



Securing the Food Systems
of Asian Mega-Deltas for
Climate and Livelihood
Resilience



Protocol for Participatory on-Farm experiment for Aquaculture Homestead Pond



WorldFish Cambodia
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WF Technical Assistance provision for Securing the food systems of Asian Mega-Deltas for climate and livelihood resilience (AMD). Work Package 1: Adapting deltaic production systems

1. INTRODUCTION AND OBJECTIVE

The Asian Mega-Deltas is one of the CGIAR's research initiatives which aims to create resilient, inclusive and productive deltas, which maintain socio-ecological integrity, adapt to climatic and other stressors, and support human prosperity and wellbeing, by removing systemic barriers to the scaling of transformative technologies and practices at community, national and regional levels.

Work Package 1 (WP1), Adapting deltaic production systems, one of AMD's five work packages, will facilitate scaling innovation to support resilient diversified deltaic production systems and reduce environment footprints and climatic risks. This will be done by stakeholders in learning alliances, providing technical knowhow on land suitability and agronomy, fisheries/aquaculture and enabling value chain development.

At the local scale, **WP1 (Adapting Deltaic Production Systems)** builds networks with partners to establish learning alliances within which communities can explore new agriculture production enabled opportunities for sustainable intensification and engage with new value chains to meet burgeoning demand from within and outside delta regions.

The main objective of the demonstration is:

- 1) To identify the potential productions for income and nutrient for rural people;
- 2) To introduce and demonstrate the technologies adapted climate resilience to increase productivities.

2. METERIALS AND METHODOLOGIES

2.1 Experiment Design (Treatment and control design)

This experiments are carried out by raising good quality of fingerling and separated in 7 demonstration site. There are 3 site in Sithor Kandal district, Prey Veng and 4 site in Tramkak district, Takeo province)

Table 1: Treatment design

Experiment Description	Type of experiment Aquaculture homestead pond
Fish species or Fingerling stocking	- Silver Barb 50% (5-7Cm) - Tilapia 30% (5-7 Cm) - Carp fish (Sliver carp = 5%, Indian Carp = 15%), (5-7 Cm)
Stocking Density	- 4 Head/m ²
Feed and Feeding	- Homemade feed 50% (Duck weed, Azoola...) - Commercial feed 50% (protein 28% – 40%)
Harvest Period	- 4 - 6 Months
# Fish sampling (Every month)	- ~ 10 – 15 Head

The experiment farmers will be selected in Ang Baksei village, Cheang Tong commune and Trampaing Kralanh village, Ou Saray commune, Tram Kak district, Takeo Province; and Svay Teab village, Ampil Krao commune, Sithor Kandal district, Prey Veng province.

Control design

To compare the fish growth, the project will be selected 2 farmers for control site (One site located in Takeo and another one in Prey Veng province), where located nearby experimental farmers in both provinces. The farmers raise the same fish species and applying the homemade feeding and techniques of the farmers practice.

Table 2: Control design

Control Description	Type of control Aquaculture homestead pond
Fish species or Fingerling stocking	- Silver Barb 50% (5-7 Cm) - Tilapia 30% (5-7 Cm) - Carp fish (Sliver carp = 5%, Indian Carp = 15%), (5-7 Cm)
Stocking Density	- 4 Head/m ²
Feed and Feeding (Farmer practice)	- Homemade feed 100% (Duck weed, vegetables, Azoola...)
Harvest Period	- 4 - 6 Months
# Fish sampling (Every month)	- ~ 10 – 15 Head

2.2 Project and Farmer support (Materials for demonstration)

The project will support to field demonstration farmers in terms of inputs and participation. However, farmers will contribute for the experiment as below:

1. Have own pond and well preparation which dug more than 1 year.
2. Manage the pond to ensure someone didn't steal the fish.
3. Collect inputs and make homemade feed for fish.
4. Feeding the fish with commercialize and homemade feed.
5. Observe and test pond water quality regularly.
6. Make recording into logbook regular (other activities required).

2.2.1 Pond preparation and water management

a) Pond preparation:

- ✓ Repair the dikes, water inlet and outlet pipe and level the pond bottom;
- ✓ Cut and remove aquatic weeds and grasses around the pond;
- ✓ Fence the pond if need to prevent the entry other animals.

b) Pre-stocking management:

- ✓ Liming the pond if the water contains of acidic, fill up the pond with water level and using animal manure or chemical fertilizer;
- ✓ The farmer/provincial expert will do testing pH, temperature (T⁰c), DO, NO₂, NO₃, NH₃/NH₄ and transparency of water in their pond before release the fingerling.

2.2.2. Fish species stocking and management

Three species will be released in the pond with the density of fingerling stocking 4 head/m². The fingerling will be nursing in Hapa at least three days before release into pond which is easy to monitor

fish. During nursing, the death fish will be replaced with the similar size. Fish species that will demonstration are:

- ✓ **Silver barb:** This species can eat both aquatic plant and many kinds of terrestrial plants that growth around the pond.
- ✓ **Tilapia:** This species is fast growing, can eat any type of food, can stocked in a higher density than other types of fish and can breed in the pond.
- ✓ **Carp fish:** Is a bottom feeder fish and feeds on aquatic insect larvae, worm and snails. It is mainly also relatively a fast growing fish.

2.2.3 Feed and feeding

The fish will be fed different kinds of commercial feed and supplementary feed depending on its cost and availability. The use of feed for the demonstration shall be in accordance with the standards set (see annex: 7). The feed selected for this farming practice must be high in nutrients and protein for fish growth. The quantity of feed is determined according to the type of feed and the age of the fish. And also provide adequate feeding according to the technical guidance by provincial experts of PDAFF-FiAC.

The fish species raised by the farmers will be fed in two ways: The company's feed is of good quality and contains between 30% - 40% protein to feed the young fish from the time of rearing until the young fish. 3 months old.

Then feed the big fish with between 20% - 30% protein and supplemented with ingredients that they can find on their own locally. The use and feeding of fish must follow the instructions of the aquaculture technical officer of the Provincial Fisheries Administration.

The type and amount of feed is determined by the age of the fish raised in the pond. The feed selected for this experiment was high in nutrients and protein (30% to 35%) to support the rapid growth of the fish. Feeding should be done as follows:

- The first month, feed the fish with 100% factory feed containing 30-35% protein at 3-5% of body weight/day 2-3 times/day between 7:00 am - 11:00 am and 1:30 pm - 5:00 pm.
- 2-3 months to provide 20-30% protein at 50% and 50% at 5-8% of body weight / day, 2 times / day between 7:00 11:00 am and 1:30 pm - 5:00 pm
- From the 3rd to the 6th month, 100% of the feed should be fed by farmers at 3-5% of body weight/day, fed twice a day between 7:00 am and 11:00am and 5:00pm and there will be extras such as rice, duck weed, corn or vegetables, kitchen waste... This feeding will continue until the fish are harvested by applying the feed ingredients as shown below:

Table 3: Fish feed ingredients for use by farmers

No	Ingredients	Percentage (%)	Remark
1	Rice brain, corn, soil bean ...	60	
2	Fish lipid, crab, snail, other aquatic animal ...	30	
3	Green vegetable, aquatic plan...	10	
4	Protein rate	15 - 16	

2.2.3 Fish harvesting

Fish harvesting: After raising the fish to meet market demand, the farmers can harvest partially the big fish for selling or for household consumption.

Table 4: Planning for experiment

Activities	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Pond preparation												
Fingerling stocking												
Pond and water management												
Improve water quality (Natural feed)												
Feed and feeding												
Fish sampling												
Monitoring and Record keeping												
Harvesting												

3. DATA COLLECTION AND RECORDING

There will be two level of data recording. The farmer will record in the logbook which provide by project regularly. The logbook will keep in the farmer house and the partner will check the farmer record while they follow/support the farmer. The partner staff will collect from the logbook which recorded by farmer at least once per month to put in the kobo platform.

There will be two type of data recording. The farmer will record in the logbook which provide by project regularly (see annex 2). The partner will check the farmer recording and collect at least once per month to put in the kobo platform (see annex 3).

3.1 Farm activities recording

All activities of farming will be recorded into logbook by farmer regularly. There will be record the weight, date and type of feed, kind of feed and other input, etc... (Annex: 2 - 6).

3.2 water quality checking and fish sampling

The water quality control will be checked in aquaculture pond by FiAC's officer including: pH meter, temperature (T⁰C), Dissolve Oxygen (DO), NO₂, NO₃, NH₃/NH₄ and secchi disc at least once per week or at least twice per week. Those data will be record into logbook by farmer and FiAC's officer.

The fish sampling, apply once for the first month and every month when the fish growing up, and the number of fish sampling is 10-15 Head/time, counting the number of fish, Total length, body length and body weighing. These data will be recorded in log book by farmer then check and verified by the Aquaculture Technical Officer of the Provincial Fisheries Administration Cantonment.

4. DATA MANAGEMENT AND REPORTING

4.1 Data cleaning

The partner staff will review and check the data record by farmer on a daily record in logbook. At the end of each month, the WorldFish will develop a “cleaned” data set that has been checked for errors, with corrections made when possible or removal of the data.

4.2 Data Management

The data collected will be exported from kobo and store as excel file every month as the raw data. The clean data will compile one excel file and share to team for reporting to avoid issues of version control, data duplication, and data loss. The raw and clean data will be stored in cloud storage on Microsoft OneDrive will prevent data loss in the event of damage to equipment (hard drives, servers, etc.).

4.3 Data Analysis

For each farm, the reported metrics are as follows: weight of harvested fish (kg), count of harvested fish, weight of fish consumed (kg), weight of fish processed (kg), weight of fish sold (kg), price of fish sold (KHR/kg), fish growth rate (g/month), preparation labor (hours), grow-out labor (hours), average monthly labor (hours/month), total feed weight (kg), total feed expense (KHR), preparation expenses (KHR), grow-out expenses (KHR), average monthly expenses (KHR/month), total expenses (KHR), average monthly income (KHR/month), total income (KHR), net profit (KHR).

Fish growth rates will be calculated by species only. To calculate the growth rate:

Average harvest weight of the species (g) – average weight of the species for the first month it is weighed (g) /number of months from first weight to harvest.

Report all other fish metrics by species and by total values.

For each metric, take the median or average for the treatment farms, and then do the same separately for the control farms. Report the median or average, standard deviation, and minimum and maximum values for the treatment and control farms. This can be done in a chart or a table as below.

Table template for data reporting (Create separate tables for each species and for total values).

Table 5: Data reporting for species 1:

Metric	Median or average	Standard deviation	Maximum	Minimum
Weight of harvested fish (kg)				
Count of harvested fish				
Weight of fish consumed (kg)				
Weight of fish processed (kg)				
Weight of fish sold (kg)				
Price of fish sold (KHR/kg)				

Table 6: Data reporting for species 2:

Metric	Median or average	Standard deviation	Maximum	Minimum
Weight of harvested fish (kg)				
Count of harvested fish				
Weight of fish consumed (kg)				
Weight of fish processed (kg)				
Weight of fish sold (kg)				
Price of fish sold (KHR/kg)				

Table 7: Data reporting for species 3:

Metric	Median or average	Standard deviation	Maximum	Minimum
Weight of harvested fish (kg)				
Count of harvested fish				
Weight of fish consumed (kg)				

Weight of fish processed (kg)				
Weight of fish sold (kg)				
Price of fish sold (KHR/kg)				

It may be helpful to check whether the following parameters also influenced the results. This can be done by taking an average or standard deviation by parameter category. For example, it is recommended to check the influence of pond depth, by comparing the results for ponds that are 2 meter and below to results of ponds above 2 meter in depth.

5. REFERENCES

1. Fish farming techniques in pond system, Training manual, CapFish Aquaculture project, Apr 2023
2. Rice fish culture, Training manual, Mar 2023.
3. Guideline on commercial aquaculture, October 2022. CAST CAMBODIA Project
4. Aquaculture in Cambodia Area and Rehabilitation and Regeneration Project (CARERE-2). Nov, 1999

Table 3: Feed and Feeding

Day	Type of feed (Commercial feed or Homemade feed)	Quantity (Kg/Day)	# Time/Day	Protein (%) If applicable	Remark (Time of feeding)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

Table 4: Water parameter (Time: 9:00 – 11:00 AM)/Weekly quality control

Date	pH Meter	Temperature (°C)	Dissolve Oxygen (DO)	Nitrite (NO ₂)	Nitrat (NO ₃)	Amonia/ Amonium NH ₃ /NG ₄	Water Scale (Depth)	Remark
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Scale rate	6.5 – 8.5	27 – 30 °C					30 - 40 Cm	

Table 5: Fish sampling (Time: 9:00 – 11:00 AM)/Monthly sampling

Date Sampling	Time	Fish Species	Total Length (Cm)	Body length (Cm)	Body Weight (g)	Remark

Number of fish sampling: Head

Table 6: Harvest recorded

Date	Fish Species	Total of fish (Head)	Total weight (Kg)	Total Amount	Consumption (Sold, Eat

Annex 2: Economic analysis

Table 7: Recorded on expenditure and Income

Expenditure

No	Date	Description	Quantity	Price/Unit	Amount	Other
Total Expenditure (I)						

Gross Income

No	Date	Description	Quantity	Price/Unit	Amount	Other
Total Gross Income (II)						

Profitability:

Profit = (II) - (I) = Total Gross Income - Total Expense =