

- Gel enhancers like potato starch, potato smash, rice smash and barley starch were tested and optimized for the production of different VAPs.
- Shelf life of the products at room temperature as well as at refrigerated temperature with or without addition of cryoprotectants was evaluated.

### Policy implications

- Steps should be taken to develop technical packages for commercial production of VAPs from low-cost silver carp flesh.
- Logistic support may be provided to the prospective entrepreneurs for establishment of industries for the production of VAPs from silver carp.
- Fisher women should be trained up and involved in the production and marketing of VAPs of silver carp.
- Policy decision should be taken to involve urban departmental stores, chain stores and fast food shops for marketing of the VAPs to exploit better marketing conditions, motivational level and buying ability of the urban people.
- Institutional credit should be prioritized for the VAP manufacturers.

### Livelihood implications

The present study has considerable implication on poverty alleviation and livelihood improvement of the poor fish farmers. The incorporation of silver carp in the carp polyculture system has considerably increased pond fish production but its low market price has become a serious concern to the poor fish farmers. Production of VAPs like, surimi, fish sausage, fish burger and fish sticks from low-valued silver carp flesh will provide enhanced financial benefits to the poor fish farmers and that will certainly contribute significantly to improve their livelihoods.

## Marketing of value-added products from silver carp and involvement of rural people in the production and marketing chain

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### Abstract

Cost-profit analysis and market testing of some value-added products from silver carp such as fish mince block, fish sausage, fish ball, fish stick and fish burger were analyzed during April 2001 to March 2002. The study also explored the possibility to involve rural low-income people in the production and marketing of such products. The production of silver carp was higher in greater Jessore and Mymensingh districts but the price remained low during the peak-harvesting season in October to November. The price varied with size of the fish, season, market characteristics and effective demand of the buyers. Price of about 500 g size fish was found to be Tk. 20-25/kg in the rural markets. The average size of fish in the rural markets was 380-550 g while that in the urban markets it was 700-1,200 g. The cost of production of the value added products and profit margin were assessed on the basis of market price of the raw material as well as that of the finished products, transportation, storage and marketing costs. The profit margins of 34%, 39%, 81% and 31% of their sales price were obtained for fish sausage, fish ball, fish stick and fish burger, respectively. Actual production cost could be minimized if the fish is purchased directly from the farmers. Consumer's acceptance and marketability tests showed that both rural and urban people preferred fish ball than fish sausage. However, response towards the taste, flavor and color of fish ball and fish sausage was found to vary with occupations and age of the consumers. A correlation was observed between age group and acceptance of new products. Fish ball, fish stick and fish burger were found to be the most preferable items to the farmers because of easy formulation process with common utensils. Good marketing linkage and requirement of capital had been identified as the prerequisites for operating small-scale business on value-added fish products.

**Key words:** Market-testing, Value-added products, Cost of production, Profit margin

### Research findings

- The production of silver carp was high in greater Jessore and Mymensingh districts.

- The cost of production of the value added products and marketing profit margin were assessed on the basis of market price of the raw material as well as the finished products, production, transportation, storage and marketing costs.
- Fish sausage, fish ball, fish stick and fish burger offered a marketing profit margin of 34%, 39%, 81% and 31% of their sales price respectively.
- Response towards the taste, flavor and color of fish ball and fish sausage was found to vary with occupations and age of the consumers.

### Policy implications

- Steps should be taken to minimize the cost of production of the value added products through ensuring availability of the raw material at a cheaper price as well as through minimizing the cost of production, transportation, storage and marketing costs.
- Logistic support should be provided for the establishment of industries for production of value added fishery products.
- Fisher women should be involved in the production and marketing of the value added products.
- Urban departmental stores, chain stores and fast food shops should be utilized for marketing of the value added products.
- Institutional credit should be provided to the rural poor for the production of value added fishery products.

### Livelihood implications

Low market price of silver carp has become a serious concern to the poor fish farmers. The development and standardization of techniques for the production of value added products from silver carp flesh would widen the utilization of this cheap fish. Higher return would ensure development of sustainable aquaculture practices of the species and will enhance income of the poor farmers. The research work has increased the awareness of rural people towards accepting new food products. As a result, it will ensure more and more involvement of the rural poor men and women in income generating activities for providing better nutrition and generating additional income. This will have tremendous implication on poverty alleviation and livelihoods of the rural poor.

## A study on rural women's empowerment through participation in aquaculture

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### Abstract

The study was undertaken to understand the rural women's (i) extent of participation in some selected aquaculture practices and (ii) extent of empowerment through participation in aquaculture program. Data were collected from 200 selected rural women of two districts - Sherpur and Kishoreganj. Each of the families where the selected rural women who were involved in aquaculture under the supervision of two partner NGOs of DSAP, namely - Foundation for Human Development (FHD) and Center for Rural and Environmental Development (CRED). Both conventional and participatory methods of data collection were employed where structured questionnaire and Focus Group Discussion (FGD) were used as the tools. The data collection procedure took five-months spanning from September 2004 to January 2005. Appropriate scales were developed and used in order to determine the focus variables of the study, while most analyses regarding women empowerment were done using 'before' and 'after' method. Empowerment of women was measured by five dimensions such as decision making ability, spending ability, social participation, cosmopolitaness, access to assets and resources. The ten selected aquaculture practices were: fish feeding, eradication of aquatic vegetation from fish pond, disease detection, application of fertilizer, liming, harvesting of fry and fish, fish stock management, pond excavation, use of insecticides, and sale of fry and fish. The study also aimed at determining some selected characteristics of rural women and determining relationship between their extent of empowerment and the selected characteristics. The characteristics of rural women included: age, personal education, average family education, family size, family farm size, area under aquaculture, extension media exposure, training exposure, knowledge in aquaculture, and family income. The findings revealed an overall low level of participation by rural women in aquaculture activities. However, significant level of improvement was identified regarding overall status of empowerment during the course of participation in aquaculture program under DSAP.

**Key words:** Rural women, Aquaculture, Participation, Empowerment



## Research findings

- Majority (72.5%) of the rural women had 'very low' level of participation followed by 13% and 2% having, respectively, 'low' and 'medium' participation in ten selected aquaculture practices. No woman was found having 'high' participation. On the other hand, 12.5% were found having 'no' participation, at all.
- Relatively significant level of participation by women was found in the activities like 'feeding of fishes' and 'clearing of aquatic vegetation from fish pond,' while low level of participation were identified in 'application of fertilizers,' 'liming in ponds,' and 'managing fish stock.' Very low level women participation was identified in 'fish fry catching,' 'excavating pond,' 'using insecticides,' and selling fish.'
- Majority (59.5%) of the rural women had 'low' empowerment before participating in aquaculture program followed by 31%, 6% and 3.5% having 'medium,' 'medium-high' and 'very low' level of empowerment, respectively. However, an improvement of the scenario was identified after three seasons of involvement in the aquaculture programs under the supervision of concerned partner NGOs of DSAP. Majority (46.5%) of the respondent rural women perceived that they had 'medium' level of empowerment after the involvement, which was followed by 41%, 9.5% and 3% having 'low,' 'medium-high,' and 'low' level of empowerment, respectively. No respondent was found having 'high' level of empowerment. The average empowerment score of the women 'before' and 'after' involvement in the aquaculture program showed a significant improvement.
- Rural women achieved significant extent of empowerment in all of its five dimensions during participation in aquaculture activities. Among the five dimensions they achieved substantial level of empowerment in aspects of 'family decision-making' and 'ability to spending money.' Although the changes were positive, the progress was slow in the aspects of 'social participation,' 'access to assets and resources,' and 'cosmopolitaness.'
- Majority (85.5%) of the women were found young to middle-aged, while 83% of them belonged to medium to large families having at least five members in each household. A substantial percentage (33.5%) of the women were found illiterate or could sign only, while 66.5% had different level of literacy spanning from primary school to university level. More than half (51%) of the rural women possessed medium to large family farm (more than 1 ha), while 67% had up to 0.20 ha family pond under aquaculture. An overwhelming majority (96.5%) of the respondent women had 'very low' to 'low' exposure to extension media, while 87.5% did not get any training program for acquiring knowledge and skill in aquaculture. However, 65.5% women were found having 'good' to 'very good' knowledge on day to day aquaculture practices. More than two-third women (69.5%) belonged to 'medium' to 'high' family income group, while the rest (29.5%) fell in to 'low' income group having annual family income up to only Taka 50,000.
- Rural women's extent of empowerment was positively and significantly correlated with their personal and family education, extension media contact, training

exposure, and family annual income. The other selected characteristics of rural women such as age, family size, family farm size, area under aquaculture, knowledge on aquaculture and extent of participation in aquaculture did not show any significant relationship with their extent of empowerment through participation in aquaculture.

- Although women members of the DSAP demonstration farmers' families under the concerned NGOs were supposed to increase their involvement in aquaculture activities through the 'whole family' approach, it did not occur at the desired level. Women members were little interested in participating group meeting and training programs.

### Policy implications

- The study revealed a very low level of women participation in aquaculture, which is not encouraging. Thus, proper strategies should be formulated in order to increase participation of womenfolk in different aquaculture practices. All GOs and NGOs involving in fisheries sector in Bangladesh, particularly the DoF, should focus on gender sensitive dimensions in their aquaculture programs.
- During development of aquaculture program, it must be ensured that women are given equal rights and opportunities to actively participate in it
- As the study reveals the fact that women can achieve significant level of empowerment through involving in income generating activity like aquaculture, relevant GOs and NGOs should ensure women participation in their programs as a way of achieving empowerment.
- Participation of women should be facilitated and ensured in all phases of an aquaculture program. Such step will help in keeping a program gender sensitive in true sense.
- Educated women are found having low participation in aquaculture, although this group is considered very important in any development program. Thus, proper extension strategy should be undertaken to motivate this particular women group for ensuring their participation in aquaculture programs.

### Livelihood implications

Apart from carrying out day to day household activities, women of our country are gradually increasing their involvement in aquaculture in order to secure sustainable livelihoods of their families. The pace is, however, very slow. There exist huge potentials in increasing women participation in the aquaculture sector of Bangladesh. Through increasing participation in aquaculture, women can enrich their financial and human

capitals and increase their access to social and institutional structures and processes, which would in turn pave the way of achieving their desired empowerment and improvement of their livelihood status in the long run.

## Factors affecting the adoption of aquaculture technologies by the farmers

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### Abstract

Purpose of the study was to ascertain the extent of adoption of aquaculture technologies by the farmers as well as constraints faced by them in adopting the aquaculture technologies. The study also explored its relationships with the selected characteristics of the farmers. In addition, an attempt was also made to determine some selected attributes of the technologies and their relationships with the adoption by the farmers. The study was conducted with the farmers of 10 upazilas of greater Mymensingh district who were the beneficiaries of three NGOs viz. SARA, ORD, and GRAMAUS. There were 351, 241 and 249 beneficiaries under SARA, ORD and GRAMAUS, respectively who adopted the aquaculture technologies under DSAP. About 25% farmers from each of the three NGOs were selected for the study. The total sample size was 212. Pre-designed and pre-tested interview schedules were used for collecting data from the farmers. Field data were collected from the farmers during August-September, 2004. Pearson product moment correlation co-efficient were computed in order to explore the relationships of the selected characteristics of the farmers as well as selected attributes of technology with the adoption of aquaculture technologies by the farmers. The same statistical test was used to determine the relationships between the selected characteristics of the farmers and their constraints in adopting the aquaculture technologies.

**Key words:** Fish farmers, Aquaculture technologies, Expression, Constraints of adoption

### Research findings

- Farmers had the highest adoption in respect of carp polyculture in the fish ponds (83%) followed by raising fingerlings in the nursery ponds (11.3%), rice fish farming (5.7%) and raising fingerlings in paddy fields (0.5%)
- Farmers had the highest constraints in respect of finance (47.2%) followed by availability of inputs (24.5%) and extension services (22.6%), socio-cultural and psychological constraints (22.6%) and situational and management constraints (19.3%).



- The adoption of aquaculture technologies by the farmers had significant positive relationships with their knowledge on aquaculture technologies, training received, attitude towards aquaculture technologies, and innovation proneness; none of the individual characteristics of the farmers had negative relationships with their adoption of aquaculture technologies.
- Age, education, family size, farm size, pond size, annual income, decision making ability and fatalism of the farmers exhibited no relationships with their adoption of aquaculture technologies.
- Adoption of aquaculture technologies by the farmers had also significant positive relationships with the relative advantage and compatibility of the technologies, whereas it had significant negative relationships with the complexity and task demand of the technology.
- Constraints faced by the farmers in adopting aquaculture technologies had significant positive relationships with their age, family size, fatalism and yield gap. Conversely, constraints in adopting aquaculture technologies by the farmers had significant negative relationships with their education, annual income, and knowledge on aquaculture technologies, training received, communication media exposure, and risk taking ability.

### Policy implications

- Age of the farmers exhibited significant negative relationship with their constraints in adopting the aquaculture technologies. Hence, policy decision may be taken to give preference to the younger people while selecting the potential adopters of aquaculture technologies in the rural society.
- Concerned administrators should make arrangement for non-formal education for the farmers. However, in case of lower educational level among majority of the potential users of aquaculture technologies, emphasis should be given for providing need-based training in order to supplement the educational requirement.
- Need-based training programmes may be organized by the concerned policy makers so that farmers acquire necessary knowledge and skills related to the adoption of aquaculture technologies. In order to provide effective training to the farmers, training need assessment (TNA) for different categories of farmers may be done.
- Concerned authorities should take deliberate motivational campaign so that the farmers acquire courage to take risk at least to a minimum extent. If necessary, insurance scheme may be introduced for motivating farmers for adopting aquaculture technologies.
- Concerned administrators should take necessary arrangement so as to reduce the constraints faced by the farmers in adopting aquaculture technologies as far as possible through all possible means.

- Prior to diffuse any technology in the farming community, its relative advantages over other existing technologies as well as its compatibility need to be carefully evaluated by the policy makers for its wide scale adoption by the farmers.
- Concerned administrators should give due cognizance of the complexity and task demand factors of a technology while mass scale adoption of technologies by the farmers is planned and designed. Secondly, before taking the technologies to the farmers for adoption, its complexity and task demand aspects should be considered by the policy makers.

### Livelihood implications

Almost three-quarters of the farm operators in Bangladesh are small, marginal and subsistence framers. Any kind of adventurous activities are challenging for them. They want to be ensured and confirmed to get benefit from any technology. Hence, if adequate facilities are provided and opportunities are created for these framers, they would be interested to adopt more and more aquaculture technologies to improve their livelihoods. Polyculture of carp in ponds and nursery management practices in pond, which appeared to be the highly adopted technology by the farmers, can be the good options for the subsistence farmers to improve their livelihoods.

## Factors affecting the adoption of carp polyculture in Bangladesh

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### Abstract

A study was conducted to determine the factors affecting adoption of pond polyculture in six villages of three districts namely Mymensingh, Bogra and Narshingdi in Bangladesh. In Mymensingh, 75% pond owners adopted carp polyculture technology whereas in Bogra and Narshingdi only 16% and 25% pond owners, respectively adopted this technology for fish production. The production of fish per unit area was found to be 5 to 10 times higher in Mymensingh compared to that of Bogra and Narshingdi. Fish farmers identified three main problems affecting the adoption of pond polyculture viz. lack of input used in aquaculture, low fish yield and lack of credit facilities for pond polyculture. The technological awareness of the farmers directly contributed towards use of inputs in culture ponds. The positive impact of technological dissemination found on input use, fish yield and uplifted socioeconomic condition.

**Key words:** Carp polyculture, Impact assessment

### Research findings

- Out of thirty farmers interviewed from each of the three districts, 25, 5 and 8 farmers used carp polyculture technology in Mymensingh, Bogra and Narshingdi, respectively.
- However, the farmers do not follow the guideline recommended by the Bangladesh Fisheries Research Institute (BFRI) and the Department of Fisheries (DoF) for input use.
- The production of fish per unit area was much higher in Mymensingh compared to that of Bogra and Narshingdi.
- The sampled farmers of Bogra and Narshingdi were less familiar with technical know-how of fish production in comparison to the fish farmers of Mymensingh.
- The fish farmers in Mymensingh use modern technology due to the technical support provided by the GOs and NGOs.

- Credit for fish production from commercial banks was not easily accessible to the rural pond owners.

#### Policy implications

- Modern technological support for pond fish culture should be extended to all level all over the country to increase fish production.
- Research extension linkage should be strengthened to ensure proper technology dissemination to the poor fish farmers.
- Proper, effective and timely training should be provided to fish farmers to improve their knowledge on modern fish culture.

#### Livelihood implications

The study revealed that the fish farmers who used modern technology in pond fish culture increased their household income as well as socioeconomic status. Most of the farmers, however, were found in the trade with minimal technological knowledge and as a result, are getting less return which negatively affecting their socioeconomic, nutritional and livelihood status.



## **Adoption, productivity and profitability of rice-fish and fingerling culture in three selected districts of Bangladesh**

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### **Abstract**

The study aimed to investigate the productivity and profitability of rice-fish farming. It also determined the factors affecting rice-fish and fingerling production in Bangladesh. Among the total respondents about 55% were involved in rice-fish farming, 37% in pond fish culture and rest 9% in fish nursery. Integrated rice-fish farming contributed about 83% of the annual farm income in Comilla while it was about 20% in both Kishoregonj and Chandpur districts. Among the different farming systems integrated rice-fish culture and rearing fingerlings in the nursery pond were more profitable at the farm level. Farmers earned a net return of Tk. 49,714/ha from integrated fish culture with boro rice while the net return of boro rice-alone was only Tk. 11,179/ha. This indicated that farmer could earn 218% higher net return from integrated rice-fish farming than that of boro rice only farming. Moreover, integrated rice-fish culture also reduced pesticides cost to about 77% and weeding cost to about 51% in boro season. Fingerling nursing earned highest net returns among the three technologies.

**Key words:** Rice, Fish fingerling, Adoption, Productivity, Profitability

### **Research findings**

- A farm household survey using stratified random sampling technique was conducted basing on 150 farmers from Kishoregonj, 110 from Comilla and 40 from Chandpur districts in Bangladesh during the year 2004-2005.
- Most of the farmers practicing rice-fish farming were of small and medium sized farm while rich farmers were found to operate comparatively bigger sized rice-fish farms.
- Middle-aged (21-40 yr old) and secondary level of educated farmers were more devoted to the integrated rice-fish culture.
- About 55% of the surveyed households were involved in rice-fish farming, 37% in pond fish farming and rest 9% in fish fry/fingerling nursing.
- Integrated rice-fish farming contributed about 83% of the annual farm income in Comilla while it was about 20% in both Kishoregonj and Chandpur districts.

- More than 80% rice-fish farms were located at low lying land area having sandy-loam to clay-loam soil.
- Among the rice varieties, BR-14 and BRRI *dhan*-29 were mostly (60%) cultivated in the boro season, while BR-11 and pajam covered 70% of the study area in the Aman season under the integrated rice-fish farming.
- The fish species stocked in the rice fields included *Labeo rohita*, *Catla catla*, *Cirrhinus cirrhosus*, *L. calbasu*, *L. gonius*, *Puntius* spp., *Oreochromis mossambicus*, *O. niloticus*, and *Pangasius hypophthalmus*.
- Production cost of a rice-fish farm was about Tk. 83,043 whereas it was Tk. 32,333 for boro rice cultivation.
- Gross return from boro rice, rice-fish and fingerling production were Tk. 43,513/ha, Tk. 129,758/ha and Tk. 207,177/ha respectively. Among the different farming systems, integrated rice-fish culture and fish fingerling production were the most profitable at the farm level.
- Farmers earned a net return of Tk. 49,714/ha for integrated fish culture with boro rice while the net return of boro rice-alone was only Tk. 11,179/ha. Farmer could earn 218% higher net return from integrated rice-fish farming than that of boro rice-alone farming.
- Integrated rice-fish culture are also reducing the pesticides cost to about 77% and weed control cost to about 51% in boro season though there was no significant differences in case of both the culture systems.
- Similar trend was also observed in case of aman rice and rice-fish farming systems where the net return of the integrated farm was lower than that of the integrated farm of boro rice.
- Fish fingerling culture accounted for highest net returns among the three technologies in the study locations. Farmers earned almost Tk 70,000/ha/yr as net profit for fingerling production.

### Policy implications

- Financial resources need to be allocated for the small and marginal farmers practicing rice-fish culture
- Training of farmers should be organized on rice-fish culture and fish fingerling production.
- Dissemination of sustainable rice-fish farming technology to the concerned areas and to the marginal and small farmers should be focused.
- More resources should be allocated for rice-fish culture research in Bangladesh.
- Public-private sector collaboration should be promoted for sustaining rice-fish production in Bangladesh.