Photo credit: Fani Ulan Tado/WorldFish

November 2021

Integrating nutrition and gender into community fish refuge-rice field fishery system management: A results report

Authors

Jacqueline Shieh, Dyna Eam, Miratori Kim, Kosal Mam, Phichong Ou, Vichet Sean, Somony Thay and Sarah Freed

Citation

This publication should be cited as: Shieh J, Eam D, Kim M, Mam K, Ou P, Sean V, Thay S and Freed S. 2021. Integrating nutrition and gender into community fish refuge-rice field fisheries system management: A results report. Phnom Penh, Cambodia: WorldFish Cambodia. Program Report: FISH-2021.

About WorldFish

WorldFish is an international, nonprofit research organization that harnesses the potential of fisheries and aquaculture to reduce hunger and poverty. Globally, more than one billion poor people obtain most of their animal protein from fish and 800 million depend on fisheries and aquaculture for their livelihoods. WorldFish is a member of CGIAR, a global research partnership for a food-secure future.

Acknowledgments

The authors wish to acknowledge the government partners of the Rice Field Fisheries Enhancement Project and the Feed the Future Cambodia Rice Field Fisheries II project, including the director general of the Fisheries Administration, the Fisheries Administration (national and cantonment levels), and local authorities in Pursat, Battambang, Siem Reap and Kampong Thom provinces. The authors also wish to acknowledge the nongovernmental organizations that have partnered with WorldFish in the implementation of both projects: Aphiwat Neary Khmer Organization, Cambodia Organization for Women Support, Trailblazer Cambodia Organization and the Village Support Group.

The authors also wish to acknowledge the many people who have contributed to this publication. Special thanks to the project participants who took the time to speak with us about their experiences. In addition, the authors acknowledge the members of the 140 community fish refuge committees and other supporting community members who have improved and managed community fish refuges with support from the Fisheries Administration cantonment offices, contributing to increased numbers of fish and improved food and nutrition security in surrounding areas.

This work was undertaken as part of the CGIAR Research Program on Fish Agri-Food Systems (FISH) led by WorldFish. The program is supported by contributors to the CGIAR Trust Fund. This work was also funded by the United States Agency for International Development (USAID) grant number AID-442-IO-12-00001, Feed the Future through USAID under the terms of Contract No. AID-442-IO-16-00002, and the European Union (EU) with administration by the International Fund for Agricultural Development (IFAD) under grant number 2000001538.. The donors had no involvement in study design, execution or report preparation. The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID, IFAD or the EU.

Contact

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

Email: worldfish-cambodia@cgiar.org

Creative Commons License

Photo credits

Cover photo: Image 1–2, 3b, 4–5, Fani Llauradó; Image 3a, Fani Llauradó, Trailblazer Cambodia Organization.

TABLE OF CONTENTS

List of figures

List of acronyms

CFR	community fish refuge
FiA	Fisheries Administration
KAPs	knowledge, attitudes and practices
RFF	rice field fisheries
SIS	small indigenous fish species
SDGs	Sustainable Development Goals
USAID	United States Agency for International Development
WASH	water, sanitation and hygiene

1. Executive summary

Good governance of community fish refuge-rice field fishery (CFR-RFF) systems, which are a vital source of nutritious aquatic foods, is integral to the food and nutrition security of rural households in Cambodia. Intentional integration of nutrition and gender activities into CFR management has the potential to further bolster these outcomes. Using qualitative and quantitative data, we aimed to document the impacts of the nutrition and gender activities conducted alongside CFR management activities. The following are some key recommendations from our findings:

- Training caregivers on nutrition is effective in improving knowledge and attitudes. However, as nutrition behaviors are not limited to knowledge gaps, understanding other barriers to consumption and dietary diversity, including those in the food environment, is necessary to change behaviors. Further research in these areas is recommended.
- Seasonality and intensified droughts are challenges to sustaining aquatic food availability, food security and dietary diversity. Climate-related research is needed to address these challenges, for instance through small fish domestication and cooperatives for food-safe preservation techniques.
- Providing caregivers training on recipes for fish preparation appropriate for children under 5 years old is a practical way to increase fish consumption among children. Scaling fish recipes to school feeding programs or other fisheries and agriculture interventions can be an effective way to further increase child nutrition and fish consumption.
- Increased availability and accessibility of small indigenous fish species (SIS) near the home may also contribute to increased consumption of SIS among children and dry season SIS consumption for the entire household. More research is needed to understand determinants of SIS consumption and variability across the population.
- Future research and innovation could develop pathways to provide homegrown school feeding programs with SIS and other aquatic foods from rice field fisheries, thereby improving child nutrition while also promoting and supporting CFR management and rice field fishery improvement.
- Household visioning sessions can encourage household members to more equitably share household tasks and to work together to change their nutrition and WASH behaviors. The resulting shift in division of household labor can increase available time for women, in particular, to take on entrepreneurial and community leadership roles. However, as work-based migration was considered a key challenge, further research is needed on how the visioning sessions can be adapted to reach community members outside of the home setting and include additional caregivers (male and female) that reside in the home year-round.
- Women participants and other community members noted several benefits of women's inclusion in CFR committees. These included increased self-efficacy and perceived status within the community, demonstrating an effective grassroots-led model of women's empowerment. In addition, women provided unique skillsets that contributed to improved governance of CFRs alongside men. As much of our findings were related to the leadership capacity and self-efficacy of women, further research could evaluate the contributions of technical fisheries training and capacity to women's empowerment and CFR governance.
- Impacts on nutrition, gender, food security and natural resource management, as well as water, sanitation and hygiene, are interrelated. Conducting these sectoral activities in tandem can enable impact within and across sectors, broadening the community's benefits.

2. Introduction

2.1 Overview of community fish refuge-rice field fishery systems

Rice field fisheries, or fishing done in and around rice fields especially during the flood season, is an integral source of income, food and nutrition in Cambodia. Many rural households are involved in rice field fisheries either for income or for subsistence. In the Tonle Sap region's rice farming areas, rice field fisheries provide households with 62% of the fish they consume (Freed et al. 2020).

CFR establishment and management is an effective way to enhance the productivity and biodiversity of fish in the vital fisheries system. A CFR is an aquatic habitat that is available year-round within the rice field landscape. When the refuge is managed sustainably, including protecting it from fishing, it can increase fish populations in rice field fishery areas, thereby improving fish access for local households.

Recognizing the value of CFRs, the Royal Government of Cambodia has promoted their establishment and management since 2005 (Joffre et al. 2012). Since 2012, WorldFish has worked with the Fisheries Administration (FiA), with support from USAID, to pilot and scale application of best management practices at CFR sites designated by the FiA.

Image 1: CFR members fishing in the rice fields with bamboo basket traps.

2.2 Why integrate nutrition?

Food and nutrition insecurity continue to be significant challenges in Cambodia, resulting in negative consequences on health, economic productivity and overall national development. Currently, Cambodia is off track in meeting almost all of the global maternal, infant and young child nutrition targets (Development Initiatives Poverty Research 2020). Although some progress has been made toward tackling child malnutrition, stunting rates remain exceedingly high, with 32.4% of children under 5 years old stunted in 2014 (National Institute of Statistics et al. 2015). Among women of reproductive age, no progress has been made toward reducing anemia (Development Initiatives Poverty Research 2020). Pregnant women experience an especially high burden of anemia, with 55.8% affected in 2016 (Development Initiatives Poverty Research 2020). At the same time, 13.4% of Cambodians face severe food insecurity, spending over 70% of their income on food (FAO et al. 2021).

Determinants of malnutrition among children in Cambodia are wide ranging. Key factors include (a) inadequate infant and young child feeding practices, particularly nonexclusive breastfeeding, early initiation of complementary foods and inadequate minimum diets and (b) high diarrhea burden largely driven by inaccessibility of proper WASH techniques (Development Initiatives Poverty Research 2020). High rates of malnutrition among pregnant and lactating women also contribute to intergenerational malnutrition, whereby their children also experience malnutrition (Development Initiatives Poverty Research 2020). Findings from a recent modeling study in Cambodia show that children experiencing multiple, overlapping deprivations in nutrition, health, water, sanitation and housing are more likely to experience stunting, with more than 78% of them currently experiencing two or more of these deprivations (Karpati et al. 2020). This highlights the multidimensional nature of malnutrition.

In Cambodia, improved rice field fisheries production has the potential to contribute to achieving key Sustainable Development Goals (SDGs), specifically 1, 2, 5, 6 and 12. It could also support the Royal Government of Cambodia in its commitments toward nutrition and food security, namely the 2nd National Strategy for Food Security and Nutrition (NSFSN 2019–2023). In 2016, researchers and implementers adapted the CFR management interventions with the hypothesis that focused nutrition and gender interventions alongside rice field fisheries activities would support the fishery in meeting its potential for achieving local nutrition and food security gains. The need for this type of intervention has been supported by other evidence that suggests nutrition-sensitive interventions within non-health sectors such as fisheries are integral in achieving nutrition progress (Ruel and Alderman 2013; Kumar et al. 2018).

2.3 Why integrate gender?

Women provide essential, albeit often undervalued and overlooked, contributions to small-scale fisheries. Fisheries management continues to be male-dominated, despite the large engagement of women in fisheries-related activities, including pre- and post-harvest work. In the management of Cambodia's rice field fisheries, women have mostly been involved indirectly through savings and credit groups as well as self-help groups (WorldFish 2010). Few women hold leadership or decision-making positions in management committees, despite aspirations to do so for improvements in livelihoods, capacity strengthening and perceived benefits of sustaining fisheries resources for the next generation (WorldFish 2010). In a study conducted by the FiA ("Gender implications in community based natural resource management: The roles, needs and aspirations of women in community fisheries") women respondents identified restrictive gender norms, including the inability to balance productive and reproductive roles and low self-efficacy stemming

from limited education and confidence, as the major constraints to taking on leadership roles (FiA and CBNRM 2008).

In addition to the potential to meet SDGs and links to nutrition mentioned in this section, incorporating gender activities into CFR management could allow greater and more equitable benefits for individuals, households, the CFR committee and the wider community.

2.4 Nutrition and gender impact pathways in rice field fisheries

The following nutrition and gender activities were conducted alongside activities promoting best practices for rice field fisheries and CFR management:

- **Nutrition:** caregiver training (including exclusive breastfeeding, infant and young child feeding practices, nutrition and WASH) and training and coaching on homestead gardening
- **Gender:** household visioning and inclusion of women in CFR committees.

Two projects (Feed the Future Cambodia Rice Field Fisheries II and Managing Aquatic Agricultural Systems to Improve Nutrition and Livelihoods) were designed to implement these activities in tandem. Each complemented and contributed to the other to provide impacts through a Theory of Change (Figure 1). While rice field fisheries management activities were expected to increase the accessibility and availability of fish, other aquatic animals and aquatic plants, the nutrition-sensitive caregiver training sessions and community awareness-building activities were expected to improve local consumption and nutritive benefits of fish, especially for children under 5 years of age, by increasing caregiver and household knowledge, attitudes and practices (KAPs) around positive nutrition and WASH behaviors. At the same time, gender equality sensitization activities were expected to contribute to both effective rice field fisheries management as well as improved nutrition and WASH outcomes.

2.5 Report aims

Good governance of CFR-RFF systems is integral to food and nutrition security among rural populations in Cambodia. Previously, we developed guides for establishing and managing CFRs and how to integrate nutrition and gender activities into CFR-RFF governance. Through this report, we aim to document the impacts of incorporating nutrition and gender activities into CFR management on households and communities. The impacts highlighted in this report are not a result of independent nutrition and gender activities; rather they are a result of good CFR management and governance with the addition of nutrition and gender activities.

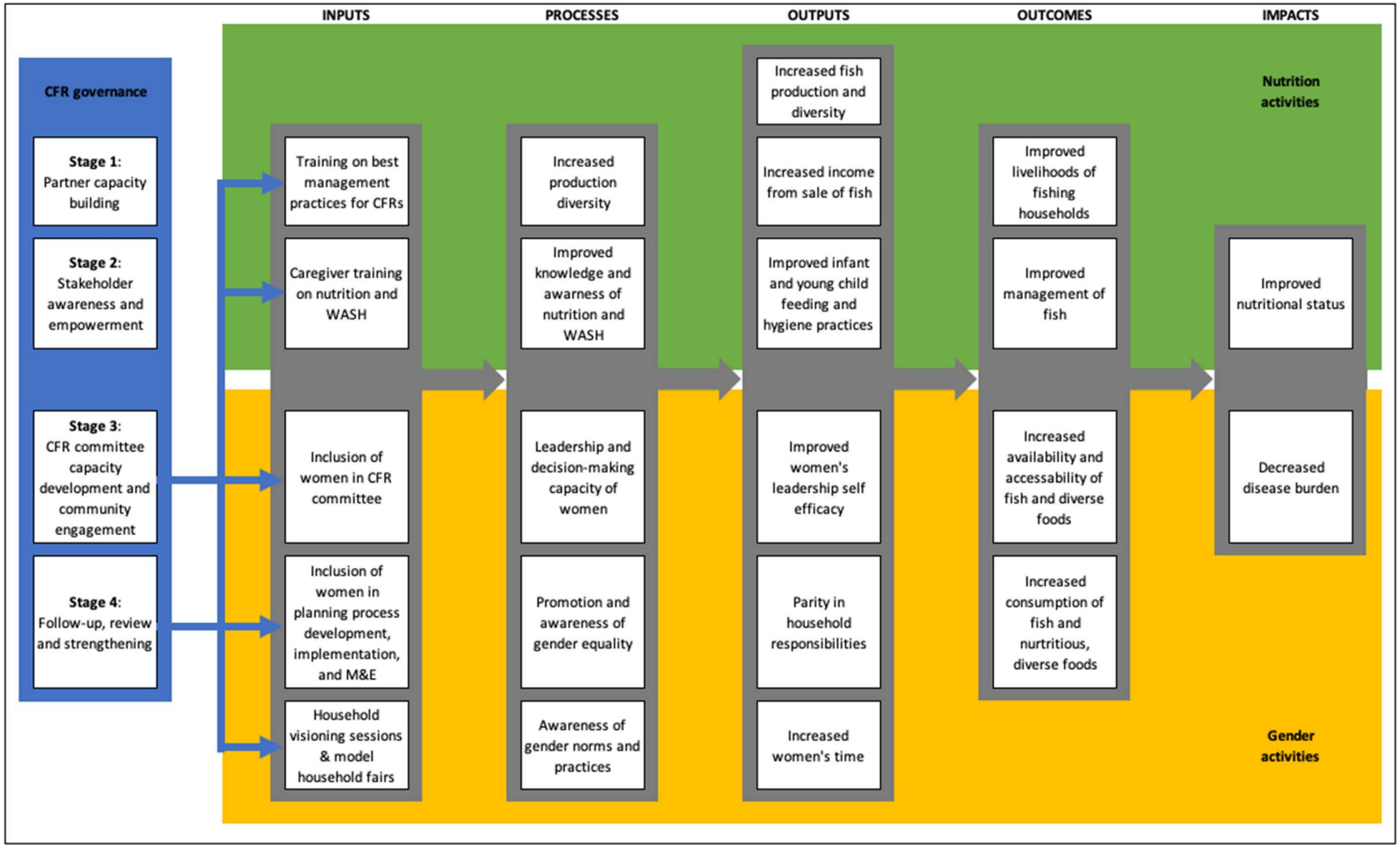


Figure 1: Theory of change for nutrition and gender activities in community fish refuge-rice field fisheries systems.

3. Methods

3.1 Study design and population

This report synthesizes quantitative and qualitative data collected between 2017 and 2021 (***Table 1***). The data were collected before, during and after implementation of CFR management interventions and nutrition and gender activities in four Cambodian provinces: Battambang, Kampong Thom, Pursat and Siem Reap.

Component	Population	Methodology	Data collection instrument	Data collection frequency and dates
Nutrition	Project households	Quantitative	Representative survey on fish catch, preparation and consumption	Twice a year; 2017–2020
	Project households	Quantitative	Representative survey on KAPs	Baseline, midline, endline; 2018, 2019,
	Project households	Qualitative	In-depth in-person interviews, focus group discussions	Endline; 2021
	Project implementers	Qualitative	Virtual interview	Endline 2021
Gender	Model households	Quantitative and qualitative	Survey (not representative) and in-depth in-person interviews	Endline and 6 months post-implementation; 2018, 2019, 2020
	CFR management committee, local authority and CFR community members	Quantitative	CFR capacity assessment (self-reported)	Baseline, midline, endline; 2017, 2019, 2021

Table 1: Summary of methods used in the report.

3.1.1 Quantitative

3.1.1.1 Nutrition

Two quantitative surveys were conducted, one focused on household practices regarding catch, preparation and consumption of fish, and the second focused on household KAPs for nutrition and WASH. The surveys differed in approach to sampling. The former focused on fishing households and sampling a large proportion of households in a small number of villages, while the latter focused on households with children under 5 years of age and sampling a few households across many villages.

Quantitative surveys on household catch, preparation and consumption of fish were conducted twice a year throughout the study period. Depending on household availability, between 805 and 884 households that engaged in rice field fisheries were surveyed in 23 villages across the four target provinces during the sampling occasions. Respondents provided detailed information on the type and weight of catch, the

preparation method for micronutrient-rich fish and the amount of micronutrient-rich fish consumed by children under 5 years of age.

Quantitative KAP household surveys on nutrition and WASH practices were conducted at baseline, midline and endline of the study period. At each point, a multistage research methodology was implemented, which incorporated a quantitative survey of 756 randomly selected households with at least one child under 5 years old, in target villages in all four target provinces. This sample provided data representative of the population of households with at least one child under 5 years old within the 134 CFRs (32,113 households in 128 villages). It had a confidence level of at least 95% and a margin of error of less than 4% for indicators. Across the three time points, the same villages but different households were sampled, and fishing households were targeted in the endline but not baseline surveys.

3.1.1.2 Gender

To capture the impacts of the household visioning sessions, we selected 20 model households (five from each province) who successfully adopted fair distribution of household responsibilities between wife and husband at least 6 months following project interventions.

To capture the impacts of training sessions on CFR committee best management practices, CFR capacity assessments were conducted at baseline, midline and endline of the study period. For each CFR in the project target area, the study population for the CFR capacity assessments were as follows:

- at least one community member from project CFRs
- at least one CFR committee member
- at least one local authority from project CFRs.

3.1.2 Qualitative

As part of the KAP household quantitative surveys on nutrition and WASH practices, 12 focus group discussions (FGDs) were also conducted, three from each province. For each FGD, at least eight caregivers were selected from the same villages as the quantitative survey and were eligible if they had received nutrition and/or WASH training from WorldFish.

A total of 26 interviews were conducted with project implementors and participants to explore the perceived impacts of nutrition and gender-transformative activities incorporated into the projects implemented during the study period. The study population for the qualitative data include project implementors and beneficiary households of the projects. The study recruited 26 participants from the following groups to participate in semi-structured interviews:

- 2 project designers
- 4 project implementors/trainers of gender and nutrition activities (1 from each province)
- 20 project participants/households of gender and nutrition activities:
  - 8 participants of nutrition and household visioning activities (2 from each province, 1 wife and 1 husband from the same household)
  - 8 CFR committee members (2 from each province, 1 woman and 1 man from the same CFR committee)
  - 4 community members from project areas (1 woman from each province)

A combination of purposive and convenience sampling was used to include (a) project implementors and participants who received nutrition and household visioning training, (b) those who are part of CFR committee leadership, and (c) other community members in the project area. Prior studies show that thematic saturation for individual, in-depth interviews can be reached within 5–12 interviews (Guest et al. 2017). As such, the sample size was calculated by balancing the ability to reach thematic saturation and feasibility with limited research staff.

3.2 Data collection

3.2.1 Quantitative

3.2.1.1 Nutrition

A total of nine sampling occasions were conducted for the quantitative surveys on household catch, preparation and consumption of fish: two each year (one each in dry season and wet season) for 2017 through 2020, and one (in dry season) in 2021. The survey instrument was delivered in Khmer and asked respondents to provide a 7-day recall of their household's fishing activities, fish consumption (including micronutrient-rich fish consumed by children under 5 years of age), and preparation of micronutrient-rich fish.

KAP household surveys were conducted during the dry season in 2018, 2019 and 2021 among caregivers of 756 households. The KAP survey instrument was pre-tested and translated into Khmer and included sections on the following: (a) the global food insecurity experience scale, (b) nutrition among adults and children, (c) sources of food, preparation, cooking and storage of food, (d) sourcing, storing and treating of drinking water, as well as hand-washing practices, and (e) defecation practices and the cleanliness of the home environment. Kobo Toolbox was used to collect the data.

3.2.1.2 Gender

To understand the impacts of household visioning sessions, a checklist was used to collect data during preparation for village fairs. This checklist included the following:

- number of household activities done by the wife prior to household visioning sessions
- the number of household activities done by the husband prior to household visioning sessions
- the number of household activities taken on by the husband after household visioning sessions
- the specific activities taken on by the husband after household visioning sessions
- specific activities other than household responsibilities the wife is able to take on after household visioning sessions.

During preparation for village fairs, field facilitators completed this checklist through discussions with the husband and wife.

For CFR capacity assessments, data were collected at three time points: 2017, 2019 and 2021. Capacity assessments were scored by CFR committee members, CFR members and local authorities from each CFR community. CFRs were scored based on a set of criteria: organization management, planning and implementation/ownership, resource mobilization, links and networking with commune councils and other institutions, and representation and participation of women. For this report, only data from the representation and participation of women was used.

3.2.2 Qualitative

The KAP FGDs were conducted in person with caregivers recruited from a list of caregivers who received training from WorldFish. Each FGD was facilitated by a group leader and a notetaker. During the FGDs, key discussion points were handwritten on a sheet. The audio for all the FGDs was recorded, transcribed and translated. A semi-structured interview guide was developed, covering nutrition and WASH KAPs and any perceived challenges to these practices.

In-depth interviews were conducted virtually with project implementers and in person with project participants between April and May 2021. Participants were recruited through discussions with provincial coordinators from the project, who helped identify suitable NGO partners and project households. The audio of the interviews was recorded, either with a phone or a tape recorder. Detailed notes were also taken during the interviews using an online form. Semi-structured interview guides were developed for the two types of respondents: project implementer and project participant. Semi-structured interview guides were further subdivided by participant types: (1) caregivers who received nutrition training, household visioning and homestead gardening training,)2) husbands who received household visioning, (3) woman from a CFR committee and (4) men from the same CFR committee. Training on nutrition and WASH were only delivered to caregivers, so only they were asked questions exploring nutrition and WASH impacts. For project implementers, the semi-structured interview guide consisted of broad, open-ended questions pertaining to domains such as perceived short- and long-term impacts of nutrition and gender activities, as well as the barriers and facilitators to implementing these activities. For project participants, the semi-structured interview guides consisted of broad, open-ended questions related to perceived impacts of project activities on the nutrition status of caregivers and children, health, access and availability of nutritious food/fish, women's empowerment in the household, and management of CFR-RFF habitats. As project implementers have a firm grasp of English, the semi-structured interview guide was delivered in English. For project participants, however, semi-structured interview guides were translated and given in Khmer.

3.3 Data analysis

3.3.1 Quantitative

Data were analyzed using summary and descriptive statistics in Microsoft Excel. The following measures were calculated:

Minimum dietary diversity: The minimum dietary diversity was considered consumption of five of seven food groups in the previous day for women of reproductive age and four of seven groups for children aged 6–23 months.

Household preparation of micronutrient-rich fish: This analysis focused on proportions of surveyed households that reported having prepared micronutrient-rich fish during the previous 7 days in whole form (the nutritional preparation encouraged in caregiver training) and by removing the head and viscera (the preparation discouraged in training).

Child fish consumption (micronutrient-rich fish): This analysis focused on the percentage of households with children under 5 years old who consumed micronutrient-rich fish in the 7 days prior to the survey period.

Gender parity: Pre- and post-household visioning gender parity was calculated by dividing the number of women's household responsibilities by the number of men's household responsibilities before and after the intervention. Ratios equal to 1 indicate perfect parity, or equal sharing of responsibilities. Ratios less than 1

indicate men have more responsibilities than women, and ratios greater than 1 indicate women have more responsibilities than men.

Representation and participation of women in CFR committees: The overall representation and participation of women in CFR committee scores was made up of sub-scores. Sub-scores for this criteria include the percentage of women in CFR committee leadership, level of participation in decision-making by women CFR committee members , number of ideas and needs from women CFR committee member taken on by committees, percentage of women community members who participated in CFR action plan implementation, and level of women benefitting from CFR committee activities. Details of the scoring schema are provided in Annex 1. Each sub-score ranged from 1 to 5, with 5 indicating strong representation and participation of women in CFR committees. Scores given by CFR committee members, CFR members and local authorities were averaged for each sub-scores. These were further averaged into an aggregate score for representation and participation of women in CFR committees.

3.3.2 Qualitative

The qualitative in-depth interviews were analyzed using an inductive-deductive approach. Coding was done using Microsoft Word, and an initial codebook was developed from intended outcomes of the project on CFR management, nutrition, homestead gardening, WASH practices and household visioning. These a priori codes were then applied to the data. Open coding was also used to derive emergent codes, concepts and themes from the transcripts. While a priori codes were neutral (e.g. availability and accessibility of fruits and vegetables), emergent codes reflected both positive and negative responses (e.g. increase in fish consumption or challenges with seasonality). Several iterations of the codebook were therefore developed and reapplied to the data. Codes were then grouped into categories to create an analytical framework. Subsequently, data were summarized by category and charted into a matrix of the analytic framework. Short summaries and quotes from each respondent relevant to each category were included in the matrix. Using the framework matrix, we directly compared and contrasted themes, identified barriers and facilitators to implementation and understood perceived impacts from respondents.

3.4 Limitations

There are a number of limitations to the methods used in this report. First, as CFR community and committee members self-assessed the capacity of their CFRs, the scores are subject to self-reporting bias. Furthermore, as these assessments were conducted annually, there is also a risk of recall bias. However, as self-reporting for capacity assessments was participatory throughout the project, it allowed for learning exchange opportunities between committees, motivating committees to improve CFR management performance over the project period.

Second, the gender parity measure was constructed from a count of activities rather than a time-sensitive approach, and used non-validated checklist; therefore, it can only be used to approximate change rather than as a precise or accurate measure of gender parity. Selection bias is also present for the gender parity measure, as the population selected was those who exhibited the desired impact behavior. We used the interviews to supplement these data, as the interviews were not conducted with model households and exemplified some of the common successes and challenges of meeting expected outcomes of the household visioning activity across participating households.

Finally, while a number of quality checks were put into place for the qualitative interviews, project implementers conducted the interviews with respondents. Therefore, study respondents may have modified their answers in response to knowing that project implementers were the ones asking them questions.

4. Results

4.1 Nutrition

Both nutrition-specific and nutrition-sensitive activities were conducted. Nutrition-specific activities included training for caregivers on exclusive breastfeeding, infant and young child feeding practices, and dietary diversity for pregnant and lactating women, all with a focus on the importance of consuming fish, particularly whole small indigenous species (SIS) fish. Nutrition-sensitive activities included promoting CFR management best practices, caregiver training on WASH practices and training on homestead gardening.

4.1.1 Nutrition-specific activities

Project respondents exhibited increased knowledge and awareness about the importance of dietary diversity and fish consumption. Most respondents were able to recall the importance of eating at least three different food groups. For example, when prompted about what nutrition information she learned from WorldFish training, one female caregiver explained:

> *I got some knowledge related to three groups of food like protection food (pumpkin, sweet potato, Callaloo, ivy gourd), energy food (rice, bean, nut, oil) and growth food (fish, beef, pork and chicken). –female caregiver from Pursat*

However, despite improved knowledge and awareness about dietary diversity, actual consumption of a diverse diet among women declined while dietary diversity among children improved throughout the project period ***(Figure 2)***. This suggests that although households know the importance of a diverse diet, other factors may affect their ability to do so, and households may prioritize their children consuming nutritious foods.

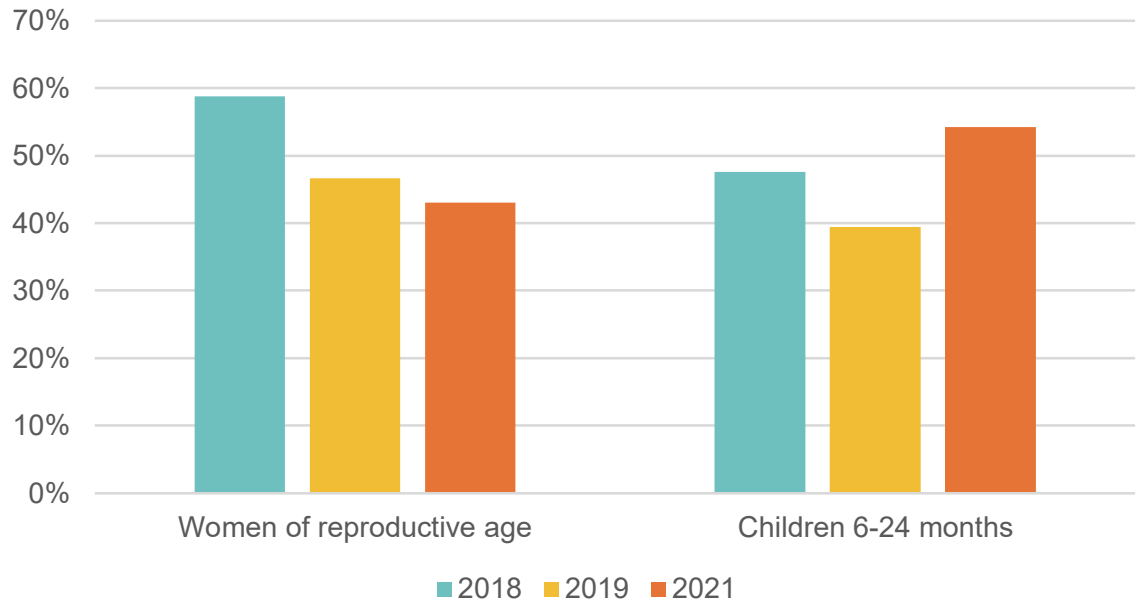


Figure 2: Percentage of women of reproductive age and children 6–24 months meeting minimum dietary diversity.

Nearly all respondents also emphasized the importance of consuming fish for both their own and their families' nutrition. The share of respondents correctly identifying the benefits of consuming fish regularly increased over the intervention period, such as ensuring good eyes/vision (from 3% to 25%), strengthening bones (from 12% to 17%), providing protein (from 10% to 20%), supporting a healthy brain (from 11% to 16%) and providing vitamins (from 22% to 24%). Findings are mixed on how this increase in knowledge translated into practice. Over the project period, an increase in the percentage of children under 5 consuming SIS was observed through the catch and consumption survey (from 5% in 2017 to 14% in 2021), while the KAP survey data revealed a decline (from 8% in 2018 to 3% in 2021). This conflicting trend between surveys may be due to unobserved differences across the samples or methodological differences in sampling or questionnaire design and phrasing.

Furthermore, local NGO implementers observed that project respondents began to consume SIS whole, a changed behavior from prior to the project when families often removed the head before consumption. Indeed, the percentage of households who prepared small fish whole increased (from 8% in 2017 to 34% in 2021), while households who prepared small fish by removing the micronutrient-rich head and viscera decreased (from 46% in 2017 to 5% in 2021). Many respondents noted the micronutrient benefits of consuming SIS whole, such as one female caregiver, who reported learning the following from WorldFish training:

> *I learned about vitamins in small fish, how to make small fish powder and the project recommended to eat the whole of small [fish], because it is plentiful in vitamins. – female caregiver from Kampong Thom*

Alongside female caregivers, some husbands attended the training for caregivers and gained knowledge around the nutritional benefits of SIS for their children. For example, one local NGO implementer in Siem Reap noted how a husband applied what he learned from the training (see quote in the box to the right).

> "A man in Othom Sranal CFR used to join in caregiver training. Then he know the benefit of small fish. When he caught small fish, he gave to his wife and explained her about benefit of small fish for her health (she was pregnant)."
>
> **– female local NGO implementer from Siem Reap**

In addition to knowledge and practice around household dietary diversity, respondents also reflected increased knowledge and awareness about the minimum acceptable diet for pregnant and lactating women. Specifically, an increased share of respondents know to change their diets during pregnancy (83% to 94%) and lactation (84% to 95%) to keep their babies healthy and growing well. A higher percentage of respondents also identified eating more frequently as an important diet change during pregnancy (10% to 19%) and lactation (13% to 23%). Furthermore, an increased share of respondents identified eating larger quantities at each meal as an important diet change during lactation (17% to 28%).

Improved KAPs around complementary feeding practices were also highlighted from the caregiver nutrition survey. The high proportion of respondents (89%) identifying 6 months as the correct age to introduce foods other than breastmilk into the diet was maintained throughout the project period, with an increasing share of respondents acknowledging that introducing additional food ensures that their baby is healthy (11% to 74%). Moreover, the high proportion of respondents that considered thick bobor krup kreung (rice porridge with added fish and vegetables) as more nutritious to feed to their children increased from 89% to 95%. A high proportion of respondents identifying vitamin A-rich fruits and vegetables (~80%) and animal-source foods (~93%) as important ingredients in bobor krup kreung was sustained throughout the project, with an increasing share of respondents identifying energy-rich foods (2% to 18%), green leafy vegetables (71% to 85%), as well as pulses and nuts (34% to 62%).

Qualitative interviews with caregivers also revealed their knowledge and continued practices around preparing fish recipes learned from WorldFish training sessions as complementary food for children. Almost all respondents mentioned using at least one of the fish recipes they learned from WorldFish training, including small fish soup, fish ball meat and small fish powder (Annex 3), with local NGO staff also observing the continued use of these recipes. However, many respondents acknowledged that small fish powder was difficult to produce year-round, as SIS are rarely present in rice fields during the dry season. The time-consuming nature of fish powder production was also a constraint identified by at least one caregiver. Additionally, FGD respondents noted the large time burden of preparing nutritious meals with fish. For example, while caregivers knew bobor krup kreung is a nutritious complementary food to prepare for their children, they preferred to prepare meals that could be consumed by the whole family, such as soup with meat or fish and vegetables.

Nearly all respondents perceived the positive impacts of WorldFish nutrition training on the health of their families, as exemplified in the following quote:

> *WorldFish nutrition activities provided a lot of benefits for my family and community. Before the project was implemented in my community, my family and other villagers were unhealthy. They always spent much money on treating illnesses. After the project implemented in my community through provided training and awareness raising on nutrition activities, my family and other villagers implemented these nutrition activities. Following the training, I observed that my family and other villagers are living with healthy life and rarely get illness." – female caregiver from Pursat*

Image 2: Caregivers feeding children bobor krup kreung, porridge enriched with SIS and vegetables.

4.1.2 Nutrition-sensitive activities

Respondents described improved food, nutrition, and water security from increased CFR productivity and homestead gardening activities. As a result of training on CFR best management practices, respondents and local NGO staff implementers reported increased availability and access to fish in rice fields for consumption and income. One male community member in Siem Reap noted that after the project CFR activities, "nowadays, where there is water, there is fish." As one female caregiver from a CFR community in Battambang explained, increased CFR productivity led to an increase in fish availability for food and income (see quote in the box below).

> "The CFR has increasingly supported my family because after establishing the CFR, the fishery resources increased, and the fish and other aquatic animals migrated to the rice field in the rainy season, thus … my family can catch the fish for 5–6 months during the rainy season. So we never buy some meats from the market. We can catch the fish for our food and some for sale."
>
> **– female caregiver from Battambang**

Some respondents described increased availability of SIS in the rice fields, ponds and canals near their homes during the wet season. This also improved the accessibility of SIS, as they could catch SIS in the natural waterbodies near their households, rather than purchasing them in markets farther away. Respondents

explained that the increased availability of SIS was beneficial to their families because they are a good source of protein and micronutrients. They also reported processing fish into small fish powder, dried fish, smoked fish and fermented fish. Some explained that they processed fish from the rice fields so that they could eat fish year-round.

Image 3: SIS being made into fish powder (left) and cooked (right).

However, this improved accessibility and availability of SIS differed depending on season and level of rainfall. Catch and consumption surveys revealed the catch of key SIS varied greatly by season and rainfall, with the greatest SIS catch during the wet seasons with the most rain. A similar pattern was observed for wet season SIS consumption (from all sources, including rice field catch, market purchase and others). A different pattern was observed for dry season SIS consumption. At the start of the project, dry season SIS consumption was about 75% lower than wet season consumption, but this gap decreased steadily and was 19% by the end of the project. In addition, the number of households reporting dry season SIS consumption increased 66% over the project period.

After receiving training on how to establish and manage a homestead garden, respondents reported increased availability and access to diverse vegetables and fruits for home consumption and income. For example, one caregiver described the benefits of her family receiving homestead garden training:

> *Having a homestead garden helps my family to have enough vegetables for daily food, minimize expenses, make healthier and safe for eating. My family home vegetable garden can support family daily food around 2–3 months per cycle. I grow many types of vegetable such as morning glory, bitter gourd, pumpkin, edible amaranth. – female caregiver from Pursat*

Respondents also emphasized that because they grew their own fruits and vegetables, they felt confident that the vegetables and fruits were safe to consume and free of pesticides. As one female caregiver explained, this confidence in the safety of their fruits and vegetables contributed to the increased intake of diverse vegetables in her household:

> *My family feels confident in the vegetables from our garden because there are no pesticides and they are organic, so they are good for our health. When we feel confident it's not harmful, we eat more. Also we have diverse vegetables, and for the surplus we can sell it to neighbor to make income from the garden. – female caregiver from Siem Reap*

Local NGO staff also noted that project respondents used both the vegetables from their homestead gardens and knowledge about the nutritional benefits of diverse foods to prepare meals with adequate dietary diversity for their families. One local NGO implementer explained how respondents used all the different types of nutrition knowledge they were given (see quote in the box to the right) .

> "The caregivers applied the variety of nutritious foods (at the back of their home are vegetable garden with green vegetables) and cook small fish with the harvested vegetable for their children."
>
> **– male local NGO implementer from Pursat**

Respondents explained that as a result of increased availability of fish, fruits and vegetables, they spend less money buying food at the market. Respondents described using this money saved on health and food expenditures, as well as investments in their homes and children's education. For example, one male husband respondent from Kampong Thom explained that he used the extra income he earned from selling fish to buy school uniforms for his children, food ingredients and vegetable seeds. Some respondents also explained that because they were able to consume more fish, vegetables and fruits, they were able to decrease their health expenditures and medical spending, as their families were sick less frequently than before the intervention.

However, seasonal availability and accessibility of fish continues to be a persistent issue for rural households, particularly for certain areas or groups. Many respondents also mentioned how it was difficult to maintain their homestead gardens during the dry season. One respondent explained that during this time, there were an abundance of insects and pests that were difficult to manage, killing their vegetables. Furthermore, FGDs conducted with caregivers across the four provinces revealed that during the dry season, it is difficult to catch fish and harvest wild vegetables. Instead, these households have to resort to buying fish and vegetables in the market. However, limited income during this time prevents caregivers from being able to purchase fish, meat and vegetables for their household, since they are expensive at the markets. These findings were exacerbated by the COVID-19 pandemic, with some households resorting to borrowing money or asking for food from neighbors, and others reluctant to do so because they were uncertain of their ability to pay them back.

While some respondents who lived close to the CFR were able to access water from it to treat and use as a source of drinking water, others were not able to because they lived farther away. However, all respondents were able to access water for other productive uses, such cooking, bathing, dishwashing and cattle rearing. Some respondents also used water from the CFR for their homestead garden. One caregiver explained that this increased the availability of vegetables and fruits for her home consumption and sale:

> *CFR contributes a lot for my family livelihood … We have enough vegetables to eat through using water from the CFR for watering the crop. We use money from selling fish and vegetables to buy the soil to fill around my house compound (for her homestead garden). – female caregiver from Pursat*

Image 4: A wife and husband water their homestead garden using water from their CFR.

Respondents also reported improved WASH behaviors, linking positive WASH practices to the prevention of sickness and promotion of health. At endline, study respondents had improved knowledge and awareness about safe food preparation. More than 90% of respondents throughout the project period knew to keep food covered, while an increasing share of respondents knew not to let animals near food (1% to 4%) and to store cooked food in a cool place (3% to 7%). Furthermore, an increased share of respondents identified keeping raw foods separate from cooked foods as a good food storage practice (0.4% to 4%). Among those that identified separating raw and cooked foods as important, a high and increasing percentage of respondents recognized that this is because raw foods have germs that can transferred between surfaces and foods (79% to 83%).

Throughout the project period, more than 70% of respondents knew to treat water by boiling and/or by filtering before drinking. Respondents also linked drinking unsafe water to negative health impacts. Specifically, most respondents recognized that drinking untreated water will lead to diarrhea (>85%) and abdominal pains (>71%) throughout the project period, with an increasing percentage of respondents identifying worms (2% to 9%) as a possible result of drinking unsafe water. These findings were paralleled in the qualitative interviews. One female caregiver explained what she learned about safe drinking water and its impact on health:

> *I had learned from the project about clean drinking water such as drink the safe water such as boiled water, (bottled) drinking water or filtered water. And since we started to do it, we have good health, especially we don't get diarrhea. – female caregiver from Battambang*

Increased knowledge of the importance of clean drinking water was also reflected in practice, increasing from 80% at baseline to 90% at endline, while drinking untreated water declined from 19% to 10% ***(Figure 3)***. Of the respondents who treat their drinking water, the majority across the project period reported

boiling water (~66%). However, compared to boiling water, a higher percentage found filtering water easy, which was supported by FGD data. Households explained that they preferred filtering water because boiling water was time consuming and households had to find fuel to do so.

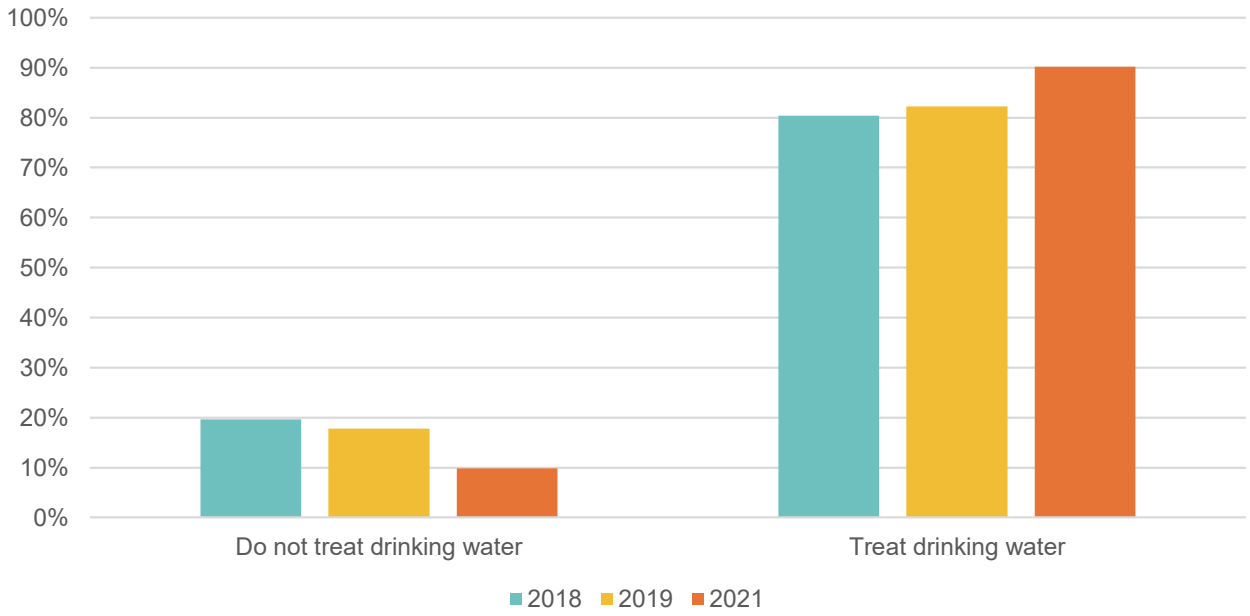


Figure 3: . Percentage of households treating water before drinking.

Additionally, respondents reflected increased knowledge and awareness about key moments for handwashing. Compared to baseline, a higher proportion of respondents at endline identified several key moments to wash their hands: after eating (30% to 35%), after touching an animal (6% to 11%), after handling garbage (14% to 17%), after handling raw food (15% to 17%), before feeding a child (27% to 31%), before eating (82% to 84%), before preparing food (40% to 49%), after cleaning child's bottom or changing diaper (4% to 18%) and after going to the toilet (39% to 52%).

Not only did a rising proportion of respondents know the key moments to wash their hands, but there was an increasing proportion of respondents who washed their hands with soap, from three times per day to four times per day at the end of the project. Respondents also linked handwashing to improved health for their families, as explained by one caregiver (see quote in the box to the right).

> "Handwashing provides many benefits to my family because it helps to prevent from illness and make my family live with healthier life. Furthermore, it becomes a good habit for my family."
>
> **- Female, Caregiver, Pursat**

Furthermore, a high and increasing percentage of respondents recognized the importance of a clean home environment (from 88% at baseline to 93% at endline), especially for family health (from 50% to 57%). These findings were mirrored in the qualitative interviews, where almost all respondents described the importance of a clean home environment when asked what they learned from the hygiene trainings. This is exemplified in the following quote, in which one female caregiver also connects her clean home with her healthier family:

I learned on how to prepare my house compound and how to prepare other materials around my house compound and how to keep and control the trash surrounding the house. Living with a clean environment helps my family to live with healthier life and prevent the diseases which are transmitted by the tiger mosquito. –(Female, Caregiver, Kampong Thom)

Project survey teams likewise observed improvements in home environments. Namely, survey teams observed a decreased presence of animal feces, animal pens near cooking and eating areas, and garbage lying around households alongside the increased presence of rubbish bins ***(Figure 4)***.

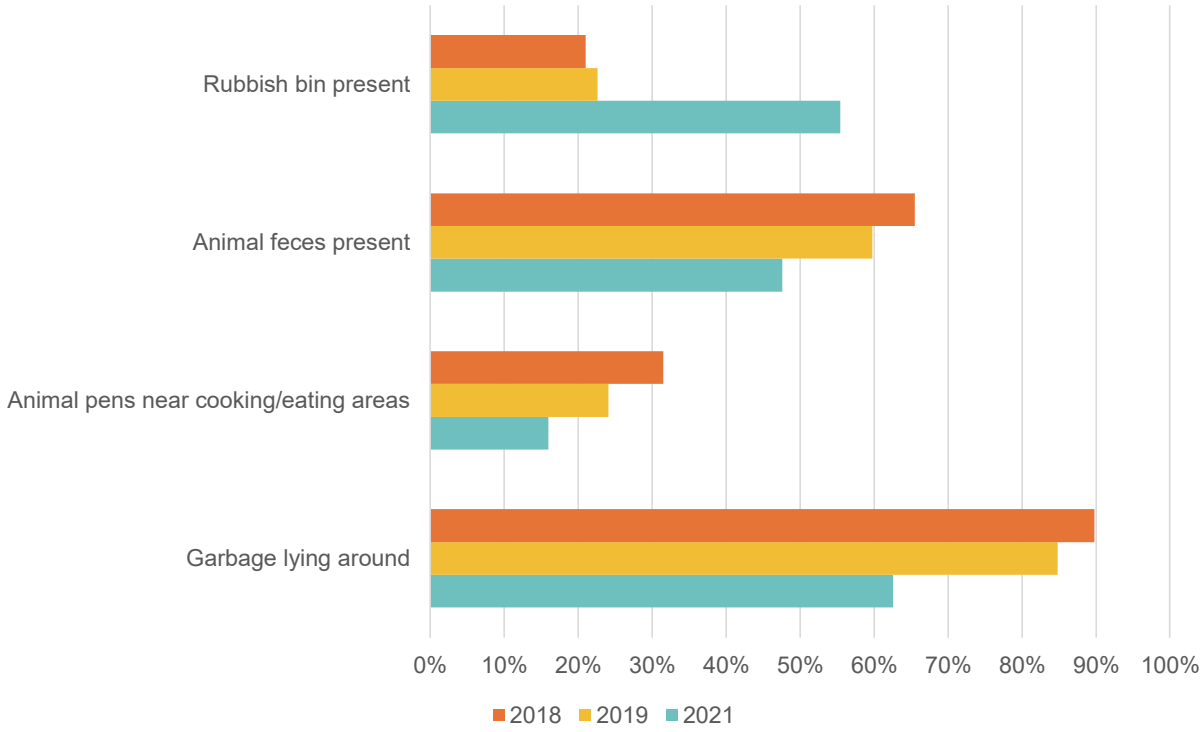


Figure 4: Observed cleanliness of respondent home environments.

Some respondents also noted how as more households improved their home environments, the community environment also began to improve. For example, community members not only began to install trash bins in their homes, but also around the community. As one caregiver's husband described, he observed that his community was able to change their waste disposal habits following household training.

I see that my community understands the negative impact of improper waste disposal, and see a reduction in open defecation, and the whole village is cleaner. – husband from Siem Reap

4.2 Gender

Gender activities were conducted at the household and community levels. Household visioning sessions were the household-level activity while village fairs and the inclusion of women in CFR committee leadership and activities were the community-level activities. During household visioning sessions, field staff facilitated discussions on improving household hygiene, particularly in food preparation and sanitation areas, and encouraged fair sharing around male and female roles in the household. Following household visioning sessions, village fairs were held, in which model households had the opportunity to share their experiences and benefits from sharing household tasks.

The inclusion of women in CFR committee leadership and activities was meant to increase the representation of women's voices, ideas and objectives in community development. The goal was to ensure the community development plan was diversified and provided benefits to all people, strengthen the capacity and self-efficacy of women to lead and take on leadership roles and improve the management of CFRs for increased fish productivity and availability. Local NGO partners and implementers were trained on the importance of women's participation and involvement in CFR management, and coached on how to encourage and facilitate women's participation in CFR activities. The CFR committee selection process, CFR committee training, community-level CFR management planning, process development, implementation, and monitoring and evaluation processes all included women.

4.2.1 Household visioning sessions and village fairs

Following household visioning sessions, respondents and local NGO staff implementers reported increased sharing of household responsibilities, with husbands taking on more household responsibilities then before the project intervention (Annex 2). Specifically for model households, household gender parity improved from before (female/male ratio of household responsibilities=1.4) to after (female/male ratio of household responsibilities=0.7) household visioning sessions. Husbands in model households took up on average an additional three household responsibilities following household visioning sessions and recognized the importance and benefits of contributing to household work. For non-model households, almost all interview respondents described sharing household responsibilities, either splitting the workload evenly or working together on each task. Most respondents also reported that they regularly discussed expectations for household responsibilities with their spouses. These findings are exemplified in the experiences of a wife and husband from Kampong Thom following the household visioning sessions (see quote boxes).

"Before involvement in the [visioning], my husband focused on earning income for the family rather than assisting with household activities, but after involvement with the [visioning] (participated in drawing visioning map), he started to understand and help me to do household tasks, [even] now. When we help each other for sharing household responsibilities, it helps to improve my family's living life and happiness. Because we have time to relax after finishing housework."

– wife from Kampong Thom

"In the past, I focused on earning income for family and my wife did most housework. Now I help to take care of the children, clean house, feed animals and do other tasks in family. In general, we [currently] always help each other in our family. I always help my wife for cooking, cleaning house, taking care of the children, feeding animals and preparing the house vegetable garden. We always discuss these household responsibilities regularly. We don't separate these household responsibilities, but we always help each other for all housework when someone is free."

– husband from Kampong Thom

A few respondents explained that village fairs encouraged other community members to also divide household responsibilities equally. For example, one respondent's relative began to divide household responsibilities after participating in their village fair:

> *My relative in the community … Before, the husband never helped the wife's work like cooking, clothes washing, but after he participated in the village fair, the husband changed a lot. Like, the husband helps [with] cooking and washing. – wife from Siem Reap*

As a result of husbands taking on additional household responsibilities, female respondents from model households reported having more time for income-generating activities (60%), homestead gardening production for consumption (50%), participating in community capacity- and/or skills-building activities (40%) and preparation of nutritious meals for the family (35%). For non-model households, some respondents also explained that sharing household responsibilities had other beneficial impacts on their families, such as reducing the risk of domestic violence, as described by one husband:

> *The benefits of sharing of tasks and responsibilities (between husband and wife) is to reduce mistakes, notice each other, to reduce resentment between husband and wife, and to bring the happiness to family. There is no domestic violence and no embarrassment to neighbors. We are respected by neighbors since they see we are good citizens with an honor in society/community. –husband from Pursat*

Local NGO staff implementers and project respondents also noted how by sharing household responsibilities, households were able to achieve the goals they set during the household visioning activities. For example, because they worked together, husbands and wives were able to install hand-washing stations, trash bins and fences around their homes as well as keep their home environments clean and maintain their homestead gardens.

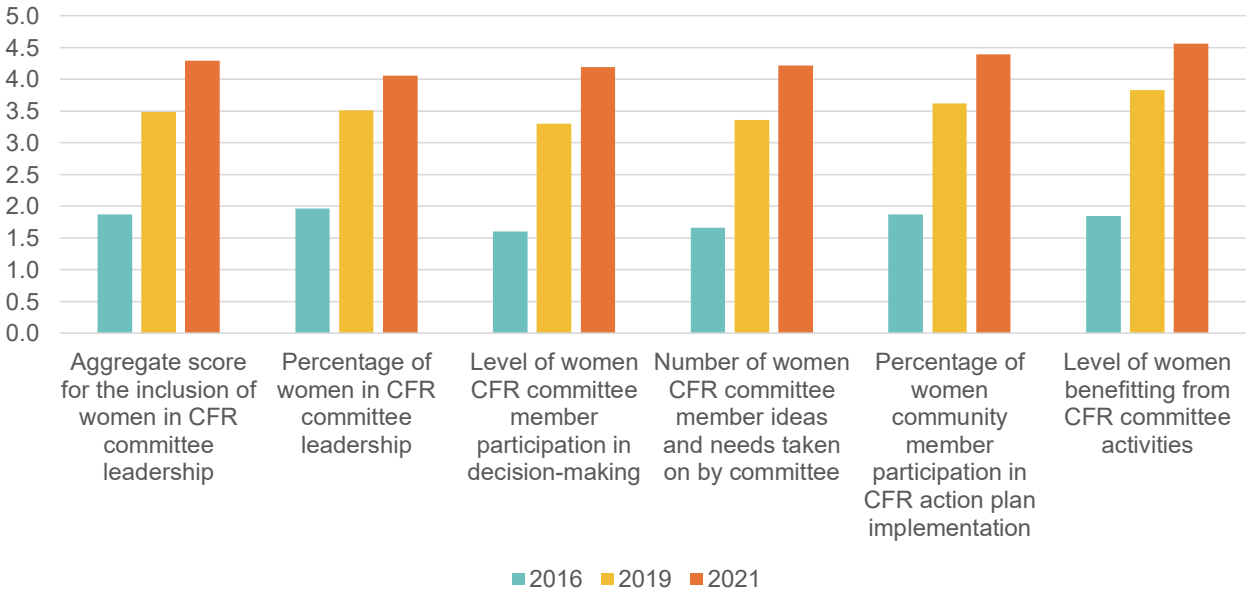
A number of challenges with the household visioning sessions were mentioned. First, one husband and wife pair explained that it was difficult to understand the household visioning activity, both in its purpose and messaging. Second, migration was seen as a frequent challenge. Men, and sometimes women, of respondent households often migrated to cities or bordering countries to work. When this occurred, household visioning sessions only occurred with one household member, usually the wife. However, as household visioning sessions were designed to be facilitated between husband and wife, having only one participant may have hampered the impact of household visioning sessions.

Image 5: A wife and husband work together on their homestead garden.

4.2.2 Representation and participation of women in CFR committees

This section will describe how women's participation in CFR committee leadership resulted in (1) increased women's participation and capacity to lead and (2) improved management of CFRs.

Overall, respondents self-reported an increase in women's representation and participation in CFR committees at the end of the project. Aggregate scores increased by 2.4 points between baseline and endline, and the final score at the end of the project reached 4.3/5 ***(Figure 5).***



Note: Actual numbers and percentages for each category were converted to a score on a 0–5 scale.

Figure 5: Aggregate and sub-scores for women's inclusion in CFR committee leadership.

When disaggregating by sub-scores, measures of women's empowerment improved in a number of ways. Following the intervention, there was an increase in women's representation in CFR committees (scores increased from 2 to 4). The largest improvement observed was for women CFR committee member participation in decision-making (+161%) from 1.6 to 4.2. Qualitative interviews also revealed CFR committee member, community member and local NGO implementer perceptions of improved leadership capacities among women CFR committee members, such as meeting facilitation, bookkeeping and fundraising. Additionally, women's needs and ideas were perceived to be increasingly accepted by CFR committee members (1.7 to 4.2). Many CFR committee members (both male and female) as well as non-CFR committee members described how this contributed to increased women's self-efficacy. In the following quote, one woman CFR committee member explains how her confidence in her own ability to lead grew following her inclusion in her CFR committee:

> *First, I was very shy about participating in CFR activities work with the CFR committee men. After the local authorities always support me, encourage me to participate, and all the CFR committee supported my ideas and brought them into consideration, it pushed and encouraged me to have confidence and be happy with my work of CFR committee leadership. – female CFR committee member from Battambang*

CFR committee members (both male and female) as well as community members recognized that, in addition to participating in decision-making, women increasingly provided their ideas, opinions and thoughts while also providing solutions to problems related to the CFR or other community matters. For example, a woman and man from the same CFR committee in Siem Reap described the change in self-confidence that women CFR committee members experienced (see quotes in the boxes).

"Before, women CFR committee members did not raise their concerns. They were shy and sometimes they thought when they raised their ideas or their points the meeting could not or would not accept them. But nowadays, they confidently make a decision and they are more confident in their ideas, providing value for the meeting. And they expect that when they raise their points or their concerns, the meeting [participants] can accept their ideas. Sometimes they think when they raise their points, even if the meeting does not accept their ideas, they still raise them. They are more active. They don't care if they are wrong or right."

– female CFR committee member from Siem Reap

"The project always encourages women or motivates women to make a decision or to raise a concern and empower women during the training, during the meeting. Before the women were scared and not active, but nowadays they are more active and they can raise more of their concerns on anything they want to express."

– male CFR committee member from Siem Reap

A local NGO implementer in Siem Reap also observed that women CFR committee members were able to have a voice in the CFR committee, and engagement with the community also increased. Likewise, respondents explained that their communities recognized the leadership capacity of women CFR committee members . One woman CFR committee member explained how, because she was able to demonstrate her leadership capacity and ability to her community through her CFR committee role, she was able to gain another leadership role in the community:

> *In the previous time, I was not involved in any local authority or commune council [activity]. When I participated in the CFR committee as a member, I was able to show my capacity, my accountability and honesty to the community and to the local authority. One time, the commune council needed a commune council assistant, so I applied for this position. And then the commune council, they knew me before and knew my work in the community and my capacity as well, so later on the commune council selected me as commune council assistant. This is a good opportunity for women in the community to demonstrate their experience or their ability. Even though they don't get the results now, but in the future they can take on more leadership roles. – female CFR committee member from Siem Reap*

Not only did women community members notice the leadership capacity of women CFR committee members, they also were influenced by women CFR committee members to be involved in leadership activities themselves. One woman community member from Siem Reap described how women CFR committee members have served as positive role models for women's leadership:

The local authority and community recognize that women are active and good leaders. This recognition has influenced other women villagers to join the community development activities because women CFR committee members are good examples for them: women CFR committee members can join other meetings or trainings or commune council meeting, and when they have a meeting, women can express their voice and show they are active in the meeting. So when other women in the community saw that, they change their opinion. Women from the community think, "If these women can do it, why can't I do?"– female non-CFR committee member from Siem Reap

As caregivers, women also play a unique role in advocating for the health of the community. For example, one female CFR committee member in Siem Reap explained that she was concerned about the risk of children drowning in the CFR. She suggested building a fence around the CFR, which the CFR committee heard and agreed to. Other CFR committee members (both male and female) and community members also described how women advocated for nutrition and WASH needs in CFR committee meetings, leading to other knock-on positive effects on the community, as described by one interview respondent:

At the CFR committee meeting, women committee members raised the hygiene concern in the village. This point was accepted by the CFR committee and community as well. Later on, they agreed and they start to do this activity from the women's idea. They installed the trash bin in the community for cleaner and more hygienic community. – female non-CFR committee member from Pursat

Respondents also explained how women's inclusion in CFR committees resulted in improved management of CFRs. Almost all interview respondents and local NGO staff implementers explained that, compared to men, women are better able to build social capital and to leverage existing social capital, both with local authorities and community members. For example, one male CFR committee member from Kampong Thom explained that women are more effective than men in establishing and maintaining relationships with commune councils, village chiefs and other stakeholders to communicate the needs and challenges of the CFR and seek support.

As a result of women's social capital, almost all respondents (male and female, committee and non-committee members) explained that women's involvement led to improved fundraising for CFR committees, community mobilization for CFR activities, and increased education and awareness building around the benefits of CFRs (both within and outside of the community). All respondents emphasized that female CFR committee members were more effective in fundraising for CFR activities, which they partly attribute to communities having more trust in women, among other reasons:

The female committee [members] are clever in fundraising and collected much money from the [community] event because they have skills in convincing people to [donate] money, good communication with other stakeholders, good record-keeping, have the trust of the people and keep the money safe. – male CFR committee member from Battambang

Image 6: Women CFR committee members fundraising for the CFR.

Respondents also explained that, compared to men, women are better able to leverage their social capital, in social groups both within and outside the community, to provide education and build awareness about the benefits of CFRs. One woman CFR committee member from Siem Reap explained how she is able to promote CFRs while doing work outside her community, and she encourages other women CFR committee members to do the same, since women often have activities in other communities:

> *While doing other activities in other villages, I also promote the CFR and what the advantages of the CFR are. And I told the other communities not to fish in the conservation area. But in the rice field, they can fish. And some villagers, they want to have the CFR as well and they ask me how to do it, how to make it, how to find supporters if they want it. I also encourage the other two women CFR committee members to do the same activities. Because they are cookers, and sometimes they have ceremonies in the communities, so they integrate the dissemination and extension of the CFR committee and the CFR advantages during their work in other communities. – female CFR committee member from Siem Reap*

5. Conclusion

Rice field fisheries are a vital resource for Cambodia, providing income, food and nutrition for many rural households. CFR establishment and management has been shown to enhance the productivity and biodiversity of these fisheries, thereby improving livelihoods and food and nutrition security for the many families that depend on them. The explicit incorporation of nutrition and gender activities alongside CFR and rice field fishery management has the potential to augment impacts on nutrition outcomes and improve women's leadership capacity and self-efficacy. This report provides evidence and perspectives of the project participants and implementers.

5.1 Key findings: Nutrition and WASH

- Although knowledge and attitudes around dietary diversity improved, consumption of a diverse diet among women of reproductive age declined. However, at the same time, consumption of a diverse diet among children 2–23 months improved. This may suggest that caregivers know that a diverse diet is important, but other barriers to consumption besides knowledge exist. Because dietary diversity was assessed during the dry season, one explanation can be that when household food insecurity is high, caregivers may be allocating the limited nutritious foods they have to their children because they know it is important for their children's health.
- Study respondents described improved access and availability to fish from rice field fisheries due to CFR establishment and management, diverse vegetables and fruits from homestead gardens, and water for multiple uses from CFRs. These improvements were most substantial during the wet season.
- Household knowledge about the importance and benefits of consuming fish, particularly SIS, improved.
- Study respondents continued to know and use at least one of the WorldFish fish recipes, including small fish soup, fish ball meat and small fish powder. However, small fish powder was time-consuming to produce, and small fish were not available year-round.
- Households prepared nutritious meals with diverse food groups. This suggests that knowledge about nutrition learned from training for caregivers was used together with improved access to aquatic foods from rice field fisheries and diverse fruits and vegetables from homestead gardens.
- WASH knowledge and behaviors (from both caregiver training and household visioning sessions) improved, particularly around hand-washing and sanitary home environments.

5.2 Key findings: Gender

- Project participants shared household responsibilities more equitably after attending household visioning sessions. This led to increased time for women to be involved in income-generating activities, community leadership and/or skill-building activities.
- Women who participated in CFR leadership and/or activities reported increased self-efficacy and leadership capacity.
- Women's inclusion in CFR committee decision-making resulted in community perceptions of improved CFR management. There was strong consensus among interview respondents of the perceived positive benefits of women's leadership roles to the community and to CFR management.

5.3 Recommendations and future research

- Caregiver training on nutrition is effective in improving knowledge and attitudes. However, as nutrition behaviors are not limited to knowledge gaps, understanding barriers to consumption and dietary diversity, including those in the food environment, are necessary to change behaviors. Further research in these areas is recommended.
- Seasonality and intensified droughts are challenges to sustaining aquatic food availability, food security and dietary diversity. Climate-related research to address these challenges, for instance, through small fish domestication and cooperatives for food-safe preservation techniques, is needed.
- Providing caregiver training on recipes for fish preparation appropriate for children under 5 years old is a practical way to increase fish consumption among children. Scaling fish recipes to school feeding programs or other fisheries and agriculture interventions can be an effective way to further increase child fish consumption.
- Increased availability and accessibility of SIS near the home may also contribute to increased consumption of SIS among children, and dry season SIS consumption for the entire household. More research is needed to understand determinants of SIS consumption and variability across the population.
- Homegrown school feeding programs with fish may be an effective way to further improve SIS consumption, and warrants further research. For instance, schools near CFRs can purchase fish from rice field fishers for school feeding programs, and CFR management and improvement can be promoted as part of these programs.
- Household visioning sessions can encourage household members to more equitably share household tasks and to work together to change their nutrition and WASH behaviors. The resulting shift in the division of household labor can increase available time for women, in particular, to take on entrepreneurial and community leadership roles. However, as work-based migration was considered a key challenge, further research is needed on how the visioning sessions can be adapted to reach community members outside of the home setting and include additional caregivers (male and female) that reside in the home year-round.
- Women participants and other community members noted several benefits of women's inclusion in CFR committees. These included increased self-efficacy and perceived status within the community, demonstrating an effective grassroots-led model of women's empowerment. In addition, women provided unique skillsets that contributed to improved governance of CFRs alongside men. As many of our findings were related to the leadership capacity and self-efficacy of women, further research could evaluate the contributions of technical fisheries training and capacity to women's empowerment and CFR governance.
- Impacts on nutrition, WASH, gender, food security, and natural resource management are interrelated. Conducting these sectoral activities in tandem can enable impact within and across sectors.

Findings from this report suggest that continued progress toward nutrition and food security require a multidimensional approach. Implementing explicit nutrition and gender activities alongside management of CFR-RFF systems is one way to help support sustainable access, availability and knowledge of a nutritious and diverse diet for rural families in Cambodia. It is our hope that the impacts and activities shared here and in the companion practitioner guide can be adapted and/or improved upon in the future multisectoral programs needed to propel a food secure future.

6. References

Development Initiatives Poverty Research. 2020. **2020 Global Nutrition Report: Action on equity to end malnutrition. The Global Nutrition Report's Independent Expert Group.** Bristol, UK: Development Initiatives.

FAO, IFAD, UNICEF, WFP and WHO. 2021. **The state of food security and nutrition in the world 2021: Transforming food systems for food security, improved nutrition and affordable healthy diets for all.** Rome: FAO. doi: 10.4060/ca9692en

[FiA and CBNRM] Fisheries Administration of Cambodia and the CBNRM Learning Institute. 2008. **Gender implications in CBNRM: The roles, needs and aspirations of women in community fisheries: Six case studies in Cambodia. Phnom Penh, Cambodia: CBNRM.**

Guest G, Namey E and McKenna K. 2017. How many focus groups are enough? Building an evidence base for nonprobability sample sizes. ***Field Methods 29***(1):3–22. doi: 10.1177/1525822X16639015

Karpati J, Neubourg C, Laillou A and Poirot E. 2020. Improving children's nutritional status in Cambodia: Multidimensional poverty and early integrated interventions. ***Maternal & Child Nutrition 16***(S2):e12731. doi: 10.1111/MCN.12731

Kumar N, Nguyen PH, Harris J, Harvey D, Rawat R and Ruel MT. 2018. What it takes: Evidence from a nutrition- and gender-sensitive agriculture intervention in rural Zambia. ***Journal of Development Effectiveness*** 10(3):341–72. doi: 10.1080/19439342.2018.1478874

National Institute of Statistics, Directorate General for Health, and ICF International. 2015. **Cambodia Demographic and Health Survey 2014.** Phnom Penh, Cambodia: NIH.

Ruel MT and Alderman H. 2013. Nutrition-sensitive interventions and programmes: How can they help to accelerate progress in improving maternal and child nutrition? ***The Lancet 382***(9891):536–51. doi: 10.1016/S0140-6736(13)60843-0

WorldFish. 2010. Gender and fisheries: Do women support, complement or subsidize men's small-scale fishing activities? Key Messages. **Issues Brief 2108.** Penang, Malaysia: WorldFish.

Annex 1: Scoring schema for the representation and participation of women in CFR committee leadership.

Sub-scores	Scoring	
Percentage of women in CFR committee leadership	1	None
	2	< 10%
	3	11%–20%
	4	21%–30%
	5	>30%
Level of participation in decision-making Among women CFR committee members	1	No ideas shared by women
	2	<10% of women's ideas shared but not accepted
	3	10%–20% of women's ideas shared and accepted
	4	31%–40% of women's ideas shared and accepted
	5	≥41% of women's ideas shared and accepted
Number of idea and needs from women CFR committee members taken on by committee	1	Not accepted
	2	1 women idea/need of women accepted
	3	2 ideas/needs of women accepted
	4	3 ideas/needs of women accepted
	5	≥4 ideas/needs of women accepted
Percentage of women community members participating in CFR action plan implementation	1	None
	2	<10%
	3	10%–20%
	4	21%–34%
	5	≥35%
Level of women benefitting from CFR committee activities	1	None
	2	Less benefit
	3	Some benefit
	4	More benefit
	5	Most benefit

Annex 2: Equal families are stronger families in rural Cambodia

Many families struggle to balance paid work and unpaid household chores. In rural Cambodia, men, as well as many women, traditionally farm, work as wage laborers and work in a range of other roles to support their families. Women are also primarily responsible for unpaid work in the household, placing burdens on their energy and well-being. The effects of COVID-19 have also severely impacted the livelihoods and household dynamics of many Cambodian families.

Srey Vun is a housewife in Tumnub Rumdeng in Siem Reap province. Like many women in Cambodia, Srey Vun had been responsible for all the chores in her household, while her husband Nheng focused on earning income. As a result, Srey Vun felt overwhelmed and exhausted, and she lost opportunities to benefit from vocational training to look for new job opportunities and even to have a social life.

"My housework never seemed to end, even when I started work early in the morning and worked till nighttime. And no one helped me or understood how I felt. I sometimes felt so bored and exhausted," she said.

With support from USAID, the Feed the Future Cambodia Rice Field Fisheries II project, led by WorldFish, is helping thousands of households like Srey Vun and Nheng's to examine beliefs about women's and men's roles at the household and community level in four provinces around the Tonle Sap Lake. This leads to tangible changes that transform household relationships and improve gender equity.

To support Srey Vun and her family, project staff facilitated exercises and conversations with Srey Vun's family to help them quantify their household work done on a daily basis, analyze issues and the causes of the problems, and develop plans to tackle to those problems and encourage more equal sharing of responsibilities.

"Previously I never touched the housework, because those tasks were women's responsibilities. I always enjoyed having a drink or chatting with our neighbors when I was free. I found some problems or even strong disagreements would happen in my family," said Srey Vun's husband, Nheng.

Through these WorldFish exercises and a series of training sessions and mentoring, both Srey Vun and her husband understood the importance of sharing tasks more equally and of changing their beliefs and practices around family responsibilities.

Now, Nheng has taken on a number of chores, including cooking, washing the dishes, cleaning the house, feeding the animals and taking care of their children.

Annex 3. Empowering women leads to improved nutrition security in rural Cambodia

The SIS in Southeast and South Asian countries are known for their high nutritional value, containing both macronutrients and micronutrients, such as vitamins and minerals. These small fish plays a major role in the elimination of malnutrition and micronutrient deficiencies in rural populations and poor households. However, many rural households in Cambodia were previously not aware of the benefits of consuming SIS that were abundant in rice fields in the villages.

With support from USAID, the Feed the Future Cambodia Rice Field Fisheries II project is supporting 140 CFRs around Tonle Sap Lake to improve rice field fisheries resource management as well as the knowledge of local villagers and other key stakeholders on WASH practices, food security and the advantages of consuming SIS.

Ms. Nai Srey Oun lives in a rural village in Kampong Thom province in Cambodia. She is the head of household with six family members, including her elder parents and two younger sisters. Before engaging with the project, her household's sole source of income was the sewing service she provided at home.

"Before engaging with the project, I did not know about benefits of small fish and fish powder for children under 5 and didn't have any knowledge and skills on how to produce small fish powder too," she said.

Srey Oun was initially just interested in joining some project activities, but later she was elected as a committee member of the Boeng Bunteay CFR and a volunteer for the village health support group. The project strengthened the capacities of committee members of all 140 CFRs, especially women like Srey Oun, through training, mentoring, study tours and field practices. Having assumed a leadership role in the community, Srey Oun now always promotes sanitation and hygiene practices and disseminates the benefits of small fish consumption and cooking methods, which maximizes the nutritional value, to local villagers and childcare givers.

The WorldFish-led Feed the Future Cambodia Rice Field Fisheries II project, in cooperation with NOURISH (another USAID-funded project) also trained volunteers from the target communities on how to produce dried fish powder made from nutrient-rich SIS as a supplement for children and lactating women. After completing a series of training sessions, Srey Oun decided to promote small fish powder to others and also make extra income for her family from selling small fish powder. She started commercial production of small fish powder in her community, always applying best hygiene practices. Her products became popular among the villagers in her community, and she was able to make modest profits from the business.

With support from the project, Srey Oun expanded her business to reach markets outside of her community through market exhibitions and social media; she posted her products on Facebook and also shared live videos. When she promoted her products, she always highlighted the benefits of small fish for pregnant women and children under 5. As a result, many people outside of her community were interested in her products and ordered using Facebook or their cellphone. On average, she was able to sell about 100 jars of fish powder per month at USD 1.25 each.

"Thanks to the project, I had an opportunity to show my fish powder at an exhibition. Now many people knew me and my products; they ordered my products via cellphone and Facebook. I was happy because my sales increased even during COVID-19 period," Srey Oun said.

SIS, which are used to produce the fish powder, are usually collected from rice fields, community ponds, canals and other water bodies by local fishers. Not only does fish powder production generate profits for fish powder producers, but it also provides incomes to small-scale fishing households during economic shocks, such as the COVID-19 pandemic, by selling small fish that otherwise may not have high commercial value.

The Feed the Future Cambodia Rice Field Fisheries II project has contributed to a stable supply of both large and small fish from rice field environments and sustained the local availability of fish in rural villages even in drought years. Through the implementation of this project, WorldFish and partners have contributed to improved food and nutrition security for over 100,000 people. Even during the drought year of 2020, there was a 20% increase in amount of micronutrient-rich SIS consumed by children under the age of 5 in the dry season when the supply of small fish typically goes down. Furthermore, the proportion of households consuming SIS whole, which maximizes its nutritional benefits, quadrupled since 2017.

WorldFish

WorldFish is an international, nonprofit research organization that harnesses the potential of fisheries and aquaculture to reduce hunger and poverty. Globally, more than one billion poor people obtain most of their animal protein from fish and 800 million depend on fisheries and aquaculture for their livelihoods. WorldFish is a member of CGIAR, a global research partnership for a food-secure future.

For more information, please visit **www.worldfishcenter.org**