided at point of export, supported by purchase data provided at national and Provincial levels as conditions of license.*

**Recommendation 18** - *Fishing communities will necessarily be responsible for managing local sea cucumber exploitation, and should be supported in this task with the development and dissemination of simple data capture and survey questionnaires (for measuring changes in average size of sea cucumbers, and capturing other stock status information – on a qualitative and quantitative basis).*

### Estimation of stock status and quota limits

**Recommendation 19** - *We are of the view that the setting and monitoring of Provincial quotas at the point of export is an appropriate and valuable management tool, and that there is sufficient information available to set precautionary species quotas at the Provincial level on an annual basis (see table below).*

**Recommendation 20** - *To facilitate quota formulation, each country should start with the revisiting of the availability and accuracy of data on harvest / production (building on the information already collated as part of this study, plus the results of dive surveys, and information from fishing communities and BdM buyers and traders).*

**Recommendation 21** - More precautionary quotas should be set for the higher value species, which are both slower growing, and have been subjected to higher, more focused and more persistent fishing effort; in this context, specific stock recovery strategies will need to be developed and put in place for Tonga, Fiji and the Solomon Islands, where most stocks may be considered as being in an over-exploited state.

#### Suggested precautionary TACs at national level

	Average over last 15 years (t/yr)	As proportion of 15 year average (%)	Precautionary overall TAC (t/yr)
PNG	455	85%	387
Solomon Islands	165	85%	140
Vanuatu	18	85%	15
Fiji	275	75%	206
Tonga	55	150%	83

**Recommendation 22** - In most Provinces three or four sea cucumber species dominate the value of local production, suggesting that the monitoring of stock status, determination of MSY, and implementation of quota ceilings and harvest control rules should focus first on these species – top of this list are sandfish, white-teatfish and lolly fish.

**Recommendation 23** - Confidence in the estimation of stock status and reference points could be strengthened using additional information on changes in the average size or the size mix of harvests / Provincial production – which can be derived from the sampling of export shipments, and also by capturing community based information through completion of simple fishermen survey questionnaires.

**Recommendation 24** - Confidence in the estimation of stock status and reference points could also be strengthened using information on the areas of different habitats existing within each Province – building on the valuable work already developed within the Reefbase Pacific project.

**Recommendation 25** - Harvest control rules should be developed to encourage fishermen to shift effort onto other species once the average size of animals falls below a given threshold.

**Recommendation 26** - It would be helpful to explore if different harvest control rules could be developed for each of free diving and reef gleaning fishing methods.

#### Compliance and managing supply chain risk

**Recommendation 27** - Regular meetings should be convened between government, industry and fishermen to discuss sector management and performance.

**Recommendation 28** - In each country BdM management should include closed seasons – the longer the closure the better; likewise, working within the national open seasons, communities should be encouraged to limit fishing to short periods of time only – possibly also using rotational area closures, and distinguishing between free diving and reef gleaning fisheries.

**Recommendation 29** - *Given that BdM fishing, processing and trade will be proscribed for at least part of any year, we do not think that the licensing of businesses that would be solely dependent on the trade in BdM is compatible with precautionary sustainable management of this sector; rather, BdM processing / trading should form a part of a diversified business, and this characteristic should be a material consideration when examining eligibility when issuing licenses.*

**Recommendation 30** - *Use of UBA gear should continue to be outlawed, and control resources focused on achieving full compliance with this; the primary target of such fishing is white teatfish and opportunities for identifying UBA caught white teatfish through the supply chain should be explored.*

### **Opportunities for regional cooperation**

21. Trade in BdM is an international business, with product sourced from all over the globe; but at the centre of this trade are a relatively small number of wholesale importers concentrated in locations such as Hong Kong, Guangzhou and Singapore. Exporters in different countries are in touch with each other – directly and via their import customers – and share knowledge and experience. In addition, funding of buying and exporting operations is often provided by the main importers, who thus have considerable knowledge of and involvement in these businesses, and who may encourage joint ownership of operations in different countries.
22. In managing this trade and these fisheries, governments operate at a disadvantage if they do not understand the structure and operation of this business, and if they do not also share information with other producer countries in similar situations to their own.
23. Extending this argument further, it is evident that many of the problems facing the industry are in part the result of or compounded by unnecessary secrecy with regard to the scale and performance of this sector, the geographical distribution of production, and those who are licensed to operate within the sector. This situation should be changed.

**Recommendation 31** - *It is appropriate that governments of producing countries share information on the beneficial ownership of the BdM trading companies that they are licensing and which operate in their respective territories; to do otherwise is to operate at a distinct disadvantage, particularly in the areas of enforcement and compliance.*

**Recommendation 32** - *It makes sense that governments should be much more open in reporting on sector performance, and that such information should be consolidated in an annual regional report.*

**Recommendation 33** - *It makes sense that most investigations into the functional dimensions of this trade, including statistical research, and liaison with the governments of importing countries, be undertaken on a regional rather country to country basis, and that the results of research that are not commercially sensitive should be routinely shared across the region.*

**Recommendation 34** - *It is not evident that the Pacific Islands and their BdM businesses are making the most of their dominant position in terms of global BdM supply; in the first instance governments should make much more effort to ensure that provision of a valid commercial invoice forms a necessary part of Customs clearance procedures, and that the information so provided is used by governments, and that the veracity of the prices quoted is confirmed (i.e. that the prices quoted are a genuine market price agreed between buyer and seller, and that transfer prices are not being used); this information should be shared in so far as commercial confidentiality allows, so that it can be used to better inform trade policy; the veracity of prices has particular importance given that in many (but not all) businesses it is the importer that is providing the working capital for BdM supply chain networks in-country.*

**Recommendation 35** - *In a further development of this market position, some investigation should be made into the opportunities for auctioning BdM product, either by country or on a regional basis, as a means of achieving higher prices for the sale of product (and thus higher revenues to national governments through taxes and tariffs, and higher revenues to fishing communities and trade intermediaries); this is a complex area of analysis, not least where there is evidence of close buyer / seller linkages, and where the market can be relatively easily rigged (where effective monopolies exist, or where apparently independent businesses are not so independent); it might also form a part of examination of the development of truly indigenous BdM processing and exporting companies (many of the new wave of BdM exporters include partners that have very close ties with BdM importers, to the extent that many could be reasonably conceived as operating subsidiaries of those companies – which may be at odds with government policy).*

**Recommendation 36** - *Existing research suggests that up to 30 per cent of potential product value is lost due to poor BdM processing; efforts need to be made to reduce this economic loss, through focused training of processor households and, where feasible, more centralised processing, and increased focus on process control; any such intervention should be coordinated at a regional level.*