CGIAR RESEARCH PROGRAM ON Fish
Led by WorldFish

CGIAR Research Program on Fish Agri-Food Systems

Annual Report 2018

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
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 results and learning achieved during 2018 in the CGIAR Research Program on Fish Agri-Food Systems (FISH). FISH made significant progress during the year in (a) producing and disseminating a suite of research innovations for sustainable development of aquaculture and fisheries across Africa, Asia and the Pacific, and (b) in moving toward stronger results-based program management through development and adoption of a monitoring, evaluation and learning platform.

Among these innovations are three fish genetics research platforms, providing new improved generations of tilapia in Malaysia and Egypt, and of three key carp species in Bangladesh. Research in these platforms has identified several new traits for future genetic selection using genomics tools, including feed efficiency and disease resistance, all critical traits for sustainable intensification under climate change. Fish disease and biosecurity research has provided new surveillance and diagnostic techniques and tools for addressing the global challenge from the emerging tilapia lake virus (TiLV). Assistance with application of these tools was provided to several countries in improving policies for health management, notably in Bangladesh, Egypt and Zambia. New partnerships established with private sector actors at global and national levels are providing new avenues for future scaling of innovations from FISH research.

FISH research on small-scale fisheries provided new knowledge of global human dependence on marine ecosystems, indicating high dependency of 775 million people on marine fisheries, and providing the basis for targeted management and policy for vulnerable small-scale fishing communities. FISH managing partner James Cook University (JCU) contributed a new framework for building adaptive capacity to climate change in tropical coastal communities, applied through cases in Bangladesh, Cambodia, Malawi, Solomon Islands and Timor-Leste. Fisheries co-management innovations in Bangladesh are helping transform the management of hilsa, the country's most important capture fishery. Research on illuminating the hidden harvests of small-scale fisheries, in partnership with the Food and Agriculture Organization of the United Nations (FAO), now extends to 52 countries. Aside from generating missing evidence on the value of small-scale fisheries to the emerging blue economy and the discourse on sustainable ocean governance for the successful implementation of SDG 14 (Life below water), this research is capturing critical insights on the nutritional value of wild-capture marine fish and the opportunities for tackling micronutrient deficiencies through fish in support of SDG 2 (Zero hunger).

Key strategic program-level research outputs in 2018 included gender, fish foresight and advancing knowledge on fish in food systems. African fish foresight modeling, in collaboration with the Policy, Market and Institutions (PIM) CRP provided new insights into fish supply-demand trends in Africa, presenting a picture of fish demand outstripping supply in the continent and highlighting the importance of new investments in aquaculture and small-scale fisheries. FISH research continues to inform policies at national, regional and global levels, with national policy

contributions made in Bangladesh, Cambodia, Egypt, India, Malawi, Myanmar, Solomon Islands, Timor-Leste, Malawi and Zambia during 2018, a strong foundation for contributions to system-level outcomes (SLOs) and the Sustainable Development Goals (SDGs).

This year, FISH joined several other CGIAR centers and CGIAR research programs (CRPs) in adopting the award-winning monitoring, evaluation and learning (MEL) platform, a results-based management system that will enable better reporting, coordination, risk management and performance evaluation as well as knowledge sharing, research dissemination and learning across the program and with external partners.

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 R&D in two flagships, Sustainable Aquaculture (FP1) and Sustaining Small-Scale Fisheries (FP2), within the context of fish in the global food system. Evidence supporting the statements below is provided in Table 1. FISH is a new CRP, but one that builds on earlier research, particularly the CRPs on Livestock and Fish (L&F) and Aquatic Agricultural Systems (AAS).

Sustainable aquaculture delivers results through improved fish breeds, aquafeeds and feed management, fish disease mitigation and aquaculture farm management and value chain system innovations. The focus is on enhancing aquaculture productivity and sustainability for millions of small-scale fish farmers. The key targets are global tilapia production systems and carp-dominated farming systems in South Asia. Dissemination of improved tilapia breeds continued throughout 2018 via public and private development partners in Asia with the genetically improved farmed tilapia (GIFT). Evidence of SLO-related outcomes includes: farm-level adoption of improved fish seed and farm management practices in five countries (Egypt, Myanmar, India, Sierra Leone and Timor Leste); and improved nutritional outcomes resulting from nutrition-oriented aquaculture investments in Bangladesh.

Sustaining small-scale fisheries research delivers results through fisheries improvements and multi-scale partnerships. Research includes co-management and community-based fisheries management; and fisheries and water management innovations in rice field agroecosystems and landscapes, particularly in Cambodia and Myanmar. The key focus in on achieving more productive and equitable management of inland and coastal fisheries. Notable achievements in 2018 were the adoption of co-management principles across large areas of the Meghna river system in Bangladesh, and the nationally important hilsa (*Tenualosa ilisha*) fishery, contributing to gains in fisheries productivity. Evidence of SLO outcomes from Asia and Pacific included adoption of fisheries management improvements, increased economic and nutritional outcomes, and water areas brought under improved co-management. Notable policy shifts are also emerging in African fish trade.

Progress in impact assessments during the year is provided in section 2.4, with multi-year assessments of the improved tilapia and fisheries co-management planned for 2019. Learning from the year indicates the need for further investment into impact assessments in FISH research, to capturing the multiple SLO contributions across the FISH CRP.

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

1.2.1 Overall CRP progress

The FISH CRP delivers benefits to the poor and vulnerable by enhancing sustainable aquaculture and small-scale fisheries; both as critical components of fish agri-food systems from local to global levels. Positive progress was made overall in 2018 in delivering priority outputs and outcomes from the two flagships, with 70 percent of all milestones in the 2018 Plan of Work and Budget (POWB) achieved (Table 5). Advancing international public good in fish agri-food systems, FISH produced 55 published articles (43 indexed by ISI), books or book chapters and several policy and technical briefs. New and critical understanding of fish in food systems is clearly emerging from the FISH CRP, reshaping traditional views on about responses to the challenges posed by climate change and meeting the growing global demand for fish.

Strategic program-level research output highlights in 2018 include gender and fish foresight. Gender research outputs on inclusive value chains and gender transformative approaches continued to well position FISH research as a leader in gender research in fish agri-food systems. Foresight modeling work in Africa provided new understanding of future fish supply-demand trends, with an article published in *Global Food Security* laying an important foundation for strategic planning and investments in aquaculture and capture fisheries in Africa. An analysis of the Zambian fish sector presents a picture of national fish demand outstripping supply and indicating that imports will continue contributing significantly to fish consumption by 2030 unless further investments are made in aquaculture and small-scale fisheries. FISH research continues to inform national, regional and global policies, with national policy contributions made in ten countries during 2018 in Bangladesh, Cambodia, Egypt, India, Malawi, Myanmar, Solomon Islands, Timor-Leste, Malawi and Zambia.

1.2.2 Progress by flagships

Sustainable Aquaculture (FP1)

FISH genetics research platforms are providing cumulative genetic gains in; GIFT tilapia in Malaysia (G17), Abbassa tilapia in Egypt (G15), Rohu carp (G2), and base populations of Catla and Silver carp in Bangladesh. Genetics research has demonstrated that feed efficiency in GIFT tilapia is heritable and quantified genetic by environmental interactions in adapting GIFT tilapia to different geographies. Genomic tools have been developed and will now be applied to enhance the rates of genetic gain in Nile tilapia. Partnerships have been established or strengthened with public and private sector hatcheries in India, Myanmar and Timor Leste to disseminate improved tilapia breeds. A new tilapia genetic improvement program made progress in Zambia.

Fish disease research has highlighted the global threat of Tilapia Lake Virus (TiLV) to wild and farmed tilapia; guidelines were prepared and widely disseminated for improving biosecurity in tilapia breeding and farming. A new on-line tool for disease risk assessment has been developed and deployed in Bangladesh, Egypt and

Zambia. Close engagement with government agencies has helped improve national aquatic animal health policies in these countries. Feeds research has demonstrated that fish production efficiency can be enhanced by maintaining a "nutritious pond" and assessments of the potential for sustainable intensification of aquaculture in Bangladesh has identified technology and management improvements that will enable a transition to more intensive aquaculture be more sustainable.

Sustaining Small-Scale Fisheries (FP2)
FISH research helped map global human dependence on marine ecosytems and a new framework for building adaptive capacity to climate change in tropical coastal communities applied to guide investments in improving adaptive capacity in both inland and coastal systems in 6 FISH focal countries. Fisheries co-management innovations were tested, 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.

Multi-functional landscape research progressed with policy and practice guidance for water planners, managers and engineers. RICE and FISH CRPs brought together six countries in Myanmar in an international rice-fish symposium, leading to the "Naypyitaw Agreement", a foundation for policy change to enable adoption of integrated rice fish system innovations by farmers at scale in Myanmar. Community fish refuge innovations in rice-field agro-ecosystems are improving landscape productivity and fish consumption in Cambodia. "Illuminating hidden harvests" research s developed an innovative methodology to assess small-scale fisheries in a 52-country research study with FAO. Intra-regional fish trade research in Africa led to significant flow on effects to policy change.

1.2.3 Variance from planned program for this year

(a) Have any promising research areas been significantly expanded? No major changes were made to the FISH proposal research plans for FP1, the work of which proceeded in line with the 2018 POWB. Research on genetics and fish health was expanded through bilateral project funding; signaling strong partnerships and demand for research in this subject area, including the need to enhance biosecurity associated with fish breeding programs and protection of core GIFT stocks. Research on scaling via the private sector also received additional funding during the year, including the new USAID-funded Feed the Future Bangladesh Aquaculture and Nutrition Activity that focuses on the application of market systems approaches to aquaculture. In FP2, Big Data, ICT, M&E and evidence-based strategic communications are streams of work that received less attention in the proposal, and although bilateral investments are small, this stream of work holds substantial potential for growth.

(b) Have any research lines been dropped or significantly cut? The allocation of W1/W2 funds to FP2 allowed significant progress to be made in this area. Nevertheless, a 60 percent reduction in W1/W2 funding (compounded by no W1/W2 funding in 2017) compared to the original FISH proposal required some reduction in activities during 2018, with reductions made to multifunctional landscape research, fish in regional food systems and small-scale fisheries

research in Africa and slowing down research and expansion of the program in Nigeria, Tanzania and Zambia, pending availability of bilateral funds. The funding shortfall was partially made up by successful bilateral fundraising during the year, including a new Oak Foundation grant on improving collaborative governance, developing global M&E systems for small-scale fisheries investments and influencing policy through strategic communication.

(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 led to some minor adjustments in focus. Given the extent to which aquaculture species are still in early stages of domestication it is important that access to germplasm is maintained. A systematic review of access and benefit sharing (ABS) revealed the limited resource base and need for further work to understand the impact of ABS on aquaculture development within Africa and Asia. The Blue Economy has emerged as a dominant development agenda to which FISH responds with research to influence in development and conservation investments and policy. Opportunities for influence and scaling social, ecological and policy innovations were taken in 2018 (including panel presentations to an audience of 18,000 on 'Women in the Blue Economy"), and with research submitted for 2019 publication.

1.2.4 Altmetric and publication highlights

During 2018, FISH produced peer-reviewed publications, briefs, manuals, reports and other documents. A total of 55 peer-reviewed publications were published, of which 34 (62 percent) were open access and 43 (79 percent) were published in Institute for Scientific Information (ISI) publications (Table 6).

Altmetric scores reveal several influential publications during the year, with three papers having scores greater than 100. The highest Altmetric score (287) was associated with a paper in *Nature Climate Change* from the FP2 team, providing a new approach to build and analyze adaptive capacity of coastal communities across five domains. The article was widely shared across 11 news networks and 479 tweets. An associated FISH program brief was prepared in cooperation with the Climate Change, Agriculture and Food Security (CCAFS) to apply these principles in diverse inland and coastal fisheries systems and provide policy guidance to national governments and investors. Another influential paper mapped global human dependence on marine ecosystems at national and global levels, also producing an associated framework to guide ocean management and policy improvements.

Other top-scoring publications related to small-scale fisheries, with a strong showing for gender-oriented papers, included a paper on gender transformative approaches to reduce inequality and postharvest fish losses, building on earlier AAS research on the gender-transformative approach, and and research of high relevance to Blue Economy and risks in gender reinforcing co-management approaches.

Top peer-reviewed publications in FP1 were related to the use of innovation systems, antimicrobial resistance (AMR) and breeding for robustness. Some key foundation papers on future breeding and genetics were published during the year, including establishing the nature of genetic-by-environmental interactions in adaptation of GIFT to different geographies and environments, and that feed

efficiency in GIFT is heritable. The publications provide an important foundation for applying genomics technologies to breed new traits into tilapia to reduce risks and enhance productivity in future.

1.3 Crosscutting dimensions (at CRP level)

1.3.1 Gender

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

Across flagships:

- Empirical analysis of the gender-transformative approach (GTA) found that the approach contributed to statistically significant change in gendered attitudes and measured dimensions of women's empowerment – and greater change in these dimensions as compared to the gender accommodative approach tested in the same study.
- FISH evidence regarding the relationship of gender norms and innovation has been generated in five focal and scaling countries by 2018, including a new publication from Bangladesh.
- Progress on a tool for assessing women's empowerment and gender-transformative change in fisheries and aquaculture: the Women's Empowerment in Fisheries Index (WEFI). The tool draws on the Women's Empowerment in Agriculture Index, but expands to mixed methods and assessing normative change. For wider release in 2021.
- The uptake of the GTA, which we have pioneered in the CGIAR, progressed during 2018. For example: the European Commission is drawing on the approach (reportedly sparked by the FISH- CARE webinar (2017) on gender-transformative change; the CGIAR Gender Research and Integrated Training program (GRIT) incorporated FISH insights and case examples in a bespoke module, supported by FISH staff; and the Zambian nongovernmental organization Caritas incorporated the FISH gender-transformative model into its microcredit program.
- The successful pilot of 'theory of change-based gender integration' coaching strategies with the Netherlands' Royal Tropical Institute (KIT) in three countries.
- A contribution to CGIAR gender capacity development regarding gender-responsive breeding through leading the CGIAR Gender and Breeding Postdoctoral Fellow (PDF) Initiative and engaging multiple CRPs interactive workshops and expert panel.

Within **FP1** :

- Evidence generated that both the quality of aquaculture employment and value chain returns differ between women and men and that there is a strong need for greater investment in and tools for gendered value chain analysis in aquaculture. This resulted in an enhanced framework for gendered value chain analysis that incorporates gender norms, power relations and access and control over assets.
- Novel insights into women's aquaculture assets in Bangladesh underscore that legal ownership is insufficient and that complementary interventions are needed to increase women's household bargaining power, capacity to innovate and ability to cope with shocks.

- New knowledge on gendered end user preferences regarding fish traits was consolidated through two systematic reviews and completing empirical studies in Egypt, Zambia, India and Bangladesh.
- A methods package was also developed and piloted for the gender-inclusive business models pathway with partner BoP Innovation Centre, specifically a scalable approach to identifying promising niches for women-led entrepreneurship.

Within **FP2**:

- Findings that gender and social inclusion and equity concerns are yet to be effectively addressed within transitions to co-management and the implementation of the Small-Scale Fisheries Voluntary Guidelines (SSF Guidelines); for example research on gender and marine-protected areas in the Philippines suggests that the areas are largely managed for 'men's fisheries' and women were less likely to actively participate in management.
- To respond to the challenges in gender-inclusive implementation of the SSF Guidelines, FISH led an interactive workshop at GAF7 on enhancing the capacity for gender integration within/by national agencies. The latter is leading to collaborative development of indicators as a tool for measurement and development of gender capacity in fisheries departments, an ongoing innovation area that will be pursued until 2021.

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

- Findings regarding the degree to which gender norms shape access to, use of and benefits from innovation have influenced FISH toward more explicit incorporation of norms in scoping studies as a means of informing planning and enhancing outcomes.
- Findings on norms and from gender-transformative research contributed to the FISH gender strategy's more explicit articulation of intended outcomes along a 'reach-benefit-empower-transform spectrum (the addition of 'transform' being a FISH adaption of the spectrum).
- Innovative gender and breeding studies evidenced the value of, and nuanced approaches for, mixed methods within gender research. To be applied within FP1 going forward, for example, combining (digital) choice experiments with qualitative methods for more nuanced, gendered understanding of trait preferences.
- Our markets and value chain-related research—and contributions to global fora such as the Sustainable Blue Economy Conference—underscored that there is a dearth of reliable evidence to inform investments in a 'blue future' in terms of social and gender inclusivity. Based on this, FISH is re-assessing needs and strategizing how FISH and the CGIAR can respond.

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

- The main challenges have been in relation to shortfalls in resources for human capacity (gender staffing) within bilateral project investments, which risks undermining gender integration and strategic research. These are compounded by increasing pressure to deliver high-target numbers in short timeframes.

1.3.2 Youth and other aspects of social inclusion/'leaving no one behind'[1]

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

- Youth participate actively in aquaculture, capture fisheries and fish value chains throughout Africa, Asia and the Pacific. Research led by the International Water Management Institute (IWMI) in 2018 focused on assessing youth in fish agri-food systems in eight FISH focal countries; Egypt, Nigeria, Tanzania, Zambia, Bangladesh, Cambodia, Myanmar and Solomon Islands.
- Research provided understanding of current youth engagement a framework for analyzing youth inclusion and identified potential interventions for more youth-inclusive aquaculture and small-scale fisheries.
- Findings from the eight countries indicate that while engagement in aquaculture and small-scale fisheries is not a first choice for many young people, those looking to engage in or remain engaged face a number of challenges: gerontocracy; access to land, finances, inputs and other resources; influence in decision-making processes; and limited knowledge and know-how. In some cases, aquaculture and small-scale fisheries are associated with hard physical labor, low pay and low social status. Yet opportunities do exist and hold promise for young people; the fast-growing aquaculture sector in particular is creating employment and entrepreneurship opportunities in fish value chains. Integration of ICTs in the aquaculture and small-scale fisheries value chains might also provide opportunities to enhance youth participation.
- Research findings are being integrated into a brief on youth in fish agri-food systems and a FISH youth strategy due for 2019 release. In addition, actions are being integrated into new youth-focused interventions in the 10-country aquaculture component of the Technologies for African Agriculture Transformation (TAAT) initiative and youth-oriented capacity development in an aquaculture vocational and entrepreneurship training investment in Zambia.

- In 2018, FISH also partnered with a number of bilaterally funded initiatives focused on the most vulnerable people. For example, technical assistance and policy advice was provided to the Government of India's Odisha State for technical advice in carp polyculture improvements and policy development for 1,768 women self-help groups in isolated regions, contributing to the Governments women's empowerment and nutrition investments (Table 1). In Bangladesh, WorldFish is also providing 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. Future impact assessments from both projects will provide learning in engaging with poor and vulnerable groups.

(b) *Important findings influencing the direction of the CRP's work:* The youth research contributes to an emerging social inclusion research agenda for fish agri-

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

food systems, helping to define four different pathways for the future youth inclusion agenda in the FISH CRP:

- Better understanding the economic, political and social drivers at global and local levels on youth inclusion in small-scale fisheries and aquaculture.
- Analysis of policy influence and actions for youth inclusion in small-scale fisheries and aquaculture production and value chains.
- Better understanding of youth aspirations and perceptions in regard to their involvement in small-scale fisheries and aquaculture.
- Building a youth-oriented approach to small-scale fisheries and aquaculture.

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

- A small team of IWMI scientists has taken the lead in FISH youth research, primarily through literature reviews and key informant interviews. Two 'youth' focal points in WorldFish have helped navigate the discussions with colleagues and partners. The 'youth' work, however, should not been conducted in isolation within FISH, and moving forward, the CRP needs to ensure closer collaboration with all crosscutting themes, particularly gender and capacity building.

1.3.3 Capacity development

FISH capacity development activities in 2018 included researchers, national partners and communities. A total of 67,687 people received short-term training through FISH, of which 25,270 (37 percent) were women. Long-term training was provided for 19 students (12 PhDs, 6 masters and 1 bachelor), of which 12 were women (Table 7).

Key capacity development initiatives in Africa included a strengthened partnership with the African Centre of Excellence in Aquaculture and Fisheries in Malawi for masters and PhD training and cooperation with the new Technologies for African Agricultural Transformation (TAAT) initiative. Training of aquaculture trainers at the Aquaculture Research and Training Center in Egypt was conducted for 40 participants from the ten TAAT countries. A new vocational aquaculture training and entrepreneurship program was launched in Zambia to equip vocational schools and small-scale fish farmers with aquaculture and business skills. The Zambian experience will provide tools, knowledge and partnerships for a future Africa-wide aquaculture vocational training. In Asia and the Pacific, strong cooperation with national partners continued in all focal and scaling countries. Practical level training tools continue to be developed and disseminated with partners; a good example being tools for small-scale fish farmers with low or no numeracy skills in Sierra Leone.

Young researchers received special attention through mentoring and special events, including: 1) a write shop in Zambia for masters and PhD students from Africa to prepare journal manuscripts from research conducted in the FishTrade for a Better Future project; 2) a write shop entitled 'Science writing and communication skills week', led by JCU; and 3) instructive videos on scientific publication on the FISH website. Gender integration was also given further attention, building on the FISH gender strategy and associated gender-integration guidelines, as noted in 1.3.1.

1.3.4 Climate change

During 2018, FISH enhanced 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 better understand human dependence on marine systems and building adaptive capacity to climate change in tropical coastal communities. A publication on measuring the potential for sustainable intensification of aquaculture in Bangladesh quantified six local and global environmental consequences of intensifying aquaculture production, showing how environmental improvements in farm management practices can be integrated into national aquaculture development programs, creating pathways for low-emissions aquaculture development.

FISH technologies and management systems have also been integrated within CCAFS climate-smart agriculture initiatives in Bangladesh, Cambodia and Vietnam, leading to several promising climate-smart agriculture innovations for vulnerable communities dependent on aquatic systems. During 2018, a gendered analysis of the learning and outcomes from these investments in Bangladesh was conducted with CCAFS, including drawing out lessons to enhance impacts of climate-smart agriculture investments in Bangladesh on vulnerable women. FISH also participated in the CCAFS-led event 'Stepping up food systems transformation under a changing climate', as part of Agriculture Advantage 2.0 at COP24 and made a presentation on the role of fisheries and aquaculture for a food systems transformation. FISH successfully secured bilateral funding and partnerships to offer two new postdoctoral positions for fish and climate change research (one to be based in Bangladesh, the other focusing on coastal fisheries based in JCU in Townsville, Australia). Both will start in mid-2019, bringing increased capacity for integration of climate change into the FISH program.

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 in 2018, despite starting in 2017 with a lack of W1/W2 funding for FP2. No changes were made to the terms of reference for the FISH Independent Steering Committee (ISC). Three ISC meetings were held in 2018, with reporting lines established to the WorldFish Board of Trustees. The ISC further conducted an in-depth review of FISH during 2018, reporting overall positive progress but identifying a few key areas for strengthening. A new ISC member, with expertise in human nutrition, was also approved during 2018. 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 179 active partnerships during 2018, of which 85 were new partnerships established during the year. Academic and research organizations made up nearly 30 percent of the partner, but 2018 was notable for significant growth in partnerships with development organizations. Eighteen new public and private partnerships were initiated during the year, strengthening the future contribution of FISH to SLOs. In 2017, 16 percent of FISH partnerships 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, 36 percent focused on piloting and 29 percent on discovery research.

This shift in partnership portfolio to enable delivery of innovation at greater scale has been firmly embedded within FISH focal countries, with 75 percent of partnerships at the national and sub-national level. At the global level, partnership with the FAO is intended to connect FISH research with global fisheries and aquaculture policy. A new partnership with a major international fish feeds manufacturer (Skretting) is opening new opportunities for scaling our aquaculture research, particularly in Africa. Private sector partnerships are key to the CRP's partnership strategy, increasing from nine in 2017 to 32 in 2018, reflecting a strategic interest in private sector engagement for delivery of impact.

In FP1, the most significant research partnership continues to be with The Roslin Institute at the University of Edinburgh, providing key genomic expertise. Fish health and aquaculture systems research also grew new partnerships in 2018. In FP2, the engagement with FAO has been significant for the Illuminating Hidden Harvests initiative, which is drawing together a global synthesis of knowledge on small-scale fisheries. A strengthened partnership with KIT, as reported in 1.3.1 is helping FISH strengthen gender-integration across the W1/W2 and bilateral project portfolio.

2.2.2 Cross-CGIAR partnerships

FISH has active partnerships with several CGIAR centers, including IRRI, IITA, ILRI, IFPRI and ICARDA and a diverse set of 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.

As an example, the transforming rice sector in Asia has led to the development of key partnerships with IRRI and IWMI, and RICE and FISH, to consider rice-fish systems and the need for high-quality evidence to support policy change to enable the development of nutrition-sensitive food systems, with a focus on the Mekong region. Such evidence is also of interest in the African context, with the partnerships looking to extend in a South-South collaborative manner to support transformation of rice-fish agri-food systems in Africa. A cooperation with WLE has been strengthened during the year, seeking to provide evidence for water managers and policy makers on opportunities for enhanced development outcomes, for integration of fish within water infrastructure and management investments.

Although FISH aligns with a number of the CGIAR research support platforms, most significant is the engagement with the Excellence in Breeding, Big Data and emerging Gender platform. Throughout 2018, the inclusion of fish (and animals) in the Excellence in Breeding Platform was pursued, with future inclusion agreed to ensure the alignment of the global fish breeding program in FP1 with the Excellence in Breeding Platform approaches. FP2, in partnership with private sector partner Pelagic Data Systems, was a winner of the CGIAR Platform for Big Data in Agriculture's Inspire Challenge for the development of an integrated data pipeline for small-scale fisheries, highlighting the contribution big data can make in the small-scale fisheries sector. Table 9 provides further details of the significant growth in CGIAR partnerships pursued during the year.

2.3 Intellectual asset

(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) and data. A study is ongoing on intellectual assets associated with the tilapia and carp breeding programs.

(b) *Patents and/or plant variety right applications.* No applications were made for patents during 2018. 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 2018 with regards to management of intellectual assets in the context of FISH.

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

FISH adopted the MEL platform in 2018. A roadmap to guide transition to a solid and coherent use of the platform was prepared and approved by the MC. A close cooperation has been established with other key centers (ICARDA, CIP and IITA) and CRPs (Roots, Tubers and Bananas and Grain Legumes and Dryland Cereals) to refine and develop the MEL platform. The MEL platform will be fully operative in FISH during 2019.

Key impact assessments for FP1 were mainly funded by W3/bilateral sources. Genetic gain research in tilapia and carp improvement programs resulted in significant research publications. However, biosecurity issues related to TiLV delayed the timely completion of research and the full achievement of expected deliverables. Funding delays also constrained completion of planned tilapia dissemination and impact studies in Myanmar and Bangladesh. Important achievements were the completion of an evaluation of local service providers in Bangladesh, which guided an aquaculture investment by the Bill & Melinda Gates Foundation and the assessment of job creation in the aquaculture value chain in Egypt.

Regular meetings of the MC and ISC 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 and MC in research support, finance, communications and administrative functions. This approach continued to be adopted in 2018. Additional efficiencies included placements of PhD students with partners (French Agricultural Research Centre for International Development, JCU, WUR and other partners); the co-funding with partners (including WUR, JCU, the Stockholm Resilience Centre) of postdoctoral scientists; and hosting and co-funding of 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 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.

Key external risk factors during 2018 were (1) uncertainty over W1/W2 and W3/bilateral funding and the associated impacts on research operations and development outcomes; and (2) instability in focal/scaling countries. The funding risk was 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.

Key internal risk factors during 2018 were (1) communications; (2) planning and reporting system; (3) retention/continuity of key staff; and (4) research quality. Communications were enhanced during 2018 through development of agreed procedures for communications and response, and through bilateral investments in strategic communications in FP2. Planning and reporting systems were significantly enhanced through the MEL adoption and support provided to staff in use of the platform. Retention of key staff is recognized as a risk to FISH. WorldFish has made investments into institutional health monitoring, including via an annual employment pulse survey in 2018 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.

2.7 Use of W1/W2 funding

Investments by W1/W2 made significant contributions to FISH progress during 2018, 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 pilots, 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. Further details are provided in Table 12.

3. Financial summary

The 2018 financial plan provided USD 4.86 million of W1/W2 funding, which combined with a 2017 carry-over provided FISH with USD 5.1 million of W1/W2 funding for the year (Table 13). The expenditure of W1/W2 funds for 2018 was USD 5.05 million (99 percent), and the W3/bilateral expenditure was USD 18.6 million. A total of USD 59,233 W1/W2 funds have been carried over to 2019. The sourcing of bilateral funds increased during 2018 beyond that predicted in the FISH proposal, with a final budget of USD 20.6 million, of which around 90 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

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

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

SLO target (2022)	Brief summary of new evidence of CGIAR contribution	Expected additional contribution before end of 2022 (if not already fully covered). *Optional narrative.*
1.1: 100 million more farm households have adopted improved varieties, breeds, trees and/or management practices	Aquaculture: Improved fish breeds, aquafeeds, fish disease control measures and/or improvements in aquaculture management practices derived from FISH research (and the earlier L&F CRP) continue to be disseminated widely and adopted by fish farm households across Africa and Asia, in multiple channels and partnerships. Evidence in 2018 from partners and bilateral project investments indicates more than 23,000 new households benefited from access to aquaculture improvements during the year, across five countries: Africa Egypt; 1,680 (STREAMS project report 2017-2018 FY) Sierra Leone; 170 (Feed the future annual progress report 2018) Asia India; 1,768 women self-help groups involved in carp-based polyculture improvements, representing 17,680 women & households (Odisha-WorldFish project report for 2018-2019 FY) Myanmar; 3,149 small-scale aquaculture households (MyCulture Annual report, 2018) Timor-Leste; 427 small-scale aquaculture households adopted GIFT (PADTL Semi-annual report 2018) Small-scale fisheries: Fisheries management improvements continued to be disseminated and adopted across coastal and inland ecosystems in Asia and the Pacific during 2018, with growing numbers of new fisher households benefiting.	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.

	Bangladesh; 4,350 households associated with improvements in hilsa management, and reported productivity gains in the fishery; (Ecofish FY 2017-2018 Report, 2018). Cambodia; 12,300 households benefiting from improvements in management of fish refuges in Cambodia (USAID RFF-2 FY 2017 and 2018 Report, 2018)	
1.2: 30 million people, of which 50% are women, assisted to exit poverty	Evidence associated with aquaculture and small-scale fisheries interventions: Bangladesh; 25,900 people (Ecofish FY 2017-2018 Report, 2018) (based on use of the USAID indicator for "Number of people with increased economic benefits derived from sustainable NRM and conservation as a result of USG assistance")	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 vulnerable women, children and men associated with aquaculture and small-scale fisheries interventions: Bangladesh; 12,000 households with increased dietary diversity resulting from fish-based carp polyculture system interventions combined with behavior change communication (Suchana EC/DFID project report, December 2018) Cambodia; 104,478 people consuming more fish at home following behavior change interventions associated with enhanced rice field fish productivity (USAID RFF-2 FY 2017 and 2018 Report, 2018) India; 2,300 children receiving more fish through school feeding programs (USAID, IPP project, Oct 2018-March 2019)	Contribution by 2022: Up to 2.4 million ha, as indicated in the FISH proposal. Whilst several bilateral projects and partners engaged with the FISH CRP target this outcome, data collection to date has focused on fish consumption and dietary diversity. Investment in further impact assessments for this SLO target is required.
3.1: 5% increase in water and nutrient efficiency in agroecosystems	No new evidence is presented in 2018 for this SLO target	Contribution by 2022: Up to 4.8 million metric tons, as indicated in the FISH proposal.

		New evidence available in 2018 (Henriksen et al, 2018) further builds the case that simple management improvements can improve water and nutrient use efficiency (and reduce GHG emissions) in aquaculture.
3.2: Reduction in 'agriculturally'-related greenhouse gas emissions by 5%	No new evidence is presented in 2018 for this SLO target	Contribution by 2022: Up to 4.8 million metric tons, as indicated in the FISH proposal. As noted above, Henriksen et al (2018) confirm simple management improvements can reduce GHG emissions in aquaculture
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 being brought under improved fisheries co-management measures. In Bangladesh, 59,151 ha of new riverine and coastal area was brought under improved natural resource management in the Padma and Tetulia rivers during 2018, further extending the habitat now under improved co-management measures in the country through the USAID-funded ECOFISH project (Ecofish FY 2017-2018 Report, 2018). In Solomon Islands, 1137 ha of marine water area was brought under improved management by 23 communities, using a new 'light touch' approach to co-management that is aligned to social and cultural norms and institutional systems within the country. (Strengthening CBRM in Malaita, Final Report 2018). In Egypt, new fisheries management recommendations were prepared for the Aswan Dam, which if successfully implemented will cover 5,000 km^2 (500,000 ha). (Management Plan for Lake Nasser fishery: Stock Assessment Study) In Cambodia, new community-managed fish refuges are being integrated into rice landscapes, covering 5,221 ha in 2017-2018, with significant potential for future expansion (USAID RFF-2 FY 2017 and 2018 Report, 2018)	Contribution by 2022: Up to 3.3 million ha, as indicated in the FISH proposal. Evidence available in 2017 and 2018 are from selected bilateral projects, but important opportunity exists to contribute to restoration of aquatic habitats at greater scale through policy change across FISH focal countries in Asia and the Pacific and through the FISH global partnerships (the FAO in particular) being highlighted in the FISH impact pathway.
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 policy contributions during 2018.

Name and description of policy, legal instrument, investment or curriculum to which CGIAR contributed	**Level of maturity**	**Link to sub-IDOs** (max. 2)	**CGIAR crosscutting marker score**				**Link to OICR (obligatory if level of maturity is 2 or 3) or link to evidence**
			Gender	Youth	Capacity development	Climate change	
Improving Food Security and Reducing Poverty through intra-regional Fish Trade in sub Saharan Africa. FISH research culminates in improved trade certification and infrastructure at Luangwa border.	2	1.3.2 – Increase livelihoods opportunity; 1.4.1/2.1.1 Reduce pre- and post-harvest losses, including those caused by climate change	0	0	1	0	MEL link: https://hdl.handle.net/20.500.11766.1/2fb317
Inclusive, evidence-based development of a National Fisheries Strategy for Timor-Leste. Reviews of recent research and a deeply consultative process engaging women and men resource users, their communities, resource managers and key stakeholders led to the co-development of a National Fisheries Strategy to enable;	1	3.3.1 Increased resilience of agro-ecosystems and communities, especially those	1	0	0	0	MEL link: https://hdl.handle.net/20.500.11766.1/15a4e4

sustainable benefits from marine fisheries to accrue equitably, inclusion of women in decision making, improved nutrition outcomes particularly among children, increased production and better livelihoods for coastal communities. This policy sets the direction for future fisheries and food security investments by government, international donors and development		including Reduced smallholders B.1.1 Gender-equitable control of productive assets and resources					
Scientific Fish Farming in Gram Panchayat Tanks by Women Self Help Groups in Odisha for increasing the income and nutrition. In order to increase the fish production, reduce the malnutrition and increase the income of women in the province, the Department of Panchayati Raj and Drinking Water (PR&DW), Government of Odisha in consultation with Fisheries and Animal Resources Development (FARD) Department and WorldFish has formulated a policy corrigendum on 29 June 2018 for long-term leasing (3-5 years) of these tanks to local Women Self Help Groups (WSHGs) for fish production on priority basis. A convergence scheme was prepared and rolled-out under the Departments of FARD, PR&DW, Women and Child Development and Mission Shakti (WCD & MS) for promotion of scientific fish farming in Gram Panchayat tanks by WSHGs. Financial and technical support is provided to WSHGs under this program through Odisha-WorldFish project, technical staff of FARD and field coordinators of WCD & MS.	2	1.3.2 – Increase livelihoods opportunity; B.1.1. Gender-equitable control of productive assets and resources	2	0	2	1	MEL link: https://hdl.handle.net/20.500.11766.1/d3000d
Improving management of the hilsa shad, *Tenualosa ilisha*, the national fish	1	1.3.2 – Increase	0	0	0	0	MEL link: https://hdl.handle.net/20.500.11766.1/dba9ba

of Bangladesh. During 2018, the USAID-funded ECOFISH-Bangladesh project contributed to the Government of Bangladesh's initiatives in policy development for the sustainable management of the national Hilsa fishery. The progress made in policy development during the year provides a strong foundation for sustainable management of the country's most valuable fishery, directly involving around 0.5 million fishers, and several multiples of that number involved throughout the Hilsa value chain.		livelihoods opportunity; 3.2.1 More productive and equitable management of natural resources					
Bill & Melinda Gates Foundation – first investment in aquaculture: USD 11.5 million. The FISH CRP and the Bill and Melinda Gates Foundation (BMGF) co-designed a new USD11.5m investment in aquaculture to increase income, diversify diets, and empower women in Bangladesh and Nigeria, two focal countries of the FISH CRP and two countries where the growth of aquaculture provides significant opportunities to enhance the income of smallholder families, the diets and nutrition of vulnerable women and children and the empowerment of women. This first engagement will generate learning for future investment decisions.	1	2.2.1 – Increased availability of diverse nutrient-rich foods; XC 2.1.3. Improved capacity of women and young people to participate in decision-making	1	1	0	0	MEL link: https://hdl.handle.net/20.500.11766.1/8b51f2

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 this reporting year.[2] 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) with link	**Maturity level (1, 2 or 3)**	**Indicate if this is:** new outcome updated case – same level of maturity updated case – new level of maturity
Feeding children's futures in rural Cambodia MEL link: https://hdl.handle.net/20.500.11766.1/132b9b	1	New outcome
"Now we always have fish": Research shows potential of rice-fishing farming in Myanmar. MEL link: https://hdl.handle.net/20.500.11766.1/ac90d7	1	New outcome
Job creation in aquaculture value chain in Egypt MEL link: https://hdl.handle.net/20.500.11766.1/326a09	1	New outcome

[2] Note that there is a partial overlap with the policies table, but it should be possible to output both tables from the management information system without additional inputs.

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

The table below provides a list of innovations from 2018.

Title of innovation with link	Innovation type	Stage of innovation	Geographic scope (with location)
FP1: Sustainable Aquaculture			
Design of tilapia single nucleotide polymorphisms (SNP) chip MEL link: https://mel.cgiar.org/innovation/addinnovation/id/146	Genetic (variety and breeds)	Stage 3: available/ready for uptake (AV)	Global
Generation 17 of the GIFT Nile tilapia strain MEL link: https://mel.cgiar.org/innovation/addinnovation/id/147	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
Generation 15 of the Abbassa Nile tilapia strain MEL link: https://mel.cgiar.org/innovation/addinnovation/id/148	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Regional - Africa
Generation 2 of rohu carp (*Labeo rohita*) MEL link: https://mel.cgiar.org/innovation/addinnovation/id/149	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
DArTseq genetic marker developed for catla (*Catla catla*) MEL link: https://mel.cgiar.org/innovation/addinnovation/id/150	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
A way to breed for a new trait of robustness in GIFT identified. MEL link: https://mel.cgiar.org/innovation/addinnovation/id/152	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global

A way to breed for feed efficiency in GIFT MEL link: https://mel.cgiar.org/innovation/addinnovation/id/153	Genetic (variety and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
A smartphone app providing aquaculture extension information MEL link: https://mel.cgiar.org/innovation/addinnovation/id/154	Research and communication Methodologies and tools	Stage 2: successful piloting (PIL - end of piloting phase)	Global
The use of water storage ponds and homestead irrigation channels for fish production in Myanmar MEL link: https://mel.cgiar.org/innovation/addinnovation/id/155	Production systems and management practices	Stage 3: available/ready for uptake (AV)	National – Myanmar
Methods for improving productivity of Aquatic Agricultural systems in Cambodia MEL link: https://mel.cgiar.org/innovation/addinnovation/id/156	Production systems and management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National – Cambodia
Stimulation of natural food production in ponds by use of low protein feeds with fiber (NSP) rich carbohydrates in tilapia culture MEL link: https://mel.cgiar.org/innovation/addinnovation/id/157	Production systems and management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	National – Cambodia
Tools to assist farmers with low or no numeracy skills to manage their aquaculture pond MEL link: https://mel.cgiar.org/innovation/addinnovation/id/158	Production systems and management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National – Sierra Leone
Low cost feed formulation with local ingredients in DR Congo (Bukavu and Kinshasa) MEL link: https://mel.cgiar.org/innovation/addinnovation/id/159	Production systems and management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	National – DR Congo
Better management practices for carp intensification by women self-help groups	Production systems and management practices	Stage 4: uptake by next user (USE)	National – India

MEL link: https://mel.cgiar.org/innovation/addinnovation/id/160			
GIFT introduction in Odisha State, India MEL link: https://mel.cgiar.org/innovation/addinnovation/id/161	Production systems and management practices	Stage 4: uptake by next user (USE)	Sub-national – Odisha, India
FP2: Sustaining Small-Scale Fisheries			
A management plan for fisheries in Lake Nasser, Egypt. MEL link: https://mel.cgiar.org/innovation/addinnovation/id/137	Production systems and management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	National – Egypt
Hilsa fisheries co-management and livelihood buffering strategies. Mel link: https://mel.cgiar.org/innovation/addinnovation/id/142	Production systems and management practices	Stage 2: discovery/proof of concept (PIL - end of piloting phase)	National – Bangladesh
Methodological innovation for 'illuminating Hidden Harvest' of small-scale fisheries. Mel link: https://mel.cgiar.org/innovation/addinnovation/id/141	Research and communication Methodologies and tools	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
Co-management of community fish refuges (CFRs) to enhance fish production, water security and adaptive capacity to climate change. Mel link: https://mel.cgiar.org/innovation/addinnovation/id/139	Production systems and management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National – Cambodia
A framework for assessing and building adaptive capacity to climate change in small-scale fisheries communities. Mel link: https://mel.cgiar.org/innovation/addinnovation/id/143	Social research	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
Solar-social innovations to reduce waste and loss and improve incomes in capture fisheries systems. Mel link: https://mel.cgiar.org/innovation/addinnovation/id/144	Production systems and management practices /Social research	Stage 1: discovery/proof of concept (PC - end of research phase)	Solomon Islands, Malawi, Zambia

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 2018, with further links to evidence provided in Part C.

FP	FP outcomes 2022	Summary narrative on progress against each FP outcome this year	Milestone (from POWB 2018)	2018 milestones status (complete, extended, cancelled or changed)	Evidence or explanation
	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.	Progress is being made in production of new generations of tilapia and carp at the 3 genetics research platforms and in dissemination of existing strains. Continued development of public and private partnerships within FISH focal and scaling countries also contribute to establishing the institutional and investments that support adoption at scale.	Milestone 1.1.1: FISH genetics research platforms operating in three countries: Bangladesh for carps; Egypt (Abbassa) for tilapia; Malaysia (Jitra) for tilapia.	Complete	Complete, though continual improvements are being made to the genetic research platforms, including through cooperation with the CGIAR Excellence in Breeding Platform, and host country in Malaysia for the Jitra facility. Biosecurity is also being prioritized for future investment, particularly with respect to risk management for TiLV.
			Milestone 1.1.2: New public/private sector partnerships established for tilapia genetic improvement and dissemination in two focal countries, one in Asia (Myanmar) and one in Africa (Zambia).	Complete	Myanmar partnership established with the Department of Fisheries and Myanmar Fisheries Federation, incorporating two public and two private satellite hatcheries for dissemination of the GIFT strain that was introduced in 2016. Zambia partnership established with the Department of Fisheries for a genetic improvement program for *Oreochromis andersonii.* Training was provided for key Zambian partners in Penang in March 2018.

			Milestone 1.1.3: IT-based performance assessment methods and tools adopted by national partners in three countries (Bangladesh, Egypt, and Myanmar).	Extended, with an ongoing process continuing to develop a suite of performance assessment tools	Tablet-based performance assessment tools were designed and tested in Bangladesh, Egypt and Myanmar. A new partnership with a private company (Skretting) was agreed to further develop these tools and extend the use performance assessment tools in tilapia aquaculture, with a focus on Africa. A new digital tool for fish epidemiology and surveillance was also developed with Norwegian research partners.
	Outcome 1.2: 2.5 million households have adopted disease detection and control strategies, cost-effective and sustainable aqua-feeds and/or improved aquaculture management practices.	Progress is being made in production of new diagnostics tools for fish disease, improved health management practices and fish feed ingredients, all of which contribute towards this outcome. As in Outcome 1.1, continued development of public and private partnerships also contributes to achieving this outcome.	Milestone 1.2.1: The benefits of better management practices (disease, feed and husbandry) assessed and yield-limiting factors identified for further improvement in four focal countries.	Complete	Study on adoption of better management practices was completed in Bangladesh and will be published in 2019. The study indicated that farmers adopting simple operational improvements had 50% higher productivity. A systematic review of yield gap in tilapia covering multiple countries was also submitted for publication (published in 2019). More specific issues-based management guidance was released, including management of the risks of TiLV to the global tilapia industry; management of disease risk and biosecurity from an aquaculture area-based management perspective; decision-making for managing infectious diseases in the aquaculture sector; and a growing set of management interventions related to the emergence of antimicrobial resistance and occupational hazards; biosecurity principles and plans in genetically improved tilapia dissemination programs. An inventory of locally available ingredients in six FISH countries was produced and will be published by May 2019. A microbial biomass-

					based diet (Novacq™) was shown to outperform benchmark commercial fish diets in laboratory experiments with GIFT fingerlings. In a series of experiments in Bangladesh, low-protein (nitrogen), high-energy (high non-starch polysaccharide carbon) diets stimulated natural food production in the pond, which compensated not only for the reduced supply of dietary protein but also contributed to a higher fish growth.
	Outcome 1.3: 4.8 million metric tons of annual farmed fish production with reduced environmental impact and increased resource-use efficiency (measured by 20% reduction in greenhouse gas (GHG) emissions and 10% increase in water and nutrient-use efficiency).	Progress is being made towards this outcome through increased understanding of the interventions for significantly reducing GHG emissions and increasing water and nutrient use efficiency (Henrikson et al, 2018). As in Outcome 1.1 and 1.2, continued development of public and private partnerships also contributes to achieving this outcome.	Milestone 1.3.1: Environmental improvement plans prepared from FISH research to be adopted by public and/or private sector partners in three countries: one in Africa (Egypt) and two in Asia (Bangladesh, Indonesia).	Extended	Three focal countries and one scaling country, namely Bangladesh, Myanmar, Egypt and Vietnam, are being examined. The research uses existing life-cycle assessment data to identify the interventions that had the best possibility to deal with the most urgent greenhouse gas emissions and other environmental constraints related to aquaculture in each of the countries. Geographic information system mapping has been used to highlight areas where conflicts could occur between aquaculture farms and forests (especially mangroves), recognizing that deforestation is a significant contributor to greenhouse gas emissions. A paper was prepared on sustainable intensification of aquaculture in Bangladesh. Findings from other countries are currently being incorporated into journal articles, providing insights into the current baselines of greenhouse gas emissions from aquaculture in the above focal countries and the opportunities and pathways for improvement within the context of growing fish demand.

	Outcome 1.4: 2.3 million poor men, women and youth access improved livelihood opportunities resulting from increased aquaculture production and associated value chains and enterprise development (of which 50% are women).	Progress is being made towards this outcome through public and private sector partners, policy and investments in FISH focal countries, informed by outcome and impact studies. Recognizing the importance of private sector pathways and entrepreneurship for achieving this goal, FISH research has initiated research on identification of entrepreneurship opportunities for women in Nigeria and received USAID and BMGF grants for private sector cooperation to achieve goals of smallholder income, women's empowerment and nutrition outcomes at scale in Bangladesh and Nigeria.	Milestone 1.4.1: Public-private sector partnerships or platforms for sustainable aquaculture R&D convened (and led by national partners) in one more focal country in Africa and two focal countries in Asia.	Complete	In 2017, FISH reported partners/platforms in Bangladesh, Myanmar, Vietnam and Egypt. These are still operational in 2018. In addition, new public-private partnerships or platforms were established and/or strengthened in India, Solomon Islands, Timor-Leste, Nigeria and Zambia. A new cooperation with the African Development Bank under the Technologies for African Agriculture Transformation initiative will extend public/private partnerships for accelerating aquaculture R&D to ten African countries from 2019-2021.
			Milestone 1.4.2: FISH research has identified business and entrepreneurship approaches and models with potential for scaling within focal countries.	Complete	A review of business and entrepreneurship approaches was completed and a journal article submitted for publication in Q1 2019. Private sector cooperation was established in Zambia on business model development and a successful proposal submitted to GIZ for scaling of business models associated with tilapia value chains in Zambia and Malawi. Country-specific studies were conducted in Nigeria to identify entrepreneurship opportunities for women.

FP2	Outcome 2.1: 1 million fishery-dependent households have reduced poverty as a result of adopting improved fisheries management.	Progress is being made towards this outcome through complementary fisheries management interventions being initiated/monitored at multiple scales from community to global, informed by evidence gathered through outcome and impact studies. A new bilateral grant from the Oak Foundation is supporting enhanced M&E of co-management interventions in FISH.	Milestone 2.1.1: Adaptive management, technology and livelihood interventions identified in marine and inland small-scale fisheries systems in at least three FISH focal and/or scaling countries.	Complete	Country-level research of co-management systems are available/under refinement in Bangladesh, Cambodia, Myanmar and Solomon Islands.
			Milestone 2.1.2: Evidence gathered and policy recommendations prepared on (i) SSF functions for food security, poverty alleviation and threats; and (ii) impacts of intra-regional and global trade patterns and policies on the pro-poor functions of SSF.	Extended, though significant progress made in 2018	Significant progress. (i) The first paper of the Illuminating Hidden Harvest study, focusing on nutrition, was published, with methodological recommendations for 60 national-level evidence-gathering case studies to be implemented with the FAO and other partners during 2019. A journal paper on production and trade patterns and their influence on nutritional potential of capture fisheries was submitted and is in review. (ii) Analyses of intra-regional fish and reported in trade in Africa and five policy briefs illustrated the scale of cross-border trade for income and food security, and the impact of inadequate market and trade infrastructure were also drafted. An analysis of seafood trade duration in ASEAN was completed. Pacific research is pending.

			Milestone 2.1.3: Establishment of partnerships and networks that span communities, national agencies and government bodies.	Complete	Complete, though partnership building continues at all levels from local to global. Partnership development in small-scale fisheries research for development has been further facilitated by a USD 1.5 million investment secured from the Oak Foundation to build collaborative networks, via the project Building Capacity, Coordination and Communication for Collective Action on Small-Scale Fisheries. Collaboration was also strengthened with the FAO for global-level network development.
	Outcome 2.2: 1.2 million people, of which 50% are women, assisted to exit poverty through livelihood improvements.	Progress is also being made towards this outcome, following the approach provided in Outcome 2.2, underpinned by a strengthening portfolio of research focused on women in fisheries management investments.	Milestone 2.2.1: New knowledge on gender-sensitive models and gender-transformative approaches to livelihood innovations for focal countries.	Complete	Complete, though research on this frontier continues. New knowledge was generated across several FISH focal countries on women's empowerment and the application of gender-transformative approaches to fisheries management, reviewed in this blog created for International Women's Day 2019 and associated timeline.
			Milestone 2.2.2: Completed production of new knowledge on gender barriers and implications in fisheries-dependent communities, surfacing hidden micro-level barriers to equality in fisheries management and innovation.	Complete	Three key papers indicate the process on this milestone: Gender and marine protected areas: A case study of Danajon Bank, Philippines Gender differences in willingness to pay for capital-intensive agricultural technologies: the case of fish solar tent dryers in Malawi Postharvest fish losses and unequal gender relations: Drivers of the social-ecological trap in the Barotse Floodplain fishery, Zambia

			Milestones 2.2.3: Conceptual framework for small-scale fisheries in fish food systems completed and being used to convene policy engagement, align investment in fisheries and re-invigorate global dialogue and strategies concerning the role of small-scale fisheries in poverty reduction.	Complete; with one further study on fish in food systems frameworks and research agendas in preparation for submission as a journal article in 2019	A conceptual framework for fish in food systems was developed through a workshop held in Penang in March 2018, and engagement in several A4NH events. The results are being integrated into the Illuminating Hidden Harvests research with the FAO in 52 countries. Research fed into a rapid assessment of fish in food systems and value chains in the Great Lakes region—reported in keynote presentations and a side event at the Pan-African Fish and Fisheries Association conference. See the side session co-hosted by SADC at the conference: Fish for food and nutrition security in the SADC region.
	Outcome 2.3: 2.1 million hectares of inland aquatic and coastal marine habitat restored and under more productive and equitable management.	Progress is being made towards this outcome through a portfolio of W3/bilateral project investments in FISH focal and scaling countries.	Milestone 2.3.1: New knowledge and collaboration on cross-scale governance mechanism, accounting for impacts of external drivers and resource competition.	Complete; with one cross-regional study pending	Multiple studies (coastal and inland capture fisheries) contributed to the completion of this milestone. Key papers produced as evidence of progress with this milestone: Intersectorality in the governance of inland fisheries Multi-scale policy diffusion and translation in Pacific Island coastal fisheries Reconciling multiple societal objectives in cross-scale marine governance: Solomon Islands' engagement in the Coral Triangle Initiative How to capture small-scale fisheries' many contributions to society? – Introducing the 'value-contribution matrix' and applying it to the case of a swimming crab fishery in South Korea Governing complex systems: Social capital for the Anthropocene

					Transdisciplinary engagement to address transboundary challenges for small-scale fishers
			Milestone 2.3.2: New knowledge of trade-offs between small-scale fisheries, infrastructure and land use.	Extended	Paper and practice brief in draft—generated through multi-stakeholder expert group meetings in 2018. Draft prepared of A guide for water planners, managers and engineers to enhance fisheries in water control infrastructure (brief and paper to be submitted 2019). Preliminary evidence summarized in a WLE/FISH practice brief and blog that was used as the basis of dialogue at Stockholm World Water Week to raise profile of the integration of fisheries within water management infrastructure. Special session highlighted here Water for Fish; Sustainable Inland Fisheries The associated brief is Improving opportunities for reservoir fisheries.
			Milestone 2.3.3. Completion of foresight analysis (accounting for environmental, demand, production trends) of small-scale fisheries performance.	Extended	Foresight analysis completed at Africa regional level and one focal country (Zambia) but delayed for other to permit inclusion of Illuminating Hidden Harvest data. Key papers from Africa are: Prospects and challenges of fish for food security in Africa Fish supply and demand for food security in sub-Saharan Africa: An analysis of the Zambian fish sector. A paper on Bangladesh is in preparation and further research on futures is pending in Asia and Pacific.

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

The following table provides overall numbers and a link to the full list of publications is provided in Part C.

	Number	Percent
Peer-reviewed publications	55	100%
Open access	34	62%
ISI	43	79%

Table 7: Participants in capacity development activities

The following table summarizes participants in capacity development activities, with additional information to be found in links provided in Part C.

Number of trainees	Female	Male
In short-term programs facilitated by the FISH CRP	67,687	25,270
In long-term programs facilitated by the FISH CRP	12	7

Table 8: Key external partnerships

The following lists up to five important partnerships for 2018 for each flagship.

Lead FP	**Brief description of partnership aims (30 words)**	**List of key partners in partnership**	**Main area of partnership.** Research/Delivery/Policy/Capacity Development/Other
1	A research partnership for **tilapia genetics and the application of genomic selection tools** is enabling the selection of tilapia based on genetic markers, expanding GIFT research beyond a faster growth-oriented focus to introduce selection for new characteristics, such as disease resistance, resilience and feed efficiency, unique and new characteristics for tilapia globally.	The Roslin Institute (UK); University of Stirling (UK); Wageningen University & Research (Netherlands); Earlham Institute (UK)	Research
1	A partnership for **fish disease diagnostics, surveillance and control** is developing epidemiology and health economic analytic tools and pond/host patho-microbiome research for early warning of fish disease. Special attention is being given to responding to TiLV transmission aspects and development of non-invasive sampling methods.	National Veterinary Institute (Norway); Centre for Environment, Fisheries and Aquaculture Science (UK); University of Exeter (UK); Mahidol University (Thailand); Mylab (Malaysia)	Research
1	The growing partnership for **assessing/managing antimicrobial resistance** in aquaculture is drawing together key globally leading research institutions in cooperation with the CGIAR Antimicrobial Resistance Hub.	University of Stirling; Centre for Environment, Fisheries and Aquaculture Science; University of Exeter; Royal Veterinary College (UK); CGIAR partners: International Livestock Research Institute; International Policy Research Institute; International Water Management Institute	Research
1	A partnership for **aquaculture genetics policies** in Southern and Eastern Africa, which has endorsed the FISH research program on genetics of three regional species, namely: *O. mossambicus* in Mozambique and South Africa; *O. shiranus* in Malawi and *O. andersonii* in Zambia and launched work on a regional strategy for access and benefit sharing for SADC	Southern African Development Community; East African Community; Food and Agriculture Organization of the United Nations; Deutsche Gesellschaft für Internationale Zusammenarbeit;	Policy and Capacity Development

	member states to share the improved genetic materials from the three regional species.	NEPAD African Biosafety Network of Expertise	
1&2	A diverse set of partners from regional to national level under the partnership between WorldFish and the African Union Inter-African Bureau for Animal Resources within the EU-funded FishTrade for a Better Future project, contributed **multiple outcomes related to facilitation of fish trade** within key African trade corridors.	African Union Inter-African Bureau for Animal Resources; Southern African Development Community; East African Community; fisheries departments in seven countries (Côte d'Ivoire, Kenya, Malawi, Tanzania, Cameroon, Zambia and South Africa)	Policy and Capacity Development
2	A partnership for Illuminating Hidden Harvests; the **contribution of small-scale fisheries to sustainable development.** Focusing on social, environmental, economic and governance contributions of small-scale fisheries at global and local scales; key drivers of change; and threats/opportunities. The partnership developed methodologies and some key formative publications in 2018, aiming for key influencing policy moments in 2020.	Food and Agriculture Organization of the United Nations; Oak Foundation; WorldFish; national partners across 60 countries	Research and Policy
1&2	The most significant gender partnership is our engagement with KIT, including in 2018 the integration of the FISH **gender strategy** across the portfolio of gender-related projects. Importantly, the partnership includes building capacity with key partners to ensure FISH is able to deliver a gender-integrated approach.	Royal Tropical Institute	Capacity building (gender)
1&2	The collaboration with these two research institutions aims to strengthen the quality of research and work on impact and outcome assessment in the field of aquaculture and small scale-fisheries. This will help to evaluate FISH specific innovations, interventions, investments and policies, and their related linkages to both the FISH CRP targets and the Sustainable Development Goals (SDGs).	Department of Agriculture, Food and Environment, University of Pisa (Italy) Integrated Research System for Sustainability Science (IR3S), University of Tokyo (Japan)	Research/ Capacity Development/Impact assessment

Table 9: Internal cross-CGIAR collaborations

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
Research on fish and human nutrition and health, including contributions to food systems reviews in Bangladesh and Nigeria; agreement on a joint PhD student (2019–2021) on modeling of fish in food systems. AMR research on uses of antibiotics in aquaculture and their potential influence on human AMR (along with the Livestock CRP).	A4NH FP1 on systems research and FP5 on AMR	Scientific and policy development value, ensuring that fish as a nutritious food is better incorporated into global and national research and policies.
Research on integration of fish into foresight studies and animal-source food supply-demand modeling in Africa, including landmark publications on sustainable aquaculture growth in Africa—Prospects and challenges of fish for food security in Africa; and Fish supply and demand for food security in sub-Saharan Africa: An analysis of the Zambian fish sector—both indicating the significance of further investment in aquaculture. Research on small-scale fisheries governance reform in Myanmar, contributing policy change that strengthened tenure rights of small-scale fisheries in the Ayeyarwardy Delta.	Policies, Institutions and Markets (PIM) CRP FP1 on foresight research and FP5 on small-scale fisheries governance reform in Myanmar	Scientific value, allowing FISH researchers to access global foresight modeling expertise and apply it to the growing aquaculture sector in Africa. Research on small-scale fisheries governance reform in Myanmar benefited from cooperation with policy researchers in PIM's FP5 on governance of natural resources.
Research on integration of fish into climate-smart agriculture projects and scaling in Myanmar, the Mekong region and Bangladesh, and an assessment of gender and climate-smart agriculture in Bangladesh. Research on modeling of low-emissions development pathways for aquaculture. High impact factor paper on adaptation in coastal communities and raising the profile of fish within climate change agendas, including the participation in Agriculture Advantage 2.0 at COP24 | Transforming food systems under a changing climate: From priorities to action.	CCAFS FP2 on climate-smart agriculture and FP3 on low-emissions development pathways for aquaculture	Scientific value as well as policy influence through COP24 in integration of fish into climate change investments.

Research with FISH FP1 in preparation of business models and co-production of a working paper on aquaculture within wastewater systems. Research to better understand fisheries in multifunctional landscapes, at national level (Myanmar) and at global levels, overall seeking to better identify, understand and enable the significant global opportunities for integrated approaches involving fish and water management. IWMI contributions at a World Water Week session on Water for Fish: Sustainable Inland Fisheries.	WLE FP3 on wastewater models and FP4 on fish in multifunctional landscapes	Scientific and policy values. The cooperation is significant from a policy perspective because of the opportunities for change in water management that can substantially increase the values of inland fisheries and their contribution to food and nutrition security.
Research in Myanmar on fish within sustainable rice systems (with co-funding from the Australian Centre for International Agricultural Research) and co-organization of a regional symposium on rice-fish systems research in Myanmar that helped identify research priorities and policy shifts for sustainable rice-fish systems, drawing on experience from across Asia.	RICE FP3 on fish rice systems	Scientific and policy values. The cooperation is significant from a policy perspective because of the opportunities for better integration of fish into rice landscapes in Myanmar, and elsewhere in Southeast and South Asia.
Jointly funded and co-supervised intern for exploratory research on fish and roots and tubers in food systems.	Roots, Tubers and Bananas CRP	Scientific value but exploring new avenues for research synergies and increase of our collective impact.
Research collaboration for strengthening the monitoring, evaluation and learning framework between two centers using both the MEL system as a web-based planning and reporting platform and co-funding of research staff. Joint recruitment was carried out for an international M&E specialist based in Egypt.	ICARDA	Research collaboration activities within FISH with a particular focus on impact evaluation and reporting, and on data collection, curation and sharing standards and guidelines.
Advice, tools and methodologies for the development of tilapia and carp breeding and genetic improvement platforms in Bangladesh, Malaysia and Egypt.	Excellence in Breeding Platform	Research benefits.
Upgrading of research data management systems within FISH and with the CGIAR Big Data Platform Inspire Challenge to test novel linkages of digital technologies to create an automated data pipeline to highlight temporal and spatial changes in fish production from small-scale fisheries.	Big Data Platform in the Organize and Inspire modules	Research benefits.

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 2018)	**Status complete, extended, cancelled, changed**	**Type of study or activity**	**Please include links to MELIA publications here. Also, optional space for comments: e.g. any interesting findings and lessons from a particular study that you would like to share (indicative 100 words)**
Studies on genetic gain in tilapia and carp improvement program.	Complete for 2018 but research extends into 2019–2021	Other	GIFT (Malaysia research platform): Production of GIFT G17 completed—nursed, tagged using Passive Integrated Transponder (PIT) tags, grow-out, harvested, breeding values calculated, selected candidate parents to produce next generation (G18). G18 delayed to allow genomic selection using new tilapia SNP chip. Key papers published relating to new breeding traits in tilapia, including breeding for robustness in GIFT and the genetic parameters of feed efficiency in juvenile Nile tilapia. Nile tilapia (Egypt research platform): Harvested G14. Data analyzed and mating list provided. Produced 128 families of G15. Carp (Bangladesh research platform): G2 of rohu and base population of catla and silver carp established. Paper submitted in 2018 and accepted for publication on the Bangladeshi *Catla catla* breeding population.
Studies to assess on-farm performance of improved tilapia strains (input use, outputs, production and profitability).	Extended	Effectiveness study	Bangladesh study was implemented at the end of 2018 and both a technical report and peer-reviewed publication are under preparation, to be published during 2019. First results confirmed the results demonstrated by the Abbassa strain in Egypt in 2017 in terms of improvements in growth, feed conversion ratios and profitability compare with existing farmed tilapia strains. As an additional but key research output, a research protocol to assess the on-farm performance of improved tilapia strains (input use, outputs, production and profitability) was developed and is under

			validation in another two countries (Myanmar, Zambia) in collaboration with both public and private sector. The protocol represents a very important opportunity to provide guidance in the sector by consolidating a methodology for those studies in different parts of the world and thus to eventually harmonize results and for extending the validity of the lessons learn. A paper was published on the potential for sustainable intensification of aquaculture systems in Bangladesh, using Life Cycle Assessment, that includes both tilapia and carp farming systems.
Epidemiological studies of tilapia diseases in Bangladesh and Egypt.	Extended	Synthesis	Using an Open Data Kit (ODK) platform, an online tool, "Tilapia epidemiology and health economics", was developed and tested. The implementation of the online tool through cross-sectional studies will take place in 2019 in Bangladesh and Egypt. This will allow for the first time the production of a georeferenced baseline related to fish health in the targeted countries. The work is ongoing and research outputs will be published in 2019.
Baseline study for the assessment of current tilapia production and productivity in Myanmar.	Extended	Synthesis	The funds for this outcome study were delayed due to an extended contract negotiation, but the project Scaling Systems and Partnerships for Accelerating the Adoption of Improved Tilapia Strains by Small-Scale Fish Farmers was eventually approved in late 2018 and the baseline study will be completed in 2019. G14 GIFT, managed according to a cohort mating system by two government hatcheries in Myanmar, was distributed to one private and one public hatchery for commercial dissemination in 2019.
Evaluating impacts of improved tilapia strains.	Extended	Effectiveness study (*ex-ante* impact evaluation)	Evaluation data was collected by June 2018, some reported at the 7th Global Conference in Aquaculture and Fisheries and good progress made in two papers: Mehar M, Mekkawy W, McDougall C, Benzie J. A systematic literature review of fish trait preferences by end users: implications for fish breeding, *Reviews in Aquaculture* (submitted on 3 March 2019). One paper under preparation with the support of Auburn University College of Agriculture and University of Pisa. The study will make evident the inferential logic between farming improved tilapia strains

			in India (Odisha) and the SLO targets, i.e. adoption/reduced poverty and improved food and nutrition security for health.
Evaluating performance of improved local service provider models.	Complete	Effectiveness study	Working paper drafted, based on experiences in Bangladesh, and in the process of publication.
Evaluating pro-poor, women targeted polyculture systems in Bangladesh.	Extended	Effectiveness study	Methodology has been reviewed (sampling strategy and research protocol) with the support of the University of Tokyo. An additional data collection will be implemented in April 2019. Paper will be submitted during 2019. The study will make evident the causality between the adoption of polyculture systems in Bangladesh and the increase in livelihood opportunities (poverty reduction), the improvement of food and nutrition security for health and gender equity.
Assessments of dissemination systems for improved fish seed in Bangladesh, Myanmar and Malawi.	Extended	Effectiveness study	The funds for this outcome study were delayed due to an extended contract negotiation process, but eventually approved. The Scaling Systems and Partnerships for Accelerating the Adoption of Improved Tilapia Strains by Small-Scale Fish Farmers will complete the dissemination studies in 2019.
Outcome studies on rice-fish system improvement models.	Completed	Effectiveness study	Primary research conducted and data generated in 2018. Outcome studies write-up scheduled for 2019, with country-specific outcome studies (e.g. Myanmar) and multi-country (e.g. Myanmar, Bangladesh) being prepared for publication.
Study of impacts of fisheries co-management, including (i) a systematic review of outcomes from co-management in Southeast Asia; and (ii) case studies in four countries.	Extended	Effectiveness study Synthesis	At least five research papers form Bangladesh, Philippines, Solomon Islands/Pacific region examined impacts of co-management approaches. Study of impacts of co-management completed through systematic review, and case studies completed at 50% by end of 2018. Case study completion and final write-up of review and cases to be complete during 2019.
Assessment of ICTs and their current and potential use in small-scale fisheries.	Extended	Synthesis	Preliminary results presented in a Southeast Asia regional expert meeting hosted in Penang, Malaysia by WorldFish and FAO on 7-8 November 2018.

			Assessment of ICT completed at 50%, with cases to be analyzed in 2019. Write-up to be complete by Q3 2019.
Impact assessment of coastal fisheries management systems in Bangladesh.	Extended	Effectiveness study Synthesis	Assessments of coastal fisheries management system completed in Bangladesh in 2017 and 2018 (paper a & b). Further independent evaluation scheduled for 2019.
Synthesis of cases of fisheries strategies in water management (including reservoirs and irrigation systems in multifunctional landscapes).	Extended	Effectiveness study	Primary research conducted and data generated in 2018. Outcome studies write-up scheduled for 2019, with country-specific outcome studies (e.g. Myanmar) and multi-country (e.g. Myanmar, Bangladesh) being prepared for publication.
MEL platform implementation.	Complete/extended	Other MELIA activity. Please specify: MEL installation	FISH CRP MELIA system has been migrated to the MEL platform (installation in 2018). 89% of ongoing projects were recorded by the end of Q1 2019. Training tools developed and training provided to FISH CRP researchers. Additional training planned to support program-wide implementation in 2019.
Job creation in aquaculture value chain in Egypt.	Complete	Effectiveness study	Employment generation across 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 paper has been accepted for publication by Aquaculture and a technical report has been published.

Note on column three options:

1. EPIA: Ex-post impact assessment (at scale)
2. Adoption study: Ex-post adoption survey (at scale)
3. Effectiveness study (development project-level adoption and impact studies)
4. Quali outcome study: qualitative outcome studies (mainly to substantiate contribution to policy or similar)
5. Program evaluation (including project evaluations)
6. Synthesis: reviews, systematic reviews, evidence gap maps
7. Other MELIA activity. Please specify: _____ (for example: learning workshop, training in MELIA, installation of management information system)

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

This table provides an update (since 2017 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 (this may be for example IEA, CCEEs and others - both CRP-specific and crosscutting)	**Recommendation number (from evaluation)** **(accepted recommendations only)**	**Text of recommendation (can be shortened)**	**Status of response to this recommendation** **Dropdown: Completed/ Ongoing**	**Concrete actions taken for this recommendation (one row per action)**	**By whom (per action)**	**When (per action)**	**Comments (including expenditure, where relevant – relate this back to predicted budgetary implications in the management response to the evaluation)**
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 2018 to strengthen research capabilities in 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	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	MC, CRP director, flagship/cross scutting leadership	End of 2021	

		with AAS should be based primarily on their potential to further the AAS research agenda.		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.			
	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	By mid-2019	
	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/cross cutting 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 developed in 2018 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. Relevant partnerships developed in 2018 were with the USAID-funded Feed the Future Bangladesh Aquaculture and Nutrition Activity and	Flagship/cluster leads within FP1	End of 2021	

				Skretting, a global feed company, the latter for performance assessments and feed trials.			
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.	CRP director, FISH gender lead	FISH gender strategy published in July 2018	

Table 12: Examples of W1/W2 use in this reporting period

Please give specific examples, one per row (including through set-aside strategic research funds or partner funds). Max. 50 words/example, but please aim for 30	**Select broad area of use of W1/W2 from the categories below (drop down). Select only one category**
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); (ii) genetics x environment research for growth and survival of GIFT and rohu carp; (iii) a first assessment of genetic architecture of GIFT using genomic selection; (iv) development of molecular markers for rohu, catla and silver carps; (v) establishment of the base population for genetic improvement of *Oreochromis andersonii* in Zambia; (vi) policy workshops with SADC and EAC states in Africa; (vii) user assessment and trait studies in India and Zambia.	Genetics and genomics research. Key research partners. Policy development
FP1, Cluster 1.2 Tilapia disease: W1/W2 funds contributed partial funding to (i) prevalence and impact studies of TiLV in genetically improved tilapia farming systems and hatcheries in Bangladesh, Egypt and Malaysia; (ii) molecular and e-DNA research to develop and test pond-side and farmer-led diagnostic platforms for serious aquatic pathogens, with a focus on TiLV and AHPND; (iii) developing biosecurity compliance protocols for GIFT breeding platforms and multiplication centers; (iv) research on prevalence, risk factors, spread and impact of summer mortality syndrome in tilapia farming systems and hatcheries in Egypt; (v) design/testing of epidemiological and economic assessment tools; (vi) 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. Research partnerships. Contingency funding for newly emerging disease (TiLV). Policy development
FP1, Cluster 1.2 Sustainable fish feed ingredients: W1/W2 funds contributed partial funding to (i) fish ingredient assessments and digestibility research; (ii) assessments of production practices ('better management practices') adoption in tilapia culture in Egypt and Bangladesh.	Research partnerships
FP1, Cluster 1.3 Aquaculture systems: W1/W2 funds contributed partial funding to (i) performance assessment tools for improved tilapia; (ii) aquaculture value chains/aquaculture system assessments in Tanzania;	Research

(iii) gender and entrepreneurship reviews and research in Nigeria and Zambia; (iv) foresight/futures research in Africa (in partnership with the PIM CRP).	
FP 2, Cluster 2.1 Resilient coastal fisheries: W1/W2 funds contributed partial funding to (i) reviews of initiatives to build adaptive capacity to climate change in capture fisheries systems; (ii) IT equipment for Solomon Islands as a learning hub for Small-Island Developing States; (ii) researcher time to a global synthesis of mapping global human dependence on marine ecosystems.	Research
FP 2, Cluster 2.2 Fish in multifunctional landscapes: W1/W2 funds contributed partial funding to (i) policy research on fish production systems and rice systems in Myanmar and co-funding of a rice-fish symposium to develop research/policy agendas in Myanmar; (ii) a review, workshop and publication on improving fisheries performance in water management infrastructure.	Research
FP 2, Cluster 2.3 Fish in food systems*:* W1/W2 funds contributed partial funding to (i) Illuminating Hidden Harvest research with the FAO; (ii) a systematic review and development of research agenda for Fish in food systems, including one workshop; (iii) capacity development workshop for early career mentoring and resource development to enhance research quality and publications; (iv) capacity development workshop and science writing mentoring to Africa early career researchers to understand impact of fish trade on the incomes and food security of low-income producers and value chain actors; (v) methodological innovation for Illuminating Hidden Harvest.	Research and capacity development
Gender: W1/W2 funds contributed funding to (i) publication of the gender strategy and related strategic gender research; (ii) communications and capacity building initiatives associated with gender integration within FISH.	Research
Youth: W1/W2 funds contributed funding to (i) development of the FISH youth strategy, including review of youth R&D activities across FISH focal countries; (ii) preparation of a synthesis paper on youth and fisheries/aquaculture.	Research

Capacity development: Preparation of the FISH capacity development strategy.	Capacity development
Monitoring and evaluation: W1/W2 funds contributed funding to: (i) M&E activities across FISH, including partial funding of some outcome/impact assessments; (ii) establishment of the FISH MEL system and events to capture learning across the program. Tables 2, 3, 5 and 10 provide further information on the activities implemented.	Monitoring, learning, evaluation and impact assessment
Program management: W1/W2 funds contributed funding to investments in core program management activities, including partial funding of key Program Management Unit (PMU) leaders and management staff, operations and learning meetings, including Management Committee and ISC meetings.	Monitoring, learning, evaluation and impact assessment

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 2018 (all figures in USD).

	Planned budget 2018*			Actual expenditure 2018**			Difference			Comments
	W1/W2	W3/bilateral	Total	W1/W2	W3/bilateral	Total	W1/W2	W3/bilateral	Total	
FP1 (Sustainable Aquaculture)	2,550,247	12,142,658	14,692,905	2,561,474	10,123,797	12,685,271	(11,227)	2,018,861	2,007,634	
FP2 (Sustaining Small-Scale Fisheries)	953,055	8,493,894	9,446,949	914,526	8,505,735	9,420,261	38,529	(11,841)	26,688	
Cross-program investments	905,366		905,366	898,823		898,823	6,543		6,543	
CRP management and support cost	703,775		703,775	678,388		678,388	25,387		25,387	
CRP total	5,112,443	20,636,552	25,748,995	5,053,211	18,629,532	23,682,743	59,232	2,007,020	2,066,252	

*2018 SMO-approved budget USD 4.86 million + 2017 carryover $252,443

**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 via the MEL platform.

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

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

Evidence C: Outcomes and milestones

Evidence D: Full list of publications published in reporting period

Evidence E: Altmetrics (Common Reporting Indicator I2)

Evidence F: Full list of current external partners

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

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