Creating the International Standard for the Trade In Live Reef Food Fish

Asia-Pacific
Economic Cooperation

APEC Fisheries Working Group
July 2005

Geoffrey Muldoon
Peter Scott

Asia-Pacific
Economic Cooperation

CREATING THE INTERNATIONAL STANDARD FOR THE TRADE IN LIVE REEF FOOD FISH

APEC Fisheries Working Group

July 2005

For further information, please contact peter.scott@aquariumcouncil.org

Prepared for
The APEC Secretariat
35 Heng Mui Keng Terrace Singapore 119616
Tel: (65) 6772 6012 Fax: (65) 6772 6013
Email: info@apec.org Website: www.apec.org

APEC#205-FS-01.1

TABLE OF CONTENTS

Executive Summary

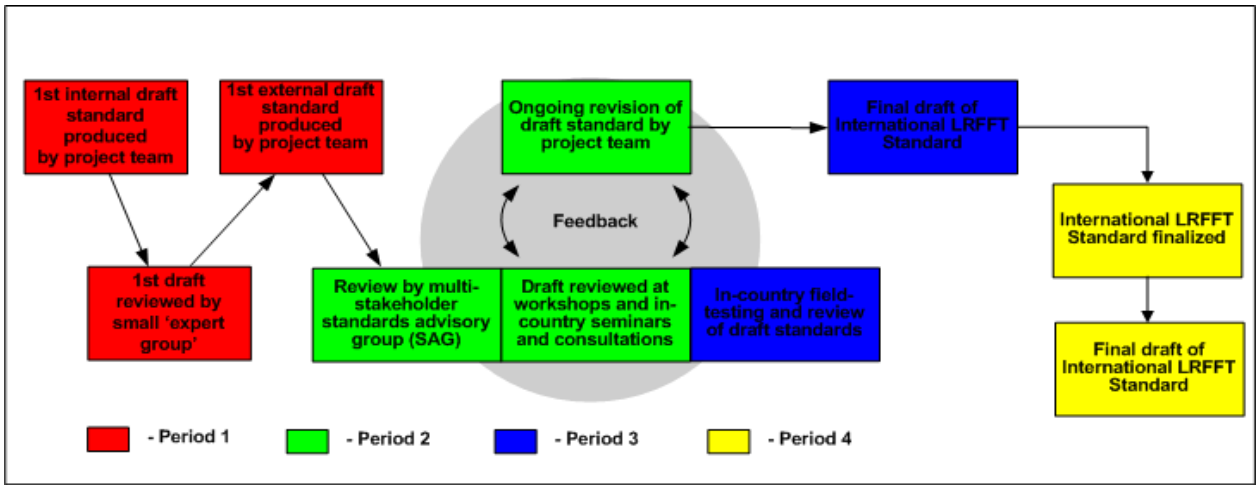
The Asia-Pacific region is home to approximately 45% of the world's coral reefs, which support greater biological diversity that any others in the world. Coral reef systems in Southeast Asia, the Western Pacific, and the Indian Ocean provided millions of people, from fishing communities to restaurateurs, with their livelihood. They feed a growing appetite for fish and supply an important source of protein for the Asian diet.

Unfortunately, the region's coral reefs faced imminent threat and destruction. According to a recent study by the World Resources Institute, 80% of South East Asia's reefs are seriously at risk of degradation, and 56% are at high risk. Although the situation is slightly better in the Western Pacific and the Indian Ocean, the possibility of irreparable destruction still exists. Destructive fishing practices are one of the most serious threats to coral ecosystems and diversity in the Asia-Pacific region. The live reef food fish trade-a wide spread industry that using cyanide, over harvesting, and depletion of spawning aggregations-is a serious and expanding driver of destructive fishing.

Today, the LRFFT in all of Asia is worth an estimated US$450-500 million dollars annually. This lucrative trade in live reef food fish has contributed to the critical state of the regions coral reefs. Growing interest in supplying this trade has driven traditional supply economies such as Indonesia and the Philippines to progressively deplete their local resources, and is now leading to the expansion of the trade into distant regions ranging from the Seychelles to Fiji. Continued overexploitation of reef resources in the economies of the Asia-Pacific region, in concert with the ongoing use of harmful fishing practices, has endangered the sustainability and future of what could be a profitable industry benefiting millions of people in the Asia-Pacific region. In recognition of the need to eliminate the trade's destructive impact on coral reef systems and to provide a foundation for a lasting trade in healthy live reef food fish within the Asia-Pacific region, a multi-organization strategy to develop environmentally and socially sustainable Standard for the trade was launched in 2002 .This report describes the work undertaken over the last two years in developing credible and robust Standard of best-practice for the live reef food fish trade through a transparent an international multi-stakeholder consultation process.

The following figure summarizes the process by which the international standard for the live reef food fish trade was developed.

Figure 1: Standards development process for the live reef food fish trade



An initial consortium comprising The Nature Conservancy (TNC), the International Marinelife Alliance and the Marine Aquarium Council undertook the early activities and work program for Period 1 of the project as in Figure 1 above. All activities in Periods 2-4 were undertaken by The Nature Conservancy (TNC) and the Marine Aquarium Council (MAC) as International Marinelife Alliance were no longer able to participate in the project.

The project inception meeting held in Hong Kong in early 2002, enabled the project team to consider which of the existing collaborative resource management models were appropriate to the trade, with consensus reached that a Voluntary Code of Conduct approach seemed the most suitable starting point. This meeting also enabled a review of existing fishery models, the identification of substantive elements for inclusion in the Standard, an outline of the *scope* within which the standard would be produced including the principal stages and stakeholder groups along the market chain for which best-practices were required and the development of a 2-year workplan and budget.

The project team extensively reviewed the lessons learned by the Marine Aquarium Council (MAC) in developing their environmentally and socially sustainable standards for the marine aquarium trade and then produced a version of this methodology to develop the international standard for the live reef food fish trade. In order to gain broad acceptance for the idea of a Standard, to understand the boundaries and limitations of any such Standard, and to produce robust and credible best practices, it was acknowledged that cooperation of all industry members was essential. The process of multi-stakeholder engagement involved:

- extensive informal consultations with individuals and organizations with experience in and knowledge of the trade;
- the participation of all APEC member economies with a history of involvement in the LRFFT;
- formation of a *Standards Advisory Group*, to review and comment on various iterations of the Standard; and
- ongoing dialogue with all participants in the live reef food fish industry (fishers, suppliers, importers, wholesalers, distributors, restaurants and consumers) through workshops, seminars and other forums;

The group responsible for drafting the Standard decided to adopt a top-down *principle* type approach to organizing the standard. This would enable the Standard itself to be a concise, easy to understand document with guidance as to satisfying the Standard to be contained in more comprehensive back-end implementation guides and manuals.

In order to address the many complex issues that the Standard would need to incorporate, technical workshops to cover the:

- assessment and monitoring of fish stocks;
- management, monitoring and enforcement priorities to regulate effort and catch;
- capture/culture, handling, husbandry and transport of wild-caught or mariculture stocks

Two expert workshops were convened, a resource management and assessment workshop and a aquaculture workshop, to establish ‘protocols’ for best-practices and to determine the key principles for inclusion in the initial Standard.

This project incorporated a lengthy multi-stakeholder process of refining the Standard, which included all important and strategic stakeholders to ensure stronger buy-in and increased credibility in their implementation. This ‘iterative revision’ process relied on two approaches;

- the formation of a Standards Advisory Group comprising key stakeholders from industry, government, non-government organizations and researchers and academics as well as individuals with experience in developing fishery codes of conduct and standards and
- the convening of several in-country consultative seminars attended by industry organizations and individuals representing fishers, suppliers, importers, exporters, restaurants, consumers and local, provincial and national government agencies

In-country workshops and seminars were held in the Pacific Islands, Thailand, Viet Nam, the Philippines, Indonesia, Australia and Hong Kong, China.

Field-based testing and assessment of the Standard was undertaken within the various source economies in order to feed back into the Standards development process and address the minimum Standards requirements. The field-testing involved a rapid assessment of in-country capacity to achieve the proposed Standard for wild-caught or aquaculture of LRFF, with the focus on the:

- Capability of undertaking assessment of fishery viability using recommended techniques;
- Practicability of implementing management aspects of the standards;
- The capacity of source economies to comply with or support these components; and
- Operation of fishing vessels, storage and husbandry and transportation aspects of the standards along the market chain.

The in-country field assessment covered all aspects of the Standards and included the most active economies in the LRFFT; namely the Philippines, Indonesia, Australia, Thailand and Hong Kong, China. The outcomes from these field-based activities fed back into the Standards development and resulted in the further refinement of its content and facilitated the preparation of supporting documentation.

A range of other project activities were undertaken to support the development of the Standard, including:

- A validation of past and new test methods for cyanide detection in fish tissues.
- A feasibility study to ascertain whether it is practicable to tag LRFFT throughout the chain from reef to restaurant to enable the country of origin and collection area or aquaculture farm to be verified in case of a disease or ciguatera outbreak.
- An industry economic and market analysis to aid supply economies in better understanding the variations in market so as to make informed decisions as to supply and management of their production of LRFF
- The production of an integrated CD and website containing the International Standards, responsible practices and implementation guidance for all Requirements including a library of existing materials (best-practice guidelines, manuals and tool-kits)
- The generation of selective outreach materials to attempt to raise awareness amongst consumers of live fish as to the general environmental concerns with respect to their consumption of various LRFF species;

Lastly, this report provides a comprehensive review of options for implementation and use of the new LRFFT Standard, and framework options under which the Standard could be used, specifically the credible application of a certification program. A timetable for implementing the Standard was produced that involved the formation of a *LRFFT Council* to manage and oversee a five year implementation program that involved:

- establishing of relationships with potential enabling agencies;
- negotiations with individual governments and regional agencies;
- an outreach, capacity building and extension program in selected economies; and

- the design and planning of a third-party certification program.

Acknowledgement

The development of this International Standard for the Trade in Live Reef Food Fish is the culmination of the efforts of numerous individuals and organizations who, over the years, have identified and championed the usefulness of and the need for a code of practice to initiate reform in this damaging, and sometimes destructive, industry. In particular Rod Salm of TNC and Paul Holthus of MAC are to be thanked for their efforts in taking this project through to inception.

While all members of the Expert Review Group and the Standards Advisory Group are to be thanked for their efforts in responding with comments to the various iterations of the Standard as it developed, a number of key individuals and their partner organizations deserve special mention for their efforts. These include Patrick Chan, the immediate past Chairman of the Hong Kong Chamber of Seafood Merchants; Dr Yvonne Sadovy from the University of Hong Kong and the Society for Conservation of Reef Fish Aggregations. Dr Mike Phillips, from the Network of Aquaculture Centers of Asia and Dr Mike Rimmer from the Queensland Department of Primary Industries are to be specially thanked for their assistance facilitating meetings of aquaculture experts and in the development of preliminary drafts of the aquaculture requirements of the Standard.

The in-country workshops could not have been conducted without organizational assistance from various individuals and their organizations. Thanks are extended to Mr Being Yeeting from the Secretariat of the Pacific Community for assistance with the Pacific Islands seminar; to Drs Mike Rimmer and Mike Phillips for Thailand workshop; to Mr Lino Alverez of MAC Philippines and the Palawan Council for Sustainable Development for the Philippines workshop; and to Ms Gayatri Lilley for the Indonesia workshop. All those individuals and organization representatives who participated in consultative seminars and workshops are thanked for their time and efforts.

The LRFFT is a remote and geographically dispersed industry and often occurs in non-english speaking regions of the Asia-Pacific. The in-country field-testing component of this project could not have been undertaken without the logistic support and translation assistance of several people. Thanks go to Mr Sih Yang Sim of NACA, who assisted with field-trips in Indonesia and Thailand, Mr Thierry Chan of Civic-Exchange who assisted with field-trips to Hong Kong, China; and China, and Ms Isabelle Cruz of MAC Philippines, who assisted on trips to the Philippines

The success of several of the supporting activities and would not have been possible without the support of individuals and their organizations. Special thanks go to Mr Kenneth Vy of Kenneth Aquamarine for making available his facilities and fish in Cairns, Australia and Hong Kong to enable us to undertake our tagging and traceability experiments. Thanks also go to Ms Suzanne Gendron of Ocean Park for assistance in distributing consumer outreach materials.

Finally thanks go to the various funding agencies; The Nature Conservancy, APEC, The MacArthur Foundation, The Packard Foundation, and the National Marine Fisheries Service for their financial support without which this Standard, and its supporting documentation, would not have been produced.

List of Acronyms and Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AFCD	Agriculture, Fisheries and Conservation Department, Hong Kong
APEC	Asia Pacific Economic Cooperation
BBL	Balai Budidaya Laut, Lampung (National Seafarming Centre, Lampung)
BFAR	Bureau of Fisheries and Aquatic Resources, Philippines
BPPT	Badan Pengkajian Dan Penerapan Teknologi (Agency for the Assessment and Application of Technologu
CE	Civic-Exchange Hong Kong
CRC	Cooperative Research Centre for Reef Research, James Cook University
DoF Thailand	Department of Fisheries, Ministry of Agriculture and Cooperative, Thailand
DoF Vietnam	Department of Fisheries Vietnam
FORKERI	Forum Kerapu Indonesia
GBRMPA	Great Barrier Reef Marine Park Authority
GRIM	Gondol Research Institute for Mariculture
HKCSM	Hong Kong Chamber of Seafood Merchants
IMA	International Marinelife Alliance
KNP	Komodo National Park
LRFF	Live Reef Food Fish
LRFFT	Live Reef Food Fish Trade
MAC	Marine Aquarium Council
MMAF	Ministry of Marine Affairs and Fisheries, Indonesia
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centers in Asia-Pacific
PCSD	Palawan Council for Sustainable Development
QDPI	Queensland Department of Primary Industries
QFS	Queensland Fisheries Service
QSIA	Queensland Seafood Industry Association
SCRFA	Society for Conservation of Reef Fish Aggregations
SPC	Secretariat of the Pacific Community
TNC	The Nature Conservancy
USP	University of the South Pacific
WWF	World Wildlife Fund
WRI	World Resource Institute

List of Figures

List of Plates

Part 1 - BACKGROUND

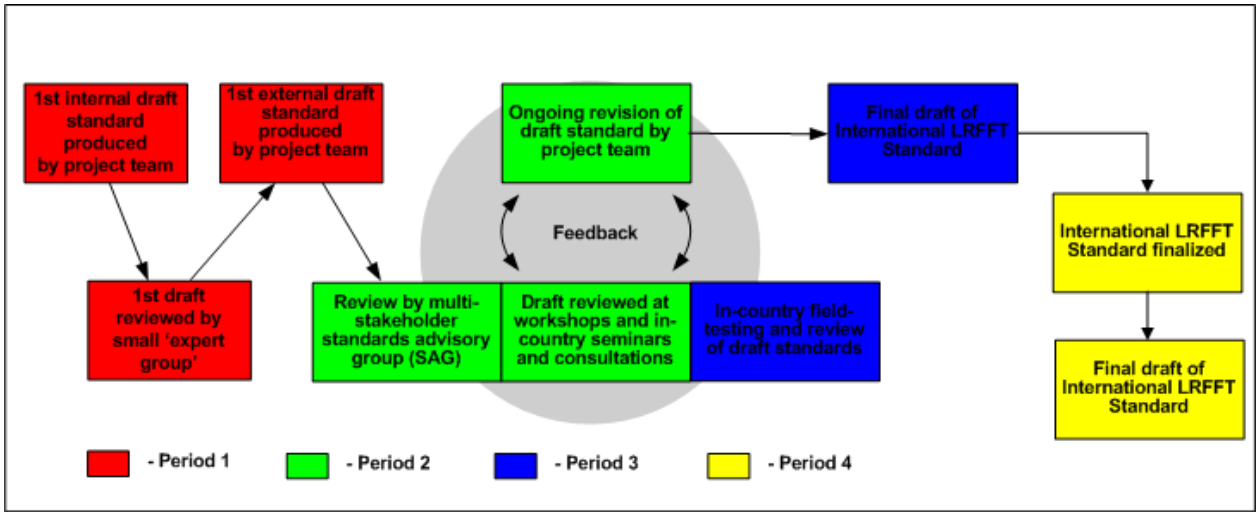
1.1 Introduction

In February 2001, The Nature Conservancy, The International Marinelife Alliance (IMA), and the World Resources Institute (WRI) convened a workshop in Honolulu that brought together major regional players to develop a collaborative strategy to address the threats posed by the live reef food fish trade in the Asia Pacific region. The workshop participants agreed that the next step was to develop a set of industry "best practice standards" for the live reef food fish trade covering the chain of custody from reef to primary consumer (be that the importer, wholesaler, restaurateur or restaurant patron). As a result of the workshop, the Conservancy, the Marine Aquarium Council (MAC), and the International Marinelife Alliance (IMA) formed a partnership to help develop these industry standards. The goal of this project is to bring together stakeholders to determine the best practices needed to ensure that the live reef food fish trade becomes a sustainable, high-value industry that improves the livelihoods of local fishers, provides a stable and healthy supply of fishes to the market, and helps protect the coral reef habitats which are the basis for productive reef fisheries. The project focuses on both wild-caught and cultured fish, and covers standards and practices relating to each aspect of the industry, from assessing reefs and target reef fish populations to dealing with human health and safety concerns. MAC agreed to provide the overall coordination for the project, which is being carried out over a two-year timeframe from January 2002 to December 2003. The project timeframe was later extended to the 31 July 2004 due to the events of the IRAQ War, SARS and Asian bird 'flu epidemics which prohibited international and regional travel in Asia

This report describes the work undertaken over the last two years in developing a credible and robust standard for the live reef food fish trade through a transparent an international multi-stakeholder consultation process.

The following (Figure 1) shows the process by which the international standard for the live reef food fish trade was developed. This involved the participation of APEC member economies, participants in the live reef food fish industry (fishers, suppliers, importers, wholesalers, distributors, restaurants and consumers). Workshops and seminars were held in Australia, Hong Kong, China, Indonesia, Pacific Islands, Philippines, Thailand and Viet Nam.

Figure 2: Standards development process for the live reef food fish trade



The project team also extensively reviewed the lessons learned by the Marine Aquarium Council (MAC) in developing their environmentally and socially sustainable standards for the marine aquarium trade and then used a version of this methodology to develop the international standard for the trade in live reef food fish.

The partnership of The Nature Conservancy (TNC), the International Marinelife Alliance and the Marine Aquarium Council undertook the initial activities and work program for Period 1 of the project as in Figure 1 above. The activities of Periods 2-4 were undertaken by The Nature Conservancy (TNC) and the Marine Aquarium Council (MAC) as the International Marinelife Alliance were no longer able to participate in the project.

As a first step in the project the team considered a number of different models that have been proposed for achieving collaborative resource management of fisheries. These include: i) certification and eco-labeling; ii) voluntary Codes of Conduct; and iii) industry standards. Of these models, certification and eco-labeling of the LRFFT was considered inappropriate at this stage due to the large volumes and number of species traded, the diffuse nature of the industry and the uniquely 'live' aspect of the product, while industry standards would seem difficult to institute for these same reasons. Voluntary codes, especially the FAO Code of Conduct for Responsible Fisheries which "sets out principles and international standards of behavior for responsible practices with a view to ensuring effective conservation, management and development of aquatic resources with due respect for ecosystem and biodiversity" seemed the more suitable starting point for the LRFFT.

1.2 Project Initiation

A project inception meeting was held in Hong Kong in January 2002 attended by representatives from the three principal co-managers the partnership, TNC, MAC and IMA. The meeting, which was preceded by an informative tour of live reef food fish markets and fish cages around Hong Kong Island, encompassed:

- A review of existing information on supply and demand issues in the Asia-Pacific region, industry perspectives on current practices and areas for improvement, existing best-practices employed in a highly regulated fishery in Australia, and recommendations based on the MAC experience;
- The identification of the substantive elements for inclusion in a Code of Best Practice and the areas where further data collection or research may be necessary;
- The strategic implementation process required to gain broadest possible involvement and acceptance of an international code of best practiced
- The development of a overall workplan, setting out specific activities and designating responsibilities for these activities to individuals within each organization, and a detailed costing of all activities

At the conclusion of the project inception meeting, a Key Partner Group made up of individuals from the three main organizations involved and the industry representative in Hong Kong, China was established, which comprised

Paul Holthus (MAC) Lead Partner	Sandy Chen (TNC – HK)
Charles Barber (IMA) Lead Partner	Frazer McGilvray (IMA – HK)
Rod Salm (TNC) Lead Partner	Thierry Chan (IMA – HK)
Peter Scott (MAC)	Geoffrey Muldoon (IMA – Australia)
Rezal Kusumaatmadja (MAC)	Patrick Chan (HKCSM)

In addition a drafting team, with responsibility for expediting the development of the standard, was formed, comprising Peter Scott, Rezal Kusumaatmadja, Geoffrey Muldoon, Frazer McGilvray and Patrick Chan.

1.3 Initial Consultations and Compilation of Background Information

During the initial months of the project the drafting team undertook extensive informal consultation with representatives of both the catching and importing sectors of the live reef food fish trade. This information was used to understand the boundaries and the limitations and acceptability of the proposed standard, within the Philippines, Indonesia, Hong Kong and China as it was essential to obtain the co-operation of the industry members in these economies in order to produce a robust and credible standard.

It was decided to during the initial months of the project to refer to the standard as a code of best practice rather than a standard as there was some nervousness amongst the industry members as to the regulatory implications of a standards document. (During the length of the project those that took part in the consultative process became less nervous about the concept of a standard and in fact towards the end of the project industry members in both Southeast Asia and Australia made inquiries as to when certification would be assigned to the standard)

Extensive documentation and information was reviewed during the initial stages of the project including a wide-ranging review of the lessons learned from the Marine Aquarium Council standards and certification program.

A financial and economic analysis commenced in period 2 of the project and continued through to the final month when this was completed. The decision to make this analysis ongoing was both to coincide with the evolving program of consultative seminars and field-testing and in response to the continuing changes in the market for live reef food fish and fluctuations in the Asian economy.

During this initial consultative phase an informal network of individuals was established who freely gave of their time whenever the drafting team had particular issues or matters that they wished to debate or seek further clarification on.

Certain issues that were deemed to be important at the beginning of the project were found to be less important towards the end of the project but others such as traceability which were initially dismissed during the earlier consultative processes became more significant as the stakeholder consultations expanded and the Standard became more tangible.

1.4 Background Information,

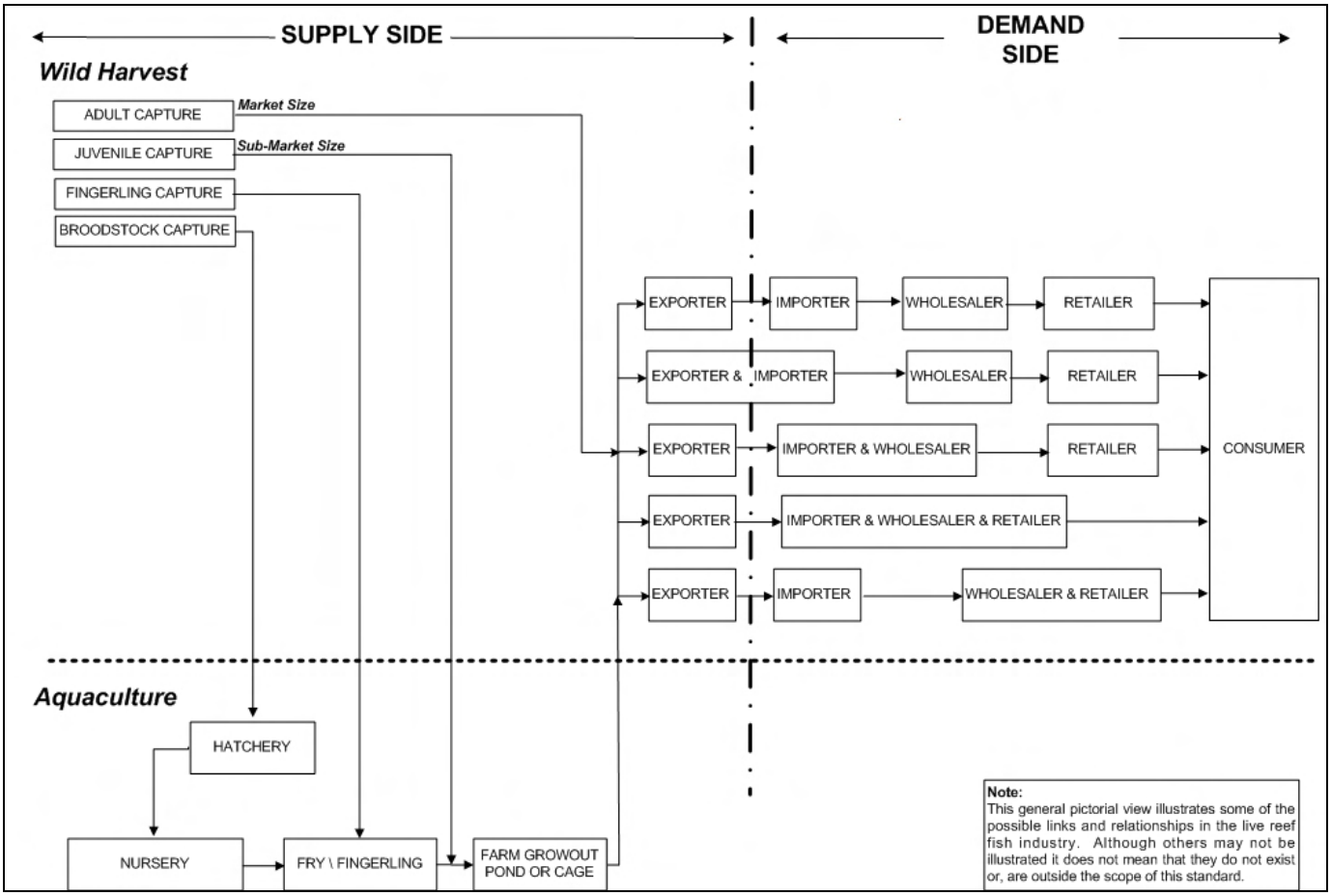
1.4.1 The Scope of the LRFFT Standard

One of the initial steps in the standards development process was to determine and outline the *scope* within which standard would be produced.

This *scope* would identify the principal stages along the chain of custody for LRFF products, and the stakeholder groups for which best-practices would be required.

This scope was then reviewed and amended during the initial months of the project until the final iteration, which describes the entire scope of application for the international standard in live reef food fish evolved (Figure 2).

Figure 3: Overall Scope Of The International Standard For The Trade In Live Reef Food Fish



1.4.2 List key elements for inclusion in LRFFT Standard

In order to produce a meaningful and effective standard, the drafting team adopted a multi-faceted process in gathering background information that included:

- Compiling all available information on current industry best practices using available background papers and reports
- A synthesis of existing codes of conduct and best-practices for fisheries and other agricultural products these included but were not limited to:
    - FAO. Code of Conduct for Responsible Fisheries.
    - Canadian Code of Conduct for Responsible Fishing Operations
    - Forest Stewardship Council Requirements and Criteria for Sustainable Forestry.
    - Marine Aquarium Council. 2001. International Performance Standards for the Marine Aquarium Trade.
    - Marine Stewardship Council. Principles and Criteria for Sustainable Fishing.

It was also possible to gain perspectives from supply and demand sectors from SE Asia, Western Pacific and China by conducting informal consultations with a broad range of individuals and organizations with experience with expert knowledge of the LRFFT.

Those engaged with were drawn from:

- staff within the key partner organizations of IMA, TNC and MAC who were based within the Asia-Pacific, specifically the Pacific Islands, the Philippines, Indonesia, Vietnam, Hong Kong and Australia;
- informed individuals within external organization who had close relationships to key partner organizations such as the HKCSM, SCRFA, SPC, NACA, QDPI; and
- relevant stakeholders attending larger meeting and conferences such as CBD and COP etc.

As a preliminary step in the development of the first draft of the standard for external review, a pre-draft standard listing key requirements was formulated by the drafting team in late April 2002. This pre-draft document, which focused on the wild-capture of target LRFF species and the Handling, Holding, Distribution of them, detailed the key requirements for inclusion in a code of best-practice for the LRFFT.

1.4.3 Preliminary Standard Structure

After careful deliberation, the drafting team decided to adopt a *principle* type of approach to the organization of the Standard. The primary reason for this approach was a recognition that the Standard itself should be a concise document and relatively easy to understand such as that of the Canadian Code of Conduct for Responsible Fishing Operations rather than the complex prose of the FAO and MSC Principles and Criteria.

It was initially decided to augment the standard itself with supportive documentation by way of a best practice document and training and implementation manuals, see Figure 3 below.

Figure 4: Initial LRFFT Standards Structure

The initial standard document itself consisted of bullet criteria with underlying descriptors that clarified those criteria. The best practice document was intended to expand on each of the bullet point criteria and describe how each member of the live reef food fish trade may seek to satisfy each of the criteria.

The third level of documentation consisted of a bringing together of the many documents that describe how best practice may be demonstrated by the separate sections of the live reef food fish trade.

The pre-draft standard was first circulated to the Key Partner Group members for internal review and comment in May 2002.

1.4.4 Preliminary Review and Revision of Standards

1.4.4.1 Developing list of key stakeholders

The goal of the project was to bring together stakeholders and build a consensus on what "best practices" are needed to ensure a sustainable industry, including sustainable reefs, fish stocks and fishing communities. It was recognized early that in order to ensure credibility, the standard must be developed through an open multi-stakeholder consultative process, engaging, where possible stakeholders from all participant groups. A comprehensive round of consultations was carried out by all members of the drafting team and key partner group to engage as many relevant government, non-government organization and industry peak body representatives and industry participants and research personnel as was possible (Attachment 7.1).

1.4.4.2 Industry Involvement with the LRFFT Standard Development

Prior to the wider dissemination of the draft standard, the project partners and drafting team had agreed that the standard would be best refined by drawing on the input of as wide a range of key industry people and researchers as possible. Ideally, by bringing these stakeholders together in both formal and informal settings, the content of the standard would be scrutinized, amended or expanded from both a technical and practical standpoint. To this end, the workplan allowed for the conduct of two technical workshops to be attended by “industry experts” and an informal electronic list.

1.4.5 Expert Workshops

The live reef food fish trade standard for both wild-caught and cultured fish is intended to cover the:

- assessment and monitoring of fish stocks;
- management, monitoring and enforcement priorities to regulate effort and catch;
- capture/culture, handling, husbandry and transport of wild-caught or mariculture stocks

To enable these complex issues to be considered and credible standard criteria to be produced two strategic technical workshops were held in Townsville, Australia and in Ha Long, Vietnam. As noted, a certification framework was considered inappropriate for the LRFFT, as was establishing protocols by which to guide stakeholders in satisfying ‘certification’ requirements. As such, the setting of standards of best practice by which to guide regional and national management schemes was the focus of these workshops.

1.4.5.1 Resource Assessment Monitoring and Management Workshop

A 3-day workshop was held in Townsville, Australia in August 2002 with the goal of defining those best-practices required to address resource assessment, monitoring and management of the LRFFT. The twenty-four attendees were chosen with this goal in mind (Attachment 7.2). The 'best practice' guidelines that emerged from the workshop recognized the limited human, financial and technical capacities of the many economies in the region that may act as an impediment to the implementation of these practices. The specific objectives for the workshop were to:

- Summarize the main fisheries dependent and independent methods to collect and analyze data in tropical coral reef fisheries;
- Prescribe the application of these techniques to the LRFFT with emphasis on assessing initial fishery viability and the ongoing assessment and monitoring programs required to sanction or approve expansion of a fishery;

- Identify management tools and strategies most appropriate for the LRFFT given capacity constraints; and
- Set down responsible fishing behavior of fishing operations in terms of capture and post-harvest handling and consumer safety.

The key outcomes from the workshop as they relate to Part 1: Principles of Wild Harvest of Reef Fish of the standard can be summarized as:

- Part 1 of the Standard was expanded from 12 to 26 principles, resulting in a more prescriptive set of requirements. This number was subsequently reduced to 21 principles;
- Part 1 of the standard was restructured into three key sections covering; a) Resource Assessment and Fishery Viability, b) Fishery Management and Planning and c) Fishing Operations;
- There was concern that operators and agencies in source economies may hold themselves up as being compliant under an internationally developed 'code', on the basis of meeting certain principles when overall, the prospects for the fishery remained unchanged. Accordingly the improved standards structure should reflect the holistic nature of the standard and the obligation for adhering to a stepwise process (i.e. a demonstration of compliance with principles in section c) fishing operations mean little without achieving fishery viability, monitoring and management compliance.
- It was recognized that the principles should stipulate an achievable target in light of capacity limitations in source economies, particularly with regard monitoring programs, so that
- Source economies can take responsibility for implementing or augmenting monitoring programs;
- Dependence on outside expertise and support is minimized and
- Sampling programs are simple and cost-effective enough to be implemented on a long-term scale.

The outcomes of the Townsville workshop were also used to develop 'tool-kits' which would serve to guide governments, regional agencies and practitioners and managers in the application of the standards.

To this end, two key output of the meeting were agreements for "Rough Rules of Thumb" for the instatement and development of a LRFF fishery and a set of "Principle Elements for Inclusion in a Fisheries Management Plan for a LRFF fishery.

Figure 5: Townsville workshop participants

Back Row (L to R): Mr Nilo Brucal (WWF Philippines), Mr Peter Scott (MAC), Mr Terry Must (Arabon Seafoods), Mr Mick Bishop (GBRMPA), Dr Domeng Ochiavillo (Reef Check), Dr Terry Donaldson (IMA), Dr Bruce Mapstone (CRC Reef), Dr Nick Dulvy (University of Newcastle), Dr Cameron Hay (USP), Dr Putu Sumardika (MMAF), Dr Simon Woodley (Facilitator), Arief Wicaksono (IMA), Mr Being Yeeting (SPC)
Middle Row: Mr Patrick Chan (HKCSM), Dr Yvonne Sadovy (SCRFA), Mr Lyle Squire (Cairns Marine), Dr Bridget Kerrigan (QFS), Mr Geoffrey Muldoon
Front Row: Dr Clive Wilkinson (GCRMN), Dr Peter Mous (TNC)
Absent: Mr Gary Carlos (CRC Reef), Associate Professor Garry Russ (JCU), Dr Bob Johannes, Mr Kenneth Vy

1.4.5.2 Aquaculture Standards Workshop

A 1-day workshop was held in Ha Long, Vietnam in September 2002 at the conclusion of a regional workshop on marine finfish culture organized by NACA and ACIAR with the goal of defining management and operational best-practices for LRFFT related aquaculture and mariculture activities.

The aquaculture standards workshop, which was timed so as to take advantage of those attending the NACA/ACIAR workshop, was attended by 40 participants from industry, government, non-government organizations and regional organizations encompassing the key persons in grouper research and development in Asia-Pacific (Attachment 7.3). The attendance of these persons ensured that the discussion would be informed by the substantial body of research into grouper culture development and technology in the Asia-Pacific region. The specific objectives for the workshop were to:

- Review the existing literature on standards development for aquaculture/mariculture;
- Identify key issues for inclusion in the aquaculture standards;
- Identify major considerations and contents for inclusion in an aquaculture standards guidelines document; and
- Identify the participatory process to be employed for subsequent testing, development and revision of the aquaculture standards.

The key issues to be addressed by the aquaculture management part of the standards for the LRFFT and priorities attached to each of these issues were as follows:

Key Issues	Priority
Collection of wild fish (larval/juveniles) for stocking and sustainability of supply	High
Improving survival of wild caught larvae and juveniles	High
Development of hatcheries and practices for quality hatchery reared fry	High
Chemical use in hatcheries/grow-out farms including product quality & environment issues	High
Grow out farm siting and habitat interactions	High
Waste control and effluent management	High
Feed supply and management	High
Fish health management, including movements	High
Food quality and safety	High
Socio-economic issues, gender and poverty	Medium
Alien species introductions and genetic implications	Low
Traceability of fish	Very Low

The key outcomes from this strategic workshop as they relate to Part 2: Principles of Reef Fish Aquaculture can be summarized as:

- The merging of aquaculture and mariculture within the section of the standard in recognition of wide spectrum of reef aquaculture practices and the close relationship between aquaculture and wild fisheries with respect to harvesting of fish seed and juveniles for grow-out and harvesting of wild-caught fresh fish for fish feed;
- Part 2 of the Standard was expanded to 11 principles that had broad acceptance as “best or better” practices that addressed the key issues outlined in the table above. This number was subsequently increased to 12 principles;
- While issue of “traceability” of cultured fish was discussed, it was recognized that industry receptiveness and acceptance would be vital to its inclusion. Discussion of this issue was left with the project partners for further discussion with the instruction that it was of very low priority;

Figure 6: Ha Long meeting participants

Attention was also given to identifying the main contents for inclusion in best-practice guidelines documents. This documentation, which is intended to provide implementation guidance for the aquaculture standards, will be developed subsequently. It was emphasized by participants at the meeting that the draft standards document will need to be widely circulated among stakeholders for review and comment.

It was also decided that it was essential to hold some local farmer workshops in 2-3 selected economies for subsequent field testing and development of aquaculture standards in consultation with stakeholders. The latter approach was thought essential to engender ownership” of the standards among industry stakeholders and a practical approach to their implementation.

1.4.6 External Review of Standards

In addition to the incorporating outcomes from the two strategic technical workshops, the drafting team sought comments from the Key Partner group for inclusion in the first complete draft of the *International Standard for the Trade in Live Reef Food Fish.*

In conjunction with the standards development activities, an *Expert Review Group* was formed to undertake a detailed review and comment of the standard to date. The expert group comprised individuals who had been receptive to the project goals and objectives and who were knowledgeable on various aspects of the LRFFT and had some experience of fishery standards. This group was tasked with reviewing this complete first draft of the standard *prior* to its wider distribution. This group consisted of:

Randall Owen (GBRMPA)	Lida Pet-Soede (Operation Wallacea)
Nelson Kile (MoF, Solomon Islands)	Mike Phillips (NACA)
Rock Kwok (AFCD, Hong Kong)	Yvonne Sadovy (SCRFA)
Ted Loveday (SSA, Australia)	Bob Pomeroy (IMA)
Joe Padilla (WWF Philippines)	Being Yeeting (SPC)
Jonathon Peacey (MoF, New Zealand)	C T Chueh, Taiwan Fish Breeding Association

In parallel with this "core " group of experts, a more comprehensive list of key stakeholders that included broad representation from relevant government departments, non-government organizations, industry peak bodies and researchers and academics, was continually being generated and regularly updated. This was to become the LRFFT Standards Advisory Group or SAG.

Part 2 – MULTI-STAKEHOLDER STANDARDS DEVELOPMENT PROCESS

2.1 Overview

With the completion of the strategic workshop input and internal key partner and expert group review of the draft standards, the project entered the "multi-stakeholder process" stage of standards development. This process sought to achieve a balance between inclusiveness, representation and effectiveness in order to expedite the process of development but not at the expense of excluding important and strategic stakeholders.
It was acknowledged by the partners that achieving this balance during the developmental phase would ensure stronger buy-in and increased credibility in their implementation. In order to broaden the stakeholder participation base, the key partners resolved that the development and refinement of the standard would be achieved through a combination of a larger, more representative Standards Advisory Group (SAG) and a series of in-country consultative seminars.

2.2 Standards Advisory Group

The Standards Advisory Group (SAG) comprised a wider group of individuals with a particular interest in the LRFFT and was convened so as to ensure adequate stakeholder consultation and involvement (Attachment 7.4). A database maintained from the inception of the project was used to invite these individuals to be a member of the LRFFT SAG (Attachment 7.5). Suggestions as to other potential SAG members were sought from this group. The SAG was finalized in December 2002, prior to the circulation of the revised standard to the group in February 2003. Other individuals did though join the SAG as a result of growing interest in the project and following their participation in the field testing activities.

The SAG was informed with the intention to undertake several review rounds of the LRFFT standard, with work of the SAG consisting of:

- Reviewing the draft standards and best practice assembled up to that point.
- Providing comments within the time frame requested.
- Reviewing and commenting on the revised standards within the time frame requested.
- Providing existing materials that should be included or referred to as a "Level Three Document" (e.g. tool kits, manuals, etc.)
- Reviewing and commenting on the next iteration of the standards (as necessary).

The review process was to be restricted to the LRFFT SAG membership and SAG members were asked not to distribute the draft documents to the general public. It was intended that the documents would be posted for wider public review following the LRFFT SAG review.

2.3 Revised Validation Approach

Under the original LRFFT Standards Workplan, field trial preparation and field trial activities were intended to field-test the outcomes from the technical workshops held in Australia and Vietnam. These two activities were initially scheduled for completion by December 2002. At a project review meeting in Coron, Philippines in August 2002, it was agreed that a feasibility study to determine the need for field-testing should be undertaken. The rationale for this was twofold. Firstly, of the two main components of the Townsville workshop; Fishery Viability and Resource Assessment and Fishery Management and Planning; it was noted that monitoring and assessment techniques used to assess fishery viability or the state of the resource were well grounded, as were management strategies.

Secondly, the practicability and efficacy of undertaking field-based assessment to measure benefits of standards adoption over current practices would be compromised by time constraints. The objectives of the feasibility study needs assessment was to determine the form and locations of the feasibility study/field assessment process, scheduled for July to December 2003.

At a subsequent project review meeting in Hong Kong in February 2003, following the feasibility study, a new activity "*Standards Validation*" was added to the workplan to acknowledge the need for a more practical approach to validating the standards' requirements early in the development process. It was further agreed that ongoing refinement of the standards and best-practice guidelines, would be best ensured through a series of focused *"consultative seminars"* conducted in source economies.

2.4 Preliminary toolkit development

The first step, prior to this consultative seminar stage, was to undertake a desktop study using the outcomes of the standards workshop held in Townsville to develop best-practice guidelines for the main themes, these being:

- Resource and fishery viability assessment methods;
- Fishery management plan components for new and existing fisheries;
- Fishing operation and processor practices

Initially it was thought that the LRFFT standard would be accompanied by a more detailed document that would act as a best practice and implementation guide to that standard. As the Standard evolved it became apparent that a compendium of relevant training and implementation manuals would be ponderous and a more manageable and accessible alternative would be required.

The drafting team spent some time looking at the alternatives to a straightforward guidance document and decided that the best-practice guidelines should probably take the form of an '*implementation tool-kit*'. It was recognized that the tool-kit would need to ensure the meaning and intent of the LRFFT standard requirements was clearly understood and that sufficient direction and explanation was included to guide the reader. As a first step, the LRFFT standard requirements regarded as justifying inclusion were identified. These were then expounded upon using existing literature to provide the necessary guidance for the requirement to be adhered to. The outcomes of this desktop study were then used to guide the conduct of the seminar workshops in the 3rd and 4th quarter of 2003 and enable substantiation and/or endorsement of the standards.

Having identified the candidate requirements of the LRFFT standard the second step was to determine the key focus of the standards validation process. These can be summarized as addressing the:

- Practicability of assessment techniques and management aspects of the standards and the capacity of source economies to comply with or support these components;
- The capability of fishing vessel operators and fish processors to meet minimum best-practice standards for capture, storage, husbandry and transportation aspects of the standards

It was intended that results of this 'analysis' would feed into the standards revision process to generate realistic and achievable best practice standards.

The need for a similar approach to the outcomes of the aquaculture standards were seen as less pertinent given the existing substantial library of "best practice" manuals for culturing and husbandry of grouper species. As such, it was decided that a separate workshop would be conducted during this consultative seminar phase to address aquaculture issues specifically.

2.5 Consultative Seminars and Workshops

As noted above, the Hong Kong meeting in February 2003 agreed that the additional refinement and validation of the LRFFT Standards and Best-Practice Guidelines would be best achieved through a series of in-country *Consultative Seminars* conducted within those source economies, or regions, where the LRFFT is in operation. These seminars were scheduled for July to September 2003 and an emphasis, where possible, was placed on coinciding them with planned international or regional events (Table 1).

Figure 7: Consultative seminar program

Date	Country/Region	Coincident Event (if applicable) & Location	Facilitator
24/08/03	Pacific Islands	3rd Heads of Fisheries Meeting, Noumea	SPC
29/09/03	Thailand	World Aquaculture Society Conference, Bangkok	WAS/NACA
14-15/10/03	Philippines	Live Reef Food Fish Initiative, Puerto Princesa	PCSD/ISDA
20/10/03	Indonesia	Jakarta	MMAF
19/11/03	Hong Kong	Hong Kong	HKCSM/AFCD
09/12/03	Australia	Queensland Reef Line Fishery Workshop, Brisbane	QFS/QSIA

A key purpose of consultative seminars was to introduce the standards development process, the standards components, project history, etc to a broad range of stakeholders perhaps not yet previously captured in the outreach activities. In particular, the use of consultative seminars was seen as vital to encouraging and ensuring meaningful participation from those stakeholders less likely to provide comments in writing and at international fora.

The consultation seminars resulted in stakeholders' greater understanding of and input to the standards development process while the main output was an analysis of the individual requirements of the standard in terms of their practicability and the capacity for or capability of stakeholder implementation of compliance. Feedback from the Consultative seminars was recorded in tabular form for relevant directives.

2.5.1 Pacific Islands, Noumea, New Caledonia – 24th August, 2003

Prior to the consultative seminar, a presentation was made to all Pacific Island delegates at the 2003 Heads of Fisheries meeting, to introduce and explain the Standard. A ½ day workshop was conducted following the Heads of Fisheries meeting which was attended by fisheries representatives from Fiji, the Marshall Islands, Tonga, Tuvalu, the Solomon Islands, the Federated States of Micronesia, Papua New Guinea, Nauru, Vanuatu and Kiribati as well as observers from SPC, FAO and the University of the South Pacific (USP).

Figure 8: Pacific Island Consultative Seminar

Key outcomes of this meeting were that:

- Significant capacity limitations in respect of resource assessment and management, in most Pacific Island countries are ably supported and assisted by regional bodies such as SPC, USP and SPREP.
- The Standard structure should clearly address the needs of new AND established fisheries and should define a sequence, as opposed to simple a collection of interrelated events;
- The Standard must recognise the different levels of authority (e.g. National, Provincial and Community) and promote coordination between them; and
- For holding and transportation of LRFF, issues such as introduction and translocation of exotic species need to be addressed

2.5.2 Bangkok, Thailand –26th September, 2003

At the Asia-Pacific meeting of the World Aquaculture Society held in Bangkok in September 2003, an update on the Standards project was presented to a special session on grouper aquaculture. This was followed by a ½ day workshop attended by stakeholders and representatives of research agencies, industry and government. The purpose of this seminar was to look at requirements in terms of its capability of being met, and outline documentation needs best-practice and implementation guidance as well as raising issues of more general concern.

Key outcomes of this meeting were:

- There being general agreement as to the intent and content of all Requirements;
- The need for Requirements to be flexible enough to accommodate the variant processes for achieving best-practice compliance;
- Recognising that best-practices will evolve over time and therefore the mechanism for disseminating best-practices should be flexible (the project team debated this flexible approach to best practice at length and decided that a Toolkit CD and simple website where information could be downloaded would be the best solution to this.);
- The need for level 3 documentation that provides extensive detailed practical guidance on implementation. It was thought that this could not be covered by one or two supporting documents.
- The need to be able to distinguish between wild-caught and cultured product and their origin emphasizes the need for some form of certification or eco-labelling; and

In terms of future activities, it was suggested that if possible, in-country workshops be conducted to obtain feedback on the Standard and that this should be done in cooperation with NACA, ACIAR/DPI – NFC and the STREAM initiative.

2.5.3 Puerto Princesa, Philippines, 15th and 16th October, 2003

A joint consultative seminar/workshop was held on the 15th –16th October 2003 in conjunction with the launch of the *Movement for a Cyanide-Free Palawan*, an initiative of live reef fish exporters and the Palawan Council for Sustainable Development. Both the seminar and workshop were attended by >60 people representing four main stakeholder groups; fishers and exporters, local government units, national government and non-government organizations. The workshop participants focused on Requirements in Parts 1 and 3 of the Standard.

Figure 9: Philippines Consultative Seminar

Key outcomes of this meeting were:

- An acceptance by all participant groups as to the content and intent of the standards and a willingness to cooperate in the progression and implementation of the Standard;
- A consensus that in terms of *Assessment Capacity*, for many Requirements, while there was considerable in-country technical capacity, limited logistical capacity existed to apply this expertise in many cases;
- A consensus among the group as to the ease or difficulty with which for most Requirements could be implemented. With respect to each Requirement however, in terms of *Practicability of Implementation* many Requirements were seen as being difficult to implement without external assistance; and
- An emphasis among the group as to the need for the field-testing of many of the Requirements. Only those Requirements which the meeting identified as both difficult to implement and in need of field-testing and that could be achieved within the timeframes of this project were considered for later field-testing.

2.5.4 Jakarta, Indonesia, 20th October, 2003

The Indonesia standards review workshop was co-organized by MAC and the Forum Kerapu Indonesia (FORKERI), an informal group consisting of government officials and industry operators with an interest in grouper aquaculture and trade. The workshop was attended by key personnel from national level government departments, fishing industry representative bodies and non-government organizations. The purpose of the seminar was primarily to strengthen industry buy-in by providing a general introduction to the standards development project to the Indonesia stakeholders and an explanatory overview of the Standard.

A review of market status and trends in China and Hong Kong, China for both wild-caught and cultured species was presented by the then Chairman of the Hong Kong Chamber of Seafood Merchants (HKCSM), Mr Patrick Chan, which was well received. The 20 participants who attended ½ day meeting identified the need for more detailed follow-up either through an additional workshop or through involvement with field testing

Figure 10: Indonesia Consultative Seminar

Key outcomes of this meeting were:

- A comprehensive review of past, present, and future market demand in China and Hong Kong, China;
- Acknowledgement of the key areas where improvement in LRFFT practices (wild caught and aquaculture) are needed and identification of strategies for implementing those improvements
- Consensus among the participants that the next step in the process would be to undertake field-testing throughout Indonesia
- Given the expansion in grouper aquaculture production in Indonesia, a need to foster alternative markets for LRFF product, either domestically or overseas, was identified.

The field-testing component of this project within Indonesia was undertaken with assistance from key agencies in the region (NACA, ACIAR, FORKERI) with knowledge and expertise in the LRFFT.

2.5.5 Hong Kong, 23rd April, 2003 and 19th November, 2003

Two separate meetings were held in Hong Kong. The April meeting was attended by industry, retail and government fishery agency representatives based in Hong Kong. The larger November meeting was attended by representatives from these groups as well as representatives from the government food and hygiene agency, non-government organizations and the research community from both China and Hong Kong, China. The purpose of both meetings was to expand the consultative process to engage with the demand side of the market chain (see Figure 2). The workshop participants focused on Requirements in Parts 1, 2 and 3 of the Standard

Key outcomes of these two meetings were:

- A call for source economies to be held more responsible or accountable for providing fish free from disease or ciguatoxins and for ensuring exports of LRFF meet any regulations with respect to species and size;
- Highlighting the importance of food safety for consumers of LRFF and the need for fish traders to be able to knowingly market their LRFF as safe and free from disease;
- Recognition by the traders of the need for an efficient system of food safety control and quality assurance mechanism;
- That the ability of traders to supply “healthy” fish will depend on a system of certification within supply economies that verifies the health of exported fish sourced from both wild-caught and aquaculture production;

- The importance of food safety in consumer markets highlights the need for a safe and cost-effective "tagging" system to enable traceability of LRFF to their origin in the supply economy
- The need to establish designated hubs or centralised ports in both source economies and China and Hong Kong, China, where LRFF are loaded or unloaded, in order to facilitate any such traceability system; and
- Because of depressed and more unstable economy, changing consumer preferences regarding wild-caught and aquaculture products, and the aquaculture production of new freshwater species the LRFF markets are undergoing major transformation.

2.5.6 Brisbane, Australia, 9th December, 2003

The seminar, which was supported by the Queensland Fisheries Service and The Queensland Seafood Industry Association, was attended by representatives from industry, government and management agencies, research institutions and non-government organizations. A preliminary assessment of this fishery was carried out during the meeting by sequentially comparing all aspects of the Standards Requirements against existing fisheries management, operation and handling, husbandry and transportation arrangements in place within the Queensland-based LRFF fishery.

Based on this and a subsequent desktop study assessment, the drafting team have acknowledged the consistency between the Standard and the current management and operation of the LRFF fishery in Queensland.

Key outcomes of these the meetings that were raised by participants related to:

- Concerns that the high standards of best-practice employed within the Australian fishery could be undermined or diminished by acceptance of lesser practices employed in other economies as meeting a "standard";
- How the standard would recognise existing management arrangements within Queensland fishery and requirement for management agencies to demonstrate compliance with principles of ESD to the national government, without additional impost (i.e. recognition of equivalence);
- A recognition by the international community that the high best-practice standards in use in the Australian fishery can provide market (e.g. financial) non-market (e.g. NGO and public perception) benefits;
- A positive response by industry to cooperate in the evaluation and gap analysis of existing regulations in the Queensland fishery against the LRFFT Standards as part of the field-testing;
- The testing fish for viruses and pathogens prior to export was considered by industry participants to be highly impractical, although the meeting supported further investigation of health screening options; and
- Support for the use of fish-tagging systems as a traceability mechanism for use by exporting economies.

Part 3 – FEASIBILITY, TESTING AND VALIDATION OF THE LRFFT STANDARD

3.1 Overview

Field assessment of the LRFFT standards was a requirement of one of the minor funders (i.e. APEC). Initially, it was envisaged that multiple field-trials would be undertaken to:

- assess and document existing practices at multiple sites and, given in-country capabilities, the prospect for affecting change through improved practices; and
- oversee the implementation of 'best-practices' in the areas of management and operation of wild-caught fisheries and handling, holding and husbandry of LRFF.

At both phases, it was intended that input from these field based activities would feed back into the Standards development process.

Following a feasibility study needs assessment, which the field-based testing and assessment activities were refined to take and make best use of the time available, better reflect capacity constraints in the various source economies and recognize the need to be adaptive with respect to the minimum standards requirements. In place of extensive field-testing at the producer level, it was resolved that the field-testing should be a rapid assessment of in-country capacity to achieve the proposed Standard for wild-caught or aquaculture of LRFF. It was agreed by the drafting team and key partner and experts group that the key focus of field-testing should be on the:

- Practicability of implementing assessment techniques and monitoring and management aspects of the standards and the capacity of source economies to comply with or support these components;
- Operation of fishing vessels, storage, husbandry and transportation aspects of the standards

It was identified that field-based consultations in producer-supply economies would refine the development of 'best practice' guidelines and facilitate the preparation of supporting documentation.

Whilst it would have been desirable, including newly established fisheries in the field assessments was not possible and activities necessarily focused on existing fisheries and aquaculture operations.

3.2 Field Testing

The two main components of the Townsville workshop were Fishery Viability and Resource Assessment and Fishery Management and Planning. Regarding the former, it was noted that techniques by which to monitor and assess fishery viability or the state of the resource were well grounded and would not benefit from being further field-tested per se.
As such, the key focus of the testing components of the project should be on the:

- Capability of undertaking assessment of fishery viability using recommended techniques;
- Practicability of implementing management aspects of the standards;
- The capacity of source economies to comply with or support these components; and
- Operation of fishing vessels, storage and husbandry and transportation aspects of the standards along the market chain.

The in-country field assessment covered all aspects of the Standards and included the most active economies in the LRFFT as shown in the Schedule below.

International Standard Component	Economy	Timeline
Part 1 – The Capture of Wild Live Reef Food Fish	The Philippines	March 2004
	Indonesia	April 2004
	Australia	April 2004
Part 2 – Aquaculture of Live Reef Food Fish	Thailand	February 2004
	Indonesia	April 2004
Part 3 – Handling, Holding and Distribution of Live Reef Food Fish	China	February 2004
	Hong Kong, China	March 2004
	Australia	April 2004

This schedule was determined on the basis of stakeholder feedback from the earlier in-country seminars and workshops, as to which Parts of the Standard and which Requirements would benefit from an assessment of practicability of implementation and capacity for compliance. Using this stakeholder feedback, a checklist was compiled of those Requirements of concern.

3.2.1 The Capture of Wild Live Reef Food Fish

As noted previously, the drafting team carried out a desktop study comparison of the operation of the LRFF fishery in Queensland against the International LRFFT Standard. This study indicated that in all cases, the Queensland fishery met or exceeded the Requirements as laid out, suggesting that the Standard had 'set the bar' at the appropriate level. This was an important consideration as there was an expectation among Australian stakeholders that the Standard should be set sufficiently high enough so as to compromise the regulatory requirements in Australia, while at the same time setting achievable targets for fishery participants and managers in other economies.

For the Philippines and Indonesia key capability and practicability issues to come out of the review were that:

- A high level of in-country expertise exists in the Philippines to undertake 'basic' resource assessment and monitoring activities, while the level of in-country expertise in Indonesia is considerably less;
- Institutional structures were sufficiently established in both economies, at both a national and provincial level, to support more effective management of their LRFF fisheries;
- For the most part, fishers and traders in both economies demonstrated little awareness of the detrimental impacts of their fishing practices such as the capture of juveniles for grow-out, and where such awareness existed, livelihood issues undermined reform initiatives;

From a capacity standpoint, there were several related issues that would hinder compliance these being:

- The lack of financial capacity of research institutions and government agencies;
- The remoteness of many fishery participants from centers of governance and regulation; and
- A lack of available information in a form suitable for distribution to fishery participants and limited avenues for dissemination of this information

While not necessarily a new revelation, these points indicate that efforts to instigate better-practices in the LRFFT would benefit from a comprehensive “how-to” tool-kit, usable by industry stakeholders, and an NGO supported capacity building and implementing program.

3.2.2. Aquaculture of Live Reef Food Fish

Thailand and Indonesia are two major suppliers of LRFF, who are developing their capacity to undertake full-cycle production of grouper species. Indonesia has three main hatcheries involved in the production of grouper species these being the :

- Gondol Institute for Mariculture Research (GRIM) in Bali
- The National Seafarming Centre (Balai Budidaya Laut) at Bandar Lampung in Sumatra; and
- The Loh Mbongi Hatchery developed by TNC in Komodo National Park, West Flores

Collectively, these hatcheries are successfully rearing a suite of grouper and snapper species from eggs including the Highfin grouper (*Cromileptes Altivelis*), Tiger grouper (*Epinephelus fuscoguttatus*), Green grouper (*E coioides*) and Mangrove snapper (*Lutjanis argentimaculatus*) which are supplied to farmers for land-based and sea-cage growout nearby the hatcheries. Thailand currently has one hatchery, operated by the Department of Fisher, based at Krabi in Phuket, Southern Thailand, which provides a small quantity of Green grouper for nearby farmers for land-based and sea-cage grow out.

Because it is more able to regulate its activities in terms of production and supply, aquaculture has been recognized as being more suitable to the best-practice environment. There has been a considerable amount of applied research undertaken into finfish aquaculture in Southeast Asia such that operational aspects of finfish aquaculture are well understood and documented. Moreover, most economies engaged in the LRFFT have extensive human capital. As such, the aquaculture component of the in-country assessment focused not so much on the practicability aspects as the capacity of economies to meet known and agreed to benchmarks.

Some of the main issues identified for either or both Thailand and Indonesia can be summarised as follows:

Requirement	Compliance limitations
Supply of hatchery fingerlings	▪ While the technology exists, the ability of hatcheries to produce sufficient fingerlings for grow-out to meet existing demand by farmers is constrained by funding and hatchery size
Sustainable use of wild-caught fingerlings	▪ Costs of hatchery fingerlings can lead to continued widespread use of fish traps to capture wild fingerlings. ▪ Elimination of the use of wild-caught fingerlings is constrained by the availability of hatchery reared fingerlings ▪ Limited capacity to enforce minimum fish trap size to eradicate capture of wild fingerlings
Aquaculture feed supply	▪ While artificial feed is readily available and feed conversion ratios (FCR) on artificial diets exceed that of fresh fish diets, the higher nominal cost of artificial feed and the perceived inferior taste of fish fed on artificial diets has hampered take up of this technology; ▪ Demonstration of the sustainability of fresh fish supplied is difficult in light of data limitations and the multiple uses of this resource.
Post-capture mortality	▪ Minimising post capture mortality is compromised by the farmers acceptance of 'acceptable' mortality levels of as high as 50% based on past experience.
Grow-out farm siting	▪ Re-siting of grow-out cages to improve water quality and reduce mortality is constrained by the preference for siting cages close to a) transport and b) village and existing 'acceptable' mortality rates; ▪ While the use of earthen ponds (e.g. Thailand), offers greater control over water quality there is limited in-country capacity to enforce regulations minimising habitat damage;
Chemical and drug use	▪ The use of chemicals and drugs throughout the industry at both grow-out and transportation stages, may be excessive and can be dictated by costs and availability of alternative technologies; ▪ There is a lack of instructional guidance on acceptable and appropriate use levels for chemicals and drugs
Fish health management	▪ Minimising the risk of the spread of pathogens is compromised by centralised collection of fish from many geographical areas, the mixing of fish from wild-caught and hatchery sources in sea-cages and the movement of broodstock between geographical areas ▪ The proximity of land-based farms and their shared use of water may increase potential for spread of fish pathogens ▪ Detection of pathogens and viruses in fish is technically difficult and testing procedures are not always available to farmers and hatcheries

3.2.3 Handling, Holding and Distribution of Live Reef Food Fish

Holding facilities for LRFF prior to transhipment vary widely across supply economies and within different markets and facilities in Hong Kong. During the course of field assessment, it has been recognised that both the simple and sophisticated technologies employed can satisfy the requirement of maintaining fish in optimum condition.

A variety of technologies are used to transport fish between the various stakeholders along the market chain, from oxygenated plastic bags in polystyrene boxes (most of Southeast Asia) to fully self-contained and oxygenated plastic bins capable of maintaining fish in good condition for up to 14-16 hours. As with holding, technologies, efforts to promote the adoption of sophisticated technologies, such as oxygenated bins used in Australia, throughout the industry will not likely be successful given adoption costs and the adequacy of existing technologies.

Food safety and fish pathogens were the most important topics discussed in Hong Kong. The participants thought that a traceability mechanism was essential to enable fish found to be diseased or possible carriers of ciguatera to be traced back to their origin.

Disease control was also an important issue as complete stocks of fish were reported to have been wiped out by diseased fish from Indonesia. The participants thought that each batch of fingerlings through two adult market size fish should be accompanied by a health certificate certifying that these fish were disease free by the exporting economy. These tests must be undertaken by a competent and accredited laboratory.

Plate 1: Feasibility Testing and Validation – Capture of Wild Live Reef Food Fish






Description of photograph

Top left Grow-out cages for juvenile Leopard coralgrouper in Surigao, Philippines
Top right Grow-out cages for juvenile Green grouper in Phang Nga Bay, Thailand
Middle left Juvenile Leopard coralgrouper being grown out in Coron, Philippines
Middle right Juvenile Green grouper being grown-out in Phang Nga Bay, Thailand
Bottom left Juvenile Humphead wrasse being sold at fresh fish markets, Surigao, Philippines
Bottom right Fishing villages are often remote from centers of government, Flores, Indonesia

Plate 2: Feasibility Testing and Validation – Aquaculture of Live Reef Food Fish






<u>Description of photograph</u>

Top left	Highfin grouper hatchery fingerlings from GRIM, supplied to farmers for land-based growout
Top right	National Sea Farming Centre, Lampung, Sumatra supplies several sea-cages with fingerlings
Middle left	Small fish traps used to capture juvenile fish for grow-out
Middle right	Fish pellets being used to feed fingerlings in land-based grow-our facility, Gondol, Indonesia
Bottom left	Fresh, or 'trash', fish being used to feed caged fish awaiting collection, Lampung, Indonesia
Bottom right	Fresh fish resource for feeding LRFF and sourced from floating nets have multiple uses

Plate 3: Feasibility Testing and Validation – Aquaculture of Live Reef Food Fish

Description of photograph

Top left Nursery at Loh Mbongi, Komodo where fish are graded regularly to minimise mortality
Top right Proximity of backyard hatcheries in Bali makes them susceptible to spread of fish pathogens.
Middle left Poorly sited cages in Phang Nga, Thailand with mortality levels of > 50% are reported. The cage siting in this instance is dictated by its closeness to transport and home fishing village
Middle right A well-sited cage in Lampung. Pen covers protect fingerlings/juveniles from exposure to sun
Bottom left Health management practices include regular grading of fish and checking for diseases
Bottom right Use of chemical baths at Lampung hatchery

Plate 4: Feasibility Testing and Validation – Handling, holding and Husbandry

Description of photograph

Top left	Connected holding tanks in Coron, Philippines making control of spread of diseases difficult
Top right	Separable holding tanks in Cairns, Australia capable of isolating outbreaks of diseases
Middle left	Packing fish by hand into Styrofoam boxes in Coron for transport by air to Manila
Middle right	Packing fish into plastic bins using nets to minimize removal of protective mucus membrane
Bottom left	Fish are placed in oxygenated plastic bags and Styrofoam boxes for transport by air
Bottom right	Fish are placed in oxygenated bins in Cairns, ready for transportation by air to Hong Kong

Part 4 – OTHER PROJECT ACTIVITIES

4.1 Overview

As part of the project other supporting activities were undertaken. These consisted of:

- A validation of past and new test methods for cyanide detection in fish tissues.
- A feasibility study to ascertain whether it is practicable to tag LRFFT throughout the chain from reef to restaurant to enable the economy of origin and collection area or aquaculture farm to be verified in case of a disease or ciguatera outbreak.
- An market analysis of the LRFFT to aid supply economies in better understanding market variations and to make informed decisions on supply and management of their LRFF production.
- The production of an integrated CD and website containing the International Standards, responsible practices and implementation guidance for all Requirements including a library of existing materials (best-practice guidelines, manuals and tool-kits)
- The generation of selective outreach materials to attempt to raise awareness amongst children and consumers of LRFFT as to the general environmental concerns with respect to the consumption of various LRFFT species.

4.2 Chemical Detection Testing

The drafting team looked at two aspects of the ongoing movement to reduce the use and dependence upon chemicals for the collection of live reef food fish. These consisted of the review of the MAC certification program progress to date with trying to eradicate cyanide use within that program and also, a validation of the existing cyanide detection tests.

The long term role and applicability of Chemical Detection Testing (CDT) as the principle response to cyanide use has a number of issues. These are the cost and difficulty of sustainable financing for maintaining an extensive network of test laboratories; the complicated science of cyanide detection; the variations of cyanide presence in fish due to variability in the time it takes to get fish to the lab; the possibility of "false positives" (i.e. fish that were caught without cyanide but show the chemical when tested) due to background cyanide on reefs from pollution or other fishing activities; the difficulty of trying to use chemical detection testing to monitor a significant portion of catch or shipments; the serious constraints to developing and implementing a credible chemical detection laboratory network in large archipelagic economies.

Through MAC the marine aquarium trade has set an example by making the non-use of cyanide part of a larger context of responsible fishing practices, i.e. one of a range of practices for which individual fishers need to take responsibility for their personal behavior and be able to be held accountable for. In implementing its certification program MAC has made a significant amount of effort focusing on developing a variety of mechanisms for preventing cyanide use in the first place, and not only on seeking to detect cyanide after it is has been used.

Cyanide Detection Testing (CNDT)

CNDT has been operational in the Philippines for several years but unfortunately the methods used have not been formally internationally peer reviewed and the test laboratories are not internationally accredited. Since the instigation of CNDT a few years ago, new test methods and equipment have been developed or adapted for use in salt water tissue sampling for chemicals such as cyanide (e.g. High Performance Liquid Gas Chromatography, Colorimetric, Histopathological Assays, Enzyme Assay). All these tests are undertaken in a laboratory and usually many hours or days following the suspected use of cyanide for fish collection.It therefore goes without saying that a portable test method that can be used in the field is also very desirable.

As part of the LRFFT project in July 2003 tests were undertaken in the chemical test laboratories of BFAR, Quezon City, Manila to compare and validate the performance of several test CDT test protocols against each other and also to see if any test protocol lent itself to field use i.e. it is portable.

Initially it was intended to undertake only one set of tests (Phase 1) to verify cyanide presence in aquarium and food fish samples by mimicking the exposure of those fish to sodium cyanide collection on the reef. These tests though had to be expanded into a supplementary program under controlled laboratory conditions (Phase 1a) following inconsistency found with the results obtained in the Phase 1.

Phase 1 testing also considered alternative sample preparation methods, analysis protocols and test apparatus/instruments these being the existing ISE Probe used by BFAR and a Photometer and Colourmetric test kits.

Phase 1 Testing Conclusions

It was determined from Phase 1 tests that:

- The ISE Probe, Photometer and Colourmetric test kits **can accurately detect** CN^- in seawater.
- It **could not be concluded** from the results of these single trials that the ISE Probe, Photometer and Colourmetric test kits are comparable in terms of detecting cyanide in fish tissues.
- It **could not** be established that CN^- presence can be reliably detected in aquarium and food fish one day after exposure to CN^- as it was probable that since the analysis was conducted one day after exposure, that the fish's metabolism had ample time to break down and excrete the CN^-.
- There appeared to be **no correlation** as to the amount of CN^- detected in aquarium fish after exposure relative to the time after exposure.
- There appeared to be **too many variables** (See figure below) involved in testing fish for CN^- presence in aquarium fish to enable a meaningful result or threshold level of exposure to be determined.
- The single trial testing used **was probably not** statistically valid enough to reach unquestionable conclusions.

Figure 11: The variables that can affect CDT results

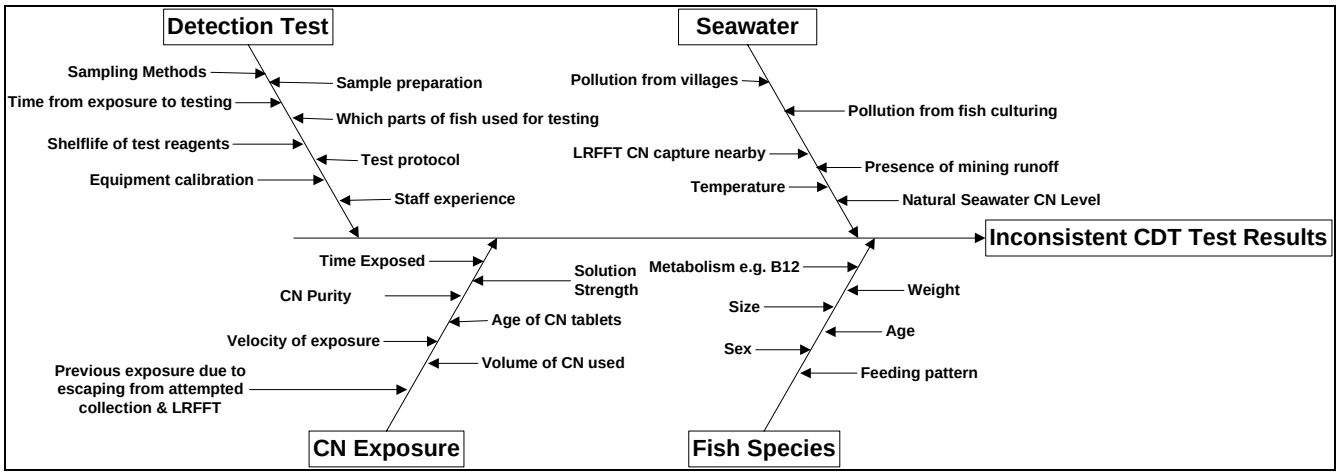
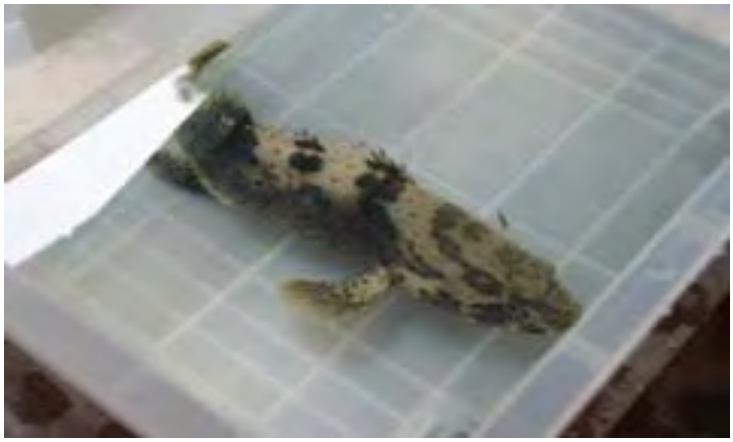


Figure 12: Green Grouper Prior To Exposures To Cyanide



As the results obtained during Phase 1 testing were inconsistent regarding a correlation between cyanide exposure and quantity of cyanide detected in the aquarium and food fish samples following exposure, it was decided to conduct additional tests. It was also agreed that the tests should be repeated by an independent laboratory that has the capability to analyze samples side by side using the ISE Probe, Photometer and Colourmetric test kits and possibly an additional more sensitive method.

The testing team then discussed and designed a further test program. This Phase 1a testing program was developed to try to establish under controlled laboratory conditions a correlation between CN^- exposure and the quantity of CN^- detected in an aquarium fish after exposure by removing as many of the variables as possible.

The Phase 1a testing was organised by BFAR and undertaken in their laboratory in Quezon City Manila by Merck and BFAR staff as a team. The ISE probe was again used side by side with a Photometer and Colourmetric Cyanide Test Kits.

Phase 1a Testing Conclusions

It was determined from Phase 1a tests that:

- Under controlled conditions the ISE Probe, Photometer and Colourmetric test kits **can detect** CN^- presence in distilled water, seawater and fish tissue matrices.
- The Photometer and Colourmetric test kits **are portable** and therefore lend themselves to field use.
- There appears to be **no correlation** between a controlled level of cyanide exposure and the quantity of cyanide detected in fish samples following that exposure.
- From the data validation of the Phase 1 and Phase 1a testing **it was not possible to set a meaningful CN^- legislative detection threshold limit.** If such a limit is possible it will require an extensive and in depth test evaluation protocol.
- These tests of Phase 1a **should be repeated by a credible laboratory** outside of the Philippines.

Follow-up Action To The Phase 1 and Phase 1a tests

It was then proposed that a peer review of the Phase 1a tests be undertaken by a credible third party laboratory outside of the Philippines and that they repeat the Phase 1a testing with particular emphasis placed on the detection of low levels of cyanide.

In May and June 2004 the Phase 1a tests were repeated in the Laboratories of the Department of Chemistry, The Hong Kong University of Science and Technology, Hong Kong under the direction of Professor Reinhard Renneberg and ably assisted by Dr. Karen Mak with the addition of and in-house enzymatic method of cyanide detection.

Summary And Discussions Of The HKUST Peer Review Tests

The cyanide detection in fish is time-dependent. The ISE method gave a relatively clearer trend of cyanide-time relationship among the three testing methods (ISE, Photometric and Colourmetric).

ISE method - No cyanide was found in blank fish. In the cyanide exposure experiment, fish exposed to cyanide without recovery were all found positive in cyanide detection. Lower cyanide levels were detected in fish that were exposed to cyanide and recovered for 1 hour. No cyanide was found in fish recovered for 1 day. Therefore, the ISE method could detect cyanide in fish that was exposed to cyanide within 1 hour after exposure, but not beyond 1 hour.

Photometric method - Relatively high level of cyanide (0.014 ppm) was detected in blank fish. However, only very low cyanide concentrations (<0.003 ppm) were found in the poisoned fish of different recovery times. In addition, the cyanide levels were too low to see any difference among different recovery times.

Colorimetric method - No cyanide was detected in the blank fish. However, there was no significant difference between the blank and the poisoned fish (0.001 – 0.003 ppm). Also, there was no significant difference among different length of recovery times.

Enzymatic Cyanide Determination - Cyanide concentration was increasing in fish with time of recovery from 0 to 2 hours. At the 3rd hour of recovery, the cyanide level declined to the level with no significant difference from the signal from the blank fish. Also, signals of fish recovered for longer than 3 hours (1 – 3 days) were not different from the blank fish. A significantly higher cyanide concentration was detected in the cyanide-killed fish having no time to recover. According to the enzymatic method results, cyanide was detoxified within hours. Therefore, any available cyanide detection methods should be done on the fish that was caught within 2 hours.

Test Accuracy:

The measurement of standard cyanide solution showed good accuracies of the three methods. However, errors were obtained in the Photometric and Colorimetric methods when measuring cyanide in fish tissues. In every treatment and cyanide detection method two or three fish were tested. This made the experiment statistically valid [Confidence level: 96 – 99.7 %]. The following table shows a comparison between the various test methods undertaken by HKUST.

	ISE method	**Photometric**	**Colorimetric**	**Enzymatic**
CN^- detection after 1 h	Yes	-	No	Yes
CN^- detection after 2 h	N/A [a]	No	No	Yes
Accuracy for seawater	High	High	High	High
Accuracy for fish tissues	High	Fair	Fair	Fair
Detection range	0.05 – 10 ppm	0.002 – 0.5 ppm	0.002 – 0.03 ppm	0.1 – 5 ppm
Portability	Poor	Good	Good	Fair
False positive in Blank	No	No	No	No [b]

[a] No data was obtained with the ISE method after 2 h of exposure.
[b] The blank signal was high in the enzymatic method. The cyanide calibration was done by subtracting the blank signal from the signal of samples.

Field Use Of The Test Methods And Equipment Used:

The ISE method needs an equipped lab for the vigorous distillation procedures, so this is not possible for the field test. The lab is suggested to be installed where is very closed to the site of fishing so that the fish can be tested within an hour after being caught.

The Photometric method can be used in the field with a portable photometer. However, the procedures for protein precipitation need to be improved to avoid interference. The comparator of the Colorimetric method is not user-friendly as the intensity of purple color was very difficult to distinguish with naked eyes. Therefore the colorimetric method was only qualitative.

Overall Conclusions

When using chemical detection testing as a deterrent to stop fishers of live reef food fish using cyanide to catch their fish it is important that the test method chosen can be undertaken and produce accurate results at an appropriate time interval following the use of cyanide. It is therefore important that such a test is accurate if carried out between 8 and 10 hours following the use of cyanide for collection. This time period is necessary as it is highly unlikely that the fishers will be intercepted within one or two hours of using cyanide for collection purposes.

From the validation testing undertaken it was found that the cyanide detoxification process in fish is very fast (within 2 hours). None of the test methods evaluated could detect cyanide in fish after 2 hours therefore, a more sensitive method is urgently needed which can detect cyanide traces after 8 to 10 hours from exposure. It might well be that no present test method will be able to do this due to the high rate at which cyanide is metabolized by the fish following exposure.

At this time the LRFFT project team is of the opinion that a peer reviewed cyanide detection test that will work accurately and reliably analyzing fish tissues between 8 and 10 hours following exposure to cyanide may likely not exist.

During the final months of the project the drafting team members met live reef food fish fishers from Indonesia who informed them that the industry was moving away from cyanide and to clove oil. Clove oil is emulsified with alcohol to make a solution that is then used in the same manner as cyanide. Being an organic compound it is thought that clove oil causes less damage to coral reefs, fish and other invertebrates but there is no evidence to substantiate this yet one way or another yet. Clove oil is though still a destructive method of fishing and is not allowed in the international standard for the trade in live reef food fish.

The project team also believes that it is more effective to take a preventative approach to chemical use for fish collection rather than continue to seek a test régime which relies upon a deterrent effect. This is particularly true when, even if a fish is found positive to cyanide, cyanide use cannot be attributed to the individual user unless they are caught in the act of using cyanide.

The live reef food fish trade is very closely related to the marine aquarium trade at the collection level. In fact many of the collectors of live reef food fish collect both aquarium and food fish throughout their normal working day. The linkage between these two activities also acts as a conduit for cyanide between those collecting live reef food fish and those collecting marine aquarium fish. The positive aspect of this relationship is that by eradicating the use of cyanide amongst marine aquarium fish collectors this will also contribute to eradicating the use of cyanide amongst those same collectors for live reef food fish trade and vice versa.

Implementation of the MAC Certification program is based not only on seeking to detect cyanide after it is has been used but also on a variety of mechanisms for preventing cyanide use in the first place. This includes significant effort on developing criteria for documenting and tracing of the organisms and links each collector to the fish that they collect. Accountability allows the development of a whole range, or "basket," of measures that focus on preventative level behavior change with collectors, as described in the five point plan as follows.

Individual Responsibility Of Collectors: fishers are required to use logbooks to document their catch and each collector's catch is identified to the individual.

Peer Pressure: fishers form collectors associations linking the accountability of the group to the continued performance and compliance of each member.

Community Involvement: collection area management planning is a multi-stakeholder effort that links the community to the fishery and the collectors.

Local Government Surveillance And Enforcement: local government fishing permits, fisheries patrols, etc. are being linked with the certification, e.g., in some instances local municipalities allow only MAC Certified fishers to fish in the area. The same principle could easily apply to collectors of live reef food fish.

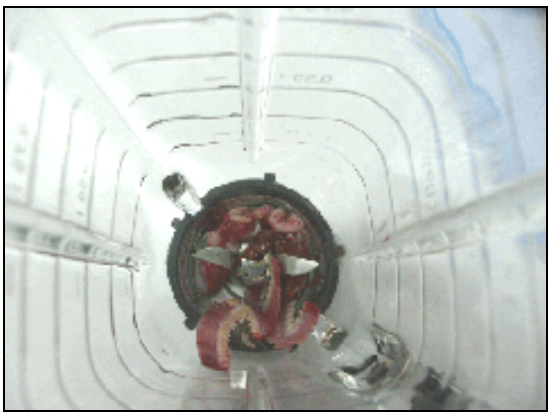
Economic Incentives: the financial return and income stability of fishers is improved by supplying the consistent quality that results from certified practices, creating an incentive to continue achieving compliance.

Finally, cyanide is not the only chemical used by fishers to collect live reef food fish. Natural chemicals such as derris root are also used and clove oil use is now being used in Indonesia. The project team believe that the approach taken by MAC with its five point prevention plan is far better than the use of a deterrent and technological enforcement tool such as cyanide detection testing particularly, as collectors now appear to be using other chemicals for collection.

The LRFFT project team is of the belief that an accurate and peer-reviewed cyanide detection test would augment efforts to deter cyanide use.

The team is also of the belief however, that the considerable time and effort that has been spent to date on evaluating existing tests has shown that organisation such as MAC may be best served by directing funds toward preventative activities (as these activities prevent all chemical use and not just cyanide) while still supporting the efforts of individuals or organizations to identify or develop a credible and peer-reviewed test that can detect cyanide in fish tissues for between 8 and 10 hours following exposure.

Plate 5: BFAR Laboratory CNDT Phase 1 and Phase 1a Testing



Description of photograph

Top left	BFAR ISE Test Rig
Top right	Sodium cyanide tables used for poisoning
Middle left	Green grouper following exposure to cyanide
Middle right	Green grouper being dissected for testing
Bottom left	Fish parts taken for analysis were weighed
Bottom right	Fish body parts ready for blending

4.3 Tracing LRFF Through The Chain From Reef To Restaurant

The traceability of LRFF had been rated as a low priority amongst the stakeholders consulted during the initial periods of the project. During Periods 3 and 4 though traceability became a more significant issue and at the meeting in Hong Kong in November 2003, the participants thought that it was essential to have a mechanism where LRFF could be traced to their origin in the supply economy within the Hong Kong, China and China markets so that diseased fingerlings and adults could be traced in situations such as outbreaks of fish disease or ciguatera.

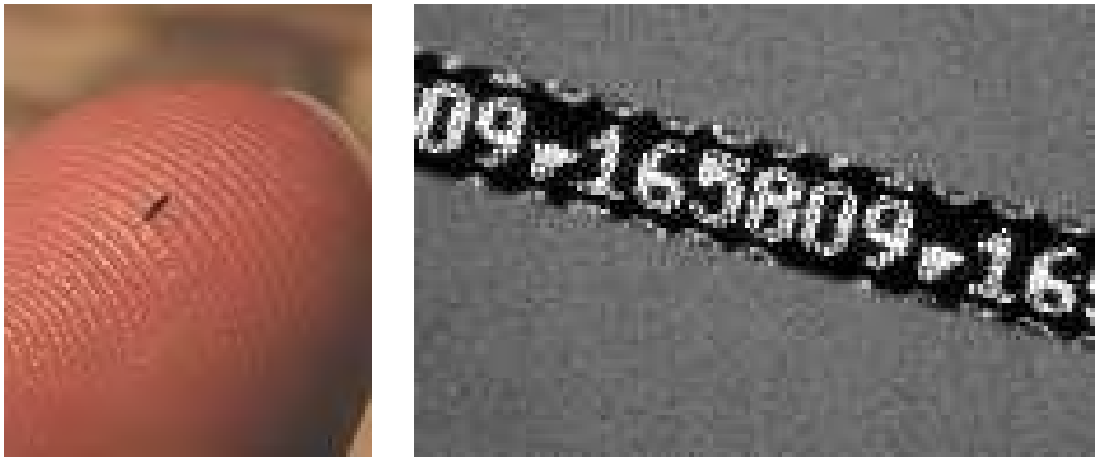
The project team designed a traceability feasibility study using coded wire tags to assess the potential to implement traceability in the live reef food fish trade (LRFFT) in terms of 'tracking' the fish from point of capture to markets in Hong Kong. Coral trout (mainly *Plectropomus leopardus*) were selected as the species to tag prior to their journey from Queensland Australia to Hong Kong. Coral trout are captured using hook and line and transported live to collection facilities in the major ports along the coast of Queensland. From there they are loaded into live shipment bins and transported live to Hong Kong by air, in oxygenated bins. From Hong Kong they are either sold to local restaurants, or transhipped to mainland China.

Tagging methodology

An essential approach to any tagging of high-value marine finfish is that it does not significantly devalue the fish. The high wholesale and retail prices obtained in the live reef food fish trade are based in part on the aesthetic appeal of the fish, which includes colors and general appearance. For this reason, the use of external tags was rejected for this study as external tags typically cause significant damage to the skin, and over time often cause unsightly ulcerations. The wounds may directly lead to fish health problems because they provide a site for pathogen access. The tags used in this study were binary coded wire tags manufactured by Northwest Marine Technology Inc. (NMT) (Seen Figure 6 below). Advantages of these tags over traditional plastic skin-penetrating tags is that the tags are (1) small, (2) bio-compatible, and (3) nothing remains penetrating the skin, thus preventing aesthetic damage and improving fish health. With no protrusion, the tags used in this study allow the wound to heal, removing any infection path. The tags are so small that they can even be used on juvenile fish.

Figure 13: Binary coded wire tags (a) showing decimal coding (etching) that allows for either batch or individual identification (b).

(a) (b)



Binary coded wire tags were injected in the mandible of each fish using a Handheld Multi-shot Tag Injector. Fish were routinely checked immediately after tagging, using a Handheld Wand Detector to determine that the tag had been injected. A full transport bin load of fish (280 fish, ~350 kg total weight) was tagged for this study.

Figure 14: Binary coded wire tags being inserted into the lower mandible of fish

Due to a technical difficulty with the tag injector, only about 150 fish were tagged on Day 1 with the remaining 130 fish being tagged on Day 2. A tagging rate on Day 2 of around 150 fish per hour was achieved although the hourly rate would likely improve with experience.

1.2.1.1 Pre-transport holding

After tagging, the tagged fish were kept in a 10 m^3 circular tank in a recirculating system, and held at about 20^oC (standard holding practice for Australian live reef food fish traders).

The 150 fish tagged on Day 1 were checked for tag retention on Day 2 with the retention check taking approximately 15 minutes for the 150 fish. Of those fish checked, two had lost tags. Both these fish were retagged prior to shipment.

Transportation to Hong Kong

All 280 fish were loaded into a standard live fish transport 'oxygen' bin. These bins are around 0.8 m^3 capacity and can transport 300–350 kg of live coral trout for around 12 hours total transport duration. Oxygen is supplied to the fish during transport from a self-contained pressurized oxygen gas cylinder, and excess oxygen bleeds off from the bin to the outside atmosphere.

Figure 15: Checking for tag retention following unloading of fish in Hong Kong wholesale facility

The fish were loaded onto a commercial flight from Cairns, Queensland, Australia to Hong Kong, China at 0900 (GMT+10) and were offloaded in Hong Kong at 1900 (GMT+8) for a total transport duration of 12 hours. The fish, once unloaded in Hong Kong were given approximately 30 minutes to re-condition and acclimatize before being checked for tag retention. The rechecking the entire of batch of 280 in Hong Kong took 30 minutes.

Results and Discussion

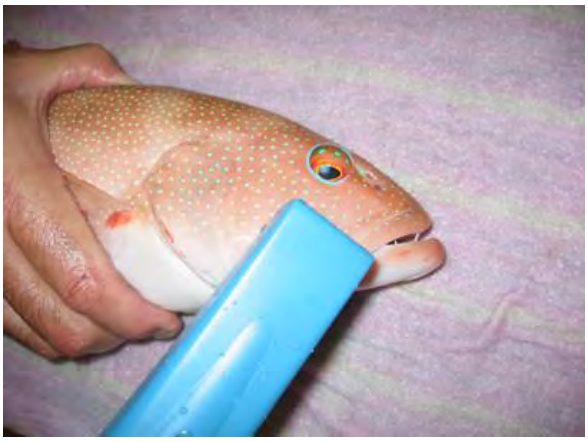
Tag retention on receipt in Hong Kong was 278 fish out of 280 (96%). There was no mortality of transported coral trout. It is likely that tag retention could be improved with additional experience. Some adaptation of the tag placement was required during the initial part of the tagging exercise so that the morphology of the fish assisted in the ease of needle/tag insertion. This decreased the fish handling time and reducing the likelihood of damage to the fish as well as tagging equipment.

The initial tag site was to the centre of one side of the fish's mandible, which was found to be difficult to penetrate, causing the tagging needle to bend. The crevice towards the tip of the fish's mandible provided a natural guide for the tagging needle and a fleshier area for tag placement.

Conclusion

This feasibility study ably demonstrated the efficacy of tracing live reef fish from their port of origin using coded wire tags. Whilst this represented a positive step toward addressing food safety and health in the consumption of LRFF, the characteristics of the LRFFT imply that additional testing be undertaken to identify the most suitable tagging approach for widespread application throughout the LRFFT. Given that the trade is artisanal in nature, is comprised of a large number of fishers, who are geographically dispersed over a wide area and has numerous sites for landing and holding fish catches before shipment the tagging method used will need to be relatively simple to use and inexpensive to operate.

Plate 6: Tagging Feasibility Study






Description of photograph

Top left	Routine check after tagging to ensure fish is injected
Top right	After tagging fish were stored in 10m^3 circular tank for 24-48 hours prior to shipment
Middle left	Tagged fish were loaded into oxygenated transportation bin for shipment to Hong Kopng
Middle right	Transportation bins being loaded in Cairns for journey to Cairns airport and Hong Kong
Bottom left	Fish being unloaded at Kenneth Aquamarine , Kwun Tung wholesale markets in Hong Kong
Bottom right	Tagged fish being re-conditioned in wells prior to checking for tag retention

4.4 Economic and Market Analysis

The project was asked to conduct an industry market analysis, primarily with the view to assisting supply economies, particularly suppliers of wild-caught LRFF, in better understanding market trends, and variations in markets. In addition to the market analysis, scenario analyses were carried out, using Thailand, Indonesia and the Philippines as case-studies, to look at potential costs of compliance improving current practices and benefits from implementing these practices.

Market Analysis

The market analysis was carried out over the period December 2002 to December 2003 during seminars and field visits. Several key indicators of market trends in the demand for LRFF in the major trade centers of China and Hong Kong, China were included in this analysis.

Trade volumes

The report outlines trends in the total volume of imports into Hong Kong over the period 1998 – 2003, including changing trends in the consumption of LRFF. While tgrade volumes have stablised since the initial declines on 1999, following the Asian economic crisis, there is also evidence that consumption of higher valued species, as a proportion of total LRFF consumption, is increasing. With the contraction in the LRRFT, the market has become more focussed on fewer – primarily high and mid-priced grouper species. The main causes of these market shifts are thought to be:

- The general improvements in transport technology and access to air transport;
- The overall decline in the LRFF market which has led to weaker retail prices and made the purchase and transport of lower-priced fish that made up the bulk of imports unviable;
- A increase in the incidence of ciguatera poisoning in the 1990's which is thought to be as a result of importing of LRFF by sea from know ciguatera hotspots in the Pacific.

Species Imports by economy of origin

The main exporting economies of wild-caught and farmed live reef fish were identified as Indonesia; the Philippines; Australia; China; Malaysia; Thailand; Viet Nam; and Chinese Taipei. Indonesia, Malaysia, Philippines, and Australia are the major exporters of high and medium-priced wild-caught live reef fish, while smaller quantities are exported from Thailand, Cambodia, Viet Nam and the Maldives. Thailand and Chinese Taipei are major exporters of farmed grouper, both hatchery produced and wild caught grow-out fish, with the former tending to rely on grow-out of juvenile fish. While Green grouper (*Epinephelus coioides*) has been produced for several years, Chinese Taipei has recently increased its aquaculture production of Tiger grouper (*Epinephelus fuscoguttatus*) and Flowery grouper (*Epinephelus polyphekadion)*. Indonesia has also recently established grouper hatchery facilities and is producing Tiger grouper and Highfin grouper (*Cromileptes altivelis*), although at the time of writing grouper from there are still up to a year away from reaching marketable size. Infrequent and irregular exports of LRFF, mainly coralgrouper and other groupers have also been reported from Fiji Islands, Marshall Islands, PNG, Seychelles, Singapore, and Solomon Islands.

While identifying trends is compromised by poor quality data, exports of the main grouper species from Indonesia, with the exception of Tiger grouper and Highfin grouper appear to have been declining during the period 1999 to 2003. In contrast exports of the main grouper species from the Philippines during this period are either stable or increasing. Total imports of Leopard coralgrouper (*Plectropomus leopardus*) in 2003 were more than 50% higher than in 1999, with Australian

exports making up more than 85% of this increase. Overall, exports of Tiger grouper have almost tripled since 1999 while exports of Flowery grouper are less than a third of their 1999 volumes.

Wholesale and Retail Prices in China and Hong Kong, China

The China and Hong Kong, China economies remained fairly robust for the duration of the financial and economic crisis in Southeast Asia that began in 1997. The LRFFT in Hong Kong, China may have been cushioned against the economic crisis early on by the strength of its currency against the currencies of all main importing economies (the Hong Kong dollar; which is pegged against the US dollar at a rate of HK$7.8 = US$1.0). From December 1999 however, the Hong Kong, China economy has been in decline as evidenced by the Consumer Price Index which has fallen from a high of 108.7 in June 1998 to 92.0 in December 2003.

During this period of deflation, wholesale and retail prices of all LRFF species have fallen and remained well below earlier reported high prices. Wholesale and retail prices for high-value species are on average, 35–45% lower in 2003 than in 1997. While price peaks during festive periods are evident for major species, overall, prices have trended downward for many of them including the Leopard coralgrouper and the Green, Tiger and Flowery groupers. Although Highfin grouper and Humphead wrasse *(Chelinus* undulates) prices fluctuate more widely, the longer-term price trends are stable. Both wholesale and retail prices are on average higher in China than in Hong Kong, China. Most fish sold in China come from Hong Kong, China, with an estimated 55–60% of all LRFF imports into Hong Kong, China being "re-exported" to China, and attract a small levy. The levy, as well as additional transportation costs, higher economic growth and higher relative status attached to consumption of LRFF in China is likely contributing to the higher prices in China.

Prices for Wild-caught versus Aquaculture species

Those LRFF species that can be sourced from both wild-caught and full-cycle aquaculture production are low-priced species such as: Green grouper, Red grouper (*E. Akaara*); Brown-spotted grouper (*E. Bleekeri)*; and Mangrove Snapper (*Lutjanus argentimaculatus*). Historically, prices paid for cultured species are considerably less than wild-caught individuals of the same species. This difference is often attributed to consumer perception that cultured fish, which spend at least part of their life being fed in captivity, do not have the same taste and flesh qualities as a wild-caught fish of the same species. On average wholesale prices for cultured species are 20-40% lower than for wild-caught species.

	1999			2002		
	Average Price			Average Price		
Species	Capture	Culture	Difference	Capture	Culture	Difference
Red grouper	427.60	270.10	-36.8%	359.00	197.90	-44.9%
Green grouper	132.00	101.20	-23.3%	121.60	95.00	-21.9%
Brown-spotted grouper	157.40	113.80	-27.7%	156.00	112.70	-27.8%
Mangrove snapper	85.10	50.80	-40.3%	83.70	52.50	-37.3%

Source: Hong Kong Agriculture, Fisheries and Conservation Department

Advances in hatchery technology over the past two to three years has resulted in Tiger grouper and Highfin grouper being successfully cultured from eggs and grown out. There are currently three hatchery operations in Indonesia capable of producing these species: the Gondol Research Institute in Bali, the National Sea Farming Centre in Lampung and the Loh Mbongi hatchery in Komodo National Park. Price comparisons between the two product forms for these species are

not yet available as the first of the cultured species have yet to reach markets in Hong Kong, but one would expect cultured individuals to retail for a lower price than wild-caught individuals.

Beach prices in Supply Economies

The beach price refers to the amount paid by the buyer for a fish when it reaches shore, just prior to export. Wholesalers and exporters in source economies and importers in Hong Kong, China pay higher prices for plate-size fish (500 g to 1 kg) than for either undersize (< 500 g) or oversize (> 1 kg) fish. In economies where undersize fish are traded, the price is usually around one quarter of the price paid for a plate size fish. Average beach prices received by fishers in the major exporting economies do not show the same downward trends as wholesale and retail prices in China and Hong Kong, China. These prices however, do not recognize any obligations the fisher has with the dealer to whom they sell their catch. The complexity of the market chain and diverse relationship between fishers and dealers/buyers in different economies makes comparing beach price across economies difficult (e.g. in some cases the fisher receives only 30% of total price while the dealer retains up to 70% as payment for supplying outboards, fuel, bait etc.). The table below shows out average beach prices

		Beach Price (US$/kg)		
Species	**Economy**	**1999**	**2001**	**2003**
Humphead wrasse	Philippines[a]	45–50	55–60	50–60
	Indonesia[b]	8–10	10–15	12–18
	Australia[c]	9–10	9–10	10–11
	Malaysia[a]	n.a.	55–60	n.a.
Highfin grouper	Philippines[a]	45–50	55–60	50–60
	Indonesia[b]	8–13	10–15	12–18
	Australia[c]	~ 29	~ 24	~ 30
Leopard coralgrouper	Philippines[d]	8–28	7–27	12–30
	Indonesia[b,d]	6–10	6–12	8–15
	Australia[c]	~ 26	~ 25	~ 30
	Malaysia[d]	10–25	10–25	n.a.
	Vietnam[d]	n.a.	10–15	n.a.
Tiger grouper	Philippines[d]	7–10	8–12	10–13
	Indonesia[b]	2–3	2–4	2–4
	Thailand	n.a.	8–10	9–11
	Australia[c]	5–6	3.5–5	6–7
Green grouper	Philippines	n.a.	5–6	3–4
	Indonesia[b]	1–2	1–2	1–2
	Vietnam[g]	n.a.	6–10	n.a.
	Thailand[d]	5–8	5–8	5–7

[a] Beach price paid per piece.
[b] Price varies depending on location with fishers in some areas receiving less than half of that paid in other parts of Indonesia
[c] Total prices paid to owner of vessel. Fisher receives 20% of market value for all species (Muldoon, unpublished data).
[d] Lower price ranges are for undersized fish (< 0.5 kg). Upper range is for good size fish (0.5–1.0 kg) ready for market.

The significantly lower prices paid to Indonesia fishers for high-value species is notable in that it does not reflect the high retail prices paid for these species. The lower price range for Leopard coralgrouper in Asian economies recognizes that they market undersize fish, as size limits are not enforced. Fish that are purchased undersize are moved to grow-out cages where they are held until they reach plate-size (and their value has increased).In Australia, fish less than the legal minimum length of 38 cm are rejected by wholesalers, while in the Philippines and Indonesia.

While Filipino fishers sometimes receive higher prices than Australian fishers for coralgrouper, catch rates in the Philippine of on average 0.4kg of fish/hour are considerably lower than in Australia, where fishers catch on average 6–10 fish/hour, weighing >600g (i.e. at least 3.6 kg/hour).

Trade Analysis

Air and sea transport options from source economies

There has been an increase in the volume of fish being transported to Hong Kong, China by air from major exporting economies. About 60% of all LRFF imported there now arrive by air. From Indonesia, almost 40%—in some areas up to 70%—of all LRFF are sent by air while for Australia and the Philippines, nearly all LRFF exports are delivered to Hong Kong, China by air. Thailand and Vietnam also rely heavily on air transport, with up to 50% of all exports transported by air. The modes of air transport differ widely. LRFF exported from Southeast Asia are transported in oxygenated plastic bags packed in polystyrene boxes, while exports from Australia are in large moulded plastic aerated or oxygenated bins. The latter can hold up to 300 kg of fish in 1m^3 of water; approximately 5 times the capacity of the polystyrene boxes.

The supplanting of traditional sea transport by air transport is seen as potentially important. On the one hand, there may be less ecological impact from, e.g., a LRFF fishery that ships small quantities frequently by air, with lower holding mortality and less need to feed fish. With fewer fish required per shipment, opportunities for a small-scale fishery that is both economically and ecologically viable present themselves. Moreover, the reduction in transportation times from weeks to days and improvement in air transport technology have resulted in reduced investment risks by importers, improved cash flows for both importers and exporters and much lower rates of mortality overall.

Cage maintenance and associated holding costs (wages, feed), while generally low, are difficult to quantify and vary according to the length of time fish are held before export (i.e. growout of undersize fish or holding of market size fish). Holding times for LRFF sent by air are around 7–10 days from first sale, including reconditioning of fish during transit, while the greater volume of fish required justifying the use of a live-fish transport vessel means longer holding times and higher total holding costs. The table below sets out estimates of operating and transportation costs by mode of transport for main exporting economies

Region / Country	Operating Costs ($/kg)		Transport Costs ($/kg)	
	Collector [b]	Exporter [b]	Air	Sea
Southeast Asia				
Indonesia	0.015	0.04	3.00–3.50	4.50–5.00 [a]
Philippines	0.01	0.02	3.70–4.70	4.50–5.00 [a]
Malaysia			1.50–2.00	4.50–5.00 [a]
Thailand	0.015	0.03	2.00–2.40	
Viet Nam	0.02	0.05	~ 3.00	4.50–5.00 [a]
Oceania				
Australia	not applicable	6.50	7.05[c] / 8.80[d]	not permitted
Fiji Islands				6.00–7.00 [e]
PNG/Solomon Islands				4.00–4.50 [e]
Indian Ocean				
Maldives				4.70–5.40 [e]

[a] Costs depend on quantity collected, fuel prices, and weather conditions affecting transportation times.
[b] Costs are daily costs per kilogram and include wages, fish food, and maintenance.
[c] Costs per kilogram by oxygenated bin (including cost of returning bin to origin).
[d] Costs per kilogram by aerated bin (including cost of returning bin to origin).
[e] Costs are based on a transport vessel capable of carrying up to 20 t, collecting 12–15 t of fish.

Fish Mortality and Transshipment

Fish mortality remains a major factor in the cost of delivering LRFF to markets in Hong Kong, China. Most fish deaths occur during the holding phase in the source economy and during the transhipment. The use of sea transport to deliver LRFF to markets usually requires the fish be held in floating cages for up to one month after capture. Mortality during the holding phase has been estimated to average as high as 50% between reef and retail, with estimates of up to 30% during the first 3–5 days of captivity. During these early phases, mortality is often the result of cyanide use but has also been attributed to poor cage conditions, overstocking of cages, poor handling and feeding practices, and the spread of disease. Mortality, particularly with sea transportation, is usually factored into the buying price at the import destination and is dictated by the condition of the fish, distance to market, and the supplier's history. Another factor dictating buying price is weight lost by the fish during transit, which can be as much as 15%. Mortality is much lower when fish are freighted by air. Mortality when using air transport is reported by exporters and importers to be less than 5% on average, attributable to the shorter holding times (7–10 days) and transhipment period.

Capital and Operational Costs

Capital investment in fishing vessels and gear varies across economies. In Australia, capital costs range from $100,000 to $450,000. This contrasts with the average investment in the Philippines of $700 for smaller operations, and up to $2,000 for larger boats capable of travelling farther and supporting more fishers. Comparable investment costs exist in Indonesia. Exporters and dealers in both economies often extend financial assistance to fishers by providing fishing equipment on a loan basis with repayments deducted directly from fishers' wages or catch revenue until the loan is repaid. During difficult times, fishers are often extended credit to supplement living costs

The main costs incurred by dealers/brokers and exporters in establishing LRFF capture and export operations are in the construction of land-based holding facilities or floating cages, and purchases of vessels, motors, and other fishing gear. Identifying these costs is complicated by the trading structures within and between economies that involve several parties between sea and restaurant. Floating cage construction costs in Indonesia are estimated to be around $2,500 per unit while in Vietnam these costs range from $800 to $1,200. In the Philippines, fish for grow-out are held in floating cages while fish ready for export are held in floating cages and land-based facilities; cage capital costs are estimated to be approximately $1,250. Capitalization of land-based facilities in the Philippines is estimated at $25,000–30,000 while in Australia, these costs are around $200,000.

In terms of costs incurred during grow-out of wild-caught or hatchery reared fry and fingerlings for market, the main operating costs are feed, purchase of fry or fingerlings, and labour and maintenance. It is generally accepted that feed accounts for approximately 50% of total production costs while fingerlings and labour account for roughly 25% each. Fish are either fed artificial diets of moist or dry fish feed or fresh fish, commonly referred to as "trash" fish or a combination of both. Artificial feeds are usually between 2 and 3 times more expensive than fresh fish. In Indonesia, artificial feed costs approximately $1/kg while the cost of fresh fish ranges from $0.4–0.6/kg. While artificial feeds cost more, their food conversion ratio (FCR) of 1.8:1 is more than 4 times that of fresh fish with an FCR of 8:1. Another disadvantage of using fresh fish is its short shelf life and the potential to cause disease when this shelf life is exceeded. As noted above however, there is a general perception amongst consumers that fish fed on artificial diets have a poorer taste than either those fed on fresh fish or wild-caught fish. As such, it is common practice to revert to diets of fresh fish between 2-3 months prior to growout species being ready for market.

Scenario Analysis

In addition to the market and trade analysis, a scenario analysis was carried out using Thailand, Indonesia and the Philippines as case-studies, to explore potential costs of improving current practices and benefits from implementing these practices.

As there is only limited data available, the estimation of potential future changes in demand for LRFF was difficult to quantify. Consultation with traders in China and Hong Kong, China, however, has indicated in response to difficulties in sourcing LRFF cost effectively, many traders are looking to new sources for live fish including both cold-water and freshwater species. It was felt however, that the scenario analysis should make the assumption that demand for high quality marine species remains at least constant, and perhaps increases on the strength of higher disposable incomes and improved economic conditions in China. This assumption is based on the availability of a superior quality marine fish through LRFF certification, and that can compete against freshwater species.

In the scenario analysis, mortality and fish quality were defined as the main issues for investigation for both wild-caught and aquaculture production. Both these aspects can be improved through better handling, husbandry and transportation practices including:

- The use of non-destructive fishing practices;
- conservative targeting of stock;
- better holding and transportation technology;
- superior feed quality, enhanced feeding practices;
- lower holding densities;
- cage siting to improve water quality; and
- improved cage maintenance

A range of increased cost scenarios and the benefits associated with the adoption of improved practices were developed. These scenarios have been reproduced and will be included on the CD toolkit.

Conclusion

Overall, a declining Hong Kong economy has led to a flat market for LRFF over the last 5 years, along with stable or falling prices for low, medium and high priced grouper species and other LRFF. The promise of possible enhanced market opportunities in China to offset this are difficult to quantify.

Costs reduction opportunities associated with production and transportation of fish to market are negligible, requiring that the focus be on improving the quality of LRFF, lowering mortality during capture, holding and transportation and establishing a system of traceability to assuage consumer fears surrounding fish health. All these activities will likely lead to an increase in the costs of supplying fish to markets, but these could be offset by increased demand for high quality LRFF.

Despite the estimated cost increases associated with improving existing practices and meeting certifiable standards, it is expected that improvements in the quality of LRFF and lower mortality from improved husbandry and transportation practices will generate sufficient benefits to make the adoption of best, or better, practices a cost neutral exercise.

4.5 Supporting Documentation

Supporting documentation for the project comprises:

- an integrated website-style CD containing all relevant information pertaining to the standards, including instructional guidance as to the implementation of the requirements and a library of existing papers, reports, manuals and toolkits;
- outreach materials that promote informed and responsible seafood consumption to all consumers of LRFFT and that educate the Hong Kong public, especially high-school age children, and tourists alike on the general environmental concerns generated by the trade.
- a PowerPoint presentation suitable for use by key partner organizations at international forums and conferences.

The final outputs of the project and format of those outputs are set out in Figure below.

Figure 16: Final outputs at project end

	FINAL OUTPUT FORMAT					PROJECT END FORMAT	
DOCUMENT	CD1	CD2	A4 WHITE	BOUND	PDF & WESITE	FORMAT	APPROVAL - PRINT RUN & DISTRIBUTION
STANDARDS	-	-	-	-	-	-	
LRFFT International Standard		√	√		√	PDF Document	
LRRFT Best-Practices Toolkit/Implementation Guide	√				√	Master CD	√
SUPPORTING DOCUMENTATION / OUTREACH							
LRFF Pamphlet		√		√	√	PDF Document	√
LRFF Fish Fan-Fold		√		√	√	PDF Document	√
LRFF Postcard		√		√	√	PDF Document	√
Executive PPT Presentation (10 Slides)		√			√	PDF Document	
Detailed PPT Presentation (40 Slides)		√			√	PDF Document	
FINAL REPORT							
Final Report			√			PDF Document	
Final Report Abstract		√	√	√	√	PDF Document	√
Final Report Executive Summary			√			PDF Document	
Next Implementation Plan and Policy Document		√		√	√	PDF Document	√
LRFFT Brochure Pack Outer Cover				√		PDF Document	

The above shows the final outputs and project end outputs. The project end outputs will be presented in the format as column 6. Column 7 shows dialogue is required with all parties to agree on printing number of copies etc. Columns 1-5 show the final format and availability of the project outputs.

4.5.1 CD Toolkits and Website

Initially, the best practice documents and implementation manuals were to be produced independently as compendium of supporting documentation or a "tool-kit" accompanying the International LRFFT Standard. In period 3, the drafting team agreed that the toolkit should take the form of one specific medium (e.g. a CD). Subsequently the drafting team decided to supplement the CD by establishing a dedicated website. The URL address for this website will be http://www.livefishtrade.org. The production of the CD toolkit and Website was sub-contracted out to the School of Communication and Design (SCD) at James Cook University.

4.5.2 Outreach Materials

The project drafting team identified that promoting informed and responsible seafood consumption would need to adopt a multi-pronged approach in order to reach two main targets groups, these being:

- Tourist's (Western and Chinese), with the key message being to that when consuming LRFF in Hong Kong that tourists are aware of how they are caught, the species that should be eaten from an environmental standpoint, how they could be cooked and where (i.e. restaurants) they can be eaten;
- Higher social classes of Chinese consumers of live reef seafood, with the key message being to encourage responsible consumption of wild-caught fish and consumption of cultured fish over wild caught species from a product attribute and sustainability point of view;

The design, development and distribution of the outreach materials was out-sourced to Civic-Exchange Hong Kong, a Hong Kong based NGO dedicated to promoting civic education amongst members of the community and to providing objective and balanced information to the public on economic, social and environmental issues.The outreach material consisted of:

- Multi-fold pamphlets with an educational theme, focusing on responsible fish consumption by addressing environmental and sustainability concerns along the Chain of Custody from point of capture to restaurant consumption and other LRFFT issues the environmental and sustainability issues of the LRFFT;
- Multi-fold fish cards (business card size) that have a consumer choice theme, focusing on responsible fish consumption including, aquaculture; and
- Two picture postcards that promoting aspects of sustainable fish capture and consumption

An example of each of these outreach materials has been included below for reference.

With assistance from Civic Exchange and their contacts networks, these materials will be distributed widely throughout the Hong Kong (See table below). These materials will also be distributed outside of Hong Kong to government agencies, non-government organizations, industry bodies and academics and researchers in existing and potential source economies.

Organisation Type	**No. targeted**	**Notes**	**Materials they will receive**
Schools (Primary and Secondary)	100	(1)	Pamphlet, Fish card and postcards
Government Departments	EPD, FEHD, AFCD	(2)	Pamphlet and Fish card
Environmental Education Centres	EPD, AFCD, CA	(2), (3)	Pamphlet, Fish card and maybe postcards
Tourist Places	2 to 5	(4)	Pamphlet, Fish card and postcards
Green Groups	4 to 8	(3)	Pamphlet and Fish card
Civic Groups / Trade Associations	3 to 4	(5)	Pamphlet, Fish card and maybe postcards
Restaurants	5 to 10	(6)	Fish cards and maybe postcards
Hotels	5 to 10	(7)	Fish cards and postcards
Supermarkets	1 (Park n Shop)		Fish cards and postcards
Airlines	1to 2	(8)	Pamphlet, Fish cards and postcards

Notes:

(1) The target is to notify the schools of the availability of the outreach materials and to send them an explanatory letter along with a sample copy of the materials. Once the schools have received the sample outreach materials then CE representative will call to confirm receipt and explain the materials including where they may fit into the curriculum.

(2) Relevant government departments only will be targeted, especially those that operate resource and education centres such as the Environmental Protection Department (EPD), Food and Environmental Hygiene Department (FEHD) and the Agriculture, Fisheries and Conservation Department (AFCD).

(3) Green groups which have an interest in sustainable fish consumption will be targeted including WWF, TRAFFIC East Asia, and the Hong Kong Marine Conservation Society. Other Green groups will also be targeted including Conservancy Association (CA), Green Peng Chau Association, Green Power, Greenpeace China, Kadoorie Farm & Botanic Garden, and the Ocean Park Conservation Foundation.

(4) Major tourist places will include Ocean Park, the Peak Tram, the Star Ferry terminal, the Jumbo Restaurant (Aberdeen) etc.

(5) Business association will be targeted including Aberdeen Fishery & Seafood Merchants Association (AFSMA), Hong Kong Chamber of Seafood Merchants (HKCSM) and the French Chamber of Commerce & Industry (FCCI).

(6) Restaurants will be targeted include Maxim's, Kamboat, Super Star, Tung Hoi, and other smaller-scaled restaurants (esp. those in Lei Yue Mun and on Lamma Island).

(7) Hotels will be targeted will include local and international hotels.

(8) Airlines will be targeted will include those based in HK, e.g. Cathay Pacific, Dragonair.

Plate 7: Consumer handy wallet size responsible eating fish guide

Plate 8: LRFFT Pamphlet

Plate 9: LRFFT Implementation and Guidance Documents CD Cover

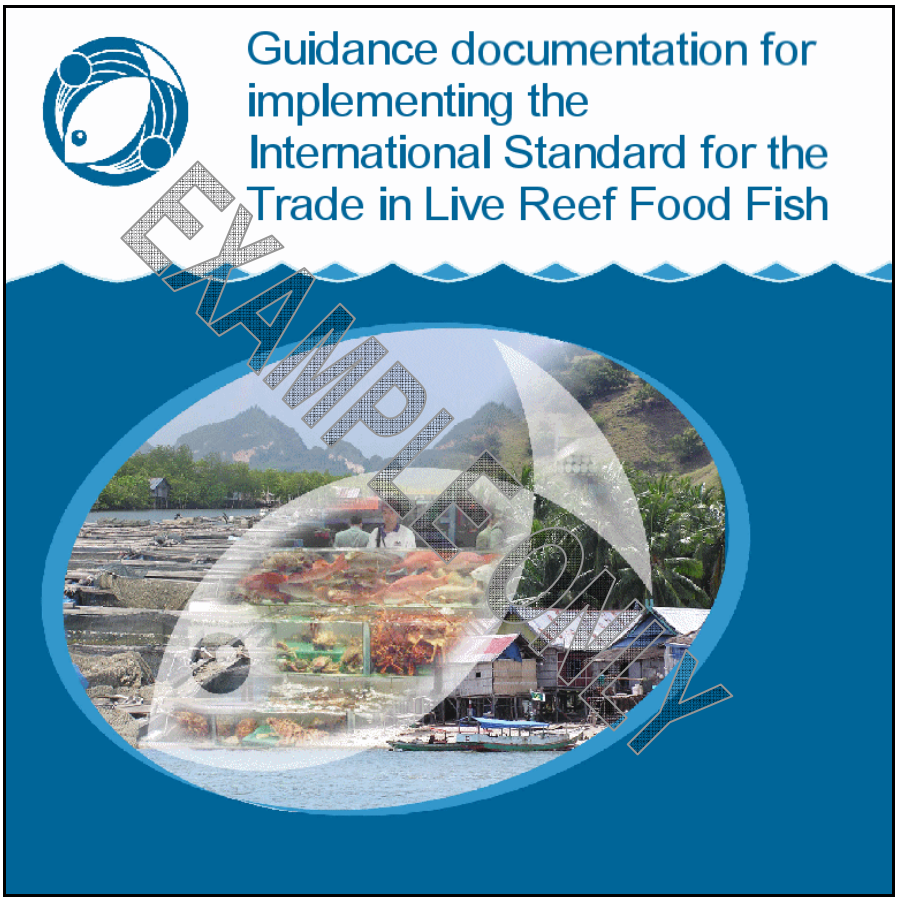


Plate 10: LRFFT Postcard

Part 5 – IMPLEMENTING THE LRFFT STANDARD

5.1 Overview

The purpose of the LRFFT project was to produce a credible and robust international standard for the trade in live reef food fish. Having achieved this, the LRFFT project team reviewed and considered options for the implementation and use of the LRFFT Standard. The LRFFT project team reviewed possible frameworks under which the LRFFT standard could be used. These included self declaration by industry members to the LRFFT standard (sometimes known as first party certification), compliance to the LRFFT standard within a program operated by a LRFFT trade association (sometimes known as second part certification) and conventional third-party certification as operated by the MAC and MAC in the fisheries sector. The certification programs offered by the following organizations were also reviewed which to a greater or lesser extent revolve around NGO second party certification and independent third-party certification.

1. Aquaculture Certification Council
2. Chemonics
3. Fairtrade Labelling Organizations (FLO) International
4. Food Certification Scotland (Salmon)
5. Forest Stewardship Council (FSC)
6. Global Ecolabelling Network (GEN)
7. International Federation of Organic Agriculture Movements (IFOAM)
8. International Organic Accreditation Service (IOAS)
9. Marine Aquarium Council (MAC)
10. Marine Stewardship Council (MSC)
11. Social Accountability International (SAI)
12. Sustainable Agriculture Network (SAN)

Due to the nature of the LRFFT trade and the need for an international program that was robust and credible it was thought by the LRFFT project team that the best method of ensuring compliance and implementation of the international standard for the trade in live reef food fish would be by using the standard within an independent third-party certification program. The following table summarizes the LRFFT review of the advantages and disadvantages of the various conformity assessment methods.

Figure 17: Certification program credibility

Certification Type	Certification Program	Unit of Certification	Certifier	Certifier Accountability	Certification Standard	General International Acceptability
First Party	Self Declaration By Supplier	No Fixed Unit. It Could Be Anything As Chosen By The Supplier.	The Supplier Themselves	None	None Or Criteria As Set By Supplier.	None
Second Party	Customer (Vendor Assessment)	As Decided By Customer.	Customer Of The Supplier	None	As Per The Customers Purchase Specification. This May Also Invoke A National Or International Standard.	Mainly National Acceptability.
Second Party	Government Scheme	As Decided By The Government Agency.	Government Agency	To The Controlling Government Agency Or Ministry.	Set By Government Agency, May Cross-Refer To An International Standard.	National Acceptability Only.
Second Party	NGO Scheme	As Decided By The NGO. (Usually Based Upon The Opinions Of Their Membership)	NGO	To The NGO's Membership.	As Set By The NGO. (Usually Based Upon The Opinions Of Their Membership)	Mainly Acceptable Amongst The NGO Community And By Consumers.
Third Party	ISO 9000 & ISO 14001 Management System Certification	As Decided By The Certifier And Their Client.	Nationally Accredited Independent Third Party Certifier.	To Its National Accreditation Agency.	ISO Standard Produced Through International Consultation..	Most Signatories To ISO. I.E. Some 200+ Countries.
Third Party	Performance Management Certification.	As Stated In The Independently Produced International Standard Used. E.G. Mac Core Standards, MSC Principles And Criteria, FSC Forestry Principles And Criteria.	Internationally Accredited Independent Third Party Certifier.	To Its International Accreditation Agency.	Standard Produced Through International Consultation With The World's Foremost Experts.	Now Generally Accepted By All As A Bona Fide International Certification Program.

5.2 The Need and Opportunity for Certification of the LRFFT Trade

With proper management, reef resources and habitat can be conserved in balance with their ability to provide for local sustenance, the collection of LRFF, aquarium organisms, and other benefits. The demand from informed consumers for environmentally sound products provides incentives for industries to adopt and adhere to standards for quality and sustainability. It was noted that at the beginning of the LRFFT project there was very little interest from the industry in adopting the LRFFT Standard as a basis for independent verification of compliance, e.g. third party certification such as that offered by the Marine Aquarium Council (for marine ornamental organisms) or the Marine Stewardship Council (for food fisheries).

Stakeholder attitudes did change though throughout the final year of the project and, several industry members have now expressed an interest in applying for third-party certification to the LRFFT Standard as soon possible if and when this becomes available.

Although government agencies, industry, and NGOs have made important efforts to address the impacts of the LRFFT trade in some areas, these have not been able to transform the industry because they have been undertaken in isolation and only addressed limited aspects of the LRFFT industry. No single government or other party has been positioned to work with the industry's full "chain of custody", the international range of other stakeholders, the consumer demand for LRFF, and the trans-boundary aspect of marine conservation issues. Responsible stakeholders see the need and opportunity for certification to ensure the LRFF trade is sustainable and environmentally sound:

- Governments and coastal communities in export economies - want a sustainable, environmentally sound trade that provides income generation and support for reef stewardship, conservation and management.

- Governments in import economies - want their consumers, policies and legislation to support a sustainable, environmentally sound trade that provides incentives for reef stewardship, conservation and management.

- LRFFT Members -want to support an industry that produces quality products using sustainable practices - both for ethical/environmental reasons and for personal reasons (i.e. these products are better value - they are healthier and safe). and want minimal mortality, healthy animals and healthy bottom line (there is no profit in a dead fish), a sustainable supply (i.e. healthy, productive reefs) and standards that codify "best practice" and create a "level the playing field".

- Conservation organizations - want a sustainable, environmentally sound trade that provides incentives for reef stewardship, conservation and management.

5.3 The Outcomes of Third Party Certification for the LRFFT Trade

By creating credible, international, multi-stakeholder standards of practice where none have existed, certification will ensure the LRFFT trade is responsible and sustainable. Certification will allow the industry and market to reject unsustainable, sub-standard practices and products. Sub-standard operators will be forced by the market to either adjust their practices "upward" or lose market support and leave the trade.

Certification will require proof of compliance with domestic law, e.g. no destructive fishing practices, and with international law, e.g. CITES permit conditions.

Going further, certification will lead to sustainable industry financing for conservation. Certification will require, among other things: monitoring of reefs and stocks for compliance with sustainability standards; industry documentation of compliance with standards and providing data to an international trade information system; and management plans and conservation areas for harvested reefs. This means the industry will be required to support monitoring, documentation and conservation and management of reefs as the way it does business - i.e. sustainable self-financing of reef conservation.

Developing economies with most reefs, and even developed economies, do not have enough funds to create, implement and enforce enough laws and management plans to protect all reefs all the time. Coastal communities with incentives to manage and conserve reefs are the only hope for widespread, ongoing, effective and financially sustainable reef conservation and management.

With market incentives and independent certification, coastal communities involved in the LRFFT trade will have motives for becoming the guardians, stewards and enforcers of management and conservation, often in remote areas rarely visited by government.

From the test case work undertaken, seminars and other studies it was apparent that economies such as Australia should find it relatively easy to comply with the requirements of the LRFFT Standard if a certification program is made available. Other economies such as Indonesia and the Philippines will require extensive outreach and capacity building for them to meet the requirements of the international standard.

If interest is confirmed in implementing the international standard through third party certification, it would be useful to have a two-phased approach to the adoption and possible third-party certification to the LRFFT Standard over a five-year timeframe.

The first phase would be for two years during which industry, local, national and regional enabling agencies and organizations could be consulted as the basis for creating a network of supply side and demand side industry members and trade associations that would be worked with and encouraged to make a commitment to compliance with requirements of the international standard as a mandatory condition of trade.

As part of the two-year period volunteer industry operators would be sought to participate as the first organisations to be subject to a gap analysis against the requirements of the LRFFT standard.

An action plan produced to enable remedial action to be undertaken to bring each operator (as appropriate) into compliance with the LRFFT Standard.

At the end of the two-year period a detailed and comprehensive review would then take place to objectively measure the interest and involvement of industry members, local, national and regional enabling agencies and other stakeholders to ascertain whether outreach, capacity building and extension training should be undertaken as a precursor to establishing an independent third-party certification program.

It is important to avoid the proliferation of yet another certification program separately for the live reef food fish trade. Certification to the LRFFT Standard for the trade in live reef food fish should integrated into an existing appropriate reef fish certification program. There is no organisation offering independent third party certification of food fish solely in the artisanal fishing sector that addresses both aquaculture and wild capture fisheries.

The MSC has plenty of food fisheries certification experience but not a great deal in the aquaculture or artisanal sector. Marine Aquarium Council (MAC) has plenty of artisanal and aquaculture fisheries experience but not with food fish. In particular MAC was also seen to undertake outreach, capacity building and extension training with artisanal fisheries communities of the type that would be required for each member of the LRFFT that wished to become certified to the LRFFT standard.

It was thought that a certification program for the LRFFT would require both the skills of MAC and the MSC with MAC being far better placed to undertake the initial implementation work on achieving industry compliance with the international standard for the trade in live reef food fish as they solely work within the artisanal fisheries sector and undertake extensive outreach, capacity building and extension training with these fishing communities, exporters and importers mainly focused within the South East Asia and Pacific. In fact there is a great synergy between the MAC certification program and live reef food fish trade as it is quite frequently the same collectors that collect marine aquarium organisms and live reef food fish.

It should also be readily possible to gain acceptance of the concept of certification to an international standard for live reef food fish from communities that have already experienced independent third-party certification for the marine ornamental organism trade.

Additionally, it is suggested by the LRFFT project team that a LRFFT Council is formed for the five-year implementation period. This Council would have a membership of the MSC, MAC, Industry Associations, local, national and regional enabling agencies and organizations with no single interest predominating. It is also suggested that MAC acts as the Secretariat for the LRFFT Council and is responsible for designing the implementation program for the industry for achieving a third party independent certification within a five-year timeframe. MAC would also be responsible and take the lead in working with fishing communities especially in the Philippines and Indonesia by undertaking appropriate outreach, capacity building and extension training for LRFFT certification with these communities.

At the end of year four of the implementation program MAC would migrate the certification program from within its organization to that of the MSC. The MSC or another body would then continue to be the sole organization running the LRFFT certification program under its own governance with the LRFFT Council being disbanded at the end of year five.

The LRFFT project team proposes an implementation plan based upon the following assumptions:

5.4 Assumptions

1. The LRFFT Standard will, of necessity, be a "living document" subject to continuing revision and elaboration.

2. The LRFFT Standard will be managed by a newly created LRFFT Council reflecting the character and nature of the LRFFT industry.
3. Implementation of the LRFFT Standard will require the services of a Secretariat of the Council to support the full and effective participation of governments and industry.
4. The newly created LRFFT Council will be structured to take account of the limited financial resources available from government and industry.

5.5 Proposed Roles and Responsibilities for the LRFFT Standard Council

1. Oversee the ratification of the international LRFFT Standard, ensuring that all governments and industry organizations are included in the process and that the process is fully transparent;
2. Conduct annual meetings to address proposals for changes to the LRFFT Standard text, on the understanding that no such changes will be put into effect without ratification by industry, local, national and regional enabling agencies and organizations ;
3. Oversee ongoing activities in support of the LRFFT Standard and its implementation, including communications and promotion;
4. Represent the LRFFT Standard in dealings with government agencies and international bodies;
5. Direct and oversee the activities of the LRFFT Council to support the LRFFT Standard.
6. At the end of the two year time period, conduct full consultations with industry, local, national and regional enabling agencies and organizations to evaluate need to move forward to a formal independent third-party certification program. The question of the continuing need for the LRRFT Council should also be assessed at this time.

5.6 The LRFFT Council Secretariat

Given the limited financial resources to support the implementation of the LRFFT Standard, and the clear agreement that the LRFFT Standard should not involve extra costs to the LRFFT industry, it is proposed that independent and government funding will provide support to the LRFFT Council.

5.7 Proposed Implementation Plan

The following is the implementation plan for phasing in the LRFFT Standards

Year	Activity	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
1	Establish LRFFT Council				
1	Undertake review of organisations that could act as Secretariat to the LRFFT Council				
1	LRFFT Council Secretariat Appointed				
1	Discussions held with APEC FWG, GEF, ADB and private foundations with respect to continued funding of the LRFFT Council				
1	Relationships established with enabling agencies and bodies such as but not limited to APEC FWG, NACA, STREAM, SPREP, PEMSEA, FSPI, CCIF and COREMAP				

1	LRFFT industry network formed of suppliers and purchasers of LRFF	
1	Awareness program undertaken with industry members and a list of 'volunteer' organisations produced that have signed a statement of commitment to comply with the LRRFT international standard through to independent certification as and when appropriate	
1	Lobbying of each APEC member economy to sign up to the 10 point LRFFT policy plan	
2	Gap analysis criteria and program agreed	
2	Gap analysis undertaken on industry members throughout the whole chain from demand side through to supply side	
2	Remedial action plans agreed with each industry member	
2	Outreach, capacity building and extension training program designed	
2	Lobbying of each APEC member economy to sign up to the 10 point LRFFT policy plan	
End of Year 2	Detailed review to objectively measure the buy-in from industry members, local, national and regional enabling agencies to ascertain whether outreach, capacity building and extension training should be undertaken as a precursor to formal certification under an independent third-party certification program. If a successful review then the implementation continues as follows:	
3	Outreach, capacity building and extension training program undertaken with industry members in Australia, Indonesia, Philippines, Hong Kong, China; Pacific; and China	
4	Third Party Certification Program Designed	
4	Pre-certification audits undertaken of industry members in Australia, Indonesia, Philippines, Hong Kong, China; Pacific; and China	
4	Certification program planned and independent third party certifiers trained and accredited to LRFFT certification program	
4	Migration commences from LRFFT Council Secretariat to the body that will in the future manage the LRFFT certification program	
5	LRFFT certification audits undertaken	
5	Certification issued to successful LRFFT industry members	

5	Proposals agreed by Industry Associations, local, national and regional enabling agencies and organizations as to how future funding for the LRFFT certification program may be secured				
5	Migration finalized from LRFFT Council Secretariat to the body that will in the future manage the LRFFT certification program				
5	Permanent body operates the LRFFT certification program under its own governance.				
5	LRFFT Council and Secretariat is disbanded				

5.8 Policy Recommendations for creating local, national and regional enabling mechanisms

It is proposed by the LRFFT product team that the following policies are adopted by APEC member states as part of a 10 point plan to achieve compliance by the live reef food fish trade to the international standard for the trade in live reef food fish.

Each member state shall:

1. Encompass the LRFFT Standard in its seafood export requirements
2. Establish Regional LRFFT Buyers Groups
3. Introduce legislation to prohibit the targeting of LRFF spawning aggregations
4. Encompass the LRFFT international standard requirements into national aquaculture and CRMP plans
5. Require mandatory health certification of all LRFF for export
6. Encourage diversification of supply so that sole reliance on one export market is avoided. This may be by promoting in country consumption
7. Mandate minimum size control for each LRFF species exported
8. Establish designated hubs for the receipt of LRFF
9. Mandate tagging of all LRFF for export from fingerling to adult market size fish
10. Jointly fund the LRFFT Management Council for a period of five years

Part 6 –PROJECT CONCLUSION

6.1 Conclusion

The goal of this project was to develop a credible and robust standard for the live reef food fish trade by building consensus on what "best practices" were needed to ensure a sustainable industry, including sustainable reefs, fish stocks and fishing communities. This was achieved through an extensive and open multi-stakeholder consultative process over the entire duration of this project. Hundreds of industry stakeholders encompassing all potential links in the market chain were included in this consultative process. These stakeholders groups included:

- fishers, buyers, middlemen, traders and exporters in all major supply economies;
- industry groups representing fishers, traders and exporters, importers, wholesalers and retailers and aquaculture producers in all major supply and demand economies;
- representatives of all relevant government agencies including but not limited to departments of fisheries, food health and safety, conservation, trade and development, primary industries in supply and demand economies;
- researchers and academics in government and at both universities and non-government organizations; and
- local, national and international non-government organizations and implementing agencies (e.g. ADB) throughout the Asia-Pacific region.

This emphasis on wide-ranging and inclusive consultation and a willingness of the drafting team to heed stakeholder concerns is widely believed to have been responsible for turning around the initial lack of support for this project, and ultimately the development of a meaningful Standard that creates a platform for the ongoing efforts to transform this often destructive trade.

In addition to the International LRFFT Standard required by the funding agencies, this project produced a suite of supporting documentation and outreach material aimed at facilitating its implementation by industry participants and regulatory agencies and promoting responsible consumption within the trade. The decision to dispense with written manuals and documentation in favour of a CD comprising Requirement interpretation and best-practice and implementation guidance has greatly improved the ability for distribution and dissemination of the Standard. Furthermore, the development of a ‘live’ website will ensure that the issue of the international standard for the trade in live reef food fish that promotes industry best practice will not be forgotten

--------End of Report--------

Part 7 – ANNEXURES AND ATTACHMENTS

7.1 Key Stakeholder List

Last Name	First	Institution	Representation
Barber	Charles	IMA	Key Partner Group/NGO
Holthus	Paul	MAC	Key Partner Group/NGO
Salm	Rod	TNC	Key Partner Group/NGO
Chan	Patrick	HKCSM	Key Partner Group/Industry
Lam	Michelle	MAC	Key Partner Group/NGO
McGilvray	Frazer	IMA-HK	Key Partner Group/NGO
Muldoon	Geoffrey	N/A	Key Partner Group/NGO
Scott	Peter	MAC	Key Partner Group/NGO
Chan	Thierry	Civic Exchange	Key Partner Group/NGO
Chen	Sandy	TNC	Key Partner Group/NGO
Kusumaatmadja	Rezal	MAC	Key Partner Group/NGO
Peitsch	Rachel	APEC FWG/US State Dept.	Government-APEC FWG
Chueh	C T	Taiwan Fish Breeding Association	Industry-Taiwan
Kile	Nelson	Min. of Fisheries, Solomon Islands	Government-Pacific Islands
Kwok	Rock	AFCD, Hong Kong	Government-Hong Kong
Loveday	Ted	Seafood Services Australia	Industry-Australia
Owen	Randall	GBRMPA	Government-Australia
Padilla	Joe	KKP (WWF Philippines)	NGO-Philippines
Peacey	Jonathan	Min. of Fishery New Zealand	Government-New Zealand
Phillips	Mike	NACA	Regional NGO/Research
Pomeroy	Bob	IMA	NGO-USA
Sadovy	Yvonne	The University of Hong Kong	Academia/Research
Vy	Kenneth	Kenneth Aquamarine (HK) Inc..	Industry-Hong Kong
Astor	Jing	Calamianes Fishermen's Assoc.	Industry-Philippines
Arzaga	Winston	Palawan Council for Sust. Development	Government - Philippines
Bishop	Mick	Fisheries Group GBRMPA	Government-Australia
Brucal	Nilo	KKP (WWF Philippines)	NGO-Philippines
Donaldson	Terry	IMA	Academia/Research
Dulvy	Nick	University of Newcastle, UK	Academia/Research
Elmer	Mark	Queensland Fisheries Service	Government-Australia
Johannes	Bob	Marine Resource Consultant	Consultant
Mapstone	Bruce	CRC Reef Research	Academia/Research
Mous	Peter	TNC-Indonesia	NGO-Indonesia
Must	Terry	Arabon Fisheries Pty Ltd	Industry-Australia
Ochavillo	Dominggo	Reef Check	NGO-Philippines
Russ	Garry	James Cook University, Australia	Academia/Research
Squire	Lyle	Cairns Marine	Industry-Australia
Sumardika	Putu	Ministry of Marine Affairs and Fisheries	Government-Indonesia
Wicaksono	Arief	IMA-Indonesia	NGO-Indonesia
Yeeting	Being	SPC	Government-multilateral
Silvestre	Geronimo	ICLARM	Academia/Research
Cabanban	Annadel	UNEP/GEF Sth China Sea Project	Government-multilateral
Cruz	Ferdinand	MAC/IMA-Philippines	NGO-Philippines
Kronen	Mecki	SPC	Government-multilateral
Pet-Soede	Lida	CCIF, WWF-Wallacea	NGO-Indonesia
Power	Mary	SPREP	Government-multilateral
Samoilys	Melita	McGill University	Academia/Research
Choat	Howard	James Cook University, Australia	Academia/Research
Leung	Siu Fai	AFCD, Hong Kong	Government-Hong Kong
Lokani	Paul	TNC-PNG	NGO-Papua New Guinea
Souter	Duncan	Queenland Seafood Industry Assoc	Industry-Australia
Wright	Andrew	SPREP	Government-multilateral

7.2 Townsville Experts Workshop Participants

Title	Name	Surname	Affiliation	Company
Mr	Mick	Bishop	Manager, Fisheries Information and Policy	Great Barrier Reef Marine Park Authority
Mr	Nilo	Brucal	Policy Officer – Coron Live Reef Fish Project	Kabang Kalikasan ng Pilipinas (WWF Philippines)
Mr	Gary	Carlos	Research Scientist, Effects of Line Fishing project	CRC Reef Research , James Cook University
Mr	Patrick	Chan	Chairman	Hong Kong Chamber of Seafood Merchants
Dr	Terry	Donaldson	Senior Scientist	IMA, Integrated Biological Research Program
Dr	Nick	Dulvy	Research Associate Ecosystem Fisheries Effects	Department of Marine Science and Coastal Management, University of Newcastle, United Kingdom
Dr	Cameron	Hay	Director, Institute of Marine Resources	University of the South Pacific
Dr	Bob	Johannes	Marine Consultant	R.E. Johannes Consultants
Dr	Brigid	Kerrigan	Project Coordinator	APEC Coral Reef and Fisheries Network
Dr	Bruce	Mapstone	Program Leader, Sustainable Industries	CRC Reef Research
Dr	Peter	Mous	Coastal Program Manager	The Nature Conservancy, Indonesia
Mr	Geoffrey	Muldoon	Program Coordinator	IMA, Australia
Mr	Terry	Must	Proprietor	Arabon Fisheries Pty Ltd. Bowen, Australia
Dr	Domeng	Ochavillo	Field Officer	Marine Aquarium Council - Philippines
Dr	Garry	Russ	Associate Professor	School of Marine Biology & Aquaculture, James Cook University
Dr	Yvonne	Sadovy	Society for the Conservation of Reef Fish Aggregations(SCRFA)	Department of Ecology & Biodiversity, Hong Kong University
Mr	Peter	Scott	Accreditation Coordinator	Marine Aquarium Council - Philippines
Mr	Lyle	Squire	Director	Cairns Marine Aquarium Fish
Dr	Putu	Sumardika	Directorate General of Institutional Capacity Enhancement and Marketing	The Indonesia Ministry of Marine Affairs and Fisheries
Mr	Arief	Wicaksono	Country Coordinator	International Marinelife Alliance – Indonesia
Dr	Clive	Wilkinson	Coordinator	Global Coral Reef Monitoring Network
Dr	Simon	Woodley	Consultant	S & J Woodley Pty Ltd
Mr	Being	Yeeting	Live Reef Fish Specialist	SPC, Marine Resources Division
Mr	Kenneth	Vy	Live Reef Fish Importer	Hong Kong

7.3 Vietnam Experts Workshop Participants

Title	Name	Surname	Affiliation	Company	Country
Dr	Mike	Rimmer	Principal Fisheries Biologist	Department of Primary Industries Northern Fisheries Centre	Australia
Ms	Elizabeth	Cox	Fisheries Biologist	Department of Primary Industries Northern Fisheries Centre	Australia
Dr	Richard	Knuckey	Fisheries Biologist	Department of Primary Industries Northern Fisheries Centre	Australia
Dr	Shannon	McBride	Fisheries Biologist	Department of Primary Industries Southern Fisheries Centre	Australia
Dr	Sagiv	Kolkovski	Project Reviewer	Australian Centre for International Agricultural Economics	Australia
Mr	Barney	Smith	Research Program Manager, Fisheries	Australian Centre for International Agricultural Economics	Australia
Dr	Kevin	Williams	Principal Scientist	CSIRO Marine Research Laboratory, Brisbane	Australia
Dr	Clarissa L.	Marte	Head, Research Division	SEAFDEC AQD, Iloilo	Philippines
Dr	Joebert	Toledo	Research Scientist	SEAFDEC AQD, Iloilo	Philippines
Dr	Gerald F.	Quinitio	Research Scientist	SEAFDEC AQD, Iloilo	Philippines
Dr	Perla S	Eusebio	Associate Scientist	SEAFDEC AQD, Iloilo	Philippines
Ms	Oseni M	Millamena		SEAFDEC AQD, Iloilo	Philippines
Ms	Veronica	Alava		SEAFDEC AQD, Iloilo	Philippines
Dr	Le Thanh	Luu	Director	Research Institute for Aquaculture No 1	Vietnam
Mr	Tran Chinh	Khuong	Marine and Coastal Programme Officer	WWF Indochina Programme Office, Hanoi	Vietnam
Y.C.	Thampi	Samraj	Project Director	Rajiv Gandhi Centre for Aquaculture (MPEDA organization)	India
Mr	Samy	Mani	Junior Technical Officer	Rajiv Gandhi Centre for Aquaculture (MPEDA organization)	India
Dr	Yvonne	*Sadovy*	Associate Professor	University of Hong Kong, Department of Ecology	Hong Kong
Dr	Jim	Chu	Fisheries Officer	Agriculture, Fisheries and Conservation Department	Hong Kong
Mr	Patrick	Chan	Chairman	Hong Kong Chamber of Seafood Merchants Ltd	Hong Kong
Mr	Khin Ko	Lay	Director (Aquaculture)	Department of Fisheries	Myanmar
Mr	Niels	Svennevig	Head, International Projects Department	SINTEF Fisheries and Aquaculture (Norway)	Denmark
Dr	Cathay	Hair	Senior Research Associate	ICLARM – The World Fish Center	Solomon Is.
Mr	Pedro	Bueno	Director General	Network of Aquaculture Centres of Asia-Pacific (NACA)	Thailand
Dr	Michael	Phillips	Environemental Specialist	NACA Secretariat	Thailand
Mr	Sih Yang	Sim	Research Associate	NACA Secretariat	Thailand
Dr	Graham	Haylor	Director, STREAM Initiative	STREAM Regional Office, NACA	Thailand
Mr	Paiboon	Bunlipatanon	Head of Station	Krabi Coastal Aquaculture Development Station	Thailand

Title	Name	Surname	Affiliation	Company	Country
Mr	Frazer	McGilvray	Executive Director	IMA, Hong Kong	Hong Kong
Mr	Peter	Scott	Certificatiuon Systems Direcitr	Marine Aquarium Council (MAC)	Philippines
Ms	Rachel	Peitsch	US State Department	APEC FWG LRFFT Project Overseer	USA
Dr	Ketut	Sugama	Diretcor	Pusat Riset Perikanan Budidaya	Indonesia
Dr	Adi	Hanafi	Diretor	Gondol Research Institute for Mariculture, Bali	Indonesia
Dr	N.A	Asmara Giri	Resaerch Scientists	Gondol Research Institute for Mariculture, Bali	Indonesia
Dr	Inneke F.M	Rumengan	Department Head	Sam Ratulangi University, Faculty Fisheries & Marine Science	Indonesia
Mr	Stenly	Wullur	Junior Lecturer	Sam Ratulangi University, Faculty Fisheries & Marine Science	Indonesia
Dr	Peter J.	Mous	Science, Training & Partnerships Mgr	The Nature Conservancy, Bali	Indonesia
Mr	Ali	Awang	Senior Fisheries Research Officer	National Prawn Hatchery, Research and Production Centre	Malaysia
Mr	Tang	Twen Poh	General Manager		Malaysia
Mrs	Hajah	Haji Yusof	Fisheries Officer	Dept of Fisheries, Ministry of Industry & Primary Resources	Brunei

7.4 Standards Advisory Group

Last Name	First Name	Institution
Alava	Veronica	SEAFDEC AQD
Alvarez	Lino	MAC
Asmara-Giri	N.-A.	Gondol Research Institute for Mariculture
Aumeeruddy	Riaz	Seychelles Fishing Authority
Awang	Ali	National Prawn Hatchery
Awira	Rib	Kiribati Fisheries
Balboa	Cristina	WRI
Barber	Charles	IMA
Bennett	Greg	Solomon Island Fisheries
Bentley	Nokome	Consultant
Bishop	Mick	Fisheries Group GBRMPA
Blyth	Peter	Tasmania
Bueno	Pedro	NACA
Bunlipatanon	Paiboon	
Cabanban	Annadel	UNEP/GEF South China Sea Project
Caleda	Mary Jean	International Marinelife Alliance
Chan	Thierry	IMA-HK
Chan	Patrick	HK Chamber of Seafood Merchants Ltd
Chen	Sandy	TNC
Cheuh	CT	Taiwan Fish Breeding Association
Chinh-Khuong	Tran	WWF Indochina Programme Office
Choat	Howard	James Cook University School of Marine Biology
Chu	Jim	Aberdeen Fisheries Offices
Clarke	Shelley	
Cornish	Andy	
Cox	Elizabeth	Queensland Department of Primary Industries
Desurmont	Aymeric	SPC--Secretariat of the Pacific Community
Donaldson	Terry	IMA
Donnelly	Ryan	Consultant
Eusebio	Perla	SEAFDEC AQD
Fegan	Brian	ACIAR
Grieve	Chris	MSC
Hair	Cathy	ICLARM – The World Fish Center
Hanafi	Adi	Gondol Research Institute for Mariculture
Haylor	Graham	NACA
Holthus	Paul	MAC
Kile	Nelson	Ministry of Fishery and Marine Solomon
Knuckey	Richard	Queensland Department of Primary Industries
Kolkovski	Sagiv	ACIAR
Kronen	Mecki	SPC
Kusumaatmadja	Rezal	MAC
Kwok	Rock	AFCD, Hong Kong
Lam	Michelle	MAC
Lay	Khin-Ko	Department of Fisheries, Yangon,Myanmar
Leadbitter	Duncan	MSC
Lilley	Gayatri	MAC
Lokani	Paul	TNC-PNG
Loveday	Ted	Seafood Services Australia
Luu	Le-Thanh	Research Institute for aquaculture No 1
Mani	Samy	MPEDA House, Panampilly Nagar

Last Name	First Name	Institution
Mapstone	Bruce	CRC Reef Research
Marte	Clarissa	SEAFDEC AQD
McBride	Shannon	Queensland Department of Primary Industries
McGilvray	Frazer	IMA-HK
McIff	Colin	US State Department
Millamena	Oseni	SEAFDEC AQD
Mohd-Yusof	Hajah-Rosinah-Haji	Ministry of Industry and Primary Resources
Mous	Peter-J.	The Nature Conservancy
Muldoon	Geoffrey	IMA
Owen	Randall	GBRMPA
Padilla	Joe	University of Philippines
Peacey	Jonathan	Min. of Fishery New Zealand
Peitsch	Rachel	US State Department – APEC FWG
Pet-Soede	Lida	CCIF, WWF-Wallacea
Phillips	Mike	NACA
Poh	Tang-Twen	Malaysia
Pomeroy	Bob	IMA
Power	Mary	SPREP
Quinitio	Gerald	SEAFDEC AQD
Reynolds	J. Eric	Food and Agriculture Organization of the United Nations
Riggs	Peter	Rockefeller Brothers Fund
Rimmer	Mike	Queensland Department of Primary Industries
Rumengan	Inneke-F.-M.	Sam Ratulangi University
Russ	Garry	James Cook University School of Marine Biology
Sadovy	Yvonne	The University of Hong Kong
Salm	Rod	TNC
Samoilys	Melita	McGill University
Samraj	Y.C.-Thampi	Rajiv Gandhi Centre for Aquaculture (MPEDA)
Scott	Peter	MAC
Short	Katherine	WWF Australia
Sim	Sih-Yang	NACA Secretariat
Smith	Barney	ACIAR
Smith-Evans	Marc	Nippon Koei Co Ltd and Associates
Souter	Duncan	QSIA
Squire	Lyle	Cairns Marine
Sugama	Ketut	Jl. K.S. Tubun, Petamburan VI
Svennevig	Niels	SINTEF Fisheries and Aquaculture (Norway)
Thong		
Toledo	Joebert	SEAFDEC AQD
Tuwai	Iliapi	International Marinelife Alliance
Vosseler	David	MAC
Vy	Kenneth	Kenneth Aquamarine Products Inc.
Walker	Shari	TNC
Why	Steve	IMA
Wicaksono	Arief	IMA Indonesia
Williams	Kevin	CSIRO Marine Research
Wright	Andrew	SPREP
Wullur	Stenly	Sam Ratulangi University
Yau	Alex	WWF Hong Kong
Yeeting	Being	SPC
	'Akau'ola	Ministry of Fisheries Tonga

7.5 Letter of Invitation to potential Standards Advisory Group members

INDUSTRY STANDARDS FOR THE LIVE REEF FOOD FISH TRADE

A collaborative project of the International Marinelife Alliance (IMA),Marine Aquarium Council (MAC), The Nature Conservancy (TNC) and interested stakeholders

Dear Colleague,

Standards Advisory Group Review

The goal of this project is to bring together stakeholders and build common ground on what "best practices" are needed to ensure a sustainable industry, including sustainable reefs, fish stocks and fishing communities. The project focuses on both wild-caught and cultured fish, and covers standards and practices relating to the assessment of fish stocks, capture and culture methods, holding, transportation, and human health and safety concerns. The intent of this project is a set of industry standards for that all responsible members of the LRFFT can work together to develop and implement.

We have reached the stage in the project where a first draft of the industry standards has been produced and reviewed by an expert group following several workshops. We would now like these to be reviewed by a Standards Advisory Group (SAG) that is a wider group of individuals with a particular interest in the LRFFT to ensure adequate stakeholder consultation and involvement. There will likely be several rounds of review.

We would therefore like to invite you to be a member of the LRFFT SAG and would also appreciate your suggestions for other potential SAG members who we may have missed.

Overview

The standards documents consist of three levels i.e. the standard, best practice document and training and implementation manuals. The standard consists of bullet point criterion with underlying descriptors to clarify those criterions. The best practice document expands each of the bullet points of the standard and is intended to describe how a participant in the LRFFT industry may seek to satisfy each of the criterions. The third level of documentation consists of training and implementation manuals.

LRFFT SAG Review Process

The work of the Standards Advisory Group (SAG) will consist of:

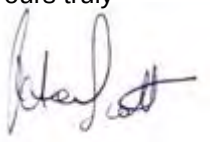
Reviewing the draft standards and best practice we have assembled from our efforts up to this point.
Providing comments within the time frame requested.
Reviewing and commenting on the revised standards within the time frame requested.
Providing any existing materials that you feel should be included or referred to as a "Level Three Document" (e.g. tool kits, manuals, etc.)
Reviewing and commenting on the next iteration of the standards (if necessary).

Confidentiality

We prefer that this review process remain within the LRFFT SAG membership. The draft Standard and Best Practice documents are meant for your review only and not for the general public. After the LRFFT SAG review, the revised document will be posted for wider public review. In the meantime we request that these documents remain confidential.

Please confirm by the 11th March 2003 whether or not you wish to be a member of the LRFFT SAG.

Yours truly



Peter Scott

LRFFT Standards Coordinator 25 February 2003

For further information, please contact: peter.scott@aquariumcouncil.org


Packard
MacArthur
APEC
NMFS
The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH
MARINE AQUARIUM COUNCIL