CGIAR RESEARCH PROGRAM ON Fish
Led by WorldFish

CGIAR Research Program on Fish Agri-Food Systems

Annual Report 2019

Led by WorldFish

In partnership with

IWMI International Water Management Institute

JAMES COOK UNIVERSITY AUSTRALIA

UNIVERSITY of GREENWICH

WAGENINGEN UNIVERSITY & RESEARCH

List of acronyms

A4NH	Agriculture for Nutrition and Health CRP
AAS	Aquatic Agricultural Systems CRP
ABS	access and benefit sharing
AMR	antimicrobial resistance
BMGF	Bill & Melinda Gates Foundation
BoP	Bottom of the Pyramid
CCAFS	Climate Change, Agriculture and Food Security CRP
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGIAR	Consultative Group for International Agricultural Research
CRP	CGIAR research program
EAC	East African Community (Burundi, Kenya, Rwanda, South Sudan, Tanzania, Uganda)
FAO	Food and Agriculture Organization of the United Nations
FCR	feed conversion ratio
FISH	CGIAR Research Program on Fish Agri-Food Systems
FP	flagship project
GIFT	genetically improved farmed tilapia
GTA	gender-transformative approach
ha	hectare
ICT	information and communications technology
IEA	Independent Evaluation Arrangement (of the CGIAR)
IDO	intermediate development outcome
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
ISC	FISH Independent Steering Committee
ISI	Institute for Scientific Information
IWMI	International Water Management Institute
JCU	James Cook University
kg	kilogram
KIT	Royal Tropical Institute (Netherlands)
L&F	Livestock and Fish CRP
LCA	life-cycle assessment
MARLO	Managing Agricultural Research for Learning and Outcomes
M&E	monitoring and evaluation
MC	FISH Management Committee
MEL	monitoring, evaluation and learning
NEPAD	New Partnership for Africa's Development

PDF	postdoctoral fellow
PIM	Policies, Institutions and Markets CRP
PMU	Program Management Unit
POWB	Plan of Work and Budget
R&D	research and development
RICE	Rice Agri-Food Systems CRP
SADC	Southern African Development Community (Angola, Botswana, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe)
SDG	Sustainable Development Goal
SLO	system-level outcome
SNP	single nucleotide polymorphism
SRF	Strategy and Results Framework (of the CGIAR)
SSF	small-scale fisheries
TAAT	Technologies for African Agricultural Transformation
TiLV	tilapia lake virus
USD	United States dollar
W1/W2	CGIAR funding windows 1 and 2
W3	CGIAR funding window 3
WLE	Water, Land and Ecosystems CRP
WUR	Wageningen University & Research

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Executive summary

This annual report provides key achievements of the CGIAR Research Program on Fish Agri-Food Systems (FISH) during 2019. The results of FISH during this year included: 1) the discovery of innovations for sustainable development of aquaculture and fisheries; 2) substantial contribution to policy influence and change across the fish agri-food system from national to global levels in Africa, Asia and the Pacific, and; 3) the delivery of improved livelihoods, nutrition and environmental outcomes to the users of FISH research, through a growing network of research collaborators and development partners. The emerging evidence and innovations from FISH are shedding light and laying a strong foundation for future impacts related to the global food systems transformation towards healthier and sustainable diets, where fish and aquatic foods have a considerable role to play.

New breeds of carp and new resilience traits for tilapia from FISH aquaculture research during 2019 led to the production of the first ever selected generation of silver carp (*Hypophthalmichthys molitrix*) in Bangladesh and the completion of experiments on each of three key resilience traits targeted by FISH (resistance to disease; feeding efficiencies and response to low dissolved oxygen), utilising the SNP chip developed in 2018. A novel digital tool was developed and applied to on-farm performance assessments of improved tilapias in Egypt and Bangladesh, and is now ready for wider application in performance assessments across key countries in Africa and Asia. Aquaculture discoveries are increasingly integrated across breeds, health and feeds research clusters in order to ensure optimal health outcomes in line with OneHealth approaches. Significant advances were made in the detection and mitigation of the tilapia lake virus (TiLV), application of a novel epidemiological and health economics tool to assess disease occurrence and risks and understanding of the TiLV transmission via tilapia eggs and sperm, all opening ways for surveillance and mitigating risks of this globally significant fish disease. The on-line digital epidemiology and health economics tools piloted in carp and tilapia farming systems in Asia and Africa are now ready for wider use, providing powerful analytical tools for assessing and managing aquatic animal health risks in fish agri-food systems. Aquaculture pathogens sequencing was combined with rapid diagnostics to build and scale a "*Lab in the Backpack*" concept to improve fish disease detection and management, which won this year's big prize at the 2019 Inspire Challenge, CGIAR's digital signature process run by the CGIAR Platforms for Big Data in Agriculture. The nutritious pond concept is being recognized as a key innovation for sustainably increasing productivity and improving environmental benefits of pond based tilapia aquaculture, attracting private sector partners for scaling in Bangladesh and Zambia.

Research on small-scale fisheries made significant progress in setting critical high level policy and investment agendas at global and national levels. High impact research products included *The Future of Food from the Sea* report and its related recommendations for decision makers as part the expert group to the High Level Panel (HLP) for A Sustainable Ocean Economy. A high impact factor journal article aimed to shift the global "Blue Economy" agenda and policy discourse towards more equitable inclusive governance. This research is informed by and enabling on the ground innovations in co-management, livelihood and technology in coastal areas, particularly Timor-Leste, Solomon Islands, and the coastal Hilsa (*Tenualosa ilisha*) fishery in Bangladesh and Myanmar. A novel predictive model for nutrition qualities of marine fish was published in *Nature*, and applied to landed catches demonstrated the significant potential of redirecting catches to address malnutrition in coastal regions. The results can now be combined with national level policy reform and behaviour change tools to enhance the nutrition and health outcomes for vulnerable coastal populations. Foundational research on increasing fisheries productivity within deltaic agricultural landscapes and water management systems led to the development of a set of new evidence-based fish and water guidelines, to be released in 2020 to guide policy development with decision-makers in the water sector, and with special attention to their application in the Mekong sub-region. Building up on methodologies developed in 2018, fifty national-level case studies were completed through a multi-partner research collaboration, co-led by FISH, FAO and Duke University, to illuminate the hidden economic, social and food and nutrition security values of small-scale fisheries, at global and national scales. This comprehensive study, along with an unique set of global and regional datasets, will provide small-scale fisheries and their critical contributions to the global sustainable development agenda with due attention in policy and investment decisions.

Part A: Narrative section

1. Key results

1.1 Progress toward SDGs and SLOs (sphere of interest, with research results frequently predating the CRP

FISH contributes to the CGIAR's Strategy and Results Framework (SRF) across all three system-level outcome (SLO) domains: reduced poverty (SLO 1), improved food and nutrition security for health (SLO 2) and improved natural resources and ecosystem services (SLO 3). FISH contributes through investments in research for development (R4D) in two flagships, Sustainable Aquaculture (FP1) and Sustaining Small-Scale Fisheries (FP2), within the context of fish and aquatic foods in global food systems. Evidence supporting the statements below is provided in Table 1.

Sustainable aquaculture research delivers improved fish breeds, aquafeeds and feed management, fish disease mitigation, aquaculture farm management and value chain system innovations. Dissemination and uptake of existing lines of improved tilapia breeds (genetically improved farmed tilapia, GIFT), carp-based fish polyculture systems, and aquaculture feed and health innovations and business models via public and private partners in Asia, Africa and the Pacific was accelerated in 2019. More than 39,000 households were reported as adopting improved fish strains and carp polyculture systems in Bangladesh, India, Myanmar and Timor Leste. Increased focus on private sector partnerships in 2019, with a new private sector engagement strategy for WorldFish endorsed by the WorldFish Board of Trustees in November 2019, has also opened new pathways for scaling key innovations and accelerating impacts.

Research on sustainable small-scale fisheries delivers results through a number of partnerships operating at various scales from community to regional levels in a number of areas: improved co-management and community-based fisheries management systems; water management innovations in multi-functional rice-dominated landscapes in the Mekong region; and improved policies that enable more productive and equitable management of inland and coastal fisheries. During 2019, more than 8,200 households adopted improved fishery management practices in Bangladesh and Cambodia. Co-management principles applied to practices across large areas of the Meghna river system in Bangladesh continue to delivered household incomes and environmental results and protect important hilsa (*Tenualosa ilisha*) fisheries, which are culturally and nationally important.

Evidence from evaluations of the overall FISH achievements in 2019 related to SLOs 1.2, 2.3 and 3.3 indicates that more than 297,000 people were assisted to exit poverty; more than 211,000 vulnerable women, children and men increased fish consumption and/or dietary diversification due to aquaculture and small-scale fisheries interventions; and 673,000 hectares of water were brought under improved fisheries co-management and aquaculture management. This year, FISH increased the number of impact assessments, including third party evaluations, to capture the multiple outcomes and impact of aquaculture and fisheries innovations and build a stronger evidence-based case on the critical role of fish and aquatic foods in the transformation of global food systems towards healthier and sustainable diets that work for people and the planet. Our goal is to ensure that the FISH research work and evidence serve as foundation for a new research program on fish and aquatic food systems in response to the global call to action for food systems transformation (Section 2.4).

1.2 CRP progress toward outputs and outcomes (spheres of control and influence)

1.2.1 Overall CRP progress

FISH delivers benefits to the poor and vulnerable in developing countries in Africa, Asia and Pacific by advancing scientific and practical knowledge on sustainable aquaculture and small-scale fisheries from local to global levels. Positive progress was made in 2019 in delivering priority outputs and outcomes from the two flagships and milestones in the 2019 Plan of Work and Budget (POWB) (Table 5). International public goods on fish agri-food systems this year included 63 peer reviewed publications (59 indexed by ISI), including journal articles, books or book chapters, plus 110 policy and technical briefs and knowledge products for dissemination, in 16 languages. New and critical understanding of fish in food systems continues to emerge from our research work, which in turn is reshaping traditional views on responses to the challenges posed by climate change, by public health issues related to the triple burden of malnutrition and by the increasing need to meet growing global demand for fish within planetary boundaries.

FISH reported 44 innovations during 2019, up from 2018 across all stages; from discovery/proof of concept; successful piloting; ready for direct uptake and uptake by next users. These innovations contribute improvements across fish agri-food system transformation, from sustainable supplies of fish from aquaculture and small-scale fisheries, through to value chain and product development. The use of FISH research at scale is increasingly helping to shape the policy environment for uptake of these innovations and this year, our work influenced development of at least 27 improved policies and/or investment decisions at various levels. These include among others: an USD10.7 million African Development Bank investment in a Sustainable Fisheries and Aquaculture Development Watershed Management project in Malawi, a Southern Africa Development Community (SADC) Regional Tilapia Genetics program and further shifts in land use policies related to rice-fish system and agricultural diversification through aquaculture in Myanmar. At national level, FISH research helped shape policies on sustainable aquaculture, land and water management and fisheries in nine countries during 2019; in Bangladesh, Cambodia, Egypt, India, Malawi, Myanmar, Solomon Islands, Timor-Leste and Zambia. Research on gender transformative approaches and a new “Women’s Empowerment in Fisheries Index (WEFI) are increasingly integrated into the outcomes being delivered.

1.2.2 Progress by flagships

Sustainable Aquaculture (FP1)

FISH research on new breeds of tilapia and carp and new resilience traits for tilapia advanced during 2019 with the production of the first ever selected generation in Bangladesh of silver carp (*Hypophthalmichthys molitrix*) and the completion of experiments on each of three new resilience traits in Nile tilapia (resistance to disease; feeding efficiencies and response to low dissolved oxygen), utilising the single-nucleotide polymorphism (SNP) chip developed in 2018. On-farm performance studies of improved tilapia in Egypt and Bangladesh were completed integrating work with cluster 3 which has developed an novel digital tool for a standardised approach to assessing on-farm performance across four focal countries. The discovery of evidence of vertical transmission of the globally important tilapia lake virus (TiLV), via eggs and sperm, highlights the benefits of the integration of our epidemiological research (cluster 2) and the development of disease resistant tilapias (cluster 1).

An innovative online digital epidemiology and health economics tool for use in carp and tilapia farming systems has been piloted and is ready for use at scale in FISH focal and scaling countries in Africa and Asia. Sequencing of aquaculture pathogens and development of rapid diagnostics attracted Inspire Big Data support to a “*Lab in a Backpack*” concept to improve fish disease detection and management. The nutritious pond concept was recognized by the Rockefeller Foundation and private sector partners as a key innovation increasing productivity and improving environmental benefits of pond based tilapia aquaculture. Experiments in tilapia showed the deficiency in dietary essential amino acid lysine is significantly reduced through controlled manipulation of pond food webs, opening avenues for more efficient tilapia pond production systems. Scoping of a new country aquaculture program to extend FISH research into Nigeria progressed well this year.

Sustaining Small-Scale Fisheries (FP2)

Four high impact journal publications during 2019 highlighted key FISH research during 2019. A paper on equitable blue economy shed light on ways to ensure equitable and sustainable management of coastal areas, complementing research and development at local levels on co-management, livelihood and technology innovations in coastal areas of Timor-Leste, Solomon Islands, and the coastal hilsa (*Tenualosa ilisha*) fishery in Bangladesh. A publication in *Nature* communicated a novel predictive model to fill knowledge gaps in nutrient composition of marine fish species and to apply that model to understand the potential of landed catches for addressing malnutrition in coastal regions. The combination of this analysis with national level policy reform and local level behaviour change tools enables a new combination of multi-level guidance and innovation for nutrition-sensitive management of fisheries. Foundational pieces of research on irrigation and fisheries, led by program partner IWMI, provided evidence-based foundations for fisheries and water infrastructure guidelines to enhance fisheries productivity in multi-functional landscapes. Fisheries co-management innovations were scaled including in the Bangladesh hilsa fishery, with significant progress in transforming the fishery towards more sustainable management. In Timor-Leste, consultation with fishers and a national convening led to the co-development of a new National Fisheries Strategy and Fisheries Law revisions governing 75,000 ha of coastal seas. Funding was secured to establish a fish in food systems research initiative in the Great Lakes of Africa, a key fisheries resource for the region with critical significance for meeting local and regional food and nutrition security needs.

1.2.3 Variance from planned program for this year

(a) Have any promising research areas been significantly expanded?

The work of FP1 proceeding broadly in line with the major themes in the FISH proposal and the POWB 2019 priorities, though some minor changes were made during the year. Research on aquaculture systems was strengthened during the year with more focus on integrated farm performance assessment tools. The genetics and fish health in particular were expanded during 2019 through partnerships and bilateral project funding, signalling strong demand for research in this subject area. Biosecurity associated with fish breeding programs and protection of core GIFT stocks was enhanced during the year, responding to the risks associated with fish disease, and the Tilapia Lake Virus (TiLV) in particular. Research on anti-microbial resistance (AMR) a critical challenge of global importance in agriculture and aquaculture was expanded in the portfolio, with FISH playing a particularly active role in the CGIAR Antimicrobial Resistance Hub. Research in this field is expected to grow further with the increasing interest and emphasis on “One Health” approaches. In FP2, research on digital tools and approaches to assessing and managing small-scale fisheries continued to expand with a further catalytic innovation grant from the 2019 Inspire Challenge of the CGIAR Platform on Big Data in Agriculture, enabling FISH to grow its innovative digital approach to small-scale fisheries sustainability. Research with IWMI and IRRI on rice-fish systems grew during the year, with promising new avenues emerging for extension of Asian rice-fish systems into Africa. Monitoring, Evaluation and Learning investments were also increased across the portfolio.

(b) Have any research lines been dropped or significantly cut?

A number of delays to work have occurred in producing the next generations of selectively bred fish and studies of on-farm performance, some related to the need to respond to an unexpected outbreak of Tilapia Lake Virus (TiLV). Most have been rescheduled for 2020 and have not required a change in program direction. No W1/W2 funding was provided in 2019 for research on inclusive and gender sensitive business and entrepreneurial models, with funds redirected to other sustainable aquaculture activities, specifically ensuring completion of the tilapia farm performance assessment tools and outcome and impact assessments.

W1/W2 allocation to FP2 allowed continued progress to be made in small-scale fisheries research, nevertheless reduction in W1/W2 funding compared to the original FISH proposal required significant prioritization. Multifunctional landscape research with IWMI, a research area of significant promise, was focused on the Mekong region, and fish in regional food systems and small-scale fisheries research in Africa remained underinvested, pending availability of bilateral funds. The funding shortfall in small-scale fisheries was partially made up by bilateral funding, notably an Oak Foundation grant on improving collaborative governance, M&E and communications and a strong cooperation with the Food and Agriculture Organization (FAO) for policy oriented research and influence. New funds were

also made available later in 2019 for research on fish in the Great Lakes food system. Research on livelihoods and innovations towards poverty reduction were decreased in emphasis, but with some re-orientation on exploring the promising pathways for enhancing nutritional outcomes from small-scale fisheries given more priority.

(c) Have any research areas taken new directions due to unexpected research results (positive or negative)?

Research findings related to the genetics of response to TiLV are leading to some significant discoveries related to the genetics of disease resistance, with TiLV disease outbreaks in a GIFT population providing a unique opportunity for close monitoring and evaluation of genetic response. Research on the micro-nutrients in coastal fisheries is also opening new opportunities to enhance the nutritional outcomes from small-scale fisheries, to which FISH is responding with further research to influence policy and development investments. This research line is also being replicated in inland systems in cooperation with FAO. Opportunities for influence and scaling social, ecological and policy innovations were also taken in 2019, including participation of several FISH researchers and partners contributing to a FAO led International Symposium on Fisheries Sustainability to develop a new vision for capture fisheries in the 21st Century, with FISH research featuring significantly in the upcoming Symposium publication and policy recommendations.

1.2.4 Altmetric and publication highlights

During 2019, FISH produced peer-reviewed publications, briefs, manuals, reports and other documents for a diverse user group. A total of 63 peer-reviewed publications were published, of which 43 (68 percent) were open access and 59 (94 percent) were published in Institute for Scientific Information (ISI) publications (Table 6. Numbers of peer-reviewed publications from current reporting period). Altmetric scores reached a significant program high for FISH in 2019, with six papers having scores greater than 100, all from the small-scale fisheries team. The highest Altmetric score (656) was associated with a paper in *Nature,* "Harnessing global fisheries to tackle micronutrient deficiencies" and five other papers related to governance, management and dependency on aquatic systems. The Nature article was widely shared across 28 news networks and 1098 tweets[1]. Another influential paper during the year integrated agriculture and marine fisheries in an analysis of key hotspots requiring adaptation investments, of importance to FISH, the Climate Change, Agriculture and Food Security (CCAFS) CRP and the future CGIAR research portfolio.

Top FP1 peer-reviewed publications included the first systematic review of yield gap in Nile tilapia farming and an assessment of hotspots of antimicrobial resistance (AMR) in aquaculture systems, providing key insights for "one health" related interventions. Key foundation papers for future fish genetics, feeds and health were published, including a systematic review of fish trait preferences, behavioural hierarchies and feed efficiency in GIFT tilapia, and vertical transmission of Tilapia Lake Virus (TiLV), the latter with major implications for control of the disease, especially in breeding programs. The tilapia yield gap review underscored the importance of developing breeds tolerant of variable dissolved oxygen levels, a key trait being explored by FISH researchers. Publications reflect increasing integration across the research clusters and set a strong foundation for applying genomics technologies to breed new traits into tilapia to reduce risks and enhance productivity.

FISH gender research had another prominent year, with a key review from the WorldFish-led CGIAR Gender Postdoctoral Fellow Initiative, a global first to connect fish breeding with user preferences, and a series of papers on gender dynamics, norms and political economy, including three new empirical studies that surface gender implications for small-scale fisheries livelihoods in the Pacific and Malawi. A 2019 Gender Special Issue of the Journal of Maritime Studies was led by a member of the FISH gender team, and emerging Scientist Surendran Rajaratnam brought together multi-country insights as editor of the first Gender in Aquaculture and Fisheries Newsletter to inform our growing livelihoods and markets work in FISH, as well as to respond to the growing call for gender and political economy analysis.

[1] Web site accessed on 14/04/2020

1.3 Crosscutting dimensions (at CRP level)

1.3.1 Gender

(a) CRP research findings, methods or tools, capacity development, policy changes or outcomes:

FISH program level gender contributions in 2019 focused on new methods and tools, capacity development and policy influence.

- *Methods and tools* development in 2019 gave special attention to women's empowerment and value chains. Despite increasing requirements for engagement with gender and women's empowerment there are still a multitude of weaknesses in understanding, strategies, and M&E in fisheries and aquaculture. One common example is projects conflating women's participation in value chains with women's empowerment, stemming from such factors as a lack of robust evidence and a dearth of reliable frameworks and methods tailored to fish agri-food systems contexts. Two key investments to address these shortcomings were made in 2019: (i) a partnership with KIT to consolidate and refine the WorldFish before-and-after (longitudinal) framework and methods for assessing women's empowerment; this 'WEFI' tool will undergo cognitive testing in 2020 before being integrated into our own M&E and made available for scaling more widely. (ii) the development of a bespoke mixed methods methodology with partner "Includovate" to assess pathways to women's empowerment in small-scale fisheries. Taking into account endogenous and exogenous framings, this methodology will enable the development of multi-dimensional SSF case studies to inform fisheries policy and practice. In 2019 FISH developed a bespoke and unique framework that brings together analytical and conceptual elements from 'value chain analysis' and 'social and gender analysis' into one comprehensive approach, advancing the field by applying an intersectional lens and enable investments in aquaculture and capture fish value chains to be designed to be more inclusive and better enable diverse women to benefit in a safe and dignified manner.
- *Capacity development* focussed on an innovative gender integration coaching program to enable more systematic gender integration in projects and build capacity of FISH team members, including partners, and to operationalize the FISH Gender Strategy. FISH and partner KIT piloted a Theory of change-based workshop and gender coaching program in Egypt, Solomon Islands and Myanmar. The model and insights in the form of a resource -- the FISH 'Guidelines for Gender Integration' – will be released in 2020 as well as starting second round piloting in India and Myanmar. FISH gender researchers also provided expert resources on gender transformative approaches to a diverse set of partners, including the USAID Oceans and Fisheries Partnership (USAID Oceans), the Coral Triangle Initiative and Helen Keller International and featured prominently in workshops for practitioners on gender transformative approaches at the CGIAR-led International Gender Conference 'Seeds of Change'.
- *Policy changes and outcomes:* FISH continued to pro-actively influence policies towards gender transformative approaches in fish agri-food systems, and more generally, illustrated in this GTA timeline. Influencing activities during the year included the 'post 2020 Global Biodiversity Framework', nudging it towards it being more gender-responsive; expert input to the European Union's initiative to apply transformative approaches in their Rome-based Agency programming; cooperation with Catholic Relief Services, West Africa Region to integrate the gender transformative approaches into micro-credit programs; and The World Seafood Congress 2019 providing a recommendation in final plenary to the WSC organizing body to move from a 'women in' to a 'gender' framing.

Within FP1, highlights included the publication of research on *gender and breeding* emerging from the WorldFish-led CGIAR Gender Post-doctoral Fellow Initiative; a new paper on *limits to accommodative approaches* that explores the question: in what ways do and can agricultural innovation programs affect gender norms?, focusing on aquaculture and agriculture programming in six villages in the Southwest of Bangladesh; and *asset ownership for women's empowerment* based on a paper by Choudhury and McDougall (2019) in Bangladesh that revealed the gendered and nuanced nature of ownership. This research argues that while ownership holds value for women's empowerment, the very nuanced and gendered nature of ownership needs to be understood and addressed for ownership to be truly empowering.

Within FP2, highlights included the publication of gender and livelihood diversification research, based on empirical case studies in three coastal communities in Solomon Islands to investigate how gender norms and relations influence agency (i.e., the availability of choice and capacity to exercise choice); new knowledge on gender dynamics, norms and political economy and a spotlight on fish value chains in Malawi elucidating women's active engagement in and contributions to fish value chains, especially as fish processors. Both studies underscore that several gender barriers continue to undermine women's ability to benefit equitably.

(b) Important findings influencing the direction of the CRP's work:

- *Limits and risks of current gender approaches and integration in aquaculture and fisheries:* evidence from two FISH studies published in 2019 (Aregu et al. 2019; Lawless et al. 2019) underscored the need for development investments to shift beyond current, relatively superficial gender (accommodative) approaches. FISH is addressing this in 2020 by spearheading the consolidation of lessons regarding deeper (transformative) approaches across the CGIAR and beyond. FISH is also responding by seeking opportunities to fill identified empirical gaps in knowledge about what transformative approaches work well, where, and for whom. Picking up on the specific livelihoods insights, FISH will be investing in research to provide an empirical 'reality check' on outcomes of policy and programming targeting women in livelihood opportunities.
- *Barriers to women in fish value chains*: Pacific and Malawi research referred to above confirmed rural women's strong engagement in fish value chains and the value of fish to women's livelihoods and households. However, it also revealed that women continue to face a complex set of interacting gender-based barriers in and along the value chain. FISH will draw on this lesson by developing and applying a gendered value chain analysis tool for use in other contexts, and applying actionable insights from this, starting in Bangladesh on 2020.

(c) Problems in relation to gender issues or integrating gender into the CRP's research:

- Short project bilateral project timeframes can reduce ability to integrate gender effectively, particularly where there are pressures for "development" oriented projects to launch multiple components at speed.
- Insufficient investment in gender research within bilateral projects, highlighting the need for integration of gender research time into project planning at an early stage.
- Insufficient gender research capabilities in the countries where we work, highlighting the need for continued gender research capacity development.

1.3.2 Youth and other aspects of social inclusion/'leaving no one behind'[2]

(a) CRP research findings, methods or tools, capacity development, policy changes or outcomes:

In 2019, the FISH study on youth in fish agri-food systems was published, highlighting the participation of youth in fisheries and aquaculture in Africa, Asia and the Pacific, identifying opportunities and challenges for participation. This key publication provides a foundation for interventions that enable youth participation in aquaculture, small-scale fisheries and fish value chains. Youth research in FISH was also complemented with two in-depth studies in Myanmar and Nigeria, providing insights and guidance on livelihood opportunities and aspirations of youth in small-scale fisheries and aquaculture, all supporting policy interventions to be made in 2020. Youth also features prominently in the Aquaculture compact of the Technologies for African Agriculture Transformation (TAAT) project with partners in focal (DR Congo, Ghana, Kenya, Nigeria and Zambia) and satellite (Burundi, Cameroon, Cote D'Ivoire, Republic of Benin and Tanzania) countries.

- In *Myanmar*, research on livelihood aspirations and outcomes of youth from small-scale fisher households was conducted in Kyonkadun Village in the Ayeyarwady Delta using a political ecology/political economy approach to understand how the livelihood opportunity spaces and aspirations of youth from a small scale fisher community are shaped by: i) changes to the fishery landscape in the region; ii) broader social, economic and political processes in the country; and iii) cultural notions of masculinity and feminity.

[2] Leaving no one behind is a key facet of the SDGs: https://unstats.un.org/sdgs/report/2016/leaving-no-one-behind

- In *Nigeria*, a qualitative study on "Youth inclusion/exclusion in aquaculture and value chains" was conducted in four states (Oyo, Lagos, Anambra and Ogun), to bring together learning and identify opportunities for enhancing youth benefits from the fast growing aquaculture sector within the country.
- In *Egypt*, research on aquaculture value chains estimated that aquaculture generates 19.56 Full Time Equivalent (FTE) jobs per 100t of produced fish, but that more inclusive female and youth targeted strategies are required to increase the benefits of aquaculture growth to young people.

FISH also continued to engage with bilateral investments in 2019 to reach the most vulnerable people with productive livelihood opportunities and nutritious fish, in Bangladesh, India and Myanmar. In India, technical assistance and policy advice was provided to the Government of India's Odisha State for technical advice in carp polyculture innovations and policy development for 2,400 women self-help groups with 24,000 women members in isolated regions, contributing to the Governments women's empowerment and nutrition investments. In Bangladesh, WorldFish continued provision of technical knowledge on tilapia and carp polyculture systems to the EU-DFID funded Suchana project that targets stunting in children among 250,000 of the most nutritionally vulnerable households in northeast Bangladesh. In cooperation with the European Union and USAID, work has started on introducing aquaculture and small-scale fisheries innovations to remote communities in Myanmar, including some of the most marginalized households.

(b) Important findings influencing the direction of the CRP's work:

- *Knowledge sharing:* the FISH assessment Youth participation in small scale fisheries, aquaculture and value chains in Africa and the Asia-Pacific provides key recommendations for four inter-linked future research priorities for youth: i) understanding the impact of economic, political and social shifts at global to local levels; ii) analysis of policy architecture that impacts youth involvement; iii) understanding the diversity of youth engagement and iv) building a youth-oriented approach. These findings were presented at the 'Seeds of Change' Gender Equality through Agricultural Research for Development Conference held at the University of Canberra in April, 2019 and at the 'Gender, water and food: perspectives and contestations' workshop organised by CGIAR and the Institute of Development Studies in Brighton, UK in December, 2019. Additionally, key messages on youth inclusion/exclusion in the aquaculture value chains were presented in Togo at the 2019 ReSAKSS Conference: Gender Equality in Rural Africa: From commitment to Outcome.
- *Capacity development:* To assist with youth oriented data collection, "A Qualitative Tools and Facilitator Training" was delivered in Nigeria, and the tools used will be more widely shared in 2020.

(c) Problems in relation to youth issues or integrating youth into the CRP's research:

- The tracking of youth-related outputs and outcomes needs further investment in the FISH M&E system (MEL) system.
- There is a need to enhance collaboration between youth research and other cross-cutting themes and bilateral projects, ensuring that youth is looked at through an intersectional lens and well-integrated into the overall program.

1.3.3 Capacity development

In 2019 FISH capacity development activities' target users - as in previous years – included researchers, national partners, farmers and communities. A total of 339 capacity development initiatives were taken up during the year, involving a total of 177,499 people (of which 145,454 women), an impressive number of people engaged, mainly through FISH bilateral projects and partnerships. Short-term training comprised 177,474 people, of which 145,441 (82 percent) were women. Bangladesh and India dominate in terms of numbers involved in short-term training, but FISH continues with wide-ranging capacity development across Africa, Asia and the Pacific. Long-term training was also provided for 25 students (12 PhDs, 5 masters, and 8 bachelors), of which 13 were women (Table 7).

In Africa, cooperation continued to strengthen with the African Centre of Excellence in Aquaculture and Fisheries in Malawi for masters and PhD training and more practical short-term training in aquaculture technologies with the Technologies for African Agricultural Transformation (TAAT) Aquaculture Compact, expanding training in aquaculture practices and policies to 12 countries. The

Aquaculture Research and Training Center in Egypt was a key FISH resource for aquaculture training in Africa, receiving 40 participants from the ten TAAT countries during 2019. The year also saw the start of work to transform the Egypt center into a "Fish for Africa Innovation Hub", with a stronger orientation to support the transformation of food systems and the fish sector through stronger linkages between scientific research and innovation to market and policy actors, as well as business and entrepreneurship development through shared learning and co-creation within an innovation ecosystem. The hub is expected to be launched in 2020. During 2019, significant progress was made in connecting FISH research to African vocational training schools and digital approaches. An online training platform for Tilapia in Africa now consists of approximately 85 animations/movies to support practical vocational training in Zambia, and the cooperation here will eventually provide tools, knowledge and partnerships for a future Africa-wide aquaculture vocational training initiative. In Nigeria, a cooperation with the PIM CRP, US partners and aquaculture stakeholders from Nigeria's South Western Region was held to develop a practitioners' guide for agriculture innovation systems.

In Asia and the Pacific, strong cooperation with national partners continued in all focal and scaling countries covering both aquaculture and small-scale fisheries. A series of "Better management practices" guidelines for tilapia farming was launched and are being integrated into trainer of trainer programs and bilateral projects across focal and scaling countries. In the Solomon Islands, exploratory work examined the development of a learning hub for scaling FISH research in fish agri-food systems more broadly within small islands development states (SIDs).

1.3.4 Climate change

During 2019, FISH continued to enhance its cooperation with the Climate Change, Agriculture and Food Security (CCAFS) CRP and contributed a number of outputs and outcomes to the CGIAR climate change portfolio. These activities reflect increasing recognition of the important role of fish within global food system transformation under climate change. FISH research included a number of papers to evaluate the vulnerability of societies to the simultaneous impacts of climate change on agriculture and marine fisheries at a global scale. Research on national policies for climate smart aquaculture production produced new guidance for pathways for low-emissions aquaculture development in Indonesia.

FISH technologies and management systems have also been integrated within CCAFS climate-smart agriculture initiatives in South Asia and the Mekong region, focussing on Bangladesh, Cambodia and Vietnam, leading to several promising climate-smart agriculture innovations for vulnerable communities dependent on aquatic systems and bringing aquaculture and fisheries innovations to the CCAFS climate-smart portfolio. During 2019, FISH also partnered with the World Farmers Organization to provide a case study of climate smart-agriculture in Bangladesh rice-fish systems to the UN COP 25 Climakers collection of stories from the field.

FISH also organized a session in the CCAFS-led '5th Global Science Conference on Climate Smart Agriculture 2019 Transforming food systems under a changing climate' and led a session on "Blue solutions; fish and the transformation to climate smart food systems". Two new co-funded postdoctoral positions for fish and climate change research started in 2019; the first based in James Cook University focussing on adaptation of coastal communities to climate change in the Pacific, and a second on building climate information services for aquaculture and fisheries in Bangladesh and India. Contributions were also made to the emerging CGIAR Two Degree Initiative.

2. Effectiveness and efficiency

2.1 Management and governance

No changes were made to the management and governance structures detailed in the FISH proposal. FISH managing partners include two CGIAR centers (WorldFish and IWMI) and advanced research institutes Wageningen University & Research (WUR), JCU and the Natural Resources Institute of the University of Greenwich. Those remain and have evolved into an active and complementary partnership. No changes were made to the terms of reference for the FISH Independent Steering Committee (ISC). Three ISC meetings were held in 2019, with reporting lines well established to the WorldFish Board of Trustees for approval of the FISH POWB, Annual Report and quarterly progress reports.

The ISC again conducted an in-depth review of FISH during 2019, reporting to the WorldFish Board of Trustees and the FISH Director and Management Committee for follow up action. Key areas of attention related to staff strengthening and focussing more attention on the role of FISH research findings in climate change mitigation and adaptation and food systems transformation. The FISH Management Committee (MC) also regularly met during the year.

2.2 Partnerships

2.2.1 Highlights of external partnerships

FISH was engaged in 248 active external partnerships during 2019, of which 98 were new partnerships established during the year. Academic and research organizations made up ~27 percent of the partners, but 2019 was notable for significant growth in partnerships with private sector (25%), national agriculture research systems (NARS) and governments (20%), the latter particularly reflecting the more significant policy contributions of the FISH in 2019.

Scaling partnerships featured prominently in 2019. Sixteen percent of FISH partnerships in 2017 were focused on aspects of scaling, with the majority (41 percent) focused on the discovery phase within the impact pathway. By 2018, 35 percent of partnerships within FISH were focused on scaling, but this has grown in 2019 to an estimated 67% of partners, a shift intended to enable delivery of innovation at greater scale within FISH focal and scaling countries.

Sixty three percent of partnerships are now at the national and sub-national level. Private sector partnerships also increased significantly during the year to 25% of active external partnerships, reflecting a shift to scaling via commercial partners, as well as some co-investment by private companies into FISH research (eg via feeds and health research), including international fish feeds companies Skretting and DeHeus, that are opening new opportunities for scaling our aquaculture research in Asia and Africa. At the global level, several partnerships seek to influence global policies. These include a partnership with FAO, which culminated in 2019 with a significant input to the International Symposium on Fisheries Sustainability: Strengthening the Science-Policy Nexus.

In FP1, the significant research partnership continues with The Roslin Institute at the University of Edinburgh, providing key genomic expertise. Fish health and aquaculture systems research also grew new partnerships in 2019. In FP2, the engagement with FAO and Duke University has been significant for the Illuminating Hidden Harvests initiative and a new cooperation with Stockholm Resilience Center and Stanford Center for Ocean Solutions (COS) and the Stockholm Resilience Centre is focussed on the Blue Food Assessment, that aims to bring FISH research to a new assessment of the role of aquatic foods (aka blue food) for planetary health and human wellbeing, as part of the EAT-Lancet initiative. A strengthened partnership with the Royal Tropical Institute (KIT) and a new partnership with Includovate is also helping FISH strengthen gender-integration and innovation across the W1/W2 and bilateral project portfolio.

2.2.2 Cross-CGIAR partnerships

FISH outputs and outcome benefit from synergies and active partnerships with several CGIAR centers and CRPs, including agri-food system and all global integrating CRPs and support platforms. These partnerships are focused on the discovery and proof-of-concept phase, seeking and building synergies on various dimensions of the food system.

Highlights of new areas of CGIAR partnerships in 2019 included: a cooperation with WorldFish, International Livestock Research Institute (ILRI), International Food Policy Research Institute (IFPRI) and International Water Management Institute (IWMI) for a shared post-doc and collaborative initiatives on modelling AMR in water systems and assessment and reduction of AMR use in aquaculture as part of the CGIAR Antimicrobial Resistance (AMR) Hub; new "futures" modelling research with PIM and IFPRI on fish supply demand modelling in Nigeria and Tanzania, the latter with ILRI on consumption of animal source foods; a special collaboration with Roots, Tubers and Bananas (RTB) that resulted in a working paper on synergies between fish and roots, tubers and bananas in food systems, with special attention to Nigeria and Bangladesh; WLE cooperation to bring FISH gender expertise to the challenge of transition of highly vulnerable wetlands to a Ramsar Conservation area in the Gulf of Mottama, Myanmar; policy assessments with Ithe nternational Food Policy Research Institute (IFPRI) and Policy Institutions and Markets (PIM); and a co-investment with A4NH on food systems research in Bangladesh through a joint PhD on fish in food system modelling.

FISH retains a close cooperation with two CGIAR platforms; the Excellence in Breeding (EiB) Platform for quality control development for tilapia and carp genetic improvement and work on the data entry forms for breeding program assessments (BAPs); and 2019 saw a strengthened collaboration with the Big Data Platform under the Inspire challenge for Rapid genomic detection of aquaculture pathogens and for scaling of digital small-scale fisheries innovations.

The FISH gender lead is a member of the Advisory Committee to the CGIAR Collaborative Platform on Gender Research, participating as a Committee member and Theme leader for the CGIAR's Annual Scientific Conference on Gender conference in 2019, co-sponsored by ACIAR and the University of Canberra ('Seeds of Change'); and leading a book chapter for the Platform's priority collaborative output in 2019, involving contributors from 6 centres. Table 9 provides further details of the significant growth in CGIAR partnerships pursued during the year.

2.3 Intellectual assets

(a) *Intellectual assets management.* Most of the intellectual assets generated by FISH are maintained in the form of scientific publications (which are inclusive of journal articles, books, conference presentations, reports), data and new technologies and innovations.

FISH sustainable aquaculture research is generating new innovations, including breeds and health products that might be of commercial significance. A study is ongoing on intellectual assets associated with the tilapia and carp breeding programs and potential commercial scaling pathways for these technologies.

(b) *Patents and/or plant variety right applications.* No applications were made for patents during 2019. Therefore, nothing has been tracked or strategically managed in terms of intellectual property rights.

(c) *Critical issues and challenges in the management of intellectual assets in the context of the CRP.* There were no critical challenges encountered in 2019 with regards to management of intellectual assets in the context of FISH.

2.4 Monitoring, evaluation, impact assessment and learning (MELIA)

The MEL platform for FISH became fully operative in 2019. A close cooperation with other key centers (ICARDA, CIP and IITA) and CRPs (Roots, Tubers and Bananas and Grain Legumes and Dryland Cereals) continues since 2018 to refine and develop the MEL platform. Communication

material and training tools have been jointly developed and training provided to all FISH researchers. A work plan for a routine based training has been developed to support further program-wide implementation and progress during 2020.

Important achievements during 2019 were related to restructuring the logic of the impact research for FP1 in order to improve the understanding about the impacts of main innovations promoted (i.e. improved tilapia, carp polyculture). However, some biosecurity issues constraints related to TiLV and delay in the dissemination of improved strains of tilapia affected the timely completion of research and the full achievement of expected deliverables. Important other achievements were the completion of the evaluation of the ecopond carp-based polyculture model implemented in Bangladesh, which indicates the value of this aquaculture innovation to mainstream social and economic benefits and women's empowerment in Bangladesh.

In small-scale fisheries (FP2), two important evaluations were conducted, in Africa (FishTrade project) and in Bangladesh (EcoFish) through the support of W1/W2 funding. In particular, the Fish Trade project evaluation demonstrates the value of investing in knowledge related to fish trading in Africa as a way for creating the preconditions necessary for changes in policy and implementation in the medium-term towards economic and food and nutrition security goals.

In addition, a number of Outcome Impact Case Reports (OICR) were supported, using W1/W2 and bilateral project resources across the two flagships and cross-cutting themes.

Regular meetings of the FISH Management Committee and Independent Steering Committee were held to monitor CRP progress. Table 10 and Table 11 provide further details.

2.5 Efficiency

An important approach to ensuring the efficiency of FISH was not to set up new management structures and systems but to rely on existing systems within WorldFish, including program management services to the CRP Director, MC and ISC meeting, research support, finance, communications and administrative functions. This approach continued to be adopted in 2019.

Additional efficiencies included placements of PhD students with partners (French Agricultural Research Centre for International Development, JCU, WUR and other partners); the co-funding and co-location with partners (including WUR, JCU, the Stockholm Resilience Centre) of postdoctoral scientists; and hosting and co-funding of research activities, PhD students and some research facilities with partners, including the fish nutrition laboratory in Abbassa (Egypt) with the private sector company Skretting, and fish health research facilities and genetic programs with national partners, including the GIFT research platform in Malaysia with the Department of Fisheries.

2.6 Management of risks to your CRP

The FISH CRP proposal provides a framework for review by the FISH Management Committee to monitor key risks and associated mitigation strategies. During 2019, a managing partner (Natural Resources Institute, University of Greenwich) took the lead in conducting a risk assessment of the FISH CRP during each face-to-face Management Committee meeting. The risks below are derived from the FISH Management Committee meeting on 16-18 October 2019.

Key external risk factors identified during 2019 were (1) funding and uncertainty over W1/W2 and W3/bilateral funding and the associated impacts on research operations and development outcomes; (2) instability in focal/scaling countries; and (3) communications. The funding risk is mitigated through gathering early intelligence on budgets and W3/bilateral funding opportunities, adjusting workplans and prioritizing and managing expectations. A regular dialogue with the System Management Office, regular review of expenditure and funding risks and proactive fundraising activities are also conducted. The impact of instability in focal/scaling countries could be significant, with this risk being mitigated through intelligence gathering by WorldFish, partners and in-country networks. Communications were enhanced during 2019 through implementation of a communications strategy and development of agreed procedures for communications and response.

Key internal risk factors during 2019 were (1) planning and reporting systems; (2) retention and continuity of key staff; (3) research quality; and (4) not meeting donor expectations. Planning and reporting systems were significantly enhanced through the MEL adoption and support provided to staff in use of the platform, also supported by increasing integration with SMO reporting processes and the CGIAR Results Dashboard. Retention of key staff is recognized as a risk to FISH. WorldFish continues to make investments into health monitoring and other initiatives to mitigate this risk. Research quality is given a high priority in all aspects of FISH implementation, including the adoption of MEL, strategic recruitments of staff into key research positions and focused investments in research quality for our own and partner scientists, using the Independent Science & Partnership Council framework as a guide. Additional investments during 2019 (and 2020) are being made in research quality.

2.7 Use of W1/W2 funding

Investments by W1/W2 made significant contributions to FISH progress during 2019, used as principal funding for some key areas of discovery research (particularly tilapia genomics), leveraging bilateral/W3 funding to produce international public goods and catalyzing new research areas. Funds were also invested into strategic gender research and youth and utilized to catalyze new partnerships with sub-regional partners in Africa, establishment of the MEL systems and investments in selected evaluation and impact studies. Due to the threat posed by the emerging TiLV, W1/W2 investments were increased into epidemiological assessments of tilapia diseases in FISH focal countries and tilapia breeding programs.

In FP2, W1/W2 was primarily used to strategically support co-management, conduct research on improving field yields and water productivity in constructed water bodies and foundational activities (workshop, science capacity, systematic reviews) to establish the fish in food systems research agenda, including methodologies for the Illuminating Hidden Harvest Initiative with FAO and Duke University. Further details are provided in Table 12.

3. Financial summary

The 2019 financial plan provided USD 6.23 million of W1/W2 funding, which combined with a 2018 carry-over provided FISH with USD 6.29 million of W1/W2 funding for the year (Table 13). The expenditure of W1/W2 funds for 2019 was USD 5.64 million (90 percent), and the W3/bilateral expenditure was USD 22.1 million. A total of USD 656,086 W1/W2 funds have been carried over to 2020. The sourcing of bilateral funds increased during 2019 beyond that predicted in the FISH proposal, with a final budget of USD 29.2 million, of which around 76 percent was spent. The allocation of bilateral funding represents an increase beyond that predicted in the FISH proposal, allowing in particular enhanced investment in research, outcomes and impacts across the CRP. Further details are provided in Table 13.

Part B: Tables

Table 1. Evidence on progress toward SRF targets (sphere of interest).

Evidence associated with these tables is provided directly in the tables, with further links provided in Part C.

SLO target (2022)	Brief summary of new evidence of CGIAR contribution	Expected additional contribution before end of 2022
1.1: 100 million more farm households have adopted improved varieties, breeds, trees and/or management practices	Evidence in 2019 from partners and bilateral project investments indicates that 41,459 households have adopted improved aquaculture and fisheries practices, derived from FISH research and disseminated via multiple channels. Bangladesh: • 16,869 households have adopted improved carp-polyculture practices (Suchana report Jan – Dec 2019; Mid-term Survey report) • 12,475 fish producers (women 8,471, 15-29 years: 2,563) have applied improved pond management practices (BANA report OCT 2019- SEP 2019, pg. 24; Brief; MELOICR276) • 3,377 households adopted improved ecopond carp-based polycultural model in Barguna Districts (Bangladesh) (Eco Pond Impact Evaluation) • 4,257 households Hilsa fishing households fully engaged in sound and sustainable Alternative Income Generating Activity (AIGAs) as a strategy to improve co-management and for building the socio-economic resilience of fishing communities. (Eco-Fish project report Jan – Dec 2019, pg.17; Brief) Egypt: • 4,481 Households have adopted integrated Best Management Practices. This value represents the 65% of the total tilapia households in Egypt (STREAMS Evaluation)	Contribution by 2022: Up to 5.0 million households, as indicated in the FISH proposal. No change to that target, as per the Theory of Change processes implemented during 2018.

1.2: 30 million people, of which 50% are women, assisted to exit poverty	Evidence associated with aquaculture and small-scale fisheries interventions shows that more than 294,817 people have been assisted to exit poverty. Bangladesh: • 121,238 (95%) beneficiaries that have adopted project delivered technologies and practices reported increased income (Suchana report Jan – Dec 2019; Midline Survey; MELOICR277; Brief) • 3,377 women that adopted improved eco pond carp-based polycultural model in Barguna Districts (Bangladesh) had improved their income (EcoPond Impact Evaluation) • 20,966 In FY 2019, ECOFISH project targeted 22,500 people (4,500 households) to ensure increased economic benefits and ensured the benefits for 20,966 people, in which 11,450 (55%) men and 9,516 (45%) women. (Eco-Fish project report Jan – Dec 2019; Brief; MELOICR215; MELOICR214) Myanmar: • 2,721 direct beneficiaries (and 4,289 indirect) assisted to exit poverty through extension services, pond rehabilitation and construction (Inland MYSAP Annual report, 2018 - 2019, pg. 16 4, Brief; MELOICR222) • 10,021 producer beneficiaries reported at least 10% increase in aquaculture production and incomes (MyCulture- Final report 2015-2019; MELOICR221; Brief) Cambodia: • 108,923 individuals benefitted directly from the project activities due to their proximity to a project-supported CFR and the fact that they catch fish and other aquatic animals (OAA) from the surrounding fisheries (USAID RFF-2 semi-Annual report APR- SEP 2019, pg.9; Brief) Egypt: • 26,032 farmers assisted through farm income generation activities and jobs at farm level (STREAMS - End Term Evaluation) • 1,539 farmers and fish retailers gained profit through rehabilitation of ponds and jobs created (YEAG- Endline Report)	Contribution by 2022: Up to 3.5 million people, as indicated in the FISH proposal.

2.1: Improve the rate of yield increase for major food staples from current <1% to 1.2-1.5% per year	N/A for FISH	
2.2: 30 million more people, of which 50% are women, meeting minimum dietary energy requirements	N/A for FISH	
2.3 150 million more people, of which 50% are women, without deficiencies in one or more essential micronutrients	Evidence exists for increased fish consumption and/or dietary diversification among 204,887 vulnerable women, children and men associated with aquaculture and small-scale fisheries interventions: Cambodia: • 124,876 people consuming more fish at home following behavior change interventions associated with enhanced rice field fish productivity. Of these at least 56194 are estimated to have met a diet of minimum diversity (USAID RFF-2 FY 2018 and 2019 Report, pg.9; 19. Brief; MELOICR216) Bangladesh: • 1,010 individuals increased their dietary diversity due to aqua nutrition interventions (BANA project OCT 2019- SEP 2019, pg. 25; Brief) • 55,897 individuals have an improved dietary diversity (Midline Survey; MELOICR277; Brief) • 15,197 people incresead their fish consumption due to the adoption of improved ecopond carp-based polycultural model (EcoPond Impact Evaluation- Preliminary Report, pgg.1, 9.) Myanmar: • 6,000 beneficiaries reported increased consumption of nutrient rich fish (MyCulture Final Report 2015-2019, pg. 10, Brief) • 1,907 beneficiaries reporting an improved diet diversity (Inland MYSAP Annual report, 2019;Brief; MELOICR222)	Contribution by 2022: Up to 2.4 million ha, as indicated in the FISH proposal.
3.1: 5% increase in water and nutrient efficiency in agroecosystems	Overall 400,000 MT of fish produced under efficient management practices and technologies, reduced the water consumption by 37%.	Contribution by 2022: Up to 4.8 million metric tons, as indicated in the FISH proposal.

	Egypt • 400, 000 MT of fish was produced using best management practices and technologies introduced by the intervention The adoption of BMPs has reduced water consumption for aquaculture activities by 37%. (STREAMS Evaluation)	
3.2: Reduction in 'agriculturally'-related greenhouse gas emissions by 5%	Overall 400,000 MT of fish was produced reducing the Green House Gases (GHG) emissions by 22% as a result of the adoption of the better management practices and technologies. Egypt • 400,000 MT of fish was produced using best management practices and technologies introduced by the intervention, reducing the GHG emissions by 22% (STREAMS Evaluation)	Contribution by 2022: Up to 4.8 million metric tons, as indicated in the FISH proposal.
3.3: 55 million ha degraded land and water area restored	Progress continues to be made in applying research to improving management of aquatic resources in FISH focal countries, specifically in water areas with a coverage of 673,212 hectares being brought under improved fisheries co-management measures. Bangladesh: • 121,158 hectares of biologically significant area under improved management - (Eco-Fish project report Jan – Dec 2019 pg. 13 - Hizla-Mehendiganj and Nijhum Dwip declaration; Brief) • 2,086 hectares of pond area under improved management (BANA report OCT 2019- SEP 2019, pg. 15; Brief;) • 228 hectares of pond under improved technologies and practices (Midline Survey; MELOICR277; Brief) Cambodia: • 1,145 hectares of which 481 hectares in areas of CFRs and rice field environment are under improved biophysical conditions as a result of the project interventions, and 64 hectares of biologically significant areas under improved natural resource management (USAID RFF-2 semi-Annual report APR- SEP 2019, pg.9; Brief) Egypt:	Contribution by 2022: Up to 3.3 million ha, as indicated in the FISH proposal.

	• 48,595 hectares of fish ponds under improved technologies and practices (STREAMS - End Term Evaluation) • 500,000 hectares area covered under new fisheries management recommendations prepared for the Aswan Dam (YEAG- End Term Evaluation)	
3.4: 2.5 million ha forest saved from deforestation	N/A for FISH	

Table 2. Condensed list of policy contributions in this reporting year (sphere of influence).

This table provides key FISH policy contributions during 2019

Title of policy, legal instrument, investment or curriculum to which CGIAR contributed	Description of policy, legal instrument, investment or curriculum to which CGIAR contributed	Level of Maturity: 1,2 or 3	Link to sub-IDOs	CGIAR cross-cutting marker score				Link to OICR
				gender	youth	capdev	climate change	
Catalyzing investments from African Development Bank for aquaculture and fisheries development in Africa as part of the scaling strategy of Fish research MELPOL275	Fish research scaled through African Development Bank investments. Investments on-going in Zambia and recently in Malawi and Cameroon. The policy case reports on early stage of Aquaculture investment in Ghana.	2 - Policy/Law etc. Enacted	1.2.1 - Improved access to financial and other services	1	1	1	0	N/A
Allowable mesh size for hilsa gillnets determined and recommended in Bangladesh MELPOL252	Allowable mesh size determined to be 6.5 cm for all types of hilsa gillnets. The Government of Bangladesh has accepted the recommendations and	1-Research taken up by government policy makers)	3.2.1 More productive and equitable management of natural resources	0	0	1	1	N/A

	processed for a gazette notification.							
Inclusion of co-management of community fish refuges (CFRs) into Cambodia's 10-year Strategic Plan for Fisheries Conservation and Management MELPOL235	Informed by FISH research, the Royal Government of Cambodia has taken significant policy measures addressing the protection, conservation and sustainable management of rich natural resources of the country.	1 - Research taken up by next user (decision maker or intermediary)	3.1.2 - Enhanced conservation of habitats and resources. 3.2.1 - More productive and equitable management of natural resources	0	0	1	1	N/A
Decentralized Fisheries Law and regulations to establish and legalize community fishery associations in Myanmar MELPOL233	Reform of the Ayeyarwady fisheries law in 2019 with corresponding regulations for establishing and legalising community fishery associations for more equitable and better managed fisheries.	2 - Policy/Law etc. Enacted	3.2.1 - More productive and equitable management of natural resources C.1.3 - Conducive agricultural policy environment	1	1	1	1	MELOICR281
Contribution to the development of the Southern Africa Development Community (SADC) Regional Tilapia Genetic improvement programme MELPOL251	FISH CRP supports the development of the SADC Regional Tilapia Genetic Improvement programme that guided to develop three national nucleus breeding programmes for tilapia in the region.	1 - Research taken up by next user (decision maker or intermediary)	C.1.3 - Conducive agricultural policy environment D.1.4 - Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	0	0	1	0	N/A
Development of Dried Small Pelagic Standards to be adopted by the	During 2019 Worldfish Malawi developed and submitted dried fish standards to the Malawi Bureau of Standards for approval to promote	1 - Research taken up by next user (decision maker or intermediary)	2.2.1 - Reduced biological and chemical hazards in the food system	1	1	1	0	N/A

Malawi Bureau of Standards MELPOL236	marketing and consumption of fish.		2.2.2 - Appropriate regulatory environment for food safety					
Contribution of FISH research to global fishery policy through the FAO International Symposium on "Fisheries Sustainability: strengthening the science policy nexus" MELPOL284	FISH research was presented in plenary and panel sections at the symposium as an input to future fisheries policy recommendations for the intergovernmental Committee of Fisheries (CoFI).	1 - Research taken up by next user (decision maker or intermediary)	3.2.1 - More productive and equitable management of natural resources 3.3.1 - Increased resilience of agro-ecosystems and communities, especially those including smallholders	1	1	2	1	N/A
Proposition of fiscal reforms to allow more sustainable and inclusive hilsa fisheries management in Myanmar MELPOL234	Research on hilsa fishery is supporting the Government of Myanmar in its fiscal strategy. Existing fiscal tools could be used to mobilise additional resources to finance sustainable hilsa fisheries management.	1- Research taken up by next user (decision maker or intermediary)	3.1.2 - Enhanced conservation of habitats and resources. 3.2.1 - More productive and equitable management of natural resources	1	1	1	1	MELOICR212
FISH research provides support to develop the National Fisheries and Aquaculture Policy in Uganda MELPOL247	FISH CRP research, through the FishTrade project funded by the European Union, provided technical inputs for development of the National Fisheries and Aquaculture Policy in Uganda	1 - Research taken up by next user (decision maker or intermediary)	2.2.2 - Appropriate regulatory environment for food safety C.1.3 - Conducive agricultural policy environment	1	0	0	0	N/A
Hilsa Conservation and Development Fund (HCDF) created	To assist sustainable financing for hilsa conservation, ECOFISH in	2 - Policy/Law etc. Enacted	1.3.2 – Increase livelihoods opportunity;	0	0	0	0	MELOICR214

and operational guideline formulated MELPOL253	coordination with DoF, established a sustainable financial structure for hilsa fisheries development thereby ensuring economic emancipation of the fishermen.		3.2.1 More productive and equitable management of natural resources					
Inclusion of fish within commodities covered by the One Stop Border Post at Busia to facilitate cross-border fish-trade between Kenya and Uganda MELPOL249	FISH research promoted intra-regional fish trade by supporting inclusion of fish within the commodities that can be traded through the One Stop Border Post at Busia, Uganda.	1 - Research taken up by next user (decision maker or intermediary)	1.2.2 - Reduce Market Barriers C.1.1 - Increased capacity of beneficiaries to adopt research outputs	0	0	0	0	N/A
Inclusion of nutritious Small Indigenous Fish in regular school meal program for 30,000 students in Odisha state (India) MELPOL280	Kalinga Institute of Social Sciences (KISS), the largest residential institute for 30000 tribal children in Odisha has approved the proposal of WorldFish to include small fish in their Mega kitchen.	2 - Policy/Law etc. Enacted	2.1.2 - Increased access to diverse nutrient-rich foods 2.1.3 - Optimized consumption of diverse nutrient rich foods	1	2	1	0	MELOICR223
Inclusive, evidence-based development of a National Fisheries Strategy for Timor-Leste that sets the direction for future fisheries and food security investments MELPOL272	Reviews of recent research and a deeply consultative process engaging resource users, their communities, resource managers and key stakeholders led to the co-development of a National Fisheries Strategy.	1 - Research taken up by next user (decision maker or intermediary)	3.2.1 - More productive and equitable management of natural resources C.1.3 - Conducive agricultural policy environment	1	0	0	0	N/A
Investment to enable implementation of the COMESA Green	FISH research catalyses investments for the construction of the facility for	1 - Research taken up by next user	C.1.2 - Increased capacity of partner organizations, as	0	0	1	0	N/A

Pass for fish on the Zambia-Zimbabwe-Mozambique border. MELPOL256	implementation of COMESA Green Pass that facilitates fish trade within the participating countries.	(decision maker or intermediary)	evidenced by rates of investment in agricultural research D.1.4 - Increased capacity for innovation in partner development organizations and in poor and vulnerable communities					
Revision of the legal regime for the management and regulation of fisheries in Timor-Leste MELPOL270	The legal framework for fisheries was revised to reflect local cultural, ecological, economic and nutrition security contexts, built on a deeply participatory stakeholder consultation process supported by FISH CRP research.	1 - Research taken up by next user (decision maker or intermediary)	3.2.1 - More productive and equitable management of natural resources D.1.3 - Increased capacity for innovation in partner research organizations	1	0	0	0	N/A
Governmental endorsement of the Better Management Practices (BMPs) for genetically improved farmed tilapia (GIFT) in Timor-Leste MELPOL238	BMPs were launched by the Minister of Agriculture and Fisheries and indicated as an important extension resource for government organizations and non-governmental organizations that train and provide support to farmers.	3 - Evidence of impact on people and/or natural environment of the changed policy or investment	1.4.2 - Closed yield gaps through improved agronomic and animal husbandry practices C.1.1 - Increased capacity of beneficiaries to adopt research outputs	0	0	2	0	MELOICR228
Investment approved for the genetically improved farmed tilapia (GIFT) Multiplication Center and Hatchery establishment at	Odisha's government approves the investment for the GIFT Multiplication Centre and hatchery at government fish farm in Kausalyaganga. WorldFish provided technical	1 - Research taken up by next user (decision maker or intermediary)	3.1.3 - Increased genetic diversity of agricultural and associated landscapes C.1.2 - Increased capacity of partner	0	0	1	0	N/A

Government Fish Farm in Odisha (India) MELPOL231	inputs and support to complete the formal process.		organizations as evidenced by rates of investment in agricultural research					
National Fish Health Management Strategy of Bangladesh MELPOL246	FISH research support the design of the National fish health management strategy of Bangladesh (NFHMSB) to protect the health and improve quality and productivity of aquaculture and fisheries.	1 - Research taken up by next user (decision maker or intermediary	1.1.2 - Reduced production risk	0	0	1	0	N/A
Proposal to amend the law number 124/1983 on fishing, aquaculture and fisheries organization in Egypt MELPOL273	FISH CRP supports the amendment of the law number 124/1983 on fishing, aquaculture and fisheries organization by raising the importance of using integrated aquaculture agriculture systems in Egypt.	Level 1 - Research taken up by next user (decision maker or intermediary)	1.3.2 – Increase livelihoods opportunity; 3.2.1 More productive and equitable management of natural resources	0	0	0	1	N/A
Public and private sector co-invest into the first public-private hatchery for genetically improved farmed tilapia (GIFT) in Timor-Leste MELPOL245	A private hatchery and the Ministry of Aquaculture and Fisheries co-invested in the first Public Private Partnership (PPP) model hatchery developed by FISH research and established in Timor-Leste	3- Evidence of impact on people and/or natural environment of the changed policy or investment	1.4.4 - Increased conservation and use of genetic resources C.1.1 - Increased capacity of beneficiaries to adopt research outputs	0	0	0	0	MELOICR244
Significant advances in the policy dialogue on land-use reform to further assist the Government of	Significant advances of the policy dialogue from the "Nay Pyi Taw Agreement" allow to further extend and expand	2 - Policy/Law etc. Enacted	1.3.2 - Increased livelihood opportunities 3.2.1 - More productive and	1	1	1	1	MELOICR213

Myanmar implement its Agriculture Development strategy MELPOL232	the transformation of land to water for fish culture under integrated agriculture.		equitable management of natural resources					
Standard harmonization for fish products in the Southern African Development Community (SADC) region MELPOL248	SADC Secretariat, WorldFish and SADC Member States, working with the SADC Cooperation in Standardisation (SADCSTAN), developed eleven harmonized fish standards for the fish standards for the SADC region.	1 - Research taken up by next user (decision maker or intermediary)	C.1.1 - Increased capacity of beneficiaries to adopt research outputs D.1.4 - Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	0	0	0	0	N/A
Support to stakeholders in Kenya to advocate for a specific regulation and standards for fish and fish products to facilitate their market and export MELPOL274	The TAAT aquaculture compact led by WorldFish provided technical support to the Aquacultural Association of Kenya to analyse and formulate the petition for for the revision of veterinary bill.	1 - Research taken up by next user (decision maker or intermediary	C.1.3 - Conducive agricultural policy environment	1	1	1	0	N/A
Sustainable fisheries management plan adopted for application by regulatory authorities and fisheries organizations in Egypt MELPOL286	Fish research has contributed to the development and approval of the Lake Nasser Management Plan in consultation with General Authority for Fish Resources Development (GAFRD), and fisheries associations.	1 - Research taken up by next user (decision maker or intermediary)	3.2.1 - More productive and equitable management of natural resources 3.2.2 - Agricultural systems diversified and intensified in ways that protect soils and water	0	2	1	0	N/A

WorldFish contributed to the declaration of the Nijhum Dwip Marine Protected Area (MPA) in Bangladesh through S.R.O. No.211-Law/2019 MELPOL250	The policy will help improve protection of hilsa migratory route, and enhance biodiversity conservation of marine fish, megafauna and birds.	2 - Policy/Law etc. Enacted	3.2.1 More productive and equitable management of natural resources	0	0	1	0	MELOICR287
Zambia fisheries curriculum and training tools update MELPOL237	The Natural Resources Development College (NRDC) and Kasaka Fisheries Training Institute (KFTI) adopted an improved curriculum and digital tools to improve the quality and reach of aquaculture vocational-training in Zambia.	1 - Research taken up by next user (decision maker or intermediary	B.1.3 - Improved capacity of women and young people to participate in decision-making D.1.1 - Enhanced institutional capacity of partner research organizations	2	2	2	0	N/A

Table 3. List of outcome/impact case reports from this reporting year (sphere of influence).

This table lists outcome/impact case reports (OICR) generated in 2019. The report covers both new outcome/impact cases or those that have progressed to a new level of maturity or updated at the same level of maturity.

Title of Outcome/ Impact Case Report (OICR)	**Link to full OICR**.	**Maturity level:** 1, 2, or 3	**Indicate if this is:** – new outcome – updated Case- same level of maturity – updated Case- new level of maturity
A nutrition-sensitive polyculture project improves dietary diversity among women and children in North-Eastern Bangladesh	MELOICR277	2	New outcome
More than 12,000 fish producers in Bangladesh adopt improved pond management practices	MELOICR276	1	New Outcome
Community Savings Schemes Financially Empower Coastal Fisher Women in Bangladesh	MELOICR215	2	New Outcome
Dissemination of nutrition-sensitive aquaculture technologies and practices generate income and nutrition benefits for small-scale farmers in some of Myanmar's poorest areas	MELOICR222	1	New outcome
Emergent aquaculture technologies in Myanmar: opportunities and key outcomes	MELOICR221	2	New Outcome
Fiscal reform: Design of an incentive-based system of hilsa fisheries management in Myanmar's Ayeyarwady Delta for more sustainable and inclusive fisheries	MELOICR212	1	New Outcome
Governing Myanmar's Inland Fisheries: towards a more sustainable fish production and inclusive benefit-sharing among fish-dependent communities	MELOICR281	2	New Outcome
Hilsa Production and Fishers' Income Increased due to co-management strategies aimed to enhance the socio-economic resilience of fishing communities in Bangladesh	MELOICR214	3	New Outcome
How rice field fisheries are netting nutrition gains for over 124,876 people in Cambodia	MELOICR216	2	New Outcome

An holistic approach in disseminating CGIAR technologies and innovations to boost the efficiency of agriculture production systems in Malawi	MELOICR219	1	New Outcome
National adoption of small-scale fisheries data system in Timor-Leste	MELOICR186	2	New Outcome
Promoting adoption of integrated agriculture and aquaculture production systems in Malawi	MELOICR218	1	New Outcome
Small fish as nutrition add on in school feeding program in Odisha, India	MELOICR223	2	New Outcome
Successful establishment of the of GIFT Satellite Breeding Program in India with more than 4,000 grow-out farmers	MELOICR230	1	New Outcome
The better management practices (BMPs) for Genetically Improved Farmed Tilapia (GIFT) in Timor-Leste help to realize the potential of aquaculture in the country	MELOICR228	2	New Outcome
The declaration of Nijhum Dwip Marine Protected Area (MPA) to generate more sustainable fishing and livelihoods while protecting the marine biodiversity in Bangladesh	MELOICR287	1	NEW Outcome
The first public-private-partnership (PPP) model tilapia hatchery in Timor-Leste boosted the country's production of GIFT fingerlings and paved the way for the aquaculture sector's sustainability	MELOICR244	2	New Outcome
The Government of Myanmar extends the promotion of integrated farming systems to accommodate more fish for smallholder farmers	MELOICR213	1	Updated case - same level of maturity
The adoption of aquaculture Best Management Practices to benefit the livelihoods and nutrition of more than 2,000 Women Self-Help Groups in Odisha, India	MELOICR279	2	New Outcome

Table 4. Condensed list of innovations by stage for this reporting year.

The table below provides a list of FISH innovations from 2019.

Title of innovation with link	Innovation Type	Stage of innovation	Geographic scope (with location)
A novel mixed-method approach to climate change vulnerability assessments for fish production systems in Myanmar MELINN379	Social Science	Stage 1: discovery/proof of concept	National (Myanmar)
Four scaling approaches for community-based, co-management for coastal fisheries in Solomon Islands MELINN138	Production systems and Management practices	Stage 1: discovery/proof of concept	National (Solomon Islands)
A smartphone app providing aquaculture extension information in Myanmar MELINN311	Research and Communication Methodologies and Tools	Stage 2: successful piloting	National (Myanmar)
Advantages of inclusion of slowly degradable fibres (non starch polysaccharides - NSP) in fish diets for circularity in food production MELINN396	Production systems and Management practices	Stage 2: successful piloting	Global
Predictive analytical and data tools enabling nutrition-sensitive management of fisheries MELINN350	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	Global
Better Management Practices (BMPs), including production of mono sex tilapia and use of probiotics, to enhance tilapia production in Cameroon MELINN362	Production systems and Management practices	Stage 3: available/ ready for uptake	National (Cameroon)
Better Management Practices for Carp Intensification adopted by Women Self Help Groups in India MELINN353	Production systems and Management practices	Stage 4: uptake by next user	National (India)
Rapid genomic detection of aquaculture pathogens MELINN249	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	Global

Big data technology and system (PeskAAS) to improve small-scale fisheries management in Timor Leste MELINN136	Research and Communication Methodologies and Tools	Stage 4: uptake by next user	National (Timor- Leste)
Boneless Hilsa products (Hilsa soup, Hilsa noodles and Hilsa minced cubes) developed for Bangladesh MELINN358	Production systems and Management practices	Stage 3: available/ ready for uptake	National (Bangladesh)
Climate smart culture of genetically improved tilapia through In-Pond Raceway System (IPRS) MELINN359	Production systems and Management practices	Stage 2: successful piloting	National (Egypt)
Co-management of community fish refuges (CFRs) in multifunctional rice/wetland landscapes to enhance fish production, water security and adaptive capacity to climate change in Cambodia MELINN361	Production systems and Management practices	Stage 2: successful piloting	National (Cambodia)
Community Fish Guards (CFGs) enhanced compliance in coastal biodiversity conservation in Bangladesh MELINN357	Production systems and Management practices	Stage 4: uptake by next user	National (Bangladesh)
Contextualized better management practices (BMPs) for genetically improved farmed tilapia (GIFT) in Timor-Leste MELINN227	Production systems and Management practices	Stage 4: uptake by next user	National (Timor-Leste)
Contextualized better management practices (BMPs) for smallholders farming tilapia (GIFT) in pond-based systems in Zambia MELINN360	Production systems and Management practices	Stage 3: available/ ready for uptake	National (Zambia)
Coral Triangle (CT) Atlas database portal built upon open source geospatial solutions to enable its sustainability MELINN352	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake	National (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, Timor-Leste)
DArTseq molecular genetic marker developed for rohu carp (Labeo rohita) MELINN151	Genetic (variety and breeds)	Stage 1: discovery/proof of concept	Global

Database of the nutrient composition of ingredients locally available for low-cost feed formulation in Africa and Asia MELINN252	Other	Stage 1: discovery/proof of concept	Global
Digital MachHaat: Food Fish Buying and Selling Service for Bangladesh MELINN376	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake	National (Bangladesh)
Digital tool for on-farm performance assessment of aquaculture systems MELINN258	Research and Communication Methodologies and Tools	Stage 2: successful piloting	Global
Fish foresight modelling tools involving quantitative assessments of fish production and consumption patterns MELINN367	Research and Communication Methodologies and Tools	Stage 2: successful piloting	National (Egypt, Nigeria, Zambia)
Generation 7 of genetically improved farmed tilapia (GIFT) has been produced in India MELINN380	Genetic (variety and breeds)	Stage 3: available/ ready for uptake	National (India)
Gangetic Hilsa ecotypes/races and its return to natal river for spawning discovered by genetic analysis MELINN355	Genetic (variety and breeds)	Stage 1: discovery/proof of concept	National (Bangladesh)
Gender inclusive methodologies for co-management of fisheries MELINN369	Research and Communication Methodologies and Tools	Stage 2: successful piloting	Global
Gender Transformative Approaches in relation to small-scale fishery and small-scale aquaculture MELINN370	Social Science	Stage 2: successful piloting	Global
Gender-inclusive sustainable livelihood diagnostic tool MELINN289	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake	Regional (Pacific)
Gender-sensitive financing mechanism for the fisheries sector in Malawi MELINN372	Social Science	Stage 3: available/ ready for uptake	National (Malawi)

Generation 1 of improved strain of Silver Carp (Hypophthalmichthys molitrix) MELINN255	Genetic (variety and breeds)	Stage 1: discovery/proof of concept	Global
Genetically Improved Farmed Tilapia (GIFT) introduction in Odisha State (India) MELINN354	Production systems and Management practices	Stage 2: successful piloting	National (India)
Land-use modelling, scenarios and decision-support tools to optimise integrated fish-agri food systems MELINN262	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	National (Myanmar)
Model for enhancing in situ produced protein and highly unsaturated fatty acids (HUFA) in shrimp ponds MELINN397	Production systems and Management practices	Stage 1: discovery/proof of concept	Global
Methodological innovation for 'Illuminating Hidden Harvest' of small-scale fisheries MELINN285	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	Global
Nearshore fish aggregating devices (FADs) for food and nutrition security and distributive justice in Timor-Leste MELINN368	Production systems and Management practices	Stage 3: available/ ready for uptake	National (Timor- Leste)
Public-Private partnership (PPP) model GIFT hatchery for scaling of Aquaculture in Timor-Leste MELINN382	Other	Stage 4: uptake by next user	National (Timor- Leste)
Raised Pond System (RPS) in Kenya MELINN363	Production systems and Management practices	Stage 2: successful piloting	National (Kenya)
Social, political, environmental and technical adjustments for viability of rice-fish systems in Myanmar MELINN260	Production systems and Management practices	Stage 2: successful piloting	Regional
Rupali: Digital platform for input and aquaculture advisory services to increase productivity and efficiency in Bangladesh MELINN375	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake	National (Bangladesh)

Smartphone-based Citizen Science Approach for Improved Fish Catch Monitoring in Bangladesh MELINN356	Research and Communication Methodologies and Tools	Stage 2: successful piloting	National (Bangladesh)
Solar updraft Aeration SUpA - Passive Aeration System for Aquaculture in Bangladesh MELINN398	Production systems and Management practices	Stage 2: successful piloting	National (Bangladesh)
Solar-social innovations to reduce waste and loss and improve incomes in capture fisheries systems MELINN381	Production systems and Management practices	Stage 1: discovery/proof of concept	National (Solomon Islands)
Systems-thinking approach for identifying hot-spots for antimicrobial resistance (AMR) emergence and elucidating pathways for human exposure in aquaculture systems MELINN225	Research and Communication Methodologies and Tools	Stage 2: successful piloting	Global
Use of "garden-irrigation systems" and "WISH ponds (Water and Fish artificial ponds lined with tarpaulin)" for fish production in Myanmar MELINN312	Production systems and Management practices	Stage 4: uptake by next user	National (Myanmar)
Women's Empowerment in Agriculture Index (WEFI), a methodological tool for assessing women's transformative change in fisheries and aquaculture MELINN371	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	Global
Typology analysis of interventions to reduce antimicrobial use in aquaculture systems MELINN226	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept	Global
Vertical transmission of tilapia lake virus (TiLV) demonstrated MELINN254	Production systems and Management practices	Stage 1: discovery/proof of concept	Global

Table 5. Summary of status of planned outcomes and milestones (sphere of influence-control).

The table provides the status of planned outcomes and milestones for 2019.

Flagship (FP)	FP outcomes 2022	Sub-IDOs	Summary narrative on progress against each FP outcome in 2019	Milestone	Milestones status: complete, extended, cancelled or changed	Evidence	Links to evidence
FP1	Outcome 1.1: 1.5 million households have access to and are using our selectively improved, faster growing and more resilient strains of tilapia and carp seed	1.4.3: Enhanced genetic gain	Spawning and production first selected generation of silver carp was completed. Catla carp were not productive in 2019 and could not be bred. Breeding is now scheduled for breeding in 2020. Experiments on key resilience traits in GIFT were completed and genomic data obtained, both key steps in the production of novel improved strains for these farmed fish of global importance.	Production of the first selected generation of Catla and silver carp (in Bangladesh) and the production of genomic data on specific traits designed to increase resilience in tilapia (global).	Extended	Silver carp first generation has been produced. Catla were not productive and are now scheduled for breeding in 2020. Samples collected for genomic analysis and data to be analysed in 2020 for genomic-based selection of GIFT in Malaysia.	Hamilton, Matthew G., 2020, "Worldfish Silver Carp Genetic Improvement Program G1 families", Harvard Dataverse Generation 1 of improved strain of Silver Carp (Hypophthalmichthys molitrix) MELINN255 De Verdal, Hugues, et al., 2019. Agonistic behaviour and feed efficiency in juvenile Nile tilapia Oreochromis niloticus. Aquaculture 505 : 271-279. Benzie, J, 2019. Interim assessment of genomic selection design in WorldFish GIFT tilapia programme. Report, WorldFish 2019.

			Good progress was made in development if integrated assessment tools for tilapia fish farming, that were used to assess performance of improved tilapia strains. Key data on performance and yield gaps in tilapia farming were analysed and findings studies published.	Assessment of adoption and performance of previous introductions of GIFT into focal countries in Asia and Abbassa strain in Egypt completed	Complete	The assessment of the impact of dissemination of genetically improved Abbassa Nile tilapia strains was conducted. Results were published in a peer review paper. In addition, a systematic literature review of the major factors causing yield gap by affecting growth, feed conversion ratio and survival in Nile tilapia was also conducted. This has been key to inform the theory of chage behind the GIFT impacts studies. A study, dataset availabe, was conducted in Bangladesh to assess GIFT diffusion at ahatchery level and to evaluate breeding performance at farm level. This has included socio-	Ibrahim, Nabil Ahmad, Ahmed Mohamed Nasr-Allah, and Harrison Charo-Karisa, 2019. Assessment of the impact of dissemination of genetically improved Abbassa Nile tilapia strain (GIANT-G9) versus commercial strains in some Egyptian governorates. Aquaculture Research 50.10 : 2951-2959. Mengistu, Samuel Bekele, et al., 2019. A systematic literature review of the major factors causing yield gap by affecting growth, feed conversion ratio and survival in Nile tilapia (Oreochromis niloticus). Reviews in Aquaculture (2019). Van Tran, Nhuong; et al, 2020, "Performance assessment of GIFT strains in Bangladesh", Harvard Dataverse, Zeller, Manfred; et al, 2020, "Myanmar Baseline aquaculture performance

						economic analysis of farms and management implications. A baseline assessment for analysing tilapia adoption was also conducted in Myanmar.	assessment", Harvard Dataverse
	Outcome 1.2: 2.5 million households have adopted disease detection and control strategies, cost-effective and sustainable aquafeeds and/or improved aquaculture management practices	1.4.2: Closed yield gaps through improved agronomic and animal husbandry practices 2.4.2: Reduced livestock and fish disease risks associated with intensification and climate change	Several promising lines of cooperation with private sector partners in fish disease diagnostics and feed ingredients were successfully pursued with co-investment during 2019. These include the partner Wilderlab for fish disease diagnostics tools through the Inspire Big Data collaboration on "*Lab in a backpack*"; and feed companies engaged in fish feeds research and scaling related to the nutritious pond concept (NPC) and novel ingredients, including Skretting, several national feed companies in Bangladesh and DeHeus (the latter funding of two PhD students from Bangladesh).	At least one private company and or one public organization investing in scaling of new fish feed ingredients and/or fish disease diagnostic tools within focal countries for improving yields	Complete	Bangladesh National Health Strategy, that provides a One Health framework for managing disease risks in aquatic animals and public and private sector cooperation and investment, has been produced. This strategy provides a framework for public and private investments in Bangladesh aquatic animal health. An MoU with Single Spark has been signed to support the start-up of new	National Fish Health Management Strategy of Bangladesh. Department of Fishery, Bangladesh, 2019. MELOICR246 MoU WorldFish and Single Spark, 2019. MoU WorldFish and De Heus, 2019. WorldFish Press Release, 2019. WorldFish and Skretting sign MoU to develop aquaculture in Africa. WorldFish website. Rapid genomic detection of aquaculture pathogens, Inspire challenge, 2019. Penang, Malaysia: WorldFish. Poster.

						entrepreneurs in Bangladesh. An MoU with De Heus, for co-investment in feed development in Bangladesh, was also concluded. A new MOU for R&D cooperation with Skretting was also signed and different activities, co-funded within this partnership, has started in Egypt. A partnership with Wilderlab was also established for developing a rapid genomic detection tool for aquaculture pathogens under Big Data Innovation grant.	BigData Platform, 2019. Rapid genomic detection of aquaculture pathogens, Inspire challenge, 2019. BigData Platform website.
	Outcome 1.3: 4.8 million metric tons of annual farmed fish production with reduced environmental impact and increased resource-	1.3.4: More efficient use of inputs 3.3.3: Reduced net greenhouse gas (GHG) emissions	(1) Better management practice (BMPs) guidelines for improving tilapia farming management have been published at global level, and progressively adapted to national circumstances through national BMP	(1) Aquaculture improvement programs being implemented in Bangladesh and Egypt and	Complete	The first Tilapia BMP workshop was held in WorldFish Abbassa, Egypt in Jan 2019. The workshop convened key	FISH CRP, 2019. FISH events: Tilapia Better Management Practices (BMPs) Guidelines Workshop. Fish CRP Website.

	use efficiency (measured by 20% reduction in GHG emissions and 10% increase in water and nutrient-use efficiency)	from agriculture, forests and other forms of land use	guidelines and bilaterally funded projects, to guide sustainable tilapia farming practices in training and extension programs. (2) The partnership platform established by the Aquaculture compact of the Technologies for African Agriculture Transformation (TAAT) project provides an	defined in Myanmar and Zambia (2) Public-private sector partnerships or platforms established and R&D	 Extended	people involved in breeding, dissemination and farming of tilapia and agreed on an approach to coordinate and facilitate the process of developing tilapia BMP products at global and country levels. Based on this global workshop and approach, 2 national BMPs have been developed in Zambia and Timor-Leste, while other countries such as Bangladesh and Myanmar and Egypt have been involved in multi-stakeholder consultations and have drafted national guidelines. FISH CRP had supported the development of the SADC Regional Tilapia Genetic Improvement	Hoevenaars, K. Wiza Ng'ambi, W. (2019). Better management practices manual for smallholders farming tilapia in pond-based systems in Zambia. Manual: FISH-2019-07. Pant, J. et al. (2019). Better management practices for genetically improved farmed tilapia (GIFT) in Timor-Leste. Manual: FISH-2019-04 MELINN227 Developing Southern Africa Development Community (SADC) Regional Tilapia Genetic improvement programme MELPOL251 MELINN360

			important conduit for scaling of improved fish farming practices in focal (DR Congo, Ghana, Kenya, Nigeria and Zambia) and satellite (Burundi, Cameroon, Cote D'Ivoire, Republic of Benin and Tanzania) countries. A partnership with the Southern Africa Development Cooperation supports further extension of best practices in aquatic genetic resources management to member countries in that region of Africa. A partnership platform became operational in Cambodia in early 2020.	agenda adopted for improving environmental performance in remaining focal countries, in Africa [Tanzania, Zambia] and in Asia [Cambodia]		programe that guided to develop three national nucleus breeding programmes for tilapia in the region. (2) Thanks to the initiatives promoted by the Technologies for African Agriculture Transformation (TAAT) project, various aquaculture research and development approaches have been developed and implemented in 10 African countries.	Technologies for African Agriculture Transformation (TAAT), 2019. TAAT Aquaculture Compact. TAAT Website. Raised Pond System (RPS) in Kenya MELINN363 Better Management Practices (BMPs), including production of mono sex tilapia and use of probiotics, to enhance tilapia production in Cameroon MELINN362 Mona El Azzazy - 27 January 2019. How aquaculture in Africa is benefiting from new technologies and best management practices. The Fish Tank blog.
	Outcome 1.4: 2.3 million poor people (of which 50% are women) access improved livelihood opportunities resulting from increased aquaculture production and associated value	1.3.1: Diversified enterprise opportunities 1.3.2: Increased livelihoods opportunities	(1) The partnership platforms established by the Aquaculture compact of the Technologies for African Agriculture Transformation (TAAT) project and by Aquaculture Technical, Vocational and Entrepreneurship Training for Improved Private Sector and Smallholder Skills (AQ	(1) Public-private sector partnerships or platforms established for scaling up and out FISH business and entrepreneurs hip models in remaining	Complete	Approaches to enhance the linkages between the private sector and smallholder commercial fish farmers have been adopted in Northern Zambia via input supply stores.	FISH CRP, 2019. First dedicated aquaculture input supply store opens in Zambia's Northern Province. FISH CRP website. Aquaculture Technical, Vocational and Entrepreneurship Training for Improved

	chains and enterprise development.		TEVET) project are key steps toward enhancing the linkages between the private sector and smallholder fish farmers in Africa.	focal countries, in Africa (Tanzania, Zambia) and in Asia (Cambodia).		Infographic from the AQ TVET project in Zambia explains the approach. The Technologies for African Agriculture Transformation (TAAT) project web site provides an outline of the countries involved and partnership approach. A policy case describes a commitment of the Southern African Development Community for scaling fish genetic improvement investments in the SADC region.	Private Sector and Smallholder Skills project in Zambia. WorldFish. Infographics, 2019. Technologies for African Agriculture Transformation (TAAT), 2019. TAAT Aquaculture Compact. TAAT Website. Developing Southern Africa Development Community (SADC) Regional Tilapia Genetic improvement programme MELPOL251
			(2)Multiple partnerships are being pursued across focal and scaling countries for scaling of FISH aquaculture technologies, showing overall positive progress in scaling.	(2) Integrated aquaculture technologies and business models validated by public and/or private partners and	Extended	Bangladesh project provides co-investment with private sector into scaling of technologies and business models.	WorldFish (2019). Feed the Future Bangladesh Aquaculture and Nutrition Activity. Dhaka, Bangladesh: WorldFish. Factsheet Cambodia American Soybean Association,

			Notable examples are: Bangladesh through private sector and market systems oriented projects involving health, feed and aquaculture management; Cambodia through a cooperation with the American SoyBean Association; Timor Leste with private hatchery investors; and African Development Bank investments in Zambia and Malawi.	receiving public and/or private sector investments for scaling in four focal countries		A cooperation with the American Soybean Association in Cambodia is scaling feeding technologies to fish farmers. Private sector investment in GIFT fish hatchery in Timor Leste. Public sector investment in GIFT genetic program in Odisha, India. African Development Bank invests in Zambia to adopt genetic technologies for development of an improved strain of Oreochromis andersonii. African Development Bank invests in a Sustainable Fisheries, Aquaculture and Watershed Management project in Malawi	2019 - WISHH Leaders Witness Soy Demand Building in Cambodia & Myanmar. American Soybean Association web site The first public-private-partnership (PPP) model tilapia hatchery in Timor-Leste boosted the country's production of GIFT fingerlings and paved the way for the aquaculture sector's sustainability - MELOICR 244 National approval for GIFT Multiplication Center and Hatchery establishment at Government Fish Farm in Odisha MELPOL231 Jere, J., December 2019. Kafue Bream Under Genetic Boost. Zambia National Broadcasting Corporation website. Sustainable Fisheries, Aquaculture Development and Watershed Management Project document, 2019. German

						that includes investment in aquaculture and genetic technologies from WorldFish research. WorldFish and U.S. Soybean Export Council (USSEC) promote the use of In Pond Raceway System (IPRS) technology in Egypt.	trade and investment website Climate smart culture of genetically improved tilapia through in pond raceways MELINN359
FP2	Outcome 2.1: 1 million fishery dependent households have reduced poverty as a result of adopting improved fisheries management	1.3.1: Diversified enterprise opportunities 1.3.2.: Increased livelihood opportunities 2.1.2: Increased access to nutrient rich foods	A series of regional and global syntheses were complete during the year, at global and national scales, with further influential deliverables along this pathway to be produced in 2020 and beyond. These syntheses include papers published on nutritional values of coastal fisheries and small-scale fisheries governance and associated country level initiatives in Bangladesh, Cambodia, Myanmar and Timor Leste. “Hidden Harvest” data sets from four countries, as part of the FISH-FAO cooperation on small-scale	Completed production of a series of key regional and global multi-case syntheses and methods on small-scale fisheries within fish food systems	Complete	Key papers published on nutritional values of coastal fisheries and small-scale fisheries governance Timor-Leste reports on fisheries and aquaculture assessment; journal article on trade flows of fish; and a journal article on collaborative governance fit for fisheries and food security in Timor-Leste.	Hicks, C.C. et al. (2019). Harnessing global fisheries to tackle micronutrient deficiencies. Nature, 574(7776): 95-98 Steenbergen, D. et al. (2019). Governance interactions in small-scale fisheries market chains: Examples from the Asia-Pacific. Fish and Fisheries, 20(4): 697-714 Juliana López-Angarita, et al. (2019). Fisheries and aquaculture of Timor-Leste in 2019: Current knowledge and opportunities. Bayan

			fisheries in food systems progress well. A regional paper on fish in food systems of Asia was completed and submitted for publication.			Country level initiatives in Bangladesh, Cambodia, Myanmar and Timor Leste have informed regional/global analyses and/or enabled FISH to put into practice synthesis findings. Bangladesh and Myanmar publications on cross-border stocks and fisheries for Hilsa in Bangladesh and Myanmar. Methodological innovation (reported 2018) employed in data collection completed with datasets lodged on MEL for Eqypt, Bangladesh, Malawi and Zambia as part of Illuminating Hidden Harvest Initiative.	Lepas, Malaysia: WorldFish (WF) Steenbergen, D. et al. (2019). Following the fish inland: understanding fish distribution networks for rural development and nutrition security. Food Security, 11(6): 1417-1432. Tilley, A. et al. (2019). Evaluating the fit of co-management for small-scale fisheries governance in Timor-Leste. Frontiers in Marine Science, 6: 392 Legal regime for the management and regulation of fisheries in Timor-Leste - MELPOL270 Rahman, M. J. et al. (2020). Hilsa fishery management in Bangladesh. Conference Series: Earth and Environmental Science, 44: 012018. Khaing, W.W. et al. (2019). Socioeconomic characteristics of hilsa fishers in the Ayeyarwady

							Delta, Myanmar: Opportunities and challenges. International Institute for Environment and Development. Country Report WorldFish, FAO and Duke University. 2018. Illuminating hidden harvests. Penang, Malaysia: WorldFish; Rome, Italy: Food and Agriculture Organization of the United Nations; Durham, USA: Duke University. Program Brief.
	Outcome 2.2: 1.2 million people, of which 50% are women, assisted to exit poverty through livelihood improvements	1.3.1: Diversified enterprise opportunities 1.3.2.: Increased livelihood opportunities 2.1.2: Increased ac cess to nutrient rich foods	Livelihood improvements, alternative livelihoods and livelihood buffers have been tested through action research – best practice guides and diagnostic tools have been developed and disseminated through established networks (e.g., regional agencies) and new investments. Technologies include fish drying tents, fish aggregating devices, solar powered freezers, savings schemes. Whilst more lessons will emerge as contexts and opportunities change this is complete as per milestone.	Completion of dissemination of learning on alternative livelihoods through continuous engagement with learning and governance networks	Complete	Peer review articles on women's participation in fisheries value chains in Malawi (Nagoli et al. 2019; Pasani et al. 2019), and guiding gender-sensitive and inclusive livelihood improvement initiatives. For Pacific region, learning on livelihoods being integrated into manual for broad dissemination	Manyungwa, C. L. Hara, M. M. Chimatiro, S. K. (2019). Women's engagement in and outcomes from small-scale fisheries value chains in Malawi: effects of social relations. Maritime Studies, 18(3): 275-285. Nagoli, J.; Binauli, L.; Chijere, A. (2019). Inclusive Ecosystems? Women's Participation in the Aquatic Ecosystem of Lake Malawi. Environments, 6(1): 3.

						through SPC and regional networks in 2020. Exposure stories published on line as part of dissemination "Ingredients of success" and "Women's use of solar power freezers" Early 2020 publication of diagnosis tool for livelihoods as an innovation – taken up by EU investment. 2020 evaluation of uptake. Fisheries technology assessed as high return on investment intervention (Tilley et al. 2019) and manual of best practice developed and adapted by regional agency in the Pacific	Lawless, S. et al. (2019). Gender norms and relations: implications for agency in coastal livelihoods. Maritime Studies, 18(3): 347-358. Hampus Eriksson. (9/8/2019). Ingredients for success. URL: https://worldfish.exposure.co/ingredients-for-success. Hampus Eriksson. (9/7/2019). The cool women of Malaita. URL: https://worldfish.exposure.co/cool-women-of-malaita. Govan, H. et al. (2019). A new idea for coastal fisheries: asking the right questions to enhance coastal livelihoods. New Caledonia: The Pacific Community. 23 pp. Alexander Tilley, et al. (13/8/2019). Nearshore fish aggregating devices show positive outcomes for sustainable fisheries development in Timor-Leste.

						High level keynote presentation on livelihood learning to 1000 fisheries stakeholders at United Nations Science to Policy Nexus meeting	Sokimi W., et al. 2020. Manual on anchored fish aggregating devices (FADs): an update on FAD gear technology, designs and deployment methods for the Pacific Island region. Noumea, New Caledonia: Pacific Community. 56 p Cohen, P. (19/11/2019). Sustain or transform; secure, safe & equitable livelihoods in small-scale fisheries. Bayan Lepas, Malaysia: WorldFish. Presentation.
	Outcome 2.3: 2.1 million hectares of inland aquatic and coastal marine habitat restored and under more productive and equitable management	3.2.1: More productive and equitable management of natural resources 3.3.1: Increased resilience of agroecosystems and communities, especially those including smallholders	(1) Three multi-stakeholder platforms have been identified and established – these are being institutionalised through 2020.	(1) Identification of cross-scale governance mechanisms to support the viability of interventions	Complete	Three multi-stakeholder platforms have been identified and established – these are being institutionalised through 2020. Theories of governance efficacy examined for fit to resource governance (including coastal systems supporting SSF) in high impact journal article	Towards Resilient and Equitable Small-Scale Fisheries. Meeting Summary, 3-5 September 2019 | Penang, Malaysia. WorldFish 2019 FAO. 2020. Report of the PAN-African Workshop on Strengthening Organizational Structures of Non-state Actors for Sustainable Small-scale Fisheries in Africa. Kasane, Botswana, 10–12 July 2019. Fisheries

						Regional policy analysis completed an published in journal article to examine efficiency of policy diffusion and opportunities to strengthen policy against global gender, food security and environmental governance commitments	and Aquaculture Report No. R1288. Rome. Morrison, T.H. et al. (2019). The black box of power in polycentric environmental governance. Global Environmental Change, 57: 101934 Song, A.M. et al. (2019). Multi-scale policy diffusion and translation in Pacific Island coastal fisheries. Ocean & Coastal Management, 168: 139-149
			(2) Progress was made during 2019 in adoption of emerging governance and production models in multi-functional landscapes in Cambodia and Myanmar, Fish rice innovations scaling in Cambodia and land use reform enabled in Myanmar will allow further scaling of rice-fish innovations. Guidelines to support adoption and application of governance and fish production models across a wider range of water infrastructure and management contexts were	(2) Wider adoption and application of governance and production models for freshwater systems	Extended	Community Fish Refuge Guide for Cambodia published, outcomes reported and disseminated through novel infographics and taken up by local partners and early evidence (GIZ donor communication) of uptake into new large sector investments. Assessments, models, scenarios	Kim, M. et al. (2019). A manual for community fish refuge-rice field fisheries system management in Cambodia. Phnom Penh, Cambodia: Fisheries Administration and WorldFish Cambodia Feed the future. Cambodia Rice Field Fisheries II. Penang, Malaysia: WorldFish. Infographic 2019. Dubois et al (2019). Integrating fish into irrigation infrastructure

			drafted during 2019 and their promotion through fisheries and water governance and management stakeholders and networks will commence during 2020 with formal release of guide.			of fish production in agricultural and water infrastructure published in peer review on rice-fish, communicated using infographics and convenings that have led to early changes in land use policy reform in Myanmar.	projects in Myanmar: rice-fish what if…? Marine and Freshwater Research, 70(9): 1229-1240 WorldFish. A win-win approach: Integrating fish into rice systems in Myanmar. Penang, Malaysia: WorldFish. Infographic. 2019 The Government of Myanmar extends the promotion of integrated farming systems to accommodate more fish for smallholder farmers - MELOICR213

Table 6. Numbers of peer-reviewed publications from current reporting period (sphere of control).

The following table provides overall numbers of peer review publications, with a link to the full list of publications provided in Part C.

	Number	Percent
Peer reviewed publications	63	100%
Open Access	43	68%
ISI	59	94%

Table 7. Participants in capacity development activities.

The following table summarizes participants in capacity development activities during 2019, subdivided according to CGIAR performance indicators, into short and long-term programs, with additional information to be found in links provided in Part C.

Number of trainees	Female	Male
In short-term programs facilitated by FISH	145,441	32,033
In long-term programs facilitated by FISH	13	12
PhDs	6	6

Table 8. Key external partnerships.

The following lists up to five important partnerships for 2019 for each flagship. A full list of current partners is provided as supporting evidence: see Evidence F: Full list of current external partnerhips

Lead Flagship (FP) & Cluster	Brief description of partnership aims (30 words)	List of key partners in partnership. Do not use acronyms.	Main area of partnership Research/Delivery/Policy/ Capacity Development/Other, please specify _____
FP1 C1	Research on genomics and genetics of advanced disease resistance and resilience traits in tilapias	a) French Agricultural Research Centre for International Development (CIRAD), Montpellier b) The Earlham Institute, Norwich c) The Roslin Institute, University of Edinburgh d) Swedish University of Agricultural Sciences (SLU), Uppsala e) Wageningen University and Research Center (WUR), Wageningen	Research (a, b, c, d, e) Capacity development (a, b, c, e)
FP1 C2	Research and delivery of epidemiological, diagnostic and management tools for reducing disease risks in tilapia and carp aquaculture.	a) Bangladesh Agricultural University (BAU) b) Bangladesh Fisheries Research Institute (BFRI) c) Center of Excellence (CENTEX) for Shrimp Molecular Biological and Biotechnology,Faculty of Science, Mahidol University, Bangkok d) Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft e) Chulalongkorn University (CU), Bangkok f) Department of Fisheries (DoF), Bangladesh g) Food and Agriculture Organization of the United Nations (FAO) h) Khulna University (KU) i) The Norwegian Veterinary Institute (NVI), Oslo j) The University of Exeter (UoE) k) University of Queensland (UQ) l) Wilderlab NZ Ltd (WNZ), Wellington m) World Organisation for Animal Health (OIE)	Research (a,b,c,d,e,h,I,j,k,l) Delivery (f) Policy (f,g,m) Capacity development (a,g,m)

FP1 C2	Research for reduction in use of antimicrobial (AMR) agents and application of “One Health” approaches in aquaculture	a) Centre for Environment, Fisheries and Aquaculture Science (CEFAS) b) Ending Pandemics (EP), San Francisco c) Fleming Fund, London d) Fish Inspection and Quality Control (FIQC), Khulna e) Food and Agriculture Organization of the United Nations (FAO) f) Khulna University (KU) g) Royal Veterinary College (RVC), London h) Stockholm Resilience Centre (SRC) i) The University of Exeter (UoE) j) University of Stirling (STIR) k) University of Waterloo (UWaterloo), Toronto l) World Animal Health Organization (OIE)	Research (a,f,g,h,I,j,k) Delivery (d) Capacity development (b,c,e,l)
FP1 C2	Research partnerships for on-farm trials and scaling of the nutritious pond concept	a) De Heus Animal Nutrition, Ede(fish feed company in Bangladesh) b) AllerAqua, Christianfeld (fish feed company in Zambia)	Research (a,b) Capacity development (b)
FP1 C3	Research for the implementation of a baseline study on tilapia farm performance in Egypt	a) Skretting Feed company, Stavenger	Research (a) Capacity development
FP1 C3	Research environmental implications of different aquaculture systems in various contexts.	a) Stockholm Resilience Center (SRC)	Research (a)
FP2, C1	Research and scaling towards more resilient and equitable small-scale, coastal fisheries and communities (gender equity, fisheries performance, climate resilience/adaptive capacity), with focus in Bangladesh, Solomon Islands and Timor Leste	a) The Pacific Community (SPC), Nouméa b) Department of Fisheries, Bangladesh c) Ministry of Fisheries and Marine Resources (MFMR), Solomon Islands d) Timor Leste Ministry of Agriculture and Fisheries (MAF), Dili e) University of Wollongong (UOW)	Research (a,e) Capacity development (a) Delivery (a) Policy (b,c,d)
FP2, C2	Research on innovations for water management and	a) Charles Sturt University (CSU), Albury	Research (a) Capacity development (a)

	governance to support increased fish production in constructed water bodies in multi-functional rice-dominated landscapes	b) Ministry of Agriculture, Livestock and Irrigation (MOALI), Napyidaw, Myanmar c) Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, Cambodia	Delivery (b,c) Policy (b,c)
FP2, C3	Increasing the connections between research and key FAO policy instruments, including representation of FISH research in the FAO International Conference on Fisheries Sustainability, November 2019 and the "Hidden Harvest" research on values of small-scale fisheries.	a) Food and Agriculture Organization of the United Nations (FAO)(relevant also for Cluster 1, and Cluster 2) b) Duke University, North Carolina	Research (b) Policy (a)
FP2, C3	Global research on fish in food systems and nutrition-sensitive fisheries management. Regional research on fish in food systems in the three priority FISH regions; Africa's Great Lakes, Mekong and Pacific Blue Foods Assessment, a component of the EAT-Lancet initiative on transformation of food systems	a) Lancaster University b) The Africa Centre of Excellence - Malawi Aquaculture and Fisheries (AquaFish) with Lilongwe University of Agriculture and Natural Resources (LUANAR) c) Stockholm Resilience Center and Stanford Center for Ocean Solutions	Research (a) Capacity development (b) Policy (c)
FP1 and FP2	Research around impacts of FISH CRP innovations and policies, including the development and testing of a methodology to a assess related projected benefits.	a) University of Tokyo b) University of Pisa, Department of agriculture, food and environment (DAFE)	Research (a,b) Policy (b)

Table 9. Internal cross-CGIAR collaborations.

[Please include collaborations with one or more CRPs or Platforms – or in some cases with other Centers, if these are not already core partners for your CRP.]

FP	Brief description of the collaboration	Name(s) of collaborating CRP(s), Platform(s) or Center(s)	Optional: Value added, in a few words e.g. scientific or efficiency benefits
FP1 C1	Quality control development for tilapia and carp genetic improvement programs. Initial work on the data entry forms for breeding program assessments (BAPs) and the application to fish genetic improvement programs.	Excellence in Breeding Platform	Improved efficiency
FP1 C2	WorldFish, International Livestock Research Institute (ILRI), International Food Policy Research Institute (IFPRI) and International Water Management Institute (IWMI) for a shared post-doc and collaborative initiatives on modelling AMR in water systems and assessment and reduction of AMR use in aquaculture	CGIAR Antimicrobial Resistance (AMR) Hub	AMR Stewardship, capacity building and Collaborative research on AMR under one health framework
FP1 C2	BIG DATA Inspire challenge project - Rapid genomic detection of a culture pathogens	Big Data platform of International Center for Tropical Agriculture (CIAT)	Collaborative research for harnessing the power of big data, bioinformatics and genome sequencing for rapid disease diagnosis in aquaculture
FP1 C3	WorldFish and ILRI - Spatial and Temporal Patterns of Consumption of Animal-source Foods in Tanzania (joint publication submitted) IFPRI and WorldFish- IMPACT Fish model update; CGIAR foresight report with all CGIAR centres; foresight research in Nigeria WorldFish and IFPRI- research in Nigeria on willingness to pay for aquaculture food safety certification, how to upgrade aquaculture supply chains to respond to the demand	Research Program on Policies, Institutions, and Markets (PIM)	Collaborative research to understand patterns of animal source foods and implications for future interventions, developing new tools and updating existing tools for foresight modelling; understand aquaculture food safety demand to upgrade aquaculture chains
FP 1 C3	Special session on fish at the CCAFS Climate Smart Agriculture Conference in Bali. With CCAFS Flagship 2 (Climate Smart Technologies and Practice), for integration of fish into Climate Smart Agriculture (CSA) projects and scaling in the Mekong region and Bangladesh, and publication of an assessment of gender and CSA in Bangladesh.	Climate Change, Agriculture and Food Security (CCAFS)	

	With CCAFS Flagship 3 (Low Emissions Development), on publication of a paper on modelling of low-emissions development pathways for aquaculture. With CCAFS Flagship 4 (Climate Services and Safety Nets), on improving access of climate information services to aquaculture farmers and fishers in Bangladesh and India (Odisha state).		
FP1 C3	A working paper on synergies between fish and roots, tubers and bananas in food systems, focusing on Nigeria and Bangladesh and identifying potential future research for development opportunities to increase our collective impact across the two CRPs.	Roots, Tubers and Bananas (RTB)	
FP2 C1	BIG DATA Inspire challenge scale-up project - A digital Pipeline for Small-Scale Fisheries	Big Data platform of International Center for Tropical Agriculture (CIAT)	Research on the automation and scaling of digital fisheries monitoring and analytics to drive inclusive SSF governance in Asia and Africa.
FP2 C2	Complementary research interests including the refinements to ecosystem-based approaches to fisheries management and associated innovations; accounting for competing demands and tradeoffs between the different uses of land and water in multifunctional landscapes; and adapting to external drivers of change and natural seasonal and inter-annual variability.	Research Program on Water, Land and Ecosystems (WLE), particularly the Flagship on Managing Resources, Risks and Competing Uses for Resilience	Joint funding successfully pursued, Scientific research design and delivery, increase likelihood of policy influence,
FP2 C2	A five-year tripartite MoU that provides a framework for cooperation on R4D initiatives focused on the sustainable intensification and management of rice-fish production systems in irrigated landscapes and wetlands in Southeast Asia	International Rice Research Institute (IRRI), International Water Management Institute (IWMI) and WorldFish	Scientific, integrated, interdisciplinary research outputs (2020 co-authored) and designed focussed on rice-fish systems. Increased potential for policy and practice influence.
FP2 C2	WorldFish & IMWI partnership on WLE-led project investigating gender in the highly vulnerable wetlands in transition to Ramsar Conservation areas in the Gulf of Mottama, Myanmar. WorldFish playing the role of senior gender advisor to the project, partnering with IMWI gender leader.	Research Program on Water, Land and Ecosystems (WLE), particularly the Flagship on Managing Resources, Risks and Competing Uses for Resilience	Started in Q4. Is applying lessons from FISH regarding methodologies to assess inclusion-exclusion in governance, drawing on earlier CGIAR GENNOVATE methodologies, as well as applying AAS and FISH (WorldFish) insights regarding gender transformative approaches.

FP2 C2	Collaborative research and co-investment into global synthesis research on policy impact pathways in fisheries contexts (agreement via Collaborating for Resilience, PIM and WorldFish) and research-backed institutional building knowledge to support existing and emergent institutional structures to protect food and nutrition security functions of small-scale capture fisheries.	International Food Policy Research Institute (IFPRI), Policy Institutions and Markets (PIM)	Scientific, policy influence, instutional strengthening.
FP2 C3	Research collaboration and advisory arrangements between early career researchers and A4NH food systems researchers to build fish in food systems research agenda. Collaboration on fish and food systems research outputs (including through co-supervision of research students) in Bangladesh and Nigeria. Co-funding of PhD on modelling of fish in food systems at Wageningen University.	Wageningen University , Agriculture for nutrition and Health (A4NH)	Co-authoring research, research advice on food system research framing and design. Co-funding and co-supervision of research
Gender	Member of the Advisory Committee to the CGIAR Collaborative Platform on Gender Research, which strengthens the CGIAR's gender integration and strategic gender research and increases the profile of the CGIAR as a gender leader in R4D. As a part of this Platform contribution, was a Committee member and Theme leader for the CGIAR's Annual Scientific Conference on Gender conference in 2019, co-sponsored by ACIAR and the University of Canberra ('Seeds of Change'); and Led a book chapter for the Platform's priority collaborative output in 2019, involving contributors from 6 centres. Additionally, was awarded a competitive grant under the Platform in the Gender and Value Chains call for strategic research.	CGIAR Collaborative Platform for Gender Research	Contributed to very successful international 'Seeds of Change' conference co-led by the CGIAR. Resulted in a first of its kind collaborative high-level, high quality output by the Platform, including the FISH/WorldFish-led chapter on gender transformative approaches (to be released in 2020).
MELIA	A close cooperation with other key centers and CRPs continues since 2018 to refine and develop the MEL platform. Communication material and training tools have been jointly developed and training provided to all FISH researchers. A work plan for a routine based training has been developed to support further program-wide implementation in 2020.	ICARDA, CIP and IITA and CRPs (Roots, Tubers and Bananas and Grain Legumes and Dryland Cereals)	Increasing efficiency and effectiveness of the FISH CRP, through the MEL and cross Center/CRP cooperation

Table 10. Monitoring, evaluation, learning and impact assessment (MELIA).

The table below provides the status of evaluations, impact assessments and other learning exercises planned in the POWB.

Studies/learning exercises planned for this year (from POWB 2019)	Status complete, extended, cancelled, changed	Type of study or activity	Description of activity / study	Links to MELIA publications
Studies to assess on-farm performance of improved tilapia strains (input use, outputs, production and profitability) in different contexts such as Bangladesh, Egypt and Myanmar. Interrelations and effects on gender, environment and human nutrition will be explored.	Complete	Program/project adoption or impact assessment	Numerous opportunities exist to strengthen livelihoods and contribute to food security and nutrition through aquaculture. Improving productivity, socio-economic and environmental performance of aquaculture is an imperative to tapping these opportunities. An integrated assessment of on-farm performance of improved tilapia strains is important to identify ways through which aquaculture contributes to the five impact areas prioritized in the CGIAR research agenda to 2030, namely food security and nutrition, poverty, gender equity, environment, and climate change. In light of this, a digital tool for on farm performance assessment of aquaculture systems has been developed and made available for use in FISH CRP focal and scaling countries and by other stakeholders such as public and private sector. This with the scope to achieve consistency, comparability and effectiveness of research and data delivered around on-farm performance of aquaculture systems. Following this approach an integrated assessment of on-farm performance of improved tilapia strains is important to identify improved tilapia strains was implemented in three countries including Bangladesh (assessment) Myanmar (baseline), and Egypt (baseline). In all three countries, the surveys looked further production and profitability of improved strains of tilapia in farming condition and examined employment by gender, food security and dietary diversity, and adaptation to climate change. Important environmental aspects include management of pond water	Van Tran, Nhuong; Shikuku, Kelvin; Rossignoli, Cristiano; Hamilton, Matthew G.; Benzie, John; Barman, Benoy Kumar; Ali, Mohammad; Karim, Manjurul, 2020, "Performance assessment of GIFT strains in Bangladesh", Harvard Dataverse Zeller, Manfred; Khor, Ling; Van Tran, Nhuong; Shikuku, Kelvin; Cheong, Kai Ching; Aung, Yee; Bahru, Bezawit; Jaime, Diana, 2020, "Myanmar Baseline aquaculture performance assessment", Harvard Dataverse Shikuku, K. et al. (2019). Aquaculture Performance Assessment in Egypt: Preliminary descriptive analysis. WorldFish. Presentation.

			and pond waste as well as energy use. For all the three studies a journal article will be published in 2020.	
Identification of dissemination systems for improved tilapia seeds in different contexts such as Bangladesh, Myanmar and Egypt.	Extended	Qualitative Outcome Study: (mainly to substantiate contribution to policy or similar)	A participatory approach to evaluation of dissemination systems for improved tilapia strains was developed and successfully implemented in Bangladesh and Malawi. Multi-stakeholder workshops were held in 2019 with breeding nucleus operators, multiplier hatchery operators, private companies, researchers, and farmers to prioritize constraints to successful dissemination of improved tilapia strains and to identify blocking mechanisms. In addition, quantitative surveys were conducted with hatchery operators and seed traders. The analysis of the data and writing of reports is complete. A manuscript will be submitted to a peer review journal in May 2020. Insights from dissemination systems evaluation in Bangladesh and Malawi are being used to provide guidance in the development of a dissemination strategy for Genetically Improved Farmed Tilapia (GIFT) - a WorldFIsh and FISH CRP related innovation - in Bangladesh and Myanmar. A stakeholder consultative meeting was already held in 2019 to discuss GIFT dissemination in Myanmar and to share results from Bangladesh. Dissemination system will be assessed in Timor Leste in 2020.	Kelvin Shikuku, Olivier Joffre, Nhuong Van Tran, Benoy Barman, Mohammad Ali, Matthew Hamilton, Manjurul Karim, Naseem Ahmed Aleem. (2020). A Participatory Evaluation of Bangladesh's Dissemination Systems for Improved Tilapia Strains.
Evaluation of the project Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD)	Extended	Program/project evaluation/ review	This external and independent evaluation assessed results of the USAID-funded "Enhanced Coastal Fisheries in Bangladesh (ECOFISHBD)" project and implemented jointly by WorldFish and Department of Fisheries (DoF-Bangladesh). The project aimed to support the Government of Bangladesh and the coastal fishing communities to improve the resilience of the Ganges and Meghna River estuarine ecosystem and livelihoods that depend upon it. The evaluation aimed to assess how and to which extent the intervention promoted by WorldFish and FISH CRP has contributed towards sustainable management of hilsa fishery in Bangladesh. Effects on livelihoods and poverty reduction have been also	Essam Yassin Mohammed. (2020). EcoFish final evaluation report.

			assessed. The evaluation used the range of methods to triangulate findings in response to a series of evaluation questions organised to outcomes and impacts generated by the project. Preliminary report is available. A complete report will be released in 2020.	
Evaluation of the project Enhancing Livelihoods while Governing Marine Resources in Pacific Island Countries: Effects of the improved fish-based livelihoods on poverty, vulnerability and inequality for women and men in Solomon Islands and Timor-Leste.	Extended	Program/project evaluation/ review	The evaluation will focus on understanding the effects of the intervention promoted by WorldFish and Fish CRP, including relevant innovations, on livelihoods and women's empowerment in Solomon Islands and Timor-Leste. The evaluation has been delayed due to an extended implementation of the project. The evaluation will be conducted in 2020.	
Evaluation of the FishTrade project: Effectiveness of policy changes on intra-regional fish trade for reducing poverty and improving food and nutrition security in Africa	Complete	Program/project evaluation/ review	This external, independent evaluation assessed results of the European Union-funded Improving food security and reducing poverty through intraregional fish trade in sub-Saharan Africa (FishTrade) project managed by WorldFish, in partnership with the African Union – InterAfrican Bureau for Animal Resources (AU-IBAR) and the New Partnership for Africa's Development (NEPAD). The evaluation used the range of methods to triangulate findings in response to a series of evaluation questions organised according to the OECD DAC evaluation criteria and therefore assessed the project's relevance, coherence, effectiveness, efficiency, impact and sustainability. Finally, the evaluation provided a set of evidence-led, actionable recommendations for future project design and implementation. A draft report was available at the end of 2019 and become publicly available at the beginning of 2020.	James Keeley, Imogen Mullett, Hannah Isaac. (2019). Final Evaluation of the FishTrade Project - Final Report.
Fish foresight modelling study in Nigeria	Complete	Ex-ante, baseline and/or foresight study	The study was completed and a report prepared to better understand future macro level fish market demand and supply trends in Nigeria. A paper will be submitted to a peer review journal in 2020.	Chan, C. Y. et al. (2019). Future fish supply and demand in Nigeria. Penang, Malaysia. WorldFish. Presentation.

				Chin Yee Chan, Hoang Long Chu, Kai Ching Cheong, Nhuong Van Tran, Michael Phillips. (15/1/2020). Nigeria fish 2020-2050: Foresight modeling and policy implications.
Policy effectiveness study : Land use policy reform (2018-2022) in multifunctional landscapes as a driver to increase income and well-being	Changed	Qualitative Outcome Study: (mainly to substantiate contribution to policy or similar)	A paper has been published on integration of fish into land use policy in a case study in Myanmar providing evidence on the implications of policy change in multifunctional landscapes to deliver income, employment, nutrition and water use benefits. The research has however been expanded due to ongoing Parliament debate about land use policy in Myanmar. A cooperation with PIM has been developed for a deeper analysis of the case in Myanmar, and to build a methodology for projected benefits of policy options being considered by the Myanmar government.	Dubois, M.J. et al. (2019). Integrating fish into irrigation infrastructure projects in Myanmar: rice-fish what if…? Marine and Freshwater Research, 70(9): 1229-1240
Ecopond and Empowerment of Women Project: Assessment of the impacts of ecopond carp-based polycultural model in Bangladesh	Complete	EPIA: Ex-post Impact assessment	The evaluation, conducted in partnership with the University of Tokyo, assessed the impacts of Ecopond and Empowerment of Women II project intervention in Bangladesh to evaluate the implemented ecopond approach as a mean to scale up the fish production in small perennial ponds managed by women in order to get increased fish production, diversity in fish production, increased household fish consumption and sale of fish for cash income. The project outcomes consistently show the potential value of the ecopond technology and its contribution to the household wellbeing. Ecoponds are the most productive source of fish in most households with a high productivity per area compared to other ponds. In addition, excess fish represent a significant resource of income to the households and serve as a supplemental livelihood source. Households using ecopond technology achieve more income from Ecopond and a higher women's	Alexandros Gasparatos, Benoy Barman, Alice Karanja, Rodolfo Dam Lam, Eric Dompreh, A. B. M. Haque, Cristiano Rossignoli. (31/12/2019). Ecopond Impact Assessment Preliminary Report and Summary of Results.

			empowerment, measured through Women's empowerment in agriculture index (WEAI). As the Ecopond's fish stock develops, it has the potential to strengthen household resilience to face periods of food insecurity. Furthermore, the contribution of increasing the fish species diversity through Ecopond technology will contribute to achieve a better household nutrition including for women and children. A preliminary evaluation report is available. A peer review paper will be submitted in the first quarter on 2020.	
Understanding the employment generation in the Egyptian aquaculture value chain: implications for meeting the Sustainable Development Goals (SDGs)	Complete	Ex-ante, baseline and/or foresight study	Employment generation along the different stages of the aquaculture value chain in Egypt was assessed. The results suggest that aquaculture can generate significant levels of employment, amounting to 19.1 FTE jobs per 100 metric tons of produced fish. This, combined with the ongoing growth of the sector, means that aquaculture can contribute substantially to efforts to meet SDG 8 (Decent work and economic growth) in Egypt. A report was published and a paper submitted. The paper was published in early 2020.	Penang, Malaysia: WorldFish. Program Report: 2019-04 Nasr-Allah, A. et al. (2020). Employment generation in the Egyptian aquaculture value chain: implications for meeting the Sustainable Development Goals (SDGs). Aquaculture, 50: 734940.
Evaluation of the Sustainable Transformation of Egypt's Aquaculture Market System (STREAMS) project in Egypt	Complete	Program/project evaluation/ review	The Sustainable Transformation of Egypt's Aquaculture Market System (STREAMS) project was funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by WorldFish in partnership with CARE and in cooperation with the Ministry of Agriculture and Land Reclamation in Egypt. This external end project evaluation identified and assessed results achieved by the STREAMS project at outcome and output levels and draws lessons learned and recommendations for WorldFish, the Donor, project stakeholders and partners. The evaluation demonstrated that the project achieved to support the 4,297 farms involved by increasing their production (+16% ton/ha average production per farm) and profit (+57,7% average increase in profit per ha), in creating 3,407 new jobs and in reducing environmental impacts (- 37% m3/ha/day water usage and -22% equivalent/ton in the CO2 emission levels)	SDC End Term Evaluation of Sustainable Transformation of Egypt's Aquaculture market System (STREAMS) Final report, August 2019.

			through the adoption of productive, efficient and climate-smart aquaculture production practices developed by FISH CRP research.	
Evaluation of the Youth Employment in Aswan Governorate; Extension of fisheries and aquaculture interventions (YEAG) project in Egypt	Complete	Program/project evaluation/ review	Youth Employment in Aswan Governorate; Extension of fisheries and aquaculture interventions (YEAG) project was led by WorldFish and supported by the Swiss Agency for Development and Cooperation (SDC). YEAG's Independent End-of-Term Evaluation envisaged to evaluate the project based on DAC Evaluation Criteria, and cross-cutting issues. Challenges and limitations, along with the lessons learnt and relevant recommendations were also addressed to ensuring evidence-based design and streamlined implementation of future similar interventions. The evaluation results shown early indications of contribution to impact of improved nutrition for poor Egyptian households (indicated by increased consumption of farmed fish), and increased economic opportunities (indicated by increase in net profits of fishers, processors and women retailers). As for gender, women retailer trainees have acquired skills that have helped increase their income levels and improve their livelihood conditions.	SDC End-term Project Result Assessment and Evaluation of the YEAG Project: Evaluation Report, 2019
Capacity development and joint learning exercises for the improvement of the Monitoring, Evaluation and Learning (MEL) platform and its integration within the CGIAR data architecture system	Complete	Other MELIA activity: Collaboration for capacity enhancement	In 2019 CRPs on FISH, LIVESTOCK, GLDC and RTB organized the 1st technical retreat for MEL developers. The main objective of the Developers Retreat was to strengthen the team building and have an overview of a fit-for-purpose data architecture across the CGIAR. In this light, the collaboration with OCS (OSU) team supported the effort to link corporate and research data.	https://hdl.handle.net/20.500.11766.1/09a519
Ensure real time data visualization based on conceptualized indicator framework (Monitoring and Evaluation of Agri-Science Uptake in Research and	Complete	Other MELIA activity: Indicator-based information visualization	The initial phase, carried out in 2019, has achieved the development and implementation of a mutual visualization dashboard (CGIAR Level Agricultural Results Interoperable System Architecture, CLARISA). However, the need for a further integration around CGIAR AR Indicators, for a better disaggregation of data, and new requirements, led	https://www.cgiar.org/impact/results-dashboard/

Extension (MEASURE) , Managing Agricultural Research for Learning and Outcomes (MARLO), CGIAR Level Agricultural Results Interoperable System Architecture (CLARISA)			the MEL-MARLO team to continue in 2020 the activities for an increased synergy of the systems under the guidance of SMO Team and in partnership with GLDC, FISH and RTB CRPs.	
MEL platform implementation	Complete	Other MELIA activity: MEL installation	FISH CRP MELIA system has been migrated to the MEL platform (installation in 2018). 95% of ongoing projects were recorded in 2019. Training tools developed and training provided to FISH CRP researchers. Routine based training planned to support program-wide implementation in 2020.	Megi Cullhaj. (12/9/2019). Guideline on how to plan a deliverable through the MEL platform. Holly Holmes (Producer, Director), Samuel Stacey, Jacqueline Muliro, Cristiano Rossignoli, Enrico Bonaiuti, Claudio Proietti, Megi Cullhaj, Sara Jani, Valerio Graziano. (30/12/2019). How MEL supports the data management cycle. WorldFish. Holly Holmes (Producer, Director), Cristiano Rossignoli, Enrico Bonaiuti, Claudio Proietti, Jacqueline Muliro, Valerio Graziano, Sara Jani, Megi Cullhaj, Samuel Stacey. (20/12/2019). Connecting MEL and ORCID. WorldFish.

Table 11. Update on actions taken in response to relevant evaluations.

This table provides an update (since 2018 reporting) on the response of FISH to recommendations made from the Independent Evaluation Arrangement (IEA) of previous CRPs (AAS and L&F) and relevant crosscutting evaluations.

Name of the evaluation	Rec. #	Text of recommendation	Status of response to this rec.	Concrete actions taken for this recommendation	By whom	When	Comments
AAS	R2	Strengthening research capacity: AAS management should rethink its approach to staffing and the allocation of human resources.	Ongoing	Assuring high quality in the recruiting process in FISH in order to guarantee the program with the right mix of human resources needed to develop science capacity across the program. Additional recruitments were made in 2019 to strengthen research capabilities in FP1 & FP2. Cross-CRP and partnership development also used to strengthen research capacity within the FISH CRP	MC, CRP director, flagship/cross-cutting leadership	End of 2021	This is an ongoing process, and research capacity and quality will continue to be strengthened in the FISH CRP, within our research teams and partners.
	R4	Increase alignment of AAS activities: The decision to associate bilateral projects with AAS should be based primarily on their potential to further the AAS research agenda.	Ongoing	All new bilateral projects are discussed and designed in order to further strengthen the FISH research agenda. By doing this, FISH pursues the greatest efficiency and effectiveness of its research by strengthening the synergies of research funded by W1/W2. A formal alignment process is applied for W3/bilateral projects, which is undergoing further refinement with the development of the MEL system. Process has been assessed through the Performance Management Standards.	MC, CRP director, flagship/crosscutting leadership	End of 2021	

	R9	Management information: A functional research management information system should be established.	Completed	The adoption of the MEL system was formally approved by the FISH MC in June 2018 and has been progressively introduced to the FISH CRP.	M&E lead, program/project leads	Ongoin	
	R10	The CGIAR should justify further investment in aquatic agricultural systems more on the grounds of comparative advantage, and to do this the focus needs to be much more on fish.	Completed	FISH brings together and mutually integrates CGIAR's existing competences around fish—aquaculture and small-scale fisheries—and the generation of new knowledge and methodological innovations. A food systems agenda has been strengthened through cooperation with A4NH under certain FISH research clusters (FP2, cluster 3: Fish in regional food systems).	MC, CRP director, flagship/crosscutting leadership	End of 2021	
Livestock	R2	Increase synergies between livestock and aquaculture.	Ongoing	The collaboration with the Livestock CRP continues to develop, recently most focused around AMR and some interaction with the CRP in relation to the research on health and feeds.	Flagship/cluster leads within FP1	End of 2021	
	R5	Establish an M&E system based on the theory of change.	Completed	The MEL system is now in place, to serve both performance monitoring and outcome evaluation on the basis of the theory of change, impact pathways and outcome targets. A set of theories of change at focal country level were further improved in 2019 to improve the capacity of the MEL system and to capture the results and performance in a more relevant, efficient and effective way.	CRP director, FISH M&E lead, FISH MEL community of practice	By mid-2019	

	R6	Build private sector partnerships for technology delivery.	Ongoing	Since its design, FISH has looked to identify potential private partners with shared objectives in order to find win-win solutions both for research and commercial interests. There was significant increase in private sectgor partnerships in 2019	Flagship/cluster leads within FP1	End of 2021	
Gender in CGIAR Research and Workplace—Evaluation Report—CGIAR Gender in Research (Vol I)	R5	CRPs should refresh and refocus their gender strategies and/or future work plans, as relevant, to ensure alignment with priorities in the Gender in CGIAR Research Policy.	Ongoing	The FISH gender strategy was completed in 2018 and various supporting actions introduced to integrate gender into FISH research and workplace activities. Onoing activities strengthen gender integration.	CRP director, FISH gender lead	FISH gender strategy published in July 2018	

Table 12. Examples of W1/W2 use in this reporting period (2019).

Specific examples	Broad area of use of W1/W2
FP1, Cluster 1.1 Genetics and genomics research in GIFT and carps: W1/W2 funds contributed partial funding to (i) production of next generations of GIFT strains (Malaysia) and tilapia genomics and genetic architecture research; (ii) further development of molecular markers for rohu, catla and silver carps in Bangladesh; (iii) support to development of new rohu and silver carp generations in Bangladesh; (vi) policy engagement with SADC and EAC states in Africa; (vii) user assessment and trait studies in Egypt and Zambia	Genetics and genomics research New tilapia and carp strains Investments in key research partners Aquatic genetic resources policy development
FP1, Cluster 1.2 Tilapia disease: W1/W2 funds contributed partial funding to (i) TiLV management and biosecurity in tilapia core genetic programs, hatcheries and farms; (ii) design/testing of epidemiological and economic assessment tools; (ii) molecular and e-DNA research for farmer-led diagnostic platforms and “lab in a backpack”; (iv) meetings/workshops for biosecurity training, and with national competent authority on national aquatic animal health strategies including surveillance plans for emerging diseases.	Tilapia disease research, focussing on TiLV mitigation Investments in key research partners. Biosecurity policy and practice development Epidemiology and economic assessment tools Fish disease diagnostics

FP1, Cluster 1.2 Sustainable fish feed ingredients: W1/W2 funds contributed partial funding to (i) novel fish feed ingredient research; (ii) development of tools for fish feed formulation using low cost ingredients; (iii) nutritious pond research and scaling of the concept; (iv) Better management practice guidelines and scaling for adaptation/adoption at focal/scaling country .	Research partnerships Novel feeds research Nutritious pond scaling
FP1, Cluster 1.3 Aquaculture systems: W1/W2 funds contributed partial funding to (i) integrated performance assessment tools for improved tilapia; (ii) national level performance assessments; (iii) policy development and scaling activities.	Improved tilapia performance assessments Scaling research
FP 2, Cluster 2.1 Resilient coastal fisheries: W1/W2 funds contributed partial funding to (i) research partnership with James Cook University for adaptive management and climate change research; (ii) researcher time to a global synthesese of sustainability trade-offs, Blue Economy and the FAO Fisheries Sustainability Conference. (iii) gender integration into co-management models	Co-management models Gender integration
FP 2, Cluster 2.2 Fish in multifunctional landscapes: W1/W2 funds contributed partial funding to (i) policy research on fish-rice systems and multi-functional landscapes in Myanmar (ii) workshop and review fisheries and water management	Water productivity and fisheries research
FP 2, Cluster 2.3 Fish in food systems*:* W1/W2 funds contributed partial funding to (i) illuminating Hidden Harvest research, continuation with FAO and Duke University; (ii) capacity development/co-funding of PhD researchers; (iii) impact/outcome assessments of fish trade in Africa investments; (iv) reviews of fish in food systems in key geographies.	Small-scale fisheries in food systems research and policy development
Gender: W1/W2 funds contributed funding to (i) strategic gender research, including ; (ii) gender integration in aquaculture and small-scale fisheries research; (ii) capacity building and coaching initiatives for gender integration within FISH.	Gender research and integration into FISH Research partners
Youth: W1/W2 funds contributed funding to (i) completion of the FISH youth strategy and working paper; (ii) presentation of synthesis paper on youth and fisheries/aquaculture at relevant conferences/stakeholder events; (iii) youth case studies in Myanmar and Nigeria.	Youth research and integration into FISH

Capacity development: (i) Preparation of the FISH capacity development strategy and MEL of capacity development indicators (ii) Support to focal countries to improve reporting of capacity development	Capacity development strategy
Monitoring and evaluation: W1/W2 funds contributed funding to: (i) M&E activities across FISH, including partial funding of selected outcome/impact assessments; (ii) continued strengthening of the MEL platform; (iii) Tables 2, 3, 5 and 10 provide further information on the activities implemented.	Monitoring, learning, evaluation and impact assessment MEL platform development
Program management: W1/W2 funds contributed funding to investments in core program management activities, including partial funding of key Program Management Unit/Team (PMU) leaders and management staff, operations and learning meetings, including Management Committee and ISC meetings.	Governance and management of FISH

Notes on column 2: **Explanation and some examples to help with categorization of the categories offered:**

(While **u**nderstanding that some activities fall into several categories, it is still convenient for system-level presentation to divide the results by main category. If a choice must be made, it is usually preferable to select a more specific category (toward the top of the list) in preference to a phase of research (bottom of list).

- **Policy:** sole or partial funding source for dissemination of findings, learning from evidence etc.; for example, policy workshops, contracts with partners working on policy etc.
- **Partnerships:** start-up and maintenance of partnerships.
- **Capacity development:** any activities reported under the capacity development indicator.
- **Other crosscutting issues:** gender, youth, climate change; e.g. funding research projects tagged as 'principal' for one of these; funding crosscutting work by the PMU; funding specific gender/youth/Climate Action 'add ons' to other projects. *In every case, it should be obvious from the title of the activity what the crosscutting issue is*.
- **Other monitoring, learning, evaluation and impact assessment (MELIA):** activities covered under the MELIA section of this reporting template
- **Contingency/emergency;** e.g. immediate unplanned response to a new virulent disease, or moving germplasm collections as a result of conflict
- **Pre-start up:** conceptualization, design, ex-ante analysis before research start-up; for example: foresight, ex-ante studies, building theories of change, proof-of-concept studies for novel areas of work. (However, start-up meetings with partners should normally be tagged as 'partnerships'.)
- **Research:** sole or partial funding source for a research line or significant research activity
- **Delivery:** funding for any activities connected with scale-up and delivery
- **Other, specify** _____

Table 13. CRP financial report.

The table below provides the status of the CRP financials for 2019 (all figures in USD).

	Planned budget 2019*			Actual expenditure 2019**			Difference			Comments
	W1/W2	W3/bilateral	Total	W1/W2	W3/bilateral	Total	W1/W2	W3/bilateral	Total	
FP1 (Sustainable Aquaculture)	2,309,839	23,057,380	25,367,219	2,286,650	15,785,904	18,072,554	23,189	7,271,476	7,294,665	
FP2 (Sustaining Small-Scale Fisheries)	998,238	6,134,652	7,132,890	943,604	6,297,402	7,241,006	54,634	(162,750)	(108,116)	
Cross-program investments	1,694,097		1,694,097	1,582,421		1,582,421	111,676		111,676	
Carry over funding	434,072		434,072	-		-	434,072		434,072	Additional investment of W2 made available in Nov 2019, carried over for priorities in 2020
CRP management and support cost	855,987		855,987	823,472		823,472	32,515		32,515	
CRP total	6,292,233	29,192,032	35,484,265	5,636,147	22,083,306	27,719,453	656,086	7,108,726	7,764,812	

*Planned budget 2019 = 2019 SMO final approved Budget USD 6.233 M + 2018 carryover of $0.059m.

**Source: Audited lead and participating center financial report

Part C: Additional evidence to be submitted through management information systems or as indicated

The evidence below is submitted separately and is available via the MEL platform.

Evidence A: Full list of policy contributions in reporting year (Common Reporting Indicator I1): in MEL

Evidence B: List of CRP innovations in reporting year (Common Reporting Indicator C1): in MEL

Evidence C: Outcomes and milestones: in MEL

Evidence D: Full list of publications published in reporting period: in MEL

Evidence E: Altmetrics (Common Reporting Indicator I2): in MEL

Evidence F: Full list of current external partners: in MEL

Evidence G: Participants in capacity development activities in the current reporting period (Common Reporting Indicator C3): in MEL

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