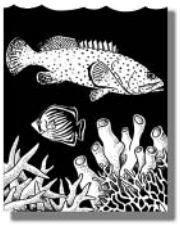

# Economic and market analysis of the live reef food fish trade in the Asia-Pacific region

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## Introduction

In 1998 the Australian Centre for International Agricultural Research (ACIAR) funded a project to look at the "Sustainable Management of the Live Reef Fish Trade-Based Fishery in Solomon Islands". A review of this project, which concluded in 2001, indicated that detailed economic analysis of marketing of the live reef fish trade would provide significant benefits to a range of stakeholders (Fegan 2002). Subsequently, it was acknowledged that any economic analysis should be extended to incorporate the whole Asia-Pacific region and include key Asian producers of live reef food fish (LRFF), which have a longer and more active history in the LRFF trade than Pacific Island producers. As such, the study will focus on the following supply countries: Indonesia, Australia, Papua New Guinea, Vietnam, Fiji and Solomon Islands.[4] Other key suppliers such as Thailand and the Philippines will be incorporated through the involvement of multilateral agencies such as the WorldFish Center in Malaysia and the Network of Aquaculture Centres in Asia-Pacific (NACA).

In July 2003, a nine-month feasibility study was commissioned by ACIAR, with a view to developing a more comprehensive proposal. The feasibility study undertook a review of a number of aspects relating to the trade, including: availability of price, quantity and trade data; suitable methods for quantifying short- and long-term demand and supply of live reef fish; suitable economic frameworks for measuring the beneficiaries of improvements in demand or supply; and key cost and risk components of the marketing chain. In addition, a network of potential collaborating organizations and universities were identified, such as the Secretariat of the Pacific Community (SPC), the WorldFish Center and Bogor University (Indonesia). Linkages with other ACIAR projects relating to improved technology for hatchery and grow-out of marine finfish in the Asia-Pacific (FIS/2002/077) were also established.

In concluding the feasibility study, a proposal for a larger two-year project was submitted to ACIAR, "Economic and Market Analysis of the Live Reef Fish Food Trade in Asia-Pacific". The project is expected to commence in July 2004 with a research team comprising Dr Brian Johnston as project leader, Dr Elizabeth Petersen and Mr Geoffrey Muldoon. It will also include research collaborators Dr Mahfuzuddin Ahmed, Dr Madan Dey and Dr Reohlano Briones from the WorldFish Center, Mr Being Yeeting from SPC, Dr Akhmad Fauzi from Bogor University and Dr Sonny Koeshendrajana from the Research Institute for Fisheries Product Processing and Social Economics, Jakarta. The remainder of this article provides some information on the trade and an overview of the proposed project.

## Background

Live reef food fish are currently sourced from more than 20 countries in the Asia-Pacific region, some located close to Hong Kong having been in the trade for some time while other more distant countries are only recent, and infrequent, participants (Petersen et al. 2004). Total recorded imports of LRFF into Hong Kong, while declining from the peaks of the late 1990s, have remained stable since then (Fig. 1).

Recent estimates, based on declared imports of LRFF into Hong Kong, place the annual volume of trade into Hong Kong at 13–14,000 tonnes (t), with a retail value of approximately 350 million US dollars (USD). As there is no requirement for the approximately 100 Hong Kong licensed live-fish transport vessels to declare imports entering Hong Kong by sea, these estimates are almost certainly lower than actual imports, which are more likely to be 15–20,000 t annually. The total regional trade has been estimated to be as high as 30,000 t per year (Sadovy et al. 2004).

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4. Although not presently a supplying country, Solomon Islands has in the past supported a LRFF fishery and there is potential for a LRFF fishery to reopen in the future.

As noted, a range of undesirable economic, environmental and social outcomes have been identified as being associated with the trade, with the focus mainly on environmental issues. These include overexploitation of coral reefs and coral reef fish and the environmentally damaging aspects of some harvesting techniques, including cyanide fishing, targeting of spawning aggregations and the capture of immature fingerlings and juveniles for grow-out (Cesar et al. 2000; Sadovy and Vincent 2002). Other aspects of the trade are not well understood and would benefit from further research, including detailed empirical analysis of demand and supply issues.

Supply analysis can enable investigation of supply responses of fishers and traders in various countries to changes in prices, based on historical data. On the demand side, the future market potential for wild-caught and cultured live reef product is largely unknown. Demand analysis can enable investigation of how consumer preferences for certain LRFF species change in response to changing prices and incomes and the effects of these changes on quantities of LRFF imported. Substitution among the various wild-caught species and between wild-caught and aquaculture species is of particular interest, as this will enable predictions of short- and long-term consumer demand.

As incomes in Asia rise over the next decade and aquaculture products become more readily available, there is an expectation that consumer demand for LRFF will likewise increase. The trade, however, is susceptible to the economic environment, as evidenced in a downturn during the Asian economic crisis. The region has not yet fully recovered from the crisis or from the Severe Acute Respiratory Syndrome (SARS) outbreak.

For the purposes of this article, common names used by the Agriculture, Fisheries and Conservation Department (AFCD) in Hong Kong, China are preferred (Table 1).

## Trade data and recent economic events

Total recorded imports into Hong Kong have remained fairly stable since 1999, when import volumes declined considerably relative to previous years (Fig. 1). Hong Kong's economy remained fairly robust for the duration of the Asian economic crisis that began in 1997, and only began to show signs of a downturn from the end of 1998. This downturn coincided with a fall in declared imports of approximately 30% in 1999, mainly in the categories of the lower-value "other marine fish" and "other groupers". In 2003, while total imports into Hong Kong rose slightly (by less than 0.5%), the

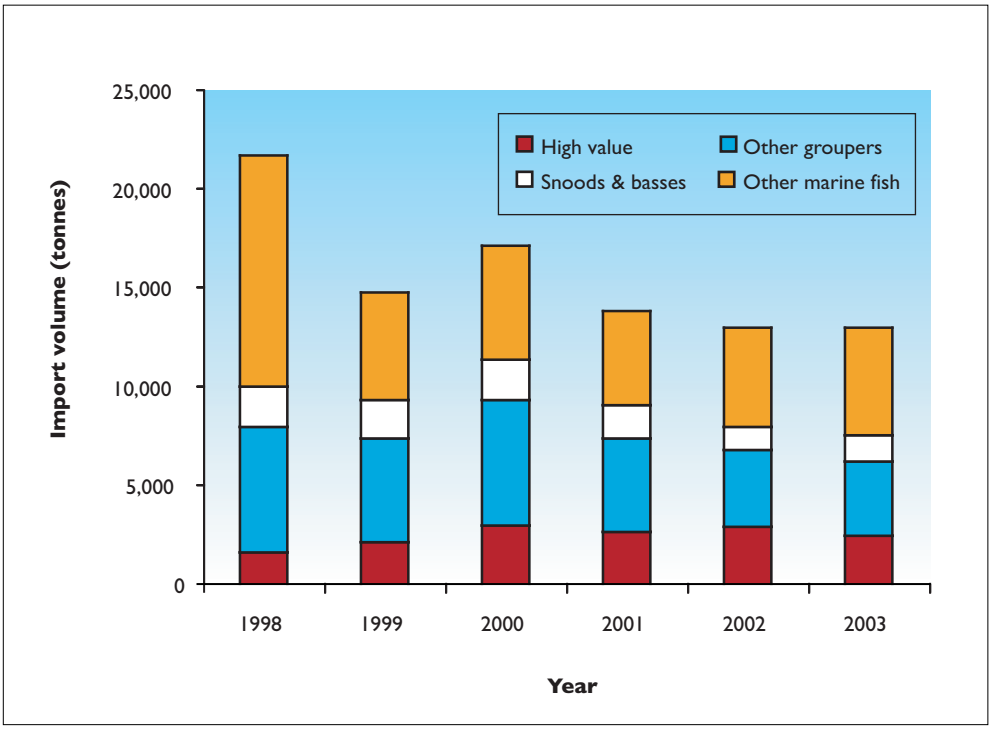


**Figure 1. Annual volumes of reported imports of all live reef food fish into Hong Kong from 1998 through 2003. High value species include highfin grouper, humphead wrasse, giant grouper, leopard coralgrouper, and spotted coralgrouper. Other groupers include the green grouper, tiger grouper, flowery grouper and other groupers. Other marine fish include wrasses and parrotfish, mangrove snapper and other fish (Source: unpublished data from Hong Kong, China Census and Statistics Department and the Agriculture, Fisheries and Conservation Department).**

SARS epidemic during that year may have influenced consumer demand for particular species. In 2003, the volume of high-value imports fell by 15%. In contrast imports of the lower-value "other marine fish" category, which had declined in three of four previous years, rose 10%.

Anecdotal evidence suggests a number of market responses to SARS influenced these changing consumption patterns. Following the first SARS reports in Hong Kong, restaurants began reporting cancellations of banquet bookings. Restaurants are traditionally the place where the higher-value and medium-value species are purchased and consumed, and so consequently much of their product is imported from overseas sources. With the number of patrons dining out at these restaurants falling markedly, many restaurants closed down for the duration of the SARS scare and, with the lower demand for high- and medium-value fish, many traders stopped buying fish from overseas suppliers. Conversely, with consumers preferring to eat fish at home as opposed to dining out, the demand for the lower-value and domestically caught fish is thought to have increased.[5]

The impact of the SARS epidemic, during April and May of 2003, on individual species can be examined by looking at trends in both prices and import volumes across recent years. There were no real discernable impacts of SARS on the import prices of most high-value and mid-value species (see Fig. 1 caption), including leopard and spotted coralgrouper, highfin grouper, green grouper and tiger and flowery grouper (Pet-Soede et al. 2004). The SARS epidemic however, does appear to have had an impact on the demand for a subset of high-value species and other grouper species. Figure 2, which compares monthly imports in 2003 and monthly imports averaged across the years 2000–2002, illustrates declines in imports of four key species or species groups in the months affected by the SARS epidemic. In April and May of 2003 imports of leopard coralgrouper were 34% and 48% lower, respectively, than the average annual imports over the years 2000–2002. Imports were also lower for green grouper and tiger grouper in April (39% and 11% lower, respectively) and May (16% and 1% lower, respectively). While imports of flowery grouper were 48% lower in April than the 2000–2002 average, imports in May were 31% higher than the 2000–2002 average. While recognising that the SARS event was likely a market demand phenomenon, it is possible that supply constraints influenced these observed declines in import volumes.[6]

During the SARS outbreak, imports from countries in closer proximity to the Hong Kong market did not decline by as much as those from countries farther away, compared with previous years. For example, imports of leopard coralgrouper from the Philippines were not significantly lower than the 2000–2002 average, while imports of this species from Australia dropped by roughly 50% in both April and May 2003. One reason might be that proximity implies lower transport costs, and hence lower total import costs, while another would be the availability of substitute markets. In Australia, local wholesalers reported beach prices being offered to fishers for live fish as low as 15 Australian dollars (AUD) per kilogram during the peak of the SARS outbreak, compared with an average price in April and May across all years from 1997 to 2002 of AUD 25.1 and AUD 25.9, respectively. Moreover, beach prices for frozen and whole fresh fish during April and May of 2003 remained steady at between AUD 16.00 and 19.00 per kilogram, depending on the weight of the fish (G. Muldoon, unpublished data; T. Must, Fish Wholesaler, pers. comm.). According to several wholesale buyers spoken to during and after the SARS outbreak, many fishermen in Australia either sold their fish fresh or frozen to domestic and overseas markets rather than live, or did not fish at all during this period.

**Table 1. Common fish species names used in this article.**

| Common name | Scientific name | Common name | Scientific name |
|---|---|---|---|
| Highfin grouper | *Cromileptes altivelis* | Tiger grouper | *Epinephelus fuscoguttatus* |
| Humphead wrasse | *Cheilinus undulatus* | Flowery grouper | *Epinephelus polyphekadion* |
| Leopard coralgrouper | *Plectropomus leopardus* | Green grouper | *Epinephelus coioides* |
| Spotted coralgrouper | *Plectropomus maculatus* | Giant grouper | *Epinephelus lanceolatus* |
| Mangrove snapper | *Lutjanus argentimaculatus* | | |

5. Patrick Chan (Chairman, Hong Kong Chamber of Seafood Merchants), personal communication.
6. Supply constraints in source countries may be related to weather (monsoon, high winds) or seasonal variations in catch rates.

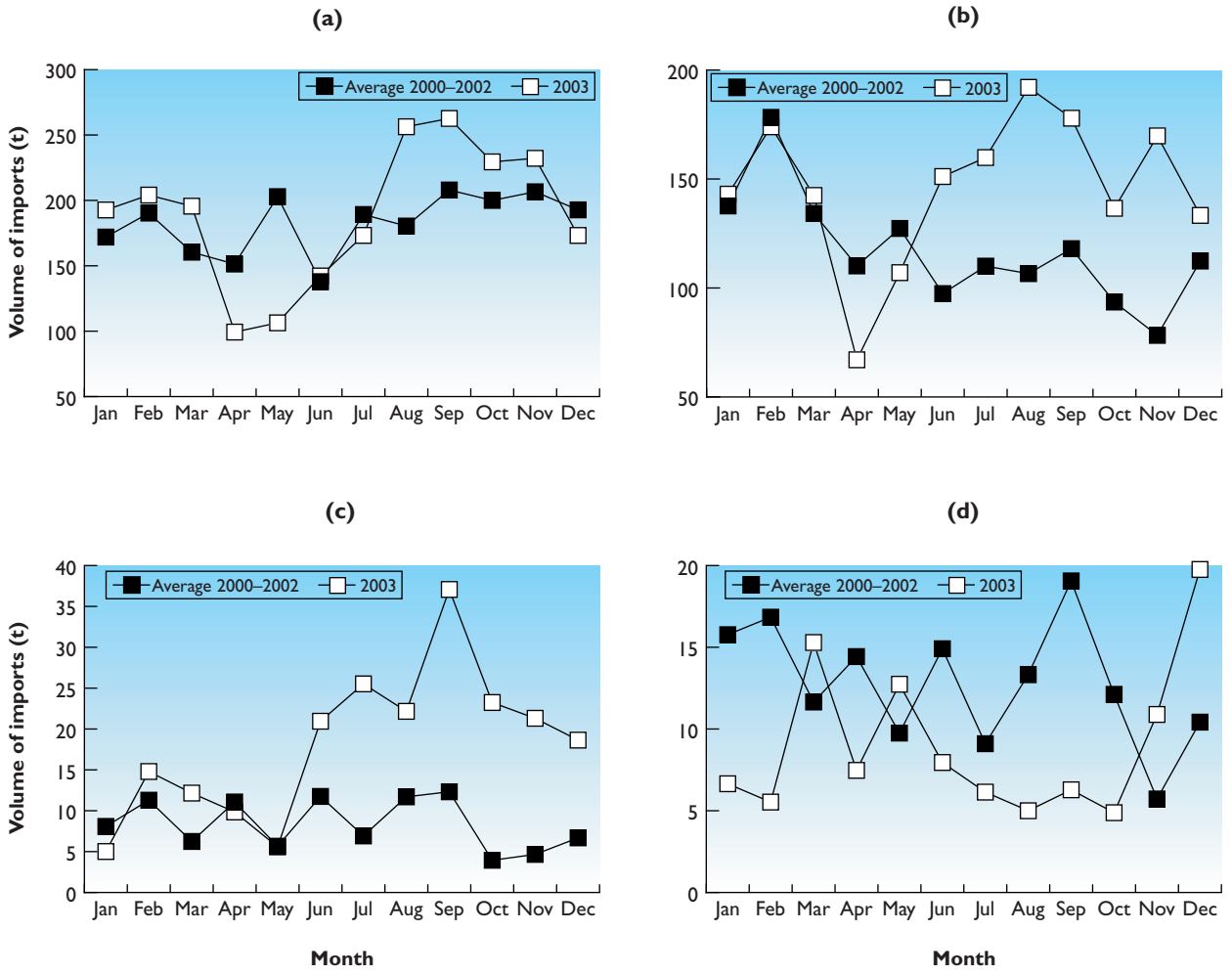


**Figure 2.** **Total monthly volume of imports of four major species or species groups: a) leopard coralgrouper, b) green grouper, c) tiger grouper, and d) flowery grouper, imported into Hong Kong from 2000 through 2003. Monthly import volumes have been averaged across the years 2000–2002 (Source: unpublished data from Hong Kong, China Census and Statistics Department and the Agriculture, Fisheries and Conservation Department).**

Pet-Soede et al. (2004) noted in a previous issue of this bulletin that prices of two high-value species, leopard coralgrouper and highfin grouper, showed little, if any, change in price in response to SARS. They did, however, note substantial price reductions in beach prices received by fishers in Indonesia for live grouper. Similarly discounted prices were "offered" to fishers in Australia, with beach prices during the SARS outbreak 40% lower than average prices for those months over the previous five years (G. Muldoon unpublished data). Although only anecdotal accounts are available for the Philippines, live fish exporters noted that beach prices paid to fishers fell by 20% during the SARS outbreak (B. Cheng pers. comm.). These discrepancies in price variations (in response to SARS) that were experienced by participants in supply and demand countries may be cause to point to market distortions and profit-taking by retailers in Hong Kong, at the expense of fishers and middlemen in supplying countries. Such inferences, however, based on these observations and with limited knowledge of the dynamics of supply and demand, would be difficult to substantiate.

A similar picture emerges for a broader range of species, including mid-value species, such that available data do not provide strong evidence of a SARS impact on price (Fig. 3). Figure 3 compares monthly retail prices in 2003 with monthly retail prices averaged across the years 2000–2002 for four species of grouper. Ignoring SARS impacts, what is of interest is that for all species, with the exception of April for the leopard coralgrouper, monthly retail prices in 2003 were lower than the corresponding monthly retail prices averaged across 2000–2002. This reinforces the anecdotal evidence provided by traders of a downward trend in prices for the whole trade. Again, discerning whether these price variations may be demand or supply

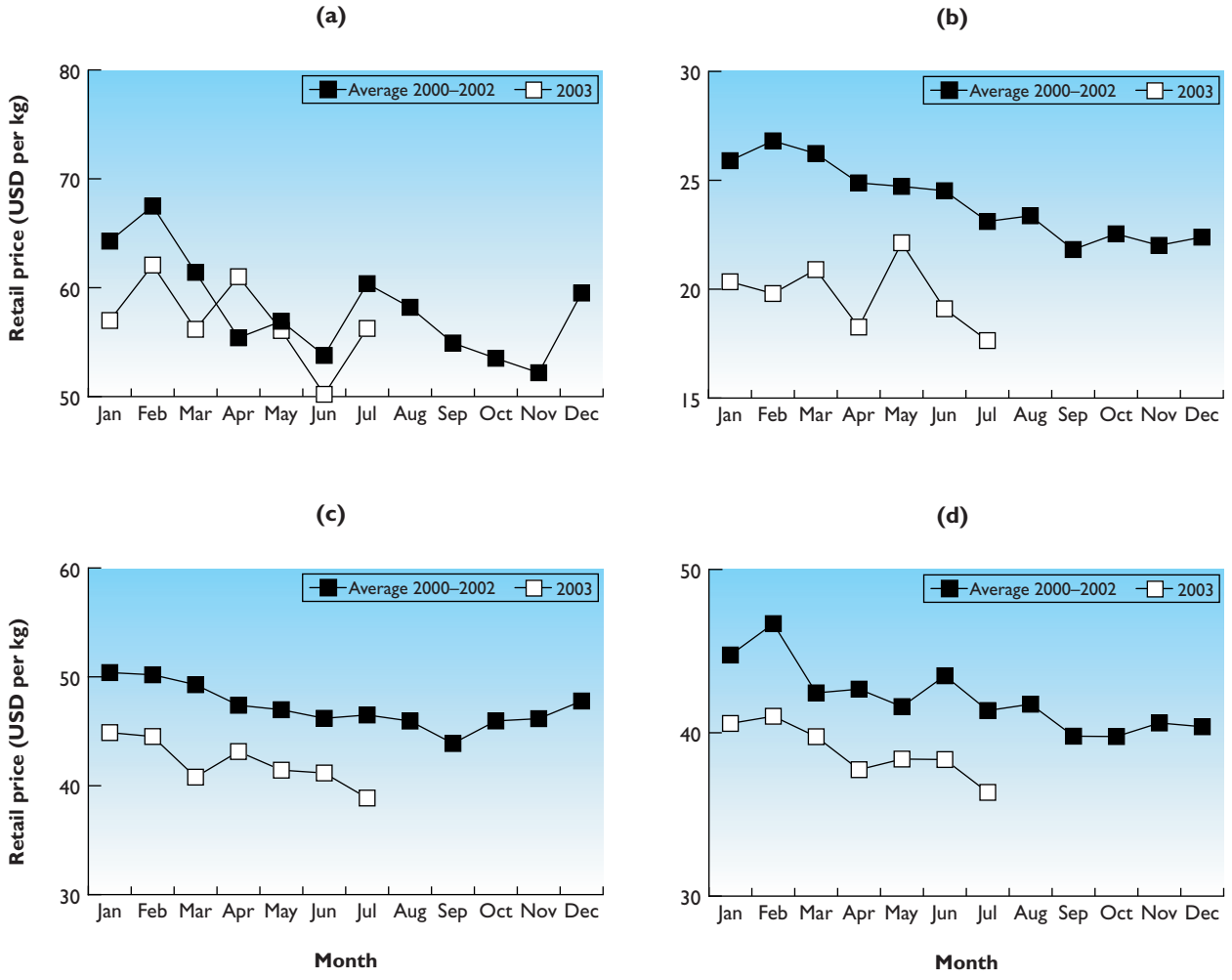


**Figure 3.** **Monthly retail prices in Hong Kong of four major species or species categories: a) leopard coralgrouper, b) green grouper, c) tiger grouper, and d) flowery grouper, imported into Hong Kong from 2000 through 2003. Monthly retail prices have been averaged across the years 2000–2002, while monthly retail prices for 2003 are only available until July of that year (Source: unpublished data from International Marinelife Alliance, Hong Kong).**

responses is difficult based on available data. While prices in 2003 were lower for all species illustrated, patterns of import volumes were not consistent. For example, leopard coralgrouper imports increased relative to the previous year in 2000 (44%) and 2002 (11%) but were stable in 2001, while tiger grouper imports increased in 2000 (36%), 2001 (16%) and 2002 (21%). In contrast, green grouper imports decreased in 2000 (13%), 2001 (5%) and 2002 (20%), as did flowery grouper imports in 2000 (45%), 2001 (7%) and 2002 (12%). A hypothesis that suggests declines in import volumes should lead to price increases is not borne out here. A more likely premise is that the market overall is depressed, as is the Hong Kong economy generally. Further investigation would be required to establish whether the discrepancies in monthly import volumes between years and corresponding price movements are, in general, supply and/or demand responses.

Aquaculture has been identified as both an alternative livelihood to engaging in often-destructive fishing practices and as a means of meeting future demand for the "higher-value" grouper species when many fish stocks in Southeast Asia are showing signs of severe depletion. It is estimated that approximately 40 per cent of all LRFF in the trade are supplied from aquaculture, although the majority of these fish come from grow-out of wild-caught juveniles to market size.

Any benefits from substituting wild-caught with cultured species depend on how successfully the mariculture industry relieves its dependence on wild stocks for juveniles and trash fish for feed through increased hatchery production and development of new diets (Sadovy et al. 2004). Moreover, the market impacts, and specifically price impacts, of this substitution may have significant effects on fisher income.

ACIAR provides funding assistance to a number of mariculture projects of live reef fish species in Indonesia and Vietnam.[7] Those projects have identified a need for economic analysis to quantify key supply and demand relationships in the market, especially with respect to assessing the potential contribution of mariculture in assisting the long-term sustainability of the trade. This project will be collaborating closely with those projects.

## Project overview

The trade in LRFF is largely unregulated, which has led to some undesirable biological, social and economic consequences. The anticipated research outputs from this project will benefit industry participants and management agencies alike, for both existing and potential fisheries. Empirical modelling of supply and demand will enable further analysis of who the major beneficiaries are likely to be from new technologies, economic growth or policy options aimed at improving market performance by, for example, regulation of fishing effort or removing inefficiencies and distortions along the market chain. Another key output will be the inclusion of key cost and revenue components along the market chain, including key risk factors, into a cost-benefit model. A spreadsheet model of the market chain will be constructed that will aid capture fishery managers and the aquaculture sector in assessing the future viability of LRFF capture and aquaculture fisheries in their countries.[8]

The study will focus on the following supplying countries: Indonesia, Philippines, Australia, Papua New Guinea, Thailand, Vietnam, Fiji and the Solomon Islands (although the Solomon Islands is currently not a LRFF supply country it has been in the past and has some potential in the future). During the feasibility study phase of this project, collaborative partnerships were established with the WorldFish Center, SPC and Bogor University. The first is hosting a regional collaborative project involving mainland China, Indonesia, Malaysia, Philippines, Thailand and Vietnam, looking at "Fish Supply and Demand in Asia", while the latter two will assist with information on developments in LRFF fisheries in Southeast Asia and the Pacific.

The overall aim of the project is to enhance the sustainable economic development of the live reef food fish trade, through economic analysis of policy options for improving market performance. The main beneficiaries of this research are likely to be small-scale and subsistence fishers in supplying countries and government agencies charged with the sustainable management of their wild-caught fisheries and investigating the potential for mariculture.

The specific research objectives of the project are to:

1) quantify short- and long-term demand of LRFF in Hong Kong and southern mainland China sourced from the Asia-Pacific region, including developing countries;
2) quantify short- and long-term supply of LRFF from wild-caught and aquaculture production sourced from the Asia-Pacific region, including developing countries;
3) measure the key cost and risk components of the marketing chain;
4) quantify likely future changes in supply and demand for LRFF arising from new technology, management practices and economic growth, and to identify the beneficiaries of these developments;
5) identify the highly-valued product attributes (e.g. colour, taste, texture) of wild-caught and aquacultured LRFF product and to examine these preferences through panel taste evaluation tests;
6) identify possible policy options to improve market performance such as catch and effort controls and adoption of improved technologies in production, storage and transportation; and
7) build capacity in economic assessment throughout the Asia-Pacific region in order to provide and coordinate economic research and disseminate information on the trade utilising the existing LRFF research and development networks (NACA, SPC, WorldFish Center).

Key research outputs of the project are:

- empirical modelling of supply and demand, taking account where possible of new technologies, changing consumption patterns and income growth;
- policy analysis for improving market outcomes for the industry in various stages of the marketing chain (including options for fishery regulation) and identification of the beneficiaries of market improvements;

7. Projects include FIS/1997/073 "Improved hatchery and grow-out technology for grouper aquaculture in the Asia-Pacific region", FIS/2002/077 "Improved hatchery and grow-out technology for marine finfish aquaculture in Asia-Pacific region" and FIS/2003/027 "Environmental impacts of marine cage aquaculture in Australia and Indonesia".
8. In A Collaborative Strategy to Address the Live Reef Food Fish Trade (Graham 2001), developing a cost-effective method for assessing the viability of export-based LRFF fisheries was identified as a key objective.

- a spreadsheet model of all costs and revenues along the market chain, including risk factors, for Australia and two Southeast Asian and two Pacific supply countries to aid fishery managers and the aquaculture sector to assess the future viability of LRFF capture and aquaculture fisheries in their countries; and
- dissemination of the results of consumer preference surveys comparing attributes of wild-caught and aquacultured LRFF products to other ACIAR and NACA mariculture research projects in order to improve hatchery production technologies and the development of new diets.

The information from these outputs will feed into a number of forums over the two-year course of the project. These include research workshops to be held in conjunction with key research collaborators in the region, workshops held by the ACIAR Mariculture Grouper project, the Asia-Pacific Economic Cooperation (APEC) Fisheries Working Group project to develop Industry Standards,[9] the annual conferences of the Australian Agricultural and Resource Economics Society (AARES) and the biennial international conference of the International Institute of Fisheries Economics and Trade (IIFET). There are also good extension opportunities for the outputs of the project through the SPC Live Reef Fish extension network.

Anyone interested in finding out more about the project or discussing it with project participants is encouraged to contact the authors.

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9. For an overview of the Industry Standards project see the article by Kusumaatmadja et al. in the previous issue of this Bulletin (Number 12, February 2004, pages 30–33, http://www.spc.int/coastfish/News/LRF/12/index.htm).