Small-Scale Aquaculture Investments for Livelihoods in Myanmar

Annual Report (Oct 2019 – September 2020)

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Acronyms

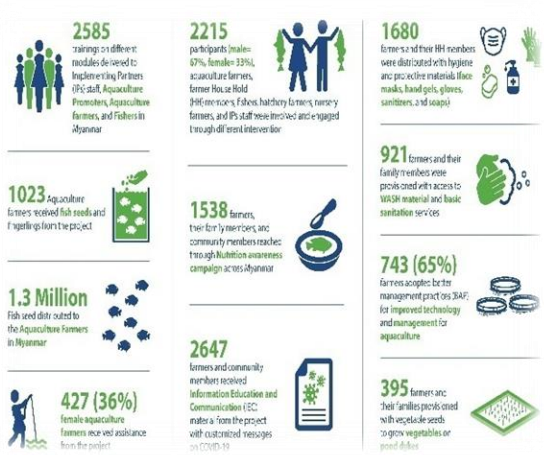
COVID 19	Novel Coronavirus 2019
BMPs	Better Management Practices
BRAC	Building Resources Across Communities
CBOs	Community Based Organizations
CoP	Chief of Party
CSOs	Civil Society Organizations
DEM	Digital Elevation Model
DG	Director General
DIP	Detailed Implementation Plan
DoF	Department of Fisheries
FCR	Feed Conversion Ratio
GAqP	Good Aquaculture Practices
GCM	Global Circulation Model
GIFT	Genetically Improved Farmed Tilapia
HHs	House Holds
HQ Penang	Head Quarter Penang
IEC	Information Education and Communications
IPs	Implementing Partners (IPs)
IRs	Intermediate Results
IWMI	International Water Resource Management Institute
KIT	KIT Royal Tropical Institute
KMSS	Karuna Mission Social Solidarity
LoP	Life of Project
M&E	Monitoring & Evaluation
MEL	Monitoring Evaluation and Learning
MFBs	Micro-Finance Banks
MFF	Myanmar Fisheries Federation
MFIs	Micro-Finance Institutions
MSA	Market System Approach/Analysis
MT	Metric Ton
NGOs	Non-Governmental Organizations
OCS	One Common System
PEOU	Perceived Ease of Use
PU	perceived usefulness
R&D	Research & Development
SBCC	Social Behavior Change Communication
SIS	Small Indigenous Species
SPAM	Spatial Production Allocation Model
SSA	Small-scale Aquaculture

Sub IRs	Sub Intermediate Results
SWAT	Soil and Water Assessment Tool
ToC	Theory of Change
ToRs	Terms of References
ToTs	Training of Trainers
USAID	United States Agency for International Development
USD	United States Dollar
WASH	Water, Sanitation and Hygiene
ZOI	Zone of Influence

1. Summary

In October, 2019 USAID awarded WorldFish a five-year activity, "Fish for Livelihoods" is a five-year (2019-2024) activity which focus on improving the nutrition status in Central and Northern Myanmar by promoting an inclusive and sustainable aquaculture growth of small-scale farmers and associated market actors. The activity is being implemented in five geographical region/states including Mandalay, Magway, Sagaing, Kachin, and Shan. WorldFish is leading this activity, but, the field level activities are operated in partnership with several development and private sector partners; BRAC, IWMI, KMSS, PACT Myanmar, Department of Fisheries (DoF) and Myanmar Fisheries Federation (MFF). The activity will lead towards three major results: increased small-scale aquaculture production, market system approach to increase access of farmers to food and safe fish, and enhanced nutrition and WASH practices behavior adoption. Fish for Livelihoods will target more than 10,000 aquaculture farmers, train them for better aquaculture practices, link them with major market actors, and provide them information through social behavior change communication (SBCC) strategy on the importance of diet-diverse nutritious food. The main approaches to achieve the above mentioned results would include improved land and water use, increased access to high quality inputs (feed, seed and equipment), capacity development and research into production, and access to credit, market-based system approaches to increase access to food-safe fish and fish products, enhanced nutrition and WASH practices via social behavior change communication activities, and develop capacities for improved production, processing and consumption of food-safe aquaculture and other fish-based products.

"Fish for Livelihoods" primarily focuses on SSA farmers. In the Year-I, (1,164) grow out SSA farmers were engaged with various interventions in 14 townships of five regions across Myanmar. In addition to that, the activity assisted several other project participants including eleven (11) hatcheries, twenty-five (25) nurseries, ninety-two (92) fishers, eight (8) feed millers, and four (04) community pond members. The activity delivered multiple trainings to these participants who were exposed with three different SSA modules. Stocking of fish in ponds in the midst of the COVID-19 crises was a challenge, but, with the help of IPs field staff an estimated 1.3 million fish seeds are stocked in 14 townships. Also, an estimated 30,000 plus Small Indigenous Species (SIS) fish are stocked in 179 ponds (Annex 1).



The Government of the Myanmar commemorated August 2020 as a Nutrition month in Myanmar. The activity mobilized communities in the townships and arranged a range of events including cooking demonstration and competitions, games, world cafe, and nutrition talks. The Nutrition campaign mobilized more than 1,500 farmers, their families, and community members in 26 events. Five hundred and seventy-five, 575 [Male=251, (44%) and Female=324, (56%)] members attended events across Myanmar. Moreover, IEC materials on Nutrition, Gender, WASH and hygiene were distributed to 1,007 [Male=594 (59%) and Female=413 (41%)] community members.

At the onset of the activity, the scoping mission was carried out to all regions for a situation assessment; potential of aquaculture, availability of nurseries, hatcheries, and identification of major market actors. WorldFish team assessed the situation and collected data on farms, fish production and income, market linkages and impediments, and availability of nutritious fish. The scoping mission ended with candid recommendations on Small Scale Aquaculture (SSA), market analysis, and gaps to be filled with

interventions. Based on the results of scoping and further research, 33 townships in select regions were identified for interventions. The inception workshop of Fish for Livelihoods Activity was organized in February 2020 at national level in the capital city of Myanmar, Nay Pyi Taw. The event was attended by more than 50 international and national delegates from Government, civil society, donors, and private sector organizations. The launch has led key external and internal audiences about the activity, what it aims to achieve for the rest of the five years.

International Water Management Institute (IWMI), one of the IPs, conducted a comprehensive study; SWAT hydrological modeling and a comprehensive literature review of 13 studies for Ayeyarwady river basin, Myanmar. SWAT modeling collected data (temporal and spatial) and data on population, agriculture livestock, fisheries and so on. The analysis juxtaposed together data from various sources to check inconsistencies and filled missing data. It gave insights on rainfall and water quality in Myanmar.

The importance of improved hygiene practices became central to halt the spread of COVID-19. The activity delivered WASH hardware to a number of individuals; toilet bowl facility to 110 individuals, filter water access to 857 individuals, and access to handwashing containers with soap to 664 individuals. IEC material designed and developed with customized messages on COVID prevention, hand washing hygiene, and protective material (face masks, soaps, hand gels, sanitizers, etc.) were distributed to an estimated number of 3,000 farmers and community members. The IEC materials were also disseminated via social media (Facebook, local mobile technology applications, LinkedIn, Twitter, WorldFish website, and CGIAR network) for internal and external audiences.

On account of increased production with improved land and water use and, increased access to information, inputs, and credits, a comprehensive literature review on scientific studies of Ayeyarwady river basin Myanmar was conducted on water resource management. Subsequently, Market System Analysis was carried out based on desk review of relevant data, articles, studies, reports and primary data collected on fish seed and feed. This analysis helped in framing concrete recommendations on where and how to intervene for results and broader impacts. WorldFish, from the onset delivered online training to IPs staff, Aquaculture Promoters (APs) and farmers which could have been done in person if COVID-19 had not hit Myanmar in March 2020. The programming continuously adapted to the COVID-19 crises. The increased adoption of the technology and its utilization was realized. The activity delivered training to SSA farmers on-line via mediums including Viber, WhatsApp, and Facebook to mention a few. With a strong presence of field staff at their respective field offices, it was ensured that Fish are timely stocked in ponds. Information Education and Communication (IEC) material was designed, developed, and disseminated to farmers and associated communities. The IEC material was tailored with customized messages on COVID-19 prevention; hand washing, coughing etiquettes and so forth. Provision of WASH material, and hygiene material (face masks, soaps, hand gels, sanitizers, etc.) to farmers and their families were provided as well.

Proposals were sought and solicited from private and development sector to implement the project at field in an innovative manner. A wide-ranging analysis of credit (cash, in kind, etc.) delivery system, access to quality inputs (seed and feed) was conducted to ascertain increased access to financial credit, inputs, seed, and feed. The analysis generated the basis for improved activity interventions to be implemented in upcoming years. In addition to this, the foundations for a thorough institutional assessment of MFF was carried out that will build the capacity of MFF, a leading private sector institution on Fisheries in Myanmar.

Market System Approach (MSA) is adopted in activity to design areas of interventions. The activity engaged two international MSA experts who physically went into the regions and gathered useful data about market value chain and major actors followed by a scientific literature review and consultations with

key market players. Major recommendations were imparted to WorldFish and IPs team members through a series of workshops conducted in February, 2020. The interventions were redesigned based on the information obtained from that workshop. Moreover, the practices followed for fish processing; dried fish and food safety, were assessed and data was collected from the field. The data and information obtained on fish processing would be helpful to generate future strategies and interventions for better business opportunities generating more income for fish processors.

Improved consumption of healthy and nutritious diet and adoption of better WASH practices through SBCC is one of the major targets of the activity. For this, the Information Education and Communication (IEC) material was developed following a consultation process (workshops, reviews, etc.) in Burmese language. The hit of the COVID 19 was felt in Myanmar in March 2020 when the initial positive cases were reported by the Ministry of Health. Additional messages on COVID-19 precautions and effective usage of Personal Protective Equipment (PPE) including face masks, hand gel, sanitizers, and soaps were added in the IEC materials. Due to CVOID-19, active mobilization of the communities in field and interventions designed to be implemented was halted; however, social media and online platforms (Skype, Viber, WhatsApp, etc.) are used to engage communities for effective communication.

"Fish for Livelihoods" with the help of a European based mobile application company, designed and developed an innovative user-friendly mobile app, "Shwe Ngar" (Golden fish). The App could be used to collect run time data, information dissemination, connecting local suppliers & buyers, and assistance in making fish feed using feed calculator. It is available in English and Burmese. The App is simultaneously embedded with famous agriculture Apps in Myanmar, Htwet Toe and Greenway, to capture farmers, fishers, and market actors across Myanmar. Also, pilot testing on developing dried small fish powder through a local food company was initiated with sample products to undergo laboratory analyses to determine the quality, as well as conduct market and cost analyses to know the viability of the products to be available widely in the country.

On cross cutting themes, Monitoring Evaluation & Learning (MEL), Gender, and Communications were integrated into the intervention designs. WorldFish has an in-house robust MEL System which will be integrated for the activity's data management. The activity MEL plan was developed in close consultation with USAID. The activity MEL Plan will serve as the key document for performance management and to track activity results over the LoP. Gender, being a key theme, is also integrated within the intervention design. In January 2020, an international Gender Expert delivered sessions in a two-day long workshop. As a result of this, an innovative approach was adopted where each of the activities included in the work plan was reviewed with gendered lens and gender perspective was integrated into them.

Communication plays a vital role to highlight the activity successes and accomplishments. In the reporting period, customized communications products were developed and shared with the external and internal audiences. Activity fact sheet, in English and Burmese, brochures, pamphlets, banners, and portraits are some of the key products designed, printed, and distributed amongst the audiences in English and Burmese.

Fish for Livelihoods is successfully launched in Myanmar. WorldFish tapped its existing resources and strengths developed over the years in Myanmar for the successful launch. Scooping mission, staffing, launch of the activity, market system value chain, activity MEL plan, IEC material, workshop, and contracts award to IPs are the major highlights of the reporting period. Fish for Livelihoods has captured roots into the ground and it will be followed with robust implementation in the forthcoming quarters. On the one hand, COVID-19 pandemic will restrict the field team mobilization and business as usual, but on the other hand, it provides abundant opportunities to think out of the box solutions to challenges for timely implementation. WorldFish is committed for provisioning of services to small pond farmers and HHs and

open for innovative service delivery methods. The new norm for us would be to continuously innovate, learn, and adapt new practices using technologies to serve the beneficiaries in the post COVID-19 era.

2. Introduction

In October 2019, USAID awarded the Small-scale Aquaculture Investments for Livelihoods in Myanmar (short form: Fish for Livelihoods) activity for 2019-2024. The project will focus on improving the nutrition status in Central and Northern Myanmar by promoting an inclusive and sustainable aquaculture growth that focuses on small-scale farmers. WorldFish is leading this activity with implementing partners including IWMI, BRAC, PACT, KMSS, and MFF. This activity aims to provide a means of ensuring the improved availability of diverse, safe, affordable nutrient-rich foods, especially for women and young children from poor and vulnerable households.

This will be achieved by ensuring that poor households have an increased ability to purchase accessible nutritious foods due to improved incomes from entrepreneurial activities including improved small-scale aquaculture in the intervention areas and the strengthening of aquaculture market systems with attention to expanding opportunities for women and youth. In addition, behavioral change work will prioritize nutrition-conscious household decisions by means of both home production and local markets. Specifically, it is expected that the adoption of fish culture technologies would contribute to improved food and nutrition security for poor households in several ways;

1. Generating income from fish culture which would be used to purchase nutritious food
2. Creating alternative employment generating activities and increasing labor productivity
3. Increasing available food supply and fish consumption

3. Goal and objectives

The project proposes to change the current scenario by contributing to the development of the necessary conditions for a more inclusive and sustainable development of the small-scale aquaculture producers to increase income, production and nutrition, especially for the most vulnerable groups. The overall development objective is:

Inclusive and sustainable small-scale aquaculture growth to enhance integrated agriculture nutrition pathways by means of improved production and market systems approaches to increase the availability of fish, income and dietary diversity, dietary and agriculture practice behavior change, reduce poverty of beneficiary populations, especially women and children, in central and northern Myanmar.

The project will ensure that fish production in areas distant to the Ayeyarwady Delta will provide fish closer to fish deficit areas while promoting market systems and value chains to deliver food safe fish and fish products to local markets. This will be accompanied by activities in the nutrition and WASH areas, to ensure a more integrated approach that comprehends various aspects of small-scale aquaculture. More specifically, the objectives for each of the three dimensions are:

1. Increase small-scale aquaculture production through strategic activities including improved land and water use, increased access to high quality inputs (feed, seed and equipment), capacity development and research into production, and access to credit.
2. Further develop and utilize market-based system approaches (MSA) to increase access to food, safe fish and fish products.
3. Enhanced nutrition and WASH practices delivered via social behavior change communication (SBCC) activities.

4. Targets

The project three components are increased SSA production, leveraging market actors, and nutrition and WASH interventions. This will target the small-holder farmers who owns small ponds in the select region those would be the direct beneficiaries of the project. The project aims to reach at least 10,000 SSA farmers during the life of the project (LoP). These farmers will be provided with SSA interventions in fish stocking management, best management practices (BMPs), efficient use of inputs, credit to access, and access to market during LoP. Increased production will in turn increase the livelihoods and income of these farmers and households (HHs). Yield (production/unit are) will be another parameter set to assess the performance of the project. Initially, the target set for the project is 3 tons per hector.

The second component of the project is about market systems and how does the different market actors, hatcheries, nurseries, whole seller, and retailers operate in different markets under varied conditions. All the market actors work in a complex environment, however, interconnected and dependent on each other. The existing value chains will be analyzed and all these market actors would be linked in an efficient and effective ways to boost the market worth as a result of project interventions. The value of annual sales of the farmers linked with market and major actors would be the benchmark to assess the project performance. The target set for the project is to achieve USD 10 million sales from the SSA production in intervention areas by the LoP.

The third component focuses on improving nutrition and adoption of effective WASH behaviors among project participants. The approach is to provide information on basic nutrition and WASH at the household level, including distribution of WASH hardware and seed kits.as well as conduct assessment of barriers and the enablers among the target group to facilitate change of behaviors, thereby achieving good nutrition. The primarily target for nutrition and WASH interventions would be the deprived women and children under the age of five. These services will also be provided to the targeted small holder farmers.

5. Approach

The WorldFish mission in Myanmar focuses on Small-Scale Aquaculture (SSA) with the aim of promoting resilience of the small-scale fishers and the sustainability of the aquaculture. The small-scale farmers are among the most vulnerable groups to external shocks and there are no sufficient measures and strong enough institutions to create safety nets and protection. As such, the small-scale aquaculture sector in the country remains underdeveloped and fragile, putting at risk the livelihoods of the ones affected. The potential for development is enormous and much can be achieved by providing to the country the technological, financial and policy tools to restructure itself.

Smallholder farmers are usually involved in freshwater aquaculture activities. However, the aquaculture environment they are involved with, presents multiple barriers, such as: poor species diversification, regulatory limitations on land and water use, unsustainable practices, low productivity, limited /no access to the market, etc. Changing these conditions to favorable ones, would boost the potential of aquaculture to respond to the increasing demand for fish and at the same time improve the livelihoods of poor smallholders. Indeed, most of the individuals that rely on small-scale production are food insecure. The nutrition quality such as dietary diversity and food safety undermine the overall well-being and health of the smallholder population, especially child-bearing women and young children.

To address the challenges discussed above, WorldFish in financial assistance with USAID will implement a five-year project. The project aimed at providing means of ensuring the improved availability of diverse, safe, affordable nutrient-rich foods, especially for women and young children from poor and vulnerable households. This will be achieved by ensuring that poor households have an increased ability

to purchase accessible nutritious foods due to improved incomes from entrepreneurial activities including improved small-scale aquaculture in the intervention areas and the strengthening of aquaculture market systems with attention to expanding opportunities for women and youth.

6. Geographical focus

The intervention will focus on five inland states and regions in Central and Northern Myanmar:

- Central Dry Zone: Mandalay, Magway and Sagaing
- North: Shan and Kachin

These areas present more challenges in relation to aquaculture development and livelihoods opportunities. The growth in aquaculture can play in important role to change this scenario by increasing production and income opportunities. A detailed mapping of the target townships and their characteristics will be developed after the scoping study, which will help to clearly and strategically identify the areas of intervention and beneficiaries. The figure – I shows the broader context of the select regions of activity intervention in Myanmar.

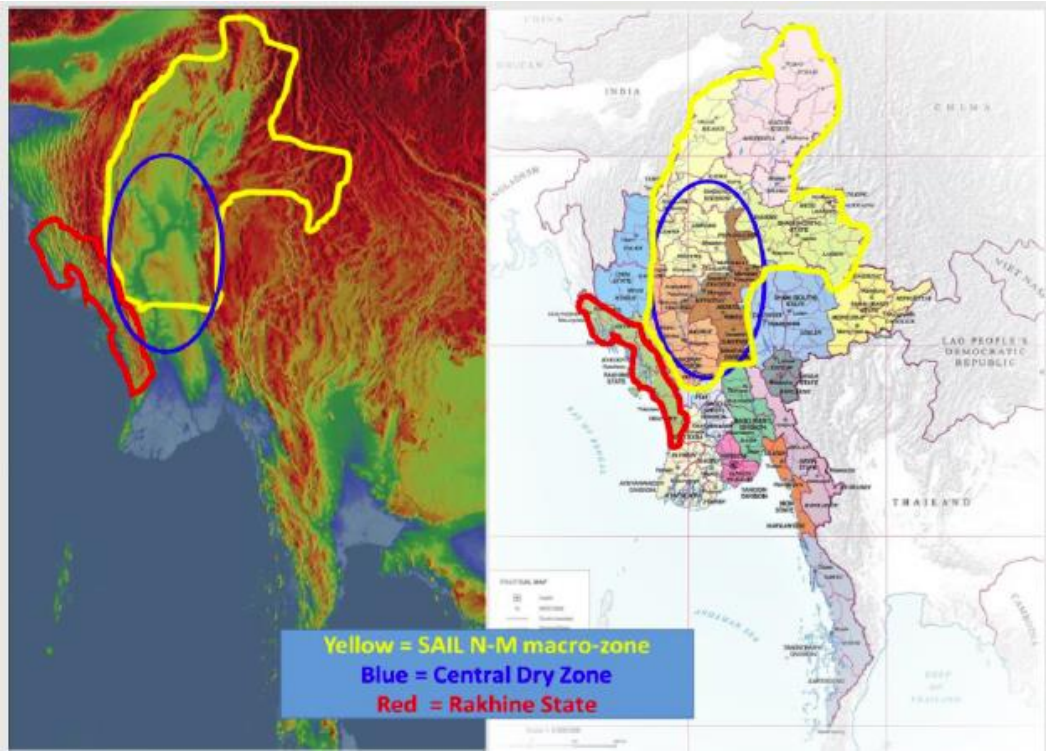


Figure 1: A Map of project zone of intervention within the broader context

7. Year I Workplan Progress

Inception phase (six months): Determining the townships in most need of assistance in terms of aquaculture production and /or improved market chains to deliver project's development goal

Carry out in-depth scoping study in the agreed intervention areas

Phase I: Broad scale scoping, team and network development, security assessment/verification, preliminary data collection and methods testing; township selection.

The scoping mission was carried out during the reporting period to the regions where for Livelihoods will implement the activities for the Life of Project (LoP). The purpose of the trips was to collect the useful information from farmers, nurseries, hatcheries, and from major market actors. The trips were conducted to Mandalay, Magway, Sagaing, Shan, and Kachin states with project teams, USAID representatives, and consultants. It was ensured during the trips that the necessary data should be collected and analyzed for a preliminary review about the townships with higher needs of SSA interventions, and have more potential for the fisheries sector. The schedule on the mission trips can be seen in the

Table 1: Scoping mission trips information

Scoping Mission Trips		
Date (s)	**Region/Area**	**Team Members**
Nov 18 - 22, 2019	Kengtung	Dr. Manjurul Karim, Dr. Khin Maung Soe, Mr. Sebastien Moineau, Mr. Nicolas Jewell, Ms. Wae Win Khaing, Ms. Nay Thah Paw, Mr. Sai Noot
Nov 27 - 31, 2019	Mandalay	Dr. Manjurul Karim, Dr. Khin Maung Soe, Mr. Sebastien Moineau, Mr. Nicolas Jewell, Ms. Wae Win Khaing, Mr. Visidh Koum
Dec 1 - 4, 2019	Sagaing	Dr. Manjurul Karim, Mr. Sebastien Moineau, Quennie Rizaldo, Ms. Than Than Swe, Ms. Aye Aye Lwin, Ms. Jessica Scott
Dec 5 - 7, 2019	Magway	Mr. Sebastien Moineau, Quennie Rizaldo, Ms. Than Than Swe, Ms. Wae Win Khaing, Ms. Mo Mo Aung
Jan 6 - 8, 2020	Shan	Travis Guymon, Dr. Manjurul Karim, Dr. Khin Maung Soe, Mr. Sebastien Moineau, Mr. Nicolas Jewell, Ms. Shwu Jau, Ms. Quennie Rizaldo, Ms. Mo Mo Aung, Mr. Visisdh Koum, Ms. Wae Win Khaing, Lal Perakum, Paul Davelic, Yin Mon Aung

Most of the data collected during the scoping were either directly from Government Websites; MoPI (Census 2014), GAD, or, in the case of township and village tract boundaries from the MIMU website. Data on Land Use (Smithsonian/EcoDev) was already acquired by the consultants. The township selection criteria were based on the following priorities:

a) **Overall risk – project implementation risk and security**. In terms of physical security from conflict and the practical limitations of travelling and operating a long-term project where official security constraints impose unfeasible difficulties from a long-term perspective. Risk is of importance in Shan North, Shan East and Kachin states.

b) **Population per township**. Total numbers of population per township, are necessary to quantify the total potential beneficiaries from project interventions.

c) **Internally Displaced Persons** (IDPs). Numbers of persons living in poverty, displaced by conflict. Total numbers of persons in camps was available from OCHA, and the camp locations were referenced to specific townships.

d) **Low levels of sanitary hygiene.** Levels of poverty and inequality evident from low levels of hygiene and exposure to disease. Source data obtained from the 2014 MoPI census.
e) **Dominant land use** present per township. The land use data were summarized for each separate township.
f) **Area of fish ponds**. Although data on numbers of fish ponds was available, the total area of ponds was selected as the more important variable. DoF data, acquired from GAD statistics per township.
g) **Low Per Capita Income**, PCI. PCI, also reported by GAD was used as the primary indicator of poverty.
h) **Low levels of nutrition**. Ministry of health statistics on malnourished children below the age of 5 years was specifically requested by the project and made available by the Ministry of Health.

All the above data were brought together into Excel for each of the 5 project regions and scored into quartiles in order the data are 'normalized' from 1 to 4. Variables were then given a weight (ie all variables multiplied together) then ranked in descending order. The townships selected were those identified as the top scoring five in each region. Weightings were set to take into account factors specific to certain regions (IDPs occurring only in parts of Shan North and Kachin) and to favor the selection towards townships in which aquaculture (in terms of fish pond area) is already established. Selected townships were linked to the Township data from MIMU and printed as maps. The details are available in Annex 1: Number on participants involved in F4L in different activities (small scale aquaculture farmers, demonstration farmers, vegetable growers, small indigenous fish, feed mills, saving funds)
Annex 2.

The scoping study was concluded with the key recommendations that adoption of a flexible/ blended Market Systems Approach to all three components (production, markets and nutrition) will be more appropriate for this project. The project could address the root causes of market dysfunction and underperformance and that should include production systems and nutrition. Acknowledging the need for the nutrition component to consider private sector incentives (in addition to Government and NGOs incentives) to promote good nutrition practices (e.g. food diversity for under five years old and breast feeding) that are not driven by large Multinational Companies objectives to sell processed food to poor and lower-middle class consumers (Annex *3*).

Phase II: After USAID approval of the phase I findings, proceed with team training and finalize methods and approach followed by detailed data collection using approved methodology/tools developed in Phase 1.

Market System Development Workshops, Value Chain Assessments
In relation with the scoping mission, consultants conducted visits and collected more data about the value chains and major market actors. After these visits, workshops were organized with the attendance of project and partners staff in Yangon. The details of the workshops can be discussed in ensuring sections.

Market Systems Design Workshop on 17th - 20th February 2020 in Yangon:
The Market System Design workshops were conducted from February 17th to 20th (full day) for Shan East, Shan South, and Sagaing regions. These workshops were facilitated by two senior market systems consultants, and were attended by representatives of USAID, Fish for Livelihoods team, MFF, BRAC, KMSS, and stakeholders including hatchery owners from the regions.

These extensive workshops helped in designing interventions specific for each region after getting inputs from local stakeholders. After identification of major market actors, challenges/barriers were listed and discussed. Subsequently, the root causes were identified with thorough discussions and deliberations

among the participants. Based on the root causes, new interventions designs were proposed to be incorporated in the Fish for Livelihoods workplan.

Market Systems Design Workshop on 24th to 26th February 2020 in Yangon:
The purpose of the workshops was to come up with a design of interventions for each of geographical areas of the project based on market systems approach. These workshops were conducted for three regions; Magway, Mandalay, and Kachin. Two consultants, Market systems experts, facilitated these workshops. Representatives from USAID, WorldFish, IWMI, partners (PACT, BRAC, KMSS), MFF, and locals from Magway, Mandalay, and Kachin.

For each region, after identification of market actors, a list of challenges/ obstacles was drawn. The participants, primarily local representatives from each region, were asked to prioritize in terms of their severity. Subsequently, an in-depth root cause analysis was carried out on identified prioritized challenges. All the market players were given due consideration in terms of their role and how they are affecting the market system of small-scale aquaculture. Finally, interventions were designed, for all three regions (Magway, Mandalay, and Kachin), addressing the most pressing causes identified through root cause analysis. These interventions will be reflected in the Fish for Livelihoods workplan and would be given priority in implementation of project activities once initiated.

On the basis of the scoping study results, conduct detailed baseline surveys in the selected townships and adjacent areas, including an analysis of existing value chains.

Phase I: Preliminary data collection and methods testing; sample household selection.

Baseline

Baseline of the activity was planned to be conducted in the second quarter of the reporting period. The purpose of the baseline was to select a sample from the 30 townships and assess their income levels, production, and what's the current economic and social condition of Fish market. WorldFish has engaged top researchers from Tokyo University for the baseline design, sample size estimation and methodology, and subsequent analysis of the data gathered from the field. Tokyo University researchers, in close consultation with WorldFish HQ Penang and WorldFish Myanmar team members, designed the baseline questionnaire "survey instrument" for data collection.

Additionally, a local consulting firm is engaged to collect the data from the field, for which the baseline ToRs were advertised. Proposals from the firms against the TOR advertisement for baseline data collection are received from three firms; Asper Consulting, SPIRE, and MSR. Fish for Livelihoods team technically evaluated the proposals according to the criteria outlined in ToRs. MSR got the highest numbers in the technical evaluation. The MSR was engaged in baseline data collection after screening as per the USAID contracting guidelines.

The initial plan was to initiate the baseline implementation in mid of March 2020, however, due to the unfortunate hit of COVID 19 in Myanmar and across the globe, the process was put on hold. The situation became more worrisome by the end of March 2020 with the identification of COVID 19 first few cases in Myanmar. The Government of Myanmar immediately responded and halt the physical movement in the country through partial lockdowns. As a result of these developments, it was made impossible to move in the field for data collection and the baseline implementation was not initiated who would have been started if the COVID 19 had not hit Myanmar.

Fish for Livelihoods baseline survey kick started in 3rd week of August. MSR – a research consulting firm, is assigned to collect data from the field. Survey tool, designed and developed by WorldFish partner, Tokyo University, was shared with MSR. MSR did scripting in English and Burmese. Subsequently, they will train Enumerators on data collection. Baseline will establish a clear benchmark to compare activity progress for the remaining period. This survey will help identifying an estimated number of potential participants (SSA Farmers) in intervention regions. In addition, Fish for Livelihoods will be able to set realistic targets on indictors – to be reflected in activity MEL plan – for life of the project. In addition to the quantitative survey, a qualitative study, comprised of six (6) Focus Group Discussions (FGDs) that identified gaps need to bridge around Myanmar major lakes (Inle Lake, Pehkon Lake) for Fishers was also carried out as part of the baseline survey.

Baseline survey was planned to completed in Year-1, but due to the uptick in COVID-19 cases in Myanmar and a server second wave, the data collection is taking more time. The data collection is still on-going in the field. The results of the study will be shared with the USAID and in the upcoming semi-annual report. The FDGs transcriptions are under analysis and synthesis, and report will be developed soon. The evidence from this qualitative survey will be used to take strategic decisions around the lakes and feeding planning loop for the rest of the years through work plan. Currently, the data is gathered from more than 30 townships in Myanmar, and will be analyzed by the Tokyo University once the data collection is completed. The targeted number of respondents is 1,500 which seems not possible because of the remote data collection via telephone calls. There are many challenges prevalent in collecting data through phone calls. However, a significant and representative number will be captured to ensure that the quality data is collected, synthesize, and reported.

Inception workshop

Project inception workshop was held in The Thingaha Hotel, Nay Pi Taw on February 28th, 2020. The purpose of the workshop was to officially launch Fish for Livelihoods activity and sharing with the stakeholders that what Fish for Livelihoods intends to achieve in the next five years. The workshop was attended by more than fifty delegates representing range of stakeholders including donor agencies, government, private sector organization, and international and national development sector organizations. (The attendance sheet is available in Annex *4).*

Michael Akester, Country Director, WorldFish gave opening speech. He emphasized on the benefits of aquaculture in Myanmar and the importance of fish and fish-based products. Travis Guymon, Activity Manager, USAID presented on behalf of USAID. In his speech, he shared his thoughts on growth of Myanmar particularly in aquaculture sector and the role of USAID in leveraging private and development sector in it. He ensured that the USAID will remain a key player to ensure economic growth and development in the country. Deputy Director General (DG), Department of Fisheries (DoF) gave keynote speech to the audience. He emphasized on the importance of aquaculture in the select regions and ensured continued support from the DoF in activity implementation regions and beyond. He lauded the role of USAID and WorldFish in the aquaculture sector in Myanmar and wished the project a huge success.

Subsequently, Dr. Manjurul Karim, Chief of Party (CoP) Fish for Livelihoods gave a comprehensive overview of the Fish for Livelihoods activity. He spoke about why this activity was needed to meet the unmet fish demand for the people of Myanmar. He spoke comprehensively about Small-scale Aquaculture Investments for Livelihoods in Myanmar's three components; production, access to market, and nutrition. He was followed by Quennie Rizaldo, Human Nutrition Specialist and Jessica Scott, Research Fellow, WorldFish, who shared their thoughts with audiences about importance and integration of nutrition and gender respectively. Ms. Sonali Senaratna, Country Representative, International Water Management Institute (IWMI) oriented the audience about the role of IWMI and its importance in Fish for Livelihoods project. A thorough question and answer session was held after all the presentations. The

delegates, primarily DoF and MFF representatives from regions; Mandalay, Magway, Shan, Sagaing, and Kachin were happy on this initiative by USAID. The workshop ended with the word of thanks from WorldFish's Country Director. The pictorial description of the event could be seen in Annex *5*.

IR 1. Small-scale aquaculture production increased by improved and land and water use, and increased access to information, high quality inputs and credit.

Sub-IR 1.1 An enabling environment is created to increase the engagement of farmers in commercial aquaculture production (water and land use and market knowledge)

***Output 1.1.1:* Increased understanding on land and water resources and policy recommendations provided**

Context: Availability of water resources is critical for the development of pond-based aquaculture. Where water is scarce (e.g. CDZ) aquaculture must be placed in context of "competition" with other water users (including irrigation). Trade-offs and synergies between aquaculture and other water users (upstream and downstream) need to be identified. Ponds are individually small, but cumulative impacts on water quantity and quality of many thousands of small ponds may be significant. Climate change will also impact water resources availability. Therefore, before planning any kind of physical interventions such as ponds, it is crucial to also assess the possible changes in future water resources.

Progress:

1. Mapping of typologies of aquaculture ponds, according to water sources and discussions on water availability and quality at selected locations: Pekhon Lake and Wetlet Township—Northern Myanmar
Identify fish pond typologies

Methodology

The three aforementioned objectives led to three components that are interlinked to the assessment of water resources, as described in the report submitted by IWMI (Annex *6*).

I. Identify fish pond typologies

In the first phase of the project, a review of existing literature on the typologies of fish ponds/aquaculture was carried out, with an emphasis on typologies related to the source of water. From this review, previous fieldwork conducted in Myanmar during the inception phase, and early field results shared by WorldFish[1], a typology of fish ponds according to their water source was developed. Each typology describes the likely nature of the source and generic comments on the availability and quality of water.

II. Mapping typologies

Typologies of existing fish ponds are expected to vary spatially. They can potentially be mapped remotely using a whole range of datasets, such as water resources and hydrogeological maps, slope and distance to streams and springs, etc., as proxies. The plan was to first build a map on a broad scale that could later berefined and applied at key townships when coupled with field validation (planned for early 2021). The resulting maps will indicate the spatial distribution of each typology, along with an indicative index of 'water

[1]Data received from WorldFish: Fieldwork conducted in Pekhon Lake area, with exact global positioning system (GPS) location of small-scale aquaculture ponds.

supply options' as a proxy of water security and resilience for further development of small-scale aquaculture.

III. Resulting description of water resources at nested scales

Opportunities and constraints of each water source at both northern Myanmar and selected township scales will be identified. The following will be highlighted for each typology:

- Current occurrence and use of this type of water source in the study area.
- Concerns in terms of water quality related to this source.
- Main risks regarding water resources availability, sustainability and climate change resilience

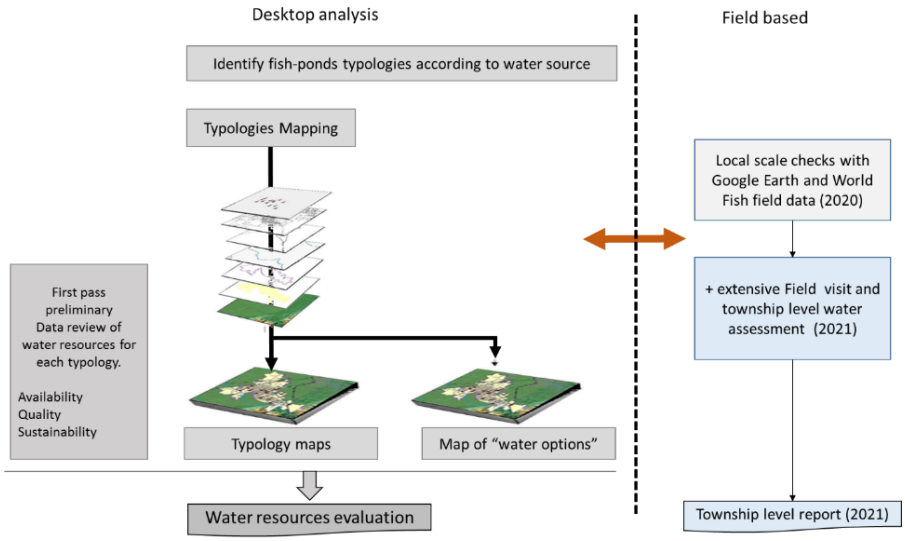


Figure 2. Overview of the workflow of the study.

Results

Sagaing region possibly has the largest area suitable for aquaculture development. However, it is interesting to note that Kachin State, although having the lowest suitable area, has relatively large areas, in theory, with more than four different water sources. This could reduce the risks related to water availability and increase resilience to climatic shocks.

Table 2: Estimated areas according to the diversity of water supply sources available.

Townships	Area (km^2)							Area possibly suitable (km^2)	State area suitable (%)	High diversity > 4 water supply options (km^2)
	Not suitable	1 source	2 sources	3 sources	4 sources	5 sources	6 sources			
Kachin	60,942	5,063	2,812	8,543	3,079	299	10	19,806	25	3,388
Magwe	15,482	9,869	11,862	5,347	1,571	144	3	28,796	65	1,718
Mandalay	9,411	7,119	7,090	5,308	1,762	291	12	21,582	70	2,065
Sagaing	48,747	11,413	15,577	12,593	4,744	582	18	44,928	48	5,345

Shan	123,760	11,435	7,091	4,575	2,110	287	12	25,509	17	2,409

Overall, water is expected to be of good quality, although there are issues of concern, including the unregulated mining operations and the possible release of heavy metals into river water, as is the case in the Chindwin and Ayeyarwady tributaries. Through bioaccumulation, this could become a hazard for development and human health. The occurrence of pesticides in water has not yet been studied, but mobilization from agricultural areas is possible. In groundwater, salinity might be a problem in some locations. Arsenic is also found in some townships, and caution must be exercised in these locations. The identification of typologies and mapping their associated spatial repartition allowed for the evaluation of the diversity of possible water sources across the study area (Figure 3). According to the resultant map, the areas with the most diverse sources of water are the Mu River valley and other valleys found in Kachin and Mandalay states and regions. Narrow valleys of Shan State also show promise, although the extent of the area is more limited.

Most of the townships selected after the inception phase of the project were based on current aquaculture development (ASPER consulting 2020), encompassing areas with the most diverse water sources, which highlights the relevance of water diversity to support aquaculture development. This is also reported by earlier field investigations conducted during the inception phase, where farmers indicated that they would often rely on multiple sources of water.

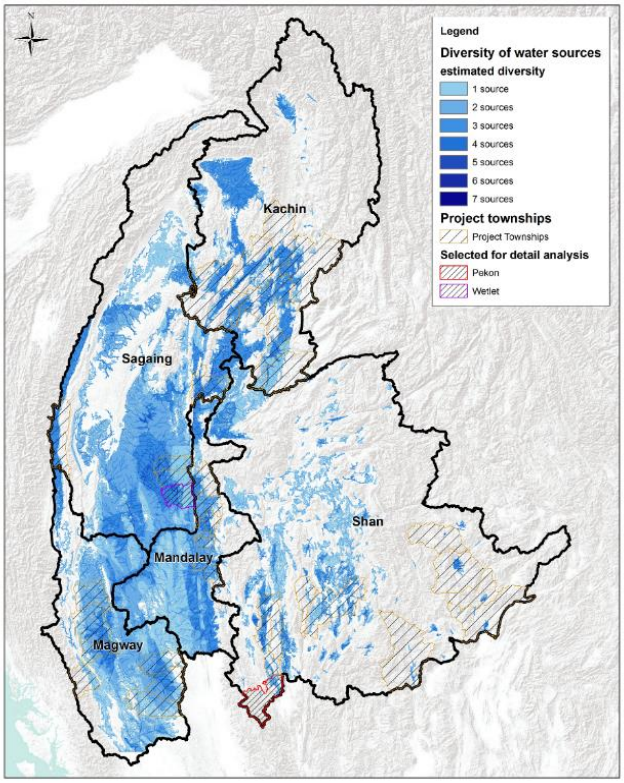


Figure 3. Diversity of theoretical water sources (or 'water supply options') for aquaculture development based on the integration of the seven typologies and their spatial distribution. A full-page map is provided at the end of this report.

2. Modelling of climate variability and water resource development (e.g., irrigation and hydropower)

Methodology

I. Description of the study area

The Ayeyarwaddy River, with a drainage area of 414,000 km2, runs from the North to the South of the country while draining more than 60% of the country into the Andaman Sea (Ghimire et al. 2020). About 91% of the basin lies within Myanmar with some parts situated in India (4%) and China (5%) (Salmivaara et al. 2013). The 2,100 km long river is the most important commercial waterway in Myanmar and the area around its mouth near the Andaman sea forms one of the largest delta systems in Southeast Asia (Sirisena et al. 2018).

The river is further divided into Chindwin, and Upper and Lower Ayeyarwaddy rivers. This study focuses on the Upper Ayeyarwaddy River Basin (UARB) which drains an area of around 337,400 km2 to a discharge station called Magway located a little downstream from the confluence point of the Chindwin and the Ayeyarwaddy River (Figure 3).

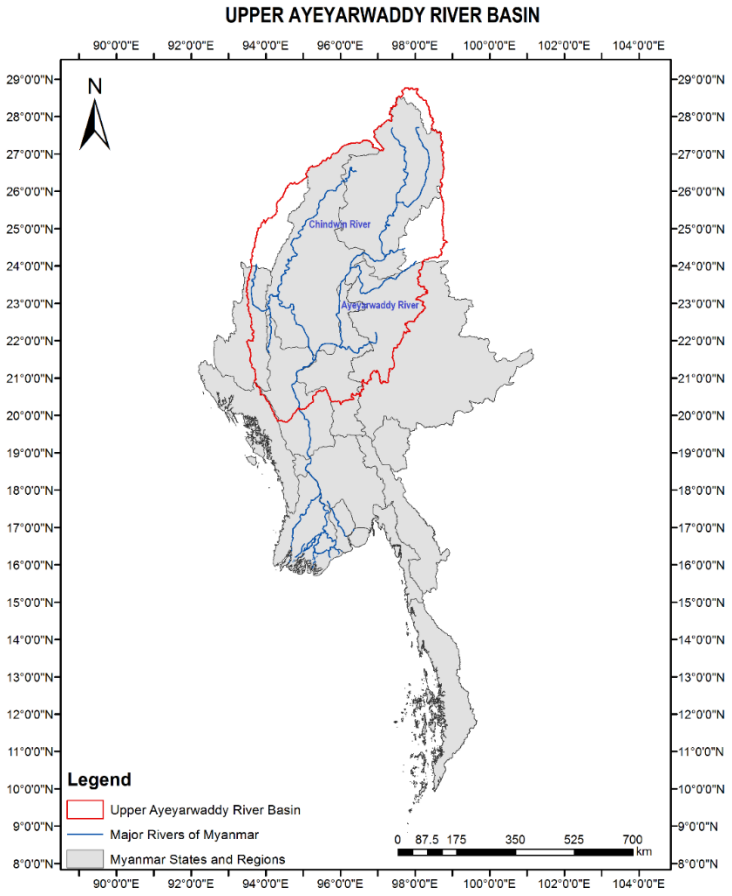


Figure 4: Map of the Upper Ayeyarwaddy river basin.

The UARB covers six regions/states of Myanmar. The basin lies within latitudes 20o N to 29o N and longitudes 93o E to 99o E. The elevation of the study area varies from 29 meters above sea level (masl) in the South to 5,775 masl in the mountainous region in the North, as per the digital elevation model (DEM) of 30 m resolution accessed from the United States Geological Survey. The middle of the basin

comprises plateaus (~500 m masl) and floodplains. Most of the study area belongs to the tropical monsoon climatic zone (Salmivaara et al. 2013). The basin is often described as ungauged because of the scarcity of hydro-meteorological data available for assessment (Chavoshian et al. 2007; Ghimire et al. 2020).

II. Data collection

Meteorological and hydrological data e.g. discharge, maximum and minimum temperature, relative humidity, precipitation, wind speed etc. required for the SWAT model have been obtained from multiple sources like the Hydrological Information Center in Myanmar, IWMI's archive and past studies, and from various scientists (e.g. IIT, Thailand) who conducted similar studies in the Ayeyarwady Basin in Myanmar.

III. Temporal data

Hourly discharge data have been obtained for 14 stations from various government and non-government sources. Likewise, hourly data for precipitation, maximum and minimum temperature, wind speed and direction, relative humidity, water level, sediment discharge and evaporation were obtained from 34, 25, 17, 17, 26, 10 and 1 stations respectively. Annex 8 contains a summary of the temporal data collected. Annex 9 shows the locations for various stations.

IV. Spatial data

Spatial data required for the SWAT model including Digital Elevation Model (DEM), land use map, soil map, shapefiles for Myanmar administrative boundaries and river network have been obtained from various sources. The following table summarizes the data. Annex 10 shows some of the spatial data collected.

Table 3: Sources of spatial data collected to set up the SWAT hydrological model

S. No.	Data type	Source	Resolution o	Resolution m
1	DEM	Hydro SHEDS	0.000833	92.463
2	Evapotranspiration	IWMI	0.05	5550
3	Land use map	IWMI	0.00027	29.97
4	Soil map	Harmonized World Soil Database	0.00833	924.63
5	Precipitation CHIRPS	IWMI	0.05	5550
6	Precipitation APHRODITE	IWMI	0.25	27750
7	DEM	SRTM - NASA	-	30

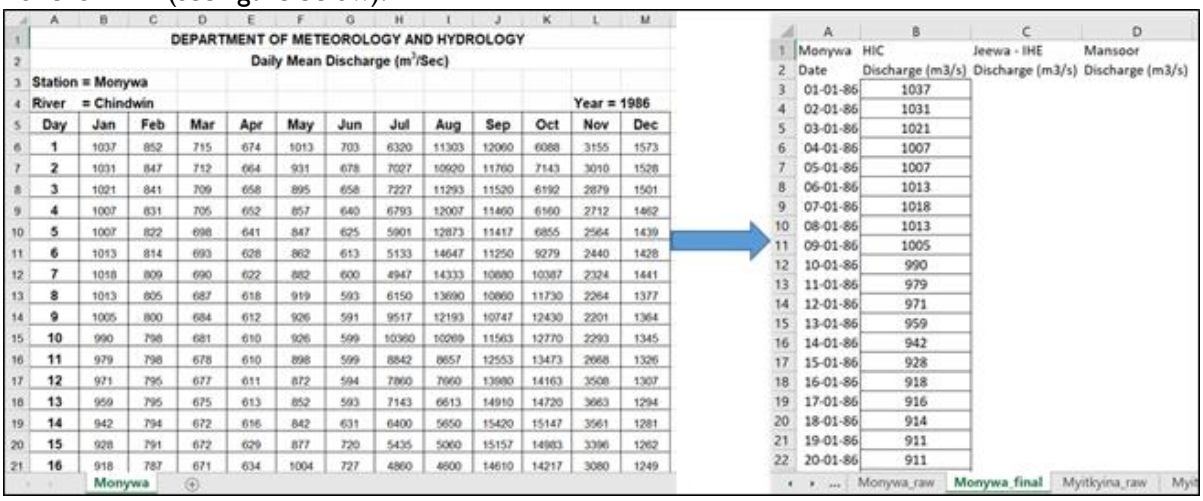
V. Other data

Data on population, agricultural production and livestock, fishery etc. are being formatted and digitized. Work is being undertaken to verify results from the Spatial Production Allocation Model (SPAM) which maps the production, harvested areas, physical areas, yield for 42 different crops under rainfed and irrigation systems. Annex *11* gives some insight into the SPAM data and its comparison with government data.

Quantile mapping bias-corrected rainfall data from downscaled GCMs were also obtained from Ghimire et al (2010). The data, whose duration is from 2021-2100, is for RCP 4.5 and 8.5 for 6 locations across Myanmar. This will be the basis for analysing the projected future climate.

VI. Data formatting and analysis

The collected data have all been checked, formatted and arranged in the order required by the hydrological model SWAT (see figure below).



DEPARTMENT OF METEOROLOGY AND HYDROLOGY

Daily Mean Discharge (m^3/Sec)

Station = Monywa

River = Chindwin

Year = 1986

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1037	852	715	674	1013	703	6320	11303	12060	6088	3155	1573
2	1031	847	712	664	931	678	7027	10920	11760	7143	3010	1528
3	1021	841	709	658	895	658	7227	11293	11520	6192	2879	1501
4	1007	831	705	652	857	640	6793	12007	11460	6160	2712	1462
5	1007	822	698	641	847	625	5901	12873	11417	6855	2564	1439
6	1013	814	693	628	862	613	5133	14647	11250	9279	2440	1428
7	1018	809	690	622	882	600	4947	14333	10880	10387	2324	1441
8	1013	805	687	618	919	593	6150	13690	10860	11730	2264	1377
9	1005	800	684	612	926	591	9517	12193	10747	12430	2201	1364
10	990	798	681	610	926	599	10360	10269	11563	12770	2293	1345
11	979	798	678	610	898	599	8842	8657	12553	13473	2668	1326
12	971	795	677	611	872	594	7860	7660	13980	14163	3508	1307
13	959	795	675	613	852	593	7143	6613	14910	14720	3663	1294
14	942	794	672	616	842	631	6400	5650	15420	15147	3561	1281
15	928	791	672	629	877	720	5435	5060	15157	14983	3396	1262
16	918	787	671	634	1004	727	4860	4600	14610	14217	3080	1249

Monywa

Monywa	HIC	Jeewa - IHE	Mansoor
Date	Discharge (m3/s)	Discharge (m3/s)	Discharge (m3/s)
01-01-86	1037		
02-01-86	1031		
03-01-86	1021		
04-01-86	1007		
05-01-86	1007		
06-01-86	1013		
07-01-86	1018		
08-01-86	1013		
09-01-86	1005		
10-01-86	990		
11-01-86	979		
12-01-86	971		
13-01-86	959		
14-01-86	942		
15-01-86	928		
16-01-86	918		
17-01-86	916		
18-01-86	914		
19-01-86	911		
20-01-86	911		

Monywa_raw | Monywa_final | Myitkyina_raw

Figure 5: Data Formatting and Synthesis of SWAT

The data from various sources were juxtaposed together to check for inconsistencies and to fill missing information where appropriate. The following figure shows a comparison of sample of rainfall data. Observations made while analysing the data can be found in Annex *12*.

Results

1. Sensitivity analysis

After setting up the model, the most sensitive parameters were identified using the SWAT Calibration and Uncertainty Program (SWAT-CUP) developed by the Swiss Federal Institute of Aquatic Science and Technology. SWAT-CUP is a widely used tool for sensitivity analysis of parameters and automatic calibration of the model (Biswajit Das et al. 2019a; Boini Narsimilu et al. 2015b; Ghimire et al. 2020; Khatun et al. 2018; Pathan and Sil 2019). In total, 25 parameters were selected for the sensitivity analysis based on expert knowledge and results from similar studies. The 10 most sensitive parameters are shown in Table 4. The model was run for 1,000 iterations using observed data from the gauging station at Magway (outlet of 20th subbasin).

Table 4: The ranking of sensitive parameters.

Rank	Parameter	Description
1	1.SOL_K	Saturated hydraulic conductivity (mm/hr)
2	HRU_SLP	Average slope steepness (m/m)
3	SLSUBBSN	Average slope length (m)
4	CH_K2	Effective hydraulic conductivity in the main channel alluvium (mm/hr)
5	RCHRG_DP	Deep aquifer percolation fraction
6	GW_REVAP	Groundwater 'revap' coefficient. Accounts for water that may move from the shallow aquifer into the overlying unsaturated zone
7	SFTMP	Snowfall temperature
8	REVAPMN	Threshold depth of water in the shallow aquifer for 'revap' or percolation to the deep aquifer to occur (mm)

9	CH_N2	Mannings 'n' value for the main channel.
10	GWQMN	Threshold depth of water in the shallow aquifer required for return flow to occur (mm H_2O)

2. Model calibration

The model is being calibrated for the period 1993–2003 and validated for the period 2004–2014. This period was selected because flow data for this period was more complete and it matches the land cover map chosen for the basin. Four stations, namely Katha, Monywa, Sagaing and Magway, are being used for the calibration and validation process, with their location depicted in Figure 7. The results from the default model run are presented in Figure 8.

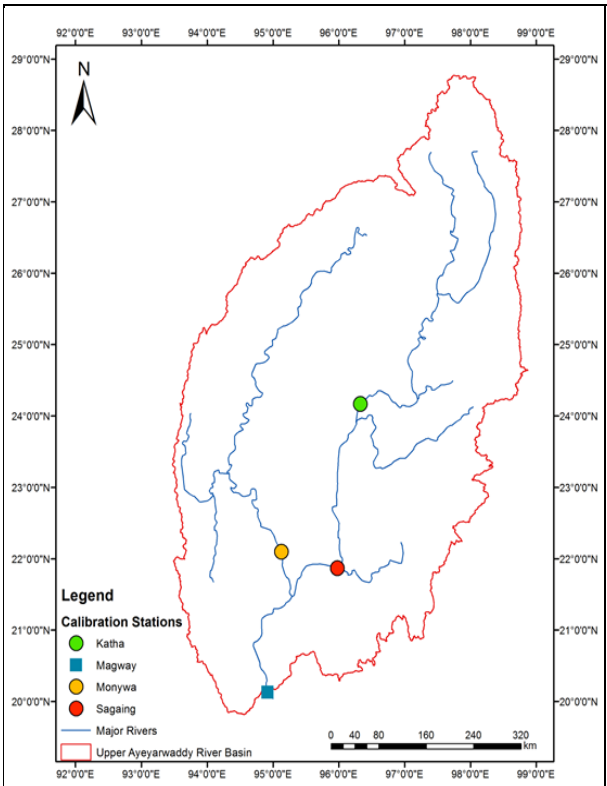


Figure 6. Location of calibration and validation stations.

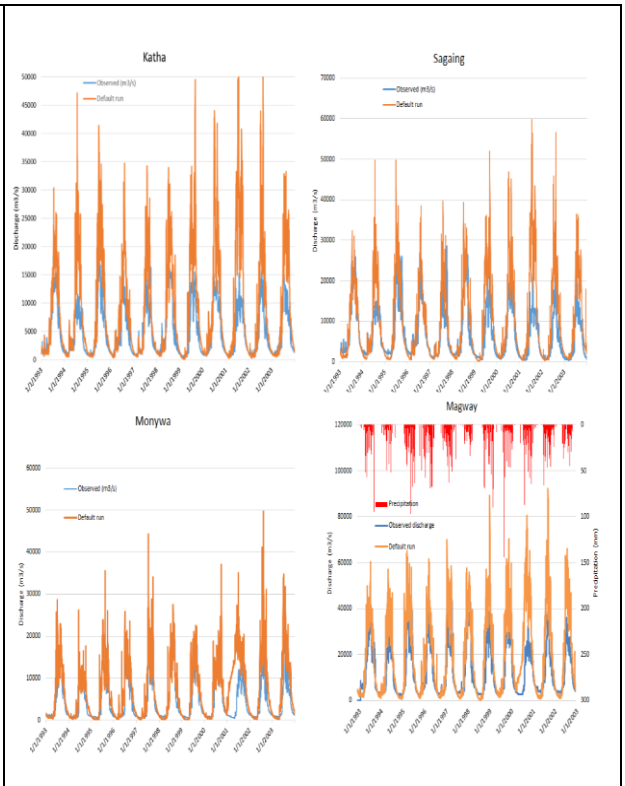


Figure 7: Results of the default model run.

After satisfactorily calibrating and validating the model, the model will be used for climate change analysis based on data from the downscaled and bias-corrected General Circulation Model (GCM) for two scenarios (RCP 4.5 and 8.5). RCP 4.5 is an intermediate scenario where emissions peak around 2040 and then decline, while RCP 8.5 is a worst-case scenario where emissions continue to rise throughout the twenty-first century. Climate change analysis will ascertain the spatial and temporal water distribution and availability in the future under these scenarios.

Conclusion

This activity offers a working hydrological model for the upper Ayeyarwaddy river basin using the soil water assessment tool SWAT with spatial and temporal data collected from the Hydro

Informatics Center - Myanmar, IWMI archives and other sources. Utilizing the 30 m resolution Shuttle Radar Topography Mission (SRTM) DEM, the model adopts the river streamflow file generated by SWAT which was then compared to the map of major rivers in Myanmar provided in the Ayeyarwaddy State of the Basin Assessment (SOBA) and Google Earth to rectify the incorrect location for main river network and some parts of the main tributaries. Sensitivity analysis was conducted with the observation that the model is sensitive to saturated hydraulic conductivity, average slope steepness and average slope length as the most sensitive ones in order. A calibration period of 1993–2003 and a validation period of 2004–2014 were used to provide the most appropriate set of parameters. It is found that the model satisfactorily predicts the low flows but is overestimating the high flows. Further future work will be conducted for the integration of the results from detailed climate analysis in Activity 3 as input into the SWAT model.

3 Climate change analysis—assess the impact on water resource availability and timing, and predict water availability

As with objectives stated in Activities 1 and 2, Activity 3 is intended to offer a detailed analysis of climate projections and the associated variation in the context of assessing its impacts on aquaculture as well as food security in the broader sense. The following section looks at the methodologies and is divided into two respective segments for tasks 1 and 2. The general overview of future work for task 3 is detailed in the conclusion section.

Methodology

A review of existing literature on the assessment of climate-related impacts was conducted. The general mechanism that influences climate in Myanmar has been investigated, with attention given to the methods adopted in some studies which provide quantitative results in the assessment of climate-related impacts.

An analysis of climate trend was undertaken using the assessment, such as 1) average statistics, 2) rainfall indices, 3) extreme values analysis for maximum daily temperature, and 4) trend analysis for temperature, rainfall indices and cumulative annual rainfall. 13 out of the 32 available stations were selected on the criteria of having considerably continuous data of (approximately) 30 years without long periods of missing values while also representing the generalized topographic and geographic zones of Myanmar. Average statistics for rainfall were obtained by averaging cumulative monthly rainfall values in each season.

Results

This section is divided into two parts: 1) Literature review, and 2) Preliminary climate analysis.

1. Part one: results of literature review on the impacts of climate change in Myanmar

1.1 Weather and Climate phenomenon in Myanmar

Implications for the climate in Myanmar can be inferred from the general monsoon trend at the global scale (Zhang and Zhou 2011) and regional monsoon systems (Christensen et al. 2013). A study by Zhang and Zhou (2011) utilized data for the period of 100 years with observations describing a general increasing trend in monsoon rainfall from 1901 to 1955 followed by a decreasing trend until 2001. In agreement with this result, a declining trend in monsoons at global and regional levels has been recorded in Asia (Horton et al. 2017). Aerosol emissions caused by anthropogenic activities have resulted in the observation of declining monsoon rainfall in South Asia according to climate model experiments (Bollasina et al. 2011). This is because the absorption of solar radiation by aerosols induces perturbations in atmospheric heat

distribution (Christensen et al. 2013). On the other hand, an overall increase in monsoonal rainfall at the global level is observed under climate projections (Christensen et al. 2013).

It could be generalized that El Niño events encompass declining monsoon precipitations at the global level while such variability in rainfall is exacerbated under the warming climate in model simulations that support the correlation between the monsoon and El Niño (Hsu et al. 2013). The period of El Niño is observed to be associated with droughts that occur in some Southeast Asian countries (Kane 1999).

1.2 Global climate change and downscaling global circulation model

The consensus of the rise in global temperatures associated with greenhouse gas (GHG) emissions caused by anthropogenic activities was concluded by research entities such as the UK Met Office Hadley Center and the University of East Anglia's Climatic Research Unit (Met Office 2016 as in Horton et al. 2017), and The NASA Goddard Institute for Space Studies and the US National Oceanic and Atmospheric Administration ((NASA 2016; NOAA 2016) as in Horton et al. 2017) which put 2015 to be the hottest year on record (Horton et al. 2017). This section examines existing literature on climate change projection, briefly at the global level, and thoroughly at national levels, extracting and describing the methodologies employed and the results obtained in such studies.

A Section on downscaling

Global circulation models (GCMs) which are also called global climate change models produce meteorological parameters such as wind speed, relative humidity (RH), temperatures and precipitation and solar radiation through solving governing equations of mass, momentum and thermodynamics (Nunez and McGregor 2007). Two approaches are usually employed in downscaling such GCM results: dynamical downscaling which utilizes regional climate models (RCMs) to transform the simulated weather results from a GCM into a physically-based model at a higher resolution (Giorgi et al. 2001); and statistical downscaling, which is executed using empirical correlations between carefully selected regional climate and meta-scale predictor parameters (Wilby et al. 2004). Uncertainty exists with prediction in future climate conditions (Horton et al. 2015).

As systematic and random model errors inherent in the GCM model simulations have resulted in considerable levels of deviations from observations, bias correction enabled by downscaling methodology in line with observed ground data is necessary (Aung et al. 2016). Table 5 summarizes the resolution of the GCMs in the study by Aung et al. (2016). Lack of accounting for surface orography also causes such deviations in large-scale GCM precipitation and regional precipitation (Schmidli et al. 2006).

Table 5: List of GCMs models in study by Aung et al. (2016).

SN	Name	Developer/Research Institute	Resolution Long. × Lat.	RCP 2.6	RCP 4.5	RCP 6	RCP 8.5
1	BCC-CSM1.1	Beijing Climate Center (BCC) and China Meteorological Administration (CMA), based on NCAR CCSM2.0.1, China	2.8125°× 2.8125°	√	√	√	√
2	BNU-ESM	Beijing Normal University, China	2.8125°× 4.0909°	√	√		√
3	CanESM2	Canadian Centre for Climate Modelling and Analysis, Canada	2.8125°× 2.8125°	√	√		√

SN	Name	Developer/Research Institute	Resolution Long. × Lat.	RCP 2.6	RCP 4.5	RCP 6	RCP 8.5
4	CCSM4	National Centre for Atmospheric Research (NCAR), USA	1.25°× 0.9375°	√	√	√	√
5	GFDL-CM3	Geophysical Fluid Dynamics Laboratory, USA	2.5°× 2.0°	√	√	√	√
6	IPSL-CM5A-MR	Institut Pierre-Simon Laplace, France	2.5°× 1.2587°	√	√	√	√
7	MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institue (The University of Tokyo), Japan	2.8125°× 2.8125°	√	√	√	√
8	MIROC5	Atmosphere and Ocean Research Institute, University of Tokyo, Japan	1.4063°× 1.4063°	√	√	√	√
9	MPI-ESM-MR	Max Planck Institute for Meteorology (MPI-M), Germany	1.875°× 1.875°	√	√		√
10	MRI-CGCM3	Meteorological Research Institute, Japan	1.125°× 1.125°	√	√	√	√

Bias correction-quantile mapping

There are several approaches that researchers have adopted in implementing bias correction for fitting GCM data with observed ground data. Some have conducted comparative studies to assess the effectiveness and reliability of such a method, concluding that probability mapping or statistical downscaling (often regarded as quantile mapping) produces the best form of optimized results (Hawkins and Sutton 2011; Teutschbein and Seibert 2012; Lafon et al. 2013). The study by Aung et al. (2016) used quantile mapping to downscale a few GCMs in Table 5 to obtain projected precipitation under all four Representative Concentration Pathways (RCPs) for projection periods of the 2020s (2010–2039), 2050s (2040–2069), 2080s (2070–2099). However, the study area is limited to the Belu River Basin. Another study by Horton et al. (2017) utilized downscaled data from the NASA NEX-GDDP datasets that are derived from the GCMs simulations under the Coupled Model Intercomparison Project Phase 5 (Taylor et al. 2012) for only two RCPs (4.5 and 8.5). This study focuses on assessing projections for rainfall, temperature and sea-level rise with identification of related consequences in agriculture, water resources, and urban areas along with other sectoral impacts. Furthermore, there is another study by Shrestha et al. (2014) looking at the impacts of climate change on irrigation water requirement and production rate of irrigated paddy at Ngamoeyeik Irrigation Project using two GCMs (ECHAM5 and HadCM3) for the periods of 2020s, 2050s and 2080s.

1.3 Repository of projection results from literature

Only rainfall and temperature have been briefly described for results of climate change projections reported in the existing literature, while other impacts are described in another section.

Identified rainfall patterns and temperature projections

The historical records note that the duration of summer monsoon has been shortened by approximately one week (Lwin 2002). A study by Aung et al. (2016) that focused on the Belu River Basin concluded that the majority of the downstream of the basin and the Inle Lake area are projected to encounter more rainfall in the future. Historically, the Mobye reservoir in the same basin has faced depletion due to low

rainfall in 1998 and 1999 while the Inle lake was reduced in size to less than half, which is attributed to climate change and excessive sedimentation (Aung et al. 2016). In comparison to the median values from the GCMs results of the same study, a slight increase was observed in most of the scenarios with the BCC-CSM1.1 and CCSM4 simulations showing respective increased values of (+37.53% and +32.26% which is in contrast with GFDLCM3 and MPI-ESM-MR models that generated a decreased annual rainfall (-20.67%). The study by Horton et al. (2017) has listed the trend in rainfall changes at the global, regional and national levels. The study's projected results in mean temperature and precipitation values, with its analysis from the source of NASA NEX-GDDP (2015), are presented in
Table 6, Table 7 and

Table 8.

Table 6. Observed rainfall changes from literature for global, regional and national rainfall (Horton, De Mel et al. 2017).

Type of rainfall event	**Spatial scale**	**Direction of change**	**Sources**
Global land monsoon	Global	Decreasing trend since 1955	Zhang and Zhou, 2011
Rainfall	Southeast Asia	Wet period getting weter and dry period getting drier	Hijioka et al., 2015
Rainfall (year-round)	South Asia	More heavy and less light precipitation	Hijioka et al., 2015
Decrease in monsoon rainfall	South Asia	Decrease	Annamalai et al., 2013
Peak-season (monsoon) precipitation	South Asia	Decrease	Singh et al., 2014
Monsoon season length	Myanmar	Decrease	Lwin, 2002
Annual rainfall	Myanmar	Decrease	Lwin, 2002
Monsoon rainfall	Myanmar	Decrease	Lwin, 2002
Drought years (of moderate intensity)	Myanmar	Decrease	Lwin, 2002
Monsoon strength	Myanmar	Decrease (since 1987)	Lwin, 2002
Extreme rainfall	Myanmar	Decrease	Hijioka et al., 2015

Table 7. Changes in mean values of projected temperature (°C) for 2011–2040 compared to the 1980–2005 average for the nation of Myanmar and in eight major regions (Horton et al. 2017).

Region	Annual		Hot Season (MARCH TO MAY)		Wet Season (JUNE TO OCTOBER)		Cool Season (NOVEMBER TO FEBRUARY)	
	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate
Myanmar (All Regions)	+0.7°C	+1.1°C	+0.8°C	+1.2°C	+0.6°C	+1.1°C	+0.7°C	+1.2°C
Ayeyarwady Delta	+0.5°C	+0.9°C	+0.6°C	+0.9°C	+0.5°C	+0.8°C	+0.5°C	+1.0°C
Central Dry Zone	+0.7°C	+1.1°C	+0.9°C	+1.2°C	+0.6°C	+1.0°C	+0.7°C	+1.2°C
Northen Hilly	+0.7°C	+1.2°C	+0.8°C	+1.3°C	+0.6°C	+1.2°C	+0.7°C	+1.2°C
Rakhine Coastal	+0.7°C	+0.9°C	+0.7°C	+1.0°C	+0.6°C	+0.9°C	+0.7°C	+1.1°C
Eastern Hilly	+0.7°C	+1.2°C	+0.9°C	+1.4°C	+0.6°C	+1.2°C	+0.7°C	+1.3°C
Southern Coastal	+0.6°C	+1.0°C	+0.6°C	+1.1°C	+0.6°C	+0.9°C	+0.6°C	+1.0°C
Yangon Deltaic	+0.6°C	+1.0°C	+0.7°C	+1.1°C	+0.6°C	+1.0°C	+0.6°C	+1.1°C
Southern Interior	+0.7°C	+1.1°C	+0.8°C	+1.2°C	+0.6°C	+1.1°C	+0.7°C	+1.1°C

Table 8. Changes in mean values of projected precipitation (%) in the 2011–2040 period compared to the 1980–2005 average in eight major regions and for the nation of Myanmar (Horton et al. 2017).

Town/city	Annual		Hot Season (MARCH TO MAY)		Wet Season (JUNE TO OCTOBER)		Cool Season (NOVEMBER TO FEBRUARY)	
	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate
Myanmar (All Regions)	+1%	+11%	-11%	+12%	+2%	+12%	-23%	+11%
Ayeyarwady Delta	-1%	+11%	-13%	+18%	0%	+10%	-27%	+13%
Central Dry Zone	+2%	+11%	-14%	+13%	+3%	+12%	-32%	+9%
Northen Hilly	+2%	+13%	-10%	+14%	+3%	+16%	-19%	+8%
Rakhine Coastal	0%	+9%	-17%	+14%	+2%	+10%	-30%	+8%
Eastern Hilly	0%	+10%	-11%	+11%	+2%	+12%	-25%	+9%
Southern Coastal	-1%	+8%	-10%	+8%	-2%	+9%	-11%	+18%
Yangon Deltaic	0%	+12%	-12%	+19%	+1%	+11%	-29%	+14%
Southern Interior	+1%	+11%	-11%	+11%	+1%	+13%	-28%	+14%

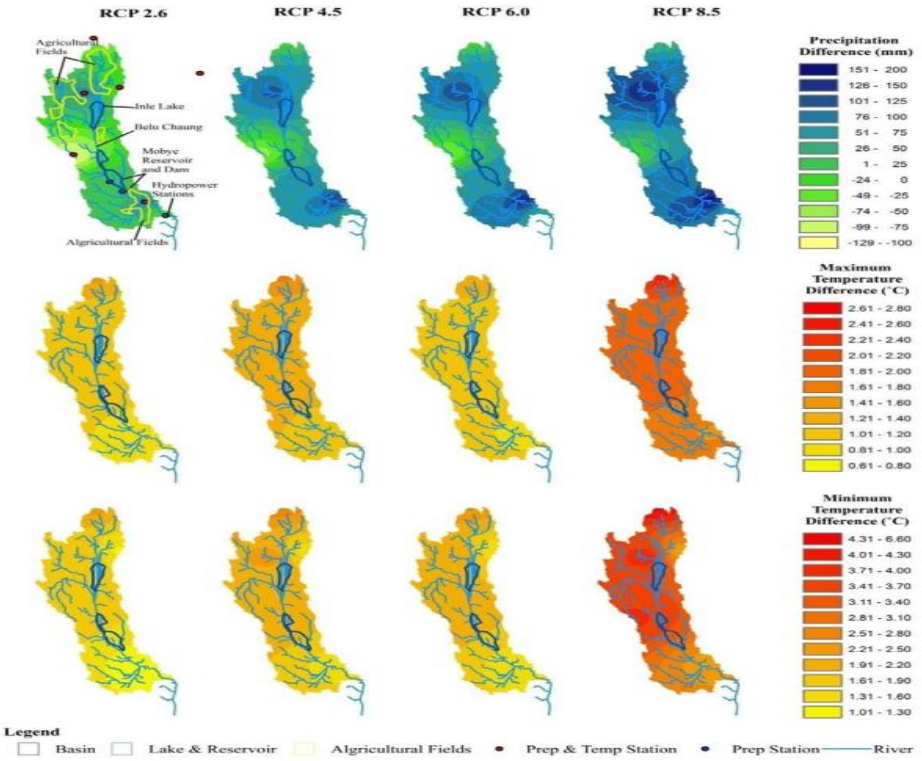


Figure 8: Expected average precipitation, maximum temperature and minimum temperature changes with respect to the baseline (1976–2005) in Belu River Basin all RCPs for the twenty-first century (Aung et al. 2016).

Past Studies on Impacts of Climate Change on water resources

One study simulated the future discharge in the UARB using the SWAT model and projected future climate from 10 GCMs from the 5th Coupled Model Intercomparison Project (CMIP-5) and predicted a decrease in annual streamflow up to 1.92%, 7.29% and 11.92% under RCP 2.6, 4.5 and 8.5 scenarios (Oo et al. 2020). Another study by the same authors using the same resources found rainfall to increase in rainy and winter season and decrease in summer in all scenarios, and temperature to steadily increase in all seasons, and even more in summer. Bias-corrected daily rainfall data of eight GCMs was collected to assess the impact on streamflow in the Upper Ayeyarwaddy River Basin using the hydrological model HEC-HMS (Ghimire et al. 2019). The study (Wu et al. 2008) concludes that climate change will potentially have a strong impact on freshwater resources. Potential changes range between decreases of 10% and 30% in average river runoff at mid-latitudes and in the dry tropics by mid-century (Milly et al. 2005).

Other Sectoral impacts reported by literature

Agriculture and food security

Agriculture is the dominant industry in Myanmar, contributing to 58% of the GDP of Myanmar, and creates employment opportunities for 67% of the working population (UNDP-Myanmar 2011). The frequency and magnitude of natural disasters including droughts and floods are projected to change due to climate change, which can lead to crop destruction and livestock kills. Planting calendars consequently need to be adjusted to the changes in the seasonality (Horton et al. 2017).

The dry zone of the country, which presents two-thirds of the agricultural lands, suffers from serious impacts on its agricultural production because of climate change. Additionally, shifts in the patterns of the precipitation enhance declines in production in the long run (Tun Oo et al. 2020). As the availability of water in the field is of paramount significance in agricultural production, the farmers in the dryland of Myanmar utilize a rainfed farming system. However, overdependence on the same makes the country's economy more sensitive to climate change (Weiss 2009). While Myanmar is part of a major agricultural region, insufficient food production affects 44% of the households.

Fishery and aquaculture

The literature of assessing such climate change impacts on aquaculture at the global level refers to the qualitative or descriptive studies conducted in Myanmar. A greater amount of potential effects of climate change on aquaculture is stated by The Intergovernmental Panel on Climate Change (IPCC). The topic attained mainstream recognition after the fourth assessment report, leading to dominant global debates (Tegart et al. 1990; Parry et al. 2007). These entail rehabilitation of aquaculture sites (Mali), small-scale farming development (Cambodia, Myanmar), increase in fish production and fish preservation (the Gambia), adaptation to new climate-induced environments, increased salinity (Bangladesh), and spatial arrangement of land use practices (Zambia) (Barange et al. 2018). Higher earnings per hectare than crop farming is generated by aquaculture, with fish farming activities creating more employment than agriculture (Belton et al. 2017).

Understating the significance of fisheries and aquaculture, the impacts of climate change for these industries as well as for coastal and riparian communities cannot be ignored; at the same time, fisheries and aquaculture are also contributors to greenhouse gas emissions offering some opportunities for mitigation efforts (Cochrane et al. 2009). At 'rapid' (a few years) time scales, the physiology of fish will be

adversely affected by the increase in temperatures, which leads to major limitations for aquaculture, shifts in species distributions and changes in abundance (Barange and Perry 2009).

2. Part two: results from preliminary analysis of observed climate records

2.1 Average statistics of rainfall

Among the stations selected for average statistics, the lowest rainfall values were observed within the central dry zone region, while stations in the northern hill region received higher rainfall in Table 10 Annex 6). The temporal pattern based on seasonal profiling shows that the cold season receives the least average daily rainfall for all stations while the wet season possesses the highest rainfall. The 30-year minimum in cumulative monthly rainfall for the wet season is found to be 111.07 mm per month at Monywa station in the central dry zone; Hkamti in the northern hill region (mountainous northern part of Myanmar) presents the 30-year maximum in cumulative monthly rainfall at 700.67 mm per month for the wet season.

2.2 Average statistics and recurrence interval of extreme temperature values

The assessment of historical maximum and minimum daily temperature shows that the central dry zone has the highest temperature when the northern part of Myanmar (mountainous region) has the lowest temperature (Annex 5). The 30-year maximum daily temperature is observed at Magway station at 39.2 °C in the hot season while the 30-year minimum daily temperature is found at Hkamti at 12.16 °C in the cold season. For all seasons, the northern hill region has the lowest minimum temperature while the central dry zone possesses the highest maximum temperature. Figure 12 (*Annex 6*) shows the recurrence level of extreme temperature values. It should however be noted that more extreme temperature values in longer recurrence time are accompanied by higher uncertainly and lower significance level.

Results in trend analysis of rainfall indices

It was observed that the hypothesis at the level of 0.05 p-values failed to assert that there are significant trends in rainfall for indices such as one-day maximum rainfall (Rx1) and 5-day consecutive maximum rainfall (Rx5) (as seen in Table 12). The same phenomenon is observed for the number of moderate rainfall days for all stations except for Magway, Pyay and Monywa stations, which showed an increasing trend of moderate rainfall (rainfall larger than 10mm/day) at 0.24–0.39 days per year. The analysis of historical precipitation records shows a mixture of trends where the hypothesis at the p-value of 0.05 failed to assert that there is a changing pattern in the annual cumulative rainfall for most of the stations. Pyay, Katha and Monywa show increasing trends, while Hkamti station shows a decreasing trend of 35 mm of annual cumulative rainfall per year at the p-value of 0.0497 which can be considered to be insignificant Table 13 (*Annex 6*).

2.3 Results in trend analysis of annual mean temperature

Assessment of climate index in terms of annual cumulative rainfall, annual mean maximum and minimum temperature are presented in Table 13. The trend observed in the historical record of maximum daily temperature shows that almost all the stations present an increasing trend of the maximum temperature (0.87–2.03 °C over approximately 30 years) at the significant p-value much lower than 0.05 except for Minbu and Magway station at which the hypothesis failed to show increasing or decreasing trend at the p-value of 0.05. A different trend pattern was observed in assessing the trend of historical minimum temperature record where almost all the stations have no trend in minimum temperature changes based on hypothesis testing at the p-value of 0.05 except for Sagaing, Mandalay and Bhamo stations, which shows an increasing trend of 0.06 °C per year (about 1.74 °C increase over approximately 30 years) at the p-value much lower than 0.05 (close to zero).

Conclusion

The general monsoon trend at the global level has implications for Myanmar's climate, as does the regional monsoon. Aerosol emission is found to be one of the factors that drive the changes in the regional monsoon along with the El Niño Southern Oscillation. Based on a preliminary analysis of historical records, the mountainous region in the upper part of Myanmar receives more rainfall with less temperature while the central dry zone has the characteristics of less rainfall with higher temperatures. The seasonal average of daily maximum temperature shows that the central dry zone has the highest daily maximum temperature for all seasons while the northern hill region shows the lowest one. The hypothesis tests on the identification of trends mostly reject the existence of trends for most of the parameters except for the maximum temperatures because most of the stations show an increasing trend. An extreme value analysis of the annual maxima series of temperature shows that extreme temperature can reach up to 48 °C at the return level of 1-in-1000 years. Future work involves downscaling the RCM projections by implementing the quantile mapping method using the observed data and the data form CORDEX (South East Asia region). The resulting projections of climate variables will serve as input for the SWAT model (from activity 2) to measure the impacts of climate changes on water resources and associated flows in addition to assessing some climate indices known to be sensitive in the context of aquaculture. As the current analysis has used Python scripts for most of the tasks, some popular R-packages will be used to validate the results obtained by Python scripts.

Output 1.1.2: Improved access to information on market and SSA technologies (BMPs)
Context

Market Systems comprised of value chains where many actors are involved at different levels providing services to farmers, however, the information available is fragmented. Fish for Livelihoods has collected relevant market information in the select townships through detailed market survey and focus group discussions. Information collected so far on market systems are being shared with project beneficiaries through adopting contemporary communication and dissemination methods including mobile Applications.

Capacity building interventions (e.g. training) of partners, private sector, actors (traders, processors, etc.), MFF, and farmers on Better Management Practices (BMP) are initiative. In addition to that, communication products including fact sheet, leaflets, booklets, posters, and videos are being developed and disseminated to the audiences, mentioned above, through online and offline channels. Gender and nutrition as integral parts of the project would be embedded in all types of capacity building activities.

Training of Trainers (ToTs) courses have already been delivered to implementing partners staff with the aim to build capacity of their staff (eg. Community Facilitators) and Aquaculture Promoters1 so that they could deliver similar training courses and messages d to market actors; farmers, processors, hatcheries, nurseries, feed mills, and feed traders.

Progress:

Tasks:

1.1.2.1: Alignment of training for gender integration throughout

A gender integration workshop was held on January 15th-16th, 2020 where we went through all the streams of Fish for Livelihoods and 'integrated gender' into activities, MEL etc. As gender isn't a standalone, each person leading a stream or activity is responsible to ensure our team practice is not being gender blind and is inclusive and accommodative (this is explained in the Fish for Livelihoods online gender doc). In training for example, this is making sure both men and women and different types of people can attend the training sessions, i.e. long full day sessions with no childcare often mean mums caring for

children don't get to attend or stay in the sessions and benefit from the training. A "Fish for Livelihoods gender building blocks" guide and other supporting material are drafted which cover gender integration through all of the parts of the project (Annex *13*). There is also a matrix drafted which is included in work plan to help prompt people to remember gender and what to do for each of the activities.

It is planned to hold another gender workshop after the baseline to develop a detailed strategy further and so everyone feels comfortable about implementing inclusive activities for Small-scale Aquaculture Investments for Livelihoods in Myanmar. The global gender team have also developed a "gender integration guideline", with the contribution from project team, this should be out any day now and we can share with the team and IPs, everyone, as a training tool for staff and guideline to refer to.

1.1.2.2: Market relevant information collected from hatcheries, nurseries, feed mills and traders, and distributed to the relevant (virtual) extension partners

Market System Analysis (MSA) was conducted from 16th November 2019 to 31st January 2020 with the aim to provide a systemic analysis of the market constraints associated with the inland fisheries market and how this can benefit Small Scale Aquaculture (SSA) in Myanmar. The key purpose of this MSA was to contribute to the outcome of the Small-Scale Aquaculture Investments for Livelihoods project. Aquaculture in Myanmar comprises three subsectors, listed in order of importance as follows: inland (freshwater), coastal (brackish water), and marine. Fisheries production is classified into three categories: (a) marine fisheries, (b) freshwater capture fisheries, and (c) aquaculture1. This MSA only deals with (b) freshwater capture fisheries, and (c) aquaculture.

The study was carried out based on a desk review of relevant data, articles, studies and reports as well as primary research in the form of private and public stakeholders' interviews, interviews with water, aquaculture, nutrition and gender specialists from the project as well as field observations. The first part of this study took place during the "Scoping Study in 5 States/Regions of Myanmar" that took place from 16th November 2019 to 21st January 2020. The second part of this study consisted of a value chain analysis with a focus on fish seeds and feeds. The seeds and feeds value chain analysis took place from 20th January to 31st January 2020 in Shan East, Shan South and Mandalay.

The third phase of this study builds on the data collected during phase one and two above described. The third phase consisted of an analysis of opportunities for pro-poor and fish consumption impact (section 4), an overview of intervention area (section 5), an analysis market structure and constraints, including the seeds and feeds value chain analysis (section 6), and an analysis of market performances (section 7) (Annex *19*).

A workshop was held in Yangon from 17th to 26th February 2020 with project stakeholders such as the Myanmar Fisheries Federation (MFF) and NGOs. The primary objective of the seven-day workshop was to present, discuss and refine the findings and conclusions of the seeds and feeds value chain and the market constraints analysis. The ultimate objective of the workshop held in Yangon in February was to engage with project partners and stakeholders to design interventions, including "quick-wins", for each of the project areas that the project will deliver as part of its implementation strategy. Figure 3 below outlines the structure of the inland fisheries market system in terms of the core value chain, supporting functions and rules which can be formal and informal. Each part is described in details in the following sections.

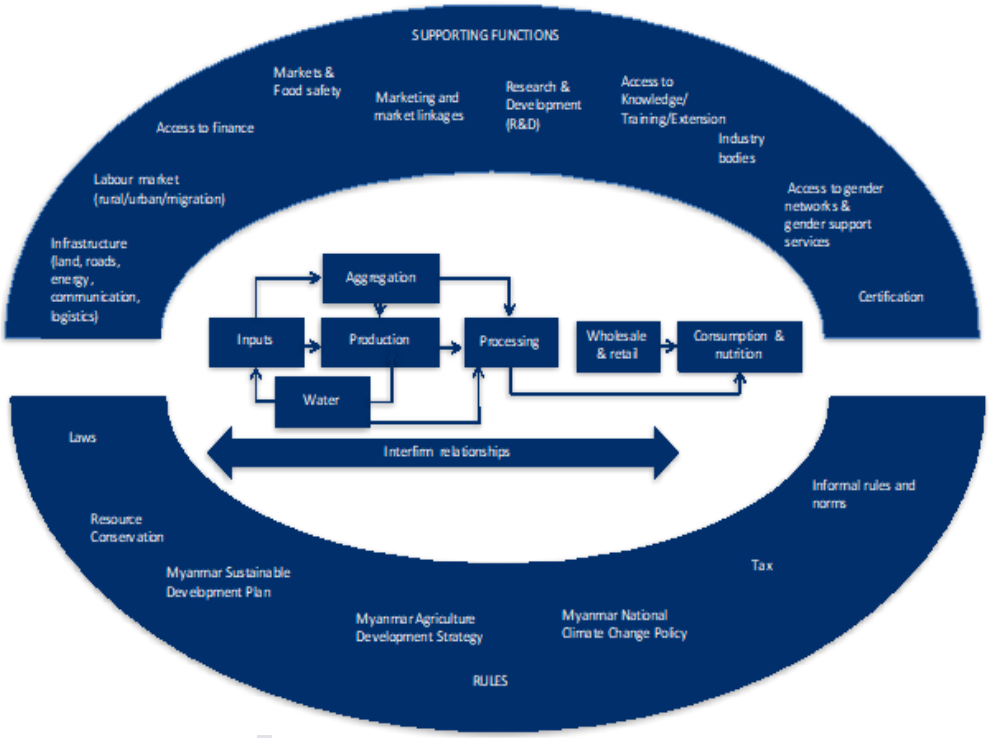


Figure 3: Structure of Inland Fisheries Market System

Figure 4 below shows the inland fisheries value chain. Each stage of the value chain is described below.

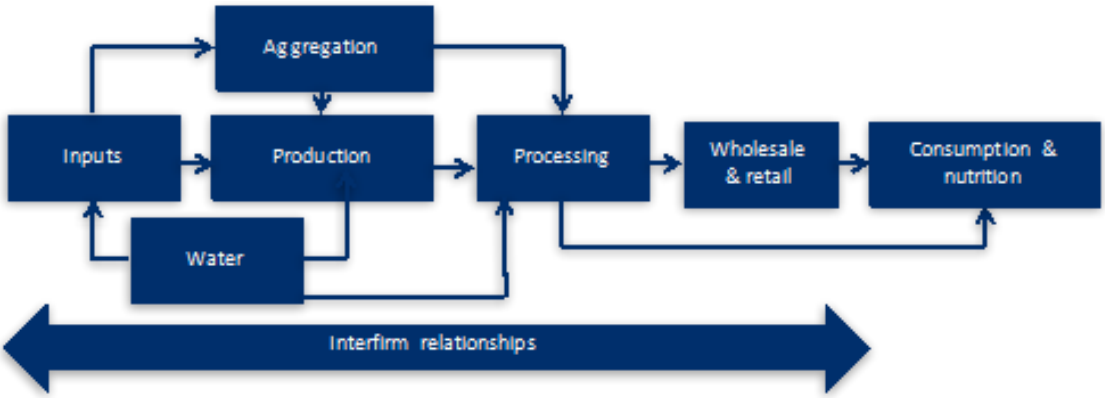


Figure 4: Inland Fisheries Value Chain

INPUTS

Seed:

The government supports the freshwater fisheries sector through its hatchery programmes, having released over 789 million fingerlings in 2013. Nevertheless, the hatchery programme is unable to meet sector needs. Moreover, increased supply of fish seeds and variety is limited by a lack of awareness of international demand and the absence of R&D for the purposes of adopting new production techniques and species. In addition, the DOF reports stocking 102 million fish seeds originating from the DOF hatcheries in open natural and constructed waterbodies, including Inns, in 2017–2018 (DOF 2018). The takeaways are provided below.

a) There is an effective demand for seeds particularly for one-inch fingerlings across all the six target areas. Preference for one-inch fingerlings among growers is driven by: (i) affordability – lower upfront cash investment; (ii) ease of transport; (iii) availability of nursery ponds from a majority of growers and (iv) risk mitigation – to reduce losses in case of natural disasters such as flooding or drought and ensure on time stocking of their grow-out ponds.
b) Specialized nurseries and those having integrated hatchery–nursery-production enterprises can contribute to promote optimal utilization of grow-out ponds if they can: (i) produce ready-for-stocking fingerlings earlier than nurseries owned by grow-out operators; and (ii) make fingerlings available throughout the year especially to growers with adequate water supply. Monosex/Genetically Improved Farmed Tilapia (GIFT) may be a viable species to jumpstart the promotion of use of bigger sized fingerlings.
c) The low number of enterprises specialized in nursery operations may be attributed to the dominance of integrated hatchery–nursery–grow-out and nursery–grow-out production farms. Nurseries in small grow-out farms generally have the lowest survival rate ranging from 30% to 40% (to be validated as most of them do not keep records). Considering the rational for these systems, it is unlikely that grow-out farms will forego their own nursery operations. As such, it may be more viable to strengthen capacity and capability of existing nurseries to increase survival rate and produce good quality fingerlings.

Except in Sagaing where traders play a prominent role in the distribution of seeds, hatcheries generally sell directly to farmers. This can provide opportunities for hatcheries to create customer loyalty through delivery of embedded advisory services (face-to-face technical advice, point-of-purchase brief technical guidance for those delivered by bus, and remote advisory services via SMS and calls). Hatcheries that may most likely benefit from delivery of embedded services to retain customers and increase sales are these that have (i) production volume can be significantly increased at affordable/minimal investment; (ii) healthy profit margin or potential to improve profitability; and (iii) an interest to expand within the short-term. Promotion of embedded services among hatchery operators will require upgrading of technical, business, and customer skills. A greater percentage of seed production from DOF hatcheries is allocated for re-stocking of public water bodies. Choice of species produced by hatcheries in the project areas is primarily influenced by consumer demand. As such, buy-in from fish retailers and consumers is important to promoting uptake among hatcheries and grow-out operators.

Feeds:

There are about 11 aquaculture feed mills in Myanmar producing sinking and floating pellets. Domestic consumption of commercial aqua feeds in 2018 was estimated at 500,000 MT with about 100,000 MT imported from Thailand and Vietnam. (Aung, November 2018) Commercial feed consumption is projected to increase to 700,000 MT in 2020. There are no specifications or standards for animal feed imposed by the government of Myanmar. Feed millers are free to use their own nutritional formulas.

Key ingredients used in the manufacture of feeds include rice bran, fish meal, peanut cake, soybean cake, sesame oil, sunflower cake, and other oil-based cake. Local production of raw materials and

ingredients is not sufficient to meet competing demands of various sectors. During the past two years, for example, farmers preferred to sell fresh peanut to exporters for the Chinese market rather than local oil mills since the former offered a higher price. Importation of ingredients except for rice bran has significantly increased during the recent years. The quality of ingredients is also inconsistent and vulnerable to contamination (e.g.: aflatoxin for groundnut). However, key takeaways from the study are as follows.

a) In areas where growers choose to engage solely with carp species, better feed rations, use of better quality and sufficient quantities of rice bran, peanut cake, and other oil cakes may be a more viable strategy to improve farm productivity and gustatory and nutritive quality.
b) In many cases, growers have limited knowledge on how to optimize their feeding strategies especially the interactions between feeding behaviour and environmental parameters and the contribution that natural productivity makes to the nutritional status of the culture system.
c) The selection of feeds by farmers is usually based on affordability and quality. Farmers generally assess quality based on past feed performance. From a more technical perspective, one of the more important criteria for feeds selection is their efficiency in terms of their Feed Conversion Ratios (FCR).

Grow-out:

Key takeaways

a) Weak compliance to GAqP and limited capacity to mitigate effects of climate change undermine profitability of operations.
b) Growers in a township generally grow the same species. Diversification of fish species can reduce risk of falling prices during peak harvest season and improve nutritional outcomes. Species such as tilapia and mola that consume plankton can also improve water quality in ponds and in effluents at harvest. Growers especially in Magway though are not so 'happy'' when mola naturally enters their ponds as they believe that these compete in the utilisation of feeds. It is important that these beliefs are addressed and farmers are trained on how to manage mola–carp–tilapia polyculture farms to ensure optimum pond performance.
c) Incomes are eroded due to lack of economies of scale (e.g.: small individual purchases of inputs, high transport cost per unit of produce, etc.) Farmers in the same village tend to help each other and share information but there have been little initiatives to exploit opportunities for collective procurement and marketing.

Processing:

A key challenge faced by fisheries processors is the limited supply of fish for processing. The production in the intervention area is currently lower than the demand which means fish is imported from other parts of the country and even, sometimes from Thailand. A key challenge for fisheries processors is the difficulty of increasing processing volumes due to low and irregular supply of raw materials. This was mentioned by a processor of smoked-fish in Sagaing during the scoping mission. What was noticeable in this cottage processing unit adjacent to the house of the owner was the likely cross-contamination that was occurring between the poultry roaming on smoked fish processed to be exported to the Indian market.

Consumption and nutrition:

Key takeaways

a) The consumer places a high level of trust in the retailer. Consumers have the tendency to transfer the responsibility of some of their consumption decisions to the retailers. As such, retailers should be among the key partners in any nutrition communication action.
b) Supply deficits of farmed fish and inability of majority of the project areas to produce fish year-round have significant impact on animal protein and nutrient intake of households in these areas given the strong preference for locally farmed fish. The high price of SIS in the local market is good for farmers

but may be detrimental to making it a popular choice among resource constraint households. Scaling up its production through pond culture can potentially reduce the price.

c) Inclusion of cooking methods/food preparation in nutritional campaigns is important to prevent nutritional degradation and potentially can motivate increased fish consumption.

Supporting Functions:

The institutional structure for Myanmar's transport sector is complex as there is no single agency with clear oversight of the sector. Responsibilities have been shared between six ministries, various city development committees and state-owned transport enterprises, where relevant. Access to electricity limits economic opportunity in the rural areas. Processors for example state that not having access to higher voltage electricity, bars them from scaling up the size of their machines. aper (10%)[26]. Internet in rural areas though is most likely also accessed through mobile phone. Main source of information on changes in the weather and environment for farmers specifically was the radio (67%, compared with 55% overall), and 61% had a radio set in their homes, Myanmar radio (82%) and Shwe FM (48%) being the most popular channels among farmers, who mostly tuned in from 6–8am, and 7–9pm.[27].

Rural land classifications do not accord with the actual land use on the ground or perceptions of its status by customary land tenure and systems. There is a degree of confusion on the status of land and ownership due to the number of old, conflicting laws on land classification and consequential differing and overlapping understandings and definitions which can then potentially contribute to land conflicts and tenure insecurity. This can particularly impact on smallholders, women and ethnic communities practicing traditional farming.

The project team has reviewed the market system strategy and key areas of interventions generated during the market system workshop organized from 17th to 26th February 2020. The priority outputs of the workshop are available in Annex *19*. The team has further prioritized the interventions and came up with plan which could be implemented as soon as the current COVID 19 crisis is over.

1.1.2.3: Disseminate information (technology and market) to all market actors through partners (private, NGOs, and private companies) and monitor outreach (actors accessing/making use of the information.

The information related to parts of market system are being disseminated to some of the market actors through partners (private, NGOs and private companies, Shwe Ngar, Htwet Toe and Greenway app) using various mediums and channels. The effectiveness and efficiency of such initiative will be monitored (actors accessing/making use of the information) adopting standard monitoring tools and methods.

1.1.2.4: Training (private sector & CBOs) on market (prices, inputs suppliers and availability, access, etc.)
Private sector comprised of key market actors and players, and development sector organizational capacity to understand information and use information obtained through various channels has integral importance. Capacity will be built through training (private sectors & CBOs) on market (prices, inputs suppliers and availability, access, etc.).

1.1.2.5: Delivery extension materials (leaflets, booklets, posters, guidebooks, videos etc.) on BMP (Better Management Practices) to relevant target groups (grow-out farmers, nurserers, hatcheries, traders, feed millers, retailers, whole sellers)

Fish for Livelihoods developed extension materials to disseminate among project participants and shared those products with. A total of 14 types of extension materials (leaflets, booklets, posters, guidebooks,

videos etc.) were developed and distributed to project and non-project participants (Annex 1 and Annex 24).

1.1.2.6: Training of indirect beneficiaries (grow out farmers) through hatcheries (DoF, MFF, private sector), nurseries, feed mills (MFF, Private), feed traders

Training of Trainers (ToT) expands the outreach of capacity building activities. ToT will be delivered to key market actors (hatchery, nursery, traders etc.) who in turn then build capacity of grow out farmers in particular. The ToT will be delivered to the market actors as soon as the COVID situation is improved and then they will deliver the same training to the farmers. However, in the meantime, the project has shared extension materials with the market actors (hatcheries and nursery operators). They have shared those materials with their respective customers (i.e. grow out farmers). A total of 02 types pamphlets were shared with the farmers through 11 hatchery and 25 nursery operators.

1.1.2.7: Training of project participants by NGOs

The project team have delivered online ToT to Community Facilitators, team leaders of Implementing Partners' (IPs) staff on Small-Scale Aquaculture technology, Nutrition, Water, Sanitation and Hygiene (WASH) and COVID- 19. The IPs staff along with WorldFish team have delivered the same training to the Aquaculture Promoters and farmers leaders. Subsequently, the farmers received trainings from IPs staff and APs online and face to face (Table 30). The training topics are broadly divided into three sections viz. Pre-stocking management and stocking management 2) post stocking and harvesting and 3) Nutrition and WASH practices. The training materials include a section on COVID 19.

A total of 27 CFs, 61 Aquaculture Promoters and 1,288 project participants received training on above topics. Apart from these, there were training sessions on mainly 03 key topics (aquaculture, nutrition and COVID 19) delivered to project participants and staff Annex 1. Despite several challenges, such as access to internet by the farmers, weak internet connection, and application used, restrictions on social distancing, all of the Aquaculture Promoters and Farmers were happy to receive all trainings delivered so far. Their neighbours also joined in for the training courses in many communities.

The total duration of the online course was four and half hours for three consecutive 3 days (1.5 hrs. x 3 days). During this 4 and half hrs course, Field Coordinators from WorldFish assisted the IPs staff, in order to ensure that the courses are delivered properly.

Table 9: Small-Scale Aquaculture, nutrition and WASH key messages online training agenda

Sections	Topics	Time
Section 1	Key steps on small-scale aquaculture technology	1.5 hrs.
1	Pre-stocking management	
2	Fish Stocking Management	
3	Post-stocking management	
4	General management	
5	Fish harvesting	
Section 2	Key Messages on Nutrition and Water, Sanitation and Hygiene	1.5 hrs.
1	Basic Good groups, Micronutrients, Balanced Diet	1.5 hrs
2	Intergenerational Cycle of Malnutrition	
3	Breastfeeding and Complementary Feeding	
4	Nutritional Value of Fish	

5	Vegetable garden production (Dyke production)	
6	Keeping the environment clean	
7	Proper Hand washing	
8	Good storage and Food handling	

1.1.2.8: Developing a mobile application for the project participants and others to access information on BMPs, nutrition, fish feed and market.

The project circulated a call for getting proposals on developing an App from qualified digital/ tech organization, companies, and social enterprise that can help farmers and interested individuals to acquire information and access on inputs e.g. fish seeds, fish feeds, and small-scale aquaculture (SSA) technology, as well as get information on improved human nutrition including effective WASH behavior messages. Additionally, the aim is for value chain actors (e.g. farmers, hatchery owners, nursery owners, processors, etc.) to link together to efficiently communicate information that increases productivity, income and improved nutrition. The qualified digital/ tech organization, companies, and social enterprise submitted proposals based on below modality/ties. The aim was to get two types of platforms developed with this initiative which are as follows-

A. Creation of a new mobile friendly platform

- Creation of mobile friendly, web-based, applications that support farmers, fish seed producers, hatchery owners, women, etc. to access inputs and information on SSA technology and human nutrition messages
- Designing of web/mobile information based on the content provided by Fish for Livelihoods team
- Setting up of farmers' monitoring "tab" or equivalent that can support farmers' and Fish for Livelihoods project team track pond productivity (e.g. Feed Conversion Ratio calculator, fish size, etc.) and piloting
- Fish for Livelihoods project contract ends

B. Utilizing an existing mobile friendly platform

- Providing a chatbot or similar that can support farmers to access inputs and information on SSA technology and human nutrition messages as mentioned above
- Designing of web/mobile information based on the content provided by Fish for Livelihoods team
- Setting up of farmers' monitoring "tab" or equivalent that can support farmers' and Fish for Livelihoods project team track pond productivity (e.g. Feed Conversion Ratio calculator, fish size, etc.) and piloting.

Several interested companies submitted their proposals on this call. Single spark, the Netherlands, and Village link, Myanmar were selected to develop new app and using their existing app respectively. The key outputs are being delivered by these companies includes-

The name of the app developed by single spark is Shwe Ngar (Golden Fish). An online event to launch launching was organized by WorldFish and USAID on 13th October 2020. WorldFish Myanmar office with support and help from USAID Burma office, launched Shwe Ngar mobile application in that event. The panelists in the launch have a broader representation of delegates from United States Agency for International Development (USAID), WorldFish, Department of Fisheries (DoF), and private sectors notable Myanmar Fisheries Federation (MFF). The launch was broadcast via Zoom call and was simultaneously stream live at USAID Burma Facebook page. This launch of Shwe Ngar application engaged significant members on both mediums. The Zoom call recorded 187 participants who joined this virtual

launch. The viewership during the live stream peaked till 135 whereas more than five thousand viewers watched the launch video during first two weeks.

Sub-IR 1.2 Efficiency of aquaculture production increased systems

Output 1.2.1: **Farmers adopted improved fish farming practices in a range of production systems (e.g., ponds, rice-fish systems)**

Context:
Participation and adoption in aquaculture are expected to increase family earnings through higher employment levels, which in turn lead to higher net incomes. It is evident that adoption-consumption linkages can be achieved via two different pathways: firstly, direct consumption of fish produced by the household, and secondly by bringing down market price for fish due to an increased abundance/supply of fish products in the local market (Ahmed and Lorica,2002). Even if the trend of aquaculture in Myanmar is positive so far, the growth of this sector has been disproportionately influenced and constrained by several factors including existing land use policy, despite significant potential contribution of small-scale aquaculture to local and regional markets providing increased income and nutrition (Belton et al., 2015). In Myanmar, aquaculture development faces key constraints including a lack of a comprehensive information base on aquaculture, a lack of proven management approaches and technologies for the scaling-out of suitable innovations, a poorly developed domestic market, most importantly unclear land tenure and access to extension services.

Progress:
Tasks:
1.2.1.1: Issue calls for business models/concepts from private sector businesses (eg. MFF) and organizations (NGOs/CBOs/CSOs) on increased adoption of improved best management practices (BMP) for SSA including rice-fish systems

This Activity solicited proposals from NGOs and private sectors (eg. MFF) in order to get their ideas on how SSA could be supported and developed to reach Fish for Livelihoods objectives. The Activity launched a first call and received proposals from organizations interested and submitted an application on ideas/concepts that would address key constraints associated with small-scale aquaculture and associated businesses in the areas mentioned above that help to achieve the Activity's objectives of inclusive business and economic growth. The call was quite broad and included following key areas of interventions-

1. Improve accessibility and availability of quality fish and tilapia seed and feed at the smallholder farmer level, including women and youth, along with technical services on best management practices (BMP).
2. Strengthen small-scale business enterprises like fish hatcheries, nurseries and local service providers (LSP)/associations so that entrepreneurs can provide services to smallholder men, women and young fish famers.
3. Deliver training package/curriculum and offer technical training for hatchery technicians and technical persons involved in the aquaculture sector or interested in entering the sector.
4. Strengthen supply channels for safe fish products (dried, fermented and salted fish)

5. Increase gender-integrated nutrition awareness and practices (consumption of nutritious food, dietary diversity and hygiene practices), and Deliver enhanced nutrition and WASH practices through social and behavior change communication (SBCC) programs.

1.2.1.2: Review and evaluate the business models/concepts, co-design business plans with selected applicants and sign grant agreements or contracts (including BRAC and Pact + identified partners)

The Fish for Livelihoods team reviewed the proposals submitted by the interested applicants (NGOs, private sectors),-elected partners based on their proposals and signed contracts with the aim to get specific activities and outputs delivered. The project has so far selected a total of 1,173 households through preselected implementing partners (BRAC, PACT and MFF), KMSS (Pekhon and Kengtung) and Pekhon Lake committee and Inlay lake committee (Table 10). The project IPs has also selected Aquaculture Promoters (APs) and Farmers leader (FL) to help implement the project. The detail list Aquaculture promotors and IPs staff are available in Annex 17.

Table 10: Number of project beneficiaries by implement partners and areas

Sr	Region	Township	IPs	# of Vill. Tract	# of Vill.	Year 1 participants							Year 1 Participant		
						# of SSA Farmer	# of Hatchery	# of Nursery	# of Demo	# of Feed Miller	# of Fisher men	# of Community Pond	M	F	Total
1	Kachin	Banmaw	MFF	1	6	11							8	3	11
2	Kachin	Mansi	MFF	1	2	4							4		4
3	Kachin	Momauk	MFF	1	2	5							5		5
4	Kachin	Moe Kaung	MFF	5	6	10							10		10
5	Kachin	Myitkyina	MFF	9	13	20	2						19	1	20
6	Kachin	Wai Maw	MFF	5	11	50	1						48	2	50
7	Magway	Ngape	PACT	4	4	33			1				22	11	33
8	Magway	Salin	PACT	7	11	186		2	9				156	30	186
9	Mandalay	Mandaya	BRAC	21	30	200	1	5	10	1			167	36	203
10	Sagaing	Khin U	BRAC	12	22	200	1	5	10	1			165	39	204
11	Sagaing	Kale	F4L				2						2		2
12	Shan East	Tachileik	KMSS	4	21	82	0	3	20	2			75	10	85
13	Shan East	Kengtung	F4L, WF				1						1		1
14	Shan South	Nyaung Shwe	F4L, WF				3			1			2	2	4
15	Shan South	Pekhon	KMSS	5	26	83		3	4	1	50	4	133	7	140
16	Shan South	Pin Laung	KMSS	2	3	14			2	1	42		54	2	56
17	Shan South	Pindaya	MFF	6	10	64		2	3	0			40	26	66
18	Shan South	Taunggyi	BRAC	4	8	200		5	10	1			192	14	206
19	Shan South	Nyaung Shwe	Inle Lake Committe			11							2		2
20	Shan South	Pekhon	Pekhon Lake												0
			Total	75	161	1,173	11	25	69	8	92	4	1,105	183	1,288

1.2.1.3: Facilitate implementation of agreed business plans, grant management and reporting

The Fish for Livelihoods team has assisted the IPs in implementing the agreed work plan/business plan, monitor activity and financial management and get reports as agreed with the respective IPs. There are Field Coordinators devoted to support each of the IPs in respective townships from 5 regions/states.

The F4L project supported 1,288 farmers with trainings, fish seed, fish feed (partially) and visits through IPs in 20 townships from 5 regions/states._

F4L assisted implementing partners in setting up demonstration ponds with the aim to maximize fish production more efficiently and profitably through providing intensive technical and input support to the

demonstration farmers. A total of 69 demonstration ponds established in 64 villages in 9 townships (Madaya, Khin U, Salin, Ngape, Taunggyi, Pekhon, Pin Laung, Pindaya, and Tachileik). The demonstration ponds were stocked from May to October depending on the availability of water with a total of 72,156 seed of Indian major carps and tilapias with average weight of 30 g (

Table 11). The average size of the stocked is varies from 250 to 400 g. It was noticed that the neighboring farmers learnt better management practices from the demonstration ponds. They learnt how to properly fed their fish, Feed Conversion ratio (FCR), maintain the water quality of the pond water and so on.

Table 11: Details on demonstration ponds

Sr	IPs name	Township	# of village tract	# of village	Demo Farmers			# of Fish Species								Total Pond Area (Acre)
					M	F	Total	Rohu	Silver Barb	Common carp	Grass Carp	Silver carp	Mola and other SIS	Tilapia	Total	
1	BRAC	Madaya	10	10	9	1	10	14,160							**14,160**	4.26
2	BRAC	Khin U	7	9	6	4	10	13,710							**13,710**	4.60
3	PACT	Salin	5	7	6	3	9	2,175	3,370						**5,545**	1.35
4	PACT	Ngape	1	1	1		1	100	300						**400**	0.07
5	BRAC	Taunggyi	4	8	10		10			3762	869		1,000		**5,631**	0.87
6	KMSS	Pekhon	4	4	3	1	4			3200	120	800			**4,120**	0.91
7	KMSS	Pin Laung	2	2	2		2					1600			**1,600**	0.08
8	MFF	Pindaya	3	3	3		3			1470	4,410				**5,880**	1.48
9	KMSS	*Tachileik	4	20	19	1	20	5,934		2,940			2,000	13,236	**24,110**	3.74
			40	64	**59**	**10**	**69**	**36,079**	**3,670**	**11,372**	**5,399**	**2,400**	**3,000**	**13,236**	**75,156**	**17.35**

1.2.1.4: Stakeholder consultation workshop with aqua-pharmaceutical and aqua equipment/machinery companies and identify priority intervention areas

Workshops engaging several market actors including aqua-pharmaceutical and aqua equipment/machinery companies were organized on August 31, 2020 in Yangon to understand their business, constraints and identify priority areas where Fish for Livelihoods could intervene in order to making their business more viable with the key aim to connect them with the aquaculture chain actors (including farmers) so that all are benefited through boosting up their business and income opportunities.

A total of 16 participants joined in the workshop including 10 staff from Fish for Livelihoods. There were representatives from Altech biotechnology, Evonik, Biomin and Trade domain participated in the workshop. They are operating their business around feed additive, probiotic supplement, water treatment, animal nutrition, disease and health across the country.

Key outcome of the workshop-

The participants discussed about key challenges exist with their business, possible factors associated with such challenges and impacts on the market. The summary of the discussion points presented in the below table.

Table 12: Key outcomes of the workshop organized with the aqua-pharmaceutical/equipment companies

No.	Challenges	Causes	Impact/outcomes
1.	Low market price	Low export	Low profit/low interest in feed/pharmaceutical
2.	Low profit	Poor pond management/feed/breeding/ high production cost	Low interest to make commercial
3.	Poor record keeping and calculation	Poor technical knowledge on feed/pond management	Less profit/more production cost
4.	Low demand from feed detailers in townships	Low demand from farmers for feed/pharmaceutical	Companies can't make wholesale distribution
5.	Poor interest on using them	Poor knowledge/hard to reach for communication on aqua-related products	Decreased demand on aqua related products
6.	More traditional methods/misbelief/misused of products	Less education on modern fisheries	Poor survival rate/low fish production
7.	Low trust on products	Exposure with Previous bad companies and products	Low interest on using again
8.	Poor health conditions of fish and poultry	Communication gap/less gov support on animal health	Low survival rate
9.	Low survival rate of broods	Bad transportation/bad nutrition management/bad pond management	Low profit in selling fingerlings
10.	Poor meat quality	Poor nutrition methods/support/knowledge	No export quality
11.	No audit or evaluation system on fish quality	No lab/no technician/no practice/no system for good quality practice	No quality fish and fish meat for export or high-priced products

The participants also discussed about potential partnership collaboration with Fish for Livelihoods with the aim to address the market challenges. They also expressed interest to intervene following aspects with the support from F4L.

a) Market linkage workshop: participants should be farmers, retailers, wholesalers, MFF, private companies.
b) Knowledge sharing events/channels on aqua nutrition/feed/ FCR calculation/breeding: through mobile apps like shwe ngar, htwet toe (WF can negotiate private companies to share their product information in mobile apps), through collaborative activities between WorldFish and private companies, through grant supports to private sectors
c) To set up farmers' market: opportunities to meet customers directly and can reduce the big gap between pond price and market price.
d) Demo pond collaborated with private companies: product promotion and support from private companies for their product marketing. Exchange visit
e) Feed formulation support: Evonik can work with that. They have technician for that and they can also do feed promotion. They can also support amino acid test.

f) Setting up lab for fish quality and water quality: we can try SGS company and MITT company for that. There is water quality test kit which can test p^H level, ammonia, aflatoxin, oxygen with around 15,000 MMK. It is called Aqua Vbc kit Thailand-made.
g) Water quality test: collaborate with water resource department, private company like Myanmar supreme company. It can make quarterly test, knowledge sharing activity in necessary townships.
h) Knowledge sharing events on fish flesh quality: Altech company can help on training to staff/farmers with local and external consultant
i) Aqua products exhibitions in township level: currently silver sea journal used to organize in City level. We can discuss with them to organize.

Sub-IR 1.3 Increased access to credit and financial instruments

Output 1.3.1: Credit and financial instruments targeting smallholder aquaculture producers and processors introduced and further developed

Context:

Access to financial credit has been a challenge always for smallholders' aquaculture producers. Small-scale Aquaculture Investments for Livelihoods in Myanmar, with a novel approach, will address this challenge in a wat that all the benefits go to smallholder and farmers. Financial capital would leverage farmers capital and they will purchase more inputs (seeds, fingerlings, feeds, etc.) for them. These inputs will turn into enhanced outputs as the productivity will be improved. Increased financial resources will have a positive effect on the production and income of the farmers. Small-scale Aquaculture Investments for Livelihoods in Myanmar, with the help of a micro finance consultant, will establish a credit delivery system. This system will provide soft micro loans to the farmers. One of the partners, BRAC, is having the expertise in micro finance, as being one of the largest MFIs in the world. Fish for Livelihoods will implement micro credit-based interventions which will provide credits to different actors linked directly or indirectly with the beneficiaries. Piloting new interventions e.g., a revolving community fund and alike would be the hallmark for these interventions in community.

Progress:

Tasks

1.3.1.1: Identify credit delivery systems (i.e. formal loans via INGOs, local CBOs, and or in-kind assistance from input suppliers) in the project intervention areas to help sustain aquaculture initiatives and draft a plan on how the private sector is able to provide access to the necessary inputs to SSA households

The project hired Inclusive Finance and Development Associates (IFDA) who have experience of working with micro-finance sector for small-scale farmers in agriculture and aquaculture in Myanmar. The consultant has experience and understanding local context for SSA and fisheries, and are aware about the in and out of the effects of micro lending on fish harvest. The project is also expecting to get community based micro lending programs (cash, in kind, etc.) designed for small holders through this consultancy work. The IFDA was assigned to perform the following activities mentioned below;

a) Policy, Rules, and Laws: assess the current enacted policies, laws, rules and regulations of government pertaining to microfinance businesses in agriculture in Myanmar. This pertain to the laws for MFBs, MFIs, NGOs, CBOs, and other private and public micro loan providers,
b) Current options to access credit: what credit (cash, in kind, inputs etc.) do they currently have access to and what they currently do with the credit,
c) Major Actors: who are the major actors (MFBs, MFIs, NGOs, CBOs, other private and public entities) currently providing credit to the communities and farmers,
d) Gaps identification: what are the gaps in the current micro credit delivery systems,

e) Repayment: who is mainly responsible for repaying- and who is actually repaying, what is the use of the credit),
f) Willingness to take loan by SSA farmers: are the farmers willing to take and repay loan. Do they think this will add value and access will grant them the increased access to input and production?
g) Gender integration: on how formal/informal credit 'accessed' and used by different types of women and men as different approaches in different contexts in select project areas.

The key findings from the assignment carried out by IFDA is summarized here-

Micro Credit Opportunities for SSA Farmers in Myanmar:

Opportunities to access micro credit for SSA farmers in Myanmar are scarce. One of the key challenges is that there is no customized product available for SSA farmers due to the seasonal, not consistent, income. One of the sub components of "Fish for Livelihoods" is to increase SSA farmers' access to credit in Myanmar. For this, a comprehensive study, with the help of a consulting firm, was carried out to assess the micro credit situation in Myanmar, especially in the intervention areas. The brief summary of the study is discussed under and the detailed report could be accessed (Annex 16).

The formal lending system in Myanmar has grown and diversified in the recent decade with the help of liberalized regulations and foreign investments. Various entities providing formal credit include State-owned Banks, Private Banks, Foreign Banks, Cooperatives, Non-Banking Financial Institutions (NBFIs), Microfinance Institutions (MFIs), registered Pawnshops, and the government-sponsored Mya Sein Yaung (MSY) project.

The informal lending system in Myanmar comprises of money lenders, acquaintances, VSLAs, and unregistered pawn shops. Even though the interest rate charged is extremely high, it is still preferred by the borrowers in rural areas mainly due to the availability of necessary cash at the time of emergency along with flexible repayment options. Among the informal lending channel, loans from Village Savings and Loan Associations (VSLAs) were widely procured by small-scale aquaculture (SSA) farmers in various townships.

The availability of both formal credit providers and non-formal credit providers vary widely across each township. MADB is present in all the townships while Non-Banking Financial Institutions (NBFIs) and Foreign Banks are not found anywhere in the study townships.

The study also focused on the credit availability to SSA farmers in six townships i.e. Khin-U, Madaya, Pekon,Salin, Tachileik (Tarlay town), and Waingmaw in the states/regions selected by WorldFish for the intervention. For this, KIIs were conducted with 180 SSA farmers and several value chain actors. 11% SSA farmers interviewed were females with the highest proportion in Khin-U (17%) followed by Salin (13%). Only 6% farmers reported fish farming as their primary source of income whereas 90% farmers reported it to be their secondary source. 20% farmers in Waingmaw, 3% in Madaya, and 3% in Pekon did not report fish farming even as their secondary source of income. The study identified key challenges around the following areas;

- Current Lending System in selected townships
- Credit Options and hindrances/inhibitions in accessing them
- Ownership and repayment behavior
- Requirements of SSA farmers
- Gender Inclusion
- Regulatory Environment

Gaps identified

- There is no formal source available that caters to the needs of small-scale fish farmers. As the fish feed is the major expense of the fish farming business and is dependent on the bodyweight of fishes in the pond, its requirement increases over the growing period. Also, a single time disbursement can lead to improper loan utilization. No microfinance product to this requirement of multiple disbursements in tranches.
- VSLAs are providing loans for fish farming in the various township but the loan amount is insufficient and loan tenure also does not match the growing period. Additionally, the community fund is managed in the personal savings account of an individual. Such practices are unsustainable and fraught with the risk of fraudulent withdrawal and ownership conflicts.
- There is an immense disparity in fish farming practices across townships. The wide variation in aquaculture practices and investments by small fish farmers indicates a significant lack of skills and know-how on fish farming.
- Fish feed is the costliest input in fish farming. It is also the single most important factor affecting fish growth. The lower the quantity of fish feed required for obtaining a kilogram of fish harvest, the better is the perceived quality of feed. The respondents lacked awareness of the significance of the feed quality and thus, require to be trained in this aspect.Pond registration for fish farming is a statutory
- requirement. During our study, none of the SSA farmers were found to have obtained the necessary licenses for fish farming. This non-registration of ponds also inhibits SSA farmers from accessing benefits out of DoF schemes such as the provision of quality fingerlings worth MMK 40,000 under Covid-19 Economic Relief Plan (CERP).

Proposed Solutions

The study team proposes four models based on international best practices as well as suitability to local conditions. These models proposed aim to promote channels for providing credit to SSA farmers and developing their capacity to undertake sustainable business. The proposed models are:

- Revolving fund Grant to Community Organization
- Revolving Fund to NGOs/IPs
- Fish Feed as working capital support to Small Scale Aquaculture Farmers
- Hybrid Model - MFI for Credit Access & NGO/IP for AqBDS, IDS

Sub-IR 1.4 Increased access to fish seed through engaging and strengthening linkages between private and public sector

Output 1.4.1*:* Improved knowledge and understanding of the existing seed sector

Context:

Fish seed production and supply systems in Myanmar relies on both private and public sectors. However, the majority of the seeds are being produced come from government hatcheries. Rohu (*Labeo rohita*) is the most common species stocked, followed by *Barbonymus gonionotus* and *Catla catla*. There are 26 active government hatcheries, producing about 650 million fish fingerlings, of which 68% are Rohu. In addition to government hatcheries, 39 private hatcheries exist, producing 1,875 million fry and fingerlings to support the sector. Nevertheless, the hatchery programme is unable to meet sector needs. There are two main annual peaks in stocking seed, the first in June-July at the onset of the monsoon, the second during late-monsoon in October. Smaller scale farmers depend on private hatcheries, nurseries while larger farms are more likely to nurse their own seed.

Progress:

Tasks:
1.4.1.1: Improved knowledge and understanding of the existing seed sector

An assessment on fish seed demand, availability, production and associated networks has been conducted with the help of consultant/s. The consultants recommended several areas of interventions which are taken into consideration to address through Fish for Livelihoods (Annex *18*). It was noticed thatdemand for fingerlings is higher than supply. Key constraint to scaling up of prodction is the limited access to water especially during the dry season. Government prioritizes water access of farm land especially those planted in paddy. Other issues raised by operators include: (1) high cost of electricity; (2) land tenure (private hatcheries); (3) capacity limited by hatching jars (DOF), (4) lack of nursery operators and (5) lack of knowledge on inbreeding and bloodstock management. The project is aiming to address these issues over the next couple of years.
1.4.1.2: Assessment of existing seed (carp, prawn, tilapia, catfish) demand, availability, production (including SIS), nursery and supply networks, and bio security audits at national and ZOI level

There are two main annual peaks in stocking seed in grow-out ponds, the first in June-July at the onset of the monsoon, the second during late-monsoon in October. Nursery operators have been and could play crucial roles in ensuring supply of seed for the grow-out farmers. Larger farms tend to nurse their own seed while small farms rely on nurseries. However, despite the tendency for larger farms to vertically integrate nursing functions the market for seed is vibrant.

Sources of purchased seed include specialized nurseries (23% of all seed stocked), fingerling traders who buy and sell seed from nurseries (23%), and private hatcheries (9%) (Ben et al, 2017). Small farms stock seed at larger average sizes than medium and large farms. This may be related to the tendency of smaller farms to stock seed sourced from nurseries, and to run shorter production cycles than large farms, thus requiring large seed in order to attain marketable size in time. Small farms are more likely than medium or larger farms to purchase seed from nearby nurseries. The overall production rate (kg/ha) at farm level is relatively low as a result of lack of access to quality and large seed on time. This effectively reduced the culture period to a nursing stage rather than a grow-out phase, thereby affecting the resulting size and weight at the time of harvesting. However, overall scenario by project areas are given below.

Nyaungshwe
There are a few enterprises in Nyaungshwe which are specialized in nursery operations. Fries/hatchlings are sourced from the Nyaungshwe hatcheries. Main customers are growers within South Shan. One nursery operator recounted fish mortality due to pesticide run-off from nearby farms. Private seed producers in Nyaungshwe can potentially be tapped to provide advisory services. Aside from relatively high profit margin (about 50% to 60% of sales), the owners have good basic technical skills which can further be developed through training and technical assistance. Practices and infrastructure would require some upgrading to be aligned to good aquaculture practices. Delivery of embedded services can also potentially contribute to their objective of increasing market share.
Sagaing
There are two private hatcheries in Kale township and one DOF hatchery in Shwebo. There is also a DOF hatchery near Kale, although it is administratively located in Shin State. The main species cultured in private hatcheries are rohu, grass carp, common carp, catla, and mrigal. The hatcheries have nursery and grow-out ponds. The other main actors in the fish seeds value chain in Sagaing are the traders who purchase seeds from the hatcheries and sell to growers. Hatcheries give the traders a 5% commission. Growers may also buy directly from the hatcheries. One hatchery sold the fingerlings on credit but repayment rate was low at 15%. It is important to understand reason/s for non-repayment and assess whether credit complemented with advisory services can improve repayment rate. In the short term, it may be more prudent for the hatchery to improve quality of fingerlings, ensure timely production (aligned with water

availability for grow-out ponds) and complement this with effective advisory services as a means of growing its client base.

Magway

The state has no private hatchery and two DOF hatcheries in Tandwinggyi and Pwyinpyu. Growers source their seeds from DOF hatcheries and Mandalay especially in Kume. They prefer the later for quality seeds. The growers generally buy 1-inch fingerlings. Given the constraints on both water quality and availability as well as absence of commercial feed suppliers, focus should be on facilitating access to seeds of species that thrive well in inns under extensive culture system and the promotion of self-reproducing species.

Mandalay

There are nine hatcheries in Mandalay operating as part of a vertically integrated hatchery and production farm. Four of the hatcheries are operated by DOF and the remaining five are private enterprises. Major species include rohu, common carp, grass carp, mrigal, catla, and other exogenous species. Pangasius fingerlings are sourced from Yangon hatcheries. The hatcheries sell their seeds to growers in Mandalay, Yangon, Magway, Kale, and other states. Mandalay growers absorb about 40% of the production. Fingerlings sold to Yangon are sent via bus. Fingerling are transported in plastic bag with 500 to 1,000 pieces of 1-inch fingerlings and placed in a box for protection. Growers from neighbouring townships in Magway pick up the fingerlings themselves from the hatcheries. San Pya hatchery only produce seeds for their own grow-out ponds.

Kachin

There are thirteen hatcheries in Kachin of which, eight are owned by private enterprises. The remaining five are DOF hatcheries. Major species are rohu and other native carp species. Hatcheries are generally underutilized and operating below par. Survival rate is generally low ranging from 20% to 50%. The hatcheries are part of an integrated nursery and grow-out production system.

1.4.1.3: Opportunities in the seed sector identified

The government supports the freshwater fisheries sector through its hatchery programmes, having released over 789 million fingerlings in 2013. Nevertheless, the hatchery programme is unable to meet sector needs. Moreover, increased supply of fish seeds and variety is limited by a lack of awareness of international demand and the absence of R&D for the purposes of adopting new production techniques and species. In addition, the DOF reports stocking 102 million fish seeds originating from the DOF hatcheries in open natural and constructed waterbodies, including Inns, in 2017–2018 (DOF 2018). Considering the above context, constraints and opportunities the project has started addressing the following key barriers as identified through the value chain analysis.

- Limited technical capacity of hatcheries to improve productivity and quality, diversify to other species, scale up to meet local demand, and innovate
- Limited diversity of fish seeds available leading to a lack of diversity and limited availability of high-nutritious fish on markets
- Limited availability and access to high quality and diverse broodstocks leading to inbreeding and limited diversity
- Limited knowledge and exposure to modern aquaculture production and postharvest technologies
- Lack of business management skills
- Market distortion created by DoF hatcheries create market entry barriers for private hatcheries Absence of small- and large-scale nursery operators
- Limited technical know-how and skills to improve survival rate

The project has developed grow-out pond stocking plan which will help guide the team to start stocking fish seed from mid of May 2020. The ponds were stocked accordingly.

1.4.1.4 Establish seed nurseries for women

F4L established 25 new nurseries (02 in Salin, 05 in Madaya, 05 in Khin U, 03 in Tachileik, 03 in Pekhon, 02 in Pindaya, 05 in Taunggyi) with the key objectives to improve access to seed at remote areas, meet demand of fish seed throughout the year and develop capacity of women participants with the support from Fish for Livelihood project. A total of 03 women and 22 men nurseries were trained and involved in this business. Starting from May 2020, the nursery operators nursed 459,990 small fries and hatchlings of different species including tilapia, rohu, silver barb, grass carp, common carp and intha carp and produced fingerlings with good survival rate which will be accessed by ~300 grow-out farmers in 2020 and 2021(Table 13). The project organized workshops involving 17 nursery operators and 30 grow-out farmers and 05 Aquaculture Promoters in Taunggyi, Pindaya, Khin U and Madaya township with the aim to establish linkages between them. As a result, nursery farmers were able to 1) develop their own nursery business plan including cost-benefit analysis and 2) establish linkages with seed supply sources (hatcheries) and grow-out farmers.

Table 13: Nurseries established with the support from F4L

Region	Township	IP	Year 1 Nursery Farmers			# of Fish Species							Total Pond Area (acre)
			M	F	Total	Tilapia	Rohu	Silver Barb	Grass Carp	Common carp	Intha carp	Total	
Magway	Salin	PACT	2		2		12,000	15,000				**27,000**	**0.31**
Mandalay	Madaya	BRAC	5		5		150,000					**150,000**	**1.5**
Sagaing	Khin U	BRAC	4	1	5		150,000					**150,000**	**1.6**
Shan East	*Tachileik	KMSS	3		3	61,200						**61,200**	**0.84**
Shan South	Pekhon	KMSS	3		3					20,200	12,000	**32,200**	**0.86**
Shan South	Pindaya	MFF		2	2				12,000	3,000		15,000	**0.14**
Shan South	Taunggyi	BRAC	5		5					24,500		**24,500**	**0.24**
			22	**3**	**25**	**61,200**	**312,000**	**15,000**	**12,000**	**47,700**	**12,000**	**459,900**	**5.49**

Output 1.4.2: Linkages strengthened and new ones established between fish farms, nurseries and hatcheries

Context:

There is an effective demand for fish seeds, particularly for small size fingerlings across all the six target areas of Small-scale Aquaculture Investments for Livelihoods in Myanmar. Preference for small one-inch fingerlings among growers is driven by: (i) affordability – lower upfront cash investment; (ii) ease of transport; (iii) availability of nursery ponds from a majority of growers and (iv) risk mitigation – to reduce losses in case of natural disasters such as flooding or drought and ensure on time stocking of their grow-out ponds. Small size fingerlings (one inch and less), which are technically still fries, are vulnerable to predation and have a low survival rates compared to bigger sized seeds. This implies low survival rate and sub-optimal utilization of ponds. In addition, small size fingerlings imply longer cultivation period. The negative implications of using very small seeds appear to more severe among growers in Magway who stock directly to grow-out ponds. Specialized nurseries and those having integrated hatchery–nursery-production enterprises can contribute to promote optimal utilization of grow-out ponds if they can: (i) produce ready-for-stocking fingerlings earlier than nurseries owned by grow-out operators; and (ii) make fingerlings available throughout the year especially to growers with adequate water supply. Monosex/Genetically Improved Farmed Tilapia (GIFT) may be a viable species to jumpstart the promotion of use of bigger sized fingerlings.

Progress
Tasks:
1.4.2.1: Issue call for business models/concepts from private sector businesses and organizations on increased availability of improved seed in the ZOI
The Fish for Livelihoods team visited potential private and public hatcheries and assessed their existing technical and business capacities. In addition, the team also discussed how the hatcheries could be involved in extending their business through strengthening their existing linkages with seed traders, nursery operators and grow-out farmers. As a result, a total of 11 hatcheries are upgraded with the support for F4L under signed contracts (details are available in section 1.4.2.3).

1.4.2.2 Explore sources of good quality brood and distribute to hatcheries

The quality of Indian Major Carp brood stocks are genetically eroded, due to well documented malpractices applied during the last decades in Myanmar. Several studies have shown the superior growth performance and resistance to diseases of wild-collected fry vs. hatchery produced seed. Therefore, replacement of breeders was planned by using wild origin breeders. The replacement of breeders requires large financial and technical effort. For economic and biological reason, replacement is planned at the rate of 20 % per year. However, the quality of the spawn is being produced from the old stocks can be significantly improved if the wild-origin males are used to fertilize the eggs of the old stocks of females. The possible quantity of old females mated with wild males is depending on the number of wild males related to number of females in a given hatchery. Males can be used repeatedly at 3-4 weeks interval in well managed pond (feeding, flushing and aeration). Considering that the spawn which will be produced could be designated to produce market fish and will never be used as broodfish, the improved fish originated from crossbreeding of old and new stocks, as well as the repeated use of males will not result genetic degradation of next generation.

Keeping this simple technique in mind F4L sourced brood stock of Mrigal in Southern Than as demand of this species in the region is high. The project made a linkage with wild brood supplier in Twnatay township to ensure supply of quality brood to hatchery located in Southen Shan. It is noteworthy that the fries are collected from the rivulet of Ayeyarwaddy river and are reared as brood stock at U San Win private farm in Twantay township which are meant to sell brood to hatchery. A total of 1,300 mrigal wild brood with the size 20 tical-50 tical have distributed to U Hla Kyaw hatchery in Nyaung Shwe in September 2020. The project will continue this process in year 2, 3 and 4.

1.4.2.3: Facilitate implementation of 08 model hatcheries (carp or tilapia) and nursery systems by the selected private sector using BMPs together with distribution networks which could be further tested and scaled during following years (cost sharing with private sector).

Fish for Livelihoods took several initiatives with the aim to increase efficiency of hatcheries and upgraded existing hatcheries considering the context as mentioned in above section 1.4.2.2 in particular. A total of 09 contracts were signed with 09 private hatcheries in the project areas. The key aims of this activity are to 1) building capacities of hatcheries in order to improve fish seed production and economic performances, and 2) engage them in adopting embedded services to sustain their business. The assumption is that hatcheries that may most likely benefit from delivery of embedded services to retain customers and increase sales are these that have (i) production volume can be significantly increased at affordable/minimal investment; (ii) healthy profit margin or potential to improve profitability; and (iii) an interest to expand within the short-term. Promotion of embedded services among hatchery operators will require upgrading of technical, business, and customer skills. Choice of species produced by hatcheries in the project areas is primarily influenced by consumer demand. As such, buy-in

from fish retailers and consumers is important to promoting uptake among hatcheries and grow-out operators.

In Myanmar, the hatchery owners are experiencing high mortality of seeds. One of the vital reasons that triggers this mortality is the poor quality of water, which was repeatedly noted during the Fish for Livelihoods' scoping mission. All hatchery owners in the region have been using cloth/net made hatching hapas to incubate eggs, and then transfer seeds to the nursery ponds by scooping net. Thus, the pores of hapa get clogged due to silt deposition which reduced dissolved oxygen in water and eventually caused increased mortality. This problem becomes severe with old and outdated incubation nets used for many years, who would remain effective for couple of years only.

To address this challenge the project introduced modern technology equipment in total of 09 hatcheries (03 in Nyaung Shwe, 02 in Kalay, 01 in Keng Tung, 02 in Myitkyina and 01 Wai Maw township) despite having troublesome COVID 19 situation and limited movements across Myanmar (Table 14). Overall, the Fish for Livelihoods project have supported fish hatcheries technically and upgraded existing production facilities through setting up 18 steel incubation jars, 06 oxygen towers, 07 water tanks (fiber), roofing, fencing and solar panels. The key aims of this activity are to 1) building capacities of hatcheries in order to improve fish seed production and economic performances, and 2) engage them in adopting embedded services (eg. supporting their customers through providing access to information) to sustain their business.

The project has successfully set up the steel hatching jars systems in these hatcheries. The innovative technology is used in setting up oxygen tower to increase the level of oxygen in hatchery water and steel hatching jar method for incubating eggs. The equipment comes with breeding tank facilities, water tower, fiber tank, hatchling steel jars, and oxygen tower. Each steel jar is with a volume of about eight liters and bottom sieve. It has its own inlet pipe with valve and an overflow with pipe, thus both inlet and outlet water flows could be managed. The jars could usually be left connected with all water flow connections after a respective incubation cycle or might be disconnected for cleaning as and when required. This system can build and expand with additional jars easily.

Table 14: Number of hatcheries and facilities supported in 2020

Sr.No	Region	Township	Name of hatchery	Steel Jar	Oxygen tower	Water tank& tower	Roofing & Fencing	Solar panel	Distributed time
1	Southern Shan	Nyaung Shwe	U Hla Kaw	4	1	1	0	0	Mar-20
2	Southern Shan	Nyaung Shwe	U Htun Shwe	2	1	1	1	0	Mar-20
3	Southern Shan	Nyaung Shwe	Nan Win Htwe	2	1	0	1	0	Mar-20
4	Sagaing	Kalay	U Kyaw Ngwe	4	1	1	1	0	Jun-20
5	Sagaing	Kalay	U Zarni Aung	4	1	1	1	0	Jun-20
6	Eastern Shan	Keng Tung	U Sai Htun Latt	2	1	1	1	1	Aug-20
7	Kachin	Wai Maw	U N-Gang La Tawng	4	1	1	0	0	Oct-20
8	Kachin	Myitkyina	U Hpauyu Tu Myat	4	1	0	0	0	Oct-20
9	Kachin	Myitkyina	U Bawm Ying	2	1	1	0	1	Oct-20

It is observed that the hatching capacity of steel jar is double than the cloth jar. For example, a total of 3,500,000 Rohu fries and 1,200,000 Grass carp was produced through steel jars while the cloth jar could produce 1,500,000 Rohu fries and 600,000 Grass carp per time at U Hla Kyaw hatchery in Nyaung Shwe (Table 15). Oxyen towers increased dissolve oxygen in the water which led to higher survival rate of eggs. Fiber tanks were used to store water more efficiently at seven hatcheries. Overall, bio-security of five hatcheries were improved through proper fencing, roofing and setting up foot bathing platform which eventually minimized the risk of pest and disease outbreak.

The demand of seed is impacted due to restrictions imposed due to COVID-19. However, the scenario varies from location to location. Even if seed production was increased because of the facilities set up by F4L, the overall seed demand was low in 2020 as compared to 2019 in Southern Shan State while it was high in Kalay. The 03 project supported hatcheries (01 in Nyaung Shwe, 02 in Sagaing) produced and sold seed to more farmer in 2020 as compared to previous years as a result of F4L's interventions.

Table 15: Seed Production and number of farmers purchased seed from 04 Hatcheries in Nyaung Shwe and Sagaing Township

Sr.No	Region	Township	Name of hatchery	# of seed production		# of farmer purchased seed	
				2019	2020	2019	2020
1	Southern Shan	Nyaung Shwe	U Hla Kaw	231,909,909	138,752,218	344	614
2	Southern Shan	Nyaung Shwe	Nan Win Htwe	843,330	749,630	147	121
3	Sagaing	Kalay	U Kyaw Ngwe	1,700,000	1,900,000	700	750
4	Sagaing	Kalay	U Zarni Aung	2,500,000	3,000,000	600	700

Introduction of Nile Tilapia from Thailand

The project introduced mono sex nile tilapia from Nam Sai Farms Company Limited, Thailand to meet demand of tilapia in Myanmar. A total of 61,200 fries (length-2.5 cm and weight 0.25 g) along with nursery feed from Nam Sai Farm was procured from Nam Sai on September 23, 2020. Namsai Farms provided all required document including a Thai health certificate from Department of Fisheries issued by the Aquatic Animal Health Research and Development Division confirming that the seeds were free of all Office International des Epizooties (OIE) diseases. Incoming shipment of tilapia from Mae Sai, Thailand to Tachileik, Myanmar was inspected at the border by the relevant Myanmar government authorities and issued with an appropriate Product Movement Document by the Myanmar Department of Fisheries.

The seeds were then nursed 18 hapas [(hapa size-12'x 6' x 1' each) and (3,600 seed/hapa for 10 hapas and 3,150 seed/hapa 8 hapas)] in Tar Lay Township for 19 days in nursing hapas with static water earthen ponds by nursery farmers trained by Fish for Livelihoods. The stocking density was 450-500 fish/m^2. Fish were fed @15% body weight at week 1 which was reduced to 10% during week 2. Fish for Livelihoods nursery farmers been cleaned the hapas once a week. Surprisingly 61,915 seed with (size-4 cm and weight 5-6 g) were harvested from the nursing hapas, hence, the survival rate was > 100 % survival, suggests that initial stocking number was a bit higher as Nam Sai packed >2% seed to compensate mortalities.

Sub-IR 1.5 Increased availability and access to quality affordable feed using agricultural co-products by farmers

Output 1.5.1: **Improved feed formulation adopted by small and commercial feed mills**

Context:
There are about 11 aquaculture feed mills in Myanmar producing sinking and floating pellets. Domestic consumption of commercial aqua feeds in 2018 was estimated at 500,000 MT with about 100,000 MT imported from Thailand and Vietnam. (Aung, November 2018) Commercial feed consumption is projected to increase to 700,000 MT in 2020. There are no specifications or standards for animal feed imposed by the government of Myanmar. Feed millers are free to use their own nutritional formulas. The cost of manufactured pellet is considered to be 10% to 30% higher than in other countries of the region due to lack of competition in the sector. Commercial feed pellets are not commonly used due to their high price.

The aquaculture sector struggles with inadequate quantity and quality feed supply. Importation limits on enriched flours and other key inputs compels hatcheries to use oilseed cakes as an alternative. However, there is also a short supply of cake for the fisheries sector since a large majority of the cake is absorbed by the livestock sector. Also, it has only been possible to import oilseed cake since 2012 and current volumes remain insufficient to satisfy a growth in hatcheries production. Another issue is the uncertain quality of the cake that is imported, as border controls of oilseed cake imports remain inadequate due to limited testing facilities and the absence of standards against which to evaluate the product. In order to stimulate hatcheries production and demand for quality feeds, it is important to ensure fish farmers are informed of the issues associated with feed quality.

Progress:

Tasks:

1.5.1.1: Assessment of existing feed (carp, prawn, tilapia, catfish) quality, demand, availability of ingredients and feeds, production capacity, and supply networks at national and ZOI level

Feed is the major cost in aquaculture, accounting for 70% of operating costs on average among the farms surveyed. In general, about one quarter of farms use rice bran exclusively, and another 62% use rice bran in combination with other agricultural by-products (oilcakes, brewery waste, etc.) as it was reported by Ben Belton in one of his report. Nine percent of farms use pellets in combination with other feeds, while only 6% use pelleted feed exclusively. The agro-processing byproducts most widely used as feeds were rice bran (used by 86% of farms) and peanut oilcake (44% of farms). Other oilcakes (mainly sesame),

brewery waste and broken rice were each used by 6-12% of farms. Large farms were more than three times as likely to use peanut oilcake as small ones, likely reflecting its relatively high price.

In the project areas, commercial feed pellets are used mainly by growers of tilapia (monosex; Thai or China seeds) and Pangasius. Growers of the various carp species use farm-made feeds consisting of rice bran, groundnut cake, cottonseed cake, sunflower cake, soybean cake, and broken rice. Key ingredients used in the manufacture of feeds include rice bran, fish meal, peanut cake, soybean cake, sesame oil, sunflower cake, and other oil-based cake. Local production of raw materials and ingredients is not sufficient to meet competing demands of various sectors. Considering this situation and above context, Fish for Livelihoods aimed to assess existing feed quality, demand, availability of ingredients and feed, supply networks at national and ZOI level with the help of consultants (Annex *18*).

1.5.1.2: Issue call for business models/concepts from private sector businesses and organizations on increased availability of improved feed in ZOI (De heus)

WorldFish, in partnership with The Aquaculture and Fisheries Group of Wageningen University and De Heus has established a fully-funded PhD studentship in Bangladesh with WorldFish for fish nutrition field experiments. The partnership is now being extended to Myanmar where we plan to run trials with improved fish feeds. During the current covid-19 pandemic the WorldFish virtual survey of the fish value chain has been commented on by De Heus managers in that they state that they have not experienced transport difficulties of raw materials to their fish feed fabrication plants or distribution of the finished product. The proposed agreement between Fish for Livelihoods and De Heus is yet to signed because for current COVID pandemic._

1.5.2.3: Review and evaluate the business models/concepts, co-design business plans with selected applicants and sign grant agreements or contracts (cost sharing)

This activity been cancelled.

1.5.2.3 Facilitate implementation of agreed business plans, grant management and reporting

Linked with above section (1.5.2.3).

1.5.1.6: Use of feed calculator (mobile) app for small and medium scale feed producers for optimizing their feed formulation and ingredient selection

As elaborated in above section xxx 1.1.2.8 Shwe Ngar app is developed in partnership with Single Spark which included feed ingredients along with price and contact details of feed mills under operation in Myanmar. The project is building capacity of farmers on use of Shwe Ngar app including feed calculator and how to make homemade feed through practical demonstration.

1.5.1.7: Establish innovations for feed involving women

Context:

In terms of access to productive resources, women in Myanmar face more barriers than men in accessing or owning land e.g., participating in consultations and decision-making processes regarding land, and in utilizing dispute mechanisms[1]. Internalized gender roles, differences in education, skills and abilities, or lack of time or money cause social or cultural gender-inequalities[2]. In fisheries value chains men and women have distinct roles, and their socio-economic status influences their power relations. Women

constitute about half the population involved in fisheries development activities. In some developing regions women have become important fish entrepreneurs who control significant amounts of money, finance a variety of fish-based enterprises, and generate substantial returns for households and communities.

Progress:
The project has selected 03 women entrepreneurs and built their capacity on feed production using small-scale feed mills as test basis and see how it works in this works. The main aim of this activity would be to improve access to affordable feed at community level.

Sub-IR 1.6 Enhanced capacity and role of MFF and its associations in supporting SSA for improved management practices
Output 1.6.1: Institutional analysis of MFF performed and alternatives to enhance their capacity identified

Context: Myanmar Fisheries Federation (MFF) is an integral player and IP in Small-scale Aquaculture Investments for Livelihoods in Myanmar. Capacity development of MFF will benefit direct and indirect beneficiaries as well. A comprehensive institutional assessment of MFF will be carried out. The assessment will highlight major gaps in MFF organizational mechanisms. These gaps will be filled through various interventions exclusively designed. In addition to that, MFF will serve as an IP as a private entity in select region and townships. The market systems approach will be followed in implementation to strengthen value chains through different market actors involved and engaged with MFF. Market systems approach will be aimed through establishment of organizational system strengthening strategy for MFF. The strategy will focus on identified gaps through institutional assessment.

MFF proposals will be reviewed and it will be ensured that the interventions include novel and creative approaches benefitting SSA businesses. The new and novel mechanisms established with MFF will be piloted and replicated in other regions of Small-scale Aquaculture Investments for Livelihoods in Myanmar. MFF, having a national foot print, will help support the SSA business and farmers across the country. Implementation at the national level will be a challenge. A senior national advisor, consultant, will help MFF in coordination and implementation of all the arrangements and interventions designed through institutional assessments.

Progress:
Tasks
1.6.1.1: Facilitate participatory institutional analysis of the MFF and its associations to see their existing roles and capacity around production and market systems (with particular focus on supporting functions) and managing natural resources

MFF, an institution with presence all across Myanmar has the ability to impact beneficiaries directly and indirectly. The project will facilitate participatory institutional analysis of the MFF and its associations to see their existing roles and capacity around production and market systems (with particular focus on supporting functions) and managing natural resources. A consultant has been hired in order to carrying out an institutional appraisal of the MFF. In consultation with the team members the consultants will define in more detail the level of effort to be placed at national and state/regional levels as well as agreeing on the initial capacity levels requiring assistance – individual level, association level, organizational level etc., and in so doing will be expected mainly to 1) define initial capacity development areas requiring assistance and 2) decide on the scope. The overall objectives of this assignment would be to carry out an institutional appraisal of the MFF in designing capacity development plan in support of delivering on the Fish for Livelihoods project objectives. In this connection the consultant will:

- Assess MFF targets and strategic goals
- Develop competency frameworks
- Evaluate employee/association (team) competencies and needs for interventions
- Evaluate the organizational capacity of the MFF to deliver
- Design a capacity development plan for MFF support to the project

1.6.1.2: Proposals submitted by MFF in relation to developing inclusive market system and sustainable management practices which benefit the project beneficiaries

MFF has submitted proposals to support F4L activity as one of the implementing partners (IP) to help improving existing SSA, fisheries and associated market systems using their existing networks. It is assuming that they will come up with unique set of skills which will be exploited through this partnership.

1.6.1.3: Review the proposal to be submitted by MFF Kachin and MFF Southern Shan and facilitate drafting plan on implementation of the market systems identified

The proposals submitted by MFF Kachin and Southern Shan were already reviewed and finalized with the help of project team. Subsequently, a fixed amount sub-grant agreement between the WorldFish and the Myanmar Fisheries Federation (Kachin State) and Southern Shan have been signed on May 09, 2020 and June 3, 2020 respectively.

In order to efficiently implement and to closely monitor the activities, MFF Kachin State has formed a Project Management Committee with 9 members. MFF Kachin has recruited two local coordinators (Kachin State- MFF) and 4 Community Facilitators for implement the project and help monitoring field activities. MFF, Southern Shan have also formed a team to implement the project in Pindaya, Southern Shan. The details on number of project participants MFF is supporting in year 1 are provided in Table 16.

Table 16: Number of participants supported by MFF Kachin and MFF Southern Shan during first year.

<table>
<tr><th rowspan="2">Townships</th><th colspan="3">Nos of participants</th></tr>
<tr><th>Grow-out farmers</th><th>Nursery operators</th><th>Feed mill owners</th></tr>
<tr><td>Waingmaw</td><td>50</td><td>1</td><td>1</td></tr>
<tr><td>Myitkyina</td><td rowspan="3">30</td><td rowspan="3">1</td><td rowspan="3">1</td></tr>
<tr><td>Mogaung</td></tr>
<tr><td>Mohnyin</td></tr>
<tr><td>Mansi</td><td rowspan="2">20</td><td rowspan="2">1</td><td rowspan="2">1</td></tr>
<tr><td>Bhamo/Momauk</td></tr>
<tr><td>Pindaya</td><td>61</td><td>2</td><td></td></tr>
<tr><td>Total</td><td>161</td><td>5</td><td>3</td></tr>
</table>

1.6.1.4: Facilitate implementation of the systems identified above around SSA business

MFF conducted a survey to generate list of all aquaculture farms exists in Myitkyina, Waingmaw, Moenyhin, Moegaung, Bhamaw, Mansi and Pindaya. The survey has been carried out with the support from student from Myitkyina University and Kachin State MFF while MFF Southern Shan carried out the survey themselves. A total of 425 farmers (250 from Waingmaw and Myitkyina, and 175 from Bhamo) were surveyed so far (**Error! Reference source not found.**).

1.6.1.5: Coordinate implementation of the systems identified above around SSA business

MFF Shan: The first phase intervention focused on Pindaya township in Southern Shan State, Myanmar from June 1 until September 30, 2020. MFF Shan aimed to increase aquaculture production and income opportunities for 61 small-scale growers, 2 nurseries and 3 demo ponds.

Table 17: Summary of the planned activities and progress made so far by MFF (Pindaya) Southern Shan

Sr	Activities (planned)	Progress	Remark
1	Survey of project areas, pond locations and number confirmed	Completed in June, 2020	3days all staffs operating
2	Conduct participatory community appraisal (PCA) to initiate grower groups (10 villages)	Completed 10 villages; 66 people participated in the workshop	All villages operating PCA
3	Group formation and leader selection (3 grower groups)	9 grower groups are formed and an aquaculture promoter is selected for each group.	Group forming for fishermen is pending due to the fact that it involves a large group of people and thus risky to have a meeting or planning.
4	Monthly support to group leaders (3) pers*6mth*30 USD)	Agreement with the aqua. promoter of 3 grower groups; monthly support starts in May	
5	Staff capacity building (ToT and exposure)	2 staff, 3 days	Face to face and online training
6	Training (Basic aquaculture, nutrition and gender) for 3 grower groups (66 fish farmers)	Aquaculture concept sharing to promoters individually is 100% done.	some farmers are not well educated
7	Support (fish seed, feed, pond renovation, etc.) to 3 grower groups (61 fish farmers)	Completed selecting 61ponds that water is available in July and having farmers renovate or prepare ponds	Fish seed (fingerlings) and fish feed, harvest net, digital weighing will be supported in July August September.
8	Support to develop/renovate nursery ponds (2 ponds)	2 nursery ponds have been renovated.	Other ponds need selecting and developing.
9	Support for establishment of demo. Ponds (3 ponds)	3 demo ponds have been successfully identified, selected, renovated and prepared.	
10	provided water filter, vegetable seed and Nutation vinyl	Some of the fish farmers are more advance and realized the importance of pure water	

MFF Kachin:

Table 18: Summary of the planned activities and progress made so far by MFF Kachin

Sr. No	Month	Activities
1	May	- Hiring Staff for this project - Meeting with MFF-Kachin and all staff to discuss this project. - Survey project area, porn location and confirmed selection farmer. - Participating SSA online training.
2	June	- Technical support visit to farmer. - Species selection, stocking density and provide seed to farmers. - Procurement of fish seed. (Moegaung, Bahmaw). - SSA training for selection farmers (Moegaung, Bahmaw).
3	July	- SSA training for selection farmers (Myitkyina, Waingmaw). - Provide modulated training on nutrition and gender. - Procurement of fish seed. (Waingmaw, Myitkyina). - Support to pond preparation farmers.
4	August	- Provide record book to farmers. - Monitoring to farmers. - Attended to Leader ship training at Yangon.
5	September	- Training for Feed Mill operation. - Training for developing Nursery pond. - Providing support to private hatcheries.

Immediate impacts of project interventions as reported by MFF:

a. Project staff become more aware of fish farming and community relations
b) Becoming more interested in local Environmental farmers in fish farming
a. Increased enthusiasm among project farmers on fish farming
b. More focus on fish farming than ever before
c. More successful fish farming than ever before
d. Increased growth rate of farmed fish
c) Gaining more understanding with the staffs of F4L

IR 2. Increased access to food safe fish and fish products in the markets

Sub-IR 2.1 Clustered production using BAPs to improve direct marketability of product increased

Output 2.1.1: **Improved market linkages among aquaculture market actors**

Context: Value chain analysis of fish seed and feed is an integral part of Fish for Livelihoods market systems approach. The value chain of select regions and states will be carried out thorough consultants and internal Fish for Livelihoods team members. The analysis will identify who are the major actors; traders, retailers, suppliers, processors, and so on in the market.

The trend of fish supply and demand will be assessed and then all the information obtained through this process will be consolidated for market system approach and design. After collection of all relevant information, consultant will conduct workshops, one day each per region with Fish for Livelihoods team, partners, and stakeholders; DoF, MFF, and donors. The workshops will help in design of project interventions and customized solutions for each region depending on major market system actors. All the

ideas captured in these workshops will be documented in a report. Major recommendations on intervention designs will be reflected in field activities and will become part of the Fish for Livelihoods work plan in year 1 and in subsequent years.

Progress:

Tasks

2.1.1.1: Value chain analysis of fish feed and seed and market system strategy development

A comprehensive value chain analysis of each region has already been carried out and the results are shared with the team, USAID, partners, and other stakeholders. Value chain analysis of fish feed (partly covered din 1.5.1.1) and seed (covered in 1.4.1.1) and market system strategy development (Annex 18).

2.1.1.2: Market systems design workshop

A workshop was held in Yangon from 17th to 26th February 2020 with WorldFish and Fish for Livelihoods project partners such as the Myanmar Fisheries Federation (MFF) and NGOs. A full day was devoted for the each of the working areas i.e. Mandalay, Magway, Sagaing, Kachin, Shan East, and Shan South were allocated for the workshop. The primary objective of the seven-day workshop was to present, discuss and refine the findings and conclusions of the seeds and feeds value chain and the market constraints analysis. These refinements have been included in the final version of the inland fisheries market systems analysis. The ultimate objective of the workshop held in Yangon in February was to engage with project partners and stakeholders to design interventions, including "quick-wins", for each of the project areas that Fish for Livelihoods will deliver as part of its implementation strategy. The following Table 19contains key information derived around key segments of aquaculture and fisheries market through the market system analysis and used as a key document during the workshop to exploring areas of interventions by six areas of the project. Key outcomes of this workshops are available in the Annex 19 and Annex 21.

Table 19: Key segments of aquaculture and fisheries market through market system analysis

High feasibility for Fish for Livelihoods	**Medium feasibility for Fish for Livelihoods**	**Not feasible for Fish for Livelihoods**
Water - Limited data on and understanding of water availability and water/landscape dynamics - Lack of water quality testing services - Lack of advisory services on water use efficiency/water saving technologies for hatchery, nurseries and Small-Scale Aquaculture (SSA). **Inputs – Seeds** - Limited technical capacity of hatcheries to improve productivity and quality, diversify to other species, scale up to meet local demand, and innovate - Limited diversity of fish seeds available leading to a lack of diversity and limited availability of high-nutritious fish on markets - Limited availability and access to high quality and diverse broodstock - Lack of business management skills - Market distortion created by DoF hatcheries create market entry barriers for private hatcheries - Absence of small- and large-scale nursery operators	**Water** - Lack of access to and availability of water - Water purchase power for aquaculture as opposed to water usage for agriculture - Limited water retention capacity of soils in dry zones - Surface water and ground water pollution due to the utilisation of chemical fertilisers and pesticides, integrated chicken/pig and fish farms, and widespread utilisation of single use plastics - Conflict between rice farmers and SSA farmers **Land** - Difficulty to secure land ownership (and land use limit aquaculture investment and create concerns and fears for farmers - Lack of consistency, clarity and cost on the process to obtain pond license, lack of trust by farmers	**Leasehold fisheries** - No GIS for demarcation of Inn, tender, and open fishing grounds; license freshwater fishers; and ID cards technology are not being used; - Limited understanding and analysis of the Inn's management, the impact of stocking in open and natural water bodies its impact on the environment and biodiversity; - Conflict between companies managing inns and small holder aquaculture farmers and/or fisherman, conflict between fishing and farming areas; **Roads** - Lack of road system limits potential sites for cluster development around SSA hubs and limit quick access to market and market information **Electricity**

High feasibility for Fish for Livelihoods	Medium feasibility for Fish for Livelihoods	Not feasible for Fish for Livelihoods
- Limited technical know-how and skills to improve survival rate **Inputs - Feed** - Limited availability, accessibility and affordability of feed in rural areas - Lack of market research on feed - Increasing lack of feed ingredients and lack of innovation to find alternative ingredients for feed - Inconsistent quality of feed ingredients and vulnerability to food safety risks - Companies have difficulties to access financial services and do not offer financing options to farmers **Production – Grow-out ponds** - No or limited access and availability a of Small Indigenous Species (SIS, e.g. Mola), eels, prawns and non-exotic species seeds (e.g. Mrigal) - Lack of information about the quality of seeds and farmers/traders/aggregators are unable to distinguish between good and poor seeds - Limited knowledge and access to knowledge about fish and pond management including climate smart technologies - Limited or no access to fishing gears - Lack of collective initiatives to promote economies of scale, reduce transaction costs, and improve bargaining power. **Processing** - Limited supply of fish for processing - Lack of knowledge, productive assets and market linkages to process nutritious and healthy products and/or prevent nutritional degradation **Consumption and nutrition** - Consumers are not aware of the nutritional benefit of the different species of fish - Under five years old and children do not benefit from regular consumption of fish - Small size fish from the wild is expensive due to low and erratic supply **Logistics** - Ice is not always available and is expensive when ice factories are not located around harvesting point and markets **Market** - Low public awareness and weak adoption of food safety practices among vendors	and business on the outcome of the application they make to obtain a land title or a land use permit **Communication** - Market players are not exploiting ICT **Logistics** - The market is not performing well for high-value live and fresh fish, eels and shrimps due to a lack of cold chains and specific supply chains - Ice is expensive when ice factories are not located around harvesting point and markets **R&D** - Limited budget allocation to conduct R&D for value-added aquaculture in general and SSA in particular - Limited budget allocation to research, produce and maintain reliable statistics, geospatial and market data on inland fisheries in general and SSA in particular - Disconnect between research, innovation, development and market between DoF and the private sector - Human resources and capacity are inadequate to support effective resource management, training, and extension activities. **Industry bodies** - MFF is not reaching its potential to support SSA development as well as financial and technical support from third parties, or to act as the main focal point for coordination, planning, information sharing, and investment - MFF vision, mission and objectives do not seem to be formalised and coordinated at the central, state/region level and township level - Limited lobbying for small-scale fisher registration **Marketing and market linkages**	- Lack of availability of low cost power **Access to finance** - Limited financial access to banking facilities, high interest rates and collateral **Certification** - Lack of awareness of GAqP and GMP - Lack of training capacity by DoF, MFF, the private sector to create GAqP and/or GMP training modules and roll it out **Laws** - Farmland Law restricts the conversion of land registered for rice cultivation for any other permanent purposes without authorization being given - VFV Land Law contributed to weakening land tenure for small landholders - Farmers still face difficulties to get land titles and license for their existing ponds or do not want to declare/register their ponds - Farmers are worried because they cannot prove the ownership/legality of their ponds; - New aquaculture farmers are having difficulties getting a license and existing farmers are concerned with penalties they could get. **National Plans and Strategies** - The Myanmar Sustainable Development Plan does not sufficiently address the link between inland fisheries and sustainability. - The ADS does not include a road map, resourcing and monitoring plan to implement aquaculture related outputs **Tax**

High feasibility for Fish for Livelihoods	Medium feasibility for Fish for Livelihoods	Not feasible for Fish for Livelihoods
- Lack of facilities in the market to facilitate safe fish handling - Market vendors lack knowledge of product quality, cannot afford to invest/upgrade their stall/shop and lack basic business skills **Marketing and market linkages** - Weak bargaining power of farmers; pricing system primarily based on size and "freshness" (which refers mainly as 'fish is breathing') which disincentives quality, food safety, and nutritional value - Limited direct commercial linkages between producers and processors challenges the consistency of both quality and supply and limits opportunities for integration and value addition - Weak market information flows **Access to finance** - Lack of financial product providing small loans to SSA farmers - Risk aversion and lack of capacity (product design & finance) among some market players in the chain particularly farmers to avail of credit services - Inability among many farmers to provide collateral (e.g. land titles/land certification use) **Food safety** - Low public awareness and lack of hygiene across all functions in the value chain **Gender networks** - Lack of awareness and examples of successful gender associations/networks and lack of specific support available for women economic empowerment **Resource conservation** - Lack of support to the development of local community-led Environment Conservation Committee and Environmental Management Fund **Climate change** - No example of and research on climate-smart aquaculture technology and system in Myanmar and how these systems can help farmer adapt to and mitigate climate change **Informal rules** - Innovative mechanism pioneered by the DFID-funded Pyo Pin that provide an opportunity for communities to create more inclusive and resilience resource management and governance system is not being adapted for replication in the intervention area	- Poor marketing activities make it more difficult for SSA and SMEs to find new business opportunities and create partnerships with buyers **Gender** - The quality of sex-disaggregated and gender data on inland fisheries has been low and not systematic - Special needs of women in relation to child care are not being sufficiently considered by businesses employing women - Increased aquaculture production increase labour burdens on women and youth, and women are not involved in production-related decision (e.g. purchase of inputs) **National Plans and Strategies** - Lack of awareness of strategies and plans at the state/region and township level.	- Lack of clarity on revenue associated with licensing of inns, ponds and sale of seeds - Lack of clarity regarding the type of land converted to ponds, the actual conversion rate of farm land to aquaculture ponds and the net value of these conversions - Lack of innovation from the DoF to collect revenue without disrupting the market - Limited regularization of the status of illegally constructed ponds, if their operators are in possession of legal agricultural use rights and land is not the subject of land restitution claims.

High feasibility for Fish for Livelihoods	Medium feasibility for Fish for Livelihoods	Not feasible for Fish for Livelihoods
- Local norms on fish quality hinders promotion of food safety		

2.1.1.3: Stakeholders consultation workshop with fish market actors (wholesale, transport, retail, processing), and associations at national and ZOI level and identify priority intervention areas

On 19th March, the project team visited to Mobye fish market in Pekhon township. The purpose of market visit is 1) to observe the different types of fish species selling in Mobye and 2) to meet with fish retailers to get the information on fish market system. The most commonly selling fish species are Rohu, Common Carp, Intha Carp, Tilapia, Grass Carp, Silver Carp, Snakehead, Silver barb and Feather barb. Among the fish species, Rohu are importing from Yangon as it is less production from aquaculture and capture fishery in Pekhon. Other species are collecting from fisherman in Pekhon Lake. As production from aquaculture pond in local area, common carp, grass carp and tilapia are found in the market. Local intha carp species is high demand and the price is 8000 MMK per viss. The price of other species are ranging from 3500 MMK-4500 MKK per viss. The price is varied for fresh fish and dead fish. The imported fish are transported by car with ice box or bag from Yangon. Locally collecting fish are carried with ice or without ice. Normally retailer go to fisherman or middleman in the early morning to collect fish that they can sell out in a day. It is found the fishes are stored with ice at the back of selling display. Most of the retailers can sell out all fish which are meant to sell in one day. In term of investment retailers are using own capital to selling the fish.

The project team organized a meeting with dried fish processors in Nyaung Pin Thar village, Pekhon township. The purpose the meeting is 1) to observe the types of dried fish and 2) to know the dried fish processing market system. Majority of dried fish observed are snakehead, tilapia, feather barb and goby. Snakehead and tilapia dried fish the most commonly product in the dried fish market. To make the dried fish, fresh fish are bought from the fisherman in Pekhon lake. Dried fish processing is home based business and are sold either in the village or in Mobye market, Pekhon market and even export to Loikaw township. Dry fish can be produced year-round and production is more in the summer and winter season. In the raining season, the price of dried tilapia fish is higher compared to another season. The price is stable for snakehead and other species. The prices are Tilapia 3,500–4,500 Ks /viss, snakehead 4,000 ks/viss, feather barb 8,000 Ks/viss and Goby 4,000 Ks/viss. In the dried fish processing, only salt is the main ingredient and Trefle Gros leaf is used to kill bacteria in the raining season. Insecticide is also applied sometimes. In term of investment processors are using own capital for the dried fish processing. The team concluded to go for further study to understand the quality of the processed fish, supply and demand to make decisions on next steps.

Context:
Program team in lead with Training and Communications Coordinator will conduct Stakeholders consultation workshop with fish market actors (wholesale, transport, retail, processing), and associations at national and ZOI level and identify priority intervention areas.

2.1.1.4 Issue call for piloting fish marketing collectively engaging small-scale aquaculture farming households and explore possible fields of cooperation with buyers like Blue Circle Foods in USA among others
1,000 household beneficiary fish farmers have been selected in the project's work areas. Once basic pond preparation and aquaculture best management practice information has been delivered the possibility of clustered farming practices will be tested. Typically, this involves between 10 and 100 farmers in any given area interacting closely by virtual platforms such as the Greenway aquaculture smartphone application (or similar) and Facebook. In some cases, Viber or WhatsApp are also used. The sharing of information assists farmers with access to information about a range of inputs (fish seed, feed, water, fertilizer) and markets

(harvesting costs, market prices, market demand, volume required, seasonality, transport costs). In addition, information on how to avoid covid-19 is being delivered. When the cluster or collective operates as a coordinated unit there are usually benefits regarding the economy of scale. Thus far the work has reached the virtual training stage. The project is in contact with the German wholesale group METRO in Myanmar regarding the direct marketing of quality fish. Contacts with foreign buyers has been put on hold during the current closure of the export market.

2.1.1.5 Issue call for strategies of intervention /action plans on the identified priority areas
This activity will be done immediately after COVID 19 crisis.

2.1.1.6 Review proposals submitted on priority areas of intervention and on piloting fish marketing collectively and engaging small-scale aquaculture farming households and explore possible fields of cooperation with buyers like Blue Circle Foods in USA

This activity will be done immediately after COVID 19 crisis.

Sub IR 2.2 Reduced post-harvest loss
Output 2.2.1: Enhanced capacity of fish processing and fresh fish trading actors to adopt food safety practices
Context:
Field experience shows there is poor observance on food safety practices and limited understanding on characteristics of quality fish among supply chain actors that result to loss of income because of early deterioration of fish, and consequently, harming the health of consumers. Fish for Livelihoods provides training to various actors in the aquaculture fish supply chain to increase their knowledge on the importance of observing food safety practices and applying good methods of quality control, as well fish preservation methods that can help in boosting their income and promote good health and nutrition to consumers.

In addition, Fish for Livelihoods links with private sector companies such as media agencies, financial entities, among others to stir interest on the growing potential of small-scale aquaculture market in creating opportunities for income and for involving women in entrepreneurial activities.

Progress:
Tasks
2.2.1.1: Consultation workshop with finance institutions, ICT companies', media organizations, advertising agencies to increase engagement of private sector in aquaculture markets.

Due to COVID-19 pandemic, this workshop will be organized in year 2.

2.2.1.2. Facilitate development of national fish health management plan through a consultative process led by Dept. of Fisheries & MFF

2.2.1.3: Capacity building and providing information to fish-based product processors and fresh fish collectors/traders align to food safety standards.

Before above task was undertaken, Fish for Livelihoods circulated the call for proposal for assessing the supply chain of aquaculture fresh fish and other fish-based products in the intervention townships as there is gap of information in the sector. The key objectives of this call were as follows. In-depth understanding on the current processes, networks and practices of fresh fish and fish-based products (dried fish, smoked fish, fermented fish) supply chain actors 1) fish and fish-based product producers, 2) collectors, 3) traders, 4) fish wholesalers, 5) fish retailers, and 6) processors, as well as preferences and practices of local people

in consuming aquaculture fish and fish-based products (including farmed or non-farmed small indigenous fish species) in the areas mentioned above.

- Existing practices on how fish products are produced, preserved and marketed
- Weaknesses and opportunities of the aquaculture fish and fish-based product supply chain sector, and recommendations that lead to improve practices on delivering safe and good quality fresh fish and fish-based products to local consumers, as well as promote gender inclusiveness resulting to better income and nutrition for households.

Asper consultancy firm was hired to carry out these assessments with regard to trading and processing innovations in fish value chains. The work is divided in two phases; scoping and roll out implementation. The preliminary work for scoping is conducted by key informant interviews (KII) and focus group discussions (FGD) among market actors (fish processors, processed fish retailers and wholesalers, fresh fish retailers and wholesalers) on their current market structure.

- Initially, the plan was to conduct the data collection in 7 townships (Pekhon, Taunggyi, Madaya, Myitkyina, Bhamo, Salin, and Ngape) from 2nd week to 4th week of September but due to resurgence of new COVID-19 cases and restrictions imposed, the data collection for both KII and FGD are rescheduled in October and November, respectively. Meanwhile, consultants conducted an online training on the 2nd week of September on how to conduct key informant interviews and the use of kobo application among the community facilitators (25 participants) who will serve as the enumerators.

- Based on the findings from the scoping, consultants will help develop solutions and activities with the market actors that can improve their production and income. The identified solutions will be tested in selected project areas and will be scaled out before year 2 ends; the roll out implementation phase. Details on how Asper will work with F4L over next two quarters are available in Annex 20.

Output 2.2.2: Increased business opportunities around fish processing
Context
While aquaculture farming remains a male dominated activity in Myanmar, post-harvest activities e.g. marketing and processing are commonly led by women that results to increase income and better nutrition of the family. However, there are gaps of information that are focused on supporting the improvement of methods and processes of small-scale fish processors, thus, Fish for Livelihoods engages experts that uses bottom up and gender-inclusive approaches to help create applicable business model and innovative technology/ies.

Tasks

2.2.2.1: Assessment of fish processing and marketing mechanisms in the area.
This is integrated to above call for proposal for assessing supply chain actors (see section 2.2.1.3). The findings from the report will be reported at end of this year.

2.2.2.2: Issue call for business models/concepts from private sector businesses entities and organizations on improved post-harvest market.

Due to unfortunate circumstance, partnership with BoPinc did not push through, however, the work is taken over by Asper consultancy. This is related to output 2.2.1.3 above. After the scoping mission as mentioned earlier, the roll out phase will have the following activities~~; 1)~~ Co-designed extension package, including technical aspects related to fish handling and processing as well as business models and relevant

financial training through BoP women's empowering methods. 2) training and developing of extension materials, 3) Pilot testing of extension packages for different market actors (processors, retailers, etc.), and 4) scale out of the extension package in 7 townships. The progress of this partnership will be reported for next reporting period.

2.2.2.3: Review proposals submitted on business models/concepts from private sector businesses and organizations on improved post-harvest market linkages

Related to above point 2.2.2.2.

2.2.2.4. Facilitate implementation of agreed business models/concepts on improved post-harvest market linkages

This is related to above point. 2.2.1.3.

IR 3. Improved nutrition, food safety and Water, Sanitation and Hygiene practices

Sub-IR 3.1 Improved adoption of nutrition and wash behaviors
Context:
From observation and previous project experience, there is a limited awareness on importance of good nutrition and poor adherence of WASH and food safety practices among households that can lead to poor nutrition outcomes especially among young children. The Fish for Livelihoods team engages government institutions, NGOs, private sector and communities to gather information and understanding of the current practices and on-going activities related to nutrition and WASH that can help in designing relevant complementary activities and information focused on changing behaviors.
Progress:
Tasks
3.1.1.1: Review baseline findings to prioritize key nutrition issues and WASH behaviors to focus and who are the priority group to tailor community activities

Due to COVID-19 pandemic, baseline study started only in September 2020. We are waiting for the baseline report findings.

3.1.1.2: Consultation workshop with local and International NGO's working in health, nutrition and WASH in Kachin and Southern Shan

Due to COVID-19 restrictions, instead of conducting face to face workshop, an online consultation meeting was conducted separately for Kachin and Southern Shan led by the Human nutrition specialist of the project. There were 20 NGO staff invited to join the meeting but unfortunately, only 16 participants from non-partner NGOs working in agriculture, health, nutrition and WASH, as well as partners attended the meeting. The attendees shared their experiences in the areas that Fish for Livelihoods are working, and provided recommendations of possible areas that can be reached by the project through small scale aquaculture technology, nutrition and WASH trainings.

3.1.1.3: Developed and printed communication materials on nutrition and effective WASH behaviors based on the Essential Nutrition Actions and Essential Health Actions messages; includes the importance on consumption of micronutrient-rich small fish (SIS), farming SIS, etc.

Prior to distribution of various information, education, and communication (IEC) materials, Fish for Livelihoods team has compiled and conducted a review workshop on the different materials developed by

other WorldFish projects in Mandalay, the activity was participated by partners and selected farmers (in total 15 pax) in the area. Subsequently, the team created a pamphlet/leaflet that contains the key messages from the small-scale aquaculture and nutrition manual with emphasis on the importance of consuming fish and diverse food in improving nutrition. A total of 8,386 multiple IEC materials distributed in the project areas. Below table shows the list of IEC materials redesigned, developed, printed and distributed in the project communities.

Table 20: List of IEC materials developed

Name of IEC materials	Type of IEC materials	Key messages
Key messages on nutrition, WASH and COVID-19	Pamphlet	Basic nutrition, dietary diversity, nutrient value of fish, importance of handwashing, using improved toilets and drinking safe water, what to know about COVID-19 and the etiquettes
Benefits of consuming SIS for the first 1000 days of life	Poster	SIS when eaten whole provides Vitamin A, calcium, Iron, Zinc and essential fatty acids that is vital for growth and development
Small fish make you and your child smart and healthy	Poster	SIS can be integrated with large fish in homestead ponds, can be cooked in variety of dishes and can be eaten with vegetables to improve dietary diversity
Handwashing with soap and clean water at critical times	Poster	Importance of washing hands with soap and clean water; after going to the toilet, before preparing the food, after cleaning the child's bottom, before eating, before feeding the children/family to have a healthy and happy life.
Small fish-pumpkin balls recipe	card	It shows the basic ingredients and methods of preparing and cooking SIS with vegetables
WASH stickers	stickers	1. Washing hands with soap and clean water can save your life! 2. Hey! Do not leave without washing hands with soap! 3. Drink filtered water or boiled water for your health
Correct method of handwashing with soap and clean water	poster	It shows the 8 steps of washing hands with soap and clean water

3.1.1.6: Engage digital and ICT companies social to disseminate basic nutrition, effective WASH practices, and food safety messages to wider audience beyond the project participants.

Align to the current trend on the use of digital applications to disseminate information, Fish for Livelihoods team engaged~~s~~ Single Spark, a software company to digitize SSA, nutrition and WASH messages. The partnership can support in disseminating key information on basic nutrition, effective WASH practices, and importance of food safety (similar to section 1.1.2.8).

Shwe Ngar app(https://play.google.com/store/apps/details?id=nl.singlespark.goldenfish&hl=en) is currently available on google play store and in used. One of the modules/sections of the app is knowledge database; it contains Basic nutrition and WASH topics that users can read to get information on good infant and young child feeding practices, maternal nutrition, food safety and clean sanitation and hygiene. The module/ section is updated in the process.

In parallel to contracting Single spark for development of Shwe Ngar App, Fish for Livelihoods engaged with Village link (http://www.villagelink.co/), a local agriculture technology company through Htwet Toe

application to disseminate the use of the app and to share updates and information on basic nutrition, effective WASH practices and SSA technology. According to the latest report from village link, the nutrition information was viewed by 143,048 users and received reactions of 1,759 users. In addition, these information are cross posted to Htwet Toe's facebook page to widely reach the communities that are heavily reliant on facebook for news and information.

Sub-IR 3.2 Improved consumption of diverse, safe and nutritious food

Context:

Currently, there is a gap of information on the nutritional value and the quality of fish-based processed products that are commonly consumed by local people. Fish based processed products such as dried fish, smoked fish, fermented fish are nutrient-dense food that can fill nutrient needs especially for the vulnerable groups, and thus, important to ensure that it is safe and of good quality by analyzing these products to provide accurate information to consumers.

Processed fish and aquatic animal products, such as dried and fermented fish, are estimated to contribute to a third of total fish consumption. Understanding the unique contribution of micronutrients from this important food source is comprised by an absence of primary nutrient composition data. Recipe estimates and secondary data highlight these products as nutrient-dense foods that can contribute to intakes of at-risk nutrients, especially for vulnerable groups. The project will fill this knowledge gap by sampling commonly consumed fish-based products for laboratory analysis of macro and micronutrients.

In addition, to increase availability of nutritious and diverse food in rural households where undernutrition and micronutrient deficiencies exists, Fish for Livelihoods provide nutrient-rich small fish brood stock for farming and diverse vegetable and fruit seeds for planting in homestead gardens and pond embankments. In addition, as malnutrition is link to poor environment and poor hygiene, Fish for Livelihoods distributes WASH hardware e.g. latrine, water containers, and soaps to priority groups to facilitate adoption of effective behaviors resulting to improved nutrition.

Furthermore, to address underlying causes of malnutrition; poor nutrition knowledge and inadequate child feeding practices, Fish for Livelihoods provides knowledge and basic information on nutrition especially on the importance of eating fish, vegetables and having diverse diet to achieve good nutrition among rural households. As well as conducting social behavior change communication activities (e.g. role plays, demonstration, support groups, etc.) focusing on the barriers and the enablers of changing and adoption of good behaviors among priority group.

Progress:

Tasks

3.2.1.1: Food safety (and nutrient) analysis on local fish based processed products.

Commonly consumed Myanmar fish-based products have been identified through national consumption surveys and initial scoping local markets in the Fish for Livelihoods project townships. This forms the bases for which specific products require analysis. Local and international laboratory facilities are being identified and their respective resources and ability to analysis fish product sample for macro and micronutrient profiles required, full analysis requires international laboratory facilities.

In parallel, during the past 6 months, the need for developing fish-based product for vulnerable groups (infants over 6 months, young children and pregnant and lactating women) has been explored by meeting different private sector companies that shares similar vision as WorldFish on reducing malnutrition rates in the country, as well as have the capacity to pilot the activity. Consequently, to make the process transparent for interested companies, Fish for Livelihoods has circulated a call for proposal for companies to undertake this activity with the support of WorldFish team. The activity results will be reported in the coming 6-month period.

Due to the pandemic, this activity is postponed because of the inability of the researcher to collect multiple samples in different regions and states. In lieu to this activity, the project

contracted FedWell foods (http://www.fedwellfoods.com/), a local food company that produces and sells nutritious products in the country to pilot development of dried small fish powder product, the aim is to make local fish-based products available among vulnerable groups e.g. infants, young children and pregnant and lactating women. The detailed report of the Fedwell foods could be accessed at Annex 14.

In order to come up with the current dried small fish powder mixture, the team undergone 5 formulations of varying amount of the ingredients (e.g. dried small fish powder, chickpea powder, onion, garlic, sugar, and salt). After the sensory evaluation, the team decided that the mixture on below table makes the dishes acceptable for many. The addition of pepper takes out the fishy smell when the mixture is added to cooked food, while pepper may not be suitable for infants, the team take this to account by possibly packing it separately and not mix it with other ingredients.

Table 21: Ingredients used to prepare small fish powder

Fish species	Ingredients	Quantity
Mola	*Fish powder	*3 teaspoons
	*Chick pea powder	*1/2 teaspoon
	*Palm sugar	*1.5 teaspoons
	*Onion powder	*1/4 teaspoon
	*Garlic powder	*1/4 teaspoon
	*Pepper	*1/8 teaspoon

The mixture can be added to current FedWell Foods products such as rice porridge, soups and noodles to increase the nutrient quality of the dish. With the next round of funding, the plan is to conduct cost and market analyses and send the product for macronutrient, microbial, and heavy metal analyses at a local with international standards laboratory. The analyses ensure that the product is safe and fit for consumption.

3.2.1.2: Provision of seed kits depending on the types of seed identified that are grown in the area for vegetable dyke production among beneficiary households.

A total of 363 households (see annexes for detailed list) who received vegetable and fruit seeds (e.g. bottle gourd, eggplant, cucumber, chilli, mustard, tomato, long beans) from F4L. With the distribution, it will support in improving dietary diversity among household members especially children and women of reproductive age.

Table 22: Types of vegetable grown on and around pond-dikes

Implementing Partners	Areas	Total	# of HHs distributed		Types of vegetables and fruits
			Men	Women	
BRAC	Taunggyi	200	186	14	Carrot, Chilli, Lady Finger, Papaya
KMSS Pekhon	Pekhon	16	12	4	Bean, Lettuce, Cucumber,Mustard,Tomato
MFF Pindaya	Pindaya	34	33	1	lady finger, water cress, Roselle leaf
PACT	Salin	80	66	14	bitter gourd, bottle gourd, pumpkin and egg plant
	Ngape	33	22	11	long beans, bottle gourd, ridg gourd, Pumpkin and brinjal (Egg plant)
Total		**363**	**319**	**44**	

3.2.1.3 Provision of Small indigenous fish species (SIS) seed among beneficiary households

After stocking of large fish in homestead ponds, the activity is preceded by integration of SIS (e.g. Nga bel phyu (Mola), Ngar Maut Tot, Ngar Khone Ma (Pool barb), Ngar Zin Yine, etc.) into the ponds. A total of 261(Men- 232 Women-29) project participants (see annexes for detailed list). After 1-2 months of stocking, SIS can be partially harvested and can be consumed every week without spending money and the surplus can be sold for additional income. SIS eaten whole with vegetables provides a nutritious meal for the family.

Table 23: Promotion of SIS based carp polyculture

Implementing Partners	Areas	Total	# of ponds stocked		Type of SIS
			Men	Women	
BRAC	Taunggyi	85	76	9	Spotted barb,Burmese Loach
	Khin U	35	31	4	Nga bel phyu (Mola), Ngar Maut Tot, Ngar Khone Ma (Pool barb), Ngar Zin Yine
	Madaya	42	31	11	Ngar Khone Ma (Pool barb), Ngar Zin Yine, Ngar Maut Taut, Ngar Hpyin Tha Let, Ngar Maut Tot
KMSS Kengtung	Kengtung	78	68	10	Three spot gourami, Burmese barb and Spotted barb)
PACT	Ngape	21	15	6	Nga tha let Thoe (Burmese Loach)
Total		**261**	**221**	**40**	

3.2.1.4: Pilot testing of WASH package materials (e.g. soap, tippy taps, clay water filter, etc.) to increase adoption of improved WASH practices among beneficiary households.

Prior to distribution, Field coordinators and community facilitators conducted a participatory workshop that assessed WASH needs of the communities. Afterwards, CFs used a set of criterion to identify households who are eligible to receive handwashing stations, water filter and toilet bowls.

At the current period, there are a total of 406households who received WASH facilities (see annexes for detailed list). See below table for breakdown on the number and type of WASH facilities provided by the project. The distribution of WASH facilities enables household to practice effective WASH behaviors; use improved toilet for defecation and disposal of feces at all times, drink safe and treated water, and wash hands with soap and clean water at critical times/ occasions.

Table 24: Types of WASH materials distributed among project participants

Implementing Partners	Areas	# of HHs distributed					
		Handwashing stations with soap		Water filter		Toilet bowls with pipe	
		Men	Women	Men	Women	Men	Women
BRAC	Taunggyi			22	3	0	0
	Khin U	49	6	49	6	0	0
	Madaya	20	5	20	5	0	0
KMSS Pekhon	Pekhon	5	6	3	2	2	1
	Pinlaung	11	0	17	0	0	0
PACT	Salin	11	1	17	5	11	0
	Ngape	13	7	0	0	7	3
MFF Pindaya		0	0	20	0	0	0
Total		**109**	**25**	**148**	**21**	**20**	**4**

In addition, a phone interview was carried out by community facilitators in October to gather feedback on WASH hardware usage among randomly selected project participants (36 pax from Ngape, Salin, Khin U, Madaya, Taunggyi, Pekhon, Pindaya). Below are the key responses from the WASH users;

1. Explain the change in practices/behaviors among household members.

Majority of the users who received handwashing containers with soap reported to practice handwashing with soap at critical times/ occasions (after defecation, before cooking, before and after eating, after cleaning the child's bottom, after working in the field) regularly. Moreover, because the handwashing containers and soap are available and situated in conspicuous place, it helps in reminding to practice the behavior.

On the other hand, one user mentioned that at present, it is easier to promote the new behavior because people in the village are worried of catching COVID-19, hence, they wash hands with soap regularly as a preventative method.
While for those who received water filters, they reported that household members are only drinking filtered water nowadays. One user added that he is not worried that he will fall sick because he knows that the water he drinks is clean.

2. Explain the advantages and disadvantages in using particular WASH hardware.

Majority responded that one of the advantages in using handwashing containers and water filter is that it keeps them healthy, consequently, it saves them money because there is no need to buy medicines and go to health clinics for treatment.

On the other hand, according to users who received water filter, the main disadvantage of using it is that they have to wait for a period of time to drink water as the filter drips slowly. In addition, it was mentioned that once the filter breaks, they will need to find the replacement which is not available in the village and can be unaffordable.

3. Are there any changes in general well-being when you and your family members (especially young children) started adopting new WASH behaviors? Are they less sick, etc.?

Majority responded that they noticed that family members especially young children are not sick.
Moreover, the users expressed that they don't feel worried of falling sick because it is unlikely to happen since they have adopted the new behavior of washing hands with soap and drinking filtered water.

4. What are the reasons in maintaining this new behavior?

All of the users responded that they will continue practicing the behavior as it prevents from diseases and it will result to positive nutrition outcomes.

5. What are the reasons not continuing adoption of new behavior?

Two users mentioned that the only reason they will not able to continue drinking filtered water is when the filter breaks or when it needs replacement since they are unable to afford in buying a new one.

On the other hand, few users mentioned that those who will not continue practicing the behaviors are those who do not want to change and are fixed on traditional ways which can result in acquiring diseases.

6. What was/were the reaction of your neighbors or the community when they see that your family has new WASH facility and adopting to new WASH behavior?

Majority mentioned that their neighbors are following new practice of handwashing with soap regularly in their own homes because they learn from the users the benefits of practicing the behavior. However, there are few neighbors who are not unable to drink filtered water because the water filter is not available in the village but they shared that they are willing to practice as well if they have it at home.

7. Did the new facility and adoption of good practice among household members spark change among neighbors and the community? If yes, explain the change.

Majority of the users indicated that the change they observed is the adoption of handwashing with soap regularly by their neighbors. For users of water filter, few mentioned that their neighbors expressed that they want to purchase water filter in the future so they will have clean water at home and they can stop buying water from the bottle.

Below table shows the number of individuals using WASH hardware; toilet bowl with 107 individuals, water filter with 857 individuals, handwashing containers with 664 individuals and neighbors adopted to new WASH behavior with 175 households.

Table 25: Adoption/adaptation of WASH practices

SL#	Questions	PACT	BRAC	MFF Pindaya	KMSS Pekhon	Total
1	No. of farmers continue to use the toilet after receiving it?	21	N/A	N/A	3	24
2	No. of HH members continue to use the toilet after receiving it?	95	N/A	N/A	12	107
3	No. of farmers continue to use the water filter after receiving it?	22	105	20	21	168
4	No. of HH members continue to use the water filter after receiving it?	109	490	135	123	857
5	No. of farmers continue to use the handwashing stations with soap after receiving it?	32	80	N/A	21	133
6	No. of HH members continue to use the handwashing stations with soap after receiving it?	157	367	N/A	140	664
7	No. of farmers reported to practice handwashing with soap and clean water at critical times	110	80	N/A	136	326
8	No. of neigbouring households reported adopting to new WASH behavior (handwashing with soap, using improved toilet, drinking safe water) *spill over effect*	150	15	N/A	10	175

Sub – Intermediate Result (IR) 3.3: Improved diet diversity and food safety for young children and women of reproductive-age through SBCCs and nutrition education

Context

F4L addresses one of the underlying causes of malnutrition; poor nutrition knowledge and inadequate child feeding practices by providing knowledge and basic information on nutrition especially on the importance of eating fish, vegetables and utilizing a diverse diet to achieve good nutrition among rural households. As well as conducting social behavior change communication activities (e.g. role plays, demonstration, support groups, etc.) focusing on the barriers and the enablers of changing and adoption of good behaviors among priority groups.

Progress

Task/Activities (s)

3.3.1.1. Training and workshop on nutrition sensitive fish agri-food system to increase understanding on the linkage of agriculture/ aquaculture and nutrition in addressing malnutrition in Myanmar for implementing partners in selected townships

Face to face training was not possible due to COVID-19 restrictions, the Human Nutrition Specialist conducted an online training to the field coordinators (FCs) on 27th April, 2020. Afterwards, FCs delivered the training online to the community facilitators and aquaculture promoters with a total of 44 (19 women; 25 men) participants. The training enhanced the understanding of how our project can support in addressing the underlying causes of malnutrition in Myanmar; food insecurities, poor knowledge and poor infant and young child feeding practices and poor environment. In addition, the common assumptions when implementing nutrition sensitive projects such as; income lead to improve nutrition, women are the main participants of nutrition activities, etc. were also discussed by the participants.

3.3.1.2. Conduct of Training of Trainers focusing on nutrition especially on the consumption of fish and Small Indigenous fish and vegetables resulting in dietary diversity, and improved WASH practices to implementing partners.

Similar to above constraints, face to face training was not conducted. However, the FCs were able to deliver online training to a total of 51 (18 women; 33 Men) community facilitators and aquaculture promoters. In addition, when the restrictions due to COVID-19 eased, they were able to review the topics in person.

The topics covered were basic nutrition, such as infant and young child feeding, causes of malnutrition, food groups, vegetable and fruit production, effective WASH practices and postharvest and food safety and quality control.

3.3.1.3. Social Behavior Change communication activities on nutrition and improved WASH practices such as cooking demonstration, formation of Mothers support group, nutrition month campaigns, etc. at different venue (markets, health center, etc.) (Includes nutrition messages in SBCC strategy promoting consumption of nutrition fish)

For this reporting period, there are a total of 376 individuals (158 women; 218 Men) that were reached through nutrition awareness activities that were conducted in the project villages.

In light of the COVID-19 pandemic, the project provided PPE materials to 747 individuals (340 women; 407men) as a precautionary measure when in trainings or any event that requires being with other individuals. Moreover, provision of these materials reinforces the message that in order to protect ourselves and the community we need to act responsibly by wearing masks correctly and to wash hands with soap and water or use sanitizer at all times.

The above messages were highlighted again during the nutrition month campaign held in August. Every year, the National Nutrition Centre under the Ministry of Health and Sports celebrates nutrition month and encourages stakeholders to do the same putting emphasis on the importance of good nutrition for all people here in the country. Fish for Livelihoods and partners conducted multiple activities in the communities such as World Café, hanging of posters, cooking demonstration, nutrition talks, games, quizzes, and cooking competitions.

Banners with theme "Invest in Nutrition: Join hands in building the nation" and posters were put up in the venues, aside from that, pamphlets, recipe cards, soaps and masks were distributed to the attendees. A total of 575 (324women; 251men) individuals attended these events in Kengtung, Pekhon, Pinlaung, Pindaya, Taunggyi, Khin-U, Madaya, Salin, and Nga Phe. Women, men and children participated in the community's celebration while observing precautionary Covid-19 measures as directed by the national and local authorities.

In parallel to this, event photos were shared to USAID Communication's team and Village link team, these photos were featured in USAID Burma facebook page and Htwet Toe app, respectively.

8. Project management and cross-cutting

8.1 Activity management

a) **Implementation modality**

Some of the administrative activities were discussed under this section. On account of coordination and collaboration with USAID and Economic Growth (EG) office Burma, regular post award meetings were convened after the award. USAID EG office designated Mr. Travis Guymon activity manager for the Small-scale Aquaculture Investments for Livelihoods in Myanmar. He took active participation in the scoping mission and accompanied the team in some of the important regions. There remained an active involvement and engagement of USAID's EG office due to aquaculture and fisheries project. Also, this activity compliments other activities of USAID, for example MAPSA – an activity lead by IFPRI in the same regions where this activity will be implemented. There are many mutual interests as the MAPSA is conducting comprehensive research in food security and there is complementariness in fisheries and nutrition sector for both activities.

In house, WorldFish activity team has organized several internal meetings to review the progress, plan, and for programmatic and financial performance management. The project is being operated valuing relations and opinions of all Implementing Partners (IPs) and continuing in harmony. IPs took an active participation in these meetings and eventually the contracts were signed with them during the reporting period. However, at the end of the reporting period in March 2020, the COVID effects started impacting the implementation and had halt some of the important activities which would have been conducted if COVID 19 had not arrived. Nonetheless, COVID 19 pandemic and the crises gave WorldFish and IPs window of opportunities to adapt, innovate, and collaborate in this tough challenge. The project team and IPs are open to innovation and adaptation through learning. There will be much to report in the next report on how successfully the situation was tackled and new ways of implementation tried and tested in the challenging time.

b) Supporting project beneficiaries:

The project has plan to support project benefices with technical information on SSA, improving access to critical inputs (seed, feed and credit) and making linkages with aquaculture value chain actors. The team is working on how to develop market actors' capacity in order to ensure that market function well and poor are benefited. The lists of all participants are provided in Annex 1.

c) Project governance

We, the project team, believe that we and our partners have equal power and accountability. The only factor that might make one partner's perspective take precedence over another's is greater knowledge or more experience in a particular area of expertise. The roles and responsibilities are assigned within the team depending on the demands of the situation and the particular competencies of the partners.

d) **Human resources**

During the reporting quarter, Fish for Livelihoods project recruited 15 full time project staff for Yangon and Mandalay offices. This includes CoP, DCoP, Field Coordinators (4), Training and Communications Coordinator, M and E and Communications Specialist, M&E Coordinators (2), Finance and Operation Manager, Finance officers (2), Project Support Officer, Admin Assistant and Finance Assistant (Figure 5).

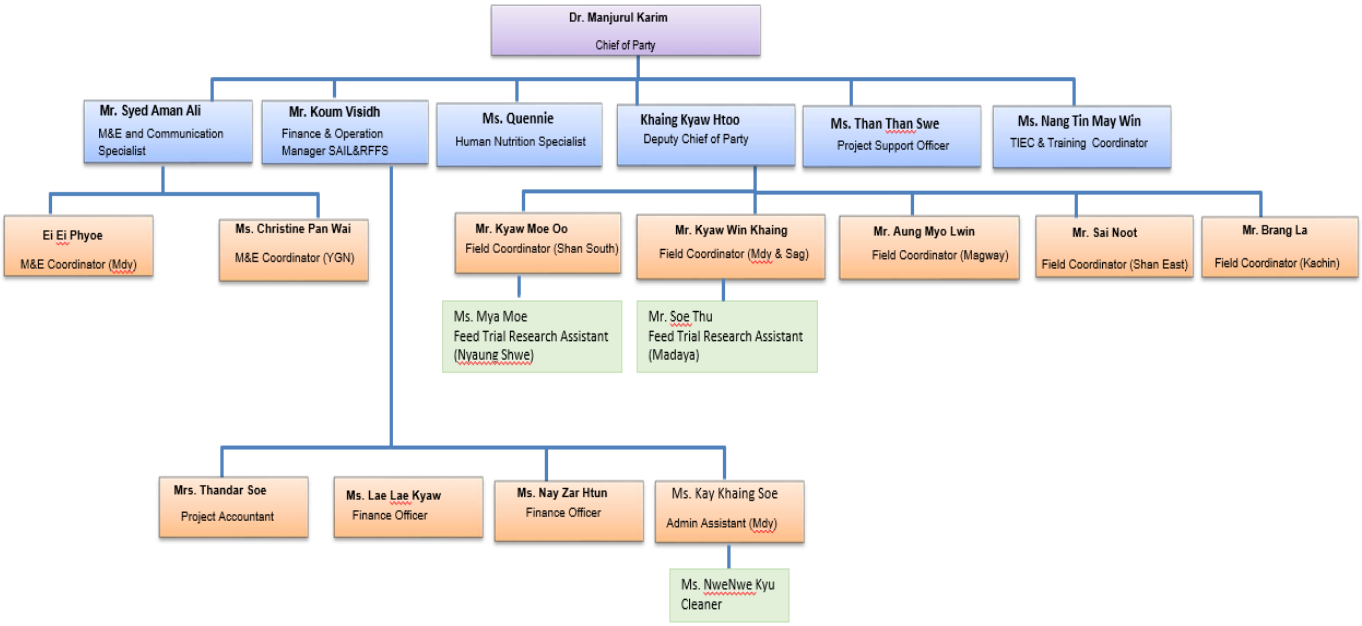


Figure 5: Organogram of Fish for Livelihoods

Fish 4 Livelihoods is also aiming to link with an important learning platform and networking opportunity for FRDN members, project partners and WorldFish to extend learning from the direct beneficiaries to indirect beneficiaries. This network and relationships are represented diagrammatically below that will also benefit from CGIAR network.

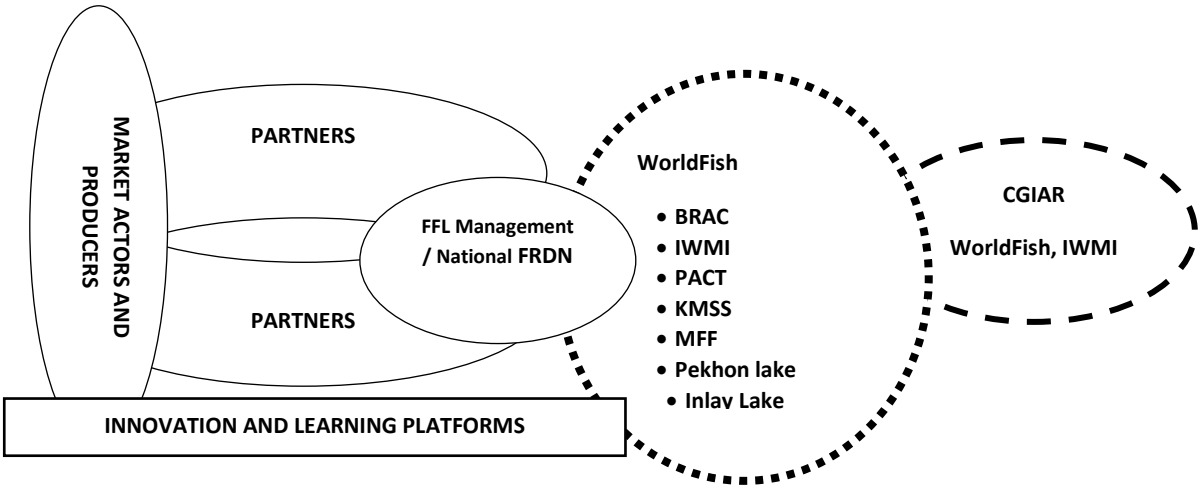


Figure 6: Fish for Livelihoods Network

The FFL Management Committee and National FRDN play an important role in supporting regional partners and FRDN groups with the extension of SSA knowledge to the regions, market actors, producer groups, and communities and they represent innovation and learning platforms. The networking and learning will be supported through village exchange visits, provision and dissemination of communication materials.

8.2. Grants and finance

Table 26: Fund Status (as of September 30th, 2020)

Fund Status	Amount (USD)
Fund (Year 1) (Period from 01 Oct. 2019 to 30 Sep. 2020	2,000,000
Expenditure (Period from 01 Oct to 31 Dec 2019)	173,738
Expenditure (Period from 01 Jan to 31 Mar 2020)	422,501
Expenditure (Period from 01 Apr to 30 Jun 2020)	417,232
Expenditure (Period from 01 Jul to 30 Aug 2020)	920,556
Cumulative Expenditures up to 30 Sep 2020	1,934,027
Balance As of 30 Sep 2020	65,973
% of Spending	97%

**Figures are rounded*

Note:
Fund has been reached WorldFish's bank account on 23 October 2019 with the amount of USD 1,960,000, i.e. net of CSP USD 40,000.

Budget versus Expenditures for this reporting period (from October 2019 to September 2020)

Table 27: Budget vs Expenditure (Oct 2019 - Sep 2020)

Budget description	**Budget** (Oct 2019 - Sep 2020)	**Expenditure** (Oct 2019 – Sep 2020)	**Balance**	**% spent**
Salary and Benefits	629,263	619,210	10,053	98%
Consultancy	183,851	232,109	(48,257)	126%
Travel	43,465	46,476	(3,010)	107%
Project Operating Expense (Field)	53,000	63,415	(10,415)	120%
Project Operating Expense (Office)	42,620	61,687	(19,067)	145%
Survey, Training and Workshops	30,802	34,206	(3,224)	110%
Communications and Publications	22,056	35,399	(13,344)	160%
Equipment	12,122	31,936	(19,814)	236%
Partners	643,837	480,849	162,898	75%
Indirect Costs	298,983	288,919	10,064	97%
CGIAR System Cost	40,000	40,000	0	100%
Total (USD)	**2,000,000**	**1,934,027**	**65,973**	**97%**

**Figures are rounded*

Expenditures Narrative

a. Salary and Benefits; the expenditure was USD 610,053, representing 98% of planned budget. The variance is due to the variation between estimated rates and actual costs (estimated > actual).
b. Consultancy; expenditure was exceeding the estimated budget- due to more consultancy services have been engaged and additional costs incurred during the period of COVID- restrictions.
c. Travel; was slightly higher than planned in order to provide safe transportation services to staff to carry out field visits.Project Operating Expense (Field); was exceeding the planned budget- by using unspent funds under partners to cover expenses for PPE-materials to prevent COVID- 19 transmission to communities, and providing fish seed and feed mill to farmers.
d. Project Operating Expense (Office); was more than estimated budget. More spending on setting up project office in Mandalay and renovation of the project of office at MFF, in Yangon to accommodate the increased number of project team.
e. Surveys/training/workshops; It is slightly over planned budget. Some surveys could be done remotely (mobile surveys).
f. Communications and publication; More printings, including posters, sign boards, T-shirts, pamphlets, etc.. have been done and additional costs incurred than planned.

g. Equipment and office facilities; When the budget had been revised, it was under-estimated, I.e. some equipment such as motorbikes, GPS, drones, cameras- had not been incorporated into budget revision.
h. Partner's; As expected that there would be some underspending under partners' budgets, even after the budget review and reductions. The underlying reasons were because i) of more restrictions have been imposed due to 2nd wave of COVID-outbreak and ii) some partners require longer time to close September 2020-booking account and to prepare final financial report for Year period (until September 2020)- so that their September 2020's expenses could not be captured into the progress expenditure report (from October 2019- September 2020) of the Year 1 period.

8.3. Monitoring Evaluation and Learning

Monitoring Evaluation & Learning (MEL) is an important and integral component of the project. WorldFish believes in effective Monitoring & Evaluation (M&E) of project activities to ascertain that the desired results are achieved and communities are impacted. WorldFish has an internal MEL system which will be used to monitor and track performance and learning will be embedded during the course of the implementation. However, in this reporting period the focus was to design a comprehensive activity MEL plan based on USAID format, design theory of change, logic model, logical framework, and selection and adoption of set of indicators that will measure the performance of the project.

One of the important tasks since the project inception was to resource MEL department with adequate human resource. An international MEL expert was hired along with a national M&E coordinator to equip the department with sufficient human resources. In addition to this, MEL department, in this reporting period, designed and developed project Theory of Change (ToC) along with results framework to capture and map the linkages that how the project results will be achieved through activities and outputs at various levels. MEL has provided continuous assistance to project activities in field and to all the activities where and when was required.

MEL team has played a pivotal role in the design and development of work plan and further elaborating it into detailed implementation plan (DIP). Additionally, MEL department has an additional role to lead project communications portfolio and that's why they worked closely with the communications team and helped them in designing different communication products for the project. All the support and assistance before, during, and after the workshops conducted during the period was leveraged to the program team.

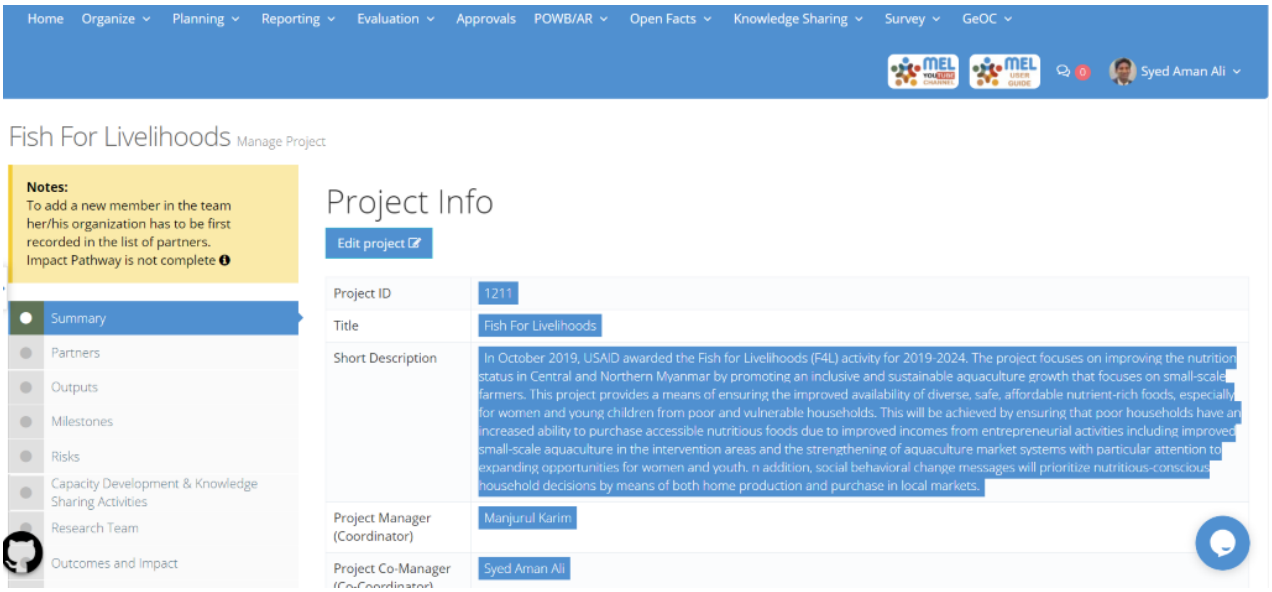
MEL department lead the project baseline which was supposed to be conducted during the reporting period. However, due to the COVID 19 pandemic the data collection was not possible despite the selection of the data collection. A team of seasoned and high-level researchers from Tokyo University helped WorldFish in designing methodology, survey questionnaire, and sampling. They will do the analysis and prepare the baseline report as well. The final draft of survey questionnaire is developed with multiple revisions and is ready for pilot testing as soon as the situation will be back to normal and enumerators will be allowed to collect the data from the field. The survey questionnaire is designed to address the needs of the project indicators which will measure the project performance. Baseline report will provide a prudent data on setting realistic targets for the project on most of the indicators. Additionally, this will help establishing a benchmark that will be achieved by the end of the project.

One of the major contributions from MEL was the development of activity MEL plan. Activity MEL plan is a document that illustrates how the project performance will be measured during the LoP. Activity MEL plan was designed and multiple revisions were discussed with USAID specially on indicators and the rationale of their selection. The other major sections of MEL plan constitute how and when the data will be collected from field as well as on the indicators. It discusses the ToC, project results framework and the potential linkages of IRs with sub-IRs. Activity MEL plan is a live document that will be

reviewed intermittently and the changes will be adopted on the basis of learning during the implementation of the project.

WorldFish MEL Platform:

WorldFIsh MEL platform is a central CGIAR platform that capture, record, collect, analyze, and archive data of all CGIAR centers as a central repository. "Fish for Livelihoods" data and key documents are uploaded and archived in the MEL platform. This data is accessible to WorldFish higher management for their review and if they want to make decision based on the data. In addition to that, communication products can be accessed and shared with broader external audiences using this platform. The platform can be directly accessed at (https://mel.cgiar.org/) and the activity page could be accessed at (https://mel.cgiar.org/projects/1211) A screenshot below illustrating how does the project page looks like in the MEL platform.



Indicators Achievement:

Despite challenges of COVID-19, "Fish for Livelihoods" accomplished significant numbers on five indicators. The activity was able to engage more than 2000 participants with different interventions; training, in kind assistance, WASH, nutrition, fish seeds, access to credit to mention few. The table below provides the information on the indicator's achievements for the Year-1.

Table 28: List of indicators with targets and achievement made so far

Indicator	Targets Overall	Target Year-1	Achievement Year-1	Gender	Type
EG.3-2: Number of individuals participating in USG food security programs [IM-level]	10,000	1,000	**2215**	Male = **1474** Female = **741**	Farmers SSA = **1148** Nursery, Hatchery Farmers = **44** Fishers = **92** Community Pond Member Leaders = **4**

Indicator	Targets Overall	Target Year-1	Achievement Year-1	Gender	Type
					IPs Staff Trained = **116** HH members who accessed WASH services = **811**
E.G. 3.2-24: Number of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance	60% of 10,000	600	743 (62%)	Male = **654** Female = **89**	SSA Farmers = 743
GNDR 2: Percentage of female participants in USG-assisted programs designed to increase access to productive economic resources [IM-level]	30%	30%	17%	N/A	N/A
HL.8.2-2: Number of people gaining access to a basic sanitation service as a result of USG assistance [IM-level]	TBD	TBD	110	Male = **53** Female = **57**	Rural Residence = **110**

8.4. Gender and youth

Fish for Livelihoods has implemented the commitment to gender integration during the project inception phase through a participatory workshop to inform the design of the gender mainstreaming throughout all pathways of the Fish for Livelihoods project.

On the 15th and 16th January 2020, 19 participants of which 68% were WorldFish staff and remaining were project partners, attended the two-day Fish for Livelihoods Gender Integration Workshop in Yangon (Annex 22). Fish for Livelihoods engaged senior specialist gender input from the KIT Royal Tropical Institute in the design and jointly facilitated workshop by Dr Julie Newton (KIT) and Jessica Scott (WorldFish).

The overall goal of the workshop was to help WorldFish Fish for Livelihoods staff and partners understand what gender integration implies for Small-scale Aquaculture Investments for Livelihoods in Myanmar. The workshop provided a starting point for supporting project staff to prioritize relevant gender outcomes and identify feasible and realistic gender integration strategies to achieve the development and gender objectives of the project/program.

The achieved objectives of the workshop include:

- Jointly identified the key gender outcomes to be achieved in the project.
- Jointly identified key areas in the project where gender integration can take place.

- Fostered enthusiasm and learning for gender; this included core gender concepts for participants with less experience in gender and built on gender training previously provided to WorldFish staff and partners in 2017,18 and 19.

This was achieved through:

- Revision of the Fish for Livelihoods theory of change to integrate gender throughout the project.
- Identified priority gender outcomes and relevant gender strategies for different impact pathways of Small-scale Aquaculture Investments for Livelihoods in Myanmar, forming the gender building blocks for each pathway and IR.
- Identified where there is need for better gender integration in layers of data required for different outputs and identify strategy/next steps to meet these needs.
- Reviewed opportunities to better integrate gender into MEL.

Outputs from the workshop can be seen in the updated work plan, where gender is not a standalone activity line, though a vertical intersection across all IRs with clear gender integration points for the relevant IR activity. The facilitators synthesized the workshop findings, risks and opportunities and detailed entry points for each IR in the Gender Strategy Building Blocks document, this serves as detailed reference for the respective IR leader and team to apply when implementing their activity.

Further gender analysis is required for more detailed design of specific interventions and will be gathered through the baseline survey and community appraisal when fieldwork recommences. These meetings will be important to ascertain what different women and men want and need in terms of program along the fish value chain and within the three pathways of Small-scale Aquaculture Investments for Livelihoods in Myanmar.

Gender and Social Inclusion Workshop:

The workshop aimed to support the project team and the partners in order to ensure the integration of gender and social aspects in the project implementation. The structure of the workshop was designed to recall their existing knowledge on the concepts and discussions were framed around their experiences while working in the field to look for possible solutions to the major issues or to find a possible way to approach them if they were out of their hands. The key messages were taken from 1) Gender integration workshop by KIT, 2020 and 2) Love, A. & Weber, N. (eds.) (2020). *Make Me a Change Agent: An SBC Resource for WASH, Agriculture, and Livelihoods Activities*. Based on the Make Me a Change Agent resource published by The TOPS Program in 2015. Washington, DC: SCALE Award and PRO-WASH Award.

Participants

The workshop was held on August 25, 2020 and was intended for the field facilitators from WorldFish and the partner organisations; IWMI, MFF, KMSS, Brac, Pact, Inle Lake Authority, and Pekhon Inn Conservation Committee. They were held using MS Teams in two sessions with around 20 people in each session. It was separated into two sessions to allow every participant to take part in the discussions and to avoid confusion it might cause because of limited network connection.

Discussions

- The discussion points were prepared with questions for the participants before diving into the concepts. The gender integration in all aspects of the project was briefly discussed.
- The participants discussed some of the gender issues they faced where they worked and what to do if there were not direct solutions on it.

- The discussions were around social norms within the communities, in particular, when the questions on the ownership were asked in a community, most of the participants would mention men's names. It is not only because of the social norms but also the patriarchal structure of the country. Most of the fixed assets were registered under men's names, and it was considered the right practice whereas men are considered as head of the household according to the formal family registration.
- The prejudices and realisation of own's culture were also discussed because it is important for the staffs who are working with the different communities in order to understand and respect the differences.
- The misconception between women empowerment and gender equality was also discussed. For example, what if a man told a woman that if they asked for women empowerment, they should plough the rice like a man while a man can cover more than a woman does. It reached to the discussion that what if a woman wants to do a job which is initially considered men's job, and there are women who are stronger than men and sometimes social norms restrict them not to perform the same as men.

Recommendations

- Although everything from the presentation slides were mentioned during the workshop, it was impossible to evaluate the understanding of each participants.
- At least one long face-to-face workshop is recommended as the complementary.
- The Power Point presentation of the session is annexed at Annex 23.
-

8.5. Environment/climate change

Climate change and environmental degradation has impacted our globe in an unprecedented manner since the beginning of 21st century. According to Global Climate Risk Index 2019 report, Myanmar is amongst the top three most climate affected countries in the world for the last two decades. Climate change directly impacts the food security and hit hard the downtrodden segments in a country. More than 60% of animal protein in Myanmar is obtained from Fish. The climate hit could be felt by the fisheries and especially the small holders whom livelihoods are associated with small-scale aquaculture. The risks and dangers associated to the climate change would be mitigated for sustainable growth.

Fish for Livelihoods builds an overwhelming emphasis on environment and builds strategy to mitigate hazardous environmental impacts. For this, an Environmental Monitoring Mitigation Plan (EMMP) is would be developed and implemented to ensure that the project won't affect the climate adversely. The ToRs of EMMP are developed and advertised and an international consultant was hired to develop EMMP not only for this project rather for the whole Myanmar. The considerations weregiven to the incumbent who has the requisite knowledge of USAID environmental regulations (Reg 216), including key rules and regulations, and policies on environment and climate. The WorldFish, for this assignment, ensured that the intervention in Myanmar would make positive contributions towards better environment and water management practices. Do no harm is one of the core principles of WorldFish and, this will be followed here as well. The international consultant came up with a comprehensive EMMP that could be adopted for the remaining life of the project.

ENVIRONMENTAL MITIGATION AND MONITORING PLAN (EMMP)

The EMMP for project farm ponds, hatcheries and nurseries on the following pages is in part generic due to the delay caused by COVID-19 travel restrictions that prevented the consultant from visiting all of the sample field sites. It is useful for interim purposes, and will be supplemented by provisions for fish processors as well as additional farm ponds, feed mills, hatcheries and nurseries, as data become available.

The EEMP is a living document, to be updated as new data become available (Annex 29). The monitoring responsibilities should be re-formatted by the monitor(s) into tables for each class of mitigators (farmer, facility operator, F4L project manager, contractor) by grouping items for monitoring under the period headings:

Environmental and social impacts are often related to lack of good management at the appropriate scale. They may occur as a consequence of inappropriate design, site selection, construction, farm operations, and/or processing and other supply chain activities. Many impacts such as disease outbreaks, water diversion and use, and habitat loss and degradation, are cumulative over time. Responsible aquaculture requires not only consideration of impacts at the farm level, but cumulative impacts at the larger landscape and watershed scale. Expansion beyond a system's carrying capacity will have negative consequences even with well-run individual aquaculture operations. The cumulative effect of fish die-offs in enclosed water bodies (e.g. bays, small coves, and lakes) where excessive permitting of fish cage culture farms resulting from excessive organic loadings from feed and fish excrement can result in anoxic water conditions. Die offs also have down-stream impacts on feed suppliers, processors, and marketers.

The mitigation hierarchy principles are defined below. Each of the principles is applied in order, starting with the topmost principle. 1) Avoidance: measures taken to avoid creating impacts from the outset (including direct, indirect and cumulative impacts), such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity. 2) Minimization: measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts) that cannot be completely avoided.

3) Rehabilitation/restoration: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/or minimized.
4) Offset: measures taken to compensate for any significant residual, adverse impacts that cannot be avoided, minimized and/or rehabilitated or restored, in order to achieve no net loss or preferably a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity. 5) Compensation: measures to recompense, make good or pay damages for loss of biodiversity caused by a project that can fall short of achieving no net loss or a net gain. For instance, this may occur if: conservation actions have been planned to achieve no net loss; losses and gains of biodiversity have been quantified; no mechanism is in place for long term implementation; it may be impossible to offset the impacts; or compensation payments are used for training, capacity building, research or other outcomes that will not result in measurable conservation outcomes on the ground.

8.6. Communications

Communications plays a key role to inform project beneficiaries, internal and external audiences on how the project is doing in terms of results accomplishments. An effective communications strategy targets different audience with tailor made products depending on the information to be shared with each of them. Communication could be done through advocacy and resource mobilization to change behavior. The role of communications is vital to share and disseminate information with the different group of stakeholders including market actors.

The project from the onset tried to build innovative and novel communications products for the internal and external audiences. A coherent document in the shape of project branding guidelines was needed which was developed in close consultation with USAID communications team. This document provides that how to design communication products customized for different groups of audiences (external and internal). The standardization of messages to be delivered to the audiences throughout

the LoP was detailed in the document. Subsequently, the document outlines the criteria on design, layout, and standard messages for the communications products.

As a cross cutting theme, the communications department helped the program team to brand all the work carried out so far. Be it designing the communication products for the workshops (banners, standees, vinyl, etc.), development of Information Education Communication (IEC) materials (fact sheet, roll out banners, pamphlets, brochures etc.) and incorporating informative messages on COVID 19 and its precautions in all the designed products.

IR 3 of the project revolves around the importance of good nutrition and adoption of effective WASH practices. A large part of this component will be achieved through social behavior change communication (SBCC) activities. Communication department helped in designing communication methods, tools, and products for nutrition and WASH. One of the consistent messages delivered through these products was on COVID 19 which hit Myanmar in late March; however, the need was forecasted before from the situation of the entire world. The importance of Personal Protective Equipment (PPE) for the beneficiaries while dealing with market actors is another area which were discussed through these communication products. The list of some of the major communication products developed are as follows and, these are accessible in Annex *24* as well.

- Farmer record book (FRB) - pond management & record book keeping
- Fish feed nutrition & feed management in aquaculture pamphlet
- Fish for Livelihoods project animation video
- Nursery pond management for Carp species
- Nutrition and COVID-19 pamphlets
- Small-Scale Aquaculture (SSA) and COVID-19 pamphlets
- Fish for Livelihoods, Why Fish Pamphlets
- Fish for Livelihoods, Poster_1000 days
- Fish for Livelihoods, Poster_Myanmar_Mola Comic Story
- Fish for Livelihoods, Recipe Card Fish Pumpkin Ball
- Fish for Livelihoods, Partial Harvest
- Fish for Livelihoods, Q&A_MM_FA_
- Hand Washing Poster
- Hatchery Booklet Burmese
- Hatchery Pamphlet English
- Nursery Pamphlet
- Knowledge Database for Shwe Ngar App
- Regular Fertilization to substitute Feeding
- Seed Transportation
- SIS fish Polyculture Management
- ToT manual
- WASH Practices
- Fish for Livelihoods, Branding guidelines and templates
- Program Brief_2020-08_USAID Nutrition approaches in the Fish for Livelihoods
- CAARP Integrated Agriculture and Aquaculture Management training
- Infographic_Tilapia_The plain truth
- Poster Important factors for a healthy and happy family, Flowers

Shwe Ngar (Golden Fish) Mobile phone application

Amidst the unprecedented challenge of COVID-19, the importance of mobile data collection using innovative technological tools has been growing and new norm across the globe. Mobile phone

applications, online and offline software programs, and remote data collection tools are at the center of the communities serving as eyes and ears for decision makers with a limited or no access to travel and physically observe programmatic activities.

Myanmar, a country where 60% of the animal protein comes from aquatic foods – mainly fish, was hit with COVID-19 in March 2020. The outbreak disrupted some of the field activities for various projects, however, the physical monitoring became a huge challenge because of the travel restrictions imposed by the governments. WorldFish Myanmar in one of their projects, Fish for Livelihoods funded by USAID, took this challenge as an opportunity and designed a customized mobile phone application "Shwe Ngar (Golden Fish)" with the help of an international company, Single spark.

On 13th October 2020, WorldFish Myanmar office with support and help from USAID Burma office, launched Shwe Ngar mobile application in a virtual event. The panelists in the launch have a broader representation of delegates from United States Agency for International Development (USAID), WorldFish, Department of Fisheries (DoF), and private sectors notable Myanmar Fisheries Federation (MFF). The launch was broadcast via Zoom call and was simultaneously stream live at USAID Burma Facebook page.

This launch of Shwe Ngar application engaged significant members on both mediums. The Zoom call recorded 187 participants who joined this virtual launch. The viewership during the live stream peaked till 135 whereas more than five thousand viewers watched the launch video during first two weeks of launching this app.

The Figure 9 below depicts the home screens of four modules of the mobile application.

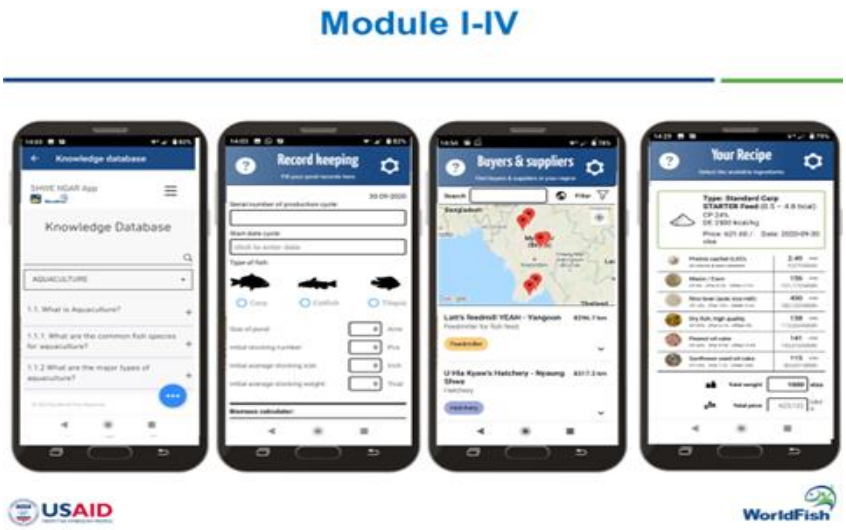


Figure 9: Modules of Shwe Ngar Mobile Application

As of November 10th, 2020, after around a month of the launch, Shwe Ngar application has been downloaded by 364 users. The application is available in English and Burmese providing amazing opportunities to users to take advantage from this great innovation for Myanmar. The Shwe Ngar application is embedded and integrated with an existing major agriculture application Village link (*Annex 25*).

In addition, F4L is also collaborating with Greenovator and sharing key messages, newsletters, technologies and related documents through their Greenway app. The table below depicts the number of users on the Green way mobile application. The number of users who are fish farmers and their associated activities tracked as of October 2020.

Total registered users on Greenway application	299,972
Total fish farmers	6,872
Registered as fish technicians	1,740
Traders	52
Others (who interest in Fishery)	99
Total	**8,763**

These Fish farmers posed 654 questions in the discussion section. Out of 654, 627 (96%) questions were answered successfully from the representative who sat at the hotline to answer queries.

Village Link, Htet Toe mobile application: "Fish for Livelihoods" innovatively engaged external audiences and targeted them with electronic communications channels using mobile phone applications. As part of heightening visibility of IEC material and increased outreach in Myanmar, one of the commonly used agricultural mobile application – Htet Toe, was embedded with the Shwe Ngar application. The content disseminated via Htet Toe application about fisheries, SSA farming, fish stocking, nutrition, and COVID-19 is viewed 356,426 times by users. The videos are watched 372,467 times with more than 41,000 "likes, reaction count, comment, save, and share". In addition, the users posted 74 questions who were responded adequately. In terms of the capacity building of WorldFish and IPs staff, village link delivered training to 28 staff for better understanding of the application on how it works with farmers. The details of the numbers can be seen in the Annex 25.

8.7. Capacity development

Reviewing SSA Manual and Participatory Rural Appraisal Workshop

Introduction: Small Scale Aquaculture Investment for Livelihood team organized, with the support of the USAID, the workshop was on reviewing on Small-Scale Aquaculture technology Manual and Participatory Rural Appraisal tools at Victoria Palace Hotel in Mandalay. The workshop was conducted on 12th March 2020 which brought together teams of WorldFish, Myanmar Fisheries Federation and Implementation Partners such as Building Resources Across Communities (BRAC) and Karuna Mission Social Solidarity (KMSS) and where participants acknowledged that broader initiative for good training materials and effective training result.

The specific objectives of the workshop were as follow;

- To review the technical support flow
- To review and modify topics in Small- Scale Aquaculture manual
- To review the methodology and follow up action plans of each module
- To review Participatory Rural Appraisal tools and technical support after training

Summary on proceedings

The workshop was attended by 15 participants from Yangon, Mandalay, Magway, Pehkon, Shwebo and Nyaung Shwe from Building Resources Across Communities (BRAC), Karuna Mission Social Solidarity (KMSS), PACT Myanmar, Myanmar Fisheries Federation and WorldFish.

The workshop constituted a good opportunity to foster the networking among Field Coordinators and Community Facilitators and the sharing of knowledge on technical and training experience in the context of improved methodology, post training activities and effective development delivery and results. The workshop met their objectives of reviewing the technical support flow, modifying topics in Small-Scale Aquaculture manual, methodology and the development of new approaches in delivering Small Scale Aquaculture Technology and Participatory Rural Appraisal Tools and post training activities. Participants shared their own experience in delivering the training. Participants reviewed all the topics, methodology from three modules and Participatory Community Appraisal. Participants emphasized professional discussion, evaluation and feedback of the proposed changes for Small-Scale Aquaculture manual. As a result, this workshop enables to modify the Small- Scale Aquaculture manual that engages audience with understandable and usable key messages with various methods, flows logically for better learning and able to apply in fisheries production.

Small-Scale Aquaculture Technology, Nutrition and WASH key messages online training

Introduction: Field Coordinators of Small-Scale Aquaculture Investment for Livelihood team organized, with the support of the USAID, the online trainings were provided on Small-Scale Aquaculture technology, Nutrition, Water, Sanitation and Hygiene (WASH) and COVID- 19 messages to our implementation partners.

Prior to above mentioned training plan, one hour of online Nutrition and WASH knowledge sharing training was provided on 27th April 2020 to Field Coordinators by Quennie Vi Rizaldo, Human Nutrition Specialist (Sustainable Aquaculture) from WorldFish. The purpose of the activity was to update the current activities, reinforce the understanding of the linkage of agriculture/ aquaculture and nutrition among field team, ensure that the presentation is delivered effectively to Community Facilitators and Aquaculture Promoters by the Field Coordinators. Last but not least, to gather ideas on the next nutrition and water, sanitation and hygiene (WASH) activities.

As a result, participants understood the importance of integrating gender, water, sanitation and hygiene into other development priorities such as good nutrition to achieve its objective of health households and communities in Aquaculture fields.

The specific objectives of the online training are as follow;
At the end of the training, the participants will be able to

- Repair dike and bottom of pond, eradicating of aquatic weed, removing carnivores and non-cultured fish
- Manage pond preparation of filling water, application of lime and fertilizer
- Determine different fish species, habitat and its stocking density
- Manage supplementary feeding and dragging chain
- Identify some common problems and its probable remedy
- Practice partial harvesting, re-stocking and complete harvesting
- Understand the nutritional value of fish and food groups
- Understand intergenerational cycle of malnutrition
- Practice dyke production

- Keep the environment clean
- Practice good storage and food handling
- Understand how to protect from Coronavirus (COVID 19)
- Wash hands systematically with water and soap

Following Table 29 is the agenda for Basic Aquaculture Technology, Nutrition and Water, Sanitation and Hygiene online training.

Table 29: Agenda for basic aquaculture technology and WASH

Sections	Topics	Time
Section 1	**Key steps on Small-Scale Aquaculture Technology**	**3 hrs.**
1	Pre-stocking Management	Day 1 (1 ½ hrs.)
2	Fish Stocking Management	
3	Post-Stocking Management	Day 2 (1 ½ hrs.)
4	General Management	
5	Fish Harvesting	
Section 2	**Key Messages on Nutrition and WASH**	**1 ½ hrs.**
1	Basic Food Groups, Micronutrients and Balanced Diet	Day 3
2	Intergenerational Cycle of Malnutrition	
3	Breastfeeding and Complementary Feeding	
4	Nutritional Value of Fish	
5	Vegetable Garden Production (Dyke Production)	
6	Keeping the Environment Clean	
7	Proper Hand Washing	
8	Good Storage and Food Handling	

Summary on training:

The online training was attended by Community Facilitators from Taungyi, Pekhon, Madaya, Khin U, Myeikhtila, Yangon, Salin, Ngaphe, Mandalay and Nyaung Shwe, a total of 30 participants from Building Resources Across Communities (BRAC), Karuna Mission Social Solidarity (KMSS), PACT Myanmar and Field Coordinators from WorldFish the purpose of cross learning.

The key messages on Small-Scale Aquaculture, Nutrition and Water, Sanitation and Hygiene online training were conducted for three days with 1 and half hours of each section. Trainings were conducted simultaneously in all regions. Following tables are participants attendance records for Basic Aquaculture Technology, Nutrition and Water, Sanitation and Hygiene online training delivered in April 2020 and details information of the participants.

Although it was online training, the participants were very active and enthusiastic in learning, sharing their experience and eager to attend more training. It was a result of good practice and an extra effort of all Field Coordinators to help participants persist and learn deeply. Field coordinators facilitated online courses via social applications such as Viber, Skypes and Messenger and produced participant-learning outcomes comparable to those of in-person courses.

Participants interact with the Field Coordinator and their peers while motivate themselves, direct and regulate their own learning, and seek appropriate help when needed during online training. The

online training met their objectives in promoting awareness of the technical information to make positive change of knowledge among participants about Small-Scale Aquaculture in the household pond and to improve human nutrition, promotes increasing the consumption of fish and vegetables.

Institutional Capacity Building:

Institutional capacity building has been an integral part of the activity. There is an ongoing capacity building of all the IPs who are the partners in activity implementation. The IPs staff members were exposed to different capacity building initiatives, primarily through training. In August, 2020 "Fish for Livelihoods" invited key personnel of IPs to Yangon, and delivered them training conducted by external trainers in extension management, photography, leadership, and team building. In addition to this, day to day routine support and assistance remained a regular feature throughout the implementation during entire year.

A major activity focused on institutional capacity building was the institutional assessment of the Myanmar Fisheries Federation (MFF). A team of seasoned consultants were hired to assess MFF and, frame recommendations based on their findings where are the gaps that need to be filled. The consultants thoroughly examined MFF internal capacity and proposed vivid recommendations to be implemented in remaining years.

The consultants have identified five gaps within the MFF, ranked with the highest priority issue at the top, which demand swift and expansive attention:1. Financial aptitude, 2. Capacity building of fisheries and ecological best practices, 3. Visibility & reporting back to WorldFish from MFF, 4. Market Systems Approach to develop and involve more actors, and 5. Human Resources and Administration processes. The identified gaps will be filled with an increased amount of support, collaboration, and coordination by and between WorldFish and MFF in Year-2 and beyond. The detailed report can be accessed at Annex 26.

Training Delivery to SSA Farmers;

Delivery of trainings to farmers on different modules through in person and virtual mediums has been the key success of the activity in Year-1. Due to the COVID-19 restrictions, WorldFish and IPs staff members delivered trainings to farmers via online using Viber, WhatsApp, Skype, and MS Teams. There were issues around internet connectivity as well as limited mobile access to SSA farmers, but still, all farmers who are supported in Year-1 received trainings from the project. These trainings are delivered on six (6) modules to 1,178 SSA farmers. Most of the SSA farmers, in fact all, received multiple trainings on all the modules. In aggregate, "Fish for Livelihoods" activity arranged trainings for more than 6,000 attendees, with an SSA farmer attending 6 training on average (Table 30).

From May to Oct 2020, training delivered to SSA farmers

Online training and face to face training delivery are on-going in a COVID-19 smart-manner in small groups wearing appropriate face mask and make sure the social distancing in the Fish for Livelihoods project areas by the IPs staffs with the support of Fish for Livelihoods Field Coordinators.

MFF staff, supported by the Fish for Livelihood Field Coordinator, Kachin Region, have continued to deliver training services on sustainable small-scale aquaculture. The one-day SSA and nutrition pamphlet training with key messages on pre-stocking management pond preparation and stocking management, post stocking and harvesting managing, and nutrition and WASH practices was conducted and 100 (2 women) people attended the training course in May and June 2020. Delivery of three modules on small-scale

aquaculture (SSA) and improved human nutrition was finished in June 2020 and 100 (2 women) people attended.

BRAC staff, supported by the Fish for Livelihood Field Coordinator, Mandalay Region, have continued to deliver training services on sustainable small-scale aquaculture. The two-day SSA and nutrition pamphlet training with key messages on pre-stocking management pond preparation and stocking management, post stocking and harvesting managing, and nutrition and WASH practices was conducted and 200 (35 women) people attended the training course in Khin U in June 2020, and the one-day SSA and nutrition pamphlet training with key messages on pre-stocking management pond preparation and stocking management, post stocking and harvesting managing, and nutrition and WASH practices was conducted and 200 (31 women) people attended the training course in Madaya in June and July 2020. Delivery of three modules on small-scale aquaculture (SSA) and improved human nutrition was finished in Khin U, 72 (12 women) people attended and in Madaya, 39 (8 women) people attended in Sep 2020.

PACT Myanmar staff, supported by the Fish for Livelihood Field Coordinator, Magway Region, have continued to deliver training services on sustainable small-scale aquaculture. The three-day SSA and nutrition pamphlet training with key messages was conducted. On day one, 174 (29 women) people attended the training course on pre-stocking management pond preparation and stocking management, and on day two, 176 (29 women) people attended the training course on post stocking and harvesting managing, and on day three, 177 (29 women) people attended the training course on nutrition and WASH practices in Salin in June 2020. Delivery of one module on small-scale aquaculture (SSA) and improved human nutrition was finished in Sep 2020, and 25 (7 women) people attended and the training is ongoing for the two modules in Ngape.

KMSS Kentung staff, supported by the Fish for Livelihood Field Coordinator, Eastern Shan State, have continued to deliver training services on sustainable small-scale aquaculture. The one-day SSA and nutrition pamphlet training with key messages on pre-stocking management pond preparation and stocking management, post stocking and harvesting managing, and nutrition and WASH practices was conducted and 100 (10 women) people attended the training course in Tachileik in June 2020. Delivery of three modules on small-scale aquaculture (SSA) and improved human nutrition was finished in Oct 2020 and 100 (8 women) people attended.

MFF Myanmar staff, supported by the Fish for Livelihood Field Coordinator, Southern Shan State, have continued to deliver training services on sustainable small-scale aquaculture. The two-day SSA and nutrition pamphlet training with key messages was conducted. On day one, 42 (10 women) people attended the training course on pre-stocking management pond preparation and stocking management, and post stocking and harvesting managing, and on day two, 75 (26 women) people attended the training course on nutrition and WASH practices in Pindaya in July and August 2020.

KMSS Southern Shan staff, supported by the Fish for Livelihood Field Coordinator, Southern Shan State, have continued to deliver training services on sustainable small-scale aquaculture. The one-day SSA and nutrition pamphlet training with key messages on pre-stocking management pond preparation and stocking management, post stocking and harvesting managing, and nutrition and WASH practices was conducted, and 58 (1 women) people attended the training course in Pekhon, and 13 people attended the training course in Pin Laung in June 2020.

BRAC staff, supported by the Fish for Livelihood Field Coordinator, Southern Shan State, have continued to deliver training services on sustainable small-scale aquaculture. The three-day SSA and nutrition pamphlet training with key messages was conducted. On day one, 176 (22 women) people attended the training course on pre-stocking management pond preparation and stocking management, and on day two, 173 (22 women) people attended the training course on post stocking and harvesting managing, and on day three, 176 (22 women) people attended the training course on nutrition and WASH

practices in Taunggyi in June and July 2020. Delivery of three modules on small-scale aquaculture (SSA) and improved human nutrition was finished in Sep 2020 and 206 (12 women) people attended.

Table 30: Number of men and women participants received trainings

Training topic	Start Date	Finish Date	# of men trained	# of women trained	Total # Trained
Pamphlet training on pre-stocking management pond preparation and stocking management	28-May-2020	8-Aug-2020	923	140	1,063
Pamphlet training on post stocking and harvesting managing	28-May-2020	8-Aug-2020	922	140	1,062
Pamphlet training on nutrition and WASH practices	28-May-2020	9-Aug-2020	942	157	1,099
SSA Module 01 training	28-May-2020	20-Sep-2020	501	49	550
SSA Module 02 training	28-May-2020	09-Oct-2020	361	39	400
SSA Module 03 training	28-May-2020	23-Sep-2020	483	42	525
Total			**4,132**	**567**	**4,699**

Annex 1: Number on participants involved in F4L in different activities (small scale aquaculture farmers, demonstration farmers, vegetable growers, small indigenous fish, feed mills, saving funds)

Annex 2: Report on scoping mission - township selection (attached)

Annex 3: Report on scoping mission - existing market system (attached)

Annex 4: List of attendees of the inception workshop (attached)

Annex 5: Pictorial description of major activities conducted during the reporting period (attached)

Annex 6: Year 1 annual report submitted by IWMI (attached)

Annex 7: Summary of literature review completed by IWMI (attached)

Annex 8: Summary of temporal data collected by IWMI (attached)

Annex 9: Maps of stations developed by IWMI (attached)

Annex 10: Spatial data generated by IWMI (attached)

Annex 11: Data on rice production developed by IWMI (attached)

Annex 12: Observations made during data formatting and analysis (attached)

Annex 13: Gender strategy building blocks (attached)

Annex 14: Report submitted by FedWell (attached)

Annex 15: Gender integration matrix (attached)

Annex 16: Comprehensive analysis on existing credit delivery systems in Myanmar (attached)

Annex 17: List of IPs staff and Aquaculture Promoters (attached)

Annex 18: Market system strategy report (attached)

Annex 19: Market system workshop outputs (attached)

Annex 20: Work plan submitted by Apser for post-harvest innovation (attached)

Annex 21: Market system workshop ppt (attached)

Annex 22: Report on gender workshop (attached)

Annex 23: Report (ppt) on gender workshop-2 (attached)

Annex 24: List of IEC materials developed by F4L (attached)

Annex 25: Report submitting by Village link on the Htwet Toe application (attached)

Annex 26: Institutional assessment of Myanmar Fisheries Federation (MFF) (attached)

Annex 27: List of Activity staff

SL #	Name	Position	Start Date	End Date	Project	Office Location (DOF/MFF/MDL)	Contact number	Email
1	Naw Nay Thah Paw	Grants & HR Specialist	19-Aug-15	18-Aug-20	All projects	DoF	9420038769	n.naw@cgiar.org
2	Kyaw Win Khaing	Field Coordinator	19-Sep-16	31-Jan-23	F4L	MDL	9422522847	k.khaing@cgiar.org
3	Mo Mo Aung	M&E Coordinator	25-Sep-17	6-Apr-20	F4L	MFF	9256046101	A.Mo@cgiar.org
4	Sai Noot	Field Coordinator	1-May-20	30-Apr-23	F4L	Keng Tung	95250718	s.noot@cgiar.org
5	May Thu Oo	Financial Controller	3-Dec-18	2-May-21	All projects	DoF	9450024375	mt.oo@cgiar.org
6	Than Than Swe	Project Support Officer	9-Oct-19	15-Dec-20	F4L	MFF	9692300398	t.swe@cgiar.org
7	Wae Win Khaing	Social Awareness Officer	6-Nov-19	31-Aug-20	F4L+Gender	DoF	9973670505	W.Khaing@cgiar.org
8	Thandar Soe	Project Accountant	14-Jan-20	13-Jan-21	F4L	MFF	09444431270, 09423000270	Thandar.Soe@cgiar.org
9	Nay Zar Tun	Finance Officer	3-Feb-20	2-Feb-23	F4L	MDL	09972949778/09259340229	n.tun@cgiar.org
10	Kyaw Moe Oo	Field Coordinator	1-Feb-20	31-Jan-23	F4L	Shan	9953872093	k.oo@cgiar.org
11	Lae Lae Kyaw	Finance Officer	24-Feb-20	23-Feb-23	F4L	MFF	9422026565	l.kyaw@cgiar.org
12	Latt Thiri Aung	Training & Communication Coordinator	1-Mar-20	20-Sep-20	F4L	MFF	9421029684	l.aung@cgiar.org
13	Aung Myo Lwin	Field Coordinator	1-Mar-20	28-Feb-23	F4L	Magway	09 422487980	Aung.lwin@cgiar.org
14	Kyaw Min Thein	Deputy Chief of Party	9-Mar-20	23-Oct-20	F4L	MDL	9260288332	K.Thein@cgiar.org
15	Naw Christine Pan Wai	M&E Coordinator	1-Apr-20	31-Mar-23	F4L	MFF	9764662438	C.Wai@cgiar.org

SL #	Name	Position	Start Date	End Date	Project	Office Location (DOF/MFF/MDL)	Contact number	Email
16	Daw Than Than Win	Cleaner	1-Apr-20	31-Mar-21	F4L	MFF	9253223079	N/A
17	Khin Maung Soe	National Program Advisor	1-Apr-20	31-Mar-21	Allprojects	DoF	09972361448 /09794668682	m.khin@cgiar.org
18	Michael J. Akester	Country Director	1-Feb-17	31-Jan-23	Allprojects	DoF	9961167548	M.akester@cgiar.org
19	Manjurul Karim	Chief of Party	1-May-09	31-Oct-22	F4L	MFF	9970449868	m.karim@cgiar.org
20	Jessica Scott	Research Fellow	30-Oct-17	7-Oct-20	F4L+Gender	DoF	9970622286	Jessica.scott@cgiar.org
21	Visidh Koum	Finance and Operations Manager (SAIL&RFF2)	23-Apr-07	3-Nov-22	F4L 75%	MFF	9964750191	V.Koum@cgiar.org
22	Syed Aman Ali	M&E and Communication Specialist	13-Jan-20	12-Jan-23	F4L	MFF	9766142645	S.A.Ali@cgiar.org
23	Quennie Vi Rizaldo	Human Nutrition Specialist	4-Nov-19	3-Nov-22	F4L	MFF	9457794034	Q.Rizaldo@cgiar.org
24	Kay Khaing Soe	Admin Assistant	6-Jul-20	5-Jul-21	F4L	MDL	9401088964	
25	New New Kyu	Cleaner	1-Jul-20	30-Jun-21	F4L+MYSAP	MDL	9402624011	
26	Brang La	Field Coordinator	5-Oct-20	4-Oct-23	F4L	Kachin	9423437380	B.La@cgiar.org
27	Su Su Mon	Field and Data Associate	1-Oct-20	30-Sep-21	F4L	Nyaung Shwe	9795801562	s.mon@cgiar.org
28	Mya Moe	Feed trial Research Assistant	2-Sep-20	1-Jan-21	F4L	Nyaung Shwe	9428363900	m.moe@worldfishcenter.org
29	Soe Thu	Feed trial Research Assistant	15-Oct-20	14-Feb-21	F4L	Madaya	9962648300	s.thu@worldfishcenter.org

Annex 28: Year 1 2019- 2020 sub-grants status of the Activity

No.	Sub-Grant #	Sub-Grantees contact detail and address	Business title	IR & Sub IR	Area coverage	Targeted beneficiaries (No)	Agreement period	Program budget (USD)		
								Contribution		Total budget
								Activity	Sub-Grantee	
1	PLA12196	**IWMI: Dr. Sonali Senaratana Sellamuttu** Head Office: 127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka, P.O. Box 2075, Kolombo, Sri Lanka Email: s.senaratnasellamuttu@CGIAR.ORG	Country Representative	- Series of maps with location of ponds and their linkages to both surface water (rivers, lakes) and groundwater - A database of spatial (land cover, soils, DEM) maps and temporal data (climate, hydrology) will be established - A fully function hydrological model for the Upper Ayeyarwady. The model will be further refined calibrated and validated during the implantation phase. - Report on future climate change in the Upper Ayeyarwady river basin	Upper Ayeyarwady	N/A	01 Nov 2019- 30 Sep 2020			220,865
2	PLA12240	**BRAC:** **Dr. ATM Tariqul Islam** Myanmar Office: No. 17, Pyi Thar Yar Housing, Street 1, 15 Ward, Yankin Township, Yangon, Myanmar Email: tariqul.i@brac.net	Country Representative	- support aquaculture grow-out farmers to increase fish production and income - provide technical training to feed mill operation and nursery pond - support to establish feed mill and develop nursery pond - support to 3 private hatcheries in Nyaung Shwe, support (visits, monitoring performance) to - 3 existing hatcheries in Madaya, Khin-U and Nyaung Shwe	Across 3 regions: Madaya (Mandalay); Khin-U (Sagaing); Nyaung Shwe (Shan)	600	01 Feb 2020- 30 Sep 2020			166,339
3	PLA12244	**KMSS- Pekhon:** **Joseph Cet Lynn** Pekhon Office: Sacred Heart Cathedral, Main Road, Nyaung Kone 2 Quarter, Pekhon 06061, (Southern) Shan State, Myanmar Email: kmss.pekhon@gmail.com	Director	-Promoters and group leaders will receive training from staff and gain experience from exposure trips, then they will share their learning and experience to other members in the groups and potential growers/fishermen. -Start-up support for fishermen/fish folks and grower groups (feed mill, nursing ponds) -Support to excavation/preparation of new small ponds -Conduct fish value chain and market assessment	Pekhon and Pinlaung	100	01 Feb 2020- 30 Sep 2020			60,341

No.	Sub-Grant #	Sub-Grantees contact detail and address	Business title	IR & Sub IR	Area coverage	Targeted beneficiaries (No)	Agreement period	Program budget (USD)		
								Contribution		Total budget
								Activity	Sub-Grantee	
4	PLA12257	**PACT Institute (Myanmar):** **Natasha Sakolsky** Myanmar office: Crystal tower 15th floor, Kyun taw street, Kamaryut Township, Myanmar **Email:** nsakolsky@pactworld.org	Executive Director	-Support aquaculture grow-out farmers to increase fish production and income -Support to develop nursery pond -Support fish seed market linkage -Support to 3 private hatcheries in Magway support (visits, monitoring performance) to		300	01 Mar 2020- 30 Sep 2020			120,000
5	PLA12272	**KMSS- Kengtung:** **Ah Chu Stephen** Office address: Catholic Church Compound, Soom Saat Hill, Eastern Shan State, Kengtung (06231), Myanmar Email: kkssdirector@gmail.com	Executive Director	-Promoters and group leaders will receive training from staff and gain experience from exposure trips, then they will share their learning and experience to other members in the groups and potential growers/fishermen. -Start-up support for fishermen/fishfolks and grower groups (feed mill, nursing ponds) --Conduct fish value chain and market assessment	Eastern Shan State	100	1 May to 30 September 2020			41,358
6	PLA12270	**MFF – Kachin:** **U Ingarla Tung** Address: No 99, Thidar Ward, Myitkyina Township, Kachin Email: nganglatawng84@gmail.com	Chairman	-Promoters and group leaders will receive training from staff -Provide support to grow out farmer -Support to excavation/ preparation of new small ponds (if needed) -Technical support to feed miller and nursery pond -Start up support to establish feed mill and develop nursery pond _Provide support to 2 private hatcheries	Kachin State	100	1 April – 30 September 2020			20,496

No.	Sub-Grant #	Sub-Grantees contact detail and address	Business title	IR & Sub IR	Area coverage	Targeted beneficiaries (No)	Agreement period	Program budget (USD)		
								Contribution		Total budget
								Activity	Sub-Grantee	
7	**PLA12295**	**MFF- Pindaya** **U Myat Min Soe** Address: 15/9, Ngway Kyal Phyu St, Ye Aye Kwin Ward, Taunggyi Township, Southern Shan state Email: gldn12@gmail.com	Secretary	-Formation of farmer groups and selection of aquaculture promoters - Promoters and group leaders will receive training from staff -Provide support to grow out farmer -Start up support to establish develop 2 nursery ponds and 3 demo-ponds	Shn State	50	1 June- 30 September 2020			14,800
8		**Inle Lake Authority Office Committee** **U Myat Min Soe** Address: Inle Lake Authority Office, Win ward, Kan Nar St, Nyaung Shwe township, Southern Shan state Email: nle.lakeauthority@gmail.com	Assistant Secretary	-Technical support and assistance for breeding, nursing program and trials -Support brood production and demonstration pond	Naung Shwe Township, Southern Shan State		5 April - 30 September 2020			4,000
9		**Pekhon Lake Conservation Committee** **U Aung Thein** Address: Pekhon Lake Committee Office, Pehon-Loi Kaw road, la Wal village, Pekhon Township, Southern Shan state Email: pklakeconservationcommittee@gmail.com	Secretary	- Technical support and assistance for breeding, nursing program and trials -Provide fisherman with knowledge on sustainable fisheries resources conversation and access to fish -Carry out lake conversation activities	Pekhon Township, Southern Shan State		1 May – 30 September 2020			5,553

No.	Sub-Grant #	Sub-Grantees contact detail and address	Business title	IR & Sub IR	Area coverage	Targeted beneficiaries (No)	Agreement period	Program budget (USD)		
								Contribution		Total budget
								Activity	Sub-Grantee	
10		**U Zar Ni Aung-Hatchery** **U Zar Ni Aung** Address: Aug Thit Sar Ward, Kalay Township Phone Nr.: 09-259862944	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Sagaing Division. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Sagaing Division, Kalay Township		15 March – 30 September 2020	Hatchery's roof and floor renovation, tank renovation and walkway development	1,448	4,172
11		**U Sai Htun Latt-Hatchery** **U Sai Htun Latt** Address: Noung Kone Village, Noung Kone Village Track, Keng Tung Township, Shan State (East)	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Shan State. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Keng Tung Township, Shan State (East)		26 June – 30 September 2020	Hatchery's tank renovation and walkway construction	607	5,964
12		**Nann Win Htwe-Hatchery** **Nann Win Htwe** Address: Taung Poe Koe Lone Village, Ti Law Village Track, Nyaung Shwe Township, Shan State (South) Phone Nr.: 09-899525628	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Shan State. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Nyaug ShweTownship, Shan State (South)		10 March – 30 September 2020	Hatchery's roof and floor renovation, Nursery pond renovation	1,697	3,724

No.	Sub-Grant #	Sub-Grantees contact detail and address	Business title	IR & Sub IR	Area coverage	Targeted beneficiaries (No)	Agreement period	Program budget (USD)		
								Contribution		Total budget
								Activity	Sub-Grantee	
13		**U Hla Kyaw- Hatchery** **U Hla Kyaw** Address: Inn Ywar Village, Ti Law Village Track, Nyaung Shwe Township, Shan State (South) Phone Nr.: 09-256371955	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Shan State. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Nyaug ShweTownship, Shan State (South)		5 March – 30 September 2020	Hatchery's roof and floor renovation, Nursery pond renovation, Feed mill	1,976	5,632
14		**U Htun Shwe-Hatchery** **U Htun Shwe** Address: Inn Ywar Village, Ti Law Village Track, Nyaung Shwe Township, Shan State (South) Phone Nr.: 09-428385493	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Shan State. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Nyaug ShweTownship, Shan State (South)		9 March – 30 September 2020	Hatchery's roof renovation, Oxygen tower	741	2,538
15		**U Kyaw Ngwe-Hatchery** **U Kyaw Ngwe** Address: Min Hla Village, Nat Pyin Village Track, KalayTownship, Sagaing Division Phone Nr.: 09 - 250205749	Hatchery's owner	- Support quality fish seed (including small indigenous fish species) production and nursing. - Ensure supply of quality seed for project and non-project beneficiaries in the townships under Shan State. - Provide farmers with knowledge on improved small-scale aquaculture technologies and access to quality feed.	Sagaing Division		12 March – 30 September 2020	Hatchery's roofing, tank renovationand walkway construction	1,517	4,241

Annex 29: Environmental Mitigation and Monitoring Plan (EMMP)

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
Farm ponds					
A. Farm pond site selection					
1. Conflicts with other site users and interference in livelihoods of local communities	On and off-site damage to resources and social conflicts	Appropriate regional land use planning consultation process Participation of local people in aquaculture projects Resettlements/compensation agreements	Farmer	Project ES&H officer	Once, or when changes occur
2. Selection of ecologically sensitive site	Potential loss of biodiversity and wetland habitat	Careful site selection and integration of aquaculture into integrated coastal management Management plan which identifies ecologically sensitive sites Habitat restoration, e.g. replanting of mangroves Maintain buffer areas around farm Prior assessments of impacts	Farmer	Project ES&H officer	Once, semi-annually, or when changes occur
3. Habitat clearing for the construction of ponds or other forms of aquaculture	Destruction or alteration of critical habitats such as mangroves	Avoid siting ponds in mangrove forests. If mangroves are cut, promote the restoration of mangrove forests. Use already cleared land whenever possible; reuse existing ponds before creating new ones to minimize disturbance of soil and vegetation Site ponds on the landward side of mangrove forests; leave the seaward side undisturbed and ensure adequate flow of freshwater for the mangroves.	Farmer	Project ES&H officer	Once, or when changes occur
4. Hazards to aquaculture from nearby pollution sources (e.g. agriculture, industry)	Water pollution from industry, agriculture affecting sustainability of aquaculture	Careful site selection. Pre-treatment of water. Pressure by aquaculturists to reduce pollution from other sectors	Farmer Farmer & Project Manager	Project ES&H officer	Semi-annually
5. Flooding, cyclones	Damage to physical facilities and loss of stock and pond discharge	Careful site selection. Pond design taking account of extreme climatic events (e.g. pond dyke height to prevent flooding). Buffer zones for wind breaks (e.g. mangroves)	Farmer	Project ES&H officer	Once, or when changes occur
6. Water quality	Water quality deterioration caused by self-pollution from aquaculture effluent	Careful site selection in relation to carrying capacity. Management practices and effluent controls	Farmer	Project ES&H officer	Quarterly

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
		Strategic planning to keep number of farms within carrying capacity.			
7. Selection of site with poor soil quality	Soils inappropriate for aquaculture, e.g. acid-sulphate soils.	Soil surveys to identify problem soils (acid sulphate, peat). Construction and design to minimise disturbance of problem soils.	Project ES&H officer	Project ES&H officer	Once, or when changes occur
8. Fish/shrimp seed availability	Potential impacts on biodiversity caused by over-harvesting of wild stocks.	Careful assessment of requirements Development of hatcheries Sourcing of wild broodstock	Farmer	Project ES&H officer	
9. Disease problems	Potential impacts caused by presence of serious pathogens/ disease problems	Disease surveys of existing farms to assess risk. Introduction of risk management strategies to reduce risk.	Project ES&H officer	Project ES&H officer	As indicated when information is acquired
B. Farm pond design					
1. Attention to problems in A., above	As above.	As above.	Farmer	Project ES&H officer	One time
2. Socio-economic impacts	Social inequities leading to social unrest	Participation of local people in aquaculture projects. Understand socio-economic conditions prior to project, and ensure developments do not negatively impact local people.	Farmer	Project ES&H officer	One time
3. Impacts due to infrastructure	Hydrological changes caused by poor design	Roads, canals and other infrastructure should not block estuarine flow. Maintain buffer areas	Farmer	Project ES&H officer	One time
4. Aesthetics	Aesthetic impacts	Development of green buffer zones	Farmer	Project ES&H officer	One time
C. Farm pond construction					
1. Site clearance	Damage to terrestrial and wetland habitats and water quality problems during construction	Maintain buffer areas. Ensure site disturbance is limited to immediate construction area Roads, canals etc should be constructed to minimise vegetation clearance. Sediments removed during construction should be disposed of in suitable locations. Excavation/disturbance of potential acid-sulphate soils should be minimised. Regulatory requirements should be followed during clearance and disposal of soils and vegetation.	Farmer	Project ES&H officer	Weekly during construction
2. Infrastructure development (access roads, canals)	As above	As above.	Farmer	Project ES&H officer	Weekly during construction

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
3. Obtaining filling materials	Removal of filling materials required for dykes, founda-tions, access roads may impact habi-tat, water quality	As above	Farmer	Project ES&H officer	Weekly during construct-ion
4. Dyke compaction	Poorly compacted dykes will lead to seepage problems.	Dyke compaction testing during construction.	Farmer	Project ES&H officer	Weekly during construct-ion
5. Labour, worker safety	Accidents and health issues	Provision of suitable infrastructure to support labour. Worker safety training Inspection of worker areas and on-site housing, if any.	Farmer	Project ES&H officer	Weekly during construct-ion
10. Erosion and/or seepage from pond construction on slopes	Sedimentation or seepage onto adjacent properties	Build berms between facilities. Build ponds on soils with adequate clay content to avoid seepage into groundwater and surface water. Space ponds well apart. Build settling pond if necessary and feasible.	Farmer	Project ES&H officer	Weekly during construct-ion
11. Rerouting of water flows through pond enclosures	Spreading of disease Changes in hydrologic patterns	Evaluate how much water can be withdrawn from source or how much effluent it can receive without altering its ecological equilibrium. Construct adequate water inlets and outlet systems. Use lower stocking densities and less intensive production system. At the watershed level of planning, strengthen management of water flows.	Farmer ßGov't	Project ES&H officer Project mgt.	Weekly during construct-ion Continual
D. Farm pond operation and management					
1. Solid waste disposal	Impacts on surrounding land-use/wetland habitats	Non-organic, solid waste materials should not be dumped into mangrove forests etc,, but disposed of safely. If feasible, reduce, recycle, and buy-back plastic waste, including lines, containers, netting, etc.	Farmer	Project ES&H officer	Quarterly or semi-annually
2. Waste water/effluent discharge into the ecosystem and open waters. This may include aquaculture feed, waste, and chemicals used for pesticide control, disinfection, and growth promotion.	Impacts on local water quality and sediments; loadings of nitrogen, phosphorous, organic matter, suspended solids, and 5-day biochemical oxygen demand	Use settlement basins. Environmentally sound disposal of pond bottom sediments. Water exchange minimized and water recycling Discharge of pond effluent into areas with adequate tidal flow.	Farmer	Project ES&H officer	Quarterly or semi-annually

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
		Dispose of dead/diseased fish in prompt and sanitary manner. Minimise leaks from water pumps, generators, etc Use polyculture, e.g., raise several species, including herbivorous species to consume excess nutrients Salination avoided by vegetated buffer zones, pond liners, pond dyke compaction and site selection on low seepage soils. Sandy soils require special liners to eliminate seepage. Do not exceed recommended stocking densities. Use high quality feed and increase the frequency of feedings Use feed pellets designed to float longer in the water column. Settle effluents released at time of harvest.			
4. Water intake and conveyance	Potential impacts on hydrology from poorly flushed tidal creeks. Drawdown of groundwater supplies Water pollution problems impacting water quality	Water supplies from well-flushed supplies. Reduce or eliminate use of groundwaters. Site selection to reduce/eliminate the need for use of freshwater in brackishwater ponds.	Farmer	Project ES&H officer	Quarterly or semi-annually
5. Harvesting and pond bottom management	Stirring up and discharge of pond bottom sediments leading to water pollution. Sedimentation caused by inappropriate disposal of pond sediment.	Harvesting techniques which do not stir up bottom sediments. Partial harvesting Settlement pond to catch and trap pond sediment. Sediment management techniques which do not require sediment removal (e.g. ploughing, drying). Sediment disposal away from waterways. No flushing of pond sediments with water.	Farmer	Project ES&H officer	At harvest time if feasible
6. Use of chemicals/water treatment	Potential impacts on workers health Water pollution Impacts on aquaculture product quality	Use of approved chemicals according to standard practices. Reduce disease problems through preventative management, not chemicals. Education of workers in safe use/handling of chemicals.	Farmer	Project ES&H officer	QuarterlyMore frequently if there are problems
7. Seed collection/supply	Loss of biodiversity caused by harvesting of wild stocks.	Improved fishing techniques that reduce damage to non-target stocks. Development of hatcheries.	Farmer	Project ES&H officer	Semi-annually

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
8. Introduction of non-endemic and invsasive species	Introduction of pathogens, predators, parasites, and disease	Select native rather than exotic species Use tilapia and other species that are cultivated worldwide that may be appropriate enthrough they are not native.	Farmer	Project ES&H officer	Semi-annually
9. Feed and feed management in intensive culture	Deterioration in pond environment and water quality impacts on surrounding	Use hatcheries to provide eggs and larvae Use low pollution/nutritionally appropriate diets Implement effective feeding strategies	Farmer	Project ES&H officer	Quarterly
10. Disease outbreaks and disposal of mortalities	Economic impacts on stock, product quality and native populations.	Implement preventative health management strategies. Sanitary disposal of mortalities.	Farmer	Project ES&H officer	During incidents; semi-annually
11. Operational failures	Sudden impacts caused by loss of stock and discharge of saline and nutrient rich pond water	Accommodating operational failures in system design and management procedures. Routine dyke maintenance essential. Dykes should be designed to withstand flood events.	Farmer	Project ES&H officer	During incidents; semi-annually
12. Labour force	Impacts on water quality and habitats due to increased population.	Provision of sanitary conditions for workers. Environmental awareness training for workers	Farmer	Project ES&H officer	Monthly
Hatcheries and Nurseries					
A. Hatchery/nursery site selection					
1. Conflicts with other site users	On and off-site impacts resources and social conflicts	Appropriate regional land use planning Consultation process Participation of local people in aquaculture projects Resettlements/compensation agreements	Farmer	Project ES&H officer	During incidents; semi-annually
2. Selection of ecologically sensitive site	Potential loss of biodiversity and wetland habitat	Careful site selection Management plan which identifies ecologically sensitive sites Habitat restoration, e.g. replanting of mangroves Maintain buffer areas around hatchery Prior assessments of impacts	Farmer	Project ES&H officer	One time
3. Hazards to aquaculture from nearby pollution sources (e.g. agriculture, industry)	Water pollution from industry, agriculture affecting sustainability of aquaculture	Careful site selection Pre-treatment of water, selection of water sources Pressure from aquaculturists to reduce pollution from other sectors	Farmer Gov't	Project ES&H officer Project mgt.	Quarterly Continual
4. Typhoons, flooding, hurricanes	Damage to physical facilities and loss of broodstock and pond discharge	Careful site selection.	Farmer	Project ES&H officer	One time

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
		Hatchery design taking account of extreme climatic events. Buffer zones for wind breaks (e.g. mangroves)			
5. Water quality	Water quality deterioration caused by self- pollution from hatchery effluent	Careful site selection in relation to other hatcheries. For large numbers of small-scale hatcheries, common effluent treatment systems Good hatchery management practices Design of inflow/effluent systems to control self-pollution. Treatment of effluent/effluent controls	Farmer	Project ES&H officer	One time
6. Fish/shrimp broodstock availability Trapping and collection of wild eggs, larvae, juveniles, and adults for aquaculture production	Over-harvesting of wild broodstock. Insufficient broodstock for hatcheries	Careful assessment of requirements for sourcing wild broodstock Development and use of hatcheries	Farmer Project manager & farmer	roject ES&H officer	Semi-annually
7. Disease problems	Presence of non-endemic and invasive species Introduced pathogens, predators, and parasites	Disease surveys of existing farms/broodstock sources to assess serious diseases and pathogens risk. Introduction of risk management strategies within hatcheries to reduce risk. Careful disinfection/health management protocols for broodstock and seed. Health certification and quarantine protocols. Adoption of SPF (specific pathogen free) technologies.	Farmer	Project manager	Quarterly or as requested
B. Hatchery/nursery design					
1. Attention to problems A(1) to A(7) above	As above.	As above.	As above.	As above.	As above.
2. Socio-economic impacts	Social inequities.	Participation of local people in aquaculture projects. (*note: small-scale hatcheries/nurseries projects offer good scope for involvement of local people*) Understand socio-economic conditions prior to project, and ensure developments do not negatively impact local people.	Farmer	Project ES&H officer	At project outset and semi-annually
3. Impacts due to infrastructure	Local hydrological or salinity changes caused by poor design	Roads, canals and other infrastructure should not block tidal flow. Maintain buffer areas around hatchery.	Farmer	Project ES&H officer	At project outset and semi-annually
4. Aesthetics	Aesthetic impacts	Development of green buffer zones	Farmer	Project ES&H officer	At project outset and semi-annually

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
		Avoid unsightly water supply/discharge canals, pipes. Locate away from tourist sites (e.g. high value beaches).			
C. Hatchery/nursery construction					
1. Site clearance	Damage to terrestrial and wetland habitats and water quality problems during construction	Maintain buffer areas. Ensure site disturbance is limited to immediate construction area Roads, canals etc should be constructed to minimise vegetation clearance. Sediments removed during construction should be disposed of in suitable locations. Excavation/disturbance of potential acid-sulphate soils should be minimised. Regulatory requirements should be followed during clearance and disposal of soils and vegetation.	Farmer	Project ES&H officer	Weekly during construct-ion
2. Infrastructure development (access roads, canals)	As above	As above.	As above	As above	As above
3. Obtaining filling materials	Removal of filling materials required for dykes, foundations, access roads may impact habitat, water quality	As above	Farmer	Project ES&H officer	Weekly during construct-ion
4. Labour, worker safety	Labour force noise, groundwater drawdown, sewage)	Provision of suitable infrastructure/facilities to support labour.	Farmer	Project ES&H officer	Weekly during construct-ion
D. Hatchery/nursery operation and management					
1. Solid waste disposal	Impacts on surrounding land-use/wetland habitats	Non-organic, solid waste materials should not be dumped into mangrove forests etc, but disposed of safely.	Farmer	Project ES&H officer	Quarterly
2. Waste water/effluent discharge	Impacts on local water quality and sediments	Use of settlement basins, borrow pits and other techniques to treat discharge water. Take particular care in treatment of water containing disease control/disinfectant chemicals.	Farmer	Project ES&H officer	Quarterly

Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
		Water exchange minimised and water recycling when possible. Discharge of hatchery effluent into areas with adequate tidal flow. Avoid contamination of freshwater with saline effluent. Disposal of dead/diseased animals in sanitary manner. Minimise leaks from water pumps, generators etc			
4. Water intake and conveyance	Drawdown of groundwater supplies Water pollution problems impacting water quality	Water supplies from well-flushed supplies. Minimise use of groundwaters (although may be most suitable disease-free water source).	Farmer	Project ES&H officer	Quarterly
5. Use of chemicals/water treatment	Potential impacts on worker health Water pollution Impacts on aquaculture product quality (e.g. chloramphenicol)	Use of approved chemicals according to standard practices. Reduce disease problems through preventative management, not chemicals. Education of workers in safe use/handling of chemicals.	Farmer	Project ES&H officer	Quarterly
6. Broodstock collection/supply	Loss of biodiversity caused by harvesting of wild stocks.	Species selection Select native rather than exotic species. Consider using some species (e.g., tilapia) that are cultivated worldwide and may be appropriate even though they are not native. Gather information about the biology and ecology of the organism to be farmed (life cycle, nutritional requirements, tolerance to environmental change, etc.) to ensure that the species will survive in the planned aquaculture environment.	Farmer	Project ES&H officer	Quarterly
7. Feed and feed management in hatcheries	Deterioration in tank environment and poor effluent quality, leading to water quality impacts on surrounding environments	Use low pollution/nutritionally appropriate diets Implement effective feeding strategies Careful feed control, monitoring	Farmer	Project ES&H officer	Quarterly
8. Disease outbreaks and disposal of mortalities	Economic impacts on stock, product quality and native populations.	Implement preventative health management strategies (e.g. quarantine, isolation of infected ponds. maintain strict hygiene). Stock certified pathogen-free fish Promptly remove and dispose of diseased, dying, or dead fish	Farmer	Project ES&H officer	When incidents; Quarterly

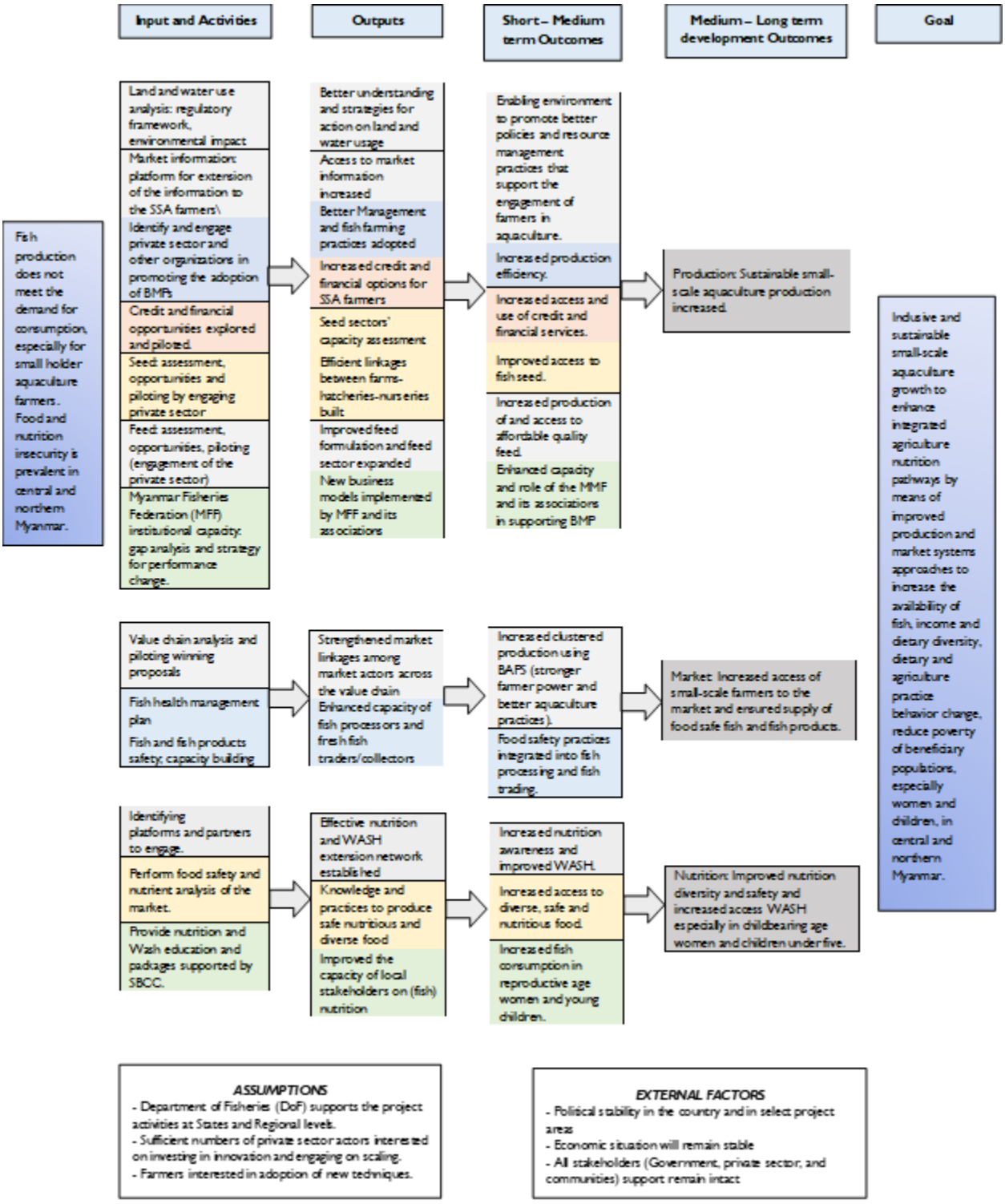
Actions affecting environment	Potential impacts	Potential mitigation measures for negative impacts	Mitigator	Monitor	Frequency
9. Operational failures	Sudden impacts caused by loss of stock and discharge of hatchery water	Accommodating operational failures in system design and management procedures. Routine hatchery/nursery maintenance essential.	Farmer	Project ES&H officer	When incidents; Quarterly
10. Labour force	Impacts on water quality and habitats due to increased population.	Provision of sanitary conditions for workers. Environmental awareness training for workers	Farmer	Project ES&H officer	Semi-annually
E. Post-harvest processing					
1. Facility renovation and construction	Disturbance to existing natural habitat	Avoid natural habitats if possible, Use low impact construction materials and methods if not possible Avoid proximity, e.g., less than 30 meters of permanent or seaons water bodies	Farmer	Project ES&H officer	Semi-annually
2. Air pollution from smoking and drying facilities	Air pollution	Use energy-efficient smokers for wood smoking. If available and economically feasible, substitute other energy sources for wood to inhibit deforestation; use wood from certified producers.	Farmer	Project ES&H officer	Semi-annually
3. Use of fish for fishmeal	Reduction in availability of fish for local consumption	For domestic markets, promote investment in processing of affordable and nutritious species	Farmer	Project mgt.	Semi-annually

Annex 30: Theory of change of the Activity

Small-scale Aquaculture Investments for Livelihoods on Myanmar "Theory of Change" statement is;

*"**IF** Small-Scale Aquaculture (SSA) farmers capacity developed on improved aquaculture management practices and they adopted Better Management Practices (BMPs) and market systems functions well,*
***THEN** this will improve production, income, and nutrition for rural poor, especially for women and children, in central and northern Myanmar"*

Annex 31: Activity Logic Model



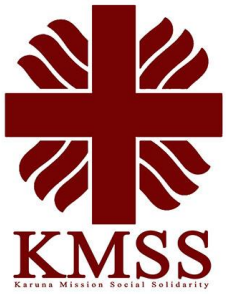
Logos


WorldFish


DEPARTMENT OF FISHERIES
MYANMAR


IWMI
International Water
Management Institute


MYANMAR FISHERIES FEDERATION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