Uplifting of Bote communities displaced from Kali Gandaki 'A' Hydropower Project by Cage-fish culture in Kali Gandaki Reservoir of Nepal

Fish Culture Development Training, EICA, Cairo, Egypt (2011)

This project is the outcome of a group efforts to whom credit and technical responsibility goes. This project is based on an assignment which was given to course participants and supervised by Dr. Abdel Rahman El Gamal as a part of "Fish Culture Development" Training course. This annual course is organized by the Egyptian International Centre for Agriculture – (EICA). Names of the team members, countries and pictures are shown in the following slide.

2011

Project team

Sitting (left to right: Anada Sugathapla (Sri Lanka), Deepak Bhusal (Nepal), Baboucarr Senghore (Gambia)

Standing (left to right): Zaw Zaw Hwte (Myanmar), Ibrahim Alzubidi (Jordan), Babalola Jacob Olalekan (Nigeria)

Project Details

Project Title	Uplifting of Bote communities displaced from Kali Gandaki 'A' Hydropower Project by Cage-fish culture in Kali Gandaki Reservoir of Nepal
Project Proposed By	English Group
Project Presented In	Fish Culture Development Training, EICA, Cairo, Egypt
Project Location	Kali Gandaki 'A' Hydropower Project Area, Syangja, Nepal
Beneficiaries	Bote communities of Syangja, Parbat, Palpa and Gulmi district covering seven VDCs
Total Cost of the Project (NRs)	1 533 000/-
Duration of the Project	3 Years

Background

- Nepal is landlocked with total area 147 181 sq km
- Total water surface coverage of country is 2.7 percent
- Fresh water resources are in the forms of rivers, lakes, reservoirs, swampy lands, village ponds and irrigated paddy
- Provides suitable habitat for at least 187 indigenous fish species
- Utilization of these water resources for aquaculture could play vital role for subsidizing import and income generation for people dependent on it

Background.....

Estimated water surface area of Nepal

Resource	Estimated area (ha)	Coverage percent	Potential for fisheries (area in ha)
Natural waters	401 500	49.12	-
Rivers	**395 000**	**48.32**	**-**
Lakes	**5 000**	**0.61**	**-**
Reservoirs	**1 500**	**0.18**	**78 000**
Village ponds	6 700	0.81	14 000
Marginal swamps and Gholes	11 100	1.35	-
Irrigated paddy fields	398 000	48.69	-
Total	**817 300**	**100.00**	

Background.....

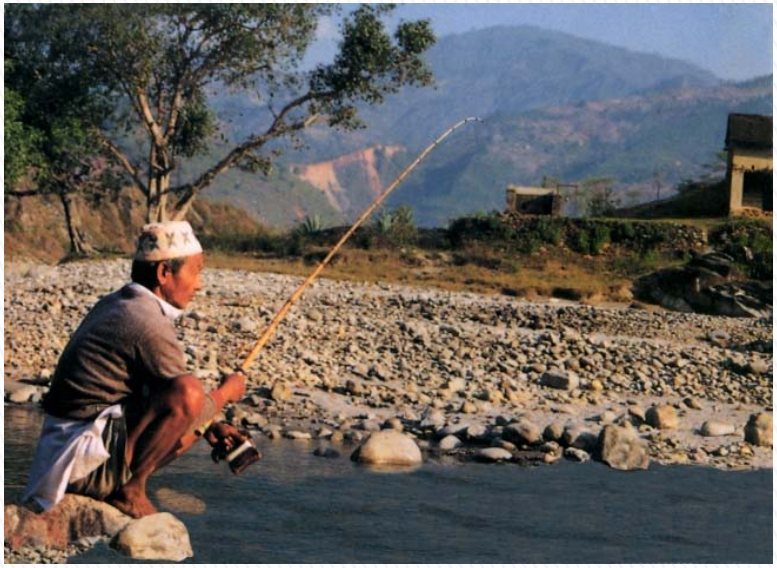
- Reservoirs are of major important regarding cage-fish culture where water current is less and cage landing will be safe

- Most of the reservoirs in Nepal are formed for the purpose of hydroelectricity generation and are located in mid-hills

- Many people with their major occupation are displaced by such type of hydroelectric project

Background.....

- Specially, Bote/Majhi communities are displaced by such project
- These are the traditional fisher communities fishing in natural water resources for livelihood
- Impounded water in the reservoir may benefit such displaced people if used for aquaculture



Major reservoirs of Nepal

Reservoirs	Area (ha)	Physiographic Region	Purpose
Jagadishpur	175	Terai plain	Irrigation
Trishuli	16	Mid-hill	Hydroelectricity generation
Marshyandi	62	Mid-hill	Hydroelectricity generation
Kulekhani	220	Mid-hill	Hydroelectricity generation
Kali Gandaki	500	Mid-hill	Hydroelectricity generation

Project Purpose

- Increasing population and increased demand of food has placed tremendous pressure in terrestrial as well as aquatic food production
- This has resulted fishing pressure in natural waters bodies causing over exploitation of natural stocks
- This can clearly seen by catch size in volume and number especially in cold-waters economically important fish species like Asala (*Schizothorax spp*), Katle (*Nelissocheilus hexagonolepis*) and Sahar (*Tor putitora*)

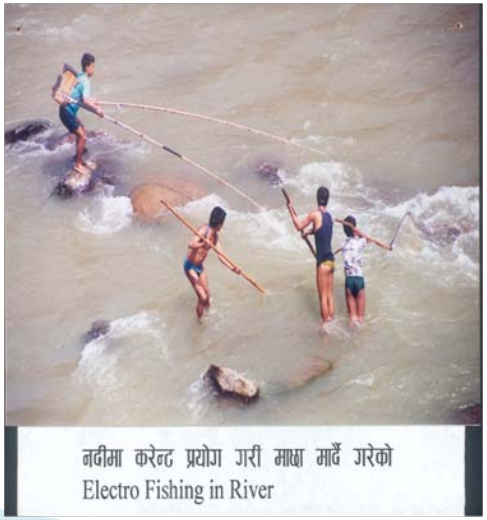
Past

Present

Project Purpose.....

- At present due to several activities results depletion of fish stock in natural water bodies

- Only the way to overcome such problems is fish stock enhancement and mobilization of communities for its effective utilization and conservation



Project Purpose.....

- Utilization of lakes and reservoirs for cage-fish culture using traditional fisher communities (e.g. Bote. Majhi etc) for fish production helps:

  - to decrease fishing pressure on natural water resources

  - conserve aquatic biodiversity

  - uplift the livelihood (nutrition, income and employment)

Objectives

General objective of this project is to improve household's earning and nutrition of Bote communities affected by Kali Gandaki 'A' Hydroelectric project.

Specific objectives are:

- Develop low cost cage-fish culture package for fisher communities of Kali Gandaki reservoir
- Enhance fish stock and increase fish catch from Kali Gandaki reservoir and its feeding rivers

Project Justification

- The Bote are the traditional fishing communities that reside around reservoir and riverbanks of Kali Gandaki
- They are highly affected and majority are displaced by Kali Gandaki 'A' Hydroelectric and are identified as one of the most vulnerable groups in the project affected area
- Fishing in rivers, lakes and streams has been their way of life to support their livelihood
- Less availability of natural fish stock after construction of dams in the Kali Gandaki 'A' Hydroelectric Project has reduced their income affecting their livelihood
- Introduction of cage-fish culture in these communities can compensate the loss and support their livelihood

Project Justification.....

- The successful story of cage-fish culture in Lake Phewa, Begnas and Indrasarober reservoir and its contribution for uplifting livelihood of the marginalized traditional fisher communities is an example that can be applicable to similar types of lakes and reservoirs
- The previous study of water quality parameter of Kali Gandaki reservoir shows that temperature remains between 20-25 ^{0}C for the period of 8 months (February 15 to October 15) and drops down below 20 ^{0}C for rest four months
- Availability of suitable temperature for the period of 8 months allows the fish to grow for a marketable size
- The present proposal is one of such a strategy for dissemination of a self sustainable and low cost cage-fish culture which will be developed and scaled up at community level for strengthening livelihood of low income and marginal people of the country

Major Assumptions

- There are not much visible factors, which might contribute to the project failing to achieve its output
- Good cooperation by participating fisher communities and government line agencies in the participatory program is expected for success the project
- Related biotic and abiotic factors will remain favorable
- There will be working environment in the project sites throughout the project period

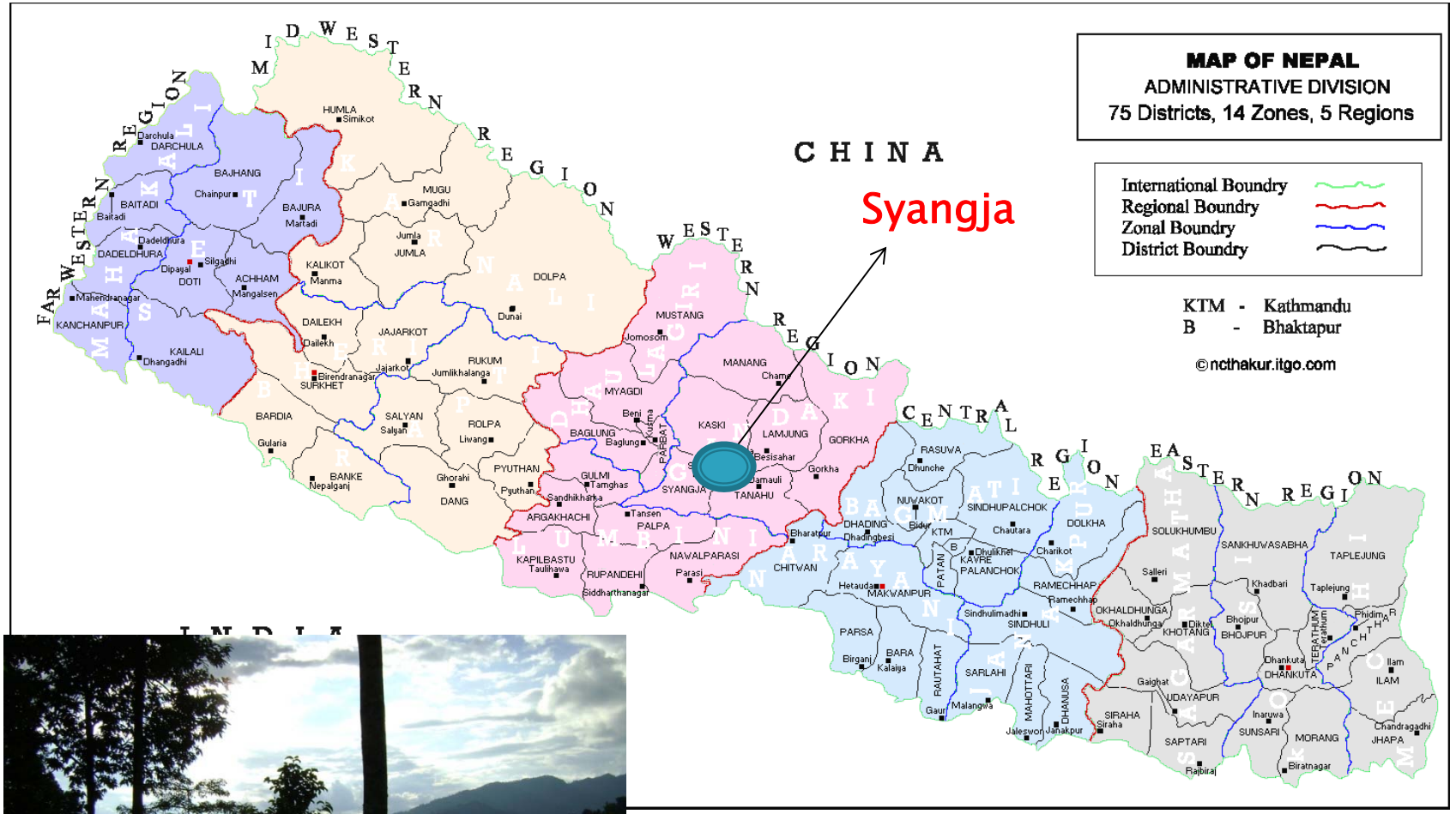
Research and Development Design

The following research and development activities will be carried out to generate the project outputs

Project Duration and Site

- Project will be launched for a period of 3 year starting from October, 2012 and ending in September, 2015 in Kali Gandaki Reservoirs of Syangja District of Nepal

Research and Development Design.....



Kali Gandaki Reservoir

Research and Development Design.....

Site survey and household's survey

A field and household's survey will be carried out in upstream and downstream of the Dam area of the reservoir to understand the existing situation, household income, inclusion of animal protein in their family diet, available resources, constraints and opportunities of the fisher communities. It will be carried out during the beginning of a project

Research and Development Design.....

Selection of family member for cage-fish culture

For 1st year 50 family members will be selected based on following criteria:

- Fisher who is still depending on reservoirs and its feeding rivers for livelihood and don't have any alternative job
- Past fisher who changes their occupation due to lack of food sufficiency and are marginal or owned less than 3 Ropanies of land (1 ropanies = 500m^2)
- Fisher having less opportunities whose income is less than NRs 10 000 (1 US$ = 78 NRs)

Note: Project will continues for 2nd and 3rd year with same criteria. New criteria will be set in absence of fisher meeting above criteria

Research and Development Design.....

Community Formation and mobilization

- Selected 50 members will be divided into 2 communities of 25 members each
- Executive committee holding 7 members will be formed in each community
- Each year 2 group having same number of members will be added for cage-fish culture
- At the end of the project there will be 150 members within 6 groups

Research and Development Design.....

Water quality analysis and monitoring

Measurements of water quality parameters of reservoir and its feeding river will be carried out for a complete one year cycle by the fisheries technician working in Cold Water Fisheries Development Center, Beltari, Syangja (CWFDC)

Water quality parameter

Water Quality Parameter	Measurement Unit	Frequency
Temperature	^{0}C	Weekly
Dissolve oxygen	Mg/l	Weekly
Transparency	M	Weekly
pH	Nautical unit	Weekly
Ammonia	Mg/l	Monthly
Chlorophyll-a	Mg/l	Monthly
TDS	Mg/l	Monthly
Alkalinity	Mg/l	Fortnightly
Hardness	Mg/l	fortnightly

Research and Development Design.....

Assessments of fish catch statistics

- Fish catch data of the reservoir and its feeding rivers will be assessed for complete one year cycle

Research and Development Design.....

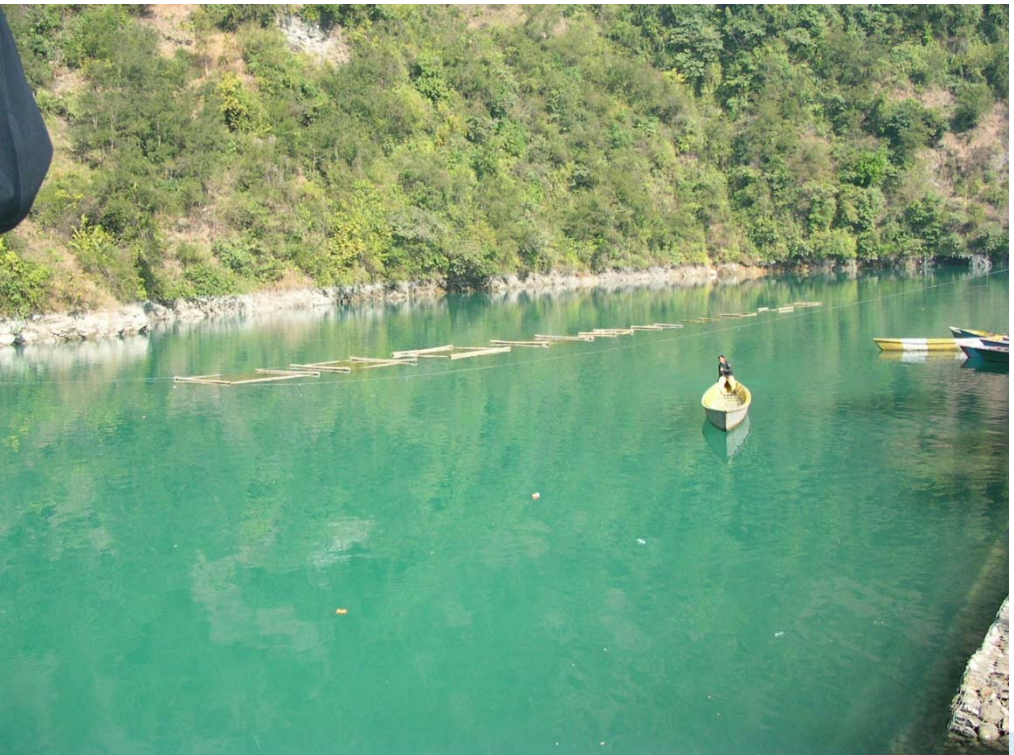
Cage Details for cage-fish culture

- **Cage size:** Cage size of $50m^3$ having dimensions 5m L x 5m W x 2m D
- **Net:** British nylon net of 19mm mesh size
- **Cage frame:** Locally available bamboo pole. It has floating capacity so it will help to reduce the cost on float
- **Sinker:** Stone will be used as sinker. Plastic rope will be used for holding stone and will tie up with 4 vertical bamboo pole

Research and Development Design.....

- Floating type cage with top portion close with net will landed in series. To prevent sailing, it will anchor on either side of the reservoir bank with a rope

Total number of cages 50 i.e. 1 cages/family member



Research and Development Design.....

Fish Species and Stocking Details

- Silver carp (*Hypophthalmichthys molitrix*) and Bighead carp (*Hypophthalmichthys nobilis*)
- Silver and Bighead both are planktons feeder. Silver feeds on phytoplankton while Bighead feeds on zooplankton
- Both can attain good growth and size relatively in a shorter period of time. Availability of natural plankton in Kali Gandaki reservoir will allows them for good growth and survival
- So no supplementary feeding is required

Research and Development Design.....

- **Stocking ratio:** Silver : Bighead = 4 : 1

(Phytoplankton to Zooplankton ratio is 5:1)

- **Stocking density:** 10 fingerlings/m^3 of water. Total number of stocked silver carp will be 400 and Bighead stock will be 100
- **Stocking size:** Advanced fingerlings 4-5 inches size will be used for stocking in cage
- **Sources of fingerlings:** Fingerlings will be obtained from nearby governmental fish farms i.e. Fisheries Development Center, Bhandara and Fisheries Development Center, Hetauda

Research and Development Design.....

- **Conditioning and acclimatization of fingerlings:** Conditioning of fingerlings will be carried out in farms for a period of 1 day before transportation. Acclimatization will be done in the reservoir where the fingerlings will be stocked in hapas for a week. During this period mortality of weak and unhealthy fingerlings may occur. After 1 week stocking of healthy fingerlings will be carried out in cages
- **Stocking of fingerlings in cages:** Stocking will be done on the 5^{th} month of the project. At this time the water temperature starts to increase and will be more than 20 ^{0}C. To minimize the temperature stress to fingerlings same schedule will be followed for 2^{nd} and 3^{rd} year

Research and Development Design.....

Management of cages, harvesting and marketing of fish

- Monitoring of cage will be done regularly and fouling in the cage will be removed
- Harvesting of fish will be done between 8-9 months after stocking when the fish get marketable size between 500-600 grams
- Fish from the cages will be harvested alternately for efficient marketing. The demand of fish is high in nearby Highway Corridor so marketing will be ease

Research and Development Design.....

Watch House

- For the security of the cages watch house will be constructed close to the cage landing area

Research and Development Design.....

Fisher training

- For each community, two sets of practical based training of 3 days each will be conducted

1. Cage construction, installation and management
2. General fish farming system

Cage installation and management training will be conducted before landing cage while general fish farming system training will be conducted immediately after stocking of fish in cages

Revolving Fund

- Revolving fund of NRs 50,000 will be provided to each community to make ease for purchasing necessary inputs used for cage-fish culture
- Any sort of interest will not bear on this amount
- This amount of money will be reimbursed and delivered to new communities on 2nd year after harvesting of fish by first two communities from cage
- Same process will be followed till 3rd year
- At the end of the project it will be handed over 6 communities for formation of co-operative

Research and Development Design.....

Open water indigenous fish stocking

- Per year stocking of 100 000 fingerlings of indigenous fish species i.e. Sahar (*Tor putitora*), Katle (*Neolissocheilus hexagonolepis*), Asala (*Schizothoraz progastus*) and Gardi (*Labeo dero*) will be done in reservoir and its feeding rivers till project period
- Stocking size ranges between 2-3 inches
- Sources of indigenous fish fingerlings are Cold Water Fisheries Center, Mirmi, Syangja and Regional Fisheries Research Center, Begnas, Pokhara

Uptake pathway

- All the technical expenses during the project will bear by the government
- Cost of cage and fish fingerlings should bear by the individual member of the community
- There will continuous flow of technical support and extension services during and after completion of the project
- Periodical interaction between the communities, governmental line agencies and associated will be organized
- A workshop for stakeholders and other related organization and professionals will be organized at the end of the project period

Report preparation and publication

- Trimester, annual and final reports will be prepared
- Project findings will be documented and published
- Technology develop will be implemented to other lakes and reservoirs for the benefit of low income people

Project Outputs

- Households earning and nutrition of the Bote communities affected by Kali Gandaki 'A' Hydropower Project will be improved
- Low cost cage-fish culture package with fisher's participation will be developed and disseminated
- Information on time series of various water quality profiles (Physical, Chemical, Biological) of Kali Gandaki Reservoir and its feeding rivers available
- Fish catch in the Kali Gandaki Reservoir and its feeding rivers will be assessed and increased

Beneficiaries

- The primary beneficiaries of this project will be the low income marginalized fishermen
- Women will also equally benefit from the outputs of this project as they are mostly involved in fish catch, production and marketing systems
- This project results will also provide opportunities for farmers living in similar conditions i.e. lakes and reservoirs towards commercialization of cage fish culture
- NGOs/INGOs, traders, stakeholders and other CBOs will also be benefited from the project output
- None of the group in the society will be disadvantaged from the developed output/technologies.

Financial Summary

Governmental Funding

Financial Summary					
S. N.	Activities	Budget (NRs)			
		1st Year	2nd Year	3rd Year	Total
1	Site survey and household survey of fisher communities	40 000	-	-	40 000
2	Water quality analysis and monitoring	50 000	-	-	50 000
3	Assessment of fish catch statistic	50 000	-	-	50 000
4	Fisher training	120 000	120 000	120 000	360 000
5	Open water fish stocking	200 000	200 000	200 000	600 000
6	Boat house	100 000	-	-	100 000
7	Revolving fund	100 000	-	-	100 000
8	Uptake pathway	20 000	20 000	50 000	60 000
9	Report preparation and publication	10 000	10 000	50 000	70 000
	Subtotal	**690 000**	**350 000**	**420 000**	**1 460 000**
	Contingency (5%)	34 500	17 500	21 000	73 000
	Total	**724 500**	**367 500**	**441 000**	**1 533 000**

Calendar of Operation for Project Period

Calendar of Operation				
Activities	Years			Responsibility
	1 Year	2 Year	3 Year	
Site survey and households survey				Fisheries technicians appointed in DADO and CWFDC, Syangja
Selection of members for cage-fish culture				Under the monitoring of FDD staff Fisheries technicians posted in DADO and CWFDC, Syangja
Community formation and mobilization				*Community formation in guidance of Fisheries technicians *Mobilization is responsibility of Community itself
Water quality analysis and monitoring				Fisheries technicians posted in DADO and CWFDC, Syangja
Assessment of fish catch statistics				FDD staff in co-ordination with Fisheries technicians posted in DADO and CWFDC, Syangja
Fisher training				Fisheries technicians posted in DADO and CWFDC, Syangja
Revolving fund distribution				FDD staff
Boat house				FDD staff
Cage landing and stocking of fish				Community members in presence of fisheries technicians
Management and maintenance of cage				Individual member for their own cage
Open water indigenous fish stocking				FDD staff in active participation of communities
Harvesting and marketing of fish				Community members
Uptake pathway				FDD staff, Fisheries technicians posted in DADO, CWFDC and CWFRC, Syangja
Report preparation and publication				FDD staff

Calendar of Operation for 1st Year

Calendar of Operation												
Activities	**Months**											
	Kartik	**Mangsir**	**Poush**	**Magh**	**Falgun**	**Chaitra**	**Baisakh**	**Jesth**	**Ashad**	**Shrawan**	**Bhadra**	**Ashwin**
	Oct/Nov	Nov/Dec	Dec/Jan	Jan/Feb	Feb/Mar	Mar/Apr	Apr/May	May/June	June/July	July/Aug	Aug/Sep	Sep/Oct
Site survey and households survey	■	■										
Selection of members for cage-fish culture			■									
Community formation and mobilization			■									
Water quality analysis and monitoring	■	■	■	■	■	■	■	■	■	■	■	■
Assessment of fish catch statistics	■	■	■	■	■	■	■	■	■	■	■	■
Fisher training												
- Cage construction, installation and management				■								
- General fish farming					■							
Revolving fund distribution			■									
Boat house			■	■	■							
Cage landing and stocking of fish					■							
Management and maintenance of cage	■	■	■	■	■	■	■	■	■	■	■	■
Open water indigenous fish stocking							■					
Harvesting and marketing of fish	■											■
Uptake pathway	■	■	■	■	■	■	■	■	■	■	■	■
Report preparation and publication	■	■	■	■				■				■

Economics of Cage fish Culture

Capital costs (NRs)						
Particulars	**Unit**	**Quantity**	**Per Unit Amount**	**Total Amount**	**Economic Life (Years)**	**Annual Depreciation**
Nylon net (19 mm mesh size)	m	60	80	4800	3	1600
Nylon rope (10 cm diameter)	m	100	25	2500	3	834
			Total	**7300**		**2434**
Annual costs (NRs)						
A. Operating costs						
Fingerlings	No.	600	2	1200		
Bamboo poles	No.	6	80	480		
Jute rope	kg	4	60	240		
Nylon string	kg	1	300	300		
Brush (Cleaning fouling)	No.	2	70	140		
Transportation				200		
Miscellaneous				500		
			Sub-total	**3060**		
B. Fixed costs (NRs)						
Annual depreciation				2434		
Contingency (10% over operating cost)				306		
			Sub-total	**2740**		
Total (Operating costs + Fixed costs)				**5800**		
Income from fish sale (50% home consumption)	**Kg**	**125**	**160**	**20000**		
Net profit (Income from fish - Annual costs) = 14200						
Rate of return over annual costs = 194.5%						
Rate of return over capital costs = 244.8%						
Mortality 10%						
Productivity = 5 kg/m^3						
Average size of fish harvest = 550 gms						
RR over annual costs = Net profit/Annual costs*100						
RR over capital costs = Net profit/Capital costs*100						

Availability of fish for home consumption

- Average family size 5.6 (CBS, 2009/10)
- Availability for home consumption 125 kg (50%)
- Per capita availability = 125/5.6 = 22.3 kg which is more than national average (3.5 kg)

SUKRAN
THANK YOU
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