

## Post stocking management

### Feeding

Even though the fish utilises the limited natural food from the pond, it is essential to supply compound feed for growth during the culture period. Less expensive feed made from plant ingredients is usually fed due to its omnivorous feeding habit, to reduce the cost of feed. This fish readily accepts sinking, slow sinking and floating feed types. 1-2 mm floating pellets containing 30-32% protein at the rate of 2-3 % body weight is sufficient enough for the growing fish. Floating feed has the beneficial effect of assisting farmers to gauge the consumption pattern, utilisation, acceptability of feed and activeness of fish during feeding. This is also helpful to curtail the ration size during winter months and facilitates health management if at all required during the operational period.

### Environment management

The culture environment deteriorated due to accumulation of metabolites and unutilised feed material. Mostly, water quality parameters such as dissolved oxygen are seriously affected, apart from ammonia accumulation during the culture activity. This is usually seen in cement cisterns while undertaking grow out activity compared to pond condition. Mortality of fish due to asphyxia is usually observed during the early morning. Hence it is essential to exchange water intermittently to give the optimum environment for their growth and to avoid the fish loss.

### Health management

Incidence of disease is often found during the winter season or during the shifting of winter to summer. Diseases such as fin rot, ulcers/red patches near the tail or on the body are found. These can be controlled by frequent water exchange at the beginning of incidence. It is better to segregate the affected fishes, to restrict further spread of disease. Usually before the incidence, fish show slow swimming and feed poorly. Hence it is essential to take care of environmental management to restrict the incidence of disease.

### Harvest

It is better to go for monoculture of this species as it shows vigorous feeding behaviour and may apply pressure on other species. Culture at low stocking densities yields better fish

size compared to high stocking density even though the hectare production is low. Fish of 50-60 g are highly preferred by consumers as there is a habit of eating single fish in the dish.

There is ample opportunity to culture this catfish in cement tanks or ponds. The growth of fish always remains low during cement tank rearing compared to pond culture, about 15-20 g in average weight. The higher growth in ponds might be due to the availability of natural feed and their utilisation by the fish. The growth and yield patterns of this fish have been evaluated at different densities, which indicated that up to 40,000/ha are good enough to produce marketable fish within a years' time with a production range of 1.5-2.0 t/ha. The yield can be enhanced at higher densities such as 50,000/ha, but this may result in small fish. In this situation, the culture period can be increased to harvest larger fish. But farmers generally prefer to reduce the culture period to lower risk.

The time of stocking may be another management aspect to get better growth or yield in this fish. The required size of fingerlings is only available just prior to the winter season. So the growth of fish is hampered accelerates only when the water temperature reaches around 27-28°C. Hence the stocking of fish should be so adjusted that the fish gets more growing period for higher growth.

### Better management practices

- The fish should not be cultured with multi-species as it shows active feeding behaviour, which may restrict growth of other species.
- As the fish grows slow, it is better to culture it at a low density to achieve marketable size in a shorter growing period.
- The culture of this fish emphasises the stocking of larger, stress-free fingerlings to benefit growth, survival and yield.
- Good oxygen levels in the culture environment must be ensured during morning hours to avoid asphyxia, which may lead to mass mortality.
- Floating feeds containing 30-32% protein must be provided for optimal growth and to facilitate monitoring of feeding and ration size during the culture period.

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## Accelerated poverty alleviation of tribal households - cage fish farming by displaced fishers in reservoirs of Jharkhand

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Jharkhand, a new Indian state created in 2001 presents a unique culture, demography and geographical characteristics. Around 28% of the states 33 million people (2011 census) are tribal, forming a group in the state. Agriculture is the predominant livelihood for rural communities and subsistence level farming dominates the food production system, with limited opportunities for on-farm employment to landless people for the greater part of the year. There is limited scope

for labour movement in search of employment, particularly in tribal and hill areas where road and communication networks are limited. However, fisheries and aquaculture are regarded as an integral part of food production system and livelihood for over 135,000 people who are dependent on fishing and related activities, with major participation of tribal fishers.



With the team effort of Department of Fisheries (DoF) the state has the distinction of achieving high growth in fisheries and aquaculture during the last decade of around 49% per annum over the base year (2001) and 9.4% over previous year. Fish production has increased to 116,000 tonnes worth around Rs. 1 billion (US\$150 million) from the initial 14,000 tonnes. The concerted efforts of DoF have resulted in continually improved production and sector growth in spite of several predicaments, transforming fisheries and aquaculture activities in the state from subsistence level to extensive, semi intensive and near commercial scale in some segments.

In the initial phase of development DoF had couple of major challenges to address. One was to mainstream the tribal communities who lost their land and other assets due to reservoir construction by the government, and the other was to bridge the fish demand – supply gap.

Our efforts to mainstream the paths of tribal people to improved livelihoods and prosperity was addressed by way of roping them in, initially to reservoir fisheries activities, by extending support in the form of fish seed for reservoir stocking, nets and watercraft. As a first step, this could only marginally remediate lost incomes and employment opportunities. The uncertainty in fish catch, slowing resource productivity and catch rates, employment and income loss, continued to negatively affect livelihoods even after the intervention. However, the main benefit of this support was in building community confidence and improving community relations with DoF staff.

Due to the increased economic needs and necessities of life, the community regarded the gains as inadequate to raise their financial status and continued to feel aggrieved. Hence, offering them better alternative economic activities to sustain them became the next challenge to the government.

Jharkhand has a very large fish eating population (over 70% of its population) with a very moderate per capita fish consumption of around 7-10 kg/year due to limited fish availability (per capita availability of fish 20.5 g/day against the national average of 24 g). The state has experienced critical imbalance in demand and supply of fish and hence closing the demand gap against the backdrop of a growing population, economic progress and rise in per capita fish

consumption was another major challenge, through augmentation of the supply side. At this stage, the state was looking out for multi-pronged approaches to facilitate a several-fold increase in fish production and profitability in a short span of time, while addressing community socio-economic concerns in the development process.

At that point in time the few available alternatives to the government were to i) harness available water bodies to their best and optimum productivity levels, ii) enhance resource productivity through better management practices, and/or iii) shifting production practices to input based approaches.

The predominance of rain-dependent seasonal tanks, small water bodies, uncertainty of water availability for fish farming activities, and poor investment capacity of fishers and private resource owners heavily constrained implementation of these options. The latter alternative of input (feed) based intensive farming practices required a good quality and perennial water supply throughout the year and active private participation and investment. Unfortunately circumstances were not congenial at the time due to heavy demand on the state for community welfare, and as proven technologies for intensive farming were not at all in practice.

Having partly succeeded in taming the volatile situation across the affected regions, DoF started looking at options with the potential to remedy the situation, while addressing fish demand and supply. During 2011-12, the department was associated with central institute involved in experimenting with cage fish farming in one of the reservoirs close to Ranchi, and the fish production result was quiet encouraging.

This has provoked a new thinking of taking the activity further forward through community development objectives in selected reservoirs as they are the only reliable perennial water bodies of the state. They were also the only option to integrate cage farming activity with ongoing reservoir development programs facilitating higher production and income and a year round supply of fish to markets, thus meeting both the ends of increasing fish production and providing dependable income to fisher communities and displaced tribal people.





## Why cage fish culture?

The economic dictum is that available resources (natural and human and material) should be put to optimum use to generate the most efficient outputs. Farming of pangasius (*P. hypophthalmus*) fish in cages is an intensive farming activity that potentially provides a high return per unit of material and labour invested. In comparison with open reservoir fishing, cage culture offers many times more production from a given water area. A water volume of 96 m<sup>3</sup> has the potential to produce anywhere between 3.5-4.5 tonnes of fish in 10-12 months while the catch in reservoirs is around 80-140 kg/ha. At the same time, it has potential to generate around 200-250 person-days of employment to fishers compared to a mere 4-5 days fishing (assuming a daily catch of 5 kg/person). The prevailing advantage of labour share by tribal fishers helps to minimise operational cost. These driving forces encouraged the DoF to embark upon this ambitious programme for the first time in the state.

## Initial predicaments for implementation

The major constraints for adoption of cage fish farming by displaced fishers was the high cost of infrastructure and operations in terms of feed, labour and seed. A total non-availability of skilled labour with experience in cage farming and absence of support services added to the complexity.

## Right opportunity at the right time

At about the same time, the Government of India had established a National Mission Programme on Protein Supplementation (NMPS) and prioritised cage fish farming as a means to produce high volumes of fish for this goal. The Jharkhand DoF did not lose any time and jumped onto this new program convincing the state government to provide financial support for implementing the project. Thus 2011 saw the start of a new journey in fisheries horizons in Jharkhand with many challenges ahead.

## Coping with predicaments

Having committed to this innovative scheme, the DoF was confronted with a challenge of how to manage this new production system and to support displaced fishers, who lacked skills and experience in fish farming and had limited financial status, when the technical team of the DoF also had no previous exposure to cage fish farming. Cage construction, siting and farming of pangasius were new challenges to all! However, the DoF staff took up this challenge in earnest. Teams of technical personnel were positioned in each selected reservoir and were tasked to go all out to not only learn the new technology by themselves, but also train and convince fishers to participate as well.





### Uncertainty of takers

Cage culture is a high investment - high return proposition and entails huge costs, both fixed and recurrent. Even though a subsidy of up to 90% was available on infrastructure and inputs, individual displaced fishers were not in a position to take up the activity independently and hence the Department decided to rope in the Fishers Cooperative Societies of the displaced fishers to the venture and launched a mass campaign to convince the societies to join hands with Department. Although initially the response was not encouraging due to about a 10% share without assured returns, only a few societies came forward to trial the venture with support and involvement of Department.

### Implementation

The activity was moved forward in the Chandil reservoir of Saraikela district with twelve batteries comprising 46 cages and two cage house (GI pipe model) for farming and six batteries (24 cages) for seed rearing. Similarly at Tenughat reservoir, Bokaro district (twelve plus six batteries) with two cage houses were established during 2011-12 under the direct supervision and management of the DOF staff. It was a kind of pre-testing of the technology, with regards to the technical feasibility of the venture and its suitability as a development intervention to the societies.

### Development phase

Based on initial success and the confidence built both in DOF staff and the participating fisher societies, cage farming was expanded to reservoirs of several other districts over a five year period. A 'push and boost' strategy was adopted by DOF to implement, refine and stabilise the activity and make it popular among the members of fisher societies. The steps included:

- Mobilising fisher cooperatives and their members, educating them on the advantages and benefits of cage culture.
- Confidence building in operating both fishing and cage based farming in the same reservoir.
- Providing technical support and training to fishers.
- Efforts made for fabrication of cages.
- Selection of suitable sites in reservoirs.
- Support for mooring and fixing of cages.
- Empanelment of suppliers.
- Seed procurement.



- Arrangements and intermediation for the feed supply and delivery.
- Establishment of a feed mill on site and production by roping in members of fisher societies.
- On-site technical support and oversight by DoF personnel in production of the first crop and advisory support for the subsequent crops.
- Improvements to existing marketing channels and arrangements.

During different phases of implementation, several issues were encountered including uncertainty of seed supply, frequent hikes in feed cost, heavy mortality of young stock, lukewarm market response and natural vagaries of heavy winds that damaged the cages, some to the point where they could not be used. The DoF staff handled the situations and moment of crisis without becoming disheartened and were ably supported by the resilient outlook of fishers against all odds. These incidences proved to be blessings in disguise to the “Mission Cage Culture” as they created opportunities for research and development. As the time passed with instances of success in activity, more and more fisher societies asked for support and later, with gained confidence and earnings from the activity, demand from individual fishers also surged and DoF was to make way for the new development.

### **Trial and error / learning by experience strategies**

It would be unrealistic to claim that the first experiment was a great success at the first go. Like any new technology, cage culture also had some teething trouble initially but the DoF personnel motivated progressive fishers at all levels and stages of farming and would not let go of the opportunity. Several grey areas were identified in the process and remedies were developed for each on a continued basis. The second and subsequent trials made use of new applications and changed approaches which started paying rich dividends in the form of better yields and profitability. The response, though lukewarm in the initial period, built up over a period of time due to relentless and sustained efforts of the DoF personnel.

### **Impacts**

“Mission Cage Culture” proved to be a great boon to resource poor displaced fishers in terms of incremental income (a net profit of Rs. 100,000-120,000/cage) and average fish production of 3.5-4.5 tonnes/cage/year under the best management practices. The additional employment generated was around 250 person-days/cage. Considering the production in 2,452 cages spread across 17 districts of the state in 25 reservoirs, and also in abandoned coal pits, by 2015-16 the annual contribution to fish production was estimated at 9,800 to 10,000 tonnes. This was equivalent to around 6-7% of total state fish production with a value of around Rs.750 – 800 million. The annual employment generation from entire activity was estimated at over 435,000 person-days.

Cage farming has contributed to both social capital formation and financial empowerment. As a result, the previously poor displaced tribal people are now able to generate higher income from the activity, which has significantly improved their livelihoods, generate various other assets. It has become



an added source of income and most of them have been able to cross the poverty line and are leading a more comfortable life. They have also accumulated some durable assets due to improvement in household income. The activity has also supported others involved in intermediation, sales and marketing. Consumers have benefitted in terms of improved access to fresh fish and live fish to their door steps at an affordable price. All of this progress, observed at different levels of the production and supply chain, has proven the success of the activity and are a testament to the efforts of DoF personnel.

### **Conclusion**

The DoF now feels that this segment of farming could be a feasible platform for inclusion of displaced tribal people and for enhancing state fish production. In years to come with refinement of technologies, better positioning of support services, innovative processing and value addition, developing semi processed and processed, ready to cook and ready to eat products, the activity could serve as one of the major engines for economic growth for the reservoir fishers of rural Jharkhand.

The success of the initiative and the process adopted in implementation by the Department of Fisheries has added new dimension to reservoir fisheries activities in the entire country and has opened up new opportunity for private investment by entrepreneurs, communities and public-private partnerships.