Journal of the Andaman Science Association Vol. 21(1):104-108 (2016)
ISSN 0970-4183, Printed in India


**B.C. Mohapatra*, P.P. Chakrabarti, N.K. Barik, D. Majhi, S.K. Mahanta, H. Sahu, S. Lenka, A. Nanda, S. Mishra and P. Jayasankar**
*ICAR – Central Institute of Freshwater Aquaculture (Indian Council of Agricultural Research)*
*Bhubaneswar- 751002, Odisha, India*
**bcmohapatra65@gmail.com*

## Abstract

ICAR-All India Coordinated Research Project (AICRP) on Plasticulture Engineering and Technology (PET), centre at ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar has designed and developed a complete set of hatchery system in fibre-reinforced plastic (FRP) material for fish breeding and hatchery rearing of seed. The portable hatchery has been found to be a suitable gadget, as the users can easily install and operate it anywhere in India. In one run 1.0-1.2 million carp spawn can be produced from the system. The system is suitable in field conditions for breeding most of the cultured Asiatic carps *viz.,* Rohu (*Labeo rohita*); Catla (*Catla catla*); Mrigal (*Cirrhinus mrigala*); Kalbasu (*Labeo calbasu*); Fimbriatus (*Labeo fimbriatus*); Silver carp (*Hypophthalmichthys molitrix*); Grass carp (*Ctenopharyngodon idella*); and Common carp (*Cyprinus carpio*). With some modifications this system has been used for breeding of Magur (*Clarias batrachus*); *Pangasianodon hypophthalmus*; Pabda (*Ompok bimaculatus*); Tengra (*Mystus vittatus* & *M. gulio*); Silver barb (*Puntius* sp.), etc. In lean season the system can be used for ornamental fish rearing or common carp breeding or water storing. This hatchery can be a tool for fish biodiversity conservation through seed production of endangered and threatened fish. The unit can be operated by unemployed youth, Gram panchayat and Cooperative Society on self-operational / rental basis. By December, 2014, it has been installed in 26 states and A&N Island of the country.

**Keywords:** FRP carp hatchery, seed production, biodiversity conservation, portable

## Introduction

The earlier part of 20th century has witnessed the carp seed collection from Bundhs and riverine resources by adopting different devices and collection methods. In India for the first time in 1957, carps were induced bred in captivity by administering carp pituitary extract. The breeding of carps, hatching of eggs and rearing of hatchlings up to spawn stage were carried out in different rectangular hapas made up of cloth. They were fixed in the pond for clear oxygenated water. In hapa system, the entire operations were weather dependent and subject to various environmental hazards. During seventies, glass jar hatching units of various capacities were designed and made to use successfully for hatching. The system had its own drawbacks for commercial seed production. During eighties, the carp eco-hatchery technology got familiar in India. During nineties, different models of hatcheries with different materials (HDPE, PVC, LDPE liner, Ferro-cement, etc. in various shapes and sizes) came to the existence with certain degrees of success at research level, but, they could not penetrate to the grassroots levels. The ICAR-AICRP on Plasticulture Engineering and Technology, centre at ICAR-CIFA, Bhubaneswar has designed and developed the complete set of hatchery system in FRP for carp fish breeding and hatchery rearing of seed (CIFA, 2004 & 2005; ICAR, 2005; Mohapatra *et al*., 2003; 2004; 2005, 2007, 2008 & 2011a). In one operation it can produce 1.0 - 1.2 million carp spawn.

The developed system has several merits like: easy for transportation to different farm sites, easy installation and operation, low water consumption during fish breeding and spawn production, easy to repair, less space requirement for installation, less weight and durability of the product for 10-15 years. In lean season the system can be used for ornamental fish rearing or common carp breeding or water storing. The unit can be operated by unemployed youth, Gram Panchayat and Cooperative Society on self-operational / rental basis. The innovation

of this technology is contributing substantially to the blue revolution and biodiversity conservation of the country by producing fish seed at the desired places. Its introduction is reducing the transportation difficulties and uncertainties in getting stocking material from different far off places to the aqua-farm sites.

Many fish species are in decline and some are going to be endangered due to combination of over-exploitation, contamination of their natural habitats due to pollution, uncontrolled introduction of exotic fish species, habitat modification due to river-valley projects, excessive water abstraction and siltation, etc. In India 320 fish species comes under threatened categories (Lakra, *et al*., 2010). The conservation measures of these species can be achieved through declaration of their habitats as biospheres, zoological parks, and ranching of pure fish seed through artificial or induced breeding. FRP carp hatchery is the best gadget for transportation to the destination in any corner of India for induced breeding of endangered freshwater fish species.

## Portable FRP carp hatchery set up

The system (Fig.1) consists of four major parts *i.e.,* breeding/ spawning pool; hatching/ incubation pool; egg/ spawn collection chamber, and overhead storage tank/ water supply system.

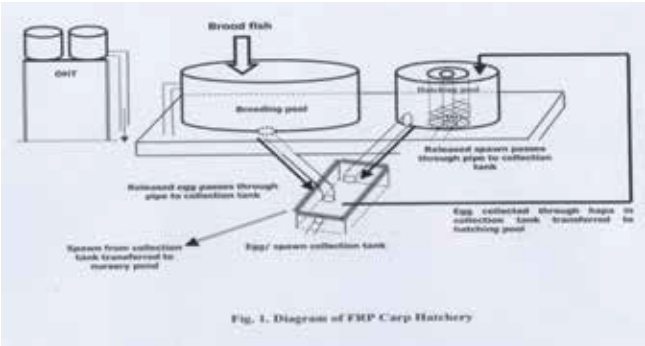


Fig. 1. Diagram of FRP Carp Hatchery

## i. Breeding/ spawning pool

The breeding pool is cylindrical in shape with 2.15 m diameter, 0.9 m height and 3409 liter capacity (operation capacity: 2950 liter). The bottom is with uniform slope (1:22) towards outlet at the centre. The wall thickness varies 4.2 – 6.0 mm. To provide water circulation/flow, 5 numbers of 15 mm diameter rigid PVC elbows are fitted at the bottom of the sidewall at equal spacing. Five numbers of rigid PVC nipples 15 x 75 mm are fitted with elbows in the same direction. A single point water inlet of 25 mm diameter is also fitted at the sidewall of the bottom. All the water inlet pipes are interconnected and fitted with individual full-way valves to control the flow of water. One shower is provided at the top of the tank to sprinkle and aerate the water. The water supply to the pool comes from the overhead tank. The system is suitable for breeding 10-12 kg of female carps in field conditions. The breeding success has been recorded at cent percent level in various carp species. The flow rate during egg collection is maintained in the pool at 1-1.5 l/ sec. depending on species.

## ii. Hatching/ incubation pool

The pool is cylindrical in shape with 1.4 m diameter, 0.98 m height and 1200 liter net egg incubation volume. It consists of egg incubation chamber, FRP inner chamber, water supply system and accessories. The FRP inner chamber of the tank is with 0.4 m diameter and 89 cm height, covered with nylon bolting cloth of 0.25 mm mesh to filter the excess water to the drain. Five numbers of RPVC (15 mm diameter) duck-mouths are fitted at the bottom of the hatchery at 45$^{o}$ in between outer and inner chamber at equal distances to get required water flow for the eggs. It has drainage outlets fitted at the centre and at the outer chamber for draining and cleaning purposes. The carp eggs are introduced in the outer chamber of the system and water flows continuously through the duck-mouths. The excess water flows continuously through the cloth of the inner chamber to the outlet pipe. The carp eggs hatch out in 14-18 hour and remain in the pool for 72 hour. The spawn is collected from the hatching pool through PVC hose pipes/spawn collection tank. It has the capacity of hatching 1.0-1.2 million eggs per operation. at 0.3-0.4 l/ sec.

## iii. Eggs/ spawn collection tank

This is a rectangular tank of size 1.0 × 0.5 × 0.5 m with capacity of 250 liter. Its wall thickness is 3 mm and

is reinforced with MS angle of 25 × 25 × 5 mm at all sides from the bottom in a height of 0.35 m. The water level in the tank is maintained at a height of 0.45 m (net water volume 225 liter). To drain the excess water, PVC pipe of 63 mm diameter and 150 mm length is fitted at a distance of 38.7 cm from the bottom. Cotton inner hapa of the tank size is fixed inside it to collect eggs/ spawn from breeding/ incubation pool, respectively.

### iv. Overhead water tank

Water storage tank of minimum capacity 2000 liter is required to operate the hatchery unit. The breeding pool and hatching pool are connected to the water storage tank separately or together in the same water line. One 1.0 HP pump set is required to fill the storage tank periodically to supply water to hatchery continuously.

### Species suitable for breeding

The system is suitable in field conditions for breeding of most of the cultured carps in India *viz.,* Rohu (*Labeo rohita*); Catla (*Catla catla*); Mrigal (*Cirrhinus mrigala*); Kalbasu (*Labeo calbasu*); Fimbriatus (*Labeo fimbriatus*); Silver carp (*Hypothalmichthys molitrix*); Grass carp (*Ctenopharyngodon idella*); Common carp (*Cyprinus carpio*); etc (Mohapatra *et al*., 2011b & 2013). With some modifications, this system has been used for breeding of Magur (*Clarias batrachus*); *Pangasianodon hypophthalmus*; Pabda (*Ompok bimaculatus*); Tengra (*Mystus vittatus* & *M. gulio*); Silver barb (*Puntius* sp.), etc. In lean season the system can be used for ornamental fish rearing or common carp breeding

### Popularization of the technology in India

The graph (Fig.2) shows the number of hatchery units established across the country from the year 2003 to 2014. Till December 2014, there are 293 hatchery units established with as high as 73 units in the year of 2013 alone. There is growing confidence of the technology adopters from the date of commercialization of the technology in 2006.

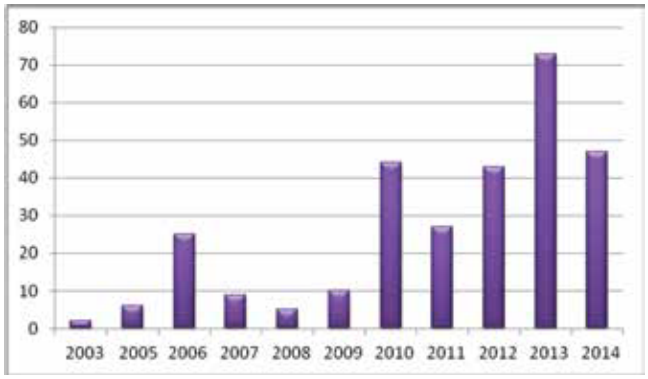


**Fig. 2. No. of hatchery units established (year wise) across the country**

Geographically, the portable FRP carp hatchery units have been installed and benefited to all regions of the country (Fig.3).

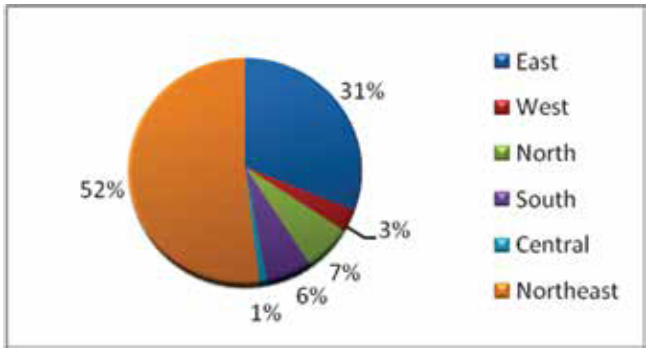


**Fig.3. Dissemination of portable hatchery technology across the regions**

Around 52% of the total installations were done in Northeast region of the country, where fish is in high demand. The next important region to which the technology penetrated is Eastern region, where 31% of the installation was done.

The most important end-users are the KVKs, regional centers and headquarters of ICAR institutes (Table 1; Fig.4). The SAUs and universities are the second important beneficiary. To produce and meet the demand of fish seed for their region, the state governments in many states have established these units in their own state. Amalgamated plantation private limited (unit of Tata Tea) has come forward to produce seed for their own requirements using portable FRP hatchery.

**Table.1. Portable hatchery units with different stakeholders in India**

(As on 31 December, 2014)

| Organizations | Number of Units |
|---|---|
| ICAR Institutes including their KVKs | 55 |
| SAU/ CU/ Univ./ Colleges including their KVKs | 63 |
| State Fisheries Departments | 45 |
| Sambalpur, Keonjhar & Mayurbhanj Districts of Odisha (under NAIP) | 12 |
| Keonjhar, Kendrapada, Nayagarh & Mayurbhanj Districts of Odisha (Under DBT) | 12 |
| Tribal communities of India (under TSP-CIFA) | 11 |
| Northeastern states (under NEH – CIFA) | 68 |
| Khordha District of Odisha (AICRP on PET and DST) | 6 |
| Corporates/ NGOs including their KVKs | 17 |
| Private Farmers | 4 |
| **Total Units** | **293** |

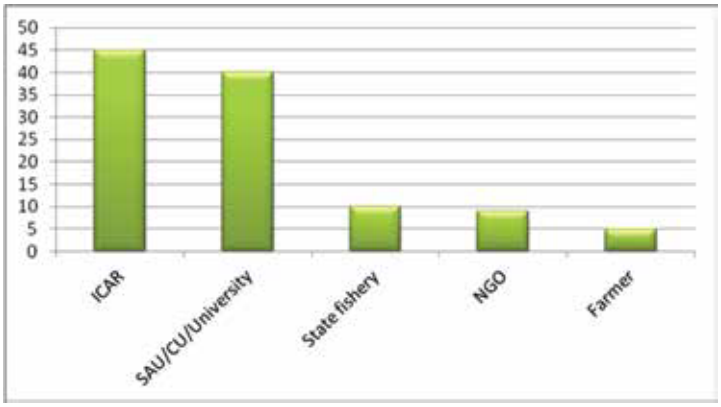


**Fig.4. End users of portable FRP carp hatchery**

The NGOs like Ramakrishna Mission, Sahavagi Bikash Abhijan, West Utkal Agriculture centre and HESCO are producing large numbers of seed to supply and to improve the livelihood of the nearby localities. But, the most important end-users who earn high level of profit are the individual entrepreneurs, who run the hatchery for commercial purpose and are able to generate income to sustain their family. Overall the hatchery technology is giving benefits to all sections of the society.

## Impact to society

The portable hatchery ensures both direct and indirect benefits. The direct benefits are accrued through increased production of seeds leading to increased fish production in the region. The hatchery operators are benefited through increased income from hatchery, whereas, seed rearing group generates income by rearing fry and fingerlings from spawn which is the output of hatchery. The indirect benefits are in terms of better quality seed, local seed production, assured quality, training of manpower etc. A farmer Mr. Trilochan Swain, Badalahanga, Jagatsinghpur, Odisha purchased one hatchery unit from CIFA in May 2006 and put it for operation in that year. He found it very handy for operation for both carp and magur after a small modification. He could produce an average of ten lakhs spawn per cycle for carps and forty thousand for magur. At Peninsular Aquaculture Division of CIFA, Bangalore the FRP carp hatchery was installed in September 2002. This is the only hatchery that the Division has, and regularly the peninsular carps are bred in it year after year. Content Sheet of Fishing Chimes, 28(4) July 2008 states "*One of the outstanding achievements of CIFA in recent years is the standardization and successful popularization of*

*portable Fiberglass Reinforced Plastic Carp Hatcheries. This breakthough deserves to be acclaimed as an excellent follow-up development to the introduction of the epoch making induced breeding technology in 1957*". As per the communication (F.No.NFDB/Z-II/CIFA/IAP/PFRP-03/2013-14/1348 Dated 28/10/2013) received from the National Fisheries Development Board, Ministry of Agriculture, Govt. of India, Hyderabad the "FRP Carp Hatchery Technology became a Technology for the whole nation."

## Acknowledgement

The authors are thankful to the Indian Council of Agricultural Research for financial assistance through AICRP on Plasticulture Engineering and Technology. The authors are also thankful to the Director, ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar for support to carry out the work.

## References

CIFA (2004). Portable FRP carp hatchery. pp.22-23. In: CIFA Technologies, (Eds.) Sarangi, N., Jena, J.K., Das, B.K., Sahoo, P.K. and Mohapatra, B.C, Central Institute of Freshwater Aquaculture (ICAR), Bhubaneswar.

CIFA (2005). Parigamaniya (portable) FRP Carp Hatchery. pp. 27-30. In: CIFA Pradyogiks, (in Hindi), (Eds.) Sarangi, N., Jena, J.K., Das, B.K., Sahoo, P.K. and Mohapatra, B.C., Central Institute of Freshwater Aquaculture (ICAR), Bhubaneswar.

ICAR (2005). Portable plastic carp hatchery. pp 55-58. In: Aquaculture Technologies for Farmers. (Eds.) Jena, J.K., P.C. Das, B.K. Das, Mohapatra, B.C., Sarangi, N., Modayil, M.J., Vass, K.K., Ravichandran, P. and Ayyappan, S., Indian Council of Agricultural Research, New Delhi.

Lakra, W.S., Sarkar, U.K., Gopalkrishnan, A., & Kathirvelpandian, A. (2010). Threatened freshwater fishes of India. ISBN:978-81-905540-5-3, ICAR-NBFGR, Lucknow. 20 p.

Mohapatra, B.C., Sarkar, B. & Singh, S.K. (2003). Use of plastics in aquaculture. pp 290-305. In: Plasticulture intervention for agriculture development in North Eastern Region. (Eds.) Satapathy, K.K. and Ashwani Kumar. ICAR Research Complex for NEH Region, Umiam, Meghalaya.

Mohapatra, B.C., Singh, S.K., Sarkar, B. & Majhi, D. (2004). Portable carp hatchery for carp seed production. p 132-135. In: Technologies on Livestock and Fisheries for Poverty Alleviation in SAARC Countries. SAARC Agricultural Information Centre, Dhaka.

Mohapatra B.C., Singh, S.K. Sarkar, B. & Sarangi, N. (2005). Portable FRP carp hatchery: An aid for rural aquaculture. p. 515-522. Proceedings International Conference on Plasticulture and Precision Farming, November 17- 21, 2005, New Delhi, India.

Mohapatra B.C., Sarkar, B. Singh, S.K. & Majhi, D. (2007). FRP carp hatchery and its economics. pp: 11-18. Workshop on Portable hatchery for better carp seed production. 31 August - 1 September 2007, Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar, Odisha, India.

Mohapatra B.C., Sarkar, B. & Sarangi, N. (2008). Portable FRP carp hatchery technology successful adoption in India. *Fishing Chimes*, **28**(4): 48-52.

Mohapatra, B.C., Sarkar, Bikash, Barik, N.K. & Jayasankar, P. (Eds.), (2011a). Application of Plastics in Aquaculture. pp 1-112. ICAR-AICRP on Application of Plastics in Agriculture, Cooperating Centre at Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha.

Mohapatra B.C., S.K. Mahanta, S. Chandra, D. Majhi & A.E. Eknath, (2011b). Seed production of rohu (*Labeo rohita* H.) in FRP hatchery in Nuagaon Block, Nayagarh District, Orissa. *E-planet*, 9(1): 35-39.

Mohapatra, B.C., Barik, N.K., Sarkar, Bikash, Majhi, D., Mahanta, S.K. & Sahu, H. (2013). Carp seed production in FRP carp hatchery by women self-help-group in Odisha. pp 8-10. In: Plasticulture in Field: Success Stories of All India Coordinated Research Project on Application of Plastics in Agriculture. (Ed.) Bhatnagar, P.R. AICRP Cooperating Unit, ICAR-CIPHET, Ludhiana.