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International Agricultural Research**



# Resilient Small-scale Fisheries Symposium

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# 147

Research that works for developing countries and Australia

# Resilient Small-scale Fisheries Symposium

Proceedings of a workshop held in Penang,  
Malaysia, 5–7 September 2017

*Editors:* Philippa Cohen, Cindy Huchery and Matthew Roscher



**Australian Government**

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**Australian Centre for  
International Agricultural Research**

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Cover Mrs Bitinesi drying her parboiled *Engraulicypris sardella* (Usipa) in a solar tent fish dryer at Msaka Fishing Community along Lake Malawi. Usipa is caught by a crew of ten people using a Chilimira fish net. The solar tent fish dryer in the picture is an improved fish processing technology that is being tested and adapted through research under the IDRC/ACIAR funded project 'Improved Processing and Marketing of Healthy Fish Products in Inland Fisheries in Malawi'. Without the solar tent fish dryer there are higher rates of fish spoilage, leading to poor prices at market. The solar tent fish dryer is one technology that has helped to reduce post-harvest fish losses, increase incomes and reduce drudgery amongst women along Lake Malawi (Photo: Asafu Chijere).

# Foreword

Fishing is a critical contributor to global food and nutrition security. Demand for fish will continue to rise, according to the best estimates by the OECD and the World Bank. Despite the growth of aquaculture, capture fisheries will continue to supply most of the fish consumed in much of the developing world over coming decades. The great majority of these fisheries are small-scale, operating in rivers, lakes and wetlands, and estuaries and coastal seas.

Small-scale capture fisheries (SSF) generate food and income, often where formal markets and supply chains function poorly. Pressures from within and external to SSF threaten sustainability and the equitable distribution of the benefits they provide. The social, ecological and institutional complexity of small-scale fisheries has thwarted the search for universal solutions.

Small-scale capture fisheries have long been a sector of focus of the Australian Centre for International Agricultural Research (ACIAR). The overarching goal of the ACIAR Fisheries program is to improve the productivity and sustainability of fisheries, alongside investment into aquatic farming systems, in partner countries and in Australia, through international research partnerships. Capture fisheries research is directed towards innovative resource management approaches, the elimination of serious adverse environmental impacts arising from fishing practices, and better use of existing harvests.

Ongoing and innovative efforts to realise each of these three outcomes are strongly reflected in the research presented and discussed at the Resilient Small-scale Fisheries Symposium hosted by WorldFish and the CGIAR Research Program on Fish at Penang, Malaysia, in 2017. We are very pleased that our funding enabled this science meeting to happen successfully. The diversity of presentations captured within this proceedings mirrors the diversity and dynamism of small-scale fisheries. Discussions during this symposium illustrate that small-scale fisheries are a distinctive productivity sector—worthy of special attention and focused research.

The critical reflections on the role of research in making tangible and equitable contributions towards poverty alleviation and livelihood improvement reflect the niche position of research in development and the opportunities for positive change this offers.



Professor Andrew Campbell  
Chief Executive Officer  
Australian Centre for International Agricultural Research



# Preface

Small-scale capture fisheries (SSF) play a critical, and often irreplaceable role in nutrition and livelihood security—particularly in developing country contexts. Yet, SSF and their benefits are poorly accounted for by national and regional fisheries, food security, and development policy. This oversight is attributable, in part, to limited empirical evidence of the scale of benefits provided by SSF, the consequences that would result from their dysfunction and a lack of solutions fit to account for contemporary social, ecological and economic trade-offs. The information deficit that plagues SSF is also reflected by the challenges that SSF research faces in measuring and accounting for impact. While a number of initiatives have sought to better account for the contribution of SSF, and the impact of research efforts, there remain significant data gaps. The deficit of evidence and dispersed nature of existing evidence seriously hinders the ability to maintain a profile of SSF in the food security, nutrition and environment policy arenas. The justification and sound design of a research agenda able to address some of the challenges SSF face is similarly challenged by the deficit of evidence of impact.

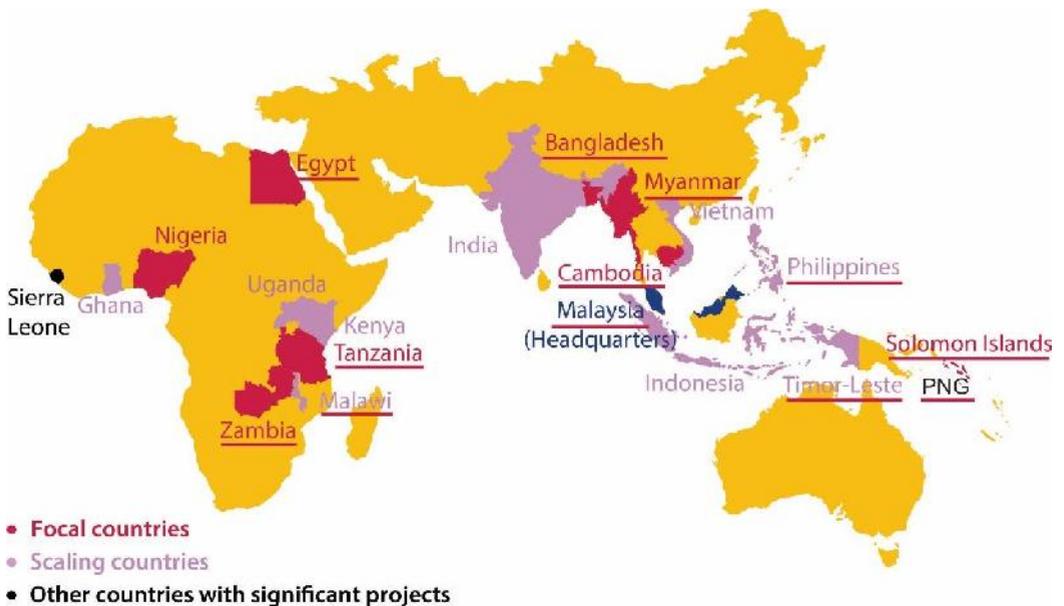
The *Resilient Small-scale Fisheries Symposium* offered an opportunity to WorldFish and our partners to critically examine, collate and refine the range of research approaches employed to understand and improve SSF. The symposium set out to: (1) facilitate linkages between SSF researchers—including those with a focus on gender, nutrition and aquaculture; (2) create a synthesis of evidence of the impact of SSF research towards food and nutrition security, livelihoods and equity; and (3) strengthen a SSF research program in terms of research alignment, quality and impact.

The overarching questions for researchers who hold a concern for realising development outcomes through their work is ‘have past investments in SSF led to wellbeing improvements for poor people?’ and ‘how can future investment in SSF research contribute to positive impacts on the wellbeing of the poor?’ To examine these questions the symposium focused on research findings and the role of research around six overarching themes (Figure 1). Within sessions, researchers illustrated through their presentations the diversity of SSF, the range of geographies and the distinctive systems they are working in, as well as the different ways in which research is used to understand and catalyse development outcomes.



**Figure 1.** The sessions of the SSF symposium that broadly reflect the hypotheses for research entry points and research impact indicated in the CGIAR Research Program on Fish Agrifood Systems (FISH), Flagship 2 proposal (Source: P. Cohen)

These proceedings serve as a brief summary of the *Resilient Small-scale Fisheries Symposium* and as a window into the breadth and depth of research being undertaken around SSF. Research was presented from more than 12 different countries across Africa, Asia and the Pacific (Figure 2). SSF systems described by research included coral reef ecosystems (Figure 3a), coastal pelagic waters, rice fields (Figure 3b), rivers and estuaries (Figure 3c), large inland lakes, and constructed or artificial water bodies. Research approaches included large dataset global studies to local single-community case studies, historical accounts for forward-looking scenarios of food production, national-level assessments of governance capacity to accounts of participatory processes used to navigate conflict and build governing capacity, and gender-transformative approaches applied alongside what might be considered more ‘classic’ fisheries management and development efforts.



**Figure 2.** The countries of focus in the FISH CGIAR Research Program. Research from those countries underlined was presented at the symposium (Source: WorldFish Strategy 2017–2022).



**Figure 3.** (a) Father and son fishing in Lau Lagoon, Solomon Islands (Source: Johan van der Ploeg). (b) Fisherman retrieving bamboo trap from a rice field fishery, Boeng Kbal Khla Community Fish Refuge, Battambang, Cambodia (Source: Chhuon Leang). (c) Hauling in a hilsa catch in Bhola, Bangladesh (Source: Mohammad Mahabubur Rahman).

The presentations and discussions had a particular focus on research that is tightly tied to, and embedded within, processes to realise development outcomes. The summary of each session is overviews and discussions relative to the propositions and approaches to SSF research for development proposed in the CGIAR Research Program on Fish Agrifood Systems (FISH), and in particular the program's SSF-focused Flagship 2 proposal.

Two keynote presentations provided broad perspectives first on the emergence, through time, of small-scale fisheries onto a research and development agenda (Box 1) and second on the role and implementation of research on pathways to impact (Box 2).

#### **Box 1. Keynote presentation, Simon Funge-Smith**

##### **'Small-scale fisheries on a research development agenda; How did we get here?'** **Simon Funge-Smith, Food and Agriculture Organization of the United Nations**

Simon Funge-Smith provided a historical account of the emergence of the framing of SSF into global discussions on fisheries, environmental sustainability and development. The term SSF emerged from what was predominantly referred to historically as artisanal fisheries. The first mention of SSF was in the 1992 UN Earth Summit, but it was not until the late 1990s that the Advisory Committee on Fisheries Research of the Food and Agriculture Organization specifically discussed SSF. It was as recent as 2005 that SSF became a standing item of discussion on the agenda of the Advisory Committee and there was a call for better assessment and tools to study SSF. In 2008 a global conference was dedicated to SSF and the first steps were made towards what is now the *Voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication* finalised in 2012. In the same year, the first comprehensive global quantification and value of hidden capture fisheries, the SSF, was conducted. But, Simon concluded, even in 2017 we still do not know the value of SSF contributions to economies, human wellbeing, and food and nutrition security.

Simon asked in his plenary, 'How can we see that research contributes to outcomes for small-scale fisheries?' Understanding impacts and change in SSF is hard because the benefits that SSF provide are frequently intangible values. Simon set three challenges towards which research should contribute. First, we still have an insufficient understanding of the value of SSF. Second and related, we do not have an understanding of the costs that would be involved in replacing the services that SSF provide and, conversely, what are the savings made on mitigating strategies (return on investment) that avoid the loss of SSF benefit and functions. Third, we need to provide critical assessments of how research contributes to international instruments and how research informs policies at different scales. Fourth, Simon reflected that we, as researchers, have a major role to play in addressing public perceptions; the media sees conservation, biodiversity and the need to protect the oceans but does not adequately portray people fishing in the oceans and the need to protect livelihoods, and people have a poor perception of how SSF work. Simon described a large global analysis that was just now commencing, referred to as Hidden Harvest II, which will evaluate fisheries from an economic perspective but will examine in depth the broader dimensions of SSF

**Box 2. Keynote presentation, Chris Barlow**

**‘Small-scale fisheries—pathways to impact’**

**Chris Barlow, Australian Centre for International Agricultural Research**

In his keynote address, Chris Barlow reflected on pathways to impact for investments into SSF governance and research, using an historical investment in the improved governance of the Mekong’s inland capture fisheries as an example of substantial success. The Mekong’s inland capture fisheries represent 2% of the world’s capture fisheries landings. This is equivalent to two million tonnes per year (70,000 semi-trailers full of fish), represents 40–80% of animal protein eaten in the region and supports the livelihoods of many millions of people. Yet, at the commencement of the Mekong Fisheries Program, fisheries were not considered important; irrigation and hydropower were considered as priorities. Over 15 years the Mekong Fisheries Program raised the profile of fisheries to be the first priority in discussions about the river.

Chris identified several factors that he attributed to the success of the program, largely related to the enabling environment for program success. These were: (1) a long-term relationship with a major donor; (2) a dedicated, engaged and long-term leadership team; (3) strong partnership and linkages with national fisheries agencies; (4) effective, multi-faceted and substantial communication efforts supported by 30% of total funding directed towards communication; (5) the institutional context allowed the program to interact with the river commissions of four countries, and acted as a forum for communication, political dialogue and international advocacy; (6) research was produced based on robust data, including those used for valuation of the fishery benefits; (7) research findings were validated by aligned, but external to the program, research (conducted by WorldFish mainly); and (8) policy engagement and advocacy was supported by non-government organisations who helped to push fisheries issues to the front of the public discourse.

Whilst the project was a substantial success, Chris conceded that when hydropower became influential, the social concerns—associated with smaller-scale fisheries—became overshadowed by discussions about economic gains of hydropower. Chris highlighted an example of an influential study that had demonstrated the economic value of fisheries, and used replacement costs to illustrate the scale of lost fish protein due to the dams. Chris reiterated the point made by Simon Funge-Smith that studies like this, of the replacement value and value of fishery, are critical when large development and economic interests become influential—yet he concluded that these studies are not done enough or not done well. Chris similarly reflected on communication—that a characteristic of fisheries systems is their complexity; however, communicating complexity and fisheries values needs to be done clearly and strongly aligned to a different audience.



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# Acknowledgments

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# Agenda

<b>Day One: Tuesday 5 September 2017</b>	
8:00-8:30	Opening remarks. <i>Blake Ratner</i>
8:30-8:50	Realising development outcomes: challenges and opportunities for small-scale fisheries research. <i>Pip Cohen</i>
8:50-9:10	Strategic partnerships and resourcing for research and development impact. <i>David Shearer</i>
9:10-9:20	Celebrating and catalysing research and development outcomes through communications. <i>Toby Johnson</i>
9:20-9:30	Online measures of research impact, performance and visibility. <i>Cindy Huchery</i>
9:30-9:50	Media representations of fish for Pacific island food security. <i>Sarah Sutcliffe</i>
9:50-10:10	Conceptualising, achieving and measuring impact. <i>Ravinder Kumar</i>
10:10-10:40	Morning tea
10:40-11:40	<b>Discussion. Session chair: Pip Cohen</b>
11:40-12:00	Community-based resource management in north-east Bangladesh. <i>Firoz Khan</i>
12:00-13:00	Lunch
13:00-13:20	Conservation for sustaining livelihoods: ecosystem-based adaptive co-management of freshwater fisheries in Cambodia. <i>Kosal Mam</i>
13:20-13:40	Rice field fisheries in Cambodia: enhancing the productivity through community-managed fish refuges. <i>Miratori Kim</i>
13:40-14:00	Post-harvest loss management of small fish pelagics in Lake Malawi. <i>Joseph Nagoli</i>
14:00-14:20	Equity and ecosystem services in coral reef small-scale fisheries: understanding social difference, values, priorities, and fairness. <i>Jacqueline Lau</i>
14:20-14:40	Applications of GIS in aquaculture and resilient fisheries. <i>Shwu Jiau Teoh</i>
14:40-15:10	Afternoon tea
15:10-16:10	<b>Discussion. Session chair: David Mills</b>
16:30-18:30	Cocktail party
<b>Day Two: Wednesday 6 September 2017</b>	
8:00-8:30	Keynote: Institutional intersections for enhancing research in development on SSF. <i>Simon Funge-Smith</i>
8:30-8:50	A (almost) blank canvas: building a sustainable, nutrition-sensitive fisheries sector in Timor-Leste. <i>David Mills</i>
8:50-9:10	Multi-scale policy translation in Pacific islands coastal fisheries. <i>Andrew Song</i>

**Session 1.  
Tracking and  
realising  
research  
impact and  
development  
impact**

**Session 2.  
Fisheries  
management  
and technology**

9:10-9:30	Improving governance of inland fisheries in the Ayeyarwady Delta. <i>Xavier Tezzo</i>	<b>Session 3. Governance, institutions and external drivers of change</b>
9:30-9:40	Prospect of fisheries in Africa: business-as-usual projections with the IMPACT fish model. <i>Chin Yee Chan</i>	
9:40-9:50	Prospect of fisheries in Africa: baseline projections with the IMPACT FISH model. <i>Nhuong Tran</i>	
9:50-10:10	Exploring prospects for increasing fish production and adapting livelihoods in man-made water bodies in the Mekong basin. <i>Sonali Senaratna</i>	
10:10-10:40	Morning tea	
10:40-11:00	Securing SSF benefits: village by village or institutional reform. <i>Hugh Govan</i>	
11:00- 11.15	TBTI and book launch: 'Inter-Sectoral Governance of Inland Fisheries'. <i>Andrew Song</i>	
11.15-12:00	<b>Discussion. Session chair: Blake Ratner</b>	
12:00-13:00	Lunch	<b>Session 4. Gender and equity</b>
13:00-13:20	Gender and equity in SSF research: dimensions and directions. <i>Cynthia McDougall</i>	
13:20-13:40	Towards building better women-responsive fish value chains. <i>Chikondi Manyungwa-Pasani</i>	
13:40-14:00	Gendered post-harvest losses between women and men informal fish retailers in Aswan, upper Egypt. <i>Seamus Murphy</i>	
14:00-14:20	Gender-transformative approaches: applying approaches from AQ to SSF. <i>Afrina Choudhury</i>	
14:20-14:40	Bridging policy, research and practice: integrating gender considerations in small-scale fisheries investments. <i>Sarah Lawless</i>	
14:40-15:10	Afternoon tea	
15:10:16:10	<b>Discussion. Session chair: Cynthia McDougall</b>	
<b>Day Three: Thursday 7 September 2017</b>		
8:00-8:30	<b>Keynote: Some donor commentary on R&amp;D on small-scale fisheries. Chris Barlow</b>	<b>Session 5. Food and nutrition security</b>
8:30-8:50	Dried small fish: a super food for the first 1,000 days of life to build healthier and more prosperous nations. <i>Shakuntala Thilsted</i>	
8:50-9:10	The contribution of small-scale fisheries to nutrition in Solomon Islands rural communities. <i>Joelle Albert</i>	
9:10-9:30	Steady, reliable and low technology: recognising and strengthening the role of women and youth in fisheries food security in Timor-Leste. <i>Alexander Tilley</i>	
9:30-9:50	Poverty, food and water insecurity in fishing communities: evidence from the Philippines. <i>Michael Fabinyi</i>	
9:50-10:10	Drivers of nutritional quality and the potential for meeting global nutritional needs from fisheries. <i>Christina Hicks</i>	
10:10-10:40	Morning tea	
10:40-11:00	The vital role for capture fisheries in contributing to nutrition: lessons for nutrition-sensitive approaches along the continuum of fish production systems. <i>Jessica Bogard</i>	

11.00-12:00	<b>Discussion. Session chair: Shakuntala Thilsted</b>	<b>Session 6. Livelihoods and value chains</b>
12:00-13:00	Lunch	
13:00-13:20	Global-to-local sourcing networks and sustainability of small-scale fisheries. <i>Hampus Eriksson</i>	
13:20-13:40	Technical and social innovations to help fish processors shift in pathway out of the social-ecological trap in the Barotse Floodplain fishery, Zambia. <i>Steve Cole</i>	
13:40-14:00	Sardines in Timor-Leste: characteristics and contributions of a small pelagic fishery, <i>Kimberley Hunnam</i>	
14:00-14:20	Fish from small-scale coastal fisheries, or tilapia pond aquaculture? <i>Daykin Harohau</i>	
14:40-15:10	Afternoon tea	
15:10-16:00	<b>Discussion. Session chair: Gareth Johnstone</b>	
16.00-16:15	<b>Next steps. Pip Cohen</b>	
16.15-16.30	<b>Closing remarks. Gareth Johnstone</b>	

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# Session 1: Tracking and realising research impact and development impact

This first session focused less on small-scale fisheries research, but instead was designed to draw attention and discussion to the more overarching elements that are now considered as critical components of a research in development program. The elements of research in development discussed here were: (1) partnerships that enhance impact; (2) communication strategies for influence and impact at scale; (3) evaluations of public and media perceptions; (4) strategies to ensure competitive and visible research profile; and (5) rigorous and transparent evaluations of progress along impact pathways. Individuals and programs working on research for development cannot focus solely on numerous or high-profile publications, or on promotion of messages or activities through communication and outreach. A research in development program must resource, and address, all of these five components.

The first presentation looked at resourcing and partnerships as critical foundations for a research for development program. David Shearer described some of the global shifts in the donor landscape. A result of these more competitive funding environments was illustrated by a challenge the WorldFish-led SSF program was facing, i.e. the availability of funds from more traditional donors was lower, and these donors were prioritising investments in more classic agricultural sectors that could, arguably, make more straightforward cases for historical and future return on investment. David Shearer described the critical role of partnerships to ensure research was responding to locally, nationally and regionally identified priorities and opportunities for impact. ‘Getting partnerships right’ (and the strategies and decisions used to do that) were fundamental to ensure that research was conducted in a way that would ultimately realise sustainable and equitable development outcomes. One perspective of this way of researching in different partnerships is described by the ‘change mechanisms’ described for the Flagship proposal on SSF. Discussions highlighted that in the design, delivery and scaling of small-scale fisheries research there were three different typologies of partners (and described in the Flagship 2 proposal) to ensure science quality places relevance and development outcomes and impacts at scale.

The second element described was the strategic use of communications that extended research to, but critically beyond, a science audience. Toby Johnson, who leads the WorldFish and FISH communications work, described the use of a variety of communication strategies, products and channels that could be used to fit the objectives of raising profile, communicating research and influencing policy. Discussions neatly summarised that ‘communication is more than just promotion, it’s a tool of engagement’.

Sarah Sutcliffe (an honours student with James Cook University/WorldFish) viewed communications more from the consumer side, by employing discourse analysis to determine what information and perspectives about the role of fish for food security were actually being reported by media. Sarah highlighted that there is in fact a clear disconnect between scientific and media discourse around the topic. The insights from her research offer key points to which a communication strategy might respond to increase reach and accuracy in the media.

Ravinder Kumar (a Monitoring, Evaluation and Impact Specialist from the Natural Resources Institute at the University of Greenwich) described the development of logic behind an impact pathway for the Flagship 2 research in development program, and the opportunities and challenges in using this as a framework for designing and implementing monitoring and evaluation (M&E). Discussion highlighted that in a research in development program any M&E system cannot be considered as separate—it is built on science and so our research is an integral part of it.

A substantial part of the discussion that ensued after these presentations focused necessary responses to the shifting and challenging funding landscape. It was noted that there is a fundamental issue with work that is focused on natural resource management; ‘donors don’t want to hear that we are just stopping further degradation, government donors want to hear about production increase’. ‘That’s why aquaculture gets an easier time than wild-capture fisheries including small-scale fisheries—despite the fact it is just as

important'. It was surmised that in talking about research and development investments in SSF, we needed to use language about the improvements that will be realised, not just about maintaining status quo. There are enormous positives associated with SSF, such as the number of people involved who have no other opportunities for income and livelihood, and the fact that fish are incredibly nutritious and vital for people's health.

Discussions concluded that we need to articulate, more convincingly and clearly, the return on investment—in framing this, it was noted that the delivery of public good is different from the delivery of impact. There is currently no convincing argument for investment for SSF. We need to clearly answer 'What is the value of secure livelihoods and secure nutrition?' Research is not putting a price on this—yet the perspective shared was that this offers a convincing case. Simultaneously, discussants noted the risks of assigning monetary values to non-monetised services and benefits small-scale fisheries provide.

# Strategic partnerships and resourcing for research and development impact

David Shearer<sup>1</sup>

## *Abstract*

WorldFish's vision is 'to be the research partner of choice for delivering fisheries and aquaculture solutions in developing countries.' Our strategy (WorldFish 2016) outlines how we are committed to delivering impact through partnerships as we believe the most 'effective impacts are delivered through multi-stakeholder partnerships that share a common vision of how innovation and science underpins the development of fisheries and aquaculture systems in developing economies.'

The WorldFish strategy identifies engagement with national agricultural research and extension systems (NARES) as critical, development institutions as playing a critical role in impact pathways, advanced research institutes complementing WorldFish's research capacity, a need to integrate with CGIAR centres given the complexity of challenges and an interest in expanding collaboration with the private sector. The Independent Evaluation Arrangement of the CGIAR conducted an 'Evaluation of Partnerships in the CGIAR', which is the first comprehensive assessment of the CGIAR's engagement in partnerships. The evaluation concluded that the most effective CGIAR partnership allowed each partner to work to their comparative advantage. The CGIAR comparative advantage was identified as a combination of two factors: presence in, and knowledge of, many countries where it works; and a reputation as a solid scientific partner, in some cases a world leader. WorldFish's model for impact through science, advocacy, development and resourcing is evolving in a complex and dynamic environment. Focused and strategic partnerships will be the key success factor to strengthen livelihoods and improve food and nutrition security through fisheries and aquaculture research.

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# **Celebrating and catalysing research and development outcomes through communications**

**Toby Johnson<sup>1</sup>**

## *Abstract*

Effective communications give visibility to our research and are essential to achieving research and development outcomes at scale. Whether focused on outputs, outcomes or interim reporting, communications are also a critical element in terms of raising awareness of the work, generating stakeholder support, and raising the profile of research potential and impact amongst policymakers and funders. The FISH communications capacity will support: a comprehensive and proactive media outreach approach; dedicated and active support for online resources, such as a dedicated website and building communities via social media and print publications; and development, coordination and participation in strategic events and policy initiatives. The different channels and products will provide a route to influence specific audiences including partners, donors and policymakers. The program will embrace a culture of knowledge sharing and learning that sustains productive relationships, partnerships and networks, including linkages across CGIAR Research Programs. We will also provide publicly accessible reporting on progress towards outcomes, demonstrating accountability towards funders, partners and local stakeholders. Aligned communications will ensure that we are all telling the same story and this will be critical as we interact with the various different interlocutors. Activities will set out to communicate research and impact in a way that positions FISH as the research program of choice to affect development outcomes in our target geographies.

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# Online measures of research impact, performance and visibility

Cindy Huchery<sup>1</sup>

## *Abstract*

SSF research-for-development ultimately seeks to deliver measureable development impacts. Yet, simultaneously, research performance and impact are judged based on measures of research output and uptake within academia itself. Increasingly these measures of research quality, output and uptake are determined using online resources and tools. Given that an online presence and measures of performance are now the main way in which organisations, researchers and research outputs are found and assessed, how do we ensure that we have a strong online research presence? In this talk, I will use examples from WorldFish, in particular small-scale fisheries research, to examine current research standing. I will then go through a few key steps that an organisation and individual researchers can take to make sure that they, their research and their organisations are visible online in way that reflects the quality of research we undertake. I explain, from a range of perspectives, why each measure and tool is important.

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# Media representations of fish for Pacific island food security

Sarah Sutcliffe<sup>1</sup>, Philippa Cohen, Amy Diedrich, Andrew Song

## *Abstract*

There is overwhelming consensus among academia, civil society and national governments across the world that fisheries, especially small-scale fisheries, are critical for food security, particularly in small island developing states (Bell et al. 2009). What is still unclear is whether a similar image of fisheries, food security and marine issues is being presented to the public and influencing their perceptions. It has been shown that for social and environmental issues such as climate change, media coverage exerts a much stronger influence on public opinion than direct exposure to scientific information (Brulle et al. 2012); both by drawing widespread attention to the issue and shaping public discourse (Holt and Barkemeyer 2012; Mazur and Lee 1993). The aim of this research is to determine how the concept of 'fish for food security' is prioritised and represented in media discourse in the Pacific, relative to expert discourse. A systematic analysis of media discourse was used to determine what representations of fisheries and food security in the Pacific are reaching the public, both in Pacific island countries and territories, using Solomon Islands as a case study, and in Australia. The analysis shows how prominently the subject is featured in media, relative to other mainstream issues in the Pacific, the context in which fisheries are discussed, sources of information frequently utilised by journalists, and the language used to describe fisheries and the role they play in the food security of the Pacific Islands. To provide further context, key stakeholder interviews of journalists as well as representatives of fisheries management agencies, researchers and non-government organisations (NGOs) have been used to investigate the extent to which agencies deliberately collaborate with media to communicate with the public, the methods used to collaborate with media organisations, and their perceptions of media coverage of the issue of fisheries and food security. The combination of the interviews and media analysis reveals gaps in media coverage of specific fisheries and food security issues, as well as identifying concerns of the public and media, which are not adequately addressed or communicated by researchers and policymakers. The knowledge gained from this research can be used to assist governments, NGOs and other stakeholders in communicating more effectively with the public, to build support for managing fisheries for food security and achieving the goals outlined in the New Song and the SSF guidelines.

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# Conceptualising, achieving and measuring impact

Ravinder Kumar<sup>1</sup>, Adrienne Martin

## *Abstract*

Sustaining and increasing the contribution of small-scale fisheries to poverty reduction, food and nutrition security requires a three-dimensional approach: conceptualising, achieving and measuring impact. This paper presents preliminary options and emerging ideas for the FISH CGIAR Research Program, Flagship 2 proposal (small-scale fisheries) to consider for improving conceptualisation, achievement and measurement of research and development impact. Through a series of relevant examples connected with the FISH CGIAR Research Program theory of change, the paper demonstrates how a better understanding and reflection on research outputs, research outcomes and development outcomes can avoid confusion in these result statements in the visualised impact pathway of each research stream/cluster of activities within the FISH CGIAR Research Program. Each research activity has its own vision and a story to tell as to how 'change' will happen (originally captured in the change mechanisms described in the CGIAR Research Program proposal). These should be succinct statements of the research outputs and research outcomes, and how they lead to development outcomes, laid out as a theory of change. It is important for the FISH CGIAR Research Program to consider intermediate links ('what it takes' to reach there) between these elements. These intermediate links have the potential to better define and build the logic within the theory of change, and also can help the CGIAR Research Program in understanding missing links (if any). In practical terms, they are the change mechanisms and associated strategies utilised by the program. Also, assumptions and risks need to be defined to ensure that the proposed pathway of change is grounded in reality and that risk management strategies are implemented and monitored. Additionally, one to three 'indicators' are required at each result level (output, research outcome and development outcome), which can then be linked to system-level outcomes and intermediate development outcomes. This approach allows for greater reflection on how systemic change can happen, which can address the Flagship project 2 critique regarding weak articulation of the understanding of complexity of systematic change in SSF. It can help to meet donor requirements for clarity on the CGIAR Research Program's research and development contribution. Achieving impact will require a 'development outcome' focus in annual planning and budgeting, and diligent planning of annual milestones. The CGIAR Research Program can also consider cluster-wise allocation and depiction of budgets on various clusters of activities within a flagship. Measurement of impact in the CGIAR Research Program is challenging, given the diversity of research streams, data and reporting requirements. Therefore it necessitates application of a systematic and standardised approach in a knowledge-to-action sequence. Utility orientation in any measurement or monitoring and evaluation (M&E) is critical for ensuring that it contributes to both accountability and learning aspects. Cascaded M&E approach can be considered by the CGIAR Research Program. Cascaded M&E allows tracking of a knowledge-to-action sequence, starting at research activity or cluster level and then building up an aggregated picture. This could allow for collection, reflection and generation of knowledge at various geo-levels: site, country, regional and global. Overall, the paper proposes provisional options and ideas to develop an effective M&E system that is less 'report-based' and more of a support to 'pursuing science'.

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## Session 2: Fisheries management and technology

The overarching hypothesis of the SSF flagship of the FISH CGIAR Research Program is that ‘fisheries management and technology innovations can increase fisheries production, environmental sustainability and food security’ (FISH CGIAR Research Program 2017, p. 3). In a research for development context ‘local adoption and dissemination of technologies and management practices’ is very often fostered through participatory action research *with* fishers and their broader fishing communities (this is referred to as ‘change mechanism a’ in the FISH CGIAR Research Program). Participatory approaches to diagnosing problems, and crafting and testing solutions, came across as a strong theme of this session.

Presentations from Bangladesh and Cambodia described the community-based forms of collaborative management tested in the flooded haor areas of Bangladesh (Figure 4a) and in the freshwater fisheries (Figure 4b) and the rice-field fisheries (Figure 4c) of Cambodia. Measures of success included quantitative assessments of fish catch trends and fish biodiversity measures to persecution of legitimacy and governability of the management systems themselves. The study from Malawi moved further along the value chain and examined the use of solar tents as a technological innovation to reduce post-harvest loss and increase fish quality and shelf life (Figure 4d). The study of the Papua New Guinea communities examined sites where customary forms of management were already practised over their coral-reef fisheries (Figure 4e). The study sought to understand perceptions of equity and fairness of a range of ecosystem services within those small fishing communities. Whilst the study was not testing or examining fisheries management or technology itself, it demonstrated that it is important that when aiming for or measuring ‘success’, outcome measures should be framed around local perceptions of fairness and equity, rather than an external view of ‘if it is equal, it is fair’. The final presentation took a step back and out of the community level to examine the various ways in which geographic information systems (GIS) have been, and can be, used in aquaculture and fisheries management planning and monitoring. GIS products can themselves be considered technologies that might aid in broader scale (national or regional) fisheries management and assessment (Figure 4f).

The discussions that followed focused on the approaches that enabled outcomes from fisheries management and technology developments to be realised and sustained in any particular location. The session discussions heavily emphasised strong community engagement and voice in navigating solutions—particularly through the application of participatory approaches. Strong consideration must be given to local ecological knowledge and its complementarity to scientific knowledge. There was an emphasis based on the need for long-term and stable relationships with NGOs, government and communities.

The presentations from Cambodia on community fish refuges and co-management, and the presentation from Malawi on the drying tents, described a range of positive outcomes that were measured and perceived in the local study sites. In sum, the presentations suggested that the action research initiatives had developed models fit for context that were able to bring about positive change. Nonetheless, the targets set by the sustainable development goals and a range of initiatives (including the FISH CGIAR Research Program) are ambitious and will require these outcomes to be wide-scale and experienced by many more people, i.e. than just those in the case study communities. Symposium participants were asked to reflect not only on ‘what strategies are being pursued to ensure that this research leads to outcomes in the places/communities where we work directly’, but also ‘what strategies are being pursued to ensure that this research leads to outcomes at broader scales?’

It is recognised that not all (and in fact very few) ‘projects’ will have the scale of impact needed to reach these ambitious goals—but when considered together, there is potential to have this ‘scaled-up impact’. A key strategy highlighted to realise impact at scale was to draw together best practice recommendations from the multiple case studies where a particular innovation was developed and tested.

These best-practice guidelines need to become, in an appropriate form, more widely available—from the cases presented here, this might resemble a best-practice model of fish-rice refuges, or technical and social guidelines for building and managing fish drying tents, etc. The strategy of scaling up outcomes must also include the communication of success stories back to donors, to partners and to those agencies that might take up those practices in their efforts more broadly. Scaling might include the (organic or assisted) spread of an innovation between communities or fishers, the changes in practices that mean NGOs and governments are promoting a practice/innovation, and/or policy and governance shifts that allow an innovation to spread. Participants highlighted that monitoring and evaluation processes need to be established as part of and in association with scientific enquiry, to track positive, negative and unanticipated outcomes. It was simultaneously noted that just as critical as determining a tested set of ‘best practice’ lessons and guidance, it is important to employ research to determine the contexts in which these lessons, models and practices will ‘fit’ and be of value. This reflection recognises the typically diverse and dynamic nature of SSF, and will also mean that research needs to determine where and how lessons, models and practices need to be adapted and adjusted, or where entirely different management or technology innovations are necessary.

Participants reflected on the role of the researcher in the process of realising outcomes at scale. In the early stages of research, the focus is on testing and refining the management or technological innovation (referred to as ‘proof of concept’). At this stage, research is also focused on understanding local changes that have occurred, for what outcomes and for whom. The focus of research then might shift to understanding and improving the strategies and structures that enable the innovation to spread, to develop understandings of the context in which it may or may not fit, how an innovation might be adapted or adjusted to as a solution fit for broader fisheries systems, and understanding the scale and nature of broad-scale outcomes.



**Figure 4.** (a) Community-based resource management in the flooded haor areas in Bangladesh (Source: F. Khan). (b) Ecosystem-based adaptive co-management in the freshwater fisheries in Cambodia (Source: K. Mam). (c) Community-managed fish refuges of the rice field fisheries in Cambodia (Source: M. Kim). (d) Use of solar tents as a technological innovation to reduce post-harvest loss and increase fish quality and shelf life in Malawi (Source: J. Nagoli). (e) Local perception of fairness and equity of the coral reef fisheries in Papua New Guinea (Source: J. Lau). (f) Geographic information systems used in aquaculture and fisheries management planning and monitoring (Source: S.J. Teoh).

# Community-based resource management in north-east Bangladesh

Firoz Khan<sup>1</sup>, M.G. Mustafa, Gopal Chandra Sarker

Country: Bangladesh
System: Freshwater fisheries
Innovation: Community-based resource management (CBRM)

## Abstract

In Bangladesh, millions of rural men and women live in extensive, low-lying and deeply flooded haor wetland areas. Resources of this area are threatened by increasing population pressure, loss of connectivity with breeding ground and habitat degradation due to siltation and harmful practices, which impacts the livelihoods of people depending on fisheries. The Community-based Resource Management (CBRM) project supported by the International Fund for Agricultural Development (IFAD) aimed to improve sustainability of aquatic resources by empowering resource user groups to manage fisheries resources in north-east Bangladesh. The CBRM initiative was implemented by Bangladesh's Local Government and Engineering Department (LGED). The purpose of this study is to assess the impact of community managed fisheries using quantitative indicators of fish production, biodiversity, abundance and change of fisher livelihoods. An investigation was performed from 2008 to 2012 to assess the impacts of community-based resource management on fisheries production, biodiversity and abundance in 30 waterbodies in north-east Bangladesh. Fish catches were monitored for 8 days per month in each sampled waterbody, and catch by species and by gear were recorded for each gear type operated on the same day. Annual average fisheries production (kg/ha) was found to be 590, 610, 674, 621 and 470 kg/ha in the years 2008–12 respectively. Analysis showed an increasing trend from 2008 to 2011, but decreasing rapidly in 2012. Lower fish production in 2012 was due to a shorter monsoon and less rainfall. This shortfall was also reflected in Fisheries Department statistics for inland capture fish production, which showed 1.05 and 0.95 million tons respectively in 2010–11 and 2011–12. Daily catch rates per fisher is an indicator of fish abundance, income and food security, and average daily catch rates by fishers by gear found 1.54, 1.28, 1.91, 2.29 and 2.27 kg from 2008 to 2012 respectively. Species diversity in the study areas showed wide variation over the years, with total species numbers of 96, 105, 108, 103 and 122 in 2008–12 respectively. The study revealed that overall, 89% of waterbodies showed upwards trends in biodiversity, and *Puntius sophore*, *Nandus nandus*, *Wallago attu*, *Channa punctatus* and *Labeo calbasu* were the dominant species in the study areas. Seven critically endangered and 15 endangered species were recorded during the study period, of which four critically endangered and 14 endangered species showed increasing trends. The study proved that community-based resource management approaches aimed in haor areas improve fisheries production, biodiversity and abundance.

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# Conservation for sustaining livelihoods: ecosystem-based adaptive co-management of freshwater fisheries in Cambodia

Kosal Mam<sup>1</sup>, Yumiko Kura, Seila Chea, Dyna Eam

Country: Cambodia
System: Freshwater fisheries
Innovation: Ecosystem-based adaptive co-management

## *Abstract*

While pursuing conservation objectives of protected area management, mitigating impacts on local livelihoods remains a major challenge everywhere, and in Cambodia in particular. Enforcement of rules would be far from effective if such application results in local livelihoods being compromised, which is the main reason for low-level commitment by local communities. Adaptive co-management—taking into account the existing socio-ecological and administrative context, and adopted in a participatory process of planning, decision-making and conflict resolution—can overcome this constraint. This presentation summarises the process and lessons learned from the establishment and management of five fish conservation zones (FCZs) in a section of the Mekong River in Cambodia from 2011 and 2017. The paper is from a practitioner’s perspective, and presents how the approach used resulted in positive outcomes in terms of resource status as well as behavioural change of local stakeholders.

Local communities were motivated to take the lead in a participatory decision-making process, presenting and selecting sites that have high potential for practical management and positive outcomes on resource recovery, while minimising adverse impacts on poorer members of the community. Community members negotiated among themselves and agreed on a management plan for each FCZ based on what was practical and enforceable, as well as ‘fair’, taking into consideration the level of access and dependency of some households on fishing to sustain their livelihoods. The approach employed participatory decision-making processes involving not only the target communities, but also other stakeholders, either because of their dependence on the resource, their experiences working in the area or their legitimate administrative power. Coupled with a range of non-monetary incentives and social safeguards for the poor, the approach improved the legitimacy of the initiative, fostered social learning among the participants and in turn contributed to more effective and institutionally sustainable co-management effort. Perceived positive impacts in fish productivity from protection of three initial FCZs between 2011 and 2014, along with the regular revision of social safeguard measures for poor families living next to FCZs, resulted in two additional FCZs being proposed by neighbouring communities in 2014 and an increased level of effort by communities to patrol and protect the FCZs in a more coordinated fashion.

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# Rice field fisheries in Cambodia: enhancing the productivity through community-managed fish refuges

Miratori Kim<sup>1</sup>, Vichet Sean, Vanvuth Try, Alan Brooks,  
Celine Sieu, Yumiko Kura

Country: Cambodia
System: Rice field fisheries
Innovation: Community-managed fish refuges

## *Abstract*

Rice field fisheries are a significant contributor to annual fish production in Cambodia and vital to the food security of rural poor. This seasonal open-access resource has been a source of protein and nutrients for Cambodian households for centuries, yet it has never been properly managed. Recently, the Royal Government of Cambodia has given attention to enhancing rice field fisheries by supporting the development of at least one community fish refuge (CFR) in every commune possible. This presentation summarises the approach and results of the Rice Field Fisheries Enhancement Project (2012–16), which supported 40 of those fish sanctuaries and local communities to effectively manage rice field fisheries resources. The project adopted an approach that combined: (1) physical interventions to improve the habitat of the CFR and connectivity between the refuge and surrounding rice field ecosystem; and (2) capacity building of the local community to plan, prioritise and implement these interventions and protect the fish refuge. While physical interventions were based on existing fish ecology and aquaculture principles, the governance dimension of the project was innovative. A four-step approach was used to strengthen existing community-based organisations (CFR Management Committees) to develop and implement a CFR management action plan in collaboration with a wide range of local stakeholders (commune authorities, local Fisheries Administration, religious groups, private sector, local NGOs). Capacity of the CFR Management Committees and results of the action plan were self-assessed every 6 to 12 months to identify achievements, gaps and barriers, and make adjustments accordingly. Engagement of a wider group of stakeholders and transparency of the planning process were seen to improve the quality of the action plans, and increased their legitimacy and fostered broader community support. Identifying and bringing together key actors opened multiple avenues for funding CFR activities through pagodas, the Fisheries Administration Cantonment, NGOs, private companies and other local entities. After 4 years of implementation, through the effective management of fish refuges by CFR Management Committees and communities, fish biomass increased by an average of 30% across project sites. Regression analysis showed that project interventions significantly improved water quality in the CFR, which facilitated the survival of fish in the refuge through the dry season. By improving the effectiveness of the CFR, household catch of fish and other aquatic animals from rice fields increased by 17%, illustrating the benefits of improved governance of common resources on food security for rural poor communities in aquatic agricultural systems.

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# Post-harvest loss management of small fish pelagics in Lake Malawi

Joseph Nagoli<sup>1</sup>

Country: Malawi
System: Freshwater lake
Innovation: Post-harvest loss management

## Abstract

Post-harvest fish losses defined as physical, nutrient and economic losses that render fish unavailable or nutritionally deficient for human utilisation in Africa reach as high as 50% of the landed fish. The Malawi National Fisheries Policy reports that fish post-harvest losses in Malawi range from 30 to 40% of the landed fish. These losses are high in the small pelagics because these species have volatile seasonal abundance and so are more difficult to handle during peak fishing periods. In the last 10–15 years, the composition of fish catches in Malawi has shifted from large cichlids to small pelagics such as Usipa (*Engraulicypris sardella*), Kambuzi (*Haplochromines*), and Matemba (*Barbus* spp.). For example, Usipa currently accounts for 70% by volume of the estimated 116,128 tons of fish caught in 2014. The popular larger species, such as those in the Chambo fishery, collapsed due to illegal fishing and disregard for regulations related to mesh size, minimum catch size and the October to December closed season. The shift to small pelagics in Malawi fisheries has implications for fish post-harvest losses, as almost all the small forage fish are perishable with poor post-handling practices. These losses affect the entire fisheries value chain: the network of actors and interlinkages from fishing to fish consumption. These losses affect a considerable portion of fisher folks' profits, and the general public loses considerable nutritious food in a country where fish contributes 60% of national dietary animal protein and 40% of the total protein supply. This research was therefore aimed at first validating the extent of post-harvest losses of small pelagics in Malawi using a more reliable methodology. The current estimates on post-harvest losses are based on old and anecdotal information, with very little field data on the precise extent of post-harvest losses. Using a load tracking methodology, by measuring losses along the value chain replicated over three fishing seasons (rainy and humid, hot and dry, cold season), the general post-harvest losses was estimated to be at 33%, with over 40% occurring at the landing site. Second, the research adopted a solar tent dryer and tested it for drying efficiency, profitability and fish quality. Processing fish using the solar tent dryer and its allied activities in the form of packaging and proper marketing reduced post-harvest losses by 20%. Reductions in post-harvest losses were assessed by levels of: (1) contamination by measure of the progress of spoilage that is dependent on sensory assessment (total volatile base nitrogen levels); (2) sensory and organoleptic quality; (3) nutrient content; and (4) shelf life of the solar dried fish.

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# Equity and ecosystem services in coral reef small-scale fisheries: understanding social difference, values, priorities and fairness

Jacqueline Lau<sup>1</sup>, Christina Hicks, Georgina Gurney, Joshua Cinner

Country: Papua New Guinea
System: Coral reef fisheries
Innovation: Analysis of ecosystem services in customary tenure

## *Abstract*

Many people in tropical small-scale fisheries depend on coral reef ecosystem services. However, benefits from these ecosystem services are rarely evenly distributed or equally governed within communities. Given the exponential growth of ecosystem service-based approaches in research and practice, there is a need to understand both whether and how different people value and prioritise coral reef-related ecosystem services, and what people perceive of as fair in governance. We address these gaps in two ways. First, we used a rating and ranking exercise in 28 coral reef fishing communities in the western Indian Ocean to determine people's ecosystem service priorities, and then disaggregated these by social-economic characteristics including wealth, age and level of education. We found little evidence of social differentiation in how people rank the importance of ecosystem services, or rank priorities for improvement. However, the wealthiest group prioritised an improvement in habitat services. When we repeated the exercise in Papua New Guinea with men and women within the same households, we found no differences in preferences. Our findings suggest that gender-based and intersectional inequities likely manifest in realms (e.g. practices, norms, and attitudes) that disaggregating ecosystem services preferences may not illuminate. Second, we conducted two in-depth case studies of coral reef fisheries in Papua New Guinea; one with a strong customary management system, and one where customary management has slowly eroded. We ask specifically, what do people perceive to be fair in customary management and practices around ecosystem services, and how do these perceptions manifest in customary practices (or not)?

We found that in the strong customary system, participation and deliberation was high, and the community had regular community meetings. In addition, perceptions of fairness differed in both places. For instance, in one place, many people complained that young men spear-fishing at night was unfair, and they also emphasised that it was ultimately unfair to stop them because they needed to feed their families. In the other case study, spearfishing at night was totally banned, with very high compliance. Our results suggest that deliberative governance of ecosystem services is learned and re-affirmed through regular practice. In addition, local context, people's identities and social relationships intersect with perceptions of fairness. Development or management programs may need to understand and pursue equity differently depending on local perceptions. To pursue equity and social transformation in small-scale fisheries, these intersecting identities should be accounted for, including through fostering practices, and spaces, of deliberation that include marginalised groups.

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# Applications of GIS in aquaculture and resilient fisheries

Shwu Jiau Teoh<sup>1</sup>

Country: Global
System: All types
Innovation: GIS

## *Abstract*

Application of geographic information systems (GIS) has been playing an increasingly important role in planning and managing aquaculture and fisheries resources more efficiently. This presentation provides an overview of the use of GIS for planning, and monitoring and evaluation (M&E) tools in aquaculture, and the potential for its application in planning for resilient small-scale fisheries. In recent decades, WorldFish has successfully developed GIS-based methodology for determining recommendation domains, places and sets of conditions for which a particular target aquaculture technology is considered feasible, for promoting freshwater aquaculture in a number of countries of Asia and Africa (Kam et al. 2008; National Directorate of Fisheries and Aquaculture (NDFA) 2012). GIS could greatly help in assessing the potential area for development of aquaculture, which is influenced by a range of biophysical, social and economic factors. The data collected during the GIS analysis and the suitability maps produced contribute to inventory and monitoring aquaculture development projects for better management. In fisheries, GIS has been widely applied to marine fisheries, but there have been fewer applications in inland fisheries management and planning. The application of GIS mainly focuses on: (1) mapping the aquatic resources and fisheries-based human activities; (2) modelling for sustainable management of fisheries resources; and (3) fisheries management and monitoring. To encourage or improve data sharing and accessibility, WorldFish has developed a number of databases and marine resources atlases to host the data contributed from various partners. The framework used for determining recommendation domains for aquaculture should scale up for sustainable planning and management of marine, coastal and inland fisheries resources. GIS can help in planning interventions to both aquaculture and fisheries, which could lead to more sustainable aquaculture as well as resilient fisheries.

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## Session 3: Governance, institution and external drivers of change

The FISH CGIAR Research Program Flagship proposal on SSF presents an overarching hypothesis on governance that ‘research insights and capacity building directed toward windows of opportunity can transform governance and institutions to amplify food security and sustainability outcomes from livelihood, governance and fisheries management innovations’. This session shared a diversity of research approaches employed to both understand and engage in processes of governance improvements and reform. The session addressed analysis of the challenges of SSF beyond the community scale, the value of scenario building, capacity/institution building and ability to learn from local innovations in the design of broader reform efforts.

The session included a range of methodological approaches. For example, Andrew Song presented qualitative analysis of the current policy environment in the Pacific region and how it might respond to the evolution (and potentially increasing influence) of international norms—asking how these link to, interact with and influence governance norms existing at national and regional scales (Figure 5b). This focus on discourse analysis complemented subsequent presentations focused on quantitative analysis, demonstrating the importance of data-informed scenarios of fisheries production (the relative role and growth of aquaculture and capture fisheries) for informing and influencing policy debates and strategies. Chin Yee Chan and Nhuong Tran’s presentations on foresight modelling provided an example of the potential for such an approach to influence policy and investment decisions at a regional scale (Figure 5d).

Contrasting cases also demonstrated the varying possibilities for influencing institutional and governance change in different national contexts. Timor-Leste and Myanmar both feature rapidly changing governance landscapes. In Timor-Leste, still a very young nation with limited capacity for fisheries management and enforcement, research presented by Dave Mills highlighted the potential for rapid improvement through community-based initiatives such as introduction of fish aggregating devices (FADs) to increase catch and reduce pressure on coral reefs (Figure 5a). In Myanmar, research on inland fisheries and governance efforts, presented by Xavier Tezzo, showed that managing conflict is a key driver of change, and a push for more equitable resource allocation policies presents a window of opportunity (Figure 5c). Sonali Senaratna Sellamuttu of the International Water Management Institute addressed governance challenges in more confined environments—new ecosystems in constructed water bodies in the Mekong basin where governance interactions spanned local resources users, government management authorities and hydropower operators (Figure 5e). Research there focused on trialling an ecosystem approach to fisheries management, specifically through the construction of structures to support refuges to ensure stability and return of fish supply as water levels change.

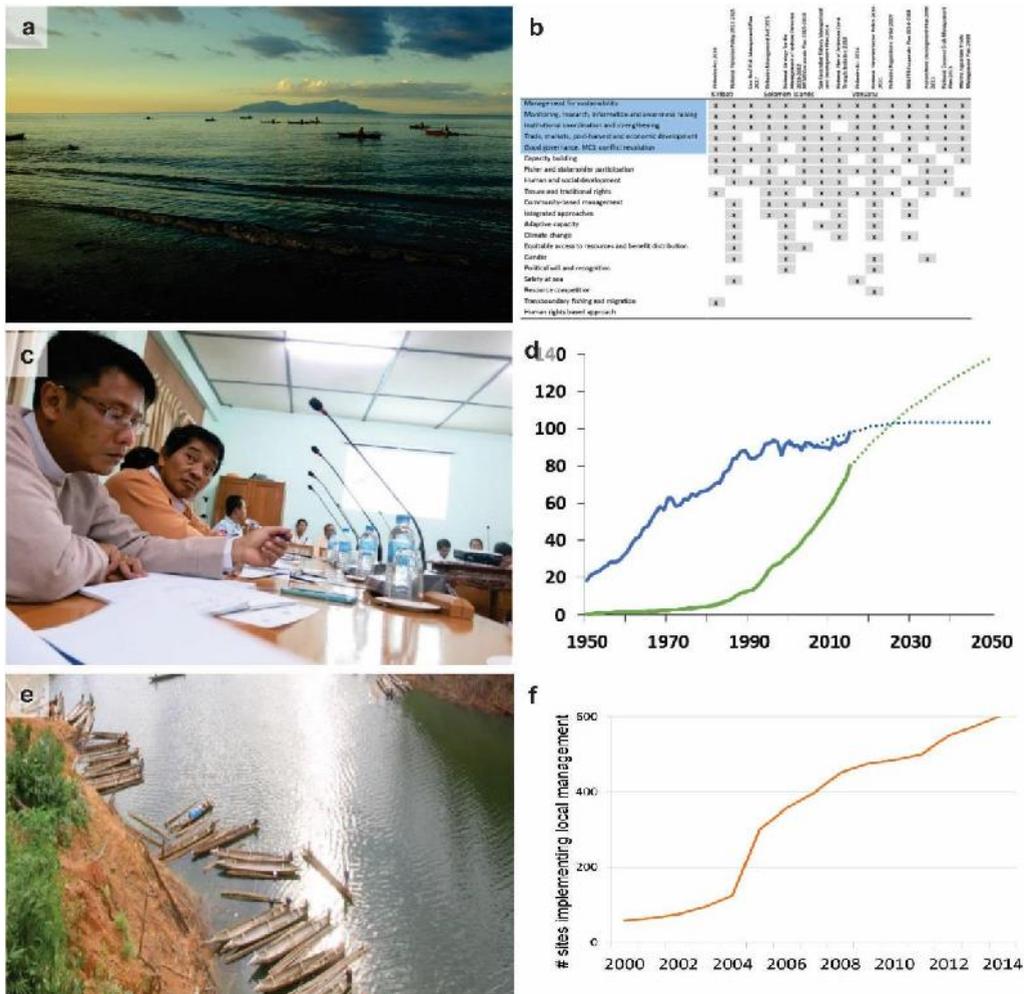
The cases also prompted reflection on the contrast in outcomes presented from marine and inland fisheries contexts. One participant reflected that looking across the research described on inland and marine systems, he was struck by the relative prevalence of positive outcomes in inland systems: ‘We just had three talks on how easily we can have a win-win situation for conservation and livelihoods, whereas in the marine sector we perhaps more frequently encounter tensions between those two. Win-win is far less obvious and harder to come by. So the potential for ecosystem based approaches seems to be higher in inland systems because of the quicker return and sustainability of the system, which is not the case in marine fisheries. Perhaps the analogy in marine systems is the high turnover small-pelagics.’

Hugh Govan’s presentation on local innovation and prospects for scaling up through the Locally Managed Marine Areas (LMMA) network approach (Figure 5f) prompted further discussion around the question posed to all presenters at the start of the symposium: ‘What strategies are being pursued to ensure that research leads to outcomes in the places/communities where we work directly and at broader scales?’ Hugh had discussed the role of peer-to-peer learning, networks of practitioners and support

agencies, and a range of other strategies that have been applied and tested (to a limited degree) to accelerate the spread of local management innovations. In response to a query on the most effective or appropriate roles and functions of networks at different levels, Hugh responded that ‘the Fiji LMMA network was effective at the national level, but in other countries this wouldn’t have worked’, noting that in many contexts beginning at the community level is best.

The different aspects of scaling were discussed. Participants noted the importance of understanding the potential ‘scale of influence’ in terms of benefits that SSF governance improvements can yield for nutritional outcomes, livelihoods and ecosystem status. Any proposition for achieving these changes must have a robust grounding in local-level experiences, and account for community interests and needs. A diversity of approaches must also be considered, which include capacity building of civil society organisations, peer-to-peer exchanges, networks and coalitions, and investments in institutional strengthening and linkages—in addition to direct support to policy development.

Discussions converged around the role that research plays in the governance space—many of the examples researchers provided in this session illustrated that they are active participants in governance processes and are themselves agents of change alongside other stakeholders, i.e. researchers are not just observers. In many instances, research is directly supporting capacity building of governors and management of stakeholders at a range of scales.



**Figure 5.** (a) Timor-Leste governance developments are framed around attempting to build fishing capacity in its marine fisheries (Source: D. Mills). (b) The presence and absence of 20 themes were assessed to examine the coherence between 15 national policies in the Pacific region (Source: A. Song). (c) Research on the governance of inland fisheries in Myanmar are focused on managing conflict and contestation (Source: A. Tezzo). (d) Data-informed scenarios of fisheries production are important for informing and influencing policy debates and strategies (Source: C.Y. Chan). (e) New ecosystems in constructed water bodies in the Mekong basin are facing governance challenges where governance interactions spanned from local resources users to hydropower companies (Source: S. Sellamuttu). (f) The spread of local management (i.e. community-based resources management, locally managed marine areas and/or special management areas) throughout the Pacific from 2002 until 2014 (Source: H. Govan).

# A (almost) blank canvas: building a sustainable, nutrition-sensitive fisheries sector in Timor-Leste

David Mills<sup>1</sup>, Alexander Tilley, Mario Pereira, Acácio Guterres

Country: Timor-Leste
System: Coastal fisheries
Innovation: Develop its fisheries sector with technologies like FADs

## *Abstract*

The fisheries sector in Timor-Leste is remarkable for a number of reasons. As a new, post-conflict nation with the scars of a 'scorched-earth' departure by occupiers, institutions are young and lack resources for research and management, and infrastructure is rudimentary. As an island nation, the low level of fisheries activity, the basic technology employed by coastal fishers and ultimately the low levels of fish consumption are both surprising and perplexing. While rich oil resources have enabled a remarkably quick transition from extended conflict to a peaceful democracy, these resources are finite and rapidly depleting: the nation *must* transition quickly to a post-oil, diversified economy. Meanwhile, Timor-Leste continues to struggle with high levels of poverty and one of the highest rates of childhood stunting globally. The fisheries sector has an important role to play both in nation building and in diversifying diets to improve nutritional outcomes. WorldFish is partnering with the Ministry of Agriculture and Fisheries (MAF) in Timor-Leste to identify the optimal development pathway for the fisheries sector within this context. Research has shown that fishers rarely specialise, but that fisheries activities are important as a stable, supplemental income and food source that is less subject to shocks than other natural resource-based livelihoods. While key ecological parameters of fish stocks remain unknown, research suggests technology such as FADs, enabling coastal fishers to move beyond reef fishing, will lead to positive outcomes for livelihoods and nutrition security. This presentation will integrate livelihood, technological and policy research being conducted by WorldFish and MAF, and highlight innovative future directions that seek to facilitate the optimal development of a fisheries sector contextualised to the needs of Timor-Leste.

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# Multi-scale policy translation in Pacific islands coastal fisheries

Andrew Song<sup>1</sup>, Philippa J. Cohen, Quentin Hanich, Tiffany H. Morrison,  
Temarewe Tekatau, Neil Andrew

Country: Pacific region
System: Coastal fisheries
Innovation: Diffusion of policies from supranational to national

## *Abstract*

International agreements forged between heads of states must be made relevant and actionable at the national level to facilitate on-ground implementation. Yet, despite policymaker optimism and advances in governance theory, such multi-scale diffusion remains a significant challenge. This study focuses on understanding national-level ‘readiness’ that enables the diffusion of supranational policies to take effect. We analyse the diffusion of two supranational policies on coastal fisheries in the Pacific—the ‘Small-Scale Fisheries Guidelines’ and ‘the New Song’—to the national level in three countries: Kiribati, Solomon Islands and Vanuatu. Our approach combines instrumental perspectives on policy coherence (through a document comparison of the policies produced at two levels) with cognitive-normative understandings of policy images by government officers in charge of policy deliberation and delivery (through interview). We find supranational–national policy coherence across most themes except emerging social themes such as ‘gender’ and ‘human rights-based approaches’. Perceptions and interpretations of government officers explain the observed pattern. More crucially, government officers’ images (encompassing judgements, aspirations and convictions) represent the dynamic, nuanced and personal attributes involved in policy interpretation and implementation. Multi-scalar policy diffusion is therefore a translational process facilitated by national-level bureaucrats, and the policy images held by these bureaucrats offer practical and context-driven insights for mediating policy ideas into action. Mobilising translational processes and policy images is therefore essential to realising successful local uptake of international consensus.

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# Improving governance of inland fisheries in the Ayeyarwady Delta

Xavier Tezzo<sup>1</sup>, Win Ko Ko

Country: Myanmar
System: Inland freshwater fisheries
Innovation: States and regions policies and legislations reform, with community management models

## *Abstract*

The extensive networks of rivers and floodplains have historically supplied the bulk of fish for domestic consumption and are essential to the Myanmar economy and people's livelihoods. Faced with increasing problems of resources exhaustion, the governance of freshwater fishery in Myanmar is relatively weak. It consists in right-based management systems, which have been largely shaped under British rule and further nurtured by extractive economic policies under the successive political regimes. The lack of appropriate data further complicates the task to improve fisheries management and is largely attributable to the decades of political turmoil and isolation during which the sector was under the stranglehold of state corruption. Since 2010, the country has been going through a period of unprecedented political and economic reform. Increasing policy attention is being granted to improve sustainability and equity of natural resources management, including fisheries. The recent decentralisation of legislation allowed states and regions to enact their own policies and legislation. In 2012, the Ayeyarwady region, i.e. the most productive inland fisheries, was among the first to enact a new Freshwater Fisheries Law, offering a unique opportunity to address prevailing sustainability and equity issues. In that reform context, there have been emerging initiatives with a range of community management models. These experimentations have been propelled by contestations from resource users, the outstretched hand of the reformist government and an increasing engagement of civil society organisations. It is in that fast-changing environment that WorldFish has developed a program of research in close collaboration with the Department of Fisheries. The presentation will revisit four years of such collaborative research work, consisting in characterising Myanmar freshwater fisheries, documenting and supporting its policy reform. Finally, the presentation will outline the future research agenda to support improved governance of inland fisheries in the Ayeyarwaddy Delta, emphasising the main obstacles, risks and opportunities ahead.

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# Prospect of fisheries in Africa: business-as-usual projections with the IMPACT fish model

Chin Yee Chan<sup>1</sup>, Nhuong Tran, Shanali Pethiyagoda

Country: Africa
System: All fisheries
Innovation: International Model for Policy Analysis of Agriculture Commodities and Trade (IMPACT) model for scenario planning

## *Abstract*

Africa has diverse fish resources for generating benefits including food and nutrition security, poverty alleviation and livelihood. Hunger and malnutrition are widespread in this continent. More than 20% of the African population is estimated to be undernourished. Fish is a critical source of essential proteins, minerals and micronutrients, which are crucial for combating malnutrition in Africa. Further, fish represent over 20% of animal protein intake in 20 African countries. The fishing sector is estimated to generate income for over 10 million people in Africa; over 2.5 million people are involved in fishing and three times this number in trading and processing. In 2015, capture fisheries supplied 83% of total fish production in Africa; more than half was estimated from small-scale fisheries. Almost all fish from small-scale fisheries is used for food. Despite the high dependence on fish as a source of animal protein, Africa—especially sub-Saharan Africa—has a low per capita fish consumption compared to other developing countries in the world. While developing countries as a whole are net fish exporters, the African region is a net fish importer. This paper examines past, present and future trends of fish in Africa to explore policy implications and potential investment interventions to address the continent’s challenges in ensuring sustained fish growth to meet the surging continental demand. Using the International Model for Policy Analysis of Agriculture Commodities and Trade (IMPACT) of the International Food Policy Research Institute (IFPRI) with an updated fish model developed in collaboration with WorldFish, the business-as-usual scenario of fish production, consumption and net trade in the African region was projected to 2050. Future growth in capture fisheries production for Africa is projected to be stagnant. However, capture fisheries will continue their dominance as a source of fish supply until 2050. Although per capita fish consumption remains low, more imported fish is projected to meet demand from the growing population. Given the importance of small-scale fisheries for food security in Africa, the quest to improve global statistics on the data gap of small-scale fisheries is indispensable.

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# Prospect of fisheries in Africa: baseline projections with the IMPACT fish model

Nhuong Tran<sup>1</sup>

Country: Africa
System: All fisheries
Innovation: International Model for Policy Analysis of Agriculture Commodities and Trade (IMPACT) model for scenario planning

## *Abstract*

We will present the baseline projections from fisheries in Africa but will place more emphasis on the projections around capture fisheries, with some points specific to small-scale fisheries. Foresight modelling tools (IMPACT and ASIAFISH country-level fish sector models) work with fish catch/outputs and link supply side to consumption/demand side via market prices. These tools can be used to conduct research related to fisheries management and interventions. Generated knowledge/results then can be used to inform fisheries planning and management decision.

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# Exploring prospects for increasing fish production and adapting livelihoods in constructed water bodies in the Mekong basin

Sonali Senaratna Sellamuttu<sup>1</sup>, Matthew McCartney,  
Yumiko Kura, Peter-John Meynell

Country: Mekong
System: Constructed water bodies/freshwater fisheries
Innovation: Reservoirs

## *Abstract*

In the Mekong basin the number of reservoirs is rapidly increasing as a result of irrigation and hydropower development. The fisheries yielded from such reservoirs are often promoted as an important secondary benefit to landscape alterations. However, previous research indicates that reservoir fisheries pose significant challenges in terms of management and sustainability (Phounsavath et al. 2011; Starr 2014). The natural fish yields of reservoirs vary greatly from one reservoir to another, depending on multiple factors whose respective roles remain unclear (Bernacsek 1997; Moreau and De Silva 1991). Stocking can be quite unsuccessful (de Silva and Funge-Smith 2005; Lorenzen and Garaway 1998), its cost-effectiveness is often questioned, and management decisions and responsibilities around a newly controlled environment are challenging (de Silva 2001; Lorenzen 2014; Miao et al. 2010). Lastly, the limited number of species usually stocked—compared to the original riverine biodiversity—can be detrimental to nutritional security of women and children (Thilsted et al. 2014). There is significant scope to improve the design and management practices of reservoirs to maintain productivity and diversity of native species in reservoir fisheries, which is less costly in the long term and can make it more resilient to seasonal and inter-annual variability (McCartney et al. 2016). We propose using an ecosystem management approach that seeks to strike a balance between benefiting from the natural resources provided by an ecosystem and maintaining the ecosystem's ability to provide them sustainably. In the context of reservoirs, adopting an ecosystem management approach requires a change in conceptualisation. A departure is taken from the conventional idea of reservoirs as isolated, barren bodies of water that disconnect river systems, disrupt the life cycle of migratory fish and are operated solely to maximise hydropower production, to the idea that reservoirs are aquatic habitat, interconnected with the surrounding aquatic and terrestrial landscape, in which beneficial ecosystem functions can, if carefully managed, be sustained and enhanced. Our research proposes to build on earlier research in the Mekong and focus on testing techniques and management frameworks aimed at maximising the natural fish production in these reservoirs without compromising other uses of reservoir water, e.g. ensuring connectivity between reservoir and upstream spawning grounds, creating conservation zones and artificial wetlands in and around the reservoir as dry season refuges for brood fish and juvenile fish (McCartney et al. 2016; Meynell 2014). Further, we will test and promote access strategies that promote equitable benefits from these fisheries, in particular nutrition, for women and children.

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# Securing SSF benefits: village by village or institutional reform

Hugh Govan<sup>1</sup>

Country: Pacific islands
System: Coastal fisheries
Innovation: LMMA network

## *Abstract*

The health of coastal fisheries and other resources in the Pacific islands has historically depended on regulation by coastal communities based on customary tenure arrangements. Over the last two decades work has progressed in understanding and piloting how community approaches can function in the modern context of increasing commercial pressures, land-based development and population growth. Regional and national policies have been informed by these experiences and are strongly supportive of community approaches but still less than 10% of communities are thought to have received government or non-government support and there is little evidence of government institutional or budgetary support—for SSF generally, and for community-based approaches specifically. For community-based approaches to contribute to resilience and food security of island nation populations, they would need to be supported in a major proportion of communities that need them. The LMMA Network and more recently WorldFish have explored the use of networks and peer learning to promote diffusion, and also the more formal policy, governance and institutional approaches. The presentation aims to promote discussion on some of the key considerations: what do communities need, how can they best get it, who could deliver it, how can communities be represented in policy development; in short, challenges and opportunities to achieving impact at the scale of community-based approaches to livelihoods and resilience.

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## Session 4: Gender and equity

In the opening presentation, Cynthia McDougall (Gender Research Leader for WorldFish and the FISH CGIAR Research Program) explained that gender and social analysis in commons (in the sense of resources accessible to all members of a society) research is critical in that it can surface and enable research to address ‘dilemmas’, namely risks and potential perverse outcomes. Broadly, WorldFish and the FISH CGIAR Research Program’s small-scale fisheries research and development goals are to improve the resilience of fishers, reduce poverty, and drive improvements to food and nutrition security. In seeking achieving these goals, often idealised research and development pathways assume the delivery of an initiative to a target group will serve as a catalyst for realising these outcomes for the society broadly.

However, through reflecting on past experiences and lessons, WorldFish and FISH recognise that delivery of an initiative may lead to only some social groups adopting and benefiting from an innovation. Other social groups—such as women or the poorest fishers or other marginalised groups—face greater restrictions. In the worst instances these negative but unintended outcomes may include conflict, exclusion (or elite capture), and declines in nutritional health and benefits. Effective gender analysis can help identify socially constructed differences between people and therefore proactively address these risks (Figure 6).



**Figure 6.** Effective gender analysis can help identify socially constructed differences between people, and accommodate or proactively address these differences in the way in which a program is designed and delivered. The way in which organisations and initiatives consider and work with gender can be viewed on a spectrum; there are a range of strategies that help organisations and initiatives move away from gender-blind approaches, and towards more accommodating and transformative approaches (Source: Lawless et al. 2017).

Afrina Choudhury (gender specialist at WorldFish) highlighted in her presentation that in small-scale fisheries and aquaculture sectors women’s roles and contributions are often undervalued or overlooked in policy. Women tend to participate in low-paid, low-quality jobs, and have less rights than men to access and make decisions related to resources. The presentation provided by Seamus Murphy provided an illustration of this broader point by using research on the Lake Nasser fishery in Egypt where sex-

disaggregated data on roles and profitability in marketing fish products showed women earn less gross income, have smaller-scale enterprises and experienced greater impact to price decreases that were a result of the loss of product quality.

Gender inequalities are exacerbated by national laws that do not recognise women as fishers, and fisheries policies rarely recognise the pre- and post-activities that women are usually involved in. Cynthia and Afrina both highlighted the need to apply a gender and social lens to small-scale fisheries research and development not only early in the engagement process, but also across the life cycle of the project. Through this process, WorldFish and FISH are able to be proactively informed to develop meaningful and inclusive research strategies, and be well positioned to achieve positive impact.

Other presentations in the session highlighted that there are a multiplicity of gender impact pathways. These included: (1) experimentation with a variety of gender-transformative approaches; (2) ensuring gender and social impacts are achieved at scale; and (3) capacity building through working with other stakeholders.

Presentations by Cynthia, Afrina and Sarah Lawless (a PhD candidate at James Cook University/WorldFish) illustrated WorldFish's commitment to using a gender-transformative approach (GTA) throughout the countries in which WorldFish works. This method seeks to spark critical reflection and support locally led shifts in the norms, relations and barriers preventing gender equality. Afrina presented some lessons gained from applying GTA to aquaculture projects in Bangladesh, and highlighted how these lessons could be applied in the context of small-scale fisheries. These approaches required working at both the household and community scales using mechanisms such as behaviour change communications, participatory action research and integrating guided processes within technical trainings. Afrina provided an example where household social consciousness raising exercises were introduced to families to encourage local acceptance of women's roles in catching and selling fish and becoming extension workers. In addition, this project will use participatory debates and invite community officials to ensure inclusive discussions.

Additionally, in terms of empowerment-focused methods, Chikondi Manyungwa-Pasani (a PhD candidate with the University of the Western Cape, and representative of the Department of Fisheries Malawi) applied an appreciative enquiry method in her research investigating women's participation in freshwater small-scale fisheries value chains in Malawi. This included the use of 'envisioning change' tools to establish how women's participation in value chains has contributed to improvements in the livelihoods and social cohesion at household as well as community levels.

During plenary discussions, it was suggested that when using any tools and methods that seek to empower women, interventions needed to be careful their impacts do not lead to conflicts or resentment from men. Cynthia's presentation highlighted that a GTA is explicitly designed around avoiding these implications and that the approach seeks to find a 'win-win' solution for both women and men. Whilst gender-responsive methodologies and project design and implementation were highlighted as important in the presentations, plenary discussions raised issues related to the monitoring and evaluation of gendered impact. Steven Cole and Afrina Choudhury suggested using the adapted women's empowerment in agriculture index (WEAI) and the newly developed women's empowerment in fisheries index (WEFI) surveys to enable before and after comparison to measure individual and community perceptions regarding an intervention's impact. The discussions also highlighted that a GTA can be expensive, and may not be of interest to all donors (although it is very much to some). However, it was cautioned that at a minimum research and development needs to respond to the needs and constraints of women as well as men. Thinking about the ways we engage with communities could bring about outcomes we did not know were possible.

Several presentations reflected on the importance of ensuring gender research achieved impact at various scales. Whilst Afrina's presentation highlighted the use of gender-transformative strategies at the household scale, Seamus and Chikondi's research explored the influence of fisheries value-chains as an entry point to ensuring more inclusive wealth generation and a more equitable spread of benefits. Value chains are viewed as important to understand the complex policy and structural challenges in small-scale fisheries development. However, value chain research and development has often been too narrowly focused on the structural elements of production. Seamus's research on the Lake Nasser fishery in Egypt found that women were experiencing greater post-harvest losses than men, and hypothesises that women

are under greater pressure to sell within a shorter window due to gendered differences in women's and men's time-labour burden. Chikondi's research observed that women's increased participation fisheries value-chains in Malawi has given them the motivation to participate in a village savings and loans scheme, which has also enhanced the cohesion at the community level. In looking further across scales, Sarah's presentation suggested global approaches to addressing gender inequalities in small-scale fisheries (i.e. commitments in fisheries policies or those made by donors) are often disconnected with local understandings of gender. Plenary discussions echoed the need for gender research to have impact at different scales. It was suggested there was a need to look beyond just the fisheries sector and to collaborate with other sectors, e.g. health, education or agriculture. It was suggested this could be achieved through forming coalitions and action collectives. Some participants reflected on their own experiences in working with the health and education sectors who are perceived as being generally very proactive in development.

The third impact pathway discussed both in the presentations and discussions focused on the tension between global gender directives and local capacities to facilitate gender-based change.

Sarah suggested despite high-level commitments to gender (e.g. in fisheries policies, or donor directives), development organisations and practitioners are challenged to translate these requirements into practice. Afrina noted that traditionally, many organisations working in fisheries have combated gender issues in an accommodative manner—where change was brought by working around existing norms and stereotypes. Importantly, it was recognised that to achieve impact at scale, WorldFish must recognise the knowledge and capacities of partners and other stakeholders to identify and meaningfully address gender inequalities—particularly if they don't have a history of working with gender. Through capturing the voices of development practitioners in Solomon Islands, Sarah and colleagues were able to develop a practical tool that was tailored to provide gender-accommodating and transformative guidance in accordance with the common challenges practitioners faced. These kind of approaches emphasised that partner and stakeholder capacity building should not only be about hosting trainings, but also working *with* partners and stakeholders to build capacity as a key pathway to deliver impact. It was encouraged that WorldFish continue to work with organisations who have gender expertise (i.e. Promundo), as they are able to offer different tools and perspectives, and can continue to build WorldFish's own capacity around gender.

Concluding discussions suggested that a challenge for the small-scale fisheries program moving forward was to showcase how these gender interventions have led to greater equity, food security and sustainable management of natural resources.

# Towards building better women-responsive fish value chains

Chikondi Manyungwa-Pasani<sup>1</sup>, Mafaniso Hara, Sloans K. Chimatiro

Country: Malawi
System: Freshwater SSF (on Lake Malawi)
Innovation: Women's participation in the value chains

## *Abstract*

Value chains are an increasingly popular approach to understanding complex policy challenges in agricultural development, including fisheries. However, value chain research and development has often been too narrowly focused on the structural elements of production, resulting in lack of adaptive capacity. This paper provides a synthesis of findings for a study that was undertaken to examine the changes that have occurred on women participating in small-scale fish value chains in communities dependent on fisheries at Kachulu beach on Lake Chilwa and Msaka beach on Lake Malawi.

The research sought to demonstrate the powerful benefits and lessons that women's participation in the value chains can offer for sustaining household livelihoods and enhancing the cohesion at both household and community levels. This research was designed to investigate what women have achieved and aspire to achieve as a result of participating in fish value chains. The objectives of the study were to determine the changes and improvements that have occurred among the women participating in the fish value chains. The focus was to establish how women participation in fish value chains has contributed to improvements in the livelihoods and social cohesion at household as well as community levels. Gendered household approach and envisioning change tools were used in obtaining information from the respondents of the study. In undertaking the research, key informant interviews and focus group discussions using the 'appreciative inquiry' approach were conducted with 20 participants in the two study sites (10 participants from each site). A number of positive changes were found to have occurred among the women, including improved livelihoods at both household and community levels, and improved household status for women and children. Women have been experiencing changes in their social life and increased social cohesion at the household level. Their participation in the value chains has given them the motivation to participate in the village savings and loans, which has also enhanced the cohesion at the community level. The changes that have occurred as a result of participation of women in fish value chains can be an effective way of addressing poverty.

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# Gendered post-harvest losses between women and men informal fish retailers in Aswan, Upper Egypt

Seamus Murphy<sup>1</sup>

Country: Egypt
System: Freshwater SSF (on Lake Nasser)
Innovation: Gendered post-harvest losses between women and men

## *Abstract*

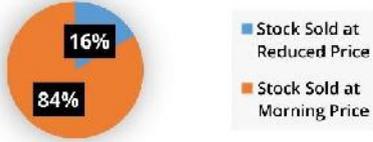
Aswan is the third poorest governorate in Egypt (Central Agency for Population Mobilization and Statistics (CAPMAS) 2017). Fishery activities are concentrated around Lake Nasser and sustain primary livelihoods for around 10,000 small-scale fishermen, 90 wholesaling businesses and 450 informal retailers. A value chain analysis study carried out by WorldFish demonstrated that Lake Nasser's fisheries value chain activities generate 42 jobs (full-time equivalent), approximately half of which are youth, for every 100 tons of fish caught and traded (Nasr-Allah et al. 2016). Only a proportion of this fish is processed, which generates a further six jobs for every 100 tons processed. Furthermore, Aswan's fisheries provide a crucial source of food to Upper Egypt's populations in Aswan, Assuit, Qena and Sohag. In Egypt, almost all fish is sold whole fresh or live by women informal retailers to consumers, with little evidence of value addition throughout supply (Kantor and Kruijssen 2014). At the retail node, randomised sampling across three governorates have shown women earn less gross income than men, have smaller-scale enterprises (lower cost of fish purchased linked to lower volumes for some and different species mix), have lower variable costs and earn lower net profit (Kruijssen et al. in press). These studies find that post-harvest losses contribute significantly to profitability constraints of these fish trade enterprises. Because there are limited cold chain facilities, sales prices decline over the course of the day. This reduced price reflects the loss of fish quality throughout the day between 'morning price' and 'afternoon price', which is representative of post-harvest losses. Assessments of gross profitability (selling price minus buying price) between fish sales in the morning and in the afternoon were compared. During peak season, significant differences were found in the proportion of fish sold at a reduced price between women and men retailers (Figure 7).

Post-harvest loss assessments of women and men retailers will draw on the mixed methods framework development by WorldFish, which combines the Exploratory Fish Loss Assessment, Gross Margin Analysis and the Women's Empowerment in Fisheries Index. So-called 'micro-surveys', using mixed methods approaches to 'load tracking', have been proposed by the FAO SAVE FOOD initiative. This study will sample specific groups of actors at each transaction node of specific loads in the supply chain, to provide sex-disaggregated data on gendered post-harvest losses across Aswan's fish value chains.

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### Women Retailers Post Harvest Losses



### Men Retailers Post Harvest Losses

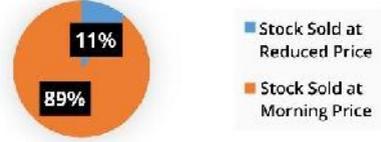


Figure 7. Portion of fish sold at reduced price by women and men fish retailers (Source: S. Murphy)

# Gender-transformative approaches: applying approaches from AQ to SSF

Afrina Choudhury<sup>1</sup>

Country: Multiple case studies
System: SSF and aquaculture
Innovation: Gender-transformative approaches

## *Abstract*

Many common gender issues cut across the small-scale fisheries (SSF) and aquaculture (AQ) sectors. There are: women's increasingly undervalued contributions; the division of labour that routes women into low-paid, low-quality jobs with unequal access to better jobs and wages; and their unique vulnerability to ecological change. Also pertinent are the stereotypes and norms that envelope women's and men's lives, which dictate and divide their reproductive and productive roles, and which determine their life choices. When it comes to resource rights and decision-making, women's important roles and contributions are almost ignored. This is exacerbated by national laws that do not recognise women as artisanal fisherfolk (because the definition does not identify the pre- and post-activities that women are usually involved in). Traditionally, many organisations working in this sector have combatted these issues in an accommodative manner—where change was brought only to the degree allowed while adhering to the existing norms and stereotypes. A common example is to introduce alternate livelihoods for women only in the homestead area. WorldFish in Bangladesh has evidence from many of its own accommodative approaches (e.g. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) study) that women do not use new technologies and innovations in a vacuum. They are constantly influenced and shaped by gender relations and institutions. A Gennovate study found that women's reasons for their own innovations also revolved around norms. WorldFish has introduced various gender-transformative approach mechanisms that understand and incorporate these findings into the AQ sector. These approaches can also be utilised in the SSF sector. They include household approaches, behaviour change communications, participatory action research and integrating guided processes within technical trainings, to name a few. An example of an intervention with these approaches was to introduce household-level social consciousness-raising exercises to the families introduced to women-conducive harvesting technology. Similar exercises were introduced to the communities of two types of groups: the harvesting technology groups (to build acceptance of women catching fish); and local service provider groups (to build acceptance of women acting as input sellers plus as extension workers). A second example was to merge these exercises with technical trainings (e.g. Cereal Systems Initiative for South Asia in Bangladesh, CSISA-BD), to enable women to combat both social and technical challenges when adopting an innovation. The presentation will showcase these approaches and provide examples of building them into SSF.

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# **Bridging policy, research and practice: integrating gender considerations in small-scale fisheries investments**

**Sarah Lawless<sup>1</sup>, Kate Doyle, Philippa Cohen, Hampus Eriksson,  
Anne-Maree Schwarz, Helen Teioli, Agnetha Vavekaramui, Elsie Wickham,  
Rosalie Masu, Ronelle Panda, Cynthia McDougall**

Country: Solomon Islands
System: Coastal fisheries
Innovation: Practical guidelines to bridge the gap between policy commitments and local research insights

## *Abstract*

Research promoting the role, contributions and value of women in small-scale fisheries has led to gender equality being prioritised in global, regional and local fisheries policies and development investments. These policies and investments require development initiatives to more explicitly target gender inequalities through their programs. However, development organisations and practitioners are challenged to translate these requirements into practice due to a lack of practical knowledge about how to identify, address and transform inequalities in local contexts. Using Solomon Islands as a case, this study seeks to bridge the gap between policy commitments and local research insights, to provide practical guidance for considering gender in development initiatives. We expanded upon the findings of Cohen et al. (2016) and Lawless et al. (in press) who identified how gender norms and relations influenced the opportunities and constraints men and women faced in livelihoods. We combined insights from these data with the experiences of more than 40 government and non-government representatives who shared the challenges they encountered in facilitating equitable participation and benefits for women, men and youth within their development, environmental management and fisheries initiatives. These data suggested that at the community scale women, men and youth faced different constraints in their abilities to access and benefit from development initiatives. These were grouped according to four main areas: (1) participation in development; (2) access and control over resources; (3) gendered divisions of labour; and (4) decision-making power. In response to the identified constraints, we developed a practical tool, organised according to these four groups, to support gender accommodating and transformative design and implementation of local development initiatives. We discuss the opportunities of this tool in small-scale fisheries development. We also discuss a developing area of research that extends beyond the local scale, to examine multi-scalar influences in addressing gender inequalities.

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## Session 5: Food and nutrition security

Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care (Committee on World Food Security 2012). In her opening address, Shakuntala Thilsted (Research Program Leader, Value Chains and Nutrition, WorldFish) reflected that in terms of realising development outcomes, the ‘food and nutrition security’ framing encourages integration of policies, strategies and actions across multiple sectors that support eradication of hunger and malnutrition. Small-scale fisheries are in many contexts a critical sector, supplying an irreplaceable animal-source food, which provides multiple essential and highly bioavailable micronutrients, fatty acids and animal protein. Therefore, as proposed in the FISH CGIAR Research Program, it is critical to protect and enhance the food and nutrition security functions that small-scale fisheries provide. Through improved availability of and access to affordable, safe, nutritious fish by poor consumers, especially women and young children, Flagship proposal 2 will contribute to the 2030 targets of the CGIAR system level outcome: ‘Improve food and nutrition security’.

The United Nations System Standing Committee on Nutrition (UNSCN) expresses food and nutrition security as a single, integrated goal that considers: food production; food preparation and diets; food systems; socio-economic, biological and sociological factors; as well as health and sanitation. Research presented and discussed in this session examined the role of SSF in food and nutrition security through a range of these perspectives.

Research presented by Shakuntala Thilsted highlighted examples from Cambodia, Lake Malawi and Lake Kitangiri (in Tanzania) where research on fish production and preparation illustrated the critical role dried small fish play to nutrition and human health. Data presented showed that dried small fish are an exceptionally rich source of micronutrients and fatty acids in people’s diets. In addition to the measures of micronutrients and fatty acids in the fish themselves, Dr Thilsted explained that the ways in which these fish are prepared and consumed make them ‘an irreplaceable animal-source food for the poor’, by improving dietary diversity and enhancing micronutrient bioavailability from other foods in the meal. Because these fish can be processed (dried) and stored, they are able to extend the duration of fish consumption as well as reach non-fish producing areas, overcoming one of the challenges of distribution. Dr Thilsted described WorldFish-led work in Bangladesh that has developed three unique fish-based products (Figure 8a) to increase the portion size and frequency of intake of this culturally accepted, nutrient-rich food by women and children in the first 1,000 days of life—a critical period of human development and growth. Discussions highlighted that these innovations could be tested, modified and scaled to improve nutritional outcomes in several countries in Africa and Asia.

The study presented from Timor-Leste focused on factors and patterns around production and harvesting—in this case through gleaning—that had food security implications at the household level (Figure 8c). The study, led by Alex Tilley, illustrated that catches from women and youth fishing through gleaning were in fact critical for nutrition because their catches were predominantly consumed within households (rather than sold). The geographic location of these fishing activities, the focus on small fish and shellfish, and the low to no profile the gleaning fishery holds in the eyes of policymakers meant that some management measures being proposed (size limits and closure of nearshore fishing grounds) to promote ‘environmental sustainability’ may pose a threat to the nutritional contribution provided by these fisheries. On the other hand, an understanding of fisheries production and harvesting could inform a ‘nutritional-sensitive approach’ to management design and protect nutritional benefits—and avoid management decisions that, whilst addressing ‘environmental management’, might have harmful nutritional outcomes. Discussions that followed highlighted that the perverse nutritional and gendered outcomes from the implementation of size limits or restrictions of nearshore fishing grounds were concerns also throughout the Pacific region.

Four studies highlighted very different aspects of the role of small-scale fisheries from a food systems perspective—employing large dataset quantitative research to localised deep ethnographic work. First, a presentation highlighted the necessity of an ‘aquatic-agricultural food system’ perspective and interventions to improve nutrition. Second, ethnographic research highlighted the links between food and water security—the tight connections to fluctuations in poverty and hardship. Third, a perspective was provided on the continuum of ‘fish production systems’ highlighting shifts in production patterns and prevalence of aquaculture relative to capture fisheries. Fourth, a global and quantitative analysis examined patterns of production and international trade as driving the nutritional potential of fisheries to particular nations.

Joelle Albert presented research conducted in Solomon Islands where the management of small-scale fisheries is seen as essential to maintain the foundational role fish plays in food security in rural communities; however, simultaneously, the acute nutritional concerns in these areas stem from multiple factors—largely factors beyond fisheries systems (Figure 8b). In this case, a nutrition-sensitive approach to facilitate improvements to nutrition must consider the broader aquatic agricultural food system and behaviours around consumption and food choices.

Mike Fabinyi presented ethnographic research from communities in the western Philippines, and examined food and water security as it is situated and influenced by a range of factors (Figure 8d). This work highlighted that factors, which other studies might frame as being outside of the ‘food system’, are highly influential on food security outcomes. In this case, research highlighted that food and water insecurity were linked, synergistically, through access to money, sickness and labour time, and are driven by broader forms of poverty.

Jessica Bogard presented published research from Bangladesh that illustrated the shift in the fish production system through time—from fish being predominantly sourced from small-scale capture fisheries, to a growing proportion of fish coming from aquaculture (Figure 8f). Whilst there was a net increase in fish consumption, analysis showed that intakes of iron and calcium from fish had declined significantly. This research highlights how food system and fish production policies must not only focus on maximising production and productivity, but also need to take on a ‘nutrition-sensitive approach’ that considers the nutritional qualities of fish species and the way in which they are being prepared and consumed. Discussions that followed highlighted the ongoing efforts (including those within Flagship 1 of the FISH CGIAR Research Program) to improve the nutritional quality of fish produced from aquaculture—including efforts to develop, diversify and refine polyculture technologies.

The presentation by Christina Hicks took a more global view of fish in food systems and looked at the global trends in nutritional potential of fish production and trade. Her research used global datasets to identify key geographies where there is good understanding of the nutrition value of marine finfish (Figure 8e). The analysis then determined where marine fisheries hold the greatest potential for improving nutritional security, by comparing the geographic distribution in nutritional yield from fisheries, prevalence of nutritional deficiencies, and the importance of fisheries to food and livelihoods.

Discussions continued on the value of large and existing datasets to gain insights into consumption patterns; however, many national household income and expenditure surveys or censuses do not collect sufficient data that can be useful. One participant noted that household expenditure surveys are powerful to calculate consumption from fisheries, but they can also raise more questions than answers. Nonetheless, discussants identified these surveys as an opportunity, through partnerships, to increase insights into nutritional trends and concerns. It was noted that the planned updated version of the publication *Hidden harvest: the global contribution of capture fisheries* (World Bank 2012), to which WorldFish will contribute, will explore the value and limitations of such datasets for understanding the contributions of SSF to diets and nutrition. It was noted that the research community has an opportunity to influence the kinds of data collected through the household income and expenditures surveys that are led by governments. For example, in Bangladesh, World Bank discussed with WorldFish about the collection of data on fish supply and use. This information can then be valuable to influence national development policies and strategies in the overall fisheries sector.



**Figure 8.** (a) In Bangladesh, WorldFish has developed a prepared instant product of powdered fish, rice, orange sweet potato and oil, to be served as a porridge for infants and young children, at the initiation of complementary feeding of the child at six months of age (Source: S. Thilsted). (b) Solomon Islands face the double burden of malnutrition: obese adults and stunted children. Diet quality is extremely poor (Source: J. Albert). (c) In Timor-Leste, women’s fishing activities play a major role for food and nutrition of their family (Source: A. Tilley). (d) In the Philippines, food and water insecurity co-occurrence shows how these are driven by broader forms of poverty (Source: M. Fabinyi. Photo: Alex Felipe). (e) A global approach identifies key geographic regions where marine fisheries hold the greatest potential for improving food and nutrition security (Source: C. Hicks). (f) In Bangladesh, the declining proportion of fish supply from capture fisheries and the growing proportion from aquaculture result in increased total fish consumption, but intakes of iron and calcium from fish declined significantly (Source: J. Bogard).

# Dried small fish: a super food for the first 1,000 days of life to build healthier and more prosperous nations

**Shakuntala Thilsted<sup>1</sup>, WorldFish and partner staff from Bangladesh, Cambodia, Myanmar, Malawi, Sierre Leone and Zambia**

Country: Bangladesh
System: Capture fisheries
Innovation: Dried small fish as a super food

## *Abstract*

Good nutrition in the 1,000 days between a woman's pregnancy and her child's second birthday lays the foundation for the woman's wellbeing; optimal birth outcome; the woman's ability to care for and breastfeed her child; and the child's ability to grow, develop, learn and thrive; and thus offers a unique window of opportunity for healthier and more prosperous nations. In Bangladesh, WorldFish has developed three unique fish-based products to increase the portion size and frequency of intake of the culturally accepted, nutrient-rich food, fish, by women and children in the first 1,000 days of life. Using dried small fish species (a very concentrated source of multiple minerals and vitamins, essential fatty acids, and animal protein) from capture fisheries, these products are: a fish chutney of dried small fish with oil and spices for women, to be served as an accompanying dish to daily meals; a prepared instant product of powdered fish, rice, orange sweet potato and oil, to be served as a porridge for infants and young children, at the initiation of complementary feeding of the child at six months of age; and an instant fish powder to be added to appropriate dishes for both women and children. Pregnant and lactating women who consume a heaped tablespoon of the fish chutney daily report of 'feeling stronger', producing 'a lot of milk' and their children are 'getting more milk, being satisfied and growing well'. Their infants are called 'Pusti Bachcha' (healthy/well-nourished child) by the community. Building on this research, WorldFish and partners are developing and promoting culturally acceptable, ready-to-use, easy-to-store, safe and nutritious fish products for the first 1,000 days of life, in several countries in Africa and Asia. Robust, long-term efficacy and effectiveness studies at country level are needed to evaluate the impact of these products in both women and children as well as to conduct a cost-benefit analysis, using disability-adjusted life years (DALYs). Stable and affordable supplies of sufficient quantities of safe, dried small fish are a prerequisite for making full use of the superb potential of fish-based products for the first 1,000 days of life. Engagement of and investments by the public and private sector will enable expanded product development and scaled distribution through various channels, including national food distribution programs for vulnerable population groups, school feeding programs and commercial sales.

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# The contribution of small-scale fisheries to nutrition in Solomon Islands rural communities

Joelle Albert<sup>1</sup>, Jessica Bogard, Faye Siota, Joe McCarter, Salome Diatalau, Josephine Maelaua, Shakuntala H. Thilsted

Country: Solomon Islands
System: Coastal fisheries
Innovation: Better access due to community-based fisheries management initiatives

## *Abstract*

In Solomon Islands, subsistence-oriented small-scale fisheries and farming are the backbone of the rural economy. Despite this largely subsistence living, rapid population growth, shortages of arable land, declining fisheries productivity and the burgeoning trade of low-quality imported food have created challenges for nutritional security. The double burden of malnutrition is prevalent in Solomon Islands rural communities, with both overweight/obese adults and stunted children. While community-based fisheries management initiatives to date have contributed to more secure access to coastal fisheries for rural communities, this study aimed to understand how better access to fish is related to improvements in nutrition. Using the UNICEF framework for malnutrition, this study used a multi-method approach to assess nutritional status and diet quality of women and young children in four rural Solomon Islands communities. Results highlight that coastal fisheries were the primary animal-sourced food across all study communities, contributing on average to the diets of 50% of women and 40% of young children in the 24 hours assessed. However, the diet quality of women and young children across all study communities was extremely poor, driven by diets low in diversity. Diets generally lacked the consumption of dairy, nuts and seeds, fruit, and vegetables. In combination with low-diversity diets, there was a high proportion of women and young children that consumed energy-dense, nutrient-poor foods (mostly fats/oils and sweet drinks) and a high proportion that consumed imported/store foods such as rice and tinned tuna. Participatory research with the study communities through problem tree analysis identified potential drivers of nutrition issues including challenges in agriculture (declining yields), a lack of nutrition knowledge, a preference for imported foods (due to taste and convenience) and a shift to a market-based economy. Clearly these results highlight that, while the management of small-scale fisheries is essential for food security in rural Solomon Islands communities, nutritional issues stem from multiple factors. A nutrition-sensitive approach to the broader aquatic agricultural food system is integral to improve food and nutrition security in rural Solomon Islands communities.

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# Steady, reliable and low technology: recognising and strengthening the role of women and youth in fisheries food security in Timor-Leste

Alexander Tilley<sup>1</sup>, Agustinha Duarte, David Mills

Country: Timor-Leste
System: Coastal fisheries
Innovation: Role of women and youth to food and nutrition security and household income

## *Abstract*

Recognising and quantifying the role of women and youth in fisheries has profound implications for management, poverty alleviation and development policy. Fishing is a crucial activity in the multiple livelihood strategies of coastal communities in Timor-Leste, and women and youth are integral, yet almost entirely neglected groups in decision-making. Using community-based collections of small-scale fisheries landings across 10 communities around Timor-Leste, we quantify the contribution of women and youth fishing activities (WYFA) to food and nutritional security, and income at household and community scales. We compare productivity of WYFA with traditionally male-dominated small-scale fishing activities and catch rates. Catches from WYFA are consistent throughout the year, and are predominantly consumed at household and community levels, with only large individuals and high-value species being sold. WYFA are restricted to reef areas and lagoons, intertidal areas, mangroves and seagrass beds. Given the value of these nearshore environments in terms of ecosystem services, there is a strong incentive to engage women and youth in fisheries management and stewardship of marine resources. However, top-down, biodiversity-focused management processes such as establishment of national parks is likely to further marginalise women and youth from management of coastal resources, as well as threaten reliable and low-technology access to fish protein and micronutrients critical in reducing malnutrition. The growing focus on community-based resource management as a process from which to build decentralised governance in Timor-Leste, is an opportunity to incorporate women and youth as crucial actors in, and drivers of, this process.

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# Poverty, food and water insecurity in fishing communities: evidence from the Philippines

Michael Fabinyi<sup>1</sup>

Country: The Philippines
System: SSF
Innovation: Links between food and water security and poverty

## *Abstract*

Fisheries are widely recognised to be very important for food security in low-income rural maritime households, yet many households remain food insecure. Food insecurity is closely linked to other social conditions, and the linkages between these conditions and their underlying drivers are less well explored in maritime contexts than they are for terrestrial contexts. In this paper I draw on fieldwork from a small island in the western Philippines to examine the linkages between food and water insecurity. Food insecurity is common, and characterised by a lack of funds to buy food, particularly during periods of bad weather. Water insecurity is also characterised by the need to pay for the delivery of drinking water from one of several remote sources. Food and water insecurity are linked synergistically through money, sickness and labour time. I argue that both food and water insecurity are driven by broader forms of poverty. Understanding the relations between food and water insecurity and the wider drivers of poverty should generate better understandings of how food and water insecurity is generated and reproduced in maritime contexts.

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# Drivers of nutritional quality and the potential for meeting global nutritional needs from fisheries

Christina Hicks<sup>1</sup>, E. Allison, P. Cohen, C. D’Lima, N. Graham, K. Nash, A. MacNeil, D. Mills, M. Roscher

Country: Global
System: Marine fisheries
Innovation: Identification of drivers of nutritional quality of fisheries

## *Abstract*

There has been growing recognition of the potential role of fisheries in addressing food security. Early efforts focused on the contribution fisheries make to protein consumption and household incomes. However, aligned with the shift in food security research from a focus on nourishment to one on nutrition, the focus in fisheries has shifted to the micronutrient content of fish and consequent potential for meeting nutritional needs. Clear evidence exists that certain species of fish (e.g. anchovies or small indigenous species) contain high concentrations of vital nutrients (e.g. iron or zinc). However, we do not know how generalisable these values are across the full range of species consumed; how the resultant nutritional yields from fisheries landings are geographically distributed; or the extent to which these nutritional yields are capable of meeting people’s nutritional needs. Drawing on ecological theory, we used a trait-based approach to identify the environmental and ecological characteristics that predict nutrient variability among marine fishes. We used a Bayesian hierarchical model to develop expected conditions for how six micronutrients are related to 20 variables associated with each species diet, mobility, thermal regime, growth rate and size. We applied our models to five years (2011–15) of marine landings data to estimate the global distribution of nutritional yields from fisheries. By comparing the geographic distribution in nutritional yield from fisheries, prevalence of nutritional deficiencies, and the importance of fisheries to food and livelihoods, we suggest key geographies where marine fisheries hold the greatest potential for improving nutritional security.

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# The vital role for capture fisheries in contributing to nutrition: lessons for nutrition-sensitive approaches along the continuum of fish production systems

Jessica Bogard<sup>1</sup>, Geoffrey C. Marks, Sami Farook, Jillian Waid, Kazi Toufique, Benjamin Belton, Abdulla Mamun, Shakuntala H. Thilsted

Country: Bangladesh
System: Capture fisheries and aquaculture
Innovation: Differences in nutrient intake between capture fisheries and aquaculture

## *Abstract*

Aquatic food systems are in transition; global capture fisheries are in decline and aquaculture is rapidly expanding. Nutritional quality of fish varies according to species, size, their food sources and the environments in which they are produced. A global shift away from diverse capture species towards consumption of a select few farmed species has implications for nutrition, which are yet to be explored. We conducted temporal analyses using nationally representative household income and expenditure surveys, corresponding to this transition (1991–2010) in Bangladesh of fish consumption from capture fisheries and aquaculture, and associated nutrient intakes from fish. Over time, we found that people consumed more fish in total, with a declining proportion from capture fisheries, and a growing proportion from aquaculture. Whilst total fish consumption increased by 30%, intakes of iron and calcium from fish declined significantly (by 15% and 14%, respectively,  $P < 0.01$ ), and intakes of zinc, vitamin A and vitamin B12 remained unchanged. This is driven by a greater reliance on farmed fish species, which are generally of lower nutritional quality compared to species from capture fisheries. Our results highlight both the vital role for capture fisheries in contributing to nutrition, and the unintended negative consequences of policy decisions that are narrowly focused on maximising production and productivity of food systems. Indicators used in the monitoring and evaluation of agricultural interventions must go beyond these measures to also consider nutritional quality. The complementary role of capture fisheries and aquaculture must be harnessed if food and nutrition security goals are to be achieved. As fisheries become an increasingly important food source for many, it must embrace a nutrition-sensitive approach and promote diversity over a continuum of production systems. These include polyculture of large exotic and small indigenous fish species, homestead ponds connected to rice fields, community fish refuges and dry season ponds in rice fields.

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## Session 6: Livelihoods and value chains

The overarching hypothesis of the FISH CGIAR Research Program is that ‘Livelihood and market innovations can build resilience in fishing communities’ (FISH CGIAR Research Program 2017, p. 3). The premise is that improved opportunities for fishers to generate income can be built within fisheries value chains. Simultaneously it is recognised that in certain contexts where fisheries are considered to be overexploited, concerns about resources sustainability and vulnerability of livelihoods mean that opportunities outside of the capture fisheries sector will be necessary to maintain food security, alleviate poverty and promote environmental sustainability. ‘Livelihoods’, in a broad sense, are considered to be a means of generating income, securing food or spending time. In many systems SSF are one of many livelihoods that a person or household might engage in; importantly, in many contexts, the livelihoods of people involved in SSF are typically diverse and dynamic. Despite these broad and dynamic livelihood portfolios, the benefits that SSF-associated livelihoods provide are often critical to human wellbeing and can act as a social safety net (Béné et al. 2015). Value chains (and in this session the term ‘market chains’ and ‘supply chains’ were also used as a synonym) are considered to be ‘...the full range of activities which are required to bring a product or service from conception, through the different phases of production ..., delivery to final consumers, and final disposal after use’ (Kaplinsky and Morris 2001, p. 4).

The first presentation by Hampus Eriksson illustrated a ‘global’ perspective of fisheries value chains (Figure 9a) highlighting that value chains connect geographies that are very distant. The presentation illustrated that global demands (e.g. the high-value commodities such as *beche-de-mer*) can create new value chains and exploitation where previously there was no fishery (Figure 9a). The presentation highlighted that a look at local-scale exploitation and management will be insufficient to explain or govern a value chain.

Markets can be viewed as threats to local environments (through over-exploitation), and an economic and development opportunity on which fishers can capitalise. The role of research in this context is to examine the two questions the presenter posed: (1) how can local environments be managed sustainably in the face of escalating demands and market forces? and (2) how can fishing communities govern supply chains in ways that are advantageous to them?

Local alternative or supplementary livelihoods were discussed in two presentations, both examining application in the Pacific region. Eriksson highlighted three considerations from research for interventions that aim to promote livelihood diversity: (1) firstly, that promoting livelihood diversity can introduce a labour burden, particularly for women (Cohen et al. 2016); (2) diversifying to other sectors is associated to risk (Eriksson et al. 2017); and (3) that diversifying within the same sector is less risky, but may not reduce exposure or resource dependence (Béné et al. 2015). The second case presented by Daykin Harohau (a PhD candidate of James Cook University/WorldFish) examined the role of small-pond aquaculture specifically—being a strategy that has been promoted in Solomon Islands in an attempt to address a future ‘fish for food’ gap. Daykin considered the role of pond aquaculture *alongside* (rather than a replacement for) the role of wild capture fisheries that concentrate, in Solomon Islands, in coastal waters (Figure 9b and c). This presentation highlighted that a range of social and geographic factors are at play (but currently only just starting to be understood through research) that might mean small-pond aquaculture is a viable and preferred strategy that leads to outcomes for local people. Whilst aquaculture and alternative livelihoods can sound very promising, both presenters highlighted that there are historical engagements in these areas that suggest uptake and benefits are more difficult and complex to realise in practice.

Discussions reflected that the way in which livelihood interventions have been framed in the past can be characterised as: to create incentive for local community to be engaging in sustainable resources management; and/or to distract fishers from fishing so as to reduce fishing pressure. But these

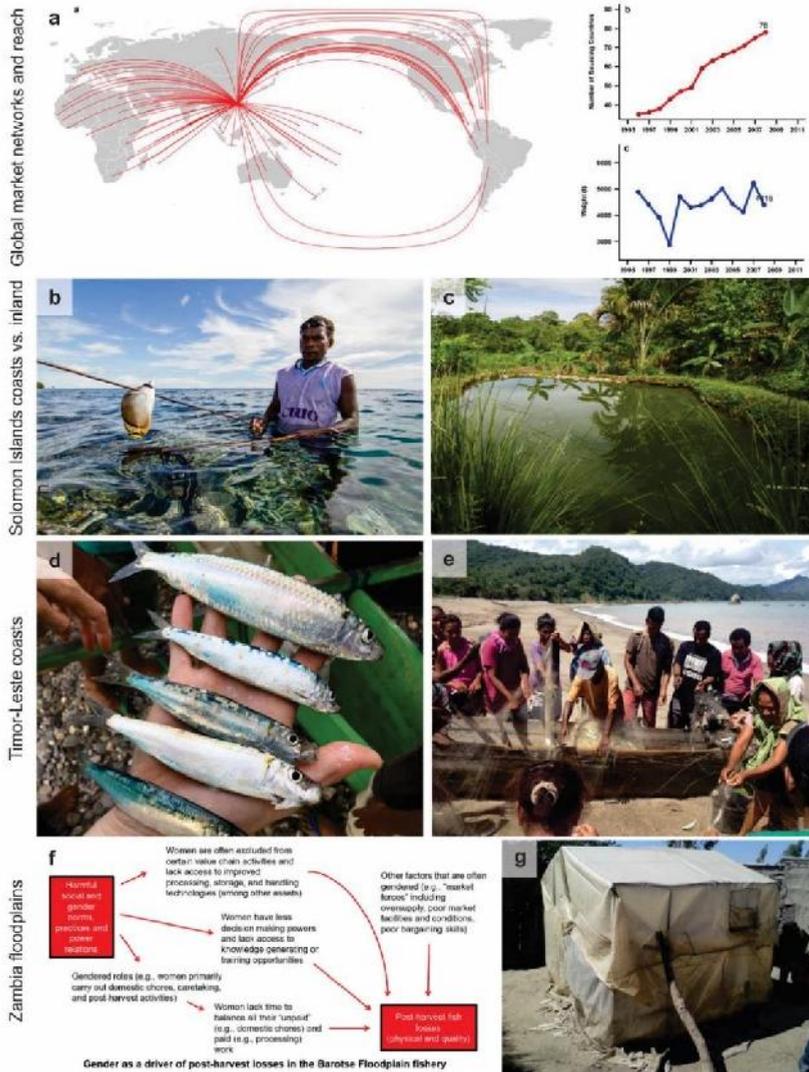
propositions have been shown to be ineffective at their ultimate goal—in sum there needs to be a shift in the way we work with livelihoods for community benefit.

Presenters in general reflected that any work or research on livelihoods needs to be cognisant of the fact that livelihoods are impacted by external drivers of change, and they exist in and interact with a dynamic environment. It is for this reason that in many contexts where fishing is important, livelihoods are highly diverse and livelihood initiatives deliberately seek to build diversity. Whilst resilience theory broadly suggested high diversity confers greater resilience, the costs of managing a diverse livelihood portfolios can do the reverse and weaken any resilience gains made. Discussions drew out the difference between livelihood diversification vs. enhancing existing livelihood, and highlighted that a strategy might not always be ‘either/or’. Theory resilience narrative that increased diversity equals increase resilience. Discussants suggested there was huge potential to explore the area of livelihood alternatives.

Value chains were discussed in three presentations. Kimberley Hunnam presented a description of the small-pelagic or sardine-focused fisheries of Timor-Leste (Figure 9d) that, through direct engagement and long value chains, provided benefits and nutritionally rich food to many people in Timor-Leste (Figure 8e). The work described, in depth, a fishery that has previously been overlooked by research and agencies that have a concern with fisheries and food security.

Both Hampus Eriksson and Steven Cole discussed innovations along the value chain that were principally designed to reduce loss and increase value of products already being produced by small-scale fisheries (Figure 9g). The presentation from Steven Cole, although discussing the value of a technical value chain innovation, focused simultaneously on novel ways in which to introduce and test that innovation—specifically aiming to enhance gender equality and in particular by applying a ‘gender transformative approach’ (Figure 9f). This presentation highlighted a distinction from a more functional perspective—that the *way* in which research was conducted could in fact catalyse social change (rather than position social change as the outcome that will follow a successful technical innovation and be understood by research).

In the discussions that followed, presenters reflected on the various roles and forms of partnerships for scaling up. Steven Cole reflected that research was not just focused on the scale and the distribution of benefits from a particular innovation, but that research evolved to understand how that innovation (technology paired with the innovative testing and delivery) could be used more broadly—therefore research was applied to determine lessons that can be scaled up (scalability or strategies to scale). The role of partners in uptake and potential sustainability of innovation, for example in Zambia, going forward needs to try to bring out the value of not engaging women.



**Figure 9.** (a) 'Contagious exploitation through a global seafood sourcing network' (reproduced from Eriksson et al. 2015) illustrates where sea cucumbers are sourced for the Hong Kong market or node in that value chain, and inset graphs (Source: H. Eriksson). The graph illustrates that this network has been growing in reach through time (Source: D. Harohau). (b) The critical role of coastal fisheries livelihoods in Solomon Islands (Source: D. Harohau). (c) Research that considers complementary livelihoods offered by small-pond aquaculture (Source: K. Hunnam). (d) The, until now, poorly described sardine fisheries of Timor-Leste where research is now illuminating the details of the species targeted, the fishing grounds of focus (Source: K. Hunnam). (e) The people and value chains that connect the resource through value chains to food security and income benefits (Source: S. Cole). (f) A gender analysis of the value chain revealed gender constraints were leading to post-harvest losses in the value chain of the Barotse floodplain fishery (Source: S. Cole). (g) With this analysis as a guide, a 'gender transformative approach' was applied to test a technical innovation that might not only lead to reduction of post-harvest losses, but also that shifted the norms and relations that had previously perpetuated inequitable and sub-optimal livelihood outcomes.

# Global-to-local market chains and sustainability of small-scale fisheries

Hampus Eriksson<sup>1</sup>

Country: Global/Solomon Islands
System: SSF in general/coral reef fisheries
Innovation: Enhance existing livelihoods vs. livelihoods diversification/SSF supply chain infrastructure to reduce waste and increase market access

## *Abstract*

SSF comprise complex production and supply networks, and most of the fish that is eaten has been caught and traded by someone other than the consumer. Global and local market chains connect distant sources of supply with urban areas of high demand. This has been identified as both a threat to local environments and an opportunity to local fishers to capitalise on a global or urban economy. This presentation discusses two major considerations in this context: (1) how can environments be managed sustainably in the face of escalating demands and market forces? and (2) how can communities govern supply chains in ways that are advantageous to them? I present data on the forces at play in global and local sourcing networks that are important to determine management and regulatory responses that 'fit'. In places where there is high dependence on SSF it is difficult to reduce pressure by regulation alone due to high dependence for livelihoods. To support pathways out of perpetual overexploitation, opportunities to sustainably enhance and diversify livelihoods and incomes will need to be pursued. Efforts to diversify livelihoods outside of the fisheries sector can be difficult to sustain and are associated with elevated risks. Recent experiences from the SSF program in Solomon Islands indicate that the most feasible and locally prioritised activities are those that support enhancement of existing livelihoods—initiatives that are appropriate to local capabilities. For example, in Solomon Islands we are examining the performance of SSF supply chain infrastructure to reduce waste and increase market access. However, such initiatives do not directly reduce dependence on resources and may contradict the objective of environmental sustainability. Such initiatives therefore raise critical questions about whether they unintentionally perpetuate overexploitation, or if they are contributing to pathways out of poverty and therefore resource dependency.

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# Technical and social innovations to help fish processors shift in pathway out of the social-ecological trap in the Barotse Floodplain fishery, Zambia

Steve Cole<sup>1</sup>, Cynthia McDougall, Alexander M. Kaminski, Alexander S. Kefi, Alexander Chilala, Gethings Chisule

Country: Zambia
System: Floodplain fishery
Innovation: Improved fish processing technologies and communication for social change (gender)

## *Abstract*

The Barotse Floodplain fishery is an important source of livelihood for resource-poor women and men in western Zambia. Sub-optimal efforts by Department of Fisheries and the traditional authority to manage the fishery have resulted in heightened illegal fishing and overfishing, and a decline in fish stocks and average sizes over the past decade. It is thought that such rigid behavioural responses are applied due to having a lack of capacity to adapt, leading to overdependence on the fishery and, ultimately, unsustainable outcomes—referred to in the resilience literature as a social-ecological trap. This presentation expands this often-cited trap framing by applying a gender lens and looking beyond the primary sector (fishing) to include considerations of a secondary sector (post-harvest processing). Post-harvest losses (e.g. discarded fish or fish sold at a reduced price) create economic and food/nutrition security challenges for value chain actors and increase the need for more fish as fishers, processors and traders attempt to recover their losses. Research shows that, on average, more women than men experience losses across this fishery value chain, and that women processors experience significantly higher losses compared to men processors. Gendered barriers, along with lack of access to technologies, contribute to these losses. To address this development challenge, a research project tested both improved fish processing technologies and a communication for social change intervention as a possible escape pathway from the trap in this fishery not commonly recognised in the literature. The results suggest that approaches that combine technical innovation to reduce losses with social innovation to enhance gender equality may hold promise for enabling resource-poor fishery-dependent value chain actors to shift in pathway out of social-ecological traps, especially women.

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# Sardines in Timor-Leste: characteristics and contributions of a small pelagic fishery

Kimberley Hunnam<sup>1</sup>, David Mills, Natasha Stacey

Country: Timor-Leste
System: Small pelagic (sardines) fisheries
Innovation: Describe and identify opportunities for small-scale sardine fisheries

## *Abstract*

Small-scale fisheries make essential contributions to food security and coastal livelihoods. While there has been much previous research on the importance of tropical coral reef fisheries in the Asia–Pacific region, far less attention has been paid to small pelagic fisheries. Yet these fisheries are, by their nature, more productive and more resilient to fishing than reef fisheries; and can be as, or more, important for income and the supply of nutritious food. This study is investigating small-scale sardine fisheries in Timor-Leste with the overall aim to identify potential opportunities for delivering and sustaining greater benefits from this social-ecological food system. Fish landing surveys, semi-structured discussions with fishers and fish traders, as well as observations, have been undertaken in communities using three river-associated fishing locations along Timor-Leste’s north coast. Preliminary findings suggest that sardine fisheries are seasonal, and associated with rainfall and turbid river plumes. Fishers work close to the shore using small-mesh gillnets from both motorised and non-motorised canoes to catch a number of sardine species, as well as other small pelagic and estuarine fish. Sardines are important as both income and food. Fish are transported to inland communities and district centres by fish traders, or sold directly to consumers on the roadside. Most sardines are sold fresh—only surplus (unsold) fish are dried; however, this was uncommon during the reportedly poor 2016–17 season. Sardines are commonly eaten by fishers, fish traders and their families, and are a popular food among Timorese as they are more affordable than large fish. Research is ongoing, with the next phase focusing on exploring household consumption patterns and fishery distribution.

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# Fish from small-scale coastal fisheries, or tilapia pond aquaculture?

Daykin Harohau<sup>1</sup>

Country: Solomon Islands
System: Small-scale inland pond aquaculture
Innovation: Small-scale inland pond (tilapia) aquaculture

## *Abstract*

In Pacific island countries, SSF are vital for subsistence livelihood and local economies. In Solomon Islands, fish predominantly supplied through SSF provides 90% of total animal protein in people's diets, with average fish consumption of 33 kg of fish/person/year (Bell et al. 2009; Weeratunge et al. 2011). Increasing population (particularly in rural areas), unsustainable fishing practices, coastal/agricultural developments and impacts of climate change are predicted to lead to a shortfall of 6,000 to 20,000 tons of fish supplied from coastal fisheries. This is provided the current rate of fish consumption is maintained by 2030. This looming deficit stimulated the national government to promote alternative avenues to secure fish supply for the future. Notable avenues are: improving fisheries management strategies and capacity (e.g. use of FADs (Albert et al. 2014); improving community-based fisheries management, including the use of periodically harvested closures (Cohen and Alexander 2013; Cohen and Foale 2013; Foale et al. 2011); and developing inland pond aquaculture (Cleasby et al. 2014; Harohau et al. 2016). This paper focuses on small-scale inland pond aquaculture as an alternative or additional source of fish supply in rural areas (Cleasby et al. 2014; Harohau et al. 2016). Currently, rural household tilapia ponds (the exotic Mozambique tilapia) produce 726–1,819 kg of fish/ha/year and have the potential to contribute to household nutrition and income (Harohau et al. 2016). However, this productivity has not yet led to substantial improvements to rural farmers' livelihoods, food security and wellbeing. This has been demonstrated through rural inland households' (tilapia and non-tilapia farming households) persistently poor diets (Andersen et al. 2013; Jones et al. 2014), limited uptake of pond aquaculture and un-sustained practice of tilapia farming. This paper aims to understand the impacts of social dynamics, geographical locality and access to market, in influencing adoption and sustainability of tilapia pond aquaculture and the relative impacts on people's livelihoods, wellbeing and food security. In this presentation, I consider the constraints and opportunities for tilapia pond aquaculture relative to the role of fish from small-scale fisheries in Solomon Islands future.

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# Conclusion

These proceedings serve as a brief summary of the *Resilient Small-scale Fisheries Symposium* and illustrate with examples the breadth and depth of research being undertaken in a range of SSF systems. The symposium sought to bring focus and critical reflection to the role of research in contributing towards development outcomes such as reducing poverty, fostering greater environmental sustainability, facilitating gender and social equity and improving livelihoods, and food and nutrition security. As such, the symposium was a showcase of research that is tightly tied to, and embedded within, processes to realise development outcomes. Whilst challenging to summarise, some overarching points emerged from presentation and discussions in the six sessions. These included reflection of the approaches and strategies that are being employed to ensure that research leads to outcomes in the places/communities where it is conducted, but critically also at broader scales.

## **(1) Tracking and realising research impact and development impact**

- In addition to conducting rigorous and embedded research that responds to stakeholder needs, an effective research in development program must resource and address the following five elements: (1) partnerships that enhance impact; (2) understandings of public and media perceptions; (3) communication strategies to promote influence and impact at scale; (4) a competitive and visible research profile; and (5) rigorous, critical and transparent evaluations of progress along impact pathways.
- Communicating research and development investments in SSF language should describe the improvements that will be and have been realised, rather than just messages about maintaining status quo. There are enormous values associated with SSF, such as the number of people involved who have no other opportunities for income and livelihood, and the fact that fish are incredibly good and vital for people's health. An influential but underdone area of research and associated communication is demonstrating the replacement cost of the benefits SSF provide.

## **(2) Fisheries management and technology**

- Whilst fisheries management and technology are probably more classic fisheries interventions, research concerned with impact heavily emphasises the necessity and value of strong community engagement and voice in designing, testing and refining management and technology innovations—particularly through the application of participatory approaches. Cases illustrate action research initiatives to develop models/innovations fit for context and are able to bring about positive change. Strong consideration must be given to local culture, social structures and ecological knowledge, and complementarity to scientific knowledge. There was an emphasis based on the need for long-term and stable relationships with NGOs, government and communities.
- Very few 'projects' will have the scale of impact needed to reach ambitious goals (associated with food and nutrition security, poverty alleviation, and environmental sustainability), but when considered together there is potential to have this 'scaled-up impact'. A key strategy for research to contribute to impact at scale is to draw together best practice recommendations from the multiple case studies where a particular innovation was developed and tested in different contexts. These best-practice guidelines need to become, in an appropriate form, more widely available. Strategies for scaling up outcomes must also include the communication of success stories back to donors, to partners and to those agencies that might take up those practices or contextual understandings in their efforts more broadly. Scaling might include the (organic or assisted) spread of innovations between communities or fishers, shifts in NGO and government

practices that promote a practice/innovation, and/or policy and governance shifts that allow an innovation to spread.

### **(3) Governance, institutions and external drivers of change**

- Whilst small-scale fisheries a diverse and often well understood by local case studies (including those that examine local governance processes and innovations), outcomes at the local scale might be equally impacted by structural barriers, enabling environments or external drivers of change—and therefore these are critical to understand and engage with in research for development.
- Different aspects of scaling were discussed. Participants noted the importance of understanding the potential ‘scale of influence’ in terms of benefits that SSF governance improvements can yield for nutritional outcomes, livelihoods and ecosystem status. Any proposition for achieving these changes must have a robust grounding in local level experiences, and account for community interests and needs. A diversity of approaches must also be considered, which include capacity building of civil society organisations, peer-to peer exchanges, networks and coalitions, and investments in institutional strengthening and linkages—in addition to direct support of policy development.
- Discussions converged around the role that research plays in the governance space. Many of the examples researchers provided in this session illustrated that they are active participants in governance processes and are themselves agents of change alongside other stakeholders (i.e. researchers are not just observers). In many instances, research is directly supporting capacity building of governors and management stakeholders at a range of scales.

### **(4) Gender and equity**

- Within small-scale fisheries and aquaculture sectors, women’s roles and contributions are often undervalued or overlooked in research, practice and policy.
- Gender and social analysis focused on the use, management and governance of common resources is critical to address ‘dilemmas’ and avoid potential perverse outcomes. In seeking to achieve goals such as increased resilience of fishers, reduced poverty and improvements to food and nutrition security, often idealised research and development pathways assume the delivery of an initiative will serve as a catalyst for realising these outcomes for society, broadly. However, past experiences have demonstrated that, without an understanding of social difference within any social group, the delivery of an initiative may lead to only some people benefiting, and can lead to negative (unintended) outcomes for other social groups—such as women or the poorest fishers or other marginalised groups.
- Research approaches to understand and address gender inequalities include sex-disaggregated data illustrating the different roles that men and women play in fisheries and fisheries value chains, gender-sensitive assessments of fisheries policy and capacity of organisations to address gender concerns, and gender transformative approaches (delivered alongside more classic fisheries related initiatives) that aim to bring about sustainable and socially accepted shifts in gender norms and relations.

### **(5) Food and nutrition security**

- Small-scale fisheries are in many contexts a critical sector, supplying an irreplaceable animal-source food, which provides multiple essential and highly bioavailable micronutrients, fatty acids and animal protein. However, these nutritional benefits of SSF are often overlooked in debates over fisheries and food security.
- Integrated nutrition-sensitive approaches are needed to improve food and nutrition security, and mean that engagement with other sectors (such as health and water) are needed for improving food and nutrition security.
- There is diversity of fish production systems; these can be positioned on a continuum, for example, from large-scale, single species aquaculture to small-scale species-diverse capture

fisheries. The supply of diverse fish species and other aquatic animals is, in many contexts, critical for sustaining or improving food and nutrition security.

- There are few data on supply and consumption of fish (and other aquatic animals) that account for species, seasonality and intra-household dynamics. Robust analyses are limited by this data deficit, which further constrains understandings on the importance of small-scale fisheries for improving food and nutrition security.

#### **(6) Livelihoods and value chains**

- Broad hypotheses or propositions that livelihood or market innovations will lead to impact in SSF should not be oversimplified or considered to be broadly transferable across systems. With regard to applying any alternative livelihood or market innovation to build resilience, research has shown that some alternatives and market innovations can lock people into certain types of employment or supply chains that, in fact, undermine resilience or perpetuate or deepen inequality.
- The diversity of research approaches applied to different contexts demonstrates that there is a need, and there is value, in drawing on these different research lenses and methods. Part of the role of research is to deepen analysis to better contextualise livelihood alternatives or market chain innovations, and consider these within broader political, social, economic and ecological factors that contribute towards resilience. The gender lens provides one example of the benefits of widening the research approach.

The following is reflection from Dr. Marina Apgar (WorldFish alumni and Research Fellow with the Institute of Development Studies) on the nature of research discussed at the SSF symposium.

‘When we aim to ethically engage with and support social and environmental change in complex social-ecological systems, we need to be in some way immersed in that context to even pretend we can support change.

From a distance, we can study system dynamics and we can perhaps glean some understanding to offer ideas for change, but our understanding is more robust and much better able to affect change when we build it together with real change agents on the ground or within policy processes.

There are few institutional settings through which researchers can truly position themselves as across the research-social change divide—where rigorous research works together with and informs processes of social change’.



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