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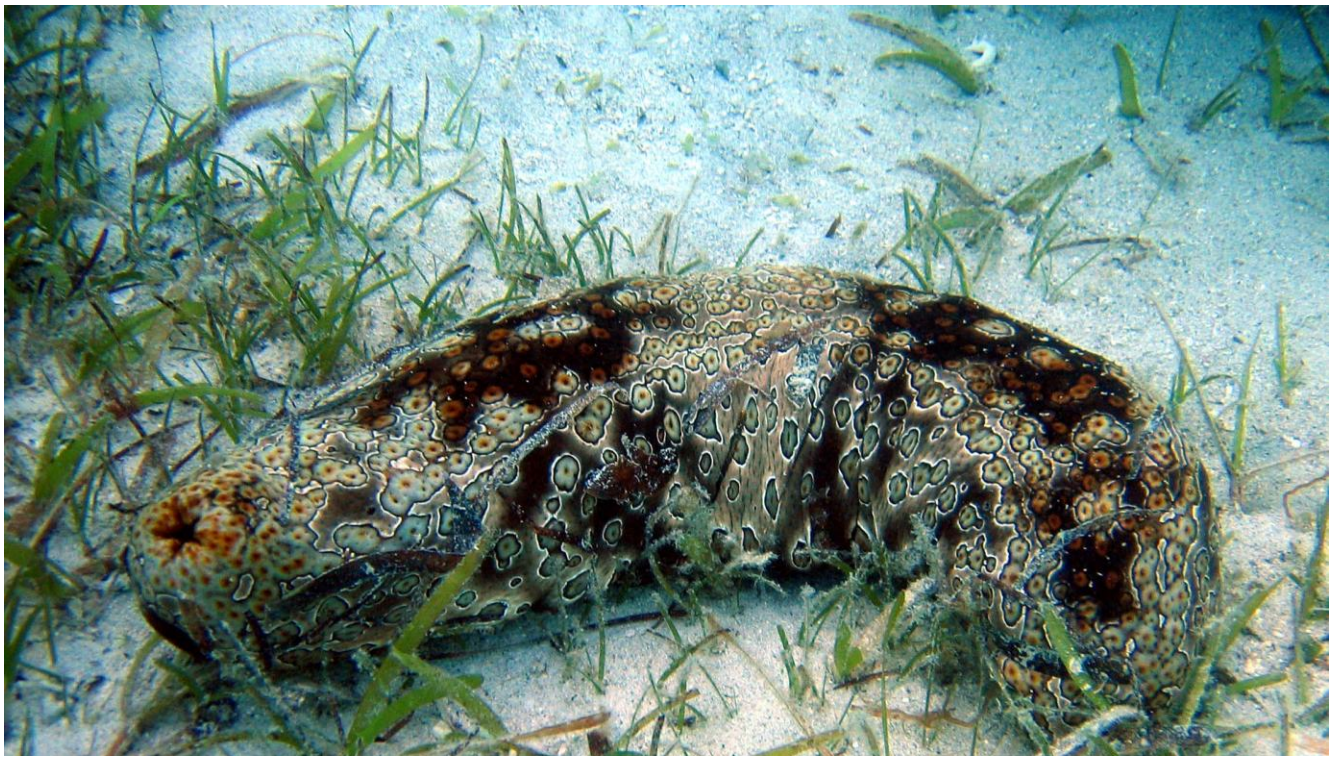
Report of the

FAO Workshop on Sea Cucumber Fisheries: An Ecosystem Approach to Management in the Pacific (SCEAM PACIFIC)

Nadi, Fiji, 15–18 November 2011



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Cover photograph: A live specimen of *Bohadschia argus* (Leopard fish), Ilot Maître, New Caledonia (courtesy of Dr Steven Purcell).

Report of the

FAO WORKSHOP ON SEA CUCUMBER FISHERIES: AN ECOSYSTEM APPROACH TO MANAGEMENT IN THE PACIFIC (SCEAM PACIFIC)

Nadi, Fiji, 15–18 November 2011

Australian Government
Australian Centre for International Agricultural Research

Southern Cross University
National Marine Science Centre

SPC
Secretariat of the Pacific Community

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS DOCUMENT

This report describes the activities and outputs of the workshop entitled *Sea Cucumber Fisheries: An Ecosystem Approach to Management in the Pacific (SCEAM Pacific)*, which was held in Nadi, Fiji, 15–18 November 2011. The report was prepared by Steven Purcell, Southern Cross University, Australia, with contributions and editing from Alessandro Lovatelli, FAO Aquaculture Officer, Department of Fisheries and Aquaculture, Rome.

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ABSTRACT

Widespread overfishing threatens the sustainability of sea cucumber fisheries and the important role they play in the livelihoods of coastal fishers. The SCEAM Pacific workshop was jointly funded and coordinated by the FAO, the Australian Centre for International Agricultural Research, the Secretariat of the Pacific Community and Southern Cross University in November 2011. The workshop brought together fishery managers from 13 Pacific island countries to foster improved management plans for PACIFIC sea cucumber fisheries. Seminars by the workshop facilitators presented contemporary fisheries science and new paradigms for management. Pre-workshop questionnaires, workgroup sessions and plenary discussions were used to help participants decide on appropriate objectives, regulatory measures and management actions for each fishery. The workshop outputs given in this report reveal the constraints and issues facing Pacific sea cucumber fisheries, and the proposed management changes and research priorities of the fishery managers.

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ACKNOWLEDGEMENTS

Foremost, thanks are extended to the 15 participants and their respective fishery agencies for their active participation, which furnished the outputs presented in this report. The workshop was co-facilitated by Alessandro Lovatelli (FAO), Ian Bertram and Kalo Pakoa (Secretariat of the Pacific Community), and Steven Purcell (Southern Cross University). Thanks also go to Nathaniel Cornuet, Luanah Yaman, Gerald Billings and Joyce Samuelu for accepting to give oral presentations on their sea cucumber fisheries on day 2 of the workshop.

The workshop was jointly funded by FAO through the contribution of the Japanese Trust Fund Project GCP/INT/104/JPN on "CITES and commercially exploited aquatic species, including the evaluation of listing proposals (Phase II)", the Australian Centre for International Agricultural Research (ACIAR) and the Secretariat of the Pacific Community (SPC). It gained considerable in-kind support from Southern Cross University, Lismore, and its staff at the National Marine Science Centre, Coffs Harbour, Australia. The workshop gained valuable guidance from Chris Barlow, ACIAR, and Lindsay Chapman, SPC.

ABBREVIATIONS AND ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
BDM	bêche-de-mer
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COFI	Committee on Fisheries
EAF	ecosystem approach to fisheries
FAO	Food and Agriculture Organization of the United Nations
GPS	Global Positioning System
HACCP	Hazard Analysis and Critical Control Point (System)
HDI	Human Development Index
MPA	marine protected area
MSY	maximum sustainable yield
NGO	non-governmental organization
OCTs	Overseas countries and territories
PARDI	Pacific Agribusiness Research for Development Initiative
PIC	Pacific island country
PROCFish	Pacific Regional Oceanic and Coastal Fisheries Development Programme
SCEAM	Sea Cucumber Fisheries: an Ecosystem Approach to Management
SCU	Southern Cross University
SMA	special management area
SPC	Secretariat of the Pacific Community
TURFs	territorial use rights in fisheries
UVC	underwater visual census

BACKGROUND

Widespread overfishing threatens the sustainability of sea cucumber fisheries and the important role they play in the livelihoods of coastal fishers (Toral-Granda, Lovatelli and Vasconcellos, 2008). Sea cucumbers are a key resource, contributing to poverty alleviation for more than three million fishers globally (Purcell *et al*., 2012). They are fished in every Pacific island country (PIC) (Kinch *et al*., 2008) and are a vital marine export commodity for numerous countries elsewhere (Anderson *et al.*, 2011, Purcell *et al*., 2012).

Sea cucumbers are one of the few marine commodities that can be easily stored and exported. Sea cucumber fisheries are one of the top non-finfish income streams for coastal people throughout the Indian Ocean, Southeast Asia and the Pacific. In Australia, sea cucumbers are fished by industrialized methods in Western Australia, Northern Territory and Queensland, and form an important export industry for about 40 indigenous fishers in the Torres Strait (Kinch *et al*., 2008). They are fished in every PIC, and in some countries have become more economically important than finfish exports (Purcell, Gossuin and Agudo, 2009). The average annual export of bêche-de-mer (i.e. dried sea cucumber) from Australia and the Central Western Pacific islands in 2004–2008 was, according to the FAO statistics, 1 300 tonnes worth about US$52 million based on an approximate average export price across species of US$40 per kilogram (Purcell, Gossuin and Agudo, 2009). However, many of these fisheries are suffering unsustainable levels of exploitation, to the point of local extinctions of some species and consequently affecting the livelihoods of hundreds of thousands of fishers.

Owing to inadequate management and/or enforcement, overexploitation of sea cucumber stocks has prompted national fishery closures in Papua New Guinea, Solomon Islands and Vanuatu within the past five years. Also, the overexploitation of certain species has led to recent species-specific closures in Fiji, the Great Barrier Reef and Torres Strait (Kinch *et al*., 2008). The closures are a demonstration that past management systems have failed but, at the same time, also give hope to the future because they show that many decision-makers are willing to take drastic measures to protect these valuable resources.

The Secretariat of the Pacific Community (SPC) has furnished information and support for ecosystem based fisheries management in a broad sense (e.g. Preston 2009 and regional workshops). It has also conducted in-country surveys of sea cucumbers in the PROCFish/C and Co-Fish[1] programmes for 17 member countries, providing comparable estimates of the status of these resources.

In response to the urgent need for improved management, the Australian Centre for International Agricultural Research (ACIAR) coordinated a regional workshop in Motupore, Papua New Guinea, in 2006 and later published a booklet, *Sea Cucumber Fisheries: A Manger's Toolbox* (Friedman *et al*., 2008). Earlier, in 2003, FAO hosted a workshop in the People's Republic of China and published a "Proceedings" with recommendations for improving the management of sea cucumber fisheries (Lovatelli *et al*., 2004). Through funding from the Government of Japan, FAO has just produced a technical manual on the ecosystem approach to managing sea cucumber fisheries (Purcell, 2010) and a simpler guidebook on putting the approach into practice (FAO, 2010). The manuals provide a "roadmap" and guidelines for developing and implementing better management of sea cucumber fisheries.

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[1] Pacific Regional Oceanic and Coastal Fisheries Development Programme (PROCFish/C) and the Pacific Regional Coastal Fisheries Development Programme (CoFish) funded by the European Commission and implemented by the Secretariat of the Pacific Community (SPC). PROCFish/C and CoFish are part of the same programme, with CoFish covering the countries of Niue, Nauru, the Federated States of Micronesia, Palau, Marshall Islands and Cook Islands, and PROCFish/C covering Fiji, Tonga, Papua New Guinea, Solomon Islands, Vanuatu, Samoa, Tuvalu and Kiribati, and the French overseas countries and territories (OCTs) of New Caledonia, French Polynesia and Wallis and Futuna Islands.

While the ACIAR and FAO manuals set the path for more sustainable sea cucumber fisheries, experience shows that fishery managers also need personal assistance in navigating through the many potential regulatory measures and management actions. This assertion is shown patently in the multilateral priorities listed in the recent Apia Policy (SPC, 2008), which include workshops for:

- assistance with the preparation of management plans, particularly for vulnerable species;
- provision of in-country assistance on preparation and implementation of national fisheries policies and management plans for coastal fisheries and ecosystems;
- training in the use of fisheries control and regulation.

To further assist fisheries agencies, a strategy was developed to hold workshops in each major region of the world where sea cucumbers are fished artisanally. To this objective, FAO, ACIAR, SPC and Southern Cross University (SCU) partnered to coordinate the first regional workshop in the Pacific from 15 to 18 November 2011: "SCEAM Pacific". The three-and-a-half day workshop aimed to bring about significant changes to management systems (both regulatory measures and actions by fishery agencies) in 13 PICs, focusing on the approaches within the ACIAR and FAO manuals. Participants were fishery managers or senior fishery officers in charge of the management of sea cucumber fisheries.

OBJECTIVES OF THE WORKSHOP

The workshop aim was to bring about significant change to management systems (both regulatory measures and actions by fishery agencies) in PICs through intensive mentoring in sustainable, and tailored strategies for sea cucumber fisheries and a forum for group-sharing of constraints and lessons learned.

The workshop's specific objectives were to:

- collate and analyse current information from Pacific sea cucumber fisheries on management practices and constraints to their acceptance by fishers;
- inform Pacific fisheries managers about technical aspects of the biology and management of sea cucumber fisheries through an "ecosystem approach";
- assist them in interpreting and putting into practice the advice provided in the recent ACIAR and FAO manuals based on their fishery.

The workshop further aimed at supporting capacity building and active mentoring to the fishery managers and senior fishery officers as a means of bringing about changes to national fishery management plans.

LINKS TO OTHER PROJECTS

The workshop was intended to build strongly upon the ACIAR workshop in Motupore, Papua New Guinea, in 2006 and subsequent manual (Friedman *et al*., 2008). That manual had been well received in the Pacific, but assistance with applying its principles to design new management systems was still needed.

The workshop also capitalized on ACIAR's investments in restocking technology and cost-benefit analyses (Projects: FIS/1995/703, FIS/1999/025).

ACIAR has invested in projects to examine options for improving the management of sea cucumber fisheries in the Solomon Islands (Project: FIS/2003/051) and Papua New Guinea (Projects: FIS/2002/110, FIS/2006/133). This workshop proved to be a timely catalyst in enabling the findings of these projects to be put into action.

The workshop made use of FAO investments in facilitating and promoting better management of sea cucumber fisheries. In addition to using the ACIAR manager's toolbox, the workshop focused around the roadmap, regulatory measures and management actions of the recent FAO manuals on an ecosystem approach to managing sea cucumber fisheries (Purcell, 2010; FAO, 2010).

The SPC has also put much recent effort into information and support for ecosystem-based fisheries management in a broad sense (e.g. Preston, 2009, and regional workshops). It also executed in-country surveys of sea cucumbers in the PROCFish/C and Co-Fish programmes for 17 member countries, providing comparable estimate of the status of these resources. The workshop further applied the ecosystem approach for sea cucumber fisheries and used the recent PROCFish surveys to help the participants to understand stocks in their countries in order to adapt their management plans.

ORGANIZATION OF THE WORKSHOP

Preparation

The project's approach was developed through discussions between FAO, SPC and SCU on the best way forward to helping low-income countries to put into practice the advice in the manuals. FAO suggested that a workshop in each major tropical region of the world with sea cucumber fisheries would be immensely beneficial, starting with the Pacific as the forerunner.

The SCU specialist, coastal management specialists at SPC and the Fishery and Aquaculture Officer of FAO worked together to prepare the agenda and prospectus for the workshop. The agenda and prospectus were sent to the participants prior to the workshop (Annexes A and B). The workshop centred on the principles within the ACIAR and FAO manuals. Each participant was told to become familiar with the principles detailed in these manuals before the workshop.

The host/partner agencies agreed that the requirements for, and issues of restocking depleted sea cucumber populations would be discussed as one of the potential management interventions. However, the stance was to caution participants about the real costs and timeframes for restocking and to at least consider other interventions.

Participants were asked in the prospectus to do their own homework and to become knowledgeable on the history of management measures used in their fishery, current constraints to compliance of regulations by fishers, and constraints within their fishery agency to apply various regulatory measures. Participants were also asked to review the status of sea cucumber stocks and export volumes from their fishery and consult their recent SPC PROCFish/C country report.

The participants were issued with a pre-workshop data form to complete and submit prior to the workshop. The form invited responses on current management regulations, enforcement capacity, management capacity, stakeholder participation and fishing activities (if known). The responses on the forms were collated, and a regional summary used in different aspects of the workshop and in the post-workshop report.

Scope

The workshop concerned only sea cucumber fisheries. The focal region for the workshop was the Western-Central Pacific islands (excluding Australia and New Zealand). Participants were invited only from countries within this region.

Strategies

The organizers intentionally kept the workshop to a small number of participants and did not allow more participants or observers. This strategy promoted greater participation among the fishery managers (participants) and avoided side-tracking discussions from external parties.

The workshop required and received active participation from the invited fishery managers. While the first day of the workshop was seminar-based, the rest of the workshop relied strongly on workgroups. Participants were required to critically examine indicators and management measures used in their fishery and join in group discussions about management problems and solutions.

The seminars provided participants with the most updated information on sea cucumber biology and ecology needed when applying an ecosystem approach to management. The facilitators covered scientifically technical concepts and explained results from recent global analyses of sea cucumber fisheries.

The agenda and facilitators led the participants through the ACIAR sea cucumber manager's toolbox (Friedman *et al*., 2008) to review indicators of stock status and apply them to their fishery.

The current management measures employed in each fishery and their effectiveness were examined. In a similar sequence to the recent FAO manuals on an ecosystem approach to managing sea cucumber fisheries (Purcell, 2010; FAO, 2010), the workshop participants followed the "roadmap" to choose alternative regulatory measures and management actions based on the stock status, management capacity and scale of fishing in each fishery. The recent PROCFish/C resource surveys guided participant countries in both of these activities.

Plenary discussion sessions after most of the workgroup sessions and seminars were instrumental in bringing out management issues and key research priorities from the participants. One plenary session was left as optional on Day 3 and, based on comments throughout the workshop by participants, that session focused on enforcement issues in sea cucumber fisheries.

PROGRAMME, VENUE AND PARTICIPANTS

Programme and venue

The workshop was held at the Novotel Hotel, Nadi, Fiji. Following information and quotes from six other hotels, this venue was selected based on the relatively low pricing of rooms, suitable meeting and break-out rooms, location and amenities (e.g. Internet access).

The workshop agenda is provided in Annex A. In brief, the workshop agenda comprised the following key components:

Day 1 Seminars by the facilitators on fishery indicators, regulatory measures and management actions appropriate for different fishery scenarios.

Day 2 Summary of data from pre-workshop forms.

Short presentations from some participants on their sea cucumber fishery, management measures in place and their effectiveness.

Break-out workgroups to work through stock health indicators for each country from the ACIAR Manager's Toolbox.

Plenary work session on fishery objectives.

Day 3 Break-out workgroups to choose the most practical regulatory measures and management actions for each fishery based on the FAO manuals.

Plenary discussions of key practical regulatory measures and management actions.

Day 4 Workgroup sessions on disparate case studies, showcasing and discussing the challenges and potential solutions.

Plenary discussions of management plans and legislation.

Participants

In coordination with the SPC, participants were selected by the facilitators from at least 11 PICs, based on:

- their intimate involvement in the sea cucumber fishery in their country;
- their position in the agency to influence management change;
- their profile to contribute strongly to the workshop.

Selected participants were sent letters of offer to attend the workshop, with their expenses paid by the project. The letters clearly informed the invited countries/participants that this was a joint FAO, ACIAR, SPC and SCU activity.

Two participants were allowed from Fiji, as the host country and because of its large fishery separated into several regions with different regional managers.

Papua New Guinea was the first country to ask to be allowed to bring a second participant, at its own cost. With the withdrawal of the participant from Wallis and Futuna Islands at a late stage in the workshop planning, Papua New Guinea was granted the second participant (Luanah Yaman), and the Papua New Guinea National Fisheries Agency paid for her travel costs.

David Orrekum from Palau was originally selected to attend but, owing to personal matters a short while before the workshop, he was replaced by Helena Rebelkuul.

The final list of participants and their contact details are provided in Annex D. See also Annex F for a group photo of the participants and facilitators.

Facilitators

Facilitators needed to be knowledgeable on sea cucumber fisheries, have a broad understanding of regulatory measures, management actions and management plans, have skills in public speaking and be capable of leading discussions in a regional workshop.

Four experts facilitated the workshop: Steven Purcell, SCU Research Fellow, as workshop coordinator/facilitator (discipline: fisheries ecology and management), and as co-facilitators Alessandro Lovatelli, FAO Aquaculture Officer (discipline: aquaculture and fisheries development), Ian Bertram, SPC Coastal Fisheries Science and Management Adviser (discipline: fisheries management), and Kalo Pakoa, SPC Invertebrate Fisheries Scientist (discipline: fisheries assessment).

The facilitators jointly chaired and coordinated the workshop. They each gave seminar presentations within their fields of expertise. The addresses and contact details of the facilitators appear in Annex D.

PRE-WORKSHOP FISHERY FORMS

Purpose

A data form was prepared and sent out to participants before the workshop (Annex C). It posed questions about the current constraints in management, resource and technical capacities of the fishery agency, current management regulations, current practices of fishers, stakeholder participation, enforcement capacity and jurisdiction of governance.

Each of the participants submitted responses by multiple-choice answers to the questions, which were collated and presented to them at the workshop.

Results

The results of the collation of responses are given below.

Human resource capacity

- Wide variation in number of scientists with skills to calculate maximum sustainable yield (MSY) for sea cucumber fishery. Fifty percent of countries have no such scientists.
- Generally, a lot of officers responsible for planning and implementing marine reserves; average six officers per agency.
- Generally, two or more fishery officers can identify sea cucumbers; average six officers per agency.
- Wide variation in number of officers trained in export inspections. More than 25 percent of countries have no trained officers.
- About 79 percent of fishery agencies have human resources and skills for underwater visual census (UVC).
- Only 21 percent of participants indicated that their agencies have funding for UVC (every three years).
- Most of the participants stated that it is difficult to obtain information on catch from fishers every month.
- 79 percent of participants stated that it was difficult or impossible to license all sea cucumber fishers in their fishery.
- 85 percent of participants stated that it was easy to license all processors/exporters in their sea cucumber fishery.

Management approach

- 71 percent of fishery agencies had not established formal management objectives for their sea cucumber fishery.
- 79 percent of agencies had not set reference points for their sea cucumber fishery.
- 86 percent of fisheries of the participating countries did not have management advisory committees with stakeholder participation for their sea cucumber fishery.

Current management regulations

- 33 percent of sea cucumber fisheries (represented at the workshop) have a national management plan.
- 50 percent of fisheries (represented at the workshop) have size limits.
- None of the fisheries limit the number of species that can be fished or limit new species from being fished.
- More than 50 percent of the fisheries ban scuba and hookah.
- In 33 percent of fisheries, fishers need a permit and must furnish logbooks.
- A list of all fishers is kept in less than 24 percent of fisheries.
- In contrast, most fisheries have a list of processor/exporters.
- Jurisdictions for enforcing regulations and delivering penalties varied greatly among fisheries.

Current fishing

- In 91 percent of the fisheries, the number of fishers is increasing.
- In 83 percent of the fisheries, fishers are collecting lower-value species more nowadays.
- In 64 percent of the fisheries (represented at the workshop), a wider range of species is now exploited than in the past.
- In 80 percent of the fisheries, the proportion of low-value species in catches is increasing.

Stakeholder involvement and communication

- On average, fishery officers visited 12 percent (±4 percent) of sea cucumber fishers in 2011.
- More than 25 percent of fisheries did not discuss management with any fishers in 2011.
- 21 percent of fisheries send out newsletters or information leaflets to fishers.

Enforcement and inspections

- On average, fishery agencies have fewer than two boats for inspections at sea. Fifty percent of fishery agencies have none.
- In 57 percent of cases, landings are practically never checked. However, in four (out of 13) of the fisheries, officers check landings one or more times per week.
- In most cases, bags of bêche-de-mer are checked occasionally, and in four (out of 13) of the fisheries they are checked regularly.
- In about 50 percent of the fisheries, inspection officers have had training in identifying dried sea cucumbers.

TECHNICAL SEMINARS

The seminar presentations delivered by the workshop facilitators comprised the following:

- status of sea cucumber fisheries: a global overview;
- history and status of sea cucumber stocks in the Pacific;
- management principles, objectives, reference points and the ecosystem approach to managing fisheries;
- assessing status of your fishery stocks: using fishery-dependent, fishery-independent and sociological indicators;
- biological and ecological constraints to classical fisheries approaches in sea cucumber fisheries;
- regulatory measures and their use in sea cucumber fisheries: size limits, gear limitation, catch quotas, logbooks and reporting;
- regulatory measures and their use in sea cucumber fisheries: temporal and spatial closures;
- actions by the fishery manager for improved compliance and adoption of management measures;
- global analysis of management measures and drivers of overfishing;
- a call to action: writing and implementing a management plan.

Presentations were also given by participants from four selected countries with differing management frameworks: Fiji, New Caledonia, Papua New Guinea and Samoa.

WORKGROUP SESSIONS

The facilitators used a number of break-out workgroup sessions during the workshop to enable participants to use the ACIAR and FAO manuals. These sessions broke the participants into 2–4 groups, with objectives to assess the status of their fishery stocks using various indicators, decide on appropriate regulatory measures and management actions, and rank fishery objectives. Regulatory measures, management actions and constraints were also examined more closely for four important case study fisheries. The break-out workgroup sessions were the following:

- decide on stock-health indicators for each country from the ACIAR Manager's Toolbox;
- work through the decision-support table to choose regulatory measures and actions for managers for each fishery;
- case fisheries, identifying main challenges and potential regulatory measures and actions to improve management.

Plenary sessions were useful after certain seminar sessions and for stimulating dialogue on broader management topics. The points from each participant were recorded simultaneously. The plenary sessions also produced some key recommendations for future research and technical support.

Results from workgroup session 1 – Fishery status indicators and decisions

Participants were divided into two groups and helped to work through the six indicators of fishery stock health presented in ACIAR's *Sea Cucumber Fisheries – A Manager's Toolbox*. Responses of "yes" to the questions received ticks in the cells, responses of "no" received crosses, and a question mark was recorded where the answer was uncertain. The collated results of the two workgroups were discussed in a following plenary session and are given in Table 1.

Once the six indicators had been scored, participants had to nominate a decision of the current status of their stocks. Importantly, participants were reminded that this is a decision-support tool and the decision about the stock status depended on other factors. As a guide to support the decision, participants were presented with the following approximate guidelines:

U - *Underexploited* – all ticks; stocks not very affected by fishing historically;

M - *Moderately exploited* – one or two crosses; but stocks appear healthy;

F - *Fully exploited* – one to three crosses or question marks; but fishing is sustainable;

O - *Overexploited* – few ticks; fishing is unsustainable; but some breeding populations still exist;

D - *Depleted* – few or no ticks; fishing is unsustainable; stocks below 10 percent of unfished abundance.

Comments from participants and facilitators during the following plenary session included the following points:

- the exercise could also be useful for different regions even within a fishery;
- other stakeholders (e.g. fishers) could benefit from going through the exercise;
- the process is rather rigid and one must look at the fishery over a longer period;
- one must guess virgin biomass or look at historical catches of high- and medium-value species and see how current catches compare with that;
- the last indicator may not accurately help to describe the stock status because it may not necessarily be more economically efficient for fishers to process their own sea cucumbers.

Results from workgroup session 2 – Regulatory measures and actions for each fishery

Participants were divided into three groups and helped to work through the FAO roadmap to determine the regulatory measures and management actions for their fishery. Facilitators stressed that the tables provided in the FAO manual (Purcell, 2010; FAO, 2010 – see Box 1) serve as a suggested starting point for guidance about what regulatory measures and management actions may be most appropriate for implementing in a particular fishery depending on: (1) the fishery type; (2) the stock status; and (3) the capacity (technical and human resources) of the fishery agency. These three questions and the suggested starting points are effectively the "roadmap" for developing a management plan.

Box 1. Tables from FAO (2010) show the suggested regulatory measures and management actions depending on the fishery type, the stock status, and the capacity of the fishery agency.

What regulatory measures are best to use?

Fishery type	Stock status	Size limits	Gear limitation	Effort and capacity control	Catch quotas	Market chain licensing and reporting	Seasonal and short-term closures	Bands or moratoria	MPAs and no-take reserves	Rotational harvest closures	Area and user access rights
Industrialized	Healthy (underexploited)	✓	?	?	?	✓	?		?		✓
	Fully exploited	✓	✓	?	✓	✓	?		✓	?	✓
	Depleted					✓		✓			
Small-scale	Healthy (underexploited)	✓	?	?	?	✓	?		✓	?	✓
	Fully exploited	✓	✓	?	?	✓	?		✓	?	✓
	Depleted					✓		✓			

What actions should managers take in implementing management?

Fishery type	Stock status	Overview of the harvested species	Fishery-independent stock surveys	Fishery-dependent stock surveys	Socio-economic surveys	Price monitoring	Support local-scale management	Establish management advisory committees	Legislation of management regulations	Assign accountability	Enforcement	Education and communication with stakeholders	Improve quality of processing through training	Restocking
Industrialized or Small-scale	Healthy (underexploited)	✓	✓	✓	✓	?	?	?	?	✓	✓	✓	✓	
	Fully exploited	✓	✓	✓	✓	?	✓	✓	✓	✓	✓	✓	✓	
	Depleted		✓		✓			?	?	?	?	?	✓	?

✓ – Apply as an essential (minimum) measure or action regardless of the capacity of the management institution.

? – Consider applying as an additional measure or action if the management institution has a strong capacity for implementation.

Table 1. Results of workgroup session 1

Indicator	Papua New Guinea	Papua New Guinea	Fiji	Fiji	Cook Islands	French Polynesia	Kiribati	Marshall Islands	New Caledonia	Palau	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
1. Are there still areas where adult sea cucumbers remain protected near the main fishing grounds?	✓	X	✓	X	X	X	X	?	✓	✓	X	X	X	✓	✓
2. Are small-scale, traditional fishing methods mostly used to harvest sea cucumbers?	X	X	✓	X	✓	X	X	X	X	✓	✓	X	X	?	✓
3. Are the abundances of sea cucumbers in the fishery stable?	X	X	X	X	✓	✓	X	?	?	✓	X	X	X	X	✓
4. Are high-value and medium-value species still abundant and well represented in catches?	X	?	✓	X	✓	✓	X	✓	✓	✓	✓	X	X	X	✓
5. Are large-sized sea cucumbers still caught? Is mostly "A" grade bêche-de-mer produced?	X	?	X	X	?	✓	X	✓	?	✓	✓	X	X	?	?
6. Do the benefits from the fishery flow mainly to fishing communities?	✓	✓	X	X	✓	X	X	?	✓	✓	✓	X	X	X	X
Decision	**O**	**M**	**O**	**O**	**M**	**O - F**	**D**	**F**	**F**	**M**	**M**	**D+**	**D**	**O**	**O - F**

Note: Fishery indicators. Ticks (✓) are "Yes"; crosses (X) are "No"; question marks (?) are unsure. **O**= Overexploited; **M**= Moderately exploited; **F**= Fully exploited; **D**= Depleted.

The collated results of the three workgroups are given in Tables 2a and 2b. Notable findings that arise from the analysis of workgroup responses are as follows:

Regulatory measures

- The regulatory measures chosen most frequently were size limits, gear limitation, exporter licensing and logbook requirements, no-take reserves and a small list of permissible species.
- Only one manager chose to limit the number of fishers in his fishery and few decided it would be good to have rotational closures.
- One-third of managers felt that TURFs (area and user access rights) would be appropriate in their fishery.

Management actions

- Most of the managers chose to conduct surveys to gain information on the fishery. This result shows a healthy regard for science in decisions on fishery management.
- All but two of the managers set the support of local-scale management institutions as a priority.
- All but one of the managers decided that management advisory committees would be good in their fishery.
- All but one of the managers set the legislation of management regulations as a priority.
- All but one of the managers set the enforcement of management regulations as a priority.
- Most of the managers decided that communication and communication with stakeholders should be an important part of their management.
- Only two managers (from Tonga and Fiji) decided that restocking was needed in their fishery (and perhaps also for Papua New Guinea).

Results from workgroup session 3 – Selected case study fisheries

Four fisheries, out of the participating countries, were selected for case studies: Fiji, Papua New Guinea, Samoa and Tonga. The case studies aimed to probe the potential regulatory measures and current management constraints in greater detail.

The participants elected to participate in one of the four case study sessions. The groups were invited to discuss idiosyncratic issues within each fishery and were given the following suggested discussion points to develop and comment on:

Management actions

- Key constraints and impediments to improving sustainability.
- How to achieve acceptable enforcement.
- Can advisory committees or local-level management be supported?
- Research or information needs.
- Define (e.g. dot points) the communication strategy with stakeholders.
- Issues with post-harvest processing and trade – how to improve the situation?
- Governance issues.

Regulatory measures

- Specifics about regulatory measures.
- Which species to put on a "permissible list" and how many to allow to be harvested.
- If quotas, how to set these and what level are appropriate?
- How could fishers be licensed? What conditions? Licence fees?
- Regulate number of buyers? Licensing requirements for buyers?
- Are more no-take marine reserves needed and what are impediments?
- Short-term closures – how many? For how long? When?

Table 2a. Results of workgroup session 2 – Regulatory measures determined by participants to be best for future management in their fishery

Country	Fishery type	Stock status	Size limits	Gear restriction	Limit number of fishers	Limit boat size	Catch quotas	Exporters need licence and submit logbook	Fishers need licence and submit logbook	Seasonal or short-term closures	Bans or moratoria	No-take reserves	Rotational harvest closures	Area and user access rights	Set a small list of permissible species	Closure-pulse fishing-closure
Papua New Guinea	SS	O	✓	✓		✓	✓*	✓	✓	✓	✓	✓	✓		✓	
Fiji	Ind/SS	F	✓	✓				✓	✓	✓	✓	✓				
Cook Islands	SS	M	✓				✓	✓	✓	✓		✓		✓	✓	
French Polynesia	SS	F	✓	✓			✓	✓	✓	✓		✓		✓	✓	✓
Kiribati	SS	D	✓	✓		✓		✓							✓	
Marshall Islands	SS	M	✓	✓			✓	✓	✓	✓						
New Caledonia	SS	F - O	✓	✓	✓	✓		✓	✓			✓		✓	✓	
Palau	SS	M	✓	✓		✓		✓	✓	✓		✓		✓	✓	
Samoa	SS	F		✓						✓		✓	✓		✓	
Solomon Islands	SS sector Ind sector	D+	✓ ✓			✓ ✓	✓		✓	✓			✓	✓	✓ ✓	
Tonga	SS	D	✓				✓	✓	✓		✓	✓			✓	
Tuvalu	SS areas Ind areas	F F		✓ ✓			✓	✓ ✓				✓ ✓				
Vanuatu	SS	O	✓	✓		✓	✓	✓			✓	✓			✓	

***** Needs to be species-specific quotas.

Note: **Ind**= Industrial; **SS**= Small-scale; **O**= Overexploited; **M**= Moderately exploited; **F**= Fully exploited; **D**= Depleted.

Table 2b. Results of workgroup session 2 – Management actions determined to be best by participants for future management in their fishery (ticks)

Country	Fishery type	Stock status	Overview of the harvested species	Fishery-independent stock surveys	Fishery-dependent stock surveys	Socio-economic surveys	Price monitoring	Support local-scale management	Establish management advisory committees	Legislation of management regulations	Assign accountability	Enforcement	Education and communication with stakeholders	Improve quality of processing through training	Restocking	Supply-chain restrictions & auctioning
Papua New Guinea	SS	O	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	?	✓
Fiji	Ind/SS	F		✓		✓		✓	✓	✓		✓	✓		✓	
Cook Islands	SS	M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
French Polynesia	SS	F	✓	?	✓	?	✓	✓	✓	✓	✓	✓	✓	?		
Kiribati	SS	D	✓	✓	✓	✓				✓		✓		✓		
Marshall Islands	SS	M	✓	✓	✓	✓		✓	✓	✓	✓	✓				
New Caledonia	SS	F - O	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		
Palau	SS	M		✓	✓		✓	✓	✓			✓	✓	✓		
Samoa	SS	F	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Solomon Islands	SS sector Ind sector	D+	✓ ✓			✓ ✓	✓ ✓		✓ ✓	✓ ✓	✓ ✓		✓ ✓			
Tonga	SS	D	✓	✓		✓		✓	✓	✓			✓	✓	✓	
Tuvalu	SS areas Ind areas	F F	✓ ✓		✓ ✓			✓ ✓	✓	✓ ✓		✓ ✓				
Vanuatu	SS	O	✓	✓	✓	✓	✓	✓	✓	✓	?	✓	✓	✓		

Note: Question marks are for management actions that the fishery manager will consider further. **Ind**= Industrial; **SS**= Small-scale; **O**= Overexploited; **M**= Moderately exploited; **F**= Fully exploited; **D**= Depleted.

The key issues discussed in the case-study groups were presented in a plenary by the manager of that fishery. The summaries of the case studies as provided by the fishery manager are as follows:

Tonga

- A key constraint and impediment to improving sustainability is political pressure.
- Use of scuba and hookah has resulted in four recent deaths. One solution could be that people hiring or buying scuba gear need to show their scuba certificate in order to purchase or rent. Those licence numbers should be recorded.
- Can advisory committees or local-level management be supported? There are special management areas (SMAs) already in place. There is an enforcement officer in each town, in charge of enforcing regulations.
- There are many important research and information needs in the Tonga sea cucumber fishery. In particular, more research is needed on biology of the sea cucumbers in Tongan waters to adequately determine size limits. Ongoing monitoring is also needed to assess stock status.
- In terms of the communication strategy with stakeholders, there is not enough consultation with fishers at present about management plan.
- There is a problem concerning post-harvest processing because the fishers in Tonga do not have the authorization to do the processing themselves. The management regulations should be changed to allow fishers to process their catch, but in tandem with a booklet and training.
- Subsistence species are currently banned.
- A shortlist of the other commercially exploited species was viewed as a good regulation to include in future modifications to the management.
- Quotas in Tonga have been hard to enforce.
- Licensing of fishers should be achievable. Oblige fishers to have a licence but make the fee nominal (e.g. 10 Pa'anga or US$5.9).
- Currently, there is a six-month fishing season, but the annual harvest per year is still too great. Shorter seasons, e.g. 3 × 1 month per year, will be considered.

Samoa

- Communication with stakeholders could be improved through radio talk-shows, news items published in local papers slot and quarterly news letters.
- The fishery department needs to facilitate training in post-harvest processing and trade of sea cucumbers.
- Governance issues are not so apparent because Samoa is at the beginning of the process in management plans.
- A short "permissible list" of species that can be harvested should be useful, and should probably exclude the high-value species. The list would mostly comprise medium- and lower-value species. There should be no harvesting of subsistence species for export. The list should be based on stock assessment.
- Quotas, if set, should use a precautionary approach. They should be based on the biomass of legal sized species, not based on a proportion of the whole population.
- They cannot license all fishers because there is so much subsistence fishing at small scales.
- The fishery department will try to regulate the number of buyers and the number of exporters.
- The fishery department has little say in whether villages can increase the number or size of no-take reserves. This is not under the Fisheries Agency jurisdiction. This is decided by the community.
- Short-term closures are not needed for subsistence, but needed for commercially exploited species.

Papua New Guinea

Management actions and issues

- The key constraints and impediments to improving sustainability are as follows:
    - geographical diversity,

- large number of fishers, not licensed,
- large number of buyers, currently not licensed,
- many exit points for product to be traded,
- previously, quotas were set on the basis of profits,
- weak enforcement.

- Enforcement could be better achieved by controlling exporters and buyers. Need memoranda of understanding with police and navy to assist in enforcement.
- The group agreed that advisory committees or local-level management should be supported. There is a national advisory committee already. The fishery agency sets the function of the committee, provides travel and per diems for committee members.
- The most important research or information needs are:
  - habitat mapping needed – key area for research,
  - more surveys on status of stocks,
  - providing awareness to communities (information need) and give communities monitoring tools suited to villagers,
  - more socio-economic information from surveys.
- The communication strategy with stakeholders needs has been fairly diverse. The strategy still needs to be defined at different levels (government level, community level) and needs to be developed at the right level for the audience. The communication needs to be two-way, i.e. involve feedback from the fishers and stakeholders.
- Post-harvest processing and trade could be improved by training of fishers in processing. Previously, training was provided to fishers, but this needs to be repeated periodically.
- An important issue in governance is communication within government. Some policies are not filtering down to communities. The wide diversity of the area is a significant challenge.

Regulatory measures

- A short "permissible list" of sea cucumbers that can be fished has not yet been applied, but will be considered. Transboundary trade is an issue in this regard.
- Quotas, have not been an effective, or easily implemented, tool in the Papua New Guinea sea cucumber fishery.
- Licensing of fishers would be very difficult, owing to the number of them in Papua New Guinea. They are the resource owners, so limiting fishers would infringe on their rights to the resource.
- Regulating the number of buyers and licensing them should be a useful tool. Buyers should be licensed, and perhaps to specific areas within Papua New Guinea. Purchasing receipts will be considered.
- The main impediment to increasing the use of no-take marine reserves is that there is no legal framework for implementing within the current legislation.
- Short-term closures were previously imposed once per year. The closure was set when sea cucumbers were believed to spawn most.

Fiji

Management actions

- Key constraints and impediments to improving sustainability:
  - monitoring and control of resources (sea cucumber):
    - scattered islands (dispersed fisheries),
    - difficulties in communication,
    - data captured is only from monthly reports.
  - law and enforcement (existing legislation),
  - sea cucumber fisheries management plan (individual qoliqoli areas),
  - absence of national fisheries management plan,
  - increased development inland has a rippling effect on the sustainability of stocks ,

  - lack of information sharing between stakeholders (NGOs),
  - limited alternative source of income stream,
  - identified as a priority fishery by national agency.

- How to achieve acceptable enforcement?
  - strengthen data collection,
  - strengthen existing regulations in place (scuba and size limit),
  - strengthen existing penalties,
  - establish a coastal enforcement unit,
  - train "enforcement officer" in enforcement activities.

- Lack of logistic capacity is a constraint (officers need to be well equipped).
- Also problematic in enforcement of regulations is the absence of a legal framework (fisheries – police = judicial).
- Honorary fish wardens are currently in place and are paid an allowance.
- Advisory committees could be both provincial management committees and national fisheries councils.
- Research or information needs:
  - size at first maturity for commercial species in Fiji,
  - data analysis on existing data for an overview of the fishery (distribution, fishing activities/method, etc.),
  - market chain analysis.

- The stakeholders include the following:
  - exporters/processors:
    - national fisheries council,
    - bêche-de-mer (BDM) council,
    - commodity task force.
  - non-governmental organizations,
  - national fisheries council – considers conservation issues,
  - fishers/communities – requires community awareness and provincial council meetings,
  - government agencies,
  - regional institutions.

- Issues with post-harvest processing and trade – how to improve the situation?
- Improve primary quality control.
- Training of officers (processing methods) to improve data information to fishers.
- Processors prefer fresh sea cucumbers, but distant fishers are processing to dry.
- Trade should comply with HACCP standards.
- Processor [Quota] control (how much buying vs. exporting).
- Key governance issues include the absence of a national management plan and the fact that there is a general governance structure is in place but none specifically for sea cucumbers.

Regulatory measures

- Fiji needs to determine what species would be best to put on a permissible list for fishing and which ones to exclude. Steps to take include an overview of the fisheries, an analysis of current existing data (species composition), then an informed decision about species to include on the permissible list.
- There should be restrictions on the harvest and trade of rare species.
- Fiji needs more consultation on the implementation of quotas.
- Existing fishers should be licensed.
- There should also be a business licence for traders and exporters. Exporters currently need to request for an exportation permit each time they export product.
- Need to regulate buyers' licences (fish and sell).

- There may need to be a ban/moratorium on sea cucumbers at the provincial level or the national level.

PLENARY SESSIONS

Day 1 – Indicators, ecosystem approach to fisheries, data in the Pacific

- Ecosystem approach to fisheries (EAF) – we need to understand the longer timeframe needed to implement EAF because it is more holistic.
- Mangers need to be careful looking at mono-specific data to understand indicators or a fishery when the fishery is multi-specific. We also need to look at, and understand, densities of species other than those most important commercially.
- Managers may wish to look at the biomass of the stock in addition to abundance. However, the two measures can give different views of the resource, so they need to be used cautiously.
- One downside of implementing management under EAF is the investment in time, but the advantage is having a holistic management that should be more durable in the long term.
- EAF is a multi-sectoral approach that includes different stakeholders.
- Papua New Guinea still had problems with resource sustainability despite good science about stock abundance and MSY and quotas. Recruitment overfishing is the biggest threat to sea cucumber populations. Quotas do not prevent fishers from collecting from new areas or collecting small animals that have not yet spawned. It may be useful to have a bioeconomic model to gauge when best to re-open a fishery. Under-sized seas cucumbers may be lower-priced but have become more important in the Chinese markets. The fishery managers need to understand economics of the fishery and trade. A big problem in Papua New Guinea was export of animals under the size of first sexual maturity.
- Chinese markets have opened up to a wider variety of product forms. The purchasing power of Chinese consumers (and the market) has increased markedly. This means the incentives to overfish sea cucumbers in the Pacific and elsewhere (in order to supply markets) will persist.
- The technical capacity to conduct surveys is now established within fishery agencies but funds are generally limited to conduct them. Also, the problem of overexploitation is common but the solutions will be different. It would be useful to include Chinese traders in sea cucumber fisheries management – they should not be excluded from the management issues.
- A number of very low-value species, previously never considered valuable, are now exploited more and more in some countries. More information is needed about the ecological damage to reefs from destructive fishing practices (e.g. turning rocks over to collect snakefish).
- Scaling up the sampling area needs careful consideration for surveys. We need to consider at what scale we are using indicators when assessing fisheries: do the indicators refer to local-scale data, provincial scale or national scale?
- There is increasing pressure within fisheries, not just by traders, but also proponents of sea ranching. Somehow, more collaboration among PICs is needed.
- More broadly, support and funding for sea cucumber management needs to be set as a priority at the FAO Committee on Fisheries (COFI) if countries believe they need more support in this area. There will be a COFI meeting in March 2012. In the last COFI meeting, there was no mention of sea cucumbers, which makes it harder to gain funding for sea cucumber projects. The work programme of FAO is based on priority issues raised at COFI. If more support is desired, then the fishery managers in the Pacific need to propose sea cucumber management as a priority issue at COFI. Participants should ask their ministers to raise the issue of sea cucumber fisheries at the next COFI meeting if this is a priority.

- The issue of funding and projects for sea cucumbers needs to be raised as a priority on national agendas.

Day 1 – Biology, ecology and regulatory measures

- There are some examples of logbook sheets from New Caledonia and Tonga.
- Not a great deal is known about connectivity of sea cucumber populations among countries, apart from the Pacific black teatfish (*Holothuria whitmaei*) and the sandfish (*Holothuria scabra*). More research is to be done in this area.
- Most of the information available on size at first sexual maturity comes from the work of Chantal Conand in New Caledonia during the 1980s. Few similar studies have been done elsewhere. This is a problem because New Caledonia is at relatively high latitude (22–24 °S) and conditions are very seasonal. More research is needed elsewhere in the Indo-Pacific, especially at lower latitude (nearer the equator).
- Animals are believed to be effectively spawning at the size at first maturity stage but, at that stage, the animals produce only a small number of eggs or sperm relative to large adults. For example, a small female may produce only a couple of hundred thousand eggs, whereas a large one could produce tens of millions of eggs in one spawning.
- Poor enforcement is a problem in sea cucumber fisheries. Management measures are often borrowed from ideas in other fisheries, but can they be enforced? Logbooks have to be tailor-designed for the fishery. Issues in some fisheries relate to the high number of fishers – how to require logbooks from all of them?
- Regarding minimum size limits, is it necessarily good to have size limits that allow the best reproducing animals to be fished.
- The longevity of sea cucumbers was something that some participants found hard to come to terms with. We need a post-graduate student to take on a project of size-at-first-maturity of sea cucumbers at locations other than New Caledonia. This needs to be put as a recommendation for research. Even from New Caledonia, it would be good to know size-at-first-maturity for other species not studied by Chantal Conand.
- Research is also needed on the environmental effects of gutting, or processing sea cucumbers on the reef. This issue was raised by fishers in Kiribati.

Day 1 – Afternoon plenary on management actions

- There are significant limitations in countries to apply management actions. Translocation of broodstock has been used with other species.
- Restocking should really be considered as a last approach. Compliance training for improved enforcement is needed.
- Papua New Guinea has a fairly successful programme of enforcement of officers. There were three or four examples of sea cucumber fishery infringements taken to court.
- The issue of processing sea cucumbers is a contentious one in Tonga. Usually, the big processors are also the exporters in Tonga. Other processing forms, like vacuum packaging, may not be so easy for some communities.
- Regarding the closure-pulse fishing-closure strategy, this strategy may be interesting for some fisheries from the point of view of the community understanding the management principle.
- Legal systems often have priorities for other offences. They tried an "instant fine" system whereby, the fishery officers can give an immediate fine on the spot. Fines have been too small in the past.
- Restocking is often done as a politically appealing intervention. This can sometimes occur even before management plans have been put in place to manage the problem.

- The management plan should best state that the revenue from fines on fishers and exporters should be ploughed back into managing the fishery.

Day 2 – General management issues

- Sometimes communication with fishers is done sporadically or periodically by the fishery agency.
- Many fisheries find difficulty complying with size limits because when animals are dried they can shrink to below the minimum size limit (but were legal size before processing).
- Enforcement in low Human Development Index (HDI) countries is a difficult problem not easily addressed. Does support from enforcement need to come from NGOs?
- The results presented on yield per fisher vs. participation rate were interesting for the participants. It will be socially unacceptable to limit the number of fishers in some countries, like Kiribati and Papua New Guinea. In Kiribati, they are trying to address problems in fisheries through alternative income streams.
- Enforcement is difficult partly because exports can follow very different supply chain routes – some by courier, some by container, some illegally.
- There is an emerging market for ground sea cucumbers (e.g. lollyfish) as a medicinal product, as is now seen in Fiji. This raises some problems for enforcement of management and trade regulations. There are many marine protected areas (MPAs) and MPA programmes, but these interventions rarely are accompanied by alternative income sources to compensate for loss of fishing grounds.
- Fishery officers in New Caledonia can inspect and identify dried product but are not vested with powers to enter premises or give fines. That may be a constraint in other fisheries.
- In the Solomon Islands, fishery officers (from level 5 and up) are vested with powers to enforce.

Day 2 – Fishery objectives

This plenary session aimed to identify and rank fishery management objectives for the Pacific countries represented in the workshop.

Participants were first asked to list a broad scope of objectives that they felt were important in their fishery. That was achieved in plenary. After ten objectives were identified and the wording was improved, each participant was allowed 10–15 minutes to privately rank each objective in order of importance in their opinion for their fishery. The objective considered most important was ranked 1, the second-most important one was ranked 2, and so on, until the least important objective, which was ranked 10. Ties were not allowed.

Table 3 gives the objectives proposed by the participants and the ranks that each of them gave.

The objective ranked most important, on average, by the fishery managers was no. 6: Maintain stocks of sea cucumbers at levels that sustain population turnover to retain stock size and remain at viable population levels over time. In a distant tie for second place in average importance, the fishery managers also wanted to see that fishing was managed to consistent levels over time, maintained employment opportunities and did not adversely affect ecosystems (nos. 1, 4 and 5).

Day 3 – Special session on enforcement in sea cucumber fisheries and trade

Problems in applying stronger enforcement

- Fiji has extension officers, but there are few enforcement officers in coastal fisheries.
- There are no enforcement officers for coastal fisheries in Tuvalu.

- Kiribati has one enforcement unit, but it focuses on tuna. One person is responsible for enforcement of sea cucumber regulations, but lacks skills for identifying sea cucumbers and carrying out enforcement.
- The agency for enforcement in New Caledonia has responsibility for other sectors, so sea cucumbers do not receive much attention. However, recently the fishery officers have been given some limited powers to report offences, and their reports have more influence in court cases. Landing of products by fishers is very dispersed, so enforcement of fishers or landing sites is very difficult.
- A problem in some cases because some fishers using scuba for other types of fishing where it is permitted (e.g. aquarium fish collecting).

Resources needed for enforcement

- Some places may need two enforcement officers in order not to feel intimidated by exporters, to minimize corruption, and to allow bags to be inspected.
- Boats are needed for inspections at sea.
- Identification cards are needed for all species, showing dried product. The identification cards, or ID sheets, should not only include the photos and descriptions, but also the legal minimum size limits.
- Inspection officers should be trained to use digital cameras for evidence for later court cases. For example, official procedures may require that the date is set correctly and verified.
- Training in how to use the Global Positioning System (GPS) for inspections at sea. Skills are needed by fishery officers to download waypoints and plot them onto maps – particularly for marine reserve infringements.

Skills/capacity needed for enforcement

- Inspection at sea requires boat drivers.
- Identifying live sea cucumbers at sea or at landing sites.
- Identifying dried sea cucumbers at processors and exporters.
- An understanding of what dried product looks like and different species feel.
- An understanding of what constitutes underwater breathing apparatus and other gears like lead "bombs". This could include examples of what different gears look like.
- An understanding of vested powers of enforcement officers. What do they have the right to do during inspections?
- Knowledge about trade modes – e.g. by air, ship.
- Skills for reporting about inspections to a standard for court cases (how to write about facts so reports are not dismissed as evidence in court).
- Diplomacy or conflict resolution or "emotional control".
- Basic safety and self-defence is also needed.
- Understanding about the biology, reproduction, fishery ecology and trade of sea cucumbers.
- Understanding about the processing stages and how they will change the size of the product.

Where to apply enforcement

- Where to go: at sea, landing sites, processors, exporters.
- Fishery regulations (e.g. permissible species and sizes) should best be enforced at export sites, but some enforcement at landing sites is still useful.

- For inspecting landings, it is useful to go with the processors when they go to buy the product in order to better record all of the fishers.

Modes/methods of enforcement

- Fishery departments should oblige the exporters as part of the licence that they have to keep the bags out of the shipping container for inspections before they send consignments.
- One strategy is for the enforcement officer to inspect a small number of random bags of sea cucumbers (e.g. six out of 50 bags). The bêche-de-mer should be measured, and the percentage of undersized product recorded.
- There should be a way (e.g. by customs) to seal containers after inspections.
- Use a ruler and measure total length along the ventral surface.
- Enforcing weight is very difficult and calibrated scales are expensive and have to be officially and regularly calibrated.
- For moratoria, there needs to be a regulation on exporting, as well as collecting sea cucumbers, otherwise it leaves a loophole for fishers to still collect and stockpile the product.
- The regulations stipulate that fishers must carry their fishing permit with them and have the boat licence number on the permit.

Inspection of gear

- One constraint is that boat and field officers are needed in order to control fishing gear such as scuba.
- Inspections at sea may be difficult for the fishery agency, but some agencies (e.g. Tuvalu) do not have difficulty in inspections at sea.
- Enforcement officers may need to take photographs at sea as a mode of evidence.
- A good idea is to state in regulations that fishers cannot have scuba gear or other banned gear in the same boat, or in their possession, as harvested sea cucumbers.
- At Kiritimati Island (Northern Line Islands, Kiribati), some aquarium fishers use scuba to collect sea cucumbers, but still collect some sea cucumbers opportunistically. This makes it a problem for banning scuba because those fishers would be excluded from collecting sea cucumbers.
- Perhaps permits for using scuba for collecting other resources should state the products that can only be collected on scuba, i.e. the regulations forbid the use of scuba to collect other products such as sea cucumbers.
- The regulations and legislation should allow for concessions/exemption to collect sea cucumbers on scuba for research or broodstock for aquaculture.

Lessons learnt

- There is a template in the Cook Islands because there has been training on enforcement for the bonefish fishery. Perhaps templates could be shared among fisheries within a country and among countries.
- Some export permits elsewhere specify certain days of the week that exporters can ship out sea cucumbers.
- Evidence is a key issue for court cases. GPS units should be used by the enforcement officers, but in some cases the defence lawyers can argue in court that the GPS used by officers was not calibrated. Therefore, the equipment used needs to be officially calibrated and verified by experts before being used by the enforcement officer.

Table 3. Results of the plenary session on fishery objectives

Ranking	Objective	Cook Islands	Fiji	Fiji	French Polynesia	Kiribati	Marshall Islands	New Caledonia	Palau	Papua New Guinea	Papua New Guinea	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
1	Sustain fishing rates at a consistent level over time	5	1	8	5	8	5	7	5	3	7	6	1	1	8	6
2	Protect sea cucumber populations for subsistence consumption and use	4	6	6	8	3	10	10	1	10	10	8	10	3	10	8
3	Maintain a good representation of proportions of high, medium and low value species (biodiversity on reefs)	6	2	1	10	9	8	4	6	2	2	5	7	7	9	9
4	Maintain/provide employment in communities through fishing	8	7	9	3	4	1	2	7	7	5	2	8	5	4	4
5	Protect reef ecosystems by minimizing damage of fishing	2	8	7	9	6	4	9	3	5	3	1	4	8	1	7
6	Maintain stocks of sea cucumbers at levels that sustain population turnover to retain stock size and remain at viable population levels over time	1	3	3	2	1	7	1	2	1	1	7	5	10	3	1
7	Maintain a healthy proportion of sea cucumber individuals above the size limit	7	4	2	6	5	9	3	4	4	6	9	6	4	7	3
8	Maximize economic returns from the fishery	10	5	10	1	2	6	6	9	6	4	3	2	6	5	5
9	Ensure benefits from the fishery remain in communities and within the country	3	9	4	4	7	2	5	10	8	8	4	3	2	6	10
10	Ensure that the values of sea cucumber stocks to stakeholders are maintained	9	10	5	7	10	3	8	8	9	9	10	9	9	2	2

Note: Participants were asked to privately rank the objectives from most (1) to least (10) important.

Support (e.g. training) needed

- Regional workshop on enforcement. Needs to include countries that already have management regulations in place (restricted participants). The workshop should include a visit to a processor/exporter. This workshop should probably target the chief enforcement officers in PICs. The workshop agenda could be relatively broad and develop a broad scope of skills. Consider also participants in management and planning sections, so the skills are developed over different sections of the government agencies and so that the lessons can be transferred back to other personnel within the agency.
- National training workshops should also be effective. These could be more technical and specific to certain resources.

Day 4 – Management plans and legislation

- A common problem is that legislation may be sound, but it is difficult to enforce.
- Some committees have been established (e.g. in Fiji), but do not have the power to implement decisions. Can the legislation or management plan stipulate the powers of some committees? Another matter often not detailed in legislation is the age of offenders that can be prosecuted.
- Consulting other legislation, or the legislative framework, is crucial to finalizing the management plan. Do other laws preside over the management plan?
- Regulations on the purchase of sea cucumbers may be needed in the management plan to ensure some price setting so that fishers receive a fair price for the fresh product.
- Licensing requirements should be transparent, to the fisher and to government officials.
- Managers should decide whether their management plan is a broad policy format or a legislative format. The management-policy format is simpler, but managers will still need to write the fishery regulations.
- Participants noted that aligning the management plan and format to the ecosystem approach to fisheries is a challenge.
- The management plan will have things that the fishery department wants, but should also consider wishes from stakeholders from the consultative process.

Day 4 – Bringing it together into an ecosystem approach

Strengthening social science

- Collaboration with agencies, or consultants, with skills in communication can be an advantage in the management process.
- More collaboration is needed with university students and NGO scientists. However, many participants felt that some NGOs are gathering data, but not necessarily sharing it with countries. There is resentment within countries about this. Sometimes, projects have conditions that state that the NGOs and university projects have to provide the data to the fishery agency. There are some protocols for data sharing policies in Fiji. There have been cases where the collaborating partners do not provide data back to countries.
- The issue of property rights can also be important – for example, coral samples being taken for use in medicine.
- Some sociological surveys have been done with a purpose in mind to benefit a project. Also, some sociological surveys are needed in multisectoral situations where fishers are involved in agriculture and other livelihood activities.

Stakeholder involvement and consultation

- Stakeholder involvement is of course important, but lengthens the time needed for developing management. Consultation processes can be very lengthy. Managers must consider the timeframe of the consultative process.
- Being directed in the consultation process to focus on key fields can help to keep the consultation process to a manageable timeframe. The management process should consider the responsibilities of stakeholders in the process.
- Stakeholders to consider:
  - environment department,
  - customs,
  - fishers or fishery organization representatives,
  - processors and exporters,
  - trade department,
  - lawyers or person from legal department,
  - non-governmental organizations,
  - community leaders.
- Fishers need to be included in the consultation. There was a case in Kiribati where village mayors were consulted and expected to inform people, but fishers were angry later because they were not informed by their local leaders.
- Consultation can, and normally is, costly, and the costs need to be taken into account.
- The fishery agency in Solomon Islands found consultation costly. Identifying key stakeholders is important in minimizing costs to a practical level.
- Consultation is costly and time-consuming, but important. Different stakeholders need to take ownership of different aspects of the management. This is predicated on effective communication strategies.
- Consultation meetings are best organized, or facilitated, by an independent person without vested interests. Moreover, people have to be provided with expenses to attend and be given a meal.
- The fishery communicator also needs to have some in-depth knowledge of the fishery and issues in order to stimulate discussion on points that matter.

CONCLUSIONS AND RECOMMENDATIONS

The six indicators of fishery health given in the ACIAR Manager's Toolbox manual turned out to be very useful to participants in being able to nominate a status category for their sea cucumber fishery. In some cases, the indicators suggested the fishery was overfished or depleted, but the participant and facilitator agreed that the situation was probably not that bad. So, the indicators and process is indeed a decision support tool and not a definitive objective process, i.e. other factors also need to be taken into account and judgement is needed to appraise whether the fishery status based on the responses to indicators should be modified.

The "roadmap" from the FAO manuals proved to be a valuable tool in suggesting a logical starting point for choosing regulatory measures and management actions. The roadmap prompted the managers to think about management measures apart from the ones they were familiar with or were currently in use.

One anomaly was that some fisheries (Solomon Islands and Tuvalu) have an industrialized fishery sector and a small-scale fisher sector, which may need to be managed separately with different regulations. The FAO roadmap was set up for single fishery modes in mind, but it can be adapted to

deal with two-sector scenarios. In those cases, the regulatory measures and management actions were decided and presented for the two sectors separately within the results tables (see Tables 2a and 2b).

The following recommendations were nominated in a final plenary session:

General

- Need more networking among PICs. An agency is needed to take on this task. Networking could possibly be improved through some network (e-mail) lists.
- This workshop is not an end-point. Participants and agencies will still need technical support from other agencies and NGOs.
- Environmental role of sea cucumbers in reef ecosystems should be considered when forming lists of permissible species.
- Support for advice species introductions to provide some fisheries with high-value species (e.g. *Holothuria lessoni* in French Polynesia and *Holothuria scabra* in Kiribati). Need to examine import protocols.
- Support to PIC fishery agencies is needed with GIS and remote sensing to derive geomorphological codes for habitat mapping.
- Need to raise the profile of sea cucumbers with NGOs. Many of these organizations are keen on turtles, but few are interested in sea cucumbers.

Funding assistance

- Funding is needed to run training courses for PICs.

Research

- Size-at-first-maturity research in different countries, particularly equatorial countries, and for different species that are lacking data.
- More studies needed at seasonal spawning of species. Future studies should examine how general the trends are compared with previous work in New Caledonia.
- Conversion ratios for some species (fresh to dry) are needed. This might best be achieved through smaller projects in different countries focusing on certain species for which data are needed.
- Research is desired on connectivity of sea cucumber populations. Currently, connectivity among populations is reasonably well understood for only two tropical species.
- Support with databases for sea cucumber fisheries (e.g. export data).
- Information needed on markets and pricing. What are prices of bêche-de-mer in China? The Pacific Agribusiness Research for Development Initiative (PARDI) of ACIAR can help with this, but more networking on this among fisheries would be good.
- Research on thresholds for minimum densities of breeding populations of sea cucumbers.

Training

- Review curricula of university courses to see if they meet the needs of fishery management.
- Bridging courses for staff in the field (technical refresher).
- Enforcement training: both a regional workshop and national technical training. Could be conducted collaboratively (SPC/FAO/SCU/others?).
- Training on species identification.
- Short simplified workshops (e.g. 1–2 days) for fishers to explain about biology and management principles (e.g. how size limits are set).

Recommendations for other similar workshops

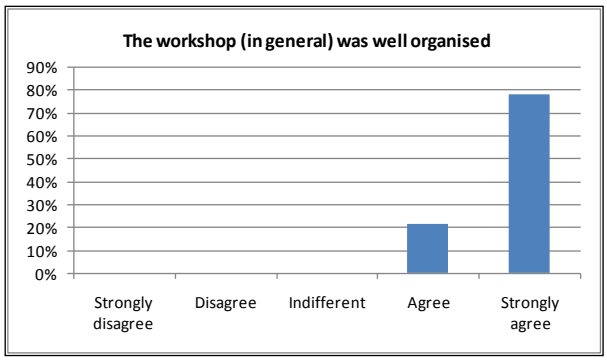
- Some sessions on how to set no-take zones for sea cucumbers would be useful.
- Some focus of on EAF discussions about how that relates specifically to sea cucumbers.
- Allowing participants to identify a key issue and leaving one session open for discussion should be useful for other workshops.

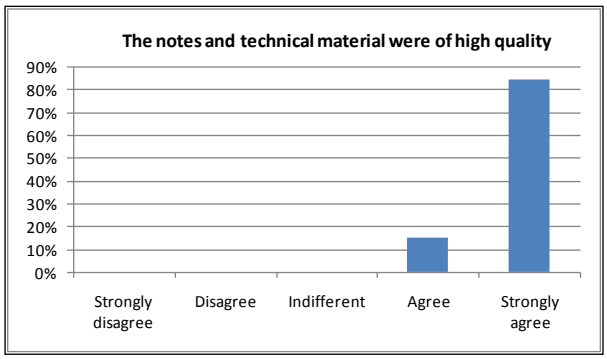
Based on the key recommendations, development agencies in the Pacific should look immediately towards coordinating a technical workshop and provide more support for training in enforcement and inspections. Agencies should also consider funding M.Sc. or Ph.D. students from Pacific Islands to do research projects on size-at-first maturity in sea cucumbers.

The future steps will be to coordinate similar workshops in other regions, namely the Indian Ocean, Southeast Asia and Latin America. The next phase is expected to be a "SCEAM Indian Ocean" workshop in Zanzibar, United Republic of Tanzania, at the end of 2012, depending on the identification of suitable funding.

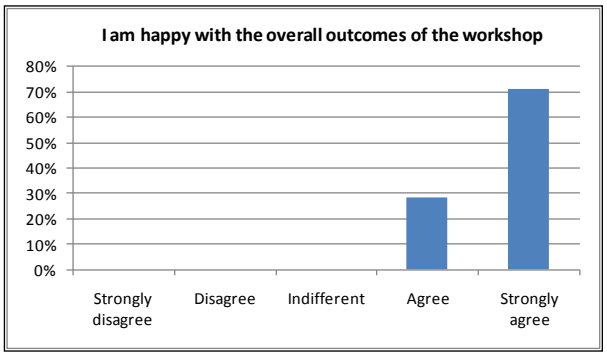
WORKSHOP SATISFACTION SURVEYS

In general, participants were pleased with how the workshop was organized and the materials they were given. See Annex E for the workshop satisfaction survey form distributed to the participants on the last day of the activity.

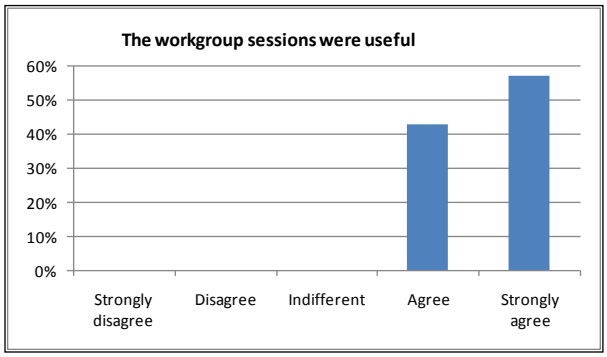


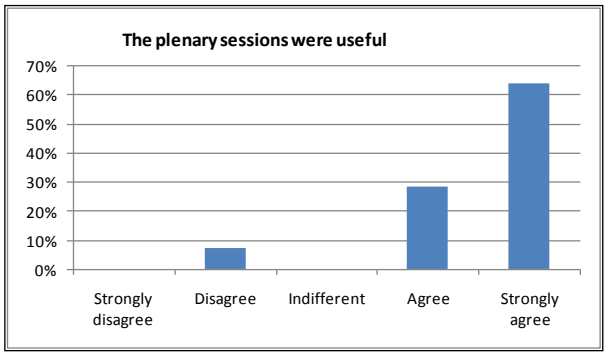


All of the participants were happy with the outcomes of the workshop.

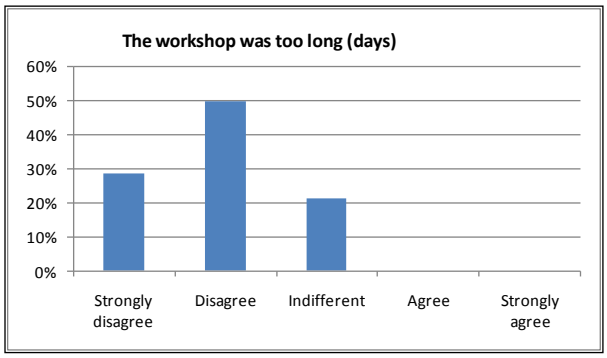


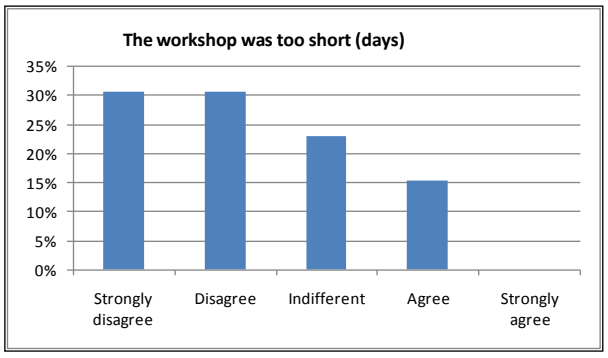
Participants felt that both the workgroup sessions and plenary sessions were useful.



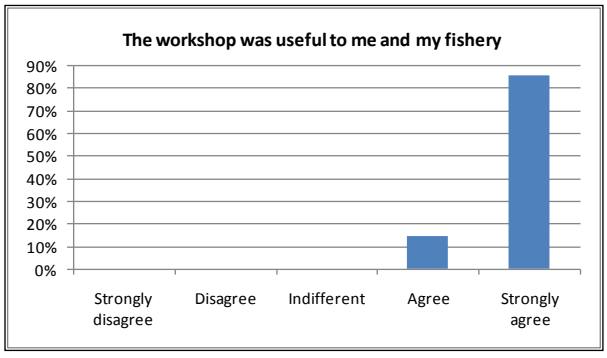


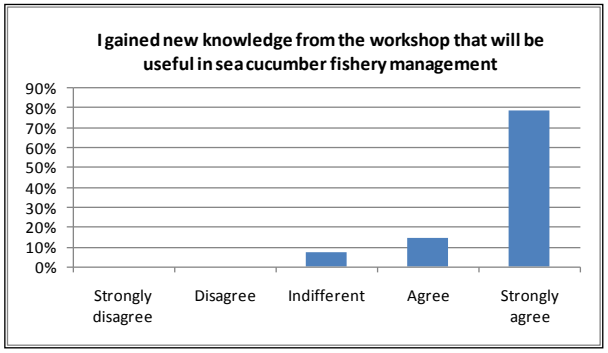
Most participants felt the workshop was neither too long nor too short.



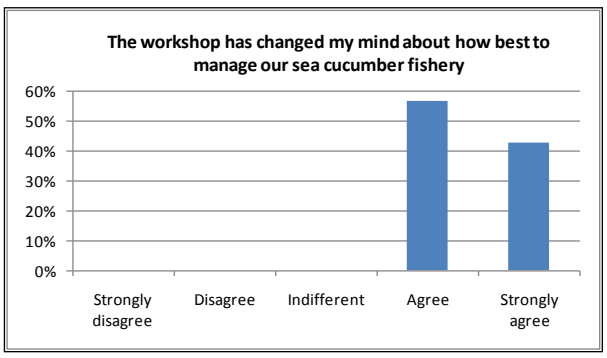


Most participants strongly agreed that they gained new knowledge from the workshop presentations, and all stated that the workshop will be useful to the future management of their fishery.





As a measure of success, all participants responded that the workshop had changed their opinion about how best to manage the sea cucumber fishery in their own country.



The participants also provided some comments at the bottom of the form. All of the comments written by participants are copied below:

- No sea cucumber fishery status available to participants during workshop. [Comment to this: the FAO Regional Review of the Pacific in 2008 gives a full account of the status and management measures used in Pacific fisheries and the participants were urged to review them before the workshop so we would not have to go through presentations on each fishery.]
- No collation of workgroup sessions formalized and distributed to participants during workshop. [Comment to this: we did indeed collate most workgroup sessions and subsequently showed that during the plenary sessions and informed them that this information would be distributed to them in a few months in the report with a CD of presentations.]
- Overload of information in some occasions and some of the presentations needed thorough discussions on its own!
- Workshop definitely timely and very, very informative! Excellent information.
- I wish to personally acknowledge all the work put into the organization, data delivered during the workshop. Note: regards and thanks also to Julie Burton for pre-workshop organization.
- Future workshop of this kind should probably include information and results, if any, on the impact of climate change in sea cucumber fisheries.
- Very productive and see how it works.
- Very appreciative, it is also timely and very important for us to move this fishery moving in the right direction.
- Very timely and important.
- I came with little knowledge on sea cucumbers and its fishery. I am very happy to leave with a wealth of knowledge on sea cucumbers and have confidence now on to review, comment and give suggestions on our draft management plans.
- The workshop was very useful and productive to my country. I am grateful for the opportunity to extend my knowledge to problems my country may encounter and will try and work for good management plan.
- Very timely and hope to have follow up meetings.
- Availability of funds (or where we can apply to) to do follow up activities on this issues. Knowledge gained is important and to keep momentum going is to at least have some funds available so we can access to keep this momentum going.

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ANNEX A – Workshop agenda

Southern Cross University
National Marine Science Centre
Australian Government
Australian Centre for International Agricultural Research
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
SPC Secretariat of the Pacific Community

Sea Cucumber Fisheries: an Ecosystem Approach to Management in the Pacific (SCEAM Pacific)

Nadi, Fiji, 15–18 November 2011

Workshop Agenda

Pre-workshop 13–14 Nov.		
Participants arrive at Novotel Nadi		
DAY 1 – 15th Nov.		
08:00		Registration. Pick up workshop documents
08:30	Alessandro Lovatelli	Introduction to workshop and overview **(Chair:** Purcell**)**
08:50	Alessandro Lovatelli	Status of sea cucumber fisheries: a global overview
09:20	Ian Bertram	History and status of sea cucumber stocks in the Pacific
10:00	***Morning tea***	
10:20	Kalo Pakoa	A regional comparison of sea cucumber stocks in the Pacific: overview of PROCFish/C project results
10:40	Alessandro Lovatelli	Management principles, objectives, reference points and the ecosystem approach to managing fisheries
11:10	Kalo Pakoa	Assessing status of your fishery stocks: using fishery-dependent, fishery-independent and sociological indicators
11:30	Plenary	Discussion of the management process and using indicators
12:30	***Lunch***	
13:30	Steve Purcell	Biological and ecological constraints to classical fisheries approaches in sea cucumber fisheries **(Chair:** Bertram**)**
14:00	Steve Purcell	Regulatory measures and their use in sea cucumber fisheries: size limits, gear limitation, catch quotas, logbooks and reporting
14:45	Plenary	Discussion of technical aspects of size limits, gear limitation, catch quotas, logbooks and reporting
15:30	***Afternoon tea***	
15:45	Steve Purcell	Regulatory measures and their use in sea cucumber fisheries: temporal and spatial closures
16:10	Ian Bertram	Actions by the fishery manager for improved compliance and adoption of management measures
16:40	Plenary	Discussion of technical aspects of temporal and spatial closures and management actions and contentious management regulations
17:00	Finish	
18:30	***Dinner***	Dinner hosted by FAO. Talei Restaurant, Novotel

DAY 2 – 16th Nov.		
08:30	Steve Purcell	Global analysis of management measures and drivers of overfishing **(Chair:** Pakoa**)**
09:15	Alessandro Lovatelli	Summary of data/results from pre-workshop forms
10:00	***Morning tea***	
10:15	Nathaniel Cornuet	Presentations of different management systems in the Pacific, their effectiveness and constraints to compliance New Caledonia
10:30	Joyce Samuelu	Samoa
10:45	Gerald Billings	Fiji
11:00	Leban Gisawa	Papua New Guinea
11:15	Plenary	Discussion and questions about current problems of fisheries management in the Pacific
12:30	***Lunch***	
13:30	Steve Purcell	Organization instructions for workgroups **(Chair:** Bertram**)**
14:10	3–4 Workgroups	Break-out workgroups to work through stock-health indicators for each country from the ACIAR Manager's Toolbox
15:00	Plenary	Collation of stock indicators from all countries and discussion
15:30	***Afternoon tea***	
15:45	Plenary	Discussion and listing management objectives for each fishery. Individual prioritisation for each fishery. Collation
16:30	Plenary	Best indicators of management performance for the Pacific sea cucumber fisheries. Discussion of reference points
17:00	Finish	
	Dinner	Free – Organise yourself
DAY 3 – 17th Nov.		
08:30	Steve Purcell	Organization instructions for workgroups **(Chair:** Lovatelli**)**
08:30	Alessandro Lovatelli	Choosing regulatory measures and management actions to use – a decision support tool from the Galapagos workshop and exceptions
09:00	2 Workgroups	Break-out workgroups (2) to work through the decision support table to choose regulatory measures and actions for managers for each fishery
10:00	***Morning tea***	
10:15	2 Workgroups	Continued
11:30	Plenary	Collation of sharing of decisions on regulatory measures and actions from workout groups
12:30	***Lunch***	
13:30	Finish	Afternoon free
	Dinner	Free - Organize yourself
DAY 4 – 18th Nov.		
08:30	Alessandro Lovatelli	Organization instructions for workgroups. **(Chair:** Lovatelli**)**
08:45	3–4 Workgroups	Workgroup session on case fisheries, identifying main challenges and potential regulatory measures and actions to improve management (3–4 case examples)
10:00	***Morning tea***	
10:15	Plenary	Collation of workgroup outputs and discussion
10:45	Ian Bertram	A call to action: writing and implementing your management plan

11:30	Plenary	Open discussion on writing management plans
12:30	***Lunch***	
13:30	Plenary	Open discussions on management plans and legislation **(Chair:** Purcell**)**
14:30	Steve Purcell	Redescribed sea cucumber species, hard-to-distinguish species groups, and uncommon commercial species in the Pacific and new FAO ID book
15:00	Steve Purcell	PARDI/ACIAR Project overview: supporting fishers to improve the quality of sea cucumber processing in the Pacific
15:15	Kalo Pakoa	SPC Exports database and LearnFishID – information tools soon to be rolled out
15:30	***Afternoon tea***	
15:45	Plenary	Aligning to an ecosystem approach to managing sea cucumber fisheries: discussion of strengthening social science inputs, communication strategies, stakeholder involvement
17:00	Closure of workshop	
18:30	***Dinner***	End of workshop dinner. Hosted by SPC. Talei Restaurant, Novotel
POST-WORKSHOP – 19th Nov.		
Participants return home		
Facilitators to conduct a post-workshop meeting for synthesis and preparation of workshop report		

ANNEX B – Workshop prospectus

Southern Cross University
National Marine Science Centre
Australian Government
Australian Centre for International Agricultural Research
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
SPC Secretariat of the Pacific Community

Sea **C**ucumber Fisheries: an **E**cosystem **A**pproach to **M**anagement in the **P**acific **(SCEAM Pacific)**

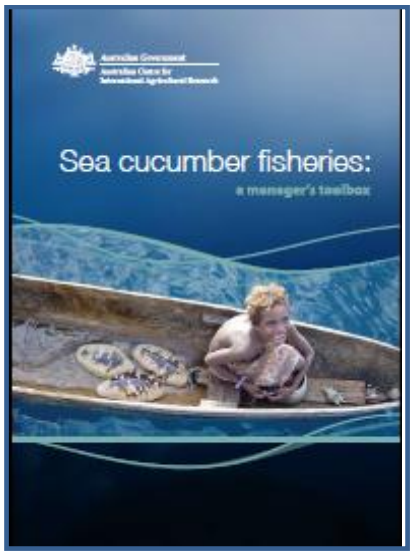
Nadi, Fiji, 15–18 November 2011

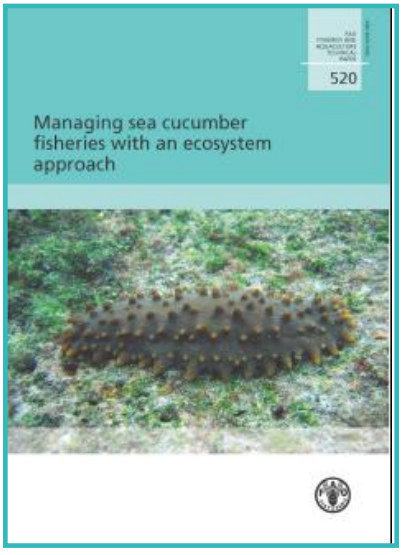
Prospectus

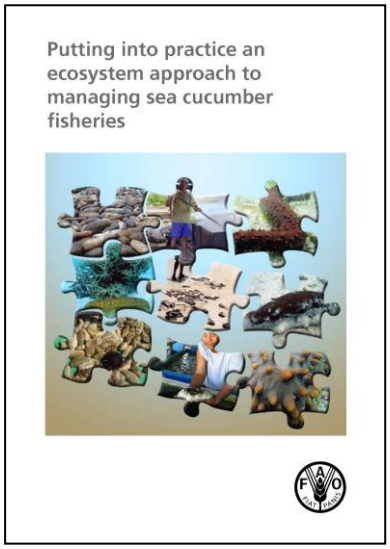
AN IMPERATIVE FOR CHANGE IN THE MANAGEMENT OF SEA CUCUMBER FISHERIES

Pandemic overfishing to critical levels currently threatens the persistence of sea cucumber fisheries and the important role they play in the livelihoods of coastal fishers. In the Pacific Islands, sea cucumbers are a key resource that contributes to poverty alleviation. They are fished in every Pacific Island Country (PIC) and in some countries have become more economically important than finfish exports. They are one of the few commodities that can be easily stored and exported. However, many of these fisheries are suffering unsustainable levels of exploitation, to the point of local extinctions of some species and consequently impacting the livelihoods of hundreds of thousands of fishers.

The Secretariat of the Pacific Community (SPC) has furnished information and support for ecosystem based fisheries management in a broad sense (e.g. Preston, 2009, and regional workshops). It also executed in-country surveys of sea cucumbers in the PROCFish/C and Co-Fish programmes for 17 member countries, providing comparable estimate of the status of these resources.







In response to the urgent need for improved management, the Australian Centre for International Agricultural Research (ACIAR) coordinated a regional workshop in Motupore, Papua New Guinea, in 2006 and later published a booklet, *Sea Cucumber Fisheries: A Manger's Toolbox* (Friedman *et al*., 2008). Earlier, in 2003, the Food and Agriculture Organization of the United Nations (FAO) hosted a workshop in the People's Republic of China and published a "Proceedings" with recommendations for improving the management of sea cucumber fisheries (Lovatelli *et al*., 2004). Through funding from the Government of Japan, FAO has just produced a technical manual on the ecosystem approach to

managing sea cucumber fisheries (Purcell, 2010) and a simpler guidebook on putting the approach into practice (FAO, 2010). The documents provide a "roadmap" and guidelines for developing and implementing better management of sea cucumber fisheries.

While the manuals are an important, and necessary step forward, the task still remains to assist fisheries agencies to use them to design new and practical management plans to save or restore sea cucumber fisheries. To this objective, FAO, ACIAR, SPC and the Southern Cross University (SCU) have partnered to coordinate this regional workshop. Its goal is to facilitate radical changes to the management of sea cucumber fisheries in the Pacific.

WORKSHOP PURPOSE

The workshop's aim is to bring about significant change to management systems (both regulatory measures and actions by fishery agencies) in PICs through intensive mentoring in sustainable and tailored strategies for sea cucumber fisheries and a forum for group-sharing of constraints and lessons learned.

The workshop's specific objectives are to:

1. collate and analyse current information from Pacific sea cucumber fisheries on management practices and constraints to their acceptance by fishers;
2. inform Pacific fisheries managers about technical aspects of the biology and management of sea cucumber fisheries through an "ecosystem approach"; and
3. assist them in interpreting and putting into practice the advice provided in the recent ACIAR and FAO manuals based on their fishery.

The workshop will centre on the principles within the ACIAR and FAO manuals. It is expected that each participant is familiar with the principles within these manuals before the workshop.

The workshop further aims at supporting capacity building and active mentoring to the fishery managers and senior fishery officers as a means of bringing about changes to national fishery management plans.

INPUTS AND PARTICIPATION

Prior to the workshop, participants should familiarize themselves with the three manuals on sea cucumber fisheries management (see page 1). They should also bring along their copies of these manuals, which we will use extensively during the workshop.

Participants should also do their own homework to be knowledgeable on the history of management measures used in their fishery, current constraints to compliance of regulations by fishers and constraints within their fishery agency to apply various regulatory measures. Prior to the workshop, each participant should review the status of sea cucumber stocks and export volumes from their fishery and consult their recent PROCFish/C country report available at:

http://www.spc.int/coastfish/en/publications/digital-library/by-country.html

Where available, participants should bring along a copy of the current management plan in their fishery.

The participants will be issued with a pre-workshop data form that they should complete and submit before 23 October. The form will need responses about current management regulations, enforcement capacity, management capacity, stakeholder participation and fishing activities (if known). The responses on the forms will be collated and a regional summary will be used in different aspects of the workshop and in the post-workshop report.

The workshop will require active participation. While the first day of the workshop is seminar-based, the rest of the workshop will rely strongly on workgroups. Participants will need to critically examine indicators and management measures used in their fishery and join in group discussions about management problems and solutions.

FACILITATORS

Four experts will facilitate the workshop:

Name	Agency and position	Discipline and role
Steven Purcell	SCU, Research Fellow	Fisheries ecologist; workshop coordinator/facilitator
Alessandro Lovatelli	FAO, Aquaculture Officer	Aquaculture and Fisheries development; co-facilitator
Ian Bertram	SPC, Coastal Fisheries Science and Management Adviser	Fisheries Management; co-facilitator
Kalo Pakoa	SPC, Invertebrate Fisheries Scientist	Fisheries Assessment; co-facilitator

The facilitators will jointly chair and coordinate the workshop. They each will give seminar presentations within their fields of expertise.

The facilitators will base the workshop closely on the ACIAR and FAO manuals and lead participants through the fishery status indicators and management principles.

AGENDA AND LOGICAL FRAMEWORK

The Agenda has been circulated. In brief, the workshop has several key components:

Day 1 Seminars by the facilitators about fishery indicators, regulatory measures and management actions appropriate for different fishery scenarios.

Day 2 Summary of data from pre-workshop forms.

Short presentations from some participants on their sea cucumber fishery, management measures in place and their effectiveness.

Break-out workgroups to work through fishery indicators for each country from the ACIAR Manager's Toolbox.

Day 3 Break-out workgroups to choose the most practical regulatory measures and management actions for each fishery based on the FAO manuals.

Plenary discussions of key contentious management issues.

Day 4 Workgroup sessions on disparate case studies, showcasing and discussing the challenges and potential solutions.

Plenary discussions of management plans and legislation.

The seminars will provide participants with the most updated information on sea cucumber biology and ecology needed to apply an ecosystem approach to management. The facilitators will cover

scientifically technical concepts and explain results from recent global analyses of sea cucumber fisheries.

The participants will follow the ACIAR sea cucumber manager's toolbox (Friedman *et al*., 2008) to review indicators of stock status and apply them to their fishery.

The current management measures employed in each fishery and their effectiveness will be examined. In a similar sequence to the recent FAO manuals on an ecosystem approach to managing sea cucumber fisheries (Purcell, 2010; FAO, 2010), the workshop participants will follow the "roadmap" to choose alternative regulatory measures and management actions based on the stock status, management capacity and scale of fishing in each fishery. The recent PROCFish/C resource surveys will guide participant countries in both of these activities.

OUTPUTS

The two primary outputs will be:

1. Sets of regulatory measures and management actions decided by each participant to be applied in their fishery. Each participant should take home these self-ascribed recommendations and seek to have them applied in their fishery.
2. An FAO Fisheries and Aquaculture Report summarizing the outcomes of the meeting. The report will include:
    - lessons from the workshop process to assist future similar workshops in the Pacific or in other regions;
    - discussion of contentious management issues raised by the participants;
    - a summary of agreed management regulations that would be appropriate to each fishery of the participants' country; and
    - case studies of disparate fishery scenarios and how a few agencies would apply different fisheries regulations.

ANNEX C – Fishery data form

Southern Cross University
National Marine Science Centre

Australian Government
Australian Centre for International Agricultural Research

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

SPC Secretariat of the Pacific Community

Sea **C**ucumber Fisheries: an **E**cosystem **A**pproach to **M**anagement in the **P**acific
(SCEAM Pacific)

Nadi, Fiji, 15–18 November 2011

Fishery Data Form

This form should take **20–30 minutes** to complete. It will help us to summarize at the workshop the current key issues and management practices among the participating countries. Your responses will help to assign the right indicators of fishery status to your fishery. This form will also identify common constraints among the different fisheries in the region.

Feel free to consult with your own colleagues to get the most accurate information you can. If you do not know the answer, or cannot obtain it, just leave the answer blank. **Please DELETE or ~~Strikethrough~~ the answers that do not apply, or write the answer in the right column.**

HUMAN RESOURCE CAPACITY	**Responses**
How many scientists are there employed by your fishery agency that would have the time and skills to calculate maximum sustainable yield models annually for your sea cucumber fishery?	
How many people, employed by your government, have responsibility for planning and implementing marine reserves?	
How many fishery officers in your country would be able to confidently and accurately identify all of your exploited sea cucumber species (live) to species level?	
How many trained persons are employed by the government to inspect bêche-de-mer shipments before they leave your country?	
Does your agency (or another service in your government) have the human resources and skills to conduct extensive underwater population surveys of sea cucumbers every 3 years?	Yes / No
Does your agency (or another service in your government) have the funding to conduct extensive underwater population surveys of sea cucumbers every 3 years?	Yes / No
At present, how easy is it to get updated information every month on the number or wet weight of sea cucumbers collected by fishers in the whole country, or in separate regions?	Relatively easy Difficult Impossible
At present, how easy is it, or would it be, to license all sea cucumber fishers in your fishery?	Relatively easy Difficult Impossible

At present, how easy is it, or would it be, to license all processors and exporters of sea cucumber in your fishery?	Relatively easy Difficult Impossible
MANAGEMENT APPROACH	**Responses**
Has your fishery agency established formal management objectives for the sea cucumber fishery?	Yes / No
Has your fishery agency set "reference points" at which management regulations will change in the fishery?	Yes / No
Do you have a sea cucumber fishery management advisory committee (or similar committee) with participation from fishers and processors?	Yes / No
CURRENT MANAGEMENT REGULATIONS	**Responses**
Do you have a national plan (and/or regulations) for the management of sea cucumbers in place now (i.e. finalized and distributed)? If yes, in what year was that enacted?	Yes / No
Are there minimum legal size limits for sea cucumbers in your fishery?	Yes / No
If yes, are there different size limits depending on the species?	Yes / No
Do you have a policy or regulations to limit the number of new species of sea cucumbers that fishers can harvest?	Yes / No
Is there an official ban on scuba and hookah in your fishery?	Yes / No
Are fishers supposed to obtain a fishing licence/permit to be able to harvest and sell sea cucumbers?	Yes / No
Do fishers need to supply logbooks in order to be re-issued with a fishing permit?	Yes / No
Do you keep a list of all sea cucumber fishers in your fishery?	Yes / No
Do you keep a list of all sea cucumber processors and exporters in your fishery?	Yes / No
How would you best describe who has jurisdiction for enforcing the management regulations and delivering penalties in your country?	National authority Provincial government Island council Community Traditional leaders
CURRENT FISHING	**Responses**
In recent years, are the numbers of fishers who collect sea cucumbers in your fishery increasing, stable or declining?	Increasing Stable Declining Do not know

Are fishers collecting lower-value species more nowadays?	Yes / No / Do not know
Are fishers collecting a wider number of species nowadays?	Yes / No / Do not know
Is the percentage of low-value species in catches increasing in recent years?	Yes / No / Do not know
STAKEHOLDER INVOLVEMENT AND EDUCATION	**Responses**
What percentage roughly of sea cucumber fishers in your country would you, or someone in your agency, have met with this year to discuss their fishing activities and management principles and/or regulations?	_____ %
Do you regularly send out (i.e. at least once per year) a newsletter or information leaflet to fishers?	Yes / No
ENFORCEMENT AND INSPECTIONS	**Responses**
How many boats are there in your country that are regularly used to do patrols of fishers including sea cucumber fishers (do not count boats that only patrol in finfish fisheries)?	
How often would fishery or compliance officers check and record the numbers and wet weights of harvested sea cucumbers at landing sites or at sea?	One or more times/week Once or twice/month A couple times/year Practically never
Are the bags of bêche-de-mer for shipments out of your country opened and inspected?	Regularly Occasionally Practically never
Have the inspection officers in your country had training in identifying dried sea cucumbers to species level?	Yes / No

ANNEX D – List of participants

Fishery managers / participants

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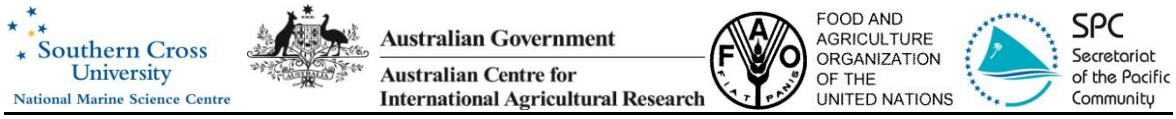
ANNEX E – Workshop satisfaction survey form



Tick ✓ the box corresponding to your answer	**Strongly disagree**	**Disagree**	**Indifferent**	**Agree**	**Strongly agree**
My travel arrangements were well organized					
The workshop (in general) was well organized					
The notes and technical material were of high quality					
The workshop was useful to me and my fishery					
I gained new knowledge from the workshop that will be useful in sea cucumber fishery management					
The workshop has changed my mind about how best to manage our sea cucumber fishery					
Seminars given by Steve Purcell were well prepared and well presented					
Seminars given by Alessandro Lovatelli were well prepared and well presented					
Seminars given by Ian Bertram were well prepared and well presented					
Seminars given by Kalo Pakoa were well prepared and well presented					
The workgroup sessions were useful					
The plenary sessions were useful					
The workshop was too long (days)					
The workshop was too short (days)					
I am happy with the accommodation and meals					
The workload was suitable and appropriate to the time available					
I am happy with the overall outcomes of the workshop					

Additional comments:

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ANNEX F – Workshop group photo

Participants and facilitators at SCEAM Pacific, Fiji, 15–18 November 2011. *Standing, from left to right*: Alessandro Lovatelli, Kalo Pakoa, Karibanang Tamuera, Jason Raubani, Steven Purcell, Tupulaga Poulasi, Gerald Billings, Ian Bertram, Arsène Stein, Leban Gisawa, Nathaniel Cornuet, Koroa Raumea, Poasi Ngaluafe, James Teri, Joyce Samuelu. *Seated, from left to right*: Helena Rebelkuul, Candice Guavis, Luanah Yaman, Mere Lakeba.

Widespread overfishing threatens the sustainability of sea cucumber fisheries and the important role they play in the livelihoods of coastal fishers. The SCEAM Pacific workshop was jointly funded and coordinated by FAO, the Australian Centre for International Agricultural Research, the Secretariat of the Pacific Community and Southern Cross University in November 2011. The workshop brought together fishery managers from 13 Pacific island countries to foster improved management plans for Pacific sea cucumber fisheries. Seminars by the workshop facilitators presented contemporary fisheries science and new paradigms for management. Pre-workshop questionnaires, workgroup sessions and plenary discussions were used to help participants decide on appropriate objectives, regulatory measures and management actions for each fishery. The workshop outputs given in this report reveal the constraints and issues facing Pacific sea cucumber fisheries, and the proposed management changes and research priorities of the fishery managers.

Australian Government

Australian Centre for International Agricultural Research

Southern Cross University

National Marine Science Centre

SPC

Secretariat of the Pacific Community

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