CGIAR

RESEARCH PROGRAM ON Fish

CGIAR Research Program on Fish Agri-Food Systems

Annual Report 2017

IWMI International Water Management Institute

WAGENINGEN UR For quality of life

JAMES COOK UNIVERSITY AUSTRALIA

UNIVERSITY of GREENWICH

Lead Center:

WorldFish

Contents

List of acronyms

A4NH	Agriculture for Nutrition and Health CRP
AAS	Aquatic Agricultural Systems CRP
ACIAR	Australian Centre for International Agricultural Research
AIN	Aquaculture for Income and Nutrition
AMR	antimicrobial resistance
ANU	Australian National University
ARC	Agricultural Research Center
ARI	advanced research institute
AU-IBAR	African Union – Inter-African Bureau for Animal Resources
BoT	WorldFish Board of Trustees
BFRI	Bangladesh Fisheries Research Institute
BMP	better or best management practices
CBFM	community-based fisheries management
CCAFS	Climate Change, Agriculture and Food Security CRP
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGIAR	Consultative Group for International Agricultural Research
CIM	Centre for International Migration and Development
CIRAD	French Agricultural Research Centre for International Development
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CLAR	Central Laboratory for Aquaculture Research
CoA	cluster of activities
CRP	CGIAR research program
DALY	disability-adjusted life year
DoF	Department of Fisheries
EAC	East African Community (Burundi, Kenya, Rwanda, South Sudan, Tanzania, Uganda)
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FISH	CGIAR Research Program on Fish Agri-Food Systems
FP	flagship project
GHG	greenhouse gas
GIFT	genetically improved farmed tilapia
GLDC	Grain Legumes and Dryland Cereals CRP
ha	hectare
IDO	intermediate development outcome
IDS	Institute of Development Studies
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPG	international public good
ISC	Independent Steering Committee
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
LVFO	Lake Victoria Fisheries Organization
MARLO	Managing Agricultural Research for Learning and Outcomes

M&E	monitoring and evaluation
MC	Management Committee
MEL	monitoring, evaluation and learning
MFF	Myanmar Fisheries Federation
NARS	National Agricultural Research Systems
NARES	National Agricultural Research and Extension Systems
NDC	nationally determined contributions
NEPAD	New Partnership for Africa's Development
NGO	nongovernmental organization
NRI	Natural Resources Institute
NVI	Norwegian Veterinary Institute
PDF	postdoctoral fellow
PIM	Policies, Institutions and Markets CRP
POWB	Annual Plan of Work and Budget
R&D	research and development
RDM	research data management
RICE	Rice Agri-Food Systems CRP
RTB	Roots, Tubers and Bananas 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)
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goal
SLO	system-level outcome
SMB	System Management Board
SLU	Swedish Agricultural University
SNP	single nucleotide polymorphism
SPIA	Standing Panel on Impact Assessment (of the CGIAR)
SRF	Strategy and Results Framework (of the CGIAR)
SSF	small-scale fisheries
SRUC	Scotland's Rural College
STREAMS	Sustainable Transformation of Egypt's Aquaculture Market System
TAAT	Technologies for African Agricultural Transformation
TBTI	Too Big To Ignore (research network)
TiLV	tilapia lake virus
ToC	theory of change
UCC	University College Cork
UNFCCC	United Nations Framework Convention on Climate Change
UoL	University of Lancaster
UoS	University of Stirling
USD	United States dollar
W1/W2	CGIAR funding windows 1 and 2
W3	CGIAR funding window 3
WLE	Water, Land and Ecosystems CRP
WRI	World Resources Institute
WUR	Wageningen University & Research
yr	year
ZAMCOM	Zambezi Watercourse Commission

1. Key results

1.1 CRP progress toward intermediate outcomes and SLOs

The CGIAR Research Program on Fish Agri-Food Systems (FISH) is a new CRP that builds on earlier CRPs for Livestock and Fish (L&F) and Aquatic Agricultural Systems (AAS) as well as prior research by WorldFish and the managing partners. Key outcomes from the two flagships of Sustainable Aquaculture (FP1) and Sustaining Small-scale Fisheries (FP2) during 2017, including milestones achieved, are summarized below and in Tables A-1 and A-2.

Highlights of FP1 milestones achieved include a new genomics research strategy for Nile tilapia; the successful development of new baseline populations for *Catla catla* and silver carp in Bangladesh; improvements in the practices and policies associated with aquaculture biosecurity, diagnostics and surveillance to manage fish disease risks in Bangladesh, Egypt and Malaysia; identification of promising novel ingredients for future aquaculture feeds; and dissemination and performance assessments of improved tilapia.

Dissemination of improved tilapia breeds continued during 2017, with partners in Egypt (Abbassa strain) and with the genetically improved farmed tilapia (GIFT) strain in Bangladesh, India, the Philippines and Timor-Leste. The GIFT strain has now been disseminated directly by WorldFish to 16 countries and continues to be in high demand. GIFT is recognized as a technological advance that has made significant contributions to tilapia supplies and livelihoods globally. Research funded by the CGIAR Standing Panel on Impact Assessment (SPIA) indicates high rates of adoption, with 53 percent of production in fish hatcheries in Bangladesh and 40 percent in the Philippines using GIFT or GIFT-derived tilapia strains. On-farm performance assessments of the Abbassa strain in Egypt indicate improvements in growth (12 percent), feed conversion ratio (FCR, 13 percent) and profitability (48 percent) when compared to existing farmed tilapia strains. Research to understand patterns of farmer adoption (SLO 1.1) and their contributions to farm productivity and income (SLO 1.2) is a priority for FISH in 2018. The combination of improved tilapia strains alongside better pond management practices also reduce greenhouse gas (GHG) emissions and nutrient efficiencies, with outcome studies in Egypt indicating significant reductions in life-cycle environmental impacts from the combination (SLO 3.1 and 3.2).

Highlights of FP2 milestones achieved include the completion of multi-year assessments of community-based fisheries management (CBFM); piloting of new fisheries management innovations in rice field agroecosystems of Cambodia and Myanmar; pilots demonstrating success in building fisheries resilience through participatory and multi-stakeholder approaches; and new insights from gender research on the capacity, motivation and barriers of men and women in fishing communities to innovate.

CBFM innovations continued to be disseminated during 2017, contributing to increasing adoption of better fisheries management measures (SLO 1.1), poverty reduction (SLO 1.2) and restoration of the productivity of aquatic ecosystems (SLO

3.3). In Bangladesh, fisheries co-management research on estuarine hilsa-dominated fisheries has resulted in over 448 conservation groups established in 81 villages since 2015 and 186,050 hectares (ha) of aquatic ecosystems brought under improved management in 2017, benefiting an estimated 25,000 people with increased incomes (Dutton et al. 2018). Adoption of CBFM also continued in coastal marine ecosystems of Solomon Islands and the rice field landscapes of Cambodia. Research on adoption (SLO 1.1) and income (SLO 1.2) derived from these investments is a priority for FISH in 2018.

Multi-year outcome studies in 107 water bodies in Bangladesh provided evidence of improved and/or sustained fisheries productivity associated with CBFM. An assessment of 10 years of CBFM in Solomon Islands identified learning networks, fostering of adaptive management systems and linkages across scales of governance as key elements in fostering sustainability and development outcomes from CBFM. Outcome studies of governance in inland fisheries, commonly operating amid competition for water resources, emphasized building resilience required novel governance approaches that reach beyond the fisheries themselves, and within multifunctional water and landscapes. This research will be further pursued in cooperation with the Water, Land and Ecosystems (WLE) CRP in 2018.

Fish in regional food systems research progressed in Africa during 2017, elucidating fish trade constraints caused by inadequate market and trade infrastructure and deficient policy and institutional frameworks. National and regional policy dialogue has led to new policies for one-stop border posts being established to enable women fish traders and processors to conduct easier and more equitable cross-border trade. Building on earlier AAS research on fishing camps in Zambia, a gender-transformative approach that combined value-added improvements in fish-processing technologies and social change communication was found to deliver significant changes in gender attitudes and women's empowerment, opening new opportunities for improving the livelihoods for women in fish value chains.

Gender research in Bangladesh, Myanmar, the Philippines and Indonesia also provided new insights on how interactions between gender norms, agency and other contextual factors shape access to, adoption of and benefits from aquaculture and fisheries. Research in fishing communities in Cambodia, the Philippines and Solomon Islands showed that gendered negotiations mediate the capacity to innovate but that wider structural constraints are important for both men and women, with implications for future gender research approaches with poor fishing communities where new ways of doing things or new technologies are being promoted. The lessons from such research have been integrated into practical guidance for rural development initiatives.

Finally, the opportunities for fish to play a bigger role in addressing undernutrition, particularly among women and children, were highlighted in micronutrient assessments and *ex-ante* research on homestead carp-based polyculture systems in Bangladesh, a high-potential avenue for FISH to contribute to SLO 2.2 and SLO 2.3 that will be further pursued with partners, including the Agriculture for Nutrition and Health (A4NH) CRP.

1.2 Progress by CRP flagships

Major results achieved by each flagship are provided below. Tables B: Milestones; C: Outputs and D-2: Innovations in 2017 provide further details.

1.2.1 Sustainable Aquaculture

The Sustainable Aquaculture flagship made significant progress in Fish Breeds and Genetics (Cluster 1), delivering research outputs and outcomes and laying a strong foundation for expanding the research portfolio and partnerships. A consortium of partners from advanced research institutes prepared a research strategy for investigating genomic selection in tilapia, with a focus on breeding three new traits into future improved tilapia strains: feed efficiency, disease resistance and stress tolerance. Base populations were established in Bangladesh for the genetic improvement of two species of carps (*Catla catla* and silver carp). Rearing of the first generation of rohu carp was also continued successfully, in preparation for the breeding of the second generation in 2018. The development of the carp improvement programs included the innovative use of small net cages (hapas) to enable the separate rearing of multiple families of very young carp. This innovation, developed initially for rohu carp, is proving to be applicable to a range of carp species, allowing increased efficiencies and economies for future carp genetic improvement and breeding programs. Dissemination plans for improved tilapias were prepared with national partners in Cambodia and Myanmar. An agreement made with the Government of Zambia to support a genetic improvement program for *Oreochromis andersonii* extends FISH genetics research to a new species in the Southern African Development Community (SADC).

Fish Health, Nutrition and Feeds (Cluster 2) made significant contributions to research on an emerging tilapia disease, tilapia lake virus (TiLV), which presents risks to small-scale tilapia aquaculture worldwide. A global review on TiLV was published, and research identified TiLV as one of the agents involved with unusual tilapia mortalities in several countries. Journal articles, training manuals and a fact sheet on TiLV were produced and widely disseminated to build awareness and capacity within FISH focal[1] countries and globally, in partnership with Mahidol University, the Norwegian Veterinary Institute (NVI), Food and Agriculture Organization of the United Nations (FAO) and others. Training was provided to researchers from Bangladesh, Malaysia, Myanmar and Egypt in TiLV diagnosis and surveillance and biosecurity assessments. Biosecurity plans were prepared for tilapia breeding programs in Bangladesh, Egypt and Malaysia. An international workshop involving 16 research institutions was successfully conducted to detail FISH tilapia health research priorities. Progress was also made with pond microbiome research (Bangladesh, India and Malawi) using metagenomics for developing mobile early warning tools, led by the partners Cefas and Exeter University. Research on health products and prophylactics used in fish farming in Bangladesh, India and Egypt, and the relation to antimicrobial resistance in cooperation with A4NH and livestock researchers, led to several key research publications.

[1] FISH countries remain as per the proposal. Focal countries are Bangladesh, Cambodia, Egypt, Myanmar, Nigeria, Solomon Islands, Tanzania and Zambia. Scaling countries are Ghana, India, Kenya, the Philippines and Timor-Leste.

Fish nutrition and feeds research within the cluster produced an inventory of locally available fish feed ingredients from six FISH focal countries, leading to prioritization of ingredients for feed development from 2018-2022. Better management practices (BMPs) for farming of genetically improved tilapia developed during the L&F CRP and WorldFish bilateral projects—e.g. the USAID-funded Aquaculture for Income and Nutrition (AIN) in Bangladesh; and SDC-funded Sustainable Transformation of Egypt's Aquaculture Market System (STREAMS)—were widely disseminated through training and workshops. A workshop hosted by Wageningen University & Research (WUR) on 11–12 December 2017 brought together fish nutrition scientists from advanced research institutes, national research systems and the private sector to prepare a research plan and milestones for the FISH feeds and fish nutrition research within the cluster. An epidemiological assessment of BMPs in Bangladesh was also conducted.

Aquaculture Systems (Cluster 3) conducted baseline assessments of aquaculture systems, using an integrated set of methods and tools, including value chain tools developed in L&F, new life-cycle analysis, and entrepreneurial assessment and gender tools, intended to provide knowledge of present performance and future aquaculture interventions. The FISH focal countries of Bangladesh, Egypt, Nigeria, Tanzania and Zambia were included in such research during the year. Aquaculture innovation platforms were supported and/or established in Bangladesh, Egypt, Myanmar and Nigeria to facilitate stakeholder interactions. A systematic review of innovation in aquaculture is informing future approaches of FISH to stakeholder engagement and scaling. National partners were engaged via symposia, workshops and various participatory consultations in Bangladesh, Egypt, Myanmar, Nigeria, Tanzania and Zambia. Such events have helped build partnerships, reviewed current knowledge of fish agri-food systems, including learning from earlier CRPs, and informed the development of the research and development (R&D) priorities for FISH, within both FP1 and FP2.

Foresight research, conducted in collaboration with the Policies, Institutions and Markets (PIM) CRP, included development of a new model for fish supply and demand in Africa. Preliminary findings were used to convene dialogue with stakeholders and policymakers, including key partners the African Union – Inter-African Bureau for Animal Resources (AU-IBAR), the East African Community (EAC), Lake Victoria Fisheries Organization (LVFO), FAO, the Intergovernmental Authority on Development (IGAD), the New Partnership for Africa's Development (NEPAD) and SADC during the World Aquaculture Society Conference in June 2017. Interactions from this dialogue led to a Call for Action and Vision for Aquaculture in Africa and new policy dialogue. The Platform for Genetics and Biodiversity Management in Aquaculture was also established, with the aim of leading the development of a set of protocols to guide sustainable genetic improvement R&D programs in the SADC and EAC regions. The platform was officially endorsed by the 36th SADC Committee on Fisheries in December 2017 and the SADC meeting of the Joint Ministers of Agriculture, Food Security, Fisheries and Aquaculture, held on 4–8 June 2018 in Johannesburg, South Africa. FISH will continue to engage with the SADC and EAC regional platforms to share knowledge on fish genetic improvement and protocols for responsible development within the region.

1.2.2 Sustaining Small-scale Fisheries

The Sustaining Small-scale Fisheries activities in 2017 were focused, in part, on the revision and resubmission of the flagship to the CGIAR Independent Science and Partnership Council. This included a revision of the theory of change (ToC) and associated milestones to improve clarity for operational purposes and linkages to nutritional outcomes within the overall FISH program structure. Partnerships were strengthened with FAO and the Too Big To Ignore (TBTI) research network—both influential partnerships to enable scaling of research via policy improvement, institutional strengthening with civil society and research responsiveness of development agencies. WorldFish also secured a bilateral investment from the Australian Centre for International Agricultural Research (ACIAR) to deliver key flagship-level activities. These included a Resilient Small-scale Fisheries Symposium that comprised 40 presentations from more than 12 countries across Africa, Asia and the Pacific. The presentations assessed innovations and pathways for impact within small-scale fisheries (SSF) systems in coral reef ecosystems, coastal pelagic waters, rice fields, rivers and estuaries, large inland lakes and constructed or artificial water bodies.

Resilient Coastal Fisheries (Cluster 1) comprises Solomon Islands as a learning hub because of the strong research program history, in addition to the potential for scaling research innovations and capabilities throughout the flagship more broadly. Further, innovations piloted and adapted in Solomon Islands (particularly ensuring social inclusivity and gender sensitivity within SSF governance) are positioned for scaling throughout the Pacific through strong partnership with regional stakeholders (e.g. The Pacific Community) as well as new investments. For example, in 2017 a new investment from ACIAR (led by research partner the University of Wollongong) was informed by FP2 design and explicitly invests in taking innovations developed in Solomon Islands to scale—firstly to three Pacific Islands countries but ultimately to the broader Asia-Pacific region (including FISH scaling country Timor-Leste) via partners. Solomon Islands researchers delivered assessments of adaptations to the CBFM innovation and developed a research agenda focused on scaling innovation adaptations focused on enhancing nutrition, fisheries and equity outcomes.

Fish in Multifunctional Landscapes (Cluster 2) made substantial progress in focal countries Bangladesh, Cambodia and Myanmar. In Bangladesh, foundational research was delivered on CBFM, with future research that will build further on gender and social inclusivity, scaling and nutrition-sensitive aspects of well-being. Substantial capacity was built within the flagship, with researchers attending and contributing to the Global Workshop on Nutrition-sensitive Fish Agri-food Systems. Researchers within all three clusters are strongly positioned to build on early research findings on nutrition-sensitive fisheries management and policy. In 2017, investments were secured and new partnerships (including with the Rice Agri-Food Systems CRP) were formalized in Myanmar that will enable research innovations in rice field fisheries in Asia in subsequent years. Research is also underway in Cambodia and Bangladesh through bilateral project investments.

Early findings have been delivered for management and technical innovations for enhanced fisheries (specifically fish aggregating devices, FADs) in both Cluster 1 and Cluster 2. Research for innovation refinements toward nutrition outcomes and gender inclusivity proceed in 2018. Strategic gender research was delivered by both

Cluster 1 and Cluster 2 in readiness to inform further developments and application of the innovations for the *Socially inclusive, resilient co-management approach* and *Gender-transformative approach to SSF value chains and livelihoods* (Table D-2).

Revisions to the FP2 ToC included greater sensitivity to the broader political economy within which SSF are situated. In 2017, this shift was reflected in three ways. First, Cluster 1 was represented in two high-level fora—the European Commission Our Oceans Conference and the United Nations SDG 14 Ocean Conference—to contribute research findings on SSF resilience and risk to dialogue on ocean governance. Second, early outputs contributed toward the innovation of *Analytical approaches to build responsive policy and investment in SSF* and shaped the research agenda, particularly Cluster 2. Third, research collaborations were built with PIM to develop innovations for *Collaborative governance for resource competition* that will increase representation of, accountability to and conflict resolution for SSF, ultimately building resilience of SSF in scenarios of resource competition.

Fish in Regional Food Systems (Cluster 3) was most affected by a lack of window 1 and window 2 (W1/W2) funds during 2017, and as such was a focus of flagship-level resource mobilization efforts, particularly with partner FAO. The evaluation of the hidden harvests of SSF progressed with the establishment of a core partnership (WorldFish, FAO, Duke University), and preliminary methodological development and proposals were submitted for funding. The FishTrade Project has also identified constraints related to inadequate market and trade infrastructure, and deficient policy and institutional frameworks, which have prevented Africans, especially women, from optimizing the social and economic benefits available from fish trade. Further analytical and policy work around fish in regional food systems is being convened in 2018.

1.3 Crosscutting dimensions (at CRP level)

1.3.1 Gender

Gender research during 2017 focused on capturing promising areas of learning from the earlier AAS and L&F CRPs, leading gender integration and research activities within the two flagships, strengthening partnerships at all levels, conducting gender capacity development among research teams and preparing the FISH Gender Research Strategy.

The gender-transformative approach is one promising area of learning from AAS. During the year, new research findings emerged from fishing camps in Zambia, where the application of a gender-transformative approach led to significant changes in gender attitudes and women's empowerment outcomes along the value chain, compared to an ‘accommodative’ approach that aims to empower women yet accommodates existing gender norms, attitudes and power relations (Cole et al. 2018). This and other insights on gender-transformative approaches were shared via a CGIAR webinar, a publication on implementation of the Small-scale Fisheries Guidelines, and research and partnerships to develop this promising approach were integrated within the FISH Gender Research Strategy.

Within the Sustainable Aquaculture flagship, empirical insights on women's empowerment in aquaculture were captured through a global review on gender in aquaculture value chains and in-depth qualitative case studies in Bangladesh and Indonesia. The research noted the limited high-quality, sex-disaggregated data regarding the distribution of benefits in the aquaculture value chain; the limited evidence on the quality of women's participation in and returns from these chains; gendered imbalances in all dimensions assessed; and provided new insights and recommendations to government, private sector and civil society to engage with these underlying barriers to create higher value opportunities for women.

FISH also contributed to enhancing the gender responsiveness of CGIAR breeding programs, through reviews of fish trait preferences, uncovering a deficit of existing trait information, including a particular gap in sex-disaggregated data and information regarding gendered influences or their implications. Additionally, the WorldFish-led cross-CRP Postdoctoral Fellow Gender and Breeding Initiative established the need for more reliable and accessible research methods and tools for addressing this gap in CGIAR breeding programs. In response, a study design workshop was hosted in 2017 for gender and breeding postdoctoral fellowships from three CRPs (FISH, RTB, LIVESTOCK), which brought together lessons and methods from market systems approaches and the private sector, leading to the development of a tool for client- and gender-responsive assessment. In partnership with the Gender and Breeding Initiative and RTB, FISH co-hosted a workshop at the CGIAR Annual Scientific Conference and Capacity Development Workshop on innovative methods, which included sharing this resource.

Within the Sustaining Small-scale Fisheries flagship, significant evidence-based insights were generated in 2017, including new knowledge on how gender relations shape innovation in SSF, based on the GENNOVATE methodology and contributions on gender equity and quality to FAO initiatives to reduce food loss and waste reduction and the implementation of the Small-scale Fisheries Guidelines. The former research shows the strongly gendered nature of men's and women's capacity to innovate, and that changes in gender norms and practices can be stimulated by women undertaking activities that were new for them.

Finally, underpinning the above, in 2017 FISH developed its Gender Research Strategy, which will form the basis of its approach and be iteratively updated based on FISH and cross-CRP learning. Key aspects laid out in the strategy include its focus on 'the three Es' (equality, equity and empowerment) as well as its three principles (gender-accommodative, gender-transformative and intersectional approaches). The strategy also presents highlights of how FISH monitoring and evaluation (M&E) will be gender responsive. The strategy, combined with the internal gender analysis methods consolidation carried out in 2017, has created the foundation for the development of gender-integration guidelines in 2018. The underpinning rationale that there is a synergy between gender equality, equity and empowerment and development outcomes such as poverty reduction and food and nutrition security is represented in the 2017 TEDx talk by the FISH gender research lead, entitled Gender Equity, Equality and Development: Beyond Zero Sum.

1.3.2 Youth

The International Water Management Institute (IWMI), a managing partner of FISH, led a review study of youth across the CRP, covering both aquaculture and SSF production systems and value chains, across eight focal countries: four in Africa (Egypt, Nigeria, Tanzania and Zambia) and four in Asia (Bangladesh, Cambodia, Myanmar and Solomon Islands). The research assessed existing gaps and opportunities, and the basis for the FISH Youth Strategy. The study aimed to: i) assess participation of youth in the sector, including opportunities and challenges for participation; and ii) improve understanding of the research and development activities of FISH and the relation to beneficial outcomes for youth. Key findings of the study included: i) youth appear to be more attracted to engaging in aquaculture production than livelihood activities in SSF, given the overexploited nature of certain SSF and rapid development of the aquaculture sector, and the perception of aquaculture as a more 'modern' activity; ii) there are significant opportunities for participation of youth in aquaculture in focal countries, requiring a youth-oriented approach; and iii) lack of access to knowledge, technologies, land and water and key inputs such as credit remain significant constraints. Recommendations include the need to formulate youth-inclusive policies, support and coordinate youth-targeted initiatives (particularly in aquaculture), allocate sufficient funds for effective implementation of national youth policies and plans, and youth-oriented investment in infrastructure, innovation and entrepreneurship. The FISH Youth Strategy is in the final stages of publication.

1.3.3 Other aspects of equity/'leaving no one behind'[2]

FISH has chosen in selected focal and scaling countries to engage with development partners that focus on reaching the poorest and most marginalized men, women and children. In Sylhet Division of NW Bangladesh, a region with high levels of poverty and undernutrition, a partnership with Save the Children led to the introduction of small-scale integrated aquaculture practices to around 28,000 marginal households during 2017. During the year, FISH also worked with Helen Keller International (HKI) to introduce small-scale aquaculture to the Chittagong Hill Tracts, a region of Bangladesh with significant undernutrition and poverty. Poor men, women and children in these bilaterally funded projects are being targeted to increase incomes and enhance dietary diversity and consumption of fish to combat undernutrition, particularly focused on vulnerable women and young children. FISH researchers have also engaged with Bangladesh government strategy development, incorporating fish within the new Bangladesh Country Investment Plan. In India, a partnership with the State Government of Odisha is seeking to introduce aquaculture in homestead and community ponds in ethnic poor communities as well as introducing nutrient-dense, small fish-based products into residential and government child care centers ('Anganwadi'). Learning from these initiatives and partnerships will enable FISH to prepare a strategy for the future to identify and target the most vulnerable groups in focal and scaling countries.

[2] https://unstats.un.org/sdgs/report/2016/leaving-no-one-behind

1.3.4 Capacity development

Capacity development is integrated within many FISH activities, in support of researchers, developing country partners and scaling within the program's ToC. During 2017, 53,856 people received formal[3] training, of which 68 percent were women. A further 20,727 people received informal training, of which 34 percent were women (Table D-1).

Formal training activities included training for PhD and master's-level researchers as well as short-term vocational training for farmers, fishers and extension personnel, conducted using various methods and tools via partners. Within the FishTrade project, a regional food systems research activity, 22 master's students from 10 countries (Ghana, Nigeria, Cameroon, Ivory Coast, Zambia, Malawi, Uganda, Tanzania, Zimbabwe and South Africa) were supported. The World Bank recently awarded a four-year grant to the Lilongwe University of Agriculture and Natural Resources (LUANAR) in Malawi to establish an African Center of Excellence (ACE) in Aquaculture and Fisheries (the AquaFish Centre). WorldFish signed an MoU as partner, providing a mechanism for an expanded cooperation in capacity building of aquaculture and fisheries researchers within Southern and Eastern Africa. Within Asia and the Pacific, a strong cooperation with national partners exists for formal training across FISH focal and scaling countries. Young researcher support was also provided through secondments and partnerships. For example, two postgraduate students received Crawford Fund Awards to support their work with FISH, and three students commenced their PhDs within the Sustaining Small-scale Fisheries flagship with managing partner James Cook University (JCU).

Formal training for fish farmers and fishers made up the largest number of participants, with 55,385 farmers/producers involved, largely via partners. Short-term vocational practical training in aquaculture is offered by FISH through the Africa Aquaculture Research and Training Center in Egypt, which during 2017 provided practical training in aquaculture technologies for 323 people (70 of them women) from 32 countries. A new cooperation with vocational education providers in Zambia was also strengthened during the year, and a coordinated Africa regional vocational training program for aquaculture practitioners will be launched during 2018, with a strong focus on measures and approaches that can equip small-scale farmers with improved management and business skills.

Informal training included a wide range of activities during the year, such as aquaculture learning platforms in Egypt and Bangladesh, knowledge exchange at international and national conferences and workshops, field events and other events for research and scaling activities, in all involving 20,727 participants during the year. The FISH Capacity Development Strategy is under preparation and will be released in 2018.

[3] Following the guidance provided for CGIAR indicators #3 and #4, formal training includes academic degrees, short or long training events (with written training objectives) and research placements or training visits. Informal training/activities include co-creation events, knowledge exchange, scaling activities and participants in trials and studies.

1.3.5 Open data

A research data management (RDM) assessment was conducted during 2017, partially resourced via the Platform for Big Data in Agriculture, leading to an action plan to enhance RDM practices within WorldFish and in FISH implementation. To oversee implementation of the action plan, recruitment of an RDM lead was initiated to strengthen, upgrade and develop research data management systems, and an updated Research Data Management and Open Access Policy was prepared for WorldFish (and approved by WorldFish executive management in April 2018). A research strategic committee was established to provide oversight, high-level guidance, direction and input to accelerate progress in implementation of the policy, overall benefiting FISH in implementing the open data commitment.

Alongside the development of the RDM policy, two standard-compliant, interoperable open repositories were identified; DSpace for publications and Dataverse for research datasets. The two repositories are being established during 2018, and will use the CGCore metadata schema to enable discovery of FISH information products. The repositories will use OAI-PMH protocol, allowing for metadata harvesting into the CGIAR GARDIAN platform and enabling discovery of agricultural data and publications across the CGIAR system and beyond. These activities were started in 2017 and are ongoing in 2018. A key challenge in implementation includes poor and unreliable network connections in some FISH focal countries. WorldFish will continue to work with focal country offices to insure effective procedures and workarounds are in place. WorldFish and FISH will also continue to support open access and open data by continually promoting the culture of knowledge sharing among FISH staff and partners. Transfer of data from 2017 to the newly established Dataverse system is ongoing in 2018, and will surpass the 2017 status shown in Table D-1 indicator C5.

1.3.6 Intellectual assets

Intellectual assets management. WorldFish has recently approved a new intellectual assets (IA) policy aligned with the CGIAR Open Access and Data Management Policy and the CGIAR Principles on the Management of Intellectual Assets. A report is provided every year to the System organization on the main progress and any challenges faced. Most of the intellectual assets are maintained in the form of scientific publications (which are inclusive of journal articles, books, conference presentations, reports) and data.

Patents and/or plant variety right applications. No applications were made for patents during 2017. Therefore, nothing has been tracked or strategically managed in terms of intellectual property rights, as specified in Table E.

Critical issues and challenges in the management of intellectual assets in the context of the CRP. There were no critical challenges encountered in 2017 with regards to management of intellectual assets in the context of FISH.

2. CRP effectiveness and efficiency

2.1 Variance from planned program

Have any promising research areas been significantly expanded? No major changes were made to the FISH Proposal research plans for the Sustainable Aquaculture flagship, which proceeded well according to plans provided in the Annual Plan of Work and Budget (POWB) 2017.

Have any research lines been dropped or significantly cut? A reduction in activities occurred in the Sustaining Small-scale Fisheries flagship due to the lack of W1/W2 funding during 2017. The funding was partially made up by successful bilateral fundraising during the year, but some key activities were reduced, including country assessments of co-management and livelihoods that are pending full completion (analysis and publication) in Solomon Islands, Bangladesh, Myanmar and Cambodia; and an assessment was not conducted in the Philippines. Synthesis of analyses spanning multiple-country cases (Clusters 1 and 2) as well as the development of a research framework and research implementation for fish in regional food systems were delayed during 2017. They are being pursued in 2018 through secured bilateral funds.

Have any research areas taken new directions due to unexpected research results (positive or negative)? N/A.

2.2 Use of W1/W2 funding

The best estimates of W1/W2 spending for FP1 are provided in Table F. FP2 received no W1/W2 funding during 2017.

2.3 Key external partnerships

FISH gave significant attention to the development of partnerships throughout 2017, creating a strong foundation for future implementation. Sixty-two formal partners were engaged with FISH in 2017, with 19 (34.5 percent) at discovery/proof of concept phase; 33 (60 percent) at piloting phase; and 10 (18.2 percent) at scaling up and scaling out phase (Table D-1, indicator C2). Highlights include partnerships with new global policy partners such as FAO, the private sector and a particular attention to national agriculture research and extension system partners.

Within the Sustainable Aquaculture flagship, partnership development occurred through initial planning for research discovery, with separate workshops in key areas of breeding and genetics, fish health, fish feeds and aquaculture systems. Two partner meetings determined the strategy for testing genomic selection in fish and the development of new resilience traits in tilapia. Developed with the French Agricultural Research Centre for International Development (CIRAD), WUR, University of Stirling (UoS), the Swedish Agricultural University (SLU), the Earlham Institute, Scotland's Rural College (SRUC) and the Roslin Institute, the meetings provided clear direction to meet goals for improved fish strains. The partnership is turning its attention to research on new characters and factors that influence fish farmers' enterprises, such as disease resistance and feed efficiency, within FP1.

Particular focus will be on aquaculture species of importance for nutrition and food security in low- and middle-income countries, initially Nile tilapia.

In addition, global partnership development has occurred within the fish health component, focusing on the initial planning of research and disseminating technologies and tools for achieving the key targets. In November 2017, 22 researchers from 16 public and private institutions came together to elaborate the FISH research program on tilapia health. The fish health partners consist of: (a) global leaders in fish disease and health research (Cefas; CSIRO; NVI); (b) other global research agencies with complementary research skills in fish health, including fish physiology and nutrition (UoS; Roslin Institute; Exeter University); (c) experienced private sector companies interested in investing in developing and commercializing aquatic animal health management tools (Merck Sharp & Dohme; Fish Vet Group); and (d) relevant national authorities and appropriate civil society organizations. Within the private sector, WorldFish continues to build partnerships with a number of organizations, including expanding the collaboration with Skretting from the joint venture fish feeds and nutrition research facility in Egypt to broader engagement in Africa (Zambia and Nigeria).

The preparation of the rebid for the Sustaining Small-scale Fisheries flagship was conducted in a manner that strengthened partnerships with JCU and FAO, and extended discussions with TBTI. Proof-of-concept partnerships in focal countries are functioning in terms of collaborative research and institutional capacity building and provide a good foundation for the effective and efficient delivery of FP2 in 2018 and beyond.

A key aspect of the development of partnerships in 2017 was within national agricultural research and extension systems, particularly with the Department of Fisheries (DoF) or their equivalent in focal countries. In several cases this involved supporting the department as it engaged in large investment and development plans for its fisheries and aquaculture sectors. Examples include the African Development Bank loan for the Zambia Aquaculture Enterprise Development Project (ZAEDP), the EU-EAC TRUE-FISH program in the Lake Victoria Basin and the World Bank-funded Bangladesh Sustainable Coastal and Marine Fisheries Project (BSCMFP), a large loan to the Bangladesh government to establish an effective system for fisheries and aquaculture management in coastal and marine waters.

2.4 Cross-CGIAR partnerships (other CRPs and platforms)

Cross-CGIAR partnerships are key to the success of FISH and were pursued in various ways during 2017, in part laying a foundation as a new CRP for expanded cooperation in 2018 and beyond. Key areas of cooperation with other CRPs are provided below and in Table H.

FISH cooperated with PIM on foresight research, leading to the development of a new fish supply-demand model for Africa that takes account of data deficiencies, several conference presentations and a key journal article (in press) on African fisheries and aquaculture futures to 2030 and 2050, laying foundations for fisheries and aquaculture planning by national agencies.

FISH also cooperated with the Climate Change, Agriculture and Food Security (CCAFS) CRP on making use of CCAFS Learning Platforms, connecting CCAFS-funded research with FISH bilateral projects in the Mekong region, Indonesia and Bangladesh, production of a paper on mitigating GHG in aquaculture as well as joint resource mobilization. FISH participated in the scientific conference and 'writeshop' held in Galway, Ireland. A joint paper that explores options for aquaculture and mitigation is under discussion. FISH-CCAFS cooperation has also contributed to identifying new approaches to integration of environmental considerations into aquaculture futures modeling and identification of technology and management practices for sustainable intensification of aquaculture in Bangladesh that mitigate GHG emissions.

Fish and rice system development offers significant opportunities for farmers in many FISH and RICE focal countries. During the year, cooperation was initiated with RICE to improve productivity and resilience of rice-fish farming systems and rice-dominated landscapes in the Ayeyarwady delta in Myanmar (with funding from ACIAR), with further collaborative opportunities being explored in Bangladesh and Cambodia.

FISH collaboration with the CGIAR Platform for Big Data in Agriculture helped strengthen research data management capabilities and adoption of open access/open data requirements, largely through the platform's Organize Module. FISH also prepared a challenge grant application for enhancing mobile technology-based data collection from aquaculture farmers on disease, performance assessments and satellite imagery data. FISH also actively engaged in the Community of Practice for Geospatial Analysis.

FISH cooperation with the CGIAR Excellence in Breeding Platform was through participation in the Expert Advisory Groups for Modules 1 (Breeding program excellence) and 2 (Trait discovery and breeding tools and services), particularly in the development of an animal-oriented breeding assessment form. FISH is working with the platform to implement expert assessments of its tilapia breeding programs in 2019.

FISH collaboration with the CGIAR Collaborative Platform for Gender Research contributed to knowledge sharing and capacity development across CRPs in four primary ways: (i) 2017 began with a FISH researchers and partner (CARE)-led webinar on measuring gender-transformative change; (ii) FISH was an active participant in the regular and special Gender Research Coordinator virtual meetings and the in-person meeting in Amsterdam; (iii) FISH actively contributed to the Gender Platform's first Annual Scientific Conference and Capacity Development Workshop, including sending a team, contributing to a panel, multiple science presentations, a flash talk and poster on the FISH Gender Research Strategy, convening a special session with cross-CRP gender initiatives; and (iv) FISH co-hosted a half-day capacity development event on innovative methods with the Gender and Breeding Initiative (via RTB). These contributions led to requests for FISH input to other CRPs, such as to CCAFS on gender-transformative approaches that was held via an in-person meeting in December 2017.

FISH collaboration with the Gender Platform has *benefited* FISH through the platform's capacity development events in the form of the GRIT workshop (to which FISH sponsored five staff), FISH participation in the ongoing CGIAR webinars and FISH staff participation in the Annual Scientific Conference and Capacity Development Workshop. FISH also led the cross-CRP Gender and Breeding Postdoctoral Fellow Initiative, which is seeking to enhance the gender and client responsiveness of CGIAR breeding programs. The initiative involves postdoctoral fellows (PDFs) from FISH, RTB, LIVESTOCK and the Grain Legumes and Dryland Cereals (GLDC) CRP (see the initiative infographic on the Gender Platform site). Cross-CRP collaboration in gender also included: i) the FISH gender research lead as a member of the Gender and Breeding Innovation Workshop Organizing Committee (which evolved into the Gender and Breeding Initiative); and ii) FISH led the case contributions from Bangladesh and the Philippines to CGIAR's cross-CRP GENNOVATE initiative.

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

FISH started work on its MELIA system during 2017, led by the University of Greenwich's Natural Resources Institute (NRI), a FISH managing partner. No W1/W2 funding was assigned to evaluations in 2017, as W1/W2 investment was oriented toward establishing the MELIA systems within the new CRP.

Key FP1 impact assessments funded by W3/bilateral sources during the year were (i) an assessment of GIFT tilapia dissemination in Bangladesh and Egypt; and (ii) completion of a SPIA research grant initiated under the L&F CRP to assess impacts of improved tilapia dissemination with genomics tools. A multi-country assessment of SSF research investments was also conducted, involving a Small-Scale Fisheries Symposium, as part of FP2 focus during the year on building an evidence base, updating the ToC and impact pathway, and strengthening the case for investment in SSF research for development.

Quarterly meetings of the FISH Management Committee (MC) and Independent Steering Committee (ISC) were also used to monitor progress at CRP and flagship level, within the framework of FISH's overall ToC. Table I provides further details, including relevant actions taken in response to evaluation recommendations from the earlier L&F and AAS CRPs.

2.6 Improving efficiency

An important approach to the efficiency of FISH implementation was not to set up new structures and systems for management 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 was adopted in 2017. Additional efficiencies included placements of PhD students with partners (JCU and CIRAD in 2017, with more to come in 2018); the co-funding with partners (including 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 in Malaysia with the DoF.

3. CRP management

3.1 CRP 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 WUR, JCU and NRI. Those remain and have evolved into an active and complementary partnership, despite starting in 2017 with a lack of W1/W2 funding for FP1 and the fact that FP3 (Enhancing the Contribution of Fish to Nutrition and Health of the Poor) was not approved in 2016. The partners also successfully worked on rebids for FP2 during 2017. Terms of reference for the ISC were approved by the WorldFish Board of Trustees (BoT) on 28 February 2017, and three ISC meetings were held in 2017, with reporting lines established to the BoT. The MC was also established and regularly met during the year.

3.2 Management of risks to the CRP

Building on the risk management strategy within the CRP proposal, the MC has identified key CRP risks and prepared a risk management framework. In close consultation with FISH partners, the MC monitors the key risks and any associated mitigation strategies. Key risks of concern in 2017 related to (i) uncertainty over W1/W2 and W3/bilateral funding and the associated impacts on research operations and development outcomes; and (ii) ensuring that the M&E systems are sufficiently robust to monitor progress toward outputs and outcomes across the FISH portfolio of W1/W2 and bilaterally funded projects.

The funding uncertainties are managed through dialogue with the System Management Office, regular review of expenditure and funding risks and proactive fundraising activities by the FISH resource mobilization group. These activities are done in close coordination with the CGIAR resource mobilization group and are fully aligned with the CGIAR Risk Management Framework and Risk Management Guidelines. The M&E risks will be managed in future through increased investment in cross-program M&E tools and methods.

3.3 Financial summary

Total spending of FISH for 2017 was USD 19.3 million, of which USD 3.4 million was funded from W1/W2 and USD 15.9 million from W3/bilateral funds (Table J).

Tables

Table A. Evidence on progress toward SLOs

Table A-1. Evidence on progress toward SLOs (sphere of interest)

SLO target (2022)	Brief summary of new evidence of CGIAR contribution to relevant targets for this CRP (with citation)	Expected additional contribution before end of 2022 (if not already fully covered)
1.1 100 million more farm households have adopted improved varieties, breeds, trees and/or management practices	FISH is a new CRP that builds on earlier CRPs (L&F and AAS) to continue the process of development and dissemination of improved tilapia strains to fish farmers. These strains arising from CGIAR research have now been disseminated directly by WorldFish to farmers in 16 countries, and the strains continue to be in high demand and widely disseminated. In 2017, FISH collaborated directly with partners in Bangladesh, Egypt, India and Timor-Leste for further dissemination. The technological advance of genetically improved farmed tilapia (GIFT) is widely recognized as making significant contributions to tilapia supplies and fish farmer livelihoods globally (Kumar and Engle 2016; Benzie and Lind 2017). SPIA-funded research (available in summary in Herdt 2018, with full report in preparation for publication in 2018) indicated almost 53% of production in sampled hatcheries in Bangladesh and 40% of that in the Philippines are GIFT or GIFT-derived strains. The SPIA study notes uncertainty in such national estimates and the need for further research to confirm contributions to farmer productivity and income as well as broader contributions to nutrition and poverty. Such research is a 2018 FISH priority.	Ongoing evaluations will provide further evidence of the contributions of aquaculture and SSF to this SLO. The CRP proposal target of 4.9 million households remains, resulting from adopted improved tilapia breeds, improved feeds, improved aquaculture management practices and improved fisheries management practices by 2022. ToC consultations during 2018 are intended to detail country-level change mechanisms for achieving this SLO, and may also lead to some revision of the targets.
	Improved fisheries co-management innovations also continue to be widely disseminated and adopted through various mechanisms, including through WorldFish-managed bilateral projects. In Bangladesh riverine fisheries, training, institutional development (including 448 hilsa conservation groups) and government policy shifts led to increasing adoption of management improvements in 2017, including by some of the most marginalized fisher communities in Bangladesh (Dutton et al. 2018).	

	Fisheries co-management and community-based fisheries management (CBFM) measures being implemented elsewhere in FISH focal countries: in Bangladesh (inland riverine regions of the NW, Mustafa et al. 2017); the Solomon Islands (CBFM in five community clusters; and in rice field landscapes of Cambodia and Myanmar. In Cambodia, improved management practices for fisheries (community-managed fish refuges) are being adopted, with 244 management plans for fish refuges integrated within community investment plans (CIPs) by March 2018 (WorldFish 2018).	
1.2 30 million people, of which 50% are women, assisted to exit poverty	No new evidence for FP1 in 2017. Quantitative analyses of the direct and indirect economic impacts, including impacts on poverty of our improvements in aquaculture productivity are in progress for Bangladesh, Egypt, India and Timor-Leste. In SSF, evidence from riverine fisheries co-management interventions in Bangladesh (evaluated by Dutton et al. 2018) showed increased economic benefits for 25,473 household members (15,180 men and 10,293 women) annually through provision of livelihood support measures during the period when hilsa fishing is banned by government legislation.	CRP proposal target: 3.5 million people.
2.3 150 million more people, of which 50% are women, without deficiencies in one or more essential micronutrients	Evidence of the potential contribution of FISH to this SLO emerged from two recent studies. Fielder et al. (2016) conducted a cost-benefit analysis of a Bangladesh national household pond investment for a vitamin A fish – the mola carplet (*Amblypharyngodon mola*). The research concluded that an 11-year, USD 23 million project would increase average daily vitamin A intakes by 7 µg retinol activity equivalent (RAE), reduce the prevalence of IVAI by 1.1 percentage points and save 3000 lives and 100,000 disability-adjusted life years (DALYs), at a cost of USD 194 per DALY saved, a financially viable and cost-effective intervention for addressing vitamin A deficiencies in Bangladesh. The mola carplet is a component of the carp-based polyculture systems that are the subject of the FISH program research in Bangladesh, with potential for scaling elsewhere in South Asia (Pakistan, India, Nepal). Castine et al. (2017) assessments of Bangladesh carp polyculture systems show that integration of the mola carplet contributes significantly to the micronutrients produced from all fish in homestead ponds. Mola contributed 98%, 56% and 35% of the total vitamin A, iron and zinc produced, respectively, despite comprising only 15% of the total fish production by weight. If consumed within the household, mola	CRP proposal target: 2.4 million people.

	could contribute half of the vitamin A and a quarter of the iron intake recommended for a family of four, annually. Further, homestead ponds are uniquely accessible to women who prepare the household food. Bell et al. (2017) and Albert et al. (2016) assessed nearshore FADs. When combined with measures to sustain catches of coastal demersal fish, operationalizing the use of nearshore FADs is expected to help several Pacific Island countries to increase community access to fish, contributing to this SLO.	
3.1 5% increase in water and nutrient efficiency in agroecosystems	No new evidence in 2017.	CRP proposal target: 4.8 million metric tons of fish per annum.
3.2 Reduction in 'agriculturally' related GHG emissions by 5%	No new evidence in 2017.	CRP proposal target: 4.8 million metric tons of fish per annum.
3.3 55 million ha degraded land area restored	Evidence of contribution to this outcome comes from WorldFish-managed bilateral projects in 2017, with 186,050 of water area under improved management through co-management in Bangladesh (Dutton et al. 2018) and (as yet unquantified) progress made in Solomon Islands, Cambodia and Myanmar. In many contexts, co-management or CBFM are the only feasible strategies to improve governance of natural resources. Reviews illustrate that outcomes of increased fish productivity, biodiversity improvements and fisher income are variable (Evans et al. 2011) but more likely to be positive for coastal, benthic and demersal and single-species fisheries (Gutierrez 2011). Recent meta-analyses (and individual cases) show fish biomass can be better than expected where there are 'high levels of local engagement in the management process ... and the presence of sociocultural governance institutions' (Cinner et al. 2016), and ecological outcomes are more likely to be positive in coastal (rather than inland) and demersal (rather than pelagic) fisheries.	CRP proposal target: 3.3 million ha of restored land and water ecosystems.

Table A-2. List of new outcome case studies from this reporting year (sphere of influence)

Title of outcome case study	No. of sub-IDO	Links to evidence*	Space for additional, very brief details, including on crosscutting issues
Studies to assess on-farm performance of improved tilapia strains (input use, outputs, production and profitability)—Egypt and Bangladesh	1.3.2: Increased livelihoods opportunities 1.3.3: Increased value capture by producers 1.3.4: More efficient use of inputs	IFAD Technical Report.	Adoption of improved tilapia strains in Egypt provides improvements in growth (12%), food conversion ratios (FCR, 13%) and profitability (48%) compared with existing farmed tilapia strains. Bangladesh study has been extended into and will be reported in 2018.
Identifying improved strains and best practices to reduce GHG emissions from tilapia farming in Africa and South Asia	1.3.4: More efficient use of inputs 3.3.3: Reduced net GHG emissions from agriculture, forests and other forms of land use	Benchmarking the environmental performance of best management practice and genetic improvements in Egyptian aquaculture using life-cycle assessment (Henriksson et al. 2017).	Life-cycle assessments indicate that the ninth generation of the Abbassa tilapia strain helped reduce life-cycle environmental impacts by up to 36%. Improved practices and genetically improved tilapia increased efficiencies in food utilization, providing both environmental and monetary improvements.

Identifying pathways for community-based management in small-scale fisheries interventions	3.2.1: More productive and equitable management of natural resources 3.3.1: Increased resilience of agroecosystems and communities, especially those including smallholders XC 2.1.3: Improved capacity of women and young people to participate in decision-making	Case studies from: Solomon Islands: WorldFish and Solomon Islands Government (2018); Blythe et al. (2017); Schwarz et al. (2017). Bangladesh: Halls et al. (2017).	Assessment framework devised and applied and will inform future MEL framework, indicators and site selection for CBFM (Blythe et al. 2017). Assessment of 10 years of CBFM in Solomon Islands conducted across direct engagements (Schwarz et al. 2017) test and critique the value of resilience principles, and illustrate that improved sustainability of CBFM is fostered through local to programmatic learning, avoidance of rigidity/fostering adaptive systems, and facilitating linkage across scales of governance, identifying elements for imbedding and testing in both Cluster 1 and 2 interventions. Assessment of 10 years of CBFM as national programs (WorldFish and Solomon Islands Government 2018) illustrates buy-in to scaling CBFM but also focuses on key shortcomings in terms of governance of external drivers, existence of models of spread and gender concerns. These areas inform FISH CRP research design and partnerships. Multi-year assessment of CBFM interventions across 107 water bodies in Bangladesh indicate that fish abundance is enhanced and at least sustained via CBFM.
Analysis of economic returns in small-scale fisheries value-chains	Sub-IDO 1.3.1*:* Diversified enterprise opportunities Sub-IDO 1.3.2: Increased livelihood opportunities Sub-IDO 1.3.3: Increased value captured by producers	Purcell et al. (2017).	Pacific small-scale fishers servicing international markets receive marginal earnings relative to other value chain actors. Upgrading of value-chain governance (and empowering local and national actors in global value chains), such as through fisher cooperatives, auction systems and ICT for price intelligence, could improve efficiency and fisher incomes.

Identifying governance responses and innovations to strengthening resilience and decreasing resource competition in fishery communities	3.2.1: More productive and equitable management of natural resources 3.3.1: Increased resilience of agroecosystems and communities, especially those including smallholders	Case studies from: 11 inland fisheries: Song et al. (2017a) and Song et al. (2017b) (e-book); Uganda, Zambia and Cambodia: Ratner et al. (2017a); Ratner et al. (2017b); Zambia, Solomon Islands: Sukulu et al. (2016); Bangladesh and Cambodia: Apgar et al. (2017).	Inland fisheries operate amid competition for water resources. Responses needed to build the resilience of inland fisheries reside outside of the fisheries themselves and within the multifunctional landscape, representing an insurmountable challenge to classic fisheries governance. Cases assess both classic and novel governance approaches applied. A synthesis (Song et al. 2017) draws insights from across 11 case studies (each fully elaborated in the e-book) (i.e. four lake fisheries, three rivers, two deltaic/coastal brackish waters and two wetland/floodplain fisheries) spanning developed countries and the FISH focal and scaling countries India, Myanmar, Bangladesh, Zambia, Kenya and Tanzania as well as Uganda, Nepal and Zimbabwe. An approach is developed to assess and identify entry points for change in system characterization, valuation, power relations and vertical policy interaction. The cases and analytical approach to be applied and further refined in Cluster 2. Ratner et al. (2017a), Ratner et al. (2017b) and Apgar et al. (2017) test and assess collaborative, participatory and negotiated approaches that have overcome resource competition, avoided conflict over use and ownership rights, and opened new opportunities for deeper governance change while achieving outputs of improved environmental governance. These approaches will be integrated and assessed in FISH and partner resource governance interventions.
Gender assessments in aquaculture	XC 2.1.1: Gender-equitable control of productive assets and resources XC 2.1.3: Improved capacity of women and young people to participate in decision-making	Case studies from: Myanmar: Aregu et al. (2017); Bangladesh and Indonesia: Choudhury et al. (2017).	Gender assessments provide a baseline of current knowledge and practices, and guidance on research and development actions required for the future.

Gender assessments in fisheries	XC 2.1.1: Gender-equitable control of productive assets and resources XC 2.1.3: Improved capacity of women and young people to participate in decision-making	Case studies from six fishing communities in Cambodia, the Philippines and Solomon Islands: Locke et al. (2017); Lawless et al. (2017), combined with and building on Cohen et al. (2016); Zambian fishing camp studies: Cole et al. (2018).	Case studies showing that gendered negotiations mediate the capacity to innovate but that wider structural constraints are important constraints for both men and women. The findings show that men's and women's capacity to innovate is strongly mediated by the behavior of their marriage partner. Consequently, gender research from a social relational perspective has an important contribution to make in understanding poor fishing communities where new ways of doing things or new technologies are being promoted. Research has been interpreted into guidance for resource management and development interventions (such as Lawless et al. 2017). Research on the application of a gender-transformative approach to fish value chains in Zambian fishing camps that combine technical innovation to reduce fish postharvest losses with social innovation to improve gender relations may hold promise for enabling fishery-dependent people to shift pathways out of social-ecological traps.

Table B. Status of planned milestones

Flag ship	Mapped and contributing to sub-IDO	2022 CRP outcomes (from proposal)	Milestone*	2017 milestones status (completed, extended or canceled)	Provide evidence for completed milestones** or explanation for extended or canceled milestones
FP1	1.3.1: Enhanced genetic gain	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.	Milestone 1.1.1: Genomic selection strategy for improved tilapia prepared with partners and integrated in 2018 FISH research plans.	Completed	Research integrated into FISH POWB 2018. Genomics research plan drafted (publication August 2018). Workshop report and *Nature Genetics* article.
			Milestone 1.1.2: Impact assessments of prior dissemination activities completed in Bangladesh, Egypt (focal countries) and dissemination of existing improved tilapia strains continued in Bangladesh, Egypt and India (scaling country).	Completed. Extended for additional data collection in Bangladesh	Prior dissemination activities in Egypt have been assessed in Egypt (IFAD Technical Report) and a journal article is in preparation. In Bangladesh, the survey was repeated to validate the 2017 assessment. Dissemination of improved tilapia breeds continued in Bangladesh, Egypt and India, plus Timor-Leste.
			Milestone 1.1.3: Gender-integrated end user preference review completed and research capacity and methods in place to conduct user preference research.	Completed	Capacity development was successfully undertaken through the Gender and Breeding PDF Initiative and methods successfully identified and consolidated in a Tool Navigator: Using market-based research methods for user-responsive innovation as well as disseminated through a workshop at the CGIAR Gender Science Conference. Journal article on trait preferences in final draft for submission.
	1.3.4: More efficient use of inputs 1.4.2/2.1.2: Closed yield gaps through improved agronomic and	Outcome 1.2: 2.5 million households have adopted disease-detection and control strategies, cost-effective and sustainable aquafeeds and/or improved	Milestone 1.2.1: Diseases of tilapia strains assessed, and biosecurity measures designed and implemented in tilapia breeding programs in Bangladesh, Egypt (focal countries) and Malaysia.	Completed	Tilapia health assessments completed, and biosecurity measures designed and implemented in Bangladesh and Egypt. New epidemiology and health economics tool developed with NVI. Key publications produced: Nicholson et al. (2017); Fathi et al. (2017); Jansen and Mohan (2017).

	animal husbandry practices 2.3.2: Reduced livestock and fish disease risks associated with intensification and climate change	aquaculture management practices.	Milestone 1.2.2: Priority ingredients identified for tilapia and carp aquafeed research via focal country assessments, cross-CRP dialogue (RICE, RTB, LIVESTOCK) and dialogue with other partners, and results integrated in 2018 FISH research plans.	Completed	Priority ingredients identified, and research integrated into FISH POWB 2018. Priority ingredient working paper drafted (publication in August 2018). Cooperation with RICE initiated in Myanmar and co-funded intern agreed with RTB, starting August 2018. Dialogue ongoing in 2018 with LIVESTOCK on cooperation in Nigeria and a global feeds and forages initiative.
			Milestone 1.2.3: Best practice guidelines for health and feed management packaged and disseminated via extension networks to fish farmers in Bangladesh, Egypt, Myanmar (focal countries) and India (scaling country).	Completed	Best practice guidelines prepared and disseminated via training courses and partners in Bangladesh, Egypt, Myanmar and India, including basic biosecurity manual. An assessment was started on farm management practices in Bangladesh to assess adoption of BMPs and outcome for future improvements.
	3.3.3: Reduced net GHG emissions from agriculture, forests and other forms of land use 1.3.4: More efficient use of inputs	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 GHG emissions and 10% increase in water- and nutrient-use efficiency).	Milestone 1.3.1: Baseline assessments of GHG emissions and water and nutrient-use efficiency in tilapia and carp farming completed and used to identify interventions in Bangladesh, Egypt and Myanmar (focal countries).	Completed in Bangladesh and Egypt. Extended for Myanmar to give more time for data analysis	Life-cycle assessments completed and published in Bangladesh and Egypt: Measuring the potential for sustainable intensification of aquaculture in Bangladesh using life-cycle assessment; Benchmarking the environmental performance of best management practice and genetic improvements in Egyptian aquaculture using life-cycle assessment. Datasets have been accessed and data analysis is ongoing in Myanmar.

	1.3.1: Diversified enterprise opportunities 1.3.2: Increased livelihood opportunities 1.4.2/2.1.2: Closed yield gaps through improved agronomic and animal husbandry practices 2.1.2: Increased access to nutrient-rich foods XC 1.1.4: Enhanced capacity to deal with climatic risks and extremes XC 2.1.1: Gender-equitable control of productive assets and resources XC 2.1.3: Improved capacity of women and young people to participate in decision-making XC 3.1.1: Increased capacity of beneficiaries to adopt research outputs.	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.	Milestone 1.4.1: Multi-stakeholder partnership platforms for sustainable aquaculture R&D convened in Egypt, Nigeria, Bangladesh and Myanmar (focal countries).	Completed in Bangladesh, Egypt, Myanmar and Nigeria	Platform developed in Bangladesh, Egypt, Nigeria and Myanmar with partners. An additional platform for feeds research in Vietnam, with bilateral funding, provides new insights into innovation processes. Bangladesh: in partnership with the EURASTIP Project; Egypt: since 2014, with hosting of major conference in 2017; Myanmar: hosting of conference (publication expected August 2018); Nigeria: workshop and country scoping analysis (publication expected August 2018). Review of innovation systems will also inform future development of each focal country program. FISH gender lead also engaged in the cross-CRP publication Guidelines for innovation platforms in agricultural research for development: Decision support for research, development and funding agencies on how to design, budget and implement impactful innovation platforms.
			Milestone 1.4.2: A gender-integrated set of methods, tools and capacity available within FISH focal countries for assessing aquaculture systems, value chains and entrepreneurial opportunities for women and youth.	Completed	Resource-consolidating methods and tools have been collated and shared internally for gender analysis by FISH researchers. The materials will be made publicly available later in 2018. Publicly available tools and methods, and publications demonstrating use of the tools include: Tool Navigator: Using market-based research methods for user-responsive innovation; Review of gender and aquaculture value chains; Women-led entrepreneurship in Bangladesh (article submitted for publication); Assessment of gender barriers in Myanmar's small-scale aquaculture sector; women's empowerment in aquaculture in Bangladesh and Indonesia, published by FAO.

	XC 3.1.3: Conducive policy environment XC 4.1.2: Enhanced capacity in partner research organizations through training and exchange		Milestone 1.4.3: Fish supply-demand modeling completed and used to inform future targeting of FISH aquaculture technologies in Africa. Results integrated into FISH 2018 research plans.	Completed	Modeling completed at Africa continental level: presentation made at World Aquaculture Society in Cape Town, June 2017. Manuscript on African aquaculture futures submitted to *Global Food Security*. Modeling completed and two publications prepared for Indonesia, addressing fish supply and demand in Indonesia to 2030 and the role of aquaculture; and environmental and socioeconomic potentials and limitations (the tools and methods developed provide lessons for Africa aquaculture development). Modeling tool being extended to Egypt in 2018, with the intention of covering all FISH focal countries with future fish-supply demand model outputs.

FP2	1.3.2: Increased livelihood opportunities 1.1.1: Increased household capacity to cope with shocks XC 1.1.4: Enhanced capacity to deal with climatic risks and extremes 2.1.2: Increased access to nutrient-rich foods XC 2.1.3: Improved capacity of women and young people to participate in decision-making XC 2.1.1: Gender-equitable control of productive assets and resources	Outcome 2.1: 1 million fishery-dependent households have reduced poverty as a result of adopting improved fisheries management.	Milestones 2.1.1: Assessments of adaptive management and livelihood interventions in small-scale marine and inland fisheries in Bangladesh, Cambodia, Myanmar and Solomon Islands (focal countries), the Philippines and Timor-Leste (scaling countries).	Partially completed. Further analysis and publication pending in Solomon Islands, Bangladesh, Myanmar and Cambodia Assessment delayed in the Philippines	Global framework of adaptive capacity of coastal communities developed and published in early 2018. Adaptive management interventions examined over 10 years for Solomon Islands and published as a journal article: Critical reflections from fostering adaptive community-based, co-management in Solomon Islands' small-scale fisheries. Empirical assessment completed and published for Bangladesh: Status of fish aggregating device fishery in the River Titas of Bangladesh, and data collection on FADs commenced in Timor-Leste and Solomon Islands. A modeling approach developed to enhance Pacific SSF: Strengthening the resilience of small-scale fisheries: A modeling approach to explore the use of in-shore pelagic resources in Melanesia. Panel study data collected in Solomon Islands, household data collected in Bangladesh, Cambodia and Myanmar for further assessments. Livelihood baseline completed and published for Timor-Leste: Livelihood diversity and dynamism in Timor-Leste; insights for coastal resource governance and livelihood development.
			Milestones 2.1.2: Assessments have informed design of adaptive management and livelihood interventions in inland areas in Bangladesh, Cambodia, Myanmar (focal countries).	Completed	Assessments informed design of interventions and research for Bangladesh, Cambodia and Myanmar. In Timor-Leste, research on livelihood diversity and dynamism was integrated into new project development on management and livelihood research.
		Outcome 2.2: 1.2 million people, of	Milestone 2.2.1: Barriers and opportunities for	Completed	Empirical research published on innovation and gendered negotiations in fishery-dependent

	1.3.2: Increased livelihood opportunities 1.1.1: Increased household capacity to cope with shocks XC 1.1.4: Enhanced capacity to deal with climatic risks and extremes XC 2.1.3: Improved capacity of women and young people to participate in decision-making XC 2.1.1: Gender-equitable control of productive assets and resources 1.2.1: Improved access to financial and other services	which 50% are women, assisted to exit poverty through livelihood improvements.	gender-equitable governance and assets in fishery-dependent communities identified.		communities in Cambodia, the Philippines and Solomon Islands. Guidance document for considering gender in rural development. Contributed case study/analysis to promoting gender equity and equality through the FAO small-scale fisheries guidelines.
			Milestones 2.2.2: Assessments completed of rice field systems in South and Southeast Asia as well as options in farming practices and policies that increase gender-equitable development outcomes for women and men small-scale farmers and fishers.	Completed	Empirical assessment of rice field systems enhancement completed in Bangladesh and published in a journal article: Effects of supplementary feeds with different protein levels on growth and economic performances of Nile tilapia (*Oreochromis niloticus*) cultured in a rain-fed rice-fish ecosystem; and an assessment completed in Cambodia: Rice field fisheries in Cambodia: Enhancing the productivity through community-managed fish refuges.
			Milestones 2.2.3: Conceptual framework for SSF in fish-food systems developed and 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.	Completed	Global Workshop on Nutrition-sensitive Fish Agri-food Systems convened with policymakers and funders as well as fisheries, food and nutrition experts. Nutrition-sensitive and food systems perspective research presented to peers (Resilient SSF Symposium, pages 57–65). Conceptual framework and perspectives for fish in food systems drafted for submission to journal in 2018.
	2.4.2: Enhanced conservation of habitats and resources 3.2.1: More productive and equitable	Outcome 2.3: 2.1 million ha of inland aquatic and coastal marine habitat restored and under more productive and equitable management.	Milestone 2.3.1: Evidence collated and research designed to determine ecosystem productivity and equity outcomes from management interventions in Bangladesh, Cambodia and Solomon Islands.	Delayed. Reviews, analysis and research designs pending for Bangladesh and Cambodia	National program and FISH program review conducted in Solomon Islands. Funding secured for reviews and assessments in Cambodia, Bangladesh, Myanmar and the Philippines in 2018. Commenced collection of new baseline data on SSF productivity in focal countries.

	management of natural resources 3.3.1: Increased resilience of agroecosystems and communities, especially those including smallholders XC 3.1.3: Conducive agricultural policy environment				

* Milestones include outputs, output use and outcomes along the impact pathways.
** Provide link to any relevant open accessible document.

Table C. Crosscutting aspects of outputs

Crosscutting	Number (%) scored 2 (principal)	Number (%) scored 1 (significant)	Number (%) scored 0	Total overall number of outputs
Gender	5 (6.94%)	12 (16.67%)	55 (76.39%)	72 (of which 36 open access and 59 ISI publications)
Youth	3 (4.17%)	7 (9.72%)	62 (86.11%)	
Capacity development	7 (9.72%)	13 (18.06%)	52 (72.22%)	

Table D. Common results reporting indicators

Table D-1. Key CRP results from 2017, in numbers

Sphere	Indicators	Data	Comments
Influence	**I1/I2.* Projected uptake (women and men)/ha from current CRP investments (for innovations at user-ready or scaling stage only – see indicator C1)**	New indicator introduced in 2018.	
	I3. Number of policies/investments (etc.) modified in 2017, informed by CGIAR research	Policies or strategies 0 major international; 2 regional (Mekong and SADC/EAC); 7 national policies (Cambodia, India, Malawi, Myanmar). Legal instruments 3 legal instruments (Cambodia and Myanmar). Major investments 4 (Cambodia, India, Zambia, up to total multi-year investment value of USD 71 million). Curricula None.	Regional: SADC/EAC platform for genetics in aquaculture and Mekong basin fisheries management strategies. National: Water and land use tenure policies enabling rice field fisheries, fish breeding, aquaculture research committee and SSF management and value chain development. Investments: Aquaculture investment projects with African Development Bank, World Bank and Odisha State government.
Control	**C1. Number of innovations by phase, new in 2017**	11 innovations at proof-of-concept phase; 6 piloted successfully; 4 available for uptake (includes policy recommendations); 1 taken up by next users (includes policy change).	Table D-2.
	C2. Number of formal partnerships in 2017, by purpose (ongoing + new)	26 academic and research partnerships (15 new in 2017); 11 development organization partnerships (7 new in 2017); 9 NARES/NARS partnerships (6 new in 2017); 3 private sector partnerships (all new in 2017);	Includes 5 global level partnerships, 19 regional/multinational-level partnerships, 26 national partnerships and 5 sub-national-level partnerships. Partnerships at various stages: Phase 1: Discovery/proof of concept—19 (34.5%); Phase 2: Piloting—33 (60%); Phase 3: Scaling up and scaling out—10 (18.2%).

		2 government partnerships (all new in 2017); 3 CGIAR partnerships (all new in 2017); 1 community-based organization and farmers' groups partnership.	
	C3. Participants in CGIAR activities 2017 (ongoing + new)	55,385 end users (61% women) in on-farm trials, farmer field days and similar; 1,537 next users (35% women) in innovation platforms, policy workshops and similar; 17,661 participants (54% women) engaged in activities where both end users and next users participated.	Including over 64,000 participants from Asia, 7,800 from Africa, 2,000 from the Pacific and 57,000 participants from Bangladesh alone.
	C4. People trained in 2017	53,856 participants (68% women) in formal training activities, including formal events and academic degrees 20,727 participants (34% women) in informal training activities.	7 long-term (>10 days) formal training events; 5 academic degrees.
	C5. Number of peer-reviewed publications	72 in 2017 (peer-reviewed FISH publications) of which 36 (50%) are openly published; 3 (4%) with open database.	A Dataverse system has been introduced to the lead center (WorldFish) in 2018, and databases are being cleaned and will be uploaded during Q3 and Q4 2018. Consequently, the open database indicator underestimates expected performance.
	C6. Altmetrics	New indicator being introduced in 2018: no report from FISH in 2017.	

* I = sphere of influence; C = sphere of control.

Table D-2. List of CRP innovations in 2017 (from indicator C1 in Table D-1)

Title of innovation (minimum required for clarity)	Phase of research*	Novel or adaptive research	Contribution of CRP (sole, lead, contributor)	Geographic scope: for innovations in phases AV* or USE* only (one country, region, multi-country, global)
FP1				
Catla carp base population	PC	Novel	Lead	
Silver carp base population	PC	Novel	Lead	
Novel carp nursery system	PC	Novel	Lead	
Improved tilapia strains**	AV/USE	Adaptive research	Lead	AV: Myanmar (GIFT Generation 15) USE: Timor-Leste (Generation 14)
Methodology for determination of fish feed efficiency	PC	Novel	Contributor	
Nutritious pond system	PC	Novel	Contributor	
FISH sector fish supply-demand model for Africa, suited to the data availability constraints of the continent	PC	Adaptive research	Lead	
Life-cycle assessment tool for analyzing future environmental impacts of aquaculture	AV	Adaptive research	Contributor	AV: Indonesia
ODK/tablet-based tool for on-farm performance assessment of improved tilapia strains	PC	Adaptive research	Lead	
Innovation system approach for aquaculture	PC	Adaptive research	Contributor	
Business models for smallholder fish farmers	AV	Adaptive research	Lead	AV: Zambia, Malawi
FP2				
Socially inclusive, resilient co-management approach	PIL	Adaptive research	Lead	Solomon Islands, Cambodia, Bangladesh, Zambia, Timor-Leste
Management and technical innovations for enhanced fisheries	AV	Adaptive research	Lead	Bangladesh, Solomon Islands, Timor-Leste
Gender-transformative approach to SSF value chains and livelihoods	PIL	Adaptive research	Lead	PIL: Zambia, PC: Solomon Islands, Timor-Leste

Adaptive capacity of SSF to climate change and other external drivers	PC	Adaptive research	Lead	
Fisheries production enhancements in constructed water bodies	PIL	Adaptive research	Lead	PIL: Cambodia, Myanmar
Collaborative governance for resource competition	PIL	Adaptive research	Lead	PIL: Cambodia, Zambia
Fish-rice system enhancements	PIL	Adaptive research	Lead	PIL: Cambodia, Myanmar, Bangladesh
Analytical approaches to build policy and investment responsiveness to SSF	PC	Novel	Lead	PIL: Melanesia

* Phases: PC – proof of concept; PIL – successful pilot; AV – available/ready for uptake; USE – uptake by next users. Here, we report only those at these phases within 2017 focal and scaling countries where FISH is actively working with partners.
** GIFT has been disseminated to 16 countries.

Table E. Intellectual assets

Year reported	Applicant(s)/owner(s) (center or partner)	Patent or PVP title	Additional information*	Link or PDF of published application/ registration	Public communication relevant to the application/registration
2017	No applications made by WorldFish or FISH partners in 2017	N/A			

* For patents, please indicate: (a) type of filling: provisional/nonprovisional, national direct, national designated, multi-territory; (b) patent status: filled, pending, matured to nonprovisional, discontinued, registered or lapsed; (c) application/registration; (d) date of filling; (e) date of registration; (f) date of expiry/renewal.
* For PVP, please indicate: (i) variety name; (ii) status; (iii) country; (iv) application/registration number; (v) date of filling; (vi) date of registration/grant; (vii) date of expiry/renewal; (viii) breeder and crop.

Table F. Main areas of W1/W2 expenditure in 2017

Expenditure area	Estimated percentage of total W1/W2 funding in 2017*	Comments
Planned research: principal or sole funding source	30%	Tilapia genomics research strategy; tilapia fish disease and biosecurity assessments; Cambodia tilapia dissemination systems; strategic gender research; fish feed ingredient research; development of on-farm performance assessment tools; aquaculture scoping studies in Nigeria and Tanzania; preparation of FISH detailed multi-year research plans with partners for fish feeds, health and aquaculture systems.
Planned research: leveraging W3/bilateral funding	60%	Synthesis of international public goods related to all three FP1 clusters: tilapia genomics and carp genetic improvement; fish health, feeds and nutrition; and aquaculture systems.
Catalyzing new research areas	5%	Fish supply-demand and foresight models for African aquaculture; novel traits in tilapia genetic improvement; partnership consultations related to genetics, fish feeds, health and aquaculture systems.
Gender	10%	Strategic gender research on sustainable aquaculture; engaging with global and focal country research teams for gender integration; preparation of FISH Gender Research Strategy and gender research tools and training.
Youth	1%	FISH Youth Strategy.
Capacity development	13%	Researcher training, research planning workshops.
Start-up or maintenance of partnerships (internal or external)	10%	Partnerships development with WUR, NRI and IWMI. Drafting of partnership strategy.
Monitoring, learning and self-evaluation	11%	Preparation of the M&E system for FISH; co-investment in selected outcome studies; program meetings and workshops to review progress.
Evaluation studies and impact assessment studies	0%	No evaluation studies or impact assessments conducted using W1/W2 funds during the 2017 FISH start-up year.
Emergency/contingency	3%	Increase in investment made in research on tilapia disease occurrence (TiLV); biosecurity assessments of tilapia genetic improvement programs; co-funding in working paper/awareness materials.
Other		None.
Total funding (USD)	3,404,000	

* It is recognized that (i) some funding may fit more than one category, but please try to apportion funding to its principal use; and (ii) percentages may not add up to 100%.

Table G. List of key external partnerships

FP	Stage of research*	Name of partner	Partner type*	Main area of partnership*
1	Phase 1	Roslin Institute	Academic and research	Genomics research for tilapia (Cluster 1).
1	Phase 1	NVI	Academic and research	Fish health and TiLV assessments; development of epidemiological assessment tool (Cluster 2).
1	Phase 1	Cefas	Academic and research	Microbiome and diagnostic tools for small-scale fish farmers (Cluster 2).
1	Phase 1	CSIRO	Academic and research	Novel feed ingredients for tilapia (Cluster 2).
1	Phase 1 & 2	CLAR, Egypt	NARES/NARS	Hosting of the Africa Aquaculture Research and Training Center in Egypt.
1 & 2	Phase 2 & 3	Department/Ministries of Fisheries in Bangladesh, Cambodia, Egypt, Myanmar, Nigeria, Solomon Islands, Tanzania, Zambia	NARES/NARS	Scaling partners in focal countries for FP1 & FP2.
2	Phase 1, 2 & 3	FAO	Multilateral	Hidden harvest research on SSF and fish in food systems research (Cluster 3). Policy development for fish in multifunctional landscapes (Cluster 2) and fish in food systems (Cluster 3).
2	Phase 1	Duke University	Academic and research	Analytical approach to hidden harvest research (Cluster 3).
2	Phase 1	University of Wollongong	Academic and research	CBFM scaling pathways within the Pacific (Cluster 1).
2	Phase 2 & 3	TBTI	Civil society	Scaling partner for SSF globally (Clusters 1–3).
2	Phase 3	Secretariat of the Pacific Community	Development organization	Scaling partner for SSF in the Pacific region.
2	Phase 1	University of Lancaster	Academic and research	Contribution to the FAO Food Bank Database on nutritional values of marine fish (Cluster 1 & 2).

* Phase 1 = discovery/proof of concept; Phase 2 = piloting; Phase 3 = scaling up and scaling out. Partner type and area of partnership follow the guideline for the CGIAR indicator C2: Partnerships.

Table H. Status of internal (CGIAR) collaborations among programs and between the program and platforms

Name of CRP or platform	Brief description of collaboration (give and take among CRPs) and value added*	Relevant FP
PIM	FISH-PIM research on foresight approaches and development of fish supply-demand models and aquaculture projections for Africa, feeding into FISH planning (FP1 & FP2) and integration of fish into the PIM portfolio of global futures and strategic foresight project. Special attention in 2017 was given to developing models that can be used in the data-poor African fisheries context.	FP1
RICE	FISH-RICE research on rice-fish systems in Bangladesh and the Ayeyarwady delta in Myanmar, the latter with funding from ACIAR. Scientific benefits come from the two CRPs working together on integrated production systems. In future, the cooperation is planned to include WLE/IWMI, bringing the science of water and landscape management into rice-fish integrated farming systems development, initially within Myanmar.	FP1 & FP2
CCAFS	FISH-CCAFS collaboration connected CCAFS-funded research with FISH bilateral projects in the Mekong region, Indonesia and Bangladesh, and production of a paper on mitigating GHG in aquaculture, as well as joint resource mobilization. FISH participated in the scientific conference and 'writeshop' held in Galway, Ireland. A joint paper that explores options for aquaculture and mitigation is under discussion. FISH-CCAFS cooperation has also contributed to identifying new approaches to integration of environmental considerations into aquaculture futures modeling, and identification of technology and management practices for sustainable intensification of aquaculture in Bangladesh to mitigate GHG emissions.	FP1 & FP2
A4NH	FISH-A4NH collaboration initiated on integrating fish within the food systems reviews of Bangladesh and Nigeria planned by A4NH FP1 as a first step to identification of specific areas for future cooperation, and with A4NH FP5 on human antimicrobial resistance (AMR), leading to preparation of papers on aquaculture and AMR, also in cooperation with LIVESTOCK.	FP1
Big Data Platform	FISH-Big Data collaboration helped identify collaborative opportunities and co-develop work plans, including supporting FISH efforts to comply with the open access/open data policy. Through the Organize Module of the platform collaboration was started, especially around fish genetics and aquaculture data. Under the Inspire Module, FISH submitted a proposal on mobile technology-based data collection from aquaculture farmers on disease, performance assessments and satellite imagery data for spatial planning for potential challenge grants. A FISH GIS scientist also participated in the Big Data Convention 2017 and the Geospatial Data Community of Practice.	FP1 & FP2
Excellence in Breeding Platform	FISH-Excellence in Breeding collaboration involved participation in the Expert Advisory Groups for Modules 1 (Breeding program excellence) and 2 (Trait discovery and breeding tools and services), particularly in the development of an animal-oriented breeding assessment form.	FP1
Gender Platform	FISH team members led a cross-CRP Gender and Breeding Postdoctoral Fellow (PDF), and FISH actively contributed to the CGIAR Collaborative Platform for Gender Research first Annual Scientific Conference and Capacity Development Workshop, including sending a team, contributing to a panel, multiple science presentations, a flash talk and poster on the FISH Gender Research Strategy and convening a special session with cross-CRP gender initiatives. Additionally, in terms of cross-CRP collaboration: i) the FISH gender research lead was a member of the Gender and Breeding Innovation Workshop Organizing Committee (which evolved into the Gender and Breeding Initiative); and ii) FISH led the case contributions from Bangladesh and the Philippines to CGIAR's cross-CRP GENNOVATE initiative.	FP1 & FP2
Scaling	Cooperation with the task force of 7 CIM seconded experts on scaling (that includes CCAFS, WHEAT, RICE and FISH).	FP1

* E.g. scientific or efficiency benefits.

Table I. Monitoring, evaluation, impact assessment and learning

Table I-1. Status of evaluations, impact assessments and other learning exercises planned in the 2017 POWB

Studies/learning exercises in 2017 (from POWB)	Status	Comments
No evaluations were planned during 2017	N/A	M&E Strategy drafted during 2017 and steps taken to adopt an online platform for FISH M&E activities from 2018.
Completion of the SPIA research grant initiated under L&F to assess impacts of improved tilapia dissemination with genomics tools	The report Estimating improved tilapia adoption using DNA fingerprinting: Philippines and Bangladesh was submitted to SPIA and is being prepared for publication. Results are summarized in a SPIA Technical Note (Herdt 2018).	The study of GIFT tilapia confirmed the widespread use of GIFT or GIFT-derived strains in both countries, accounting for almost 53% of production in the sampled hatcheries in Bangladesh and 40% of that in the Philippines. Funding limitations precluded research to confirm their contribution to farmer productivity and income, or broader contributions to nutrition and poverty. Hence, those questions remain unanswered, as do questions about spread and impact in other countries that produce tilapia in Africa, South Asia and Southeast Asia.
Assessment of GIFT tilapia dissemination in Bangladesh and Abbassa strain in Egypt	Egypt studies were completed as part of the SDC-funded STREAMS and IFAD project. Bangladesh studies were extended into 2018.	See Table A-2.
Multi-country assessment of SSF research	Completed, including evidence gathering through an ACIAR-funded Resilient Small-scale Fisheries Symposium.	These assessments provided evidence and updated the ToC and impact pathway to strengthen the case for future investment in SSF research for development.
An annual program review and planning meeting has been used to monitor progress at CRP and flagship level, within the framework of FISH's overall ToC	Management Committee meetings were held during 2017.	The Management Committee meetings represented a very fruitful moment for the regular review of program progress as well as a way for increasing research ownership and strengthening participation among different scientific leaders and partners attending the meetings.

Additional studies that were not planned in the POWB 2017 are reported in Tables A-1 and A-2.

Table I-2. Update on actions taken in response to relevant evaluations (IEA, CCEEs and others)

FISH is a new CRP. Evaluations highlighted in the table below were reviewed during 2017 as part of the work plan and strategy development for FISH. Recommendations from the AAS and L&F evaluations were reviewed, particularly during the first FISH Management Committee meeting in March 2018, and relevant actions integrated within the FISH POWB and implementation process. The CGIAR evaluation on gender was also given attention in formulating the FISH Gender Research Strategy.

Name of the evaluation	Recommendation	Management response: action plan	By whom	By when	Status
AAS	FISH management considered the specific recommendations received during the AAS evaluation and tried to capitalize on those as lessons learned. Among different recommendations received, FISH management has recognized particularly valuable the following: **R2**. Strengthening research capacity: AAS management should re-think its approach to staffing and to the allocation of human resources. **R4**. Increase alignment of AAS activities: The decision to associate bilateral projects with AAS should be based primarily on their potential to further the AAS research agenda. **R9**. Management information: A functional research management information system should be established.	Recommendations reviewed and considered in the design and implementation of FISH. Specifically: **R2.** 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. **R4.** All new bilateral projects are discussed and designed in order to further strengthen the FISH research agenda. By doing this, FISH pursues the greatest efficiency and effectiveness of its research by strengthening the synergies of research funded by W1/W2. A formal alignment process is applied for bilateral projects. **R9.** The improvement of the management system is a strong priority of FISH. Resources, both human and financial, have been invested to establish a functional results-based management system in FISH. As a key part of this, a research data management (RDM) system (OD/OA) has also been considered a priority in FISH and investments made to recruit new staff to enhance RDM (see paragraph 1.3.5 Open data).	Management Committee CRP director Program leadership	**R2.** End of 2022. **R4.** End of 2022. **R9.** End of 2017. **R10.** End of 2017.	**R2.** Ongoing. **R4.** Ongoing. **R9.** Management information system designed. Implementation within 2018. **R10.** Done.

	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.	**R10.** FISH brings together and mutually integrates CGIAR's existing competences around fish—aquaculture and SSF—and the generation of new knowledge and methodological innovations, to achieve positive development outcomes and produce greater impacts.			
L&F	**R2.** Increase synergies between livestock and aquaculture. **R5**. Establish an M&E system based on the ToC. **R6**. Build private sector partnerships for technology delivery.	**R2.** Within the specific CRPs—FISH and LIVESTOCK—the collaboration and partnership are continuing in specific areas of interest. FISH has continued some interaction with LIVESTOCK in relation to the research on health and feeds. **R5**. FISH is developing an M&E system to serve both performance monitoring and outcome evaluation on the basis of the ToC, impact pathways and outcome targets. At the same time, a set of ToC at country level is being developed in 2018 to improve the capacity of the M&E system and to capture the results and performance in a more relevant, efficient and effective way. **R6**. Developing partnerships with the private sector, in order to stimulate inclusive small- and medium-scale business development services at the local level and establish strategic collaboration with the larger scale commercial sector, is a priority for FISH and particularly for the related research in sustainable aquaculture. 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.	CRP director FISH M&E lead FISH MELCoP	**R2.** Ongoing. **R5.** End of 2018. **R6.** End of 2022.	**R2.** Ongoing. **R5.** Ongoing. **R6.** Ongoing.

		Relevant partnerships developed in 2017 were with: the BOP Innovation Center, which assisted FISH in developing strategies for private sector cooperation and women's entrepreneurship; and the West Africa Rice Company, which is testing new models to integrate fish within rice enterprises. A new market systems-oriented USAID investment in aquaculture in Bangladesh will also provide specific learning.			
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.	**R5**. To support the effective integration of gender in FISH research, the FISH Gender team has developed the FISH Gender Research Strategy.	CRP director FISH gender lead	**R5.** Gender Research Strategy published in July 2018.	**R5.** Gender Research Strategy in press.

Table J. CRP financial report

	Planned budget 2017			Actual expenditure 2017*			Difference		
	W1/W2	W3/ bilateral	Total	W1/W2	W3/ bilateral	Total	W1/W2	W3/ bilateral	Total
FP1	3,344	7,903	11,247	3,049	8,634	11,683	295	(731)	(436)
FP2	-	6,809	6,809	-	7,254	7,254	-	(445)	(445)
Strategic competitive research grant	-	-	-	-	-	-	-	-	-
CRP management and support costs	456	-	456	355	-	355	101	-	101
CRP total	**3,800**	**14,712**	**18,512**	**3,404**	**15,888**	**19,292**	**396**	**(1,176)**	**(780)**

Amounts in USD thousands.
* The difference in W3/bilateral is due to the additional expenses from new projects in the year than initially budgeted. Source: 2017 WorldFish Audited Financial Statement and Quarter 4 Report.

fish.cgiar.org

Lead Center: