Development of a management plan for Yap's sea cucumber fishery

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Introduction

Yap State is one of four states that make up the Federated States of Micronesia (FSM); the others are Pohnpei, Chuuk and Kosrae. Yap is the westernmost island in FSM, located roughly midway between Guam and Palau. Yap's outer islands stretch eastward for about 1,200 km. Its main islands (also referred to as Yap Proper) consist of Yap, Gagil, Tomil and Rumung (Manoa Mapworks and Sea Grant College Program 1988, see Fig. 1). Yap has 10 municipalities that oversee both Yap Proper and the atolls of Eauripik, Elato, Fais, Faraulep, Gaferut, Ifalik, Lamotrek, Ngulu, Olimarao, Piagailoe (West Fayu), Pikelot, Sorol, Ulithi and Woleai, Satawal, Elato and Faraulap. The total area of Yap's shallow water reefs and lagoons is less than 120 km^2.

The population of Yap State is estimated to be 12,000, with 66% of the population residing on the main islands of Yap Proper, while the remaining 34% live in the outer islands.

Like most other small island states, coastal communities in Yap have limited income earning potential, but their coastal waters are rich in marine life (Hasurmai and Fanafal 2004; Hasurmai et al. 2005) and valuable fisheries resources, including sea cucumbers (Beardsley 1971; Smith 1992; Richmond 1999; Kerr et al. 2007). Although sea cucumbers are not traditionally harvested as a protein source by Yap communities, the fishery has been active for short periods since the 1800s, mainly for export to Asian markets. In the early 1900s, harvests resumed when the Japanese were present after 1914.

Background to recent fishing activity and management interventions

There was a pulse of sea cucumber fishing activity in Yap around 1995, although commercial fishing was quickly stopped due to concerns over the status of sea cucumber stocks and the sustainability of such a fishery within a relatively small reef system. More recently, with an increase in size and demand

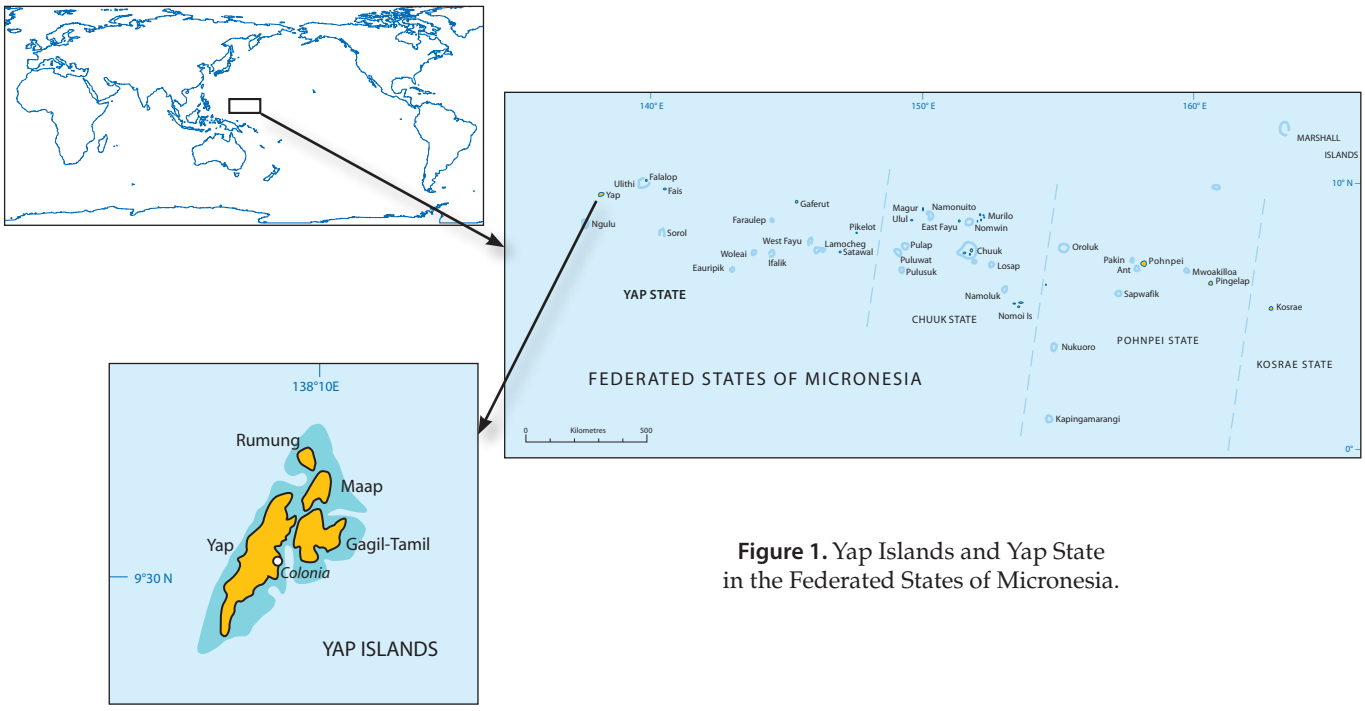

Figure 1. Yap Islands and Yap State in the Federated States of Micronesia.

1. Secretariat of the Pacific Community (SPC), Noumea, New Caledonia
2. Marine Resources Management Division (MRMD) of Yap

from markets in China, which has occurred concurrently with production declines in other parts of the Pacific, fishing effort has again focused on Yap. Fishing activity resumed in 2003, although in late September 2007, there was another moratorium on exports, due to concerns over unregulated fishing. This moratorium was declared to allow time for the development of a management plan that would regulate the fishery. Unlike the situation in other parts of the western Pacific (e.g. Papua New Guinea, Fiji, Solomon Islands) where large interconnected reef systems are associated with large land masses, Yap's smaller and more isolated reef system was recognized as being more susceptible to overfishing.

Recent surveys have documented the status of sea cucumber resources in Yap (Smith 1992; SPC 2006; Kerr et al. 2007), and have identified at least 20 commercial species (Table 1). The surveys revealed signs of impact from fishing pressure (or deficiencies in environmental capacity), but highlighted the fact that stocks were not as depleted as other sea cucumber fisheries in the Pacific, and therefore offered some potential for commercialisation. Although these studies also noted the ecologically important role played by sea cucumbers, the potential environmental impacts of beche-de-mer harvesting are poorly understood. For example, all sea cucumbers extract bacteria and organic matter from bottom sediments, and some are responsible for bioperturbation and oxygenation of the sea floor. Consequently, intensive collection may cause changes to the condition and nature of seafloor sediments with associated unknown impacts on water quality and other resources.

Data from the beginning of the most recent period of export activity are not comprehensive, however when the fishery gained momentum in 2006 and 2007, some data were collected by Yap's Marine Resources Management Division (MRMD). From these records (sourced from the three agents/processors active in this latest activity), the amalgamated exports from Yap State (Yap Proper and the outer islands) reached 17.3 tonnes (t) dry weight for 2007 alone (equivalent to approximately 230 t wet weight). This represents an alarmingly large catch given the limited scale of

Table 1. Marketable sea cucumber species groups found in Yap State. The "premium" and "standard" labelling relates to different management requirements for beche-de-mer exportation.

No	Qualification	Marketable species group	Scientific names
1	"premium"	Black teatfish (BTF)	*Holothuria whitmaei*
2	"premium"	White teatfish (WTF)	*Holothuria fuscogilva*
3	"premium"	Prickly redfish (PRF)	*Thelenota ananas*
4	"premium"	Sandfish and golden sandfish (SandF)	*Holothuria scabra,* and *H. scabra versicolor*
5	"premium"	Surf redfish (SRF)	*Actinopyga mauritiana*
6	"premium"	Stonefish (StoneF)	*Actinopyga lecanora*
7	"premium"	Blackfish (BF)	*Actinopyga miliaris* and *Actinopyga* spp.
8	"premium"	Leopardfish or tiger (TF)	*Bohadschia argus*
9	"premium"	Curryfish (CF)	*Stichopus herrmanni* and *Stichopus vastus*
10	"premium"	Amberfish (AF)	*Thelenota anax*
11	"premium"	Greenfish (GF)	*Stichopus chloronotus*
12	"premium"	Elephant trunkfish (ETF)	*Holothuria fuscopunctata*
13	"premium"	Brown sandfish (BSF)	*Bohadschia vitiensis* and *B. bivittata* and *B. koellikeri*
14	"premium"	Deepwater redfish (DRF)	*Actinopyga echinites*
15	"standard"	Lollyfish (LF)	*Holothuria atra;* can include (PF)
16	"standard"	Pinkfish (PF)	*Holothuria edulis*
17	"standard"	Snakefish (SnakeF)	*Holothuria coluber* and *Holothuria (semperothuria) non flavomaculata*
18	"standard"	Flowerfish (FF)	*Pearsonothuria graeffei*
19	"standard"	Peanutfish (PF)	*Stichopus horrens* and *S. monotuberculatus*
20	"standard"	Chalkfish (CF)	*Bohadschia similis*
21	non commercial	Candycanefish (CCF)	*Thelenota rubralineata*

the fishing grounds. The income derived from the catch would have been significant if large beche-de-mer were exported at market rates.

An examination of 10 t of this export revealed that nine marketable species groups were exported, with the "blackfish group" (*Actinopyga miliaris* and *Actinopyga* spp.) and the "lollyfish group" (*Holothuria atra* and sometimes *H. edulis*) being the most important in terms of weight (Fig. 2). Other records, which shed light on day fishing, showed that in late 2007, up to 1.5 t (wet weight) of the "blackfish group" was being taken by one agent/processor alone, prior to the fishery's closure. This agent bought wet sea cucumbers from resource owners for 21 of the last 30 days before the fishery's closure. This represents an unusually heavy period of exploitation, especially if fishers are solely targeting the correct adult size groups and processing a quality product for market. Anecdotal evidence suggests that the fishery was not operating at an optimum rate during this period, with product sizes and quality compromised. The moratorium and the development of management options were therefore timely.

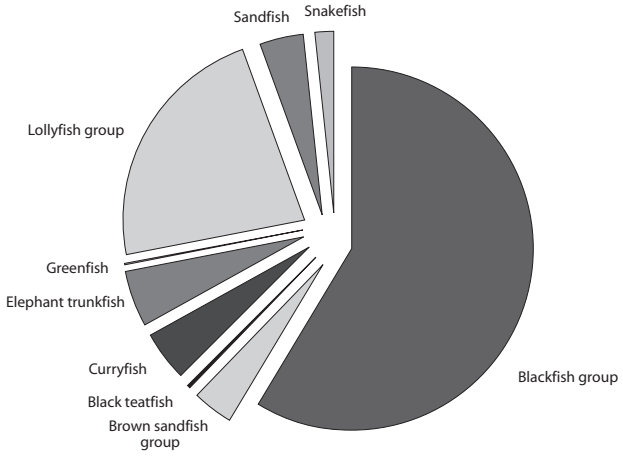

Figure 2.
Indicative breakdown of 10 t of beche-de-mer exports. Data collected by MRMD.

Formulation of a management plan

In June 2008, a management plan for the commercialisation of sea cucumber resources was developed in response to a request for technical assistance by Yap MRMD to the Secretariat of the Pacific Community (SPC).

SPC's Coastal Fisheries Programme assisted through both its management and research sections. SPC draws on data collected by its Reef Fisheries Observatory (a comprehensive database of over 74 week-long, in-water surveys conducted across 17 Pacific Island countries since 2002), and the organization's experience in various management initiatives conducted across the Pacific.

The management plan was developed through a process driven by the government of Yap, resource custodians, and other industry stakeholders, and facilitated by SPC. This ensured the process was as inclusive as possible, and that there was wide ranging, local ownership of the direction and outcome of the management plan from the very start. Management undertakings were identified through discussions held with the Governor of Yap State, the Honourable Sebastian L. Anefal, Lieutenant Governor Hon Anthony M. Tareg, director of the Department of Resources and Development, Michael Gaan, plus resource custodians and stakeholders in general consultations and a two-day workshop conducted in Colonia 17–18 July 2008 (Fig. 3).

Figure 3. Stakeholders' consultations during a two-day sea cucumber management workshop.

The purpose of the management plan is to guide the exploitation, processing and export of Yap's sea cucumber resources. In the absence of any substantive historical data and technical information, and with the limited scale of scientific assessment that has been completed to date, the management plan imposes sensible and locally relevant principles, using a "precautionary approach", to the exploitation of sea cucumbers in order to achieve the overall management vision articulated by stakeholders: "Have community and government cooperation, to sustain harvests and optimise incomes, whilst maintaining reef and local coastal environments". The ultimate goal of the management plan was also stated: "To promote economic improvement for peoples of Yap whilst maintaining sustainable harvest and stock levels."

The management plan is in the process of being finalised, and provides the framework for the state authority to guide the exploitation and harvesting of sea cucumbers in Yap. The recommended management actions require a joint effort and close collaboration between government, resource owners,

communities and agents in order to ensure sustainable utilisation, and to optimise economic returns for everyone.

Below are some important issues related to the process.

1) A management framework for the exploitation of sea cucumbers in the State of Yap (SOY) is only now being developed. In 2008, the SOY put in place an amendment of Chapter 10 of Title 18 of Yap's State Code, especially relating to sea cucumbers (Bill no. 7-57, D2, Yap State Law No. 7-35). Regulations that are to be developed around management undertakings stipulated in the management plan will operate under this new legislation.
2) There is some work needed to get the MRMD, which is a divisional branch office by law under the Department of Resources and Development, formally charged with conservation, management and development of SOY's marine resources, as by statute, the Yap Fishing Authority (YFA) is also mandated to carry out similar, if not the same, role. Efforts to address this overlap in the past have been unsuccessful.
3) The development of a management plan benefits from the social and geographic scale and structure of Yap, and the centralisation of export activity to the capital, Colonia. However, it also needs to address deficiencies in the availability of human capital and finance for ongoing management actions and enforcement.
4) There was consensus in consultative meetings that the management plan be developed around a number of recognised actions that needed to be taken by the main authority (state government and MRMD) and commercial agents. It was recognised early on in consultations that community level initiatives would be difficult to enforce, and therefore these would be allocated, but were usually non-proscriptive (see Foale 2007).
5) The management plan should be clear and readable for the average user, and flexible, so as to allow ongoing development, as more stock information and an understanding of the fishery emerge.

The main initiatives in the management plan are listed below.

- The management plan should cover all operations of the sea cucumber fishery in the SOY, including the outer islands
- Fishing should only be permitted for part of the year (suggested season August–December).
- The Authority should restrict the harvesting and collection of sea cucumbers for export to a specific list (commercial species groups in Table 1). In the matter of new species suggested for export, scientific advice will be sought before they may be considered for inclusion in the export list.
- MRMD should conduct "out of season" independent checks of stock and habitat. An independent survey or stock assessment should be conducted on designated fishing areas at least every two years
- An industry meeting should be convened during the closed season each year, to discuss last season's catches, independent survey results, and submissions from community leaders and fishers. This will allow time for reflection on the status of the fishery and a period for any realignment of management plan settings prior to the opening of the fishery. The option of discussing information prior to a new season, also allows the governor an opportunity to cancel fishing, if there are indications of an intractable problem.
- The number of agents' licences should be limited to a maximum of three.
- Agents should be required to supply completed "Sea Cucumber Buying Sheets" to MRMD (Table 2A).
- Agents should be required to complete "Sea Cucumber Export Sheets" for MRMD (Table 2B).
- All exported sea cucumber products should leave the SOY through one exit point, namely the shipping port / airport at Colonia.
- Agents should be required to present packed products to the Authority two weeks prior to shipping, in order to allow the authority time for product inspection to determine if it complies with the management plan's guidelines.
- Commercial species groups that should be included in this management plan are described as either "premium" or "standard" (Table 1). A quota shall be set for "standard" species groups individually, while a more comprehensive quality control should be implemented for "premium" species groups (Table 3a & b). For export controls of "premium" species groups, shipments will be made and checked in 10-kg packages of beche-de-mer. Each package must only include beche-de-mer from a single "species group" and be labelled so as to be easily determinable for inspections made by the checking authority (for weight and counts). All "premium" species 10-kg packages need to include a maximum rate of dry sea cucumbers set out in Table 3a. The 10-kg packages allow agents to include product with a small weight variation around the specifications for individual dried sea cucumbers, as long as the 10-kg package as a whole complies with the maximum number of sea cucumbers allowed. The 10-kg packaging system also allows the Authority some ease of checking.
- This management plan should be reviewed and adapted to respond to activity and reports, which emerge from the fishery on an annual basis at first. Once the fishery matures, it should be possible to have more secure estimates around man-

agement measures and a review might be completed every two years.
- The use of any compressed air or underwater breathing apparatus (i.e. scuba and hookah) and trawl style nets should be strictly prohibited for commercial fishing.
- Although actions of communities were not controlled by the management plan, due to a lack of capacity for training and enforcement, there was an initiative to assist customary resource owners to designate part of their fishing grounds as reserve areas where the collection of sea cucumbers is prohibited (at least one area in every municipality).
- Increasing sea cucumber productivity through cutting (splitting) should be discouraged in the fishery, and is generally not a recommended approach to increasing the fishery's productivity.

Despite the fact that available information on the fishery's history was scant, and that stakeholders needed to assimilate a large amount of industry and scientific information in order to progress with formulating the management plan, the process went well. The most critical issue now is to ensure that the management plan is legally recognised under the authority of MRMD. This will need the state

Table 2. Record sheets.

A: Buyer Record Sheet

Marine Resources Management Division, Department of Resources & Development, P.O. Box 251, Colonia Yap FSM 96943

Date:_____/_____/_____ Sheet Number:_____/_____

Name of processing company:_____ Recorder:_____

Fisher:_____ Municipality / Outer Island Group:_____

Marketable species group	Wet weight (lb and ounces)	Dry weight (not obligatory)

Comments

B: Export Record Sheet

Marine Resources Management Division, Department of Resources & Development, P.O. Box 251, Colonia Yap FSM 96943

Date:_____/_____/ _____ Sheet Number: _____/_____

Name of processing company:_____ Recorder:_____

Premium species groups		
Marketable species group	Number of 10 kg packages	Total dry weight

Standard species groups		
Marketable species group	Number of bags	Total dry weight

Marketable species group codes.

Premium species groups:

Black teatfish (BTF); White teatfish (WTF); Prickly redfish (PRF); Sandfish and Golden sandfish (SandF); Surf redfish (SRF); Stonefish (StoneF); Blackfish (BF); Deepwater redfish (DRF); Leopardfish or tigerfish (TF); Curryfish (CF); Amberfish (AF); Greenfish (GF); Elephant trunkfish (ETF); Brown sandfish (BSF).

Standard species groups:

Lollyfish (LF); Pinkfish (PF); Snakefish (SnakeF); Flowerfish (FF); ChalkFish (CF).

Table 3. Controls for "premium" and "standard" species groups for dry sea cucumbers (beche-de-mer).

a) Suggested maximum rate of "premium" species groups for dry sea cucumbers (beche-de-mer).

Species group	Wet (live) weight of required product (g)	Recovery rate wet to dry (%)	Dry weight of beche-de-mer (g)	Piece per kg	Maximum piece per 10-kg package
Black teatfish (BTF)	2,400	7.0	168.0	6	60
White teatfish (WTF)	2,500	8.0	200.0	5	50
Prickly redfish (PRF)	3,500	5.0	175.0	6	60
Sandfish (SandF)	750	5.0	37.5	28	280
Golden sandfish (SandF)	1,400	5.0	70.0	15	150
Surf redfish (SRF)	850	5.5	46.75	22	220
Stonefish (StoneF)	650	5.5	35.75	30	300
Blackfish (BF)*	500	5.5	27.5	37	370
Large blackfish (BF)* (*A. palauensis*?)	1,500	5.5	82.5	12	120
Deepwater redfish (DRF)	400	5.5	22.0	45	450
Leopardfish or tiger (TF)	1,000	4.0	40.0	27	270
Curryfish (CF)	2,100	4.0	84.0	14	140
Amberfish (AF)	3,500	5.5	192.5	5	50
Greenfish (GF)	300	3.0	9.0	115	1,150
Elephant trunkfish (ETF)	2,000	10.0	200.0	5	50
Brown sandfish (BSF)	1,000	4.0	40.0	26	260

b) Suggested quota for "standard" species groups per season (2008).

Standard marketable species group	Scientific names	Quota (dry weight, kg)
Lollyfish (LF)	*Holothuria atra*	1,000
Pinkfish (PF)	*Holothuria edulis*	(included with Lollyfish)
Snakefish (SnakeF)	*Holothuria coluber* and *Holothuria (Semperothuria) non flavomaculata*	200
Flowerfish (FF)	*Pearsonothuria graeffei*	0
Peanutfish (PF)	*Stichopus horrens* and *Stichopus monotuberculatus*	0
Chalkfish (CF)	*Bohadschia similis*	0

code to legally recognise MRMD with the relevant powers to promulgate relevant policies and management plans to facilitate fisheries management in the state.

The ongoing overview of Yap's sea cucumber fisheries and the management plan are "works in process" (Richmond 1991). The goal of better managing resources will never be encompassed and finalised in a simple document, and is necessarily tied to 1) changes in law, 2) ongoing capacity building in beche-de-mer recognition, 3) monitoring in-water stock status, and 4) industry development (including post harvest processing). Such developments might also include new initiatives. For example, a private company in Yap is planning to raise sea cucumbers, and there needs to be a process that allows the management plan to incorporate new rules for stock originating from hatchery production, if these sea cucumbers are released into the wild.

There are also a number of weaknesses in the management plan that will need to be addressed over time, notably the control over monitoring the quality of export product. Although cheap to administrate, this end-point control needs to be backed up with awareness raising for community fishers and agents alike, to ensure there is little wastage during fishing and processing. There is also the potential for some larger species, especially in the "blackfish group" (e.g. *Actinopyga palauensis*), to be exported under the current management plan format, but at a size that may compromise the "precautionary approach" ethos. Extra funding will be sought to answer these particular questions as they are identified to strengthen the management process as it moves forward.

The draft management plan has now gone through its last set of changes, as communities and stockholders had a final chance to review the draft document and make comments and suggestions. It is planned that the management plan be professionally edited in August–September 2008, and then printed for distribution in Yap. Presently, SPC and MRMD are formalising management undertakings stipulated in the management plan, as "regulations", which will be promulgated in the near future.

Acknowledgements

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