



# Methodologies for Livelihood Support through Fish Farming at High Altitudes of Arunachal Pradesh

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## ABSTRACT

Aquaculture in the hilly regime of eastern part of Himalayas could not make much headway due to lack of awareness, perspective, technical skills and low risk-taking capacity of the farmers. Simple attention to basic requirements in fish farming may spell a big difference in raising the production level by many folds, for which easier technologies are readily available. For proper land utilization, aquaculture was supported with free of cost critical inputs from various agencies for economic well being of the community. An attempt was, thus made here to evaluate the effect of awareness generation, skill dissemination and sustained level of follow up action over extended period, in transforming the aquaculture scenario of Chug village, Dirang Block of West Kameng district of Arunachal Pradesh. Study revealed that 500 farmers developed skill from fisheries training programmes, on-farm trials and Frontline Demonstrations; more than 1000 farmers gained knowledge from kisan goshies and exhibitions; 1000 fish farmers were distributed fish seeds and other critical inputs. 30 fish pond holders of Chug village adopted the technology on scientific lines with recommended dietary protein level for raising the fish production from a negligible quantity to a level of 0.4-0.6 kg/m<sup>2</sup> unit area.

**Key Words:** Aquaculture, coldwater, *Monpas*, Chug village, Arunachal Pradesh

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## INTRODUCTION

Chug village is situated 10 Km north-east of Dirang township and 52 Km from district headquarter Bomdila. The village is located at an altitude of 1450 m msl approximately with a temperature range from 5°C – 30°C. The village has a total of 58 farm families with a population of 268 belonging to schedule tribe community (Census of India, 2011) and the literacy rate is 24.3 per cent. The village is surrounded by lofty mountains, covered with forests, bestowed with a roaring river and numerous small streams, and rich diversity of flora and fauna characterizing the landscape.

Farming is the mainstay of livelihood for the people and both men and women contribute equally in agriculture and household activities. Aquaculture development could not make much headway because farmers have low risk-taking capacity, lack of awareness, perspective and technical skills. This

clearly showed that the farmers were in need of help and technical assistance for a change of attitude and cast away the traditional practices in order to reap the benefit of technological advancements in aquaculture and other production technologies. The first step to make a stride in aquaculture development in rural areas lies in involving the grass root level farmers in large number and also aiming at bringing more and more available water bodies under aquaculture. Simple attention to basic requirements like stocking density, species composition, reasonable culture duration, effective manuring and liming only may spell a big difference in raising the production level by many times, for which easier technologies are readily available (Sharma *et al*, 2010). An attempt was, thus made here to evaluate the effect of awareness generation, skill dissemination and sustained level of follow up action over extended period, in transforming the aquaculture scenario in the village.

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## MATERIALS AND METHODS

Need-based extension programmes were organized for a decade by the Krishi Vigyan Kendra, West Kameng district of Arunachal Pradesh at Chug village of Dirang Block with the objectives (i) to raise the status of aquaculture in terms of expansion of cultivable area and income generation through mass participatory approach (ii) to maximize productivity per unit of water area. Participatory Rural Appraisal (PRA) method ascertained the status and potential of fish farming in the village and therefore leading to initiation of a developmental programme with 10 numbers of farmers at the first stage. Free inputs supported with technical guidance from various institutes, organizations, financing agencies and state departments, following different extension tools led to success in dissemination of fish farming technology and its mass adoption among the villagers in the following years in a hilly regime of Arunachal Pradesh.

## RESULTS AND DISCUSSION

### The aquaculture scenario

Although fish is an accepted delicacy in the region, there was a big gap in the demand and supply. The local people are largely dependent on fish imported from other states like Andhra Pradesh, West Bengal and Assam. Profession level of fish farming remained a low key affair until the recent past and traditional to extensive culture methods using mixed riverine fish seeds was in vogue. Participatory Rural Appraisal conducted in the year 2006 by a team of scientist from Krishi Vigyan Kendra (KVK) of West Kameng district determined the status and potential of existing culture area which was found to be small yielding with extremely low fish production. Lack of awareness, skill and access to technology hindered the pace of progress to a considerable extent in the past. The villagers were totally unaware as to whom to approach for guidance and technical back up to venture in to a new economic activity. The PRA helped to witness a few numbers of unutilized fish ponds in the village which triggered the idea

to promote fish culture in the area, provided fish farmers of the village are technically guided and supported with critical inputs in the form of fish seeds and feeds for startup incentive to take up the venture.

### Intervention

Based on the findings of the PRA, the possibility of reclaiming the waste land and unused water bodies was felt in order to improve productivity and to generate income from the village ponds, by suitably adopting fish farming with the existing structures and resources, which was further intensified with horticulture and animal husbandry. In pursuance to the above fact, 10 numbers of unutilized ponds were identified (Fig. 1 & 2) and villagers owning them were asked for their consent to adopt the venture of fish farming. But nothing was possible without the technical and financial support from institutes and financing agencies. Therefore, in order to make the programme a successful one, approach was made by the Kendra during 2006-07 to National Research Centre on Coldwater Fisheries (now ICAR-Directorate of Coldwater Fisheries Research), Bhimtal, Uttarakhand and Office of the District Fishery Development Officer, Govt. of Arunachal Pradesh, Bomdila for financial assistance for preliminary renovation of the identified 10 numbers of unutilized ponds and purchase of critical inputs such as fish seeds, fish feeds, chemicals and fertilizers. Much of the effort was relieved when consent was received from ICAR-DCFR for providing financial assistance for the preliminary cost of pond repair (Fig. 3 & 4), fish seed, fish feed and necessary chemicals whereas the District Fishery Development Officer (DFDO), Bomdila agreed to provide fish seeds and fish feeds through his office supplier at the cost remitted by ICAR-DCFR, Bhimtal. Action oriented programmes with sustained technical back-up, skilled training, trials and demonstration were conducted in the village for the year to motivate and to generate awareness among the rural people in order to take fish culture on scientific lines for income generation and livelihood development.

## Livelihood support through Fish Farming

Methodologies for aquaculture adoption and expansion at high altitudinal regions.

### 1. Training programmes

Training is the process of acquiring specific skills to perform a job better. Analyzing the technology gap and need of the farmers, more than 20 training programmes in aquaculture were organized for farmers, farm women, rural youth and school drop-outs both on and off campus. Emphasis was given mainly on fish culture practices suited for mid-hill conditions. Approximately, 500 farmers were benefited from the training programmes in the district and minimum of 100 farmers from the Chug village. Financial assistance was rendered by National Fisheries Development Board, Hyderabad; NABARD, Regional Centre, Itanagar; National Horticulture Board, Gurgaon; and ATMA, Arunachal Pradesh in conducting many of these programmes.

### 2. On-Farm Trials (OFT)

On-Farm Trial is an important tool for identifying technologies in terms of location specific sustainable land use systems. Considering the topography and climatic conditions of the area, trials were conducted at the selected 10 numbers of farmers' ponds at Chug village on the technology of "Composite culture of carps" for the first time in order to determine the growth pattern and survival of the stocked Indian Major Carps (IMC) and Chinese carps at mid-altitudes region of the eastern Himalayas. Fish seeds were supplied from the Office of DFDO with the financial assistance from ICAR-DCFR as discussed above. Encouraging results were achieved in the growth of 3-pronged Chinese carps viz., silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and common carp (*Cyprinus carpio*) whereas success rate was much lower in case of IMCs viz., catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) due to slower growth in cold regime. From the OFT, it was concluded that rearing of fish at this altitude is possible with Chinese carps alone, devoid of IMCs in polyculture system.

### 3. Frontline Demonstrations

Seeing the affirmative results of OFT in carp farming, many more farmers approached to adopt fish farming in the village and nearby areas. Based on the guidelines of KVK, another methodology was followed known as Frontline Demonstration to generate production data and feedback information from technology on "3-pronged Chinese carp culture at high altitudes" by its mass adoption and expansion. Altogether, 30 fish pond holders of Chug village came forward and adopted the technology. Interestingly, the farmers renovated their existing structures as well as excavated new ponds at their own cost. The only requirement was to provide them with quality fish seeds. Therefore, quality seeds were purchased from a private hatchery belonged to Mr. Neelam Dutta, a resident of Pavo village at Biswanath Chariali of the neighbouring state Assam, and the seeds were later distributed to the fish farmers free of cost. The technique of preparation of fish feeds was taught to the farmers by the then Fisheries Scientist of the KVK by utilizing the farmer's own household resources such as maize powder or maize flour, rice bran, soybean meal, vegetable or household waste, banana leaves etc., supported with the knowledge of feeding schedule and feeding techniques. Three species of Chinese carps viz., silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and common carp (*Cyprinus carpio*) of 60 mm size were stocked in combination with a density of 3-4 fishes/m<sup>2</sup> and recommended supplementary diet was provided under low temperature conditions. The performance of each fish species in terms of growth, survival and contribution to total biomass were studied and found to be quite remarkable with a production range of 0.4-0.6 kg/m<sup>2</sup>.

### 4. Celebration of Fish Farmers' Day and Field Days

Celebrating important days such as Farmers' Day and Field Days are a method of motivating the people to adopt a new practice by showing what has actually been achieved by applying the practice under field conditions. All these important

days were organized at farmers' fields. On the Fish Farmers' Day, approximately 15,000 numbers of fish seeds were distributed free of cost to the selected beneficiaries (approximately 100 persons) every year procured either from the Regional Fish Nursery under Office of DFDO, Bomdila or from the neighbouring state Assam. Fish harvest was generally conducted with the help of the fish farmers in their own ponds to observe the production and successful results of fish farming.

### **5. Exhibitions**

An exhibition is a systematic display of models, specimens, charts, photographs, pictures, posters, information etc. in a sequence around a theme to create awareness and interest in the community. The major segment of the display was with the fish aquariums, museum specimens on important fishes, posters and charts. The farmers also bring fishes and other sellable products on the occasion and are much benefited. More than thousands of people were benefited from the exhibitions in terms of gaining knowledge and technical know-how in high-altitude fish farming practices.

### **6. Kisan gosthies and farmers-scientist Interactions**

Such programmes were arranged at a selected location under Government Administration or at farmers' field. More than 12 such meets were organized in the district since 2006 benefiting more than 500 farmers inclusive of the Chug villagers in the subjects of agriculture, horticulture, fisheries, animal husbandry and home science etc. The queries and issues raised by the farmers were answered and solved on the spot by the experts and scientists from various organizations. These meets are very effective as farmers from different villages get a platform to exchange their views and farming techniques and therefore support in expansion of innovative ideas.

### **Promotional activities for sustained aquaculture in the village**

The coldwater fisheries occupy a prominent

position especially in West Kameng district of Arunachal Pradesh. In order to make fish farming sustainable in a hilly regime amid of several constraints, it was felt to take initiation in binding the farmers in one frame so as to reduce much of their human drudgery, overcome financial inability and improving livelihood. The steps taken were as follows;

#### **a. Formation of farmers' clubs**

Farmers' Clubs were formed with financial assistance from NABARD, Arunachal Pradesh Regional Office, Itanagar and under the guidance of KVK West Kameng during 2008-2010. Two numbers of Farmers' Clubs viz., Mani Dungjur Farmers' Club (Male members) and Changpa Women Farmers' Club (Female members) were constituted at Chug village with 15 members in each club. The members resolved to deposit a sum of INR 100.00 each on every month. A joint savings account was opened at the nearest State Bank of India, Dirang Branch for each of the clubs. On completion of a year, a part of the deposited amount was disbursed as loan to individual members based on their requirement. The members discussed the issues on each month in a group meeting to undertake new farm-based initiatives and to mitigate the financial crunches by disbursing the loan amount at a minimal interest rate. The clubs performed well and the members were much benefited in terms of procurement of critical inputs as well as marketing of commodities in mass. The club members also support other villagers in undertaking fish farming by personally involving themselves in pond construction and repairing as well as lending loans in starting the venture. This led to a dramatic change in their livelihood pattern as the farmers could now avail to purchase the household commodities, afford for children education etc from the sell produce of their farm unit.

#### **b. Association with other organizations for financial and livelihood support**

(i) Seed distribution programme in collaboration with the Office of DFDO, Bomdila

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Survey was conducted during 2006-08 to identify the existing fish ponds and tanks of entire Dirang and Nafra block and a list of names of the fish farmers were proposed to DFDO, Bomdila for providing free inputs in the form of carp seeds each year. As the entire region is devoid of a fish seed hatchery, fish seeds were purchased by the Office of DFDO, Bomdila from the neighboring state Assam which were stocked initially at their Regional Fish Nursery at Salari village for acclimation. A part of these fish seeds were later procured by the KVK and were distributed free of cost to the farmers based on the estimated requirements (minimum 15000 numbers) every year. This helped to mitigate the problem of fish seed unavailability in the village and the locality.

### **(ii) Indo-Tibetan Border Police Force (ITBPF), 4<sup>th</sup> BN for aquaculture promotion under Border Area Development Programme (BADP)**

The KVK West Kameng district and Indo-Tibetan Border Police Force (ITBPF), 4<sup>th</sup> BN, Dirang, West Kameng district, Arunachal Pradesh had initiated a collaborative fisheries demonstration programme on “Economic and livelihood development of rural population through freshwater aquaculture in hill region” in the year 2010-11, giving priorities to the locals who have common interest and stake in coldwater sector development. The aim of the programme was to prepare a blueprint for a relevant, economical and viable coldwater fisheries package of practice which can easily be implicated in the hill region of the district. More than 200 farmers adopted fish farming along with raising horticulture crops (vegetables and fruits) and animal husbandry (poultry and pig), ornamental fish keeping and aquarium making, fish processing under this programme.

### **(iii) PRAGYA (NGO) – A volunteer organization for livelihood development**

The approach of PRAGYA - a Gurgaon based NGO was well supported by the KVK in conducting On-Field Demonstration & Free input distribution

programme on the title “Occupational skills in Pisciculture” during 2009 to the farmers of Chug and nearby villages (Sangti, Khaso, Namchu etc.) so as to develop livelihood options in hill regions by practicing fish farming on scientific lines. About 1000 numbers of farmers were benefited by receiving fish seeds, feeds, chemicals and fish nets from the NGO and technical guidance from the KVK.

### **Establishment of method demonstration unit in collaboration with ICAR-National Research Centre on Yak, Dirang**

In the year 2008, KVK West Kameng initiated to establish a demonstration unit in the unutilized tank of 600m<sup>2</sup> area at the premises of ICAR-National Research Centre on Yak, Dirang in collaborative mode with an objective to demonstrate the production and productivity of composite carp culture in pond fisheries at high altitudes with pre-decided protein percentage of fish feed ration. The KVK hold responsibility for implementing the work plan on scientific fish culture and its operational demonstration to the farmers whereas ICAR-NRC on Yak took charge of the financial and manpower based managerial issues. The income generated from the harvest was deposited as revenue in the account of ICAR-NRC on Yak. Approximately 10 numbers of trainings were imparted and demonstration programmes were conducted by KVK during the trial period benefiting more than 300 farmers, farm women and school drop-outs of the district. Field demonstrations comprised of feed preparation, feeding methodology, stocking procedure, liming and manuring techniques, management of water quality and fish health, harvesting etc which were very useful for easy understanding and skill development among the farmers. From the trials, the average fish production achieved was @ 334 kg/ 600m<sup>2</sup>/ 8 months. In a span of 8 months, silver carp (15%), grass carp (30%), common carp (30%) and other carps (25%) recorded a maximum individual average weight of 250g, 500g, 900g and 375g respectively. An



Fig. 1 & 2: A few unmanaged fish ponds of Chug village farmers before scientific intervention



Fig. 3 & 4: Self motivated fish farmers with their newly excavated ponds



Fig. 5: Distribution of fish seeds through Office of DFDO, Bomdila



Fig. 6: Fish seed release on the occasion of Fish Farmers' Day at farmers' ponds

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Fig. 7: Happy fish farmers of Chug village on receipt of fish seeds



Fig. 8: A fish farmer with fish seeds for release in his pond at Chug village



Fig. 9: Field demonstration at ICAR-NRC on Yak pond premises



Fig. 10: Fish harvest and sell from demonstrating unit of ICAR-NRC on Yak

experimental trial on comparative study on growth performances of carps supplemented with different dietary protein levels resulted into a production of 485 kg/ 600m<sup>2</sup>/ 8 months @ 35% dietary protein level as compared to 381 kg/ 600m<sup>2</sup>/ 8 months @ 30% dietary protein level (Baruah *et al*, 2015). The experiment concluded for inclusion of higher range of protein percentage (35%) in fish feeds for higher productivity in colder regime.

### Productivity and profitability status

The fish production from each of the pond in Chug village in a decade rose from a negligible level up to 3000-4000 kg/ha/yr, which was sold at

the local market @ Rs. 200-300/kg fish. The village with 58 farm families, and not known for any reasons has now gained much popularity for their endeavor in fish farming in the region. Establishing a fish seed hatchery in the locality and a feed mill for ready availability of critical inputs round the year will reduce much of their effort in fish farming. The success of Chug village has led to adoption of fish farming as a true vocation of livelihood in the recent times in other villages of the district viz., Khellong, Nafra, Saddle, Khoina, Rahung, Tenga, Rupa, Shergaon, Sangti, Khaso etc. The unemployment problem in these regions is growing, not because there is lack of opportunities but

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because the unemployed youth have failed to take advantage of the opportunities available. Therefore, few initiatives like forming Farmers' Clubs, SHGs, organizing regular training and demonstration programmes, OFTs and FLDs, organizing field days, farmers' meets and distribution of critical inputs in agriculture, horticulture, fisheries, animal husbandry and allied subjects has already been taken in these villages alike Chug village and hopefully progress visibility will be achieved in the coming years to come. The perception of species diversification based to altitudinal regime needs much attention today and attempts must be made for the best utilization of the available resources and conserving the environment at the same time.

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