



Noteworthy publications

Anon. n.d. Reef fisheries: Now and for the future; workshop report; July 19–21, 2006, Raffles Tradewinds Hotel, Lami, Fiji. Hosted by Fisheries Research Division, Fiji Fisheries Department, and Society for the Conservation of Reef Fish Aggregations. 34 p. [also available at: <http://www.scrfa.org>]

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Frisch A.J., Ulstrup K.E. and Hobbs J.P.A. 2007. The effects of clove oil on coral: An experimental evaluation using *Pocillopora damicornis* (Linnaeus). *Journal of Experimental Marine Biology and Ecology* 345(2):101–109. [also available at: <http://www.sciencedirect.com/science/issue/5085-2007-996549997-651270>]

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Johnston B. (ed) 2007. Economics and market analysis of the live reef-fish trade in the Asia-Pacific region. ACIAR Working Paper No. 63. Canberra: Australian Centre for International Agricultural Research. 173 p. [also available at: <http://www.aciar.gov.au/publication/WP63>]

Editor's note: The contents of the workshop proceedings are listed below, followed by the entirety of the workshop overview by Brian Johnston.

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- Workshop overview and next steps (Brian Johnston)
- Demand for fish in Asia: A cross-country analysis (Madan Mohan Dey and Yolanda T. Garcia, with M. Sirajul Haque, Jikun Huang, Praduman Kumar, Alias Radam, Somying Piumsombun, Athula Senaratne, Nguyen Tri Khiem and Sonny Koeshendrajana)
- Estimating wholesale demand for live reef-fish as food in Hong Kong (Elizabeth Petersen)
- Survey and taste test for live reef-fish in Hong Kong (Noel Wai Wah Chan)
- Wholesale and retail price integration in the live reef-fish food trade (E.H. Petersen and G. Muldoon)
- Recent developments in aquaculture of groupers in the Asia-Pacific region (Michael A. Rimmer, Michael J. Phillips and Koji Yamamoto)
- The role of the Network of Aquaculture Centres in Asia-Pacific (NACA) in addressing food safety and trade issues in cultured seafood (Koji Yamamoto)

- The impact of mortality and price risk on costs and value distribution along the market chain for live reef-fish as food: a spreadsheet analysis (Geoffrey Muldoon and Bill Johnston)
- Production and marketing of live reef-fish for food in Indonesia (Sonny Koeshendrajana)
- Disaggregated projections on fish supply, demand and trade for developing Asia (Madan M. Dey, U-Primo Rodriguez, Roehlano M. Briones and Chen Oai Li, with Muhammad Sirajul Haque, Luping Li, Praduman Kumar, Sonny Koeshendrajana, Tai Shzee Yew, Athula Senaratne, Ayut Nissapa and Nguyen Tri Khiem)
- Projections of supply and demand for the trade in live reef-fish for food (Roehlano M. Briones)
- Self-fulfilling mistake in the live reef-fish for food trade: a dynamic modelling approach (Akhmad Fauzi)
- Policy options to improve market performance in the live reef-fish food trade (Geoffrey Muldoon)

Workshop overview and next steps

Brian Johnston

Introduction

The Australian Centre for International Agricultural Research (ACIAR) is funding a three-year research project to study the economics and marketing of live reef-fish as food (LRFF) fisheries and trade. It aims to identify the conditions needed for the sustainability of supply and trade in the long term (Johnston and Yeeting 2006).

The first workshop for the project was held in Noumea, New Caledonia on 2–5 March 2005. It brought together for the first time key researchers from around the Asia-Pacific in order to present the project to the Pacific island countries involved in the trade. The workshop was successful in gaining their participation, including the sharing of information among fishery managers and discussion of the potential usefulness of the modelling approaches being developed for the project. The first workshop also secured the ongoing participation of Indonesian fishery researchers. The proceedings of that workshop have been published by ACIAR (Johnston and Yeeting 2006).

The second workshop, hosted by the WorldFish Center (WFC) in Penang, Malaysia, in March 2006, provided the opportunity for researchers to present the major findings of their investigations for peer group review and to identify critical gaps in the research to date.

Demand for live reef-fish as food

Live reef-fish are a food sought by higher-income groups. As incomes rise in Asia, particularly China, the demand for LRFF is expected to grow strongly. Three papers examine aspects of demand for LRFF. Dr Madan Dey's paper provides an overview of the importance of fish in food consumption patterns in Asian economies and how the WFC has undertaken analysis of the future demand for fish using estimated price and income elasticities derived from country data. The income elasticities for all fish types was found to be positive, implying that, as incomes rise in Asia, the demand for fish for food will continue to rise. This has major implications for the ability of fishery systems to continue to meet this demand.

Dr Liz Petersen's paper includes an analysis of the demand for LRFF in Hong Kong, the major market of the region. She found that price is not an important determinant of wholesale demand in the Hong Kong market, but income is. Live reef-fish can be considered a luxury item of food consumption and, compared to other fish products, is relatively unresponsive to price.

Ms Noel Chan's paper utilises a taste test procedure to identify whether consumers could discriminate between wild-caught and cultured fish samples of the same species. A triangular taste test method was used, in which a panel of consumers was presented with three fish samples, one of which was different. The samples were presented "blind" to the consumers. They were asked to identify the odd sample and to judge whether it was wild caught or cultured. It was found that just over 50% of the consumers were able to correctly identify the odd sample. Some 37% of the consumers correctly identified the odd sample as either wild caught or cultured. There was a general preference for the wild-caught sample, although the cultured fish sample was quite acceptable to all consumers sampled.

Developments in aquaculture

Because the future supply of wild-caught LRFF is highly constrained due to the effects of overfishing and destructive fishing practices (Sadovy et al. 2003), future growth in supply to meet rising demand is likely to come mainly from aquaculture. Recent developments in aquaculture production in the Asia-Pacific region are described in the paper by Dr Mike Rimmer and colleagues. This paper updates one presented in the first workshop proceedings (Rimmer et al. 2006). The aquaculture production of LRFF species (principally grouper species) is expanding rapidly in Asia as demand for these fish species exceeds supply from wild-caught sources. China's role in aquaculture production and consumption of LRFF species is significant yet remains poorly understood. Given the likely continued growth in incomes in China and its aquaculture capacity in other species, there is a need to gather better market intelligence on LRFF developments in China.

The Network of Aquaculture Centers in Asia-Pacific (NACA), based in Bangkok, Thailand, is playing a major coordinating role in the development of cultured seafood industries in the region. In his paper, Mr Koji Yamamoto outlines this role and covers NACA's work in improving market access and trade, food safety and trade issues, regional cooperation and information dissemination. A number of the challenges facing aquaculture are being tackled through the Asia-Pacific Marine Finfish Aquaculture Network (APMFAN) and these have direct relevance to the production and trade in live reef-fish species.

Analysis of the market chain

Fishers in relatively poor countries supplying the LRFF trade often do not have good market information. This arises because the market chain from catching to consumption is long and often involves the fish changing ownership along the chain. A frequent complaint from fishers in remote Pacific countries particularly, is that more transparency is required in the market chain. Geoffrey Muldoon and Bill Johnston analyse the impact of mortality and price risk on the costs and value distribution along the LRFF chain. They describe the market chain and develop a conceptual model that includes capital and distribution costs at each point in the chain and the possible impact of risk on production and mortality of the fish as they are transported to the market in Hong Kong. A spreadsheet model that incorporates these aspects is developed, with the intention of applying it to case studies in Indonesia and Papua New Guinea in the next stage of the work.

Production and marketing in the LRFF trade in Indonesia are examined in detail in Dr Sonny Koeshendrajana's paper. The paper reviews the background literature on the LRFF production and trade in Indonesia and provides valuable information on the production structures and financial returns from both wild-caught and aquacultured LRFF. Following the collection of data from key Indonesian institutions associated with the LRFF business, field visits and surveys were used to verify the information. In the wild-caught sector the main types of fishing are trap and hook-and-line, although evidence is also found for illegal fishing using cyanide. Aquaculture production has expanded rapidly since 1999 and now forms an important source of production. The author favours the establishment of a government plan of action to encourage sustainable live reef-fish fisheries in Indonesia and the removal of destructive practices from the fisheries.

Integrating supply and demand analyses

In order to integrate developments in Asian fisheries and to make future projections, the WFC has developed "AsiaFish", a supply and demand model. The development of the base model and its structure is outlined by Dr Madan Dey. The model, which includes the nine key supplying and consuming countries in Asia, includes demand functions for all main food-fish species and supply functions for both wild-caught and aquaculture fisheries. In its base structure, LRFF are excluded, but this is taken up in a following paper by Dr Roehl Briones. Baseline projections and projections of the AsiaFish model under different future scenarios are presented. Key future scenarios examined are higher productivity in the production of low- and high-value fish in aquaculture, reducing fishing effort and compliance with food safety and trade requirements.

In order to develop forward projections of trends and developments in the LRFF trade, the WFC was commissioned to extend its AsiaFish model to include supply and demand relationships for live reef-fish. Dr Roehlano Briones outlines in his paper how this was done and presents some preliminary projections from the initial modelling effort. The AsiaFish model had to be extended in two main ways to incorporate LRFF trade. First, data were collated on LRFF in the main producing and consuming countries for incorporation in the AsiaFish model. Second, data on individual countries' supply and demand had to be incorporated into the model and the major demand centres of Hong Kong and China included. The basic data and modelling

approaches are outlined, and the paper provides production and consumption information, supply and demand elasticities, and details of data weaknesses. Three exporting countries — Indonesia, Malaysia and the Philippines — are included in the initial model with the remaining exporters aggregated into “other”. Some simple projections are undertaken to explore the possible effects of management and technology on the fisheries and trade effects. It was found that the model was sensitive to elasticity estimates for Hong Kong — China as well as elasticities of substitution.

A paper by Dr Akhmad Fauzi outlines a new approach to modelling live reef-fish fisheries in Indonesia. In his research he applies the theory of the backward bending supply curve in a fishery to examine the dynamic conditions in a fishery for live reef-fish where the resource is limited and over-exploitation can easily occur. Applying this approach to a case study based on the Indonesian LRFF in southern Sulawesi yields some interesting results. Most notable is that, if the fishers continue to respond to increasing demand by additional fishing effort without regard to the impact on the productivity of the fishery, a chaotic dynamic occurs and the fishery collapses. This implies that fishers need to be fully informed about the possible consequences of increasing effort as prices rise and the need to ensure that there are controls over access to the resource. Further research is needed to validate the parameters of the model and to examine the economic, environmental and social consequences of new management approaches in the LRFF industry in Indonesia.

Regulation and management of the trade

The policy options for the regulation and management of the LRFF fisheries are reviewed by Geoffrey Muldoon in the final paper of the workshop. It is concluded that the unique features of these fisheries across the Asia-Pacific region will make effective management difficult to implement. These features include the limited productivity of the fisheries, the wide geographic spread of areas from which fish are taken—making policing of illegal fishing practices difficult, and the limited resource information currently available on which to base effective management strategies. Further work is needed to identify the costs and benefits of possible management strategies that could be implemented to change these fisheries from open-access to managed fisheries. Such analyses need to consider economic, environmental and social aspects.

Conclusions and next steps

The workshop participants agreed that the final stages of the project needed to focus on developing projections on further development of the LRFF trade, taking into account likely constraints on growth in a wild-caught sector that was, in many cases, already fully or overexploited. In contrast, scope for expansion exists in the aquaculture sector of the LRFF trade, particularly as the technology of hatchery production of higher-value species becomes more widely adopted. The aquaculture sector dependent on juvenile fingerlings or young fish caught from the wild is also likely to be highly constrained due to reduced stocks of wild fish.

The model developed by the WFC has considerable potential to provide projections of supply of and demand for LRFF from the major Asian countries, including China, that are already participating in the trade or developing major aquaculture capacity. It was agreed the model be extended to include all major Asian producers (Indonesia, Malaysia, the Philippines and Thailand), China and “other” (which includes Australia and Pacific island countries). There is a need to include both the wild-capture and aquaculture sectors in each country and two categories of production, low-priced species and high-priced species. Demand would be modelled for Hong Kong and China.

The market chain model also has considerable scope for further development to include case studies of Asian and Pacific island country fisheries and to include risk analyses. The information collected on the Indonesian fishery would provide a strong basis for a case study, for example.

A key challenge for the future is to identify management arrangements that would effectively constrain fishing effort in many wild-caught fisheries and stamp out unsustainable practices that damage coral reefs, such as cyanide fishing and use of explosives. The team will focus on these issues in the next stage of the project, to identify potential benefits and costs of improved management arrangements for the wild-caught fisheries across Asia and the Pacific.

The potential for aquaculture to meet the rising demand for LRFF as incomes grow across Asia and China is promising, but there are many issues warranting ongoing research. This economics and marketing project is closely integrated with the ACIAR marine finfish aquaculture project being coordinated by Dr Rimmer.

Further research and development will focus on improving the long-term sustainability of aquaculture to support the LRFF trade as well as other markets. Topics to be investigated include improving the quantity and quality of seedstock supply from hatcheries, developing sustainable grow-out feeds, documenting and promoting best management practices and addressing market issues. The growing affluence of China is a key demand issue to be studied, as is the current stated consumer preferences for wild-caught over aquaculture product. Consumers also seem to have a growing awareness of the negative impacts of both capture fisheries and aquaculture, and demand is increasing for sustainably produced fish. Improving the sustainability of the LRFF trade through both capture fisheries and aquaculture remains a significant challenge for fishers, traders, merchants and governments.

A number of follow-up actions were initiated at the workshop. The WFC is being contracted to extend the supply and demand model to include China and Thailand as supplying countries, to include two broad categories of LRFF—higher- and lower-value species, and to allow welfare effects to be captured in the model output. The market chain model is to be further developed to include risk analysis and to develop two possible case studies—one for a Pacific country and one for Indonesia. The demand analysis is to continue, to incorporate later data where these are available. All authors are continuing to develop their papers in preparation for publication in the final report for the project, due in 2007. Overall, the workshop was very successful in providing high-quality input into the research project, identifying gaps in data, information and analysis, and in providing expert guidance for the next stage of the work.

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