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Evaluating harvest and management strategies for sea cucumber fisheries in Vanuatu

Executive report

August 2016

Marc Léopold

BICH2MER Project No 4860A1

BICHLAMAR 4 Project No CS14-3007-101

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This executive report was produced specifically for consideration by the Department of Fisheries of the Government of Vanuatu following the closure of sea cucumber fisheries on December, 31st 2015. It contains key findings and advice based the author's research activities in Vanuatu between 2010 and 2016, relevant scientific literature, most recent catch and export monitoring records and interviews with managers of the Department of Fisheries of Vanuatu, community members, and members of the industry in Vanuatu conducted by the authors in March 2016.

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EXECUTIVE SUMMARY

Background

Harvest has markedly intensified in the sea cucumber fishery since Vanuatu's independence due to market globalization and growing demand in China. Major resource sustainability issues have emerged throughout the country following uncontrolled fishing activities and have prompted the DoF to react to the signs of overexploitation. By documenting and analyzing the recent history of sea cucumber fisheries since 1980, this report proposes options for a more effective harvest and management strategy for sea cucumber fisheries in Vanuatu.

Objectives

This executive report is expected to be relevant to the national management plan for sea cucumber fisheries that was endorsed in 2015. It provides information on the history of the sea cucumber fishery, fishing regulations, and research in Vanuatu since 1980. This information was interpreted in terms of resource status to assess the performance of recent harvest and management strategies for maintaining this fishery.

The objectives of this report are twofold:

1) To assess the efficiency of past harvest and management strategies of the DoF (1980-2016) for sustaining sea cucumber resources;

2) To formulate immediate management recommendations for maintaining fishery income for Ni-Vanuatu people.

Methods

Four management phases were defined (1980-2007, 2008-2013, 2014, and 2015-2016). Different relevant sources of information were used to gather a comprehensive and context-specific knowledge basis for each phase.

The author extensively used the results of his research activities conducted in Vanuatu between 2010 and 2015 as well as relevant literature about sea cucumber fisheries in the region. He conducted an expertise study at the DoF and in some coastal communities in March 2016 to access most recent catch and export data and updates concerning the sea cucumber fishery in Vanuatu.

Key findings

Vanuatu sea cucumber fishery boomed and burst between 1980 and 2007 (phase 1) owing to a free access, market-driven harvest strategy, although temporary sea cucumber bans were implemented by some communities at local scale. A total 6-year ban on sea cucumber fishing was then established (2008-2013, phase 2) and led to increase in resources (except sandfish) as showed by the biological surveys conducted by the DoF. A spatial species-specific TAC-based system was successfully tested in 2014 by the DoF and used to draft the National Management Plan for Sea Cucumber Fisheries (phase 3). However, although the 5-year NMPSCF was endorsed in July 2015, outstanding social and political pressure driven by major natural

disasters in 2015 practically forced the DoF to urgently open the fishery in the whole country during four months (phase 4). Although the DoF engaged unprecedented human resources in the management and control of the sea cucumber fishery, harvest went out of control. As a result the fishery was driven by the market similarly to phase 1. Exceptionally-high economic outputs were reached at the cost of severe resource depletion throughout the country and the squandering of possible income from this fishery in the next 5-10 years. Additionally lower-than-expected tax revenue was generated despite the appropriate legal framework in place and the high profits made by the industry.

This historical trend makes clear that the lack of effective control of fishing pressure in the fishery predictably leads to resource depletion and catch loss in the short-term, and eventually to fishery closure. Voluntary local closures may prefigure the type of harvest strategy that would be acceptable by communities. Overall the value of beche-de-mer exports fluctuated between VT15,000,000 and VT90,000,000 per year (except in 2016), ranking far behind that of any of the main primary sectors in Vanuatu. Based on historical records and present resource status, it is estimated that a 15-ton target of beche-de-mer products could be sustainably exported per annum in Vanuatu if resources are properly managed. This finding is a strong incentive for the DoF to maintain control over the fishery through the NMPSCF.

Implications for stakeholders

This research has demonstrated a benefit of implementing the NMPSCF. Uncontrolled sea cucumber fishing activities proved to have the capacity to generate economic loss for Vanuatu Government, the industry and rural communities. The estimated sustainable target export value of this fishery is around VT60,000,000 per year, which would correspond to a first sale value of about VT20,000,000 per year. This modest fishery sector would therefore provide significant income in rural economies of the country, if properly managed.

Recommendations for immediate action

Lessons learnt from management phase 1 to phase 4 should urgently be incorporated into effective planning of the sea cucumber fishery if one aims at sustaining this source of income in local communities. Direct advice was formulated in this report for managing sea cucumber fisheries in Vanuatu in 2016-2020.

1) Future fisheries regulations should strictly refer to the NMPSCF to prevent predictable negative fishing impacts and fishery collapse. A rotational harvest strategy is to be implemented since the DoF does not have the capacity to control harvest on time in many rural areas at national scale while involving all relevant bodies and providing appropriate awareness;

2) A subcommittee for the sea cucumber fishery should urgently be established based on Section 9 of Fisheries Act No. 10 of 2014 to strengthen the governance process;

3) The sea cucumber fishery should be permanently closed except in specific areas in which sea cucumber resources are sufficiently abundant to undergo harvest. In main fishery sites, harvest should be based on biomass stock assessment, local TACs and short harvest periods. In secondary fishery sites, the use of very short open seasons may be sufficient to sustain the fishery while reducing management costs;

4) All the sites that were harvested in 2015 should be closed for at least five years to allow for resource recovery. Stock assessments should be conducted by the DoF in 2020 in main fishery sites prior opening those sites;

5) Meanwhile, harvest should be authorized and strictly controlled in few sea cucumber fishery management demonstration sites between 2017 and 2020 to encourage and provide awareness of sustainable practices. It is suggested to select such demonstration sites in Aneytium and Efaté (Mangaliliu village area) Islands;

6) The harvest of sandfish (*Holothuria scabra*) and white teatfish (*Holothuria fuscogilva*) should be banned for the next 10 years throughout Vanuatu. The harvest of black teatfish (*Holothuria whitmaei*) should be cautiously controlled;

7) The presence of a fishery officer is mandatory at processing sites during harvest and should be a condition for authorizing harvest. The DoF should therefore train and empower active community members (resource monitors, fishermen associations, area secretaries) and fishery observers as authorized officers. The DoF should also appoint a costal fishery officer to coordinate the implementation of the NMPSCF across administrative divisions of the Department;

8) The number of operating processing companies must be limited at national level to facilitate the enforcement of harvest rules while preventing economic loss. All companies operating in the same fishing area should operate at the same time to allow for effective control of catch limits while reducing management costs. The same license conditions should apply to all companies processing sea cucumbers into beche-de-mer;

9) The subcommittee for the sea cucumber fishery should discuss the opportunity for a management fee to support the activities of the DoF;

10) The DoF should endorse the role of facilitator to enable fair remuneration of fishers, communities, local leaders and processing and export companies. Minimum purchasing prices per species may be agreed upon between purchasers and sellers based on 2015 and 2016 export value and established as a license condition.

11) A public forum may be organized by the DoF in Port-Vila in 2016. The objectives of such a forum would be to widely inform rural communities of the effects of uncontrolled harvest of sea cucumbers on the sustainability of the fishery and income generation, and to gain public support for the NMPSCF, particularly in the event of future natural disasters.

Keywords

Sea cucumber fishery; stock assessment; resource abundance; monitoring; management plan; rotational harvest strategy; total allowable catch; trends in catches and exports; economic returns; compliance; governance; Vanuatu.

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ABBREVIATIONS

CSCF	Subcommittee for the Sea Cucumber Fishery
DoF	Department of Fisheries of Vanuatu
FMAC	Fisheries Management Advisory Council
IRD	French Institut de Recherche pour le Développement
NMPSCF	National Management Plan for Sea Cucumber Fisheries in Vanuatu
OECD	Organisation for Economic Co-operation and Development
SPC	Secretariat of the Pacific Community
SVA	Seafood Verification Agency

1 INTRODUCTION

1.1 Context background of sea cucumber fisheries in Vanuatu

Sea cucumbers are not consumed locally by Ni-Vanuatu people. Exploitation of these resources has developed in the archipelago exclusively for the commercial production of beche-de-mer for export to Asian markets. There is anecdotic evidence that fishing for sea cucumbers was likely initiated in the early 19th century as in the neighbor countries (e.g., New Caledonia, the Solomons Islands). Although there was no quantitative record concerning target species and catches of sea cucumbers at that time, the fishery was likely operated irregularly during almost 200 years in different islands of the former New Hebrides following trade opportunities and transport constraints, similarly to sandalwood expeditions. Temporary, rudimentary processing facilities were established by foreign traders in remote coastal areas close to main fishing grounds for boiling and drying sea cucumbers that were harvested by Ni-Vanuatu people or/and foreign divers in shallow reefs. Final dried products (beche-de-mer) could then be easily stored for shipment.

The recent history of sea cucumber fisheries in Vanuatu encompassed four phases with specific harvest and management conditions: 1980-2007, 2008-2013, 2014, and 2015-2016 as presented in this report.

Exploitation of sea cucumber fisheries has markedly intensified since Vanuatu's independence due to market globalization and growing demand in China. Major resource sustainability issues have emerged throughout the country following uncontrolled fishing activities and prompted the DoF to react to the signs of overexploitation.

By documenting and analyzing this 35-yr long experience, this report proposes options for a more effective harvest and management strategy for sea cucumber fisheries in Vanuatu.

1.2 Objectives of the report

The objectives of this executive report are two-fold:

1) Assess the efficiency of past harvest and management strategies of the DoF (1980-2016) for sustaining sea cucumber resources

This report provides information on the history of sea cucumber fisheries, fishing regulations, and research in Vanuatu since 1980. This information was interpreted in terms of resource status to assess the performance of recent harvest and management strategies for maintaining these fisheries. Harvest in 2014 and 2015 was analyzed with greater details due to recent management efforts of the DoF as part of an experience-based learning process.

2) Formulate immediate management recommendations for maintaining fishery income for Ni-Vanuatu people

This report is expected to be relevant to the national management plan for sea cucumber fisheries (NMPSCF) that was endorsed in 2015 in Vanuatu. The estimated sustainable target export value of these fisheries is around VT60,000,000 per year (~15 tons of beche-de-mer). However uncontrolled fishing activities proved to have the capacity to generate economic loss for Vanuatu Government, the industry and rural communities due to high operating and management costs and short-term catches.

This report may also be used to advice harvest strategies of other reef invertebrate fisheries of Vanuatu, e.g. trochus fisheries.

2 METHODOLOGY

For the purpose of this report, four phases (1980-2007, 2008-2013, 2014, and 2015-2016) were defined to analyze harvest and management strategies of the DoF for sea cucumber fisheries. Different relevant sources of information were used to gather a comprehensive knowledge basis for each phase.

The author extensively used the results of his research activities conducted in Vanuatu between 2010 and 2015, particularly while he was permanently based at the Research and Aquaculture Division of the DoF (2010-2014). His research includes several studies related to biological resource assessments, management rules, governance arrangements, and capacity building both at community and national levels (see Reference list for details).

To complement above data and knowledge, the author conducted an expertise study at the DoF in March 2016 to access most recent catch and export monitoring data and updates concerning sea cucumber fisheries following last harvest season (September to December 2015). Specifically he conducted in-person interviews with i) managers of the DoF (Management Division, Compliance Division, Development and Extension Division, Research and Aquaculture Division, and Seafood Verification Agency), ii) three members of the industry (Natural Product Export company, Saranatai Company Limited, Laika Company Limited), and iii) community members including fishers in Efaté island (Mangaliliu and Paonangisu villages) and Aneityum island (Analkoat village). Interviewed persons presented their involvement during the last harvest season and their perceptions about possible strength and weakness of harvest and management strategies in Vanuatu since the 1980s.

Aligned with the National Management Plan for Sea Cucumber Fisheries, key findings and direct advice were formulated for managing sea cucumber fisheries in Vanuatu in 2016-2020 based on above context-specific information as well as relevant literature about sea cucumber fisheries in the region.

3 KEY FINDINGS

3.1 Phase 1 strategy (1980-2007): free access, market-driven strategy

3.1.1 The absence of specific and effective management of fishing activities

3.1.1.1 National level

1) Between 1980 and 2007, the DoF did not enforce any specific regulatory measure to maintain fishing pressure at sustainable level although minimum size limits were defined for a few species (for live animals and dry products) at the end of that period (2005). Sea cucumber resources were considered as a single stock although 23 commercial species were likely harvested (Table 1) and distributed in >80 islands of the archipelago, spreading over ~1200 km. Before the 2000s, little information was indeed available on the high vulnerability of tropical sea cucumber species to overexploitation due to their specific biological and ecological characteristics. Additionally no information was available for setting sustainable levels of fishing pressure.

2) The production of beche-de-mer was only monitored at export gates at Luganville and Port-Vila through export permits delivered by the DoF, that provided basic national fishery statistics for all species together (Figure 1). These statistics may however underestimate real catches since underreporting likely occurred particularly during the first two decades of that period.

3) A unique “fish export processing establishment license” was issued by the DoF at the fixed rate of VT100,000 per annum to any company involved in the industry for processing and exporting beche-de-mer products. However no government restriction applied in the number of operating companies that used joint venture agreements (with foreigner interest owning the larger rate of the shared agreements). Therefore the delivery of processing and export licenses and export permits did not impose any capacity or operating limitation within the sea cucumber fishery.

3.1.1.2 Community level

1) Notably some rural communities established temporary bans for sea cucumbers on a voluntary basis. The objective was to allow for increasing resources in their marine tenure for several years in order to generate income when these commercial bans were lift.

2) Although most of these contemporary taboos did not eventually prevent overexploitation of sea cucumbers due to too high commercial pressure and local socioeconomic needs, they prefigured the type of harvest strategy (i.e., spatial temporary closure) that would be acceptable by communities (see § 3.3).

Table 1. Commercial sea cucumber species present in Vanuatu waters

Scientific names	English names	Bislama names	Commercial value
Actinopyga lecanora	Stone Fish	Stonfis	**
Actinopyga mauritiana	Surf redfish	Sefredfis	**
Actinopyga miliaris	Hairy blackfish	Blakfis	**
Actinopyga palauensis	Deepwater blackfish	Dipwota blakfis	*
Bohadschia argus	Tigerfish	Taikafis	**
Bohadschia marmorata	Chalkfish	Jokfis	*
Bohadschia vitiensis	Brown sandfish	Braon sanfis	**
Holothuria atra	Lollyfish	Lolifis	*
Holothuria coluber	Snakefish	Snekfis	*
Holothuria edulis	Pinkfish	Pinkfis	*
Holothuria flavomaculata	Red snakefish	Red snekfis	*
Holothuria fuscogilva	White teatfish	Waet titfis	***
Holothuria fuscopunctata	Elephant trunkfish	Elefenfis	*
Holothuria lessoni	Golden sandfish	Kolten sanfis	***
Holothuria scabra	Sandfish	Sanfis	***
Holothuria whitmaei	Black Teatfish	Blak titfis	***
Pearsonothuria graeffei	Flowerfish	Flaoafis	*
Stichopus chloronotus	Greenfish	Krinfis	**
Stichopus herrmanni	Curryfish	Karifis	**
Stichopus horrens	Peanutfish	Pinatfis	*
Stichopus vastus	Brown curryfish	Braon karifis	**
Thelenota ananas	Prickly redfish	Paenapolfis	**
Thelenota anax	Amberfish	Ambafis	*

3.1.2 Opportunistic fishing practices and catches led to stock collapse

3.1.2.1 Fishing, processing, and export practises

1) Monitoring of fishing activities, processing and shipment of products within the country was ineffective due to lack of capacity and planning. Consequently no precise information was collected on fishing areas, respective catches and landing value of sea cucumbers at that period.

2) Since the abundance and diversity of sea cucumber species depend on reef habitat type and surface that highly vary throughout the archipelago, fishing grounds were heterogeneously distributed. It is therefore likely that resources were variably overexploited among islands and coastal villages of the country. Fishers mainly targeted the medium and high value species first, however fishing effort shifted to the low value species as the abundance of the latter species became very low due to overexploitation. Eventually exploitation shift to

new fishing grounds when operating costs became too high due to low fishing yields locally (causing so-called “serial overexploitation”).

3) Harvest was conducted by local communities (male and female) over their marine tenure. The use of scuba and hookah equipment for commercial fishing of sea cucumber was not allowed nor reported in Vanuatu waters.

4) Processing in rural areas was promoted for adding value to sea cucumber catches since product prices vary along the various processing stages. However it proved difficult to maintain consistent high quality products while many fishers used their own processing ways, which often lead to low-grade products and wastage. Some licensed processors on Efate and Santo Islands purchased raw or partly processed products for reprocessing to fully-dried products. Final beche-de-mer products were sold to exporters based in Port-Vila and Luganville, who aggregated processed products for export.

3.1.2.2 Trends in beche-de-mer export volume and value

1) According to statistics available at the DoF, total beche-de-mer exports increased rapidly from 6 tons in 1983 to 48 tons in 1997 (average: 28.2 ton/year), peaking at 66 ton/year in 1992 and 1994, and steadily declined to seriously low levels during the mid-2000s (average: 18.6 ton/year) (Figure 1).

2) This “boom and burst” trend suggests that sea cucumber stocks had dramatically declined since the late 1990s throughout the country. Similar trends in sea cucumber catches were observed in a number of countries in the Pacific region, which also supports this hypothesis although no biological data is available to confirm it.

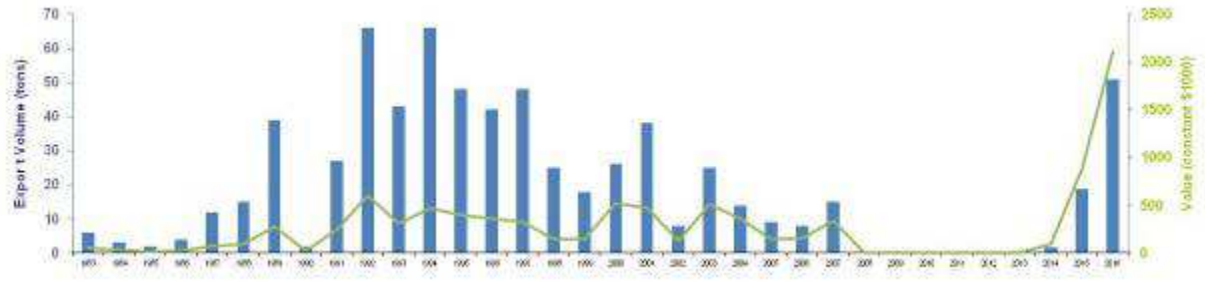

Figure 1. Vanuatu beche-de-mer export volume and value per annum from 1983 to 2016. Export volume over the period and export value between 2014 and 2016 were based on DoF data. Export value (in constant US$) from 1983 to 2007 was estimated using FAO data and GDP deflator (see Figure 2 for details).

3) Average export value (in constant US$) in world market of beche-de-mer products significantly increased from US$6-10 /kg in the 1980s-1990s (average: US$7.7 /kg) to US$12-26 /kg in the 2000s (average: US$19 /kg) as many tropical sea cucumber stocks became exhausted in the Indo-Pacific (Figure 2). This rising trend in export value made sea cucumber fisheries highly attractive to traders worldwide, including in Vanuatu.

Figure 2. Annual average value per kg of beche-de-mer products exported from Indo-Pacific countries as estimated using FAO data (annual export volumes and values - http://www.fao.org/fishery/statistics/software/fishstatj/en) **and GDP deflator of OECD countries** (World Bank http://www.worldbank.org/, 2016). * Average export value in 2014 and 2015 were estimated using DoF data on beche-de-mer exports based on export declaration forms.

4) Interestingly estimated annual value of Vanuatu beche-de-mer exports did not move in the same direction of export volumes. Estimated total export value (in constant US$) grown from US$53,000 to US$331,000 between 1983 and 1997 (average: US$220,000 /year) following the increase in catches described above, however it more or less stabilized around US$291,000 between 1998 and 2007 (Figure 1). This trend can be explained by the higher value of beche-de-mer in global market at that period (Figure 2) which compensated for the strong decline in catches in Vanuatu in the early 2000s.

5) In the management context that prevailed between 1980 and 2007, the DoF let market take its course. Consequently, as the demand strengthened, higher prices were paid to fishers resulting in a dramatic increase in fishing effort. Strong commercial incentives led to increasing fishing pressure on sea cucumber resources despite clear signs of overexploitation (and very likely low catch rates) in the late 1990s (Figure 1).
The free access, market-driven strategy eventually resulted in stock collapse in most islands of Vanuatu in the mid-2000s although this trend was hidden by the short-term profit made out of the fishery.

CONCLUDING REMARKS

Vanuatu sea cucumber fishery boomed and burst between 1980 and 2007 owing to a free access, market-driven harvest strategy although temporary sea cucumber bans were implemented by some communities at local scale. This trend makes clear that the lack of effective control of fishing pressure in the fishery predictably will lead to resource depletion and catch loss in the short-term, and eventually to fishery closure. Voluntary local closures may prefigure the type of harvest strategy that would be acceptable by communities.

Overall the value of beche-de-mer exports fluctuated between US$150,000 and US$600,000 per year between 1980 and 2007, ranking far behind (~10% or less) that of any of the main primary sectors (i.e., coprah, kava, beef). However this fishery could provide significant income in rural economies of Vanuatu. Based on historical records, it is estimated that a 15-ton target of beche-de-mer products could be sustainably exported per annum in Vanuatu (generating around US$600,000 given present export value) if resources are properly managed.

3.2 Phase 2 strategy (2008-2013): moratorium

3.2.1 The moratorium: an enforceable measure for the recovery of depleted sea cucumber resources

1) Stock collapse in the early 2000s led to the closure of the fishery by the DoF in January, 1st 2008 for a 5-year national moratorium. The objective of the national ban was to allow for regenerating sea cucumber resources. A number of neighbour countries (e.g., PNG, the Solomons) followed the same strategy at that period.

2) This moratorium was extended for another 5 years in January 2013 based on biological assessments that showed slow recovery of the resources (see §3.2.2). However, the ban prematurely ended in February 2014 due to commercial pressure (see § 3.3).

3) Consequently the sea cucumber fishery remained closed for six years. The national closure was effectively enforced although anecdotic illegal exports of small quantities of beche-de-mer were reported at Port-Vila international airport during this period. The national ban therefore resulted in effective conservation of sea cucumber resources in all islands of Vanuatu during six years (2008-2013).

4) During this period, the DoF requested the assistance of regional scientific organizations (IRD, SPC) to implement research activities for assessing i) biological impacts of the national closure on sea cucumber resources, and ii) appropriate management measures to sustain the fishery when the moratorium is lift, as part of a national management plan for sea cucumber fisheries (Appendix 3).

3.2.2 Biological assessments showed slow recovery of sea cucumber stocks

3.2.2.1 Survey design and costs

1) The stock of 20 sea cucumber species was assessed in seven islands of Vanuatu (totaling twelve fishery sites in main past fishing grounds) by the DoF with the scientific assistance of the IRD (BICHLAMAR and BICH2MER projects), the Northern Province of New Caledonia, and SPC (SciCOFish project) between September 2011 and September 2014 (Figure 3). A cost-effective survey method was specifically designed. Surveys were conducted with the help of local fishers in those sites. Awareness concerning stock status was usually provided to communities immediately after surveys.

2) In total the costs for conducting biological surveys in these sites reached about VT8,000,000 and were covered by the DoF (Government Development Fund) and external aid from France, New Caledonia, and European Union. Survey costs ranged between VT200,000 and VT500,000 per survey depending on how large and remote the fishing grounds were.

3) Surveys in other fishing grounds in Erromango, Tanna, Epi and Torres islands were planned by the DoF in 2015 (with secured budget), however they were not conducted due to time constraints when the fishery re-opened in 2014 (see § 3.3).

4) Additionally a database (BDMer v2.0) was developed in 2012 and 2013 to assist the DoF in performing statistical analysis for estimating stocks without outside expertise. Total developing costs of this tool came to VT2,300,000.

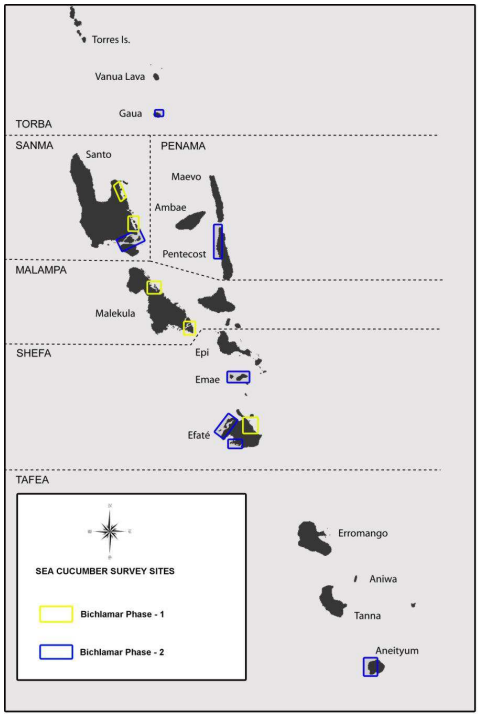

Figure 3. Survey sites for sea cucumber resources in 2011-2012 (BICHLAMAR project, phase 1 and SciCOFish project, 5 sites) **and 2013-2014** (BICHLAMAR project, phase 2, 7 sites).

3.2.2.2 Resource status

1) Overall low abundance of high value species (black teatfish, white teatfish, and sandfish) were observed in most past fishing grounds while low to medium value species were generally present at higher abundance (Figure 4). Notably moderate stocks of black teatfish were observed in Emae and Aneityum islands. This encouraging trend highlighted positive effects of the 6-year ban on sea cucumber resources. However white teatfish and sandfish were likely close to local extirpation in the survey sites.

2) The low recovery of commercially valuable species was partly expected despite the positive effects of the moratorium. Indeed two main factors likely negatively affected stock recovery: i) the excessive fishing pressure prior to the fishery closure in 2008 had severely depleted these species, resulting in very low abundance when the moratorium was established; and ii) the recruitment of juvenile sea cucumbers was limited by low abundance of mature sea cucumbers (brood stock), which reduced natural growth of wild populations.

3) Stock size of commercial species greatly differed among sites and among species (Figure 4). This is because adult sea cucumbers are coastal invertebrates that may travel very short distance only contrary to pelagic finfish resources for instance. For instance they do not migrate between islands or between community fishing grounds.

4) This finding had important consequences concerning the management of sea cucumber resources since it implied that fishery regulations should be defined by species and by area. On the contrary, if fishing pressure is controlled at national level only (e.g., trough national open season or national quota), management effort will not prevent overexploitation in most fishing grounds.

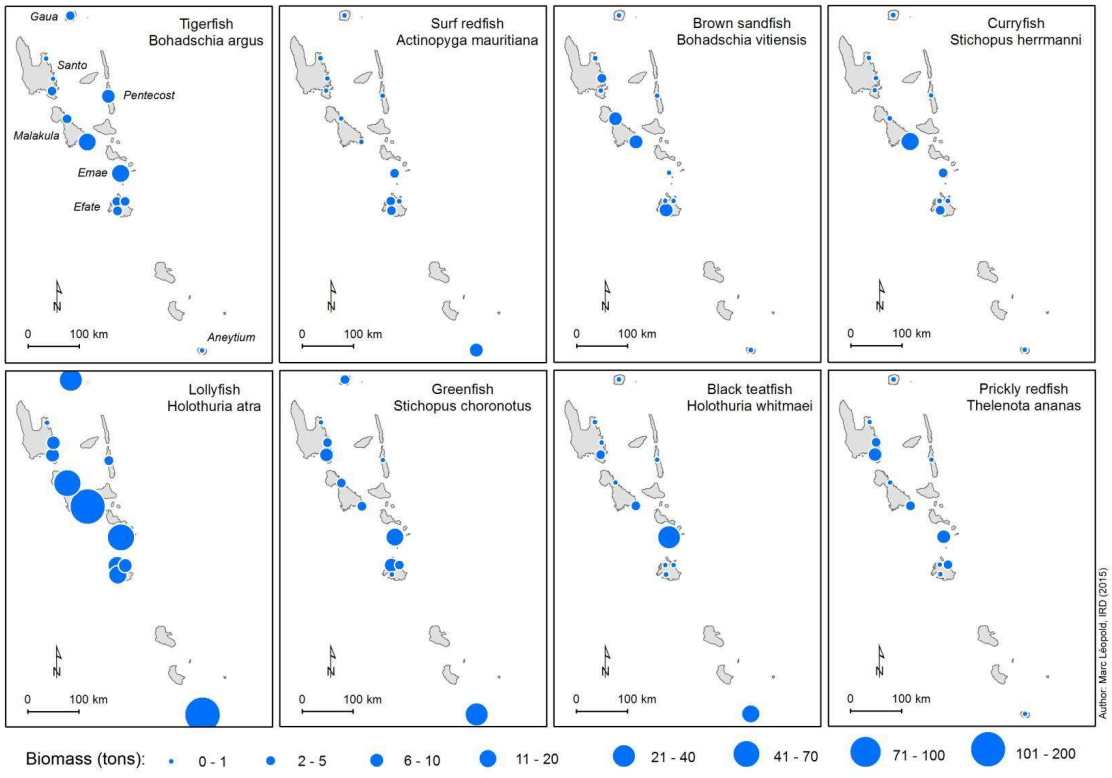

Figure 4. Stock abundance (in tons) of the 8 most abundant sea cucumber species (tigerfish, surf redfish, brown sandfish, curryfish, lollyfish, greenfish, black teatfish, and prickly redfish) in the 12 survey sites of Vanuatu (2011-2014 surveys, BICHLAMAR project). Values incorporate statistical uncertainty of biomass estimates: conservative estimates are showed.

CONCLUDING REMARKS

Contrary to previous open access, market-driven strategy (1980-2007), effective control of fishing pressure overall led to resource increase. Biological surveys allowed for detecting encouraging, positive effects of the 6-year ban on sea cucumber stocks (2008-2013) since small stocks were observed in most sites.

This finding was a strong incentive for the DoF to maintain control over the fishery through the NMPSCF. The moratorium was found to be too short to allow the full recovery of sea cucumber resources except for few species in some islands. Critical status of white teatfish and sandfish (i.e., the most valuable species) even called for a permanent fishing ban of both species.

The DoF therefore decided to extend the moratorium for 5 years to strengthen the biological growth of all species in all fishing grounds as a precautionary approach while finalizing the NMPSCF. The national plan considered regulations per species and per area as suggested by resource distribution.

3.3 Phase 3 strategy (2014): spatial TAC-based strategy

3.3.1 Designing a rotational harvest strategy at national level

1) To comply with Part 4, sections 10-11 of Fisheries Act No 10 of 2014, sea cucumber fisheries were identified as “designated fisheries” due to their commercial importance at national level. A development and conservation plan was therefore elaborated by the DoF in the form of a 5-year national management plan for sea cucumber fisheries (NMPSCF).

2) The overall objective of the NMPSCF was to rebuild sea cucumber stocks while maximizing profit for Ni-Vanuatu people in the long term. The specific objective was therefore to set and control fishing pressure at sustainable level in all fishing grounds. The base principles of the drafted national plan were threefold (see § 3.4.1 for details):

i. The *precautionary approach*, in accordance with Part 2, section 4 of Fisheries Act No 10 of 2014, and given past collapse and slow recovery of sea cucumber resources in Vanuatu (see § 3.1.2 and § 3.2.2). This approach took into account the best scientific information and understanding available on resource status and inherent uncertainty of the data related to natural resources.

ii. The *co-management approach* by ensuring that fishers (male and female) and customary right holders contribute to the decision-making process at local scale (e.g., by participating in data collection, having access to survey results, setting local fishing and sharing rules). This is to enhance local stewardship and compliance with the plan.

iii. The *adaptive approach* by ensuring that fishing pressure is set at sustainable level according to resource status in respective fishing grounds in order to prevent overexploitation.

3.3.2 The new strategy was successfully trialled in 2014

1) Although the moratorium had been extended for 5 additional years in January 2013 following the DoF’s recommendation (see § 3.2.2 Concluding remarks), the sea cucumber fishery was reopened in 2014 due to active commercial pressure from industry and foreign traders (Appendix 3).

2) However strict conditions applied in authorized harvest areas in accordance with Fisheries Regulations Order No. 11 of 2014 as presented below. Low catches were allowed to trial the drafted management plan as well as to provide extra income for communities in areas where the stock biomass had been estimated.

3.3.2.1 Setting fishing restrictions in pilot areas

1) To prevent resource depletion, the TACs were established by species and by area. All the sea cucumbers that had reached the legal catch size were included in the species-specific TACs in each authorized area based on survey results. Also these TACs could not exceed 30% of the total stock per species so as to prevent overharvesting if few juveniles or sub-adults had been recorded during biological surveys.

2) As a result, the TACs consciously underestimated catch volumes since such a precaution was felt to be warranted during the stock recovery stage and was readily accepted by fishing communities. The TACs were expressed in tons of live sea cucumbers so as to allow direct on site monitoring.

3) The DoF also reviewed minimum catch sizes for 23 sea cucumber species based on available knowledge in scientific literature (see Appendix 1).

4) The DoF authorized nine species for harvest in 2014 in seven management areas in Efaté, Malekula, Santo and Pentecost islands. This amounted to 27 species-specific TACs for a total of 45 tons (wet weight) (Figure 5). TACs were set conservatively to prevent overexploitation. No TAC exceeded 6 tons and half of them were below 1 ton, showing how low overall stocks were (see § 3.2.2).

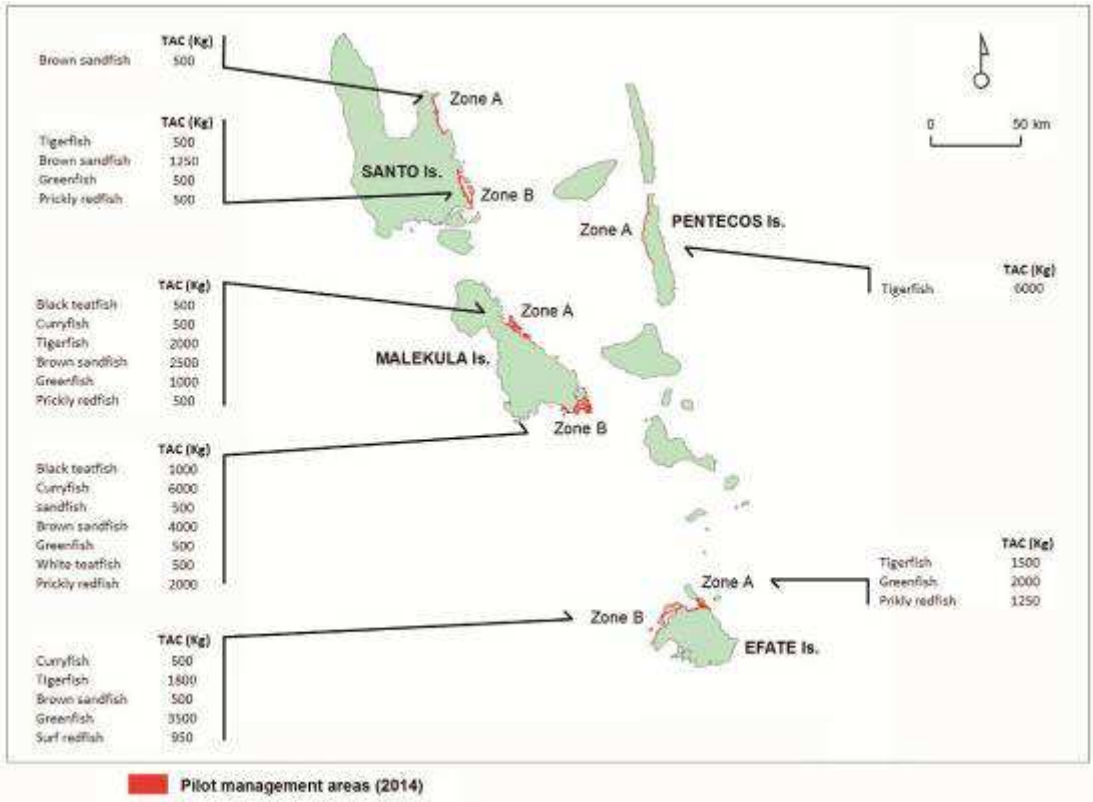

Figure 5. Pilot management areas (n=7) where restricted harvest of sea cucumber was authorized in 2014. TAC (Total Allowable Catches, or quotas) of certain species were set in each area as shown (wet weight).

3.3.2.2 Licensing, catch monitoring and enforcement of fishing rules

1) Three companies were granted processing licenses to operate in the authorized areas. Two companies were licensed in each authorized area and equitably shared the TACs.

2) Fishing was allowed in each area for a very short time (one to several days) to facilitate joint monitoring of the TACs and feedback to fishers. A fisheries officer was present during harvest to enforce size limits and monitor catches per species on-time (see logsheets in Appendix 2). Undersized sea cucumbers were returned to sea alive.
On-site catch monitoring costs were paid for by the three operators as a condition of their license. Two companies fully complied with this condition while the other company did also purchase sea cucumbers in the absence of a fisheries officer.

3) In the authorized areas mentioned above, catches did not exceed the TACs only if a fisheries officer was on-site to supervise landings. When on-site checks were not carried out by a government authority, unauthorized catches (i.e. exceeding TACs or harvest of prohibited species) were later reported. In total unauthorized catches reached 8 tons (wet weight) in Malekula and Efate islands.

4) Total catches eventually reached 20 tons (wet weight) in authorized areas in 2014. According to the DoF's records, first sale price greatly varied among species, buying companies, and communities (between ~VT40 and VT400 per kg, wet weight). First sale price averaged around VT100 per kg wet weight all species together (~ VT1250 /kg dry weight using an average wet-to-dry conversion rate of 8%). Although the first sale price of medium to high value species was occasionally considered too low by fishers, the average first sale price (all species together) could be considered reasonably fair given that the TACs were mostly composed of low to medium value species. The total first sale value of catches was estimated at about VT2,000,000.

5) The export value of sea cucumber species (dry products) ranged between VT1,000 and VT11,000 /kg and averaged VT6,190 /kg all species together (Table 2). The total export value of catches was estimated at ~VT10,000,000. This value could be considered low compared both to management and operating costs (see below).

6) Importantly feedback from communities concerning the TAC system and the necessary involvement of the DoF for controlling harvest on-site were overall very positive. Communities had endorsed sending a monitoring officer as a condition for opening the harvest season in their fishing grounds.

Table 2. Average export value of beche-de-mer products (dry weight) from Vanuatu in 2014. Source: Informal declaration from companies to DoF. * Estimated first-sale value (all species together) averaged VT100 /kg (wet weight) ~ VT1,250 /kg (dry weight) using an average wet-to-dry conversion rate of 8%.

Species	Export value of beche-de-mer (VT/kg)	Export quantity (kg)
Lollyfish	-	8
Chalkfish	950	61
Elephant trunkfish	-	11
Brown sandfish	2 660	193
Tigerfish	2 660	202
Hairy blackfish	4 750	445
Stonefish	4 760	30
Brown curryfish	4 820	6
Curryfish	6 660	153
Surf redfish	7 600	38
Greenfish	7 600	57
Prickly redfish	7 600	129
Black teatfish	9 000	178
Sandfish	11 400	35
White teatfish	11 400	158
ALL SPECIES	6 015 (AVERAGE VALUE)*	1 703

TOTAL EXPORT VALUE: (VT) 10 243 044

3.3.3 License fees and management and operating costs

1) Given that the fishery was re-opened due to strong commercial pressure and given the DoF's modest recurrent budget allocations, the DoF followed the widely accepted "user-pays principle" and additional economic consideration for setting license fees: any interest earned on the sea cucumber fishery shall contribute to meet the management costs of the management plan. The DoF would fund other management costs (e.g., permanent staff wages) while communities would make payment in-kind by taking part in the stock assessments.

2) The annual license fee was therefore proportional to the amount of sea cucumber authorized for processing. It was established at VT100 per kg wet weight. Despite this high license fee, three companies purchased 17.7 %, 28.8 %, and 53.5 % of total TACs, respectively.

3) Total license fee revenue reached VT4,500,000 for all TACs (45 tons wet weight) in 2014. It accounted for less than 60 % of the expenditures of the DoF to manage the fishery from 2011 to 2014. This cost recovery rate was due to fixed assessment costs on the one hand and very low TACs on the other hand. It may be considered too low to sustain fishery management.

4) The total export value of TACs (~3.6 tons of beche-de-mer) was estimated at around VT15,000,000 since export value on world market of beche-de-mer averaged ~VT4,200 per kg (dry weight) in 2013 (Figure 2). Total licensing costs therefore represented ~30% of the estimated export value of total allowed catches since

TACs were mostly composed of low to medium value species. Consequently license fee (~ VT1250 /kg dry weight using an average wet-to-dry conversion rate of 8%) represented about 30 % of average export value which was considered too high and unfair by the industry.

5) Additionally the companies did not fully harvest their TACs during the license year which yielded a gap in terms of their desired and achieved profit margins. Indeed total catches (20 tons wet weight) represented only 43 % of total TACs as mentioned above.

6) This gap was partly predictable for two main reasons. First the premature lifting of the moratorium had not been anticipated by the DoF, which resulted in late license granting. Second local issues often emerged due to disputed arrangements between companies and communities (e.g., resource ownership issues, unfair product pricing) which delayed or sometimes prevented harvest in the sites authorized by the DoF.

CONCLUDING REMARKS

The testing of the harvest strategy was very informative and conclusive. The DoF was able to define procedures for generalizing the species-specific TAC-based system at national level as part of the NMPSCF. Results showed that a rotational pulse fishing strategy would be required in Vanuatu in order to:

1) Reduce operating costs and increase profits,

2) Contain the costs of TAC monitoring in each open area since the presence of a fisheries officer was required on site,

3) Avoid spreading the human and financial resources available for stock assessments, and

4) Ensure compliance with fishery restrictions.

Providing comprehensive awareness to communities prior harvest (concerning management rules, pricing, licensing, etc.) was mandatory to avoid local conflicts and set fair commercial arrangements.

To increase the chances of recovering management costs, fairly setting license fee, export levy and/or a specific management fee was found to be a golden rule that should be followed by the DoF owing to the attractive, commercial nature of the fishery.

In order to make harvesting more profitable and sustainable, it was also recommended to authorize future fishery openings rationally, based on stock levels, species-specific TACs and expected profit. For instance, harvesting may be authorized only once every two to five years in each area if TACs exceed a pre-defined threshold (e.g., 2 t), while processing could be limited to few licensed companies.

3.4 Phase 4 strategy (2015-2016): short nationwide fishery opening

3.4.1 The national management plan for sea cucumber fisheries

1) In accordance with the recommendations based on sea cucumber harvest in 2014, the 5-year national management plan for sea cucumber fisheries was finalized in early 2015 and endorsed by the by the Ministry of Agriculture, Livestock, Forestry, Fishery, and Biosecurity on July, 10th 2015 (Appendix 3).

2) The plan was considered a significant achievement by the DoF. Indeed the harvest and management strategy of the NMPSCF was conscientiously defined based on the DoF's capacity and experience and the 4-year expertise contribution of the IRD and SPC (2011-2014). It was also discussed within the Fisheries Technical Advisory Committee (FTAC) of the Melanesian Spearhead Group countries in 2013 and at the Heads of Fisheries (HOF) meetings at SPC headquarters in 2012.

3) The harvest and management strategy of the NMPSCF was defined as follows (see Table 3 for details):

i. The fishery is to be managed under an indefinite closure with short open seasons based on a rotational system;
ii. During open seasons, a system of quota or Total Allowable Catch (TAC) is to be applied for each species and fishing area. Such TACs are indeed easy to understand by communities;
iii. In addition, management guidelines and specific measures aim to address data deficiency issues, observers' roles, applied research needs, fishing rights and access to community marine areas, and gear restrictions.

Table 3. Specific rules included in the 5-year National management plan for sea cucumber fisheries in Vanuatu (NMPSCF)

1. Establish permanent fishery closure: limited open fishing season, authorized areas, and quotas (or Total Allowable Catches, TAC) will be declared by the DoF when the resources stocks have recovered to healthy stock levels;
2. Establish licensing arrangements to control and monitor sales, processing and export of sea cucumber products;
3. Restrict fishing methods and gears for the collection of sea cucumbers (e.g., no use of scuba and hookah equipment, no use of "bombs");
4. Restrict the collection of certain sea cucumber species whose biological sustainability is deem to be threaten by fishing activities (e.g., white teatfish and sandfish);
5. Strengthen monitoring of resources, catches, purchases, processing, exports of sea cucumbers to support management of the fishery;
6. Establish an effective enforcement system to ensure compliance with the plan, including conditions of licenses and fishing regulations;

7. Establish an effective public awareness program to provide feedback to communities on the status of stocks and economic benefits derived from the fishery;
8. Restrict licensing to indigenous Ni-Vanuatu-owned (or over 52% shareholding) processing companies; and
9. Restrict traditional processing of sea cucumber to increase value adding through high-grade processing and exporting final products.
10. In accordance with Section 9 of Fisheries Act No. 10 of 2014, the Fisheries Management Advisory Council (FMAC) will provide recommendation to the DoF on the management, development and conservation of the sea cucumber fishery.

3.4.2 Contextual factors led to short nationwide fishery opening of the sea cucumber fishery

1) Major natural disasters severely impacted urban and rural areas throughout Vanuatu in 2015. After class 5 tropical cyclone Pam hit the country on March, 13th 2015 destroying thousands of homes and gardens, the El Niño-fuelled drought caused additional serious damage on recovering food crops including coconut plantations and household livelihoods (e.g., water shortage, drop of income from primary sector) in most islands. In this crisis context, socioeconomic needs of communities exacerbated fishing pressure on commercial marine resources such as sea cucumbers for generating income in the very short term. This contextual social demand for cash was actively and opportunistically supported by beche-de-mer traders and the local industry.

2) As a result the DoF was practically forced by communities, companies, and political leaders to urgently open the sea cucumber fishery. This fishery was used as a critical safety net. In accordance with Fisheries Regulations Order No. 120 of 2015, the DoF declared a 4-month open season for sea cucumber harvest in seven islands on August, 27th 2015 (Figure 6, Appendix 3). The open season lasted from September, 1st 2015 to December, 31st 2015.

3) As endorsed by Fisheries Regulations Order No. 120 of 2015, the DoF was practically forced to make the following breaches to the just-released national management plan:

- In the islands opened for fishing, species-specific TACs included areas that had not been previously surveyed by the DoF (Figure 6) so as to expand the number of beneficiary coastal communities.

- Many additional islands were harvested although no open season had been declared by the DoF (Figure 6) since the DoF was practically forced to satisfy any effective demand of communities for harvesting sea cucumbers. No biological data on sea cucumber resources was available in these islands.

- Species-specific TACs were consequently not based on stock assessment data. Instead they were set arbitrary at island level in order to reach a total allowable catch that was considered economically

acceptable by the fishery sector and ecologically sustainable by the DoF, i.e. 21 tons of beche-de-mer all species together (Table 4).

For comparison, the TACs recommended in the surveyed areas totaled 317 tons wet weight all species together, which was estimated at ~24 tons dry weight using species-specific wet-to-dry conversion rates (Table 4). Since open areas (i.e., whole islands) were much larger than surveyed areas, the DoF assumed that the above TAC targets were reasonable.

However the species composition and the harvest sites markedly varied between authorized and recommended TACs (Table 4). Indeed the recommended TACs only included the species that were observed at reasonable legal-sized biomass levels. They were therefore mainly composed of low value species such as Lollyfish (78 %). On the contrary authorized species also included high to medium value species that were observed at low density and/or mainly composed of small individuals (e.g., white teatfish, prickly redfish, black teatfish, curryfish, surf redfish).

- Species-specific TACs were set in dry weight instead of wet weight, which made the on-site control of TACs unenforceable by fisheries observers and authorized officers (see below).

- No restriction applied on the number of sea cucumber processing licenses due to the very strong commercial pressure of local interested investors.

- Due to time limitation the Fisheries Management Advisory Council (FMAC) was not consulted for advice for drafting Fisheries Regulations Order No. 120 of 2015 or declaring the fishery open season.

4) Before and during the open season, processing companies actively canvassed communities including in locally-closed marine areas and unauthorized islands. This generated strong local economic expectations throughout the country as well as local conflicts (e.g., between fishers, chiefs, elders, and/or resource monitors) due to divergent views on harvest and management strategy in some communities (e.g., in Efaté, Emae and Aneytium Islands). For instance some community members reminded fishers of the depletion of sea cucumber resources before the moratorium in order to attempt to limit fishing pressure during the open season.

5) The resulting harvest strategy was a nationwide 4-month fishery opening from September, 1st to December, 31st 2015. The technical breach of the national management plan had dramatic consequences on compliance with catch limits as described below.

Table 4. Total Allowable Catches (TACs, dry weight) set in Fisheries Regulations Order No. 120 of 2015 (All.) as compared to the TACs initially recommended by the DoF (Rec.) by species and island.
The recommended TACs were first estimated in wet weight and then converted into dry weight using species-specific wet-to-dry conversion rates.

Species	Islands																												All sites	
	Gaua		Santo		Ambae		Malekula		Pentecost		Ambrym		Epi		Efate		Erromango		Tanna		Aneityum		Maewo		Paama		Banks		Emae-Cook		Torba			
	All.	Rec.*	All.	Rec.*	All.	Rec.	All.	Rec.*	All.	Rec.*	All.	Rec.	All.	Rec.	All.	Rec.*	All.	Rec.	All.	Rec.	All.	Rec.*	All.	Rec.	All.	Rec.	All.	Rec.	All.	Rec.	All.	Rec.*
Amberfish	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	-	-	-	-	-	-	1.3	-
Black teatfish	-	-	0.02	-	-	-	0.02	-	0.02	-	0.02	-	0.02	-	0.02	-	-	-	-	-	0.02	0.3	-	-	-	-	-	-	-	0.9	-	-	0.1	1.2
Brown curryfish	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-
Brown sandfish	-	-	0.1	-	-	-	0.2	-	-	-	-	-	0.1	-	0.1	0.2	-	-	-	-	0.0	-	0.0	-	-	-	-	-	-	-	-	-	0.6	0.2
Chalkfish	-	-	0.2	-	-	-	0.3	-	-	-	-	-	0.1	-	0.4	-	0.1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	1.1	-
Curryfish	0.1	-	0.1	-	-	-	0.1	-	-	-	-	-	0.1	-	0.2	0.1	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	0.7	0.1
Deepwater blackfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elephant trunkfish	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	0.3	-	-	-	-	-	-	-	3.4	-
Flowerfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenfish	0.1	-	0.1	0.1	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	0.1	0.2	-	0.1	-	0.1	0.5	0.1	-	0.1	-	-	-	-	0.1	-	-	1.3	0.8
Hairy blackfish	-	-	0.2	-	-	-	0.3	-	-	-	-	-	0.2	-	0.1	-	0.2	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	1.1	0.0
Lollyfish	0.2	1.3	0.3	0.3	0.2	-	0.3	4.8	0.2	-	0.2	-	0.2	-	0.2	1.1	0.3	-	0.2	-	0.3	8.0	0.2	-	0.2	-	-	-	-	2.5	-	-	2.4	18.0
Pinkfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prickly redfish	0.2	-	0.2	0.2	0.2	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2	0.1	0.2	-	0.2	-	0.2	-	0.2	-	0.2	-	-	-	-	0.2	-	-	2.7	0.5
Snakefish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stonefish	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	3.0	-
Surf redfish	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	0.3	0.1	-	0.1	-	-	-	-	0.1	-	-	1.6	0.4
Tigerfish	0.1	-	0.1	0.2	0.1	-	0.1	0.4	0.1	0.5	0.1	-	0.1	-	0.1	0.6	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	-	-	-	0.8	-	-	1.0	2.5
White teatfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	0.2	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	0.5	-
ALL SPECIES	1.1	1.3	1.8	0.8	1.0	-	3.1	5.2	1.0	0.5	1.0	-	1.5	-	3.1	2.2	1.7	-	1.0	-	1.5	9.1	2.1	-	1.0	-	-	-	-	4.6	-	-	21.0	23.7

3.4.3 Operating conditions of the fishery

3.4.3.1 Fishing and processing practices

1) Since sea cucumber fishing grounds were located in remote areas and local communities lacked the capacity for processing sea cucumbers, harvest activities were initiated and driven by processing companies.

2) Seventeen processing companies were licensed for operating during the open season while another processing company operated throughout 2015 using a two-year research permit granted by the DoF in 2014. Although these licenses were held by Ni-Vanuatu nationals, joint partnership arrangement allowed foreign investors to partner with local Ni-Vanuatu interests and to operate in processing sites. Some of these companies simultaneously operated processing facilities in multiple islands in order to maximize sea cucumber purchase before the fishery was closed.

3) Rudimentary processing facilities were established by companies in most islands close to main fishing areas for boiling and drying sea cucumbers. Between-site shipments of fresh or partly processed sea cucumbers were also organized to minimize operating costs, which raised catch monitoring issues (see below). Partly processed products were aggregated and then shipped to Port-Vila or Luganville for reprocessing to fully-dried products. Inspection of processing establishments was conducted by the Seafood Verification Agency or fishery observers to prevent any risk of contamination of products and the environment (e.g., through water waste).

4) As a result harvest was simultaneously encouraged in dozens of fishing areas in the six provinces of Vanuatu, which rose dramatic monitoring and compliance issues (see below). Sea cucumbers were eventually harvested in all islands of Vanuatu by the end of 2015, except in Aneytium island and in few small islands with low sea cucumber resources (Aniwa, Futuna, Paama, Tongoa) (Figure 6). In Aneytium island sea cucumber harvest was locally banned by chiefs following the DoF's advice in 2014.

5) Communities frenetically engaged in sea cucumber fishing as long as companies operated in their area. Fishers included most people (male and female) from age ~15 to ~60. Female and old fishers mainly gleaned shallow species on fringing reefs and flats at low tide while young and middle-age men practiced breath-hold diving in deeper areas (1-10 m). The use of "bombs" was occasionally reported for catching high value individuals (e.g., white teatfish) in deeper waters (<20 m). Hookah and scuba equipment were not used for

collecting sea cucumbers. This resulted in intense fishing pressure in all inshore areas (0-20 m depth) in which the licensed companies operated.

6) Island-based catch limits were not enforced except in Mangaliliu village in Efaté island (see compliance issues below). Licensed companies therefore used an opportunistic depletion strategy since they did not plan to harvest sea cucumbers in the same reef areas in coming years. In practice buyers provided powerful incentive to harvest sea cucumbers as quickly as possible before the fishery was closed again. This strongly exacerbated fishing pressure. Buyers stopped purchasing sea cucumbers in communities when average size and daily catch rates of sea cucumbers dropped to non profitable levels. This strategy suggests that resources were strongly depleted in all the areas visited although there is no biological data to confirm it.

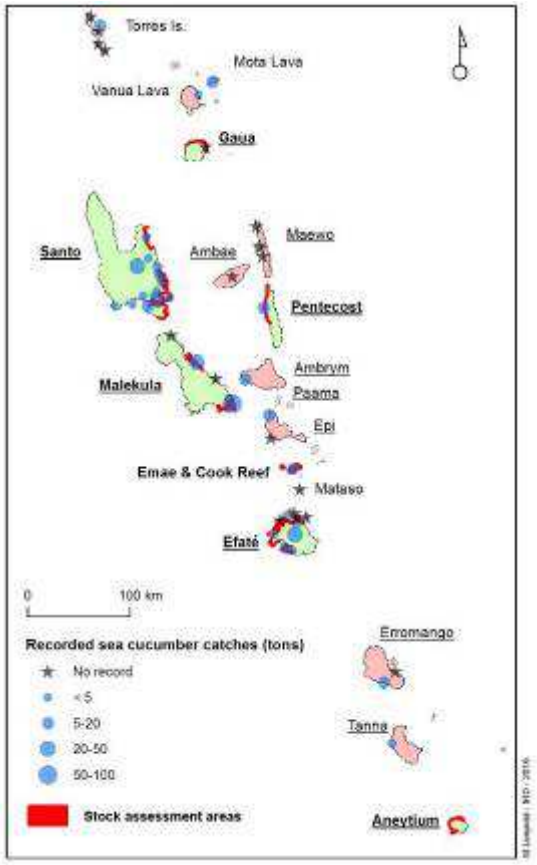

Figure 6. Harvest sites and respective recorded catches of sea cucumbers (all species together, wet weight) during the nationwide open season in 2015 (blue spots).

The open season was officially declared in September 2015 in the seven islands of Vanuatu (in green, bold names) where assessment data was available (red areas). However harvest went out of the control of the DoF and eventually occurred in many other islands (in pink, regular names). Documented harvest sites in which no catch data was collected by the DoF (no authorized observer present on site) are represented by stars. Species-specific TACs had been defined prior opening for most islands of the country (underlined names) by Fisheries Regulations Order No. 120 of 2015.

3.4.3.2 Catch records

1) The DoF engaged unprecedented human resources in sea cucumber catch monitoring during the open season since the sea cucumber fishery emerged as a priority issue. On-site catch monitoring involved seven permanent fishery officers of the Extension and Compliance Divisions (four and three officers, respectively), as well as 15 contracted fishery observers. The catch monitoring procedure was coordinated by the Research Division based at Port-Vila. The same protocol as that of 2014 was used to collect catch data (see 3.3.2 and Appendix 2). Data entry onto the DoF's server was performed by three contracted (part-time) fishery officers from November 2015 to January 2016.

2) Despite this effort the DoF was not able to monitor all fishing operations and to enforce TACs due to the high number of simultaneous fishing sites in the six Provinces. Fishery officers and observers were only based at some processing sites where catches were aggregated.

3) Overall 320 tons (wet weight) of sea cucumbers were recorded during the open season (~37 % of all estimated catches, see below). Recorded catches mainly came from Malekula, Santo and Efate islands (Table 5). However, given that ~63 % of catches was not recorded on site, available records are likely not representative of the spatial distribution of sea cucumber catch across Vanuatu islands. For instance, anecdotic or nil catch was recorded in some islands despite harvest undoubtedly occurred in those areas (e.g., Gaua, Tanna, Maewo, Ambae islands). Islands with high biological potential were targeted as a priority and were more heavily fished than other areas.

4) In total 19 species were observed in catches. Four species represented 69% of total recorded catches (namely surf redfish (22%), tigerfish (21%), brown sandfish (14%), and greenfish (11%)) while eight species totaled only ~2% % of total recorded catches. However, these records are not fully representative of the sea cucumber catch composition (see exports below).
Catches of main target species usually exceeded TACs by 100 % to above 500 % (e.g., surf redfish, tigerfish, brown sandfish, greenfish, black teatfish) particularly in Malekula, Santo and Efate islands (Table 5). The real situation is likely worse given unrecorded catches. Unauthorized species were also harvested due to their high value (e.g., white teatfish) or high abundance (snakefish) locally while several low value species were anecdotally collected regardless to allocated catch (e.g. chalkfish, elephant trunkfish).

5) Results showed that total catches at island or national level did not account for effective harvest intensity on each species. For instance, total catches in Efate island reached the TACs of all species together while

the catch of most abundant species (e.g., surf redfish, tigerfish, brown sandfish, greenfish) highly exceeded their respective TAC (Table 5).

Similarly, total Vanuatu catches did not account for harvest intensity in each island. Some islands were indeed much more heavily exploited (e.g., Santo and Malekula islands) than others (table 5).

These findings confirm that TACs should be calculated and enforced by species and by fishing area rather than at island or country level to prevent the over-optimistic interpretation of fishing impacts on resource status.

Table 5. Distribution of recorded sea cucumber catches (in kg) by species across Vanuatu islands in 2015 as compared to TACs (see colour gradient). Source: DoF.

	FISHING AREAS (ISLANDS)																ALL AREAS
	Open season declared													No open season declared			
HARVESTED SPECIES	Gaua	Santo	Ambae	Malekula	Pentecost	Ambrym	Epi	Efate	Erromango	Tanna	Aneityum	Maewo	Paama	Banks	Emae-Cook	Torba	
Surf redfish	0	8 103	0	22 553	998	9 339	5 790	8 317	6 783	805	0	0	0	5 773	548	2 524	**71 533**
Tigerfish	0	9 029	0	39 032	459	23	3 303	9 097	8	6	0	0	0	2 569	3 085	670	**67 283**
Brown sandfish	-	25 053	-	12 183	67	-	399	4 754	8	-	0	0	-	60	1 101	-	**43 625**
Greenfish	0	10 339	0	3 508	4 819	753	972	10 012	0	0	0	0	0	5 539	782	-	**36 724**
Snakefish	-	34	-	20 721	-	-	0	1 005	-	-	-	-	-	-	-	-	**21 760**
Prickly redfish	0	6 307	0	5 087	83	5	143	3 090	61	29	0	0	0	110	303	2 994	**18 211**
Black teatfish	-	3 267	-	6 053	188	1	2 207	3 473	39	17	0	-	-	390	2 392	62	**18 088**
Curryfish	0	2 652	-	7 716	-	-	57	3 729	0	-	-	0	-	-	83	-	**14 237**
Lollyfish	0	1 564	0	3 083	0	0	2	1 846	0	0	0	0	0	1 216	96	-	**7 806**
Hairy blackfish	-	535	-	6 000	1	-	26	219	0	-	0	-	-	81	39	-	**6 900**
White teatfish	-	4 617	-	1 393	65	3	148	465	0	-	0	-	-	-	34	-	**6 724**
Stonefish	-	644	-	273	-	-	12	200	-	-	-	0	-	126	836	-	**2 090**
Brown curryfish	-	-	-	0	-	-	-	2 059	-	-	-	-	-	-	-	-	**2 059**
Elephant trunkfish	0	0	0	204	0	0	4	22	0	0	0	0	0	1	572	-	**803**
Pinkfish	-	2	-	-	-	-	274	-	-	-	-	-	-	327	140	-	**743**
Chalkfish	-	0	-	631	-	-	0	0	0	-	0	-	-	-	-	-	**631**
Deepwater blackfish	-	96	-	1	-	-	-	99	145	-	-	-	-	3	-	-	**344**
Flowerfish	-	17	-	-	-	-	9	46	-	-	-	-	-	3	2	-	**77**
Amberfish	0	0	0	15	0	0	0	6	0	0	0	0	0	-	1	-	**23**
ALL SPECIES	**0**	**72 257**	**0**	**128 454**	**6 681**	**10 124**	**13 346**	**48 440**	**7 043**	**856**	**0**	**0**	**0**	**16 198**	**10 012**	**6 250**	**319 661**

Recorded catches in % TAC (TAC set)

CATCHES EXCEEDING TACs

<75% +25% +100% +200% +500% or more

Recorded catches in kg wet weight (no TAC set)

\- 0 kg <1000 kg 1000-5000 >5000 kg

3.4.3.3 Export records

1) Final beche-de-mer products were aggregated in Port-Vila and Luganville for export to Hong-Kong (97.7%) and Fiji (2.3%). Exports occurred from October 2015 to February 2016 although harvest stopped on December, 31st 2015 since sea cucumber processing was carried on after fishery closure. In total nine processing companies exported beche-de-mer in 2015 (seven companies) and/or 2016 (seven companies), including those products that had been processed by other companies that did not hold export license. Two companies exported very low quantities of bêche-de-mer (0.4 ton and 0.3 ton). The remaining companies exported from 3.97 tons to 16.53 tons of bêche-de-mer (Table 6).

2) Beche-de-mer exports reached 18.6 tons in 2015 and 50.8 tons in 2016 all species together (69.4 tons in total), which was close to highest historical records (Figure 1). Total exports therefore tremendously exceeded the total TAC (21 tons, cf. § 3.4.2) by 48.4 tons (234 %). The corresponding catch was over 1 million sea cucumbers and 939 tons wet weight (Table 7).

3) The DoF engaged unprecedented human resources in sea cucumber export monitoring during and after the open season. The Seafood Verification Agency (three permanent officers) inspected all export packages with the assistance of compliance officers. Export companies were requested to pack bêche-de-mer products by species in 20-40 kg bags and to provide a packing list invoice for each bag (indicating species, total number of pieces and weight, destination and indicative sale price). However, harvest sites were not recorded since catches from different origins had been mixed prior processing and/or packing.
For each species, half of bags were weighted (at 0.1 kg precision) and sampled by SVA officers. In each bag, 30 pieces were randomly selected (except for greenfish, 120 pieces) and weighted (at 0.01 kg precision). Individual length (in mm) was also measured to check for compliance with the minimum legal sizes (Appendix 1) and for research purpose.

4) The species breakdown of bêche-de-mer exports was made available for the first time in 2015-2016. In total 21 species were observed in exports. Four species represented 68% of total recorded catches (namely surf redfish (30%), tigerfish (15%), brown sandfish (12%), and black teatfish (10%)) while seven species totaled ~0.9% of total exports (Table 6).

5) The species breakdown of exports showed that on-site catch records and export records of three main species (surf redfish, tigerfish and greenfish) were not consistent (Table 6). These differences in catch

composition highlight that significant harvest very likely occurred in reef areas / islands that were not monitored at all by the DoF in 2015 (see Figure 6).

6) The fact that sandfish and white teatfish exports reached very low levels (i.e., 0.07 and 1.78 ton dry weight, respectively) despite intense fishing effort in suitable habitats suggests alarming depletion of both species, which will possibly lead to extirpation of both species in most islands of Vanuatu.

Table 6. Bêche-de-mer exports by company in 2015-2016 as compared to recorded catches. Differences larger than 5% are underlined. Bêche-de-mer products were recorded in dry weight and then estimated in wet weight using species-specific dry-to-wet conversion rates. Source: Seafood Verification Agency, DoF.

Species	Recorded bêche-de-mer exports (kg)										Estimated wet weight of exports (kg)*	Distribution in recorded catches (on-site monitoring)
	Companies									All companies	All companies	All companies
	1	2	3	4	5	6	7	8	9			
SURF REDFISH	5 663	181	407	5 808	3 006	3 482	1 858	41	676	21 122 (30.4%)	257 584 (27.4%)	22.4%
TIGERFISH	1 886	10	2 317	2 550	260	1 405	1 527	37	529	10 520 (15.2%)	107 347 (11.4%)	21.0%
BROWN SANDFISH	1 039		615	2 424	51	1 890	1 902		307	8 229 (11.9%)	85 718 (9.1%)	13.6%
BLACK TEATFISH	1 688	9	920	1 641	289	754	946	50	708	7 004 (10.1%)	82 400 (8.8%)	5.7%
GREENFISH	284	15	876	1 295	307	232	977	19	200	4 205 (6.1%)	155 737 (16.6%)	11.5%
SNAKEFISH	6		2 512			70	294		11	2 894 (4.2%)	21 923 (2.3%)	6.8%
PRICKLY REDFISH	855		322	798	12	358	262	17	64	2 687 (3.9%)	46 329 (4.9%)	5.7%
LOLLYFISH	397	39	297	409	554	127	510		73	2 405 (3.5%)	30 443 (3.2%)	2.4%
HAIRY BLACKFISH	35		879	27	3		151		805	1 899 (2.7%)	27 136 (2.9%)	2.2%
CHALKFISH	507		261		522	97	436			1 822 (2.6%)	30 375 (3.2%)	0.2%
WHITE TEATFISH	265		166	957	0	281	51	37	26	1 782 (2.6%)	16 974 (1.8%)	2.1%
CURRYFISH	232		377	278	31	188	400	9	20	1 535 (2.2%)	46 504 (5.0%)	4.5%
DEEPWATER BLACKFISH			40	147	1	1 219		16		1 423 (2.0%)	12 161 (1.3%)	0.1%
STONEFISH	318		30	197	37	92	70	8	519	1 271 (1.8%)	9 631 (1.0%)	0.7%
ELEPHANT TRUNKFISH			59		11	32	100		32	235 (0.3%)	2 152 (0.2%)	0.3%
BROWN CURRYFISH							100			100 (0.1%)	2 510 (0.3%)	0.6%
MIX SPECIES			78		6					84 (0.1%)	1 050 (0.1%)	0.2%
SANDFISH					72					72 (0.1%)	1 448 (0.2%)	-
PEANUTFISH							67			67 (0.1%)	963 (0.1%)	-
FLOWERFISH					1		24	3		27 (0.0%)	321 (0.0%)	0.0%
AMBERFISH	27				0					27 (0.0%)	545 (0.0%)	0.0%
ALL	13 202 (19.0%)	254 (0.4%)	10 156 (14.6%)	16 530 (23.8%)	5 163 (7.4%)	10 226 14.7%	9 675 (13.9%)	236 (0.3%)	3 970 (5.7%)	69 412	939 249	

7) For the first time, the DoF recorded the size distribution of bêche-de-mer exports of each species in 2015-2016. Importantly we observed that the exports of most species were mainly composed of undersized sea cucumbers (Figure 7). Specifically, the mode of the size distribution of the five main species (each species representing >5% of exports) was much lower than their respective minimum export sizes. As a result total exports of these species were composed of 82 % to 97 % undersized specimens (Table 7), which is abnormally high and unsustainable rate.

8) Although the high total exports recorded during the open season in 2015 may suggest healthy and abundant sea cucumber resources, such an interpretation would be misleading. Instead they resulted from intensive fishing and relatively low yields in a large number of villages' marine areas throughout the country

during the 4-month open season, as highlighted by the size distribution and species composition of exports and the fishing strategy. This confirms that sea cucumber stocks were broadly low and had only partly recovered during the moratorium.

Table 7. Estimated number of legal-sized and undersized exported sea cucumbers by species in 2015-2016. The relative weight of total samples of each species across export companies is also indicated. Source of raw data: Seafood Verification Agency, DoF.

Species	Minimum legal size (mm) of dry products	Estimated number of pieces (exports)			% export (kg) sampled
		all sizes	undersized	legal sized	
Surf redfish	120	276 577	242 174 (88%)	34 403 (12%)	0.47%
Greenfish	100	268 776	261 064 (97%)	7 712 (3%)	0.37%
Brown sandfish	120	149 170	134 084 (90%)	15 086 (10%)	0.25%
Tigerfish	150	113 664	92 837 (82%)	20 827 (18%)	0.68%
Chalkfish	70	87 284	29 731 (34%)	57 553 (66%)	0.65%
Black teatfish	150	41 197	39 019 (95%)	2 178 (5%)	1.12%
Lollyfish	100	31 277	6 145 (20%)	25 132 (80%)	1.27%
Prickly redfish	170	21 000	17 157 (82%)	3 843 (82%)	1.58%
Deepwater blackfish	150	18 736	18 736 (100%)	0 (0%)	0.49%
Hairy blackfish	100	14 314	11 858 (83%)	2 456 (17%)	0.37%
Snakefish	200	13 800	13 340 (97%)	460 (3%)	0.02%
Curryfish	150	11 598	10 743 (93%)	855 (7%)	1.69%
White teatfish	160	5 477	1 770 (32%)	3 706 (68%)	2.27%
Brown curryfish	100	2 469	1 481 (60%)	987 (40%)	1.22%
Sandfish	100	2 362	590 (25%)	1 771 (75%)	0.51%
Stonefish	100	1 312	297 (23%)	1 016 (77%)	1.16%
Peanutfish	100	311	21 (7%)	290 (93%)	9.65%
Elephant trunkfish	200	211	0 (0%)	211 (100%)	0.18%
Flowerfish	150	60	58 (97%)	2 (3%)	5.49%
Amberfish	150	NA	NA	NA	0%
Mixed species	-	NA	NA	NA	0%
ALL		1 059 594	881 104 (83%)	178 491 (17%)	0.69%

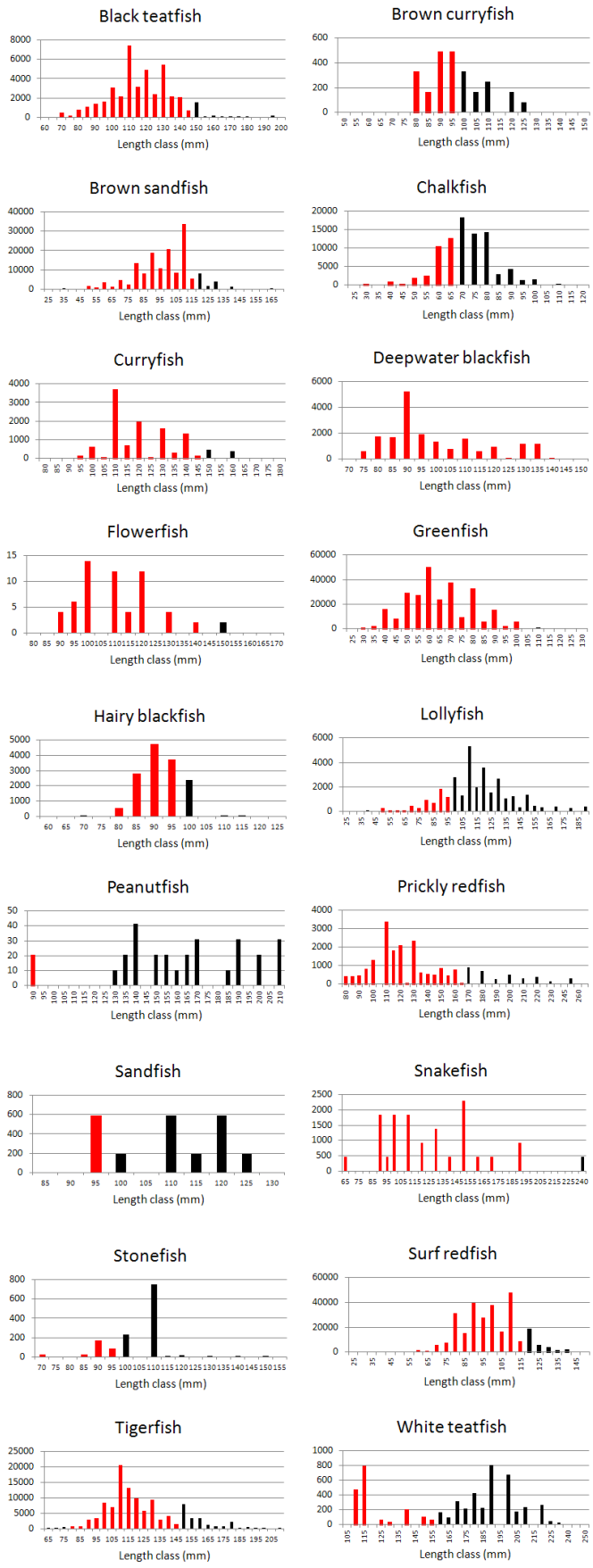

Figure 7. Estimated size distribution of total bêche-de-mer exports of each sea cucumber species in 2015-2016. Red bars indicate undersized sea cucumbers. Source of raw data: Seafood Verification Agency, DoF.

3.4.3.4 Compliance issues

1) DoF officers of the Compliance Division (including permanent officers and contracted fishery observers), the Extension and Development Division and the SVA controlled the enforcement of Fisheries Regulations Order No. 120 of 2015 during fishing and processing of sea cucumbers and prior to export of dried products.

2) A total of 15 part-time fishery observers were contracted by the DoF (Compliance Division) to involve in the sea cucumber fishery during the open season. These observers used to work as observers in the tuna fishery sector and were redirected to the sea cucumber fishery to enforce Fisheries Regulations Order No. 120 of 2015. They were trained by the Research Division of the DoF concerning species identification and the monitoring procedure. Functioning costs of fishery observers (i.e., VT2000 per diem and travel costs) were covered by the processing companies as a condition of their license.

3) A processing license was charged for purchasing sea cucumbers and processing them to dried products (bêche-de-mer). An export license was charged for exporting processed products to overseas markets. The separation of processing license from export license was to ensure efficient monitoring of the activities of license holders and the enforcement of the TACs.

4) Fishery observers played a key role in the sea cucumber fishery during the open season as acknowledged by all processing companies and local communities. Their activities were multifaceted: i) they provided awareness to communities (on minimum harvest sizes, species, prices, license conditions, etc.); ii) they worked as facilitators between buyers and local communities; iii) they worked as local coordinators of harvest operations; iv) they were responsible for monitoring sea cucumber catches and enforcing fisheries regulations. Although above activities were highly stimulating, fishery observers had not been properly prepared to such responsibility that required specific technical skills and personal capacities. For instance they had to take on-site and quick decisions concerning sea cucumber fishery management similarly to fishery authorized officers. Such tasks were not explicitly mentioned in the terms of reference of their contracts. This occasionally led to ambiguous situations where the intentions of fishery observers were unclear to local communities.

5) Despite the above management efforts of the DoF, major compliance issues emerged during the open season. Some specifications of Fisheries Regulations Order No. 120 of 2015 precluded the enforcement of the TACs despite monitoring activities:

- Contrary to the harvest strategy implemented in 2014, the processing license conditions did not set limits on the purchases of sea cucumbers by each licensed company. This weakened the DoF's capacity to stop fishing activities when the TACs of some species were reached.

- Catch-sharing between villages proved to be unmanageable once harvest had started. Given that the TACs were set at the island level rather than by area as in 2014, and that harvest simultaneously occurred in multiple fishing areas throughout Vanuatu, the DoF was not able to share the TACs between villages during the open season.

- Given that the species-specific TACs were set in dry weight rather than in wet weight as in 2014, compliance with the TACs was only controllable at export gates once processing had fully been completed, i.e. one to two months after harvest (or more since dry products can be easily stored). Therefore the DoF was unable to use catch data to enforce the TACs at the time of fishing (except in Mangaliliu village in Efaté island). As a result 50.8 tons of bêche-de-mer were exported in 2016 although total exports on December, 31st 2015 were lower (18.6 tons) than the total export limit (Table 8). This markedly stressed out that TACs should be set in wet weight to allow for controlling catch limits on time in harvest and/or processing sites.

Table 8. Total TAC, exports and catch in excess of quota (in kg of dried products) for each sea cucumber species in 2015-2016. Source of raw data: DoF, Seafood Verification Agency

Species	Total TACs (kg)	Exports (kg)			Catch in excess of quota (kg)
		2015	2016	Total	
Surf redfish	1 560	4 985	16 137	21 122	19 562
Tigerfish	1 040	3 445	7 075	10 520	9 480
Brown sandfish	600	2 468	5 761	8 229	7 629
Black teatfish	140	1 928	5 076	7 004	6 864
Greenfish	1 320	1 366	2 839	4 205	2 885
Snakefish	-	294	2 599	2 894	2 894
Prickly redfish	2 730	706	1 981	2 687	-
Lollyfish	2 400	1 045	1 360	2 405	-
Hairy blackfish	1 100	154	1 746	1 899	799
Chalkfish	1 080	957	865	1 822	742
White teatfish	540	205	1 578	1 782	1 242
Curryfish	680	516	1 019	1 535	855
Deepwater blackfish	-	57	1 366	1 423	1 423
Stonefish	3 000	86	1 185	1 271	-
Elephant trunkfish	3 380	88	146	235	-
Brown curryfish	160	100	0	100	-
Mixes species	-	84	0	84	84
Sandfish	-	72	0	72	72
Peanutfish	-	40	27	67	67
Flowerfish	-	19	8	27	27
Amberfish	1 300	0	27	27	-
ALL SPECIES	21 030	18 615	50 796	69 412	48 382

6) A total of six offences were reported in the sea cucumber fishery during the open season. Five companies breached one or two specifications of their processing license by operating without the presence of a fishery observer (n=4) and/or processing undersized sea cucumbers (n=2). Four spot fines were issues (VT50,000 or VT150,000) and two processing licenses were temporarily or permanently suspended.

Additionally the DoF unsuccessfully attempted to suspend the research permit of a processing company in March 2016 due to suspected breaches of the permit conditions.

7) The number of penalized offenses for processing undersized sea cucumber was much lower than expected given the high rate of reported undersized sea cucumbers in exports (cf. Figure 7). Indeed the DoF usually provided awareness and issued warnings at inspections, which proved ineffective in discouraging the harvest, purchase, processing and export of small sea cucumbers.
Overall size limits were largely not enforced by the DoF. Monitoring data showed that fishers harvested sea cucumbers opportunistically, whatever their size, in accordance with the depletion strategy followed by the processing companies.

3.4.3.5 Economic aspects

1) The distribution of economic returns from the sea cucumber fishery in 2015 and 2016 was analyzed among local communities, processing and export companies and Vanuatu government.

2) The feedback from local communities concerning local economic returns was overall positive to very positive (“quick money”). Local economic returns included i) payment to fishers based on purchase prices, ii) royalties to communities and/or landowners (e.g., VT50,000 to VT100,000), and/or ii) a profit-sharing rate (e.g., 5 %) to local leaders (including chiefs, council, etc.) depending on local arrangements with companies’ agents.

3) As far as fishers were concerned, local economic returns reached ~VT105,600,000 in 2015 as estimated by the total first sale value of sea cucumber catches (Table 9). This represented 35.4% of the total export value of processed products. Given that several thousands of fishers were involved in the sea cucumber fishery in 2015, the individual revenue from sea cucumber sale was likely <VT20,000 for most fishers.
Sea cucumbers were paid per piece rather than by kg. Purchase prices greatly differed among species and among buyers and averaged 100 VT/piece (equivalent to 112 VT/kg) (Table 9). Disputes were reported by fishery observers and fishery officers concerning purchase prices that were judged unfair in some communities.

4) The feedback from processing and export companies concerning economic returns was overall positive to very positive (“good business, good money”). The total export value of 2015 sea cucumber catches reached

their highest historical levels in 2015 (VT87,391,000) and in 2016 (VT210,867,000) (Figure 1). The most contributing species were surf redfish (38 % of export value), black teatfish (17.4 %), tigerfish (9.9%), greenfish (6.8%), brown sandfish (6.8%) and white teatfish (6.7%) (Table 9).
The turnover of the export companies as estimated by the total value of their respective bêche-de-mer exports ranged between ~VT15,000,000 and ~VT99,300,000 except that of two minor companies (Table 10).

5) However the feedback from Ni-Vanuatu license holders was mitigated due to perceptions of unfair benefit sharing and lack of transparency from foreign investors.

6) The total tax revenue from the sea cucumber fishery to the government of Vanuatu in 2015 and 2016 reached ~VT22,000,000 (20.8 % of total first sale value and 7.4% of total export value of beche-de-mer). This represented only ~50% of expected tax revenue. First, the processing license fee (VT100,000) and the export license fee (VT3,000,000 + 12.5% VAT) were only partly collected (~80 %). Second, the 5% export levy was not implemented. Third, most breaches of Schedule E of Fisheries Regulations Order No. 120 of 2015 concerning minimum size limits were not penalized. The reasons for the large gap between expected and achieved tax revenue remain unclear although several conflicts of interest between private and political individual bodies may be hypothetized.

7) Furthermore the processing and export fees had been set by the DoF according to a total TAC of 21 tons (dry weight) while exports eventually exceeded the total TAC by 48.4 tons (230 %). The DoF did not collect additional fees for this surplus production that should have generated additional tax revenue in comings years.

8) As a result the DoF did not recover the management costs of the fishery despite the considerable effort of all divisions of the Department and the appropriate legal framework in place.

Table 9. Average purchase price (whole sea cucumbers), total estimated first sale value (whole sea cucumbers), and average and total export value (dry products) of each sea cucumber species in Vanuatu in 2015 and 2016. Average purchase price per species (in VT/kg) was estimated from total first sale value and estimated wet weight of catches (cf. Table 6). Source of raw data: DoF - Seafood Verification Agency (export data) and Research Division (purchase prices).

Species	Average purchase price	2015	Total estimated First Sale value (VT)	Average export value of bêche-de-mer (VT/kg)		Total export value of bêche-de-mer (VT)			
	(VT/unit)	(VT/kg)	2015	2015	2016	2015	2016	Sub-Total	% Total
SURF REDFISH	100-150 VT/piece	134	34 572 133	9 604	4 060	47 877 719	65 516 546	113 394 265	38.0%
BLACK TEATFISH	400-500 VT/piece	225	18 538 548	6 664	7 678	12 847 179	38 976 990	51 824 169	17.4%
TIGERFISH	80-100 VT/piece	95	10 229 772	2 543	2 915	8 761 642	20 624 735	29 386 377	9.9%
GREENFISH	1000 VT/10L bucket or 25 VT/piece	43	6 719 408	2 873	5 806	3 923 855	16 485 633	20 409 488	6.8%
BROWN SANDFISH	100 VT/piece	174	14 916 976	1 659	2 828	4 093 063	16 290 360	20 383 423	6.8%
WHITE TEATFISH	500-2500 VT/piece	484	8 214 821	7 454	11 609	1 524 590	18 315 100	19 839 690	6.7%
PRICKLY REDFISH	150-250 VT/piece	91	4 199 971	3 465	5 469	2 447 812	10 831 380	13 279 192	4.5%
DEEPWATER BLACKFISH	100-150 VT/piece	193	2 342 029	1 515	5 597	86 100	7 645 500	7 731 600	2.6%
HAIRY BLACKFISH	100-150 VT/piece	66	1 789 251	1 028	2 894	157 912	5 052 360	5 210 272	1.7%
CURRYFISH	100-200 VT/piece	37	1 739 692	2 673	2 883	1 378 645	2 936 940	4 315 585	1.4%
STONEFISH	100-150 VT/piece	17	164 053	3 635	3 005	312 704	3 561 700	3 874 404	1.3%
SNAKEFISH	300-500 VT/10L bucket	9	207 000	702	895	206 640	2 327 160	2 533 800	0.8%
LOLLYFISH	200-500 VT/10L bucket	10	312 772	1 200	874	1 253 688	1 189 194	2 442 882	0.8%
CHALKFISH	5-20 VT/piece	29	872 842	1 651	802	1 580 731	693 960	2 274 691	0.8%
SANDFISH	100 VT/piece	163	236 152	6 185	-	447 900	0	447 900	0.2%
ELEPHANT TRUNKFISH	100 VT/piece	10	21 076	1 205	2 326	106 526	340 132	446 658	0.1%
MIXED SPECIES	80 VT/piece	98	102 723	2 667	-	223 940	0	223 940	0.1%
BROWN CURRYFISH	50 VT/piece	49	123 430	1 200	-	120 468	0	120 468	0.0%
AMBERFISH	50-80 VT/piece	14	7 800	-	2 008	0	54 700	54 700	0.0%
PEANUTFISH	100 VT/piece	32	31 101	700	700	27 955	19 215	47 170	0.0%
FLOWERFISH	100 VT/piece	19	6 000	628	600	11 902	5 016	16 918	0.0%
ALL SPECIES	99 VT/piece	112 VT/kg	105583703 VT	4695 VT/kg	4151 VT/kg	87390970 VT	210866621 VT	298257591 VT	100%

Table 10. Bêche-de-mer export value by company in 2015-2016. Source: Seafood Verification Agency, DoF.

Species	Total bêche-de-mer export value (VT)										
	Companies									All companies	
	1	2	3	4	5	6	7	8	9		
SURF REDFISH	28 316 000	3 885 000	1 431 730	30 556 000	37 335 760	6 964 000	3 529 275	24 300	1 352 200	113 394 300	(38.0%)
BLACK TEATFISH	13 504 400	69 000	5 667 565	15 693 100	3 163 404	4 524 000	4 759 700	198 000	4 245 000	51 824 200	(17.4%)
TIGERFISH	5 658 000	25 000	5 501 810	9 324 000	1 383 609	2 528 100	2 290 508	29 600	2 645 750	29 386 400	(9.9%)
GREENFISH	1 137 800	65 000	2 079 380	12 571 200	2 259 960	532 450	947 498	15 200	801 000	20 409 500	(6.8%)
BROWN SANDFISH	3 117 900		1 460 761	7 999 200	252 634	4 158 000	2 472 578		922 350	20 383 400	(6.8%)
WHITE TEATFISH	2 383 200		1 312 550	13 885 100	4 400	1 626 900	286 240	185 000	156 300	19 839 700	(6.7%)
PRICKLY REDFISH	3 420 400		991 870	6 141 700	72 272	1 790 000	654 550	17 000	191 400	13 279 200	(4.5%)
DEEPWATER BLACKFISH			74 300	331 500	2 200	7 314 000		9 600		7 731 600	(2.6%)
HAIRY BLACKFISH	207 000		1 623 990	21 600	22 480		135 432		3 199 770	5 210 300	(1.7%)
CURRYFISH	232 200		1 327 120	1 400 400	74 000	242 500	981 865	18 000	39 500	4 315 600	(1.4%)
STONEFISH	1 273 200		93 230	854 750	229 744	276 000	104 820	4 560	1 038 100	3 874 400	(1.3%)
SNAKEFISH	6 000		2 261 010			49 000	206 640		11 150	2 533 800	(0.8%)
LOLLYFISH	396 500	25 000	59 444	492 500	937 880	63 500	306 048		162 010	2 442 900	(0.8%)
CHALKFISH	507 000		130 560		1 319 338	56 400	261 393			2 274 700	(0.8%)
SANDFISH					447 900					447 900	(0.2%)
ELEPHANT TRUNKFISH			41 524		50 756	73 600	69 378		211 400	446 700	(0.1%)
MIXED SPECIES			220 700		3 240					223 900	(0.1%)
BROWN CURRYFISH							120 468			120 500	(0.04%)
AMBERFISH	54 000				700					54 700	(0.02%)
PEANUTFISH							47 170			47 200	(0.02%)
FLOWERFISH					310		14 208	2 400		16 900	(0.01%)
ALL SPECIES	60 213 600	4 069 000	24 277 500	99 271 000	47 560 500	30 198 400	17 187 700	503 600	14 975 900	298 257 800	
	(20.2%)	(1.4%)	(8.1%)	(33.3%)	(15.9%)	10.1%)	(5.8%)	(0.2%)	(5.0%)		

CONCLUDING REMARKS

Similarly to phase 1, the fishery was practically driven by the market in 2015 although the DoF engaged unprecedented human resources in the management and control of the sea cucumber fishery during and after the open season. The exceptionally high economic outputs (~VT300,000,000) were reached at the cost of severe resource depletion throughout the country and the squandering of possible income in the next 5-10 years.
Additionally harvest generated lower-than-expected tax revenue. The DoF did not recover the management costs of the fishery despite the appropriate legal framework in place and the high profits made by the industry.

Nonetheless the approval of the 5-year national management plan for sea cucumber fisheries in July 2015 was a significant achievement although outstanding social and political pressure driven by major natural disasters practically forced the DoF to urgently open the fishery in the whole country and to breach the conditions of the plan.

In practice no catch limit applied during the nationwide 4-month opening of the fishery in 2015 since the minimum size limits and the TACs were not enforced and the number of operating companies was not limited. Moreover the total lift of the moratorium during a short period (4 months) urged the companies to adopt an intensive depletion strategy by providing communities with powerful incentive to harvest sea cucumbers as quickly as possible before the fishery was closed again. This resulted in unexpectedly high fishing effort, catch level and export value at national level with predictable effects on sea cucumber resources. Two species (sandfish and white teatfish) are very likely subject to local extirpation in most islands of Vanuatu.

Lessons learnt from phase 1 to phase 4 management outputs should urgently be incorporated into effective planning of the sea cucumber fishery if one aims at sustaining this source of income in local communities.

4 RECOMMENDATIONS FOR IMMEDIATE ACTION

1) This report highlights some recommendations for immediate action here below. The main objective of these recommendations is to develop a modest sea cucumber fishery sector in Vanuatu by 2021. The sustainable target export value of this fishery is estimated at around VT60,000,000 per year (~15 tons of beche-de-mer), which would generate ~VT20,000,000 per year in rural communities.

2) The last management phase (2015-2016) has clearly showed that there is no room for improvisation in the control of fishing pressure within the sea cucumber fishery in Vanuatu due to highly active market demand. The national management plan (NMPCF) provides guidance for operational management of this fishery in terms of rules, licensing, monitoring and roles as indicated in this report. Future fisheries regulations should strictly refer to this plan to prevent predictable negative fishing impacts and fishery collapse.

3) The Fisheries Management Advisory Council (FMAC) as established by Section 9 of Fisheries Act No. 10 of 2014 should urgently establish a subcommittee for the sea cucumber fishery (CSCF). This subcommittee should be granted the role of monitoring the implementation of the national plan and establishing harvest rules and all related matters (including license conditions and fees). This subsidiary body is needed to make management decisions more powerful and to improve the transparency of the governance process while preventing conflicts of interest and penalizing the breach of management rules.

4) As established in the national management plan, the sea cucumber fishery should be permanently closed except in specific areas in which sea cucumber resources are sufficiently abundant to undergo harvest. The use of area-based and species-specific harvest rules indeed appeared as a condition of success. In main fishery sites, harvest should be based on biomass stock assessment, local TACs and short harvest periods. TACs should be defined in wet weight (whole sea cucumbers) at local level to allow for effective catch sharing, monitoring and control. In secondary fishery sites, the use of very short open seasons (1-3 days) may be sufficient to sustain the fishery while reducing assessment costs.

5) Given the outstanding fishing pressure in 2015, all the sites that were harvested in 2015 should be closed for at least five years to allow for resource recovery. Stock assessments should be conducted in 2020 in priority fishery sites prior opening those sites.

6) Meanwhile, harvest should be authorized and strictly controlled in few sea cucumber fishery management demonstration sites from 2017. The usefulness of such demonstration sites would be fourfold:

i) They will progressively provide awareness of the management strategy throughout the country;

ii) They will provide incentives to promote local stewardship and sustainable fishing practices;

iii) They will provide suitable conditions for learning how to implement the NMPSCF at both local and national levels in practice;

iv) They will allow for developing local capacities for processing sea cucumbers so as to reduce the dependency on foreign investors. Regional collaboration within the Melanesian Spearhead Group countries may be used to encourage learning between fisher communities.

It is suggested to select such demonstration sites in Aneytium island (west and northern reef area including Mystery island) and in Efaté island (western coast including Mangaliliu village, Hat island and Lelepa island). This decision should be validated by the CSCF.

7) The harvest of sandfish (*Holothuria scabra*) and white teatfish (*Holothuria fuscogilva*) should be banned for the next 10 years throughout Vanuatu due to unprecedented low levels of these resources. The harvest of black teatfish (*Holothuria whitmaei*) should be cautiously controlled due to its high market value and overall low abundance.

8) The presence of a fishery officer should be mandatory at processing sites during harvest and established as a condition for authorizing harvest. To account for limited human resources at the DoF, four directions are suggested:

i) The DoF should appoint a costal fishery officer to coordinate the implementation of the plan in local communities. This officer will work across the DoF's administrative divisions.

ii) Several fishery observers of the sea cucumber fishery should be properly trained and commissioned to coordinate harvest and enforce harvest rules. Their roles and responsibilities would be those of authorized officers.

iii) The DoF should work more closely with local communities to engage resource monitors, fishermen associations and provincial officers (area secretaries) in monitoring fishing activities. Resource monitors in sea cucumber fishing sites should also be encouraged to become fishery authorized officers through appropriate training prior to declaring an open season in these sites. Scientific and government bodies may provide guidance for such training.

iv) The number of open areas and duration of open seasons should be limited according to available human resources. A rotational harvest strategy is to be implemented since the DoF does not have the capacity to control harvest on time in many rural areas at national scale while involving all relevant bodies and providing appropriate awareness.

9) As specified in the national management plan, the number of operating processing companies must be limited at national level to facilitate the enforcement of harvest rules while preventing economic loss. Furthermore all companies operating in the same fishing area should operate at the same time to allow for effective control of catch limits while reducing management costs. The same conditions should apply to all processing companies. Specifically research permit should not be granted to any company for processing sea cucumbers into beche-de-mer.

10) The subcommittee for the sea cucumber fishery should discuss the opportunity for a management fee to support the activities of the DoF. For instance such a management fee may be established as a percentage of the estimated total export value of allocated catches and as a condition of processing and/or export licenses.

11) Unfair pricing of sea cucumber catches proved to cause local conflicts that weakened management in communities. The DoF should therefore endorse the role of facilitator to enable fair remuneration of fishers, communities, local leaders and processing and export companies. Minimum purchasing prices per species may be agreed upon between purchasers and sellers based on 2015 and 2016 export value and established as a license condition. Furthermore purchasers should pay sea cucumber per kg rather than by piece.

12) A public forum may be organized by the DoF in Port-Vila in 2016. The objectives of such a forum would be twofold:

i) To widely inform rural communities of the effects of uncontrolled harvest of sea cucumbers on the sustainability of the fishery and income generation. New stock assessments may be performed in previously assessed harvested sites to compare biomass status between well-managed and overharvested sites;

ii) To widely inform rural communities of the management strategy and to gain public support for the NMPSCF, particularly in the event of future natural disasters.

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Appendix 1. Minimum legal size and weight of sea cucumber species in Vanuatu in 2014 and 2015

Common name	Local name	Minimum size		Minimum weight		Maximum pieces	
		Wet	dry	wet	dry	1kg	10kg
Amberfish	Ambafis	40 cm	15 cm	1600g	80g	12	120
Black teatfish	Blak titfis	30 cm	15 cm	1000g	100g	10	100
Blackfish	Blakfis	20 cm	10 cm	340g	34g	29	290
Brown curryfish	Braon karifis	20 cm	10 cm	260g	10g	96	960
Brown sandfish	Braon sanfis	25 cm	12 cm	700g	28g	35	350
Chalkfish	Jokfis	15 cm	7 cm	130g	8g	128	1280
Curryfish	Karifis	35 cm	15 cm	1000g	40g	25	250
Deepwater blackfish	Dipwota blakfis	30 cm	15 cm	660g	79g	12	120
Elephant trunkfish	Elefenfis	40 cm	20 cm	1700g	221g	4	40
Flowerfish	Flaoafis	30 cm	15 cm	470g	19g	53	530
Golden sandfish	Kolten sanfis	25 cm	12 cm	660g	53g	19	190
Greenfish	Krinfis	20 cm	10 cm	150g	4g	222	2220
Lollyfish	Lolifis	20 cm	10 cm	280g	14g	71	710
Peanutfish	Pinatfis	20 cm	10 cm	190g	8g	132	1320
Pinkfish	Pinkfis	20 cm	10 cm	150g	6g	166	1660
Prickly redfish	Paenapolfis	35 cm	17 cm	1300g	91g	11	110
Red snakefish	Red snekfis	30 cm	15 cm	260g	10g	100	1000
Sandfish	Sanfis	20 cm	10 cm	300g	15g	66	660
Snakefish	Snekfis	40 cm	20 cm	340g	14g	73	730
Stonefish	Stonfis	20 cm	10 cm	650g	32g	30	300
Surf redfish	Sefredfis	25 cm	12 cm	500g	30g	33	330
Tigerfish	Taikafis	30 cm	15 cm	800g	32g	31	310
White teatfish	Waet titfis	35 cm	16 cm	1400g	126g	8	80

Appendix 2. Logsheets used for monitoring catch per species (per landing, total landing per boat and day, total landing per day) in each authorized harvest site within the sea cucumber fishery in 2014 and 2015

SEA CUCUMBER LANDED CATCH RECORD SHEET 2015

Vanuatu Fisheries Department *Sheet N°:*

Authorized officer: *Product type:* Date: / / 2015

Bags	Species	Weight (kg)	Pieces (nb)	Fisher name
1				
2				
3				
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6				
7				
8				
9				
10				
11				
12				
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SEA CUCUMBER LANDING LOGSHEET - Vanuatu Fisheries Department

To be filled by Fisheries Observer or Fisheries Authorized Officer.

WARNING: One logsheet per boat, per fishing day and per buyer / processor.

ISLAND / PROVINCE	LANDING SITE	AUTHORIZED FISHING AREA	FORM ID

FISHER NAME(S)	No OF FISHERS	FISHING DATE DD / MM / YY

FISHING METHOD(S)	DEPTH (m)	BOAT TYPE	HOURS FISHING

BUYER / PROCESSOR LICENSE No	PROCESSING / BUYING COMPANY NAME

CATCH				
SPECIES NAME	NUMBER OF PIECES	TOTAL WEIGHT (KG)	PRODUCT TYPE	PRICE PER KG

REMARKS

RECORDER NAME and SIGNATURE	BUYER / PROCESSOR NAME and SIGNATURE	DATE

SEA CUCUMBER DAILY CATCH RECORDS - Vanuatu Fisheries Department

ISLAND / PROVINCE	LANDING SITE	AUTHORIZED FISHING AREA	FORM ID

TOTAL No of BOATS	TOTAL No of FISHERS	FISHING DATE DD / MM / YY

TOTAL DAILY CATCH

SPECIES NAME	TOTAL OF PIECES	TOTAL WEIGHT (KG)	PRODUCT TYPE	PRICE PER KG	BUYING COMPANY NAME

REMARKS

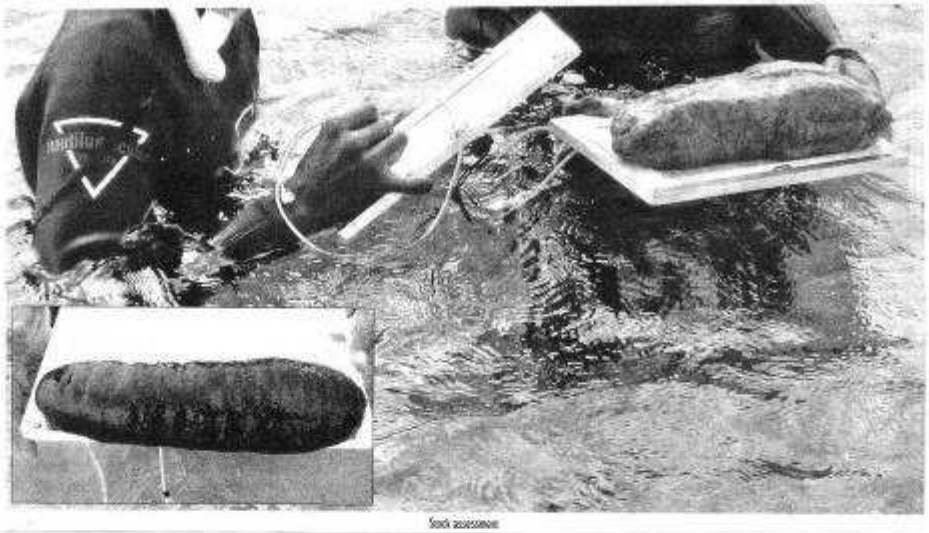
NAME of AUTHORIZED OFFICER	SIGNATURE	DATE

REMINDER : MINIMUM SIZES AND WEIGHTS		
Species name	**Minimum size (live)**	**Minimum weight (live)**
Greenfish	20 cm	150 g
Lollyfish	20 cm	280 g
Surf redfish	25 cm	500 g
Brown sandfish	25 cm	700 g
Tigerfish	30 cm	800 g
Black teatfish	30 cm	1000 g
Curryfish	35 cm	1000 g
Prickly redfish	35 cm	1300 g

Appendix 3. Daily Post Newspaper releases concerning the sea cucumber fishery in Vanuatu from 2013 to 2016

24/04/2013

Current Management Status of Sea Cucumber



Stock assessment

Sea cucumbers are one of the high value inshore fisheries species found in Vanuatu. As top choice delicacy on plate in Asian country, the pressure of harvesting increased over the past years forcing a vast depletion in the stock size of these species throughout the Pacific. Vanuatu Fisheries Department as the authorised government institution responsible for the overall conservation, management and development of fisheries resources in Vanuatu took further steps in sustainably managing the fisheries by putting in place new management arrangements since the mid-2000s.

Sea cucumbers, commonly known as 'beche-de-mer', are leathery skinned sluggish body shaped invertebrate marine species. They are mainly scavengers feeding on rich organic matters lying on the coastal sea beds. They are found along the nearshore areas at depth not exceeding 40 meters. They are distributed all over the inshore bottom areas which cover reef areas, lagoons, seagrass beds, reef drop-offs and beyond. Their distributions and abundances vary among sites and islands in accordance to species characteristics.

Harvesting of sea cucumbers started with the arrival of the first Europeans in the early 1600's. Sea cucumbers were pre-processed through 'boil and dry' methods and exported overseas (mainly to China) for proper processing, value adding and consumption. They are rated as high value species mainly because of delicacy in China but some species (eg. Lollyfish) can also be used for medicinal purposes.

The huge effort in harvesting of sea cucumber since the arrival of the first Europeans in the New Hebrides triggered the attention for proper management. Sea cucumber fishery "boomed" in the 1990s with production peaked at around 70 metric tons of dried beche-de-mer. It used to generate several millions VT per annum to local communities in the past. The boom period however indicated that the pressure from the industry to exploit the resources was beyond the control of communities which resulted in the depletion of the resources in most islands in Vanuatu despite the support of the Fisheries Department. Since the 1990s beche-de-mer exports have continued to decline until the situation prompted the government to declare a total ban in 2007. The first national moratorium was put in place from 1st of January 2008 until the 1st of January 2013.

At the period of five years moratorium, the Department of Fisheries in partnership with the IRD (Institut de Recherche pour le Développement) has conducted several sea cucumbers stock assessment surveys in some islands in Vanuatu. These islands include Reef Island from Torba province, East Santo (Port City, Hog habour, Oyster island, Mavea island, Ice island and Palekula) from Sanma province, South and Northeast Malekula (Maskelynes archipelago and Uri, Litzlitz, Urpive & Crap bay) from Malampa province, and Northern and Western part of Efate (Pele island, Paunagisu, Emua, Moso island, Havannah harbor, Tanoliu, Lelepa and Hat islands, Mangalilu) from Shefa province. There are 13 main commercial species of sea cucumbers around Vanuatu waters. The stock assessments results have indicated that all sea cucumber species have not recovered despite the non fishing period over the past years. In the sites that have been surveyed, the resources weighted only a few tonnes of live animals, which mean that they could not support any commercial harvest. The status of the Lollyfish resources was slightly better in the Maskelynes area than in the other survey sites and than any other species, however this is a low value species compared to sandfish, black teatfish, white teatfish or prickly redfish that were found in very low numbers.

Based on these assessments, the Department of Fisheries through the Ministry of Agriculture, Fisheries, Forestry and Biosecurity has extended the total ban in sea cucumber fisheries for another five years in December 2012. The ban started on 1st January 2013 and will be enforced until 1st January 2018.

The Department of Fisheries is currently defining a National Management Plan for sea cucumber fisheries with the assistance of the SPC (Community for the South Pacific). Indeed management must urgently be changed due to the failure and lack of enforcement of past regulations. This plan will update the minimum harvest size limits of the species and set new additional rules of harvest. In particular stock assessments will be requested prior to opening sea cucumber fisheries in order to determine which species and quantities can be harvested on a site-by-site basis. Areas where sea cucumber stocks are to low should indeed not be opened to fishing to prevent the total collapse of the resources (as it happened before the 2007 ban). Other specific rules will apply to processors and exporters of beche-de-mer. A similar management strategy has been launched by the Northern Province of New Caledonia in partnership with the Vanuatu Fisheries Department and the IRD.

The Department of Fisheries is now working closely with coastal communities around Vanuatu regarding sea cucumber fisheries to enforce the sustainable use of these commercial resources. No harvest is currently authorized in the country. Any fishing of sea cucumber is illegal and should be reported to the Fisheries Department. The expected positive effects of the moratorium on the stocks will be monitored over the years through further assessments in other islands in Vanuatu and also in the previous survey sites. In 2013, the resources will be assessed in South Efate (Eratap & Erakor area) in Shefa province, Aneityum in Tafea province, West Pentecost in Penama province, and Malo & Aore islands in Sanma province. Other communities who would like their resources to be assessed should contact the Department of Fisheries Research Division or Management and Policy Division.

Fisheries undertaking sea cucumber conservation

VANUATU FISHERIES Department is implementing and trialing out a new management regime on the conservation, management, development and utilization of the sea cucumber fishery in Vanuatu when the fishery opens this month. The management regime is based on a "Total Allowable Catch" or TAC system.

Under this regime, TACs have been established for specific areas around four islands in Vanuatu (Efate, Malekula, Espiritu Santo and Pentecost). License will be issued based on the TACs for each species for each area. Based on the total TACs already established for the authorized fishing areas, the new management regime has the potential to bring in almost 5 million vatu in harvest license fees alone. Such high amount of license fee has never been achieved in this fishery since the fishery started centuries ago.

Other fees payable under this regime include the provincial access license which the provincial governments are entitle to collect, community agreements and the export levy. There is strong support from the communities who are the resource owners for this management regime and also from the private sector who wish to be involved in the sea cucumber fishery.

In contrast to past practices, the opening of the sea cucumber fishery will be based on short opening and closed season in the authorized areas only. The TAC management regime will ensure that catches will not exceed the biological capacity of each fishing ground. It will also allow better control and monitoring of the fishery and the TACs that are set to be harvestable for each area, higher returns to government, provincial government and reef owners, high quality beche-de-mer products and less wastage of resources. When the TAC set for the area(s) of a province is reached, that particular province will be closed and another province will be opened. Harvest will be strictly controlled by the Vanuatu Fisheries Department with the assistance of local communities and private sector.

In the Pacific, the sea cucumber fishery has been hampered by weak management resulting in the fishery constantly coming under moratorium. The Vanuatu Fisheries Department has taken the initiative to ensure the fishery is utilized on a sustainable basis.

The TAC management initiative is a collaborative effort between the Vanuatu Fisheries Department, the IRD (Institut de Recherche pour le Développement) and private sector. The IRD has provided some scientific advice concerning stock assessment and management. The IRD scientists have gained experience from a sea cucumber fishery in New Caledonia where the TAC system has highly increased the resources and the returns to fishermen since 2008. The Vanuatu Fisheries Department also collaborates with the Fisheries Division of the Northern Province of New Caledonia to improve the management of sea cucumber fisheries there and in Vanuatu.

Ocean Products Limited (OPL), a company established and owned by Vanuatu's own young entrepreneur and businessman, Mr. Jonathan Naupa has been working closely with the Department in realizing this new management regime. It has taken the Department over two years in preparatory work and design of this management system. Wednesday 19 February 2014 will go down in the history of the sea cucumber fishery in Vanuatu as the date the first license was issued under the new TAC system. This first license totals to an amount of over 2 million vatu.

This is the first time such a high license fee is being paid for in the sea cucumber fishery since the fishery started centuries ago. The new management regime is also part of the draft "Vanuatu National Sea Cucumber Fishery Management Plan" developed in accordance with the fisheries act and which will be approved soon.

For the last 30 years, the sea cucumber fishery had been managed using a centralized management regime with a common license, the "Fish Export Establishment License". This license allowed the licensee to harvest, process and export sea cucumber. The license fee was 100,000 vatu per license per year. Once the license was issued, the licensee could harvest sea cucumber anywhere and how much that was available at his disposal.

Sea cucumber is one of the most valuable fisheries in Vanuatu after the tuna fishery, however, in terms of value, some sea cucumber species achieve higher price per kilogram when processed correctly.

There are over thousand sea cucumbers distributed throughout the world's oceans. They are both an important economical and ecological resources. Most sea cucumbers move slowly across soft and hard bottom areas of lagoons and reefs where they play an important role in cleaning the sea floor. They feed on dead plant and animal materials (detritus) in the sediments. Most sea cucumbers have separate sexes and some species undergo a sexual reproduction. Some species, like the sandfish, are relatively fast growing and reach reproductive maturity within around two years. Other species grow more slowly with lifespan of between 5 and 15 years. Successful reproduction involves fertilization of many millions of eggs, and this requires large numbers of adult sea cucumbers to be present in close proximity. That is the biological reason for controlling harvest in each fishing ground. Fertilized eggs hatch (planktonic larval stages) and drift with ocean currents from two to several weeks before settling on the sea floor as juvenile sea cucumbers. Adults appear not to move very far from the areas in which they settle. Sea cucumbers are not consumed locally by Ni-Vanuatu people, and commercial exploitation is primarily for the production of beche-de-mer for the export market. In the 1920s to 1930s beche-de-mer was an important export commodity in the former New Hebrides.

A total of 23 commercial sea cucumbers species are found in Vanuatu. The presence and diversity of species vary by areas and are determined by habitat type, so target species vary by fishing area. Fishing in the past targeted mainly the medium and high value species but this has changed as high value species become overexploited and fishing effort shifts to the low value species.

21/07/2015

New management plan for sea cucumber

Compiled by Thompson Marango

SEA CUCUMBER OR BECHE-de-mer fishery in Vanuatu will now be managed under a proper fishery management plan.

In his remarks at the signing of the plan on July 10, Christophe Emelee, Minister of Agriculture, Livestock, Forest, Fishery and Biosecurity announced the increasing interest in this product and need for such a plan to ensure resource sustainability and optimum economic benefit to communities.

Fisheries Director, Kalo Pakoa pointed out that "under the Fisheries Act, a fishery of national importance is required to be designated through a management plan".

He said the new "sea cucumber management plan serves to ensure sustainability, transparent licensing system, effective monitoring and provides opportunity for resource owners to derive optimum economic from the resources.

Estimated local buying prices in the MSG countries in 2013 ranged from VT000 vt per kilo dry for the lowest value products to VT9,000 VT per kg dry for the highest value product

"In the new management plan, sea cucumber fishery will be operated by open season to be determine based on resource stock assessment, two types of licenses will be granted, one for buying and processing raw products, and other for buying and exporting of finished products."

Mr Pakoa stated that "Beche-de-mer, also known as "Pacific Black Gold" is a highly sought after product globally in-line with growth in the Chinese market.

"In the Pacific Islands beche-de-mer trade value is estimated at around USD50 million putting it second most valuable fisheries commodity after tuna fisheries."

Sea cucumber is important in Chinese cuisine as a luxury food item for centuries as an aphrodisiac but it is also known to treat a wide variety of illness including certain types of cancer.

In the past 10 to 20 years prices have risen two to four folds, for instance the price of lollyfish (the black sea cucumber commonly found on the reef) used to be Vt20 per kilogram/dry in the 1980s is nowadays Vt1000 per kilogram dry.

Different species produce different products priced differently based on processing stages, type and form.

"In Vanuatu around 20 species of sea cucumber are exploited commercially for beche-de-mer trade.

"Estimated local buying prices in the MSG countries in 2013 ranged from Vt1000 per kilo dry for the lowest value products to Vt9,000 per kg dry for the highest value product," stated the Fisheries Department Director.

"In Vanuatu beche-de-mer is an old commodity dating back around 200 years ago. China is the main market for beche-de-mer and the market is huge.

"Weak fishery management and high demand have led to overfishing in many sea cucumber fisheries around the world."

□ Story continues on page 3

New management plan for sea cucumber

□ From Page 2

In 2008, Vanuatu took the decisive decision to shut down the fishery sector for a period of 5 years which was extended for a further five years in 2013 to allow full recovery.

Due to pressure from buyers, a new regulation was produced to allow limited harvest in 2014.

Three companies were granted licenses to operate to trial out a new harvest strategy based on total allowable catch by species and by area. The trial was met with challenges due to inadequate quality stocks since resources have not fully recovered, resource ownership issues, unfair products pricing, high cost of conducting resource assessment surveys and compliance issues.

According to the new management plan, minimum local buying prices will be implemented to allow fluctuation but not below the minimum price mark.

"Harvesting of resources is not licensed as recognition of resources owners' right over their resources and they do not need fishing licenses to fish from their reefs," stated Pakoa.

"Monitoring and export will be tracked from fishing ground right to export points.

"Many investors have shown interest in aquaculture of sea cucumber."

Meanwhile, aquaculture and ranching can also be an option, but many aquaculture and ranching trials carried out in the tropical Pacific Islands region have not been successful in producing commercial sea cucumber produce.

Pakoa said sea cucumber aquaculture has been very successful in China for one temperate species therefore the success in China does not mean it will work in Vanuatu with our local tropical species.

"So until someone can show us how to make money from sea cucumber farming only then we can learn from the experience. Otherwise, farming sea cucumber is yet a "nice to know" technology and let's be careful putting money in this kind of investment."

Other management plans also signed by Mr Emelee include the Vanuatu plan of action on sea turtle, the Vanuatu International Fishing Fleet Management Policy, and the Vanuatu Monitoring, Control, Surveillance and Inspection Plan.

27/08/2015

Sea cucumber harvest to open on September 1

Licenses restricted to Ni-Vanuatu and joint ventures

Dried sea cucumber. A total allowable catch quota limit has been set at 16 tonnes of fully dried products for the 2015 open season only. Photo supplied by Fisheries Department.

The Vanuatu Fisheries Department has been pressured to open the sea cucumber harvest season in nine selected Islands.

"Due to increasing interest and pressure to open the sea cucumber fishery, the Vanuatu Fisheries Department is announcing the opening of sea cucumber harvest season for the islands of Ambrym, Pentecost and Gaua on September 1, 2015 to 31 December 2015," stated a press release from the Fisheries Department.

Other islands not mentioned will remain close until an assessment is completed by the Department of Fisheries.

A total allowable catch quota limit has been set at 16 tonnes of fully dried products for the 2015 open season only. This open season period will be closed when the total export quota is realized before December 31, 2015 and the season will be closed even if this quota is not reached by 31 December.

The statement informs that two types of licenses will be issued, a Processing License strictly for buying and processing of raw products and Export License for buying and exporting of fully dried product.

"Both licenses are to be held by Ni-Vanuatu citizens only, where there is a joint venture arrangement, the Ni-Vanuatu partner will have the upper hand in owning a license with ownership shares of 49/51.

"Processing license will be issued by area and local islanders will be given preference for this license to promote local participation in this business. The amount of sea cucumber to be processed from an area will be based on total allowable catch as prescribed by the Minister for Fisheries".

Another requirement set out by the Department is Export License holders can also own a processing license for one area but they can purchase processed sea cucumber from other areas.

"Harvesting of sea cucumber is restricted for resource owners only, license holders and foreigners are not allowed to participate in any sea cucumber harvesting activities except for buying, processing and exporting of the finished products".

License application forms are now available at Fisheries Department Office at Paray Bay No 2. Application forms must be completed and submitted to the Director of Fisheries accompanied by an application processing fee of Vt1,000. Licenses will be issued to successful applicants upon payment of specified license fees. The Fisheries Department will work with communities and provinces to monitor all processed sea cucumbers from fishing ground right to export points. For any further information, contact the Fisheries Department on 23119 or 23621 or 5333340.

05/09/2015

Sea cucumber buying prices announced

Sea cucumber buyers licensed by the Fisheries Department will have to abide by new minimum buying prices set out by the Department in this current harvest season.

"Sea cucumber remain one of the oldest marine fisheries commodity some 200 plus years old yet many buyers, processors, exporter continue to charge poor prices to Pacific Island producers for their produces," said a recent media release from the Fisheries Department.

The new buying price sets the 'white teatfish' as the most expensive species with a minimum price of Vt3,200 per kilo for a wet (raw) product and Vt8,000 per kilo for a dry (processed) product.

The minimum price is Vt100 for a wet product of Lollyfish. A processed product of the species is Vt1000.

A total of 17 different species of sea cucumber are covered by the new set of prices.

The new set of prices are applicable to license holders during the current harvest season which starts from September 1 this year to December 31 only on the Islands of Aneityum, Efate, Santo, Emae, Malekula, Santo, Pentecost and Gaua.

"This means buyers can raise their prices above this minimum prices but cannot go below these lower prices. Fishers selling raw products should use the raw product prices and processors should use the dried product buying prices," sated the Fisheries Department.

"This is to stabilize prices and ensuring that resource owners make enough income from their resources."

Processing quality of beche-de-mer product depends on species, forms of the product, size, and processing stage or moisture level. Since the 1980s sea cucumber prices have risen as seen in Vanuatu and continue to rise as supply of wild resource to the Chinese market.

But resources have been over-fished globally and traders are moving all over the word and into deeper oceans looking for fresh supplies. In the Pacific Islands region, many sea cucumber fisheries including the region's main producer — PNG are closed because of over harvesting, this situation further limit the supply of raw sea cucumber and rise in the search for supplies and along with it rise in product prices.

Beche-de-mer prices is the most variable of all the marine fisheries products. A study in the MSG countries (PNG, Solomon Islands, Vanuatu and Fiji) commissioned by the Secretariat of the pacific Community in 2013 revealed local buying prices of dried sea cucumber products in these countries in the order of Vt1000 for the lowest value products to Vt8000 for the highest value products.

What is being received by fishers and processors for their produce in the past is too low. The report amongst its many other recommendations, called for improved management of sea cucumber fishery to improve products prices.

The table above contains the new prices announced by the Fisheries Department.

25/11/2015

Fisheries Department steps up monitoring sea cucumber harvests

The Department of Fisheries is stepping up its monitoring and inspection effort on sea cucumber harvesting operations.

As the end of fishing season draws near on 31st December 2015, fishing pressure has intensified as operators move to increase their activities.

The sea cucumber fishery management plan sets out framework for the conduct of harvest in an open season but this plan was not fully implemented. Pressure from interested local investors to open up for more licenses contributed to derailing full implementation of the plan.

The set license quota limit was not followed, recommended products prices was not used, quota by area was not implemented as it is impossible for Fisheries Department to produce TACs in a short time.

Presence of officers at all sites has been a challenge as more communities are fishing at the same time. Fisheries observers were mobilized in areas in Malekula, Santo and Malo, Pentecost, Efate and Ambrym but they are not able to be in every area at one time. Complaints have been received by communities of poaching in protected areas and illegal harvesting practices on some islands.

Harvesting of sea cucumber is reserved for resource owners only; they do not require a license to harvest resources from their reefs. All the seventeen licenses issued for the four months open season are held by Ni-Vanuatu nationals. Processing License is charged to

buyers for buying and process of products to dried stage, and exporting license for exporting of processed products to overseas market. The split in license is to ensure efficient monitoring of the activities of license holders.
Foreign investors are not permitted to hold a license; however there is a gap in the joint partnership arrangement that allowed some foreign investors to partner with local Ni-Vanuatu interests. This has seen several foreign nationals moving around with license holders.
Two other licenses have been suspended while investigation is being conducted on alleged infringements. In addition the spot fines have been issued to some operators in Vila and Santo. Department is also working with respective chiefs to investigate reports of infringements.
The Department is advising all licenses holders that it will not give any operator any chance. Sea cucumber belongs to the people of Vanuatu and illegal harvesting practices will not be tolerated. Fisheries Department is advising all community leaders to work together when allowing sea cucumber buyers into their reefs and to seek advice from Fisheries Department.

09/08/2016

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LOCAL NEWS

Sea cucumber harvest exceeds expected target

By Harrison Salmon

AROUND 71 TONNES OF BECHE-de-mer was harvested in 2015 in the country exceeding the 21 tonnes quota allocated for the four months season.

This harvest has resulted in overfishing of stocks in some areas in the islands.

Director of Fisheries, Kalo Pakoa, said: "It is important that the fishery is rested for some years to allow recovery.

'At the same time current harvest management need to be strengthened to prevent illegal activities and fair pricing of products."

As a result, sea cucumber or beche-de mer fishery in Vanuatu will remain closed in 2016.

Pakoa made this confirmation to respond to reports that the fishery sector will be open again this year.

Mr Pakoa said the sea cucumber open season in 2015 was a disaster relief to help local communities affected by TC Pam and El-Nino dry spell to get back their lives.

He said during the four months season, over 71 tonnes of dried sea cucumber was exported and over 300 million vatu was injected into the local economy and directly in the hands of village communities.

"There is no similar disaster this year and therefore any intension to open the fishery again in 2016," he said.

The Director confirmed that a local company has a valid Research Permit to conduct trial harvest, processing and exporting activities issued in January 2014 and renewed in 2015 for a further two years ending in December 2016.

"The purpose of this permit is to trial our sustainable harvest, process and exporting of processed products.

"The sea cucumber business is dominated by foreign investors and it is though such trials that we can determine if Ni-Vanuatu nationals can participate in the business without having to enter into joint partnership with foreigners.

"Fisheries Department is closely monitoring the activities of the company for the next 4 months to ensure it operates within the conditions set out in its permit," the Director said.

Around 71 tonnes of beche-de-mer was harvested in 2015 in the country exceeding the 21 tonnes quota allocated for the four months season that has resulted in overfishing of stocks in some areas in the islands. Photo:file