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STAKEHOLDER WORKSHOP ON THE MANAGEMENT OF THE LIVE REEF FOOD FISH TRADE IN PAPUA NEW GUINEA

Workshop Report



Lamana Hotel, Port Moresby, 7-9 July, 2009

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NATIONAL FISHERIES AUTHORITY

**REPORT OF THE NATIONAL FISHERIES
AUTHORITY STAKEHOLDER WORKSHOP ON
THE MANAGEMENT OF THE LIVE REEF FOOD
FISH TRADE IN PAPUA NEW GUINEA,
PORT MORESBY, 7-9 JULY, 2009.**

National Fisheries Authority of Papua New Guinea
The Nature Conservancy

Coral Triangle Support Partnership

Report of the National Fisheries Authority Stakeholder Workshop on the Management of the Live Reef Food Fish Trade in Papua New Guinea.

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CONTENTS

Acknowledgments	i
Executive Summary.....	ii
Acronyms and Abbreviations.....	iv
1. Introduction.....	1
2. Workshop Purpose and Objectives.....	3
2.1. Purpose.....	3
2.2. Objectives.....	3
2.3. Outputs.....	3
2.4. Process and Agenda.....	3
3. Workshop Report.....	5
3.1. Opening.....	5
3.2. Expectations	7
3.3. Background Presentations.....	8
3.4. Discussion of Current Management Plan Objective	21
3.5. Issue Identification, Risk Assessment and Management Actions.....	22
3.6. Management Plan Review.....	28
3.7. Recommendations	29
3.8. Next Steps	30
3.9. Evaluation.....	31
3.10. Closing.....	31
Appendix A USCTI Results Framework.....	32
Appendix B Workshop List of Participants.....	33
Appendix C Workshop Agenda.....	37
Appendix D Review of the Live Reef Food Fish Fishery operation and its management in Papua New Guinea.....	39
Appendix E Possible Issues to Consider Under EAF Component Tree.....	51
Appendix F Working Group Results: Issues, Risk Assessments and Management Actions	52
Appendix G Review of The National Live Reef Food Fish Fishery Management Plan – Annotations and Notes.....	57
Appendix H Workshop Evaluation Summary	64

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The support, dedication and positive engagement shown by all the stakeholders who participated in this workshop was greatly appreciated and inspirational. NFA showed their willingness to be innovative and seek stakeholders' input into the fisheries management planning process by requesting this workshop. The NFA staff, especially Leban Gisawa, provided considerable support and input to the development and running of the workshop. Jeffrey Kinch (SPREP) and Andrew Smith (TNC) facilitated the workshop. Geoffrey Muldoon (WWF) and Richard Hamilton (TNC) provided expert technical advice during the workshop. Kay Robinson (TNC) and Winnie Kela (NFA) ably handled the logistical support.

EXECUTIVE SUMMARY

The National Fisheries Authority Stakeholder Workshop on the Management of the Live Reef Food Fish Trade in Papua New Guinea was held in Port Moresby, 7 – 9 July, 2009. The purpose of the consultative stakeholder workshop was to review and update the National Live Reef Food Fish Fishery Management Plan (2003), bringing together 37 representatives of government (national, provincial and local), fishing industry, community and non-government organisations.

The review process applied the principles of the Ecosystem Approach to Fisheries and evaluated the plan against the International Standard for the Trade in Live Reef Food Fish.

The workshop employed a four stage process to allow all participants to contribute fully. Given the participants' wide range of experiences with the Live Reef Food Fish Trade (LRFFT)—from extensive to minimal—a series of background papers and presentations were provided. The participants were broken into three “peer” groups—community, provincial and national—to identify the issues of concern based on, and relevant to, their particular groups' experiences of the LRFFT. The groups identified key issues of concern in three broad areas: ecological, social-economic, and governance. To prioritise these issues each group was asked to undertake a simple risk assessment process, and then suggest management actions for the highest priority issues.

Using the information from the background presentations, combined with the discussion and prioritisation of the range of issues identified as associated with the LRFFT, the workshop participants then reviewed the current National Live Reef Food Fish Fishery Management Plan, suggesting specific revisions to the management plan.

In the final stage, the participants developed specific recommendations from the workshop to the National Fisheries Authority concerning the broader operation and management of the Live Reef Food Fish (LRFF) fishery in PNG. A total of seven recommendations were agreed to by the workshop participants:

1. The workshop participants recommend that NFA require any LRFF operators undertake training of local fishers in the best-practices for capture and handling of live food fish, as a requirement of any MOUs and be stipulated in the operator's license conditions.
2. The workshop participants recommend that the development and management of the LRFF fishery in PNG be based on the policy of “user pays”.
3. The workshop participants recommend that NFA require an independent service provider to conduct basic legal and financial awareness training for communities prior to their entering into a LRFF fishery MOU with operators.
4. The workshop participants recommend that NFA conducts the following research on the Live Reef Fish Fishery as a matter of priority:
 - a. Stock assessments of the target species, and impact assessments on non-target species and habitat;
 - b. Socio-economic issues, especially:

- i. Cost-benefit analysis
 - ii. Rate of return to villagers
 - iii. Potential income streams
 - iv. Benefit sharing opportunities
 - c. Initiate a detailed independent viability assessment of the LRFF fishery in PNG, focusing on:
 - i. Economic viability
 - ii. Social viability
 - iii. Biological viability
 - d. Initiate a study to identify possible alternative income generation options to the LRFFT, including assessment of “live fish” versus “fresh/chilled/frozen fish” market options.
- 5. The workshop participants recommend that NFA develop and implement a Community-Based Fishery Management (CBFM) program that incorporates fisheries management approaches and training appropriate to the management of local fisheries, including the LRFF fishery.
- 6. The workshop participants recommend that NFA modifies the existing funding mechanisms to allow improved access to funds to develop local-level fisheries.
- 7. The workshop participants recommend that NFA require all MOA/MOUs developed between land-owners and LRFFT companies be reviewed by Provincial authorities prior to signing.

The results of the workshop are being used to draft changes to the current National Live Reef Food Fish Fishery Management Plan for consideration by the National Fisheries Authority.

The workshop report, its recommendations, together with the suggested changes to the current management plan will be reviewed by NFA staff and the final changes to the National Live Reef Food Fish Fishery Management Plan made. A National Fisheries Board submission will be prepared by NFA staff that includes the revised National Live Reef Food Fish Fishery Management Plan.

Once approved by the Board the management plan will be gazetted.

The workshop evaluation indicated that the participants understanding of the issues associated with the development and management needs of the LRFF fishery in PNG had improved and the objectives of the workshop were met. The format of the group discussions and reporting back were identified by the participants as most valuable.

This workshop addressed CTSP Indicator IR2.4: *EAFM applied in priority geographies*.¹

¹ See USCTI Results Framework in Appendix A

ACRONYMS AND ABBREVIATIONS

CTSP	Coral Triangle Support Partnership
USAID	United States Agency for International Development
CTI	Coral Triangle Initiative
ACIAR	Australian Centre for International Agricultural Research
BDM	Bêche-de-mer
BSA	Benefit Sharing Agreement
CBM / CBFM	Community-Based Management / Community-Based Fisheries Management
CELCOR	The Center for Environmental Law and Community Rights Inc.
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch per unit effort
CT	Coral Triangle
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
EAF	Ecosystem Approach to Fisheries
EAFM	Ecosystem Approach to Fisheries Management
FAD	Fish Aggregating Device
FAO	United Nations Food and Agriculture Organisation
FSA	Fish Spawning Aggregations
GPS	Global Positioning System
HK	Hong Kong
ICM	Integrated Coastal Management
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unregulated and Unreported fishing
LLG	Local Level Government
LMMA	Locally Managed Marine Areas
LRFF	Live Reef Food Fish
LRFFT	Live Reef Food Fish Trade
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSEY	Maximum Sustainable Economic Yield
NFA	National Fisheries Authority, Papua New Guinea
NGO	Non-Governmental Organisation
PGK	PNG Kina
PMAC	Provincial Management Advisory Committee
PNG	Papua New Guinea
TAC	Total Allowable Catch
TNC	The Nature Conservancy
WMA	Wildlife Management Area
WWF	World Wide Fund For Nature / World Wildlife Fund

Species Names

Scientific Name	FAO Common Name	Other Common Names	Hong Kong Name
<i>Cheilinus undulatus</i>	Humphead wrasse	Maori wrasse, Napoleon wrasse	So mei
<i>Cromileptes altivelis</i>	Humphead grouper	Barramundi cod; humpback grouper, poka-dot cod	Lo shu pan
<i>Epinephelus fuscoguttatus</i>	Brown-marbled grouper	Flowery cod	Lo fu pan
<i>Epinephelus lanceolatus</i>	Giant grouper	Grouper	Fa mei, Long dan
<i>Epinephelus polyphkadion</i>	Camouflage grouper	Marbled grouper, rockcod	Charm pan
<i>Plectropomus areolatus</i>	Squairetail coralgroupers	Squairetail coral trout, bluedotted coral trout	Sai sing
<i>Plectropomus leopardus</i>	Leopard coralgroupers	Leopard coral trout	Tung sing

I. INTRODUCTION

The Live Reef Food Fish (LRFF) trade is a high-value, reef-based fishery that is characterized by a boom-and-bust cycle with one area after another being over-fished in Southeast Asia, the western Pacific and parts of the Indian Ocean. The trade is driven by the demand for live reef fish, especially in Hong Kong, Taiwan and southern China. It has resulted in the overfishing of large grouper and wrasse species, especially through the targeting spawning aggregation sites, and encouraged the use of destructive fishing methods, such as the use of cyanide.

The LRFFT has been identified as one of the critical issues to be addressed within the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security, of which Papua New Guinea is a member. The Coral Triangle Regional Plan of Action commits members to regional action and specifically agrees to the following:

Goal 2: Ecosystem Approach to management of Fisheries (EAFM) and Other Marine Resources Fully Applied:

Target 4: A more effective management and more sustainable trade in live reef fish and reef-based ornamentals achieved

The LRFF trade started in Papua New Guinea (PNG) in 1991 in the remote Hermit Islands of Manus Province. In recent years, the LRFF fishery has operated in Central, Milne Bay, Manus, East New Britain, Bougainville and New Ireland Provinces. In some of these areas, evidence has shown that the unsustainable targeting of spawning aggregation sites and the use of cyanide has been the practice for LRFF operators. For example, the use of cyanide by LRFF operators in Milne Bay Province in 1998 resulted in the cancellation of their licences. PNG has also experienced community and social impacts from the LRFFT, such as operators undertaking the fishing directly rather than using community fishers, conflicts over royalty payments and reef access, and disputes due to ambiguous agreements with the resource owners. These issues resulted in the National Fisheries Board establishing a moratorium in 1998 on the issuance of new licenses for LRFF exports.

In 2000, the National Fisheries Board approved a trial LRFF fishery in New Ireland and Manus Provinces to re-establish and assess the LRFF fishery in PNG under different management protocols. In part, the results of this trial were used to assess the viability of the LRFF fishery and to formulate a national LRFF fishery management plan.

A spawning aggregation survey at M'Buke, Manus, in 2001, found insufficient fish stocks to sustain a commercial fishery and the Board cancelled the trial license for that area. The trial continued in New Ireland Province, centred on the Tigak, Soson and Tingwon Islands and ran from February to October 2001. After the trial a management plan was formulated. The management plan was approved and gazetted in 2003 (G48, April 2003). Since that time only two licenses have been issued for the fishery.

Despite the requirements of the management plan and observer coverage, the destructive practices by LRFF operators continued. For example, in 2005 a LRFF operator in the Morobe Province was found to be using cyanide.

While there are currently no LRFFT operations in PNG, the national and provincial governments still see the LRFFT as having potential for income generation. However, the management of the fishery continues to face severe management challenges and the sustainability of the fishery remains in question.

Under the Fisheries Management Act 1998, any Fishery Management Plan needs to be kept under review and be revised as necessary. Given that requirement and the challenges with managing the LRFFT, NFA decided to undertake a review of the current National Live Reef Food Fish Fishery Management Plan. This Stakeholder Workshop on the Management of the Live Reef Food Fish Trade in PNG is a core component of that review.

NFA requested the assistance of The Nature Conservancy with reviewing and revising the National Live Reef Food Fish Fishery Management Plan (2003), and as part of the review decided to apply the principles and practices of the Ecosystem Approach to Fisheries (EAF), as well as assess the management plan against the International Standard for the Trade in Live Reef Food Fish (2004). Papua New Guinea is the first Coral Triangle Initiative country to do this.

Two representatives from the Solomon Islands Ministry of Fisheries and Marine Resources were invited to participate in the workshop to ensure that the lessons learnt and experiences of managing the LRFFT are shared across the region.

This workshop addressed CTSP Indicator IR2.4: *EAFM applied in priority geographies*.²

² See USCTI Results Framework in Appendix A

2. WORKSHOP PURPOSE AND OBJECTIVES

2.1. Purpose

To hold a focused consultative stakeholder workshop to review and update the National Live Reef Food Fish Fishery Management Plan (2003), bringing together representatives of government (national, provincial and local), industry, community and non-government organisations.

2.2. Objectives

- To review the current National Live Reef Food Fish Fishery Management Plan (2003)
- Outline a revised National Live Reef Food Fish Fishery Management Plan
- Apply Ecosystem Approach to Fisheries (EAF) principles and align the plan with the International Standard for the Trade in Live Reef Food Fish
- Provide specific recommendations on the sustainable development and management of the live reef food fish trade, and identify research and monitoring priorities
- Identify specific follow-up activities, including an implementation work plan, timeline, resource needs and materials, NFA work program needs and priorities, and linkages to the Coral Triangle Initiative PNG National Plan of Action
- Ensure that species and habitats of special interest are addressed in the management plan

2.3. Outputs

- Summary report of the workshop
- Outline / draft of a revised National Live Reef Food Fish Fishery Management Plan
- Identified follow-up activities and implementation plan
- Participants with an understanding of the management needs of the Live Reef Food Fish Trade

2.4. Process and Agenda

Due to the broad representation at the workshop, and the need for each of the participants to fully contribute, facilitators rather than a workshop chair were used. The workshop was run informally, and all participants were encouraged and given equal opportunity to express their views. While the workshop was predominantly conducted in English, Tok Pidgin was encouraged whenever someone felt more comfortable expressing themselves in that language, especially in the working groups. The participants list is provided in Appendix B, and the full Agenda for the workshop is provided in Appendix C.

In summary, the agenda for the workshop was:

Tuesday 7 July – Focus: Welcome, objectives, introductions, expectations and background

- Welcome & introduction to workshop
- Overview of workshop procedures, objectives, agenda, expected outputs

- Introduction of participants, who they represent, what their expectations, issues and concerns are for the workshop
- Overview of the Live Reef Food Fish Trade in PNG
- Presentations on specific issues and perspectives
- Review and discussion of the current Management Plan Objectives

Wednesday 8 July – Focus: International Standard for the Trade in Live Reef Food Fish; applying the Ecosystem Approach to Fisheries to the identification of issues, risk, priorities and management actions

- Elaboration of the International Standard for the Trade in Live Reef Food Fish (discussion)
- Overview of CITES listings relevant to the LRFFT
- EAF process for issue identification, risk assessment, prioritisation and management actions for high priority issues
- Group work: Community/Resource Owner group; Provincial Government group; and National Government group

Thursday 9 July – Focus: Review of current National Live Reef Food Fish Fishery Management Plan; recommendations; follow-up process; wrap-up and closing

- Group work: Review the current of National Live Reef Food Fish Fishery Management Plan – taking into consideration the Internal Standards and the issues, priorities and actions identified
- Discuss and agree on changes to the National Live Reef Food Fish Fishery Management Plan
- Discussion and agree on specific recommendations from the workshop participants on the sustainable development and management of the LRFF trade in Papua New Guinea
- Discussion and agreement on the follow-up activities
- Workshop evaluation
- Wrap-up and closing

3. WORKSHOP REPORT

3.1. Opening

The workshop was opened by the National Fisheries Authority Acting Managing Director, Mr. Terry Ward:

“It is with honour I make these short remarks to mark another chapter of Live Reef Food Fish Trade, its development and management in Papua New Guinea.

Before I proceed to make my remarks, let me take this opportunity to acknowledge the presence of;

- Colleagues from the Solomon Island Fisheries and Marine Resources Ministry
- Colleagues from the Department of Environment and Conservation
- Our partners from The Nature Conservancy
- Industry representatives
- Provincial Fisheries Advisors and Planners from Manus, Milne Bay, Morobe, New Ireland, Autonomous Bougainville Government and Central Province
- Resources owners impacted by the fishery
- Interested operators
- Ladies and Gentlemen

I would like to take this time also to acknowledge and thank the US Government under USAID program, who provided the core funding through our development partners, TNC, in making this important workshop eventuate.

Ladies and Gentlemen, you will be hearing a lot about the live reef food fish trade and how it has developed and been managed nationally, regionally and internationally by various presenters during the workshop. You have a pool of experts in this room, so I urge you to bombard them with queries about the trade.

In Papua New Guinea, the Live Reef Food Fish Trade commenced operation in early 1990s with operations in Manus, East New Britain, New Ireland, Central and in Milne Bay Provinces. The fishery presents PNG with potential opportunities and problems.

With compounded problems the trade brings with it, the Government of PNG imposed a nationwide moratorium in 1998 on issuance of licences for Live Reef Food Fish Trade.

Nevertheless, as a relatively small-volume, high-value fishery, the Live Reef Food Fish Trade has the potential to contribute significant income directly to fishing communities at the same time spreading effort across potential fisheries within coastal and nearshore area to avoid the tragedy of over exploitation.

So with renewed interest and in line with National Government policy, a trial permit was issued in 2000 with strict licensing conditions enforced in an attempt to develop a management plan for the trade in PNG.

It took three years of trial, before the current management plan was developed, endorsed and gazetted to become a legal document to manage the trade in PNG. I would like to thank TNC and New Ireland Provincial Fisheries Division for your support in achieving the first ever Live Reef Food Fish Fishery Plan in the country or region for that matter.

Ladies and Gentlemen, since the inception of the new management plan, the average annual landing for the fishery is around 7 tonnes valued at PGK120,000. Though small in terms of quantity and value compared to other fisheries, the trade has the potential to contribute to improving livelihoods of those communities involved, if managed effectively.

With the current situation we are facing with other fisheries—for example the *bêche-de-mer* fishery closing for three years—we need to step up our efforts with our attempt to find effective management solutions to create alternative livelihoods for our coastal communities and I believe this workshop will discuss more on these issues.

Ladies and Gentlemen, as we move to another chapter on the management of the trade in PNG, bear in mind the new concepts being promoted internationally, especially the Ecosystem Approach Fisheries management. I will remain curious to see how the principles of this concept can be built into our existing plan on the Live Reef Food Fish Fishery, and thus use the same model to review all our existing plans.

Noting the increase in the adverse impact of climate change and other natural causes, I challenge you all to come up with the best management plan that builds in management measures, resilience indicators and adaptive approaches to ensure this fishery is sustainable for years to come.

With these short remarks Ladies and Gentlemen, I am informed that your workshop purpose is to "...hold a focused consultative stakeholder workshop to review and update the National Live Reef Food Fish Fishery Management Plan (2003), bringing together representatives of government (national, provincial and local), industry, community and non-government organisations", who are all here now.

I am also advised that the objective of this workshop is to revise the current management plan in an attempt to incorporate principles of new management concepts like the one I alluded to earlier.

Ladies and Gentlemen, I am confident that during this workshop you will identify all issues that can be translated into management synergies to make this fishery achieve its objectives and also continue to promote the PNG Government's fisheries policy.

With these remarks, I wish you all a meaningful discussion and I look forward to receiving the revised management plan for 2009.

Thank you all."

3.2. Expectations

In any workshop involving people from different sectors and backgrounds there are always a range of expectations. To allow all the participants to understand each other's differing perspectives, they were asked to introduce themselves and say what they wanted out of the workshop. The expectations covered a range of themes:

- Sustainability – biological; social; commercial
- Question of commercial viability
- Equity and benefit sharing
- Management – role of government; role of partners; CITES issues; plan should reflect local and provincial needs
- Knowledge (learning and sharing)
- Building capacity – industry; management; monitoring

The full range of expectations and issues were:

<ul style="list-style-type: none"> • By-catch problem • Monitoring data • Sustainability • Is it commercially and socially viable (long-term) • Local fisheries – local benefits • Government role in developing fishery • Government only interested in large scale fisheries • Returns to people from commercially viable fishery • Learn and contribute to community • Share knowledge • Sustainability and strong management • Learn about LRFFT • Role of partners in managing • What role can we play in management • How to raise local capacity • Export regulations – national and international • Revised plan reflects provincial and local needs 	<ul style="list-style-type: none"> • Understanding of LRFFT take to communities • Management plan captures community interests • Clear management guidelines and resource guidelines • Benefit sharing • Guidelines – social; economic; environmental – sustainability • Sharing biology and monitoring knowledge • Opportunities for expansion of LRFFT (especially with BDM closure) • Good to have stakeholder involvement in management • To achieve workshop objectives • External impacts of fish and habitats from land-based activities • Sustainability and management of fishery • Understand how PNG is managing LRFFT and incorporating EAF • Information gathering on LRFFT 	<ul style="list-style-type: none"> • Learn and contribute • Understand benefits • Sustainability – environment; economic; community • Management plan suited to community • Understand why NIP fishery was closed • Spawning aggregations not properly surveyed • Consider banning LRFFT • Participatory approach used • Need information on CITES – what can be exported? • Monitoring – need fully trained observers able to identify species • Need workshop to have balance – e.g. prices, investors at risk • Need awareness • Want to learn about species and management plan • Issue of “MOUs” – often unrealistic expectations • Trade barriers and opportunities
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3.3. Background Presentations

To ensure that all participants had a basic understanding of the range of issues associated with the LRFF fishery, a series of background papers and presentations were provided. While some of the participants were very familiar with the fishery, others had an understanding of only certain aspects of the fishery, yet others only a very limited knowledge of the fishery. The background papers and presentations were concise and targeted on the objectives of the workshop.

3.3.1 OVERVIEW OF THE LIVE REEF FOOD FISH FISHERY IN PAPUA NEW GUINEA (SUMMARY)

Leban Gisawa (National Fisheries Authority) presented an overview of the Live Reef Food Fish Trade in PNG. The following is a summary of his presentation. The full background paper is provided in Appendix D.

Characteristics of past operations: The history of PNG's live reef food fish trade has been one of "boom and bust", the use of noxious substances to stun and capture fish, and the targeting of fish spawning aggregations. Other issues associated with the trade have included: the companies undertaking the fishing rather than the communities, conflicts over royalty payments and reef access and ambiguous MOUs with the resource owners.

Management of the trade: The National Fisheries Board imposed a moratorium on the issuance of licenses in 1998. After pressure from operators to lift the moratorium, the Board approved a trial fishery in Manus and New Ireland Provinces in 2000. A spawning aggregation survey at M'Buke, Manus, in 2001, found insufficient fish stocks to sustain a commercial fishery and the Board cancelled the trial license for that area. The trial continued in New Ireland Province.

Trial Results – Catch composition: A total of 7,014 kg of fish were caught, with 59% from Tigaks, 29% from Kavieng, 9% from Soson and 3% from Tingwon.

Trial Results – Export composition: A total of 6,118 kg of fish were exported, with *Epinephelus fuscoguttatus* making up 31%, *E. polyphkadion* 27%, *Plectropomus areolatus* 12%, *Cheilinus undulatus* 11%, with smaller volumes of a range of other species.

Trial Results – Income generated: The 6.1 tonnes of fish exported generated around PGK130,000. Of this PGK11,000 was shared among the fishers; PGK4,500 was paid to each of the respective community accounts; and PGK80,000 was spent by the company on expenses.

Trial Results – Fishing methods: Two variations of traps – trap strings and single traps – were used, as well as normal handlining (non-selective), snorkel handlining (selective) and droplines (fish stressed).

Management actions: As a result of the trial a management plan was formulated. Awareness materials and programs were undertaken, and a decision was made to have 100 % observer coverage on the LRFF vessels, along with the development of the necessary log books and equipment. A database was also created.

Management framework: The management plan was approved and gazetted in 2003. It required site-specific licensing conditions; established a Management Working Committee; full observer coverage; and other management measures, including: catch limits (Total Allowable Catches – TAC); and restrictions on fishing methods and handling (handlines only; fish cage specifications; transshipments;

diseased fish; bans on fishing spawning aggregations, diving spots, the use of hookah and scuba, and poisons). Areas of operation were designated; and monitoring and reporting requirements established.

The fishery still operates under this management plan (G48 – April 2003). Some data on the fishery was provided and can be seen in Appendix D. Currently there are no LRFFT operations in PNG.

Discussion

It was noted that there had been considerable concerns expressed about the LRFF trade. Why had the past fisheries been closed, and had those closures been analysed? Most closures had been due to community backlash against the operators. In at least one case it was due to the confirmed use of cyanide. No detailed analysis of the closures has been undertaken. It was suggested that this information would be very useful and should look at community expectations, MOUs related to community development, and the targeting of spawning aggregations.

In New Ireland Province the fishery closed due to a number of reasons, including: unrealistic expectations of benefits; fishing of spawning aggregations with too many traps; failure in making payments and low catch rates; and the MOU training requirement was not complied with. Other examples were noted by the participants: In Manus in 2000, Golden Bowl was forced out by the community after a few weeks due to issues with custom; in 2006 in Manus NISP apparently operated well following the management requirements, but there were issues over prices paid and the distribution of the payments to the management committee; and in 2006 in Manus the operator provided an in-kind payment of boats and motors which, however, were impounded due to non-payment of duties by the operator.

Concern was expressed that Provincial government authorities only get to review the initial proposal, not the MOUs entered into between the companies and the resource owners. It was suggested that Provincial governments should review and approve any MOUs and contracts. This issue should be considered in the management plan review.

While spawning aggregations had been closed to fishing in 2003 after the Management Plan was gazetted, there were examples of spawning aggregations still being heavily fished, for example in Manus in 2005.

Hong Kong trade data indicated that fish from PNG entered Hong Kong in January, February, June and September 2006, even though LRFF fishing in PNG ceased in 2005. These were the last shipments made from the fish caught in Manus.

It was noted that all the monitoring to date has been on the fish catches and spawning aggregations, but there is a need to also consider socio-economic monitoring.

The use of cyanide in the fishery was discussed. There were anecdotal accounts of its use as far back as 1991 in the Hermit Islands. There are two documented accounts of cyanide use in the fishery: Milne Bay in 1998; and Morobe Province in 2005. It was suggested, but not confirmed, that the cyanide is being illegally shipped in, and that inspections of shipping should be improved. The industry representative noted that shipments to Hong Kong are tested for cyanide. However, recent studies have indicated that cyanide cannot be effectively detected in fish after about 2-3 hours due to it being rapidly metabolised.

It was noted that the management plan revisions need to address the issues of cyanide use and the targeting of spawning aggregations.

3.3.2 THE LIVE REEF FOOD FISH TRADE IN THE CORAL TRIANGLE (SUMMARY)

Presentation by Dr. Geoffrey Muldoon (WWF).

The Live Reef Food Fish Trade (LRFFT) is a major fishery within the Indo-Pacific, concentrated on the Coral Triangle region. It is currently valued at US\$850M. The trade demand is centred on Hong Kong, with the harvesting of fish having spread from Hong Kong to the Philippines, to Indonesia and then to the Pacific and Indian Oceans as the target species were successively depleted. In Indonesia it is currently focused on eastern Indonesia, having depleted the target species in other areas.

Concerns with LRFFT

The LRFFT has a history of resource over-exploitation and unsustainability. Destructive fishing practices include: the targeting of spawning aggregations; cyanide use; and the capture and retention of juveniles for grow-out. In addition there is limited enforcement and monitoring of international trans-shipment (e.g. CITES listed species) and trans-boundary trade and IUU (e.g. live fish trade vessels). There is potential for growth in market demand, especially in China.

Trends in Live Reef Fish Production

The LRFF species are considered over-exploited, as measured by declining catches. There has been an increasing trend in total recorded imports into Hong Kong of LRFF species by air since 1998, but has been declining in the last two years. Catches of LRFF species in the Philippines, Indonesia and Malaysia are steady or increasing since 2002. Imports into Hong Kong rose by 27% from 1999 – 2006, but have fallen in the last two years. Coralgrouper imports into Hong Kong have risen 193% since 1998; with coralgrouper exports from the Philippines rising by 72% since 1998. Total tiger grouper exports from Indonesia have risen by 740% since 2002, but it should be noted that the increase in tiger grouper exports from Indonesia is being driven by an increase in hatchery production and grow-out.

The “Coral Triangle” (CT) region was identified by using coral and reef fish diversity as the two major criteria. The boundaries of this region were defined by scientists as covering all or part of the exclusive economic zones of six countries: Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands and Timor-Leste. Covering only 1.6% of the planet’s oceanic area, there is broad scientific consensus that the CT represents the global epicentre of marine life abundance and diversity – with 76% of all known coral species, 37% of all known coral reef fish species, 53% of the world’s coral reefs, the greatest extent of mangrove forests in the world, and spawning and juvenile growth areas for the world’s largest tuna fishery.

In August 2007, President Yudhoyono of Indonesia proposed to other CT leaders a new multilateral partnership to safeguard the region’s marine and coastal biological resources: the *Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF)*. The CTI Regional Plan of Action is a living and non-legally binding document, to conserve and sustainably manage coastal and marine resources within the Coral Triangle region, which takes into consideration laws and policies of each country, and was endorsed in March 2009. Goal 2, Target 4 deals with the Ecosystem approach to fisheries and a more effective management and more sustainable trade in live reef fish. (<http://www.cti-secretariat.net>)

Value Distribution and Risk in LRFFT

The perception among fishers and suppliers is that the price they receive is too low (Figure 1). The financial costs and risks increase as the product moves along the market chain (e.g. storage, transport, mortality risks). High storage and transport costs are a function of remoteness of fishing grounds and distances to market. One shipment of fish may cost as much as \$US75,000. By air, transport costs can make up 50% of value added. The risk of mortality is of vital importance as it can lead to both: loss of revenue from sale of fish; and increased per unit costs of transporting and marketing fish. The mortality risk is not factored into the 'value' distribution effect.

There are high risks of mortality during storage and transport. Most deaths occur during the holding phase in the source country where mortality can be as high as 30%. During transshipment by sea mortality can be as high as 10-20%. Weight loss in fish during transit can be 5-10%. The live nature of the fishery means the risk of mortality is of paramount importance as it can lead to both loss of revenue from sale of fish and increased costs of transporting and marketing the fish.

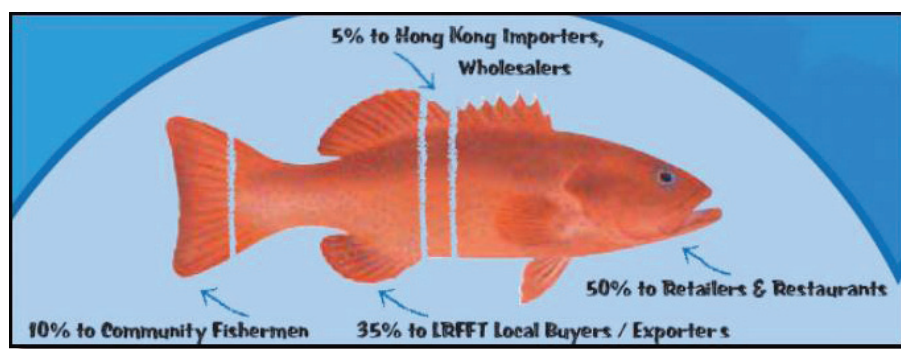


Figure 1: Representation of earnings from "one fish" (source: SPC, TNC, IMA LRFFT Awareness Materials 2002)

Are gains being unevenly distributed along the market chain relative to cost and risk?

All intermediaries face one of two risk types: price risk; and mortality risk. Mortality occurs at each stage of the market chain, such that the initial consignment decreases cumulatively along the market chain.

The average loss per shipment for an exporter is approximately US\$3,000, while for the fisher the average loss is approximately US\$200. With given marketing and transport costs, the exporter faces the greatest loss from fish mortality. The fisher profits regardless of whether fish is sold alive or dead.

Discussion

The issue of mis-reporting can occur at both ends, exporting and importing. When catches are transported by sea in a Hong Kong registered vessel, there is no requirement for the shipment to be declared on entry to Hong Kong. Exports are often not well recorded in-country before shipping. If shipped by air then good records are available.

There have probably been some cases of price transferring (i.e. where the declared price on export is different to the import price). ACIAR has attempted to estimate the 'beach price' by working back from the sale price, but the problem is that there is a considerable amount of vertical integration of the companies involved making it difficult to calculate these figures at the various stages of the supply chain.

3.3.3 THE ECOSYSTEM APPROACH TO FISHERIES (SUMMARY)

Presentation by Dr. Andrew Smith (TNC).

The Ecosystem Approach to Fisheries (EAF) is an improved approach to developing and managing coastal fisheries and aquaculture. It takes into account the broader effects of fishing on the environment, as well as the effects of other sectors on fisheries and the ecosystems within which they occur.

An **ecosystem** is a dynamic community of plants, animals (including people) and micro-organisms and their non-living environment, interacting as a functional unit.

Conventional fisheries management aims to manage human activity in a way that maximises fisheries production, economic benefits, employment or national revenues. The EAF focuses not only on these aspects, but also on ensuring a broader range of ecosystem services and functions. This in turn provides a greater array of human benefits, maintains alternative development options, guarantees long-term resource sustainability, and ensures that coastal ecosystems are resilient enough to withstand other stresses.

The FAO defines EAF³ as an "...approach to fisheries [that] strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries." The purpose of EAF is therefore "...to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by the marine ecosystem" (FAO 2003).

The Secretariat of the Pacific Community's Coastal Fisheries Program and TNC has produced a booklet to raise awareness of what the EAF means in the Pacific context and provides suggestions and guidelines for its implementation. It describes the steps and activities needed to implement the EAF, and provides background information on relevant technical areas.⁴

What are the Ecosystem Approach to Fisheries Principles?

Important principles in applying the EAF include:

- Not allowing fishing operations to cause undue disruption or damage to ecosystems through overfishing, depletion of non-target species, habitat damage or pollution;
- Ensuring ecosystems are healthy and resilient so that they can endure unexpected environmental and other shocks;
- Improving compliance with fishery management measures through greater stakeholder engagement; and
- Recognising that marine resources have alternative values (such as recreation and tourism) in addition to extractive ones.

³ FAO Fisheries Department. 2003. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries, No. 4, Suppl. 2. Rome. 112 p.

⁴ Preston, G. 2009. The ecosystem approach to coastal fisheries and aquaculture in Pacific Island Countries and Territories. Secretariat of the Pacific Community and The Nature Conservancy. Noumea, New Caledonia. 20pp. (http://www.spc.int/coastfish/Reports/EAFM_Workshop/EAFM_Booklet.pdf)

In practice, implementation of the EAF will require us to:

- Scale back unrealistic expectations of the amounts that coastal fisheries can produce;
- Apply a conservative, precautionary approach to fisheries management, often without the benefit of fishery information;
- Set aside reserves or protected areas to increase ecosystem resilience;
- Promote more stakeholder participation in the fishery management process;
- Establish rights-based methods of fishery management, instead of open-access 'free for all' arrangements; and
- Establish integrated coastal management mechanisms that involve many sectors, not just fisheries.

How Can the EAF be Applied to the Review of the Management of Live Reef Food Fish Fishery?

There are a number of ways that the EAF principles should be applied to reviewing and revising the PNG LRFF Fishery Management Plan:

- All key stakeholders need to be involved in the management planning process. This will ensure that the broader societal goals are taken into account—as opposed to short-term economic or social goals;
- The LRFF fishery needs to be considered in a broader context. All the *direct* and *indirect* effects of the fishery on species and habitats need to be considered, including those related to the ecological, social, economic and governance, while also considering the external effects on the fishery;
- Once the range of key issues have been identified a risk assessment needs to be made to prioritise those issues for more effective targeted management action;
- Allowance must be made for uncertainty—e.g. by applying the precautionary approach to management. There are a number of gaps in our knowledge of the target species as well as how ecosystems function. EAF encourages use of the 'best available knowledge' in decision-making, including both scientific and traditional knowledge, while promoting risk assessment/management and the idea that decision making should take place even where there is a lack of detailed scientific knowledge;
- Build on existing fisheries management frameworks, institutions and practices (government and cultural) and ensure management actions are implementable;
- Ensure that the management actions maintain viable fish habitats and an appropriate age-structure in the fish populations; and
- Apply an adaptive management system that stresses the importance of establishing mechanisms for monitoring and feed-back loops (Figure 2).

Discussion

No questions were asked.

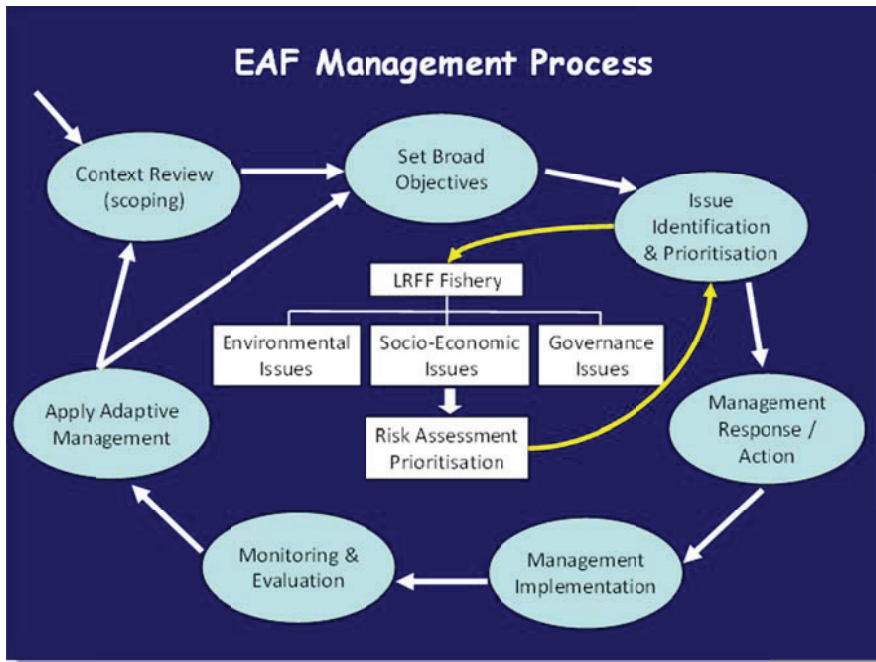


Figure 2: Ecosystem Approach to Fisheries (EAF) adaptive management process.

3.3.4 INTERNATIONAL STANDARD FOR THE TRADE IN LIVE REEF FOOD FISH (SUMMARY)

Presentation by Dr. Geoffrey Muldoon (WWF).

What is Collaborative Resource Management?

The idea of “collaborative resource management” is not new and describes the situation whereby all stakeholders participate in the management of a natural resource, leading to better management and a more sustainable trade. In particular, these collaborative management programs are aimed at industry engagement and are based upon common agreed-to principles and standards as a means to conserve resources, regulate quality and promote trade. Inevitably these standards and principles are built around the idea of “Best Management Practices” of both the resource and the extractive users of the resource.

These collaborative models consistently recognise the need to consider a whole chain-of-custody approach to management of the resources. The use of standards as a collaborative management tool usually arises when industries independently initiate the standardization or regulation of their trade because they recognize the benefits they stand to gain from such systems.

What is the International Standard for the Trade in Live Reef Fish?

In recognition of the need to eliminate the trade's destructive impact on coral reef ecosystems and to provide a foundation for a more responsible trade in LRFF within the Asia-Pacific region, a multi-organization strategy to develop environmentally and socially sustainable standard for the trade was launched in 2002. The goal of the project was to bring together stakeholders to determine a suite of best practices for the LRFF with the outcome being to encourage a more sustainable, high-value industry that can improve the livelihoods of local fishers, provide a stable and healthy supply of fishes to the market, and help protect the coral reef habitats which are the basis for productive reef fisheries.

The Standard is *voluntary* and covers all practices relating to all aspect of the industry, from assessing reefs and target reef fish populations to dealing with human health and safety concerns. The Standard focuses on capture of wild live reef food fish; the aquaculture of live reef food fish; and the handling, holding distribution and marketing of live reef food fish (Figure 3). It is aimed at being a standard to which all responsible members of the LRFF trade will adhere.

A *principle* type approach was adopted in the organization of the LRFFT Standard. The initial standard document would consist of bullet criteria with underlying descriptors clarifying those criteria and would be augmented with supportive documentation by way of best practice documentation that would expand on each of these bullet points and describe how LRFFT members may seek to satisfy each of the criteria. The scope of the standards was broad and was intended to capture the principal stages along the chain of custody, and the stakeholder groups for which best-practices would be required.

The International Standard for the Trade in Live Reef Food Fish recognises many of the aspects of an EAF. The EAF principles set out the guidelines for management of the LRFF Fishery in PNG. The International Standard for the Trade in Live Reef Food Fish, provides a framework for augmenting the EAF approach as an internationally accepted approach by establishing a suite of best-practices and principles to guide the behaviour of all relevant stakeholders, particularly industry and the private sector.

More information on the International Standard for the Trade in Live Reef Food Fish can be found at: <http://www.livefoodfishtrade.org>.

Discussion

No questions were asked.

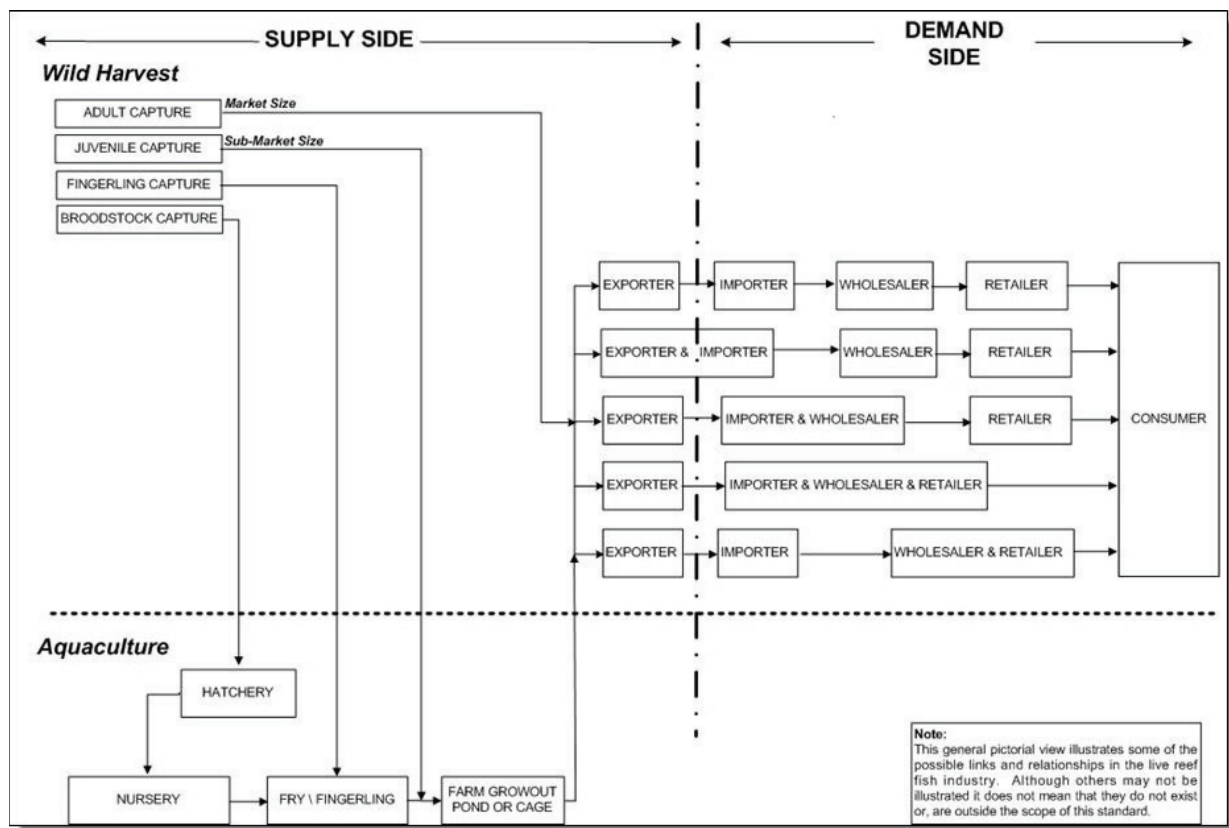


Figure 3: Overall Scope of the International Standard for the Trade in Live Reef Food Fish

3.3.5 TARGET SPECIES LIFE CYCLES AND FISH SPAWNING AGGREGATIONS (SUMMARY)

Presentation by Dr. Richard Hamilton (TNC).

This presentation began by summarising the life cycles of target species of the Life Reef Food Fish Trade (LRFFT). It explained how target species of fish have two distinct phases, a pelagic (open water) larval phase and a benthic (associated with the sea floor) juvenile/adult stage. Since many people have incomplete knowledge of spawning and the larvae phase these life cycle stages were explained in the most detail. The presentation then outlined how many target species of the LRFFT have life history characteristics that make them unable to sustain heavy or even moderate fishing pressure. These characteristics include, slow growth, late sexual maturity, natural rarity, low natural mortality, sex change and the fact that nearly all target species of the LRFFT form Fish Spawning Aggregations (FSA).

It was stressed to workshop participants that the number one reason many target species of the LRFFT are so vulnerable to overfishing is the fact that they form FSA, when large numbers (100s or 1000s) of mature fish travel to a specific location at a specific time to reproduce. These aggregations are highly attractive to fishers as FSA can produce substantial catch volumes of fish over relatively brief time periods. But as a result, FSA and associated populations are highly vulnerable to overfishing, through both direct removal of adults and through reductions to reproductive output (removal of fish before they have a chance to spawn). In Melanesia LRFFT operations and night spearfishing activities routinely target FSA, often resulting in very large reductions of breeding stock.

This in turn can result in localized population declines and subsequent reductions in food security and income to fishing communities.

The presentation then provided an overview of what we know now know about FSA of grouper in Melanesia. This was done by drawing on results from FSA monitoring and research programs that have been conducted in various locations in Melanesia in the past five years. Key aspects highlighted were that throughout Melanesia groupers begin to aggregate at FSA after the full moon. Spawning occurs just prior to or around the new moon, with aggregations dispersing shortly after this. Many species such as the brown-marbled grouper and camouflage grouper have a well defined spawning season that typically lasts between 4-5 month each year, and for such species seasonal closures are an option when the spawning season is known. However the squaretail coral grouper shows little annual seasonality, with FSA occurring in every month of the year.

The presentation ended by suggesting management options for the LRFFT based on what we know about the Melanesia situation. These management suggestions all fall under the concept of adopting the precautionary approach and included; lunar and seasonal closure, incorporation of FSA in MPA networks and a complete ban on the LRFFT.

Discussion

Has there been any research on the length at which sex change occurs? Using the graph shown in the presentation, the change occurs from about 10 years, or 62 cm, but most change occurs much older and at a larger size than that.

Has there been any work on distribution patterns of spawning aggregations? They vary, squaretail coral grouper form a lot of aggregations which are habitat dependent. It also depends on the amount of reef area.

Why is there the difference between the timing of the Dyual and Tigaks aggregations? We are not sure, but may be differences in temperature patterns and it also suggests different fish stocks.

3.3.6 SPECIES AND HABITATS OF SPECIAL CONCERN (SUMMARY)

Presentation by Dr. Richard Hamilton (TNC).

This presentation provided information on large vulnerable coral reef fish species that are now overfished in many parts of Papua New Guinea. These species all display life history characteristics that make them unable to sustain moderate to heavy fishing pressure (i.e. slow growth, late sexual maturity, natural rarity and aggregating for the purpose of spawning). Consequently, they deserve special management considerations under the revised PNG LRFF fishery management plan in order to ensure their long term persistence.

The first species discussed was the humphead wrasse (*Cheilinus undulatus*). The humphead wrasse is a conspicuous indicator of general fishing pressure throughout the Coral Triangle region. It is a prime target of both the LRFF operations and spear fishers, with populations typically declining markedly once LRFF operations occur. This species is listed as Endangered on the IUCN Red list and is now also listed on CITES Appendix II. It was recommended that to conserve this species a ban on the commercial use of this species should be considered in Papua New Guinea.

The giant grouper species (*Epinephelus lanceolatus*) and the humpback grouper (*Cromileptes altivelis*)

are also listed on the IUCN Red list. Both species are also naturally rare and prime targets of the LRFFT. It was also recommended that a ban on the commercial use of this species should be considered in Papua New Guinea. The squaretail coral grouper (*Plectropomus areolatus*) has also recently been listed as Vulnerable on the IUCN Red list. Its vulnerability largely due to *P. areolatus* aggregating in the hundreds or thousands at predictable times and locations for the purpose of spawning. It was recommended that to sustain breeding populations of this important food fish in PNG the revised PNG LRFFT fishery management plan considers; firstly, banning LRFFT operations from exploiting FSA sites, and secondly, banning LRFFT from purchasing *P. areolatus* in the 10 days leading up to and including the new moon in every month of the year.

The presentation ended by providing an overview of the habitats of concern that should also be protected under an EAF management approach. These habitats included fish spawning aggregation sites, spawning migration routes/corridors, and nursery areas for vulnerable species.

Discussion

What population trends have you seen during monitoring? They have been variable due to the artisanal fisheries which also target the aggregations. Overall some sites remained stable. The Manus monitoring showed a rapid decline, but with some improvement after the aggregations were protected. Protecting aggregations is only part of the issue, especially if fishing pressure continues away from the aggregation. So only protecting spawning aggregations is not enough, other fisheries management actions are required too.

3.3.7 FISHING INDUSTRY PERSPECTIVE (SUMMARY)

Presentation by Mr. Clifton Walai (Golden Bowl Restaurant)

He noted that the LRFFT can provide foreign income, provides employment at the community level and provides direct benefits e.g. royalties, at the community level.

Golden Bowl operated the LRFFT with vessels licensed for Central, Manus, and Western Provinces. The Provincial governments would request them to come in, they would sign a standard MOU (developed by NFA), but some communities provided complex MOU's to be signed. Before operating they would conduct awareness with the Ward members.

The catch was subject to weighing and then payment. They would train young people to fish by using experienced Chinese instructors, as catching LRFF is difficult and they need to be handled and de-gassed carefully to ensure maximum survival rates. Aerators and pumps were needed to do the fishing.

He noted that there have been others using cyanide, as well as bribery used to cover-up its use.

They rely on local knowledge to find fish. Now he knows why spawning areas are important, but he noted that it is the people that take the company to the aggregations sites. He said there is a need for awareness about the importance of fish spawning aggregation sites.

It is his understanding that there is a need for a special permit from DEC to catch wrasse.

For transporting they use two methods of shipping—vessels take about 17-20 days and result in at least 10% mortality; and airfreight only results in less than 2% mortality.

Under the license conditions, records are kept by Golden Bowl and by NFA. License conditions were not tied and he found the NFA observers were not qualified—for example they couldn't identify the species adequately. His company kept 'true' records, whereas the observers just guessed. He expressed concern that fish occasionally died during the monitoring and measuring of the fish by the observers. One time the observers had to re-weigh and measure the fish, and vessel from Hong Kong had to keep moving around which cost them money.

Every place they operated they had problems with resource owners. Some would agree and some wouldn't. In New Britain they have registered their reef, so they were easy to deal with as there were no disputes over reef areas.

Golden Bowl has a local setup in Port Moresby where they sell any by-catch live in the restaurant. They are still catching and selling some live fish with people in Port Moresby for their restaurant trade.

Discussion

With regard to registered reefs, were there places where they were not available and there was communal ownership? How do you pay? Golden Bowl pays for fish per kg and we pay the community through the Ward Councillors with in-kind, not cash. 2% goes to community—calculated against the export value of the product.

Where do you see role of provincial governments? The Provincial government should get the proposals and be contacted through NFA as part of licensing process. They should not be involved in operations.

What is the time frame in working with communities? The management plan should consider getting data and information back to provinces.

What are some of the reasons they don't agree? We need to ensure that there are sufficient fish stocks in the area, as a vessel costs a lot to relocate.

How do you do stock assessments? By diving and snorkelling. One time we did an aerial survey using Chinese observers to look for spawning aggregation sites.

What is the break-even point? It is different for different species: humphead wrasse it is 1 tonne; for other species it is 2-3 tonnes. To justify shipping to HK we need a vessel with 6 tonne limit. The price per kg in Manus PGK4, in Central PGK8. For humphead wrasse the maximum is about PGK12/kg, humpback grouper it is PGK8/kg; squaretail coral grouper PGK6-7/kg and the others about PGK3-4/kg.

Who sets bench mark for price? The market determines it through demand and supply.

How does Golden Bowl operate? We brought in 15 trainers (mostly Chinese). Once we had an MOU for the area we sent in the trainers. We then picked up trained fishers from the community. Determined the royalty schedule. Where they went depended on the weather. Once they had got the limit of fish, then we arranged for the pick-up, then requested the license to export and brought in the carrier vessel and exported to Hong Kong.

Concerning the mother-ships: What is the mortality rate? About 10%.

What are they fish fed? [no answer]

How long does it take to ship from Pt Moresby to Hong Kong? About 17-20 days. We also exported some using air freight.

3.3.8 COMMUNITY PERSPECTIVE (1) (SUMMARY)

Presentation by Ms Piwan Langarap (Pere, Manus Province)

We have a lot of fish spawning aggregation sites in our area and our knowledge of them is high. People are fully dependent on seafood for their livelihoods, cash, school fees, and so on.

The main threat is overfishing—using both introduced and local methods. Over-population has caused fish stocks to really decrease. There has been a degradation of the resource.

With the LRFFT, people did not support the introduction of it into our area. One issue was about benefits sharing—we think it is better catching and selling the fish at the market locally.

The community is into conservation and has taken action to manage our spawning aggregation sites.

Discussion

No questions.

3.3.9 COMMUNITY PERSPECTIVE (2) (SUMMARY)

Presentation by Mr Renson Aisoli (Kavieng, New Ireland Province)

There have been benefits from the LRFFT. It has generated some income which has assisted families and local fishers; assisted with school fees; and the spiritual environment [through church fees].

People were not aware of the environmental impact prior to the fishery. The main problem is we need to limit impacts. Destructive practices, such as targeting spawning aggregations prior to LRFFT. Now we are aware of the situation, will try and assist.

Discussion

No questions.

3.3.10 OVERVIEW OF CITES (SUMMARY)

Presentation by Jeff Kinch (SPREP)

Papua New Guinea became a CITES signatory in 1976. CITES has three Appendices that list species of wildlife. Each Appendix has different requirements and levels of protection.

In 2004, the humphead wrasse, *Cheilinus undulatus*, was listed on CITES Appendix II because of concerns that it was actually or potentially threatened by exploitation, especially by the international live reef food fish trade.

An Appendix II listing of a species does not necessarily mean that it is currently threatened with extinction nor that trade in that species will be limited, however, any such trade must be determined not to be detrimental to the survival of the species in the wild, and should only involve specimens that were obtained in compliance with national laws for the protection of fauna and flora. Appendix II includes species that may become threatened if their trade is not effectively regulated.

To ensure that trade in an Appendix II-listed species is non-detrimental, a number of steps must be completed prior to export.

First, the Scientific Authority of the State must advise that the export would not be detrimental to the survival of the species.

Second, the Management Authority of the State must be satisfied that the specimens were not illegally obtained. The Scientific Authority may also determine that limits should be placed on the export of a

species in order to maintain it throughout its range at a level consistent with its role in the ecosystems in which it occurs. Annual quotas are one example of such limits. The Management Authority is ultimately responsible for the issuing of permits.

In relation to importation of Appendix II-listed species, the importing State must require the prior presentation of the export permit or re-export certificate. Some importing states, most notably the members of the European Union, have taken stricter measures and require the prior issuance of an import permit before Appendix-II specimens can be imported. If a species is re-exported, the re-exporting State's Management Authority must be satisfied that the species was imported in accordance with CITES provisions.

3.4. Discussion of Current Management Plan Objective

The workshop was asked to look at and provide some initial feedback on the current management plan's objective, shown below. The purpose of this session was not to re-draft the Objective at this stage, but to have the workshop as a whole begin considering objectives prior to breaking into groups.

Discussion

4. OBJECTIVES

The broad objective of this national plan is to ensure that use of the LRFF resource is sustainable and well regulated.

The National Plan objectives are specifically:

- a) To manage the LRFF fishery in the management areas so that the size of the stock tends towards one that will give the maximum sustainable economic yield (MSEY).
- b) To ensure the LRFF Fishery in the management areas is viable in terms of biological, social and environmental.
- c) To ensure the promotion of sustainable fisheries development practices for the participation and benefit of the traditional resource users;

In relation to section 4. a) "...the size of the stock tends towards one that will give the maximum sustainable economic yield (MSEY)" concern was expressed that it is not feasible to estimate or determine a "maximum sustainable economic yield" given the lack of knowledge of the fish stocks, especially as it is a multi-species fishery. The need for "risk assessment" was also raised.

On section 4. b), it was suggested that prior to any fishing there needs to be a baseline survey conducted, during both aggregation times and outside aggregation times. In addition to "...biological, social, and environmental" viability, there is a need to ensure economic viability also. This section should also refer to the need for the "precautionary approach" to be applied.

On section 4. c), it was suggested that capacity development be included in the objectives.

The issue of determining "management areas" was raised: Should they be the specific area of operation? Do they need to be based on ecological or jurisdictional boundaries, or both?

The key themes emerging from the discussion suggested that the management plan objectives should:

- Focus on ensuring a sustainable LRFFT by ensuring the precautionary approach is included. Viability of the LRFFT should include:

- Biological
- Environmental
- Social
- Economic
- Promote and apply best practices
- Benefit and fully involve traditional resource owners, and include wider communication and consultation with all levels of government (including Provincial and Local).

It was pointed out that the objectives of the management plan need to comply with the relevant sections of the *Fisheries Management Act 1998* (No. 48), specifically section 25. Management Objectives and Principles, and section 28. Fishery Management Plans. Copies of the *Fisheries Management Act 1998* (No. 48) were made available to the participants for reference.

3.5. Issue Identification, Risk Assessment and Management Actions

Prior to reviewing the current National Live Reef Food Fish Fishery Management Plan (2003), the workshop participants were broken into three groups—community, provincial and national—to identify the issues of concern based on, and relevant to, their particular groups' experiences of the LRFFT.

The method used in the workshop to identify issues and then prioritise them through risk assessment was based on a modified version of an EAF framework developed in Australia and applied to the tuna fisheries in the Pacific.⁵

Each group was asked to identify issues associated with the LRFFT in three broad areas: ecological; social-economic; and governance. An issue identification component tree was used to help identify a range of issues under each main area (Figure 4). A more detailed list of a range of possible issues was also provided to the groups (see Appendix E).

⁵ Fletcher, W., K. Sainsbury, J. Chesson and T. Hundloe (2004) National ESD Framework Project: Information Package – Ecological Risk Assessment. Version 4 .FRDC Project Team (<http://www.fisheries-esd.com/a/pdf/EcologicalRiskAssessment.pdf>)

W.J. Fletcher (2008) A Guide to Implementing an Ecosystem Approach to Fisheries Management (EAFM) for the tuna fisheries of the Western and Central Pacific Region. Forum Fisheries Agency, Honiara, Solomon Islands. Version 5 March 2008. 70pp. (<http://www.fisheries-esd.com/a/pdf/EAFM%20GUIDE%20Version%205.pdf>)

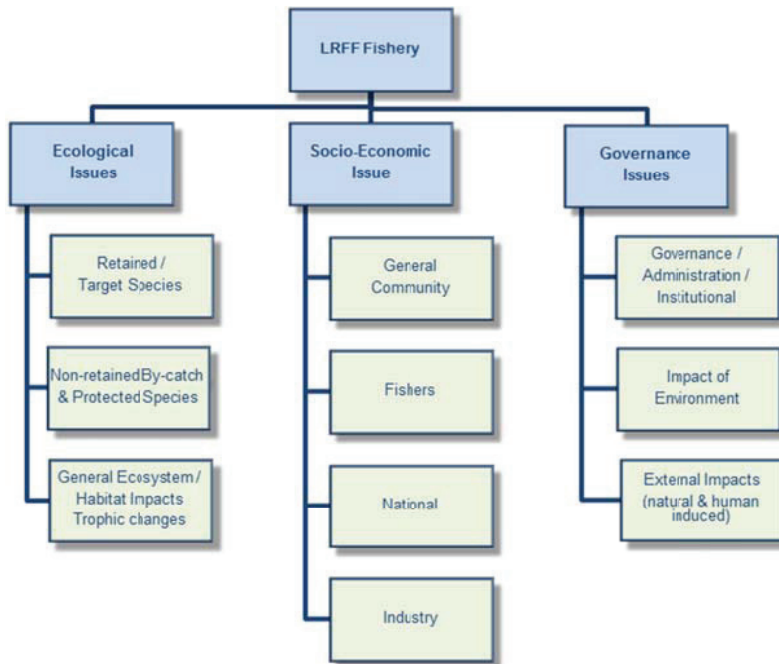


Figure 4: Issue identification component tree guide.

The full results of the issue identification are provided in Appendix F, and a summary shown in Table 5 below.

The community group identified a total of 23 issues of concern to them: 6 were ecological; 8 socio-economic; and 9 were governance related.

The provincial group identified a total of 13 issues: 4 ecological; 5 socio-economic; and 4 governance related.

The national group identified a total of 37 issues: 15 ecological; 13 socio-economic; and 9 governance related.

To prioritise these issues each group was asked to undertake a simple risk assessment process.⁵ In discussing each issue, the participants considered the sources of risk, the consequences or impacts, and the likelihood that those consequences may occur. A semi-quantitative scoring approach was used where each impact and likelihood were rated according to and Table 2. The “Risk Value” was then determined by multiplying the value of the impact with the likelihood to get the risk value and resulting risk ranking, as shown in Table 3. The risk ranking provided a guide as to the level of management action required (Table 4).

Table 1: Evaluation of impacts or consequences.

Level	Description
0 – Negligible	Very insignificant impacts, probably not measurable against background variability
1 – Minor	Possibly detectable but minimal impact
2 – Moderate	Maximum acceptable level of impact
3 – Severe	Above acceptable limit. Wide and long-term negative impacts
4 – Major	Very serious impacts, likely to require long restoration time to undo
5 – Catastrophic	Widespread and permanent / irreversible impacts

Table 2: Evaluation of likelihood of occurrence.

Level	Description
1 – Remote	Insignificant probability of occurring
2 – Rare	May occur in exceptional circumstances
3 – Unlikely	Uncommon, but has been known to occur either here or somewhere comparable
4 – Possible	Some evidence that it could occur
5 – Occasional	May occur
6 – Likely	Expected to occur

Table 3: Risk Values – numbers in cells indicate the risk value, the colours indicate risk rankings.

		Impact / Consequence					
		Negligible	Minor	Moderate	Severe	Major	Catastrophic
Likelihood		0	1	2	3	4	5
Remote	1	0	1	2	3	4	5
Rare	2	0	2	4	6	8	10
Unlikely	3	0	3	6	9	12	15
Possible	4	0	4	8	12	16	20
Occasional	5	0	5	10	15	20	25
Likely	6	0	6	12	18	24	30

Table 4: Example of Risk Values, Rankings and Outcomes.

Risk Ranking	Risk Values	Risk Levels	Likely Management Response
Negligible	0	0	Nil
Low	1 – 6	1	As considered necessary
Moderate	7 – 12	2	Specified mgmt action required
High	13 – 18	3	Possible increase in existing mgmt actions
Extreme	> 19	4	Additional mgmt actions (exceptional circumstances)

The workshop participants tended to rank the impacts and likelihood quite highly, resulting in relatively high risk rankings. Having identified the highest priority issues, each of the three groups then discussed and decided on possible management actions to deal with the issues ranked as an “Extreme” risk.

The detailed results of the issue identification, risk assessment and management actions are provided in Appendix F. A summary of the issues ranked “Extreme” and “High” are shown in Table 5 below.

Each of the working groups reported back to the full workshop, with the discussion focused on clarification and elaboration of the issues and the proposed management actions.

Table 5: Summary of issues, risk assessments and management actions.

Issue	Risk		Suggested Management Actions
	Risk Value	Risk Ranking	
Lack of awareness of the effect of LRFF and general ecosystems	30	Extreme	Awareness programs (NFA, NGOs, Government)
Lack of community-based fisheries management plans	30	Extreme	Community-based management plans (NFA, NGOs, Government, Communities)
Destructive fishing methods: - Use of cyanide and nets - Wastage and by-catch - Use of SCUBA/hookah diving	30	Extreme	1. Enforcement of existing plan 2. Awareness of issues 3. Termination of license
No devolution of management power from NFA to Provinces to make their own rules and regulations	30	Extreme	1. Review the Fisheries Act 1998 to address this issue (long term) 2. Delegation from Managing Director to Province to perform functions at Provincial level to implement LRFF Management plan (short term) 3. CBM and LLG laws developed
No decentralisation of financial power from NFA to Provinces	30	Extreme	
Reef tenure disputes -- lack of consultation by all parties on development of Memorandum of Agreement (MOA)	30	Extreme	1. Have Provincial Government involved in development of MOA 2. More awareness to create understanding of MOA

Issue	Risk		Suggested Management Actions
	Risk Value	Risk Ranking	
National level -- Population increases (community / Province)	30	Extreme	1. Demographic studies 2. Effort control (e.g. man-hours, CPUE)
False promises to community by investors	30	Extreme	Strict adherence to MOA -- security deposit held by Province -- user pay policy
Sustainability issues	24	Extreme	Awareness programs (NFA, NGOs, Government)
Pressure on target species from fishing activities: - IUU - Artisanal fishing - Commercial fishing	24	Extreme	1. Impose ban on destructive fishing methods 2. Demarcate fishing areas (zonation) 3. Rotation of fishing activities (different fisheries)
Ecosystem / habitat impacts -- license conditions (LRFFT species specific)	24	Extreme	Revise current conditions and incorporate additional ones
95% of catch from spawning aggregation sites	24	Extreme	1. Close LRFFT in PNG 2. Closed seasons 3. CBM incorporates spawning sites 4. Specific management plans for each Province
Full recognition of community rights	24	Extreme	Conduct para-legal training (NFA, CELCOR)
Avoid 'political' influence	24	Extreme	Form PMACs (NFA, Provincial Government)
Need for sustainable financing	24	Extreme	1. Increase funding 2. Collaboration
Governance capacity (manpower / institutional)	24	Extreme	Strengthen
CBFM / LMMA / MPA / WMA	24	Extreme	Strengthen
Anthropogenic: - Develop policies to manage the number of traps, etc - waste management (e.g. boats /pens)	24	Extreme	
Night fishing	24	Extreme	Control
Human migration	24	Extreme	1. Control effort 2. Encourage CBFM 3. Alternative fisheries (e.g. BDM, FADs, seaweed)
Lack of institutional capacity to monitor fishing operations at Provincial and local levels	24	Extreme	Put cost of monitoring onto operator
Lack of share of benefits	24	Extreme	Develop BSAs (NFA, Industry, Government, Communities)
Need for awareness	24	Extreme	Conduct awareness

Issue	Risk		Suggested Management Actions
	Risk Value	Risk Ranking	
Need for capacity building (manpower / institutional) at all levels, including Provincial	24	Extreme	1. Institutional strengthening 2. Value-added
Poaching and ownership disputes	24	Extreme	More awareness of issues
Lack of stock assessment data: - Data is not available to communities - No baseline surveys	20	Extreme	Stock assessments (NFA, NGOs, Communities)
Fishing on target species spawning aggregations	20	Extreme	Impose ban
Ecosystem / habitat impacts form illegal practices	20	Extreme	Impose ban
Anthropogenic impacts on Ecosystem / habitats	20	Extreme	Include management guidelines / standards (e.g. LRFF; MARPOL)
Need for awareness (of ecosystem / habitat impacts) at all levels	20	Extreme	Conduct awareness
No stock assessment	20	Extreme	Baseline stock assessment before LRFFT allowed in -- feasibility assessment
Empower LLG	20	Extreme	Review and amend MOAs (NFA, Provincial government)
Coral harvesting -- habitat destruction	20	Extreme	1. Impose ban 2. Coral planting / farming
Lack of socio-economic surveys	20	Extreme	Conduct socio-economic surveys (NFA, NGOs, Government, Communities)
Ecosystem / habitat impacts -- minimise through Integrated Coastal Management (ICM) (involve: Forestry, mining, agriculture, fisheries)	18	High	Working committee consisting of all stakeholders / agencies
Lack of equity participation	18	High	
Spin-offs (eco-tourism)	18	High	
No consultation between stakeholders	18	High	
Destruction of community structure (equity and benefit sharing)	18	High	
Insufficient target species baseline data: - Life cycle - Biology - Sustainable level	16	High	
Lack of by-catch or protected species baseline data	16	High	
Lack of awareness of protected species	16	High	

Issue	Risk		Suggested Management Actions
	Risk Value	Risk Ranking	
Clear clarification on customary marine boundaries	16	High	
Lack of networking with partners and stakeholders	16	High	
Create networking among partners and stakeholders	16	High	
Political support	16	High	
Lack of infrastructure development	16	High	
Marine tenure	16	High	
Foreign exchange (remittances)	16	High	
Price transferring	16	High	
Alternative income generation	16	High	
Lack of understanding on the biology of targeted species, connectivity of systems, etc	15	High	
National level -- fishing areas	15	High	
Loss of life (no awareness / training)	15	High	

3.6. Management Plan Review

With the information provided by the background presentations, combined with the discussion and prioritisation of the range of issues identified as associated with the Live Reef Food Fish Trade, the workshop participants then reviewed the current National Live Reef Food Fish Fishery Management Plan.

In the same three groups—community, provincial and national—participants reviewed the management plan section by section and identified changes needed: additions, deletions and edits.

Each of the groups presented their findings and these were discussed and recorded. The suggested changes are provided in Appendix G.

The key suggested changes included:

- “Objectives”:
 - Revise the Objectives of the management plan to include the Precautionary Approach;
 - Remove the reference to MSEY;
 - Include the need for economic viability.
- “Management Arrangements”:

- Make adjustments to the “Management Arrangements” to ensure that an effective and functional structure is provided;
- Include Benefit Sharing Arrangements;
- Remove the reference to TAC as they cannot be determined for this fishery;
- Include DEC as a member of the Management Working Committee;
- “Management Measures”:
 - Remove the reference to TACs and include the precautionary approach;
 - Include a new section on ‘holding’ and make existing section for ‘handling’ only;
 - Add restrictions on night diving;
 - Provide greater specificity on spawning aggregation restrictions;
 - Include the Provincial authorities in consultations;
 - Change “Conservation” heading to “Holding”;
 - Require a bond be posted by operators;
 - Include resource owners in monitoring; add socio-economic monitoring;
 - Include Provincial Fisheries reporting.

Based on the three working groups’ outputs from the workshop, draft changes to the current National Live Reef Food Fish Fishery Management Plan were prepared immediately after the workshop for consideration by the National Fisheries Authority.

3.7. Recommendations

This Stakeholder Workshop on the Management of the Live Reef Food Fish Trade in Papua New Guinea brought together 37 representatives of all levels of government—national, provincial and local, the fishing industry, communities and non-government organisations. In the final session the participants were given the opportunity to make specific recommendations from the workshop to the National Fisheries Authority concerning the broader operation and management of the Live Reef Food Fish Fishery in PNG.

A total of seven recommendations to the National Fisheries Authority were agreed to by the workshop participants:

1. The workshop participants recommend that NFA require any LRFF operators undertake training of local fishers in the best-practices for capture and handling of live food fish, as a requirement of any MOUs and be stipulated in the operator’s license conditions.
2. The workshop participants recommend that the development and management of the LRFF fishery in PNG be based on the policy of “user pays”.
3. The workshop participants recommend that NFA require an independent service provider to conduct basic legal and financial awareness training for communities prior to their entering into a LRFF fishery MOU with operators.
4. The workshop participants recommend that NFA conducts the following research on the Live Reef Food Fish Fishery as a matter of priority:

- a. Stock assessments of the target species, and impact assessments on non-target species and habitat;
 - b. Socio-economic issues, especially:
 - i. Cost-benefit analysis
 - ii. Rate of return to villagers
 - iii. Potential income streams
 - iv. Benefit sharing opportunities
 - c. Initiate a detailed independent viability assessment of the LRFF fishery in PNG, focusing on:
 - i. Economic viability
 - ii. Social viability
 - iii. Biological viability
 - d. Initiate a study to identify possible alternative income generation options to the LRFFT, including assessment of “live fish” versus “fresh/chilled/frozen fish” market options.
5. The workshop participants recommend that NFA develop and implement a Community-Based Fishery Management (CBFM) program that incorporates fisheries management approaches and training appropriate to the management of local fisheries, including the LRFF fishery.
 6. The workshop participants recommend that NFA modifies the existing funding mechanisms to allow improved access to funds to develop local-level fisheries.
 7. The workshop participants recommend that NFA require all MOA/MOUs developed between land-owners and LRFFT companies be reviewed by Provincial authorities prior to signing.

3.8. Next Steps

3.8.1 PROCESS

Mr Leban Gisawa (NFA) informed the workshop of the process that will be followed after the workshop:

- The workshop report will be compiled by the workshop facilitators and the National Fisheries Authority staff as soon as practical.
- Based on the outputs of the workshop, changes will be made to the current National Live Reef Food Fish Fishery Management Plan
- The final draft report and the draft changes to the National Live Reef Food Fish Fishery Management Plan will be circulated to all participants for comment, along with a CD containing all the background papers, the presentations and a range of relevant reference papers on the LRFFT.
- The workshop report will be finalised after a suitable time for comments to be received.
- The workshop report, its recommendations, together with the suggested changes to the current management plan will be reviewed by NFA staff and the final changes to the National Live Reef Food Fish Fishery Management Plan made.

- A National Fisheries Board submission will be prepared by NFA staff that includes the revised National Live Reef Food Fish Fishery Management Plan.
- Once approved by the Board the management plan will be gazetted.

3.9. Evaluation

All participants were asked to complete a workshop evaluation form. The purpose of the evaluation was to assess whether or not the participants felt the workshop was effective and achieved its objectives, and to inform the workshop design of the up-coming Solomon Islands LRFFT management workshop.

A total of 23 completed forms were returned. The full results of the evaluation are provided in Appendix H. In summary, the workshop participants felt that their understanding of the issues associated with the development and management needs of the LRFF fishery in PNG had improved (average score = 4.4 /5). Similarly, the participants believed the objectives of the workshop were met (average score = 4.3 /5).

The aspects of the workshop that were most appreciated were:

- The opportunity to provide feedback on the management of the fishery
- The use of break-out groups—community, provincial, national—that allowed exchange of experiences and discussion of ideas with peers.
- The format of the workshop and the use of risk assessment tool.

The areas where the workshop could have been improved included:

- Background information should have been distributed earlier.
- Greater participation by resource owners, industry and NFA staff.
- Allow more time to review the management plan (i.e. have a 4 or 5 day workshop, rather than 3).
- Hold in an area where the LRFFT has operated to get more first-hand experiences.⁶

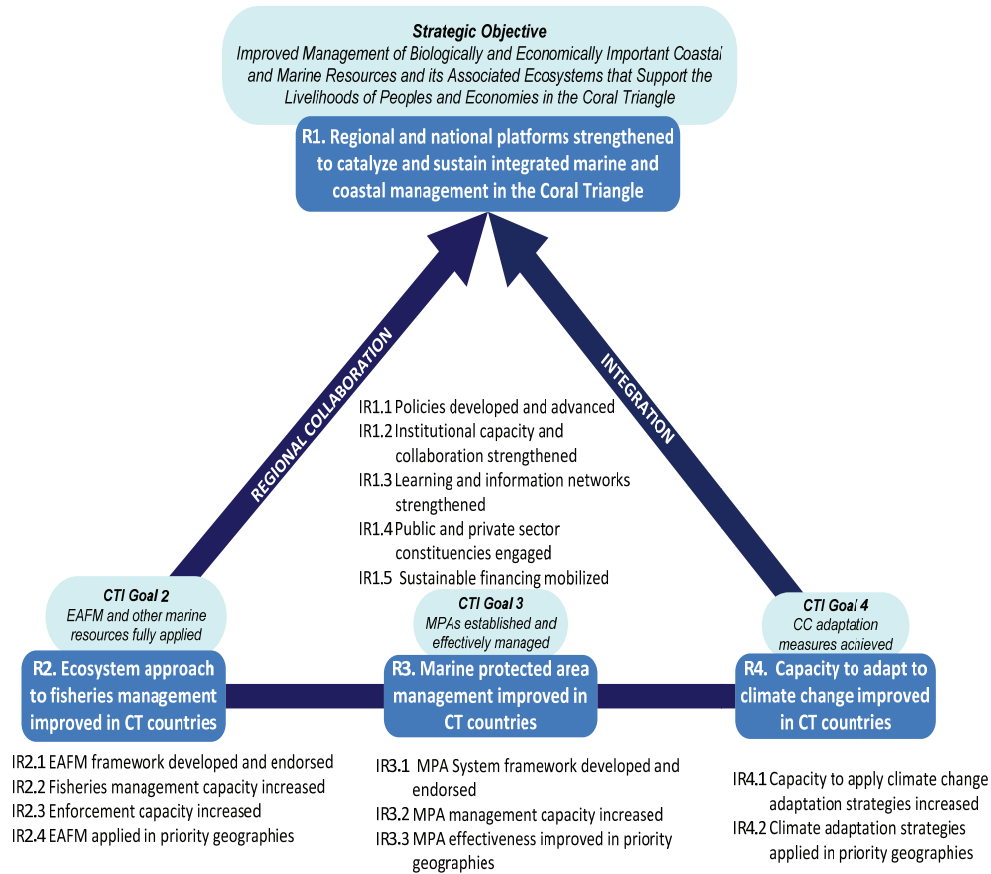
3.10. Closing

The workshop was closed by Mr Leban Gisawa on behalf of the NFA Managing Director.

⁶ Note: the workshop was originally planned for Alotau, Milne Bay Province—which has experienced the LRFFT—but for logistical issues and costs it was transferred to Pt. Moresby.

APPENDIX A USCTI RESULTS FRAMEWORK

Progress for CTSP is measured against the USCTI Support Program Consolidated Results Framework illustrated below.



CTSP uses the USCTI set of common indicators to measure program progress:

Common USAID Indicators to Measure Program Progress

1. Number of hectares in areas of biological significance under improved management.
2. Number of hectares under improved natural resource management as a result of USG assistance.
3. Number of policies, laws, agreements or regulations promoting sustainable natural resource management and conservation that are implemented.
4. Number of people receiving USG-supported training in natural resources management and/or biodiversity conservation.

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APPENDIX C WORKSHOP AGENDA



NATIONAL FISHERIES AUTHORITY STAKEHOLDER WORKSHOP ON THE MANAGEMENT OF THE LIVE REEF FOOD FISH TRADE IN PAPUA NEW GUINEA



LAMANA HOTEL, PT. MORESBY, 7 – 9 JULY 2009

AGENDA

Workshop Purpose:

To hold a focused consultative stakeholder workshop to review and update the National Live Reef Food Fish Fishery Management Plan (2003), bringing together representatives of government (national, provincial and local), industry, community and non-government organisations.

Workshop Objectives:

- To review the current National Live Reef Food Fish Fishery Management Plan (2003)
- Outline a revised National Live Reef Food Fish Fishery Management Plan
- Apply Ecosystem Approach to Fisheries (EAF) principles and align the plan with the International Standard for the Trade in Live Reef Food Fish
- Provide specific recommendations on the sustainable development and management of the live reef food fish trade, and identify research and monitoring priorities
- Identify specific follow-up activities, including an implementation work plan, timeline, resource needs and materials, NFA work program needs and priorities, and linkages to the Coral Triangle Initiative PNG National Plan of Action
- Ensure that species and habitats of special interest are addressed in the management plan

Outputs & Outcomes:

- Summary report of the workshop
- Outline / draft of a revised National Live Reef Food Fish Fishery Management Plan
- Identified follow-up activities and implementation plan
- Participants with an understanding of the management needs of the Live Reef Food Fish Trade

Monday : 6 July 2009

Morning	Participants arrive
10:00 onwards	Participant registration (ongoing throughout the day)
Evening	NFA and facilitation group preparation session [<i>NFA staff and facilitators</i>]
	Free

Tuesday : 7 July 2009

9:00 – 10:00	<ul style="list-style-type: none">• Welcome and introduction to workshop• Overview of workshop procedures, objectives, agenda, expected outputs• Group photograph
10:00 – 10:30	<i>Morning break</i>
10:30 – 12:30	<ul style="list-style-type: none">• Introduction of participants, who they represent, what their expectations, issues and concerns are for the workshop• Revise agenda, procedures, outputs based on expectations—reach common agreement

12:30 – 1:30	<ul style="list-style-type: none"> • Overview of the LRFFT in PNG (plus discussion)
1:30 – 3:15	<p><i>Lunch</i></p> <p>Presentations on specific issues:</p> <ul style="list-style-type: none"> • The Live Reef Food Fish Trade in the Coral Triangle • Ecosystem Approach to Fisheries • International Standard for the Trade in Live Reef Food Fish • Target species life cycles and fish spawning aggregations • Species and habitats of special concern
3:15 – 3:30	<i>Afternoon break</i>
3:30 – 5:00	<p>Presentations on specific issues (cont.):</p> <ul style="list-style-type: none"> • Fishing industry perspective presentation • Community perspective presentation • Identify specific issues, concerns, questions • Overview and discussion of review agenda for Wednesday's sessions
Evening	Free

Wednesday : 8 July 2009

8:30 – 10:00	<ul style="list-style-type: none"> • Elaboration of the International Standard for the Trade in Live Reef Food Fish • Overview of CITES listings relevant to the LRFFT • Review and update of NFA <i>National Live Reef Food Fish Fishery Management Plan</i>
10:00 – 10:30	<i>Morning break</i>
10:30 – 12:30	<ul style="list-style-type: none"> • Review continued
12:20 – 1:30	<i>Lunch</i>
1:30 – 3:00	<ul style="list-style-type: none"> • Review continued
3:00 – 3:30	<i>Afternoon break</i>
3:30 – 5:00	<ul style="list-style-type: none"> • Review continued
Evening	Free

Thursday : 9 July 2009

8:30 – 10:00	<ul style="list-style-type: none"> • Review of previous day's discussions • Discuss and agree on changes to the National LRFF Fishery Management Plan
10:00 – 10:30	<i>Morning break</i>
10:30 – 12:30	<ul style="list-style-type: none"> • Discuss and agree on changes to the National LRFF Fishery Management Plan (cont.)
12:20 – 1:30	<i>Lunch</i>
1:30 – 3:00	<ul style="list-style-type: none"> • Agree on specific recommendations on the sustainable development and management of the LRFFT, and identify research and monitoring priorities • Discuss and agree on specific follow-up activities
3:00 – 3:30	<i>Afternoon break</i>
3:30 – 5:00	<ul style="list-style-type: none"> • Next steps, wrap-up and close • Workshop closing
Evening	Workshop dinner (hosted by National Fisheries Authority)

Friday : 10 July 2009

Morning	Participants depart
All day	<p>NFA staff and facilitation group:</p> <ul style="list-style-type: none"> • Collate workshop results and produce draft workshop report • Produce initial draft of revised National LRFF Fishery Management Plan • Start drafting the submission to NFB • Prepare draft implementation plan, timeline, costing of resource needs and materials, and NFA work program needs and priorities

APPENDIX D - REVIEW OF THE LIVE REEF FOOD FISH FISHERY OPERATION AND ITS MANAGEMENT IN PAPUA NEW GUINEA

Prepared by Leban Gisawa (NFA)

Introduction

The LRFFT is a low volume, high value fishery, with Hong Kong the largest consumer of live reef fish, accounting for 60 % by weight of live reef fish (Lau and Parry-Jones, 1999). Live reef fish is eaten during special occasions such as special festivals or ceremonies and during the closure of business agreements. Higher priced reef fish such as humphead wrasse (*Cheilinus undulatus*) are eaten as a status symbol (Lau and Parry-Jones, 1999). The introduction of the live reef fish fishery to PNG in 1990 brought mixed blessings (Lokani and Kibikibi, 1998). LRFFT operations venture into very remote areas and can provide a source of income to local fishers who may otherwise not have the means of transporting chilled or frozen fish to local markets for sale.

However, the trade also brought in a new set of problems in the form of destructive fishing methods. Cyanide fishing has been practiced and LRFFT operators have consistently sought out and targeted spawning aggregation sites. Often lines of traps were purposely placed along known spawning migration routes and at spawning sites by local divers operating on hookah gear (Hamilton *et al.*, 2004; 2005). The deliberate targeting of spawning aggregation sites has been a major concern in PNG and is considered a significant threat to the sustainability of target fish stocks, and typically leads to a “boom and bust” pattern of operation. Cyanide causes problems due to its impact on non-target fish species, corals and other invertebrates and the marine environment in general. Its confirmed use in the live reef food fishery in PNG has been a concern to the Government agencies and other stakeholders.

In order to effectively manage the live reef food fish trade in PNG and minimise the negative impact on the coral reef systems, an understanding of the history of the live reef fish fishery in PNG is required. This review compiles available information on the live reef food fish fishery in PNG, in order to assist in assessing current status and management regimes.

Impact of LRFFT on Coral Reefs

The threat from the Live Reef Fish Trade comes mainly from the use of cyanide to capture fish and the targeting of spawning aggregations. Depending on the level of concentrations, cyanide can cause direct mortality to fish and other sedentary organisms. Other threats associated with cyanide and other fishing methods of the live reef fish trade, include coral structural damage caused by placing corals and rocks around traps to increase the catchability of the traps and fishermen breaking off coral to have access to fish stunned by cyanide and trapped inside coral structures. Although the use of cyanide has been confirmed in PNG (per. Obs.) investigations by the National Fisheries Authority in New Ireland (e.g. Mobiha, undated) and Milne Bay Province has not been able to identify any significant coral and reef damage. This can probably be attributed to the discrete use of cyanide by fishermen in trying to avoid detection and prosecution.

Undoubtedly the more serious consequence of the LRFFT in PNG to date is the fact that it has systematically sought out Fish Spawning Aggregations (FSA), with these aggregations typically being overfished in less than one year of commercial exploitation (Hamilton *et al.*, 2004; 2005).

Hamilton and Matawai (2006) provide data from underwater surveys at a FSA site in Southern Manus that was collected before, during and after a LRFFT operation. The data shows a 67 % percent drop in the densities of squaretail coral grouper (*Plectropomus areolatus*) after only six months of exploitation to supply the LRFFT. In many areas of PNG, FSA aggregations have been targeted by subsistence, artisanal and LRFFT operations simultaneously, leading to their rapid depletion. In many locations night spearfishing for local markets has impacted negatively on FSA even in areas where LRFFT operations have never occurred.

Impact on Communities

The live reef fish trade results in both positive and negative impacts to communities. Positive aspects primarily relate to income generation for rural communities through royalties and by community members being paid for the fish they catch. Negative social impacts are widely documented throughout the Pacific (i.e. Sadovy *et al* 2003) and PNG is no exception.

Richards (1993) points out that live reef fish operations are as disruptive as bait fishing, especially in relation to the distribution of royalties. Physical confrontations between clans and sub-clans have occurred at Hermit Islands and Tsoi Islands in New Ireland (Richards, 1993). Similar incidents have occurred at Mait Island also in New Ireland and Good Enough and the Trobriands Islands in Milne Bay Province. In the Cateret Islands, Bougainville Province, sections of the community are suing the company that operated there for damages in compensation for trespass to land, trespass to customary marine tenure, trespass to goods and continuous trespass. This case was filed in July 1999 with regard to the fishing operation that occurred in 1994.

In almost all the operations the companies pay a royalty to the community on top of the individual payment to fishermen for their fish. The impacts on the community can be so disruptive, both for the community and the company, that the company often just packs up and moves on. Drawing from past experiences in PNG any fishing operation that excludes resources owners and communities where development and exploitation of the resource is to take place is very likely to result in the disruption of the fishing operations. In the consultation process a 100 % endorsement by the resource owners or community is an absolute pre-requisite to a successful fishing operation. Ignorance of this would result in the disruption of the operations of the company.

Almost all the live reef fish operations in PNG have ignored socio-economic issues although some issues may have been addressed. In general this in some way may have contributed to the early downfall of the operations. The most important socio-economic issues are;

- Reef ownership
- Fishing and use rights
- Fishing of spawning aggregations, and
- Royalty distribution

A live reef fish operation that intended to operate in New Ireland in 1992 failed to start due to conflict over fishing grounds with the villagers (Aini and Hair, 1995). Richards (1993) similarly, cites a socio-economic reason as a contributing factor in the closure of the operation at Western Islands in Manus Province. The issue of reef ownership and financial benefits in the Trobriand and Good Enough Islands operations contributed to their early closures.

History of the Fishery

Since the commencement of the live reef fish fishery in PNG in 1991, growth of the fishery has been minor. The fishery has not increased to the extent that it has in the Philippines and Indonesia. Annual harvest of live reef fish in PNG has ranged from a low of fewer than 3 tonnes in 1993 to a high of over 35 tonnes in 1997. The relatively low yield of the fishery can be partially attributed to the need to negotiate access to reef areas owned by a large number of coastal and island communities.

In 1998, a moratorium was imposed on the LRFFT in Papua New Guinea, following information that LRFFT operators were secretly using cyanide (Gisawa and Lokani, 2001; Gisawa, not dated). However, realizing that there was much interest in the LRFFT and that there were opportunities for local communities to benefit from it, the National Fisheries Authority (NFA) approved two trial LRFFT licenses in late 2000 (Gisawa and Lokani, 2001). The purpose of the trial was to collect the necessary biological and social information required to develop management plans for future LRFFT operations in PNG (Gisawa, not dated). One trial license was issued for NISP around the Tigak area in New Ireland and the other was approved to operate at M'Buke Islands in Manus Province (Gisawa and Lokani, 2001). The operation in New Ireland was the only one of the two that commenced. New Ireland Sea Products (NISP) commenced fishing in February 2001, but by April 2001 its license was suspended for reasons relating to reef tenure disputes and unregulated fishing (Gisawa, not dated).

The trial operations recommenced from August to October 2001 and catches from these operations were monitored by NFA staff. In late 2001 a total of 6,100 kilograms of fish were exported to Hong Kong, with the most common species by weight being *E. fuscoguttatus*, *E. polyphekadion*, *C. undulatus* and *P. areolatus* respectively (Gisawa, not dated). The species composition reflects what local knowledge surveys (Hamilton et al., 2004) have revealed, that LRFFT activities around Kavieng have largely concentrated on spawning sites. The three serranid species listed above are known to aggregate to spawn in overlapping territories during similar lunar and seasonal periods. Upon completion of the LRFFT trial in Kavieng, NFA advertised for new LRFFT licenses. Two new licenses were granted and fishing occurred in New Ireland, Manus and Milne Bay Province to 2006. Since that time there has been very little fishing activity in PNG.

PNG'S Live Reef Food Fish Exports

Fish, which is being caught alive, are kept in cages at various sites. These are transhipped to carrier vessels for transport to the markets in Hong Kong. Live reef fish operators who are based in PNG are responsible for catching the fish. Once a profitable quantity is accumulated (at a minimum 10 tonnes, but sometimes lower e.g. Table 1) an order is placed for a live reef fish carrier vessel to be chartered from Hong Kong. The trip from PNG to Hong Kong takes about 12 to 14 days.

Table 1. Export from Milne Bay made in September 1997 broken down into the major types of fish. All fish were declared at an export price of K10.00.

Species	Number	Weight	Value
Coralgrouper	900	700	7,000
Humpback grouper	500	400	4,000
Humphead wrasse	175	1,350	13,500

Species	Number	Weight	Value
Big Rock Cod	170	1,500	15,000
Rock Cod	3,500	1,450	14,500
High Fin Coral Trout	50	100	1,000
Mixed Fish	800	600	6,000
Total	6,095	6,100	61,000

Before export an approval from the National Fisheries Authority is required by law. In most cases inspection of the fish is required but is not necessary under current legal requirements. A listing of the type of species by common name, quantity and value is given as part of the export requirements. The export data is important as it highlights not only the target species required in the market but also other information such as the by-catch (when compared with the actual catch data), fish mortality. The total annual Live Reef Fish exports between 1991-1999 are shown in Table 2, with export weights and values grouped into common names. It is expected that the actual exports may be higher than officially recorded, since anecdotal accounts of illegal exports have been documented.

Table 2. Annual Live Reef Fish Export based on declared exports grouped into common names. It is expected that the actual exports may be higher than officially recorded.

Year	Species	Quantity (kg)	Value (Kina)
1991	Wrasse	4,101	24,606
	Grouper	3,356	20,136
	Coral grouper	215	11,290
1992	Wrasse	8,888	53,328
	Grouper	4,699	28,197
	Coralgrouper	2,662	15,975
1993	Wrasse	820	4,920
	Grouper	210	1,050
	Mixed reef Fish	150	375
1994	Reef Fish	4,100	24,634
1996	Coralgrouper	1362	13,620
	Rock Cod	156	1,560
	Wrasse	2,983	29,830

Year	Species	Quantity (kg)	Value (Kina)
1997	Rock Cod	2,887	62,289
	Coralgrouper	6,404	14,3081
	Grouper	6,001	77,675
	Wrasse	8,837	28,3116
1998	Other	663	10,976
	Humpback grouper	6	240
	Coralgrouper	8,327	333,080
	Rock Cod	1,637	65,470
	Wrasse	1,755	70,180
1999	Other	32	1280
	Coralgrouper	339	4,894.3
	Rock Cod	5,372	47,378
	Wrasse	503	9,736

A typical export of live reef fish may contain seven groups of fish types (Table 1). Aini and Hair (1995) provide a listing of the species exported from Kavieng. A total of 22 species from 6 families was exported from that export shipment. Although the typical target species is restricted to at least six species (e.g. Table 1), the live reef fish market demand may change to include species, which were not exported in the past.

Fishing Methods

Only hand lines are currently allowed for use in the live reef food fish fishery in PNG. Hooks used in hand-lines are normally barbless to minimise damage to the fish, but barbed hooks are known to have been used. Bait used and the fishing time is made by choice of the fishermen based on experience. Traps were used up until 2000, when they were banned due to the fact that their use was damaging the reef, since fishers were breaking up the reef and placing coral around the traps to make them look like part of the reef matrix.

Cyanide, although illegal, has been used in PNG. Former PNG fishermen in all the operations have acknowledged the use of cyanide in the capture of live reef food fish. The cyanide method used is the same as those used in the Asia region (see Barber and Pratt, 1997). The method involves diluting cyanide in a squirt bottle to a concentration that will not kill fish. The fishermen take the squirt bottle underwater using hookah and squirt the cyanide as close as possible to the target fish. If fish retreats into crevices fishermen squirt cyanide into the crevices. Once the fish is stunned, fishermen break the corals in order to extract the fish.

Fishermen normally fish off a specially fitted dinghy with a seawater tank compartment that allows free flow of seawater into the tank. The fish are kept in the tank compartment for the duration of fishing and used to transport the catch to the proper fishing vessel where they are kept or further transported to cages anchored off the reef or nearby islands.

Fish kept on the fishing vessel or on anchored cages need to be feed regularly. Sources of feed are the by-catch from hand-line and traps and sometimes from fish which die while in the cages or holding tanks in the fishing vessels. If there is insufficient fish food from the by-catch the live reef food fish operator employs net fishing to capture fish food. In the New Ireland live reef fish operations villagers were encouraged to catch fish and sell it to the operation. The villagers used a variety of methods ranging from spear fishing to net fishing. The New Ireland live reef food fish operator also used a small purse seine fishing method to capture schooling pelagics for fish food.

Target Species

No authoritative study is available on the live reef food fish target species in PNG but in general the humphead wrasse (*Cheilinus undulatus*) and squaretail coral grouper and groupers (serranids) are the principal species targeted. *Plectropomus areolatus*, *Plectropomus leopardus*, *Epinephelus fuscoguttatus* and *Epinephelus polyphkadion* are all prime targets of the LRFFT. High priced fishes are the principal target species. Aini and Hair (1995) list 24 species from a single export from Kavieng.

Catch Rates

No consistent monitoring of catch rates in live reef fish operations have been undertaken in PNG. Limited data that have been analysed give some indication of the catch rates for handline.

Catch rates reported from PNG are relatively low compared to the Asia region. Catch rates for handline fishing range from 0.3 kg/boat per day to 20 kg/fishermen per day. Preliminary assessment

found a relatively high catch range from 0.5 to 20 kg per fishermen in the Hermit islands of Manus Province. Catch rates of target species for the Goodenough Island operation averaged 5 kg/fishermen/day (Table 3; Lokani and Kibikibi, 1998). Aini and Hair (1995) found relatively low catch rates at Tsoi (0.3 kg/boat/day) and the Tigak Islands (0.3 kg/boat/day) in New Ireland Province during trial fishing by a live reef fish operator.

Table 3. Target species catch rates for the Good Enough Island operation (from Lokani and Kibikibi, 1998). The effort used was 64 fishermen using one hook fishing from 5am to 6pm.

Month 1998	Days Fishing	CPUE Kg/line/hr	CPUE Kg/fishermen/day	Catch Per Month
February	14	0.34	4.23	3,795
March	20	0.41	5.26	6,875
April	4	0.36	4.79	1,226
Total	38			11,896

History of the Live Reef Fish Operations by Province

Live reef fish operations have followed a similar pattern. Each operation establishes a contact with links to the area intended for fishing. The operation identifies a key person to organise the licences to be obtained from the National Fisheries Authority. This is followed by a series of agreements signed between the operator and the villages in the area of operation. The agreements cover access to reefs, compensation and other financial benefits.

The first live reef fish operation took place at Hermit Islands (see Figure 1), Manus Province in 1991. This was followed by other operations in New Ireland, Bougainville, Milne Bay, East New Britain and Central Province (Figure 1). In New Ireland Live reef fish operations were undertaken, at the East Coast, Tsoi, Tigak Islands and Mait Islands. The operation in Bougainville was undertaken at Cateret Islands.

Manus Province

The live reef fish operation at Hermit Islands in Manus Province occurred between July 1991 to mid-1992. The operation was endorsed by the provincial government. At least four export shipments totalling 23.9 metric tonnes were made during the 18 month operation (Richards, 1993). Fourteen species were known to have been targeted by the operation but only four species were recorded in the catch data. These were *Epinephelus malabaricus*, *E. polyphkadion*, *Plectropomus leopardus* and *Cheilinus undulatus*. The catches of *E. polyphkadion* declined over time between July 1991 and May 1992. There was also a decline in the average weight of *C. undulatus* during the same period of fishing (Richards, 1993). The catch rates for the target live reef fish ranged from 0.5 to 20 kg per fishermen per day. This catch is lower than the 30 kg catch rate reported in Asia.

In 2005 the New Guinea Islands Sea Products (NGISP) LRFFT company began operations off the south coast of Manus. NGISP immediately expressed interest in fishing known spawning sites in the

area. Between July and December 2005 the community of Tawi caught 13 tonnes (t) of fish for the LRFFT. Approximately 50 % of this catch was made up of *P. areolatus*, with the humphead wrasse (*Cheilinus undulatus*) and *E. fuscoguttatus* being the second and third largest components of the catch. At least half of the *P. areolatus* captured was taken from a large spawning site in the area, resulting in a dramatic drop in densities of groupers at this site (Hamilton and Matawai, 2006). Operations ceased in 2006 due to license conditions and social disputes.

New Ireland Province

Two companies operated from New Ireland province off the east coast of New Ireland and at Mait Island (see Figure 1). The east coast operation was undertaken between 1992 and 1993. That operation recorded a single official export of 1.64 tonnes of wrasse. It is understood that other species were also targeted.

The Mait Island operation took place between 1997 and 1999. A total of 5.506 tonnes of fish comprising wrasse, coral grouper, grouper and sea perch was initially exported in 1997 (Table 4). The operation made a second export in 1999 which also happened to have been the only export for that year totalling 6.214 tonnes. The second export was accumulated for a period of more than one year. Arrow head and rectangular traps and handline fishing methods were used. Although local fishermen actively participated in fishing, the operation also employed a core group of foreign fishermen from the Philippines.

Table 4. Declared Export of live reef food fish from Kavieng on 23/10/97.

Species	Weight (kg)	Unit Price (US\$)	Value (US\$)
Wrasse	926.5	12	11118.0
Coral grouper	51.5	9	463.5
Grouper	4340.5	7	30383.5
Sea Perch	188.0	7	1316.0
Total	5506.5		43281.0

In response to concerns that there was overfishing and the use of destructive fishing methods at Mait Island, Mobiha (unpublished) conducted an underwater visual census of reef fish at Mait Island in 1997. The survey also undertook to provide a spot check on the physical damage, if any, that may have been caused by fishing. The survey recorded 570 individuals from 49 species in a survey area of 0.477 hectares. Among thirteen families recorded, Acanturidae, Lenthinidae and Lutjanidae were the most common. Labridae and Serranidae targeted in the live reef food fish trade were less common. No coral damage could be identified.

East New Britain Province (Baining)

Little information is available from the live reef fish operation at Baining in East New Britain. The operation is thought to have lasted for less than one year. The company that operated at Baining moved on to Cateret Islands in Bougainville and then later to Kavieng.

Milne Bay Province

Two live reef operations were undertaken at Milne Bay Province at Trobriand Islands and at D'Entrecasteaux Island. The Trobriand Islands operation took place between 1996 and 1997 while the D'Entrecasteaux Islands operation was undertaken between 1997 and 1998 (see Table 1 and 2). Both operations were joint venture arrangements between Hong Kong based companies and local companies. In both instances the arrangement was for the Hong Kong based company to provide finance and for the fishermen training, while the local partner was to provide labour and access to the traditional fishing grounds.

Both operations officially exported a total of 35 tonnes valued at half a million kina (National Fisheries Authority Statistics). It is suspected that the actual export of fish from the province was much higher than this. In addition to the official export, the actual volume of fish caught is thought to be twice that of the actual export, taking into consideration the by-catch and the mortality of fish during fishing and during storage in the cages.

The operation that was based at D'Entrecasteaux Islands operated 8 X 500 kg cages located at eight different locations. A 25,000 kg capacity cage was anchored off the main base at Watuluma. To supply these holding/storage cages with live fish a total of 24 dinghies crewed by two fishermen each fished for six days a week, from 6 am to 6:30 pm (inclusive of travel time to the fishing ground).

North Solomon Province

The live reef fish operation undertaken in Bougainville was restricted to the Cateret Islands under an arrangement with certain individuals from that village. The operation commenced in 1994 and was undertaken by a company that was based in Kavieng. Two shipments of fish were made but there are limited records on the catch composition and volume of fish. Aini and Hair (1995) estimated 1763.8 kg of fish from the Cateret Islands was landed at Kavieng in two shipments in September and November 1994. Most of the fish (80 %) landed in September was caught by Chinese fishermen employed by the live reef fish operator. Only 20 % was landed by local fishermen. Local fishermen improved their catch significantly to account for 60 % of the catch landed in November 1994.

Vaiola louti, *Epinephelus microdon* and various species of the genus *Plectropomus* comprised much of the catch during a 12-day fishing period in November 1994. Although a target species, *Cheilenu undulatus* was not recorded (Aini and Hair, 1995). There is no explanation given for its absence from the catch, but may be attributed to the earlier fishing effort, although no data is available for the earlier fishing period. Aini and Hair (1994) estimated the catch for the Cateret Islands at 3.8 kg/boat/hr, which is higher than the catch rates recorded for the Tigak Islands.

Certain individuals and the Cateret Area Committee were not happy with the operation of the company and consequently forced the company to close its operation in November 1994. Among the complaints raised by the community was unpaid royalties as agreed to for access to the traditional reefs, unpaid wages for the local employees, unpaid fees for various services provided and fishermen not paid for fish sold to the company. Six years after expelling the company from the island, the complainants finally filed a Writ of Summons at the Waigani National Court in June 1999, claiming for damages and compensation for trespass to land, trespass to customary marine tenure, trespass to goods and continuous trespass. The outcome of the court challenge is, however, not known.

Legislative Framework for Fishery Management

All live fish operators in PNG are required to obtain licenses from the National Fisheries Authority as required by the Fisheries Management Act, 1998. Licenses issued for live fish operations have been issued under very specific conditions, which included banning the use of cyanide and the use of hookah. Enforcement of these conditions has improved compared to its initial establishment.

In an effort to make live fishing sustainable, a new approach to management was adopted by the National Fisheries Authority in 2003. This involves the introduction of a comprehensive fishery management plan for the live reef food fish fishery. Under the live reef food fish fishery management plan all live fish operations are regulated with the involvement of the provinces and the traditional resource owners/communities. This is achieved with two levels of the fishery plan. The first level is the establishment of the National Fishery Management Plan, which is broad, applies to the whole country and provides the framework for the second level of the fishery plan, which is site based and involves the communities in its formulation and enforcement. The second level is through a “site specific management guidelines” specified in the national management plan, however, in all cases the guidelines only forms part of the licensing conditions.

The live reef fish fishery can also be managed using various provisions of the Fisheries Management Act, 1998. However comprehensive management is best achieved through a fishery management plan as provided for under Section 28. Licensing conditions (Section 43) and Gazettal Notices (Section 30) can be invoked to cater for any specific restrictions on fishing.

Present Catch Records

The operation of the live reef food fish trade in PNG is rather slow under the current management regime. Generally the catch was low due to the transfer of the knowhow to the resource owners (Gisawa & Lokani, 2001). The current management regime only allows locals to do the fishing while the operators provide the market for the fishermen. Operations of the trade in PNG require 100 % observer coverage as outlined in the management plan. The activity is organised such that live fish carrier vessels act as platforms from which fishing is conducted. Specially designed dinghies are dispatched from the carrier vessels with two local fishermen in each dinghy in each daily fishing trip. At the end of each day’s fishing, fish are weighed and recorded for all dinghies. An average fishing trip takes about two to three weeks and once the vessel is back at the station, the accumulative weight is calculated for each dinghy and the money equivalent is paid to the respective fishermen.

Since its inception under the current management regime, the live reef food fish fishery has always been operated under one licence with multiple pick up stations at different provinces. It was not until in late 2004 when the second licence was issued. The latter licence operates out of Central Province and exports to Hong Kong by air via Cairns (Table 5). The beach price offered to fishermen varies between the two operators. The company exporting by sea offers slightly higher price than the one exporting by air, presumably due to the different cost involved. In late 2005, the latter had its license terminated due to evidence of the use of cyanide in capturing fish. It was suspected that the last licensee could not operate because of management disagreements; however, information received from fishermen is that they could not operate viably because of the stringent management controls like prohibiting fishing on spawning aggregation sites.

Table 5. Live reef food fish export from the respective management areas under the current management regime.

Year	Milne Bay		Central		New Ireland		Total	
	Qty (Kg)	Value (PGK)	Qty (Kg)	Value (PGK)	Qty (Kg)	Value (PGK)	Qty (Kg)	Value (PGK)
2001	0	0	0	0	6,166	112,276	6,166	112,276
2002	0	0	0	0	0	0	0	0
2003	0	0	0	0	7,212	126,192	7,212	126,192
2004	14,278	337,650	0	0	0	0	14,278	337,650
2005	7,220	184,618	9,350	71,862	0	0	16,570	256,480
Total	21,498	522,268	9,350	71,862	13,378	238,469	44,226	832,598

There was no export recorded in 2002, as the quantity of fish kept in cages could not warrant a viable export. The species composition also differs between provinces and companies (Table 6).

Table 6. Species composition from export declaration and observer reports

Species	2001		2002		2003		2004		2005		Total	
	Qty	PGK	Qty	PGK	Qty	PGK	Qty	PGK	Qty	PGK	Qty	PGK
Humphead wrasse	759	30,354	0	0	731	30,419	1,727	71,866	2,580	33,150	5,797	165,789
Leopard coralgroupers	0	0	0	0	0	0	9,447	211,681	8,901	173,040	18,348	384,721
Squaretail coralgroupers	827	15,891	0	0	987	15,797	1,669	32,055	321	6,679	3,804	70,422
Humpback groupers	45	1,813	0	0	0	0	0	0	0	0	45	1,813
Brown marbled groupers	3,628	58,067	0	0	4,071	58,641	0	0	568	10,000	8,267	126,708
Camouflaged groupers	0	0	0	0	1,273	20,375	1,435	22,049	0	0	2,708	42,423
Mix groupers	109	1,047	0	0	0	0	0	0	4,200	33,611	4,309	34,658
Snappers (<i>Largentimaculatus</i>)	627	4,017	0	0	0	0	0	0	0	0	627	4,017
Snappers (<i>L.rivulatus</i>)	170	1,088	0	0	150	960	0	0	0	0	320	2,049
Total	6,165	112,277	0	0	7,212	126,192	14,278	337,651	16,570	256,480	44,225	832,600

The accumulative weight of live reef food fish exported out of PNG under the current management regime between 2001 and 2005 is over 44 mt valued at over K0.8 million (Table 1 and 2). The annual average for export by quantity is around 7 tonnes valued at around \$US40,000. The common target species making up most of the export quantity is the leopard coral grouper (*Plectropomus leopardus*) and brown marbled grouper (*Epinephelus fuscoguttatus*).

National Fisheries Authority's policy at present on the live reef food fish trade is to allow the fishery to develop under a very strict management regime. The policy gives effect to the National Government's export driven policy in an attempt to stabilize the country's economy. In 2005 it was thought that the fishery exports for the live reef food fish would increase over the coming year due to an additional licence and the increase in the number of pick-up points. However this was not the case. By 2006, only one licensed operator was operating under a joint venture arrangement with locals from the western islands of Manus Province. Live reef fish fishery is one that is wholly nationalised with fishermen and locals being nationals. The fishery, unlike that in Asia, has an active management plan gazetted and enforced by NFA. Recently NFA has adopted into its operational requirements the CITES listed Humphead wrasse under the auspices of regional cooperation in collaboration with the Department of Environment and Conservation (DEC) and the management plan is now due for review. There were no exports in 2007 and 2008, and by 2009. Only one company (Golden Bowl) was still operational, exclusively targeting stonefish in Central Province which it exported via air from Port Moresby. It is, however, envisaged that the LRFFT may expand again in the future as stocks in the Philippines and Indonesia become more overfished and the global economy recovers.

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APPENDIX E POSSIBLE ISSUES TO CONSIDER UNDER EAF COMPONENT TREE

Ecosystem Issues:	
<ul style="list-style-type: none"> • Target Species <ul style="list-style-type: none"> ○ groupers ○ large wrasses ○ coral trouts ○ others • By-catch Species <ul style="list-style-type: none"> ○ Others species w/ hook & line, traps, poisons ○ Feed fish (for pens) ○ Bait for hand lines • Special Species (protected) <ul style="list-style-type: none"> ○ humphead wrasse 	<ul style="list-style-type: none"> • Fish Community Structure <ul style="list-style-type: none"> ○ Removal of large males ○ Trophic structure changes • Ecosystem / Habitat <ul style="list-style-type: none"> ○ Coral reef damage from traps, poison, etc. ○ Spawning aggregations ○ Water quality around pens ○ Land-based impacts ○ Natural impacts (bleaching; earthquakes; storms, etc) ○ Man-made impacts (dredging; sediment; etc)
Socio-Economic Issues:	
<p><i>Community Well-Being</i></p> <ul style="list-style-type: none"> • Fishers <ul style="list-style-type: none"> ○ Income ○ Work related injuries ○ Food ○ Well-being • Industry <ul style="list-style-type: none"> ○ Income, profit ○ Work related injuries ○ Risk – storage, shipping ○ Community relations ○ Fuel, supplies ○ Fees and licenses ○ Training ○ Market price variability ○ Demand fluctuations • Local Community <ul style="list-style-type: none"> ○ Employment ○ Food ○ Fees ○ Cost to alternative activities / opportunities 	<ul style="list-style-type: none"> ○ Social disputes – resource ownership; equity; benefits ○ Fuel, boats ○ Training ○ Cultural values and issues • General community <ul style="list-style-type: none"> ○ Employment ○ Food ○ Fees ○ Cost to alternative activities / opportunities ○ Social disputes – resource ownership; equity; benefits ○ Fuel, boats ○ Training ○ Cultural values and issues • National <ul style="list-style-type: none"> ○ Management capacity ○ Export income ○ License fees ○ National social and economic plans ○ Food security
Governance:	
<p><i>Ability to Achieve (Governance)</i></p> <ul style="list-style-type: none"> • Institutional • Legal Framework <ul style="list-style-type: none"> ○ National ○ Provincial ○ Other • Management Plan • Compliance • Enforcement • Monitoring • Research • Resources to manage at national and provincial levels <ul style="list-style-type: none"> ○ Staff capacity ○ Financial resources 	<ul style="list-style-type: none"> • Consultation <ul style="list-style-type: none"> ○ Community ○ Industry ○ Provinces ○ Inter-agency • Reporting • Information and awareness • Inter-agency cooperation <p><i>External factors (natural and human induced)</i></p> <ul style="list-style-type: none"> • External Drivers (fisheries and non-fisheries sources) <ul style="list-style-type: none"> ○ Climate change impacts (bleaching, etc.) ○ Development ○ Land-use impacts ○ Market forces

APPENDIX F - WORKING GROUP RESULTS: ISSUES, RISK ASSESSMENTS AND MANAGEMENT ACTIONS

Issue	Group	Objective	Risk				Indicator	Performance Measure	Management Action
			Impact	Likelihood	Risk Value	Risk Ranking			
Lack of awareness of the effect of LRFFT and general ecosystems	Community	Ecological	5	6	30	Extreme		Awareness programs (NFA, NGOs, Government)	
Lack of community-based fisheries management plans	Community	Ecological	5	6	30	Extreme		Community-based management plans (NFA, NGOs, Government, Communities)	
Destructive fishing methods: - Use of cyanide and nets - Wastage and by-catch - Use of SCUBA/hookah diving	Provincial	ecological	5	6	30	Extreme	No. of account / reports of cyanide use	Decrease by 50%	
No devolution of management power from NFA to Provinces to make their own rules and regulations	Provincial	governance	5	6	30	Extreme	Provincial government more involved in making management decisions	Increased delegation of power from Managing Director to Provincial Fisheries 1. Review the Fisheries Act 1998 to address this issue (long term) 2. Delegation from Managing Director to Province to perform functions at Provincial level to implement LRFF Management plan (short term) 3. CBM and LLG laws developed	
No decentralisation of financial power from NFA to Provinces	Provincial	governance	5	6	30	Extreme			
Reef tenure disputes -- lack of consultation by all parties on development of Memorandum of Agreement (MOA)	Provincial	governance	5	6	30	Extreme	Provincial governments involved in establishment of MOAs	100% of MOAs done with Provincial Government	
National level -- Population increases (community / Province)	National	socio-economic	5	6	30	Extreme		1. Demographic studies 2. Effort control (e.g. man-hours, CPUE)	
False promises to community by investors	Provincial	socio-economic	5	6	30	Extreme	Security deposit held in trust account by Province prior to fishery commencing	10% of export value held as deposit (10% of shipment value?)	
Sustainability issues	Community	Ecological	4	6	24	Extreme		Awareness programs (NFA, NGOs, Government)	

Issue	Group	Objective	Risk			Indicator	Performance Measure	Management Action
			Impact	Likelihood	Risk Value			
Pressure on target species from fishing activities: - IUU - Artisanal fishing - Commercial fishing	National	ecological	4	6	24	Extreme	1. Impose ban on destructive fishing methods 2. Demarcate fishing areas (zonation) 3. Rotation of fishing activities (different fisheries)	
Ecosystem / habitat impacts -- license conditions (LRFFT species specific)	National	ecological	4	6	24	Extreme	Revise current conditions and incorporate additional ones	
95% of catch from spawning aggregation sites	Provincial	ecological	4	6	24	Extreme	1. Close LRFFT in PNG 2. Closed seasons 3. CBM incorporates spawning sites 4. Specific management plans for each Province	
Full recognition of community rights	Community	Governance	4	6	24	Extreme	Conduct para-legal training (NFA, CELCOR)	
Avoid 'political' influence	Community	Governance	4	6	24	Extreme	Form PMACs (NFA, Provincial Government)	
Need for sustainable financing	National	governance	4	6	24	Extreme	1. Increase funding 2. Collaboration	
Governance capacity (manpower / institutional)	National	governance	4	6	24	Extreme	Strengthen	
CBFM / LMMA / MPA / WMA	National	governance	4	6	24	Extreme		
Anthropogenic: - Develop policies to manage the number of traps, etc - waste management (e.g. boats /pens)	National	governance	4	6	24	Extreme		
Night fishing	National	governance	4	6	24	Extreme		
Human migration	National	governance	4	6	24	Extreme	1. Control effort 2. Encourage CBFM 3. Alternative fisheries (e.g. BDM, FADs, seaweed)	
Lack of institutional capacity to monitor fishing operations at Provincial and local levels	Provincial	governance	4	6	24	Extreme	Put cost of monitoring onto operator	
Lack of share of benefits	Community	Social-economic	4	6	24	Extreme	Develop BSAs (NFA, Industry, Government, Communities)	
Need for awareness	National	socio-economic	4	6	24	Extreme	Conduct awareness	

Issue	Group	Objective	Risk			Indicator	Performance Measure	Management Action
			Impact	Likelihood	Risk Value			
Need for capacity building (manpower / institutional) at all levels, including Provincial	National	socio-economic	4	6	24	Extreme	1. Institutional strengthening 2. Value-added	
Poaching and ownership disputes	Provincial	socio-economic	4	6	24	Extreme	Drop in disputes	
Lack of stock assessment data: - Data is not available to communities - No baseline surveys	Community	Ecological	5	4	20	Extreme	Stock assessments (NFA, NGOs, Communities)	
Fishing on target species spawning aggregations	National	ecological	4	5	20	Extreme	Impose ban	
Ecosystem / habitat impacts from illegal practices	National	ecological	4	5	20	Extreme	Impose ban	
Anthropogenic impacts on Ecosystem / habitats	National	ecological	4	5	20	Extreme	Include management guidelines / standards (e.g. LRF; MARPOL)	
Need for awareness (of ecosystem / habitat impacts) at all levels	National	ecological	4	5	20	Extreme	Conduct awareness	
No stock assessment	Provincial	ecological	4	5	20	Extreme	Baseline stock assessment before LRFF allowed in -- feasibility assessment	
Empower LLG	Community	Governance	4	5	20	Extreme	Review and amend MOAs (NFA, Provincial government)	
Coral harvesting -- habitat destruction	National	governance	4	5	20	Extreme	1. Impose ban 2. Coral planting / farming	
Lack of socio-economic surveys	Community	Social-economic	4	5	20	Extreme	Conduct socio-economic surveys (NFA, NGOs, Government, Communities)	
Ecosystem / habitat impacts -- minimise through Integrated Coastal Management (ICM) (involve: Forestry, mining, agriculture, fisheries)	National	ecological	4	4	18	High	Working committee consisting of all stakeholders / agencies	
Lack of equity participation	Community	Social-economic	3	6	18	High		
Spin-offs (eco-tourism)	National	socio-economic	3	6	18	High		
No consultation between stakeholders	Provincial	socio-economic	3	6	18	High		
Destruction of community structure (equity and benefit sharing)	Provincial	socio-economic	3	6	18	High		

Issue	Group	Objective	Risk				Indicator	Performance Measure	Management Action
			Impact	Likelihood	Risk Value	Risk Ranking			
Insufficient target species baseline data: - Life cycle - Biology - Sustainable level	National	ecological	4	4	16	High			
Lack of by-catch or protected species baseline data	National	ecological	4	4	16	High			
Lack of awareness of protected species	National	ecological	4	4	16	High			
Clear clarification on customary marine boundaries	Community	Governance	4	4	16	High			
Lack of networking with partners and stakeholders	Community	Governance	4	4	16	High			
Create networking among partners and stakeholders	Community	Governance	4	4	16	High			
Political support	National	governance	4	4	16	High			
Lack of infrastructure development	Community	Social-economic	4	4	16	High			
Marine tenure	National	socio-economic	4	4	16	High			
Foreign exchange (remittances)	National	socio-economic	4	4	16	High			
Price transferring	National	socio-economic	4	4	16	High			
Alternative income generation	National	socio-economic	4	4	16	High			
Lack of understanding on the biology of targeted species, connectivity of systems, etc	Community	Ecological	5	3	15	High			
National level -- fishing areas	National	socio-economic	3	5	15	High			
Loss of life (no awareness / training)	Provincial	socio-economic	5	3	15	High			
High mortality rate of catch	Provincial	ecological	3	4	12	Moderate			
Lack of recognition of community committees	Community	Governance	4	3	12	Moderate			
Licensing issues	Community	Governance	3	4	12	Moderate			

Issue	Group	Objective	Risk				Indicator	Performance Measure	Management Action
			Impact	Likelihood	Risk Value	Risk Ranking			
Networking and collaboration of all relevant stakeholders	National	governance	4	3	12	Moderate			
Social disorder	Community	Social-economic	3	4	12	Moderate			
Lack of information on restricted species	Community	Ecological	4	2	8	Moderate			
Climate change or natural disasters	National	ecological	2	4	8	Moderate			
CITES Annex I -- specific to Humphead wrasse	National	ecological	2	4	8	Moderate			
By-catch species size control	National	ecological	2	4	8	Moderate			
By-catch methods of capture	National	ecological	2	4	8	Moderate			
Hookah and SCUBA gear	National	governance	4	2	8	Moderate			
Destructive methods	National	governance	4	2	8	Moderate			
Lack of understanding on tenure-ship systems	Community	Social-economic	2	4	8	Moderate			
Lack of genuine resource owners participation	Community	Social-economic	2	4	8	Moderate			
Recognising fishing practices	Community	Governance	2	3	6	Low			
Cages and traps	National	governance	3	2	6	Low			
Method of capture (open / closed seasons)	National	ecological	1	4	4	Low			
Harmonise all in-country policies and regulations	National	governance	2	2	4	Low			
Incentives	Community	Social-economic	2	2	4	Low			

APPENDIX G REVIEW OF THE NATIONAL LIVE REEF FOOD FISH FISHERY MANAGEMENT PLAN – ANNOTATIONS AND NOTES

THE NATIONAL LIVE REEF FOOD FISH FISHERY MANAGEMENT PLAN

Objectives

The broad objective of this national plan is to ensure that use of the LRFF resource is sustainable and well regulated.

The National Plan objectives are specifically:

a) To manage the LRFF fishery in the management areas so that the size of the stock tends towards one that will give the maximum sustainable economic yield (MSEY).

b) To ensure the LRFF Fishery in the management areas is viable in terms of biological, social and environmental.

c) To ensure the promotion of sustainable fisheries development practices for the participation and benefit of the traditional resource users;

Working Groups' Comments and Suggestions

Key:

C = Community

P = Provincial

N = National

See Workshop report section "Error! Reference source not found."

The objectives of the management plan need to comply with the relevant sections of the *Fisheries Management Act 1998* (No. 48), specifically section 25. Management Objectives and Principles, and section 28. Fishery Management Plans

Concern was expressed that it is not feasible to estimate or determine a "maximum sustainable economic yield" given the lack of knowledge of the fish stocks, especially as it is a multi-species fishery. The issue of "risk assessment" was also raised.

The issue of determining "management areas" was raised: Should they be the specific area of operation? Do they need to be based on ecological or jurisdictional boundaries, or both?

It was suggested that prior to any fishing there needs to be a baseline survey conducted, during both aggregation times and outside aggregation times. In addition to "...biological, social, and environmental" viability, there is a need to ensure economic viability also. This section should also refer to the need for the "precautionary approach" to be applied.

It was suggested that capacity development be included in the objectives. Need to promote and apply best practices.

Precautionary Approach

A precautionary approach will be applied to the management of the Live Reef Food Fish resource, non-target, associated and dependent species, taking into account the best scientific evidence available on the status of the stocks and the uncertainties inherent in those data;

MANAGEMENT ARRANGEMENT

- a) The live reef food fish fishery shall be managed nationally. A Management Working Committee (MWC) should be established in each of the affected provinces to provide advice to NFA and or NMAC on the management of the live reef food fishery.

- b) The role of the MWC will be to review the site specific licensing conditions including: total allowable catch, size limits, gear restrictions, reporting, closed seasons and areas and any other relevant issues directed by the NFA or NMAC and or relevant Provincial Executive Council (PEC). The final decision on the fishery management remains with the Managing Director.

- c) The committee shall meet twice a year preferably once in June and the other at the end of the year or unless directed by the Managing Director.
- d) MWC shall be a voluntary job and the Managing Director shall approve the appointment of the members.
- e) The MWC shall consist of the following persons, upon approval of the Managing Director;
 - i) One National Fisheries Authority representative or his nominee who shall be the chair,
 - ii) Two resource owner representatives from each of the identified communities affected,
 - iii) One representative from the Provincial Fisheries headquarters from each of the affected province,
 - iv) One dive association representatives or a tourism officer.
 - v) One representative from the marine conservation related non-government organisation whose objectives include conservation of the marine environment and resources and,
 - vi) A representative from the operator.
- f) Only one representative from each organisation shall be allowed to cast a vote.
- g) A MWC maybe established in each province where live reef food fish fishery intends to operate.
- h) Prior to taking up membership, representatives will be required to disclose any direct or indirect personal or pecuniary interests in the fishery. The nature of his/her interest shall be recorded in

N: Move to include in Objectives

C: All of this section needs to be implemented, functional and workable (NMAC)

N: Formation of 1 x MWC with composition as in (e)

P: Good idea, but want to see NFA finance the operational costs of the Provincial (MWC)

N: With specific time closure

N: Include BSA for (a) consideration

N: Delete NMAC

N: MWC not right group so change to NLRFC (specific to LRFF)

P: No TAC should be set for LRFFT as cannot be determined

N: Delete 1st sentence to "MD shall..."

N: Inclusion of DEC as co-chair

N: Note that no scientist is on committee – consider adding

P: Include representation from DEC

N: Reduce to 1 resource owner rep [comment: suggest need more than 1 rep]

N: Remove this section

N: Remove this section

the minutes of the first meeting of the committee.

MANAGEMENT MEASURES

7.1 Catch Limits

a) Total Allowable Catch (TAC) for the target species may be set for each management area and/or shall be set based on the new information.

b) If a TAC for the target species in a management area is approached, fishing shall cease and total TAC for that management area will be reviewed.

c) The NFA may review the level of catch for the Live Reef Food Fish species every three months or when:

- (i) The TAC for the target species is being approached for a particular management area;
- (ii) An opportunity to expand the management area is presented;
- (iii) New information on the status of the stocks shows a reduction in the level of fishing effort is needed due to significant interaction with subsistence fishing, or localised depletion; or

d) The NFA reserves the right to cease operation in a management area if it considers necessary to maintain a healthy LRFF stock

7.2 Fishing Methods

a) Fishing for live reef food fish shall be restricted to handlining only.

b) The licensee shall be allowed one station with a series of fish holding cages not exceeding 20 in number for each management area. Each fish cage shall have minimum dimensions of 3m x 3m x 4m with a holding capacity not exceeding 700kg.

c) For transshipment purposes, fish cages may be towed to one management area only upon receipt of written approval from the Managing Director at least fourteen days prior to actual transshipment.

d) A quarantine cage shall be constructed separately from fish cages for keeping diseased fish for observer and quarantine purposes.

C: Add: Harvesting and storing be reserved to resource owners [comment: do they have the capacity and skills to do this?]

N: Leave as it is, although recognised that TAC not practical

P: Remove sections 7.1 (a), (b), (c) (i.e. remove TAC) and include the precautionary approach to management

N: Delete "total"

N: Delete all bullets but incorporate (ii) and (iii) into (c)

N: Replace "3 months" to "annual"

N: Need additions (reworded)—make expressly for handlining

N: (b) to (d) in wrong place move to "handling / holding" facility

N: Include new section before 7.3 "Holding" that includes 7.3 (b)- (d)

N: New section "Holding"

- "size" to be changed to "density" e.g. 8 fish /m³ (aerator)
- Use of chemicals for anti-

7.3 Restrictions

- a) Export by the licensee of target species of sizes less than the approved size limit as in schedule 2 is prohibited.
- b) Fishing for live reef food fish within or close proximity of a declared spawning aggregation site is prohibited
- c) Fishing for live reef food fish or other related activities within or close to the known diving spots is prohibited
- d) Fishing for live reef food fish within the Torres Strait Protected Zone is prohibited.
- e) Fishing for live reef fish shall be restricted to only resource owners employing fishing methods specified in section 7.2 (a).
- f) The use, storage and transportation of explosives, noxious substances (including cyanide and naturally derived substances in any form) for the purpose of killing, stunning, rendering disabled or capturing of fish is prohibited.
- g) The use of hookah gear and SCUBA for capturing fish for live reef food fish is prohibited.
- h) Feeding diseased fish to fish kept in cages is prohibited.
- i) Diseased fish shall be in cremated or buried under ground.

7.4 Areas of operation

- a) The operator in consultation with the resource owners shall demarcate specific fishing areas and submit a written approval from the resource owners. The approval shall have the consent of the entire community.
- b) The NFA shall require an “area specific management guidelines” as part of the licensing conditions. These conditions shall include;
 - (i) Spawning grounds identified by NFA or the local community to be declared as prohibited areas for fishing or other related activities.
 - (ii) Any traditional ground or area of sea identified by the local community as a no fishing zone.
 - (iii) Fishing pattern as approved by the communities in the management areas.
 - (iv) A set total TAC for each of the target species.
 - (v) Closed seasons and areas
- c) NFA in consultation with resource owners shall require specific areas in the management areas to be closed to fishing, as it considers necessary for the health of the resource or marine environment.

bacterial and curing

- To minimise stress using proper handling techniques

N: Restrictions:

- Night diving

C: Define areas with points (GPS). Specify “close proximity”

P: Fishing for LRFF from spawning areas must be done 1000 meters away

C: Define areas with points (GPS). Specify “close”

N: Hookah scuba gear are concerns

N: Include roots

N: Shift to under new “handling “section

C: Replace / amend to read “NFA in consultation with Provincial Government and resources owners...” [also change in sub-sections 7.4 (b), (c)]

P: Must be practically enforced

P: NFA in consultation with the Provincial Fisheries and resource owners shall require specific areas in the management areas to be closed to fishing as it considers necessary for the health of the

7.5 Licensing

a) Under this plan, the following licences are applicable;

- (i) Export
- (ii) Aquaculture
- (iii) Carrier Vessel
- (iv) Storage facility

b) Licence fees as set out in (a) are as prescribed in schedule I of the Fisheries Management Regulation 2000

c) Under this Plan, only three (3) operators will be issued licences. Total number of operators is subject to review as necessary.

7.6 Conservation

a) Fish holding cages shall be located at a distance of at least 20 metres away from any land base.

b) Fish cages shall be located in water deeper than 5 metres.

c) Fish holding cages shall be located in areas that have constantly prevailing circulating water.

d) The NFA may require the operator to move fish cages to locations it considers more suitable if measures set out in (a), (b) and (c) have not been met.

e) In an event an operator wishes to cease operation in a management area, all gear and equipment used for fishing and other related activities shall be taken away or disposed in an

resource and/or the environment

C: Possible inclusion of another applicable license "Fish Buyers License"

N: Add new "buyers license"

N: Remove (as only relates to aquaculture)

N: Add new section: "License procedures" after 7.5 (a)

C: Include only three "national" (operators registered in PNG) incorporated companies

P: Require license operator to pay K50,000 bond fee prior to actual operations in the resource management area. To be held in trust. [comment: How did you arrive at that fee? Based on estimate of how much has been owed to communities in past]

C: Define "conservation" – possible amending it to "holding site" as content doesn't match title

N: Remove all current subsections and place under "Handling" / "Holding"

N: Add new sections (e.g. protection of FSA)

N: Encourage MPAs, CBFM, LMMA, etc.

P: Current points not relevant to Conservation

environmentally friendly manner.

7.7 Monitoring

NFA shall determine the percentage of observer coverage for each management area. The licensee is required to cooperate with observers in all aspects of sampling and monitoring.

7.8 Reporting

- a) The licensee shall report to NFA the following information: all fish (target and non-target species) bought, the weigh of each fish (in kilograms), how much it was bought for (in kina), when it was bought and when and where it was caught. This information shall be set out in the form in schedule 3.
- b) The licensee shall keep record of daily fish mortality in holding cages, including reasonable attempts to specify the cause of deaths. This information may be submitted upon request by NFA.
- c) Licensee shall report to NFA each time LRFF is to be exported detailing the species, weight (in kilograms) and value (in US dollars). All the details of the export shall be contained in the certificate of fitness for the export of fish and fishery products as contained in appendix D of *Fisheries Management Regulation 2000* or any other form approved by the NFA Audit and Certification Unit.
- d) The information required in paragraphs (a) and (b) shall be submitted at the end of each month to NFA's Information and Licensing Section.
- e) Failure to submit the required reports set out in section 7.8 (a), (b) and (c) above by more than ten (10) days or submitting incorrect or false data may result in suspension or cancellation of the fishing licence under Sections 19 and 20 of the *Fisheries Management Regulation 2000*.

8. AMENDMENT

The National Live Reef Food Fish Fishery Management Plan shall be kept under review from time to time when necessary.

9. RESEARCH

C: Inclusion of "resource owners" to conduct observations with some form of approved recognition granted or stipulated in the BSA / MOA. Issued with ID cards. [comment: currently the Observers are paid and trained by NFA. Better to have local committees monitor their own resources. Also need someone to 'observe the observers']

C: Possible new section to Mgmt Plan: "Awareness" to include participation of all partners

P: Add socio-economic monitoring

P: Include Provincial Fisheries in reporting (7.8 (a), (b), (c))

C: Include resource owners and Provincial Government to access information required in paragraphs (a) and (b)

C: Include national NGOs. Need to broaden as NFA may not have

the capacity or funding

a) NFA may carry out, in collaboration with reputable national or regional or international organisations, a program of research on Live Reef Food Fish stocks in every management area. Parameters for research may include inter-annual variability, reproductive aspects, catch per unit effort, the species breakdown of catches, and size structure by species in the catches.

b) Baseline surveys for the purpose of assessing the standing stocks of LRFF, determining spawning aggregation sites and monitoring shall be carried out. These surveys shall form the baseline information held by NFA.

APPENDIX H WORKSHOP EVALUATION SUMMARY

1. Do you feel that you have a better understanding of the issues associated with the development and management needs of the Live Reef Food Fish Fishery in PNG?

1 ----- 2 ----- 3 ----- 4 --◆----- 5

(no)

(yes)

Average = 4.4 (n = 23)

Sample comments:

- This approach should be applied to other fisheries, especially those inshore fisheries that affect resource owners.
- Now understand clearly the process of venturing into the LRFF fishery.
- The workshop was very informative
- Due to stakeholder interactions and discussions I have acquired more knowledge on the LRFFT in PNG.
- A lot was shared between stakeholders, particularly from the industry, communities and the government.

2. Do you believe the workshop objectives were met?

(circle response)

1 ----- 2 ----- 3 ----- 4 --◆----- 5

(no)

(yes)

Average = 4.3 (n = 23)

Sample comments:

- Almost covered all areas.
- 90% yes, but a bit more focus on amendments should be taken into consideration ...and the licensing.
- Objectives were fully met.
- Yes, I think so as we all contributed and shared.

3. What did you like best about the workshop?

Sample comments:

- Group discussions.
- Breakout groups to discuss issues and management actions.
- The interactive sessions, especially the group work and feedback.
- Participation level.
- Presentation of materials. Time well managed.
- How the workshop was structured and facilitated.
- Risk assessments and identification of issues into ecological, socio-economic and governance levels.
- The workshop was the best yet in comparison to other similar workshops, as interactive, different stakeholders were very informative and active, with practical experiences being shared.

4. What could have been done to improve the workshop?

Sample comments:

- Written comments/recommendations throughout the workshop for members too shy to speak out.
- More stakeholder, resource owner representation.
- More participation by industry and leaders of government.
- More participation by NFA.
- Hold future reviews in LRFFT communities to more get bottom up perspectives.
- More time to review the existing plan.
- Provinces to get background information earlier.
- Provide more simple definitions of terms used.

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