

# A HANDS-ON TRAINING HELPED PROLIFERATION OF TILAPIA CULTURE IN BANGLADESH

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## ***Abstract***

Realizing the need to develop appropriate skills of extension worker, 2<sup>nd</sup> Fisheries Training and Extension Project (FTEP-II) funded by Department of International Development (DFID), UK focused to develop the skills of DOF officials as trainers. The main goal of the project was to demonstrate the direct benefits to the poor that could result in by improving the capacity of trainers and by supporting the application of this capacity in extension service delivery. Under the project, a group of selected DOF officers (extension workers) were sent to the Asian Institute of Technology (AIT) based in Thailand for training on mono-sex hatchery management and cage culture of tilapia in 2001.

Thinking to apply the knowledge and skills gained through 4-week hands-on training, one of them upon his return to workplace (Fish Breeding and Training Center, Raipur) collected F6 generation of Genetically Improved Farmed Tilapia (GIFT) from Bangladesh Fisheries Research Institute (BFRI) which was originally from ICLARM, now World Fish Center. Applying selective breeding high quality seeds of GIFT were produced and 3.7 million seeds were distributed among the farmers during 2002. By motivating the private farmer and providing the technical support, a mono-sex tilapia hatchery and grow-out farm (Ambar Fisheries) was established in Laxmipur district in 2002. In the same year, cage culture was promoted among private entrepreneurs. As a result, 40 cages (6mX3mX1.5m=27m<sup>3</sup>) were set in the Dakatia River in Chandpur. Following the success, cage culture expanded to Laxmipur district in 2006 due to which demand for seed increased. Under the technical assistance of the same person, Pioneer Fisheries and hatcheries started its operation in Chandpur district in the same year. After the success of these first few hatcheries which produced several millions of high quality sex-reversed tilapia fry, many others showed interest. At least four hatcheries came into operation between 2006 and 2008 in mid-southern part of Bangladesh. After this, proliferation of mono-sex hatcheries and cage culture started in many parts of Bangladesh. About 3,500 cages are in operation now in Chandpur along the Dakatia River, 500 cages in Laxmipur along the Meghna River. Culture involves stocking of 37-40 sex-reversed tilapia fry of 20-25 g size per m<sup>3</sup>. Fish grow around 400 g in 6-7 months giving around 15kg/m<sup>3</sup> productivity when fed floating feeds. Mortality remains <5% and FCR around 1.75. Altogether, these cages are producing at least 3,200 metric tons of tilapia annually. At least 600 people including 5% women are working in the cages. Four feed producing companies are providing 6,000 MT of floating feed annually. Probably, as a result of intensification and contamination from other countries, farmers as in other countries, are facing disease problem which is threatening the tilapia industry. A solution has to be explored.

## 1. INTRODUCTION

### 1.1 Background

Bangladesh has the sub-tropical monsoon climate with temperature range ranging from 11 to 34°C. Bangladesh is composed of mainly the great combined delta and flood plains criss-crossed by numerous rivers and their tributaries. There are over 250 large rivers in the country. The three major rivers, the Padma, the Brahmaputra and the Meghna, drain a catchment extending over Bhutan, Nepal, India, Bangladesh and China. The total area of these river basins is about 1.5 million sq km of which 8% is in Bangladesh. Bangladesh alone has about 4 million hectares of inland open water area and 0.3 million hectares of inland closed waterbed (Banglapedia, 2003). The inland closed water bodies especially the ponds and shrimp-farms are almost on peak of utilization and losing their production potentials day-by-day. But most of the inland open water bodies including extensive floodplains are still left for capturing the natural stocks and un-utilized. Increasing pressure of population over the natural resources, siltation, and water pollution by industries and agriculture are causing decline in the natural fish stock critically while the demand is increasing rapidly. Wise use of the potential vast flowing water by promoting culture fish in cages could assist in fulfilling the demand of national protein intake as in other Asian countries. After the liberation of the country a number of NGOs (e.g. CARE-Bangladesh and others) along with the relevant government department tried for decades but unfortunately due to some factors the technology didn't sustain in the country. However, Department of fisheries (DoF) collaborating with other governments and NGOs continue to promote cage culture. A remarkable breakthrough was achieved when some DoF field level officials had the opportunity to receive training from the Asian Institute of Technology (AIT) based near Bangkok, where the technology mono-sex seed production was developed. One of the authors of this paper serving for the DoF being based in Fisheries Training Institute was able to translate the knowledge and skill gained from the high quality training into practice in Bangladesh. Cage culture in rivers has been introduced in Bangladesh successfully to support poor communities residing in two districts; Chandpur and Laxmipur. Six large-scale mono-sex hatcheries have been established so far working with the private sector. The technology has been disseminated to other parts of the country. Gradually, a number of organizations along with the government and various social sects have also been involved. This has efforts has been a model as it brought in a huge direct and indirect benefits to the communities in a number of ways, such as, by producing high quality protein near the doors, creating employment opportunity, increasing family income and supporting economic activities through linkages with private sector. This paper highlights the approaches used hoping that it could be a model for others in Bangladesh as well as rest of the world.

## 1.2 Tilapia – species of choice

Tilapia, especially Nile tilapia (*Oreochromis niloticus*), better known as aquatic-chicken, has become the second most important fish species in world aquaculture after carps overtaking salmonids. Although native to Africa tilapia have been introduced around the globe and its farming is growing rapidly especially in Asia including Bangladesh because of their fast growth, ease of breeding and accept a wide range of feeds including planktons from natural sources, high disease-resistance and tolerance to poor water quality and low dissolved oxygen levels. Tilapia is gaining popularity in the west as well because of its white muscle with mild flavor with no intra-muscular bones. Tilapias are a good source of protein and a popular target for artisanal and commercial fisheries in Bangladesh. Although tilapia is alien species, it is considered almost like a native species in Asia. It is raised in inland ponds, lakes, reservoir, and artificial tanks and even in lowland agricultural fields. Developing the GIFT variety by ICLARM (now WorldFish Center) and development of Sex Reversed Tilapia (SRT) seed production technology by the Asian Institute of Technology (AIT) has added new dimension in tilapia aquaculture. Farmers have been well-acquainted with tilapia culture. Mozambique Tilapia (*Oreochromis mossambicus*) was first introduced to Bangladesh in 1954 but due to the black color, excessive breeding nature, and low productivity character of the fish it could not be well accepted by the farmers. In 1974, UNICEF arranged the introduction of *Chitralada* strain of Nile tilapia from Thailand (Hossain, 2005) which proved to be far better and farmers started its farming. Further introduction was in 1994 by the WorldFish Center. Tilapia farming gained importance in Bangladesh only during last ten years only.

## 1.3 Cage culture

Cage culture has been successfully practiced most Asian countries adopting which China, Vietnam, Thailand, Taiwan and Malaysia have increased their national fish production by several folds and leading the international tilapia market and producing better sized tilapia whole frozen and fillet (Am. Tilapia Assoc., 2010). As Bangladesh has high population density and regularly losing agricultural lands for urbanization, closed water bodies to produce fish is limited; and production has reached to high enough of its capacity. Now is the time to introduce cages in flowing river-water to increase the fish production promptly. Vast open water-bodies are still unused. Following the other countries of Asia cage culture here may be the appropriate tool for additional fish production. Although for the last three decades Asia is leading in cage culture whereas Bangladesh was and still is far behind despite having huge water resource. Various attempts were made in promoting cage culture as summarized in Table 1.

Although cage culture has a history, due to various reasons, cage culture in Bangladesh did not take off as in other Asian countries. Almost all the efforts, even well-established CARE-Cages, encountered sustainability problem due to the following reasons:

1. Lack of quality net
2. Lack of suitable floating feed
3. Poor selection of fish species suitable for cage farming
4. Lack of required technical know-how
5. Absence of skilled manpower to operate the cages
6. Lack of concerted efforts and
7. Socio-economic problems (e.g. poaching, conflicts etc.)

**Table 1:** History of cage culture in Bangladesh

Duration	Activities	Remarks
1977	Commercial cage culture was included in the National Development Program.	Target was to promote fish production utilizing the vast open water.
1978	Department of Fisheries and Bangladesh Agricultural University introduced cage culture mainly for research of the post-graduate students of Fisheries Faculty.	These experimental cages were mainly as a part of post graduate student's course-curriculum.
1980	Bangladesh Fisheries Development Corporation and Bangladesh Krishi Bank jointly started cage project in Kaptai Lake.	Poor management and lack of technical know-how resulted ending of project.
1986-87	Department of Fisheries introduced cage culture of Indian major carps in Kaptai lake.	Hand-made feed could not bring any good result.
1981-84	Department of Fisheries derived experimental cage culture in different places of the country; the remarkable one was the cages in Dhandmondi lake in Dhaka town.	Survival rate was good but production of <i>O. niloticus</i> was not up to the satisfactory level.
1983-84	In the same Dhanmondi lake cage culture of Rohu Catla, Mirgal, Bighead, Silver and Nile tilapia was trialed. Survival rate was high and production rate was poor.	The survival rate was high
1987-1991	BFRI tried experimental cage culture in Kaptai Lake.	Hand-made feed was used, no good result was obtained.
1992	CARE-Bangladesh and North-west Fishery Extension project introduced cage culture in Kakrul beel (floodplain) in Rangpur.	Leasing complexity of the beel caused stopping of the activities.
1993-95	North-west Fishery Extension project run cage culture with women groups in many places of Chirirbondor and Parbotipur.	Cutting off the nets by crabs finally became a threat.
1995	CARE-Bangladesh undertook the project "Cage Aquaculture for Greater Economic Security" (CAGES) for experimenting in Meghna-Gomti river.	The technology couldn't be proved economically sound and therefore, was not disseminated.
1996	North-west Fishery Extension project along with RDRS started cage culture at Dimla and Aditmari.	Tilapia was found to be the best species for cage culture followed by Pangsias.

Source: DoF, Bangladesh

## **2. NEW APPROACHES OF TECHNOLOGY TRANSFER**

This section describes the approaches of technology transfer activities step-wise.

### **2.1 High Quality Training**

Funded by the Department of International Development (DFID), UK, Fisheries Training and Extension Project (FTEP-II) realized the need to develop appropriate skills of extension workers of DOF officials as trainers. The ultimate goal of the project was to demonstrate the direct benefits to the poor that could result in by improving the capacity of trainers and by supporting the application of this capacity in extension service delivery. Under the project, a group of 18-members were selected DOF officers (extension workers) for 4 training at the Asian Institute of Technology (AIT) based in Thailand on mono-sex hatchery management and cage culture of tilapia in July 2001. The 4-week long training program that combined with theoretical knowledge with practical hands-on session in field work and exposure visits to operating farms provided adequate information and skill to promote the tilapia culture upon return.

### **2.2 Initiation at Office**

Immediately upon return after receiving the training, broodstock of GIFT F6 generation from Cox's Bazaar Marine Station one of the BFRI's stations were obtained and reared at government Fish Hatchery and Training Center (FH&TC), Raipur. As FH&TC was supplying high quality seeds of carps to the fish farmers of mid-to-southern part of the country, there was a good opportunity to provide information and motivate them supplying them some GIFT seeds for their trial. Within short period of time farmers of the region showed interests in GIFT due to its good performance. Within a year in 2002, about 3.7 millions of GIFT fry were produced and supplied to the fish-farmers which were produced through selective breeding and feeding with simply wheat bran twice a day. In addition to supplying high quality fry, FH&TC provided technical supports to the farmers including field visits.

### **2.3 Public-Private Partnership I: Ambar Hatchery**

Farmers gradually realized the need of SRT hatchery in their area. Fortunately during the farm visit at Laxmipur district, 15 km away from the station, a private entrepreneur was about to start a fish farm who was in need of technical support to expand the farm. Providing technical supports, a small unit of SRT hatchery was requested to add expanding its area to 40 acres in mid of 2002. The hatchery unit started producing SRT seed commercially from 2003. The brood stock was developed from the GIFT stock from Fish Hatchery and Training Center, Raipur. Annual this hatchery is supplying about 50 millions tilapia. After knowing it, five small farm owners showed their interests in starting tilapia hatchery. With required

technical assistance these farms also started production of mono-sex tilapia since 2004. Gradually the mono-sex tilapia started getting popularity replacing mixed-sex tilapia farming.

#### 2.4 Introduction of Cage Culture in Dakatia River, Chandpur

During the establishment of Ambar Fisheries and Hatchery, a net factory at Comilla, 60 km away from the hatchery, was communicated about the demand / need of a large amount of netting materials required to prepare hapas. It was also revealed that the Managing Director visited Thailand several times for the raw materials of net-production and who was also encouraged to initiate cage culture. As a result, interest in producing the cage-nets was started. After getting technical specification, nylon nets suitable for cage culture started. Initial trials with some 40 cages in Dakatia River in September 2002 were funded by the net factory itself. For the trial, initially Indian major carps were used with feeding of hand-made feeds using feeding trays but without a success. Failure was due to jumping nature of the carps against the water current, low growth and occurrence of diseases. Even then the trial continued with shrimps and Thai Sarputi (*Barbodes gonionotus*), but still with no good result. Finally, mono-sex tilapia fry were selection which was the turning point for the success of tilapia cage culture. The fish got marketable size in six month. After a year of success operation people of surrounding areas were suggested to apply the same technique.

#### 2.5 Public-Private Partnership II: Pioneer Hatchery

Number of interested cage farmers increased, so the demand for mono-sex fry. As a result it was felt that the single SRT hatchery was not enough to supply adequate fry. In 2006, a Pangus farmer Mr Mosharef Hossain Chowdhury from Chandpur near the cage culture area expressed his interest to establish a tilapia hatchery. Then the second private monosex hatchery named "Pioneer Fisheries & Hatchery" was started at the end of 2006, which started supplying seeds in 2007 (Fig. 1). This hatchery played key role in booming the cage culture through supplying quality seeds. As this hatchery was the second one, with the experience from the first one, the setup is far better equipped and well-organized as it was known from where to collect the materials and how to construct the facilities. Thus, the annual production of this hatchery reached up to 100 millions of seeds.



**Fig. 1** Pioneer tilapia hatchery

## **2.6 Training and Field Visits**

After the successful introduction of cage culture in Chandpur, the Department of Fisheries, Bangladesh, concentrated its activities and efforts at the community level. Fisheries Training Institute, Chandpur offered training on cage culture where necessary facilities required for the hand-on practical training were developed gradually. Using the practical working experience, a 7-day training module has been developed which is used in all training centers for training to the farmers as well as department staff. DoF has trained 167 Field Assistances (helping hand of Upazila Fisheries Officers), 78 Upazila Fisheries Officers (extension workers in Upazilas) and 148 investors so far. In addition, DoF arranged visits for 48 District Fisheries to Chandpur to share the of experience cage culture. Similarly, DoF arranged the same type of visits for 42 enthusiastic fish farmers from different areas of the country. As a result of this attempt in combination with the efforts made by other organizations such as BFRI and others, over 70 mono-sex tilapia hatcheries exist in Bangladesh which supply high quality fry to the cage well as pond farmers throughout the country.

## **2.7 Involvement of NGOs**

In 2007, the then responsible Advisor to the Ministry of Fisheries and Livestock of care taker government invited various NGOs to get involved in helping riverside Zatka fishing communities who used to catch juvenile Fish with a view to generating income through cage culture especially during ban period of fishing. In response, ActionAid, Bangladesh supported the costs of hands-on training to 25 Zatka fishers at Chandpur and BRAC Bank (<http://www.bracbank.com/index.php>) provided loans to them to start a cage each.

## **2.8 Involvement of Army**

It was during the period of care-taker government, the army officers were trying to work closely with grass-root people and local governments. In a routine program they visited the cage culture activities and expressed their desire to help poor people through cage culture from their benevolent fund. Accordingly they organized 80 landless riverside-dweller-families and set 80 cages for them. The local government was involved in the committee for better run of the project. The then Army Chief inaugurated the program by stocking tilapia in cages and media highlighted it. As a result various departments, local elites, media correspondents paid more attention to the activities which got the national coverage by mass-media. As a result some people from different part of the country came to visit Chandpur and thereafter some of them introduced cage culture in their places. Although there is no actual number of cages and production, it has spread many parts of the country.

### 3. SALIENT FEATURES OF THE TECHNIQUES

#### 3.1 Mono-sex hatcheries

All the basic techniques and procedures learned from the training at AIT have been followed but the materials required for hatcheries have been designed or obtained locally. Set-up of the hatchery, equipment and materials (e.g. incubation jar) differ slightly. However, fry production has been achieved to a highly satisfactory level. Although the level of production as well as the quality is still to improve in order to make comparable to the Thai counterparts.

#### 3.2 Cage Dimension and Orientation

Cage dimensions were basically used the same as in Thailand (6 m X 3 m). Cage frames are made up of 2.54 cm diameter GI pipe. Cage height is maintained 2 m maximum as the Dakatia River is not so deep. The cage frames are arranged in series keeping 45 cm gap between two to accommodate exhausted barrels. The frames are set by connecting rods with clamps in each head. As the river water has multiple use covering inter district river-path navigation, cages have been arranged in a single row (Fig. 2) either one side or both the sides of the river leaving enough space in the middle of the river for navigation.



Fig. 2 Cages along the river in Chandpur.

#### 3.3 Netting Material and Mesh

A group of laborers have been trained to make the cages for farmers. The netting materials are purchased locally. Rolled nets are purchased from the factory. They cut and sew to the particular shape and size of hapa/cages. As stocking size of fingerlings is 15-20 grams, the mesh size has to be around 2 cm. A finer meshed net (locally called Rachel net) of 0.5 meter height is attached to the upper inner side of cages to protect the floating feed pellets escaping out. A larger meshed (5 cm) net is used to cover the cages on top to protect from birds e.g. pelicans, eagles and others.

#### 3.4 Floating the Frames and Setting the Nets

The cage frames are attached one another in a series supported to float by 2-3 exhausted 200L barrels. As the river water gets saline (influenced by ebb-tide) the steel sheets of barrel last only two years. So

farmers are using the plastic barrels nowadays. The whole structure is then hardened by binding with bamboos around the structure. The setting of frames and barrels are done on the land first and then pushed over the river water, placed in a suitable place and then tied with anchors in all sides. Then the cage-nets are attached with floating frame suspending down with the help of half-bricks tied at each corner. After setting the cages, they are left exhausted for about 15 days so that the inner parts of the nets lose their roughness so that fishes would not be wounded.

### **3.5 Stocking Size and Stocking Density**

Farmers stock larger fingerlings e.g. 20 g although there is higher mortality compared to smaller ones during transportation from hatcheries/nursery ponds. Stock of 1,000-1,100 mono-sex tilapia fingerlings per cage of 27m<sup>3</sup> (6m X 3m X 1.5m) i.e. 37-40 per m<sup>3</sup> is applied. Increasing the density beyond this increases the mortality.

### **3.6 Feeding Rate, Frequency and FCR**

Floating feed was first introduced by RUPSHEE fish feed in Bangladesh only in 2006. Before 2006 feeding in cages was difficult job as it was not clear how the sinking feeds were used by the fish. Production of floating feeds assisted farmers a lot as farmers can observe and control feeding. Feeding is done twice daily to satiation level spreading over the water surface in each cage. During feeding the cages are not disturbed by any other activities. A number of companies are supplying floating feeds; the quality of them is more or less similar. Good feeding management in cages ensures the FCR remain less than 1.75, whereas, inexperienced new farmers use more feeds unnecessarily.

### **3.7 Sorting and Grading**

Depending on the feed quality, variation in fish size becomes obvious. Fishes are graded and kept in different cages. Better the quality of feed and shorter will be the seed sorting interval. Normally, sorting is done once a month that means during the culture cycle of 6-7 months it requires 5-6 sortings. Fish are sold when they get larger than 400 gm. If smaller fish are kept further to grow. Sorting is done from late morning to noon.

### **3.8 Marketing Pattern**

Unlike pond cultured fish, marketing of caged fish is very easy. Retailers come to the cage sites at a pre-set time, and collect on desired amount of fishes. The cage operators usually sort out the marketable sized fishes a day before selling date. Feeding is stopped 6 hours before harvest. Usually fish sellers collect two times from the cages, in the morning and in the afternoon and sell them in different markets even in neighboring village markets. In addition, some sellers collect caged-fishes early in the morning and ferry live-fishes to the urban housing areas to sell live fishes.

## 4. RESULTS AND IMPACTS

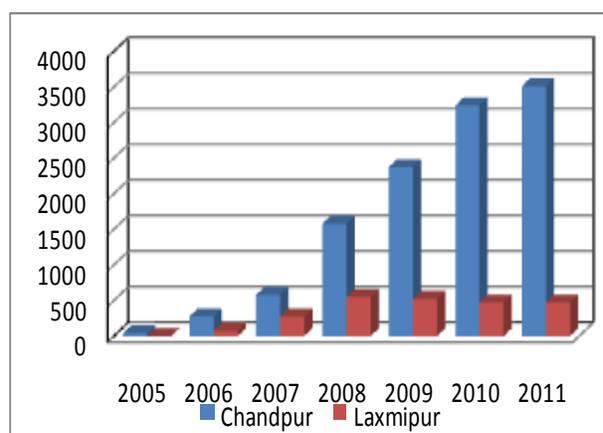
### 4.1 Extension Trends of the Technology

Until the end of 2005, nobody paid attention to the activities in Chandpur. Farmers started showing interest only when it was demonstrated from trials with farmers and proved to be economically profitable at the household level. Once proved, number of families interested increased gradually and so the number of cages (Fig. 3). Various social sects such as, other businessmen, unemployed youth groups, primary school teacher, started involving in the venture. Thus at the end of 2006, a total 276 cages were functioning in Dakatia river and in 2007 the number increased to 578. Especially, after the involvement of Bangladesh Army, mass media highlighted and many more people came to learn about the activities and many people started getting involved indiscriminately and remarkable competition was observed for placing the cages in the rivers. At the end of 2008 the number raised to 1,580 and in following two years (2009 and 2010) the figure raised to 2,375 and 3,241 and at the moment there are 3,510 cages in the river Dakatia alone in Chandpur.

It was also possible later in October 2006 to transfer the cage culture technology to nearby district i.e. Laxmipur only after having success in the district where training center was located. A total of 78 cages were introduced first in a canal of Meghna river near Barishal-Laxmipur steamer Ghat. In the following year the number increased to 273 and then in 2008 it reached to 550 covering 2 km canal leaving only one side for navigation. However, during the following years the numbers of cages at Laxmipur have declined because some poor farmers could not continue supporting the feeding cost (Table 1 and Fig 4).

**Table 2.** Number of cages by year

Year	Chandpur	Laxmipur
2005	40	0
2006	276	78
2007	578	273
2008	1580	550
2009	2375	523
2010	3241	475
2011	3510	475



**Fig 3:** Number of cages in Chandpur and Laxmipur districts of Bangladesh

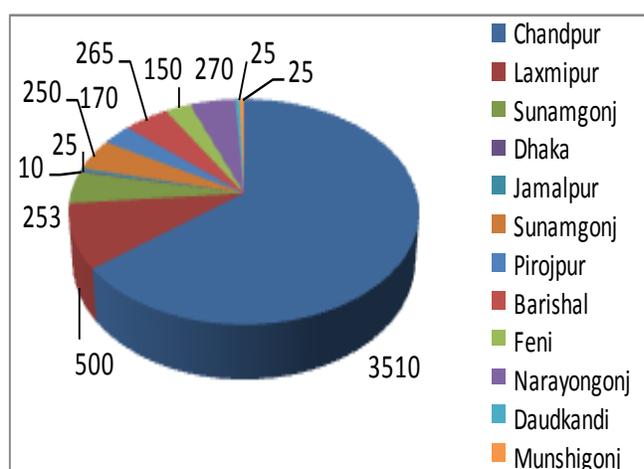
From the very beginning well-being of the communities was highlighted as basic motive behind the investment in cage culture to avoid profit oriented rich people and their businesses. Gradually, when more people got involved, seed and feed demand increased which provide the opportunities for the larger companies to get involved. Some of the cage farmers have at least five cases in Laxmipur have sold out their cages due to shortage of funds to buy feed.

## 4.2 Impacts so far

A total of nearly 4,000 cages of Chandpur and Laxmipur are now producing approximately 3,200 metric tons of tilapia annually with the local market value of US\$4.6 million using about 600 metric tons of floating feeds with the value of US\$0.26 million. Each kilogram of tilapia is sold at US\$1.75. In some areas, cages are managed under single and multiple ownerships at least 124 units known. On an average, each unit employs at least 5 people, thus a total of 620 men have got direct employment in cage farming. About 10 feed-agents are supplying feeds with about additional 30 people are working for maintaining the feed marketing channel. In the two districts about 25 laborers are involved in making cages and 10 more people work in different places for setting up the cages in rivers. About 25 retail fish sellers are involved in marketing the caged tilapia on regular basis. Cage farming has now expanded throughout the country, especially after the involvement of Army, which was covered by the mass media. Many farmers from different part of the country paid visit to Chandpur who have introduced cage culture in their places. Although there is no actual number of cages and production, it has spread many parts of the country. Table 3 presents initial report.

**Table 3.** Fish cage spots / districts

Sales	
Spots	No of cages
Chandpur	3510
Laxmipur	475
Sunamgonj	253
Dhaka	10
Jamalpur	25
Sunamgonj	250
Pirojpur	170
Barishal	265
Feni	150
Narayongonj	270
Daudkandi	25
Munshigonj	25



**Fig 4:** Expansion of Chandpur model cage culture to other districts

Thus the cage farming has created a lot of jobs in various levels of process that links producers with consumers. Cage culture and other associated activities have developed several indirect employment opportunities. Women's participation is limited as the activity requires working in the large volume and deep water (river) and far away from their homes. However, few women are involved in groups, especially fisher families who reside near the river. In such cases, illiterate fisher women have got donation or loan from NGOs. Even then female members often are assisted by their husbands.

More interestingly, illegal fishing and netting has drastically reduced due to the presence of cages in these two districts as they cover almost all the areas along the river side (total coverage is 84,000 square meters of river surface). Therefore, it has helped conserve the natural stock and their breeding. During feeding period small indigenous fishes from outside the cage enter and share some percentage of the same feed. Thus cages culture has ensured food for natural stock and preserved serving as fish sanctuary. Increased population of small fish species around the cages are observed clearly.

## **5. PROBLEMS ASSOCIATED**

Although the cage culture technology has been introduced in Bangladesh with new approaches and new dimension, it has not been easy and without obstacles. Dense population, illiteracy, economic insolvency, rivalry and jealousy to each other, non-cooperation from many sects, social conflicts and few others are affecting its expansion. The major problems encountered are as follows:

### **5.1 Conflicts of Interest**

Initially the river Dakatia was selected for setting up cages, due to its' non-turbulent environment, security, easy transport of cage materials, seeds, feeds and giving suitability of marketing the fishes to surrounding numerous urban and village fish-markets. Until 2005, since the technology was not well-known to the people, it was thought that the whole Dakatia could be used for cage culture except the areas where industries and poultry farms release the effluents. However, when more and more people came to learn from one another, conflicts of interests started in the use of river. Some people marked their places with red-flags until they installed the cages; turning some cases into cruel conflicts. Concerned authorities and sects had to compromise with the riverside dwellers to solve the crisis.

### **5.2 Cages Damaged by Ships**

The same rivers are used for inter district navigation. A good number of steamers run from Dhaka to Chandpur daily. All these steamers crossing the main stream of Meghna reach Chandpur. On their arrival

they settle down in the secure inner ghats which are about 5-7 km inside from the Dakatia, where numerous cages have been installed on both the sides. The steamers especially in the foggy winter night sometimes run over the cages unknowingly. Thus another type of conflicts aroused between cage-owners and steamer-drivers. The strong association of steamer owners did not pay attention to the crying of cage operators. As a measure, the cage operators have installed security lights with series of bamboo poles over the cage structures. At the same time, the steamer drivers have been requested to drive their vehicles cautiously particularly around the cage culture area.

### **5.3 Poaching from Cages**

Fish poaching is common in the rural areas. It is even easier for poachers to get fish from the cages and run away. Some cage operators faced the problem in these two districts especially during nights. Despite having guards, sometimes it happens at other end of the same cage row. Electrification with security lights and increasing number of guards, the level of poaching has been controlled to some extent.

### **5.4 Lack of Legal Right**

According to the public rule of the Bangladesh each citizen has an equal right over the river on condition that he/she doesn't disturb others. However, nobody can set any permanent structure on the river. Sites have been selected with due consideration of these rules. Cages have been installed leaving ghats which are used by villagers for bath and collecting water for house-hold use and leaving navigation route free. Even then when the cages are great in serving people by producing rich protein, creating employment opportunities, farmers still can't have legal right over the places in river. Considering this as a critical problem, cage farmers formally submit request to the District Collector (DC) and they have been allowed in condition that the cage structures are only temporary and would not disturb any navigation route.

### **5.5 Disease Problem**

Since 2008, in the cages at Chandpur and Lamxipur are facing the most acute problem with disease. Like other countries in Asia, the pond tilapia aquaculture is also suffering from diseases. Last year about 30% of the cages fishes died due to disease. A particular size of fishes was affected by the diseases. Teachers and Fish disease scientists from Bangladesh Agricultural University and BFRI visited the cages during the crisis. According to them bacteria it was due to the bacterial disease caused by *Streptococcus sp.* However, no specific diagnosis was possible. In addition to the disease, it might have been due to the combination of factors involving water quality. Some solution is still to be explored to help the farmers.

## 6. RECOMMENDATIONS CONCLUSIONS

Unlike some of the other Asian countries, cage culture in Bangladesh is still in its infancy. There are still a lot to do to reach the level that cage farming would play an important role of food security to the poor people as well as earn foreign currency by export. Based on the experience of direct involvement, the followings are recommended:

- Government should formulate appropriate policies and regulations for the cage farming and provide legal right over the places charging annual fees per cage or unit area. If necessary, quota system can be established for a given area/village selected based on the suitability.
- Keeping in mind that tilapia can be a good source of foreign earnings as other Asian countries, technical expertise should be developed within relevant departments so that whole production process can be monitored and certified. For example, environmental condition, seed quality, stocking density, feeds and feeding practices, post harvest handling, processing and so on.
- There are about 145 shrimp export companies in Bangladesh, 63 of which are approved by EU. These have the capacity of exporting 265,000 MT fish and shrimps. But these factories are getting only 50,000 MT for export which means only 18-20% of their capacity has been used so far. They do not have anything to export especially during October to late February. As tilapia is produced throughout the year, exporting tilapia fillets would be one of the best options. Therefore, production of export quality tilapia in cages in huge volume would need concerted efforts including developing national policies and promotion. In order to create export market some sorts of certification schemes for export grade tilapia production, would be necessary e.g. good aquaculture practices (GAP) and HACAP.
- Since the mono-sex tilapia hatcheries are the base of tilapia industry, they should be well-equipped with technology and quality brood stocks. Some hatcheries are dealing with the broods from authentic sources through BFRI, but majority are using broods either from unknown origin or from residual seeds of some farms which are genetically inferior. International organizations, such as AIT and GIFT Foundation, should have direct involvement for periodical refreshment of the brood stocks and monitoring and certification of seed produced local hatcheries.
- Floating feeds are mostly produced in the country, partially from Thailand as well, and production of quality tilapia greatly depends on feed quality. A lot of farmers are complaining about the quality of feed produced in Bangladesh. Government should monitor the production process and the quality including the levels of nutrients as mentioned in the feed-bags.

A number of issues emerged among the cage owners which were not possible to solve on individual basis. Some issues such as, moving workers from one cage-owner to another, fish poaching, conflicts

with ship-owners, lack of legal right over position on river-site, became too burning ones to stop the tread. Considering all the issues the cage owners arranged a meeting on 14<sup>th</sup> August 2010 and formed an association named "Bangladesh Cage-Owners Association" and its legal registration procedure is ongoing. They have setup an association office at Chandpur, from where they do the formal communications to relevant parties and organizations in any crisis.

In conclusion, cage culture has started a new era for aquaculture history in Bangladesh. Farmers are dreaming of big success in the venture. Cage farming needs expansion throughout the country. A good training to enthusiastic staff and practical exercise to develop and test new model of technology at the center where they are based play a critical role. Once a successful model is demonstrated, farmers and other stakeholders get interested in to apply and also support. Transfer to technology is more efficient through public-private partnership. As a result of this venture, cage culture of tilapia has been expanded in Bangladesh producing quite a large volume. However, production is consumed within the country. Bangladesh may start exporting tilapia, if production further increases and if the marketing infrastructure is developed that emphasize certification of quality, processing, and storage, and exploring the market. World is looking for quality farmed fish to feed the people. Tilapia has been considered the best candidate species. When the fish is started to export, it will further boost tilapia farming in Bangladesh. Similar to Prawn / shrimp, tilapia could play greater role towards reducing poverty through generating more income to the farmers, increasing employment and supplying animal nutrition. Every relevant and interested sect, government or non-government organization needs to join in hands to make it a success.

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