

Section 3: Annexes

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Annex 3.1 List of acronyms

A4NH	Agriculture for Nutrition and Health
AAS	Aquatic Agricultural Systems
ADB	Asian Development Bank
ARC	Agricultural Research Center
ARIs	Advanced Research Institutes
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AU	African Union
AU-IBAR	Inter-African Bureau for Animal Resources
AU-NEPAD	New Partnership for Africa's Development
ASEAN	Association of Southeast Asian Nations
BAR	Bureau of Agricultural Research
BAU	Bangladesh Agricultural University
BCC	behavior change communication
BFAR	Bureau of Fisheries and Aquatic Resources
BFRF	Bangladesh Fisheries Research Forum
BFRI	Bangladesh Fisheries Research Institute
BMP	best management practices
BoT	Board of Trustees
BRAC	Bangladesh Rural Advancement Committee
CAADP	Comprehensive African Agriculture Development Program
CAPri	Collective Action and Property Rights initiative
CARE	Cooperative for Assistance and Relief Everywhere
CCAFS	Climate Change, Agriculture and Food Security program
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CEFAS	Center for Environment, Fisheries and Aquaculture Science
CGIAR	Consultative Group for International Agricultural Research
CIRAD	French Agricultural Research Centre for International Development
CODEC	Community Development Centre
COMESA	Common Market for Eastern and Southern Africa
CORAF	Conference of African and French leaders of agricultural research institutes
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CLAR	ARC-Central Laboratory for Aquaculture Research
CNRS	Centre for Natural Resource Studies
CRP	CGIAR research program
CTI	Coral Triangle Initiative
DAE	Department of Agriculture Extension
DALYs	disability-adjusted life years
EAC	East African Community
eDNA	environmental DNA
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FETA	Fisheries Education and Training Agency
FiA	Fisheries Administration
FISH	CGIAR research program on fish agri-food systems
FRDN	Fisheries Research and Development Network
FP	flagship project
GAFRD	General Authority for Fisheries Resources Development
GIFT	Genetically Improved Farmed Tilapia
GIS	geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HIES	Household Income and Expenditure Survey
HKI	Helen Keller International
HSPH	Harvard University School of Public Health
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
IBAMO	Iligan Bay Alliance of Misamis Occidental
IDE	International Development Enterprise

iiDE	International Institute for Development of Environment
IDO	Intermediate Development Outcomes
IFPRI	International Food Policy Research Institute
IFReDI	Inland Fisheries Research and Development Institute
IIFET	International Institute of Fisheries Economics and Trade
ILRI	International Livestock Research Institute
INGO	International Non-Governmental Organization
IP	intellectual property
IPG	international public good
IPGs	international public goods
ISC	Independent Steering Committee
ISPC	Independent Science and Partnerships Council
IUCN	World Conservation Union
IWMI	International Water Management Institute
JCU	James Cook University
JHU	Johns Hopkins University
JHU-CCP	Johns Hopkins University Center for Communication Programs
KIT	Royal Tropical Institute
KFTI	Kasaka Fisheries Training Institute
L&F	Livestock and Fish
LCA	Lifecycle analysis
LCA	Lifecycle assessment
LGED	Local Government Engineering Department
LIFDC	Low-income Food-Deficit Countries
LMMA	Locally Managed Marine Area network
LUANAR	Lilongwe University of Agriculture and Natural Resources
LVFO	Lake Victoria Fisheries Organization
M&E	Monitoring and evaluation
MC	management committee
MECDM	Ministry of Environment, Climate and Disaster Management
MFMR	Ministry of Fisheries and Marine Resources
MRC	Mekong River Commission
MSD	Merck Sharp & Dohme
MSU	Michigan State University
NARS	National Agricultural Research Systems
NARES	National Agricultural Research and Extension Systems
NEPAD	New Partnership for Africa's Development
NGOs	nongovernmental organizations
NRI	Natural Resources Institute
NRDC	Natural Resources Development College
NULS	Norwegian University of Life Sciences
OAIS	Open Archival Information System
PAMB	Protected Area Management Bureau
PIM	Policies, Institutions and Markets program
R&D	research and development
RIA2	Research Institute for Aquaculture No. 2 (Vietnam)
RICE	Rice agri-food systems program
RTB	Roots, Tubers and Bananas program
RVCL	Royal Veterinary College London
SAARC	South Asian Association for Regional Cooperation
SADC	Southern Africa Development Community
SDG	Sustainable Development Goal
SDGs	Sustainable Development Goals
SIWRP	Sub-Institute for Water Resources Planning (Vietnam)
SLO	system-level outcome
SNP	single nucleotide polymorphism
SPC	Secretariat of the Pacific Community
SSF	small-scale fisheries

SRF	Strategy and Results Framework (of the CGIAR)
SRUC	Scotland's Rural College
STRP	Scientific and Technical Review Panel
SUA	Sokoine University of Agriculture
SUN	Scaling Up Nutrition
SUZA	State University of Zanzibar
TGAC	the Genome Analysis Centre
ToC	theory of change
TSA	Tonle Sap Authority
UCC	University College Cork
UN	United Nations
UoS	University of Stirling
USAID	United States Agency for International Development
WLE	Water, Land and Ecosystems
WRI	World Resources Institute
WUR	Wageningen University

Annex 3.2 Partnership strategy

Introduction

The program engages a network of multi-stakeholder partnerships to harness emerging science in aquaculture and fisheries and channel this towards achieving improved development outcomes at scale. These partnerships are central to the impact pathways of FISH and the program's theories of change, and the capacity to work effectively in partnerships is an essential requirement for staff working in the program. The present Partnership Strategy summarizes key elements of the program's approach to identifying and working through these partnerships.

Types of partners

The program recognizes five broad types of partners working along the pathway from discovery to proof of concept and scaling. We recognize that many partners work across all three stages, but that most have a particularly important role to play in one.

CGIAR centers and programs. FISH will be led by WorldFish, leveraging the close alignment between the program's strategic goals and the mandate of the Center. IWMI will bring important expertise and networks in water management, governance and resilience, and will lead the fish in multifunctional landscapes cluster of FP2. In addition, the FISH CRP will partner with other CRPs on specific areas where there are strong complementarities between the programs. Similarly, the program will seek to work closely with other CRPs in each of the focal countries, in particular the countries identified as priorities for CGIAR site integration. (See details on CRP linkages and site integration in Annex 3.7). Individual Centers will also contribute to specific research topics as required, such as Bioversity on sustainable intensification.

Advanced research institutes (ARIs). A central premise of FISH is that the program provides an opportunity to enhance CGIAR capability and impact by building strong partnerships with ARIs. The program delivers on this commitment by engaging ARIs in the discovery and proof of concept stages of the program's research. This includes in particular ARI partners who not only complement CGIAR capacity directly with their skills in the specific areas of research required by the program, but also extend the program's networks and open opportunities for capacity development and scaling. Reflecting this approach, three ARIs have been engaged as managing partners (see modalities): the Aquatic and Fisheries Group in the Animal Sciences Department at Wageningen University, which brings leading-edge science capacity in fish nutrition, health and aquaculture feeds development; the Australian Research Council Centre of Excellence in Coral Reef Studies at James Cook University (JCU), which brings together leading research institutions focusing on ecosystem goods and services of coral reefs; and the Natural Resources Institute (NRI) at University of Greenwich, which brings expertise in fisheries postharvest technology and food safety. Each of these ARIs will lead a flagship cluster of activity and serve on the program's management committee.

A broad range of other ARIs will provide specific contributions at discovery and proof of concept stages in each flagship. For example, a coalition of ARIs will work through the program to apply recent advances in molecular genetics to further enhance the rate of genetic gain in the program's research on improved breeds of tilapia and carp. This will involve discovery research, including development of a single nucleotide polymorphism chip for tilapia, and delivery research through support to national breeding programs in focal countries in Africa (Egypt, Nigeria, Tanzania, Zambia) and Asia (Bangladesh, Cambodia, Myanmar). Similarly, Johns Hopkins University (JHU)'s School of Public Health will contribute expertise in designing randomized control trials to test the impact of consumption of fish and fish-based products on health, pregnancy and child development outcomes in Bangladesh (discovery and proof of concept). JHU's Center for Development Communication also brings strong capability in the design of behavior change communication and will lead design of this research (proof of concept).

National Agricultural Research and Extension Systems (NARES). National research partners, including government research institutions and universities, are central to the program's research in all focal countries. This includes both discovery and delivery research, and many of these institutions also play key roles in scaling through capacity development and policy influence. For example, the Bangladesh Agricultural University (BAU) will lead experimental trials in the management of mola broodstock and polyculture systems (discovery), while also leading research on the application of successful approaches within household farming systems in Bangladesh (proof of concept). BAU will also work with the Bangladesh Fisheries Research Institute in conducting trials and field testing of diagnostic tools, best management practices, novel prophylactics and vaccines in research stations and farmers' ponds for both tilapia and carp (discovery and proof of concept). Similarly, in Egypt, Ain Shams University will lead field research on genotype-environment interactions of the Abbassa tilapia strain (discovery), and Kafr El Sheikh University and the Central

Laboratory for Aquaculture Research will lead farm trials and verification of aquaculture systems research (proof of concept).

Private sector. Effective private sector partnerships are essential for successful scaling and extensive use of the technologies developed through FISH, in particular for flagships 1 and 3. As a result, private sector engagement is being pursued wherever appropriate at all stages of the program's impact pathways, from development and testing of technologies (discovery and proof of concept) through design and implementation of scaling strategies. For example, at the global level we are partnering in flagship 1 with [Skretting](#) through a new research facility at the WorldFish Abbassa facility for raw material evaluations and fish feed developments (discovery), Merck/MSD on the development of new treatments for emerging tilapia diseases (discovery), and [Aquaspark](#) in development and testing of models for financing of emergent aquaculture enterprises (discovery-scaling). Similarly, in Bangladesh, we will continue existing collaboration with Nicobena in the development of a fish chutney (discovery-scaling) and Mark Foods in development of fish-based complementary foods (discovery-scaling).

Development institutions. Many different types of development institutions, including government ministries responsible for fisheries and aquaculture, food security, and environment; national and international NGOs working at local to global scales; regional and global development agencies; and bilateral and multilateral donors play critical roles at all stages in the program's impact pathways. For example, in Solomon Islands the Governments of Malaita and Western Provinces; the Ministry of Fisheries and Marine Resources; and the Ministry of Environment, Climate and Disaster Management have collaborated in designing the program's research agenda. This has not only helped ensure that the program addresses provincial and national priorities but also helps establish the enabling environment essential for effective interventions and national and regional scaling (proof of concept-scaling). Similarly, the Department of Fisheries Research Division has co-designed the program's research agenda in Myanmar and will help foster the necessary enabling environment for implementation.

At the regional level, the program will work closely with the Secretariat of the Pacific Community (SPC) to align research with the regional initiative on coastal fisheries and food security. The [Noumea Strategy](#) has universal support from political leadership in the region to chart a new course for coastal fisheries. Through ongoing bilateral projects WorldFish is already closely involved in the network of national agencies seeking to ground the initiative in national fisheries policy agendas, and this will be strengthened through the FISH program.

Similarly for flagship 1 has been designed to align explicitly with the priorities of the African Union's Pan-African Plan of Action for sustainable aquaculture development and national priorities such as improved seed, feed and fish health that are being pursued under this framework. By working closely with AU-IBAR and NEPAD in the design and implementation of this research agenda, and in the dissemination of outputs through support to capacity development and policy initiatives, the program is also positioned to contribute to achieving outcomes at wider scale as an increasing number of African countries expand their investment in aquaculture development under their CAADP compacts (scaling).

At global and regional levels, the program will work closely with a number of international development agencies to scale innovations and influence institutional norms. These will include FAO with whom WorldFish already works closely, as well as EC, GIZ, IFAD USAID, World Bank and other development investors. As part of the design of the FISH program, GIZ convened a workshop on scaling that brought together development partners engaged in fisheries and aquaculture. Building upon this workshop, GIZ/CIM will provide an integrated expert to support scaling activities of FISH.

Selection of partners

To identify specific partners in each of the focal countries and at regional and global levels, the program has considered the mandate, capacities and track record of potential partner institutions. In some cases, these institutions self-select given their unique mandate (for example, dedicated government agencies), but for most research partners and many development partners there are many potential options. In these situations we have drawn upon documented evidence of comparative advantage and track record, including publication record and annual reports, as well as specific CGIAR experience of working with these institutions.

Partnership modalities

The program recognizes two primary levels of partnership engagement and associated modalities:

Managing partners lead clusters of activity, and in this capacity serve on the program's management committee. Managing partners are WorldFish, which leads the program; IWMI, which leads the cluster on fish in multifunctional landscapes in flagship 2; the Department of Aquaculture and Fisheries at Wageningen University, which leads the cluster on fish health, nutrition and feeds in flagship 1; the Australian Research Council Centre of Excellence in Coral Reef Studies at JCU, which leads the cluster on resilient coastal fisheries in flagship 2; and the NRI at University of Greenwich, which leads the cluster on fish for nutrition and health of women and children. Program partnership agreements will be established with each of the program's managing partners.

Implementing partners engage in specific aspects of the program along the pathway from discovery to delivery research to scaling. A range of modalities are used to govern this collaboration, including memoranda of understanding and agreement designed to align activities of the program and partners, and funding contracts covering specific activities undertaken by partners. For example, WorldFish has long-standing agreements with the governments of most of the focal countries and most of the regional partners identified, and these will be developed further to embrace the requirements of FISH. Similarly, WorldFish and IWMI already work in existing CRPs and bilateral projects through funding contracts with a range of partners that will play key roles in FISH. The FISH CRP will build upon these and develop new contracts and agreements as required.

Strategic partnerships

Many of the program's partners will come together to form strategic partnerships focused on pursuing components of the program at either the cluster or sub-cluster level. A selection of these partnerships is summarized in Table 1.

The tables on strategic partnerships should be used, together with the narrative information on partnership and partnership strategy, to show engagement with a range of partners and partnerships and how this contributes to the delivery of key outcomes. The tables should thus provide illustrative examples of how the partnership strategy is operationalized within the ToC, and not a complete list of CRP/FP partners.

Table 1. Illustrative examples of FISH strategic partnerships. Two examples are provided for each FISH flagship.

Example # and name	1. Tilapia genomics consortium
Convenor of the partnership and their role	WorldFish. Convene consortium of key groups working on tilapia genomics, together with others developing genomic selection theory and its application to fish.
Specific focus and objective	Use of advanced genomic techniques to accelerate development of improved tilapia breeds, and subsequently carp.
Science agenda	Development of a single nucleotide polymorphism chip for tilapia as an approach to the rapid genotyping required, drawing on recent experiences with Atlantic salmon; application of novel methods to develop biomarkers that reflect the integrated effects of environment, feed and disease.
Geographical focus/location	Global discovery research in support of national breeding programs in focal countries in Africa (Egypt, Nigeria, Tanzania, Zambia) and Asia (Bangladesh, Cambodia, Myanmar).
Role of the CRP/FP in the partnership	Convening of the consortium and facilitation of its focus on priority traits in focal countries.
Key CGIAR partner(s) and their (its) role(s)	WorldFish: Convenes the consortium.
Key 'external' partner(s) and their (its) role(s)	Roslin Institute - University of Edinburgh; University of Stirling; Scotland's Rural College (SRUC); James Cook University; Nofima (genomic tools for identification and incorporation of resilience traits and efficiencies in fish genetic improvement programs); The Genomic Analysis Centre, University of Norwich; Bangor University (methods for genomic analysis of tilapia genetic diversity and domesticated-wild tilapia interactions in Africa); Wageningen University and CIRAD (research on fish genetics environment, yield gaps and feed efficiencies).
Contribution to ToC and impact pathways	The consortium will contribute to achieving the research outputs identified under cluster 1 in the FP1 impact pathway, and in particular faster-growing and resilient tilapia and carp strains; new productivity and resilience traits identified and incorporated into fish breeding programs; and knowledge on genomic tools and methods to accelerate genetic gain and incorporate new traits into fish breeding programs. Through the program's wider partnerships and country-level research, capacity development and policy activities, these outputs will in turn contribute to the development outcomes specified, notably: fish farm households have access to and are using faster-growing and resilient tilapia and carp strains; and fish farming households have increased fish yield and income from adoption of improved fish breeds.
Example # and name	2. Fish health partnership
Convenor of the partnership and their role	Aquatic and Fisheries Group in the Animal Sciences Department, Wageningen University. Convene partnership of leading research groups addressing fish health issues in aquaculture systems.
Specific focus and objective	Development of technologies for improved fish health and enhanced performance of genetically improved fish breeds.
Science agenda	Population-based studies to assess farm performance and disease susceptibility of improved tilapia strains in different agro-climatic conditions. Development of environmental DNA (eDNA) technology to characterize fish and pond microbiomes, and assess their role in growth and development and in disease susceptibility and resistance.
Geographical focus/location	Global discovery research in support of national breeding programs in focal countries in Africa (Egypt, Nigeria, Tanzania, Zambia) and Asia (Bangladesh, Cambodia, Myanmar).
Role of the CRP/FP in the partnership	Convening of the consortium and facilitation of its focus on priority traits in focal countries.
Key CGIAR partner(s) and their (its) role(s)	WorldFish: On-station research in Egypt, Bangladesh and Malaysia.

Key 'external' partner(s) and their (its) role(s)	Aquatic and Fisheries Group in the Animal Sciences Department, Wageningen University (convenes the partnership); CEFAS, Exeter University and University of Stirling (characterization of pond microbiomes, development of pond-side diagnostics and early warning tools, novel alternative prophylactic products); ARC-CLAR, Kafr El Sheikh University and Suez Canal University (field testing of diagnostic tools, fish health management packages, novel prophylactics and vaccines in research stations and farmer ponds for tilapia); BAU and BFRI (trials and field testing of diagnostic tools, fish health management packages, novel prophylactics and vaccines in research stations and farmer ponds for tilapia and carp).
Contribution to ToC and impact pathways	The partnership will contribute to achieving the research outputs identified under cluster 2 in the FP1 impact pathway and in particular fish disease surveillance and diagnostic tools; integrated fish feed and health management packages for improved fish strains; and knowledge on fish nutrition, health and genetic interactions to inform future fish breeding programs. Through the program's wider partnerships and country-level research, capacity development and policy activities, these outputs will in turn contribute to the development outcomes specified, notably: fish farmers and private sector investing in fish disease diagnostic tools; and public and private agencies and NGOs incorporating fish health improvements into aquaculture extension activities.
Example # and name	3. Partnership for resilient coastal fisheries
Convenor of the partnership and their role	The Australian Research Council Centre of Excellence in Coral Reef Studies at James Cook University (JCU). Convene consortium of key groups working on resilient coastal fisheries.
Specific focus and objective	Using research to improve decentralized management and livelihoods in coastal fisheries.
Science agenda	Analysis of the contribution of multi-scale governance to increasing ecological sustainability and gender-equitable benefit flows from fisheries. Tradeoffs between longer-term systems sustainability, resilience and food security, and more immediate improvements to wellbeing. How to build resilience in SSF at national, sub-national and local levels to account for external and local drivers of change.
Geographical focus/location	Global discovery analysis in support of, and learning from, place-based research in focal countries (Philippines, Solomons, Tanzania).
Role of the CRP/FP in the partnership	Convening of the partnership and facilitation of its focus on priority traits in focal countries.
Key CGIAR partner(s) and their (its) role(s)	WorldFish: Field research in Philippines and Solomons.
Key 'external' partner(s) and their (its) role(s)	JCU (design of research agenda for coral reef fisheries); Solomon Islands: Provincial Governments, Ministry of Fisheries and Marine Resources, and Ministry of Environment, Climate and Disaster Management (co-design of research agenda and enabling environment for interventions; policy development); <u>Philippines</u> : National Fisheries Research and Development Institute; Bureau of Fisheries and Aquatic Resources (BFAR) (co-design of research agenda and enabling environment for interventions; policy development); Palawan State University and UP Marine Science Institute (lead research on fisheries governance); <u>Tanzania</u> : Ministry of Livestock and Fisheries (co-design of research agenda and provision of enabling environment for interventions; policy development); University of Dar es Salaam and Tanzania Fisheries Research Institute (research on community fisheries); Promundo (guidance on gender and livelihoods).

Contribution to ToC and impact pathways	The partnership will contribute to achieving the research outputs identified under cluster 1 in the FP2 impact pathway and in particular co-management models for inclusive governance, food security and sustainability; tradeoffs assessed between sustainability, resilience, food security and wellbeing; and alternative livelihood strategies assessed. Through the program's wider partnerships and country-level research, capacity development and policy activities, these outputs will in turn contribute to the development outcomes specified, notably: management measures promoting gender-equitable resource access, control of assets and benefits for fishery-dependent households; policies and programs aligned to support improved livelihood opportunities, increased incomes and adaptive capacity; marine environments producing higher yields, contributing to livelihoods; and increased socio-ecological resilience of productive systems under better management.
Example # and name	4. Partnership for resilient small-scale fisheries in multifunctional landscapes
Convenor of the partnership and their role	IWMI. Convene partners across all stages of the impact pathway.
Specific focus and objective	Using research to improve decentralized management and livelihoods in inland fisheries in contested landscapes.
Science agenda	Analysis of the contribution of multi-scale governance to increasing ecological sustainability and gender-equitable benefit flows from fisheries. Tradeoffs among alternative demands on landscapes and water, resilience and food security, and more immediate improvements to wellbeing. How to build resilience in SSF at national, sub-national and local levels to account for external and local drivers of change.
Geographical focus/location	Global discovery analysis in support of, and learning from, place-based research in focal countries (Bangladesh, Myanmar, Cambodia and Zambia).
Role of the CRP/FP in the partnership	Convening the partnership and integrating research to maximize cross-geographic lessons and the production of IPGs.
Key CGIAR partner(s) and their (its) role(s)	IWMI (partnership leadership and field research) and WorldFish (field research in focal countries).
Key 'external' partner(s) and their (its) role(s)	Cambodia Inland Fisheries Research and Development Institute (rice field fisheries research); Dhaka University (research on governance); Sylhet Agricultural University (lead research on socio-economics of fishing households); Myanmar Department of Fisheries Research Division, Universities of Yangon, Mandalay, and Yezin (field research on fisheries); University of Zambia (field research on fisheries ecology and community fisheries).
Contribution to ToC and impact pathways	The partnership will contribute to achieving the research outputs identified under cluster 2 in the FP2 impact pathway, and in particular co-management models for inclusive governance, food security and sustainability; tradeoffs assessed between sustainability, resilience, food security and wellbeing; and alternative livelihood strategies assessed. Through the program's wider partnerships and country-level research, capacity development and policy activities, this research will contribute directly to research outcomes and to the development of management measures promoting gender-equitable resource access, control of assets and benefits for fishery-dependent households; policies and programs aligned to support improved livelihood opportunities, increased incomes and adaptive capacity; inland fisheries producing higher yields, contributing to livelihoods; and increased socio-ecological resilience of productive systems under better management.
Example # and name	5. Research partnership on farming of small indigenous fish
Convenor of the partnership and their role	WorldFish. Convene partners working at discovery, delivery and scaling stages of the pathway for pond polyculture and rice field fisheries.
Specific focus and objective	Development of technologies for increased production of high nutrient content small indigenous species of fish (SIS) within pond polyculture farming systems and rice field fisheries.

Science agenda	Overcoming technical and gendered barriers to production and harvesting of SIS in pond aquaculture and rice field fisheries. Research focus in polyculture on removing dependency on wild broodstock for mola and subsequently other species of SIS; optimizing pond management and harvesting frequency to maximize productivity and production of mola and other SIS; and understanding how best to support women to partially harvest mola and other SIS on a regular basis to promote household consumption without increasing workload. Research focus in rice field fisheries on how to improve production by (1) managing connections between rice fields and stocks of nutrient-rich fish in associated canals, beels and ponds; (2) optimizing stocking approaches; (3) improving governance and community management of fish refuges.
Geographical focus/location	Bangladesh and Cambodia for discovery and delivery research, followed by South and Southeast Asia for scaling.
Role of the CRP/FP in the partnership	Convening of the consortium and facilitation of its focus on priority traits in focal countries.
Key CGIAR partner(s) and their (its) role(s)	WorldFish: Convening the partnership.
Key 'external' partner(s) and their (its) role(s)	Bangladesh Agricultural University (BAU) (experimental trials of fish species mix, pond management, feeding and breeding in controlled ponds); IFreDI (field trials on models for rice-fish culture, based on improved management of community fish refuges); LGED (field trials on models for rice-fish culture, with enhanced stocking of nutrient-rich small fish); Department of Fisheries (Bangladesh) and Fisheries Administration (Cambodia), NGOs and wetland user groups (field trials of selected pond polyculture and rice field technologies).
Contribution to ToC and impact pathways	The partnership will contribute to achieving the research outputs identified under cluster 1 in the FP3 impact pathway, and in particular production technologies developed for mola and other SIS; woman- and youth-friendly harvesting technologies; and fisheries models incorporating nutrient-rich fish and nutrient-rich crops. Through the program's wider partnerships and country-level research, capacity development and policy activities, these outputs will in turn contribute to the key development outcomes specified: women, children and youth with regular access to nutrient-rich small fish from their own ponds or rice field fisheries, allowing consumption of fish by these target groups.
Example # and name	6. Partnership for fish in the first 1000 days
Convenor of the partnership and their role	WorldFish. Convene partners with expertise spanning fish production, human nutrition, behavioral change communication, food processing and marketing.
Specific focus and objective	Overcoming barriers to consumption of fish by pregnant and lactating women, and infants aged 6–24 months.
Science agenda	Ethnographic research, dietary recalls and trials of improved practice to understand the obstacles currently limiting intake of nutrient-rich fish by women and children. Design and testing of behavior change communication interventions aimed at overcoming behavioral obstacles and increasing the incorporation of fish into high-quality diets. Testing scalable production methods and marketing approaches for fish-based products. Tests of the efficacy of these products for child growth and health outcomes.
Geographical focus/location	Initial focus on discovery and delivery research in Bangladesh and Cambodia followed by delivery research in Tanzania and scaling in East Africa.
Role of the CRP/FP in the partnership	Convening of the partnership.
Key CGIAR partner(s) and their (its) role(s)	WorldFish: Convening the partnership and field research in Bangladesh and Cambodia.
Key 'external' partner(s) and their (its) role(s)	Bangladesh: JHU-CCP, HKI (development of behavior change communication [BCC] tools and approaches); JHU and icddr,b (formative research and trials on acceptability and use of fish-based products); NGOs (integration of BCC for

	increased fish consumption and use of fish-based products in mother and child health and nutrition projects); Nicobena and Mark Foods in the development of fish-based complementary foods; <u>Tanzania</u> : Copenhagen University, Muhimbili University, Sokoine University, Harvard (development of fish-based products; formative research and trials on acceptability and use of fish-based products).
Contribution to ToC and impact pathways	The consortium will contribute to achieving the research outputs identified under cluster 2 in the FP3 impact pathway, and in particular tools and models for effective BCC; efficacy studies of fish-based products in first 1000 days of life; scalable models for the production of fish-based products in Bangladesh; and fish-based products in Tanzania and Cambodia. Through the program's wider partnerships and country-level research, capacity development and policy activities, these outputs will in turn contribute to the key development outcomes specified: consumers, and in particular pregnant women and young children, have equitable access to fish-based products; and mothers demonstrate increased willingness to provide fish and fish-based products to young children.

Annex 3.3 Capacity development strategy

Role of capacity development in FISH theory of change

As a strategic enabler of impact, capacity development is important in all four change mechanisms of the FISH theory of change. It is required to support movement from the research output of the three flagships to research outcomes and ultimately to development outcomes. For each mechanism of the theory of change, capacities of key stakeholders along the pathway are identified:

- capacity of aquaculture farmers to assess technology needs and apply improved practices and fishing communities to implement co-management (change mechanism a);
- capacity of private investors to identify appropriate opportunities and enterprises to adopt innovative business models (change mechanism b);
- public sector capacity to design and implement policy and regulatory measures that affect the viability of scalable technologies, management practices and organizational innovations (change mechanism c);
- civil society capacity to promote solutions drawing on research evidence, as well as the capacity of development agencies to integrate these into their programming and investment priorities (change mechanism d).

Strengthened policies and institutions are an integral part of the scaling strategy to reach program-level outcome targets. Consequently, the sub-IDO *enhanced institutional capacity in public sector and private research organizations* is identified as a goal at CRP level. Further, *improved capacity of women and youth to participate in decision-making* will be achieved through the program's gender and governance research. Program research on sustainable aquaculture (flagship 1) seeks to contribute to *increased capacity of beneficiaries to adopt research outputs* relating to aquaculture technologies and *enhanced individual capacity within partner research organizations* to conduct aquaculture technology research. Research on sustainable small-scale fisheries (flagship 2) seeks to contribute to *enhanced capacity to deal with climate risks and extremes* with an emphasis on poor households and *enhanced capacity of women and youth to participate in decision-making* around small-scale fisheries management. Research on fish for nutrition and health (flagship 3) seeks to contribute to *enhanced capacity of women and youth of poor households to engage in decision-making* around production and consumption of fish as part of a micronutrient-rich diet.

Use of CGIAR Capacity Development Framework

The CGIAR Capacity Development Framework identifies nine elements to help organize, plan and implement capacity development activities using a systems approach (Figure 1). Our strategy identifies how each of the elements will be pursued to develop the capacities required to ensure quality implementation and support movement along the impact pathways (see next section for specific interventions in each flagship).

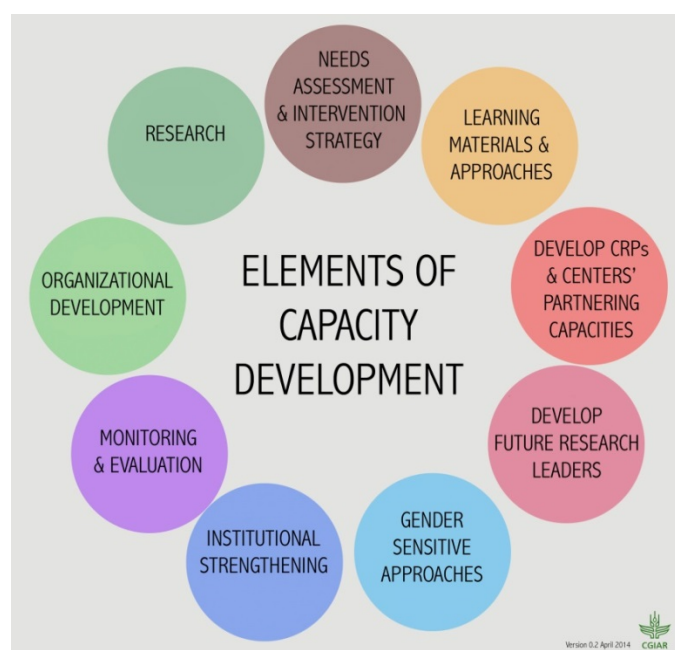


Figure 1. Elements of the CGIAR Capacity Development Framework.

In designing and implementing the FISH capacity development strategy, we draw upon learning from the L&F and AAS CRPs, which supported development of the CGIAR framework, as well as our work through bilateral projects. Specifically, the strategy will use a systems approach to capacity development, building on learning from the AAS CRP (Apgar et al. 2015) and associated methodologies that include working across individual, institutional and organizational

spheres, which have been used successfully to develop capacity in gender research and practice (Sarapura et al. 2015). We will build on capacity development within fish value chains in Bangladesh through L&F and its use of novel training methods and strategies, such as developing husband-wife family teams and career progression for national scientific staff. We will use the high-quality learning materials developed with partners through bilateral work on aquaculture technologies in Bangladesh, and build on the strong track record for training African researchers in aquaculture technologies at the Abbassa aquaculture research and training center in Egypt. To build capacity around small-scale fisheries, we will continue to use training materials developed through work on community-based marine resource management in the Pacific (WorldFish 2013).

CRP-level coordination and cross-cutting areas

At the program level, there are three ways in which capacity development will involve cross-flagship coordination: (1) monitoring and evaluation (M&E) of capacity development (element 7) will be integrated into program M&E through identification of specific capacity indicators and tracking for learning and progress as theories of change are evaluated; (2) development of FISH and managing and implementing partners' capacity to collaborate (element 3) will support the partnerships strategy (see Annex 3.2); and (3) geographic and thematic coordination of capacity development activities across flagships will be managed through coordination among capacity development leads in each flagship.

Capacity development interventions are also instrumental to the FISH program's gender and youth strategies. Specifically, capacity development will enable interventions in gender-sensitive technologies and innovation processes, women-targeted opportunities, and gender-transformative strategies contributing to gender outcomes, including improved capacity of women and young people to participate in decision-making. Further, capacity to implement quality gender research will be developed through work with the cross-flagship gender team. FISH will promote youth engagement in small-scale fisheries and aquaculture by using age-relevant skills training methods and content, including on fingerling production and distribution, feed and handling methods, and co-management and youth leadership.

Strategic capacity development actions within FISH flagships

Each of the FISH flagships will implement a program of capacity development activities organized around the nine elements of the CGIAR framework. This will enable quality implementation with local stakeholders and partners and consequently support the change mechanisms and sub-IDs identified in their theories of change. Table 1 provides a summary of the prioritization of the nine elements for each flagship. Criteria used to prioritize include the importance of the element to successful implementation of research activities and change mechanisms and the level of investment required.

Table 1. Summary of prioritized elements in each flagship.

Flagship	Elements of the CGIAR Capacity Development Framework ¹								
	1	2	3	4	5	6	7	8	9
1. Sustainable aquaculture	High	High	Medium	Medium	High	High	Medium	Low	Low
2. Sustaining small-scale fisheries	High	High	Medium	Low	High	High	Medium	Low	Low
3. Enhancing the contribution of fish to nutrition and health of the poor	High	High	Medium	Medium	High	High	Medium	Low	Low

Four elements will be implemented at high intensity through activities in all flagships (needs assessments, intervention strategies, and innovative learning materials and approaches that are gender- and youth-sensitive, and work on institutional strengthening), while two will be implemented with medium intensity (developing CRP partnering capacity and M&E of capacity development). Relevant indicators to monitor capacity development progress as part of FISH M&E are shown in Table 2.

¹ 1: Needs assessment and intervention strategy; 2: Learning materials and approaches; 3: Develop CRPs' and Centers' partnering capacities; 4: Develop future research leaders; 5: Gender-sensitive approaches; 6: Institutional strengthening; 7: Monitoring and evaluation; 8: Organizational development; 9: Research on capacity development.

Table 2. Indicators for M&E of capacity development.

Element	Indicators
Capacity needs assessment and intervention strategy design	(Adapted) needs assessment methodologies available in published form Proportion of CapDev budget allocated to interventions consistent with capacity needs assessment recommendations (disaggregated by implementing organization and flagship)
Design and delivery of innovative learning materials and approaches	Proportion of learning materials developed for external audiences piloted with representative audiences Participant evaluation of training and workshops to assess increase in knowledge and skills Number of people trained (disaggregated by sex, age, job or role, location, and literacy)
Apply gender-sensitive approaches throughout capacity development	Proportion of capacity needs assessments that proactively target women and youth Number of capacity development activities in gender approaches and toolkits initiated (disaggregated by type)
Institutional strengthening	Number of institutional assessments conducted with NARs Number of policy decisions informed by engagement and information provided by FISH Outcome evaluation citing improved institutional capacity in achievement of other FISH outcomes

Implementation strategy within flagships

(1) Needs assessment and intervention strategy, learning material and approaches, gender-sensitive approaches, and M&E (elements 1, 2, 5 & 7)

These four elements of the framework are understood as part of a capacity development process that starts with identifying specific capacity needs of critical stakeholders. Each flagship has already broadly identified the target stakeholders and thematic areas that will inform more detailed capacity needs assessments to be carried out at the outset where necessary.

Flagship 1 will focus on the capacity needs of smallholders to effectively demand and adopt new aquaculture technologies and apply best management practices, as well as the needs of service providers to effectively supply inputs, knowledge and skills targeted at men and women fish farmers. In Africa and Asia, a focus on enhanced capacity for aquaculture technologies research in partner organizations will continue.

Flagship 2 will focus on the needs of natural resource management NGOs and government agencies, multi-stakeholder networks, regional and inter-governmental agencies, and individual researchers within national research institutes in focal countries. The flagship will assess the following capacity areas: gender-sensitive and transformative approaches, learning and governance networking, community livelihood and co-management interventions, and responsive and accountable institutions.

Flagship 3 will focus on the capacity needs of public and private sector actors (such as hatcheries) to manage a central mola broodstock and improve pond management, and of women farmers to harvest small fish. For work with fish value chains in Africa and South Asia, the flagship will identify needs of implementing partners and value chain actors to develop and test appropriate gender-inclusive technological, market and institutional approaches to reduce waste and achieve improvements in fish consumption by women and young children.

Across all interventions, the learning methods and materials used will be gender- and youth-sensitive. Implementation will use a blended learning methodology across three phases of learning: learning in, from and for action (Garison and Kanuka 2004; Wilson and Biller 2012). This will build on experience of developing quality materials in past work. M&E will be integrated into CRP-level learning processes, including annual reviews within flagships to revisit capacity needs and inform annual planning of interventions and monitoring of capacity development indicators.

(2) Developing CRPs' and Centers' partnering capacities (element 3)

Development of the capacity for FISH, participating CGIAR Centers, and managing and implementing partners to work together will be implemented within each flagship by working with multi-stakeholder partnerships designed to harness emerging science in aquaculture and fisheries (see Annex 3.2).

(3) Institutional strengthening (element 6)

The program aims to develop public sector capacity to design and implement policy and regulatory measures that affect the viability of scalable technologies, management practices and organizational innovations for aquaculture, fisheries and nutrition outcomes. To achieve this, each of the flagships will focus on specific interventions with associated institutions.

Flagship 1 will focus on strengthening public institutions and private sector organizations, such as farmer associations, to manage fish breeding programs, integrate new technologies into extension and outreach programs, and achieve research and development outcomes at scale. Interventions will use policy dialogues associated with multi-stakeholder forums and innovation platforms (in Egypt), engaging decision-makers through the research process (in Bangladesh), and conducting participatory action research with partners to test and adapt new institutional arrangements (in Zambia).

Flagship 2 will work towards institutional strengthening in two modes. First, it will develop the capacity of learning and governance networks and platforms to realize impact (i.e. to become more than the sum of their parts) through multi-stakeholder engagement. Second, it will increase the capacity of institutions (national public institutions and regional intergovernmental institutions) to help secure the ecological sustainability, food security and poverty alleviation functions of small-scale fisheries through targeted capacity development, multi-stakeholder dialogues and strategic planning activities.

Flagship 3 will focus on strengthening public and private partners to develop and use technologies for production of nutrient-dense fish. It will test gender-inclusive and women-targeted methods, technologies, institutional options and products for addressing postharvest loss challenges and other value chain issues identified through multi-stakeholder processes and platforms formed as learning alliances; i.e. “a series of linked platforms existing at different institutional levels (e.g. community, district, national, regional, global) created with the aim of bringing together a range of stakeholders interested in innovation and the creation/use of new knowledge in an area of common interest” (Moriarty et al 2005).

(4) Develop future research leaders (element 4)

Flagship 1 will develop future aquaculture research leaders in both Africa and Asia through internships and masters and PhD programs with discovery and upstream research partners to accelerate national capacity for research and extension. A new partnership with the University of Malawi, as a NEPAD African center of excellence for aquaculture research, provides an opportunity to enhance postgraduate training of aquaculture researchers within sub-Saharan Africa.

Flagship 3 will work with postgraduate students and develop individual and tailored capacity-strengthening plans. These will be delivered by our partners in tertiary education and supported by those engaged in research.

Annex 3.4 Gender analysis and priority setting in FISH

This section presents the gender analysis that informed and shaped FISH priority setting and research design. It draws in particular on learning from L&F and AAS CRPs in FISH focal and scaling countries.

Sustainable aquaculture [FP1]

Women's involvement in small-scale aquaculture production helps increase productivity (Jahan et al. 2010) and fish consumption within the household (Heck and Béné 2007; Jahan et al. 2010; Kawarazuka and Béné 2010). Yet women's participation in small-scale aquaculture production is low compared to men (Jahan et al. 2015). Lack of access to and control over key assets such as land or ponds (Veliu 2009; Ndanga et al. 2013), capital, skills, technologies, and extension services (Puskur and Pant 2015) limit women's engagement. Moreover, social norms and power relations shape—and limit—women's adoption and use of aquaculture knowledge, technologies and practices through extension (Farnworth 2015; Morgan et al. 2016). Therefore the program will identify and test innovative strategies to increase women's engagement in small-scale aquaculture production by addressing these barriers.

Women receive lower returns and are disproportionately represented in less-profitable nodes of aquaculture value chains (Kruijssen et al. 2013). Driving factors identified to date include the following:

- women's limited access to credit (Bene and Merten 2008; Kruijssen et al. 2013; Ndanga et al. 2013)
- women's limited aquaculture skills, land and technologies (Veliu 2009; Weeratunge et al. 2012; Ndanga et al. 2013)
- harassment in the marketplace (Kantor and Kruijssen 2014)
- mobility restrictions (Morgan et al. 2016)
- time and labor burdens doing unpaid work (Shirajee et al. 2010)
- socialization towards income generation in less-profitable activities (Weeratunge et al. 2012).

Women also display lower levels of entrepreneurship than men and more frequently abandon entrepreneurial ventures (Weeratunge et al. 2012). Thus, the program will focus on refining and testing factors, models and strategies by which poor women can equitably participate in and benefit from the entrepreneurial and employment opportunities presented by aquaculture.

Finally, program scoping has identified two important areas not addressed in L&F: assessment of gendered preferences and needs; and gendered impacts of genetically improved fish, fish feeds and disease prevention practices. Insights in these areas are needed so that fish breeding, feeds and disease innovations equitably meet the needs of both women and men. The FISH CRP will therefore prioritize these areas in flagship 1.

Sustaining small-scale fisheries [FP2]

Decision-making in small-scale fisheries governance tends to be widely gender-imbalanced (Hilly 2012; Schwarz et al. 2014; Cohen and Steenbergen 2015; Cole et al. 2015; Rajaratnam et al. 2015), with men dominating resource decision-making and men's priorities more strongly reflected in resource-management strategies (Weeratunge et al. 2012; Kruijssen et al. 2013). Gender norms and power relations underpin these imbalances, shaping women's relatively low agency in determining their time spent on and involvement in activities inside and outside their homes (Weeratunge et al. 2012; Cole et al. 2015; Rajaratnam et al. 2015). Without fundamental changes to norms and power relations, improvements in governance and gender mainstreaming (Hilly et al. 2011) are unlikely to be sustained and may be only partially effective in addressing gender biases in representation and distribution of authority in decision-making. To combat this issue, the FISH CRP prioritizes research on strategies for enhancing effective participation of women in fisheries and natural resources management and governance, including identifying and testing novel ways to increase gender-equitable engagement in decision-making. This ensures that both visible and underlying factors shaping participation are addressed.

There are substantial gender inequities in access to and control of natural resources, including land and many aquatic resources (Weeratunge et al. 2012; Burnley et al. 2014; Kwashimbisa and Puskur 2014; Cole et al. 2015; Rajaratnam et al. 2015). Addressing these inequities requires understanding of (1) which assets are most beneficial to women and men to support their individual and joint livelihood security; and (2) why gender asset gaps exist (Weeratunge et al. 2012). The first research area was not pursued in AAS or L&F, and will be addressed in FISH. Investigation of the second focal area through AAS elucidated the potent roles of gender and social norms in shaping access, innovation and poverty outcomes (Cole et al. 2015; Rajaratnam et al. 2015). Furthermore, gender analysis indicated that strengthening fisheries conservation risks *negatively* affecting the livelihoods of poor women most dependent on these resources (Schwarz et al. 2014). In response, assessing strategies for win-win scenarios for women's livelihoods and ecological outcomes will be a priority for FISH. This includes testing the innovative, gender-transformative approach to microfinance piloted in AAS that applies gender-transformative strategies to overcome barriers to women's control over savings and create potential investment for alternative livelihoods.

Enhancing the contribution of fish to nutrition and health of the poor [FP3]

In Bangladesh, the relatively poor fit of small fish-harvesting technologies with women's needs was identified as an obstacle to women's involvement in homestead fish farming (Morgan et al. 2015). Early findings from pre-tests of women-targeted technologies indicate that they warrant full investigation. Moreover, AAS analysis signaled the need for research to address women's time and labor burdens in small-scale aquaculture (Weeratunge et al. 2012). In response, FP3 will focus on developing and testing women-targeted technologies and test labor- and time-effective strategies to enable women to raise and harvest small fish.

L&F identified significant sex-disaggregated data gaps in existing fish value chain literature, including extent of participation and costs and benefits of engagement, as well as a need for further understanding of policy and informal factors that result in gendered inclusions or exclusions. L&F found that women were concentrated in postharvest aspects of value chains (Macfadyen et al. 2011; Weeratunge et al. 2012), meaning that the estimated 27% postharvest losses in fisheries (Kelleher 2005) have a negative effect on women's incomes. Moreover, preliminary action research signaled that when a postharvest innovation is introduced and external partnership is involved, men's interest in postharvest roles increases. This suggests that women's postharvest roles must be protected for innovations to have positive gender impacts. The FISH CRP will generate sex-disaggregated data across fish value chains and evaluate factors that result in gendered exclusion or inclusion. As detailed for each FP in section 2, the program will identify and assess opportunities to protect and expand women's engagement in and benefits from fish value chains, including women-targeted processing techniques and fish-based product opportunities.

The global recognition of the importance of fish in nutrition for children and pregnant and lactating women has not translated into increases in consumption in many social and economic contexts (Thilsted 2012). Preliminary evidence from both Asia and Africa indicates that withholding animal-source foods from women and children is fairly common (Gittelsohn and Vastine 2003; Nguyen et al. 2013). Consumption of fish depends on household decisions about child feeding practices and intra-household distribution of food (Puskur and Thilsted 2012), which are influenced by norms, attitudes and perceptions about appropriateness of fish for particular groups. Improving women's involvement in household decisions, including about intra-household food distribution, can result in higher levels of empowerment (Weeratunge et al. 2012). In response, the FISH CRP will undertake novel research into potential for scalable gender-transformative strategies to catalyze integrated behavior shifts in gender and social norms, women's empowerment, and intra-household food distribution.

Operationalization of gender in FISH

Gender research will be integrated in the research agenda for each flagship, supported by a cross-cutting team coordinated by the Gender Research Lead. This section presents the aims, organization, operationalization and indicators for M&E.

Aims

The overall aims of the gender research team in the program are to do the following:

- Apply and support gender analysis to shape the priorities, agenda and design of the CRP and each of the three flagships.
- As a part of each flagship, undertake cutting-edge strategic gender research leading to the identified products and outcomes in each of the three flagships.
- Support all FISH research so that it is effectively gender-inclusive and gender-integrated, including through sex-disaggregated, intersectional analysis, as appropriate.
- Identify, develop and empirically test needed methods for gender research, in particular for assessing transformative change and women's empowerment.
- Contribute to systemic gender changes via gender capacity building for and with researchers and local to international partners, including young female scientists.
- Contribute to the continued development of gender in CGIAR through scientific and collaborative engagement in the CGIAR Collaborative Platform for Gender Research.

Organization

The gender team will be comprised of the Gender Research Lead (Senior Scientist at WorldFish), a team of gender researchers in all FP countries and headquarters, and a wider FISH gender community of practice (CoP), engaging an interdisciplinary group of scientists and partners. The Gender Research Lead will engage closely with the FISH Independent Steering Committee to ensure science quality and depth and breadth of gender in FISH research. The team will communicate and collaborate with gender researchers in other CRPs around emerging areas of interest, in particular on synergies between the entrepreneurial work in Livestock on animal feeds and the planned work in FISH on aquafeeds. It will contribute to and benefit from engagement in the new Gender Platform, including around methodological development and strategies for effective gender integration in CRPs. Further, it will contribute to and benefit from the CGIAR investment in gender through the Consortium's PostDoctoral Fellow Program, focusing on building the capacity of emerging scientists from developing countries.

Operationalization

Building on the success of the gender approach in L&F and AAS, the gender team will be organized towards the achievement of its goals by developing and implementing a road map for effective integration and implementation of gender research in FISH. The road map will be based on a collaborative process of visioning, goal-setting and action planning across key areas, including capacity development, research quality, outputs and M&E. This process will involve gender team and CoP researchers, as well as the FISH management committee and partners. The road map will be revisited and updated each year as part of ongoing M&E, catalyzing learning about progress and strengths, weaknesses or gaps, challenges, and opportunities, thus enabling iterative improvement in the planning and implementation of gender research (see also Annex 3.6).

As part of research activity planning in FISH, flagship research teams will involve gender researchers to consider in what way and to what extent gender is relevant to their research and integral to achieving the research aims. Researchers will jointly establish how the research will be *gender-integrated*, if there will be *strategic* gender research, and/or if *gender-transformative* strategies are required or should be tested. These are distinguished as follows:

- Gender-integrated research is defined by CGIAR as research that integrates consideration of gender into technical research of the principal topic of study; for example, plant breeding, aquaculture, postharvest technology development or systems intensification (CGIAR 2015). Note that the FISH CRP will aim to be intersectional in its approach to gender; i.e. addressing cross-cutting differences such as age, wealth, livelihood groups, caste or ethnicity, rather than simply distinguishing men vs. women.
- Strategic gender research is defined by CGIAR as research that studies gender as the primary topic in a social analysis designed to understand what the implications of gender are for agriculture; for example, how men and women allocate labor resources in intra-household decision-making about farm production (CGIAR 2015).
- A gender-transformative approach to research is an approach that "can be applied within research to examine, question and, most fundamentally, enable changes in inequitable gender norms, attitudes, behaviors and practices and the related imbalances of power (IGWG 2010). Through encouraging critical awareness among men and women of social inequality and practices, [gender-transformative approaches] help people challenge and re-shape distribution of and control over resources, allocation of duties between men and women, and access to and influence in decision making (Caro 2009). They also enable men and boys to question the effects of harmful masculinity, not only on women, but also on men themselves" (Meng 2015, 1 in McDougall et al. 2015, 42).

In terms of research processes and methods, all types of FISH research will be gender-inclusive (i.e. applying tested and innovative strategies, methods and tools to ensure that women and men have equitable opportunity for, quality of engagement in, and returns from participation in FISH research processes).

In conjunction with the above, the gender team will organize integration and collaboration between various activities for the sake of coherence and synergies and spearhead synthesis of gender research across activities, generating international public goods as a result. Moreover, the gender team—together with the FISH flagships and management committee—will work with research teams to identify and address gender-related capacity development processes and initiatives. These will include in-house processes such as iterative reflection processes and mentoring, as well as externally led capacity development such as trainings and workshops. This will dovetail with the CGIAR Gender Platform capacity development agenda.

Monitoring and evaluation

As noted above, M&E for learning in relation to gender takes place annually through a systematic review based on the gender road map. The Gender Research Lead will partner with the M&E Lead to quantitatively track indicators of progress. The proposed M&E framework is in Table 1 below. These indicators focus on the proportion of activities that are gender-integrated and gender-strategic, on research products that reflect gender, and on gender capacity development. The evaluation of gender-related development outcomes is addressed as part of the broader results-based management approach in Annex 3.6.

Table 1. Indicators for monitoring and evaluation of FISH gender research integration, outputs and outcomes.

Focus of M&E	Indicators	Source	Timing
Gender integration in FISH research and capacity building	Percentage of activities that are gender-integrated; i.e. with sex-disaggregated data and analysis	Activity progress reports	Annual
	Percentage of activities that are gender-strategic; i.e. express gender within problem statement and research design and include gender-focused research questions or activities, including those targeting women or girls	Activity progress reports	Annual
	Number of female and male staff, partners, and local women and men who participated in trainings focused on gender, women or girls	Activity progress reports	Annual
	Extent to which gender plans and goals for gender integration, strategic gender research and gender-transformative research, as expressed in gender road map, are implemented and met	Participatory review of gender road map	Annual
	Extent to which gender plans and goals for capacity development expressed in gender road map are implemented and met	Participatory review of gender road map	Annual
Research products (outputs)	Percentage of outputs (peer-reviewed journal articles and in-house publications) presenting gendered analysis (i.e. sex-disaggregated data and analysis)	Activity progress reports	Annual
Research outcomes	Application of FISH gender findings, learning and insights in partner programming	Partner reports	3 years
Development outcomes	Reduction in gender gap in control over productive assets and resources (Sub-IDO XC 2.1.1)	Program impact assessments and evaluation reports	5 years
	Improved capacity of women and young people to participate in decision-making (Sub-IDO XC 2.1.3)	Program impact assessments and evaluation reports	5 years

Annex 3.5 Youth strategy

The FISH CRP adopts a youth-responsive research agenda to engage young women and men in aquaculture production, small-scale fisheries and fish value chains that are socially just and economically and ecologically sustainable. The program seeks to increase opportunities for safe and rewarding youth employment and entrepreneurship in aquaculture and small-scale fisheries value chains in diverse geographic regions and socio-economic contexts. Further, our research on governance, management and technological innovations will deliberately engage youth and determine the factors and processes that enable or hinder youth participation and representation.

Challenges and opportunities for youth in small-scale fisheries and aquaculture

In 2025, the youth population in Asia is estimated to exceed 1 billion (Ashford et al. 2006), while in sub-Saharan Africa, 17 million young people enter the job market every year (Losch 2012). Because of limited employment and enterprise opportunities for youth in rural areas, rural to urban migration is increasing, leaving a large aging population in rural areas. Barriers to youth participating and investing in fisheries and aquaculture production and value chains range from limited access to fishing grounds and land, capital, inputs, and knowledge and training on fisheries and aquaculture management and markets, to youth perceptions of the sectors as undesirable (cf. White 2012; van Asseldonk 2015).

To unlock the potential of the younger generation to develop entrepreneurial capabilities for productive livelihoods within small-scale fisheries and aquaculture value chains, youth policies have to be examined at the intersections of gender and other social and economic divisions. Any innovations that target youth must also ensure basic norms of safety and human rights. This is especially important given that in both the fisheries and aquaculture subsectors there are documented abuses of labor standards, including the use of child labor. According to the International Labor Organization (ILO), child labor is “work that impairs children’s well-being or hinders their education, development and future livelihoods.” In the case of the capture fisheries and aquaculture subsectors, children have been found to engage in a wide variety of activities, both in the harvesting and farming of fish and in related processing and marketing operations. The use of child labor appears to be widespread in the informal small- and medium-scale sectors; a preliminary study by the FAO and ILO notes “the total number of child laborers in fisheries and aquaculture in the world is likely to be many millions” (FAO-ILO 2011). A study in Cambodia indicated that children make up over 30% of fish-processing workers (Chhorviririth et al. 2005). Efforts to improve fisheries governance can provide a vehicle to address such abuses (Ratner et al. 2014).

With a lack of data and context-specific studies indicating the relevance of and opportunities for female and male youth in small-scale fisheries and aquaculture, youth are often neglected as a specific target group in policies and as relevant stakeholders and agents of change within these landscapes. Socio-cultural norms and practices within gerontocratic societies also limit youth decision-making abilities and access to resources. Hence social, cultural, institutional and economic barriers and opportunities for youth to engage in fish value chains by adopting innovations in production, processing and trade need to be understood and targeted to promote sustainable youth employment and entrepreneurship. Youth engagement has trans-generational importance: youth are gatekeepers to the diffusion of innovative ideas and knowledge within households. It is therefore essential to target them in efforts to promote adoption of novel agricultural technologies, as well as in behavior change communication interventions on nutrition and health.

Enabling youth engagement and livelihood opportunities through FISH

The program will use qualitative studies to explore and investigate the perceptions of female and male youth on their roles, aspirations and needs with regard to livelihood opportunities in small-scale fisheries and aquaculture value chains. Particular capacity development needs will be addressed through the capacity development needs assessment in each focal country. The program will adopt rights-based approaches to engage with youth, to help create socially just and safe, youth-friendly livelihood opportunities and positively inform fishery reform processes. All research activities involving youth will be subject to the research ethics review and child safety policies of the lead center, WorldFish.

The FISH CRP will use research to build on and align with national and international efforts, such as the National Youth Policy of Zambia and the Pan-African Fisheries and Aquaculture Policy Framework and Reform Strategy on youth. These aim at increasing economic participation, entrepreneurship development (including aquaculture, education and skills development) and health for youth throughout the country. We will also work with other agencies with greater outreach to youth. As needed, the program will access technical inputs from groups experienced in capacity development and facilitating networking, meetings and workshops for youth, such as KIT and AgroProFocus. Other

potential partners are the nongovernmental organizations Concern Worldwide, Caritas and Self-Help Africa, as they have far-reaching development programs for youth.

A summary of key youth-focused research elements is provided below for each flagship.

Flagship 1: Sustainable aquaculture

As the fastest-growing food production sector in the world, aquaculture is well placed to create new opportunities for employment and entrepreneurship among young people in Africa and Asia. Integration of youth-focused research in FP1 will be informed by an assessment in the focal countries of Bangladesh, Egypt and Myanmar during 2017. The assessment will elaborate subsequent research priorities, as well as specific processes to follow during research implementation. FP1 will also designate one young scientist based in Myanmar as a focal point for youth research, with responsibilities for wider coordination, sharing of learning and cross-country synthesis of youth research.

Consultations made during the program design stage indicate a number of key areas of focus. The program will test approaches that enable youth to use (or develop capacities to use) IT within various elements of the aquaculture value chain; for example, to identify suppliers of improved fingerlings or fish feed or to contact traders to buy their farmed fish. In Bangladesh, there are emerging opportunities for partnering with IT service providers such as mSTAR to pilot the use of mobile services and organizations such as Amar Desh Amar to test the potential for farmers to sell aquaculture products, where young people can play key roles in the computer center and selling points.

FP1 will support the incubation of youth aquaculture businesses, including mentoring, business attachments or competitions, such as a new Aquaculture Business Incubator proposed in Myanmar in collaboration with [Project Hub Yangon](#). WorldFish experience with an ASEAN youth innovation prize, as part of the [YSEALI project](#), will also inform approaches to be adopted in FISH. The development of suitable business models to be developed and tested through FISH, involving young people and the use of IT in different aspects of the aquaculture value chain, can then be adapted to the scaling countries under FP1 (i.e. Zambia, India and Nigeria). We will also collaborate in Nigeria and Tanzania with the IITA [Youth Agripreneurs program](#), where there are emerging opportunities to include aquaculture.

Providing specialist aquaculture services (e.g. fish harvesting teams or pond preparation and construction teams with better equipment than individual farms can afford) is another opportunity to employ youth that will be tested in Egypt under FP1, cluster 3. As 50% of the people employed in aquaculture in Egypt are less than 30 years old, there is huge potential to include youth in such enterprises.

Young people have proven to be important team members in community-managed aquaculture processes, such as the monitoring of on-farm performance of fish stocks. Under cluster 1, young people can therefore be considered agents of research and employed in teams for data gathering and monitoring processes, as in the case of fish farming in Bangladesh, Myanmar and Egypt. This will also help improve their technical skills and organizational capacity.

Flagship 2: Sustaining small-scale fisheries

FP2 will engage with young people as targets for research and policy development, as co-researchers, and as agents of change in fishery-dependent households and communities. Youth bring a unique perspective and energy to collective action problems and often play important roles in catalyzing change. However, in many social and economic contexts youth do not enjoy the opportunities, empowerment and 'voice' of other members of society.

In fishery co-management action research in clusters 1 and 2, we will continue to engage with youth in developing momentum for change as a particular constituency in decision-making and implementing resource management plans. Community engagement in Myanmar, Bangladesh, Cambodia, Solomon Islands and the Philippines will target youth by providing forums for youth inclusion and participation in decision-making. While we have experienced greater success where youth have been involved in management and research (i.e. higher compliance and fit of fisheries management, and high quality and sustainability of resource monitoring), in our future research we will more fully engage with youth aspirations and support them to have a voice in program-related decisions.

We will engage with young people as opinion makers and innovators to help scale successes in co-management. We will exploit a range of media, including smartphone apps, theatre, comics and traditional media to spread awareness of co-management innovations. We will include young people in participatory scenario development to give voice to a distinct range of opinions, including those of male and female youth, about the future. Where applicable, FP2 will work with national agencies for education and youth affairs to deepen awareness of natural resource management issues among young people and to promote next-generation research leaders and policymakers.

In cluster 3 we explore two case studies of intra-regional trade—in the Great Lakes fish trade corridor in Africa (Uganda, Kenya and Tanzania) and the Mekong Delta (Cambodia and Vietnam). We will explore opportunities for enhancing the safety of and improving the benefits derived by male and female youth engaged in different segments of these fish value chains. We will also investigate what structural support is required, such as inputs, finance, knowledge and skills, for different social and economic groups of young men and women. In terms of knowledge and skills, we will place special emphasis on better understanding the role that IT could play in capture fisheries value chains and how young people may get involved.

Flagship 3: Enhancing the contribution of fish to nutrition and health of the poor

In FP3, we will assess the existing and potential roles of youth in nutrition-sensitive aquaculture production, and develop and test youth-responsive technologies to maximize the production of nutrient-rich fish in pond polyculture systems in Bangladesh (cluster 1). The technologies we test and promote will explore ways of minimizing the time demands on women in particular, including young women. We will work in close partnership with organizations such as Helen Keller International and Save the Children, whose networks can help scale the impact of our research beyond our focal geographies.

Under cluster 3, which focuses on research to increase consumption of nutritious fish in the first 1000 days of life, we are considering targeting schools as a channel to drive behavior change. Targeting school curricula provides an opportunity to raise youth awareness on the importance of fish for pregnant and lactating women and for infants and young children. Given that many of the adverse pregnancy outcomes that contribute to maternal mortality worldwide occur during the first pregnancy (such as pre-eclampsia and early preterm delivery), and growing evidence that the nutrients in fish can help prevent those outcomes, targeting adolescents with those messages is important. We will also explore collaborations with school feeding programs, building on the results of a survey by the Global Nutrition Foundation that suggests there is strong demand for more information about fish and animal-source foods in school feeding programs in many countries throughout the world.

Annex 3.6 Results-based management

Introduction

FISH will implement outcomes-focused results-based management (RBM) to support improved program performance. We will use this approach to improve learning and accountability, track progress towards our objectives, and provide quality information for adaptive program management. We also plan that the RBM system will include systematic and rigorous evaluation to identify effective implementation strategies that are evidence-based.

Our focus on results measurement is embedded in the program's overall theory of change (Section 1.3, Figure 2), where feedback and associated learning is based on the routine monitoring of progress towards intermediate outcomes. Information generated will be used to validate the theory of change, to understand the shifts in assumptions that have occurred, guide adaptive management as needed and update the program and flagship level theories of change.

Framework

RBM starts with program design and is part of the ongoing cycle of program planning, implementation, reporting and evaluation. It also supports budgeting, particularly as course corrections become important based on evidence produced. Key steps in this cycle include:

- Defining clear impact pathways and their theories of change (including assumptions and identifying actors and the changes expected from them where possible);
- Monitoring of outputs, outcomes and impacts;
- Evaluation and impact assessment;
- Learning and progressing learning agendas;
- Adaptive management and budgeting.

Each of these steps is summarized below together with a summary of implementation plans and main budget elements.

Impact pathways and theories of change

The program's impact pathways and theories of change describe how we envisage the program's research leading to outputs, and in turn to outcomes and impacts. The RBM system will track progress along these pathways, and the validity of our assumptions and approaches to managing risk, and use learning and feedback loops to modify design and implementation so as to enhance performance. We will integrate program and flagship level investment in RBM with that conducted as part of bilateral projects. Using this system, we will keep our impact pathways and theories of change under regular review and adapt as necessary.

Monitoring

The RBM system depends on the continuous collection and analysis of data on outputs, outcomes and impacts, together with information on our key assumptions underpinning our theories of change and associated risks. We will use these data to track progress against a set of program milestones (see Performance Indicators Matrix) as part of annual assessments of progress. Impacts will be assessed through dedicated and discrete impact assessment studies. For sub-IDs we will use a suite of specific indicators. A first analysis of these is provided in Table 1, and a refined list will be developed in preparing for program implementation. We will complement these indicators with methods to estimate our contribution to SLO targets. A first description of these is provided in Table 2, and these will also be developed further in preparing for program implementation.

Table 1. Key indicators used to track progress towards the sub-IDOs.

Indicator	Sub-IDO's	Method of measurement	Where	Frequency
IDO: Improved diets for poor and vulnerable people				
Women's average fish consumption per day	Increased access to diversified nutrient-rich food	Surveys using locally adapted tools or extrapolation from secondary data (HIES etc)	All focal countries	Every three years
Child's average fish consumption per day (6-24 months of age)				
Women's minimum dietary diversity score (WDDS)	Increased access to diversified nutrient-rich food	Surveys. Will include separate disaggregation of the animal source foods group to capture fish specifically.	Bangladesh, Cambodia, Tanzania	Every three years
Child minimum dietary diversity score (MDDS)	Increased access to diversified nutrient-rich food	Surveys, secondary data. Separate disaggregation of fish as noted above.	Bangladesh, Cambodia, Tanzania	Every three years
WFP Food consumption score	Increased access to diversified nutrient-rich food	Surveys, secondary data	Bangladesh, Cambodia, Tanzania	Every three years
% of youth (young men and women) with increased awareness of the importance of fish to improve nutrition of pregnant and lactating women and infants (disaggregated by gender, age and wealth)	Increased access to diversified nutrient-rich foods	Household surveys, surveys in targeted schools	In flagship 3 areas	Every three years
IDO: Improved food safety				
Percent reduction in microbial and/or chemical contamination of fish	Reduced biological and chemical hazards in the food system	Sample surveys	Bangladesh, Tanzania	Every three years
IDO: Increased productivity				
Average production (kg/hectare/year)	Closed yield gaps through improved agronomic and animal husbandry practices	Logbooks, sample surveys, partner reports	FP1 focal countries	Annually
	Reduced livestock and fish diseases			
Estimated breeding value gain/year for target traits (%)	Enhanced genetic gains	Routine collection through breeding program	FP1 focal countries	Per generation (most often annually)
Percent reduction in postharvest loss (physical and/or nutritional)	Reduced pre- and postharvest losses	Sample surveys, value estimation along the value chain	Bangladesh, Tanzania	Every three years
<ul style="list-style-type: none"> • Feed conversion ratio • Water use efficiency (kg/fish/m³ water) (kg/fish/m³ nitrogen) (kg/fish/m³ phosphorus) 	More efficient use of inputs	Sample surveys/logbooks	FP1 focal countries	Every three years

<ul style="list-style-type: none"> • Disease prevalence (%) • Loss due to disease (survival/stocking) compared to baseline 	Reduced livestock and fish diseases	Sample surveys/ logbooks	FP1 focal countries	Continuous monitoring minimum 1 cropping cycle.
IDO: Increased incomes and employment				
# of women and men fish farmers and fish value chain actors with increased income (disaggregated by age and wealth group)	Diversified enterprise opportunities Increased livelihood opportunities	Sample surveys	FP1 focal countries	Before/after
# of women and men assisted to exit poverty through livelihood improvements	Increased livelihood opportunities Increased capacity to cope with shocks	Household Surveys, Wellbeing indicators from OECD (2013), Household Income and Expenditure Surveys, national census data and other third party sources (e.g. development partners)	All FP2 sites	Every three years
# of women and men employed in aquaculture (disaggregated by age and wealth group)	Increased livelihood opportunities	Government employment reports; Household Income and Expenditure/LSMS surveys	All FP1 countries	Every three years
# youth (young men and women) involved in socially just and safe youth employment in aquaculture and fisheries value chains	Increased livelihood opportunities	Surveys and extrapolation from government employment reports, household income and expenditure/LSMS surveys	FP1 cluster 3 and FP2 cluster 1 and 2 target areas	Before and after interventions
IDO: Enhanced benefits from ecosystem goods and services				
% increase in yield from better fisheries management practices	Increased access to productive assets, including natural resources More productive and equitable management of natural resources	National and community catch monitoring programmes and sample surveys of fishery-dependent men and women; Survey tool adapted from Women's Empowerment in Agriculture Index (WEAI) for equitable flow of benefits	All focal countries	Every three years
IDO: Natural capital enhanced and protected, especially from climate change				
# hectares of aquatic and coastal marine habitat restored and under more productive and equitable management	Enhanced conservation of habitats and resources Increased resilience of agro-ecosystems and communities, especially those including smallholders Enhanced adaptive capacity to climate risks	Sample surveys, sub-national and national statistics, public domain databases of area under management maintained by WorldFish and FISH partners.	All focal countries	Every three years
IDOs: Cross cutting				
# households with increased capacity to deal with climate risks	Enhanced capacity to deal with climatic risks and extremes	Household surveys, wellbeing indicators from OECD (2013), Household	All focal countries	Every three years

and extremes		Income and Expenditure Surveys, national census data and other third party sources (e.g. development partners)		
# of women with increased control of productive assets and resources (disaggregated by age and wealth)	Gender-equitable control of productive assets and resources	Survey tool adapted from Women's Empowerment in Agriculture Index (WEAI) embedded within CL research	All focal countries	Before and after flagship interventions
# of women with increased influence in community fisheries-related decision-making (disaggregated by age and wealth)	Improved capacity of women and young people to participate in decision-making	Survey tool adapted from Women's Empowerment in Agriculture Index (WEAI), embedded within CL research	All focal countries	Before and after interventions
# of women with increased influence in intra-household decision-making (disaggregated by age and wealth)	Improved capacity of women and young people to participate in decision-making	Survey tool adapted from Women's Empowerment in Agriculture Index (WEAI), embedded within CL research	FP3 focal countries	Before and after interventions
# youth (young men and women) with increased influence in decision-making in resource management plans for small scale fisheries and aquaculture (disaggregated by gender, age and wealth)	Improved capacity of women and young people to participate in decision-making	Survey tool adapted from Women's Empowerment in Agriculture Index (WEAI)	In FP1 cluster 3 and FP2 cluster 1 and 2 target areas	Before and after interventions
# partner staff trained (disaggregated by sex, job/role, location and literacy) Change in knowledge and skills of training participants	Enhanced individual capacity in partner research organizations through training and exchange	Documentation of training activities Participant evaluations of training activities	All countries where training is done	Summarized annually
# of youth and women participating in decision-making for a Change in attitudes towards youth and women participating	Enhanced capacity of youth and women to engage in decision-making	Documentation of decision making constituency	Target Countries	Every third year

Table 2. Proposed methods for measuring CRP contributions to SLO targets.

SLO target and indicator	Contribution by Flagship	Method to estimate contribution
SLO Target 1.1: 1.5 million farm households have access to and are using faster-growing and more resilient FISH strains of tilapia and carp	Flagship 1: 1.5 million	Tracking of improved broodstock dissemination to hatcheries in all countries and records of fingerling dissemination from hatcheries to grow out farmers. Validation of this approach using direct sampling is currently being undertaken in Bangladesh for GIFT Tilapia using molecular assay and will selectively be undertaken in other countries to validate the approach described above.
SLO Target 1.1: 2.5 million farm households have adopted disease detection and control strategies, cost-effective and sustainable aquafeeds and/or improved aquaculture management practices	Flagship 1: 2.5 million	Sample surveys, coverage estimates based on analysis of secondary data from public and private sector partners on sale of feed, feed use surveys, estimates of dissemination, use of data from government monitoring and quality control programs. For shrimp, uptake of Specific Pathogen Free (SPF) certified seed will be measured directly. In countries where similar certification is available for fish seed we will sample hatcheries/multiplier centers/farmers to estimate adoption of this practice.
SLO Target 1.1: 1 million fishery-dependent households have improved wellbeing as a result of adopting improved fisheries management	Flagship 2: 1 million households	Household surveys in places where FISH works directly, augmented by secondary data from Household Income and Expenditure Surveys (HIES), national census data and other third party data to extrapolate to national and regional scales. Indicators and sampling will utilize WorldFish implementation of OECD (2013) wellbeing indicators.
SLO Target 1.2: 1 million people, of which 50% are women exit poverty through livelihood improvements	Flagship 2: 1 million people	Detailed sample surveys in places where FISH works directly augmented by secondary data from HIES, census data and other third party data to extrapolate to national and regional scales.
SLO Target 3.3: 2.1 million hectares of aquatic and coastal marine habitat restored and under more productive and equitable management	Flagship 2: 2.1 million ha	Sample surveys, sub-national and national statistics, public domain databases of area under management maintained by WorldFish and FISH partners.
SLO Targets 3.1 and 3.2: 4.8 million metric tons of annual farmed fish production with reduced environmental impact and increased resource use efficiency (measured by 20% reduction in greenhouse gas emissions and 10% increase in water and nutrient-use efficiency) ²	Flagship 1: 4.8 million MT	An environmental baseline will be established for all focal countries (already done for Bangladesh and Egypt). Sample surveys will be used to assess adoption of best practices and LCA analysis (building on LCA L&F research on tilapia VCs in Egypt). National aquaculture statistics will provide data on volumes. Coverage estimates will be based on analysis of secondary data from public and private sector partners.
SLO 3.3: 3.3 million ha of ecosystems restored through more productive and equitable management	FP1: 1.25 million ha FP2: 2.1 million ha	GIS mapping of land use before and after program implementation, complemented by surveys of ponds under better environmental management practices (FP 1), and surveys, sub-national and national statistics, public domain databases (FP2).

² Note: in PIM Table A, SLO Target 3.2 is expressed as Gt reduction in greenhouse gas emissions. To make this conversion, we tentatively use a global average for farmed aquatic animal production. 1 million tonnes of global aquaculture production (excluding seaweeds) releases 7.4 (Hall, et al. 2011) to 5.5 (Waite, et al. 2014) Mt CO₂ eq per million metric tons of aquaculture production at farm gate (per year). We assume the lower 5.5 Mt CO₂ eq per million metric tons for this calculation. A 20% reduction in GHG emissions equals 1.1 Mt CO₂ eq. for every million metric tons of fish produced. For 4.8 million Mt of aquaculture production, "business as usual" GHG is 26.4 Mt CO₂ eq/yr (or 0.026 Gt CO₂ eq/yr). A 20% reduction would reduce from 26.4 to 21.1 Mt CO₂ eq/yr, or a saving of 5.3 Mt CO₂ eq./yr. (0.005 Gt CO₂ eq./yr.).

SLO 2.3: 2.4 million people, of which half are female, with one or more micronutrient deficiencies eliminated.	Flagship 1: 0.7 million Flagship 2: 0.3 million Flagship 3: 1.4 million people	We will collect information through baseline and follow-up surveys on fish consumption (frequency, amount, and species) as well as dietary diversity measures (minimum dietary diversity for women (MDDW) and for children (MDDC) and the WFP Food Consumption Score in FISH CRP Focus countries and will rely on secondary information to estimate changes in fish consumption in other settings where our M&E information suggests our research has been scaled. In our ex ante estimation of the contribution of value chain interventions to these SLO targets (flagship 3, Table 14), we have used first estimates of the volume of fish moving through the value chain each year, waste rates, and ability of the interventions to improve access, and used average fish consumption figures per capita to estimate the number of people benefitting. As we move to implementation, we will adjust estimates based on actual findings of the baseline assessment and tracking of true fish volumes/reduced rates of waste.
SLO 2.4: 4.6 million women of reproductive age consuming more food groups as a result of increased fish consumption ³	Secondary: Flagship 1: 1.8 million Flagship 2: 0.6 million Flagship 3: 2.2 million	

Evaluation and Impact Assessment

We will conduct a rolling program of discrete, well-constructed, and specific evaluations and impact assessments to support effective decision-making and systematic learning. Evaluation activities will be coordinated by the Independent Steering Committee (ISC) and be supported by internal evaluation resources and external contractors. We see internal resources as essential for effective data collection and to ensure evaluation use; external contractors are essential to guarantee independence and methodological rigor. Internal evaluation responsibilities will be integrated into the research work of CRP staff but coordinated by the M&E Lead, other program staff and ad hoc external advice.

Evaluation activities will draw on available monitoring data and seek to rigorously ‘test’ the theory of change. They will also aim to establish causal links between CRP actions and observed outcomes using both counterfactual and ‘theory’ based methodologies. Some controlled interventions and comparative data will be generated, thus supporting experimental and quasi-experimental design and analysis. However we anticipate that much of the data available will be observational, requiring a broader range of methods to support causal claims.

The Independent Steering Committee will commission a Common Evaluation Framework (CEF) from a suitable evaluation contractor that will guide a program of evaluative activities. The CEF will identify: a detailed evaluation time-plan; High Level Evaluation Questions (HLQs); a range of appropriate methods to address such HLQs; the kinds of quantitative and qualitative data that will be needed; how this data will be collected; and outline guidance for data analysis and synthesis.

The two main arms of the evaluation will be (1) Annual Evaluations and Reviews (AERs) and (2) Impact Assessments (IAs). AERs will be flagship specific and where possible cross-country comparative, and will complement ‘real-time’ and routine monitoring data. Timing of IAs will be aligned with expected outputs. For example whenever particular research products, or significant program components (thematic or geographical) are reaching significant milestones such as completion of bilateral projects, or when specific research products are approaching their anticipated peak level of adoption. IAs will also conduct meta-analyses of a suite of projects in specific countries or regions. IAs will focus on estimating the realized economic, social and environmental benefits of FISH research outputs; the contribution and value added of CRP interventions; and contingent and contextual factors that support claims for CRP effectiveness. We see the latter as an essential foundation for future up-scaling. Wherever possible these assessments will disaggregate impacts for men, women and youth.

AERs will be undertaken primarily by external contractors, although working collaboratively with internal evaluation resources. IAs will be primarily undertaken by internal resources but with methodological support from external contractors and advisors.

³ Note: in PIM Table A, SLO target 2.4 is expressed as % reduction in women of reproductive age consuming less than adequate number of food groups. To convert the target of # women to % by country and region, we have relied on estimates of # poor people dependent on aquatic agricultural systems (Béné and Teoh 2015) or number of poor as the best available proxy for the target group (denominator). Estimates of contributions to the overall % target will be revised in line with CGIAR guidance once this is available.

The outputs of AERs and IAs will provide systematic insight into the achievement of intended outcomes, and guide allocation of resources to maximize outcomes, including shifting the program's approach as required. We intend to synchronize our in-country AERs as part of site integration in Bangladesh, and other feasible CGIAR integration sites as we expand our program to leverage the potential resources of multiple CRPs. We will stagger the timing of AERs as noted in Table 3 according to the relative progression of each flagship. The timetable for IAs will be finalized by the Independent Steering Committee following the advice of the contractor preparing the Common Evaluation Framework. It is anticipated that a single integrated IA workstream will be designed linked to sub-IDOs and SLO targets rather than Flagships although drawing on Flagship data. IA outputs will be timed to link with key CRP decisions and review points.

It is anticipated that the AER for each flagship as well as the synthesis CRP evaluation will be conducted as Center-Commissioned External Evaluations (CCEE). The IEA commissioned evaluation that will be conducted once during the first six years of the program will be able to draw on the outputs of the planned program of AERs and IAs. If timed correctly, this IEA commissioned evaluation may take the place of the synthesis CRP evaluation.

Table 3. Initial list of proposed AERs and IAs.

Year	Purpose	Geographies
2017	Common Evaluation Framework	Global
2018	Flagship project 1	Global with focus on Bangladesh and Egypt
2018-2020	Impact Evaluation Workstream	Cross Flagship and Global
2019	Flagship project 2	Global with focus on Bangladesh and Myanmar
2020	Flagship project 3	Global with focus on Bangladesh Cambodia and Tanzania
2021	Synthesis CRP evaluation	Global

Learning

FISH will collect information collected through the program's monitoring, evaluation and impact assessment frameworks to support learning at multiple levels. We will use annual reviews in each focal country to consolidate learning from implementation across cluster research activities, with a focus on validating or revising the hypotheses of our impact pathways and theories of change. Similar program meetings will be held annually with cluster and flagship teams comparing learning across countries, to feed into the annual planning cycle, providing opportunity for corrective measures to be taken.

Adaptive management and budgeting

The FISH ISC and Management Committee will use the systems described here to adjust program implementation as required to improve performance. We will normally do so on an annual cycle and annual budget allocations will reflect documented performance against milestones, including stopping particular lines of research should the evidence support this. Particular emphasis will be given to acting upon the conclusions and recommendations of external evaluations as agreed with the ISC.

Implementation

The RBM system will be managed by a dedicated M&E team, headed by the M&E Lead, serving on the program management committee and reporting to the program director. However we recognize that sustaining a results-culture that measures performance by achievement of the *outcomes* we have outlined for the CRP requires senior-level leadership to establish and reinforce the right incentives (Mayne 2007). Our approach to RBM will therefore include investment in capacity development of senior science staff at global and country levels. This will incorporate specific training on managing for outcomes—including effective engagement with partners and tracking research outcomes amongst other key metrics appropriate to the specific context.

Main Budget elements:

- 1 M&E Lead, also actively engaged in research design & implementation
- 1 full-time, central international scientist position focused on M&E design and implementation;
- 1 central international program coordination position overseeing output planning and monitoring;
- Database management specialist and research data management specialist;
- FP leads responsible for coordinating with these above roles on implementation of RBM
- Dedicated staff in focal countries;
- Annual workshops to document qualitative outcomes and learning and revisit theories of change.

Annex 3.7 Linkages with other CRPs and site integration

Linkages to global integrative CRPs and cross-cutting platforms

FISH has been designed in collaboration with each of the global integrative CRPs, in addition to the cross-cutting platforms. The rationale for these links is summarized here, with details provided in Tables 1 and 2a.

Policies, Institutions and Markets (PIM). Making smart choices among various agricultural technologies and investment options requires a comparative perspective across food production sectors. Therefore, we will continue to collaborate with PIM to develop and apply foresight modeling tools and models to conduct ex ante assessment of alternative aquaculture technologies, policies and investment options and explore future fish supply and demand scenarios at national, regional and global levels. Impact assessment domains will include fish supply, demand, trade, prices, and implications on fish food security, nutrition and health. The IMPACT model developed by IFPRI and the fish sector model developed by WorldFish (AsiaFish) will be used in foresight modeling research. Additional linkages with PIM focus on three opportunities to jointly develop and leverage comparative lessons and tools:

- *Value chain assessment.* We will continue to collaborate with PIM on value chain tools and innovations, including postharvest loss assessment tools. PIM will provide general methodologies, which we will adapt, pilot and use for fish value chains. The FISH CRP therefore provides PIM with a context to test the suitability of tools for a specific commodity. Fish, with the highest trade value among the agri-food commodities, has many unique features distinct from agricultural crops. This includes great diversity and variation in the species and products being traded; the limited correlation of price trends in wild and farmed species; the great variation in income and price elasticities of demand between species, regions and income groups; and high perishability. Because of these features, fish requires specific attention. Collaboration between PIM and FISH is important, as PIM provides the tools and methods, while FISH provides the specific expertise on fish value chains. In addition, FISH will draw on PIM's research on broader trade policy issues where required. The FISH CRP will also link into the broader postharvest waste and loss platform that PIM has been setting up with FAO.
- *Gender equity.* The FISH program will be an active player in and contributor to the CGIAR Collaborative Platform for Gender Research (PIM FP6). We will contribute to gender agenda setting and increasing visibility of gender in CGIAR through active engagement in the platform and dissemination of quality gender outputs, ranging from peer-reviewed scientific publications to popular media. We will apply the experience from L&F and AAS to support the gender methods development aims of the platform, including refining tools for assessing women's empowerment in fisheries contexts. Drawing on PIM learning regarding the Women's Empowerment in Agriculture Index, the FISH program will contribute by refining and testing ex ante and ex post gender assessments and the adapted tool for fisheries initiated under AAS: the Women's Empowerment in Agriculture Index for fisheries. Moreover, while benefiting from the platform's continued development of sex-disaggregated standards and protocols, the FISH CRP will build on AAS and L&F experience in the area of gender-transformative strategies by further developing and sharing empirically tested methods and tools for gender-transformative change.
- *Policies and institutions for inclusive natural resource governance.* PIM FP5 has been designed to develop analytical tools, synthesize lessons, and strengthen policies and institutions aimed at securing resource tenure for poor producers and promoting inclusive governance of agro-ecological landscapes. Fisheries governance is a priority for comparative analysis alongside forest, pastureland and water management cases, which face comparable challenges of gender and social equity in stakeholder representation, participation in decision-making, and public and private sector accountability towards poor resource users. Tools such as the Collaborating for Resilience approach aim to promote inclusive multi-stakeholder deliberation over the roots of resource competition and strategies to address these. PIM FP5 will enable an exchange of lessons on the application of such tools across countries and resource systems, and derive policy lessons for governments, development agencies and civil society networks. The FISH CRP will apply these in its work on small-scale fisheries and in addressing competition over water and land as an aspect of sustainable intensification of aquaculture.

Climate Change, Agriculture and Food Security (CCAFS). To identify adaptation options most appropriate to expected future climate regimes, we will use CCAFS climate modeling to better understand where our aquaculture technologies can contribute most effectively to adaptation to climate change across our key geographies. We will continue partnership on documenting the outcomes of local innovations as part of the FISH scaling strategy to aid in influencing policies and investments targeting future climate-smart agriculture. In Cambodia, Lao PDR and Vietnam, we and other CCAFS partners are developing a process in which fishing and farming communities prioritize and test a suite of climate-

smart agriculture technologies and practices suited to the local context, such as rice field fisheries enhancement and dry season water management for aquaculture. This approach will be refined and scaled out to other communities through action research and peer learning, and contribute to sub-national agriculture planning at commune and district levels. In the Mekong Delta in Vietnam and Cambodia, FP2 will also consider the inadvertent risks to fisheries brought by infrastructure-based strategies favored by local governments for climate adaptation, such as construction of dikes and irrigation schemes.

We will work with CCAFS to communicate evidence on climate-smart aquaculture options, such as water-use efficiency, disease management and responses to salinization in coastal deltas. Research on climate-smart farming systems, involving integration of fish into household farming systems, has shown promise in Bangladesh and Vietnam, and such experiences will continue to be explored, increasingly scaling from both countries to elsewhere in Asia and Africa.

Agriculture for Nutrition and Health (A4NH). Fish provide exceptional nutritional benefits but remain poorly represented in nutrition strategies of national governments and development agencies. Our partnership with A4NH will address this gap by strengthening the evidence on nutritional outcomes and disseminating cost-effective solutions for nutrition-sensitive fish production, processing, and behavioral change to improve fish consumption by women and children. Our research results, focused on production and consumption of nutrient-rich fish, will feed directly into A4NH research at country and regional levels to develop and promote policies that enable food system innovation and scaling for improved dietary diversity and healthier diets. This will be fostered through the strong partnerships A4NH has developed with international and regional networks such as Scaling up Nutrition (SUN) and the Comprehensive African Agriculture Development Programme (CAADP).

We will also partner on risk assessment and mitigation for fish food safety. Working with A4NH FP3, our work on fish value chains for poor consumers will benefit from A4NH research on technological and institutional solutions and appropriate policy and regulatory options, especially for perishable foods sold in informal markets, where the majority of poor people buy and sell fish.

Water, Land and Ecosystems (WLE). The productivity and sustainability of inland fisheries depend critically on changes in the broader landscape, notably water resource infrastructure and land-use change. Our partnership with WLE seeks to ensure that deliberations over basin and watershed-scale resource competition and development scenarios address fisheries outcomes. FISH FP2 research at landscape level in Cambodia and Vietnam will be nested within the basin-scale analysis of water variability and water benefit tradeoffs for the WLE flagship on managing resource variability and competing uses for increased resilience. This will provide a route to promote adaptation within a broader biophysical and socio-economic context. Similarly, FP2 work in Bangladesh will contribute to and benefit from the basin-scale perspective offered by WLE work in the Ganges basin. At more local landscape scales, we will partner to optimize water management in crop and fish production, and to manage water quality and pollution risks associated with aquaculture intensification. WLE research with AAS in Bangladesh has shown how water management regimes and governance remain critical to achieving productivity gains for farmers from improvements in integrated rice and fish farming technologies. FISH research on scaling new aquaculture technologies will benefit from ongoing links with WLE addressing these critical dimensions of the broader landscape.

Genetic Gains Platform. FP1, through its cluster on fish breeds and genetic improvement, is the focus for links with the Genetic Gains Platform. The platform is expected to provide bioinformatics tools and services, genotyping and sequencing tools and services, and phenotyping tools and services to support the improvement of fish (tilapia and carp) breeding programs to achieve more rapid genetic gains. The FISH CRP will contribute to the community of practice in animal breeding and provide an opportunity for the platform to consolidate learning on genetic gains in fish, as well as testing tools and methodologies, including key metrics around breeding program performance (e.g. rates of genetic gains, delivery to farmers and use of varieties).

Big Data Platform. Investments by the FISH program into fish genomics open new opportunities for genetic improvement of fish and new gene discoveries. Genomic approaches applied in the CRP will generate large amounts of data, and new and improved data management and analytical approaches are required. Collaboration with the Big Data Platform will allow the CRP to access methods and approaches to managing and analyzing larger databases through consultations and training. The platform will also gain access to large datasets of fish genetics and related data, helping to make them more widely used by allied research programs globally.

Linkages to other agri-food system CRPs

Particular site integration activities also include links with the following AFS CRPs:

RICE on integrated rice-fish systems. Integrated rice-fish systems are widely practiced in Asia, particularly in the coastal deltas of South and Southeast Asia, where the addition of fish to rice farming systems can yield significant productivity, income and nutritional gains for farm households. FISH will collaborate with RICE to identify opportunities for further promotion of such integrated systems through site integration in Asia (Bangladesh, Cambodia and Myanmar) and to identify opportunities for scaling such systems to Africa. In addition, a research partnership between CSIRO and FISH provides access to technology that uses microbial processes to bio-convert plant wastes, such as rice husks, into a bioactive product (Novacq™). This technology enhances the growth and health of farmed prawns and eliminates the need for wild-harvest fishmeal in prawn feeds, a world-first achievement in aquafeed sustainability. In collaboration with RICE, we will test the bioconversion efficiency of different forms of rice waste (including variations in pre-processing the waste) for conversion into bioactive ingredients for fish feeds, then test the effects on the growth of tilapia and shrimp. Proof-of-concept trials will be done in the Philippines in partnership with IRRI and national partners CLSU and BFAR. Successful proof of concept would provide a sound basis for subsequent funding support for scaling up the technology in Asia and then Africa, enabling local entrepreneurs to develop aquafeed enterprises, a focal point for capacity development for the aquaculture industry.

Roots, Tubers and Bananas (RTB) on cassava waste inputs to novel aquafeed. In collaboration with RTB we will explore use of Novacq™ technology to test the bioconversion efficiency of different forms of cassava waste (including variations in pre-processing the waste) and the bioactive effects on the growth of crustaceans (prawns and crabs) and fish (tilapia and catfish). The proof-of-concept trials will be done in Tanzania in partnership with IITA postharvest research on livelihood improvements through demand-oriented interventions for competitive production and processing of cassava, the ENABLE Youth Research and Training Center, and the Institute of Marine Science in Zanzibar. Successful proof of concept would enable subsequent funding support for scaling up the technology, enabling local entrepreneurs to develop aquafeed enterprises, a focal point for capacity development for the emerging aquaculture industry in Africa.

Livestock on animal health and human nutrition. Cross CRP-collaboration will be achieved by strengthening the already established research partnerships between WorldFish and ILRI under L&F flagships on livestock animal health, feeds and forages, and livelihoods systems, the latter with an emphasis on value chains and animal-source foods and human nutrition. We will continue to share experiences on best use of ingredients for fish feeds, making extensive use of ILRI feed ingredient data and NIRS capacity. Tilapia disease has been identified as a topic of mutual interest for joint research in Egypt under the animal health flagship and new investigations into unsolved fish disease problems, building on analysis started in L&F. We will seek access to BecA hub with scope for training and capacity development in animal health and continue sharing of analytical methods and tools across the Livestock and FISH CRPs.

Site integration

Primary countries for site integration are FISH focal countries Bangladesh, Nigeria and Tanzania (each highest priority ++ for CGIAR site integration), and Zambia (high priority + for site integration). In these countries we aim to partner with PIM, A4NH, CCAFS and WLE, where possible, on analyses of opportunities to integrate fish-based solutions in support of national policies on food security, nutrition, land and water management, and climate change adaptation. In addition, we look to develop linkages to other agri-food system CRPs and their associated Centers in these countries. This includes collaboration with RTB on the use of cassava waste inputs to novel aquafeed. Further details of this intended collaboration with other CRPs is provided in Table 2b, together with a summary of the status of country and partner engagements to advance this site integration.

In addition to this focus on high-priority countries for CGIAR site integration, the FISH CRP will pursue opportunities for collaboration with other CRPs in other countries wherever possible. For example, WorldFish and IWMI have already worked closely with IRRI to identify opportunities for collaboration in Myanmar's Ayeyarwady Delta, and this will be pursued through collaboration between FISH, WLE and RICE. This collaboration will also be pursued in Cambodia.

Table 1. Overview of inter-CRP collaboration: Provide and receive.

FISH CRP			
	FP1: Sustainable aquaculture	FP2: Sustaining small-scale fisheries	FP3: Enhancing the contribution of fish to nutrition and health of the poor
PIM	<p><i>FISH provides:</i> Analysis of aquaculture technology options and scenarios for integration in comparative foresight modeling</p> <p><i>Receives:</i> Impact assessment methods and tools for technology adoption and scaling; gender analysis and outcome evaluation tools</p>	<p><i>FISH provides:</i> Governance analysis of floodplain and coastal fisheries systems; strategies to sustain gender-equitable access for marginalized groups</p> <p><i>Receives:</i> Synthesis of learning on processes of multi-stakeholder dialogue to improve natural resource governance</p>	<p><i>FISH provides:</i> Co-development of fish value chain assessment and postharvest loss assessment tools</p> <p><i>Receives:</i> Value chain methods and approaches; results from broader trade policy research in target countries; scaling postharvest fish value chain innovations in regional-level interventions</p>
A4NH	-	-	<p><i>FISH provides:</i> Research on role of fish in meeting nutrition and health goals; integration into agricultural development and nutrition strategies; risk assessment and mitigation on fish food safety</p> <p><i>Receives:</i> Ex ante, ex post evaluation regarding progress against nutrition targets; support to analyze food safety strategies</p>
CCAFS	<p><i>FISH provides:</i> Climate-smart aquaculture options (including water-use efficiency, low-emission production, adaptation responses to salinization in coastal deltas)</p> <p><i>Receives:</i> Integration of aquaculture in policy engagement on climate adaptation and mitigation</p>	<p><i>FISH provides:</i> Analysis of climate resilience in small-scale fisheries; links between climate change and nutrition (e.g. coral reef fisheries productivity)</p> <p><i>Receives:</i> Integration of fisheries in policy engagement on climate adaptation</p>	-
WLE	<p><i>FISH provides:</i> Water-use efficiency for aquaculture productivity in multifunctional aquatic landscapes; management of water quality and pollution risks with aquaculture intensification</p> <p><i>Receives:</i> Analysis of aquaculture in mosaic of land uses and food production in peri-urban and nearby rural areas</p>	<p><i>FISH provides:</i> Research on connectivity of natural systems for aquatic biodiversity and fisheries productivity</p> <p><i>Receives:</i> Policy convening on water governance in focal basins, including tradeoffs related to water infrastructure (dams, irrigation systems, etc.) and fisheries productivity</p>	-

Livestock	<p><i>FISH provides:</i> Expertise in aquatic epidemiology and aquatic animal diseases; information on aquaculture feeds and feed ingredients</p> <p><i>Receives:</i> Expertise in bacterial disease diagnostics, molecular biology and livestock vaccines; information on feed quality of aquaculture feed and feed ingredients; aquafeed ingredients for testing in aquaculture diets</p>	-	<p><i>FISH provides:</i> Joint research on strategies to incorporate animal-source foods into diets of infants and young children; development of measurement tools and approaches to enhance the availability, affordability and consumption of animal-source foods</p> <p><i>Receives:</i> Methods for value chain assessment applicable to perishable products; methods for assessing contribution of animal-source foods in human nutrition</p>
RICE	<p><i>FISH provides:</i> Research on productivity improvements in rice-fish farming systems and technology for research on production of novel bioactive ingredients for fish feed from rice wastes</p> <p><i>Receives:</i> Rice productivity management practices integrating aquaculture in target geographies; research on rice byproducts</p>	<p><i>FISH provides:</i> Productivity improvements for wild-capture fisheries in rice field systems</p> <p><i>Receives:</i> Scaling opportunities through integration of rice-fish innovations in broader rice system productivity improvement programs</p>	-
RTB	<p><i>FISH provides:</i> Technology to bio-convert cassava waste into bioactive ingredients in fish feeds and testing in fish feed trials</p> <p><i>Receives:</i> Postharvest research on demand-oriented interventions for competitive production and processing of cassava; research on women and youth employment in cassava value chains</p>	-	-
Genetic Gains Platform	<p><i>FISH provides:</i> Fish breeding programs as a core resource for genomic analysis; technology for rapid genomic assessment of tilapia and data from breeding programs</p> <p><i>Receives:</i> Genomic tools to accelerate the speed of genetic gain in fish; access to shared genotyping platforms; assistance in data analysis methodologies and breeding program management</p>	-	-
Big Data platform	<p><i>FISH provides:</i> Access to fish genetics and related data</p> <p><i>Receives:</i> Approaches and training in the analysis of large datasets</p>	-	-

Table 2a. Partnerships with other CRPs (activities, mode, geographies and outcomes sought).

Submitting CRP: Fish Agri-Food Systems (FISH)

Partner CRP	Activity [country(ies) in which this takes place]	FISH role	Collaborating CRP role	Collaboration mode	Output; added value; target countries
PIM	Foresight modeling [Malaysia]	Participate in community of practice, provide biophysical and other attributes for general modeling suite, run scenarios of particular interest to CRP, share results	Development and maintenance of core modeling suite, training, convening community of practice, coordination and synthesis of cross-cutting foresight studies	Co-investment (ongoing)	Scenarios with different assumptions about technologies Value: for decisions on investment in research, value for regional and national planning for climate-preparedness Bangladesh, Nigeria, Tanzania, Myanmar
	Strengthening value chains [Bangladesh, Egypt, Tanzania]	Developing tools and methods, applying to fisheries and aquaculture value chains, sharing lessons with community of practice, disseminating PIM and CRP results to stakeholders in relevant value chains	Developing research tools and methods, convening community of practice, prioritization of value chains and enabling environment constraints, coordination and synthesis of cross-cutting value chain studies, maintaining online platform for dissemination	Parallel investment (ongoing)	More systematic understanding of bottlenecks in value chains and workable interventions Value: cross-CRP learning Bangladesh, Egypt, Tanzania
	Measuring and reducing postharvest losses [Bangladesh, Tanzania]	Co-development of methodology, application of methodology in fish value chains, sharing of findings to the research, development and policy communities	Developing methodology, coordinating joint studies, convening to discuss results and disseminate; linkage into the global postharvest waste and loss platform	Parallel investment (new)	Rigorous quantification of postharvest losses, design of cost-effective interventions Value: cross-CRP learning, integrated view Bangladesh, Tanzania
	Managing shared landscapes (inland and coastal fisheries governance; aquaculture expansion) [Myanmar, Bangladesh, Cambodia, Tanzania]	Governance analysis of floodplain and coastal fisheries systems, analysis of sources of competition over natural resources and strategies to sustain gender-equitable access for marginalized groups	Development and management of online resource center, training materials; convening to share approaches and results, providing tenure and governance inputs into landscape-level interventions tested; synthesis of policy lessons	Co-investment (ongoing); joint resource mobilization	Shared body of work covering a range of resources within shared landscapes Value: cross-CRP learning, joint policy impact Myanmar, Bangladesh, Cambodia, Tanzania

	CGIAR Collaborative Platform for Gender Research	Participating in collaboration through the platform, applying and disseminating good gender research practices, raising visibility of gender in CGIAR research, contributing gender-transformative strategies	Managing platform	Parallel investment (PIM funds platform, FISH funds gender research)	Better coordination of gender research, strategic prioritization Value: cross-CRP learning, joint impact All focus countries
A4NH	Integration of fish in nutrition strategies of national governments and development agencies [Bangladesh, Zambia, Tanzania]	Strengthening the evidence on nutritional outcomes and disseminating cost-effective solutions for nutrition-sensitive fish production, processing and behavioral change benefiting women and children	Enabling country performance on improving human nutrition	Co-investment (ongoing)	Strong evidence of nutritional value of fish Value: integrated policy engagement Bangladesh, Zambia, Tanzania
	Risk assessment and mitigation for fish food safety [Bangladesh, Tanzania]	Analysis of food safety and fish quality issues along the chain integrated into the consumer-focused value chain assessments	Research tools and methods	Parallel investment (new)	Improved understanding of food safety risks along fish value chains in target countries Value: cross-CRP learning, integrated view Bangladesh, Tanzania
	Reducing postharvest fish losses [Bangladesh, Tanzania]	Expand research to reduce postharvest fish losses, increase penetration of distant markets with fresh fish, and improve fish drying and smoking processes	Research tools and methods	Parallel investment (ongoing)	Identification of value chain enhancement measures Value: integrated policy engagement Bangladesh, Tanzania,
CCAFS	Foresight analysis and scenario development	Analysis of the impacts of climate change on fish production and associated livelihood and nutrition outcomes in our target geographies	Analysis of future climate scenario projections; early warning systems of monsoon shifts and saline incursions, feeding into design of climate-smart aquaculture systems	Co-investment (ongoing)	Improved understanding of aquaculture technologies that enhance adaptation to climate change Value: for regional and national planning, cross-CRP learning Bangladesh, Cambodia, Myanmar, Pacific

	Climate-smart agriculture [Cambodia]	Assess and communicate evidence on climate-smart aquaculture options and small-scale fisheries adaptation responses	Management of learning platform on ex ante evaluation and priority setting Communication of fisheries and aquaculture solutions in policies and investments targeting future climate-smart agriculture	Co-investment (ongoing)	Proven process of designing, testing and scaling climate-smart fish interventions Value: integration of various CGIAR Centers' expertise within a village context Cambodia
WLE	Managing resource variability in multifunctional landscapes [Bangladesh, Cambodia]	Integration of fisheries and aquaculture development scenarios with broader research on multiple uses of water and land resources at landscape and river-basin scales	Analysis and convening on basin and watershed-scale resource competition and development scenarios; analysis to optimize water management in crop and fish production, and to manage water quality and pollution risks associated with aquaculture intensification	Parallel investment (ongoing) Joint resource mobilization (new)	Improved knowledge and tools to inform water development decisions and policies Value: integration of agri-food system innovations through water management lens Bangladesh, Cambodia
Livestock	Animal disease detection and prevention; value chain assessment; animal-source foods and human nutrition [Bangladesh, Tanzania]		Methods for value chain assessment applicable to perishable products; methods for assessing contribution of animal-source foods in human nutrition	Parallel investment (ongoing) Joint resource mobilization (new)	Identification of technological and institutional innovations to improve the performance of fish value chains based on the assessments Value: joint impact Bangladesh, Tanzania
RICE	Integrated rice-fish systems [Philippines]	Improve the productivity of both rice and fish; investigate microbial processes to bio-convert rice waste to bioactive aquafeed ingredients	Lead integrative farming system design in rice-dominated farming system areas; introduce novel rice management technologies that support the introduction of new fish; lead systems research on rice-based farming systems	Co-investment (new)	Technologies and methods to increase system productivity, proven aquafeed technologies Value: cross-CRP learning, joint impact Bangladesh, Cambodia, Myanmar, Philippines
RTB	Conversion of cassava waste into fish feed [Tanzania]	Investigate use of microbial processes to bio-convert plant wastes, such as cassava waste, to bioactive aquafeed ingredients		Co-investment (new)	Proven aquafeed technologies ready for scaling Value: encourage private sector investment and entrepreneurship Nigeria, Tanzania

Genetic Gains Platform	Genetic improvement of tilapia and carp [Egypt, Malaysia]	Develop genomic tools to accelerate the speed of genetic gain, close the yield gap and enhance the production efficiency of our breeding programs for tilapias and carps	Provide the managing platform	Parallel investment (ongoing)	Proven tools and methods to achieve genetic gains in fish breeding programs Value: cross-CRP learning Bangladesh, Egypt, Nigeria, Tanzania, Myanmar, Cambodia, Zambia
Big Data platform	Managing big data produced by genetic improvement of fish	Provide access to large datasets of fish genetics and related data; access data analysis tools	Provide methods and approaches to managing and analyzing larger databases, such as through consultations and training	Parallel investment (ongoing)	New data and data management approaches on genetic improvement of fish Value: cross-CRP learning Bangladesh, Egypt, Nigeria, Tanzania, Myanmar, Cambodia, Zambia

Table 2b. Plans for site integration in CGIAR target countries.

Target country (++) and + countries that are focal countries for FISH)	Define steps taken so far (March 2016) to establish national-level engagement with other CRPs towards site integration	Define plan and schedule through which your CRP will provide relevant elements for development of CGIAR site integration in this country
Bangladesh ++	In Bangladesh, a CGIAR Advisory Committee has been in operation for three years. This provides a venue for the seven CGIAR centers (and seven CRPs) present in Bangladesh, together with AVRDC and IFDC, to meet with NARES and ministry officials and strengthen alignment of CGIAR research with national priorities and processes. Two meetings were held in 2015, and two are scheduled for 2016. For FISH, WorldFish currently serves as Secretary to the Committee.	WorldFish has been engaged in research to support the development of aquaculture and fisheries in Bangladesh for over 20 years, and IWMI has been engaged in water management issues for a similar period. This has involved close collaboration with other CGIAR Centers and their related CRPs, notably IRRI, CIMMYT and IFPRI. FISH will build on this strong foundation to develop collaboration with other CRPs, in particular with RICE on rice field fisheries; WLE on fish in multifunctional landscapes; PIM on the development of tools and methods being used in study of fish value chains; CCAFS on the design of climate-smart aquaculture systems; and A4NH regarding nutrition-sensitive fish production, analysis of food safety and fish quality issues, and integration of learning in national nutrition strategies.
Nigeria ++	A national site integration and consultation workshop was convened by IITA in Abuja, Nigeria, on 16–17 November 2015. This meeting brought together all CGIAR Centers working in Nigeria and a wide range of stakeholders in the agriculture sector to examine how CGIAR can be better integrated in the country's agriculture R4D efforts. WorldFish was unable to attend this meeting, but has liaised with IITA to engage in follow-up CGIAR integration activities, and pursued country engagement plans with national partners.	A roadmap to further development of site integration in Nigeria has been developed, and WorldFish will engage in this process in its role as lead Center for FISH. A critical next step will be a workshop on 11–15 April 2016 to support a new African Development Bank initiative on Technologies for African Agricultural Transformation (TAAT). WorldFish will attend this workshop on behalf of FISH with a specific focus on integrating aquaculture development elements within the initiative, including in particular in Nigeria, Tanzania and Zambia. Discussions with partners and with other Centers and CRPs during this workshop will be used to further strengthen targeting of FISH in Nigeria, and a series of follow-up actions will be agreed upon for implementation in the remainder of 2016.
Tanzania ++	The Tanzania CGIAR stakeholders' consultation workshop was held during 3–4 December 2015 and agreed upon principles of success and major opportunities for integration between and among CGIAR Centers, CRPs and national partners. FISH was not represented at the workshop, but follow-up discussions are being pursued.	An initial roadmap to further development of site integration in Tanzania has been developed, and WorldFish will engage in this process in its role as lead Center for FISH. Specific areas of integration being pursued are linkages with PIM on the development of tools and methods being used in the study of the small fish value chain from Lake Victoria; with A4NH regarding integration of fish in national nutrition strategies, and analysis of food safety and fish quality issues in the small fish value chain; and with RTB regarding conversion of cassava waste into fish feed.
Zambia +	The Zambian site integration consultation workshop was held during 9–10 February 2016 and brought together key stakeholders from government, research and academic institutions, donors, NGOs and the private sector. The Zambian National Agriculture Investment Plan (NAIP) provided a basis for the discussions and will be a key focus for alignment of the CRPs in Zambia. FISH was represented at the workshop by WorldFish.	An initial set of steps for site integration in Zambia have been agreed upon, and this will be developed after GCARD3. WorldFish will engage in this process on behalf of FISH and pursue best opportunities for integration with other CRPs. This is likely to include WLE on fish in multifunctional landscapes, and with PIM on governance of inland fisheries.

Annex 3.8 Staffing of management team and flagship projects

A summary of the skills, experience and capacity of the science teams engaged in FISH is provided in the attached CVs. Roles are summarized below and grouped by flagship. Cross-cutting roles are listed as well. Flagship leaders are named first, followed by respective cluster leaders and then key science leadership. Contributors may be listed more than once, where they contribute to multiple flagships. No CV is provided for the Program Director, as this position will be subject to international recruitment.

Name	Institution	Role in FISH
Flagship 1: Sustainable aquaculture		
Michael Phillips	WorldFish	Flagship Leader
John Benzie	WorldFish	Leader Cluster 1: Fish breeds and genetics
Johan A.J. Verreth	Wageningen University	Leader Cluster 2: Fish health, feeds and nutrition
Nhuong Tran	WorldFish	Leader Cluster 3: Aquaculture systems
Nigel Preston	WorldFish	Sr. Advisor: Sustainable Aquaculture
Conner Bailey	Auburn University	Sr. Scientist: Social analysis of aquaculture
Federica Di Palma	The Genome Analysis Centre	Sr. Scientist: Genomics and aquatic biodiversity
Ross Houston	University of Edinburgh	Sr. Scientist: Genomic resources for fish
Hans Komen	Wageningen University	Sr. Scientist: Fish genetics and environment
David Little	University of Stirling	Sr. Scientist: Aquaculture systems analysis
Vishnumurthy Mohan Chadag	WorldFish	Sr. Scientist: Aquatic animal health
Max Troell	Stockholm Resilience Centre	Sr. Scientist: Aquaculture and resilience
Amber Huff	Institute for Development Studies, University of Sussex	Scientist: Livelihoods, gender and aquaculture
Sloans Chimatiro	WorldFish	Policy Advisor: African aquaculture
Flagship 2: Sustaining small-scale fisheries		
Neil Andrew	WorldFish	Flagship Leader & Principal Investigator: Small-scale fisheries governance
Joshua Cinner	James Cook University	Leader Cluster 1: Resilient coastal fisheries
Sonali Sellamuttu	IWMI	Leader Cluster 2: Fish in multifunctional landscapes
Phillipa Cohen	WorldFish	Leader Cluster 3: Fish in regional food systems
Blake Ratner	WorldFish	Principal Investigator: Governance
Robyn Johnston	IWMI	Principal Investigator: Water and land resources management
Matthew McCartney	IWMI	Principal Investigator: Water resource management and ecosystem services
Eric Baran	WorldFish	Sr Scientist: Inland fisheries ecology and management
Abdul Wahab	WorldFish	Sr Scientist: Inland fisheries ecology and management
Steve Cole	WorldFish	Scientist: Gender equity
Yumiko Kura	WorldFish	Scientist: Fisheries policy and management
Flagship 3: Enhancing the contribution of fish to nutrition and health of the poor		
Shakuntala Thilsted	WorldFish	Flagship Leader
Chris Brown	WorldFish	Leader Cluster 1: Nutrition-sensitive aquaculture production
Chris Bennett	Natural Resources Institute, University of Greenwich	Leader Cluster 2: Reducing waste and loss in fish value chains
Andrew Thorne-Lyman	WorldFish	Leader Cluster 3: Fish for nutrition and health of women and children
Ilaria Tedesco	Natural Resources Institute, University of Greenwich	Principal Investigator: Economic fish waste and losses
Benoy Barman	WorldFish	Scientist: Small indigenous fish production technologies
Froukje Kruijsen	WorldFish	Scientist: Fish value chains
Sloans Chimatiro	WorldFish	Policy Advisor: African regional fish trade

(Vacancy)	Natural Resources Institute, University of Greenwich	Principal Investigator: Nutritional post-harvest loss and food safety
Cross Cutting Roles		
Andrew Thorne-Lyman	WorldFish	M&E Lead
Cynthia McDougall	WorldFish	Gender Research Lead
Ian Scoones	Institute for Development Studies, University of Sussex	Principal Investigator: Expanding assets and livelihood opportunities for resource-poor women and youth

PROFILE

Integrated aquaculture systems specialist:

- Over 30 years' technical leadership and policy guidance on sustainable aquaculture with experience covering freshwater and marine aquaculture systems and engagement with government, university, development agencies, NGOs and private sector.
- Leadership of multi-national and multi-stakeholder research and development teams over more than 25 years, with geographical experience in Africa, Asia, Europe and the Pacific.
- More than 140 research publications covering aquaculture technologies, aquatic farming systems, water quality, environmental and sustainability assessments of aquaculture, aquaculture policies and sector development strategies. 49 peer-reviewed papers and book chapters.

EMPLOYMENT

2014 to date	Program Leader, Sustainable Aquaculture, WorldFish, Malaysia
2008 – 2014	Principal Scientist, Aquaculture and Genetic Improvement Discipline, WorldFish, Malaysia
2003 – 2008	Program Manager, Aquaculture, Intergovernmental Organisation of the Network of Aquaculture Centers in Asia-Pacific (NACA), Bangkok, Thailand
1994 – 2003	Aquaculture and Environment Specialist, Intergovernmental Organisation of the Network of Aquaculture Centres in Asia-Pacific (NACA), Bangkok, Thailand

EDUCATION

1982	PhD Aquaculture and Fish Behaviour, University of Stirling, Scotland, UK
1979	BSc (Hon), Biological Sciences, University of Lancaster, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Karim, M., Sarwer, M.H., **Phillips, M.J.**, Belton, B. (2014) Profitability and adoption of improved shrimp farming technologies in the aquatic agricultural systems of southwestern Bangladesh. *Aquaculture* 428–429: 61–70.
- Cleasby, N., Schwarz, A.M., **Phillips, M.**, Paul, C., Pant, J., Oeta, J. Pickering, T., Meloty, A., Kori, M. (2014) The socio-economic context for improving food security through land based aquaculture in Solomon Islands: a peri-urban case study. *Marine Policy* 45: 89–97.
- Jonell, M., **Phillips, M.**, Rönnbäck, P., Troell, M. (2013) Aquaculture certification: Does it make a difference? *Ambio* 42 (6): 659–74.
- Bene, C., Allison, E., **Phillips, M.** (2011) The Forgotten Service. Food as an Ecosystem Service from Estuarine and Coastal Zones. In van den Belt M. and Costanza R. (eds) *Ecological Economics of Estuaries and Coasts*. Waltham, MA: Academic Press.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Contributions to global aquaculture policy documents (FAO, World Bank); leadership of scientists and development consortia addressing several key aquaculture development challenges over the past three decades, including post-earthquake and tsunami rehabilitation (with ADB, FAO) and assessments of impacts of aquaculture on the environment and ecosystem approaches to aquaculture (with World Bank, WWF and FAO). Major grants awarded: Solomon Islands Aquaculture (ACIAR AUS 1.2M); Aquaculture and the Poor (GIZ, €1.2M); Aquaculture for Food Security, Poverty Alleviation and Nutrition (European Union FP7: total project €1.2M); Sierra Leone integrated agriculture-aquaculture (USAID, USD 3M). Recipient of World Bank "Green Award for 2006" (for research and development of the *International Principles for Responsible Shrimp Farming*). Member, Program Management Committee, Livestock & Fish. Theme Leader, Productivity, AAS.

ROLE IN FISH

Flagship Leader, FP1 Sustainable aquaculture

BENZIE, JOHN

PROFILE

Principal scientist and Theme Leader for Genetics in Livestock and Fish:

- More than 30 years' experience in aquaculture and natural resource management in marine and freshwater systems working in government, university and private sectors.
- Leading multidisciplinary national and international research groups for more than 25 years on aquaculture and biotechnology development in Australia, Europe, America, Asia and Africa.
- Areas of work include quantitative, population and molecular genetics and their application to ecological, natural resource management and biotechnology developments in aquaculture. Leading breeding programs in aquatic organisms, including shrimp, fish and molluscs. More than 168 publications, including 3 books; editor for leading journals: *Aquaculture*, *Molecular Ecology*. Over 140 peer-reviewed publications.

EMPLOYMENT

2013 to date	Principal Scientist, Leader of the Genetics Group, WorldFish, Malaysia
2008 to date	Professor of Marine Molecular Biodiversity/Marine Molecular Ecology, University College Cork, Ireland
2003 – 2008	Head of R&D, Moana Technologies, Hong Kong
2000 – 2003	Professor and Director, Centre for Marine and Coastal Studies, University of New South Wales, Australia

EDUCATION

1986	PhD Genetics, Australian National University, Canberra, Australia
1978	BSc (Hon) First class, Zoology, Aberdeen University, Aberdeen, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Ma, T.H.T., **Benzie, J.A.H.**, He, J-G., Sun, C-B., Chan, S-M. (2014) PmPPAF is a pro-phenoloxidase activating factor involved in innate immunity response of the shrimp *Penaeus monodon*. *Developmental and Comparative Immunology* 44: 163–172.
- Korres, N.E., O'Kiely, P., **Benzie, J.A.H.**, West J.S. (eds) (2013) *Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes*. Earthscan/Routledge, Taylor & Francis Publishing Group. 442pp.
- O'Farrell, B., **Benzie, J.A.H.**, McGinnity, P., de Eyto, E., et al. (2013) Selection and phylogenetics of salmonid MHC class I: Wild brown trout (*Salmo trutta*) differ from a non-native introduced strain PLoS ONE PONE-D-12-34666R2.
- Bourlat, S.J., Borja, A., Gilbert, J., Taylor, M.I., Davies, N., **[Benzie, J.]** et al. (2013) Genomics in marine monitoring: New opportunities for assessing marine health status. *Marine Pollution Bulletin* 74: 19–31.
- **Benzie, J.A.H.**, Nguyen, T.T.T., Hulata, G., Bartley, D.M., et al. (2012) Promoting responsible use and conservation of aquatic biodiversity for sustainable aquaculture development. In R.P. Subasinghe, et al., eds. *Farming the Waters for People and Food*. Proc. Global Conf. on Aquaculture 2010, Phuket, Thailand. Sept. 2010. Pages 337–383. FAO, Rome and NACA, Bangkok.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Development of improved black tiger strain now fully commercialized. More than AUD 20M in grants in Australia in genetics of marine systems and aquaculture, 1990–2003; Belgian Dept. Sci. &Tech. €2.1M sex determination in shrimp, 2005–07; EUFP7 Knowledge transfer in marine genomics to industry and government €0.99M 2011–13.

ROLE IN FISH

Leader, Cluster 1 – Fish breeds and genetics, FP1 Sustainable aquaculture

PROFILE

Aquaculture and fisheries researcher and trainer:

- More than 15 years' experience leading and mentoring multidisciplinary teams on research into the interface between animal, (a)biotic environments and human use; the interaction of nutrition and water quality in intensive production systems; and sustainability assessments of farmed seafood.
- Key research focus is developing aquaculture and aquaculture farming systems that are ecologically sustainable. Other research interests include the fate of nutrients and nutrient dynamics in different production systems of fish; e.g. in ponds, in recirculating aquaculture systems and at the animal level.

EMPLOYMENT

2012 – 2015	Director, Graduate School, Institute of Animal Sciences, Wageningen University, The Netherlands
2000 to date	Professor, Aquaculture and Fisheries, Wageningen University, The Netherlands
1996 – 2000	Associate Professor, Fish Culture and Fisheries Group, Wageningen University, The Netherlands
1993 – 2003	Guest Professor, Aquaculture, Gent University, Belgium

EDUCATION

1994	PhD Agricultural and Environmental Sciences, Wageningen University, The Netherlands
1974	MSc Zoology (Hons), Gent University, Belgium

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Asaduzzaman, M., Rahman, M.M., Azim, M.E., Islam, M.A., Wahab, M.A., Verdegem, M.C.J., **Verreth, J.A.J.** (2010) Effects of C/N ratio and substrate addition on natural food communities in freshwater prawn monoculture ponds. *Aquaculture* 306: 127–136.
- Saravanan, S., Geurden, I., Figueiredo-Silva, A.C., Kaushik, S.J., **Verreth, J.A.J.**, Schrama, J.W. (2013) Voluntary feed intake in rainbow trout is regulated by diet-induced differences in oxygen use. *The Journal of Nutrition* 143: 781–787.
- Saravanan, S., Geurden, I., Orozco, Z.G.A., Kaushik, S.J., **Verreth, J.A.J.**, Schrama, J.W. (2013) Dietary electrolyte balance affects the nutrient digestibility and maintenance energy expenditure of Nile tilapia. *British Journal of Nutrition* 110: 1948–1957.
- Giatsis, C., Sipkema, D., Smidt, H., Heilig, H., Benvenuti, G., **Verreth, J.A.J.**, Verdegem, M. (2015) The impact of rearing environment on the development of gut microbiota in tilapia larvae. *Scientific Reports* 5, 18206. DOI: 10.1038/srep18206
- Joffre, O.M., Bosma, R.H., Bregt, A.K., van Zwieten, P.A.M., Bush, S.R., **Verreth, J.A.J.** (2015) What drives the adoption of integrated shrimp mangrove aquaculture in Vietnam? *Ocean and Coastal Management* 114: 53–63.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Member, National Scientific Advisory Board, INRA, France (2006–2010) and INRA's Division Phase (2011–2013); Member, Scientific Advisory Board Fac Fisheries, South Bohemian Univ., Czech Republic (2014). President, European Aquaculture Society (2004–2006); Member, Board of EAS (1996–2008). Co-Chair, Working Group on Recirculation Systems, European Aquaculture Technology and Innovation Platform (EATiP) (2011–2012). President, Steering Committees Conferences "Aquaculture Europe 2015"; "World Aquaculture 2006." Scientific Director: NWO-WOTRO Program Project "Disentangling the Social and Ecological Drivers of Ecosystem Change in Lake Victoria," SEDEC (2009–2013); Nutritious Ponds (2015–2018). Scientific Director, WU-INREF (interdisciplinary research) programs "Resilience of Coastal Populations and Aquatic Resources" RESCOPAR (2007–2013), POND (2000–2006) and BestTUNA (2011).

ROLE IN FISH

Leader, Cluster 2 – Fish health, feeds and nutrition, FP1 Sustainable aquaculture

TRAN, NHUONG

PROFILE

Scientist and economics foresight modelling leader, WorldFish, Malaysia:

- Interdisciplinary (social, economic and environmental management) researcher specializing in aquaculture and fisheries development.
- Areas of work include econometric & foresight modelling, economics sociology of fish value chain configuration, climate and environmental change.

EMPLOYMENT

2013 to date	Scientist, Policies, Economics and Social Science, WorldFish, Malaysia
2011 – 2013	Postdoctoral Fellow, Policies, Economics and Social Science, WorldFish, Malaysia
2006 – 2011	Research Assistant, Agricultural Economics & Rural Sociology Department, Auburn University, USA
2004 – 2005	Vietnamese Coordinator, PORESSFA project funded by EC, Vietnam

EDUCATION

2011	PhD Applied Economics, Agricultural Economics & Rural Sociology, Auburn University, USA
2010	MS Rural Sociology, Agricultural Economics & Rural Sociology, Auburn University, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Tran, N.**, Nguyen, A. V. T., Wilson, N. (2014) The differential effects of food safety regulations on animal products trade: The case of crustacean product trade. *Agribusiness* 30 (1): 30–45.
- **Tran, N.**, Bailey, C., Wilson, N., Phillips, M. (2013) Governance of global value chains in response to food safety and certification standards: The case of shrimp from Vietnam. *World Development* 45: 325–336.
- **Tran, N.**, Wilson, N., Hite, D. (2013) Choosing the Best Model in the Presence of Zero Trade: A Fish Product Analysis. In J.C. Beghin (ed.) *Non-Tariff Measures with Market Imperfections: Trade and Welfare Implications (Frontiers of Economics and Globalization volume 12)*. Emerald Group Publishing Limited. Pages 127–148.
- **Tran, N.**, Wilson, N., Anders, S. (2012) Standard harmonization as chasing zero (tolerance limits): The Impact of veterinary (cloramphenicol analytical) standards on crustacean imports in Canada, EU, Japan, and the U.S. *American Journal of Agricultural Economics* 94 (2): 496–502.
- Dyer, J., Bailey, C., **Tran, N.** (2009) A “disadvantaged class”: Ownership characteristics of heir property in a black belt county. *Southern Rural Sociology* 24 (2): 192–217.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- Leading foresight modelling activity in WorldFish, global futures and strategic foresight project/CRP PIM, L&F.
- Leading climate-smart aquaculture project in Vietnam, CRP CCAFS SEA office. Coordinating PORESSFA project funded by EC in Vietnam.
- Managing VIE 97/030 Project implemented in Vietnam, funded by UNDP and UNOPS.
- 2009–2010 Norman Borlaug Leadership Enhancement in Agriculture Program (LEAP) Award.
- 2006–2009 Ford Foundation International Fellowship Award.
- 2005 Australian Collaboration for Agriculture and Rural Development (CARD) program and Vietnamese government grant (500,000 AUD) for Better Management Practices Application in Aquaculture in Vietnam.

ROLE IN FISH

Leader, Cluster 3 – Aquaculture systems, FP1 Sustainable aquaculture

PROFILE

Marine sciences specialist:

- Over 25 years' technical leadership and policy guidance in coral reef ecology, fisheries ecology, sustainable aquaculture, and the development and application of advanced genetics and nutritional technologies to enhance the productivity, sustainability and market quality of aquaculture.
- Experience leading multidisciplinary research teams that have contributed to the economic and environmental sustainability of aquaculture industries in Australia, Vietnam, China, Indonesia, Saudi Arabia, Mexico and Brazil.
- More than 100 publications (81 peer-reviewed) covering marine biology, invertebrate embryology, coral reef ecology, aquaculture research (reproductive biology, genetics), and biotechnology and environmental management. Holds 3 patents.

EMPLOYMENT

2015 to date	Director General, WorldFish, Malaysia
2014 – 2015	Research Program Director, Integrated Sustainable Aquaculture Production, CSIRO Agriculture Flagship, Australia
2013 – 2014	Acting Director, CSIRO Food Futures Flagship, Australia
2002 – 2013	Theme Leader, Breed Engineering, CSIRO Food Futures Flagship, Australia

EDUCATION

1985	PhD Marine Biology, University of Sydney, Australia
1978	BSc (Hon), Marine Sciences, Bangor University, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Glencross, B.D., Irvin, S., Arnold, S., Blythe, Bourne, N., **Preston, N.P.** (2014) Effective use of microbial biomass products to facilitate the complete replacement of fishery resources in diets for the black tiger shrimp, *Penaeus monodon*. DOI: 10.1016/j.Aquaculture.2014.02.033
- Coman, G.J., Arnold, S.J., Wood, A.T., **Preston, N.P.** (2013) Evaluation of egg and nauplii production parameters of a single stock of domesticated *Penaeus monodon* across generations. *Aquaculture* 400–401: 125–128. DOI: 10.1016/j.Aquaculture.2013.03.015
- Sellars, M.J., Wood, A., Murphy, B., Coman, G.J., Arnold, S.J., McCulloch, R.M., **Preston, N.P.** (2013) Reproductive performance and mature gonad morphology of triploid and diploid Black Tiger shrimp (*Penaeus monodon*) siblings. *Aquaculture Research* 44: 1493–1501. DOI: 10.1111/j.1365-2109.2012.03156.x
- Glencross, B.D., Tabrett, S.J., Irvin, S., Wade, N., Anderson, M., Blyth, D., Smith, D.M., Coman, G.E., **Preston, N.P.** (2013) An analysis of the effect of diet and genotype on protein and energy utilization by the black tiger shrimp, *Penaeus monodon*: Why do genetically selected shrimp grow faster? *Aquaculture Nutrition* 19: 128–138.
- Sellars, M.J., Wood, A., Murphy, B., McCulloch, R.M., **Preston, N.P.** (2012) Triploid black tiger shrimp (*Penaeus monodon*) performance from egg to harvest age. *Aquaculture* 324–325: 242–249.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Led CSIRO research and development program (AUD10M) on prawn breeding and feed, leading to improved prawn varieties and new prawn feed additive (NovacqTM); cumulative benefits of novel prawn feed between 2014 and 2023–24 valued at AUD 1.9 billion. Chair of World Aquaculture Working Group on Shrimp Breeding and Genetics (2002). Major awards: CSIRO Award for Establishing Food Futures Flagship 2003; Australian Aquaculture Award for services to the prawn farming industry 2010; Winner, Environment, Agriculture and Food category, The Australian Innovation Challenge 2013, for the development of NovacqTM; CSIRO Medal Science for Impact Award 2014; and Fellow of the World Aquaculture Society 2014.

ROLE IN FISH

Senior Advisor, FP1 Sustainable aquaculture

BAILEY, CONNER

PROFILE

- Rural sociologist with extensive experience on marine fisheries (Malaysia, Indonesia, the Philippines, Canada and the U.S.) and aquaculture (Indonesia, the Philippines, Vietnam, Norway, Brazil).
- Experience consulting on marine fisheries and aquaculture with USAID, FAO and World Bank.
- Fluent in Bahasa Indonesia/Malaysia and basic Spanish.

EMPLOYMENT

2015 to date	Professor Emeritus, Auburn University, USA
1994 – 2015	Professor, Auburn University, USA
1988 – 1994	Associate Professor, Auburn University, USA
1985 – 1988	Assistant Professor, Auburn University, USA

EDUCATION

1980	PhD Development Sociology, Cornell University, Ithaca, New York, USA
1974	MA International Affairs (southeast Asia), Ohio University, Athens, Ohio, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Bailey, C.** (2015) Transgenic salmon: Science, politics, and flawed policy. *Society & Natural Resources* 28 (11): 1249–1260. DOI: 10.1080/08941920.2015.1089610
- Lima, J.S.G., **Bailey, C.** (2015) Shrimp Farming as a Coastal Zone Challenge in Sergipe State, Brazil: Balancing Goals of Conservation and Social Justice. In Finkl, C.W., Makowski, C. (eds.), *Environmental Management and Governance: Advances in Coastal and Marine Resources*. Coastal Research Library 8. Cham, Switzerland: Springer International Publishing. Pages 233–252. DOI: 10.1007/978-3-319-06305-8_9
- **Bailey, C.**, Jensen, L., Ransom, E. (eds). (2014) *Rural America in a Globalizing World: Problems and Prospects for the 2010s*. Morgantown, WV: West Virginia University Press. 705 p.
- **Bailey, C.**, Gramling, B., Laska, S. (2014) Complexities of Resilience: Adaptation and Change within Human Communities of Coastal Louisiana. In Day, J., Kemp, P., Freeman, A., Muth, D. (eds). *The Once and Future Delta*. New York: Springer. Pages 125–140.
- Nhung Van, T., **Bailey, C.**, Wilson, N., Phillips, M. (2013) Governance of global value chains in response to food safety and certification standards: The case of shrimp from Vietnam. *World Development* 45: 325–336.
- **Bailey, C.** (2013) [Remaking Fish for Aquaculture in the United States; From Selective Breeding to Genetic Engineering](#). Professional Report No. 4-2013. Oslo, Norway: National Institute for Consumer Research (SIFO).

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Served as Principal Investigator on 16 competitive research grants between 1992 and 2019 that brought in USD 2.2 million. Seven were national competitive grants involving inter-disciplinary teams of scientists accounting for USD 2.014 million. Recipient of two Auburn University awards for being the top researcher (2013). President of the Rural Sociological Society (2011) and Chair of the University Senate at Auburn University (2005–06). Awarded the Distinguished Diversity Research Award in 2008 (Auburn University) and the Excellence in Research Award in 2007 (Rural Sociological Society).

ROLE IN FISH

Sr. Scientist – Social analysis of aquaculture, FP1 Sustainable aquaculture

DI PALMA, FEDERICA

PROFILE

- Over 10 years' experience in managing and coordinating large-scale collaborative genome sequencing projects, including recently leading the Cichlid Genome Project (Brawand et al., *Nature*, 2014).
- Extensive experience in computational analysis, especially of whole genome sequencing, transcriptome and epigenetic data.

EMPLOYMENT

2015 to date	Professor of Vertebrate Genomics, School of Biological Sciences, University of East Anglia, UK
2014 to date	Director of Science and Head of Vertebrate and Health Genomics, The Genome Analysis Centre, Norwich, UK
2014 to date	Visiting Scientist, The Broad Institute of Harvard and MIT, Cambridge, MA, USA
2010 – 2014	Assistant Director, Vertebrate Genome Biology, Genome Sequencing and Analysis Program, The Broad Institute of Harvard and MIT, Cambridge, MA, USA

EDUCATION

1998	PhD Immunogenetics, University of Reading, UK
1995	BSc (Hons) Cell and Molecular Biology, University of Essex, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Brawand, D., Wagner, C.E., Li, Y.I., The Cichlid Genome Consortium, Ponting, C.P., Streelman, J.T., Lindblad-Toh, K., Seehausen, O., **Di Palma, F.** (2014) The genomic substrate for adaptive radiation in African cichlid fish. *Nature* 513: 375–381.
- Carneiro, M., Rubin, C-J., **Di Palma, F.** et al. (2014) Rabbit genome analysis reveals a polygenic basis for phenotypic change during domestication. *Science* 345: 1074–1079.
- Keane, M., Craig, T., Alföldi, J., Berlin, A.M., Johnson, J., Seluanov, A., Gorbunova, V., **Di Palma, F.**, Lindblad-Toh, K., Church, G.M., de Magalhães, J.P. (2014) The naked mole rat genome resource: Facilitating analyses of cancer and longevity-related adaptations. *Bioinformatics* (AOP; *in press*).
- **Di Palma, F.** et al. (2014) An improved canine genome and a comprehensive catalogue of coding genes and non-coding transcripts. *PlosOne* 9: 1–11.
- Amemiya, C.T., Alföldi, J., et al., **Di Palma, F.**, Lander, E.S., Meyer, A., Lindblad-Toh, K. (2013) Comparative analysis of the genome of the African coelacanth, *Latimeria chalumnae*, sheds light on tetrapod evolution. *Nature* 496: 311–316.
- **Di Palma, F.** et al. (2011) The genomic basis of adaptive evolution in threespine sticklebacks. *Nature* 484: 55–61.
- Alföldi, J., **Di Palma, F.** et al. (2011) The genome of the green anole lizard and a comparative analysis with birds and mammals. *Nature* 477: 587.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Manager of large-scale Col Vertebrate genome sequencing project (USD 2M/year); Broad Institute Large Scale Genome Sequencing and Analysis award. PI on Broad Institute NHGRI, NIH, ARRA award. Ad hoc reviewer for *Science* and *Nature*. Member, Editorial Board, *Journal of Genomics*.

ROLE IN FISH

Sr. Scientist – Genomics and aquatic biodiversity, FP1 Sustainable aquaculture

HOUSTON, ROSS D.

PROFILE

- Group leader at the Roslin Institute with experience successfully leading large-scale (inter)national research projects to develop genomic resources for finfish and shellfish species and their implementation to improve disease resistance in aquaculture breeding programs.
- Successful track record in knowledge exchange via close collaboration with private and public sector bodies, including discovery and implementation of a major locus (QTL) affecting virus resistance in salmon.
- 35 peer-reviewed journal publications relating to subject areas such as genomics, selective breeding, gene expression, disease resistance, genotyping by sequencing, etc.
- Associate editor for *G3: Genes, Genomes, Genetics* and *Nature Scientific Reports* journals.
- Plenary or invited speaker on aquaculture genetics and genomics at major international conferences including Plant and Animal Genome 2015, and International Society for Animal Genetics 2016.

EMPLOYMENT

2014 to date	Group Leader, Senior Lecturer, The Roslin Institute, University of Edinburgh, UK
2010 – 2015	BBSRC-funded Institute Career Path Fellowship, The Roslin Institute, University of Edinburgh, UK
2004 – 2010	Postdoctoral Research Fellow, The Roslin Institute, University of Edinburgh, UK

EDUCATION

2004	PhD Genetics, University of Aberdeen, UK
2000	BSc (Hon), Human Biology, Loughborough University, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Robledo, D., Taggart, J.B., **Houston, R.D.** (2016) Gene expression comparison of resistant and susceptible Atlantic salmon fry challenged with Infectious Pancreatic Necrosis virus reveals a marked contrast in immune response. *BMC Genomics*, in press.
- Tsai, H.Y., Hamilton, A., **Houston, R.D.** (2015) Genome wide association and genomic prediction for growth traits in juvenile farmed Atlantic salmon using a high density SNP array. *BMC Genomics* 16: 969.
- Gonen, S., Baranski, M., **Houston, R.D.** (2015) Mapping and validation of a major QTL affecting resistance to pancreas disease (salmonid alphavirus) in Atlantic salmon (*Salmo salar*). *Heredity* 115: 405–14.
- **Houston, R.D.**, Taggart, J.B., Hamilton A. (2014) Development and validation of a high density SNP genotyping array for Atlantic salmon (*Salmo salar*). *BMC Genomics* 15 (1): 90.
- **Houston, R.D.**, Haley, C.S., Bishop, S.C. (2010) The susceptibility of Atlantic salmon fry to freshwater Infectious Pancreatic Necrosis is largely explained by a major QTL. *Heredity* 105: 318–327.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- Workpackage leader for disease resistance in the €6M Euro EU FP7 project FISHBOOST: Boosting European aquaculture by advancing selective breeding to the next levels (2014–2019). Coordinating large-scale disease challenge and genomics experiments with collaborators across EU countries.
- BBSRC Institute Career Path Fellowship (£1.4M; 2010–2015) including discovery of marker predictors of resistance to Infectious Pancreatic Necrosis virus in salmon. The discovery and its commercial application made the final of the BBSRC Innovator of the Year competition in 2014.
- PI for recent RCUK-CONICYT Newton award (£0.5M; 2016–2018): Utilising functional genomic variation for improved disease resistance in Chilean salmon aquaculture.

ROLE IN FISH

Sr. Scientist – Genomic resources for fish, FP1 Sustainable aquaculture

KOMEN, HANS (JOHANNES)

PROFILE

- 25 years' experience in research in aquaculture; the last 12 years working specifically on the design of breeding programs for aquaculture species.
- Experience covering freshwater and marine aquaculture species and engagement with government, university, development agencies, NGOs and private sector.
- More than 100 peer-reviewed research publications covering various aquaculture research areas, such as sex determination, clonal reproduction techniques, stress physiology, and estimation of genetic parameters for a suite of aquatic species, most notably the Nile tilapia. H-index 32.

EMPLOYMENT

2015 to date	Senior Researcher, Aquaculture Group, Wageningen Livestock Research, Wageningen University, The Netherlands
2007 to date	Associate Professor and Teamleader, Animal Breeding and Genomics Group, Wageningen University, The Netherlands
2004 – 2007	Assistant Professor, Animal Breeding and Genetics Group, Wageningen University, The Netherlands
1997 – 2004	Assistant Professor, Aquaculture and Fisheries Group, Wageningen University, The Netherlands

EDUCATION

1990	PhD Genetics, Wageningen University, The Netherlands
1985	MSc (Cum Laude), Biology, Wageningen University, The Netherlands

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Omasaki, S., **Komen, H.**, Kahi, A.K., Charo-Karrisa, H. (2016) Defining a breeding objective for Nile tilapia that takes into account the diversity of smallholder production systems. *Journal Animal Breeding and Genetics*, in press.
- Diopere, E., Maes, G. E., **Komen, H.**, et al. (2014) A genetic linkage map of sole (*Solea solea*): A tool for evolutionary and comparative analyses of exploited (flat)fishes. Plos One DOI: 10.1371/journal.pone.0115040
- Besson, M., **Komen, H.**, Aubin, J., et al. (2014) Economic values of growth and feed efficiency for fish farming in recirculating aquaculture system with density and nitrogen output limitations: A case study with African catfish (*Clarias gariepinus*). *Journal of Animal Science* 92 (12): 5394–5405.
- Sae-Lim, P., **Komen, H.**, Kause, A., et al. (2014) Identifying environmental variables explaining genotype-by-environment interaction for body weight of rainbow trout (*Onchorynchus mykiss*): Reaction norm and factor analytic models. *Genetics Selection Evolution*. DOI: 10.1186/1297-9686-46-16
- Sae-Lim, P., **Komen, H.**, Kause, A., Van Arendonk, J. A. M., Barfoot, A. J., Martin, K. E., Parsons, J. E. (2011) Defining desired genetic gains for rainbow trout breeding objective using analytic hierarchy process. 2012. *Journal of Animal Science* 90 (6): 1766–1776.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Member of the executive board and chair of the education committee of EU-funded European graduate school EGSABG, a consortium of four universities that have developed a joint PhD degree program. Member of the executive board and workpackage leader for FISHBOOST, economic evaluation of fish breeding programs in Europe. Program leader for training of early stage researchers; responsible for formulation of long-term breeding program for the African chicken genetic gains program: Bill & Melinda Gates-funded program.

ROLE IN FISH

Sr. Scientist – Fish genetics and environment, FP1 Sustainable aquaculture

LITTLE, DAVID C.

PROFILE

Specialist in aquatic resource development and capacity building with an Asian focus:

- Over 30 years of experience in interdisciplinary research and education, significant proportion based in the Region generating around £10 million income.
- Published over 100 academic papers and reviews; (h index 27; ~2500 citations). Total number of peer reviewed publications: 106.
- Supervised over 100 postgraduate student research projects, of which more than 20 have been PhDs.
- Key role as coordinator and partner of interdisciplinary and intercultural research for development.

EMPLOYMENT

2009 to date	Professor of Aquatic Resource Development, Institute of Aquaculture, University of Stirling, Scotland, UK
1997 – 2009	Employed on research and teaching contracts
1984 – 1997	Asian Institute of Technology, Agricultural and Aquatic Programme, Thailand
1980 – 1982	VSO based in Thailand

EDUCATION

1989	PhD Aquaculture, University of Stirling, Scotland, UK
1983	MSc Aquaculture and Fisheries Management, University of Stirling, Scotland, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Bush, S.R., Belton, Hall, D. Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P.J., Hatanaka, M., Kruijssen, F., Ha, T.T.T., **Little, D.C.**, Kusumawati, R. (2013) Certify sustainable aquaculture? *Science* 341: 1067–1068.
- Rico, A., Phu, T.M., Satapornvanit, K., Min, J., Shahabuddin, A.M., Henriksson, P.J.G., Murray, F.J., **Little, D.C.**, Dalsgaard, A., Van den Brink, P.J. (2013) Use of veterinary medicines, feed additives and probiotics in four major internationally traded aquaculture species farmed in Asia. *Aquaculture* 412–413: 231–243.
- Haque, M.M., **Little, D.C.**, Barman, B.K., Wahab, M.A. & Telfer, T.C. (2012) Impacts of decentralized fish fingerling production in irrigated rice fields in Northwest Bangladesh. *Aquaculture Research* 1–20. DOI: 10.1111/are.12000
- Belton, B., Haque, M.M., **Little, D.C.** (2012) Does size matter? Reassessing the relationship between aquaculture and poverty in Bangladesh. *Journal of Development Studies* 48: 1–19.
- Watterson, A., Little, D., Young, J.A., Murray, F.J., Doi, L., Boyd, K., Azim, E. (2012) *Scoping a Public Health Impact Assessment of Aquaculture with Particular Reference to Tilapia in the UK*. Public Health. 18p DOI: [10.5402/2012/203796](https://doi.org/10.5402/2012/203796)

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Nominator Pew Marine Scholarships (2015–); Member, Academic reference group, Fishmongers Company (2015–); Member, Technical Committee, Aquaculture Standards, Seafood Watch Programme, Monterey Bay Aquaria; Section Editor Sustainability and Society, *Aquaculture journal*, Elsevier (2011–); Director, Board of World Aquaculture Society (2010–2014); Member, Standards Oversight Committee, BAP, Global Aquaculture Alliance (2010–); Member, Project Assessment Committee, Farmers in Transition Fund, IDH, Netherlands (2014–); Member, Panel of Advisers, Commonwealths Scholarships Commission (2010–); Member of the editorial board for CABI Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources; Member of the Standards Committee for aquaculture of the Soil Association (2003–).

ROLE IN FISH

Sr. Scientist – Aquaculture systems analysis, FP1 Sustainable aquaculture

MOHAN, CHADAG

PROFILE

- Over 30 years' technical leadership and policy guidance on sustainable aquaculture; over 30 years' experience in aquaculture and aquatic animal health management.
- Expertise on fish and shrimp pathology, aquatic epidemiology, surveillance and risk management, small-scale aquaculture.
- Secured funding and implemented several national, regional and international research and development projects in the area of aquatic animal health.
- Published over 60 research papers.

EMPLOYMENT

2014 to date	Senior Scientist Aquaculture, WorldFish, Penang
2009 – 2014	Research and Development Manager, NACA, Bangkok, Thailand
2003 – 2009	Coordinator Aquatic Animal Health Program, NACA, Bangkok, Thailand
2000 – 2003	Professor of Fish Pathology, College of Fisheries, UAS, Mangalore, India

EDUCATION

1990	PhD Institute of Aquaculture, University of Stirling, UK
1982	MFSc (Master of Fisheries Sciences), College of Fisheries, UAS, Mangalore, India

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Partho, D., Khan, S.H., Karim, M., Belton, B., **Mohan, C.V.**, Phillips, M. (2015) Review of the history, status and prospects of the black tiger shrimp (*Penaeus monodon*) hatchery sector in Bangladesh. *Reviews in Aquaculture*. DOI: 10.1111/raq.12094
- Rodgers, C.J., **Mohan, C.V.**, Peeler, E.J. (2011) The spread of pathogens through trade in aquatic animals and their products. *OIE Scientific and Technical Review* 30 (1): 241–256.
- Walker, P.J., Gudkovs, N., **Mohan, C.V.**, Raj, V.S., Pradeep, B., Sergeant, E., Mohan, A.B.C., Babu, G.R., Karunasagar, I., Santiago, T.C. (2011) Longitudinal disease studies in small-holder black tiger shrimp (*Penaeus monodon*) ponds in Andhra Pradesh, India. II. Multiple WSSV genotypes associated with disease outbreaks in ponds seeded with uninfected postlarvae. *Aquaculture* 319: 18–24.
- Sahoo, A.K., **Mohan, C.V.**, Shankar, K.M., Corsin, F., Turnbull, J.F., Thakur, P.C., Hao, N.V., Morgan, K.L., Padiyar, P.A. (2010) Clinical white spot disease status in *Penaeus monodon* during the middle of the culture period-its epidemiological significance. *Journal of Fish Disease* 33: 609–615.
- Walker, P.J., **Mohan C.V.** (2009) Viral disease emergence in shrimp aquaculture: Origins, impact and the effectiveness of health management. *Reviews in Aquaculture* 1: 125–154.
- **Mohan, C.V.**, Chinabut, S., Kanchanakhan, S. (2008) Perspectives on aquatic animal disease contingency planning in the Asia-Pacific region. In Changing trends in managing aquatic animal disease emergencies. *Rev.sci.tech.Off.int.Epiz.* 2008, 27 (1): 89–102.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Secured funding and implemented several regional aquatic animal health projects in Asia-Pacific in previous role at NACA. Involved in two aquatic animal health (UK Newton fund) and one area-based management (WOTRO, Netherlands) bilateral projects approved for implementation in 2016. Best Teacher Award for the year 1997 by ICAR, India, and served as Chairperson of Fish Health Section (FHS) of the Asian Fisheries Society (AFS), Manila, for the period 2012–2014. Editorial Board Member for *Reviews in Aquaculture*.

ROLE IN FISH

Sr. Scientist – Aquatic animal health, FP1 Sustainable aquaculture

TROELL, MAX

PROFILE

- System ecologist/marine biologist working with a broad range of sustainability and governance issues related to social-ecological systems, with emphasis on coastal and marine ecosystems.
- Main research areas: environmental, social impacts and sustainability of aquaculture; challenges for governance of coastal and marine ecosystems; identification and valuation of ecosystem functions and services; resilience of social-ecological systems; identification and implication from regime shifts in marine systems and aquaculture's role for food security.
- More than 90 publications covering environmental management, ecological economics, resource biology and social-ecological modelling that impacts marine conservation policies and aquaculture practices.

EMPLOYMENT

2008 to date	Senior Researcher, Stockholm Resilience Centre, Co-leader of Marine Governance Theme, Stockholm University, Stockholm, Sweden
1996 to date	Senior Researcher, Director of Beijer Aquaculture Program, The Beijer Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm, Sweden
1996 – 2009	Researcher, Department of Ecology, Environment and Plant Science, Stockholm University, Stockholm, Sweden

EDUCATION

1996	PhD Systems Ecology, Stockholm University, Sweden
1994	Licentiate Degree Systems Ecology, Stockholm University, Sweden

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Béné, C., Arthur, R., Norbury, H., Allison, E.H., Beveridge, M., Bush, S., Campling, L., Leschen, W., Little, D., Squires, D., Thilsted, S.H., **Troell, M.**, Williams, M. (2016) Contribution of fisheries and aquaculture to food security and poverty reduction: Assessing the current evidence. *World Development* 79: 177–196.
- Henriksson, P., **Troell, M.**, Rico, A. (2015) Antimicrobial use in aquaculture: Some complementing facts. *PNAS* 112 (26): E3317.
- Österblom, H., Jouffray, J.B., Folke, C., Crona, B., **Troell, M.**, Merrie, A., Rockstrom, J. (2015) Transnational corporations as 'keystone actors' in marine ecosystems. *PLOS One* 10 (5).
- Krause, G., Brugere, C., Diedrich, E., Ebeling, M.W., Ferse, S.C.A, Mikkelsen, E., Perez Agundez, J.A., Stead, S.M., Stybel, N., **Troell, M.** (2015) A revolution without people? Closing the people-policy gap in aquaculture development. *Aquaculture* 44: 44–55.
- Cao, L., Naylor, R., Henriksson, P., Leadbitter, D., Metian, M., **Troell, M.**, Zhang, W. (2015) China's aquaculture and the world's wild fisheries. *Science* 347 (6218): 133–135.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Swedish coordinator for joint bilateral research programs: The implementation of re-circulation systems in abalone farming (SEK 450,000; 2003-2006) and Integrated culture of abalone and seaweed in land-based systems (SEK 430,000; 2000-2003). Received funding for one PhD student from SAREC (Swedish Agency for Research in Economical Developing Countries; SEK 1,600,000). Coordinator for the Swedish partners in a EC project: Assessment of mangrove degradation and resilience in the Indian sub-continent: The cases of Godavari estuary and South West Sri Lanka (SEK 821,554; 2003-2006).

ROLE IN FISH

Sr. Scientist – Aquaculture and resilience, FP1 Sustainable aquaculture

HUFF, AMBER

PROFILE

Social anthropologist and political ecologist:

- Research spans rural terrestrial and marine livelihoods, human health and wellbeing, the production of social, environmental and health policy, and resource struggles in Madagascar and Southern Africa.
- Main research areas include political ecology, social anthropology, environmental policy & change, conservation, rural livelihoods, terrestrial and marine livelihoods, nutritional health, poverty, and resilience.
- Total number of peer-reviewed publications: 7.

EMPLOYMENT

2014 to date	Research Fellow, Institute of Development Studies, United Kingdom
2013 – 2014	Post-doctoral Research Associate, The Department of Health Policy and Management, The University of Georgia, Athens, USA
2011 – 2014	Temporary Assistant Professor, The Department of Anthropology, The University of Georgia, Athens, USA

EDUCATION

2011	PhD Anthropology, The University of Georgia, Athens, Georgia, USA
2004	BA, Anthropology, The University of Southern Mississippi, Hattiesburg, Mississippi, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Huff, A.** (2014) Weathering the 'long wounded year': Livelihoods, nutrition, and changing political ecologies in the Mikea Forest region, Madagascar. Winner of the Eric Wolf Prize of the Political Ecology Society, 2013. *Journal of Political Ecology* 21 (1): 83–107.
- **Huff, A.** (2012) Exploring discourses of indigeneity and rurality in Mikea Forest environmental governance. Special issue: "Environmental Justice in Madagascar: Understanding Processes and Social Impacts of Conservation and of Natural Resource Extraction." *Madagascar Conservation & Development* 7 (25): 58–69.
- Tucker, B., **Huff, A.**, Tsiazonera, J.T., Hajaso, P., Nagnisaha, C. 2011. When the wealthy are poor: Poverty explanations and local perspectives in Southwestern Madagascar. *American Anthropologist* 113 (2): 291–305.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Recipient of the Eric Wolf Prize. Weathering the 'long wounded year': Livelihoods, nutrition, and changing political ecologies in the Mikea Forest region, Madagascar. Awarded by the Political Ecology Society (PESO). Awarded National Science Foundation Graduate Research Fellowship and J. William Fulbright Scholarship, US Institute of International Education (co-funded with NSF) Social change, livelihoods and health among Mikea diversified forager-farmers of Southwestern Madagascar. Major grants awarded: Contradiction, Conflict, and Value: Contextual Dynamics Around Green Development and the Financialization of Nature in Southern Africa, funded by ESRC STEPS Centre; Understanding New Forms of Conflict Around Green Development Policies and Resource Financialization in Southern Africa, funded through the IDS programme on Strengthening Evidence-based Policy; Subsistence decisions in southwestern Madagascar: Coping with poverty and hunger or social learning? Funded by the National Science Foundation.

ROLE IN FISH

Scientist – Livelihoods, gender and aquaculture, FP1 Sustainable aquaculture

CHIMATIRO, SLOANS KALUMBA

PROFILE

- Senior specialist with more than 15 years' experience in research in fisheries and aquaculture administration, policy reform, and project management at a senior government level.
- Policy advisor on fisheries and aquaculture to the Southern African Development Community (SADC), the Common Market for Eastern and Southern Africa (COMESA) and the New Partnership for Africa's Development (NEPAD).
- Conversant with fish processing, quality assurance and trade issues within the framework of regional integration and improving market access for African fish products.
- Presented the Action Plan to the Heads of State and Governments during the Abuja Summit and was instrumental in formulating the 2005 NEPAD Fisheries and Aquaculture Action Plan.
- Head of Fisheries at NEPAD responsible for (i) the development of the Pan-African Fisheries & Aquaculture Policy Framework & Reform Strategy; (ii) assisting African countries to design and implement fisheries policy and governance reforms; (iii) designing innovative investment strategies for small and medium enterprises in fisheries and aquaculture.

EMPLOYMENT

2014 to date	Program Manager, Aquaculture & Genetic Improvement, WorldFish, Zambia
2009 – 2014	Head of Fisheries, NEPAD Agency
2002 – 2006	Director of Fisheries, Malawi Department of Fisheries, Malawi
1999 – 2002	Deputy Director of Fisheries, Malawi Department of Fisheries, Malawi

EDUCATION

2004	PhD, Fisheries Science, Rhodes University, South Africa
1993	MSc, Aquaculture, University of Malawi, Malawi

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Onyango, P.O., **Chimatiro, S.**, Sumaila, R. (eds). (In press) *Accelerating Economic Growth and Food Security in Africa: The Contribution of Capture and Aquaculture Fisheries*. Springer, Mare Book Publication Series.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

As Director of Fisheries in Malawi, initiated the "Save the Chambo Campaign" as Malawi's response to the World Summit on Sustainable Development (WSSD), and the Presidential Initiative on Aquaculture as Malawi's response to the African Union/NEPAD Pan-African Fisheries. As Head of Fisheries at NEPAD, initiated and led the development of the Pan-African Fisheries & Aquaculture Policy Framework & Reform Strategy that was approved by African Union Heads of States in 2014 and supported the integration of fisheries and aquaculture in the CAADP. Significant grant awards: International Partnership for African Fisheries Governance and Trade (£9 million) and NEPAD-FAO Fish Partnership (NFFP) (USD 1.2 million).

ROLE IN FISH

- Policy Advisor – African aquaculture, FP1 Sustainable aquaculture
- Policy Advisor – African regional fish trade, FP3 Enhancing the contribution of fish to nutrition and health of the poor

ANDREW, NEIL

PROFILE

- Expertise in fisheries research with a focus on small-scale fisheries, food security and poverty reduction.
- Experience and publication record of research in inland and marine fisheries in Africa, Southeast Asia and the Pacific region, as well as global and regional syntheses and perspectives.
- More than 25 years' experience in technical and corporate leadership roles in large research organizations and advisory boards.
- More than 105 peer-reviewed publications on marine ecology, fisheries, development and resilience (Google Scholar h = 39, i10 = 95, total citations = 5591 at 25 March 2016).

EMPLOYMENT

2013 to date	Principal Scientist and Regional Director, Pacific and Island Asia, WorldFish
2005 – 2012	Director, Natural Resource Management, The WorldFish Center, Malaysia
2003 – 2005	General Manager, National Institute of Water and Atmospheric Research, New Zealand
1998 – 2003	Principal Scientist, National Institute of Water and Atmospheric Research, New Zealand

EDUCATION

1988	PhD, University of Sydney, Australia
1982	MSc (First Class Honours), University of Auckland, New Zealand

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Eriksson, H., Osterblom, H., Crona, B., **Andrew, N.L.**, Wilen J., Folke C. (2015) Contagious exploitation of marine resources. *Frontiers in Ecology and the Environment* 13: 435–440.
- Bell, J.D., Adams, T.J.H., Allain, V., Andréfouët, S., **Andrew, N.L.** et al. (2015) Diversifying the use of tuna to improve food security and public health in Pacific Island countries and territories. *Marine Policy* 51: 584–591.
- Albert, J.D., Beare, D., Schwarz, A-M., Albert, S., Warren, R., Siota, J., **Andrew, N.L.** (2014) Contribution of nearshore fish aggregating devices (FADs) to food security and livelihoods in Solomon Islands. *PLoS ONE* 9(12): e115386
- Hall, S.J., Hilborn, R., **Andrew, N.L.**, Allison, E.H. (2013) Innovations in capture fisheries are an imperative for nutrition security in the developing world. *Proc. Natl. Acad. Sci. USA*. 110: 8345–8348.
- Morand, P., Kodio, A., **Andrew, N.L.** et al. (2012) Vulnerability and adaptation of African rural populations to hydro-climatic change: Experience from fisher communities of the Inner Niger Delta (Mali). *Climatic Change* 115: 463–483.
- Schwarz, A-M., Béné, C., Bennett, G., Boso, D., Hilly, Z., Paul, A., Posala, R., Sibiti, S., **Andrew, N.L.** (2011) Vulnerability and resilience of remote rural communities to shocks and global changes: Empirical analysis from the Solomon Islands. *Global Environmental Change* 21: 1128–1140.
- Walker, B.D., Sayer, J., **Andrew, N.L.**, Campbell, B.D. (2010) Resilience in practice: Challenges and opportunities for natural resource management in the developing world. *Crop Science* 50: 10–19.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- Contributions to regional and global fisheries science and policy forums, symposia and documents with FAO, World Bank, and SPC.
- More than 20 years' experience in project leadership of large multi-stakeholder projects.
- Recent major grants awarded: 2013 ACIAR Research Grant FIS/2013/074 (USD 4.2 million) for Pacific small-scale fisheries governance, 2015 ACIAR Research Grant FIS/2015/031 (USD 1.2 million) for fish in regional food systems.

ROLE IN FISH

Flagship Leader, FP2 Sustaining small-scale fisheries

Principal Investigator – Small-scale fisheries governance, FP2 Sustaining small-scale fisheries

CINNER, JOSHUA

PROFILE

Research explores how social, economic and cultural factors influence the ways in which people use, perceive and govern natural resources. Works closely with ecologists on interdisciplinary research topics, including defining the socioeconomic factors that drive successful marine conservation, understanding resilience and thresholds in social ecological systems, and examining vulnerability to environmental change. 102 peer-reviewed publications.

EMPLOYMENT

2014 to date	Professorial Research Fellow, ARC Centre of Excellence for Coral Reef Studies, James Cook University, Australia
2012 – 2014	Principal Research Fellow/Associate Professor, James Cook University, Australia
2008 – 2012	Senior Research Fellow/Senior Lecturer, James Cook University, Australia
2006 – 2007	Postdoctoral Research Fellow, James Cook University, Australia

EDUCATION

2006	PhD, James Cook University, Australia
2000	MSc, University of Rhode Island, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Cinner, J.** et al. (2015) Changes in adaptive capacity of Kenyan fishing communities. *Nature Climate Change*. (In press.)
- **Cinner, J.** et al. (2015) A framework for understanding climate change impacts on coral reef social-ecological systems. *Regional Environmental Change*. (In press.)
- **Cinner, J.**, McClanahan, T.R. (2015) A sea change on the African coast? Preliminary social and ecological outcomes of a governance transformation in Kenyan fisheries. *Global Environmental Change* 30: 133–139.
- Eckstrom, Suatoni, Cooley, Pendleton, Waldbusser, **Cinner, J.** et al. (2015) Vulnerability and adaptation of US shellfisheries to ocean acidification. *Nature Climate Change* 5: 207–214.
- **Cinner, J.**, MacNeil, M.A., Basurto, X., Gelcich, S. (2014) Looking beyond the fisheries crisis: Cumulative learning from small-scale fisheries through diagnostic approaches. *Global Environmental Change* 23: 1359–1365.
- MacNeil, A., Graham, N.A.J., **Cinner, J.** et al. (2015) Recovery potential of the world's coral reef fishes. *Nature* 520: 341–344.
- **Cinner, J.**, Huchery, C. (2014) A comparison of social outcomes associated with different fisheries co-management institutions. *Conservation Letters* 7: 224–232.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

2015–2018	Pew Fellowship in Marine Conservation
2014–2020	ARC Centre of Excellence grant
2011–2015	ARC Discovery Grant-Australian Research Fellowship.

ROLE IN FISH

Leader, Cluster 1 – Resilient coastal fisheries, FP2 Sustaining Small-scale fisheries

SENARATNA SELLAMUTTU, SONALI

PROFILE

- 17 years' experience in natural resource management, sustainable livelihoods and poverty reduction-related issues in the context of agricultural and aquatic systems (including coastal and inland systems).
- Over 50 articles, book chapters, technical reports and policy briefs published on these topics (including 21 peer-reviewed publications).
- Led and managed a number of multidisciplinary projects in Southeast Asia, South Asia and Africa.

EMPLOYMENT

2011 to date	Senior Researcher, Acting Theme Leader, Head of IWMI Southeast Asia Regional Office, Vientiane, Lao PDR
2006 – 2010	Researcher – Livelihood Systems, IWMI HQ, Sri Lanka & IWMI Southeast Asia
2000 – 2001	Head, National Marine & Coastal Program, IUCN, Sri Lanka
1999 – 2000	Policy Fellow, Sustainable Use Initiative/Ford Foundation, IUCN, Washington DC, USA

EDUCATION

2006	PhD, Imperial College London, UK
1995	MSc Ecosystems Analysis and Governance, University of Warwick, Coventry, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- McCartney, M., Rebelo, L. M., **Senaratna Sellamuttu, S.** (2015) Wetlands, livelihoods and human health. *In* Wetlands and Human Health. Edited by C. M. Finlayson, P. Horwitz and P. Weinstein. *Wetlands: Ecology, Conservation and Management* 5: 123–148.
- **Senaratna Sellamuttu, S.**, Aida, T., Kasahara, R., Sawada, Y., Wijerathna, D. (2014) How access to irrigation influences poverty and livelihoods: A case study from Sri Lanka. *Journal of Dev. Studies* [ISI] 50 (5): 748–768.
- **Senaratna Sellamuttu, S.**, de Silva, S., Nagabhatla, N., Finlayson, M., Pattanaik, C., Prasad, S. N. (2012) The Ramsar Convention's wise use concept in theory and practice: An inter-disciplinary investigation of practice in Kolleru Lake, India. *Journal of International Wildlife Law and Policy* [ISI] 03–04: 228–250.
- **Senaratna Sellamuttu, S.**, de Silva, S., Nguyen Khoa, S. (2011) Exploring relationships between conservation and poverty reduction in wetland ecosystems: lessons from ten integrated wetland conservation and poverty reduction initiatives. *International Journal of Sustainable Development & World Ecology* [ISI] 18 (4): 328–340.
- **Senaratna Sellamuttu, S.**, Finlayson, M. C., Nagabhatla, N., Diphoorn, L. (2011) Exploring linkages between changes in land cover (use) patterns, local perceptions and livelihoods in a coastal wetland system in Sri Lanka. *Journal of the National Science Foundation Sri Lanka* [ISI] 39 (4): 391–402.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Co-Chair for the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) Asia-Pacific Regional Assessment (2015–2017). Involves a team of 130 scientists covering 5 sub-regions and 68 countries. IWMI Representative on the Ramsar Convention's Scientific and Technical Review Panel (STRP) for 2013–2015. Lead for the STRP Working Group on Wetlands and Poverty Eradication (2013–2015). Member of Working Group (2009–2012) and provided significant inputs to Ramsar Resolutions on wetlands and poverty. Member of AAS CRP Strategic Leadership Group. Major grants awarded: CPWF Mekong1 (USD 1.6 million); CPWF PN71 (USD 570K); LIFT (USD 400K).

ROLE IN FISH

Leader, Cluster 2 – Fish in multifunctional landscapes, FP2 Sustaining small-scale fisheries

COHEN, PHILLIPA

PROFILE

- Interdisciplinary (social science and ecology) researcher who specializes in small-scale fisheries and food security. Research addresses the increasingly urgent need to improve environmental sustainability and food security in developing countries, particularly for securing the contribution of fisheries to incomes and diets of large numbers of people living in rural and remote areas.
- Solution-orientated and applied research that provides guidance to development policies and interventions, particularly via CGIAR.
- 23 peer-reviewed publications.

EMPLOYMENT

2013 to date	Scientist, WorldFish, Australia; Research Fellow, ARC Centre of Excellence for Coral Reef Studies, James Cook University, Australia
2011 – 2013	Consultant, WorldFish, Australia, Solomon Islands, Timor Leste
2010 – 2011	Reef Life Survey, Tasmanian Aquaculture & Fisheries Institute, Australia
2007 – 2009	ReefBase Pacific Coordinator, WorldFish, Fiji

EDUCATION

2013	PhD, ARC Centre of Excellence for Excellence, James Cook University, Australia
2000	BSc (Hons) Marine, Freshwater & Antarctic Biology, University of Tasmania, Australia

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Case, P., Evans, L., Fabinyi, M., **Cohen, P.**, Hicks, C., Prideaux, M. et al. (2015) Rethinking environmental leadership: The social construction of leaders and leadership in discourses of ecological crisis, development and conservation. *Leadership*. In press.
- **Cohen, P.**, Steenbergen, D. (2015) Social dimensions of local fisheries co-management in the Coral Triangle. *Environmental Conservation*. In press.
- Evans, L., Hicks, C., **Cohen, P.**, Case, P., Prideaux, M., Mills, D. (2015) Understanding leadership in the sustainability sciences. *Ecology and Society* 20: 50. DOI: 10.5751/ES-07268-200150
- Jupiter, S., **Cohen, P.**, Weeks, R., Tawake, A., Govan, H. (2014) Locally-managed marine areas: Multiple objectives and diverse strategies. *Pacific Conservation Biology* 20: 165–179.
- Mills, M., Álvarez-Romero, J., Vance-Borland, K., **Cohen, P.** et al. (2014) Social network analysis for systematic conservation planning. *Biological Conservation* 169: 6–13.
- **Cohen, P.**, Cinner, J., Foale, S. (2013) Fishing dynamics associated with periodically-harvested marine closures. *Global Environmental Change* 23 (6): 1702–1713.
- **Cohen, P.**, Alexander, T. (2013) Catch rates, composition and fish size from reefs managed with periodically-harvested closures. *PLoS ONE* 8(9): e73383. DOI: 10.1371/journal.pone.0073383

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- 2014 Young Tall Poppy Science Award
- 2010 Coral Reef Initiatives of the Pacific, Research Grant
- 2009 Australian National Network in Marine Science, Internship Grant
- 2009 Secretariat of the Pacific Regional Environment Programme, WorldFish Center contract

ROLE IN FISH

Leader, Cluster 3 – Fish in regional food systems, FP2 Sustaining small-scale fisheries

PROFILE

- Responsible for overall research strategy and leadership, with oversight of WorldFish's research programs in aquaculture, small-scale fisheries, and value chains and nutrition.
- An environmental sociologist, research focuses on natural resource governance, conflict, and cooperation from local to regional scales. Specialist in participatory multi-stakeholder dialogue to build institutional and policy innovation addressing competition over common-pool resources (land, water, forests, fisheries).
- Skilled in executive leadership, organizational change, participatory facilitation, experiential education and conflict mediation. Fluent in English, Spanish, French and Khmer (Cambodian).
- 30 peer-reviewed publications, plus 20 policy reports and practitioner guidance publications.

EMPLOYMENT

2014 to date	Research Director, WorldFish, Malaysia
2003 – 2014	Program Leader, Governance; Regional Director, Mekong, WorldFish, Cambodia
2000 – 2003	Consultant and Faculty Appointments: World Bank, University of Minnesota, USA
1997 – 2000	Sr. Associate and Regional Program Manager, World Resources Institute, Thailand

EDUCATION

1997	PhD, Development Sociology (Rural and Environmental Sociology), Cornell University, USA
1995	MS, Development Sociology and MPS, Rural Development Administration, Cornell University, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Ensor, J., Park, S., Hoddy, E., **Ratner, B.D.** (2015) A rights-based perspective on adaptive capacity. *Global Environmental Change* 31: 38–49.
- **Ratner, B.D.**, Mam, K., Halpern, G. (2014) Collaborating for resilience: Conflict, collective action, and transformation on Cambodia's Tonle Sap Lake. *Ecology and Society* 19: 31.
- **Ratner, B.D.**, Åsgard, B., Allison, E.H. (2014) Fishing for justice: Human rights, development, and fisheries sector reform. *Global Environmental Change* 27: 120–130.
- **Ratner, B.D.**, Cohen, P., Barman, B., Mam, K., Nagoli, J., Allison, E.H. (2013) Governance of aquatic agricultural systems: Analyzing representation, power, and accountability. *Ecology and Society* 18: 59.
- **Ratner, B.D.**, Meinzen-Dick, R., May, C., Haglund, E. (2013) Resource conflict, collective action, and resilience: An analytical framework. *International Journal of the Commons* 7: 183–208.
- **Ratner, B.D.**, Allison, E.H. (2012) Wealth, rights, and resilience: An agenda for governance reform in small-scale fisheries. *Development Policy Review* 30: 371–398.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- Led cross-regional, action research resulting in governance innovations that improved resource access, reinforced livelihood security, and reduced social conflict in Cambodia, Uganda and Zambia, with lessons from the [Collaborating for Resilience](#) approach now applied in Bangladesh, Solomons, Philippines and India.
- Led cross-regional exchange and synthesis of lessons aimed at strengthening collective action for management of water, forests and fisheries in conflict-sensitive environments of Asia, Africa and Latin America.
- Led participatory research to build collective action and strengthen civil society-state linkages in Cambodia's Tonle Sap Lake, contributing to more effective community advocacy for reform.

ROLE IN FISH

Principal Investigator – Governance, FP2 Sustaining small-scale fisheries

PROFILE

Principal Research Scientist, International Water Management Institute and IWMI Representative in Myanmar:

- 30 years' experience in water and land resources research, with emphasis on a cross-disciplinary approach and integration of scientific, economic and social information to address management questions.
- Broadly based expertise in sustainable land and water management, the role of water in mediating interactions between agriculture, ecosystems and climate change, and the implications for management and ecosystem services. Project experience encompassing basin planning, riverine and wetland ecosystem health, irrigation and agricultural water management, land degradation, hydrological modelling and remote sensing/GIS in Southeast Asia, Africa, Australia and the Pacific.
- 75 research and policy publications (28 peer reviewed) covering river basin management and planning, hydrological modelling, sustainable agricultural systems, climate change and river health.

EMPLOYMENT

2009 – 2016	Senior and Principal Researcher at IWMI, Sri Lanka; IWMI Representative in Myanmar
2007 – 2008	Program Leader, Sustainable Rivers Audit, Murray Darling Basin Commission, Canberra, Australia
2006	Environment Advisor, Australian Agency for International Development, Canberra, Australia
2002 – 2005	Basin Planner Mekong River Commission, Phnom Penh, Cambodia; Vientiane, Lao PDR

EDUCATION

1990	PhD, University of New England, Armidale, Australia
1981	MSc Geochemistry, University of Leeds, Leeds, United Kingdom

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Hoanh, C., Smakhtin, V., **Johnston, R.** (eds) (2016) *Climate Change and Agricultural Water Management in Developing Countries*. CABI and IWMI. 227pp.
- **Johnston, R.**, Smakhtin, V. (2014) Hydrological modeling in large river basins – How much is enough? *Water Resources Management* (Online first) DOI: 10.1007/s11269-014-0637-8
- de Silva, S., **Johnston, R.**, Senaratna Sellamuttu, S. (2014) Agriculture, irrigation and poverty reduction in Cambodia: Policy narratives and ground realities compared. Penang, Malaysia: CGIAR Research Program on Aquatic Agricultural Systems. Working Paper: AAS-2014-13.
- Rebelo, L.M., **Johnston, R.**, Karimi, P., McCornick, P.G. (2014) Determining the dynamics of agricultural water use: Cases from Asia and Africa. *Journal of Contemporary Water Research* 153: 79–90.
- **Johnston, R.**, Cools, J., Liersch, S., Morardet, S., Murgue, C., Mahieu, M., Zsuffa, I., Uyttendaele, G.P. (2013) WETwin: A structured approach to evaluating wetland management options in data-poor contexts. *Environmental Science & Policy* 34: 3–17.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Led the team responsible for delivering first Sustainable Rivers Audit for Murray Darling Basin; budget of AUD 13 million over 3 years, involving a team of around 100 people (including State agency staff, researchers, consultants and independent ecologists) to provide evidence-based research for river management. Led IWMI's input to WETWIN and AfroMaison participatory research projects to integrate ecosystem services concepts into land and water resources management in Africa, linking research to local government planning in Ethiopia, South Africa and Tunisia.

ROLE IN FISH

Scientist – Water and land resources management, FP2 Sustaining small-scale fisheries

PROFILE

- Over 20 years of experience in water, natural resources and ecosystems-related research, with geographical experience in Africa, Asia and Europe.
- Contributed to, and managed multi-disciplinary teams, dealing with (i) decision support systems for large dams; (ii) water storage and climate change; (iii) agricultural and competing water use; (iv) the role of wetlands in supporting livelihoods; (v) hydropower; (vi) malaria in the vicinity of reservoirs; (vii) environmental flows; and (viii) integrating natural and built infrastructure.
- More than 250 publications covering hydrology, water resources, large dam planning and management, environmental impact, ecosystem services, climate change, food security, and human health. 100 peer-reviewed papers, research reports and book chapters.

EMPLOYMENT

2014 to date	Theme Leader, Ecosystem Services, IWMI, Lao PDR
2012 to 2014	Office Head, IWMI Southeast Asia, Lao PDR
2002 – 2012	Sr. Researcher & Principal Researcher, IWMI (South Africa, Ethiopia and Lao PDR)
1989 – 2002	Scientist and Senior Scientist, Centre for Ecology and Hydrology, Wallingford, UK

EDUCATION

1998	PhD Wetland Hydrology, University of Reading, UK
1988	MSc Engineering Hydrology, Imperial College, London, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Kibret, S., Lautze, J., **McCartney, M.P.**, Wilson, G., Luxon, N. (2015) [Malaria impact of large dams in sub-Saharan Africa: maps, estimates and predictions](#). *Malaria Journal* 14: 339.
- **McCartney, M.P.**, Rebelo, L-M., Senaratna Sellamuttu, S. (2015) Wetlands, Livelihoods and Human Health. In Finlayson, C.M., Horwitz, P., Weinstein, P. (eds) *Wetlands and Human Health*. Springer. Pages 123–145.
- **McCartney, M.P.**, Khaing, O. (2014) A Country in Rapid Transition: Can Myanmar Achieve Food Security? In Sekhar, N.U. (ed). *Food Security and Development*. Oxford, UK: Routledge-Earthscan. Pages 79–103.
- Lacombe, G., **McCartney, M.P.** (2014) Uncovering consistencies in rainfall trends across India (1951–2007). *Climatic Change*. DOI: 10.1007/s10584-013-1036-5
- Zemaddin, B., **McCartney, M.P.**, Langan, S., Sharma, B. (2014) A participatory approach for hydrometeorological monitoring in the Blue Nile River Basin of Ethiopia. Colombo, Sri Lanka: International Water Management Institute (IWMI Research Report 155). DOI: 10.5337/2014.200 32pp.
- **McCartney, M.P.** (2013) Wetlands and Livelihoods: The Value of Wetlands for Livelihood Support in Tanzania and Zambia (Chapter 2). In Wood, A., Dixon, A., **McCartney, M.P.** (eds). *Wetlands Management and Sustainable Livelihoods in Africa*. Routledge and Earthscan. Pages 43–62.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Contributed to broad-ranging reviews for national and international organizations such as the UK Department for International Development (DFID), the World Conservation Union (IUCN), the United Nations Environment Programme (UNEP), FAO and the World Bank. Steering committee member, UNEP Dams Development Project (2002–2004). Member, Ramsar Science and Technical Review Panel (STRP) contributing to the working groups on wetlands and agriculture, and wetlands and water resources (2007–2015). Major grants awarded: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, International Climate Initiative: €936K; GIZ: rethinking water storage for climate change in sub-Saharan Africa €1.12 million; CPWF: Improved livelihoods through dam management USD 637K and others. Adjunct Research Fellow, Charles Sturt University, Australia.

ROLE IN FISH

Scientist – Water resource management and ecosystem services, FP2 Sustaining small-scale fisheries

PROFILE

Specialist in sustainability of fishery resources, environmental management and research for development:

- 25 years' experience as senior scientist, project leader or expert in 12 countries.
- Leader of six large research projects (USD 0.5–1.5 million), component leader of nine research or capacity-building projects, scientist in four research projects and independent expert in four reviews and assessments.
- 31 refereed publications; 24 books, chapters or booklets; 21 science articles and policy briefs.
- Focus on aquatic resources, food security, infrastructure development impacts and mitigation, ecological services and sustainable productivity.

EMPLOYMENT

2000 – 2016	Research Scientist then Senior Scientist, WorldFish, Cambodia
1998 – 2000	Consultant, UNDP, World Health Organization, IUCN, IRD/ORSTOM and others
1996 – 1998	Lecturer and Consultant, Biology, University Claude Bernard Lyon 1, France
1995 – 1996	Postdoctoral Fellow, University Lyon 1, France

EDUCATION

1995	PhD Biological Oceanography, University of Brittany and ORSTOM, France
1990	MSc Marine Biology, University of Brittany, France

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Winemiller, K.O., McIntyre, P.B., Castello, L., Fluet-Chouinard, E., Giarrizzo, T., Nam, S., Baird, I. G., Darwall, W., Lujan, N.K., Harrison, I., Stiassny, M.L.J., Silvano, R.A.M., Fitzgerald, D.B., Pelicice, F.M., Agostinho, A.A., Gomes, L.C., Albert, J.S., **Baran, E.**, et al. (2016) Balancing hydropower and biodiversity in the Amazon, Congo, and Mekong. *Science* 351 (6269): 128–129.
- **Baran, E.**, Guerin, E., Nasielski, J. (2015) Fish, sediment and dams in the Mekong. Penang, Malaysia: WorldFish, and CGIAR Research Program on Water, Land and Ecosystems (WLE). 108 pp.
- Ziv, G., **Baran, E.**, So Nam, Rodríguez-Iturbe, I., Levin, S. A. (2012) Trading-off fish biodiversity, food security, and hydropower in the Mekong River Basin. *Proceedings of the National Academy of Science* 109 (15): 5609–5614.
- **Baran, E.**, Chum, N., Fukushima, M., Hand, T., Hurtle, K.G., Jutagate, T., Kang, B. (2012) Fish biodiversity research in the Mekong Basin. In Nakano S., Yahara T. and Nakashizuka T. (eds.): *The Biodiversity Observation Network in the Asia-Pacific Region: Toward Further Development of Monitoring*. Tokyo: Ecological Research Monographs, Springer. Pages 149–164.
- Dugan, P.J., Barlow, C., Agostinho, A. A., **Baran, E.**, Cada, G. F., Chen, D., Cowx, I.G., Ferguson, J.W., Jutagate, T., Mallen-Cooper, M., Marmulla, G., Nestler, J., Petrere, M., Welcomme, R.L., Winemiller, K.O. (2010) Fish migration, dams, and loss of ecosystem services in the Mekong Basin. *Ambio*. 39: 344–348.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Recipient of 2011 WorldFish Board Research Award, 2011 Team Award of the International Association for Impact Assessment and 2005 WorldFish outstanding performance award. Organizer or co-organizer of eight large-scale national and international scientific meetings and contributor to 62 international symposia or meetings (15 as keynote speaker). Contributor to 60+ news articles, 9 video documentaries and 8 radio programs; cited in *Nature*, *Science*, *National Geographic*, *The New York Times*, *The Economist* and *Time*. Development, with partners, of 19 successful project proposals worth USD 11.9 million. Average fundraising over 10 years (2004–2014): USD 880,000 per year.

ROLE IN FISH

Sr. Scientist – Inland fisheries ecology and management, FP2 Sustaining small-scale fisheries

PROFILE

Aquaculture and limnology specialist:

- 35 years' experience at Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh; served as Professor & founding Head of Dept. of Fisheries Management, Dean of Faculty of Fisheries.
- Extensive research and consultancy experience on freshwater and coastal aquaculture, water quality and pond dynamics, and open water capture fisheries.
- 96 research publications in peer-reviewed journals covering aquaculture technologies, water quality & environmental impacts. 12 book chapters.

EMPLOYMENT

2014 to date	Team Leader, Enhanced Coastal Fisheries In Bangladesh (ECOFISH ^{BD}), WorldFish, BD
2010 – 2012	Dean, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, BD
2007 – 2014	Host Country Principal Investigator, USAID CRSP & AquaFish Fish Innovation Lab
1996 – 1998	Head, Dept. of Fisheries Management, Bangladesh Agricultural University, Mymensingh, BD

EDUCATION

1986	PhD Aquaculture, University of Stirling, Scotland, United Kingdom
1979	MSc Fisheries Biology & Limnology, Bangladesh Agricultural University (BAU), Myanmar

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Wahab, M.A.**, Nahid, Sk. A. A. M., Ahmed, M.N., Haque, M.M., Karim, M.M. (2012) Current status and prospect of farming of Giant River prawn *Macrobrachium rosenbergii* (De Man) in Bangladesh: A review. *Aquaculture Research* 43: 970–983.
- **Wahab, M.A.**, Kadir, A., Milstein, A., Kunda, M. (2011) Manipulation of species combination for enhancing fish production in polyculture systems involving major carps and small indigenous fish species. *Aquaculture* 321: 289–297.
- Asaduzzaman, M., **Wahab, M.A.**, Verdegem, M.C.J., Mondal, M.N., Azim, M.E. (2009) Effects of stocking density of freshwater prawn *Macrobrachium rosenbergii* and addition of different levels of tilapia *Oreochromis niloticus* on production in C/N controlled periphyton based system. *Aquaculture* 286: 72–79.
- **Wahab, M.A.**, Kunda, M., Azim, M.E., Dewan, S., Thilsted, S.H. (2008) Evaluation of concurrent rice- freshwater prawn small fish culture in rain-fed rice fields in central Bangladesh. *Aquaculture Research* 39: 1524–1532.
- **Wahab, M.A.**, Alim, M.A., Milstein, A. (2003) Effects of adding the small fish punti, (*Puntius sophore*), and/or mola, (*Amblypharyngodon mola*), to a polyculture of large carp. *Aquaculture Research* 34 (2): 149–164.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Development of 10 sustainable technologies in freshwater and coastal aquaculture widely practiced in Bangladesh, Nepal and Cambodia. Pioneer researcher on nutrient-rich mola fish research in the South Asia region. Led World Bank-funded Flood Action Plan-17: Fisheries project in North Central region of Bangladesh in 1992–93. Presently leading the USAID-funded Enhanced Coastal Fisheries in Bangladesh (ECOFISH^{BD}) project in Bangladesh. Major grants awarded: Environment and socioeconomic assessment of shrimp farming in Bangladesh (USD 240,000, NORAD); Sustainable Ethical Aquaculture Trade (SEAT) (USD 313,000, EU); Economic Incentives to Conserve Hilsa Fish in Bangladesh (USD 61,000, DFID's Darwin Initiative); and Enhancing Aquaculture Technologies and Adaptive Measures to Climate Impacts in Bangladesh (USD 310,000, USAID AquaFish Innovation Lab).

ROLE IN FISH

Sr. Scientist – Inland fisheries ecology and management, FP2 Sustaining small-scale fisheries

COLE, STEVEN

PROFILE

- Expertise in social/gender inequality, food and livelihood security, nutrition, rural land tenure and labor arrangements, and masculinity and women's empowerment in small-scale fisheries.
- Experience and publication record of research in Zambia.
- 14 research publications (7 peer-reviewed) on social/gender inequality, vulnerability, food and livelihood security, nutrition and health, rural labor arrangements, small-scale fisheries, gender-transformative approaches (Google Scholar h = 3, i10 = 2, total citations = 57 at 28 March 2016).

EMPLOYMENT

2015 to date	Social Scientist, WorldFish, Zambia
2013 – 2014	Postdoctoral Fellow, WorldFish, Zambia
2004 – 2012	Independent Consultant/Research Assistant (e.g. for USAID, Michigan State University, Baylor University) while pursuing PhD, USA

EDUCATION

2012	PhD Biological Anthropology, University of Arizona, USA
2004	MSc Agricultural and Resource Economics, University of Arizona, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Rajaratnam, S., **Cole, S.M.**, Kruijssen, F., Sarapura, S., Longley, C. (Accepted). Gender inequalities in access to and benefits derived from the natural fishery in the Barotse Floodplain, Zambia, Southern Africa. *Asian Fisheries Science Journal*.
- **Cole, S.M.**, Puskur, R., Rajaratnam, S., Zulu, F. (2015) Exploring the intricate relationship between poverty, gender inequality, and rural masculinity: A case study from an aquatic agricultural system in Zambia. *Culture, Society and Masculinities* 7 (2): 154–170.
- Longley, C., Thilsted, S.H., Beveridge, M., **Cole, S.M.**, Nyirenda, D.B., Heck, S., Nielsen, A-L.H. (2014) The role of fish in the first 1,000 days. *International Development Studies Bulletin* Special Collection (September): 27–35.
- **Cole, S.M.**, Hoon, P.N. (2013) Piecework (*ganyu*) as an indicator of household vulnerability in rural Zambia. *Ecology of Food and Nutrition* 52(5): 407–426.
- **Cole, S.M.** (2012) The relationship between relative deprivation and adult nutritional status in rural Zambia. *American Journal of Human Biology* 24: 800–805.
- **Cole, S.M.**, Tembo, G. (2011) The effect of food insecurity on mental health: Panel evidence from rural Zambia. *Social Science & Medicine* 73(7): 1071–1079.
- Crooks, D.L., Cliggett, L., **Cole, S.M.** (2007) Child growth as a measure of livelihood security: The case of the Gwembe Tonga. *American Journal of Human Biology* 19(5): 669–675.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

- Leader of a research project on aquaculture and nutrition (Irish Aid-funded, USD 2.5million). P.I. for WorldFish on a multi-partner research project on postharvest fish losses and gender (IDRC/ACIAR-funded, CAD 1.6million). Both projects are in Zambia.
- Integrating (and testing) gender-transformative approaches in small-scale fisheries-focused research projects.
- Peer-review journal referee since 2011.

ROLE IN FISH

Scientist – Gender equity, FP2 Sustaining small-scale fisheries

PROFILE

Natural resources management specialist:

- 18 years of research and program management experience in fisheries policy, aquatic ecosystem services assessment and management, and biodiversity conservation, and engagement with government, university, development agencies and NGOs.
- Leadership role in multi-disciplinary research and development projects in several countries in Southeast Asia and Africa; contribution to global and regional syntheses by UNEP, FAO, World Bank, and the Ramsar Convention on Wetlands.
- More than 30 research publications on water resources, ecosystems and biodiversity, and fisheries; 17 are peer reviewed (Google Scholar: h = 11, i10 = 12, total citations = 3729 at 28 March 2016).

EMPLOYMENT

2008 to date	Regional Program Manager, WorldFish - Greater Mekong Region, Cambodia
2005 –2008	Regional Program Coordinator, WorldFish Center - Greater Mekong Region, Cambodia
1998 – 2004	Research Analyst (Senior Associate from 2001), People and Ecosystems Program, the World Resources Institute (WRI), Washington DC
1997 – 1998	Independent Consultant (clients – WWF, Conservation International, World Bank)

EDUCATION

1997	MA Environmental Science and Policy, Clark University, Worcester, Massachusetts, USA
1992	BA English Literature and Language, Aichi Prefectural University, Nagoya, Japan

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Kura, Y.**, Joffre, O., Laplante, B., Sengvilaykham, B. Coping with resettlement: A livelihood adaptation analysis in the Mekong River Basin. Submitted to *Land Use Policy*. Under review.
- **Kura, Y.**, Joffre, O., Laplante, B., Sengvilaykham, B. (2014) Redistribution of water use and benefits among hydropower affected communities in Lao PDR. *Water Resources and Rural Development* 4: 67–84.
- Mills, D J., Westlund, L., de Graaf, G., **Kura, Y.**, Willman, R., Kelleher, K. (2011) Underreported and Undervalued: Small-scale Fisheries in the Developing World. In Pomeroy, R.S., Andrew, N.L. (eds). *Small-scale Fisheries Management*. CAB International.
- Watson, R., Revenga, C., **Kura, Y.** (2006a) Fishing gear associated with global marine catches: I. Database development. *Fisheries Research* 79 (2006): 97–102.
- Watson, R., Revenga, C. **Kura, Y.** (2006b) Fishing gear associated with global marine catches: II. Trends in trawling and dredging. *Fisheries Research* 79 (2006): 103–111.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Establishment of WorldFish's in-country representation and operation in Cambodia and Myanmar: management of annual program portfolio of approx. USD 2–3 million; lead role in 15 projects of various sizes (USD 300K to 2 million), addressing community-based natural resource management and capacity building of government research institutes. Major grants awarded: Mekong fisheries and aquaculture R&D (Japan, cumulative USD 1.5 million since 2007); reservoir water management (CPWF, USD 1 million 2010–2014); rice field fisheries enhancement (USAID, USD 6 million 2016–2021); contributed to securing over USD 12 million in grants to WorldFish. Science focal point for CRP Water, Land, and Ecosystems. Focal point for CCAFS Climate Smart Village in Cambodia.

ROLE IN FISH

Scientist – Fisheries policy and management, FP2 Sustaining small-scale fisheries

THILSTED, SHAKUNTALA HARAISINGH

PROFILE

- Expertise, experience, research, academic teaching and mentorship in food-based strategies, with focus on fish for improved food and nutrition security in low-income countries.
- Leading science direction, execution of research program, partnerships and funding strategy for the research program: Value Chains and Nutrition at WorldFish.
- Areas of work include nutrition-sensitive capture fisheries and aquaculture, nutrient-rich small fish in combating and preventing micronutrient deficiencies, fish-based products in the first 1000 days of life.

EMPLOYMENT

2015 to date	Research Program Leader, Value Chains and Nutrition, WorldFish, Cambodia
2010 – 2015	Senior Nutrition Scientist, WorldFish, Bangladesh and Cambodia
1992 – 2009	Associate Professor (Nutrition in Low-Income Countries), Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Denmark
1991 – 1992	Associate Professor, Department of Production Physiology and Human Nutrition, The Royal Veterinary and Agricultural University, Denmark

EDUCATION

1980	PhD Physiology of Nutrition, Department of Animal Science, The Royal Veterinary and Agricultural University (Faculty of Life Sciences, University of Copenhagen), Denmark
1976	Postgraduate Course in Physiology of Animal Nutrition, Veterinary Faculty for FAO Fellows, The Royal Veterinary and Agricultural University, Denmark

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Thilsted, S.H.**, Thorne-Lyman, A.L., Subasinghe, R., Webb, P., Bogard, J.R., Phillips, M.J., Allison, E.H. (2016) Sustaining healthy diets: The role of capture fisheries and aquaculture for improving nutrition in the post-2015 era. DOI: 10.1016/j.foodpol.2016.02.005
- Béné, C., Arthur, R., Norbury, H., Allison, E.H., Beveridge, M., Bush, S., Campling, L., Leschen, W., Little, D., Squires, S., **Thilsted, S.H.**, Troell, M. (2016) Contribution of fisheries and aquaculture to food security and poverty reduction: Assessing the current evidence. *World Development* 79: 177–196.
- Fiedler, J., Lividini, K., Drummond, E., **Thilsted S.H.** (2016) Strengthening the contribution of aquaculture to food and nutrition security: The potential of a vitamin A-rich small fish in Bangladesh. *Aquaculture* 452: 291–303.
- Bogard, J.R., **Thilsted, S.H.**, Marks, G.C., Wahab, M.A., Hossain, M.A.R., Jakobsen, J., Stangoulis, J. (2015) Nutrient composition of important fish species in Bangladesh and potential contribution to recommended nutrient intakes. *Journal of Food Composition and Analysis* 42: 120–133.
- Powell, B., **Thilsted, S.H.**, Ickowitz, A., Termote, C., Sunderland, T., Herforth, A. (2015) Improving diets with wild and cultivated biodiversity from across the landscape. *Food Security* 7: 535–554.

OTHER EVIDENCE OF LEADERSHIP, MANAGEMENT AND DELIVERY

Leader and technical advisor of global (UN, HarvestPlus) and national (Denmark, Bangladesh, Kenya) advisory bodies on food and nutrition security, e.g. Member, Technical Advisory Committee, USAID Nutrition Innovation Lab. Project leader for several WorldFish-led projects within fisheries and nutrition in Africa and Asia, with funding from multiple sources, e.g. DFID, IFAD, World Bank. Guest speaker in various international forums, e.g. World Food Prize, United Nations Informal Consultative Process on Oceans and the Law of the Sea, World Aquaculture Conference 2015. Co-supervisor of postdoctoral and PhD fellows.

ROLE IN FISH

Flagship Leader, FP3 Enhancing the contribution of fish to nutrition and health of the poor

BROWN, CHRISTOPHER LYON

PROFILE

- Lead researcher for WorldFish on fisheries and aquaculture activities in Bangladesh and South Asia. Coordination and professional development of ~300 employees and bilaterally supported projects at a total of ~USD 10 million per year.
- Expertise in fish physiology and development, culture and nutrition. 15 years USAID-sponsored leadership in the Philippines.
- Fish physiologist with tenured academic program direction in two large, minority-serving US universities; program building and leadership experience. Advisement and support of 21 graduate and postdoctoral students. Design and construction of two new laboratories.
- Areas of work include progressive analysis of fish culture systems, genomics and DNA, nutrition, pathology, hatchery technology.
- 85 published contributions, including 4 books edited, 1 sole-authored, 81 scientific articles. Most peer-reviewed in international scientific journals, some chapters, a majority either first- or senior-authored. As of March 2016, 1993 citations of my contributions; h-index = 23, i-10 index = 47.

EMPLOYMENT

2015 to date	Science Leader, WorldFish, Bangladesh and South Asia
2007 – 2015	Division Chief, NOAA, US Department of Commerce, USA
2000 – 2007	Marine Program Director and Professor of Biology, Florida International University (Tenured), USA
1989 – 2000	Aquaculture Coordinator and Full Professor, University of Hawaii (tenured), USA

EDUCATION

1989	Postdoctoral Scientist, University of California, Berkeley, California, USA
1984	PhD, Biology/Physiology University of Delaware, Newark, Delaware, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Yan, S., Wang, M., Yang, C.-P., Zhi, T.T., **Brown, C.L.**, Yang, T.-B. (2016) Comparative phylogeography of two monogenean species (Mazocraeidae) on the host of chub mackerel, *Scomber japonicus*, along the coast of China. DOI: 10.1017/S0031182016000160
- Yan, S., Catanese, G., **Brown, C.L.**, Wang, M., Yang, C., Yang, T.-B. (2015) Phylogeography study on the chub mackerel (*Scomber japonicus*) in the Northwestern Pacific indicates the late Pleistocene population isolation. *Marine Ecology* 36 (3): 753–765. DOI: 10.1111/maec.12267
- Reynaud, Y., Millet, J., Couvin, D., Rastogi, N., **Brown, C.L.**, Couppié, P., Legrand, E. (2015) Heterogeneity among *Mycobacterium ulcerans* from French Guiana. *PLoS ONE* 10(2): e0118597. DOI: 10.1371/journal.pone.0118597
- **Brown, C.L.**, Urbinati, E., Zhang, W., Brown, S.B., McComb-Kobza, M. (2014) Maternal thyroid and glucocorticoid hormone interactions in larval fish development, and their applications in aquaculture. *Reviews in Fisheries Science and Aquaculture* 22 (3): 207–220.
- **Brown, C.L.**, Yang, T.-B., Fitzsimmons, K., Bolivar, R. (2014) The value of pig manure as a source of nutrients for mass culture of Nile tilapia in ponds (a review). *Agricultural Sciences* 5: 1182–1193.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Uninterrupted extramural support for research as PI beginning in graduate school; funds from numerous US federal, private and international sources. Extensive networking through collaborative research in Asia and Europe. Served as leader of a National Geographic expedition in remote Brazil, taught biodiversity at a Smithsonian Institution research station in Panama.

ROLE IN FISH

Leader, Cluster 1 – Nutrition-sensitive aquaculture production, FP3 Enhancing the contribution of fish to nutrition and health of the poor

BENNETT, CHRISTOPHER

PROFILE

- 28 years of experience in development consultancy and research, much of which (14 years) has been spent embedded as a long-term advisor in various developing countries (Namibia, the Philippines and Nigeria).
- Deputy Director of the Natural Resources Institute (www.nri.org) and Faculty Deputy Director of Research and Enterprise responsible for leading NRI in these areas of practice.
- Recognized expert and practice leader on postharvest economics, including value chain analysis and commodity markets. Leads work in NRI on the economics and value chain aspects of postharvest losses.
- Expert in the preparation and evaluation of agricultural research projects, having been a Team Leader on five major CGIAR Reviews.
- Expert in agricultural, fisheries and natural product marketing policy and managing research into trade in commodities with 20+ years of experience advising donors and governments on agricultural marketing policy for both perishable and non-perishable products.

EMPLOYMENT

2015 to date	Deputy Director, Natural Resources Institute, University of Greenwich, UK
2006 – 2015	Head of Department, Food & Markets Department, Natural Resources Institute, University of Greenwich, UK
1998 – 2006	Advisor on trade, marketing & agricultural policy, Government of Namibia
1994 – 1998	Advisor on trade, marketing & agricultural policy, Government of Philippines

EDUCATION

1987	MSc Development Administration, University of Birmingham, UK
1983	BSc (Hon), Economics, University of Liverpool, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Bennett, B.** (2015) Smallholder cassava production and the cassava processing sector in Africa. Editorial for a special edition of the *Journal Food Chain*, Practical Action Publishing.
- Abdulsalam-Saghir, P., **Bennett, B.**, Quaye, W., Tu Viet Phu, Sanni, L., Martin, A. (2015) Gender analysis of households' decision-making to reduce post-harvest losses of cassava in Ghana, Nigeria and Vietnam. *Food Chain*.
- Forsythe, L., Nyamanda, N., Mwangwela, A., **Bennett, B.** (2015) Beliefs, taboos and minor crops: The case of Bambara Groundnut in Malawi. *Food, Culture and Society* 18(3).
- Naziri, D., Quaye, W., Siwoku, B., Wanlapatit, S., Tu Viet Phu, **Bennett, B.** (2015) The diversity of postharvest losses in cassava value chains in selected developing countries. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 115(2).

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Team Leader of several major research initiatives and consultancies, including a program in West and Central Africa to improve cassava processing funded by the International Fund for Agricultural Development (IFAD). Editorial Board Member, *Journal Food Chain*. Member, Panel of the Global mFarmer Mobile Phone Initiative. Member of the Organising Committee of the first Global Postharvest Losses Symposium. Has led and won numerous large grants from funders including IFAD, Millennium Challenge Corporation & McKnight Foundation.

ROLE IN FISH

Leader, Cluster 2 – Reducing waste and loss in fish value chains, FP3 Enhancing the contribution of fish to nutrition and health of the poor

THORNE-LYMAN, ANDREW L.

PROFILE

- Senior Nutrition Specialist, Theme Leader Nutrition, WorldFish, Malaysia.
- Nutritional epidemiologist and anthropologist, 18 years of experience working on issues related to nutrition in low-income settings with expertise on epidemiology and study design, food security, measurement of diet and nutritional status, and qualitative research methods.
- 30 peer-reviewed publications, including many in top nutrition and medical journals.

EMPLOYMENT

2014 to date	Senior Nutrition Specialist, Team Leader, Impact Evaluation, WorldFish, Malaysia
2014 to date	Adjunct Lecturer, Department of Nutrition, Harvard School of Public Health, USA
2013 – 2014	Director of Nutrition Research, The Earth Institute, Columbia University, USA
2001 – 2008	Public Health Nutrition Officer, UN World Food Programme, Italy

EDUCATION

2013	ScD Nutrition, Harvard School of Public Health, Boston, MA, USA
1997	MHS International Health, Johns Hopkins School of Public Health, Baltimore, MD, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Thorne-Lyman, A.L.**, Spiegelman, D., Fawzi, W.W. (2014) Is the strength of association between indicators of dietary quality and the nutritional status of children being underestimated? *Maternal & Child Nutrition* 10 (1): 159–160.
- Global Burden of Disease Collaborators. (2014) Global, regional, and national levels and causes of maternal mortality during 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*.
- **Thorne-Lyman, A.L.**, Fawzi, W.W. (2012) Vitamin D during pregnancy and maternal and infant health outcomes: A systematic review and meta-analysis. *Paediatric and Perinatal Epidemiology*. Suppl 1: 75–90. (Second most cited publication in this journal for 2012).
- **Thorne-Lyman, A.L.**, Valpiani, N., Sun, K., Semba, R.D., Klotz, C., Kraemer, K., Akter, N., de Pee, S., Moench-Pfanner, R., Sari, M., Bloem, M.W. (2010) Dietary diversity and household food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. *Journal of Nutrition* 140 (1): 182S–8S.
- Campbell, A.A., **Thorne-Lyman, A.L.**, Sun, K., de Pee, S., Kraemer, K., Moench-Pfanner, R., et al. (2009) Indonesian women of childbearing age are at greater risk of clinical vitamin A deficiency in families that spend more on rice and less on fruits/vegetables and animal-based foods. *Nutrition Research* 29 (2): 75–81.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Investigator, 'Aquaculture for Low Income Consumers' (BMZ/GiZ funded). Principal Investigator, Harvard School of Public Health, USAID Nutrition Innovation Lab in Nepal. Julius B. Richmond Fellowship from the Harvard Center on the Developing Child, 2011; NIH Doctoral Training Grant, 2011–13; Peipers Fellowship, 2009. Co-Leader, United Nations Food Security and Nutrition Assessment, Darfur, Sudan, 2005.

ROLE IN FISH

Leader, Cluster 3 – Fish for nutrition and health of women and children, FP3 Enhancing the contribution of fish to nutrition and health of the poor

PROFILE

Economist with expertise in development, agriculture and commodity markets:

- 8 years of experience in agricultural and development consultancy and research. Long-term experience in Syria; short-term missions to Paraguay, Nigeria, Turkey, Oman, Mauritius, Kenya, Mozambique and Uganda.
- Experience in projects—as leader and team member—on cost-benefit analysis; agricultural commodities value chain studies; policy impact analysis; risk assessment; training and backstopping national analysts of ministries and research institutes; preparation of capacity-building material; data collection, management and analysis; econometrics; economic modeling; international trade; environmental economics.
- Commodity experience includes roots and tubers; grains; fisheries; fruits and vegetables; water and irrigation.
- Italian national, fluency in English and intermediate working knowledge of French.

EMPLOYMENT

2014 to date	Economist, Natural Resources Institute, University of Greenwich, UK
2011 – 2014	Policy Officer/Economist at Food and Agriculture Organization of the UN (FAO), Italy
2009	Junior Economist at Food and Agriculture Organization of the UN (FAO), Italy
2007	Junior Agricultural Economist at Food and Agriculture Organization of the UN (FAO), Syria

EDUCATION

2013	PhD Economics, University of Rome Tor Vergata, Italy
2004	MSc Territorial Marketing and Local Development, Catholic University, Italy

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Tedesco, I.**, Pelloni, A., Trovato, G. (2015) OECD agricultural subsidies and poverty rates in lower income countries. *International Journal of Food and Agricultural Economics* 3(2), Special Issue: 31–49. (ISSN 2147-8988, E-ISSN: 2149-3766).
- Pelloni, A., Stengos, T., **Tedesco, I.** (2015) Aid to agriculture, trade and take-off (forthcoming submission).
- **Tedesco, I.**, Brouwer, R. (2015) Sweetpotato value chains in Mozambique and the potential role for commercial fresh root storage. NRI report, June 2015, University of Greenwich, Chatham: UK.
- **Tedesco, I.**, Stathers, T. (2015) Sweetpotato value chains in Kenya: A business opportunity for puree processing and the potential role for commercial fresh root storage. NRI report, February 2015, University of Greenwich, Chatham: UK. 117pp.
- **Tedesco, I.**, Bellu', L.G., (2015) Supporting evidence-based decision making through impact analysis of policy options for sustainable development, food security and inclusive growth in Nigeria. Rome: Food and Agricultural Organization of the UN (FAO) (forthcoming).
- Battaglia, L., Bellu', L.G., Dieng, C., **Tedesco, I.** (2013) Development paradigms and related policies. Rome: Food and Agricultural Organization of the UN (FAO), Technical Cooperation Division, EASYPOL working paper.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

2007- 2010	Full Scholarship, PhD Program, University of Rome Tor Vergata, Italian Ministry of Education
2004	Tuition fee, MSc Territorial Marketing and Local Development, Catholic University
1997–2002	Scholarships, Undergraduate Program, Bocconi University

ROLE IN FISH

Principal Investigator – Economic fish waste and losses, FP3 Enhancing the contribution of fish to nutrition and health of the poor

BARMAN, BENOY KUMAR

PROFILE

Specialist in the field of aquaculture and aquatic resources management:

- More than 25 years' experience working in Bangladesh, Vietnam, Thailand, Nepal and India.
- Has led a number of projects for WorldFish related to small indigenous fish species and facilitating access to aquaculture technologies by the poor in Bangladesh.

EMPLOYMENT

2012 to date	Senior Scientist/Project Leader, WorldFish, Bangladesh and South Asia
2003 – 2012	Scientist/Project Leader, WorldFish, Bangladesh and South Asia
2002 – 2003	Postdoctoral Fellow, University of Stirling, UK & WorldFish, Bangladesh
2001	Senior Upazila Fisheries Officer, Department of Fisheries (DoF), Bangladesh

EDUCATION

2000	PhD Technical Science, Aquaculture and Aquatic Resources Management, Asian Institute of Technology, Bangkok, Thailand
1990	MSc Aquaculture and Aquatic Resources Management, Asian Institute of Technology, Bangkok, Thailand

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Pant, J., **Barman, B.K.**, Murshed-E-Jahan, K., Belton, B., Beveridge, M. (2014) Can aquaculture benefit the extreme poor? A case study of landless and socially marginalized Adivasi (ethnic) communities in Bangladesh. ISSN 0044-8486. *Aquaculture* 418–419: 1–10. <http://www.sciencedirect.com/science/article/pii/S0044848613004857>
- Little, D.C., **Barman, B.K.**, Belton, B., Beveridge, M.C., Bush, S.J., Dabaddie, L., Demaine, H., Edwards, P., Haque, M.M., Kibria, G., Morales, E., Murray, F.J., Leschen, W.A., Nandeesh, M.C., Sukadi, F. (2012) Alleviating Poverty through Aquaculture: Progress, Opportunities and Improvements. In Subasinghe, R.P., Arthur, J.R., Bartley, D.M., De Silva, S.S., Halwart, M., Hishamunda, N., Mohan, C.V., Sorgeloos, P. (eds). *Farming the Waters for People and Food*. Proceedings of the Global Conference on Aquaculture 2010, 22–25 September 2010, Phuket, Thailand. FAO, Rome and NACA, Bangkok. Pages 719–783.
- **Barman, B.K.**, Little, D.C. (2011) Use of hapas to produce Nile tilapia (*Oreochromis niloticus* L.) seed in household foodfish ponds: A participatory trial with small-scale farming households in Northwest Bangladesh. *Aquaculture* 317: 211–222.
- Haque, M.M., Little, D.C., **Barman, B.K.**, Wahab, M.A. (2010) The adoption process of fish seed production in northwest Bangladesh: An understanding through quantitative and qualitative investigation. *Journal of Agricultural Extension and Education* 16 (2): 161–177.
- Haque, M.M., Little, D.C., **Barman, B.K.**, Wahab, M.A. (2010) The adoption process of fish seed production in northwest Bangladesh: An understanding through quantitative and qualitative investigation. *Journal of Agricultural Extension and Education* 16 (2): 161–177.
- **Barman, B.K.**, Karim, M. (2007) Analysis of feeds and fertilizers for sustainable aquaculture development in Bangladesh. In Hasan, M.R., Hecht, T., De Silva, S.S., Tacon, A.G.J. (eds). *Study and analysis of feeds and fertilizers for sustainable aquaculture development*. FAO Fisheries Technical Paper. No. 497. Rome: FAO. Pages 113–140.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Received Best Fisheries Officers Award of Rajshahi Division from DoF, Bangladesh. Obtained Fellowship Award for Doctoral and Postdoctoral Studies from DFID. Developed several project proposals in collaboration with other colleagues of WorldFish and awarded from donors (DFID, EU, IFAD, BLUE GOLD and others), declared as champions for leading an IFAD-WLE program-funded project.

ROLE IN FISH

Scientist – Small indigenous fish production technologies, FP3 Enhancing the contribution of fish to nutrition and health of the poor

KRUIJSSEN, FROUKJE

PROFILE

- Agricultural development economist with over 12 years of experience in applied research on agri-food value chains and sustainable development.
- Lead researcher for WorldFish on fisheries and aquaculture value chains, markets and trade, providing leadership and support to projects across Asia and Africa.
- Areas of work include improved fish value chain analysis tools, improved models for inputs and service provision, upgrading and governance in fish value chains, and gender integration in value chain approaches.

EMPLOYMENT

2013 to date	Scientist, Markets and Trade, WorldFish, the Netherlands
2010 – 2013	Postdoctoral Fellow, Markets and Trade, WorldFish, Malaysia
2008 – 2010	Independent Consultant, Netherlands (part-time)
2005 – 2008	Associate Scientist, Bioversity International, Malaysia

EDUCATION

Ongoing	PhD International Development, Radboud University, Nijmegen, The Netherlands
2003	PhD MSc Agricultural Development Economics, Wageningen University, The Netherlands

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- Henriksson, P.J.G., Rico, A., Zhang, W., Ahmad-Al-Nahid, Sk., Newton, R., Phan, L.T., Zhang, Z., Jaithiang, J., Dao, H.M., Phu, T.M., Little, D.C., Murray, F.J., Satapornvanit, K., Liu, L., Liu, Q., Haque, M.M., **Kruijsen, F.**, de Snoo, GR., Heijungs, R., van Bodegom, P.M., Guinée, J.B. (2015) A comparison of Asian aquaculture products using statistically supported Life Cycle Assessment. *Environmental Science & Technology* 49 (24): 14176–14183.
- Farnworth, C.R., Kantor, P., **Kruijsen, F.**, Longley, C., Colverson, K. (2015) Gender integration in livestock and fisheries value chains: Emerging good practices from analysis to action. *International Journal of Agricultural Resources Governance and Ecology* 11 (3/4): 262–279.
- Jespersen, K.S., Kelling, I., Ponte, S., **Kruijsen, F.** (2014) What shapes food value chains? Lessons from aquaculture in Asia. *Food Policy* 49–1: 228–240.
- Ponte, S., Kelling, I., Jespersen, K.S., **Kruijsen, F.** (2014) The blue revolution in Asia: Upgrading and governance in aquaculture value chains. *World Development* 64: 52–64.
- Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, Md.S., Mol, A.P.J., Hatanaka, M., **Kruijsen, F.**, Ha, T.T.T., Little, D.C., Kusumawati, R. (2013) Certify Sustainable Aquaculture? *Science* 341: 1067–1068.
- **Kruijsen, F.**, Keizer, M., Giuliani, A. (2009) Collective action for small-scale producers of agricultural biodiversity products. *Food Policy* 34 (1): 46–52.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

2016 to date	Project leader 'Aquaculture for Low Income Consumers' (BMZ/GiZ funded)
2014 to date	WorldFish focal point for CRP PIM
2014 to date	Theme leader, 'Equitable access to markets,' senior leadership team member, AAS
2013 to date	WorldFish research area leader 'Value Chains'
2012 to date	WorldFish focal point for 'Systems Analysis for Sustainable Innovations' Flagship and 'gender initiative' and member of WorldFish leadership team for CRP L&F
2010–2013	Principal Investigator 'Sustaining Ethical Aquaculture Trade' project (FP7-EU funded), leading work package on social and economic dynamics in aquaculture value chains
2005–2008	Grant from the Netherlands Associate Experts Programme of the Ministry of Foreign Affairs. Assignment with Bioversity International.

ROLE IN FISH

Scientist – Fish value chains, FP3 Enhancing the contribution of fish to nutrition and health of the poor

THORNE-LYMAN, ANDREW L.

PROFILE

- Team Leader, Impact Assessment, WorldFish, Malaysia.
- Nutritional epidemiologist and anthropologist, 18 years of experience working on issues related to nutritional surveillance in low-income settings with expertise on epidemiology and study design, food security, measurement of diet and nutritional status, and qualitative research methods.

EMPLOYMENT

2014 to date	Senior Nutrition Specialist, Team Leader, Impact Evaluation, WorldFish, Malaysia
2014 to date	Adjunct Lecturer, Department of Nutrition, Harvard School of Public Health, USA
2013 – 2014	Director of Nutrition Research, The Earth Institute, Columbia University, USA
2001 – 2008	Public Health Nutrition Officer, UN World Food Programme, Italy

EDUCATION

2013	ScD Nutrition, Harvard School of Public Health, Boston, MA, USA
1997	MHS International Health, Johns Hopkins School of Public Health, Baltimore, MD, USA

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Thorne-Lyman, A.L.**, Spiegelman, D., Fawzi, W.W. (2014) Is the strength of association between indicators of dietary quality and the nutritional status of children being underestimated? *Maternal & Child Nutrition* 10 (1): 159–160.
- Global Burden of Disease Collaborators. (2014) Global, regional, and national levels and causes of maternal mortality during 1990-2013: A systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*.
- **Thorne-Lyman, A.L.**, Fawzi, W.W. (2012) Vitamin D during pregnancy and maternal and infant health outcomes: A systematic review and meta-analysis. *Paediatric and Perinatal Epidemiology*. Suppl 1: 75–90. (Second most cited publication in this journal for 2012).
- **Thorne-Lyman, A.L.**, Valpiani, N., Sun, K., Semba, R.D., Klotz, C., Kraemer, K., Akter, N., de Pee, S., Moench-Pfanner, R., Sari, M., Bloem, M.W. (2010) Dietary diversity and household food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. *Journal of Nutrition* 140 (1): 182S–8S.
- Campbell, A.A., **Thorne-Lyman, A.L.**, Sun, K., de Pee, S., Kraemer, K., Moench-Pfanner, R., et al. (2009) Indonesian women of childbearing age are at greater risk of clinical vitamin A deficiency in families that spend more on rice and less on fruits/vegetables and animal-based foods. *Nutrition Research* 29 (2): 75–81.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Investigator, 'Aquaculture for Low Income Consumers' (BMZ/GiZ funded). Principal Investigator, Harvard School of Public Health, USAID Nutrition Innovation Lab in Nepal. Julius B. Richmond Fellowship from the Harvard Center on the Developing Child, 2011; NIH Doctoral Training Grant, 2011–13; Peipers Fellowship, 2009. 30 peer-reviewed publications, including many in top nutrition and medical journals. Focal point on measurement of nutrition impact and results-based management, Strategy and Policy Division, UN World Food Programme Headquarters. Co-Leader, United Nations Food Security and Nutrition Assessment, Darfur, Sudan, 2005.

ROLE IN FISH

M&E Lead (Cross-cutting role)

MCDUGALL, CYNTHIA

PROFILE

- Interdisciplinary, gender and social equity-oriented researcher and team leader with a background in systems thinking.
- Lead and support the development and implementation of gender-integrated, strategic and transformative research across WorldFish research initiatives, including in AAS and L&F, in relation to aquaculture, fisheries management, value chains and livelihood strategies, including micro-credit.
- Main research areas: Gender, community development and livelihoods, natural resource governance, social learning and adaptive collaborative management.
- Total number of peer-reviewed publications: 22 journal articles, book chapters and edited books.

EMPLOYMENT

2015 to date	Senior Scientist, Gender & Equity Theme Leader, WorldFish, Malaysia
2013 – 2014	Independent Consultant
2013	Researcher/Research Award Recipient, Ecosystems Approaches to Health Programme, The International Development Research Centre (IDRC), Canada
1998 – 2008	Research Fellow, Scientist and Science Associate, Adaptive Co-Management Project—Nepal Team Leader, Participatory Research and Gender Analysis Focal Point, Center for International Forestry Research (CIFOR), Indonesia & Canada

EDUCATION

2015	PhD Knowledge, Technology and Innovation Group, Wageningen University, The Netherlands
1994	MPhil Environment and Development, Department of Geography, Cambridge University, United Kingdom

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **McDougall, C.**, Ojha, H. Forthcoming. The persistence of power in community-based natural resource management: A theoretical perspective. *Ecology and Society*.
- **McDougall, C.**, Banjade, M.R. (2015) Social capital, conflict, and adaptive collaborative governance: Exploring the dialectic. *Ecology and Society* 20(1).
- **McDougall, C.**, Jiggins, J., Pandit, B.H., Thapa Magar Rana, S.K., Leeuwis, C. (2013) Does adaptive collaborative forest governance affect poverty? Participatory action research in Nepal's community forests. *Society & Natural Resources* 26 (11): 1235–1251.
- **McDougall, C.L.**, Leeuwis, C., Bhattarai, T., Maharjan, M.R., Jiggins, J. (2013) Engaging women and the poor: Adaptive collaborative governance of community forests in Nepal. *Agriculture and Human Values* 30 (4): 569–585.
- Ojha, H., Paudel, N.S., Banjade, M.R., **McDougall, C.**, Cameron, J. (2010) *The Deliberative Scientist: Towards an Approach to Integrating Science and Politics in Forest Resource Governance in Nepal*.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Successfully fundraised and led collaborative multi-year, multi-scale systems-based governance research (2000–2008). Contributed to establishment of Research Chairs in Health and Global Environmental Change in Sub-Saharan Africa (2013). Keynote presenter: *Gender and Systems Research*. International Conference on Integrated Systems and Sustainable Intensification. IITA, Ibadan, Nigeria (March 2015). Recipient of Research Award, International Development Research Centre (IDRC); Queens' College Bursary, Cambridge University; Dean's Honour Role, Trent University; Economics Letter of Recognition, Trent University; Trent University Entrance Scholarship, Trent University.

ROLE IN FISH

Gender Research Lead (Cross-cutting role)

SCOONES, IAN

PROFILE

- Research focuses on the intersections of livelihoods, agrarian and environmental change, and policy processes.
- Worked extensively on issues of land and livelihoods in Africa, including on land reform, agricultural commercialization and investment, and impacts on agrarian economies.
- Has managed many large, complex interdisciplinary research programs, with partnerships across the world.
- Total number of peer-reviewed publications: 25 books.

EMPLOYMENT

- 2002 to date Professorial Fellow, Director of ESRC STEPS Centre, Institute of Development Studies, University of Sussex, UK
- 1995 to date Fellow in Environment and Development, Institute of Development Studies, University of Sussex, UK
- 1989 – 1995 Research Associate, Drylands and Sustainable Agriculture Programmes, International Institute for Environment and Development, London, UK
- 1985 – 1989 Research Associate, Renewable Resources Assessment Group, Centre for Environmental Technology, Imperial College of Science and Technology, London, UK

EDUCATION

- 1990 PhD Imperial College of Science and Technology, University of London, UK
- 1985 MSc Ecological Management (Distinction), Centre for Environmental Technology, Imperial College, London, UK

SELECTED RECENT PEER-REVIEWED PUBLICATIONS

- **Scoones, I.**, Leach, M., Newell, P. (eds) (2015) *The Politics of Green Transformations*. London: Routledge.
- Catley, A., Lind, J., **Scoones, I.** (eds) (2013) *Pastoral Development in Africa: Dynamic Change at the Margins*. London: Earthscan/Routledge.
- **Scoones, I.**, Marongwe, N., Mavedzenge, B., Mahenehene, J., Murimbarimba, F., Sukume, C. (2010) *Zimbabwe's Land Reform: Myths and Realities*. Suffolk: James Currey.
- Leach, M., **Scoones, I.**, Stirling, A. (2010) *Dynamic Sustainabilities: Technology, Environment, Social Justice*. London: Earthscan.
- Wolford, W., Saturnino, M., Borras, J., Hall, R., **Scoones, I.**, White, B. (eds) (2012) Governing global land deals: The role of the state in the rush for land. Special Issue, *Development and Change* 44 (2): 189–210.
- **Scoones, I.**, Fairhead, J., Leach, M. (2012) Green grabbing: A new appropriation of nature? Special Issue. *Journal of Peasant Studies* 39 (2): 237–261.
- **Scoones, I.**, White, B., Borras, J., Hall, R., Woolford, W. (2012) The new enclosures: Critical perspectives on corporate land deals. *Journal of Peasant Studies* 39 (3–4): 619–647.

OTHER EVIDENCE OF LEADERSHIP, PROGRAM MANAGEMENT AND DELIVERY

Weekly Zimbabwe land blog on ongoing work on land and agrarian change, receives around 3000 views per month. Jointly oversees around £3m per year of research grant funding, from ESRC, NERC and DFID. PI on a number of major research programmes, including the ESRC-funded STEPS Centre, and the Future Agricultures Consortium's China and Brazil in African Agriculture programme. Winner of ESRC's Outstanding International Impact Prize in 2015.

ROLE IN FISH

Principal Investigator – Expanding assets and livelihood opportunities for resource-poor women and youth (Cross-cutting role)

Annex 3.9 Open access management

CGIAR regards results of its research and development activities as international public goods and is committed to widespread dissemination to advantage the poor, especially smallholder producers in developing countries.

The FISH strategy for management of open access should be read in conjunction with its strategy on intellectual asset management. The FISH program will rely on the policies, procedures and capabilities of the lead Center, WorldFish, to ensure compliance with the [CGIAR Open Access and Data Management \(OADM\) Policy](#) and its [Implementation Guidelines](#), both of which have been adopted by the WorldFish Board. Follow this link for more information on WorldFish's [Ownership and Archiving of Research Data Policy](#).

This policy framework stipulates that open access is required for all CGIAR information products. Information products include peer-reviewed journal articles; reports and other papers; books and book chapters; data and databases; data collection and analysis tools (e.g. models and survey tools); video, audio and images; computer software; web services (e.g. data portals and modeling online platforms); and metadata associated with the information products above. Key exceptions include information that is sensitive due to privacy concerns, political sensitivity and adverse effects on farmers' rights; and confidential information associated with permitted restrictions or subject to limited delays to seek IP rights.

The program will use Creative Commons licensing on its self-published information products. All program publications (journal articles, book chapters, policy briefs, factsheets, manuals and guides), along with other published knowledge products (tools and software), will be catalogued and searchable via a FISH program website, in addition to other outlets. For its peer-reviewed research publications, the program will encourage its scientists to publish in open access journals. In those instances where publishing in fee-paying journals is preferred, the program will purchase open access privileges. To ensure proper deposit of journal articles, a pipeline tracking system will be implemented to ensure the program has a clear view of the journal articles and other external publications (e.g. book chapters) to be produced each year, and to ensure that fees for open access are included in the communications budget for particular research activities.

Open access database products produced and maintained by the program will include geo-tagged data, as relevant, on topics such as the genetic characteristics of farmed fish species, comparative data on the implementation of fisheries management regimes, household survey data, and estimates on fish postharvest waste and losses in different locations. Where appropriate global database projects exist, data collection and storage protocols will be designed to contribute to these. Finished datasets will be migrated to the open source [Dataverse](#) network hosted by Harvard University.

Notable databases that will be generated or contributed to by the FISH program include the following:

- **FishBase.** Through FP1 and FP2, the program will contribute aquaculture species data to FishBase, the world's leading open access database on fish biology. WorldFish maintains this database, which was developed by ICLARM (now WorldFish) in the 1980s.
- **Coral Triangle Atlas.** Under FP2, the FISH program will contribute data research in the Philippines and Solomon Islands. The Coral Triangle Atlas (CT Atlas) is an online GIS database, providing governments, NGOs and researchers with a view of spatial data at the regional scale.

Qualitative research information consisting of ongoing knowledge and learning that is amassed over time will be made readily accessible to researchers and other program partners via the CGXchange Google Apps tool. The cloud-based system emphasizes collaboration and learning. A hierarchical set of repositories has been established to co-develop, store and access research information and learning outputs by people working on the same program across the world. Collaboration within and across countries and regions is supported with tools and guidelines and complemented by training and support provisions.

Critical issues and anticipated challenges

To ensure adoption of best practices, WorldFish, as the lead Center for FISH, will continue to participate in the CGIAR Open Access Implementation Working Group and the CGIAR Data Management Task Force, which takes a lead role in coordinating implementation, with a focus on data management. Will provide oversight of data standards and provide policies on standards and interoperability protocols across CGIAR open access repositories.

Research data management and open access implementation will comply with the FAIR principles, which stipulate that information products should be findable, accessible, interoperable and re-usable.

FISH research staff, visiting scientists, consultants and collaborators are expected to be efficient when writing and publishing scientific data and information products (whether through journal publication, accessible databases or other means), in line with the [CGIAR OADM policy](#). The program supports publication in open access journals. Individuals or teams generating data have the first right to publication unless they specifically waive this right. The FISH program will aim to make all information products open access, subject to the legal right and legitimate interest of stakeholders and third parties, including intellectual property rights, confidentiality, sensitivity, and farmers' rights and privacy, with respect to personally identifiable information as described in Annex 3.10 on the intellectual asset management strategy. The decision to provide open access is subject to the value and relevance of the information product to the broader public and with respect to the quality and general characteristics of the product.

Specific conditions are set on the sharing and use of (raw) prepublication scientific data (PSD), meaning all research data, databases, data analyses, data interpretations, draft presentations, reports, manuscripts, intellectual property (whether in preparation or filed, but not published), or other documentation of research results or outputs that are confidential to, or not (yet) disclosed by partners engaged in implementing research within the FISH program.

Project planning and implementation

The FISH management committee will ensure that research teams include the cost of implementing research data management and open access principles in activity budgets and will ask for information about application of these principles as part of the reporting process. Periodic meetings will be organized with managing partners to discuss status of delivery and any concern related to research data management and open access.

At project planning, agreements will be made among project partners on the sharing of PSD, the anticipated resulting information products, publication strategies, and the storage and sharing media to be used. Where PSD sharing is required to meet the objectives of multi-organization projects or programs, the project team should define principles and procedures for data sharing at the initiation of the project or at an appropriate time thereafter. Such principles and procedures for data sharing may be embodied as clauses in a funding or collaboration agreement and will be assessed by the implementing Centers prior to contract execution. Where sensitive data (because of IP, contractual obligation, publication or other reasons) is to be shared between organizations, a confidentiality and nondisclosure agreement will be entered into, which defines the purpose of the data transfer, confidentiality arrangements, and the ways in which the data may be used. Donors or R&D collaborators may request data sharing or confidentiality policies or mechanisms, but such requests must be consistent with the pertinent policies of the implementing Centers and in line with the [CGIAR Principles on the Management of Intellectual Assets](#). Within 12 months after completed data curation and quality control, or within 6 months from publication, information products will be made available through dedicated and pertinent open access media.

Table 1. Deposit schedules from the CGIAR OADM Policy and Implementation Guidelines.

Types of information products	Transition deposit schedule (until 1 October 2018)	Policy deposit schedule (until 2 October 2018)
Peer-reviewed versions of journal articles	As per the Policy Deposit Schedule unless OA is prohibited or subject to a longer embargo period by publisher	Ideally, at the time of publication Latest: 6 months from publication
Self-published journals, books, reports etc.	Immediately	As soon as possible Latest: within 3 months of completion
Reports and other papers	As soon as possible Latest: within 6 months of completion	As soon as possible Latest: within 3 months of completion
Externally or commercially published books and book chapters	As per the Policy Deposit Schedule	As soon as possible Latest: within 6 months of completion
Data and datasets	As per the Policy Deposit Schedule	As soon as possible Latest: within 12 months of completion of data collection or appropriate project milestone, or within 6 months of publication of the information products underpinned by that data
Video, audio, scientific images	As soon as possible Latest: within 6 months of completion	As soon as possible Latest: within 3 months of completion
Photographs	As soon as possible Latest: within 6 months of completion or publication	As soon as possible Latest: within 3 months of completion or publication
Computer software/applications/code	As soon as possible Latest: within 6 months of completion	Upon completion of software development and associated publication where applies
Metadata	As soon as possible Latest: before or on publication of the information product	As soon as possible Latest: before or on publication of the information product
Core/corporate governance documents appropriate for public consumption	As soon as possible	As per 'reports' category of information product (core/corporate governance documents not currently addressed separately in the Policy)

Operations

To ensure sustainability after the CRP ends, the implementing Centers will be responsible for maintaining open access databases and information products. These Centers will follow their OADM policies developed in line with the CGIAR OADM policies and guidelines. The technical OADM infrastructure will adhere to the FAIR principles described above. Data will be findable and accessible through websites of FISH and the implementing Centers and their partners. File formats include jpg, jpeg, xls, csv, doc, avi, mkw, xml, pdf, ascii, and others—preferably open formats that facilitate interoperability. The FISH website provides access to publications (journal articles, books and book chapters, reports, serials, manuals, working papers, research notes, policy briefs, brochures, posters, videos, audio podcasts, images, infographics, and other web tools), datasets (agronomic and socio-economic, survey, experimental, statistical, crop, variety, genetic, etc.), and software and tools (e.g. simulation and statistical models, biometric tools, advisory systems, and aquaculture management tools). FISH information products will be made freely available through these and other websites, such as dedicated project websites.

Within Dataverse, data and databases are as much as possible interoperable: syntactic interoperability is achieved through the use of standard protocols. Databases can be queried using standard protocols on web-based and user-friendly interfaces, and are downloadable, accessible and re-usable through well-described ontologies and explanatory annotations. All datasets are distributed under a [Creative Commons Attribution-NonCommercial 4.0 International License](#). The publication materials are either fully downloadable or linked to third-party websites in cases where copyrights apply (e.g. certain journals that are not open access). For publications that are not copyrighted by third parties (such as certain publishing companies), a [Creative Commons Attribution-NonCommercial-NoDerivs 2.0 Generic License](#) is used. Data is only made available that has passed data curation and data quality-control standards.

WorldFish will conduct regular training for its staff and partners' staff on data management. The research support hub team will conduct quarterly training courses that cover various areas of data management, including research data planning; data collection, authentication and analysis; data storage, backup and security; and data archival, sharing and collaboration.

Staff engaged in program implementation will be expected to archive their PSD, published, metadata and other information products on a regular basis in institutional repositories managed by data managers. Aggregation of data into databases or other data repositories should occur through processes that clarify publication intent and authorship expectations.

The program will track and assess the impact of open access and open data, and will coordinate with the CGIAR Open Access Implementation Working Group to design and implement measures of success.

Capacity and budget for implementation

Capabilities to support implementation are centered in a WorldFish research support hub that includes a research data management support specialist, database specialist, and administrative staff dedicated to publications tracking and management, along with a grants and contracts unit and legal advisory services to monitor compliance in contracting procedures. The primary responsibility for compliance with open access management rests with research and communications teams, and the budget for this is reflected in the FP research budgets. Additional costs to support implementation and compliance for IA and OA jointly, including oversight by the management committee, are included in the program management budget.

Annex 3.10 Intellectual asset management

The FISH program will rely on the policies, procedures and capabilities of the lead Center, WorldFish, to ensure compliance with the [CGIAR Principles on the Management of Intellectual Assets](#) and its [Implementation Guidelines](#), both of which have been adopted by the WorldFish Board. Information products produced by managing and implementing Centers and partners are subject to these policies.

“Intellectual Assets (IA)” refer to any results and/or products of research and development activities, of any nature (including, but not limited to, knowledge, technologies and know-how), whether or not they are or can be protected by intellectual property rights. Examples of IA are peer-reviewed journal articles; reports and other papers; books and book chapters; data and databases; data collection and analysis tools (e.g. models and survey tools); video, audio and images; computer software; web services (e.g. data portals and modeling online platforms); and metadata associated with the information products above; novel germplasm products (varieties, strains, discovered genes, markers, etc.); and novel water, pest and fish disease management technologies.

“Intellectual property (IP) rights” refer to ownership rights over intellectual property (or applications thereof), whether registered or not, granted in any jurisdiction, including but not limited to copyrights and related rights, database rights, patents, industrial design rights, germplasm variety rights, trademarks and service marks, geographical indications, and trade secrets.

Critical issues and anticipated challenges

The lead Center, managing partners and other research partners will ensure, as permitted by law, that they have the rights to the information products produced by their staff, visiting scientists, consultants, students and any other person acting on their behalf. Therefore, the Centers and partners have stewardship and ownership responsibilities towards the information products produced under FISH. Partners will typically co-own information products created under the program, as specified in letters of agreement or partnership contracts.

Parties engaged in program implementation will secure appropriate licenses in accordance with their policies and the CGIAR IA policies as required. They may enter into agreements for the acquisition and use of third-party IA that restrict the global accessibility of the products or services resulting from the use of such IA for commercialization, research and development provided that: (1) they are, to the best of their knowledge, unable to acquire equivalent IA from other sources under no or less restrictive conditions; (2) the products or services that are intended to result from the use of such third-party IA will contribute to the goals and objectives of the program; and (3) managing and implementing Centers and partners shall use their best efforts to ensure that such third-party IAs are only used in relation to, or incorporated into, such intended products or services.

The program will access specialized legal services as required to ensure that policies and practices for IA management are consistent with the following:

- the Convention on Biological Diversity (CBD) and its objectives, including conserving biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits from the utilization of genetic resources
- fundamental rights outlined in the Universal Declaration on Human Rights and other relevant international treaties
- all applicable international treaties, and supranational and national laws on IP

Project planning and implementation

Mechanisms to ensure compliance include IA obligations in staff contracts and partner agreements, a tracking system of databases and publications in progress, confirming that partners follow prior informed consent and confidentiality principles in data collection and storage, and centralized data management protocols.

The FISH management committee will ensure that research teams include the cost of implementing IA principles in project budgets (i.e. open access costs for publications and datasets) and apply IA principles in their reporting processes. Meetings will be organized periodically with cluster leaders to discuss the management and delivery of IA principles. Expectations around IA management and IP sharing arrangements will be included in all project contracts. These will be developed and agreed upon with project partners, including the appropriate distribution channels as per relevant institutional and CGIAR IA policies.

With respect to fish genetic improvement and dissemination, reviews of IP regimes have been completed with respect to patent and fish breeders' rights protection in Asia (Bangladesh, Cambodia, Myanmar, Philippines), Africa (Egypt, Zambia), and Pacific islands (Solomon Islands).

WorldFish will base its data preservation strategy on the Open Archival Information System (OAIS) reference model (ISO 14721:2012); the repository system will provide long-term access to submitted works along with associated metadata. In order to provide long-term access, WorldFish will back up files in a secure and redundant manner, periodically refresh the storage media, and migrate obsolete file formats to recommended open file formats.

Operations

As a condition of program participation, WorldFish and the FISH managing partners commit to keeping their program-related IAs, including germplasm, inventions, improvements, data, processes, technologies, software, trademarks and publications, as freely available as possible to any public or private sector entity in compliance with the CGIAR Open Access and Data Management (OADM) Policy and its Implementation Guidelines. To the extent possible and when appropriate, publication or contractual provisions will be used to ensure that such information, innovation or material remains available for use by the public and private sectors.

In accordance with all relevant biosafety, quarantine, import and export regulations, WorldFish and partners will supply samples of fish genetic resources, whether or not they are conserved in their genebanks, to others for the purposes of research, breeding, and training for food and agriculture. This will be done under the terms of a Standard Material Transfer Agreement and within the limits of capacity and availability, provided they are not subject to IP or other contractual restrictions set by FISH collaborators. Transboundary transfers of live fish will take place in line with the recommendations and guidelines set out in WorldFish policies on [movement of tilapia from Asia to Africa](#), and other non-binding international declarations, such as the [Nairobi Declaration on aquatic biodiversity conservation](#) and the [Dhaka Declaration on ecological risk assessment of genetically improved fish](#).

For innovative models and private sector involvement, WorldFish and managing partners will establish collaborative relationships with the public and private sectors, including civil society organizations. These relationships will enable the FISH program to achieve its goals and objectives, enhance the quality and impact of research, contribute to capacity development, and ensure continued availability and delivery of information and inventions.

In the case of improved fish breeds and feed formulations, time-limited licensing may be pursued to enable commercialization under certain conditions where this is deemed the most effective route to bring the technologies to scale. Where access to patented technology is required, such as the CSIRO aquafeed technology, we will negotiate the terms and conditions of the FISH CRP license to operate. We will adopt this same approach for other patented technologies, including disease screening and prevention technologies.

Capacity and budget for implementation

Capabilities to support implementation are centered in a WorldFish research support hub, including a research data management support specialist, database specialist, and administrative staff dedicated to publications tracking and management, along with a grants and contracts unit and legal advisory services to monitor compliance in contracting procedures. The primary responsibility for compliance with intellectual asset management rests with research teams, and the budget for this is reflected in the FP research budgets. Additional costs to support implementation and compliance for IA and OA jointly, including oversight by the management committee, are included in the program management budget.

Annex 3.11 References

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Annex 3.12 Response to ISPC commentary on the resubmission of the FISH CRP pre-proposal (2017–2022)

In its review of the pre-proposal for a FISH CRP (September 2015), the ISPC recommended that the Fund Council invite the proponents to submit a revised pre-proposal that addresses the main concerns and recommendations of the ISPC. The resubmission of an overview of the FISH CRP pre-proposal was received by the ISPC in January 2016. The resulting ISPC commentary was structured around the four main recommendations made previously by the ISPC and focused on the extent to which the resubmission provided a response to these concerns and recommendations, giving the ISPC confidence that a strong full proposal would be submitted. The ISPC acknowledged that considerable progress had been made but considered that a number of the points and concerns from its previous review still needed substantial additional attention. Each of the recommendations made by the ISPC in its most recent commentary is provided below, along with a summary of the response addressed in the full proposal.

Original ISPC Recommendation 1. *The CRP’s analysis of sector dynamics, ToC, impact pathways, targets, and budgetary allocations need revisiting to address the issues detailed in the ISPC commentary.*

Recommendation: *Meeting future demand growth is highlighted as the central challenge for the CRP. The narrative, however, is not clear on its analysis and understanding of the significant regional differences in addressing this challenge. The current narrative describing impact pathways and ToC needs additional clarity on the changes required, impact pathways, and how these will ensure the systemic change necessary at both local and global levels to achieve the impact at scale that the CRP is aiming for.*

Response: In response to this recommendation, we internally reviewed the probability of the FISH CRP’s success across four dimensions:

- science challenge and capability (science base, technical challenge and project complexity, world-class capability relative to others, and unique capacity)
- capacity to deliver (track record of leadership, team composition and effectiveness, scientific partnerships and linkages, and infrastructure and equipment)
- clarity of planned outcomes (quantitative and qualitative)
- clearly defined delivery pathways (capacity of focus countries, stage of partner involvement, partner capacity to co-invest, and end-user capacity to adopt research advances).

The results of this review have been incorporated into the revised FISH impact pathways and theories of change. We have included identified risks and assumptions for CRP and flagship levels in the design of corresponding strategies and risk management actions (see sections 1.3 and 1.15, as well as theory of change for each flagship). To test assumptions and improve results at the CRP and flagship levels, we will use an integrated approach to outcome evaluation and impact assessment. These assessment activities will help us refine the targeting and design of project activities and demonstrate quantitative progress towards SLO and IDO targets, enabling us to adjust investment in our research areas and geographies for best impact. The revised impact pathways and theories of change were also key to the revision of the proposed FISH budgetary allocations.

Original ISPC Recommendation 2. *The CRP needs to show that it has selected its priority research opportunities based on its comparative advantage and address the quality of science in the associated research activities.*

Recommendation: *The FISH resubmission makes the case for the CRP’s contribution to all three SLOs, via significant contributions to IDO targets in 7 priority focus countries and 7 other scaling countries. While this initial targeting effort is commended there is a need for further prioritization and a process that would allow the CRP to set and refine its research strategies and targets its specific areas of comparative advantage.*

Response: We comprehensively reviewed and refined our geographic focus based on the following factors:

- the current status and projected future potential of aquaculture and SSF in developing countries
- the probability that FISH and its managing and implementing partners can effectively and competitively respond to demands for research and deliver impacts at scale
- striking a balance between the needs of producers and consumers in regions where the poor already have good access to fish versus regions where the potential to increase supplies of fish and improve livelihoods is yet to be realized
- where FISH can best integrate and optimize the co-contributions of aquaculture, small-scale fisheries and fish value chains to reduce poverty and improve food security alongside improvements to environmental sustainability.

From this review we selected six priority focal countries: three in Asia (Bangladesh, Myanmar and Cambodia) and three in Africa (Zambia, Nigeria and Tanzania), where we can most coherently integrate our multidisciplinary strengths in sustainable aquaculture, SSF and enhancing the contribution of fish to nutrition and health of the poor. Two additional countries will constitute a focus for particular areas of research: Egypt as a research hub and training center for our aquaculture capacity development in Africa, and Solomon Islands as a hub for our learning networks on SSF governance in the Pacific. As detailed in the revised FISH proposal, in selecting our focal countries and scaling countries, we applied a series of metrics tailored to each of the three flagships (sustainable aquaculture, sustaining small-scale fisheries, and enhancing the contribution of fish to nutrition and health of the poor). See section 1.1 and details in each flagship on focus and scaling countries.

Recommendation: *The SLO2 description would benefit from further clarification of its intention in respect of “small indigenous fish species”. What would be the justification for a significant investment in this area, and what research strategy do the proponents suggest to pursue? Similarly, in the SLO3 description on resource governance in aquaculture, FISH needs to clarify its comparative advantage in this area, and how this integrates with related global and regional initiatives.*

Response: The justification for investment in the production of small indigenous fish species and the proposed research strategy are fully articulated, with relevant citations, in the revised proposal (detailed in FP3). In summary, the potential for controlled, year-round production of highly nutritious small indigenous fish in small-scale enterprises in the developing world is a new approach based on initial discovery research in Bangladesh that has significant potential to scale in South and Southeast Asia. Fish farming in Asia is dominated by carp and tilapia, comparatively large species whose major nutritional value is their contribution to dietary protein. There are, however, several species of small freshwater fish, notably mola (*Amblypharyngodon mola*), that are a rich source of the nutrients needed for healthy growth and brain development, including iron, zinc, vitamin A, vitamin B12, calcium and essential fatty acids. Extensive field experiments in Bangladesh have demonstrated that mola can be grown in polyculture with tilapia, carp and other commonly cultivated large fish species without adversely affecting total productivity. Ex ante analysis has shown that scaling up production of mola in a national program could be a cost-effective nutritional intervention for reducing vitamin A deficiency. We contend that conducting research to overcome barriers to achieving such scaling of mola production, alongside our research on the more established tilapia and carp sectors, provides FISH significant additional capability to contribute to the SLO nutrition targets.

Recommendation: *The analysis of national fisheries strategies in the Pacific regions and importance of inshore fisheries for national food security and well-being, suggests demand, but clarification of the comparative advantage for the CGIAR, and FISH in particular, in this area is required. This is particularly important, as the Pacific does not seem to be part of the priority focus areas of the CRP. The confirmation of the CAADP national stakeholders’ commitment to the FISH program is welcome but more details will be needed in the full proposal on the research priorities and the targets of FISH in SS Africa, and how they are embedded in NEPAD and the CAADP roadmap.*

Response: In the revised proposal, particularly in the FP2 narrative, we detail the comparative advantages for FISH and its managing and implementing partners contributing to national fisheries strategies in the Pacific, as well as the importance of inshore fisheries for national food security and wellbeing. We also clarify the reasons for and extent of the engagement of FISH in the Pacific. Likewise, we more clearly articulate FISH research priorities and targets in SS Africa, and how they are embedded in the CAADP roadmap. We highlight this for FP1 in particular, where the program has been designed to align explicitly with the priorities of the African Union's Pan-African Plan of Action for sustainable aquaculture development, and the national priorities such as improved seed, feed and fish health being pursued under this framework. By working closely with AU-IBAR and NEPAD in the design and implementation of this research agenda (including via facilitation of a regional workshop in March 2016) and in the dissemination of outputs through support to capacity development and policy initiatives, the program is also positioned to contribute to achieving outcomes at wider scale as an increasing number of African countries expand their investment in aquaculture development under their CAADP compacts.

Recommendation: *The gender narrative in the CRP needs to provide additional evidence of its understanding of gender, and how this has shaped the CRP research agenda. Inclusion of the lessons learned in the past and how current proposals build on that is equally important. In addition, providing a clearer link of the gender narrative to the subsequent descriptions of the Flagships and clusters is also recommended.*

Response: We have addressed this concern via a comprehensive expansion of the gender narrative, as now detailed in section 1.4, in each of the flagships and in Annex 3.4.

Recommendation: *A recurrent issue in the current narrative seems to be the absence of other CRPs (apart from IWMI in FP2; cluster 1). Much more information will be required in the full proposal on the links with other CRPs, e.g. PIM's role in foresight; and the role of other AFS-CRPs e.g. on feeds; nutrition; resource use; diets; food safety etc. Moreover, lessons learned in the current AAS, and Livestock & Fish CRPs, and how these are integrated, acted upon, and taken forward in the current proposal need clarification.*

Response: We have addressed this concern with a more detailed and inclusive narrative of the engagement of FISH with other CRPs. We detail the nature of FISH collaborations with four global integrative CRPs: PIM, CCAFS, A4NH and WLE. Additional, targeted linkages include those between the aquaculture breeds research and the CGIAR platforms on Genetic Gains and Big Data. Particular site integration activities also include new links with RICE on integrated rice-fish systems, RTB on cassava waste inputs to novel aquafeeds and Livestock on animal health and feeds. An overview of cross-CRP integration is provided in Annex 3.7, Table 1.

Original ISPC Recommendation 3. *The CRP needs to clarify its networking and partnership arrangements, roles and responsibilities on the basis of comparative advantage and subsidiarity.*

Recommendation: *Compared to the previous version of the pre-proposal, there have been significant changes in the strategy and design of the CRP partnership. However, the partnership approach needs further details, and clarification; what, for example does the "careful selection of partners in target countries" entails. The partners are still largely presented as a list, with no evidence of the strategic thinking underlying choices and the comparative advantage of the selected research partners in the various clusters. In addition, limited attention seems to have been given, thus far, to national partners, site integration, and country objectives. Given the number of clusters suggested to be led by partners and ARIs, there is a need to document the leadership and value added of WorldFish. Further clarity on how the CRP will link its development and testing of foundational science and practice to global multi-stakeholder initiatives critical to knowledge application, systemic change, and impact at scale, is also required.*

Response: We have addressed this concern via a more detailed explanation of our partnership strategy, including partner types, partnership modalities, selection of partners, and the competitive advantages and specific contributions of these partners along the discovery, proof of concept and scaling stages in the impact pathways. This includes a more detailed illustration of partnerships for each cluster of activity and examples of strategic research partnerships, as well as cross-CRP collaboration and site integration. We have also provided further detail on the comparative advantage of WorldFish and partners in section 1.8 on Partnerships and Comparative Advantage. We complement this with further information on multi-stakeholder partnerships in the flagship narratives, and an illustrative sample of these is tabulated in Annex 3.2 (Partnership Strategy).

Original ISPC Recommendation 4. *The CRP needs to provide a rationale for its geographical focus, and a strategy on how it will link local level multi-stakeholder partnership with higher-level alliances, thereby creating conditions for the systemic innovation that is required to attain the levels of impact indicated.*

Recommendation: *The revised FISH pre-proposal states its focus on local and system-level analyses and interventions to support improved governance of fish food systems, but does not elaborate convincingly on the rationale for this. It is also not clear whether the proposed focus on “governance of fish food systems” is related to capture fish systems, inland, sea, aquaculture, or all of the above. The FISH regional focus and particularly the differential features of this focus need further clarification. The current network of partners and partnership seems to be lacking clear pathways or processes that will contribute to systemic change and impact at scale (see comment #3 above). The only description that gives a hint of this is in relation to the mentioned partnership with the SPC. Similarly in SS Africa, evidence should be presented on how the CRP’s research will be embedded in the AU-NEPAD and the CAADP strategies, for instance in targeting the Malabo declaration goals. More information will also be needed on the specific role and the comparative advantage of FISH in these processes.*

Response: We have clarified the program’s focus on fish food systems; i.e. building “the evidence base needed to influence policy” enabling productive and equitable SSF and the associated change mechanisms specified in the impact pathway and theories of change for flagship 2. We have also provided more specificity (in Annex 3.2, summarizing the program’s Partnership Strategy) on the mechanisms through which we believe that the program’s research can lead to systemic change. We provide more detail on our partnership with SPC, which builds on long-standing collaboration, and with AU-IBAR and NEPAD, focusing on the African Union’s Pan-African Plan of Action for sustainable aquaculture development.