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Rearing of Fish Fingerling in Cages in Reservoir for Food Security and Rural Livelihood

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Abstract: *"Fish Fingerling Bank" concept initiated by the unemployed rural youth of Therawadi village of Ahmednagar Dt in Maharashtra is worth mentioning. This project was funded by the Rajiv Gandhi Science and Technology Commission (RGSTC), Mumbai. In first phase, beneficiaries selected from the Therawadi village and formed a Self Help Group (SHG), group was further registered as Dr. Babasaheb Ambedkar SHG in the office of the Taluka Magistrate. Each member of the group was encouraged to deposit an amount of Rs. 200/- per month in the SBI account of SHG. One battery of four cages (each cage 6*4*2 m.) is fabricated and installed in the Palaswada reservoir of the village. The training on fish culture in underutilized water bodies was given to the SHG in research station as well as on site comprising seed stocking, feeding, cleaning of the cages, counting of the seed, conditioning and packing of the seed etc. Three lots of fish fry of Catla and Rohu (20:80) having 10-15 mm size were stocked @ 1000 no/m^3 in all cages and nursed for two months to attend the size above 80 mm. Around 66% survival was achieved by feeding three times ground nut oil cake and rice bran (1:1) and mineral mixture (Agramin 2%) @ 15 percent of the body weight. Before selling the seed to the farmers, a one day workshops on fish culture in farm ponds was conducted and distributed leaflet to the farmers. Fish Fingerling was sold to the 120 farmers having their farm ponds. As on March, 2014, the SHG earned revenue of Rs. 6, 47, 985/- by way of selling 4.06 lakh fingerlings and an amount of Rs. 66,000/-as monthly savings are also deposited in the SBI account. Indirectly 120 farmers who started rearing fishes in their farm ponds (4,030 gunthas) are likely to produce around 100 tons of fish. Fish fingerling was also released in the open water of the same reservoir having 25 ha areas. The concept was conveyed to the farmers from 12 talukas at project site. This is the first Self Help Group in the Maharashtra State which ventured in to such a type of fish culture.*

Keywords: *SHG, cage culture, reservoir management, management of un-utilized water bodies.*

INTRODUCTION

Basic techniques of cage fish culture have been developed and now considered economically viable in China, Thailand, Hong Kong, Taiwan, Malaysia, Singapore and Indonesia. The method is simple and highly profitable compared to pond culture [1]. Cage aquaculture systems play very important role in the Cambodian aquaculture because it contributes about 70% of total aquaculture production [2]. In Europe, cage culture of rainbow trout in fresh water began in the late 1950s and in Norway, Atlantic salmon followed in the 1960s. More than 40% of its rainbow trout comes from fresh water cages [3]. Cage culture of fresh water fish is adopted in USA, in 1964 [4]. Cage culture of fish, and more recently prawns, is now practiced throughout the world [3]. Now, more than 70 species are cultured in cages of various shapes and sizes in both flowing and stagnant waters [5].

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Fish culture in cages is not a traditional technology in Maharashtra state like pond culture. It is a relatively new technology in Maharashtra state. In contrary to the development in the South-East Asia commercial cage aquaculture technology is yet to be established in Maharashtra, India. Despite having enormous potential to increase fish production in underutilized water bodies (lakes, farm ponds and reservoirs) the average inland productivity in India remains low, varying from 30-100 kg/ha. Cage aquaculture can be effectively introduced in the inland open waters, particularly in reservoirs, lake to increase fish production. This is to note that no serious attempt has been made to introduce cage aquaculture in reservoir for stock enhancement practices in the state except some experimental attempts. The success of rearing of fry to fingerling of Indian major carps, common carp confirm their suitability for cage aquaculture. The stocking densities between 150-200 fry/m^3 are ideal for stocking of these fishes with a survival rate of 50 to 75% [6]. In this regard, lessons learned from the success of cage aquaculture in the South-East Asia proved beneficial for developing sustainable cage aquaculture for stock enhancement in the state and helped to improve food security and livelihoods of rural population, particularly the resource poor landless farmers and fishers.

It is, therefore, the objective of this work was to enhance the productivity of under-utilized aquatic resources through regenerative and bio-secure cage aquaculture practices for poor rural landless fisher community and also to improve their nutrition status and livelihoods. To achieve this goal, the specific objective is to establish Fingerling bank by adopting the cage aquaculture technology in under-utilized aquatic resources.

MATERIALS AND METHODS

The experiment was conducted in cages suspended in Palaswada reservoir. Catla and Rohu (20:70%) fry of initial length 15 mm used for trials. Fry was stocked 1000 no. m^{-2} into four net cages (6 m × 4 × 2 m, 4 mm mesh size). Wooden walkways were made to connect the all cages. Water depth in the reservoir was 7 m throughout the nursing period.

FISH SAMPLING

Prior to stocking, a total number of 30 fry from the initial stock was randomly sampled. At the end of 8^{th} week feeding period a final sampling was made again of 30 fish from each cage to determine growth performance.

WATER QUALITY

Water quality were analyzed by taking integrated water column samples at 10.00 h from 3 points of the cages for total ammonium nitrogen (TAN), total alkalinity, total suspended solids (TSS) and total volatile solids (TVS) using standard methods (APHA, 1985). Dissolve oxygen (DO), temperature and pH were measured at three different depths (25cm below water surface, middle, and 25cm above pond bottom) at 06.00, 10.00, 14.00 and 18.00 h.

STATISTICAL ANALYSIS

Data from individual fish were treated as independent samples. Analyses were performed by using statistical application. Data of water quality parameters open water were analyzed by using statistical *t*-test.

RESULT AND DISCUSSION

Rajiv Gandhi Science and Technology Commission, Mumbai sponsored project entitled "Community based adoption and management of fresh water fish cage culture in underutilized aquatic impoundment for food security and rural livelihood" is implementing at Palaswada reservoir, Therawadi, Karjat (Taq) of Ahmednagar (Dt). The baseline information of the reservoir: It is manmade reservoir with total area is 25 ha, catchment area of the reservoir is 8.2 km^2.Water spread area is 22 ha, Maximum water depth 17.00 m and mean water depth is 6.5 m (Figure 1).

FABRICATION OF FLOATING CAGES

One battery of four cages is fabricated by using one inch non rusting GI pipe of C class grade and installed in the reservoir water. One cage comprises of 6mx4m with inner frame, 6.3 m × 4.3 m of outer frame. Outer and inner frame connected at different 12 points by GI Pipe fixing with 06 number of 220

Figure 1: Cages installed in reservoir

liter capacity air tight PVC barrel. 0.3 m wide cat walk with marine ply on top of all cages and 1m height railing on one of 4 m side of cage frame. Finer mesh nets having size 6 m x 4 m × 2m with Polyester white knotless nets of 04mm mesh size. HDPE 18 ply nets of type 75 mm on the outside as protective nets. 8 mm ropes on the four top sides and along 4 corners of the nets are fixed to each floating cage frame. Top bird nets having size 6 m × 4 m and inner feeding net having size 6 m × 4 m × 0.5 m was fixed to each cage.

FORMATION OF SELF HELP GROUP (SHG)

In first phase, A Self Help Group (SHG) comprising 12 unemployed youth is formed in Therawadi village of Karjat Taluka of Ahmednagar (Dt). SHG registered in the office of Taluka Magistrate in the name of "Dr. Babasaheb Ambedkar Self Help Group"and the account of the SHG is opened in the State Bank of India, Karjat. Each member is depositing Rs. 200/- as monthly saving in the bank. The technical and financial assistance were provided from the sanctioned grants of the project during the project duration. However, the generated income through proposed activities and the membership saving of an amount of Rs. 200/- per member were deposited in the nationalized bank on Self Help Groups (SHG) account. Out of the total income, 60% amount distributed among the members of SHG and 40% amount are kept in the bank and would be used as recurring expenditure after completion of the proposed project for sustainable development.

The members of the SHG were given proper training of five days duration in the Marine Biological Research Station, Ratnagiri with regards to rearing of IMC upto fingerling size in cages. Underutilized water resource in terms of reservoir having 25 ha area is tapped for proper utilization to fish culture by way installing one battery of four cages.

STOCKING AND NURSING OF FRY IN CAGES

In second phase, three lots of fish fry of Indian Major Carps @ 1000 no. m^{-2} having 10-15 mm size was stocked in all cages and nursed for two months to attend the size above 80 mm. Locally available feed ground nut oil cake and rice bran at ratio 1:1 were used as feed. Feed were provided in plastic trays, morning and afternoon, approximating 10% of the biomass per day in each cage initially and reduced to about 3% gradually. Participated beneficiaries are trained on site of all the activities such as seed

stocking, feeding, cleaning of the cages, counting of the seed, conditioning and packing of the seed etc. In this way the fingerling Bank is established in the cages and was ready to distribute to the farm pond holders.

FINGERLING DISTRIBUTION

Before distribution of fish fingerling to the farmers one day workshop was conducted at the office of the Taluka Agricultural Office, Karjat, Ahmedhagar (Dt.). One hundred fifty farm pond holders are participated in the workshop.

Detailed technical information on fish culture in farm pond was given to the farmers. Leaflet in local language on "Shettalyateel Matsyasavrdhan" was distributed to the farmers. 120 farmers started rearing of IMC by procuring fingerling from the SHG. 4.06 lakhs fingerling are distributed to the farmers and more than 100 acre farm pond areas are brought under fish culture first time in Maharashtra.

REVENUE COLLECTION

As on March, 2014, the SHG earned a revenue of Rs. 6,47,985/- by way of selling fingerlings to the farmers. First time in Maharashtra State, Fish fingerlings are also sold to the farmers in agricultural exhibitions Many farmers/Farm ponds holders have been visited the stall and purchased fish seed. A total of Rs. 66,000/-was deposited as monthly contribution in the SBI on SHG account.

DEMONSTRATION OF CAGE CULTURE AND FINGERLING BANK CONCEPT

Demonstrated Fingerling bank concept and cage aquaculture technology to farmers from 12 talukas of Ahmednagar (Dt), at project site. Establishment of such FINGERLING BANK not only encouraged by the farm pond holders of the area but also by the state Government agencies like State Fisheries Dept., NGOs and ATMA of the district. Members of the mens and women's SHG are visited the cage culture site. An amount of Rs. 1.50 lakh earned revenue is also distributed to the beneficiaries of SHG for their livelihood.

FINANCIAL FLOW OF FISH FINGERLING PRODUCTION IN CAGES

Financial analysis calculated (Table 1) for establishment of Indian Major carp fingerling bank in cages (size 6*4*2 m). Catla and Rohu fry (20:80) with 10-15 mm length were stocked @ 1000 numbers/m^3 in the cages and reared for a period of 60 days. The survival rate of fry to fingerling in cages was 66 percent. The selling cost of fingerling was Rs. 1/- for 1st lot and Rs. 2/- for 2nd and 3rd lot. 50,000 fingerlings are released into the open water of the same reservoir in which cages are installed.

Figure 2 shows the cash flow of cages in which fingerling bank is established. The quality of fingerling reared in the cages is better than the existing practice of fingerling rearing in pond. Therefore, the fish fingerling produced in the cages fetched higher selling price compare to the existing practice of fingerling rearing in pond.

Table 1
Financial analysis for establishment of fingerling bank in cages

Sr. No.	*Description*	*Lot 1*	*Lot 2*	*Lot 3*	*Total*
1.	Labor charges 135 mh @ Rs 150/–/ batch	13500/–	13500/–	13500/–	40,500/–
2.	Cost of paint @ Rs.120/ kg	–	–	480/–	480/–
3.	Polyethylene bags @ Rs.150/ kg (150*5)	750/–	1500/–	1200/–	3,450/–
4.	Cost of fish fry (2 lakh fry/battery/lot)	52,000/–	60,000/–	60,000/–	1,72,000/–
5.	Cost for medicine /Chemical	500/–	500/–	–	1000/–
6.	Transportation cost	9,000/–	9,000/–	9,000/–	27000/–
7.	Oxygen cylinder (450*3)	450/–	450/–	450/–	1350/–
8.	Cost of feed	10675/–	10000/–	5000/–	25675/–
A.	A. Total cost	86875/–	94950/–	89630/–	2,71,455/–
B.	B. Income from fingerling sales	1,49,890/–	2,34,475/–	2,63,620/–	6,47,985/–
C.	Net Income (B – A)	63,015/–	1,39,525/–	1,12,990/–	3,76,530/–
	Survival (%)	66	67	69	67

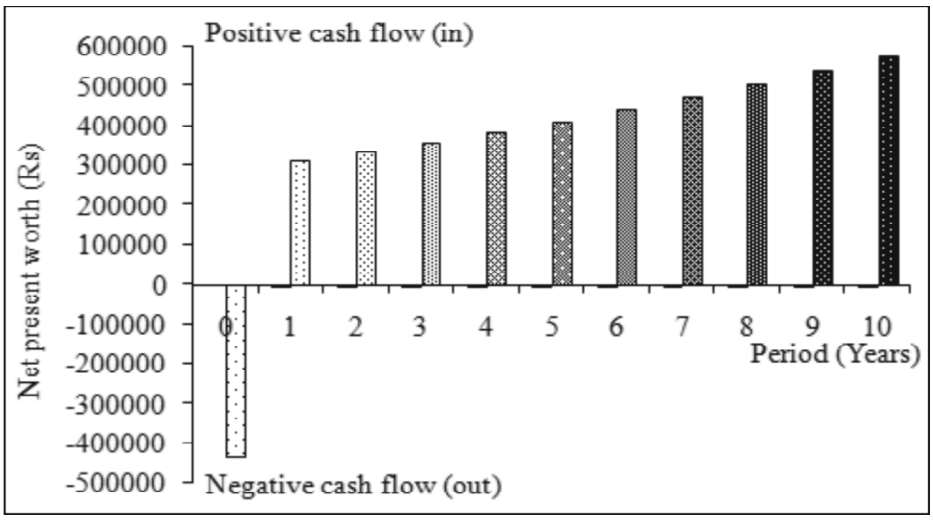

Figure 2: Cash flow of fish fingerling Bank

The net present worth (NPW) is the difference between the present worth of all cash inflows and outflows of experimental cage units. Cash outflow is only at the beginning of the project in first year only. This indicates that the present experimental cage battery is financially viable for installation. The financial analysis showed that the average net income/year (for 10 year) is about 4,35,640/- and the pay-back period is also less than 1.5 years.

Dr. Anil Kakodkar, Chairman, RGSTC has appreciated the progress of the project and advised to spread the same concept all over Maharashtra. Dy. Project Director, ATMA, Ahmednagar has awarded first prize comprising Rs. 20,000/- to the SHG for the year 2013-14.

CONCLUSION

It is desirable to stock the lakes, reservoirs, farm ponds etc. with fast growing fish species at a definite stocking density for sustainable development of culture based capture fisheries. In presence of astronomical number of fishes in the natural ecosystem, it requires 8-10 cm size carp seed as a stocking material. Generally to attain such a size it takes several months in earthen ponds where percentage of recovery is also very low. To stock such ecosystems even at a modest rate, the specific size stocking materials are not available at plenty throughout the year. On the other hand, transportation of fish fingerlings from the production centers to the water bodies is practically difficult. In these circumstances, cage culture in large water bodies would be a viable solution. In this regard, an attempt has been made to raise carp seeds in cages at the project site which was found to be successful and economically viable. In conclusion, establishment of a "Fish Fingerling Bank" in the interior Maharashtra State has given a new source of avenue to the farm pond holders and also help to enhanced livelihood of the rural unemployed youth.

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References

Siri, B. (2009), Coastal Aquatic Feed Research Institute, 41/14 Moo 9, Sukhumvit Rd., Bangphra, Amphur Sriracha, Chonburi Province, Thailand 20110.

Department of Fisheries, (2001), Report on Aquaculture in 2001. PIU-the Fisheries Component, DOF, Phnom Penh, Cambodia. Technical paper No. 4, 3-28, 33-35.

Beveridge, M.C.M. (1987), Cage culture Fishing News Books Ltd, Farnham, UK, 352.

Coche, A.G. (1976), A General Review of Cage culture and its application in Africa. FAO Conference on Aquaculture, Kyoto, Japan. Tech. Paper no. FIR:AQ/Conf/76/R.37.

Coche, A.G. (1978), Review of cage aquaculture, Aquaculture, 13: 157-189.

CIFE, (2008), Annual report, 2007-08: 25-26.