

wealth Scholarships Commission, the programme allows people to study while working, primarily targeting students for whom a conventional face-to-face course, locally or overseas, is not an option. Studying at distance has its own challenges and students need high levels of motivation to complete the certificate (yr 1), diploma (yr 2) and full masters (yr 3). The programme is designed around successive modules over the first two years followed by a project year based on a part-time commitment of 10-15 hours/week. Regular contact with local tutors by mobile phone and with UK-based tutors through the internet helps to support

students self-learning. Continuous assessment of participation in discussion boards and electronically submitted assignments are key features of the programme. The relationship with the workplace is critical; potential participants require letters of support from their employers and the project year is designed around an issue identified by the student and his/her employer.

The education and training session of the WAS meeting at Busan, Korea will be reflecting on the changing face of education with representatives from Asia, Australia and Europe. Flexible

learning, the role of internships and combining work with study through Distance Learning will be featured.

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## Hatchery management in Bangladesh

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To meet the increasing demand for animal protein in Bangladesh, adoption of intensive and extensive culture practices on certain selective species of fishes is very important. Induced spawning has opened the door of new era in the production of fish throughout the world.

For intensive and extensive fish culture it is necessary to ensure the supply of suitable sized good quality fish seed in sufficient quantities. The main source fish seeds in Bangladesh are spawn produced in government and private hatcheries, and some collected from rivers.

The seed collected from natural breeding grounds have many problems such as the inclusion of seed of predatory fishes or disease. Wild seed is collected and handled in crude and unscientific methods that can potentially lead to large scale mortality during transportation from collection centres to nursery ponds and also in the nursery ponds after release. Therefore, emphasis should be placed on expansion of hatchery facilities to supply high-quality fish seed required to support aquaculture development.

For proper planning, management and sustainable development of hatcheries it is necessary to identify the specific problems and requirements of an area. We conducted a survey to collect

information on hatchery management that we hope will be helpful to fish culturists, farm managers, production specialists, policy makers and extension workers. The results of the present study will also provide valuable information to researchers who are interested to conduct similar type of study in future.

### Materials and methods

Production season of fish seed generally starts in March and ends by late August every year. However the survey for collection of data was conducted during March to September. The study area was Kotwali Thana under Jessor district. Data was collected by direct interviews with individual respondents. Questions were asked systematically in a very simple manner with explanation wherever it was felt necessary and the information recorded.

Results and observations

### Establishment of hatcheries

The establishment year of the surveyed hatcheries ranged from 1981 to 1985. The maximum hatcheries in the surveyed area were established

in 1986-91. Table 1 shows the year of establishment of the hatcheries in the studied areas.

### Occupation of the hatchery owners

On the basis of occupation the hatchery owners have been divided into two types. The first type is hatchery business only and the other type is hatchery business and others. Among the surveyed 21 hatcheries owners, nine earn their livelihood from only the hatchery business and 12 had other business interests such as service, agriculture etc.

### Educational status

The educational status of hatchery owners of the surveyed areas are presented in table 3. Out of 21 private hatcheries owners 9.52% were illiterate but had the ability of signature. About 14.29% and 23.81% of hatchery owners had primary and high school education respectively. 23.81% and 19.02% hatchery owners had SSC and HSC level education respectively. Only 9.52% owners had graduation level education.

## Training status of hatchery owners

The training status of the private hatchery owners are presented in the table 4. Out of 21 private hatchery owners 14.29% had no training while 19.05% had received short term training from the District Fisheries Office. 55% owners received training from others owners / farm managers. The rest gained their knowledge on hatchery operation through personal contact with the Upazilla Fisheries Office.

## Source of funds for hatchery operation

About 47.62% of owners had funds for seed production from their own sources. About 33.33% and 14.29% of owners got their funds as a loan from relatives and friends and from banks respectively. Only 4.76% hatchery owners got their loan from NGOs. It was observed during investigation that there was less contribution of NGOs and there was no contribution of the money lenders (mohazon) in the survey areas.

## Transportation facilities

During investigation it was observed that the hatchery owners had no transportation facilities of their own. The buyers hired truck or pick up vans even manually operated vans for hatchlings transportation.

## Communication facilities of hatcheries

The communication facilities of surveyed fish hatcheries are shown in table 6. About 52.38% owners mentioned the facility as excellent i.e. they are satisfied for existing communication facility while 37.08% and 9.52% owners mentioned the facility as good and not good respectively.

## Status of employees of hatcheries

Status of the staff of hatcheries is presented in table 7. From the table it is found that the surveyed hatchery had no specialist but they employed skilled

**Table 1: Year of establishment of the hatcheries in the region under investigation**

Year of establishment	No. of hatcheries	Percentage
1980-85	7	33.33
1986-91	11	52.38
1992-97	211	14.29

**Table 2: Occupation status of the hatchery owners of surveyed area**

Type of occupation	No.	Percentage
Only hatchery business	9	42.86
Hatchery+service	5	23.81
Hatchery+agriculture	6	28.57
Hatchery+others	1	4.76

**Table 3: Educational status of the hatchery owners of the studied area**

Educational status	No. of hatcheries	Percentage
Illiterate but having ability signature	2	9.52%
Primary education	3	14.29%
High School Education	5	23.81%
S.S.C Education	5	23.81%
H.S.C Education	4	19.02%
Graduate Education	2	9.52%

**Table 4: Showing the training status of hatchery owners**

Source of training in fish seed production	No. of hatcheries	Percentage of hatcheries with trained personnel
No training	3	14.29
Short term training	4	19.05
Consulting with UFO	14	66.67
Others	1	0

**Table 5: Funding source of the hatchery owners of the surveyed area**

Source of funds	No. of hatcheries	Percentage
Self	10	47.62
Self + relatives + friends	7	33.33
Bank	3	14.29
Self + NGOs	1	4.76
Mohazons	0	0

**Table 6: Communication facilities of the hatcheries**

Type of communication facilities	No. of hatcheries	Percentage
Excellent	11	52.38
Good	8	37.08
Not good	2	9.52

**Table 7: Status of staff of fish hatcheries in the surveyed area.**

Type of employee	Temporary employee	Permanent employee	Mean monthly salary	Mean daily salary
Officer	0	0	0	
Specialist	0	0	0	
Skilled	12	9	3895.24±332.38	87.14±3.73
Unskilled (labours)	119			

and unskilled labourers. Labourers work as permanent and temporary basis. The mean monthly salary of skilled labourers was Tk. 3895.24 ± 332.38 and mean daily salary of unskilled labourers was Tk, 87.14 ± 3.73.

## Area of hatcheries

It was observed that the maximum area of hatcheries in the surveyed area was 24.75 decimals and minimum was 5.78 decimal with an average of 11.12 ± 5.19 decimal. Hatchery sizes of the study area are shown in table 8.

## Number of ponds in hatcheries

The present investigation deals with the only fish seed producing hatcheries. This type of hatchery cannot rear fry or fingerlings as they do not have nursery or rearing ponds, only producing spawn. They had only stocking ponds for brood stock management. The maximum number of stocking ponds was six and the minimum was two with an average 4±1.05. During investigation it was observed that every fish hatchery owner had their own brood stock pond. As regard to ownership it was observed that the ponds were their own or leased.

## Water and soil quality of ponds

Table 10 shows the water and soil quality conditions of the ponds. Answering the question about water and soil quality about 80.95% and 19.05% owners claimed that water qualities of their hatcheries were satisfactory and moderately satisfactory.

In terms of soil quality of the ponds about 90.40% and 9.52% owners of the hatchery mentioned as satisfactory and as moderately satisfactory respectively.

## Occurrence of fish disease in hatcheries

About 95.24% owners reported that there were no fish disease problems in their farms, while the rest of the owners reported that there were occasional attack of fish disease. It was a remark-

**Table 8: Area of hatchery in the surveyed area**

Area (ac)	No. of hatcheries	Percentage
0.05-0.110	13	61.90
0.1-0.15	3	14.29
0.15-0.2	3	14.29
0.2-0.25	2	9.52

**Table 9: Shows the number of ponds in the hatcheries**

Number of ponds	No. of hatcheries	Percentage
2	2	9.52
3	4	19.05
4	8	38.10
5	6	28.57
6	1	4.76

**Table 10: Water and soil quality of the surveyed fish hatcheries**

Characteristic	% of hatchery		
	Satisfactory	Moderate	Unsatisfactory
Water quality	80.95	19.05	0
Soil quality	90.48	9.92	0

**Table 11: Occurrence of fish disease in private hatcheries**

Category of occurrence of fish disease	No. of hatcheries	Percentage of occurrence
No disease	20	95.24
Seldom attack	1	4.76
Every year attack	0	0

**Table 12: Category of land ownership of surveyed hatchery**

Category of land	No. of hatcheries	Percentage
Own	7	33.33
Own + leased	11	52.38
Only leased	3	14.29

**Table 13: Data showing the supplementary feeding used in different hatcheries**

Name of feeds	Minimum	Maximum	Mean ± SD
Fish meal	10%	25%	18.14 ± 5.33
Oilcake	15%	38%	25.10 ± 5.39
Rice bran	20%	50%	38.9 ± 11.93
Wheat bran	6%	22%	12.67 ± 4.74
Flour	2%	6%	4.38 ± 1.16

**Table 14: Showing the use of fertilizers in different hatcheries**

Name of fertilizer	Minimum	Maximum	Mean±SD
Urea	4%	12%	7.43±2.45
TSP	3%	10%	6.12±3.14
MP	1%	3%	2.1±1.32
Cow dung	10%	15%	7.8±2.15

able observation that in no farms was there any serious fish disease problem in the survey period.

## Category of land ownership

61.90% owners reported that the land used for hatchery purposes was their own land and the rest 38.10% reported having both leased and own land. But no owner had only leased land for hatchery purposes. Table-12 shows the category of land ownership percent distribution.

## Supplementary feeds used for brood fishes

During the present investigation it was found that the use of feed for brood fish was comparatively common. These type of feeds were used for better growth of brood fish. Both inorganic and organic fertilizers were used to increase the pond vegetation and productivity. The types of feed, fertilizer, lime used by the private hatcheries are shown in table 13.

## Fertilizer

The types of fertilizers used in private hatcheries in this region are urea, TSP, MP and cowdung:

- Urea: Fertilizer urea used in these hatcheries ranged from 4% to 12%. TSP: Fertilizer TSP used in these hatcheries ranged from 3 to 10%.
- MP: Fertilizer MP used in these hatcheries ranged from 1% to 3% with an average  $2.1 \pm 1.32\%$ .
- Cowdung: The use of cowdung in these hatcheries ranged from 10% to 15%.

## Problems and constraints faced by private fish hatchery owners

The problems and constraints faced by the private fish hatchery owners in the study area have been categorized under

**Table 15: Problems of the owners of private fish hatcheries in the surveyed area**

Kinds of problems	No. of hatcheries	Percentage of total farms
<b>A. Technical</b>		
1. Lack of technical knowledge	6	28.57
2. Lack of chemicals and fertilizers	0	0
3. Non availability of food	0	0
4. Insufficient water in dry season	2	9.52
5. Diseases	1	4.76
<b>B. Economic</b>		
1. Lack of credit	6	28.57
2. Lack of marketing facility	2	9.52
<b>C. Social</b>		
1. Theft of fish	5	23.81
2. Poisoning in pond as enmity	2	9.52
3. Toll collection by terrorist	5	23.81
4. Joint partnership	3	14.29
5. Problem of taking lease of pond	4	19.05
<b>D. Natural calamity</b>		
1. Flood (caused by heavy rain)	5	23.81
2. Other natural calamity	0	0

four general types, such as technical, economic, social and natural. Fish seed farm owners responded to these problems regarding operation of their farms are presented in table 15. About 28.57% and 9.52% owners claimed that the production of farms hampered due to lack of technical knowledge and insufficient water in the dry season. Among economic problems it was reported that the lack of credit and lack of marketing system were crucial constraints. Among social problems the theft of fish and toll collection by terrorists were main constraints then the problems related to leasing. Only 23.81% of hatchery owners faced the problem of flood.

## Recommendations

The following policy and recommendations are suggested depending on the findings of the present study:

- Credit for fisheries is not easily available or institutionalized. An appropriate system to provide credit with low interest rate from institutional sources should be established.
- For overcoming the problems of inbreeding as suggested by hatchery owners (i) government hatcheries should have "brood banks" to supply quality broodstock to the private hatchery owners, (ii) collecting wild, non domesticated fish species from rivers or natural habitats, (iii) purchase cultivated, genetically

improved species from other fish farms or hatcheries with well known origin.

- Government should take positive steps to train up interested people on modern methods of hatchery management.
- For induced breeding, supply of various types of inputs should be ensured at low cost and government should control and check the quality of inputs.
- For better seed production appropriate dosage for hormone should be administered.
- The problem of poor quality fish seeds due to inbreeding depression in the private hatcheries must be addressed.

## Conclusion

Apart from some adverse socio-economic and other impacts, fish farms present in this region contribute a remarkable amount to inland fish production in Bangladesh. As the fisheries sector plays a vital role in the socioeconomic development, opportunity for employment, poverty alleviation of large number of population, we have to reduce all the adverse impacts of aquaculture for sustainable growth in the future. The NGOs and government