



Feed the Future Cambodia-Rice Field Fisheries II

FINAL REPORT

Agreement Number: AID-442-IO-16-00002

Period of Performance: June 10, 2016 to September 09, 2021

Submission Date: December 3, 2021

Feed the Future Cambodia- Rice Field Fisheries II

FINAL REPORT

Prepared by



WorldFish - Headquarters

Jalan Batu Maung, Batu Maung

11960, Bayan Lepas, Penang, Malaysia

Tel: (+60-4) 626 1606, Fax: (+60-4) 626 5530

www.worldfishcenter.org

WorldFish - Greater Mekong Region

#18, Street 410, Sangkat Boeung Trobek, Khan Chamkamorn, Phnom Penh, Cambodia.

Tel: +855-23 223 206/ 208, Fax: +855-23 223 209

worldfish-cambodia@cgiar.org

In partnership with:

Akphivath Neary Khmer Organization (ANKO)

Village Support Group (VSG)

Trail Blazer Cambodia Organization (TCO)

Cambodia Organization for Women support (COWS)

Teuk Saat 1001

and:

Fisheries Administration, Ministry of Agriculture, Forestry, and Fisheries, Cambodia

DISCLAIMER

The author's views expressed in this report do not necessarily reflect the views of the United States Agency for International Development or the United States Government

Cover photo: (Top left) A young girl in Pursat province eats a meal of nutritious small fish and vegetables. Kakada Kongvichet/ANKO. (Bottom left) A bride and a groom releasing brood fish into Trapeang Khnarkantraing CFR, Siem Reap. Chouen Ratha/TCO. (Top right) Fishermen collect fish caught using bamboo traps, Tramper CFR in Pursat. Fani Llaurado/WorldFish Cambodia. (Bottom right) A part of the project infographic. WorldFish Cambodia.

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS	3
EXECUTIVE SUMMARY	4
INTRODUCTION	9
PROJECT APPROACH	10
PROJECT INTERVENTIONS AND ACHIEVEMENTS	11
a) Interventions during the period April – September, 2021	11
b) Project Outputs and Outcomes	11
INTEGRATION OF CROSS-CUTTING ISSUES	35
a) Gender Equality and Female Empowerment	35
b) Environmental Compliance	36
c) Sustainability Mechanisms and Local Community Empowerment	38
COORDINATION AND PARTNERSHIP	40
a) Cambodian Government	40
b) USAID-funded Projects	41
c) Other Development Partners	42
MONITORING AND EVALUATION	44
a) Biological Monitoring Survey	44
b) Catch and Consumption Survey	45
c) Livelihood Survey Results	47
d) Knowledge Attitude Practice (KAP) Survey on Food, Nutrition, and WASH	49
e) CFR Governance Capacity Assessments	52
CHALLENGES AND SOLUTIONS	54
a) Climate Anomalies	54
b) Irrigation and Road Infrastructure Development	55
c) Commune and National Elections in 2018	56
d) COVID-19 Pandemic	57
LESSONS LEARNED	59
CONCLUSION AND RECOMMENDATIONS	61
ANNEXES	62
Annex 1. Publications and Knowledge Management Products	
Annex 2. Comparison of Actual Expenditures with Budget Estimates	
Annex 3. Public Events, Field Visits, and Press Coverage	
Annex 4. Success Stories and Beneficiaries	
Annex 5. List of Sub-partners and Grantees	
Annex 6. Activity's MEL Plan	
Annex 7. Electronic Datasets	
Annex 8. List of Project-Supported CFRs and Map	

ACRONYMS / ABBREVIATIONS

ANKO	Akphivath Neary Khmer Organization
BioM	Biological Monitoring
CCM	Catch and Consumption Monitoring
CFi	Community Fishery
CFR	Community Fish Refuge
CIP	Commune Investment Plan
COWS	Cambodia Organization for Women Support
EMMP	Environmental Mitigation and Monitoring Plan
FAO	Food and Agriculture Organization
FiA	Fisheries Administration
FiAC	Fisheries Administration Cantonment
FtF	Feed the Future
FY	Fiscal Year
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Corporation for International Cooperation)
KAP	Knowledge, Attitude, Practice
MAFF	Ministry of Agriculture, Forestry and Fisheries
OAA	Other Aquatic Animals
PNGO	Partner Non-Governmental Organization
RFF	Rice Field Fisheries
RFF II	Feed the Future Cambodia Rice Field Fisheries II
SBCC	Social Behavior Change Communication
SIS	Small Indigenous fish Species
TCO	Trailblazer Cambodia Organization
TWG-Fi	Technical Working Group for Fisheries
USAID	United States Agency for International Development
VSG	Village Support Group

EXECUTIVE SUMMARY

Introduction

The Cambodian Fisheries Administration (FiA) is in the process of establishing 1,200 Community Fish Refuges (CFRs) throughout Cambodia, in order to protect and enhance the productivity of Rice Field Fisheries (RFFs). With the financial support of USAID, WorldFish implemented the *Rice Field Fisheries Enhancement Project* (RFF Phase I, 2012-2016), followed by the *Feed the Future Cambodia Rice Field Fisheries II* (RFF II, 2016-2021), in collaboration with Akphivath Neary Khmer Organization (ANKO), Cambodia Organization for Women Support (COWS), Trailblazer Cambodia Organization (TCO), Village Support Group (VSG), Teuk Saat 1001, and Fisheries Administration (FiA).

RFF II aimed to improve food and nutritional security of poor and vulnerable rural households in the Tonle Sap floodplain region in Cambodia, through enhancing the rice field fisheries and associated food production systems. The project also integrated rice field fisheries systems with more efficient and equitable use of water in CFRs for increased productivity and availability of nutritious food crops, including vegetables and other aquatic animals (OAA).

In order to achieve the stated goals and objectives, project applied three main approaches, at a total of 140 CFRs in 4 target provinces, namely Siem Reap, Kampong Thom, Pursat, and Battambang:

1. Scaling up the sustainable CFR management approach, tested and refined through RFF Phase I, to new locations in suitable rice field fisheries environments;
2. Developing and validating a multi-purpose use and governance model for water in CFRs, by integrating the fish refuge function of CFR with other food production and livelihood diversification activities; and
3. Enhancing nutritional outcome of increased fish and other food production through awareness raising, education and behavior change among household members about the importance of fish and dietary diversity for health and child growth and development, and appropriate food preparation, safe drinking water, hygiene and sanitation.

Economic and nutritional impacts of the project

- 365,045 people gained improved economic benefits derived from sustainable rice field fisheries management.
- 43% of women in reproductive age who were direct beneficiaries of the project were found to have consumed a diet of minimum diversity.

Outcome 1: Increased productivity in rice field fisheries

Activities:

- Supported the registration of 53 new CFRs with the government.
- Supported the development of 453 annual management plans cumulatively, with the participation of 5,191 community representatives (1,877 women, 36%)
- Conducted over 1,000 awareness raising and training events at local schools and in villages, reaching the cumulative 79,504 participants (45,003 women, 56.6%).
- Directly supported over 2,000 interventions of various types and scope to improve the physical conditions and the management of CFRs.
- Assisted the CFR committees to obtain local support to self-finance a total of 4,218 activities.

- Assisted the CFR committees to raise a total USD 302,915 of own funds from individual donations and fundraising events.

Achievements:

- The total productivity of rice field fisheries in ZOI increased by 5 kg/ha/year, despite two consecutive years of severe drought in 2019 and 2020.
- 80% of project-supported CFRs had higher biomass of fish during at least one of the survey occasions in 2020 compared to 2017.
- 481 hectares in areas of CFRs and rice field environment are under improved biophysical conditions as a result of the project interventions.
- The species richness scores of CFRs in *Category 2. Community pond without flooding* and *Category 3. Community pond with flooding* increased by 17% and 21% respectively, from 2017 to 2021, using the Margalef's diversity index. This is presumably the result of good management practices by the local committees.
- The average score of CFR governance capacity increased from 1.9 in 2016 to 4.2 in 2021. 81% of the CFRs scored 4 or above.

Outcome 2: Increased economic benefit and community resilience through use of CFR water

Activities:

- Supported the development and updates of 140 CFR by-laws regarding the management of rice field fisheries and CFRs, including the benefit-sharing and conflict resolution mechanisms for multiple uses of water. This helped resolve water allocation issues during drought at 18 CFRs, and flood damage recovery at 31 CFRs.
- Supported 78 demonstration plots of vegetable gardening using CFR water, and scaled out good practices to 1,725 people. Average household net income from vegetable gardening was \$39 per production cycle. 82.3% of the beneficiaries planned to continue with the practice, indicating this intervention was very successful and was widely adopted.
- Established 12 drinking water filtration plants owned and managed by the local communities as social enterprises. Based on average monthly sales figures all 12 project-supported water kiosks reached Tier 1 level sales performance (selling 2,550 bottles/month and generating profits) in some months within less than 2 years from their launch. 83% of the kiosks were performing at either profitable or breakeven point even during the rainy season in 2021 when the bottled water sales typically goes down.

Achievements:

- Although average household fish catch declined by 8%, from 221kg in 2017 to 203kg, the quality of the fish seems to have increased as the average value of the fish caught (\$/HH/year) increased by 70%, from \$303 in 2017 to \$516 in 2021.
- Average quantity of fish sold increased by 80%, from 161kg in 2017 to 289kg in 2021, and cash income from selling the fish increased by 232%, from \$221 in 2017 to \$734 in 2021, indicating that many households were able to sell extra catch and gain higher income.
- 120,483 people and 101 schools and health centers have gained access to basic drinking water services thanks to the 12 project-supported drinking water stations.

Outcome 3: Increased availability and consumption of fish, combined with hygienic food preparation and water drinking practices

Activities:

- Held 398 ToT events and trained a total of 5,261 participants representing VHSG, health centers, or caregiver groups, including 5,010 women (95%). The community trainers went

on to conduct 1,566 caregiver training sessions with a total 9,244 participants, including 8,511 women (92%).

- Held 687 awareness raising events at local schools and villages and reached 53,466 students (24,070 boys and 29,396 girls) and conveyed key messages on nutrition and hygiene to these children who were caregivers of younger siblings and future parents.
- Conducted “household visioning” exercise to promote cleanliness in homestead environment and gender-balanced allocation of household labor, for 3,189 households (9,486 participants, 69.5% women). Held 162 village fairs events, with participation of 6,287 people (5,030 women, 80%), where model families, who had successfully implemented household visioning, shared their experience with others.

Achievements:

- 213,138 people (51.5% females) consumed more fish at home compared to the baseline.
- 20,915 children under 5 (0-59 months), 48.7% girls, reached with nutrition-sensitive interventions of the project.
- Household environment saw remarkable improvements; prevalence of garbage lying around declined from 90% to 62%, animal feces from 66% to 48%. 73% of the households had soap and water at a handwashing station commonly used by family members.
- Percentage of children under five years-old consuming small fish steadily increased, from 5.1% in March 2017 to 14% in March 2021. This indicated that caretakers prioritized feeding children with small nutritious fish even when its supply was limited in the dry season.
- Complementary feeding of infants in 6-8 months of age with solid or soft food in addition to milk improved in frequency. Caretakers who were feeding food items to the breastfed babies 3 times or more each day increased from 80% in 2018 to 87% in 2021.
- Dietary diversity for children between 6 to 23 months old improved. The percentage of children whose dietary diversity met WHO recommendation increased from 47% in 2018 to 54% in 2021.

Outcome 4: Improved policy environment for future scale-out

Activities:

- Implemented project M&E surveys: the Biological Monitoring surveys (BioM) – 17 times, the Household Fish Catch and Consumption Monitoring surveys (CCM) – 9 times, the Livelihood Surveys – twice, the Knowledge Attitude Practice (KAP) survey on food, nutrition, and WASH – 3 times, CFR Capacity Assessment – 3 times.
- Supported 6 students' thesis research at RFF II sites at Bachelor's and Master's levels, with WorldFish researchers and senior staff of FiA co-supervising them.
- Developed and published:
 - Guidelines and User Manual for Community Fish Refuge-Rice Field Fisheries System Management in Cambodia
 - Integrating Nutrition and Gender into Rice Field Fisheries System: A Practitioner's Guide
 - 4 academic journal articles
 - 10 videos
 - 14 web articles and success stories
 - Contribution to 2 books
- Held or participated in over 20 public events at international and national levels
- Hosted over 30 field missions and study tours of various visitor groups, including the Cambodian government and the US government officials.

Achievements:

- Contributed to the development of: the Fisheries Law, the Agriculture Strategic Development Plan (ASDP), the Strategy on Food Security and Nutrition, the Environment and Natural resource Code, and the Strategic Plan for Fisheries Conservation and Management.

Challenges and Solutions

- **Climate anomalies**—changes in the timing and duration of the rainy season, less-than-usual rainfalls, hotter-than-usual dry season, resulted in drought conditions and widespread water shortages in 2019 and 2020. The reduction in CFR water levels meant lower survival rate for the fish in CFR and competition among various water users. The project team identified CFRs vulnerable to drought and developed a drought response plan for each of these CFRs in collaboration with the CFR committees and local authorities to prepare them for the upcoming dry season.
- **Irrigation and road infrastructure development** changed water flow patterns in floodplains and created physical barriers to fish migration, and blocked connectivity among rice field habitats. In response, the project supported earthworks to improve channels and canals connecting CFRs to surrounding rice field fisheries and advised the CFR committees about how to negotiate with relevant stakeholders to secure water flows and rice field connectivity. WorldFish scientists also advised the relevant government agencies and donors investing in irrigation infrastructure development on “fish-friendly” practices.
- **COVID-19 Pandemic** presented the biggest obstacle to the project activities in 2020 and 2021, restricting travels and large gatherings of people. Several project activities, including community events and field visits, were postponed or cancelled. The project team was eventually able to resume some field activities by adjusting the approaches for delivering training sessions, including smaller groups of people to allow physical distancing, and conducting virtual training or coaching via video calls

Lessons Learned

- Importance of strengthening local capacity and community engagement in CFR and rice field fisheries management.
- Importance of site-specific, tailored strategies for physical and environmental improvement and management of CFRs.
- Need for systematic mechanisms to provide sustained financial resources and technical support for CFRs.
- Need for integration of CFR management into land and water development planning at district and provincial scales.

Conclusion and Recommendations

- CFRs were proven an effective strategy to sustain rice field fisheries for local communities as a source of household income and nutritious fish for children in the Tonle Sap region of Cambodia. Further scale-out of the CFR management guidelines to other provinces would help enhance the livelihoods of rural communities and their resilience to negative impacts of climate change.
- Building the capacity of CFR committees, consisting of local village volunteers, was the most important factor in improving the management and institutional sustainability of CFRs. Systematic mechanisms are needed to provide sustained financial resources and technical support for CFRs.
- The SBCC of the project achieved positive behavioral changes in the cleanliness of the household environment, hygienic food preparation, and clean drinking water among

the beneficiary households. On the other hand, it was difficult to improve the dietary diversity of women in reproductive age. Further support on technologies and practices to improve food production/availability in the homestead and local environment can improve dietary habits of women.

- Rice field fisheries and CFRs are threatened by intensification of rice cultivation and infrastructure development. In order for CFR to remain viable as a strategy for fish conservation, it is critical that CFR management is integrated into district and provincial level development planning processes.
- Building on successful experiences of the RFF II, CFR approach of multi-purpose use of water should be scaled-out and expanded to other rice-fish and aquatic food systems, including rice-fish culture and aquaculture. Further research of the link between climate change and aquatic food systems, and how this system contributed to the livelihood of people, nutrition, food security and climate change mitigation and adaptation, is also needed.

INTRODUCTION

Rice field environment supports a diverse ecosystem of aquatic flora and fauna that rapidly expands across flooded rice fields during the onset of the rains, and provides a “free” nutritious food source for many rural poor. Almost a quarter of inland fish production in Cambodia comes from Rice Field Fisheries (RFFs), representing a total supply of around 158,700 tons (Fisheries Administration 2017). This important natural resource is under threat from overfishing and environmental degradation, and it can only be sustained if properly managed.

The Cambodian Fisheries Administration (FiA) is in the process of establishing 1,200 Community Fish Refuges (CFRs) throughout Cambodia, in order to protect and enhance the productivity of RFFs. A total of 884 CFRs had been designated as of 2019. The CFRs are demarcated bodies of water or parts of bodies of water where fishing is prohibited and where communities apply various management measures to improve fisheries production and enhance biodiversity. During the wet season, fish and other aquatic animals (OAAs) can migrate from the CFRs to rice fields and associated habitats where they may then be harvested by community members. The RFF system includes the CFRs, fish migration paths (natural or constructed channels) as well as rice fields and associated habitats (such as patches of swamp, small watercourses and ponds) all of which are mainly seasonal.

With the financial support of USAID, WorldFish implemented the Rice Field Fisheries Enhancement Project (RFF Phase I) and improved the management of 40 CFRs in the four Feed the Future target provinces in the Tonle Sap region between 2012 and 2016. With the project support local CFR Committees implemented site-specific interventions to enhance natural rice field fisheries' productivity. WorldFish and Fisheries Administration of Cambodia MAFF developed best practice guidelines covering both technical and institutional aspects of CFR development and implementation. A follow-on project (RFF Phase II) was designed, building on the achievements and the lessons learned during Phase I, to scale out the best practices in CFR management in order to improve food and nutrition security for the poor and to build community resilience to the impact of climate change.

Feed the Future Cambodia Rice Field Fisheries II (RFF II) aimed to improved food and nutritional security of poor and vulnerable rural households in the Tonle Sap floodplain region in Cambodia, through enhancing the rice field fisheries and associated food production systems. The program objective was also to integrate rice field fisheries systems with more efficient and equitable use of water in CFRs for increased productivity and availability of nutritious food crops, including vegetables and other aquatic animals (OAA). WorldFish led the program implementation in the four Feed the Future target provinces in the Tonle Sap region—Siem Reap, Kampong Thom, Pursat, and Battambang—in collaboration with local partners: Akphivath Neary Khmer Organization (ANKO), Cambodia Organization for Women Support (COWS), Trailblazer Cambodia Organization (TCO), Village Support Group (VSG), Teuk Saat 1001, and Fisheries Administration (FiA). The project also carried out synergetic activities with other USAID-funded projects, including NOURISH /Save the Children, Feed the Future Innovation Labs, and Nutrient-Rich Vegetable Project/AVRDC.

PROJECT APPROACH

In order to achieve the stated goals and objectives, project applied three main approaches as described below:

1. Scaling up the sustainable CFR management approach, tested and refined through RFF Phase I, to new locations in suitable rice field fisheries environments;
2. Developing and validating a multi-purpose use and governance model for water in CFRs, by integrating the fish refuge function of CFR with other food production and livelihood diversification activities; and
3. Enhancing nutritional outcome of increased fish and other food production through awareness raising, education and behavior change among household members about the importance of fish and dietary diversity for health and child growth and development, and appropriate food preparation, safe drinking water, hygiene and sanitation.

The first approach involved specific field interventions to enhance the biological and ecological productivity of rice field fisheries through improving biophysical conditions of CFRs. The interventions improved water storage capacity and water retention of the CFRs and their conditions as dry season refuges for native fish species of various sizes and habitat requirements. We also implemented a series of awareness raising and training events to increase the capacity of local communities to sustainably manage CFRs, apply best management practices in CFRs, and also become financially independent as community institutions.

In the second approach, the project supported the local communities to adopt practices that would increase economic benefit of CFR through multiple use of water, and community resilience to climate-related shocks, such as extreme flooding and prolonged droughts. These included home gardening of vegetables with low chemical inputs, homestead pond aquaculture of nutrient-rich small indigenous fish species (SIS), and commercial safe drinking water stations owned and managed by the communities. The project also supported the local communities to establish mechanisms for water user conflict resolution and disaster preparedness during severe drought years.

The third approach consisted of developing and implementing Social Behavior Change and Communication Strategy (SBCC) on healthy and nutritious diet and WASH. The project carried out awareness raising events and training at both community and household levels, including household visioning exercise for the household members to identify priorities in cleaning homestead environment and agree on gender-balanced allocation of tasks and responsibilities.

Additionally, the project worked with different level of the Cambodian government to create policy environment that is supportive of the integrated approaches of the project in improving RFF environment and its management at the community level: FiA at the national level; various technical line agencies at the provincial level; district government, Commune Councils, and village committees and working groups at the local level. The project also collaborated with local schools, health centers, and pagodas.

The project infographic represents the integrated approach of the project and is available at the project [web page](#).

PROJECT INTERVENTIONS AND ACHIEVEMENTS

a) Interventions during the period April – September, 2021

The project was extended by 3 months, from June 9th to September 9th, 2021, in order to accommodate final project closure activities that had been postponed due to the government restriction of public events and large gatherings associated with COVID-19. Below are the major activities during this period:

- The project closure meetings at communities were held in May 2021.
- Handover of the 12 water kiosks to the local communities was done in August 2021.
- The project closure workshop was held online on September 15, 2021.

Further details on other activities implemented during this period are in the RFFII Workplan and Update for April – September 2021.

b) Project Outputs and Outcomes

- **365,045 people gained improved economic benefits derived from sustainable rice field fisheries management**, 23.3% higher than the LOP target (296,100).
- **43% of women in reproductive age** who were direct beneficiaries of the project were found to have **consumed a diet of minimum diversity**, lower than the LOP target of 60%. This was likely due to reduced income to purchase food resulting from COVID-19.
- **13,858 people received short-term agricultural sector productivity or food security training**, more than doubling the LOP target of 6400.

OUTCOME 1: INCREASED PRODUCTIVITY IN RICE FIELD FISHERIES

- The total **productivity of rice field fisheries in ZOI increased by 5 kg**, from 64 (kg/ha/year) in 2017 to 69 (kg/ha/year) in 2020. Although the increase was below the life of project (LOP) target of 50 (kg/ha/year), we consider this a positive outcome overall after two consecutive years of severe drought in 2019 and 2020.
- Of the 55 CFRs where the biological monitoring was conducted, **80%, or 44 CFRs had higher biomass of fish** during at least one of the survey occasions in the endline year compared to the survey results of same months in the baseline year (75% is the LOP target).
- **481 hectares in areas of CFRs and rice field environment are under improved biophysical conditions** as a result of the project interventions, exceeding the LOP target by 6 hectares.

Output 1.1: Increased capacity of communities to sustainably manage CFRs

Supporting new CFRs and developing their action plans

The project identified and **supported a total of 140 CFRs in the 4 target provinces**, including 35 CFRs supported during the Phase I, and 53 newly-registered CFRs. The site selection took several steps. First the CFR selection criteria was developed and agreed to by WorldFish, partner NGOs, and two relevant departments within the FiA headquarters, namely the Department of Aquaculture Development (DAD) and the Department of Community Fishery Development (CFDD), and the FiA Cantonment (FiAC) offices in the 4 target provinces. The criteria covered the physical aspects of the site, social issues surrounding the site, and legal and institutional support for the implementation of the sites (**Box 1**).

Second, the site selection team, consisting of WorldFish, PNGOs, and FiAC staff, used these selection criteria to identify candidate sites among those CFRs that had already been registered with FiAC in the 4 target provinces. Then the team went to the candidate sites and gathered information through focus group discussion with local authorities, community representatives and civil society organizations (CSOs) working in the area. Initially the project team was not able to identify sufficient number of CFRs to meet the project target of 140. Thus, the site selection team went on to identify new sites suitable for designation as CFR and supported the registration of these new sites (47 sites) in 2016, reaching a total of 134 sites. The commitment of the local communities to improve

Box 1. CFR site selection criteria

- **Physical aspects**
 - Site in which the CFR had not dried up during dry season over the past five years
 - Low density of aquatic plants or high density of aquatic plants with possibility of improvement
 - There is an established connection or potential for the development of a connection between CFR and rice fields
- **Social aspects**
 - The selected site will benefit the poor and households (HH) living in the zone of influence (ZOI) (more than 60% of HHs in ZOI do fishing in rice fields)
 - Fishing in rice fields is accessible to all and not only to the land owner
 - Commitment of participation from the community and other stakeholders in the area in rice field fisheries management
- **Legal aspects**
 - There is no conflict or potential conflict surrounding land ownership and use
 - There is no potential conflict surrounding water usage
 - There is recognition from relevant authorities to designate the site as CFR (FiAC, local authorities and community people)
- **Institutional aspects**
 - The local authorities and FiAC agree to and support the development of a CFR committee and commit to participate in project implementation
 - There is already a community organization (CFR committee) in place or there is potential for the establishment of a CFR committee and future function

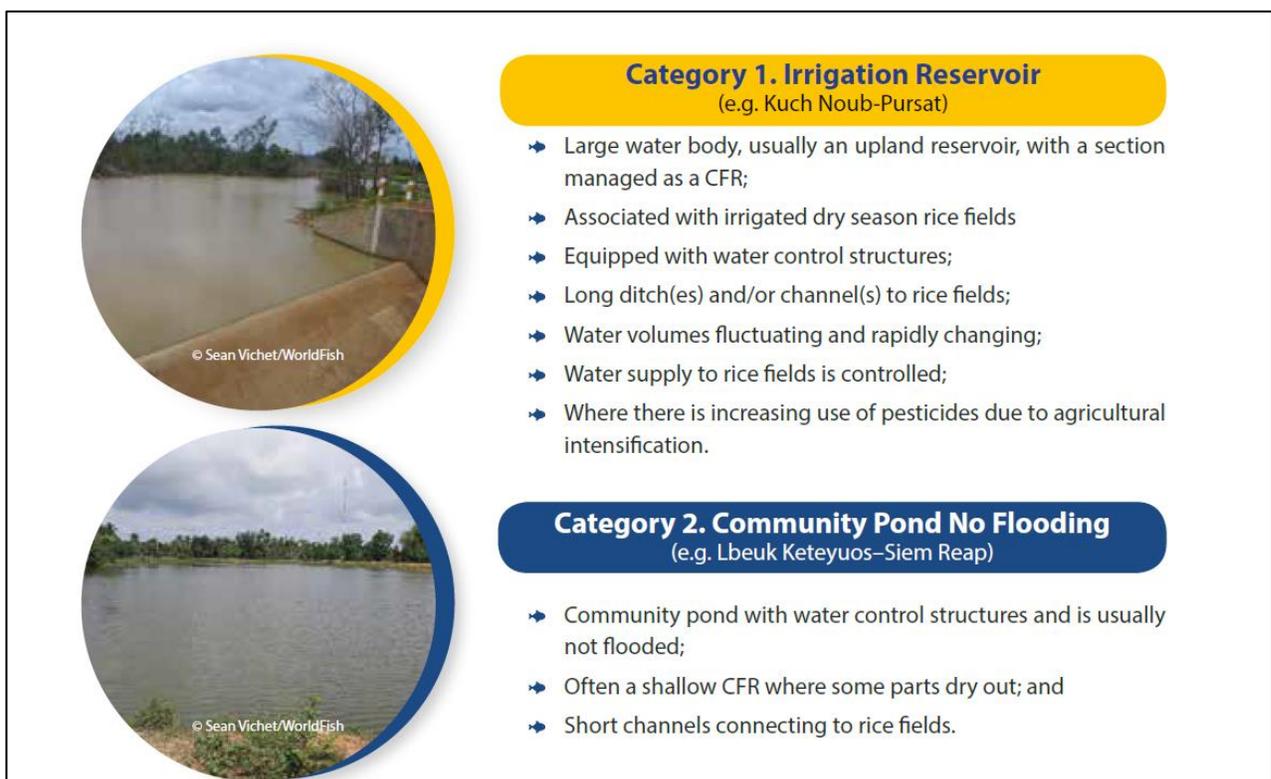


Figure 1. CFR Categories 1&2

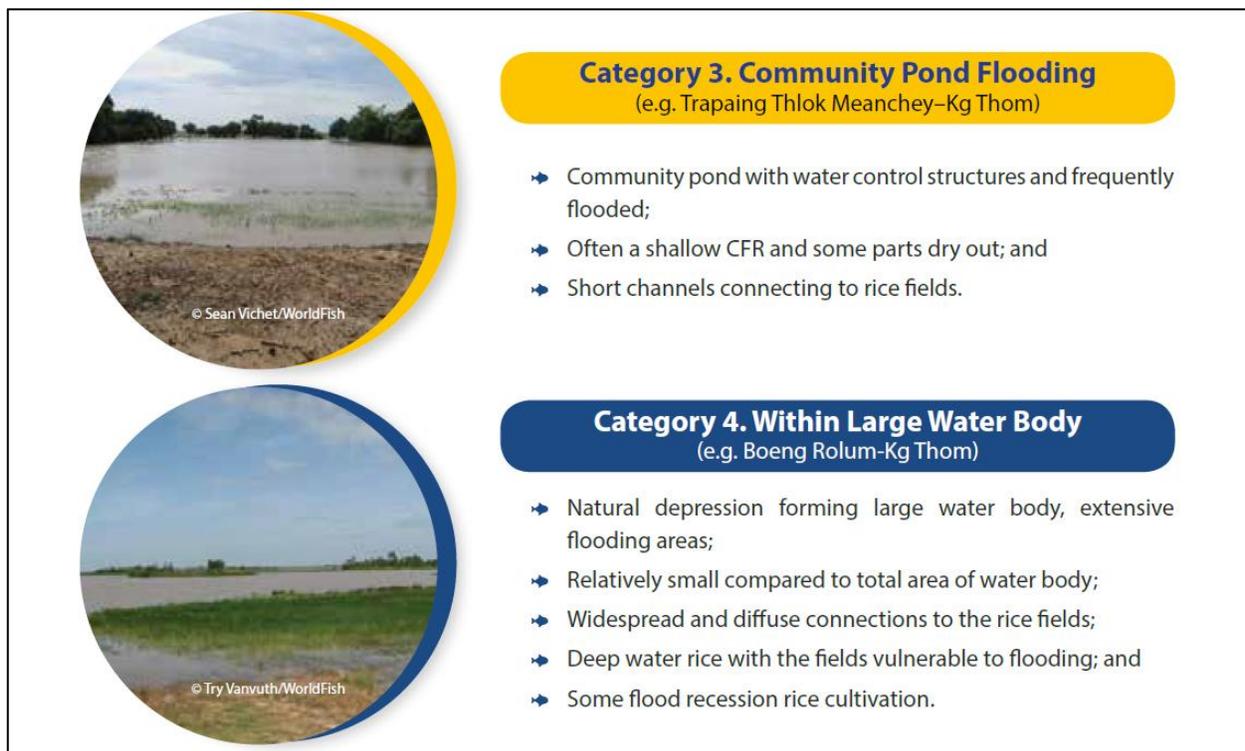


Figure 2. CFR Categories 3&4

the management of CFRs according to the project guidance was essential in making the final site selection. In 2018, the project was able to register 6 additional sites as CFRs because more communities became interested in establishing CFR within their villages, having seen the success of some neighboring villages with CFRs supported by RFF II. The total number of CFRs supported by RFF II finally reached the original target of 140.

Four categories of water bodies were selected as CFRs (**Figure 1** and **Figure 2**):

- Category 1. Irrigation reservoirs
- Category 2. Community ponds with no flooding
- Category 3. Community ponds with flooding
- Category 4. Within large water bodies

All project-supported CFRs revised respective by-laws which were then approved by the relevant government authorities at the provincial level. The CFRs also developed and revised annual action plans and monitored and reflected on the progress of implementation annually. Cumulatively the project supported **the development of 453 annual management plans** with the participation of 5,191 community representatives (1,877 women, 36%).

Awareness raising and training of local communities and other stakeholders

The project team and partners conducted over 1,000 awareness raising and training events at local schools and in villages, including refresher training, covering such topics as the importance of RFF/CFR, how to enhance the productivity and manage RFF, the principles of good governance of CFR, Fisheries Law, reaching the cumulative **79,504 participants (45,003 women, 56.6%)**. This output was 800% higher than the original LOP target. The attendance was substantially boosted by a few changes to the project's awareness raising strategy: 1) holding community events in the evenings when more community members, especially women, were

able to attend; 2) School awareness raising programs with school principals and administrators encouraging attendance in the events.

Pre- and post-evaluation of the trainees on CFR management across the four provinces (see **Figure 3**) showed that the participants increased their average score dramatically, by 70% in Battambang to 211% in Pursat, demonstrating strong improvements in their knowledge on these topics after the training.

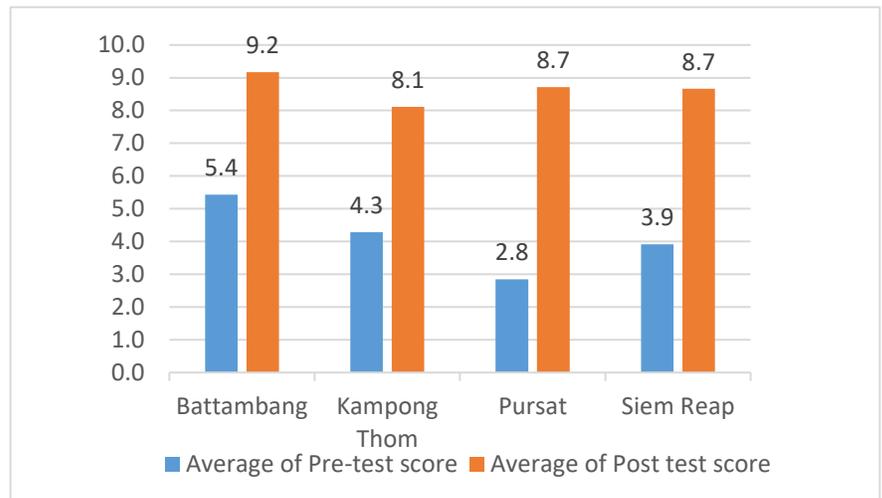


Figure 3. Participant knowledge on CFR management

Building capacity of CFR committees

The project team provided continuous backstopping and follow up to the CFR committee members and commune and village leaders throughout the project period, regularly visiting the sites and facilitating community meetings, especially prior to annual reflection workshops. Five elements of good governance were promoted in the capacity building (Kim and Brooks 2015¹, see **Box 2**) and were used as indicators for scoring the governance capacity of each CFR during the annual reflection and assessments. The regular and consistent support was critical in building the capacity of the CFR management committee members to sustain CFR management independently. The governance capacity assessment of 140 CFR committees, conducted 3 times during the project period, showed significant improvement in the average score in the organizational capacity of the committees, from 1.9 the baseline assessment in 2016

Box 2. Characteristics of Good Governance of CFR

Organizational management: committee has held regular meetings, developed bylaws, and defined roles and communication among executive members.

Planning and implementation: committee has developed and implemented priority action plans, monitored the progress, and were able to resolve problems and conflicts.

Resource mobilization: committee has collected funds from various sources, used the funds through transparent and participatory decision-making processes, and kept records of transactions.

Linkages and networking: committee has a good relationship with local authorities, Fisheries Administration, NGOs, other civil society organizations, and private sector. Some items in CFR action plans have been integrated into commune investment plans and received support from various local stakeholders. The committee members attend commune council meetings.

Representation and participation: committee members represent both women and men and are from different locations in the community. All has actively participated in planning, decision-making, and implementation of the action plans.

to 4.2 in the endline assessment in 2021 (See Section: *Monitoring and Evaluation* for more detailed results).

¹ Kim, M. and Brooks, A. 2015. Good governance of rice field fishery management. Penang, Malaysia: WorldFish. Program Brief: 2015-19.

Output 1.2: Increased application of sustainable management practices in CFRs

Implementation of improved CFR management practices

The project-supported CFR committees **implemented over 2,000 interventions** of various types and scope to improve the physical conditions of the CFRs and to facilitate conservation and the management of CFRs over the project period of 5 years (see Error! Reference source not found.). Key achievements were as below:

- Deepening the part of CFRs to improve water storage and retention: 148 times, removing a total soil volume of 1,162,286 M³
- Expanding the size of CFRs to improve water storage and retention: 17 CFRs, removing a total soil volume of 483,747 M³
- Installing or improving water inlet/outlet to improve connectivity with rice fields: 118 CFRs, 158 times
- Installing dams/spillways to improve connectivity with rice fields: 41 CFRs, 45 times
- Removal of excessive aquatic plants to improve water retention and quality: 361 times, cumulative area of 91.9 hectares
- Installed *samrah* or tree trunks in the ponds for small and juvenile fish: 263 times, cumulative area of 3.5 hectares
- Planted tree seedlings and plants to recover desirable aquatic vegetation and tree shades around the water bodies: 326 times, a total of 20,338 tree seedlings
- Released broodfish of native species to help the stock recovery of desirable species: 84 CFRs, a total 1.3 metric tons of fish
- Installed and/or repaired fence to keep cattle from entering into the refuges: 95 CFRs, a total 22km of fence
- Constructed/renovated canals to improve connectivity between CFR and rice fields: 79 CFRs, total canal length of 70km
- Cement/wooden poles to mark the boundaries of conserved rice field areas and CFRs: 72 CFRs, total of 921 poles

Table 1. Cumulative number of CFR interventions (2017-2021)

Dam on outflow/spillway of CFR	# CFR	41
	# dam/dike	45
Install or improve water outlet and inlet	# of CFR	118
	# of outlet/inlet	158
Water gate	# of CFR	11
	# of water-gate	12
Deepening part of CFR	# of CFR	148
	m3	1,162,286
Expand CFR	# of CFR	17
	m3	483,747
Control/remove aquatic-plant/weeds in CFR	# of CFR	361
	m2	919,021
Install samrahs in CFR	# of CFR	229
	m2	33,273
Install trunk in CFR	# of CFR	34
	# of trunk	2,068
Plant flooded forest around/in CFR	# of CFR	100
	# of tree	8,789
Plant aquatic plants in CFR	# of CFR	58
	m2	6,853
Plant tree on CFR bank	# of CFR	168
	# of tree	11,549
Stock fingerling fish in CFR ²	# of CFR	73
	# fingerling	192,313
Stock broodfish in CFR ³	# of CFR	84
	kg	1,283
Fencing around CFR to prevent buffalo or cow	# of CFR	95
	m of fence	22,021
Install CFR sign boards	# of CFR	144
	# of signboard	224
Install guarding house	# of CFR	78
	# of guard house	78
Support patrolling boat	# of CFR	32
	# of boat	32
Provide patrolling material- lights, etc.	# of CFR	129
Install water level measurement pole in CFR	# of CFR	109
Construct/renovate canals to improve connectivity between CFR and RF	# of CFR	79
	meter	69,997
Install rice field refuge (ponds)	# of CFR	71
	# of RF pond	436
Install rice field refuge (concrete rings)	# of CFR	1
	# of RF ring	2
Install rice field sign board	# of CFR	1
	# of signboard	3
Install cement poles for marking CFR and conservation boundary	# of CFRs	40
	# of pole	330
Install wooden poles for marking CFR and conservation boundary	# of CFRs	32
	# of pole	591

² Only the wild fingerlings of native fish species sourced from local rice fields were stocked into CFRs, as instructed by FiA, and were generally donated by local fishers.

³ Only the wild fish of native species sourced from local rice fields were stocked into CFRs. as instructed by FiA, and were generally donated by local fishers.

In addition to the interventions directly supported by the project, **a total of 4,218 CFR activities were either directly supported by local stakeholders or self-financed by the communities** using the funds raised by themselves, with backstopping from the project (see **Box 3** for an example). The number of activities in CFR action plans supported by other stakeholders are listed below:

- 1,073 integrated into Commune Investment Plans (CIPs), administered by Commune Councils
- 132 supported by Commune Councils
- 121 supported by other NGOs and donor projects
- 64 supported by the government line departments
- 218 supported by companies, Buddhist monks, private individuals
- 2,610 supported by CFR members or CFRs' own funds

The project-supported **CFRs raised own funds of a total USD 302,915** from individual donations and fundraising events to finance CFR improvements. These achievements are strong indication that the project-supported CFR committees will be able to continue implementing the best practices in CFR management with locally-available financial and in-kind, after the life of RFF II.

Box 3. Co-financing CFR earthworks

The management committee of *Boeng Laork* CFR in Kampong Thom province, a newly established in 2018, successfully completed earthworks to expand their CFR's water storage capacity, and improve the connectivity with rice fields through the installation of two inlets/outlets. These activities received substantial financial contributions from the local Commune Council and a project of United Nations Development Program (UNDP). With support from RFF II team, the CFR committee requested and secured funding of US\$5,850 (23.4 million Riel) from the Commune Investment Funds and US\$11,700 (46.8 million Riels) from the UNDP's Strengthening Resilient Livelihood (SRL) project. This is just one example of numerous other CFR activities implemented with financial contribution from the local government budgets and is a strong indication that the CFR management activities will continue to be implemented after the life of RFF II at these locations.



A CFR expanded with Commune support.

OUTCOME 2: INCREASED ECONOMIC BENEFIT AND COMMUNITY RESILIENCE THROUGH MULTI-PURPOSE USE OF CFR WATER

- Average **quantity of fish caught (kg/household/year) declined by 8%**, from 221kg in 2017 to 203kg in 2021. This was likely because the entire country was **negatively affected by two consecutive years of drought in 2019-2020**. (The original LOP target was 230kg). The percentage of decline was relatively small considering the magnitude of drought.
- Despite the decline in the quantity of fish catch, the **quality and the value of the fish seems to have increased. Average value of fish caught (\$/household/year) increased by 70%** from \$303 in 2017 to \$516 in 2021, and was 50% higher than the LOP target of \$345.
- Average **quantity of fish sold (kg/household/year) increased by 80%**, from 161kg in 2017 to 289kg in 2021, indicating that many households were able to gain extra catch to sell.
- **Average cash income from selling the fish (\$/household/year) increased by 232%**, from \$221 in 2017 to \$734 in 2021. This indicate that the **households were able to catch and sell fish that are not only in higher volume but also of high value.**

- 31,363 people (417% of the LOP target) were directly supported by the project to adapt to the effects of climate change through a household member receiving training in CFR management and CFR water use.
- **120,483 people** (200% of the LOP target) **and 101 institutions – including schools and health centers – have gained access to basic drinking water services** thanks to the 12 project drinking water stations.

Output 2.1 Increased capacity of communities to adapt to climate change through access to CFR water in dry season

Facilitating benefit-sharing and conflict resolution in CFR water management

The project supported development and/or revision of community by-laws of the 140 CFRs to clarify rules and regulations with regards to the management of rice field environment, CFR, and water. The 140 by-laws were approved by the relevant provincial authorities. The process also involved clarifying benefit-sharing and conflict resolution mechanisms when water allocation issues arose. The entire Mekong region experienced a shorter-than-usual rainy season with less rainfall in 2018 and 2019, resulting in water shortage in Cambodia during the following dry seasons of 2019 and 2020. The project team conducted a review of 8 CFRs that experienced water shortages in the dry season of 2019 and identified mitigation measures (**Box 4**). Then the team monitored the water levels in all CFRs and prepared drought response / mitigation plans before the next dry season started in January 2020. Eighteen project-supported CFRs were identified as vulnerable to water shortages, some at risk of complete dry-out by the next rainy season in May 2020. The mitigation measures included:

- expanding CFR water storage capacities, including by constructing or improving dams and canals
- removing excess aquatic plants in order to reduce water evaporation from CFR
- restricting the quantity/frequency of water withdrawal from CFR for domestic uses
- prohibiting water withdrawal from CFR for commercial purpose other than for authorized drinking water station
- negotiating with heavy water users for reduction of water withdrawal from CFR for irrigated rice cultivation

CFR infrastructure as well as the institutional mechanism for resolving water allocation issues turned out to be useful when Cambodia also experienced extreme flood event in mid-October 2020. The flood affected all 4 provinces

Box 4. Drought risk assessment and mitigation measures

The Cambodian Ministry of Water Resources and Meteorology published a drought warning during the dry season in 2019, due to the impact of El Niño, and anticipated delay the commencement of the rainy season until the late May. In anticipation of water shortages in some CFRs, especially those supplying water for water kiosks, RFF II commissioned a review of 8 CFRs to a consultant specialized in drinking water supply. The consultant conducted basic water budget analysis of each of the selected CFRs, estimated the risk of dry-out of the water bodies, and recommended mitigation measures, including the identification of alternative sources of water as backup plan, improve the water storage and retention capacity of CFR, and improve the accuracy of the water budget data and manage the withdrawal accordingly.



People in karts lined up to take water from Anlous Dong CFR, Battambang Province, March 2019.

supported by the project, especially Pursat and Battambang, and resulted in physical damages to a total of 31 CFRs (10 CFRs in Kampong Thom, 10 CFRs in Pursat and 11 CFRs in Battambang). However, this natural disaster demonstrated additional benefit of CFRs in climate adaptation: absorbing excess flood water from surrounding rice fields and residential areas. CFR committees were instrumental within the respective communities in coordinating flood relief and recovery efforts, such as repairing irrigation dams, dikes, rural roads, and water inlets/outlets.

Supporting multi-purpose CFR model for food production

The project supported a range of activities at household and community levels to diversify economic benefit of CFR through multiple use of water.

- **Small indigenous fish species (SIS) polyculture** in rice field refuge ponds. To take advantage of the water remaining in small refuge ponds in the rice fields at the beginning of dry season, the project team provided technical support to households that volunteered to test innovative aquaculture method to supplement income and home consumption of fish: simultaneous culture of commercial carp species and small wild fish stocked from surrounding rice fields. In 2018, a total of **9 households participated in the demonstration plots** of this method. While the participants were happy with the benefits of this activity, not many other households were interested in adopting this method in their own rice field ponds. Based on the result from the demonstration plots, most households thought that the income gained from selling the farmed fish was not satisfactory for the time and labor it took to raise the fish. By 2019, the project stopped recruiting additional households to participate in this activity.

- **Commercial production of nutrient-rich SIS fish powder.** In order to add value to the surplus harvest of SIS from rice fields and ponds, the project supported the development in fish products and recipes, that could:

1) retain high micro-nutrient contents of SIS after cooking; 2) extend the shelf life of SIS by several months when SIS is not available in the wild, and; 3) were easily prepared and consumed by women in reproductive age and small children. NOURISH had developed a program to train and support small-scale enterprises to produce and commercially market fish powder products made with SIS. In August 2018, RFF II facilitated for 16 aspiring business women among the project beneficiaries to participate in the NOURISH training course to learn how to produce fish powder using SIS and sell the professionally-packaged products at a commercial scale. Of the 16 women who received the training, 2 in Kampong Thom



Box 5. A rice farmer couple is running a side business selling nutritious fish powder made from rice field fish in the local community with the project support.

province continued to run successful small fish powder production businesses and sold 10 to 140 containers of nutrient-rich small fish powder per month in 2021. The main reasons behind their successful business seemed to be quite localized; the availability of SIS as raw material at low cost throughout the year, and the high consumer demand, including tourists visiting the Sambor Prey Kuk temple, designated as a UNESCO World Heritage site.

- Vegetable gardening in homestead and CFR banks.** To derive additional benefit of the water stored in CFRs and rice field ponds during dry season, the project promoted the CFR committees and neighboring households to grow nutritious vegetables in home gardens and on the banks of CFRs to supplement income and for home consumption. The project staff provided training to participating households on improved vegetable gardening techniques, including the use of water from CFRs and rice field ponds, water saving techniques, weed control, insect and pest management, installing trellis, cropping and composting to make organic fertilizer. The project supported **a total of 78 demonstration plots**, including 23 gardens on CFR banks, and 55 homestead gardens. The number of plots **exceeded the original target by 40%** because this activity turned out to be very successful and popular among the beneficiary households. **Table 2** shows basic cost and benefit of the home garden of 643 beneficiary households, showing an average household net income of \$38.83 per one production cycle of 90 days.

Table 2. Basic cost-benefit analysis of home vegetable gardens (n = 643, 1 cycle = 90 days)

No	Items of expenditure	Total
1	Vegetable seeds	\$4.57
2	String, trellis, water can, net	\$15
3	Labor	\$12.12
<i>Total expenditure for home gardening</i>		\$31.69
No	Gross Income	
1	Vegetables sold	\$50.66
2	Vegetables given out or home consumed	\$19.86
<i>Total income from home gardening</i>		\$70.52
No	Net Income	
<i>Net Income from home gardening</i>		\$38.83

Hundred and fifty-five training events were held to scale out the improved vegetable farming techniques, with **participation of 1,178 people** (805 women, 68%). In addition, the project organized field days, village events where other farmers visited demonstration plots and learned from model farmers. A total of 43 field day events were held, with participation of 1,725 people (1,005 women, 58%). **Table 3** summarizes the outcomes of the project support on home gardening of vegetables, based on a household survey. The percentage of households continuing to grow vegetables in their home gardens in the survey period of Nov. 2020 and Mar. 2021 (dry season) was 76.2%. More than half of the households reported that vegetables were available for home consumption from home garden in 6 months or more in the previous year. Forty five percent of the households reported selling the vegetables for cash income, and 82.3% were planning for a next crop cycle. These **outcomes indicate the home gardening was very successful and was widely adopted by the project beneficiaries**; however, the results also show the limited success in Siem Reap and Battambang where the households faced challenge in water access during the previous year.

The support for vegetable gardens on CFR banks created an incentive for CFR committee members who took on guard duties and stayed next to the refuge overnight. They were allowed to harvest the vegetables and sell or use for own home consumption. The home gardening extended the benefits of CFR to households who were not involved in fishing nor CFR management directly; thus helped gain their acceptance of and support for the CFR management.

Table 3. Home vegetable garden outcomes

	Number of surveyed HH	Growing vegetables	Products available in 6-12 months	Sold	Planting next cycle
K. Thom	256	90.6	90.5	62.9	89.8
Siem Reap	259	48.6	4.8	32.4	82.6
Battambang	204	86.8	15.3	45.1	85.1
Pursat	221	81.9	66.3	39.4	69.6
Total	940	76.2	50.7	45.1	82.3

Output 2.2: Increased access to safer drinking water from CFR in dry season

Establishing safe drinking water stations managed by local communities

Based on careful assessment of local needs and feasibility, the project **established 12 drinking water filtration plants** (called water kiosks) that uses water from CFR water bodies in the 4 target provinces (3 in Siem Reap, 3 in Kampong Thom, 5 in Pursat, and 1 in Battambang) and are **owned and managed by the local communities as social enterprise (Box 6)**. The main rationale behind this activity was to increase access to safe and affordable drinking water to the project beneficiaries, many of whom previously used untreated water from CFR for drinking during dry season putting themselves at risk of water-borne diseases.



Box 6. A completed safe drinking water kiosk in Boeng Romlech, Pursat province.

The project team considered several options for providing water purification technology to the communities, including *Bio-Sand* filters for individual households and large-scale Slow Sand Filtration Systems that could supply water for 100 households. In the end the decision was made to establish commercial water stations to produce bottled drinking water with full-fledged water purification system using more advanced filtration and UV disinfection technology, with a strong desire and commitment of the local communities to extend access to high-quality drinking water.

Having reviewed candidates for partnering on this activity, in 2017 the project selected *Teuk Saat 1001* a social enterprise that had been operating a franchise of over 200 commercial water kiosks in several provinces in Cambodia selling water under a brand name *O-we*⁴. The company shared the same values and objectives as our project: providing safe drinking water at affordable cost to as many people as possible. The company also implemented programs to distribute safe drinking water to schools for free. The timing of collaboration was perfect as the company was also in process of expanding its network of franchisees. This activity was rolled out gradually due to the complexity in preparation and gaining support from local authorities. The first 5 water kiosks in Pursat became operational in 2018 and 7 more kiosks became operational in 2019.

The project staff regularly visited all 12 CFRs that have established water kiosk with the project support, to continue supporting the water station operations and ensure EMMP compliance. In addition, *Teuk Saat 1001*, the project partner, conducted monthly water quality inspection at

⁴ <https://www.teuksaat1001.com/>

these water stations to ensure that the bottled water meets the company's strict quality standards.

Sales performance and business viability of drinking water stations

Between June 2018 and February 2021, 12 project-supported safe drinking water stations in the four provinces sold a total 755,706 bottles of water (20 liter each), including those bought back by Teuk Saat 1001 for its water bottle donation to schools. On average each operating kiosk sold 1,773 bottles per month in Year 1 (June 2018 – May 2019), which increased to 2,167 per month in Year 2 (June 2019-May 2020). The sales remained stable in Year 3 (June 2020 – May 2021) at 2,240 per month, despite temporary closure of some water kiosks due to management issues, and suspension of water bottle distribution due to COVID-19-related school closures from April to August 2020, December 2020, and April to May 2021 (see Error! Reference source not found. – excluding the months when some kiosks suspended operation⁵). The steady increase in the sales of water, even during the rainy season, reflect the change in local community behavior towards purchasing properly treated drinking water rather than relying on free but untreated rain water or pond water for drinking.

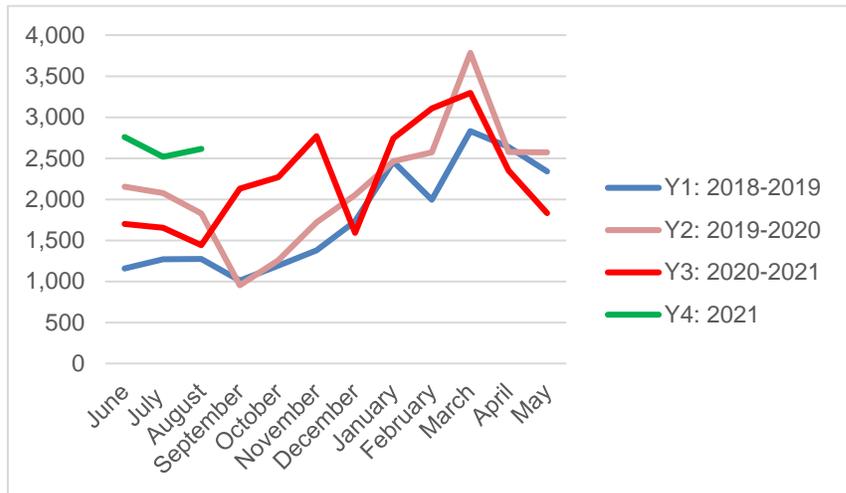


Figure 4. Average water bottle sold per kiosk

Teuk Saat 1001 typically allows 18 months for a water kiosk to become fully self-sufficient as a business enterprise. Based on average sales figures in twelve-month period from June 2018 to May 2019 (Year 1), 2 (17%) out of the 12 stations were classified as Tier 1 (profitable), 1 (8%) was Tier 2 (breakeven point), and 9 (75%) were Tier 3 (selling less bottles than needed to breakeven)⁶. In June 2019 to May 2020 (Year 2), the performance significantly improved: 4 (33%) out of the 12 stations were in Tier 1, 2 (17%) was Tier 2, and 6 (50%) were Tier 3. In Year 3, the performance improved even more: 4 (33%) in Tier 1, 5 (42%) was Tier 2, and 3 (25%) were Tier 3 (Table 4 Table 4). Despite the school closures in 2020 and 2021, the bottled water sales continued to grow in the project-supported water kiosks. As Figure 4 shows, Year 4 started out with the highest sales figures for those months compared to previous years, with schools being fully open.

All 12 project-supported water kiosks reached Tier 1 level sales performance (selling 2,550 bottles/month) in some months within less than 2 years from their launch. This means that the bottle sales by relatively weaker kiosks can be expected to rise again when constraints are removed. In fact, 83 percent of the water kiosks were found financially viable even during the rainy season of 2021 (June – August 2021). Seven stations were classified as Tier 1, 3 were classified as Tier 2, and only 2 stations were classified as Tier 3. This is a very encouraging result

⁵ The sudden decline in the December 2020 sales was caused by COVID-19-related school closures. The general sales of water bottles remained high.

⁶ For the purpose of monitoring, Teuk Saat 1001 defines business performance of water kiosks as following: Tier 1 station - when the sale volume is greater than 1,700 liters or 85 bottles per day; Tier 2 station - when the sale volume is between 1,500 to 1,700 liters, or between 75 to 85 bottles per day; and Tier 3 station - when the sale volume is below 1,500 liters, or 75 bottles per day.

for the project-supported kiosks and a perfect timing for full handover of these facilities to the local communities.

Table 4. Sales performance of water kiosks

	Y1 (Jun 2018 – May 2019)	Y2 (Jun 2019 - May 2020)	Y3 (Jun 2020 – May 2021)
Tier 1 (profitable)	2	4	4
Tier 2 (breakeven)	1	2	5
Tier 3 (low sales)	9	6	3
Average monthly sales	1,773	2,167	2,240

Handover of water kiosks: the project-supported water kiosks have been in operation for almost 3 years since June 2018, and were ready for a handover of full management responsibilities to the local communities. Originally, workshops had been scheduled in February and March 2021 at each of the 12 water kiosks to share experiences and plan for the handover of the management to the local committee. However, due to the February 20 community outbreak of COVID-19, these workshops were eventually cancelled due to the restriction on large gatherings still effective as of the end of the project. In August, the management of water kiosks and the associated assets were handed over from the project to the respective local management committees consisting of community representatives and local authorities.

OUTCOME 3: INCREASED AVAILABILITY AND CONSUMPTION OF FISH, COMBINED WITH HYGIENIC FOOD PREPARATION AND WATER DRINKING PRACTICES

- 213,138 people (51.5% females; 219% of the LOP target) consumed more fish at home compared to the baseline.
- 9,527 tons of nutrient-rich value chain commodities (fish from rice fields) produced for direct home consumption (5.5% less than the LOP target)
- 20,915 children under 5 (0-59 months), 48.7% girls, reached with nutrition-sensitive interventions of the project (105% of the LOP target)
- 9,425 children under two (0-23 months), 47.4% girls, reached with community-level nutrition interventions of the project (230% of the LOP target)
- 4,659 people demonstrated increased knowledge and awareness about clean drinking water sanitation and hygiene, lower than LOP of 20,000 people. The monitoring surveys showed that the level of knowledge and awareness was already very high at the baseline, leaving little margin for improvement (the average KAP survey score was 11.5 out of 12 at the baseline).
- 73% of the households had soap and water at a handwashing station commonly used by family members, slightly less than the LOP of 75%.

Output 3.1: Increased knowledge and awareness about the nutritional benefits of fish and a diversified diet and;

Output 3.2: Increased knowledge and awareness about clean drinking water and sanitation

Development of a strategy for social behavior change and communication (SBCC) and training and communication materials

In early 2017 WorldFish completed the development of a Social Behavior Change Communication (SBCC) strategy as part of the overall communication strategy of the project, in consultation with USAID-funded NOURISH, WorldFish's Senior Nutrition Advisor, and the Food Security and Nutrition Forum led by the Council for Agricultural and Rural Development (CARD) of the Cambodian Government. The contents of the strategy built on the existing materials previously developed by other NGOs and relevant projects, including SHARE, USAID-funded HARVEST, Helen Keller International, and NOURISH. The SBCC strategy includes the identification of target audience groups, communication channels, types of activities and products to be used by the project to achieve the objectives around dietary diversity and hygienic food preparation, and WASH.

The training and communication materials developed by the project for the purpose of SBCC on nutrition included (full list of communication materials are available in **Annex 1**):

- Fish-based product ideas and cooking recipes for women and children in first 1,000 days of life
- Training of Trainers manual for the field staff and community leaders in SBCC and nutrition education
- Monitoring and Evaluation Plan for documenting progress in dietary diversity and adoption of nutrition-sensitive activities
- "Sound bites" script for TV and radio broadcast of key messages
- Contact list of people working on food and nutrition issues in Cambodia
- Posters and presentation slides on relevant topics

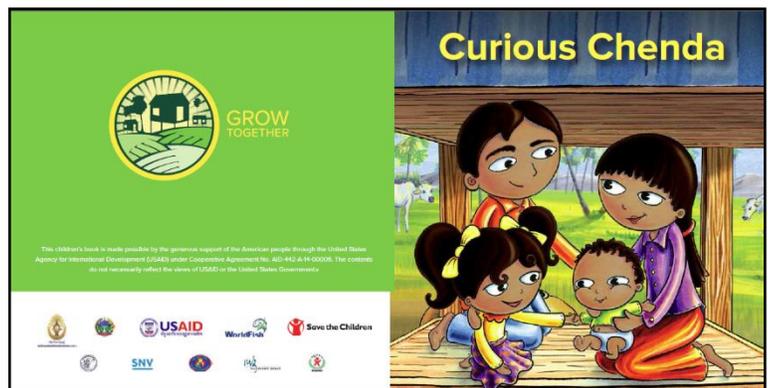


Figure 5. Cover of Curious Chenda

WorldFish ensured that these communication materials and tools were in alignment with the guidelines of the National Center of Health Promotion, at Ministry of Health, which was responsible for consistency and accuracy in information and messages disseminated by various NGOs donor projects on nutrition and health (See further details in



Box 7. Recipe for Samlor Korkor with whole small fish won an award at the Feed the Future global recipe contest.

COORDINATION AND PARTNERSHIP).

The project collaborated closely with the NOURISH team to jointly develop some of the communication materials listed above, namely the ToT training manual on hygiene and sanitation in food preparation, and a recipe for fish powder processing, and provided inputs to NOURISH communication campaign activities, such as the development of a TV spot and "soundbites" scripts, for recorded messages to be aired on radio, and children's storybook called *Curious Chenda*⁷.

With the purpose of identifying more simple and effective way in promoting food and nutrition diversification among women and children under 5 years old, the project promoted traditional Khmer recipes that can be modified to improve its nutritious contents, including a popular dish among all Cambodians called *Samlor Korkor*, or Khmer Fish and Vegetable Stew (**Box 7**). The project modified the recipe of this stew to include whole small fish, long beans, ivy gourd, and pumpkin, so that the stew will provide micronutrients often lacking in average Cambodian diet. The recipe won the best savory recipe award among dozens of entries from around the world at a global contest organized by Feed the Future in early 2017⁸.

Delivering effective behavior change and communication campaigns

The implementation of the SBCC started in the mid-2017 and took place in several stages. First the RFF II team (WorldFish staff and PNGO staff) received Training of Trainers (ToT) on nutrition and WASH from NOURISH staff, many of whom were specialists in nutrition and health education. Second, the RFF II team provided the ToT sessions to existing and future community trainers: Village Health Support Group (VHSG) members, staff of health centers, and caregiver group leaders. Then finally the project facilitated for the most competent individuals among the trainees to carry out further awareness raising events and training sessions within their respective communities to reach large number of trainees.

Mainly in 2018-2019, the project team held **398 ToT events and trained a total of 5,261 participants** representing VHSG, health centers, or caregiver groups, including 5,010 women (95%). WorldFish and PNGO staff also provided refresher ToT to the community trainers in 2020-2021. With support from the project, the community trainers conducted **1,566 caregiver training sessions with a total 9,244 participants**, including 8,511 women (92%) in 2018-2021. In addition, the project team conducted **687 awareness raising events at local schools and villages**, covering several topics – not only on importance of RFF and CFR, but also nutrition and hygiene. It was particularly important to convey key messages on nutrition and hygiene during these events at school, because in rural villages older children often serve as caregivers of younger siblings. The project **reached 53,466 students** through these events, including 24,070 boys and 29,396 girls.



Box 8.
A caregiver feeding *Samlor Prohail*, a traditional soup dish with micronutrient-rich fish, to a young girl in Kralanh district, Siem Reap province.

In late 2017 (Year 2), the project team realized that some trainees found it difficult to apply new knowledge into practice because they were already overburdened with housekeeping tasks. Thus the team started to test another method called "**household visioning**" exercise to promote **cleanliness in homestead environment** and **gender-balanced allocation** of household labor. This participatory exercise was held for

⁷ Further information on NOURISH activities are found at: <https://nourishproject.exposure.co/>

⁸ <http://blog.worldfishcenter.org/2017/02/one-pot-fish-stew-wins-best-savory-recipe-in-contest/>

individual household, where a facilitator asked the family to draw two layout maps of the homestead environment together: one drawing of the current state of the homestead, identifying places that needed to be cleaner or more organized; another drawing of a desired future state of the homestead environment specifying who needed to be responsible for improving which part of the homestead. For example, if a household had pig pen or chicken coop near where the children played, they had to organize the layout so the children did not get direct contact with animal feces. A total of **3,189 households (9,486 participants, 69.5% women) conducted household visioning exercise**. In 2019-2020, the project organized **household village fairs** in target communities where other households visited and learned from model families, who had successfully implemented household visioning, about the importance of fish and dietary diversity, appropriate food preparation, hygiene and sanitation. A total of 162 village fairs events were held, with participation of 6,287 people (5,030 women, 80%).

The project team also made follow-up visits to the caregivers who received training previously, and the households who conducted household visioning exercise, to monitor their practices and reinforce key messages. The positive outcome of household visioning was reflected in the results of the Knowledge Attitude Practice endline survey conducted by an external consultant team in 2021. The survey showed marked improvements in the cleanliness of homestead environment among the project beneficiary households (see **Figure 14** in the section *Knowledge Attitude Practice (KAP) Survey on Food, Nutrition, and WASH*).

OUTCOME 4: IMPROVED POLICY ENVIRONMENT FOR FUTURE SCALE-OUT

- The project contributed to 3 “agricultural and nutritional enabling environment policies being analyzed, consulted on, drafted or revised, approved and implemented”, namely the Fisheries Law, the Agriculture Strategic Development Plan (ASDP), and the Strategy on Food Security and Nutrition (LOP target - 2)
- The project contributed to 3 “laws, policies, regulations, or standards addressing climate change adaptation being formally proposed, adopted, or implemented”, namely Environment and Natural resource Code, ASDP, and the Strategic Plan for Fisheries Conservation and Management (LOP target - 2)

Output 4.1: Increased integration of lessons from the project into government and development partner strategies

Implementing a Communication Strategy

By the early 2017 a communication strategy for RFF II was developed to guide the project team and partners to ensure efficient communication internally between field staff, management staff, support staff, partner NGO staff, and also with external stakeholders such as donors, government agencies, local authorities, and the general public. The main objectives of the communication strategy were as below:

- To provide a framework for informing, involving, and obtaining information from, all participants throughout the duration of the project implementation;
- To ensure that stakeholders feel consulted and informed about the project approaches, progress, outcome and impact of the project as well as raising concerns or ask questions in a way that is appropriate for them;
- To promote adoption of improved management practices demonstrated by the project; and
- To promote behavioral change of target beneficiaries on dietary habits and hygienic food preparation.

The project developed a detailed SBCC strategy, as a sub-component of the communication strategy, to specifically guide the implementation of awareness raising and training activities on nutrition and WASH (see Sections above, Outputs 3.1 and 3.2, for further details on SBCC).

Following the strategy, the project organized, or participated in a number of events to share information on the status of the project implementation to key stakeholders as well as the general public throughout the life of the project (for further details, please see Public Events and Press Coverage in **Annex 3**). Communication materials such as the project brochure, project site profiles, posters, and infographics were produced and disseminated at these events, including trade fairs and exhibits organized by the Cambodian government and universities. A number of technical and scientific publications were also developed in collaboration with FiA and academic research partners. These materials were disseminated through traditional communication channels such as press releases and conference presentations, but also through social media (See full list of Publications in **Annex 1**).

Designing and implementing M&E surveys

After the project inception in late 2016, WorldFish held a series of meetings internally and externally with other USAID/Feed the Future partners working in Cambodia—namely NOURISH, World Vegetable Center, and Tufts University (Feed the Future Nutrition Innovation Lab) to discuss priorities in M&E survey and indicators of respective project to identify synergy. Also with guidance from the USAID M&E Advisor from Washington DC, WorldFish modified the M&E framework and tools that were originally developed for RFF Phase I to address key performance indicators of RFF II, selected from a wider range of thematic USAID indicator guidelines, on Feed the Future, Global Climate Change, Biodiversity, and WASH. WorldFish team also added a few custom indicators for the purpose of informing the Cambodian government policies on fisheries management and for supporting future research. The RFF II Monitoring and Evaluation Framework was drafted in October 2016 and was updated 5 times until August 2019 to reflect adjustments in the indicator guidelines.

Based on the experience of RFF Phase I (2012-2016), the RFF Phase II team updated the survey protocols and tools for regular monitoring surveys conducted with in-house human resources: the **Biological Monitoring surveys (BioM)**, which was meant to monitor and assess effectiveness of the project interventions on rice field fisheries species diversity and biomass; **and the Household Fish Catch and Consumption Monitoring surveys (CCM)**, with an objective to monitor and assess household fish catch from various habitats including rice fields, post-harvest utilization of the fish, and pattern of household consumption of fish, including consumption of micronutrient-rich SIS by children. In addition, the project carries out 3 other surveys: **Livelihood Surveys** aimed to compare the changes in the contribution of rice field fisheries in livelihood and food security of the target beneficiaries over time; **Knowledge Attitude Practice (KAP) survey on food, nutrition, and WASH** assessed the changes in knowledge, attitude, and practice of the beneficiaries regarding dietary habits, food preparation, and hygiene; **CFR Capacity Assessment** was carried out to monitor progress in the capacity of project-supported CFR committees in good governance and management of CFR. Summary of the surveys is in **Table 5**. The major findings of the M&E surveys are presented in the Section

Table 5. Summary of M&E surveys

Survey	Method	Frequency	Sample size	Number of surveys	Implemented by
BioM	Experimental set gillnet fishing inside of CFRs	Four times/year (Feb., May, Aug., Nov.)	56 CFRs	17 (Feb. 2017 – Feb. 2021)	Project team
CCM	Longitudinal survey of households based on recall of previous week	Twice/year (March and September)	884 households in 23 villages where CFRs are located	9 (Mar. 2012 – Mar. 2021)	Project team
Livelihood	Longitudinal survey of households based on recall of previous year	Baseline and endline	1280HH in 104 villages (2017), 699HH in 100 villages (2021)	2 (Jan. 2017, 2021)	External consultant
KAP	Household survey based on recall of previous week	Baseline, midline, endline	756 households in same 36 villages	3 (Mar. 2018, 2019, 2021)	External consultant
CFR Capacity Assessments	Scoring by stakeholder groups of the previous year	Baseline, midline, endline	134 CFRs (2017), 140 CFRs (2019 & 2021)	3 (Dec. 2016, 2018, 2020)	Project team

Supporting university student research

WorldFish facilitated and supported a total of **6 students' thesis research** at RFF II sites at Bachelor's and Master's levels, with WorldFish researchers and senior staff of FiA co-supervising their field studies and the theses (**Table 6**). First, the WorldFish management team met with Deputy Dean of the Fisheries Faculty from Royal University of Agriculture (RUA) to present an overview of the project and discuss opportunities for student involvement. It was agreed that the university would publicly announce the opportunity for applying for thesis research grants and select suitable candidates based on research proposals from the students, then the faculty members submit the nominated students for WorldFish to confirm. Fisheries Administration also agreed to contribute to student selection and supervision of their thesis research. Possible research topics relevant to RFF II were shared with RUA for the announcement. Similar discussions were held with a Professor at the Faculty of Sociology and Community Development, whose expertise include fisheries research, to identify research topics and suitable students to apply for the research grants.

Four students from the Faculty of Fisheries at Royal University of Agriculture completed their Bachelor's thesis and successful defense, and graduated in the mid-2019. Two Master's students from the Faculty of Sociology and Community Development at University of Battambang presented their thesis to WorldFish in early February 2020. After some corrections and adjustments were made, the students completed their study in April 2020.

Table 6. Student thesis research completed at RFF II sites

N	Name	Topic	Completion dates
1	Ms. Ith Laisang (Kampong Thom, Kampong Svay district)	A Study to Determine the Household Benefit (multiple uses) from the Rice Field Fish Refuge Pond in Kampong Svay district, Kampong Thom province.	Bachelor's degree in August 2019
2	Mr. Proeung Rithy (Kampong Thom, Stung district)	A Study to Determine the Effectiveness of Eco-Shelters (Samrash) in Fish Refuge Ponds to Attract Small Indigenous Fish in Stong district, Kampong Thom province.	
3	Mr. Yong Eneat (Siem Reap, Kralanh district)	Household Catch and Use of Fish and Other Aquatic Animals from the Rice Fields, Kralanch district, Siem Reap province.	
4	Ms. Soeun Chantrea	Comparison study on fish species diversity and other aquatic animals in lateral connected trapped-ponds and non-lateral connected trapped-ponds, Stong district, Kampong Thom province.	
5	Ms. Saroeut Yong	Large scale spatial and temporal patterns in fish community and structures in rice fields around the Tonle Sap Lake, Cambodia.	Master's degree in April 2020
6	Ms. Lita Mom	Rice field fisheries consumption patterns around the Tonle Sap region, Cambodia.	Master's degree in April 2020

CFR Best Practice Guidelines

The best practice guideline of CFR management had been drafted based on the learning from the Rice Field Fisheries Enhancement Project (RFFEP 2012 - 2016). The guideline provided guidance on how to design functional CFRs, and appropriate interventions to improve CFRs and other rice field environments, including connecting canals and water ways, so that rice field ecosystems support fish and other aquatic animals to thrive and provide food and income to local communities in a sustainable manner. WorldFish continued to build on the new knowledge and lessons learned as the implementation of RFF II progressed.

The draft guidelines were first reviewed internally and externally by experts on rice field/wetland fisheries to get feedback from peers in and outside of Cambodia. In April 2018 the project management team and other staff met with the FiA Department of Aquaculture Development to discuss and confirm key contents of the draft guidelines. After the feedback from FiA were incorporated, Dr. Rick

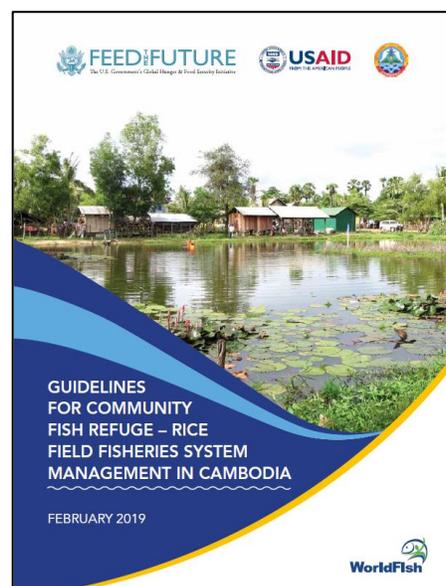


Figure 6. Cover of the CFR guidelines

Gregory, a well-known fisheries expert in the region and a member of the Asian Institute of Technology program that originally introduced CFR concept to Cambodia in the mid-1990s, provided final inputs to the guidelines as a co-author. In September 2018 the guidelines were submitted for final review and approval by H.E. Eng Cheasan, FiA Director General. Based on his feedback, the guidelines were finalized.

The project team completed the publication of **Guidelines for Community Fish Refuge-Rice Field Fisheries System Management in Cambodia** in collaboration with FiA in February 2019⁹. The guidelines were formatted into **User Manual** ([English](#)) and **Guidelines** ([Khmer](#) and [English](#) versions) and print copies were widely distributed through the government system as well as NGO networks and to universities. For example, FiA distributed 500 hard copies of the Khmer language guidelines at National Fish Day at Boeung Snaur Reservoir, Oddar Meanchey province on 1 July 2019. In attendance were H.E. Yim Chhai Ly, Deputy Prime Minister of Cambodia; H.E. Eng Cheasan, Director General of FiA; H.E. Sok Silo, Deputy Secretary General, Council for Agriculture and Rural Development (CARD) amongst other senior representatives.

Practitioner Guide on integrating nutrition and gender activities

In August 2021, the project team also completed the publication of **Integrating Nutrition and Gender into Rice Field Fisheries System: A Practitioner's Guide**, in [Khmer](#) and [English](#) languages. The aim of this guide is to ensure that rice field fishery production result in community-wide benefits, especially maternal and child health and nutrition and men and women's co-leadership. This guide describes the steps and process of integrating nutrition and gender activities into the management of rice field fisheries and Community Fish Refuge, and implementation barriers and enablers of these activities.

Contribution to the government policies and strategies

The project team reviewed and provided information, feedback, and written inputs to the process of developing/revising several policies and strategies of the Cambodian government, and also to a global policy dialogue. The key areas of contribution were as below:

- Reviewed numerous draft versions and provided written inputs to multiple Chapters of the **Fisheries Law** as part of its revisions led by FiA since 2017, including *Chapter 3 – Fishery domain*, *Chapter 4 – Sustainable fishery management*, *Chapter 5 – Fishery protection and conservation*, and *Chapter 15 Offenses and penalties*;
- Provided inputs and feedback to the FiA contribution to the **Five-Year Strategic Plan 2019-2023 for Agriculture Sector** led by MAFF, launched in December 2019 and included resilience to climate change;
- Provided inputs and feedback to the draft **Environment and Natural Resources Code of Cambodia**, led by the Ministry of Environment;
- Provided inputs and feedback to the questionnaire for the **Cambodia Inter-Censal Agriculture Survey (CIAS)** 2019, led by the Ministry of Planning, especially to the survey modules on aquaculture and capture fisheries;
- Provided written inputs and data based on RFF II lessons to FiA's **Strategic Plan for Fisheries Conservation and Management 2019-2028**, which adopted the CFR approach as one of the main pillars of fisheries conservation for the first time;

⁹ A PDF version is available at:

<https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/3632/Guidelines-for-CFR-RFF.pdf>

- Regularly participated in and provided inputs at the Development Partner and **Technical Working Group on Fisheries (TWG-F)** bi-monthly meetings, including the development of Annual Action Plan for the Fisheries Sector, and progress reporting;
- Provided written inputs to the development of the **Voluntary Guidelines on Food Systems and Nutrition**¹⁰ led by FAO, based on the learning from the RFF II about the role of fish in seasonal changes in food systems, and the importance of water for food security and nutrition; and
- Contributed to the **National Strategy for Food Security and Nutrition (NSFSN) 2019-2023**, led by CARD and launched in November 2020, through the Technical Working Group for Food Security and Nutrition.

Representation in public events and conferences, hosting international and local visitors and study tours

Various project team members attended and made presentations on the approach, results, and lessons from RFF II, at a number of international conferences and policy fora in and outside of Cambodia. The project team also hosted numerous field missions and study tours to RFF II project sites and shared our knowledge and lessons for scaling out CFR/RFF management approaches (See **Annex 3** for the full list of events, visitors, and study tours). Of these, the most notable events are listed below.

Here is a list of **major public events and conferences** where the RFF II was represented:

- The annual **National Fish Day events** held by the Royal Government of Cambodia at national and provincial levels every year on July 1st, 2017, 2018, 2019¹¹, and attended by thousands of people representing the general public. In addition to participating in these events, the project contributed to printing of Fish Day banners and FiA and WorldFish publications, including RFF II project publications, for free distribution to the participants of these events;
- The annual **National Nutrition Day events** held by CARD in Phnom Penh in November of 2017 and 2018 and attended by thousands of people representing the general public. The project team set up an exhibit booth at these events and shared information to the general public. His Excellency Yim Chhey Ly, Deputy Prime Minister, and His Excellency Veng Sakhon, Minister of MAFF, visited the RFF II project booth



Box 9. Project staff engaged students at a National Nutrition Day 2018 event with an interactive quiz about rice field fisheries, small fish species and nutrition (top); Miratori Kim, the former RFF II Project Manager, explaining the benefits of RFF II to His Excellency Yim Chhey Ly (bottom left).

¹⁰ http://www.fao.org/fsnforum/activities/discussions/cfs_food_systems_nutrition?page=7

¹¹ Large public events to celebrate Fish Day were not held in 2020 and 2021 due to COVID19

and learned about the project and its benefits for the nutrition security of Cambodian people (**Box 9**).

- The annual **Science, Technology, Engineering, and Mathematics (STEM) fairs** held by universities and the Ministry of Education, Youth and Sport in Cambodia, attract tens of thousands of students from all over the country every year. RFF II team set up an exhibit booth at these events and shared information on fish biology, wetland ecology, and technical interventions applied by the project, to the students.
- On December 5-8, 2017, WorldFish hosted approximately 130 visitors from 19 countries who participated in **Global Workshop on Nutrition-Sensitive Fish Agri-Food Systems** in Siem Reap¹², Cambodia. The event was chaired by the Deputy Prime Minister of Cambodia, His Excellency Yim Chhey Ly, and was attended by senior officials of EU, IFAD, USAID, World Bank, Bill and Melinda Gates Foundation, FAO, and JICA. Participants also included scientists, academics, and the Royal Government of Cambodia officials from FiA, CARD, and the MAFF. The event showcased achievements of RFF II through presentations and participants' field trips to RFF II sites.
- WorldFish organized a session on Nutrition-sensitive Rice-Fish Food Systems at **the 5th International Rice Congress 2018** in Singapore, October 15-17, 2018, one of the biggest and most prestigious international conferences on rice, attracting thousands of participants worldwide. The RFF II team presented the project approach and results highlighting the advantages of integrating wild capture fisheries in rice production systems. The session attracted about 40 participants, including representatives of FAO, IFAD, Japan, and other agencies and research institutes from around the world.
- WorldFish organized a session titled 'Community-based Conservation Measures and Nutrition Outcomes in Rice Field Fisheries' at **the 3rd World Small-Scale Fisheries Congress**, October 22-26, 2018 in Chiang Mai, Thailand, where the RFFII team presented the project approach and results. The session was attended by 50-60 participants, representing small-scale fisheries management practitioners and researchers from all over the world, including the African Development Bank, Nigeria, Ghana, and Sri Lanka.
- RFFII team participated in a **World Food Day event** in Pursat on October 19th, 2019, where Yumiko Kura, former RFF II Chief of Party (2016-2019), was **awarded the Commander of Sahametrei medal**, conferred by the Prime Minister of Cambodia, for her outstanding contribution to the country's fisheries sector. The medal recognizes those who have provided distinguished services to the king and people of Cambodia¹³.

The project hosted numerous field visits to the project sites, including **field missions by senior officials** from the US and/or Cambodian governments (listed chronologically below):

- On September 26, 2016, Ms. Polly Dunford, the new **Mission Director of USAID Cambodia**, visited Lboeuk Keteyuos CFR in Siem Reap province, met with the committee members and local authorities, and learned about key achievements of the RFF Phase I and a vision and planned interventions of the Phase II.
- On August 24, 2017, Mr. Michael Newbill, the new **Deputy Chief of Mission (DCM), the US Embassy in Cambodia**, visited Tropeang Kuy CFR at Santay village, Danrun commune, Sotr Nikum district, on his very first field mission since taking up the post in Cambodia.

¹² <https://fish.cgiar.org/news-and-updates/press-releases/global-workshop-closes-commitment-enabling-environment-new-research>

¹³ See further details of the award at <http://blog.worldfishcenter.org/2019/10/yumiko-kura-of-worldfish-honored-by-cambodian-government/>

- On September 8, 2017, WorldFish hosted Ms. Veena Reddy, the new **Deputy Mission Director of USAID Cambodia** to visit Lboeuk Keteyos CFR in Siem Reap Province to understand CFR management/concept, small fish powder processing, and preparation of meal for children using small fish and small fish powder.
- On October 26, 2017, the project team hosted a field visit by His Excellency Professor Nao Thuok, **Secretary of State of MAFF**, and 13 staff from FiAC and MAFF, to meet with the Damnak Kranh CFR Committee, local authorities, and community people.
- On December 4, 2017 the project hosted a field mission led by His Excellency Eng Cheasan, **Director General of FiA**, including Dr. Hav Viseth, **Deputy Director General of FiA**, Mr. Thay Somony, **Director of the Department of Aquaculture Development**, other FiA staff, and Mr. Aymeric Roussel, NRM – Rural Development Attaché, the **EU Delegation to Cambodia**, and Ms. Marie Lecomte, Project Officer for Fisheries and Aquaculture at the **French Agency for Development (AFD)**. The group visited two CFRs and surrounding RFFs in Siem Reap province.
- On March 20, 2019, the project hosted a field mission led by H.E. Veng Sakhon, **Minister of MAFF**, including other senior officials from MAFF and FiA, Ms. Veena Reddy, **Mission Director of USAID Cambodia**, and other senior representatives from USAID Cambodia, to Boeng Kampeng CFR, Pursat province (**Box 10**.)
- On December 10, 2019, H.E. W. Patrick Murphy, the **US Ambassador to Cambodia**, visited Trapeang Neang Noy CFR, Kampong Thom province (**Box 11**).
- On January 18th, 2020, Mr. Richard Parker, **Assistant Administrator, Bureau for Legislative and Public Affairs**, and other senior officials from USAID headquarters in Washington DC visited Trapeang Prey CFR in Siem Reap province.
- On 20 June 2020, H.E. Nao Thuok, **Secretary of State of MAFF**, the Chief of the Provincial Department of Agriculture, and representatives from FiAC visited Damnak Kranh CFR in Pursat province.



Box 10. H.E. Veng Sakhon, Minister of MAFF and Ms. Veena Reddy, Mission Director, USAID Cambodia, listen to a presentation of the results achieved by the RFF II project in Pursat province, March 20, 2019. (Photo credit: MAFF Facebook)



Box 11. Dr. Sarah Freed, WorldFish Cambodia, and TCO staff hosting H.E. W. Patrick Murphy, the US Ambassador to Cambodia, and Ms Sothira Seng, USAID Cambodia, at Trapeang Neang Noy CFR, Kampong Thom province.

The project team hosted numerous **study tours and training events** for international and local participants to the RFF II sites, including some major events listed below:

- In December 2016, **USAID held annual GLEE event in Cambodia**, focusing on climate smart agriculture, entitled Climate-Smart Agriculture Global Learning and Evidence

Exchange (CSA-GLEE)¹⁴. WorldFish Scientists gave presentations at the main conference as resource persons. In addition, RFF II project team organized a part of the field study tour by over 100 GLEE participants from around the world, mostly USAID staff and grantees, to the Trapeang Kuy and Labeuk Kitayous CFRs in Siem Reap province. The participants learned how a CFR contributes to climate change adaptation, through helping blood fish survive through dry season and serve as a supplementary source of domestic water for people in dry season.

- On August 27, 2017, the project hosted a study tour by a **delegation from Lao PDR, Vietnam, Philippines**, as well as officers from the Battambang Provincial Department of Agriculture and the Cambodian Department of Agriculture Extension, MAFF. A total of 27 participants (8 female) attended this event. The international delegation comprised of government line agency officials, community leaders, and farmers implementing *Climate Smart Village* initiatives under the global CGIAR research programs on Climate Change, Agriculture, and Food Security (CCAFS), in Southeast Asia.
- On July 9-13, 2018 a group of 13 people, including RFF II project team members, local NGO partner staff, and FiA officials, participated in **a study tour to Bangladesh** as part of an IFAD-funded global project. The main purpose of this study tour was to learn from good practices in small-scale fish production in Bangladesh and share lessons with the local counterparts there.
- On September 18-25, 2019, the **Scaling Up Nutrition (SUN) Civil Society Network Asia** Regional Workshop was held in Siem Reap, Cambodia. At the request of SUN Secretariat, the project team hosted a group of 15 workshop participants, representing civil society organizations from various countries in Asia, to visit Trapeang Kuy CFR in Siem Reap (**Box 12**). Project staff presented an overview of rice field fisheries in Cambodia, the nutritional benefits of fish and integrated WASH and social behavior change activities.
- On November 7, 2019, a **delegation from Odisha State in India**, including four high-level officials of the state government, and two WorldFish-India staff implementing a USAID-funded project in India, visited Ou Rolum CFR in Siem Reap, following an official courtesy visit to the WorldFish headquarters in Malaysia. The purpose of the visit was to understand nutrition-sensitive activities related to fish, and any relevance for policy and programming in India – specifically for school feeding programs and other initiatives.
- In November 2019, as part of the project completion workshop of the IFAD-EU-funded *Small Fish for Nutrition* project, **representatives from research institutes and universities in several countries in Africa, including Ghana, Malawi, and Zambia**, visited a project CFR in Siem Reap. The participants learned about the importance of small rice field fish for household nutrition security.
- In December 2019, researchers from FiA and **researchers from Bangladesh, Japan, and Myanmar** visited two project CFRs (Siem Reap and Battambang), as part of a regional expert workshop on existing knowledge on biology and aquaculture of nutrient rich SIS.



Box 12. Regional and international SUN-CSA representatives in front of a CFR in Siem Reap province.

¹⁴ <https://agrilinks.org/events/climate-smart-agriculture-global-learning-and-evidence-exchange-csa-gee-cambodia-1>

INTEGRATION OF CROSS-CUTTING ISSUES

a) Gender Equality and Female Empowerment

One of the five indicators used for the CFR governance capacity assessment scoring was gender equality in the CFR committee membership. The project assessed the CFR committees' status of gender balance by the level of female representation in the committee leadership and the level of female participation in CFR management activities. The project **built the capacity of women in leadership roles** in the CFR governance as shown in **Table 7**. The main constraint for women to take on leadership roles in the CFR committees was that they were too busy with housework to participate in community work. To alleviate this challenge, the project conducted household visioning exercise (see below).

Table 7. Female representation in CFR committees supported by RFF II

	2017	2018	2019	2020	2021
Project-supported CFR	134	134	140	140	140
Number of committee members	1,371	1,362	1,402	1,402	1,402
Number of women on committees	312	318	330	330	330
% women	22.8	23.3	23.5	23.5	23.5

In addition, the project directly supported **women's economic empowerment** through skills development in a number of livelihoods activities. As described in *Output 2.1 Increased capacity of communities to adapt to climate change through access to CFR water in dry season*, the project supported a total of 55 homestead vegetable gardens and provided 155 training events on improved vegetable farming techniques in order to extend the benefits of well-managed CFR water bodies to neighboring households, especially in dry season. Of the 1,178 participants to the training events, 805, or 68% were women.

Sixteen aspiring businesswomen among the RFF II beneficiary households were trained in commercial production of nutrient-rich SIS fish powder in 2018, based on recipes and production method of NOURISH. Two women continued to produce SIS fish powder and ran successful business of selling it in jars in 2021. The 12 project-supported drinking water kiosks also employed women as technicians and business managers. These were salaried positions fully funded by the revenue of the kiosks generated from selling water bottles. Of the 36 people directly employed at the 12 water kiosks, 10 were women. 3 out of the 10 women were entrepreneurs/managers, who were responsible for running the water kiosk businesses.

The project placed an emphasis on gender equality and female empowerment through SBCC activities implemented under *Output 3.1: Increased knowledge and awareness about the nutritional benefits of fish and a diversified diet* and *Output 3.2: Increased knowledge and awareness about clean drinking water and sanitation*. Our strategy was to **improve the knowledge and the capacity of both men and women** to care for own health as well as the health of their families, especially children. While the participants in caregiver training sessions were almost entirely women (92%), the project reached significant number of teenage boys and girls— both were current, and future caretakers of small children—through awareness

raising events held at local schools. Of the 53,466 students reached by these events, 45% were boys and 55% were girls.

Another method the project applied to trigger behavior change and **promote gender equality at household level was the household visioning exercise**. Through this participatory exercise, the participant families identified together the places within their homestead that needed to be cleaner or more organized to attain cleaner, more hygienic environment for children. The exercise asked them to specify who needed to be responsible for improving the cleanliness of which parts of the homestead, often resulting in a shared realization that wives/mothers were already overburdened with tasks and could not take on more responsibilities. Consequently, husbands/fathers as well as older children realized that they had to become part of cleaning homestead environment and took on responsibilities for specific tasks, such as tidying the residential areas, keeping domestic animals away from babies, and making sure there was a hand washing area with soap near the toilet (**Box 13**). Through a total of 3,189 household visioning exercises, the project improved the awareness and knowledge of 2,898 men, or 30.5% of the participants, about the importance of gender equality in household work.

b) Environmental Compliance

Between the late 2016 and the early 2017, the project team, with technical support from an environmental consultant, drafted the project Environmental Mitigation and Monitoring Plan (EMMP) in consultation with the local stakeholders and relevant government authorities. The final version received the USAID approval in February 2017. The approved EMMP was then translated into simple checklists in Khmer language and the project staff was trained on its use. In addition, the National M&E Coordinator of WorldFish Cambodia, who took the main responsibility of overseeing the EMMP application, conducted periodical field monitoring and support to the project team and documented findings in EMMP action plans as part of the semi-annual planning and reporting. Moreover, USAID Cambodia officers conducted periodical monitoring visits to RFF II sites to ensure compliance to EMMP and advised the project team on mitigation measures.

The EMMP listed 29 potential Identified Adverse Environmental Impacts (IAEI) of the projects in three sectors: (1) Small Scale Construction for CFR physical environment improvement; (2) Multi-purpose use of CFR water (drinking water and irrigation); and (3) Fisheries and Aquaculture. In addition, during the early consultation stage, a total of 34 meetings were held with local stakeholders and their recommendations were incorporated into the EMMP checklists. The most notable finding was that two CFRs (Boeng Preah Ponley and Boeng Tonle Oum in Pursat Province) were located in areas designated as historical/archaeological sites, with potential

Box 13. Balancing household chores and community work

Sarom and Samnang, a couple with three sons in Kampong Thom province, participated in a household visioning exercise facilitated by WorldFish to discuss how to balance the share of responsibilities at home. Having established that Samnang the wife on average spent 1.5 times more hours on household chores than Sarom the husband, the couple decided to hand over more tasks to Sarom so that Samnang can contribute more to community work, such as CFR management. Samnang now has a leadership role in the CFR committee in her village and are proud of the contribution she makes for the benefits of the whole village.



restriction on the activities that could be done within these areas. However, the CFR committees at both locations received written approval from the Provincial Governor, Chief of the Department of Culture and Fine Art, Chief of the Department of Tourism and Environment in Pursat province, and respective local authorities to proceed with intervention activities provided that appropriate precautional measures were taken to avoid damaging objects of archaeological significance in case such objects were found¹⁵.

The WorldFish M&E Coordinator provided continued backstopping support to the M&E officers of 4 PNGOs and the WorldFish provincial coordinators (PCs) in the 4 target provinces on how to abide by the EMMP manual and the M&E team conducted a series of follow up activities and spot checks to monitor compliance by earthworks interventions to EMMP requirements. Over the subsequent years (2017 - 2021), the PNGO staff **conducted EMMP follow-up at all 140 CFRs every year**. The PCs conducted 499 EMMP follow-up activities at cumulative 487 CFRs, or 122 sites per year on average. The WorldFish M&E Coordinator conducted spot checks at 40 CFRs, or 28.5% of the project-supported CFRs, during the first two years of the project when small-scale construction works were carried out in over 100 of the CFRs, to ensure the CFR committees and other local stakeholders understood the EMMP procedures clearly and followed through with the commitments (**Table 8**). The frequency and the total number of spot checks in each province were slightly different, reflecting the number of IAEI items to check at each CFR. In addition, all 12 drinking water kiosks established with support from the project were inspected by PNGO staff, WorldFish PCs, and the WorldFish M&E Coordinator on separate occasions every year to ensure their compliance to the EMMP requirements. When the local communities or PNGO staff observed possible non-compliance they reported to the WorldFish staff immediately and the mitigation measures were taken, with additional follow-up by the WorldFish PCs (**Table 9**).

Table 8. EMMP monitoring visits (2017- 2021)

	Number of CFRs checked for EMMP compliance		
	by PNGOs	by PCs	by M&E Coordinator
Pursat (33 CFRs)	129 (4 times each)	66 (average 2 times each)	8 (24%)
Siem Reap (44 CFRs)	175 (4 times each)	163 (3.7 times each)	11 (25%)
Battambang (26 CFRs)	104 (4 times each)	109 (4.2 times each)	7 (27%)
Kampong Thom (37 CFRs)	145 (4 times each)	149 (4 times each)	14 (38%)
Total	553	487	40 CFRs

Table 9. Environmental compliance issues and mitigation measures

Common issues encountered	Mitigation measures
Inappropriate management of excavated soil and littering the site by the contractor	Reminded the construction companies of the EMMP conditions in their contract and had them move the soil to a location where it does not flow into CFR nor block a village pathway and clean the site.
Fish needed to be temporary relocated from CFR during excavation	A smaller pond was created next to CFR and fish was relocated there before the construction on CFR started. After the construction ended, the

¹⁵ No objects of archeological significance was found at the project sites during the project period.

	small pond was connected to the CFR to allow fish to swim back.
Polluted water from nearby settlement and factories flowed into CFR during flood season	A dike was built around CFR to prevent polluted water from flowing into the CFR
Cashew trees were planted around CFRs to stabilize the banks but fallen leaves in water degraded fish habitats	Cashew trees were removed and more suitable trees were planted
Some local community members wanted to release hatchery-raised fingerlings into CFR on ceremonial occasions	The project staff explained the ecological risk of releasing hatchery-raised fish, especially exotic species, into the wild to the local community and convinced them to use wild broodfish instead
Unsafe levels of Arsenic detected in 2 CFRs that were candidates for drinking water kiosk establishment.	The project did not select the 2 sites for water kiosks, and informed relevant local authorities of the result of water quality testing for their further action.
CFR water levels too low during dry season, resulting in high water temperature/low oxygen level for some fish to survive	Removing excessive aquatic plants from CFR, installing aeration divide in CFR, pumping water in from wells.
CFR water quality unsuitable for water kiosks during dry season, and/or insufficient quantity	Use alternative source of water for kiosks, such as ground water wells, different reservoir or ponds.
Over withdrawal of water from CFR for rice irrigation and domestic uses during dry season	The local authorities and CFR committee members discussed with village chiefs, commune representatives, and with individuals withdrawing water from CFRs, and agreed on restricting the use of water from the CFR (e.g., irrigation for only 1 rice crop cycle, 1 tractor per week for domestic use, not for sales).

c) Sustainability Mechanisms and Local Community Empowerment

The main sustainability strategy of the project, and an emphasis in the capacity building of the CFR committee members, was to **improve their ability to communicate the importance of their work and achievements** to other local stakeholders as well as external actors, including provincial and district governments, line agencies, and other NGOs. The ability to communicate is essential for the CFR committees to build trust with, and continue rallying support from various local actors, both financial and in-kind, and sustain CFR management activities after the life of RFF II. The project staff coached CFR committee members through holding various village meetings, hosting visitors and study tours, and presenting at provincial reflection workshops, so that they were able to clearly articulate their activity plans and achievements in the forms of flip charts, posters, and verbal presentations to others who were not familiar with their work of CFR committees.

As results of the project effort, the CFR committees have also **become confident in articulating issues they faced and their needs for support** from local authorities, for example, for obtaining formal authorizations for their activities and resolving conflict with other water users. Thanks to effective communication between the CFR committees and respective Commune Councils, a total of 1,073 activities in support of CFRs were integrated into respective Commune Investment Plans (CIPs) in 2017-2021, and 131 received funding support from the Commune Councils.

Several CFRs became very **successful in raising funds from general public** within their respective communities to support CFR management activities, and some were able to obtain large donation or in-kind contribution from local businesses, or negotiate deals with construction

companies to expand CFRs at no cost in exchange of the excavated soil. The project-supported CFR committees were able to implement over 3,000 activities in 2017-2021, either with own funds, CIP funds, or in-kind support from other community members, Buddhist monks, or business people, and other NGOs. 2,550 activities were implemented with CFRs' own resources. The CFR committees raised a total of USD302,618 from individual donations and fundraising events to support its activities. These achievements are strong indication that the project-supported CFR committees will be able to continue implementing the best practices in CFR management with locally-available financial and in-kind, after the life of RFF II.

Another sustainability mechanism the project emphasized was **network building among CFRs**. The project held annual reflection workshops where CFR committee representatives got together and each CFR shared their experience and learning by presenting and reflecting on their plans and achievements, while other CFRs offered feedback, suggestions, and advices. They also had chance to identify and discuss common issues and challenges, and solutions. The project team also organized exchange visits for CFR committee members to visit CFRs in other provinces so they could observe situation in different contexts. The project also held some thematic inter-provincial exchange visits, among water kiosk operators and business managers, and vegetable gardeners, facilitate peer-to-peer learning and support.

COORDINATION AND PARTNERSHIP

a) Cambodian Government

During the inception stage of the project in the mid-2016, the project team held a meeting with His Excellency Eng Cheasan, Director General of Fisheries Administration (FiA), and the Department of Aquaculture Development (in charge of CFR) to discuss specific areas of collaboration through RFF II. Formal letters of collaboration were subsequently exchanged. Following key activities were agreed and implemented in close **collaboration with FiA**:

- Supported establishment of new CFR sites in the 4 target provinces, to the extent feasible (53 new CFRs were registered with the project support);
- Carried out assessment of the status of existing CFRs and selected project sites, including those supported by TCP FAO/FiA project on Best Practices Management of Community Fish Refugees;
- Provided some infrastructure support to the selected CFRs as appropriate (more than 100 CFRs received infrastructure improvements);
- Supported establishment of a network of CFRs for cross learning;
- Developed a database of project-supported CFRs including digital mapping of the locations;
- Assessed the performance of CFRs through monitoring surveys;
- Provided financial support to and co-supervised local university students on their thesis research at RFF II sites; and
- Develop joint FiA/WorldFish publications, including the Guideline on CFR development and management.



In January 2019, WorldFish and FiA jointly held a ceremony at the FiA conference room in Phnom Penh where H.E Eng Cheasan, Director General of FiA, presented certificates to representatives from 18 best-performing CFR committees and their local authorities from Pursat, Battambang, Siem Reap and Kampong Thom. More than 50 participants attended this ceremony and provided strong motivation for the CFR representatives to continue working hard to improve their management practices in the following years. Senior FiA representatives from the headquarters and the Cantonment office attended in annual reflection workshops held in each of the 4 target provinces at the end of each year and presented awards to best-performing CFR committees of the year (**Box 14**).

FiA officials from the four FiA Cantonment offices—namely Battambang, Pursat, Kampong Thom, Siem Reap—were instrumental in identifying and registering new CFRs for the project support. Their close collaboration was also essential for implementing the monitoring and environmental compliance activities, in particular the quarterly Biological Monitoring surveys.

Similar discussion also took place in 2016 with representatives of Ministry of Water Resources and Meteorology (MOWRAM), including His Excellency Bun Hean, Secretary of State, and His Excellency Hell Tony, Secretary General of the Tonle Sap Authority. **Added value of the project to ongoing work of MOWRAM** discussed and implemented were:

- Increased the benefits of existing reservoirs to local communities by using them as CFR;
- Physical improvements made to existing reservoirs for CFR functions and helped maintenance of infrastructure and increased potential for irrigation;
- Capacity of selected Farmer Water User Groups strengthened to improve the management of irrigation schemes/reservoirs and coordinate multiple water user demand;
- Facilitated integration of CFR into irrigation reservoir management;
- Development of guidelines for CFRs to optimize water utilization for multiple users; and
- Provided training for FWUGs/CFR management committees to improve water use efficiency in rice farming and management of the reservoirs for multiple benefits.

In 2017, the project team sought additional guidance from Mr. Tek Channarin, the Head of Administration Bureau, National Center of Health Promotion, at **Ministry of Health** (MOH), with regards to training and communication materials used for SBCC on nutrition and WASH. He suggested that the project team build on existing materials and contents that had already been approved by MOH, pay careful attention to giving credit to the original source materials, and also consult relevant **Provincial Departments of Health** as well as FiA Cantonment offices to request their collaboration in implementing SBCC. The project team presented the materials developed for the SBCC activities of RFF II to provincial health departments for approval and sought collaboration for further training and conducting awareness raising to Village Health Support Group (VHSG) members, caretakers and community people in target areas. The provincial health departments approved of all the materials for training at the community level, and their staff and district health centers (district level) worked with our PNGO staff to hold ToT sessions for VHSGs and provided backstopping to VHSGs when they conducted their first Caregiver Group training sessions in target villages.

b) USAID-funded Projects

RFF II collaborated formally and informally with a number of other USAID-funded projects working in Cambodia, especially those implemented through Feed the Future programs in the same target provinces.

The RFF II team collaborated closely with the **Save the Children/NOURISH** team, mainly to create synergy through activities under Outcome 3, namely the development and implementation of SBCC on nutrition and WASH. RFF II received substantive in-kind support from NOURISH, especially on the ToT training manual on hygiene and sanitation in food preparation, and the method for commercial fish powder processing, and reciprocated by providing inputs to some of the NOURISH's communication campaign materials, including a TV spot and "soundbites" scripts, for airing on radio.

The World Vegetable Center (AVRDC), courtesy of their USAID-funded project promoting homestead gardening of nutritious vegetables in Cambodia (2016-2018), provided initial seed and technical inputs for establishing homestead vegetable gardens and also gardens on RFF II-supported CFR banks. The AVRDC project and RFF II jointly funded positions within PNGOs designated to providing continued backstopping to the participating farmers in the beneficiaries in the 4 FtF target provinces.

RFF II team collaborated informally with a number of **Feed the Future Innovation Labs** active in Cambodia, especially Sustainable Intensification Innovation Lab led by Kansas State University, Nutrition Innovation Lab led by Tufts University, and AquaFish Innovation Lab led by Oregon State University, mainly by providing inputs and feedback to the research agenda and coordinating support to local partners in Cambodia. WorldFish scientists contributed to a number of activities led by **CE SAIN** (Center of Excellence on Sustainable Agricultural Intensification and Nutrition (SAIN)), established within the Royal University of Agriculture and was the designated local partner to all FfF Innovation Lab projects in Cambodia. For example, WorldFish scientists participated in review committees of student research proposals and theses on relevant topics. The RFF II team also contributed to a number of public events and conferences organized by CE SAIN/RUA, including the *First International Sustainable Agricultural Intensification and Nutrition Conference* in January 2018.

RFF II interacted with several other USAID-funded projects over the course of few years to exchange information and explore areas of collaboration/synergies. WorldFish scientists also gave a seminar on Mekong fisheries and the CFR approach to a group of Young Eco Ambassadors from the **Wonders of the Mekong** project in August 2018. In mid-2019, RFF II Chief of Party attended a coordination meeting among four USAID-funded projects – **Greening Prey Lang (GPL)**, **Sustainable Water Partnership (SWP)**, and **HARVEST II** – to discuss potential areas of collaboration with regards to resource management issues especially in Kampong Thom province. The discussion led to a field mission by SWP team to RFF II sites in Kampong Thom to learn about the project approach and related water management issues. In June 2019, WorldFish and partner staff organized a field visit of two senior staff from Winrock International, leading SWP, to learn from RFF II project experiences in how to build and sustain CFRs.

The **Communications team of USAID Cambodia** undertook a number of activities to build the capacity of RFF II team members in capturing success stories. First, the WorldFish national M&E coordinator participated in a training course organized by USAID Cambodia on communications. Based on some of the modules during this training, two resource people from USAID Cambodia Mission delivered training module on skills for taking good photographs through a two-day training course in June 2017 for other WorldFish and PNGO staff, covering such topics as taking and captioning photographs, and planning for, developing, and writing Success Stories. A total of 17 people (4 females) participated in this training course. The outcome of this investment in building local capacity in communications are quite significant, as shown in the success stories collected by the trainees (See **Annex 4** for a full list of success stories).

c) Other Development Partners

At the request of a **GIZ-funded Multisectoral Food and Nutrition Security (MUSEFO)** project, the RFF II team provided a training to MUSEFO partner staff in August 2017 to improve their knowledge and understanding of the CFR/RFF concept, importance of small indigenous fish for nutrition, and how to prepare small fish for children under 2 years old. A total of 16 participants (5 females) including 2 GIZ staff, 6 CEDAC staff, 6 demonstration farmers, and 2 Provincial Department Officers from Kampong Thom and Kampot provinces participated in this training. In addition, RFF II contributed to development of another GIZ project in Cambodia. Following a number of coordination activities with GIZ, including GIZ attendance at the 2018 RFF II annual provincial reflection workshop in Kampong Thom, a field visit by the GIZ Mission to a RFF II site, a new GIZ project called '**Sustainable Aquaculture and Community Fish Refuge Management (SAFR)**'¹⁶, being implemented in Kampong Thom from 2020-2023, has adopted CFR approach

¹⁶ <https://www.giz.de/de/downloads/giz2020-en-cambodia-fischrei-sv.pdf>

as a major pillar of the project. SAFR, with an overall objective to support food insecure population of Cambodia to gain more fish products and higher incomes, will use the WorldFish-FiA Guidelines for CFR-RFF System Management in Cambodia, during the implementation.

WorldFish Scientists contributed significantly to the formulation of '**Cambodia Programme for Sustainable and Inclusive Growth in the Fisheries Sector**' (**CapFish**), an EU-funded program to Cambodia¹⁷, the largest fisheries sector support ever in the country. In addition to providing information and data to EU consultants during the earlier feasibility assessment stage, the RFF II team hosted a joint field mission by **FiA, EU Delegation to Cambodia**, and the **French Agency for Development (AFD)** to CFRs in Siem Reap in 2017, for them to learn from the lessons of the two USAID-funded RFF projects.

RFF II was part of a number of exchange programs organized by **WorldFish and/or CGIAR** to establish collaboration and synergies among its global and regional programs. The RFF II team members participated in a series of regional study tours and workshops involving their peers from Cambodia, Bangladesh, India, and Myanmar, where the respective WorldFish country offices were implementing USAID-funded projects. In 2018 RFF II project team members and FiA representatives visited WorldFish programs in Bangladesh to share knowledge and experience. In 2019, RFF II hosted visitors from Bangladesh, India, Myanmar, as well as several African countries. The most notable outcome was the synergy with ongoing and upcoming **EU/International Fund for Agricultural Development (IFAD)**-funded projects in support of **Aquaculture of Small Indigenous Species of Fish** for nutrition security in these countries. Many of the participants of these exchange visits recognized the value of CFR approach in enhancing wild fish stocks in seasonal wetlands.

In 2017, RFF II hosted a group of 27 people from Lao PDR, Vietnam, and Philippines to visit CFR sites, as part of the **CGIAR research program on Climate Change, Agriculture, and Food Security (CCAFS)**. The visitors saw the relevance of CFR approaches in the rice field environments in their respective home country and regions, and expressed keen interest in conducting own experiments in CFR.

RFF II team collaborated with some universities in the US, including co-authoring a journal article¹⁸ with **Cornell University** researchers, and contributing to a book¹⁹ published by Professor Laurence Smith at **Brown University**. The RFF II project work was also a basis of three other journal articles and one chapter led by WorldFish scientists in Cambodia²⁰, published in collaboration with other WorldFish offices, **IRRI, IWMI, and FAO**.

¹⁷ <https://www.khmertimeskh.com/635822/eu-launches-124m-project-to-boost-fisheries-sector/>

¹⁸ <https://doi.org/10.5751/ES-11053-240318>

¹⁹ <https://northernchange.brown.edu/rivers-of-power-book/>

²⁰ <https://www.sciencedirect.com/science/article/pii/S0165783620301326>

<https://www.frontiersin.org/articles/10.3389/fsufs.2020.576179/full>

MONITORING AND EVALUATION

This section presents major findings of the project M&E surveys.

a) Biological Monitoring Survey

Recovery of fish biomass in CFRs after decline during drought years. Biological Monitoring (BioM) survey results show that, after an initial increase in 2018, the biomass of fish in CFRs declined in 2019 and 2020, most likely because of the two consecutive years of drought conditions in these years, characterized by delayed onset of, and less than average rainfall in the rainy season. The delayed rainy season affected spawning migration of fish and reduced habitat extent for the fish to feed and grow. However, the BioM survey data show dramatic recovery of fish and OAA in February 2021, to the level comparable to 2018 in terms of the weight of fish caught per square meter of net used for the monitoring survey (**Figure 8**). This is most likely the result of extreme flood event in October - November 2020, which created favorable rice field habitats for fish to breed and thrive in the early dry season in Dec. 2020 – Feb. 2021. This is an encouraging indication that the fish population in rice fields may also recover in the upcoming rainy season of 2021, and also supported by the CCM survey results below showing that RFF catch indeed increased in March 2021.

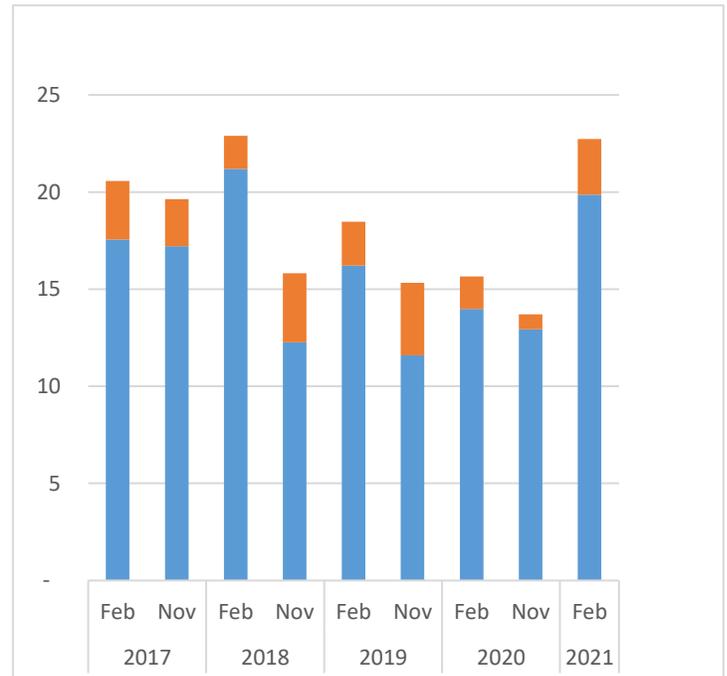


Figure 7. Average fish biomass in CFR (g/m²)

Species richness gradually recovered in Categories 2 & 3 CFRs. Based on the number of fish and OAAs caught in the experimental fishnet and the number of species in the catch, we assessed species richness of CFRs using the Margalef's diversity index.²¹

As **Figure 9** shows, the species richness of CFRs in *Category 2. Community pond without flooding (C2)* and *Category 3. Community pond with flooding (C3)* gradually increased from 2017 to 2021, from 2.03 in 2017 to 2.37 in 2021, and from 2.20 to 2.67, respectively. These CFRs are relatively small in size, less diverse in habitat types within CFR than the other two categories, and are presumably more influenced by the management practices of respective CFR committees. On the other hand, CFRs in *Category 1. Irrigation reservoir (C1)* experienced slight decline in the average Margalef's index, from 2.68 in 2017 to 2.43. The species richness in the CFRs in *Category 4. Within large water body (C4)* remained stable throughout the project period (2.41, except for a dent in 2019, the severe drought year).

²¹ The Margalef's diversity index depends heavily on the sample size and effort, and standardizes the number of species encountered against the total number of individuals encountered. It is calculated through the following formula: $(S-1)/\ln(N)$, where S = total number of species and N = total number of individuals in the sample. Margalef, R. 1968. *Perspective in Ecological Theory*. University of Chicago Press, Chicago, USA.

The slight increase in the species richness in C2 and C3 CFRs over the course of 5 years is an encouraging result. Another important finding is that the average species richness index in the CFRs supported since RFF Phase I (started in 2012) were higher in 2017 than the CFRs that newly joined the project in Phase II (2016-) for C1, C2, and C3. As the project progressed, the average species richness of the Phase I sites and Phase II sites seemed to converge (i.e. the scores of Phase II sites increased to the level similar to the Phase I sites). This indicates that species richness in relatively small CFRs can be recovered through good management over several years. On the other hand, species richness in C1 CFRs continued to decline for both Phase I and Phase II sites. Further analyses on the biophysical characteristics, management interventions, and fish and OAA biomass and species richness are in progress and will be disseminated in future publications of WorldFish.

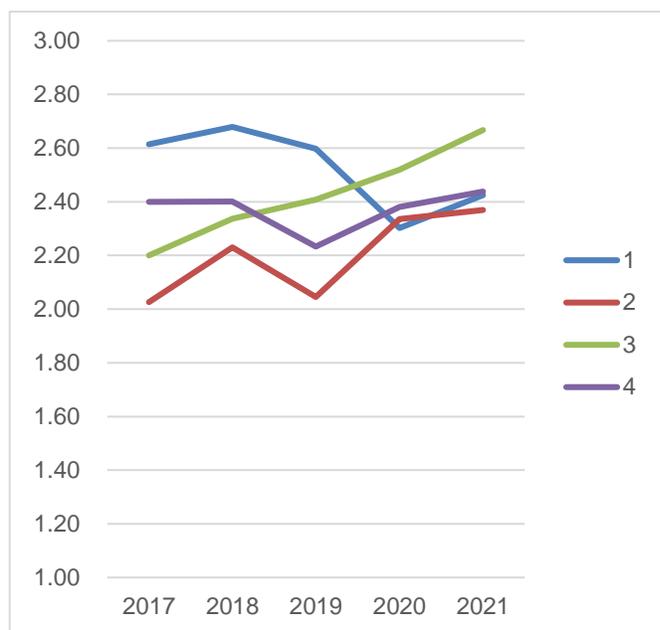


Figure 8. Average species richness index score by CFR category

b) Catch and Consumption Survey

Dramatic recovery of rice field fish catch in early 2021, after declines during drought years.

Household Fish Catch and Consumption Monitoring (CCM) survey results were consistent with the results of the BioM survey above. Household fish catch in the dry season of 2018 showed an initial increase after the project implementation started; however, the catches in the wet season (September) of 2019 and 2020 were lower than 2018 because of the less than average rainfall and reduced extent of flooded rice fields for fishing in those years²².

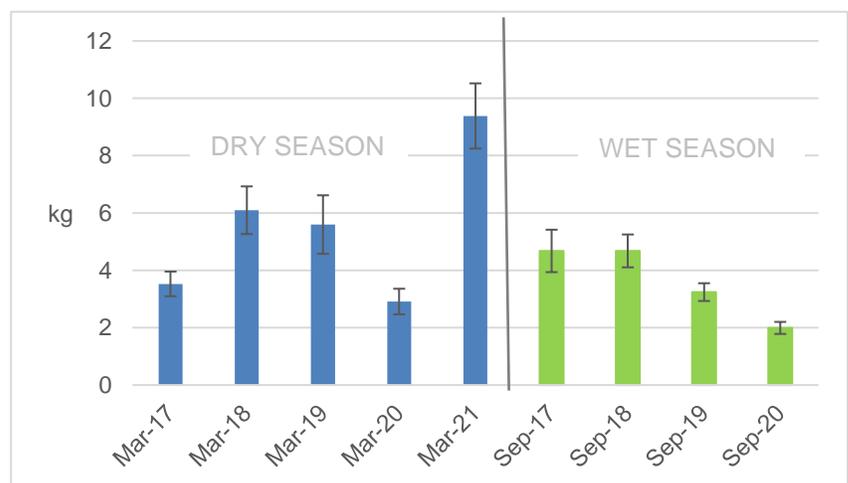


Figure 9. Average fish catch per week per household inside Zone of Influence

The catches in the following dry season (March 2020) were much lower after two consecutive years of drought. However, most likely thanks to the recovery of fish stocks in rice fields later in the year during wet season (as reflected in the BioM result of February 2021 above), the catch dramatically recovered in March 2021, 9.38kg/household/week. This was the highest catch level

²² The prolonged 2019 dry period and the late, shortened 2019 wet season in Cambodia reduced the size and accessibility of rice field flooded areas for fish feeding and spawning in the 2019 'wet season'. This, in turn, contributed to lower average fish catch and consumption figures in September 2019 and March 2020 compared to baseline results.

ever recorded since the monitoring started in March 2017, despite in the middle of dry season when the extent of fishing grounds is normally limited (**Figure 10**). The recovery of rice field fisheries in March 2021 was likely the result of extreme flooding in October - November 2020, which created favorable conditions for fish to thrive in the rice field environment in the early dry season of 2021.

Increase in fish sold and processed. **Figure 12** shows that household fish catch in March 2021

resulted in large amount of surplus for the households to sell and/or process for consumption later. It appeared that households also increased the quantity of fish they kept for home consumption to 4.4kg/week/household, 60-64% more than what they were able to keep in March 2017 and 2020 (the years of low catch due to drought). This likely meant that they didn't have to purchase fish from market for home consumption in March 2021 (fishing households tend to sell wild fish of high commercial value and purchase cheaper aquaculture fish for home consumption). The amount of fish the households were able to sell more than doubled compared to March 2020, indicating significant increase in cash income from selling the fish. The quantity of fish processed in March 2021 almost quadrupled compared to the same month in 2017 and 2020, and more than doubled compared to 2018 and 2019; thus the project beneficiary households were able to save and store large quantity of fish in 2021 as safeguard, either for home consumption or selling later.

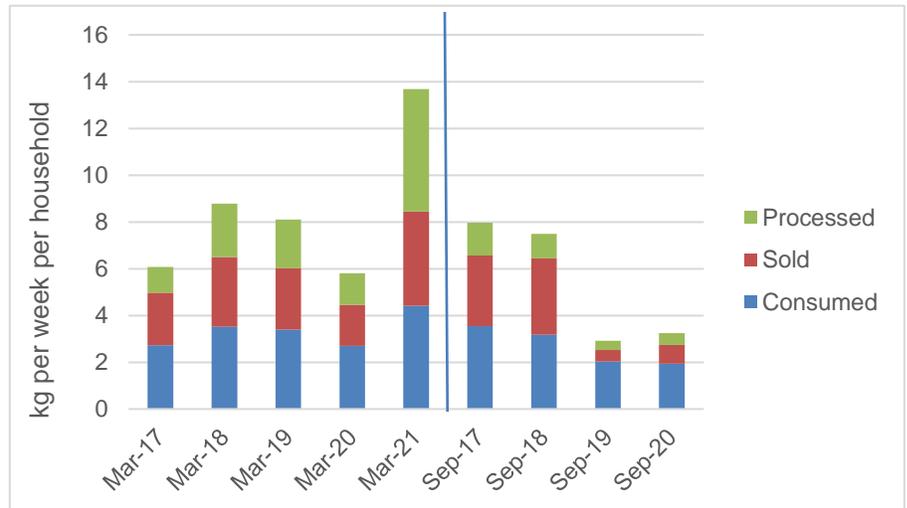


Figure 11. Household utilization of fish

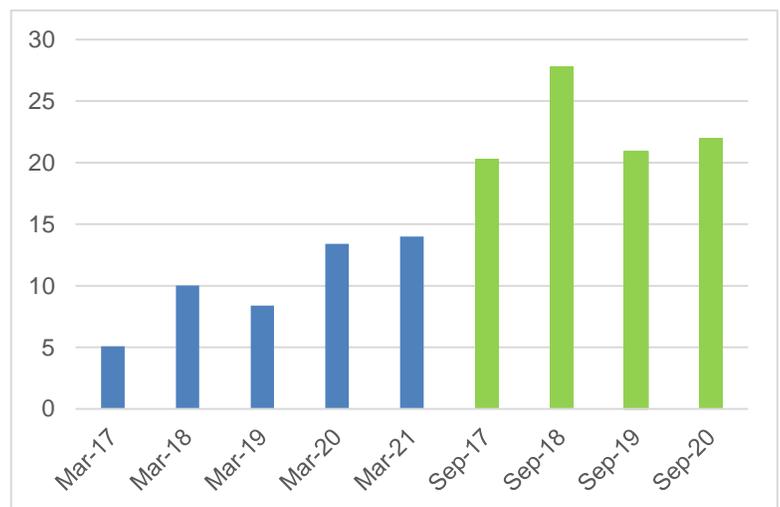


Figure 10. Children under the age of 5 consuming small fish (%)

Steady increase in consumption of

nutrient rich small fish. Despite the fluctuation in fish catch, the proportion of households and of children under five years of age consuming small fish species have shown steady increase (see **Figure 11**). The percentage of households reporting consumption of small fish during the week prior to the survey in March 2021 was 31%, a rate comparable to September in previous years (September is wet season and small fish is easily available from rice fields for home consumption). This indicates that caretakers responded to project behavior change messaging

at awareness-raising events and caregiver sessions, and prioritized feeding children with small nutritious fish even when its supply was limited.

Household preparation of fish has become more nutrition sensitive. Figure 13 shows the percentage of households who remove the viscera and head of small fish species before consumption (parts which are rich in nutrients) has decreased markedly since 2017. In March 2021, 34% of the household reported consuming small fish whole, instead of removing head and viscera, compared to below 8% in 2017. These results show that more families are making sure they keep the parts of fish that are rich in nutrients when preparing meals at home, indicating the effectiveness of project caregiver sessions and awareness-raising activities of the project.

c) Livelihood Survey Results

Table 10. Sample sizes of livelihood surveys

Table 10 shows the number of households interviewed in the baseline and endline surveys. The sampling methodology was established to represent households living within the ZOI of all CFRs supported by RFF-II (Treatment), and households living in the vicinity of CFRs not supported by RFF-II

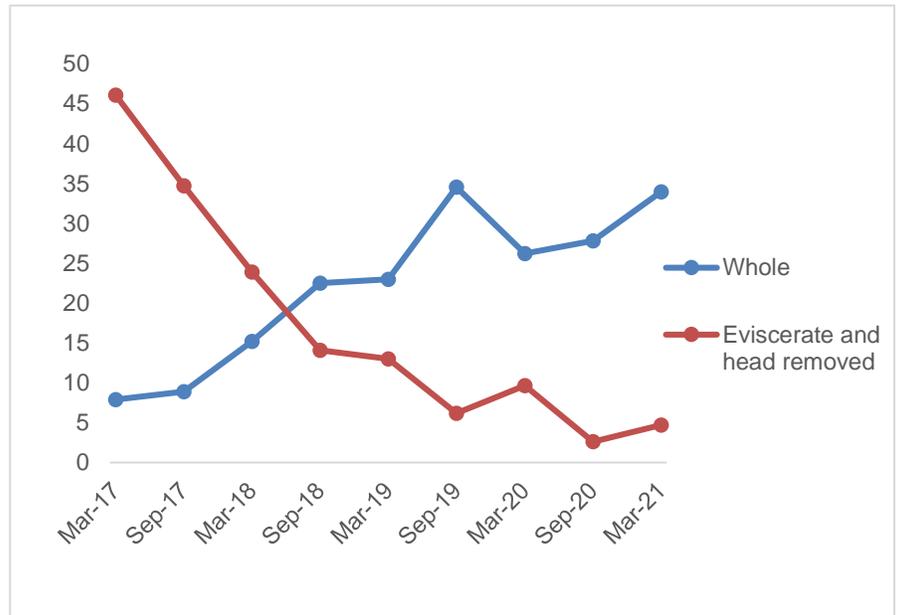


Figure 12. Preparation of small fish for home consumption (%)

Province	Baseline (2017)			Endline (2021)		
	Treatment	Control	Total	Treatment	Control	Total
Battambang	200	50	250	128	16	144
Kampong Thom	260	60	320	116	46	162
Pursat	240	50	290	144	21	165
Siem Reap	360	60	420	202	26	228
Total	1060	220	1280	590	109	699

(Control). For the baseline survey, the sample size was calculated to require at least 1,058 families for the Treatment group, and the Control group to be approximately 20% of the Treatment group. The household sample size per village was set at 10 families and village sample size per

CFR at 1-2 villages (total of 104 villages). The sample size of CFRs included in the baseline survey was 53 sites. The endline survey was a longitudinal survey, sampling approximately 55% of the same households interviewed for the baseline survey.

Average fish catch quantity per household declined in the project ZOI but the percentage of households engaged in fishing was higher than in the control sites. On average, quantity of fish caught (kg/household/year) declined by 8%, from 221kg in 2017 to 203kg in 2021, likely due to the negative influence of two consecutive years of drought in 2019-2020. The average household fish catch also declined for control sites, from 233kg in 2017 to 179kg in 2021 (-23%). The proportion of surveyed households reporting fish catch in the endline year was much less than the baseline year for both treatment sites and control sites. However, 78% of the households were still engaged in fishing at treatment sites, while only 56% of the households were fishing at control sites (Table 11). These results indicate that fish populations in the rice field environments

around the project-supported CFRs remained relatively stable and accessible to local households despite reduced extent of fishing grounds and likely declines in fish populations elsewhere during the much of 2020.

Table 11. Average household fish catch and income

	Treatment sites (CFR supported by RFFII)			Control sites (CFR not supported)		
	Baseline	Endline	% change	Baseline	Endline	% change
Number of surveyed HH	1060	589	---	220	110	---
Number of HH engaged in fishing	947	457	---	206	62	---
% HH engaged in fishing	89%	78%	-11%	94%	56%	-38%
Annual fish catch per surveyed HH (kg)	221	203	-8%	233	179	-23%
% HH selling fish	53%	72%	+19%	54%	83%	+29%
Annual quantity of fish sold per HH selling fish (kg)	161	289	+80%	195	290	+49%
Total value of the fish sold (USD)	221	734	+232%	267	737	+176%

Amount and the value of fish sold increased in the project ZOI compared to control sites.

The percentage of surveyed households who sold the fish they caught increased from 53% in 2017 to 72% in 2021. The similar increase was also observed among households at the control sites (54% and 83%, respectively). This was likely the result of increased market value of wild fish in recent years. Among the households in the Treatment group who sold fish, the average quantity sold increased from 161kg in 2017 to 289kg in 2021 (+80%). The rate of increase was lower for households in the Control group, from 195kg in 2017 to 290kg in 2021 (49%). The higher quantities of fish caught and sold by households in the Control group when compared to the Treatment group at the baseline was probably because the CFRs at the control sites were not well protected nor properly managed. The surveyed households at control sites are likely to be catching fish from CFRs although they are not allowed to do so. This practice is not sustainable in a long run, and may have contributed to the greater decline in catch at the endline for Control households when compared to Treatment households. An average price of fish sold by households in ZOI was \$ 1.37 per kilo in 2017, and was \$2.54 per kilo in 2021, according to the CCM survey results. The average value of the fish sold by the households in the Treatment group more than tripled from USD221 to USD734 per household. The increase of USD513 is a significant amount for rural households in Cambodia. The fish price increase reflects not only the general inflation in the wild fish prices, but also an increase in the quality of fish catch, i.e. increased share of high value fish species in the catch. The Livelihood survey respondents reported increased catch and sales of climbing perch, walking catfish, and freshwater crabs, all relatively high-value species, between the baseline and the endline.

The increase in cash income from fishing was spent on education and health-related expenses.

Fishing as a share of total income increased from baseline (21%) to endline (28%) for the treatment group, but remained same in the control group. The most important purpose of expenditure of income from fishing was day-to-day expenses, followed by education of children, and health/medical expenses. The proportion of the fishing income allocated to these expenditures was unchanged before and after the project and similar for the treatment and control groups. The results indicate that despite fluctuating fish catch and income, the rice field

fishery will continue to play an important role in the livelihood of rural rice farming communities in the foreseeable future.

The year 2020 was a difficult year overall for household livelihoods and income. The survey results show that the proportion of households experiencing income shocks was much higher in the endline survey year of 2020 compared to the baseline year of 2016. In both years, the most commonly reported income shocks were loss of crops and productive assets. However, in 2020 two major incidents clearly impacted household income: climate anomalies and COVID-19. High percentages of households in both treatment and control groups reported experiencing crop loss during the period August – October 2020 (22% of treatment households and 27% of control households). According to the FGDs conducted in parallel to the household survey, the crop losses were caused by prolonged dry spells in the middle of rainy season in August and September, and an extreme flood event in October 2020. Much higher rates of job losses were reported during the period March – October 2020, compared to the same period in 2016, presumably attributable to the impact of the COVID-19 pandemic on the economy, such as the closure of factories and tourism-related businesses, the return of migrant workers from Thailand, border closures, and generally weakened commerce.

d) Knowledge Attitude Practice (KAP) Survey on Food, Nutrition, and WASH

The Social Behavior Change Communication (SBCC) strategy of the project aimed at enhancing nutritional outcome of the project through awareness raising, education, and behavior change around nutritional value of fish, dietary diversity, appropriate food preparation, safe drinking water, hygiene and sanitation for maternal health and child growth and development. The KAP surveys were conducted by external consultant 3 times during the project implementation to assess the effectiveness of the SBCC interventions. The baseline survey was conducted in March 2018, the midline in March 2019, and the endline in March 2021.

Table 12. Sample size of KAP survey

Province	Village	Household
Battambang	10	210
Kampong Thom	10	210
Pursat	8	165
Siem Reap	8	165
Total	36	756

Error! Not a valid bookmark self-reference. shows the number of households interviewed in the KAP surveys (n = 756). The sampling methodology was established to represent households living within the ZOI of all CFRs supported by RFF-II, and was standardized for the baseline, midline, and endline surveys. While the same villages were repeatedly surveyed, **the households were selected based on the following criteria:**

- at least one member engaged in fishing within the RFF system in previous year;
- at least one child under 5 years old; and
- not undertaking seasonal migration out of the home village.

Once the eligible household was selected for the interview, the questionnaire was administered to the main caregiver of the youngest child aged under five years old. We **conducted the KAP surveys in March, in the middle of dry season when livelihood options are limited and many households are vulnerable to food and water shortages.** The respondents were asked to recall their actions in the previous week or a day before the interview, depending on the question. The dietary and WASH practices in March are likely to reflect the conditions of the surveyed

households at “lean months” of the year. Therefore, **the results of the surveys do not necessarily reflect their status for the whole year.**

Increased knowledge and practice on sanitary food preparation, hand washing, clean homestead environment. While the percentage of respondents with knowledge of appropriate hand washing practices was already high at the beginning of the project period, the frequency of hand-washing increased at the endline compared to midline and baseline surveys. In the endline survey, the average frequency of handwashing by the respondent was six times per day, a significant increase from the average of four times per day reported in the earlier surveys. Out of the six times of handwashing, they used soaps four times a day on average, also an increase from three times a day reported in the earlier surveys. This was presumably the result of nation-wide campaign to prevent the spread of COVID-19, which was also integrated into the project's SBCC activities since the mid-2020. The project team included training on COVID-19 prevention measures at all training events from then on.

Household environment saw remarkable improvements over the project implementation period. The awareness of the importance of clean homestead environment to avoid contamination of food and keep the family healthy increased from 50% at the baseline to 57% at the endline. More importantly, the project survey teams observed marked improvements in home cleanliness during the endline survey (**Figure 14**).

At the baseline the surveyors found that in most of the home areas there was garbage lying around (89.8%), and/or animal feces were present (65.5%). The prevalence declined for garbage (62.6%) and animal feces (47.6%). In addition, the proportion of surveyed households who had rubbish bins more than doubled, from 21% at the baseline to 55% at the endline.

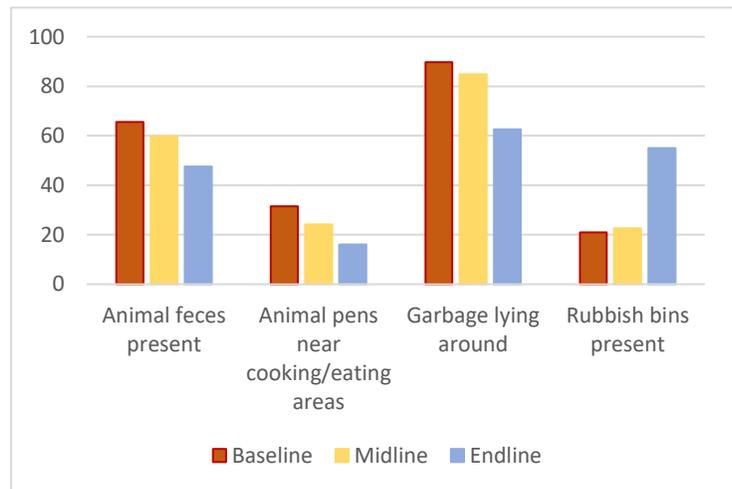


Figure 13. Cleanliness in homestead environment (%)

Limited impact on dietary diversity of women in reproductive age (WRA). It has been a common knowledge that an average Cambodian diet consists mainly of rice, fish, and vegetables. The survey confirmed that the frequency of consuming fish in family meals and the average amount of fish consumed remained high throughout the project period. Over 90% of the respondents reported eating fish at home on the previous day before the survey, throughout the project period. Consumption of grains (presumably rice) was reported by over 99.5% of the respondents in all surveys, while consumption of “other vegetables”²³ was reported by 83-86% of the respondents.

Integrating more diverse food groups, other than these 3 groups, into daily diet was perceived either “difficult” or “somewhat difficult” by 33.2% of the respondents at the baseline. This perception slightly declined to 29.4% at the endline. However, the surveys did not detect any improvements in the actual behavior in order to increase dietary diversity. The frequency of

²³ However, this category does not include “dark green leafy vegetables” and “vitamin A rich vegetables and fruits” that are considered more important from nutritional perspective.

consumption of other important food groups, namely “dark green leafy vegetables”, “vitamin A rich vegetables and fruits”, and “nuts and seeds”, declined during the project period²⁴.

shows the percentage of the surveyed households, who reported a diet in the previous day with Minimum Dietary Diversity (MDD) score of five food groups²⁵ or higher, declined during the project period. The percentage of Women at Reproductive Age (WRA) who scored MDD of 5 or higher was 58.8% at the baseline, but gradually declined to 46.4% at the midline, then 43% at the endline. The reason for this decline is unclear, however, presumably related to the income declines/crop losses due to drought in 2019 and 2020, and COVID-19-related income loss in 2020-2021 (see the *Livelihood Survey Results* above, and the section *Food insecurity persists in the project ZOI due to climate and economic shocks*). Despite the growing level of awareness and knowledge among WRA and caretakers of the importance of complementary feeding of the children and dietary diversity throughout the project period, the actual dietary practices appeared to be heavily affected by availability of home-grown food for subsistence and ability to purchase food from markets or others. For example, the percentage of the surveyed households reporting the cultivation of crops and vegetables at the time of the survey declined from 72.8% at the baseline to 58.7% at the midline, and 47% at the endline. Fifty one percent of the households were categorized as experiencing severe food insecurity at the baseline, using the FAO tool on Food Insecurity Experience Scale (FIES). The percentage declined to 39% at the midline but increased to 64% at the endline. The degree of food insecurity is not uniformly distributed across the target provinces. In Battambang and Pursat the level of food insecurity declined from the baseline to the endline. On the other hand, the rate of food insecurity roughly doubled in Kampong Thom and Siem Reap, which was partially attributed to the impact of COVID-19.

e) CFR Governance Capacity Assessments

Five elements of good governance (Kim and Brooks 2015, see **Box 2**) and a set of indicators were used for scoring the governance capacity of each CFR during the annual reflection workshop and self-assessments. The CFR Capacity Assessments, conducted three times during the project implementation for each of the project-supported CFRs, show steady increase in the capacity of CFR committees on average (**Figure 15**). The average score was 1.9 at the baseline survey in 2016, and improved to 3.6 at the midline survey in 2018, then to 4.2 at the end line in 2021. A hundred and thirteen CFRs, or 81% of the project-supported CFRs scored 4 or above. Main reasons behind some CFRs scoring below 4 was low scores on “resource mobilization” and in the case of one CFR “representation and gender balance”. Further assistance to these relatively weaker CFRs in recruiting women to join CFR committees and participate in committee meetings, and in improving their communication skills to raise funds and in-kind support from other local community members is needed.

²⁴ We were not able to find other studies with comparable information to verify whether this was a nation-wide trend.

²⁵ FAO recommends that Minimum Dietary Diversity score for WRA (MDD-W) be at least five out of ten food groups.

CHALLENGES AND SOLUTIONS below.) Availability of vegetables and fruits in own home gardens was limited in the midst of dry season in March; if the household income was also limited in that time period due to poor harvest earlier in the year or limited wage labor opportunities due to COVID-19, the households would not spend limited cash on purchasing diversified food items.

Table 13. MDD scores of adults and WRA

MDD Score	All respondents			WRA		
	Baseline (n=756)	Midline (n=756)	Endline (n=756)	Baseline (n=597)	Midline (n=528)	Endline (n=581)
0-4	42.6%	55.3%	59.0%	41.2%	53.4%	57.0%
5	28.2%	21.7%	21.2%	28.6%	21.4%	20.8%
6-10	29.2%	23.0%	19.8%	30.2%	25.2%	22.2%
Average	4.90	4.50	4.39	4.80	4.40	4.48

On the other hand, our findings can be interpreted rather favorably in a broader perspective. More than 80% of the respondents were in the MDD scores of 3-6 throughout the project period, and the average score was constantly above 4, as

shows. The percentage of WRA consuming MDD of 5 or above in a similar study conducted by FAO at different location²⁶ was 41% in 2018/2019, lower than the beneficiaries of RFF II, who achieved 43% in 2020.

Dietary diversity for children between 6 to 23 months old improved. Contrary to the results on the diet of adults and WRA, the results for children below the age of 2 years old were quite positive. More respondents reported feeding their infants in 6-23 months of age more frequently with solid or soft complementary food in addition to milk, as recommended by the project SBCC, compared to the midline and baseline surveys. At the baseline, 79.5% of care takers reported feeding their breastfed babies between 6-8 months of age with complementary food items 3 times or more each day²⁷. This percentage increased to 86.6% at the endline.

According to World Health Organization (WHO), the recommended MDD score for children between 6 to 23 months of age is four out of seven food groups consumed each day²⁸. The percentage of children whose dietary diversity met this recommended score increased from 47% at the baseline to 54% at the endline. The survey results indicated that the dietary diversity for children by different age groups all increased between the baseline and endline surveys (**Table 14**). The precise reason why the midline survey results show decline in the dietary diversity of children under 2 years old is unclear; however, it is likely related to the reduced availability of home-grown food and/or fish catch during the survey period due to severe drought in 2019. The percentage significantly recovered during the endline survey contrary to the results for all respondents above. This could be the positive outcome of the results showing mothers and caregivers paying more attention to the quantity and frequency of feeding small children despite the food security challenges.

Table 14. MDD score of children between 6-23 months of age

MDD score	Baseline			Midline			Endline		
	6-8mos (n=50)	9-11mos (n=52)	12-23mos (n=230)	6-8mos (n=47)	9-11mos (n=48)	12-23mos (n=215)	6-8mos (n=74)	9-11mos (n=59)	12-23mos (n=212)

²⁶ FAO. 2021. Minimum dietary diversity for women. Rome. <https://doi.org/10.4060/cb3434en>

²⁷ The WHO recommendation for complementary feeding of infants between 6-8 months of age is 2-3 times a day.

²⁸ <https://www.who.int/data/nutrition/nlis/info/infant-and-young-child-feeding>

0-3	80.0%	76.9%	41.2%	89.3%	75.1%	53.0%	77.1%	55.9%	32.0%
4	8.0%	15.4%	36.1%	4.3%	20.8%	24.2%	12.2%	18.6%	27.4%
5-7	12.0%	7.7%	22.6%	6.4%	4.2%	22.8%	10.9%	25.5%	40.6%
MDD>=4	20.0%	23.1%	58.7%	10.6%	25.0%	47.0%	23.0%	44.1%	67.9%

Food insecurity persists in the project ZOI due to climate and economic shocks. Despite the growing level of awareness and knowledge among WRA and caretakers of the importance of complementary feeding of the children and dietary diversity throughout the project period, the actual dietary practices appeared to be heavily affected by availability of home-grown food for subsistence and ability to purchase food from markets or others. For example, the percentage of the surveyed households reporting the cultivation of crops and vegetables at the time of the survey declined from 72.8% at the baseline to 58.7% at the midline, and 47% at the endline²⁹. Fifty one percent of the households were categorized as experiencing severe food insecurity at the baseline, using the FAO tool on Food Insecurity Experience Scale (FIES). The percentage declined to 39% at the midline but increased to 64% at the endline. The degree of food insecurity is not uniformly distributed across the target provinces. In Battambang and Pursat the level of food insecurity declined from the baseline to the endline. On the other hand, the rate of food insecurity roughly doubled in Kampong Thom and Siem Reap, which was partially attributed to the impact of COVID-19.

f) CFR Governance Capacity Assessments

Five elements of good governance (Kim and Brooks 2015, see **Box 2**) and a set of indicators were used for scoring the governance capacity of each CFR during the annual reflection workshop and self-assessments. The CFR Capacity Assessments, conducted three times during the project implementation for each of the project-supported CFRs, show steady increase in the capacity of CFR committees on average (**Figure 15**). The average score was 1.9 at the baseline survey in 2016, and improved to 3.6 at the midline survey in 2018, then to 4.2 at the end line in 2021. A hundred and thirteen CFRs, or 81% of the project-supported CFRs scored 4 or above. Main reasons behind some CFRs scoring below 4 was low scores on “resource mobilization” and in the case of one CFR “representation and gender balance”. Further assistance to these relatively weaker CFRs in recruiting women to join CFR committees and participate in committee meetings, and in improving their communication skills to raise funds and in-kind support from other local community members is needed.

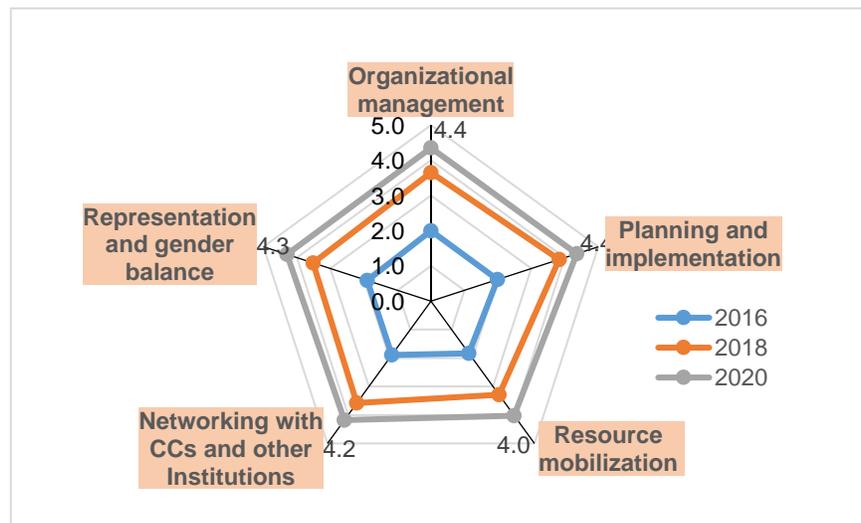


Figure 14. Average scores of CFR capacity assessment of 140 CFRs

²⁹ However, over 50% of the households cultivating vegetables at the time of endline survey were growing and home consuming nutrient-rich vegetables such as morning glory, eggplant, and amaranth, approximately doubling the percentage comparing to the baseline and endline surveys.

CHALLENGES AND SOLUTIONS

a) Climate Anomalies

Early onset of, and prolonged rainy season in 2017. Some project activities, such as deepening/expanding CFRs, involved small earthworks and were difficult to carry out effectively during rainy season. Because heavy rains started earlier than usual in April in 2017, some project CFRs were not able to complete the earthworks before the rainy season. The project advised the CFR committees to suspend the earthworks until the following dry season, due to start in December 2017. However, a prolonged wet season with rainfall continuing into November and December 2017 slowed down the earthwork activities further. Moreover, unseasonable heavy rainfalls and storms during the dry season (in February and March 2018) resulted in suspension or delay in the ongoing earthwork.

Earthworks resumed in January 2018 when the roads to the CFRs became accessible. In addition, to catch up with the delay, the project reviewed community action plans and made arrangements with the CFR committees and local authorities to re-allocate some budget from the plans for pumping water out of the ponds in order to speed up excavation, especially for CFRs in Categories 2 and 3. The project team also expedited the review and approval of action plans and the budgets for the remaining CFRs to start earthworks ahead of schedule during the dry season of 2018, and complete them before the rainy season began in 2018. Earthworks for CFRs in Categories 1 and 4 were postponed until mid-April or May when these areas were sufficiently dried out for earthworks. 99% of the planned earthworks were completed by the end of May 2018 despite the challenging conditions.

Drought conditions in two consecutive years of 2019 and 2020. Less-than-usual rainfall in the wet season of 2018 (May – October), followed by a hotter-than-usual dry season in January – April of 2019 resulted in widespread water shortages in the Mekong region, and an increase in water withdrawal from project CFRs for irrigation of rice as well as domestic uses, especially in areas where other sources of water had already depleted. The reduction in CFR water levels meant lower survival rate for the fish in CFR and competition among various water users. Some individuals took advantage of the water shortage situations and pumped excessive amount of water from CFRs for commercial sale in some rural areas elsewhere, which created conflict with the local households for whom the access to water from the CFR was a matter of survival.

Another drier-than-usual wet season followed in May – November 2019, and a hotter- and drier-than-usual and prolonged dry season in the first half of 2020 exacerbated the problem even further. Some project-supported drinking water stations had to suspend operation due to degradation in water quality, despite high demand for clean drinking water in these dry months. The delayed onset of the 2020 wet season and the reduced extent of the Tonle Sap floodplain led to lower levels of inundation of rice fields surrounding the 140 project CFRs. This, in turn, has affected the migration of some fish to surrounding rice fields, and led to a reduction in the fishing activities of local households in 2020.

In response to the water shortage issues, the project team conducted an assessment and proactively identified CFRs with a possibility of water levels falling below 0.5m by the end of dry season. In collaboration with the CFR committees and local authorities the project team developed a drought response plan for each of these vulnerable CFRs and prepared the local communities for the upcoming dry season. For some CFRs where project-supported water kiosks were established, the specific mitigation measures were implemented with the involvement of both local management committees and Teuk Saat 1001. For example, to manage high demand for CFR water for commercial purposes, the project team facilitated meetings of CFR

committees and local authorities where they negotiated water allocation with other water users, including significant reduction in their use of water withdrawal for irrigating dry season rice crops and for commercial sale. It was also agreed at several CFR sites to limit water withdrawal by individual households for own domestic uses to one tractor kart per week per household. (See Section *Output 2.1 Increased capacity of communities to adapt to climate change through access to CFR water in dry season* for further details on the mitigation measures taken).

Extreme flood event in October-November 2020. Having suffered through two consecutive years of drought, heavy prolonged rainfalls and an extreme flood event in October 2020 (considered the worst since 2000) came as a big surprise, causing widespread damages to road infrastructure, households, and farmlands in Cambodia. It affected 31 CFRs supported by the project damaging CFRs associated infrastructure, such as banks, access roads, guard houses, and signboards. Some water kiosks had to suspend their operation due to flood damages to access roads and for distributing water bottles to consumers.

Main project interventions were designed to improve water storage capacity and retention in CFRs, and the connectivity of CFRs with other water bodies and surrounding rice fields; thus, these were proven effective in addressing the challenges associated with flood water management. The project-supported CFR committees also had the capacity to coordinate responses to these natural disasters; in villages that experienced flood damages, CFR committees facilitated restoration of essential infrastructure in the communities, such as access roads, water inlets and outlets to CFR, and signboards. The flood event also demonstrated additional benefit of CFRs in climate adaptation: draining and absorbing excess flood water from surrounding rice fields and residential areas into the refuge ponds.

b) Irrigation and Road Infrastructure Development

Rapid expansion of irrigation and road infrastructure changed water flow patterns in floodplain and created physical barriers to fish migration, and blocked connectivity among rice field habitats. Construction of irrigation infrastructure, such as dikes and canals, divert and distribute water from rivers to rice fields can block inflow of flood water into CFRs. Similarly, construction of roads changed water flow patterns and cut off connectivity between CFR, rice fields, and other water bodies. This, in turn, can interrupt fish migrating to rice fields to complete their breeding and spawning and lead to less fish available in the rice fields to be caught by local households. One of the project-supported CFRs completely lost water in-flow because of a new canal construction immediately upstream, another CFR was cut off from the rice fields on the other side of a new road. Several other CFRs relied on nearby irrigation canals to release water to receive sufficient inflows.

In response, the project staff conducted earthworks to improve channels and canals connecting CFRs to surrounding rice field fisheries. Project staff advised the CFR committees about how to discuss with relevant stakeholders to negotiate water flows and connectivity between fish refuges and rice field fisheries. The project staff also conduct awareness raising events in villages not immediately adjacent to CFRs but in neighboring communities, focused on the importance of CFRs. This has contributed to extending the support for the CFRs and fish conservation activities. WorldFish scientists actively advised the relevant government agencies and donors investing in irrigation infrastructure development, including AFD and ADB, to consider “fish-friendly” designs and operations of the existing and new schemes. Having documented similar issues emerging in other countries in the region, including Myanmar and Lao PDR, WorldFish also worked with International Water Management Institute (IWMI) and FAO

and published a global guideline on sustainable irrigation through integration of fisheries³⁰ in 2020.

Intensification of rice cultivation resulting in excessive use of agrochemical usage in some sites.

With the expanding access to irrigation water for cultivating rice during dry season, excessive agrochemical usage was observed in some sites. Agrochemicals such as pesticides and herbicides used in rice cultivation can be toxic for fish at high concentrations, especially for fish eggs and larvae. If one farmer in the connected rice fields uses chemicals, it easily spreads to other farmers' fields with the flow of water. The control of chemical inputs in rice cultivation requires community-based approaches.

Project team conducted awareness-raising activities at community and school levels, and also during regular village and commune meetings, on the negative impacts of excessive use of agrochemicals on the environment and fish. In addition, the project staff emphasized the importance of appropriate usage of pesticides, such as the correct concentrations following the manufacturers' instructions, and the timing of application so as to avoid negative impacts during fish spawning season.

c) Commune and National Elections in 2018

Increase in the government procedure for monitoring project activities before the elections.

During the period of several months prior to the commune and national elections in June and July 2018, village and commune chiefs in the project target areas requested the project team and PNGOs to seek permission from provincial governors when conducting any group gatherings, such as meetings, workshops, or trainings, and to invite the local authorities to attend these events. This meant that the project team had to start planning any training or meetings many weeks in advance with the local authorities to ensure their participation in the event and obtain provincial government approval. The project team had never experienced this level of scrutiny until the late 2017 when the additional administrative procedure started and was concerned as to why our project faced these restrictions.

After making some inquiries we found that other NGOs and development partners were also subject to the additional procedural requirements. FiA officials kindly helped explaining to the other government authorities that RFF II was about agriculture development/fisheries management and not a politically-motivated project; and thus, the project activities would not interfere in any way the election campaigns and the results. The project team followed the requirements for prior approvals from the provincial authorities on holding group gatherings, and for the attendance of local authorities in these events. Our requests for approval and invitations were accepted by the relevant authorities and did not face problems, as long as we prepared the requests well in advance of the events.

Government officials becoming unavailable during pre-election period. Local authorities were busy campaigning during the pre-election period, and most communes in project target areas requested the project team to delay field activities to avoid any confusion of the project activities with political activities. Similarly, the level of participation from government counterparts at the national and provincial level was low for a few months before and after the national election, causing interruption in some project activities.

The project team had anticipated this problem as early as 2017, based on the previous experience during the elections in 2013. Thus, some key activities were implemented ahead of schedule before the election campaigns started. During the few months of the election period,

³⁰ FAO, WorldFish and IWMI. 2020. Increasing the benefits and sustainability of irrigation through the integration of fisheries - A guide for water planners, managers and engineers. <https://doi.org/10.4060/cb2025en>

it was a perfect timing to have self-reflection among the project team on the progress so far, having implemented the project for 2 years. The team discussed the challenges encountered and how to improve the project implementation from then on.

Change in commune leadership. After the elections were concluded, the project needed to reach out to newly-elected Commune Chiefs and Commune Councils, most of whom in Siem Reap and Battambang provinces, to re-establish relationships and communication with them. Some of these new commune leaders were not familiar with the work of RFF II and CFRs, yet their support at commune level was essential for the respective CFR Committees to succeed in their mission on the ground.

The project team held a series of project orientation meetings to inform them about the project objective and approach, etc. to familiarize them about the project. PNGO staff met some newly-elected Commune Chiefs and Commune Councils at their office to directly brief them on the project activities. The project also invited the new commune leaders to attend meetings and trainings at the district level, for them to observe the project activities directly.

d) COVID-19 Pandemic

The World Health Organization (WHO) officially declared the spread of COVID-19 to be a pandemic on March 11, 2020. The Cambodian government ordered the nation-wide closure of schools on March 16th, and other measures such as temporary bans on the exports of fish and some rice varieties, temporary border closures, restricting gatherings at entertainment venues, postponing a major national holiday (Khmer New Year) and introducing travel restrictions. From April to Jun 2020, central government and local authorities introduced restrictions on community gatherings. As a result of these factors, several activities were either postponed, cancelled, or reduced in scope, including:

- awareness-raising in communities and schools;
- field days, exchange visits and village fairs;
- caregiver group sessions;
- follow-up visits to households that previously conducted household visioning; and
- participation in scientific conferences and national events.

Due to the effects of and responses to COVID-19 during this period, it was not possible for project staff to conduct face-to-face awareness-raising in communities and schools nor caregiver sessions. The nation-wide closure of schools, which started on March 16th and continued until the early September 2020, impacted sales of clean drinking water bottles to schools (through the programs of Teuk Saat 1001). During this period, the project field staff reduced their time being physically present at project sites, and worked mainly from their offices and via video calls instead.

It appeared that the public fear of the virus waned temporarily when the replacement of Khmer New Year holiday was granted in August 2020 and schools resumed normally in September 2020. However, two community outbreaks, namely the November 28th 2020 incident and the February 20th 2021 incident, led to the return of restrictions on public events and group gathering, and school closures. The complete lockdown of the Phnom Penh capital region was implemented from April 16 to May 21, 2021. Restrictions on the travels in and out of the provinces adjacent to Thai border, including Siem Reap and Battambang, also began thereafter. Thus, additional activities of the project had to be either postponed, reduced in scope, or cancelled. More specifically, the following project activities were affected:

- provincial reflection workshops;
- public events to handover water kiosks to local communities; and

- final national workshop to announce the project closure.

The WorldFish offices operated with rotational remote working arrangements, and therefore face-to-face interactions among the project team was restricted. Traveling between Phnom Penh and provinces were also discouraged. The WorldFish office in Phnom Penh was closed for two weeks from November 30th to 14th December 14th 2020 due to the November 28 community outbreak. Another office closure was instated from March 29th 2021, in response to the February 20th incident. All WorldFish staff was required to work from home during the closures.

The project team was able to resume some field activities by adjusting the approaches for delivering training sessions, and ensuring COVID-19 prevention measures were in place. This included (where possible) conducting training activities with smaller groups of people to allow physical distancing, and conducting virtual training or coaching via video calls, including:

- Refresher ToT and WASH and nutrition refresher training sessions for VHSGs and caregiver groups, with careful COVID-19 prevention measures;
- Field monitoring and support to project drinking water stations, in sales planning and business management;
- Follow-up visits to households that previously conducted household visioning exercises to monitor their practices and reinforce key messages; and
- Production of four Khmer language videos to promote good practices in CFR-RFF system management, and dissemination online and remote usage for awareness-raising activities with physical distancing.

LESSONS LEARNED

Importance of strengthening local capacity and community engagement in CFR and rice field fisheries management. A major pillar of the project support was to build the capacity of the CFR management committee members in all 5 areas of the CFR good governance (see **Box 2**). We observed that as the committee members improved their financial accountability, ability to communicate, transparency in decision-making, fairness and equity, they were able to rally support from other local community members as well as the local government authorities, and business people. Some CFRs were extremely successful in raising funds to support their activities and obtaining in-kind contribution to the CFR maintenance activities. On the other hand, a small number of CFRs continued to struggle with limited local support. It is critical that CFRs can be sustained through local-available funding and in-kind support, rather than relying on external donor funding.

Importance of site-specific, tailored strategies for physical and environmental improvement and management of CFRs. CFRs are diverse in size, shape, and physical and ecological characteristics. While the project implemented a tailored approach to management interventions at each CFR based on its specificity, it was still unclear exactly which interventions were most effective or appropriate for different categories of CFRs, and for what purposes. During the two consecutive years of drought in 2019 and 2020, it was important that each CFR committee made own decisions in response to water shortages and degradation, and implemented mitigation measures appropriate for the conditions of each site. For example, one CFR committee decided to temporarily block fish from migrating out of CFR too early at the onset of rainy season until sufficient water level was established in the surrounding rice fields. This action prevented large-scale fish kills previously observed in rice fields due to “dry spells” in the early rainy season.

On the other hand, misguided community actions, although with good intentions, could cause damages to the CFR environment and fish. For example, some CFRs kept enlarging its size on their own initiative, by obtaining in-kind support from construction companies or local donations, in an attempt to increase water storage capacity in dry season. However, without technical guidance, it caused CFR bank erosion. Some CFRs ended up having multiple connected water bodies with varying depth and size, making it difficult to assess and manage water quality. From the fish habitat perspective, it was unnecessary to make CFR very deep, and having a major construction work done to the water body on yearly basis was a little destructive to the fish. In order to provide more specific guidance to CFR committees in the future, more detailed analysis of the Biological Monitoring data is needed in combination with the CFR characteristics and the list of interventions made at each site over time.

Need for systematic mechanisms to provide sustained financial resources and technical support for CFRs. CFR committees operated on a purely voluntary basis, and, despite successful fund-raising and rallying in-kind support by a number of CFR committees, not all the CFR committees became financially self-sufficient by the end of the project. 55 out of the 140 CFRs (39%) scored lower than 4.0 for “resource mobilization” in the CFR capacity assessment in 2020. During the project period, climate-related shocks and COVID-19 significantly affected the livelihoods of villagers whose income depended on farming activities and local commerce. This, in turn, affected their abilities to contribute from their income to CFR management activities, and led to lower funds raised in some years. 38 out of the 140 CFRs (27%) scored below 4.0 on “linkages and networking” in the assessment. This indicated that quite a few CFRs still faced difficulty accessing technical or financial support from local authorities and line agencies. We also found that the villagers where the CFRs were physically located were more likely to actively participate in the CFR management and make cash and in-kind contribution than the villagers in

neighboring communities were, because they were not fully aware of the benefits they gained from improved management of CFRs and rice field fisheries. It is important to continue facilitating communication between CFR committees and other villagers, local government authorities, and provincial and district line agencies.

Need for integration of CFR management into land and water development planning at district and provincial scales. Land and water use and infrastructure development affect the viability of CFRs as a strategy for biodiversity conservation, fisheries management, and local livelihood and food and nutrition security. Intensifying rice cultivation is another direct threat to rice field fisheries. Although CFRs have become a main pillar of the fish conservation and fisheries enhancement strategy of FiA, it is relatively unknown beyond the Commune Council level. Thus, CFRs will continue to be at risk of negative impacts from irrigation and road construction as well as land reclamation projects that are approved at higher level of administrative offices. In order to maximize the long-term benefits of CFRs, it is critical that district and provincial level development planning process consider local hydrological changes and connectivity in various aquatic habitats in rice field environment to prevent any negative impacts on CFRs and its function as dry season fish refuge.

CONCLUSION AND RECOMMENDATIONS

CFRs were proven an effective strategy to sustain rice field fisheries for local communities as a source of household income and nutritious fish for children in the Tonle Sap region of Cambodia. In addition, CFRs offered multiple benefits for the local livelihoods as a source of water in dry season for growing vegetables, supplying drinking water stations, and other domestic uses of water. Having a well-managed CFR in rural community was found particularly useful in severe drought years, when other local sources of water, such as small streams and ponds, dried up. Further scale-out of the CFR management guidelines to other provinces where CFR development is suitable, and possible refinement of the guidelines for other geographies within Cambodia, would help enhance the livelihoods of rural communities and their resilience to negative impacts of climate change.

Building the capacity of CFR committees, consisting of local village volunteers, was the most important factor in improving the management and institutional sustainability of CFRs. Effective CFR committees were able to rally cash and in-kind support from other community members to implement nearly all of the CFR management activities on their own, including small construction works to enlarge the CFR water bodies. The well-functioning committees also coordinated other community-wide activities, such as responding to extreme flood and prolonged drought, and recovery from the damages. On the other hand, some CFR committees remained too weak to self-finance its operations. Systematic mechanisms are needed to provide sustained financial resources and technical support for CFRs.

The SBCC of the project achieved positive behavioral changes in the cleanliness of household environment, hygienic food preparation, and clean drinking water among the beneficiary households. The project also contributed to improvements in the way caretakers prepared small nutrient-rich fish to encourage regular consumption by children between the age of 6 to 23 months, complementary feeding of children in breast feeding, and dietary diversity of children under the age of 5. On the other hand, it was difficult to improve dietary diversity of women in reproductive age. This was likely related to the income declines/crop losses due to drought and COVID-19, and lack of fruits and vegetables in home garden in March. Further support on technologies and practices to improve food production/availability in homestead and local environment can improve dietary habits of women.

Rice field fisheries and CFRs are threatened by intensification of rice cultivation and infrastructure development. In order for CFR to remain viable as a strategy for fish conservation, it is critical that CFR management is integrated into district and provincial level development planning process. Existing local planning tools of MAFF, e.g., Cambodia Agro-Ecosystem Analysis (AEA), and environmental and social safeguard procedures can be improved to consider the negative impact of development on floodplain hydrology and the connectivity of rice fields and other fish habitats.

Building on successful experiences of the RFF II, **CFR approach of multi-purpose use of water should be scaled-out and expanded to other rice-fish and aquatic food systems, including rice-fish culture and aquaculture.** Further research of the link between climate change and aquatic food systems, and how this system contributed to the livelihood of people, nutrition, food security and climate change mitigation and adaptation, is also needed.

ANNEXES

- Annex 1. Publications and Knowledge Management Products**
- Annex 2. Comparison of Actual Expenditures with Budget Estimates**
- Annex 3. Public Events, Field Visits, and Press Coverage**
- Annex 4. Success Stories and Beneficiaries**
- Annex 5. List of Sub-partners and Grantees**
- Annex 6. Activity's MEL Plan**
- Annex 7. Electronic Datasets**
- Annex 8. List of Project-Supported CFRs and Map**