

THE ROLE OF FISH SEED PRODUCTION AND MARKETING FUNCTIONARIES IN FISHERIES EXTENSION

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ABSTRACT

The long-range objective of an aquaculture extension system is to help the rural fish farmers to reduce their desperate state of poverty through augmenting fish production. This study was conducted to understand the present situation of fisheries extension and to make a policy recommendations for the development of fisheries extension in Bangladesh.

From the discussion it was found that the extension of technical knowledge among fish farmers and attempts to disseminate information on fish culture was very weak in the study area. The farmers usually obtained help and cooperation regarding farming technology from their fellow group members. Looking into the vastness of available water resources, the huge number of fish producers and fisherfolk, the existing extension set-up and technology transfer mechanism are considered to be extremely weak. Such realization has led to the development of aquaculture extension approach which will be treated as a participatory extension system.

The paper proposed an extension system will be helpful for mass motivation and technology transfer to pond fish farming operators at different stages such as, hatchery, nursery and pond fish farmers. It is not essential for the Upazila Fisheries Officer (UFO) to make individual contact with the pond fish farmers, which is virtually not possible for them to do so, they can use the fish seed vendors as an extension agent for their purposes such as, motivation, technology transfer, knowledge dissemination etc. and in the process of farming operations, the different stage trained farm operators also could work as an extension agent on behalf of the UFO. It is expected that, this process of extension approach might be efficient, timesaving, cost effective and beneficial to the fish farm operators. It will enhance the pond fish production as well as other fish farming operations in rural areas of Bangladesh.

Key words: Technology transfer, Motivation, Fish seed production and marketing functionaries.

INTRODUCTION

Aquaculture extension is traditionally considered as an integral part of the fishery discipline. Aquaculture extension is defined as a system of educating and training rural people to develop fish farming skills and capabilities to increase fish production efficiency wherever water bodies are available to raise fish. The extension program is usually characterized by an educational process in which new aquaculture information is disseminated to farmers from the researchers, like any kind of extension work, aquaculture extension is a non-formal education system.

Poverty, multi-ownership of ponds, non-availability of input and lack of modern methods of fish culture and fisheries management are the main reasons for low production of culture fisheries in Bangladesh, and Consequently, dissemination of technical know-how among the fish farmers is an urgent necessity. It is strongly felt that an all-out effort should be made to increase fish production in all the available water bodies. Attempts have been made to provide extension service support to primary producers of this sector. However when considering the vastness of available water and human resources and the fishery potentials in the country, the existing extension service has been unable to provide sufficient support. Realization of this shortcoming led to strong extension components being incorporated into several ongoing projects. However the department of fisheries had so far initiated no systematic institutionalized extension program. Due to the lack of a well-defined extension system, programs, direction and authority, the field personnel remained engaged primarily in fishery administration and other non-extension activities of the department.

Most technology packages for the intensification of fish farming do not allow for the fact that traditional fishpond farming is mainly a secondary occupation. Although there is a great deal of traditional knowledge about growing fish in ponds, there is a general lack of literacy and knowledge in relation to modern techniques. Also, fish farming is but one of the several production and survival options undertaken by poor producers. Their decision to invest their time, labor and other resources is based on what they consider to be the comparative advantages of fish culture as an option. The "Top down" package approach adopted by most training and extension projects do not take into account other production and survival options and strategies at small farmers. Considering the above facts in mind, this paper has designed to discuss the following aspects:

- Growth of extension services and its limitations in Bangladesh
- Farmers' attitude towards the activities of present extension system.
- Limitations of the present extension system and
- To make an approach of fisheries extension process.

GROWTH OF EXTENSION SERVICES AND ITS LIMITATIONS

Agricultural extension, which aims the transfer of more productive and useful technologies to the farmers, is essential for the growth and development of the agricultural sector. Though Bangladesh now has a large governmental and non-governmental services sector for extension work, the past results of the extension services cannot be regarded as very satisfactory.

There has been a large organizational base employing a considerable number of people to bring about the desired level of socio-economic change in rural life. In the early fifties, emphasis was given to the development of specialized agencies for each broad area of activities in all sectors of the economy. In the seventies more importance was given to the development of individual crops through the activities of extension organizations for almost all-major crops.

Proliferation of extension organizations in different sectors of rural development activities resulted in the duplication of work, conflict and contradictions, and under-use of scarce human and capital resources, which were manifested in their poor performance. Additionally it created imbalance in resource allocation and use resulting in regional imbalance in productivity through wrong priority and emphasis. The clients were drifting from organization to organization and had to spend much of their productive time to meet various needs of these organizations "Bangladesh has many extension services, some times in the same area for different enterprises under the same or different agencies or ministries. The ultimate result is occasional confusion and chaos instead of enlightenment among the farmers due to competitive claims and counterclaims by multiplicity of extension agencies in order to impress their clients. The cumulative effect of such multiple extension services has been disastrous" (Hassanullah 1991).[1]

During the early 1960s the implementation of the scheme for fisheries extension services begun. Several development projects over the years strengthened extension services through the establishment of infra-structural facilities and provision for logistic support. . With a view to increase production in culture fisheries through the transfer of modern technology to the grass root level, the Government of Bangladesh initiated fisheries extension activities during the 1975-1980 through the Department of Fisheries (DOF). A separate Ministry was formed for the development of fisheries sector along with livestock and fisheries, which has offices established in each Upazila. The Upazila Fishery Officer (UFO) has the responsibility of overall supervision of the ponds, tanks and other aquatic resources, providing technical advice and cooperation with the fish farmer towards modern fish culture and motivating the farmers towards intensified fish farming in Bangladesh. The main objectives of extension service are:

- To create awareness among the people to undertake scientific aquaculture in the unused and under-used culturable water bodies for producing enough fish by people's participation to combat malnutrition
- To supply quality fish fry to the pond owners
- To enforce the provisions of the protection and conservation of the fish act, effectively
- To impart training on fish culture to the farmers and rural youth
- To organize fairs, exhibition, competition among the fish producers, distribution of pamphlets, charts, posters etc. and
- To provide easy credit facilities to the fish farmers through Banks

Little guidance is available on present fisheries extension system, their content, presentation or means of execution. There is no monitoring system of program effectiveness. The extension agent is a general fishery official whose task range from promoting improved or modern technology, enhance credit schemes, and supplying inputs, to performing general administrative duties. This wide-range of responsibility usually results in poor performance.

The task of improving the farming community is not being well defined in direction and content is overwhelming for the extension agent, who increasingly falls back on his administrative duties as an excuse for not visiting the farmers' field. The Upazila fishery officer is playing a key role in the fisheries extension process. However as he is suffering from shortage of manpower, and other material resources such as, transportation, and financial support it makes difficult him to conduct the extension services. The extension system is a top down approach, it serves to carry out the government policy and programs to the farmers' level where farmers' participation is restricted. At present, executions of the Fisheries activities are mandated by the Deputy Director of Fisheries (DDF), District Fisheries Officer (DFO), and Upazila Fisheries Officer (UFO) Fig 1.

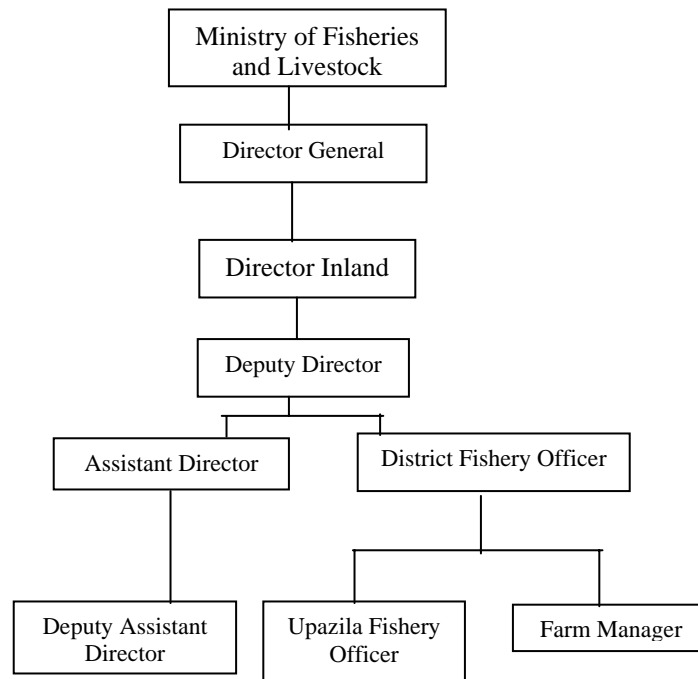


Fig 1: Organizational setup of department of fisheries for fisheries extension
Source: Department of Fisheries, (2000) [2]

Furthermore, the delivery of extension services to rural households was a serious problem due to the shortage of manpower at the grassroots level. The extension services were restricted to the supply of fish seed and training of the farmers at the fish seed multiplication farms and training centres. Moreover, very few demonstration programs were launched by different projects, where also the participatory approach was insignificant or absent. Such extension services could not encourage or advise farmers on the technical and economic aspects of aquaculture, as the extension services were not based on actual demonstrations at the farmers' level. The extension efforts were also not well organized and there was no definite plan to systematically cover the needs of the farming community. Furthermore, material input assistance mostly failed to identify the right farmers.

In general, the availability of resources for the purpose of extension work is highly inadequate. Much of the fisheries development budget goes for input subsidies, credit administration and infrastructure development and maintenance, and a very small proportion goes to extension function. Even within the extension organizations the lion's share of the budget goes for administrative overheads and maintenance expenses, very little is made available for the travel expenses of field staff and meeting the expenses for educational activities such as meetings, demonstrations, farmer training and other activities. As a result, in spite of the large budgets of organizations, very little is available for educational purposes. Consequently, the level of educational activities in terms of magnitude and quality is very low. In addition, within the same organization allocation of funds among the operational units is not based on sound principles, rather it depends on the relationship between the executive head and the unit heads of the offices. Consequently, it is observed that some units do little due to the lack of funds, and others who succeed in getting more resources find that by the time the budget allocation is actually received, the amount to be spent is too little for the effective use of the funds. Unless allocation of resources is goal-directed the question of improving effectiveness of fisheries extension system will remain a remote possibility.

However there was some realization about the importance of extension. This was reflected in the fact that extension was made an essential component in most development projects in the country, where sustainability was in doubt.

FARMERS ATTITUDE TOWARDS THE ACTIVITIES OF UPAZILA FISHERY OFFICERS

Aquaculture extension is an educational process to improve the knowledge, skills, attitudes and interests of fish farmers. It also helps in preparing them to solve their own problems for the higher production of fish and a better standard of living with minimum availability of basic needs of life. During extension work a continuous interaction between fish farmers and the extension agent is a constant process. The fish culture methods are subject to numerous natural risks and it needs constant improvement toward better-changed and manageable practices. However, the immediate function in aquaculture extension is to bring about a higher yield at every harvest so that the farmers attain a higher share. It is not just about providing them with the technical know how and experience of how to adopt the right attitude to do things by themselves, but at the time same it also about extension workers learning a lot from the farmers.

Considering the above fact, an attempt was made in the present study to find out how far the fish farmers were getting help and cooperation from the UFOs. Several questions were asked to the sample farmers at the time of the interview about which way the UFO had extended his hand for help and cooperation. The sample farmer's responses towards this aspect are shown in the Table I.

The results from the survey of the sampled farmers shows that only a small percentage of hatchery, nursery and pond fish farms were visited once or twice by the UFO before they gave certificates for sanction loans. Besides, they did not get any help or cooperation from the UFOs regarding modern fish farming. Most of them also reported that after the first visit they had never seen the UFOs in their localities again and they also failed in trying to contact them for any help or advice about fish farming. Only some of farmers reported that the UFOs had visited their ponds more than once to investigate their progress of re-excavation of ponds or other construction activities done that were possible because of the bank loan. A Study conducted by Rahman and Ali (1986), found that the majority of the pond fish farmers did not know the Upazila Fishery Officers personally and do not have any contact with them in their study areas. Some of the respondents' replied that they have some guidance and advice during their visit to the UFO office for credit purposes. [3]

Only a small number of hatchery and nursery farmers reported that they got technical advice from UFOs on brood fish rearing and hatchery and nursery management, also including topics such as, induced breeding, preparatory works, stocking rate, feed supply etc. About 19 percent of the fish farmers admitted that the UFOs gave advice regarding optimum combination of different varieties of fish species to be cultivated in ponds, control of fish disease and the optimum supply of fish feed and fertilizer for faster growth of fish.

Table I: Sample Farmers Response Regarding Help and Cooperation from the UFOs.

Nature of help /Cooperation/advice		% of respondents		
		Hatchery farmer	Nursery farmer	Fish farmer
i.	Visited the farm site once or twice	33.45	30	15.65
ii.	Technical advice offered for farm management practices	27.27	18	19.70
iii.	Necessary support services like training/credit/fish fries	9.09	4	11.86

Source: Field Survey, 2001

As the UFO has great responsibility in the progress of modern fish farming, the availability of credit for the reclamation of derelict ponds and increasing inland fish production in Bangladesh, the attitude of the sample farmers towards the activities of the UFOs was also considered crucial as a part of this study. Several questions were asked to know the attitude of the farmers of the performance of the UFOs and the results are shown in Table-II.

About 31 percent of hatchery and nursery farmers respectively reported that the performances of the UFOs was more or less satisfactory as they did not get any technical help and cooperation from the UFOs except in obtaining the certificate for sanctioning loan. Only a few percent of hatchery, nursery and fish farmer respectively reported that they were satisfied with the works of the UFOs receiving help and cooperation from UFOs whenever they needed. It is very important to mention that a substantial number of hatchery, nursery and fish farmers respectively reported that they did not know the UFOs personally.

Some of the hatchery, nursery and fish farmers reported that they were not satisfied with the work and duties performed by the UFOs. They mentioned that they tried to contact the UFOs for advice when fish were attacked by disease and for other technical advice, but failed to meet the UFOs. Many of them also replied that the UFOs had given their word to visit their farm again but they did not.

Table II: Attitude of Sample Farmers towards the Performance of the UFOs

Opinion		% of farmers category		
		Hatchery farmer	Nursery farmer	Fish farmer
i.	More or less satisfactory	31.82	31	23.44
ii.	Satisfactory	10.54	4	5.65
iii.	Not satisfactory	15.25	8.48	7.14
iv.	Do not know	41.39	58.52	63.77

Source: Field Survey, 2001.

INTERRELATIONSHIPS AMONG THE FISH FARMERS, SEED PRODUCERS AND DISTRIBUTORS

From the data of the present investigation it was revealed that there were two main sources of fish seeds in the region, such as Government Fish Seed Multiplication Farm (GFSMF), and Private Fish Seed Multiplication Farm (PFSMF). Besides these two main fish seed sources, there were also two other intermediate sources of fish seeds suppliers; they were Fish Seed Farms (FSF) and Fish Seed Vendor (FSV). Both GFSMF and PFSMF were provided with a hatchery^a and produced spawn artificially by induced breeding. They sell the majority of the spawn^b they breed directly to the FSF and stock the rest of the spawn in to their own nursery ponds^c, rearing them upto fry^d and fingerling size and then selling them to the pond fish farmer or FSV. These farms also stock some of the fingerlings of different species in the brood stocking ponds to use them for artificial breeding or household consumption.

The difference between the PFSMF and FSF is that the PFSMF is provided with a hatchery, where as the FSF does not possess hatchery. So the FSF cannot produce spawn by induced breeding. This farm has to depend for spawn supply on the GFSMF, PFSMF, and FSV for stocking their nursery/ rearing ponds. The fish seed vendors supply fish seeds from GFSMFs, PFSMFs, and FSFs directly to the fish farmers. The fish seed-marketing channel is presented in the table III.

The table reveals that FSV played the most important role in collecting fish seeds from different sources and distributing them to the fish farmers who want to stock their fishpond. Majority of the FSF (80%) marketed their produce through the FSV followed by 72% of the hatchery farmers selling their fry/fingerling through the FSV. Small percentage of FSMFs and FSFs sell their fish fry/ fingerling directly to the pond fish farmers.

Table III: Fish Seed Selling by the Fish Seed Producers

Marketing channel	% of total respondents N=100	Number of buyers (% of total buyers)	% of total seed sale
Directly to the pond fish farmers	26	350 (16.07)	12.50
Through the FSV	80	1656 (76.06)	79.21
Through the day laborer	4	171 (7.85)	8.54

Source: Field survey, 2001

Note: Farmers used more than one channel

From Table IV, it is clear that in the sampled areas 91% of the farmers collected their fish seeds through FSVs and rest of the farmers collected the seeds by themselves from GFSMFs, PFSMFs and or FSFs. Majority of the FSFs (95%) collected their fish seed from the PFSMF (Table IV). Considering the intensity of collecting fish seeds the study findings indicated that, although fish farmers collected fish seeds from different sources, they were receiving greater quantity of fish seed from PFSMFs and FSFs than the GFSMFs. It was reported that, PFSMFs and FSFs provide some kind of incentive to the FSV while they collecting fish seeds from these sources. The study conducted by D Wood (1994), reveals that the hatchery operators sell hatchlings or fry to nursery pond operators on credit, and the absence of this provision has been a constraint to the performance of FSMFs. The tied relationship between wholesalers of fingerlings and village traders intensifies the difficulties of FSMFs in targeting its fingerling output away from or independently for such relationships. With the absence of credit, wholesaler of fingerlings would buy up the FSMF stock of hatchlings and dominate their trade by selling their stock to nursery ponds.[4]

Especially the point of FSV not having to pay cash in front to buy the fish seeds from PFSMFs and FSFs rather paying it sometime later after selling their seeds. In addition FSV also get financial help from the FSMF and FSF.

Table IV: Collection of Fish Seeds by Fish Farmer and Fish Seed Vender from Different Sources.

Source	FSF (%)	% to total seed	FSV (%)	% of total seed	FF (%)	% of total seed
GFSMF	5	8	3	5	2.50	4
PFSMF	95	92	5	10	6.4	6
FSF	-	-	92	85		
FSV	-	-	-	-	91.01	90

Source: Field Survey, 2001.

In the present study majority of the fish farmers were found to buy fish seed mostly from FSVs, which might be due to easy availability as the FSVs bring the fish seeds right to their door. From the above findings it can be concluded that the PFSMFs and FSVs play a most vital role in the distribution of fish seeds to the pond fish farmers and it is also evident that GFSMFs, PFSMFs FSFs and FSVs have a strong relationship in the field of fish seed production and in the distribution process which is shown below in figure-2.

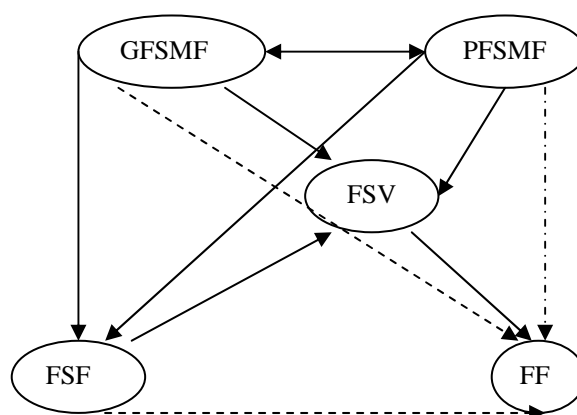


Fig-2: Interrelationship among the fish seed producers, distributors and pond fish farmers

It was found that the FSMFs, FSFs, FFs, and FSVs were not only selling and buying the fish seed from each other but they also exchanged their views, ideas and experiences on fish seed and fish culture technology which is presented in the Table -V. It was observed that though the fish seed production and marketing functionaries do not have formal training on fish seed production and fish farming, they exchange their views, ideas and knowledge based on their personal experiences. In absence of government extension support and services this traditional way of transferring technology helps the farmer as they learn from each other. It was also found that FSVs play the key role in the process of technology transfer from FSMFs and FSFs to the FFs. Lewis and Ali (1990), mentioned in their Extension Trader Strategy (ETS), the fishermen who were also fry traders, suggested that a pilot action-research project should explore the potential for linking the two roles further in a bundle of pond culture services, such as selling fry, harvesting, advising, and marketing, which would be provided by fishermen and traders to pond operators. This would strengthen the economic position of fry traders and fishermen and assist the development of improved pond culture practice in northwest Bangladesh.[5] The FSVs have a strong linkage with the PFSMFs and FSFs.

Table V: Sources of Knowledge Mentioned by the PFSMFs, FSFs, FSVs, and FFs

Sources	% of respondents			
	FSMFs	FSFs	FSVs	FFs
GFSMFs	25	14	8	6
PFSMFs	45	80	39	13
FSFs	0.00	12	75	25
FSVs	0.00	0.00	10	78
Others	30	10	20	26

Source: Field survey, 2001.

Note: Farmers mentioned more than one source

AN EXTENSION APPROACH

In order to overcome deficiencies in fisheries extension, an extension approach has been made based on the research findings, which is going to be discussed hereafter. Training and extension need to be based on what the farmers already know, do and have, taking into account the availability of resources around the homestead which can be used for fish culture and farmers' survival needs and strategies. This requires modifying the current "Top Down" extension packages (developed by NGOs and GOs) with little participation or input from farmers, and developing more of a Grass Root Up approach.

Fish farmers in general belong to the lowest socio-economic strata of the national economy. Most of them are also uneducated and illiterate or semiliterate. They also lack in innovation and adoption of modern fish culture technology. They follow traditional culture methods with inappropriate/irregular input use, resulting in a very low level of production. If the improved fish culture technology is made available to the fish farmers through an efficient extension service, higher rate of production could be achieved than the present rate. It is evident that the farmers need someone close at hand who can easily satisfy their simple needs and can translate the more complex technical knowledge in a simple way that could be easily understood by them.

All these emphasize the need for not only a dedicated and effective fisheries extension service but also an appropriate extension approach that gives definite directive to the system to ensure maximum impact of the program. There can be several approaches depending upon the nature and distribution of the type of aquatic resources, target group profile, extension manpower and infrastructure facilities.

However the problem is how to bring the more efficient improved fish culture technologies to the vast population of fish farmers, who need to know these technologies in addition to knowing how to get them implemented successfully in order to change their traditional ideas and practice to have a more efficient improved operation. The only solution is to take the already available knowledge to their doors and to create an environment to provide the momentum for aquaculture development.

Based on the above discussion, and the field level findings it can be argued that the fish seed production and marketing functionaries could play an important role in fisheries extension process. It has already been discussed that the fish seed production and marketing functionaries and the pond fish farmers have a strong interrelationship (Fig-1). To make extension teaching effective, an extension worker should make sure that he selects the right type of trainees for his program, the most appropriate subject matter for his teaching in addition adopting the right approach.

On the basis of inter-relation among the GFSMFs, PFSMFs, FSF, FSVs and the FFs the following extension approach has been proposed for the better extension services in the field of pond fisheries in Bangladesh,.

Diffusion of knowledge, skill and innovation for rural aquaculture modernization among the villagers can only be done through extension and a continuous training process. In this regard, the UFO and GFSMFs must have first-hand knowledge about the available aquatic resources in their Upazila, and then design the required development strategies and implementation of fish farmer projects. An aquaculture extension officer (UFO) brings fish farmers useful information that can help them directly increase their yields and profitability.

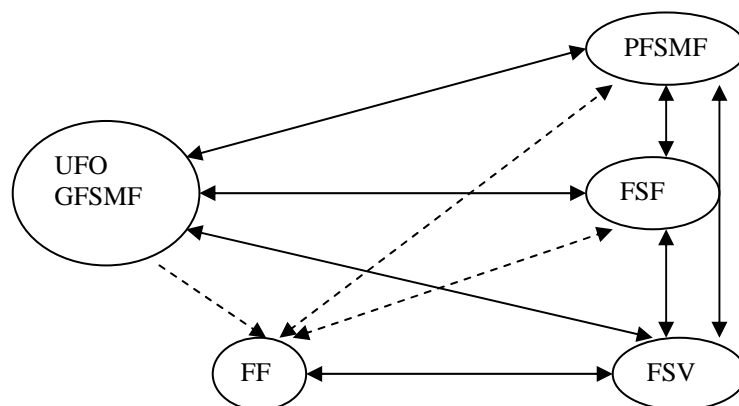


Fig-3: Concept of fisheries extension approach

A good extension worker (UFO) is looked upon by fish farmers as a person who possesses a bank of technical information that could help solve their technical problems such as disease prevention, quick growth rate, water quality and others. The major role of an extension worker (UFO) is to constantly enrich themselves with new technical information, test it and spread the solutions to the fish farmers. He should also help in conveying problems faced by farmers problems to the research centres and bring the solutions to the farmers. His main job is to translate abstract formulas on scientific language into clear, understandable common and easy language and then shows them how, when and where such new knowledge may be profitably and safely applied for a better yield. Therefore the UFO has to disseminate his knowledge through training and field demonstration processes to the grass root level farmers. The Upazila Training and Development Centre (UTDC) can be conveniently used for conducting regular training programs of fish seed production and marketing functionaries (PFSMFs, FSFs, and FSVs), which in their turn will again train the pond fish farmers about their respective area. Grogor and Alam (1990), suggested an alternative approach to the problem of extending information to food fish producers spread over a wide area is to use the networks which already exist in terms of seed supplies and food fish harvesting and experiment with ways of harnessing the mobility of these operators. The rationale for this approach was that since many fish seed traders and fishermen are already traveling between points of supply and fishponds, they can become the vehicle for carrying basic extension messages. It is possible that traders could therefore be trained in basic aquaculture practices and be motivated to pass this knowledge on to their clients.[6]

The PFSMFs could play an effective role in the field level aquaculture demonstration and training centre. The UFO, GFSMF farm manager can use PFSMFs facilities for training and demonstration purposes, because PFSMFs are situated in the rural areas and are also known by the FSFs and FSVs, they will be highly interested to attend the training courses. The PFSMFs will be interested to provide their facilities for training and demonstration purposes as it would increase their farming activities. The UFO, and GFSMF manager could be also used as trainers for conducting training courses representing from different nursery farms and FSVs. The nursery farmers and fish seed venders could be selected through discussion with the hatchery and nursery farmers respectively. The trained PFSMFs also could be used as an extension agent on behalf of the fishery official. The UFO should identify the training needs of his area and request farmers to attend training courses at regular intervals A successful extension program usually exerts a chain, which gives an impact on the community. It will stimulate other fish farmers to participate in similar extension work. It would be congenial atmosphere if the trainers and trainees are in harmony while learning the process of aquaculture practices where both parties would discuss matters in detail to find out solutions to any problem that arise. The trainer (UFO, Farm manager) should bear it in mind that farmers are key people as they know about most of the problems in depth and can give solutions from their experiences.

The proposed extension system is a participatory extension approach, which will demonstrate and disseminate appropriate technology among the farm operators through method and result demonstrations incorporating both individual and group methods of extension, day-long farm site training for farm operators, the use of instructional manuals and other training tools, a friendly relationship between demonstrators and fellow farmers, and a close monitoring operations.

The fish seed venders are the key extension workers, who could play an important role in transferring the modern aquaculture technology to the pond fish farmers. The FSVs have a strong linkage with the GFSMFs, FSMFs, FSFs, and it's possible for them to get the knowledge on aquaculture from these sources, and then they could transfer it to the rural pond fish farmers while bringing the fish seeds to the pond fish farmers. A study conducted by Islam (1998) on the performance of FSVs as an extension agent, found that the pond fish farmers who had contact with the FSVs had better management practices in their ponds than the non-contact farmers. They used more supplementary feed and fertilizers in their production practices than the other farmers (TableVI).[7]

Table-VI: Pond Fishery Management by the Contact and Non-Contact Farmers

Particulars	% of respondents	
	Contact farmers	Non-contact farmers
Supplementary feed supply	96	71
Organic fertilizer used	95	76
Inorganic fertilizer used	76	41
Aquatic weed control	64	51
Predator fish control	56	47
Use of lime	40	41

Source: Islam (1998)

The fish seed venders could be used as extension agents because:

- They have a direct contact with the fish farmers and have a good relationship with them
- They are the local people and are well known to the farmers
- Modern fish farming technology could be transferred to the fish farmers in a very simple and inexpensive way
- Possibility of being able to be in contact with a large number of fish farmers within a short period of time
- The process of technology transfer will be a participatory approach, which will ensure the participation at the farmers' level. The FSVs will get the feed back from the fish farmers and could communicate back to the UFOs without additional effort or assistance.

Several key factors are obviously key to the success of the proposed extension system. Good working relationships should be established between all parties and there also need to be appropriate training organized for extension officials, farm operators and distributors. The technologies for transfer must be need based according to local conditions and any required input should be available in a timely manner. There should be a requisite number of trainers at the Upazila level as well as resources for conducting training courses and field demonstrations.

CONCLUSION

The long-range objective of an aquaculture extension system is to help the rural fish farmers to improve their desperate poverty through augmenting fish production. One way to achieve this is by teaching them new techniques to intensify their culture operation and farm management to increase farm yield and profitability or introduce fast growing strains or species of good market value. Apart from serving the individual needs of the fish farming community, aquaculture extension programs, which form an integral part of development activities, plays a significant role in combating malnutrition, improving rural economy, creating employment and preventing migration of rural youth from rural areas to the urban city centre.

From the above discussion it was found that the extension of technical knowledge among fish farmers and attempts to disseminate information on fish culture was very weak in the study area. The majority of the PFSMFs, FSFs, and FF reported that they were not satisfied with the activities of UFOs in addition to not personally knowing UFO. Sometimes fish farmers traveled miles away from their homes seeking help, in regard to information or remedies to some immediate problems but were unable to meet with UFO, so farmers usually obtained help and cooperation regarding farming technology from their fellow group members. It was found that FSVs have been playing an important role in the technology transfer process, leading to very strong relationships with the GFSMFs, PFSMFs, FSFs and the pond fish farmers.

Looking into the vastness of available water resources, the huge numbers of fish producers and fisherfolk, the existing extension set-up and technology transfer mechanism are considered to be extremely weak; such realization has led to develop an aquaculture extension approach which will be treated as a participatory extension system.

The proposed extension system will be helpful for mass motivation and technology transfer and to the different stage pond fish farming operators like, hatchery, nursery and pond fish farmers. The main theme of the proposed extension approach is to sustain the flow of improved know-how from extension agents to fish farmers for its adoption and for the FSVs, PFSMFs and PSFs to communicate back to the extension personnel about the field problems faced by the end users during the adoption process. In other words, it will maintain a two-way information flow and thus, completing the communication cycle. It is not possible for UFOs and farm managers to keep close contact with every fish farming operator in his own Upazila. To overcome this hurdle, selected FSVs after acquiring leaderships, self-confidence and self-reliance through activities, will act as a volunteer extension worker to UFOs. The participation of FSMFs, FSFs and FSVs through the contribution of their resources, knowledge and skills are essential to enhance government fisheries extension programs. It is expected that, this process of an extension approach might be efficient, timesaving, cost effective and beneficial to the fish farm operators leading to the enhancement of the pond fish production as well as other fish farming operations in rural areas of Bangladesh.

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Endnotes

^a . Hatchery: It is the seed farm for spawning and hatching

^b . Spawn: It is the newly hatched fish larva up to the stage so long it derives food from the yolk as attached to the body.

^c . Nursery ponds: Where hatchlings are grown to fingerlings.

^d . Fry: It is the fish larva when it starts feeding upon the natural food from water body after the absorption of yolk sac and takes the actual shape of a baby fish. Fry length varies from 15-30mm.